SOCIETY FOR ECOLOGICAL RESTORATION

HUMAN DIMENSIONS OF ECOLOGICAL RESTORATION

Integrating Science, Nature, and Culture

Edited by
Dave Egan, Evan E. Hjerpe, and Jesse Abrams

SOCIETY FOR ECOLOGICAL RESTORATION

A complete list of titles in this series can be found in the back of this book.

The Society for Ecological Restoration (SER) is an international nonprofit organization whose mission is to promote ecological restoration as a means of sustaining the diversity of life on Earth and reestablishing an ecologically healthy relationship between nature and culture. Since its foundation in 1988, SER has been promoting the science and practice of ecological restoration around the world through its publications, conferences, and chapters.

SER is a rapidly growing community of restoration ecologists and ecological restoration practitioners dedicated to developing science-based restoration practices around the globe. With members in more than forty-eight countries and all fifty U.S. states, SER is the world's leading restoration organization. For more information or to become a member, e-mail us at info@ser.org, or visit our website at www.ser.org.

HUMAN DIMENSIONS OF ECOLOGICAL RESTORATION

Human Dimensions of Ecological Restoration

Integrating Science, Nature, and Culture

Edited by Dave Egan, Evan E. Hjerpe, and Jesse Abrams
Foreword by Eric Higgs

ISLANDPRESS
Washington | Covelo | London

Library of Congress Cataloging-in-Publication Data

Human dimensions of ecological restoration : integrating science, nature, and culture / edited by Dave Egan, Evan E. Hjerpe, and Jesse Abrams ; foreword by Eric Higgs.
p. cm. — (The science and practice of ecological restoration)
Includes bibliographical references and index.
ISBN-13: 978-1-59726-689-5 (cloth : alk. paper)
ISBN-10: 1-59726-689-2 (cloth : alk. paper)
ISBN-13: 978-1-59726-690-1 (pbk. : alk. paper)
ISBN-10: 1-59726-690-6 (pbk. : alk. paper) 1. Environmental sciences—Philosophy. 2. Restoration ecology. 3. Environmental management. 4. Ecological integrity. I. Egan, Dave. II. Hjerpe, Evan E. III. Abrams, Jesse.
GE300.H86 2011
639.9—dc22

2011005768

Printed on recycled, acid-free paper

Manufactured in the United States of America
10 9 8 7 6 5 4 3 2 1

Cover photographs clockwise from upper left: College students planting native trees in an urban restoration project; photograph by Kara A. Salazar. Monitoring juvenile coho salmon populations in the Tongass National Forest; photograph by Evan E. Hjerpe. Eco-art stormwater remediation project on Mattituck Inlet, Long Island, New York; photograph by Lillian Ball. Identifying areas for community fire protection near Flagstaff, Arizona; photography by Dennis Lund.

"The Roots Go Deep," by Sandy Kucinski, is reprinted in chapter 25 by kind permission of the author.

Keywords: Island Press, human dimensions, ecological restoration, social science, volunteers, ecological economics, ecocultural restoration, environmental education, restoration planning environmental stewardship, urban restoration, community-based conservation, forest management, political ecology, game theory, environmental literacy, restoration practitioner

To my parents, Cleon and Betty Egan,
and their grandchildren—Dave Egan

To Mom, Dad, Dair, and Harley—Evan E. Hjerpe

To my family, to friends near and far, and especially
to Louis—Jesse Abrams

CONTENTS

ACKNOWLEDGMENTS

Dave Egan First, I would like to acknowledge Catherine Cotton, with whom I hatched the idea for this book at the Society for Ecological Restoration Conference in Saragoza, Spain, in 2005. I would also like to acknowledge my colleagues at the Ecological Restoration Institute for their support, especially Linsey Baker, Karen Gilbreath, Shanyn Money, Diane Vosick, and Wally Covington. I thank Claudia Melrose for encouraging me to read about integral ecology. Also, my warmest regards to Cathryn McCormick for her love and guidance as the book began to take its final form. I also acknowledge Drs. Pravin Dugal, Nick Koshuta, Edward Quinlan, and their staffs for the care they gave me during two retinal detachment surgeries that occurred during the making of this book. Finally, I express my gratitude to Evan and Jesse for their help, support, and encouragement during this process.

Evan E. Hjerpe I am very grateful for the support of The Wilderness Society and the Aspenwood Foundation. Numerous discussions with staff members, particularly Pete Morton, Karen Hardigg, and Greg Aplet, greatly refined my thinking about restoration issues. I am indebted to Yeon-Su Kim for always pushing me to be a better economist. Lastly, I thank my family, Sasha, Dave, and Jesse.

Jesse Abrams Thanks to Dave and Evan for being great coeditors and collaborators. Thanks also to fellow students at Oregon State University and Northern Arizona University, and friends across the country—there are too many to name—for their support and inspiration. To community members in the White Mountains of Arizona that contributed their time to my research on the White Mountain Stewardship Contract, I am eternally grateful. Special thanks to Sue Sitko, Ed Collins, Herb Hopper, Steve Campbell, and Jerry Drury for keeping me up to date on the progress of the contract. And many thanks to Sam Burns for his contributions to the research that went into the White Mountains case study.

From all A huge and well-deserved thank you to Barbara Dean, Erin Johnson, Sharis Simonian and the rest of the staff at Island Press for all the work they have done to prepare this manuscript for publication and to promote ecological restoration, and to the Society for Ecological Restoration and its publication editors, James Aronson and Karen Holl. Last, but certainly not least, we all want to thank the contributors to this volume for their patience with us and for providing their engaging narratives and thoughtful studies to the readers of this book.

FOREWORD

Eric Higgs, School of Environmental Studies,
University of Victoria, British Columbia, Canada

There is something remarkable about the way people connect with place and each other through ecological restoration, a point made persuasively in these chapters and cases assembled by Dave Egan, Evan E. Hjerpe, and Jesse Abrams. That is also how I saw it in 1984, when a group of graduate students from the University of Waterloo joined the late Robert Dorney for a weekend field trip near Colpoys Bay in southern Ontario, Canada. Bob was a pioneer in ecological restoration and had a restless curiosity about ecosystems and how to put them back together. Trained in wildlife ecology by Aldo Leopold at the University of Wisconsin–Madison in the late 1940s, Bob moved through several careers before settling in as one of the original faculty members of the University of Waterloo's environmental studies program in 1967. He later cofounded Canada's first comprehensive ecological planning and design firm, Ecoplans, which abetted his commitment to real-world practice. Bob was also locally famous (infamous, if you asked his neighbors) for ripping up the front yard of his suburban home in the late 1960s to install a "mini-ecosystem." He was not a man given to convention, which is why on a chilly Saturday morning in October my fellow graduate students and I were ready for anything.

For several years on the piece of former farmland he owned with several friends, Bob was experimenting with techniques for restoring the land that had been damaged by intensive farming decades earlier. After more than fifty years the thin soils remained inhospitable to native species. He didn't have much to work with in terms of recipes for recovery since, at the beginning of the 1980s, there was no organized mass of scientific information about prairie and forest restoration, no professional or scientific journal to chronicle accomplishments, no Society for Ecological Restoration, and no nearby models for inspiration. The very term "restoration" was not commonly applied at the time. "Reclamation" and "revegetation" were the currency, but neither of them implied a practice faithful to ecological ideas. Bob set up two experiments. One was a grid of 1-by-2-meter plots in which he tried various treatments—soil augmentation, tilling, seeding, solarization—to ascertain what might work to break up the obdurate ground cover of orange hawkweed (*Hieracium aurantiacum*). Bob walked us carefully through these private experiments (they weren't part of a funded research project) and then asked us to imagine how we might shift from isolated plots to successful restoration at a sublandscape level. We puzzled over coffee while Bob presented his first thoughts on nodal recovery. If we created small islands of native biodiversity in an oldfield matrix, might these nodes, through succession and windborne distribution, result slowly and affordably into an ecosystem of great native biodiversity?

We sketched a layout for the field that lay below the cabin. We walked it carefully, doing rapid appraisals of soil and vegetation conditions, and noting especially any promising native floristic assemblies. Next morning we set to work on designing the restoration project, salvaging some native plants from a local source, flagging the site for follow-up study, and shoring up the nodes of biodiversity with plants and seed. We worked hard and fast, and as we did we were impelled by a vision of a recovered landscape, the same powerful type of vision that attends anyone who truly grasps ecological restoration. More than this, we came together as a group by sharing our insights, debating the merits of various interventions, and having a good amount of fun.

Described so often is the elation that one feels in working with and for natural processes. When ecosystems come together, *so do we*. During the last twenty-five years I have reflected on the many reasons ecological restoration has this effect. Certainly, people are enlarged by their exposure to natural patterns and processes; getting their hands dirty is a rare experience for many in an urbanizing world. Neighbors are brought into contact, naturalists are given a cause, political activism is kindled, and new economic arrangements emerge. Restoration satisfies emotional and moral hungers, too. We experience a lift from knowing that our depredations are at least partially absolved through restoration. We are brought to the brink of humility when we realize how easy it is to act carelessly and how hard it is to rebuild and restore. We are guided by new or rediscovered norms of wise practice. An overarching theme of this book is that the gap separating culture and nature narrows through ecological restoration; we might never bring these two together in any practical sense, but we realize that these are categories worth challenging or negotiating.

Sometimes a spark is all that is needed to ignite awareness, such as the experience I had many years later with a group of restoration students at the University of Victoria, where I now teach. Working with a local parks support group and park staff, students pulled invasive species and planted shrubs and seeds to restore a vestige of coastal Douglas fir (*Pseudotsuga menziesii* var. *menziesii*) ecosystem in Beacon Hill Park. It was not much more than two hours of labor, but when the students reported on their experience in short essays, the message was consistent: they felt connected to the place in a way they had never felt before. Several mentioned they would be back to check their plantings in future years. It is not just that bonds are formed easily, like a first romantic blush, but that the experience of love-at-first-sight endures and leads to a recognition of how such bonds are formed in other places and other times.

Finding ways of building the social, cultural, and economic capital sufficient for durable projects is a challenge that we will understand better by understanding the human dimensions of ecological restoration. This is a major contribution of this book. The contributions range from schoolyards to stewardship, and involve the works of scientists, activists, and farsighted agency staff. The chapters in each section explain the value of collaboration, volunteerism, economic innovation, education, traditional ecological knowledge, and well-wrought policy. The supporting cases amplify the main themes; a fine-grained understanding is critical to know what works and what falls short in developing restoration capacity.

We face challenges now that were relatively unknown in restoration twenty-five years ago, and a better resolved understanding of the social, economic, political, and cultural dynamics of restoration is vital to the continued success of our practice. Consider the emergence of new markets for carbon offset and the benefits that accrue economically from restoration. The notion of pricing ecosystem services in relationship to the development and recovery of natural capital is a radically new idea. Restoration stands to benefit considerably from replacing or augmenting services that can be accounted locally, nationally, and internationally. Newly developed financial instruments for conservation and restoration stand to benefit ecosystems, even while these same instruments bring new resources to communities, some in desperate need of such support. There is a worrisome side, too. The pragmatic approach of pricing ecosystem services monetizes features of ecosystems that lend themselves well to crisp accounting (e.g., flood detention) and leaves others in the shadows (e.g., social rejuvenation). Many of the examples in this book point to the subtle interplay of social and economic forces, and the particular values that need attention. Schoolyard restoration, for example, may not sequester much carbon or return hard dollars to the school, but the learning that takes place can be inestimable.

So, too, are we facing the prospect of novel ecosystems, those that depart from historical precedents through rapid environmental (climate) and ecological change (species invasion). Either one of these emerging problems presents problems of mind-numbing complexity, not only at an ecological/economic level but at a social/cultural one, too. The fine-grained accounts of real-world practices described in the following pages will make a difference in our ability to comprehend why direct intervention in ecosystems through restoration is both so satisfying and so successful. At the same time the social learning through such experiences builds resilience and makes it easier to adapt our approaches to changing circumstances.

History will continue to matter, but the challenge will be in sorting out collective values toward a new nature, one that may focus more on stabilizing self-regulating functions that provide desired services (however "desired" is cashed out). Once again, the importance of detailed studies of how people are engaged with ecological restoration will form the basis of a value system that respects the intrinsic properties of historically significant ecosystems and, at the same time, allows for appropriate gestures to changing circumstances.

Good restoration will acknowledge these challenges, but so too will it incorporate measured and modest human care. This is the essence of the arguments made in this book: people are integral to the flourishing of ecosystems, and restored ecosystems teach us a great deal about ourselves.

Chapter 1

Why People Matter in Ecological Restoration

Dave Egan, Evan E. Hjerpe, and Jesse Abrams

Ecological restoration is a practice of hope; hope because restorationists envision a better future as a result of their efforts. Ecological restoration is a practice of faith; faith because restorationists work in a world of uncertainty. Finally, ecological restoration is a practice of love; love because restorationists care about, and give their lives to, efforts that protect and enhance the lives of humans and other-than-human beings alike. Ecological restoration is a human practice, and because it is, people matter.

In this book we endorse the idea that humans are an integral part of nature and that they play a key role in determining, either consciously or otherwise, the condition of the environment in which they live. We also support the idea that the practice of ecological restoration is one of the more positive ways that humans can interact with the rest of the natural world. Moreover, we seek to show why recognizing and understanding the human dimensions of ecological restoration are critical to the success and longevity of all ecological restoration efforts, especially those undertaken at large scales, on public lands, and/or within urban/suburban settings. These are situations where restoration activities move beyond the vision and control of an individual landowner or small group of like-minded people; these activities are community-based efforts that involve the ideas and concerns of many people.

A fundamental assumption underlying the concept of ecological restoration is that humans are responsible for degrading the natural environment and, therefore, humans have a responsibility to repair it. At the heart of ecological restoration is a vision of a better relationship between humans and the rest of the world. Unfortunately, there is no unified vision of who we are as people, how the world around us operates, and what this better relationship should look like. We believe, however, that ecological restoration provides a forum within which we can study the dialogue between humans and nature, and between various human stakeholders. In this book, we do so by studying the human aspects of collaboration and community-based ecological restoration, restoration economics, volunteerism, environmental education, eco-cultural practices, and politics, governance, and planning.

One of the first things we observe when studying ecological restoration is that, because humans are intimately involved, the practice is inherently (1) value laden, (2)

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_1, © Island Press 2011

context driven, (3) prone to be immersed in disagreement and compromise, and (4) experiential.

Numerous studies have shown that determining restoration goals and best practices are value-laden activities because they involve human perceptions, beliefs, emotions, knowledge, and, ultimately, behaviors (Gobster and Hull 2000; Bright, Barro, and Burtz 2002; Morford and James 2002; Shindler, Wilton, and Wright 2002). This is problematic when one practices ecological restoration from a strictly scientific perspective, because ecological science alone fails to capture the full extent of the issues we are trying to solve or that must be bridged in order to reach a science-based solution. As historian and ecologist Robert McIntosh points out, "The conflict between the image of science as objective and value-free and that of ecology as intrinsically value-laden and a guide to ethics for humans, animals, and even trees is difficult to reconcile. Segregation of strictly scientific concerns from matters of public policy is not easy, as atomic scientists had found" (McIntosh 1986, 308). Furthermore, ecological restoration activities take place in cultural, political, and economic contexts that produce different "strains" and definitions of ecological restoration. This is especially true as one looks at projects across various regions and at international scales. In addition, these contexts are dynamic and can change with the addition or removal of even one influential person from an oversight group, management team, legislative body, or field crew. Influxes of funding, passage of key legislation or mandates, perceived crisis conditions, and increased public awareness and support can also play key roles in advancing restoration activities. Likewise, bad press, poor relationships with clients and stakeholders, and other negative associations tend to doom the best plans and override the findings of sound scientific research.

As we have seen in numerous situations (e.g., Cook County Forest Preserves, the Everglades, San Francisco nature parks, southwestern ponderosa pine forests), these two factors—value ladenness and context—can and do produce situations where disagreements have halted or canceled restoration efforts. Moreover, these two aspects of the human condition often compromise the historical authenticity (Egan 2006) or historical fidelity (Higgs 2003) of ecological restoration projects and move them closer to some other kind of conservation effort (i.e., reclamation, revegetation).

To move forward under conditions characterized by uncertainty, disagreement, and complexity, our experience tells us that, instead of seeking greater control we must use pertinent strategies, such as the democratic process, inclusiveness, and respecting local values and knowledge. We must also recognize competing land-use views, differing visions of human–nature relationships, and opposing values related to job creation and financing. Working through these strategies can help develop solutions amenable to both nature and humans.

Finally, human involvement in restoration practices is experiential in both the physical and the psychological sense, making it open for educational possibilities, artistic interpretations, and spiritual and physical renewal. These efforts can, likewise, aid in resolving situations blinded by mistrust and ignorance. Ultimately, people are innately part of restoration projects as experts, learned amateurs, or volunteers, or as the general public affected by the results of restoration projects. To leave them unrecognized because they do not fit neatly into our scientific myth of "objectivity" or because our preservationist myth of "wilderness" holds that they are to be neither seen nor heard is nothing short of absurd and certainly counterproductive to work that needs to be done to protect and restore the environment and humankind's role as steward of it.

Humans: Apart from Nature or Part of Nature?

As in most endeavors, we stand on the shoulders of those who preceded us. We inherit from them ideas, skills, practices, and theories that inform our present situation and, to the extent that they remain relevant, help us plan for the future. The practice of ecological restoration is not without these traditions. In terms of practical application, it owes much to the practices of agriculture, horticulture, gardening, landscape architecture, forestry, and other applied fields. From a more scientific perspective, ideas from ecology and the other physical sciences serve as an obvious and important foundation (Palmer, Falk, and Zeder 2006). The humanities and social sciences have, until recently, played a lesser role in ecological restoration, despite their importance to the overall success of restoration projects, and, in the case of sociology, a long relationship with ecology under the banners of human ecology (Adams 1935; Hollingshead 1940; Gross 2003) and, more recently, environmental sociology (Dunlap 1980a; Dunlap and Catton 1994; Gross 2003).

In this section, we provide an overview of some of the people, institutions, and events that have changed the Western worldview to include the idea that humans are an integral part of the biophysical world—a concept that is essential for the discussions that take place between the covers of this book.

Whereas indigenous cultures and other non-Western religions and schools of thought typically do not make a distinction between humans and nature (or culture and nature), this dualism is pervasive in Western thought (Glacken 1967; White 1967). Modern science, which has at its foundation this subject–object/us–other metaphysical position, brought this dualism forward when it externalized nature as an object of knowledge (Haila 2000).

Working within this context of modern science, early ecologists in North America and Europe (e.g., Josias Braun-Blanquet, Henry Cowles, Frederic Clements, Victor Shelford, Arthur Tansley) strove to understand plants or animals and how those species associated with one another (communities, assemblages), how various plant communities interacted with one another across the land (plant succession), and how animals interacted with the land (habitat, food webs). Despite their use of terms associated with human-related social units, these ecologists had little interest in the role humans played in the ecological settings they studied, preferring to imagine their study sites as "natural."

One of the first to allude to the problem created by separating humans from nature was the animal ecologist Charles C. Adams, who, in 1913, wrote: "With a grounding in the general principles of organic response to the total environment, the disturbances due to man are a problem in the adjustment of the highest type of animal, as a member of an animal association, to its complete environment." However, this quote is more typical of the belief that humans and human action should be ruled by the laws of nature—a popular idea during the 1910s and 1920s, and even today—than of desire to end the human–nature dualism.

The English ecologist Arthur Tansley, in a 1935 paper that not only challenged the Clementsian model of plant succession and Clements's concept of the complex organism but offered a new ecological paradigm—the ecosystem—as an alternative (Tansley 1935), provided an extremely important step in dissolving the human–nature dualism concept within ecology. Tansley not only argued for including human-caused vegetation types into the study of ecology ("We cannot confine ourselves to the so-called "natural" entities and ignore the processes and expressions of vegetation now so abundantly provided us by the activities of man" [p. 304]), he also placed humans within the natural world as an "exceptionally powerful biotic factor":

> It is obvious that modern civilized man upsets the "natural" ecosystems or "biotic communities" on a very large scale. But it would be difficult, not to say impossible, to draw a natural line between the activities of the human tribes which presumably fitted into and formed parts of "biotic communities" and the destructive activities of the modern world. Is man part of "nature" or not? Can his existence be harmonized with the conception of the "complex organism"? Regarded as an exceptionally powerful biotic factor which increasingly upsets the equilibrium of preexisting ecosystems and eventually destroys them, at the same time forming new ones of very different nature, human activity finds its proper place in ecology. (303)

Responding to Tansley's critique, Clements and Shelford, in their 1939 treatise *Bio-Ecology*, did recognize humans as the "outstanding dominant of a new order," but they deemed it premature to include the study of human ecology in any detail in their book.

Nevertheless, human ecologists (e.g., Robert E. Parks, etc.) proceeded on, using the concepts of ecology to study humans, although most plant/animal ecologists paid relatively little heed to their activities. Still, there were some connections. Indeed, the Ecological Society of America held a symposium on human ecology in 1940 (McIntosh 1986, 307). The idea of interdisciplinary work between plant/animal ecologists and human ecologists continued to hang on by the barest of threads during and after World War II, and through the early 1960s. The Ecological Society of America, for example, made attempts during the mid-1950s to elevate the discussion of human ecology and, in 1955, the National Science Foundation/Wenner-Gren Foundation for Anthropological Research coproduced "Man's Role in Changing the Face of the Earth," a conference that brought together ecologists, anthropologists, geographers, and other thinkers to discuss the past, present, and future relation between humans and nature (Thomas Jr. 1956). However, these and other smaller efforts produced little lasting effect.

So little, in fact, that by 1967 the ecologist and philosopher Paul Shepard was asking: "Whatever happened to human ecology?" (Shepard 1967). McIntosh, reflecting on the situation, concluded: "Geography, sociology, and other disciplines concerned with humans, their cultures, and their relations to the environment sometimes adopted the name but rarely the substance of ecology. . . . The several efforts to bring together ecologists and social scientists failed to integrate them or to produce really significant moves toward interdisciplinary approaches" (McIntosh 1986, 308).

But the postwar era did produce, often for military purposes, a strong interest in the study of systems and the quantification of energy flows and functions within them. In ecology, this effort was led by Eugene Odum and his brother, Howard, as they took Tansley's concept of ecosystem and Raymond Lindeman's landmark work (Lindeman 1942), and put their own stamp on holistic-type studies under the banner of ecosystem ecology or systems ecology. As important as their ecological studies and the systems studies of others (e.g., Liken and Bormann at the Hubbard Experimental Forest), was Eugene Odum's insistence on interdisciplinary studies that placed humans within the ecosystem. He indicated this viewpoint in the following:

> Until recently mankind has more or less taken for granted the gas-exchange, water purification, nutrient-cycling, and other productive functions of self-maintaining ecosystems, chiefly because neither his number nor his environmental manipulations have been great enough to affect regional and global balances. Now, however, it is painfully evident that such balances are being affected, often detrimentally. The "one problem, one solution approach" is no longer adequate and must be replaced by some form of ecosystem analysis that considers man as part of, not apart from, the environment. (Odum 1969, 266–67)

Reflecting back on the emergence and growth of ecosystem ecology, Eugene Odum wrote: "[D]uring the environmental awareness decade, 1968 to 1981, a school of ecosystem ecology emerged that considers ecology to be not just a subdivision of biology, but a new discipline that integrates biological, physical, and social science aspects of man-in-nature interdependence" (E. P. Odum 1986, cited in McIntosh 1986, 202). In the minds of many ecologists, Odum's perspective was a radical departure from traditional ecological science (de Laplante 2005), even if the reality of Odum's work did little to push the actual study of humans within ecosystems.

On the international stage, UNESCO initiated the Man and the Biosphere (MAB) Program in 1971. The program was viewed as an upgrade from the International Biological Program (IBP), which Eugene Odum chaired in the United States, in that it was less academically oriented and more pragmatic. It also placed a greater emphasis on developing countries and their ecosystems (e.g., tropical forests received a very high priority) than did the IBP. Ecosystem ecologist Frank Golley (1993), in his history of the ecosystem concept, writes: "MAB studied systems in which humans were an integral part, including cities, agricultural systems, and nature reserves (162). . . . The MAB extended ecosystem studies from natural landscapes to the human-built environment, leading to the revitalization of the subject of human ecology on ecosystem principles" (164). The 1972 United Nations Conference on the Human Environment (also known as the Stockholm Conference) endorsed the MAB Program.

Furthermore, it promoted a new, international focus on the relationship between humans and the environment that has proven, in retrospect, to be the springboard for future international environmental efforts (including an interest in climate change and sustainable development) and has been a solid foundation of European environmental efforts.

This same period saw a revival of interest in human ecology/environmental sociology with several new publications (Kormondy 1974; Sargent II 1974; Dunlap 1980a, 1980b). Like earlier efforts, this interest in ecology and humans was short-lived, disappearing as Dunlap and Catton (1994) suggest in the early 1980s as public interest in environmental issues waned during the Reagan administration. It rebounded in the late 1980s and early 1990s as the global nature of environmental issues and the human role in them became better known and more widely publicized (Dunlap and Catton 1994).

A groundbreaking work appeared in the early 1990s—*Humans as Components of Ecosystems: The Ecology of Subtle Effects and Populated Areas* (McDonnell and Pickett 1993). This book not only placed humans squarely within the context of the ecosystem, it complemented new efforts within the Chesapeake Bay area by ecologist Steward Pickett and others that ultimately resulted in Baltimore being named and funded as an National Science Foundation Long Term Ecological Research (LTER) Network site—the first in the United States to incorporate both ecological and social sciences.

In 1996, the International Council for Science (ICSU) and the International Social Science Council (ISSC) of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) created the International Human Dimensions Programme on Global Environmental Change (IHDP) as an international, interdisciplinary science program dedicated to promoting, catalyzing, and coordinating research, capacity development, and networking on the human dimensions of global environmental change. The IHDP takes a social science perspective about global change and works at the interface between science and practice.

The 1990s and early 2000s also saw the emergence of two other large-scale, human-related environmental issues—the acknowledgment of the human role in climate change and the recognition of ecological economics and ecosystem services. The work that has been done scientifically and in terms of public education about the subject of climate change has been staggering. The Intergovernmental Panel on Climate Change (IPCC) was formed in 1988 and released its first report in 1990. Its subsequent work has made very clear the strong connection between human action and the sustainability of the global environment. Similarly, but at a much smaller scale, ecological economists have made strides toward identifying the true costs of human activities that deplete or damage the existing natural capital of water, soils, vegetation, air, and the like.

As ecologists began grappling with ways to integrate economics into their discipline, other disciplines traditionally steeped in the natural sciences began coming to terms with the overwhelming importance of the social realm. Forestry, wildlife management, and rangeland management are just a few of the fields that have made the leap from a traditional narrow focus on natural sciences and technical expertise to an increasing engagement with sociology, anthropology, and conflict management. In the mid-1990s, James Kennedy and then U.S. Forest Service chief Jack Ward Thomas stressed the need to prepare young natural resource specialists to deal with people as well as natural areas (Kennedy and Thomas 1995). They argued that natural resource management should be viewed as "social value management" or, alternatively, "social conflict management" (Kennedy and Thomas 1995, 317) and that managers be explicitly trained to understand and deal with complex social-political-economic environments. The U.S. Forest Service and some other federal agencies (e.g., the National Oceanic and Atmospheric Administration) now have integrated social science and human dimensions work into their overall planning.

Finally, although ecosystem ecology as a unified discipline did not last, the human-oriented concept of the Odums continued as many systems ecologists turned their attention to applied and hybrid practices and disciplines, including conservation biology/ecology, ecosystem health and management, sustainability theory, and ecological economics (de Laplante 2005, 404–5), and, in situations where landscape- or watershed-level projects were undertaken, ecological restoration.

While this overview is admittedly brief and incomplete, we hope it has provided the reader with a sense of the foundations of the movement in ecology and the humanities away from the nature–culture divide. Moreover, we hope that it begins to demonstrate that the importance of the social sciences and humanities is now recognized in conservation efforts worldwide and has become an integral part of those efforts. The following section focuses more specifically on the pioneering efforts within the realm of ecological restoration to move beyond the human–nature dualism and embrace the reciprocal role humans have with nature.

Humanities-Oriented Work in Ecological Restoration

William (Bill) Jordan was, arguably, the first person to write consistently about interplay of humans and nature within the context of ecological restoration. Yes, there are the writings of Henry David Thoreau, Aldo Leopold, Loren Eiseley, and others (all of whom Jordan drew upon), but during his tenure (1981–2001) as editor of the journal *Restoration & Management Notes* (later *Ecological Restoration*), Jordan routinely examined ideas such as restoration as performance, restoration as a means of connecting humans to nature, restoration and education, and restoration and community. Moreover, he enjoined authors to do the same, thereby producing a journal that covered not only the scientific and managerial aspects of restoration but the philosophical, artistic, and psychological as well. In his 2003 book *The Sunflower Forest: Ecological Restoration and the New Communion with Nature*, Jordan summarized and updated many of the arguments he had made during those two decades:

> Restoration is important . . . because it is a way of returning classic ecosystems to the landscape, allowing us to go on the offensive in the struggle to ensure their long-term survival. . . . But it is also important for exactly the reasons that four generations of environmentalists have been skeptical about it: because it is

> at every point an encounter with shame. Restoration is shameful because it involves killing and a measure of hegemony over the land; because the restoration effort is never fully successful and never complete; *because it dramatizes not only our troubling dependence on the natural landscape, but—equally troubling—its dependence on us*; and because it dramatizes the restorationist's complicity, not only in the destructive acts he attempts to reverse, but, more fundamentally, in the shameful process of creation itself, in which he presumes to participate. (*Sunflower Forest*, 50, emphasis added)

While Jordan was making his points in the pages of *Restoration & Management Notes/Ecological Restoration* and elsewhere, other writers were producing books about ecological restoration and its connection to humanity and the environment for a general audience or at least that part of the public interested in environmental affairs. The first was John Berger, whose 1985 book *Restoring the Earth: How Americans Are Working to Repair Our Damaged Environment* provided a journalistic survey of people taking on the job of ecological restoration—and their responses to it. Other books of a similar stripe followed, including William K. Stevens's 1995 account of ecological restoration activities in the Chicago area, *Miracle under the Oaks: The Revival of Nature in America*, and Stephanie Mills's book, also published in 1995, *In Service of the Wild: Restoring and Reinhabiting Damaged Land*, which included accounts of her personal experience with restoring land as well as restoration narratives from across America and in India. River restorationist/writer Freeman House's *Totem Salmon: Life Lessons from Another Species* (2000) told the story of ecological restoration along the Mattole River in northern California, emphasizing the integral and mutually beneficial connection between the human community and salmon recovery. Another book that suggested similar human benefits from restoration was *Ecopsychology: Restoring the Earth, Healing the Mind* (1995), edited by Theodore Roszak and his colleagues. More recently, Peter Friederici (2006) has revisited the interaction between people and restored landscapes in his book *Nature's Restoration: People and Places on the Front Lines of Conservation*.

Social Sciences

While there were earlier works that tied the social sciences to natural resource management issues (e.g., in journals such as *Society and Natural Resources*, *Environmental Management*, *Human Ecology*), the breakthrough in terms of examining the social science perspective of ecological restoration came in 2000 with the publication of *Restoring Nature: Perspectives from the Social Sciences and the Humanities*, which was edited by Paul Gobster and Bruce Hull. Like Stevens's book, they focused on ecological restoration efforts in the Chicago area, but with an emphasis on the public and political controversy that had been under way in Chicago since 1996 about restoration activities. The product of a well-attended conference in 1998, the book examined not only the controversy and people's reaction to it, but the much larger issue of the social creation of nature or how people construct nature as part of their larger worldview.

Gobster and Hull end their important contribution by asking and answering probing questions such as, Why restore nature? Which natures are possible and acceptable? Which natures can be maintained and sustained? Which restoration project is more important than other pressing environmental and social problems, and deserves allocation of scarce resources? They conclude that seeking answers to these questions from the biological sciences is not enough. Instead, they argue, "Contributions from the humanities and social sciences are needed to help decide restoration goals, to justify them in a competitive social context, and ultimately to plan, implement, and maintain desired states of nature" (Hull and Robertson 2000, 299).

That same year, two other books appeared that brought the idea of collaboration to the wider natural resource and conservation audience. Both books—*Across the Great Divide: Explorations in Collaborative Conservation and the American West* (Brick, Snow, and Van de Wetering 2000) and *Making Collaboration Work: Lessons from Innovation in Natural Resource Management* (Woddolleck and Yaffee 2000)—stressed the need to move from confrontation to a collaborative approach in order to solve public policy stalemates. We capture a similar argument in our section on collaboration, but with an emphasis on its role in ecological restoration efforts.

In 2003, Matthias Gross, a German sociologist and cofounder of the journal *Nature + Culture*, presented us with *Inventing Nature: Ecological Restoration by Public Experiments*, a treatise about ecological restoration and the creation of nature, the split between the layperson and the expert, the opportunity that ecological restoration presents in repairing that divide through "real world" projects, as well as a review of the history of sociology/human ecology. He has followed the book with various articles; one in particular, "Beyond expertise: Ecological science and the making of socially robust restoration strategies" (Gross 2006), suggests, as we do, two forms of handling knowledge—one the conventional form of controlled, expert knowledge, the other a transdisciplinary knowledge that is evaluated in terms of its general social relevance. Gross calls this second type Mode 2 and describes it as follows: "Learning in this mode of knowledge production is immediate and is part of the discovery process, as is the case in many restoration projects" (Gross 2006). He goes on to suggest that Mode 2 is not meant to supplant the traditional form (Mode 1), but to complement it and expand its peer review process to the interested general public.

Eco-cultural Restoration: Traditional Ecological Knowledge and Cultural Landscapes

As ecological restoration matured and gained popularity during the 1990s, it expanded its reach outside the typical mainstream environmental community, especially and purposely to indigenous peoples because they have a strong interest in restoring the ecology of the areas they inhabit as a means of increasing their resource base and rejuvenating their cultures. In 1995, at the Society for Ecological Restoration (SER) Conference in Seattle, Washington, Dennis Martinez led the effort to organize the Indigenous Peoples Restoration Network as a working group within SER (Stevens 1996). The sessions he organized for that conference were a template for other similar and larger events at recent SER and Ecological Society of America conferences. Martinez has also published several articles (Martinez 1998, 2003; Senos et al. 2006) and served as the coeditor with Jesse Ford for a special issue about traditional ecological knowledge in *Ecological Applications* (Ford and Martinez 2000). Other leaders in the effort to marry ecological restoration with indigenous interests have come from academia and include M. Kat Anderson (2001, 2006; Anderson and Blackburn 1993; Anderson and Barbour 2003), Robin Kimmerer (1998, 2000, 2002; Kimmerer and Lake 2001), Nancy Turner (1995, 2005; Turner and Deur 2005), and Thom Alcoze (2003; Alcoze and Hurteau 2001). Their work has been especially important in connecting with indigenous peoples in their regions and in inspiring young scholars, including indigenous students, to continue the work they have started. Special journal issues about the topic—the December 2003 issue of *Ecological Restoration* (Egan and Anderson 2003) and a 2004 issue of *Ecology and Society* (Folke 2004)—along with conferences of the Society of Ethnobiology and the International Society of Ethnobiology, have also served to open this topic to positive discussions and action.

These efforts are aimed at restoring cultural landscapes—an approach that can work nearly anywhere, although there are those, especially in Europe, who believe that their cultural landscapes have too much history to ever be restored. As various projects in England, the Netherlands, and Spain demonstrate, that really depends on the people involved. If there is an interest in the “old ways,” then restoration of cultural landscapes, and the cultural activities that support them (e.g., mowing of meadows, restoration of fens), can produce successful restoration projects.

Design Arts

Ecological restoration has strong ties to the design arts, especially landscape architecture (Egan 1990). The foundation of this relationship extends back to the late nineteenth century in the United States: Frederick Law Olmsted’s work to restore Boston’s Back Bay Fens in 1878, and the subsequent use of native plants by landscape architects such as Jens Jensen, Ossian Simonds, Elsa Rehmann, Frank Waugh, and others during the decades prior to World War II (Grese 1992). Various writers have also made the case for even earlier or contemporaneous efforts of the design arts to restore areas in other parts of the world (Matsui 1996; Whited 1996; Hall 1997, 2005; Ignatieva 2005).

In his book *Nature by Design* (2003), Eric Higgs states so clearly, “As restorationists we are involved in the design of ecosystems and places whether we like it or not” (71), and with nods to writings by landscape planners such as Ian McHarg (*Design with Nature*, 1969) and Philip Lewis (*Tomorrow by Design: A Regional Design Process for Sustainability*, 1996), Higgs encourages restorationists to “take design to another level, a more explicit one, in which we acknowledge human agency in restoration. More than this, *we need to acknowledge that restoration is fundamentally a design practice*” (274, emphasis in original). Higgs sees “good” design as striking a balance between historic authenticity and contemporary needs, between science and art:

"Ecological restoration as a design discipline demands attention to tradition and novelty at the same time, searching creatively across the spectrum of the arts and sciences for the best way to respect ecological and cultural integrity (279), . . . Design is a practice that emphasizes intention, and good designs nurture individual and community engagement" (284). In this book, we provide a look at how environmental artists are using their skills to create restored landscapes that provide both functional value to the landscape, meaning to the public, and opportunities for individual and community participation—all ideals of Higgs's design process.

Certainly the work and writings of present-day ecological restorationists with a landscape architecture background (e.g., Dean Apostol, Keith Bowers, Leslie Sauer) attests to the foundational role landscape architecture continues to play in the practice of ecological restoration.

Ecological Economics and Systems Studies

The relationship between ecological restoration and ecological economics is relatively new but is developing quickly in light of increasing interest in the development of local, regional, and global sustainability. The ability of ecological economists to develop means of holistic accounting and to delineate concepts, such as "natural capital" (e.g., Costanza and Daly 1992) and "ecosystem services" (e.g., Costanza et al. 1997; Daily 1997), have been instrumental in moving the field forward. The value of ecological restoration has recently been conveyed in terms of augmented ecosystem services and investments in natural capital (Clewell and Aronson 2006; Aronson, Milton, and Blignaut 2006; Aronson et al. 2007). By restoring natural structure, function, and process to landscapes, restorationists can return and enhance a suite of ecosystem services that have been previously negatively affected by human disturbance. Clewell and Aronson (2006) suggest that the pragmatic rationale for restoration of ecosystems is primarily derived from these gains in ecosystem services and that this is currently one of the most compelling, yet untapped, motivations for restoration.

In this book, we agree that augmenting ecosystem services and natural capital is, indeed, a justifiable motivation for restoring landscapes, and it is one of the lenses through which we view the human dimensions of ecological restoration. We also acknowledge the transcendent work of C. S. "Buzz" Holling, Lance Gunderson, John Holland, and many others that extended ecological economics to broader systems analysis, focusing on understanding interactions among human and natural systems (e.g., Holland 1995; Gunderson and Holling 2002). These modern examinations of transformation, adaptation, and resilience (Berkes and Folke 1998; Folke 2006) provide fertile frameworks for examining the human dimensions of ecological restoration.

Education

Educational efforts in ecological restoration have occurred at three levels: K–12, college-level programs, and programs/rituals for the general public. In the realm of K–12 programs, some of the leading work has been done by the Earth Partnership for Schools Program at the University of Wisconsin–Madison Arboretum and the Education Department of Environmental Concern (St. Michaels, Maryland). These two programs have helped schools and other facilities throughout the United States by developing curricula, instructing teachers and administrators, and working with schools to restore the schoolyards with prairies and wetlands. Other smaller programs, such as the Summer Orientation About Rivers (Prairie Plains Resource Institute) and the Mighty Acorns (Chicago Wilderness), provide a more regional approach to educating youngsters about environmental stewardship and ecological restoration. The theoretical support for all of these programs can be found in the works of David Orr (1992), Peter Kahn Jr. and Stephen Kellert (2002), Gary Paul Nabhan and Stephen Trimble (1994), and Richard Louv (2005).

College-level programs and course work in ecological restoration can be found on an international scale, but especially in the United States, Canada, England, and Australia. Lavendel (1999) provided an overview of some of the college-level ecological restoration programs available in the United States at that time. The Global Restoration Network provides a more current listing (http://www.globalrestorationnetwork.org/education/).

Educational opportunities for the general public range from so-called tailgate sessions during volunteer work parties, to public lectures and other events, to signage and other interpretive devices in areas where restoration activities are taking place. While no one has written a book or even an overview article about this type of work within a restoration context, articles about these sorts of activities have and do appear from time to time in *Ecological Restoration*. For example, the March 2004 issue included an article by Colette Palamar about how to conduct a fire festival to introduce the general public to the safe use of prescribed burns (Palamar 2004).

Other Humanities-Related Areas

Other areas in the humanities that are of interest to ecological restorationists include history (reference conditions, authenticity), philosophy (ethics), and psychology (understanding human behavior). While we have made a conscious choice not to include discussions of all these areas in this book, we fully recognize their importance and include here a brief summary of a few important publications in each of these areas.

In the area of history and historical ecology, look into the publications by David R. Foster and his colleagues (2000, 2004), Eric Higgs (2003), Dave Egan and Evelyn A. Howell (2001), Peter S. White and Joan L. Walker (1997), William Cronon (1983, 1991, 1996), Carole Crumley and William H. Marquardt (1987), and Carole Crumley (1994). There have been several books about philosophical issues related to restoration. These include works by Bill Jordan (2003), William Throop (2000), Andrew Light (2005), Andrew Light and R. Holmes III (2002), and Eric Katz (1996). Additionally, it would be a huge oversight not to mention *Environmental Ethics*, which has been edited by Eugene Hargrove from 1979 to the present (http://www.cep.unt.edu

/enethics.html). In the realm of environmental psychology, there are several books of note, including those by David Abram (1996); Robert Bechtel and Arza Churchman (2002); George Howard (1997); Rachel Kaplan and Stephen Kaplan (1989); Rachel Kaplan, Stephen Kaplan, and S. Ryan (1998); and Theodore Roszak, M. E. Gomes, and A. D. Kanner (1995).

Structure of This Book

Our intention with this volume is to delve into some of the often neglected and, therefore, often misunderstood aspects of ecological restoration; areas of the practice that ultimately make the difference between "good" and "bad" (or just "mediocre") restoration, between projects that are successfully executed and those that seem unable to advance past the conceptual stage, between informed, engaged participants in restoration and apathetic bystanders. In so doing, we draw on the experiences of the chapter authors in this book—a diverse assortment of restoration practitioners and researchers from around the world. We hope the lessons contained herein will be valuable to restoration veterans and greenhorns alike, scholars and students in a range of environmental and natural resource fields, and individuals who care about restoring their local lands and waters as well as themselves and their communities.

The careful reader will find that the book is divided into three metathemes: participation, power, and perspective. These overarching metathemes emerge naturally from the narratives in this book. Moreover, they represent and illuminate ecological restoration's intrinsic characteristics of being (1) value-laden, (2) context-driven, (3) prone to be immersed in disagreement and compromise, and (4) experiential.

Participation is the undeniable essence of ecological restoration because ours is an active practice that requires participation in its planning, implementation, and management. Unlike hands-off preservation, restoration depends on an active, reciprocal engagement with the land and with all the beings, including humans, who live there. As restorationists, we are obliged to meaningful, thoughtful participation as part of our practice. Within the metatheme of participation, there are two themed sections, one of which discusses the important roles volunteers play in restoration while the second explores the often tricky and deeper world of participation in a collaborative setting. As is the case throughout the book, each of these themed sections begins with a chapter that introduces the basic theme and explores its general relation to ecological restoration. Subsequent chapters are case studies of projects, programs, and experiences within that thematic area.

Power may seem like an unusual metatheme for ecological restoration, but once ecological restoration is viewed as a practice that is value laden, context driven, prone to disagreements and compromise as well as experiential, then it becomes clear why and how power plays such a central role. Once restoration decision making is seen as involving more than embracing scientific facts, and that someone or some group typically has the power (i.e., authority, money) to support/neglect/deny a restoration effort, and that other individuals or groups also have claims to power through their engagement with the land and their neighbors, then the role of this metatheme in ecological restoration becomes more obvious. The thematic sections discussed under the metatheme of power include a section about politics, governance, and planning followed by chapters that discuss restoration economics.

The metatheme of perspective speaks to the experiential component of the practice. It is this realm where ecological restoration intersects and interacts with cultural practices that allow us to negotiate between the tension inherent in the metathemes of participation and power. Such practices help us complete the full restoration experiment by helping transform the practitioner, arguably the most important change of all. The themed sections here include eco-cultural restoration, which includes indigenous ideas about eco-cultural restoration as well as a chapter that explores the loss of eco-cultural practices and landscapes in England (i.e., cultural severance), and testimonies from four eco-artists about their work in public restoration projects in the United States and China. The other themed section looks at the role education, at all levels, can play in rounding out the complete restoration experience, both in terms of gaining technical and people skills and as an avenue for personal and community development (i.e., developing a sense of place). The case studies in this section provide a look at education efforts at the following education levels: elementary/high school, college/university, and continuing. These are real-world efforts that have already begun to bear fruit and show promise for so much more.

***

While this book is divided into various sections according to specific metathemes and thematic areas, there is sufficient interplay between the chapters to recommend that readers experience the whole menu rather than simply devouring their favorite or most well-known entrée.

Conclusion

Living in the world is becoming increasingly complex with every passing day. Environmental problems affect us all. Moreover, many of these problems do not come with easy or quick solutions; they are "wicked" problems (Rittel and Webber 1973; Conklin 2001). Such circumstances require us to move beyond "normal" science to a "postnormal science" approach (Funtowicz and Ravetz 1993) that can operate successfully and adaptively in the high-risk, high-uncertainty situations we often encounter. Moreover, these situations suggest that the pursuit of solutions to problems must be more interdisciplinary and more democratic, and must employ an "extended peer community" to assure that all aspects of the situation (both human and biophysical) are taken into account.

To deal with the situations presented by many ecological restoration projects, we need to integrate humans and nature and reconcile the boundaries between contemporary science and the society it serves (Bradshaw and Bekoff 2000). We must not only hear Aldo Leopold's observation that humans are "plain members and citizens" of the biotic community (Leopold 1949, 204), we must believe and adhere to it. In this book, we give voice to people who have studied the issues and implemented their ideas about how to integrate the human dimension into the practice of ecological restoration. We hope that you will find what they have to say inspiring, provocative, and pragmatic—and that they will give you the knowledge and courage to move forward with your ecological restoration projects.

References

Abram, D. 1996. *The Spell of the Sensuous: Perception and Language in a More-Than-Human World*. New York: Vintage Books.

Adams, C. C. 1913. *Guide to the Study of Animal Ecology*. New York: Macmillan.

———. 1935. "The Relation of General Ecology to Human Ecology." *Ecology* 16 (3): 316–35.

Alcoze, T. 2003. "First Peoples in the Pines." In *Ecological Restoration of Southwestern Ponderosa Pine Forests*, edited by P. Friederici, 48–57. Ecological Restoration Institute. Washington, DC: Island Press.

Alcoze, T., and M. Hurteau. 2001. "Implementing the Archaeo-environmental Reconstruction Technique: Rediscovering the Historic Ground Layer of Three Plant Communities in the Greater Grand Canyon Region." In *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems*, edited by D. Egan and E. A. Howell, 413–24. Washington, DC: Island Press.

Anderson, M. K. 2001. "The Contribution of Ethnobiology to the Reconstruction and Restoration of Historic Ecosystems." In *The Historical Ecology Handbook: A Restorationist's Guide to Historic Ecosytems*, edited by D. Egan and E. A. Howell, 55–72. Washington, DC: Island Press.

———. 2006. *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources*. Berkeley: University of California Press.

Anderson, M. K., and M. G. Barbour. 2003. "Simulated Indigenous Management: A New Model for Ecological Restoration in National Parks." *Ecological Restoration* 21 (4): 269–77.

Anderson, M. K., and T. C. Blackburn, eds. 1993. *Before the Wilderness: Environmental Management by Native Californians*. Menlo Park, CA: Ballena Press.

Aronson, J., S. Milton, and J. Blignaut. 2006. "Conceiving the Science, Business, and Practice of Restoring Natural Capital." *Ecological Restoration* 24 (1): 22–24.

Aronson, J., J. Blignaut, P. H. Raven, and S. Milton. 2007. *Restoring Natural Capital: Science, Business, and Practice*. Washington, DC: Island Press.

Bechtel, R., and A. Churchman. 2002. *The Handbook of Environmental Psychology*. New York: Wiley.

Berger, J. 1985. *Restoring the Earth: How Americans Are Working to Repair Our Damaged Environment*. New York: Knopf.

Berkes, F., and C. Folke. 1998. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge: Cambridge University Press.

Bradshaw, G. A., and M. Bekoff. 2000. "Integrating Humans and Nature: Reconciling the Boundaries of Science and Society." *TREE* 15 (8): 309–10.

Brick, P., D. Snow, and S. Van de Wetering. 2000. *Across the Great Divide: Explorations in Collaborative Conservation and the American West*. Washington, DC: Island Press.

Bright, A. D., S. C. Barro, and R. T. Burtz. 2002. "Public Attitudes toward Ecological Restoration in the Chicago Metropolitan Region." *Society and Natural Resources* 15: 761–85.

Clements, F. E., and V. E. Shelford. 1939. *Bio-Ecology*. New York: John Wiley and Sons.

Clewell, A. F., and J. Aronson. 2006. "Motivations for the Restoration of Ecosystems." *Conservation Biology* 20 (2): 420–28.

Conklin, J. 2001. "Wicked Problems and Social Complexity." CogNexus Institute. http://cognexus.org/wpf/wickedproblems.pdf.

Costanza, R., and H. E. Daly. 1992. "Natural Capital and Sustainable Development." *Conservation Biology* 6 (1): 37–46.

Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Sutton, and M. van den Belt. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature* 387: 253–60.

Cronon, W. 1983. *Changes in the Land: Indians, Colonists, and the Ecology of New England*. New York: Hill & Wang.

———. 1991. *Nature's Metropolis: Chicago and the Great West*. New York: W. W. Norton.

———. 1996. *Uncommon Ground: Rethinking the Human Place in Nature*. New York: W. W. Norton.

Crumley, C., ed. 1994. *Historical Ecology: Cultural Knowledge and Changing Landscapes*. Sante Fe, NM: SAR Press.

Crumley, C., and W. H. Marquardt, eds. 1987. *Regional Dynamics: Burgundian Landscapes in Historical Perspective*. San Diego: Academic Press.

Daily, G., ed. 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington, DC: Island Press.

de Laplante, K. 2005. "Is Ecosystem Management a Postmodern Science?" In *Ecological Paradigms Lost: Routes of Theory Change*, edited by K. Cuddington and B. E. Beisner, 397–419. Amsterdam: Elsevier Academic Press.

Dunlap, R. E., ed. 1980a. "Ecology and the Social Sciences: An Emerging Paradigm." Special issue, *American Behavioral Scientist* 24 (1).

———. 1980b. "Paradigmatic Change in Social Science: From Human Exemptions to an Ecological Paradigm." *American Behavioral Scientist* 24 (1): 5–14.

Dunlap, R. E., and W. R. Catton. 1994. "Struggling with Human Exemptionism: The Rise, Decline, and Revitalization of Environmental Sociology." *American Sociologist* 25 (1): 5–30.

Egan, D. 1990. "Historic Initiatives in Ecological Restoration." *Restoration and Management Notes* 8 (2): 83–90.

———. 2006. "Authentic Ecological Restoration." *Ecological Restoration* 24 (4): 223–24.

Egan, D., and M. K. Anderson, eds. 2003. "Native American Land Management Practices in National Parks." *Ecological Restoration* 21 (4): 245–310.

Egan, D., and E. A. Howell, eds. 2001. *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems*. Washington, DC: Island Press.

Folke, C., ed. 2004. "Traditional Ecological Knowledge in Socio-ecological Systems." *Ecology and Society*. http://www.ecologyandsociety.org/viewissue.php?sf=13.

Folke, C. 2006. "Resilience: The Emergence of a Perspective for Social–Ecological Systems Analyses." *Global Environmental Change* 16: 253–67.

Ford, J., and D. Martinez. 2000. Special section: "Traditional Ecological Knowledge, Ecosystem Science, and Environmental Management." *Ecological Applications* 10 (5): 1249–1340. http://www.esajournals.org/perlserv/?request=get-toc&issn=1051-0761&volume=10&issue=5.

Foster, D. R., and J. Abers, eds. 2004. *Forest in Time: Ecosystem Structure and Function as a Consequence of 1000 Years of Change*. New Haven, CT: Yale University Press.

Foster, D. R., and J. O'Keefe. 2000. *New England Forests through Time*. Cambridge, MA: Harvard University Press.

Friederici, P. 2006. *Nature's Restoration: People and Places on the Front Lines of Conservation*. Washington, DC: Island Press.

Funtowicz, S. O., and J. R. Ravetz. 1993. "Science for the Post-normal Age." *Futures* (Sept.): 739–55.

Glacken, C. J. 1967. *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century*. Berkeley: University of California Press.

Gobster, P. H., and R. B. Hull, eds. 2000. *Restoring Nature: Perspectives from the Social Sciences and Humanities*. Washington, DC: Island Press.

Golley, F. B. 1993. *A History of the Ecosystem Concept in Ecology: More than the Sum of the Parts*. New Haven, CT: Yale University Press.

Grese, R. 1992. *Jens Jensen: Maker of Natural Parks and Gardens*. Baltimore: Johns Hopkins University Press.

Gross, M. 2003. *Inventing Nature: Ecological Restoration by Public Experiments*. Lanham, MD: Lexington Books.

———. 2006. "Beyond Expertise: Ecological Science and the Making of Socially Robust Restoration Strategies." *Journal for Nature Conservation* 14 (3–4): 172–79.

Gunderson, L. H., and C. S. Holling. 2002. *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington, DC: Island Press.

Haila, Y. 2000. Beyond the Nature-Culture Dualism. *Biology & Philosophy* 15 (2): 155–75.

Hall, M. 1997. "Co-workers with Nature: The Deeper Roots of Restoration." *Ecological Restoration* 15 (2): 173–78.

———. 2005. *Earth Repair: A Transatlantic History of Environmental Restoration*. Charlottesville: University of Virginia Press.

Higgs, E. 2003. *Nature by Design*. Cambridge, MA: MIT Press.

Holland, J. 1995. *Hidden Order: How Adaptation Builds Complexity*. Reading, MA: Addison-Wesley.

Hollingshead, A. B. 1940. "Human Ecology and Human Society." *Ecological Monographs* 10 (3): 354–66.

House, F. 2000. *Totem Salmon: Life Lessons from Another Species*. Boston: Beacon.

Howard, G. 1997. *Ecological Psychology: Creating a More Earth-Friendly Human Nature*. South Bend, IN: University of Notre Dame Press.

Hull, R. B., and D. P. Robertson. 2000. "Which Nature? A Conclusion." In *Restoring Nature: Perspectives from the Social Sciences and Humanities*, edited by P. H. Gobster and R. B. Hull, 299–307. Washington, DC: Island Press.

Ignatieva, M. 2005. "Music for the Eyes: The Historical Restoration of the White Birch Area of Pavlovsky Park." *Ecological Restoration* 23 (2): 83–88.

Jordan III, W. R. 2003. *The Sunflower Forest: Ecological Restoration and the New Communion with Nature*. Berkeley: University of California Press.

Kahn Jr., P. H., and S. Kellert, eds. 2002. *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*. Cambridge, MA: MIT Press.

Kaplan, R., and S. Kaplan. 1989. *The Experience of Nature: A Psychological Perspective*. New York: Cambridge University Press.

Kaplan, R., S. Kaplan, and S. Ryan. 1998. *With People in Mind: Design and Management of Everyday Nature*. Washington, DC: Island Press.

Katz, E. 1996. *Nature as Subject*. Lanham, MD: Rowman and Littlefield.

Kennedy, J. J., and J. W. Thomas. 1995. "Managing Natural Resources as Social Value." In *A New Century for Natural Resources Management*, edited by Richard L. Knight and Sarah F. Bates, 311–22. Washington, DC: Island Press.

Kimmerer, R. W. 1998. "Intellectual Diversity: Bringing the Native Perspective into Natural Resources Education." *Winds of Change* 13 (3): 14–20.

———. 2000. "Native Knowledge for Native Ecosystems." *Journal of Forestry* 98 (8): 4–9.

———. 2002. "Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action." *Bioscience* 52 (5): 432–38.

Kimmerer, R. W., and F. K. Lake. 2001. "Maintaining the Mosaic: The Role of Indigenous Burning in Land Management." *Journal of Forestry* 99: 36–41.

Kormondy, E. J. 1974. "Natural and Human Ecosystems." In *Human Ecology*, edited by F. Sargent II, 27–43. Amsterdam: North-Holland Publishing.

Lavendel, B. 1999. "Ecological Restoration in Academia." *Ecological Restoration* 17 (3): 120–25.

Lewis, P. H., Jr. 1996. *Tomorrow by Design: A Regional Design Process for Sustainability*. New York: Wiley.

Light, A. 2005. "Ecological Citizenship: The Democratic Promise of Restoration." In *The Human Metropolis: People and Nature in the 21st Century City*, edited by R. Platt, 169–81. Amherst: University of Massachusetts Press.

Light, A., and R. Holmes III, eds. 2002. *Environmental Ethics: An Anthology*. Cambridge, MA: Blackwell.

Lindeman, R. L. 1942. "The Trophic-Dynamic Aspect of Ecology." *Ecology* 23: 399–418.

Louv, R. 2005. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*. Chapel Hill, NC: Algonquin Books.

Martinez, D. 1998. "First People, Firsthand Knowledge." Indigenous Peoples Restoration Network website, www.ser.org/iprn/pdf/First_People_-_First_Hand_Knowledge.pdf.

———. 2003. "Protected Areas, Indigenous Peoples, and the Western Idea of Nature." *Ecological Restoration* 21 (4): 247–50.

Matsui, T. 1996. "Meiji Shrine: An Early Old-Growth Forest Creation in Tokyo." *Ecological Restoration* 14 (1): 46–52.

McDonnell, M. J., and S. T. A. Pickett. 1993. *Humans as Components of Ecosystems: The Ecology of Subtle Effects and Populated Areas*. New York: Springer-Verlag.

McHarg, I. L. 1969. *Design with Nature*. Garden City, NJ: Natural History Press.

McIntosh, R. P. 1986. *The Background of Ecology: Concept and Theory*. Cambridge: Cambridge University Press.

Mills, S. 1995. *In Service of the Wild: Restoring and Reinhabiting Damaged Land*. Boston: Beacon Press.

Morford, S., and J. James, eds. 2002. *Incorporating the Human Dimension: The Role of Social Science in Natural Resource Management in British Columbia*. Forrex Series 5. http://www.forrex.org/publications/FORREXSeries/FS5.pdf.

Nabhan, G. P., and S. Trimble. 1994. *The Geography of Childhood: Why Children Need Wild Places*. Boston: Beacon Press.

Odum, E. P. 1969. "The Strategy of Ecosystem Development." *Science* 164 (3877): 262–70.

———. 1986. "Introductory Review: Perspectives of Ecosystem Theory." In *Ecosystem Theory and Application*, edited by N. Polunin. Sussex, England: Wiley.

Orr, D. 1992. *Ecological Literacy: Education and the Transition to a Postmodern World*. Albany: State University of New York Press.

Palamar, C. 2004. "Festival Fire." *Ecological Restoration* 22 (1): 39–44.

Palmer, M. A., D. A. Falk, and J. B. Zeder. 2006. "Ecological Theory and Restoration Ecology." In *Foundations of Restoration Ecology*, edited by D. A. Falk, M. A. Palmer, and J. B. Zedler, 1–10. Washington, DC: Island Press.

Rittel, H., and M. Webber. 1973. "Dilemmas in a General Theory of Planning." *Policy Sciences* 4: 155–69.

Roszak, T., M. E. Gomes, and A. D. Kanner, eds. 1995. *Ecopsychology: Restoring the Earth Healing the Mind*. San Francisco: Sierra Club Books.

Sargent II, F., ed. 1974. *Human Ecology*. New York: American Elsevier.

Senos, R., F. K. Lake, N. J. Turner, and D. Martinez. 2006. "Traditional Ecological Knowledge and Restoration Practice." In *Restoration of the Pacific Northwest: The Art and Practice of Ecological Restoration in Cascadia*, edited by D. Apostol and M. Sinclair, 393–426. Washington, DC: Island Press.

Shindler, B. A., J. Wilton, and A. Wright. 2002. *A Social Assessment of Ecosystem Health: Public Perspectives on Pacific Northwest Forests*. Corvallis: Dept. of Forest Resources, Oregon State University.

Stevens, M. 1996. "SER-'95: Indigenous Peoples Program." *Ecological Restoration* 14 (1): 35–40.

Stevens, W. K. 1995. *Miracle under the Oaks: The Revival of Nature in America*. New York: Pocket Books, Division of Simon & Schuster.

Tansley, A. G. 1935. "The Use and Abuse of Vegetational Concepts and Terms." *Ecology* 16: 284–307.

Thomas, W. L., Jr. ed. 1955. *Man's Role in Changing the Face of the Earth*. Chicago: University of Chicago Press.

Throop, W. 2000. *Environmental Restoration*. Amherst, NY: Humanity Books.

Turner, N. J. 1995. *Food Plants of the Coastal First Peoples of British Columbia*. Vancouver: University of British Columbia.

———. 2005. *The Earth's Blanket: Traditional Teachings for Sustainable Living*. Vancouver and Toronto, Canada: Douglas & McIntyre.

Turner, N. J., and D. Deur. 2005. *Keeping It Living: Traditions of Plant Use and Cultivation on the Northwest Coast of North America*. Seattle: University of Washington Press.

White, L. 1967. "The Historical Roots of Our Ecological Crisis." *Science* 155 (3767): 1203–07.

White, P. S., and J. L. Walker. 1997. "Approximating Nature's Variation: Selecting and Using Reference Sites and Reference Information in Restoration Ecology." *Restoration Ecology* 5: 338–49.

Whited, T. L. 1996. "Alpine Myths and Metaphors: The Debate over Restoration in Nineteenth-Century France." *Restoration & Management Notes* 14 (1): 53–56.

Woddolleck, J., and S. Yaffee. 2000. *Making Collaboration Work: Lessons from Innovation in Natural Resource Management*. Washington, DC: Island Press.

PART I

Participation: Volunteers

Why do people engage in ecological restoration? Is it, as Bill Jordan suggests, to overcome the shameful and destructive past actions of society; actions that continue to be reflected in postmodern industrialization? Or is it a land ethic or a sense of civic pride instilled in some people? Whatever the motive, ecological restoration depends on volunteer efforts and community involvement at every step of planning, implementation, and management. And, as restoration plays a greater role in conservation efforts, volunteers will fill even more important roles as organizers, designers, workforce, and monitors. How to make that experience a meaningful one, from both a personal and an organizational perspective, can be found in the chapters that make up this section of the participation metatheme.

Marty Lee and Paul Hancock begin the volunteer section by presenting an introductory chapter that analyzes the attributes of successful restoration and stewardship volunteer groups, including an examination of indicators that predict an individual's willingness to volunteer. Following this framework, case studies are presented describing how communities and organizations engage volunteers in restoration projects. Kellie Westervelt describes the Cape Florida Project and illustrates how volunteer recruitment can raise the level of restoration performance, increase awareness, generate financial support, and create long-term land stewardship ethics. In the next case study, Matthew Fox discusses methods for encouraging effective volunteer contributions in a time of increasingly complex land management. He details experiences from a western Australian restoration organization and provides measurable outputs resulting from volunteer efforts. In the last case study, Allegra Newman examines the ethical assumptions and terms of participation that underlie restoration processes. Focusing on urban ecological restoration in Toronto, Newman explores issues of access, equity, and diversity in urban restoration projects. Her findings speak to the tension that exists between those in power and those seeking to participate.

Chapter 2

Restoration and Stewardship Volunteerism

Marty Lee and Paul Hancock

Recent scholars writing on the topic of ecological restoration propose a holistic view of ecosystem restoration wherein both ecosystem needs and human needs must be considered in the design and implementation of restoration projects. Such a view suggests that both ecosystems and restoration practitioners benefit from restoration projects (Higgs 2003; Clewell and Aronson 2006, 2007; Light 2008). Within this reciprocal relationship, humans contribute ecological knowledge, techniques, participation, and commitment that benefit degraded ecosystems (see chap. 18, this volume). Conversely, involvement in restoration projects contributes to human well-being in a variety of ways including restoring ecosystem values, such as biodiversity and natural capital. Such actions also provide participants with psychological, physiological, economic and spiritual benefits, including learning new things, connecting with the natural environment, earning a living, doing something worthwhile, making amends for human-caused environmental damage, and realizing personally renewing experiences (Miles, Sullivan, and Kuo 2000; Clewell and Aronson 2006; chap. 16, this volume). Geist and Galatowitsch (1999) among others suggest that, while critical to successful ecological restoration, scientific knowledge alone cannot ensure success. Ongoing human participation and commitment are critical to ensuring the long-term success and sustainability of restoration projects.

Humans play various roles in ecological restoration projects: sponsors, administrators, decision makers, and practitioners—those who supervise and carry out projects in the field. This chapter focuses on a specific group of practitioners—volunteers—those people who give their time on a voluntary basis with the common purpose of preserving, protecting, and restoring nature.

Volunteers contribute thousands of hours and perform a variety of restoration functions, including education, research, fund raising, and physical labor (e.g., gathering seeds, planting trees, removing exotic plant species, and ecosystem monitoring). Land managers, researchers, and others engaged in ecological restoration are increasingly relying on the efforts of volunteers, many of whom belong to organized groups.

We refer to these organized groups of volunteers as volunteer stewardship groups,

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_2,

and they include those groups who participate in ecological restoration. Such volunteers can be considered stewards of the land, particularly when viewed from a holistic, reciprocal view of ecological restoration. Our discussion of volunteers, however, includes more than simply those who work on ecological restoration projects. In order to make use of the rich and relevant literature about volunteering, we looked more broadly at volunteers engaged in a variety of environmental stewardship projects. However, our findings translate directly to ecological restoration volunteers.

Stewardship is defined as "the careful and responsible management of our natural resources" (Merriam-Webster 1998). It is associated with a land ethic (Curtis and DeLacy 1998) that, as eloquently described by Aldo Leopold (1949), "changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect" (204). Stewardship is more than the careful and responsible management of our natural resources, it involves respect, preservation, and actions toward the betterment of our natural resources regardless of personal economic gain. The most common motivation identified for individuals involved in volunteer stewardship groups, including those involved in ecological restoration, is a desire to protect and preserve the natural environment they appreciate and care about (Donald 1997; Christie 2004; Clewell and Aronson 2006; chap. 18, this volume).

Ecological restoration can be a vehicle for building and maintaining a sense of stewardship or caring between people and the environment around them. It provides opportunities for people to connect with nature, be more involved in the environment, and, ultimately, come to respect and care about the land (Higgs 2003; Light 2008). Restoration can "serve as a kind of schoolhouse for environmental responsibility" (Light 2008, 101). This sense of responsibility and stewardship toward natural systems cultivated through participation in restoration activities can result in the creation of a committed constituency of land stewards, a constituency for conservation of natural areas (Jordan 2003; Light 2008).

This chapter presents a conceptual framework that details the components necessary for success when volunteer stewardship groups are involved in restoration projects, as well as a research example.

Conceptual Framework for Restoration and Stewardship Volunteerism

The conceptual framework for gauging the success of volunteer stewardship groups considers both the characteristics of the volunteer organization and those of the individual volunteers that contribute to success. This framework, shown in figure 2.1, is based on the literature about human motivation theory, successful nonprofit organizations, and studies of volunteers involved in ecological restoration, conservation, and environmental stewardship projects. We also conducted a survey of volunteer group leaders and land managers in order to investigate components of the conceptual framework. The results of the survey and their contribution to our proposed framework are provided at the end of this chapter.

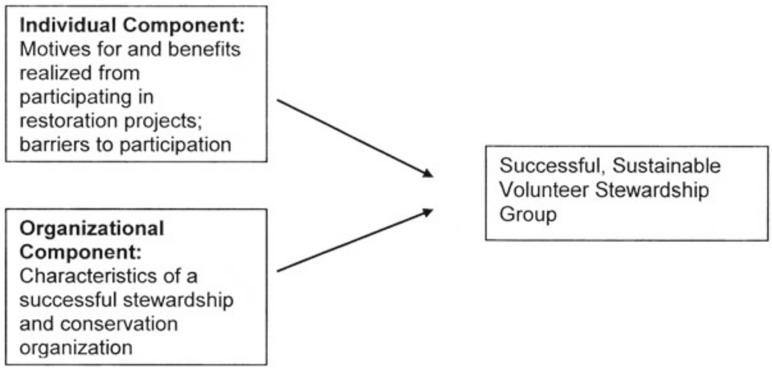

FIGURE 2.1. Components of a successful volunteer stewardship group.

Individual Volunteer Component

Interested and motivated individuals are the first component to the success of volunteer stewardship groups. Simply stated, volunteers are individuals who take part in an activity that is not required of them and for which they will not be paid (Brown 2000). Given this type of relationship, a good volunteer coordinator should recognize and understand the volunteers' motives for participating in restoration and other stewardship projects, what it takes to recruit new volunteers, and, perhaps more important, the keys for sustaining volunteer satisfaction and participation for the duration of the restoration project (Geist and Galatowitsch 1999; Ryan, Kaplan, and Grese 2001).

Motives and Benefits

Volunteer stewardship groups are composed of people with a common vision and common motives for joining and participating in volunteer stewardship programs, including ecological restoration. The most common motive is a desire, even a sense of responsibility, to heal, protect, and preserve the natural environment (Donald 1997; Schroeder 2000; Ryan, Kaplan, and Grese 2001; Christie 2004). Volunteering in restoration projects is a way for people to reconnect with nature, to "share a bond of kinship with their landscape" (Clewell and Aronson 2007). Other motives include a desire to learn new things and learn about nature (Schroeder 2000; Ryan, Kaplan, and Grese 2001; Gooch 2004), a desire for social interaction (Donald 1997; Schroeder 2000; Ryan, Kaplan, and Grese 2001), and a desire to realize personal benefits such as spiritual renewal, happiness, peace of mind, and feeling connected to the land (Clary and Snyder 1999; Grese et al. 2000; Schroeder 2000; Clewell and Aronson 2007). Collective or shared motives within a community or culture may also draw volunteers to participate in restoration projects (Clewell and Aronson 2007). For example, people may have the desire to restore a local community park or preserve used for recreation, or places with sacred or religious value—places where local residents feel a shared sense of place or attachment to a landscape.

Andrew Light (2002), a prominent environmental philosopher, argues that helping the environment, interacting with nature, learning about natural processes, feeling connected to the land, and other similar benefits realized by participants in restoration projects strengthen environmental and stewardship values among participants, making possible "stronger and better relationships of stewardship or care between human communities and the nature around them" (154). He maintains that, for this reason, public participation in restoration projects, where appropriate, is equally important to the success of a restoration project as restoring natural processes and should be considered one of the criteria for evaluating a project's success. He argues that participation in restoration is "as much about restoring the human relationship with nature as it is about restoring natural processes themselves" (155).

The benefits and satisfaction that volunteers gain from participating in something meaningful is also a significant factor in retaining volunteers and sustaining their long-term involvement in restoration projects (Donald 1997; Miles, Sullivan, and Kuo 2000; Ryan, Kaplan, and Grese 2001). It is important to nurture volunteers long term by understanding their motives and recognizing that their motives can change with time. Volunteers may initially join for altruistic reasons, but with ongoing participation, other benefits such as social interaction, becoming more attached to an area, and increased knowledge may become more important (Ryan, Kaplan, and Grese 2001). Another important contributor to long-term involvement is the need for volunteers to see that their efforts accomplish something tangible and positive (Donald 1997; Miles, Sullivan, and Kuo 2000). Volunteers are not "free labor, but individuals who will keep coming if their needs are fulfilled" (Ryan, Kaplan, and Grese 2001, 645).

Barriers and Constraints

Just as understanding and nurturing the motives and desires of volunteers can lead to successful recruitment and retention of volunteers, ignoring them can inhibit such efforts. Christie (2004) found that volunteers would commonly discontinue participation due to a perceived lack of tangible results, unrealistic expectations, a lack of guidance, and frustration with supervisors. Other barriers and constraints can affect an individual's willingness and ability to volunteer. The primary constraints to participation in voluntary activities are typically time, work commitments, and money (Scott 1994). In a study of volunteers in an environmental stewardship group, Donald (1997) found time commitments related to work, family or personal matters, and involvement in other volunteer activities were significant constraints to becoming more active volunteers.

Model of a Successful Stewardship Group

Since all of these motives, benefits, barriers, and constraints need to be kept in mind, having a useful theoretical framework for understanding and predicting willingness to participate in volunteer stewardship activities would be a powerful tool for a volunteer coordinator. The theory of reasoned action, developed by Fishbein and Ajzen in 1975 (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980), provides a useful approach to better understand the psychology of a restoration volunteer.

According to Fishbein and Ajzen (1975), the best predictor of behavior is the intention to engage in the behavior, which is a function of a person's attitudes and subjective norms (fig. 2.2). Attitudes are an individual's beliefs or positive or negative feelings about performing the behavior (Fishbein and Ajzen 1975). Subjective norms are a person's belief about whether significant others feel the individual should perform the behavior (Hale, Householder, and Greene 2003). Together, attitudes and subjective norms should explain most, if not all, of the variance in behavioral intention (Gill, Crosby, and Taylor 1986; Corraliza and Berenguer 2000; Trumbo and O'Keefe 2005). Values and beliefs are essentially synonymous in that values are the most central component of a person's belief system (Vaske and Donnelly 1999).

Values are stable beliefs that individuals use as standards to evaluate attitudes and behaviors. They are few in number, transcend specific situations and experiences, and are generally poor predictors of specific attitudes and behaviors (Vaske and Donnelly 1999; McFarlane and Boxall 2003). Basic values indirectly influence behavior through patterns of general beliefs or value orientations that, in turn, influence specific attitudes and subsequently behavior (McFarlane and Boxall 2003; Manfredo et al. 2004; Whittaker, Vaske, and Manfredo 2006). Examples of value orientations used to assess the values humans have about nature and the environment include Kellert's (1996) nine value orientations, a wildlife value orientation that includes a "protection–use" continuum (Fulton, Manfredo, and Lipscomb 1996; Bright, Manfredo, and Fulton 2000; Whittaker, Vaske, and Manfredo 2006), the biocentric–anthropocentric value orientation continuum (Shindler, List, and Steel 1993; Vaske and Donnelly

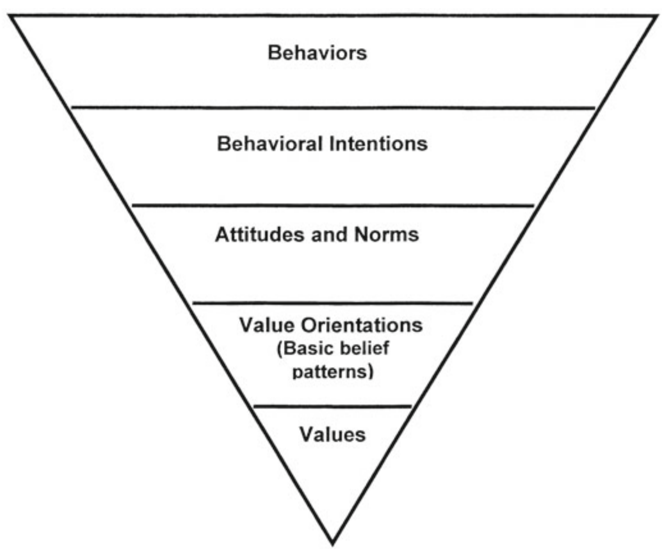

Figure 2.2. The value-attitude-behavior model (adapted from Vaske and Donnelly 1999).

1999; Vaske et al. 2001), and the "new environmental paradigm" (Van Liere and Dunlap 1980).

Behavior is the product of an opportunity and intent where intent is motivated by social norms, one's attitudes, and one's values (Monroe 2003; Gotch and Hall 2004; Huang and Yore 2004). To illustrate the relationship between these variables of the theory of reasoned action, consider a simple fictional example about an older woman participating in an ecological restoration project. She has a basic set of beliefs and values concerning the natural environment. Given her beliefs and values regarding nature, she forms an attitude toward environmentally related activities, specifically toward restoring damaged ecosystems. Her attitude toward restoring damaged ecosystems influences her intention to participate in an ecosystem restoration project. Additionally, her intention to participate in an ecosystem restoration project is also influenced by how her family and friends feel about her participation in such a project (i.e., subjective norms). Taken together, her beliefs, attitude, subjective norms, and behavioral intentions can be used by a volunteer coordinator to predict whether this woman will participate in an ecosystem restoration project or explain why she may not.

The theory of reasoned action does not include separate variables for ability to perform a behavior and does not account for situational deterrents to behavior. For example, individuals' feelings about their ecosystem restoration skills and abilities could influence their intention to participate in an ecosystem restoration project. Additionally, a situation could arise (scheduling conflicts, etc.) that would intervene between a person's intention to participate and the person's actually participating in an ecological restoration project. Another theoretical model was adapted to include these additional variables: the theory of planned behavior (Ajzen 1991).

With few exceptions (Fulton, Manfredo, and Lipscomb 1996), research has supported the relationship between values, attitudes, and behavior (Vaske and Donnelly 1999). The theory of reasoned action has been used to predict or explain behaviors such as recycling (Boldero 1995; Park, Levine, and Sharkey 1998), water conservation (Kantola, Syme, and Campbell 1982; Trumbo and O'Keefe 2005), energy conservation (Stutzman and Green 1982), participation in agricultural conservation programs (Luzar and Diagne 1999), children's environmental behaviors (Gotch and Hall 2004; Huang and Yore 2004), and environmental communication and education (Monroe 2003; Trumbo and O'Keefe 2005). This model of human behavior is useful for understanding the underlying beliefs, attitudes, and behavior of members of volunteer stewardship groups, including those involved in ecological restoration projects. However, more research in this specific area is warranted.

Organizational Component

A volunteer restoration or stewardship group is more than individual volunteers; it is an organized group with characteristics that contribute to its success and long-term viability. However, the success of a volunteer stewardship group requires more than simply bringing together a group of individuals who share a common vision. Here we define a successful volunteer stewardship group as a group that demonstrates a high level of achievement in proportion to its vision and mandate, where success is measured internally by the benefits and satisfaction realized by the individuals involved as well as externally by the group's ability to achieve desired goals, gain community support and recognition, complete assigned projects, and remain active and engaged until they are no longer needed (Millar 2003; Clewell and Aronson 2007). Two examples of volunteer restoration groups who have this level of success are the Volunteer Stewardship Network (VSN) in Illinois and the Friends of the Forest, Inc., in Sedona, Arizona. Formed in 1983, the VSN has grown to more than seventy-four volunteer groups who help public and private landowners throughout Illinois maintain and restore more than 350 natural areas. Meanwhile, the Arizona group has about four hundred volunteers who provide physical labor and financial resources to assist the U.S. Forest Service in its day-to-day operations, including protection of a recently restored riparian area. Of course, there are many other successful restoration-oriented volunteer groups in the United States and elsewhere (see chaps. 3 and 4, this volume).

McKinsey (2001) developed a model, the capacity framework, that identifies successful practices and strategies used by nonprofit organizations. In this framework, "capacity" refers to the elements of an organization and the ability of those elements to work together to perform desired functions and services. Based on studies of thirteen nonprofit organizations that included conservation groups and school improvement and health care programs, the capacity framework model describes seven elements of a nonprofit organization essential to its long-term health and effectiveness. The seven elements can be viewed as a hierarchical structure containing the following:

- Three higher-level elements—aspirations (mission, vision, and goals), strategy (actions and programs to achieve the stated goals), and organizational skills (performance measures, planning, external relationship building)
- Three foundational elements—human resources (collective capabilities, experiences, and commitment of managers, staff, and volunteers), systems and infrastructure (planning, decision making, and administrative systems), and organizational structure (governance, organizational design, job descriptions)
- Cultural elements—(shared values and practices, orientation toward performance) that connect all of the components

Millar (2003) expanded the organizational capacity elements included in the capacity framework to develop indicators by which to measure the success of stewardship and conservation organizations, including key values specific to the stewardship and conservation field. Millar (2003) tested the validity of six indicators of success in a survey of six Canadian nonprofit stewardship and conservation organizations that was designed to identify organizational best practices. Two additional indicators of success emerged from the survey. There were eight key indicators of successful stewardship and conservation organizations:

- Vision and values—a clear vision and mission, and goals that are reflected in the organization's activities and values
- Community engagement—communicating with landowners and other constituents, raising public awareness, and adapting conservation priorities accordingly
- Sustainability—demonstrating long-lasting impact by soliciting funds from a variety of sources
- Partnership-building—valuing and nurturing collaboration with a variety of partners
- Leadership and commitment—having diverse boards and effectively recruiting and retaining both staff and volunteers
- Risk management and evaluation: can demonstrate measurable outcomes to their constituents and are able to identify and deal with risk in a strategic way
- Technology—adoption of new technologies to develop systems that support and reflect the organization's mandate
- Diversity—appeal to a broad cross-section of constituents while maintaining a local focus

Millar's (2003) indicators were designed to serve as benchmarks against which stewardship and conservation organizations could measure their success, including those involved in ecological restoration projects. To empirically investigate the theoretical framework proposed, we used the capacity framework and Millar's indicators of success as a basis for surveying volunteer group leaders and land managers. In the following sections we describe the survey and the implications of our findings.

A Survey of Volunteer Group Leaders and Land Managers

Ecological restoration activities are among the many efforts provided by volunteer groups in helping land managers protect and restore ecosystems. Many of these groups work with federal agencies, such as the U.S. Forest Service, National Park Service, and Bureau of Land Management. The liaison between the agency and the volunteer groups is typically a volunteer coordinator who sets priorities, organizes activities, supervises, and even works alongside volunteers.

We surveyed the leaders of volunteer stewardship groups and the land management personnel who coordinate volunteers to (1) identify the characteristics that they felt contribute to the success of a volunteer stewardship group based on the indicators of a successful organization as already described, (2) explore the relationship between volunteer stewardship groups and the land management agency, and (3) examine the differences in the perceptions of volunteer stewardship group leaders and land management personnel as to what makes a volunteer stewardship group successful.

Our sample of volunteer stewardship groups was limited to those with available websites and, for budget reasons, to groups in Arizona, New Mexico, California, Oregon, and Washington. With those constraints, we conducted a detailed Internet search and all groups whose mission statement and overall organizational purpose matched the definition of a volunteer stewardship group were included in the sample.

Our initial sample included fifty-one volunteer stewardship groups and the names of the primary land management employee working with each group. Several groups worked with the same land management agency office, which meant that we contacted thirty-nine land management personnel. Mail-back questionnaires were sent to the volunteer group leader and the land management agency employee associated with each group.

We used standard survey research methods to develop and administer the questionnaires and to encourage participation (Salant and Dillman 1994). We sent a pre-mailing e-mail, and then a mailed questionnaire packet that included an instruction letter, the questionnaire, and a postage-paid return envelope. We sent two follow-up reminder mailings. The questionnaires included both open- and closed-ended questions. A definition of a volunteer stewardship group was provided as well as the following definition of a successful volunteer stewardship group:

> Successful volunteer stewardship groups demonstrate a high level of achievement proportionate to their vision and mandate, which is measurable internally by the satisfaction of those involved as well as externally by the level of community support and public recognition (Millar 2003).

Two open-ended questions asked volunteer group leaders and agency personnel to tell us to list the key characteristics that make a volunteer group successful and those that would contribute to a lack of success. Responses to the questions were content analyzed, and each response was placed into one of seven categories of the McKinsey (2001) capacity framework model of the elements of a nonprofit organization described earlier.

Each response was evaluated using the category definitions. We gave each category an importance rating according to the number of responses it received. The questions designed to address the relationship between volunteer stewardship groups and land management agencies focused on three key mediating variables of a successful relationship: (1) communicative interaction, (2) commitment, and (3) trust. Respondents were asked to rate each of the following statements as to its importance to the success of a volunteer stewardship group using a 5-point Likert scale of –2 through 2, where –2 was "very unimportant" and 2 was "very important":

- The relationship between the agency and volunteer group members
- Perceived trust between the agency and volunteer group members
- Formal communication (e.g., use of professional letterheads, business attire for meetings) between the agency and volunteer group members
- Consistent communication between the agency and volunteer group members
- Opportunities for social interaction between the agency and volunteer group members
- Information sharing between the agency and volunteer group members

- Resource sharing (i.e., equipment, training) between the agency and volunteer group members
- Equally shared decision making between the agency and the volunteer group regarding the projects and goals to be accomplished by the volunteer stewardship group
- Feedback provided to group members on their accomplishments
- Commitment by the agency to work with a volunteer stewardship group

Responses were summarized as an average importance rating for land management personnel and volunteer group leaders. Differences in responses between the two groups were tested using the Mann-Whitney U-Test with a significance level of 0.05.

Survey Results

Twenty-five of the land management personnel (64 percent) responded to the survey and thirty-one of the volunteer stewardship group leaders (61 percent). Of the land management personnel, nineteen respondents worked for a federal agency and six respondents worked for a state agency. The respondents were primarily volunteer coordinators or park rangers, with a few Forest Service district rangers. Their years of experience ranged from three to thirty-nine years, with an average of twelve years of experience. Years of experience among volunteer group leaders ranged from one to nineteen years with an average of five years' experience. Volunteer group leaders were most often presidents or executive directors of their organization.

Volunteer stewardship groups ranged in size from nine to almost 7,900 members (mean = 801 members). On average, they had been formally organized for fiftteen years. Members averaged fifty-one years of age and were generally evenly split between male and female volunteers. Most volunteers were Caucasian, had a college degree, and were employed full time.

Land management personnel and volunteer group leaders generally agreed on the organizational elements that most contribute to the success of a volunteer stewardship group (fig. 2.3). The culture of the organization, including the shared values and work ethic common among members of an organization, was most often mentioned. For example, respondents wrote, "[group members have] the willingness to do volunteer work when called upon" and "[they] work hard for a few hours and then have refreshments." Other elements that contributed to a group's success were organizational skills, strategy, and aspirations as illustrated by comments such as "a feeling of accomplishment," "a willingness to work on projects that are needed rather than 'fun,'" and "a clear vision of the role of the organization." The only statistically significant differences between stewardship group leaders and land management personnel in the elements that contributed to volunteer group success were systems and infrastructure (planning and decision making) ($p = .037$) and organizational structure ($p = .004$).

The comments regarding the characteristics of volunteer stewardship groups that make them unsuccessful had similar results. Strategy and culture received the most

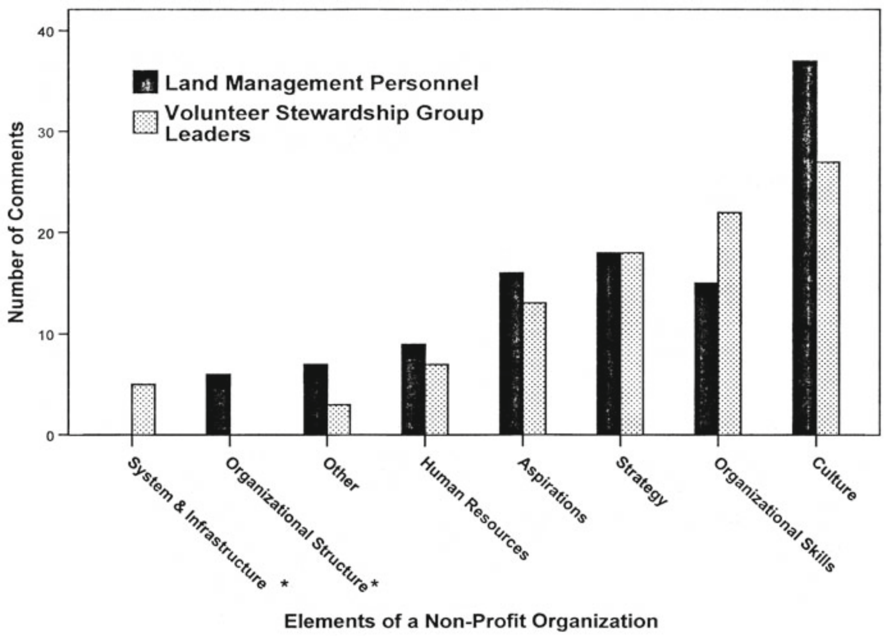

FIGURE 2.3. The number of comments from a survey of volunteer stewardship group leaders and land management personnel as to the characteristics of a successful volunteer stewardship group. *Statistically significant difference in number of responses between land management personnel and volunteer stewardship group leaders.

comments as characteristics that, when lacking, contribute the most to an unsuccessful organization. This was reflected in comments, such as "lack of communal planning/engagement with volunteers," "unrealistic goals," and "meaningless projects." No significant difference was found in the number of comments provided by land managers and volunteer group leaders as to what makes groups unsuccessful.

The relationship between the land management agency and the volunteer stewardship groups was unanimously regarded as very important (fig. 2.4). All of the relationship variables, except formal communication (e.g., using professional letterhead, wearing business attire), were seen as important attributes contributing to volunteer group success. Trust within the relationship, consistent communication, information sharing, and a commitment to work together were rated as "very important" to group success. Social interaction, shared decisions, resource sharing, and feedback were rated as being "important" to success.

Land management personnel volunteer group leaders differed on the importance of having equally shared decision making about the projects and goals to be accomplished by the volunteer stewardship group (p = .007). Shared decision making is more important to volunteer stewardship group leaders than it is to the land management personnel. Their opinions also differed on how important it is to get feedback from the land management agency regarding the group's accomplishments (p = .044). Providing feedback to volunteer groups was more important to land management personnel than to the volunteer group leaders.

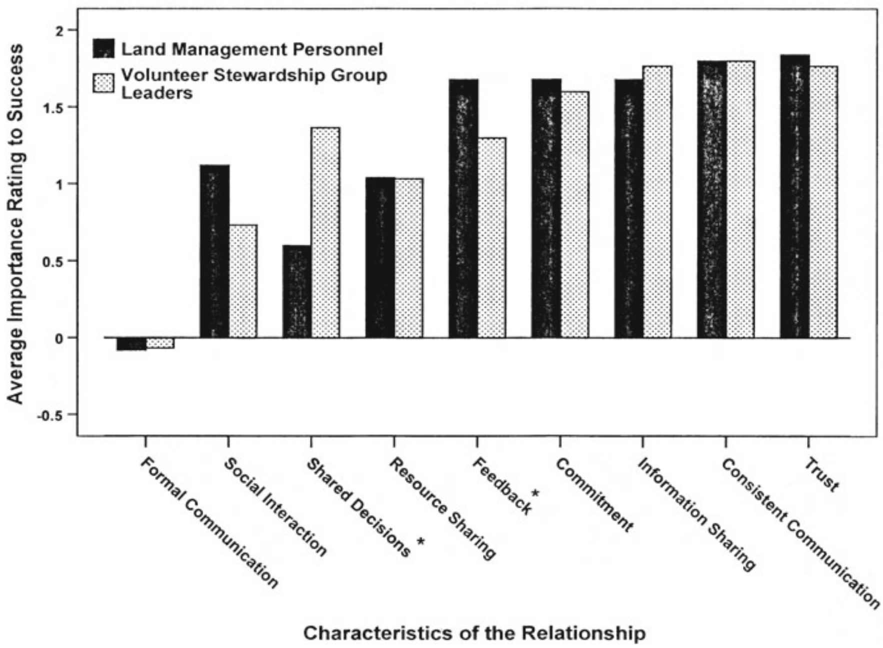

FIGURE 2.4. The average importance rating, ranging from -2 to 2 with -2 being very unimportant and 2 being very important, for each of the characteristics of the relationship between the land management agency and the group. *Statistically significant difference in number of responses between land management personnel and volunteer stewardship group leaders for a category.

Given the relatively small sample size, our results are only directly applicable to the groups sampled. However, we feel they are likely indicative of the characteristics of other similar volunteer stewardship groups and the agencies with which they work.

Conclusion

A holistic view of ecological restoration considers the benefits to ecosystems as well as those realized by those who work to restore ecosystems, including the members of organized volunteer stewardship groups who spend literally thousands of hours working to protect and restore natural ecosystems. Accordingly, to gauge the success of volunteer stewardship groups involved in restoration projects, we must consider both the satisfaction and the desires of individual members as well as the characteristics of the organization, as both contribute to the effectiveness and ability of the volunteer stewardship group to achieve its restoration goals. The elements that contribute to the success of a volunteer stewardship organization are the same ones that, when absent, will inhibit the group's success and long-term viability.

As described earlier, individuals gain a number of valuable benefits from volunteering—benefits that are critical for volunteer recruitment and retention:

- Satisfaction gained from helping the environment
- The opportunity to learn

- Socializing and meeting new people
- Gaining increased spirituality and peace
- Self-renewal and a renewed connection to the land and other people

Collectively these benefits shape the all-important shared culture of a volunteer organization.

For agencies, volunteer coordinators, and volunteers, there are a number of essential components of the relationship:

- Consistent communication
- Trust
- A commitment to work together
- Being able to see tangible, positive results of volunteer efforts through the use of field trips, presentations, and other efforts.

It is evident that both the volunteer groups we surveyed and the land managers who work with them have a sense of what it takes to have successful volunteer groups. We found few differences between the two groups as to what is needed to maintain strong relationships and successful volunteer groups. Volunteer groups and land managers share a common desire to care for and sustain the natural resources in their custody. Stewardship is at the heart of both land management and volunteering (Westphal and Childs 1994).

An ecological restoration volunteer organization embodies a community of natural resource stewards, a constituency for conservation of natural landscapes. As ecological restoration efforts expand, their potential to benefit both nature and humans will become even more apparent. In his book *The Sunflower Forest* (2003), the noted proponent of ecological restoration William R. Jordan III predicts that, during the next generation, restoration will emerge as the dominant paradigm for the conservation of natural landscapes, that millions will want to participate, and restoration will become widely valued not only as a mechanism for healing landscapes but for its equally important role in connecting people to nature, providing opportunities for learning about nature and our relationship with it, and building a wide-reaching community of environmental stewards. We hope so!

References

Ajzen, I. 1991. "The Theory of Planned Behavior." *Organizational Behavior and Human Decision Processes* 50: 179–211.

Ajzen, I., and M. Fishbein. 1980. *Understanding Attitudes and Predicting Social Behavior.* Englewood Cliffs, NJ: Prentice-Hall.

Boldero, J. 1995. "The Prediction of Household Recycling of Newspapers: The Role of Attitudes, Intentions, and Situational Factors." *Journal of Applied Social Psychology* 25 (5): 440–62.

Bright, A. D., M. J. Manfredo, and D. C. Fulton. 2000. "Segmenting the Public: An Application of Value Orientations to Wildlife Planning in Colorado." *Wildlife Society Bulletin* 28 (1): 218–26.

Brown, E. 2000. "The Scope of Volunteer Activity and Public Service." *Law and Contemporary Problems* 62 (4): 17–41.

Christie, J. 2004. "Volunteer Attitudes and Motivations: Research Findings and Their Application for Sustainable Community Involvement Programs in Natural Resource Management." In *Conference Proceedings of Effective Sustainability Education: What Works? Why? Where Next? Linking Research and Practice*. Sydney, Australia, February 18–20, 2004, http://www.environment.nsw.gov.au/cee/ConfPoceed.htm.

Clary, E. G., and M. Snyder. 1999. "The Motivations to Volunteer: Theoretical and Practical Considerations." *Current Directions in Psychological Science* 9 (5): 156–59.

Clewell, A. F., and J. Aronson. 2006. "Motivations for the Restoration of Ecosystems." *Conservation Biology* 20 (2): 420–28.

———. 2007. *Ecological Restoration: Principles, Values and Structure of an Emerging Profession*. Washington, DC: Island Press.

Corraliza, J. A., and J. Berenguer. 2000. "Environmental Values, Beliefs, and Actions: A Situational Approach." *Environment and Behavior* 32 (6): 832–48.

Curtis, A., and T. DeLacy. 1998. "Landcare, Stewardship and Sustainable Agriculture in Australia." *Environmental Values* 7: 59–78.

Donald, B. J. 1997. "Fostering Volunteerism in an Environmental Stewardship Group: A Report on the Task Force to Bring Back the Don, Toronto, Canada." *Journal of Environmental Planning and Management* 40 (4): 483–505.

Fishbein, M., and I. Ajzen. 1975. *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Fulton, D. C., M. J. Manfredo, and J. Lipscomb. 1996. "Wildlife Value Orientations: A Conceptual and Measurement Approach." *Human Dimensions of Wildlife* 1: 24–47.

Geist, C., and S. M. Galatowitsch. 1999. "Reciprocal Model for Meeting Ecological and Human Needs in Restoration Projects." *Conservation Biology* 13 (5): 970–79.

Gill, J. D., L. A. Crosby, and J. R. Taylor. 1986. "Ecological Concern, Attitudes, and Social Norms in Voting Behavior." *Public Opinion Quarterly* 50: 537–54.

Gooch, M. 2004. "Volunteering in Catchment Management Groups: Empowering the Volunteer." *Australian Geographer* 35 (2): 193–208.

Gotch, C., and T. Hall. 2004. "Understanding Nature-Related Behaviors among Children through a Theory of Reasoned Action Approach." *Environmental Education Research* 10 (2): 21.

Grese, R. E., R. Kaplan, R. L. Ryan, and J. Buxton. 2000. "Psychological Benefits of Volunteering in Stewardship Programs." In *Restoring Nature: Perspectives from the Social Sciences and Humanities*, edited by P. H. Gobster and R. B. Hull, 265–80. Washington, DC: Island Press.

Hale, J. L., B. J. Householder, and K. L. Greene. 2003. "The Theory of Reasoned Action." In *The Persuasion Handbook: Developments in Theory and Practice*, edited by J. P. Dillard and M. Pfau, 259–86. Thousand Oaks, CA: Sage.

Higgs, E. 2003. *Nature by Design: People, Natural Process, and Ecological Restoration*. Cambridge, MA: MIT Press.

Huang, H-P., and L. P. Yore. 2004. "A Comparative Study of Canadian and Taiwanese Grade 5 Children's Environmental Behaviors, Attitudes, Concerns, Emotional Disposition, and Knowledge." *International Journal of Science and Mathematics Education* 1: 419–48.

Jordan III, W. R. 2003. *The Sunflower Forest: Ecological Restoration and the New Communion with Nature*. Berkeley: University of California Press.

Kantola, S. J., G. J. Syme, and N. A. Campbell. 1982. "The Role of Individual Differences and External Variables in a Test of the Sufficiency of Fishbein's Model to Explain Behavioral Intention to Conserve Water." *Journal of Applied Social Psychology* 12: 70–83.

Kellert, S. R. 1996. *The Value of Life: Biological Diversity and Human Society*. Washington, DC: Island Press.

Leopold, A. 1949. *A Sand County Almanac: And Sketches Here and There*. New York: Oxford University Press.

Light, A. 2002. "Restoring Ecological Citizenship." In *Democracy and the Claims of Nature*, edited by B. A. Minteer and B. P. Taylor, 153–72. Lanham, MD: Rowman and Littlefield.

———. 2008. "Restorative Relationships: From Artifacts to 'Natural' Systems." In *Healing Natures, Repairing Relationships: New Perspectives on Restoring Ecological Species and Consciousness*, edited by R. L. France, 95–115. Sheffield, VT: Green Frigate Books.

Luzar, E. J., and A. Diagne. 1999. "Participation in the Next Generation of Agriculture Conservation Programs: The Role of Environmental Attitudes." *Journal of Socio-Economics* 28 (3): 335–49.

Manfredo, M. J., T. L. Teel, and A. D. Bright. 2004. "Applications of the Concept of Values and Attitudes in Human Dimensions of Natural Resources Research." In *Society and Natural Resources: A Summary of Knowledge*, edited by M. J. Manfredo, J. J. Vaske, B. L. Bruyere, D. R. Field, and P. Brown, 271–82. Jefferson, MO: Modern Litho.

McFarlane, B. L., and P. C. Boxall. 2003. "The Role of Social Psychological and Social Structural Variables in Environmental Activism: An Example of the Forest Sector." *Journal of Environmental Psychology* 23 (2003): 79–87.

McKinsey and Company. 2001. "Effective Capacity Building in Nonprofit Organizations." Unpublished report prepared for Venture Philanthropy Partners, Washington, DC.

Merriam-Webster. 1998. *Merriam-Webster's Collegiate Dictionary*. 10th ed. Springfield, MA: Merriam-Webster.

Miles, I., W. C. Sullivan, and F. E. Kuo. 2000. "Psychological Benefits of Volunteering for Restoration Projects." *Ecological Restoration* 18 (4): 218–27.

Millar, H. 2003. "Successful Stewardship and Conservation Organizations: Case Studies and Best Practices." Unpublished report prepared for the Land Trust Alliance of British Columbia, Salt Spring Island, British Columbia, Canada.

Monroe, M. C. 2003. "Two Avenues for Encouraging Conservation Behaviors." *Human Ecology Review* 10 (2): 113–25.

Park, H. S., T. R. Levine, and W. F. Sharkey. 1998. "The Theory of Reasoned Action and Self-Construals: Understanding Recycling in Hawaii." *Communication Studies* 49 (3): 196–208.

Ryan, R. L., R. Kaplan, and R. E. Grese. 2001. "Predicting Volunteer Commitment in Environmental Stewardship Programmes." *Journal of Environmental Planning and Management* 44 (5): 629–48.

Salant, P., and D. A. Dillman. 1994. *How to Conduct Your Own Survey*. New York: John Wiley and Sons.

Schroeder, H. W. 2000. "The Restoration Experience: Volunteers' Motives, Values, and Concepts of Nature." In *Restoring Nature: Perspectives from the Social Sciences and Humanities*, edited by P. H. Gobster and R. B. Hull, 247–64. Washington, DC: Island Press.

Scott, D. 1994. "The Problematic Nature of Participation in Contract Bridge: A Qualitative Study of Group-Related Constraints." *Leisure Sciences* 13: 321–36.

Shindler, B., P. List, and B. S. Steel. 1993. "Managing Federal Forests: Public Attutides in Oregon and Nationwide." *Journal of Forestry* (July): 36–42.

Stutzman, T. M., and S. B. Green. 1982. "Factors Affecting Energy Consumption: Two Field Tests of the Fishbein-Ajzen Model." *Journal of Social Psychology* 117: 183–201.

Trumbo, C. W., and G. J. O'Keefe. 2005. "Intention to Conserve Water: Environmental Values, Reasoned Action, and Information Effects Across Time." *Society and Natural Resources* 18: 573–85.

Van Liere, K. D., and R. E. Dunlap. 1980. "The Social Basis of Environmental Concern: A Review of Hypotheses, Explanations, and Empirical Evidence." *Public Opinion Quarterly* 44: 181–97.

Vaske, J. J., and M. P. Donnelly. 1999. "A Value-Attitude-Behavior Model Predicting Wildland Preservation Voting Intentions." *Society and Natural Resources* 12: 523–37.

Vaske, J. J., M. P. Donnelly, D. R. Williams, and S. Jonker. 2001. "Demographic Influences on Environmental Value Orientations and Normative Beliefs about National Forest Management." *Society and Natural Resources* 14 (9): 761–76.

Westphal, L., and G. Childs. 1994. "Overcoming Obstacles: Creating Volunteer Partnerships." *Journal of Forestry* 10: 28–32.

Whittaker, D., J. J. Vaske, and M. J. Manfredo. 2006. "Specificity and Cognitive Hierarchy: Value Orientations and the Acceptability of Urban Wildlife Management Actions." *Society and Natural Resources* 19: 515–30.

Chapter 3

From Adversity to Diversity: The Cape Florida Project

Kellie Westervelt

In the early hours of August 24, 1992, Hurricane Andrew swept across the Atlantic Ocean and Biscayne Bay, making landfall in rural Homestead, Florida. The Category 5 hurricane had sustained winds of 165 mph, with gusts reaching more than 200 mph. Considered at the time to be the costliest hurricane in U.S. history, the winds of the storm altered the face of South Florida overnight, scouring the landscape and leaving homes, infrastructure, and livelihoods destroyed in its wake (Landsea et al. 2004).

Hurricane Andrew's impact on South Florida was immediate and traumatic, but in at least one case, it was also beneficial. The eye of the storm passed fourteen miles south of Bill Baggs Cape Florida State Park, leveling its 436-acre Australian pine (*Casuarina equisetifolia*) forest. Although a popular park in the community, Cape Florida was a natural disaster long before Hurricane Andrew. Australian pines and an assortment of other invasive species had overrun the park's natural communities. In one fell swoop, the storm destroyed 98 percent of the park's exotic tree canopy—a task that resource managers had been trying to accomplish for some time (fig. 3.1). Hurricane Andrew set the stage for an ecological restoration project that would engage the community for years to come.

This chapter explores the long-standing relationship between Cape Florida and the greater Miami-Dade community. It discusses the challenges faced in restoration planning, funding, and execution in a highly publicized and politicized process, and reviews the variety of programs used to involve a diverse, multicultural volunteer pool in the restoration project. Finally, it shows the results achieved through community support and perseverance, and the power of connecting people to place.

A History of Community Activism

Cape Florida State Park is located on the tip of Key Biscayne, the southernmost coastal barrier island on the eastern seaboard of the United States. It is surrounded by the Atlantic Ocean to the east and Biscayne Bay to the west. Just seven miles south of downtown Miami, it was a very popular park, known for its historic lighthouse and

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_3, © Island Press 2011

Figure 3.1. In 1992, Hurricane Andrew, a Category 5 hurricane, caused extensive damage at Bill Baggs Cape Florida State Park. Fortunately, the hurricane destroyed a stand of exotic Australian pine (*Casaurina equisetifolia*), providing the opportunity for ecological restoration.

picturesque beach dunes. A favorite destination among tourists and residents, Cape Florida's popularity predated its status as a state park, drawing local residents and passing boaters to its shores even while in private hands.

In the 1950s, when a proposal for a housing development threatened to alter access to Cape Florida, the community rallied around a campaign led by *Miami News* editor Bill Baggs to create a state park. Although Baggs successfully lobbied the state to purchase the site, the years of dredge and fill activities in preparation for the development had provided a foothold for invasive species. By the time the park opened to the public in 1961, it had been overrun by exotics, mostly Australian pines.

Although Cape Florida resembled a moonscape in the wake of Hurricane Andrew, it was viewed by many as an opportunity to restore the park's native plant communities. In the aftermath of the storm, the spirit of community activism that led to the park's creation was harnessed once again to launch a restoration project on a scale unprecedented in the history of Florida state parks.

Restoration Planning, Funding, and Politics

Within days after Hurricane Andrew, the Florida Park Service (FPS) dispatched biologists to Cape Florida to begin the process of gathering baseline data, compiling species lists, and identifying natural communities for restoration. A team of people from within the agency, the county government, and the community were engaged in the planning process. The FPS sought information about subjects ranging from cultural resources and natural history to coastal morphology, soils, and wildlife. Dade Environmental Resource Management, a county agency that ultimately funded and performed the wetland restorations at the park, was involved in the earliest of dialogues, and the University of Miami provided expertise on an array of subjects. The American Littoral Society, a national coastal conservation group, was approached to provide community outreach, coordinate volunteers, and help with private fund-raising for the restoration project.

A 1926 aerial photograph that showed the dune and swale system of the barrier island and a 1938 thesis about the flora of Key Biscayne were among the first documentation used to set restoration parameters (McAllister 1938). Researchers determined that prior to the dredge and fill operations that so altered the site, the subtropical island park had supported six distinct natural communities: beach dune, coastal strand, mesic pine flatwoods, maritime hammock, mangrove forest, and isolated freshwater wetlands, also known as coastal dune lakes. These were identified as restoration targets. The initial group of FPS, county, and American Littoral Society staff working on the project agreed with the findings, and a shared vision for a restored Cape Florida emerged.

The park was closed for nearly a year while debris was removed, the Australian pines were mulched, and plans were drafted. During this time, the FPS lobbied Congress and the state legislature for emergency relief through direct appropriations and applied for substantial government grants. While their Natural and Cultural Resources and Park Planning bureaus continued to work with the local contingency of park staff, community advocates, and county personnel, the Bureau of Design and Construction was charged with oversight of the restoration project due to their experience administering large contracts.

Between 1993 and 1996, roughly $18 million were directed toward Cape Florida's recovery. While a good portion of the funds that poured in from multiple government contracts were used for debris removal, construction and repair, and an on-site native plant nursery, millions of dollars were earmarked for the purchase of large trees. This proved to be problematic due to the limited commercial availability of native species. Complicating matters further, time constraints inherent in government grants made it difficult to arrange growing contracts with native plant providers. Of the hundreds of species listed for Cape Florida's restoration, only sixteen were identified in the contracts and ultimately purchased. As a result, those sixteen species were overplanted, and in some cases, planted outside of their targeted natural communities (Florida Department of Environmental Protection 1994).

The American Littoral Society grew concerned with the lack of restoration specifications and the limitations contracts placed on the project. The society signed on as the nonprofit arm of the restoration effort, but it needed work plans based on restoration objectives to develop programs, generate funding proposals, and deploy volunteer resources. Based on this concern, the American Littoral Society formed a local advocacy group to generate support for ecological restoration, and it partnered with the nonprofit Institute for Regional Conservation to develop restoration guidelines and provide training to staff and volunteers.

The restoration guidelines that the Institute for Regional Conservation developed for the project functioned as a restoration plan. The peer-reviewed guidelines provided the level of detail needed to develop work plans, generate funding proposals, and direct volunteer efforts effectively. It contained sections on the natural and cultural resources of the park, planting specifications by community type, invasive species control, nursery operations, protection and enhancement of rare species, and additional considerations, such as the role of fire in the ecosystem. One of the most useful elements of the guide was a matrix listing plant taxa by community type, layer, density, and appropriate range for seed source. It was the go-to table, not only critical to developing restoration specifications but important as a monitoring and evaluation tool as well (Gann 1995).

The Advocacy Board played a vital role in getting approval for the use of the American Littoral Society's restoration guidelines. The group of community advocates facilitated dialogue between the various FPS departments working on different aspects of the project and provided a vehicle for input into the restoration process. Chaired by a respected local author, members included park biologists, a county naturalist, nonprofit executives, representatives from local conservation groups, county personnel working on mangrove restoration, and the endangered species curator from Fairchild Tropical Gardens. A member of the *Miami Herald*'s editorial board was always invited and frequently sat in on meetings. While some members were skilled in politics and community outreach, a biological review committee was established to provide feedback on the state's management plan for Cape Florida, to evaluate the volunteer restoration guidelines as they were developed, and to provide the scientific expertise to raise the standards of restoration performance. By 1995, the *Cape Florida Project Volunteer Restoration Manual* was completed and program development was well under way.

The *Cape Florida Project Volunteer Restoration Manual* was an astonishing document for its time. In the early 1990s, ecological restoration was still considered highly experimental. The Society for Ecological Restoration (SER), formed in 1988, was a young organization and its *Guidelines for Developing and Managing Ecological Restoration Projects* would not be published for another five years (Clewell, Rieger, and Munro 2000). Gaining acceptance for the guidelines was no small feat, but proved crucial to moving the project forward.

Involving the Community through Program Development

Involving the community in the park's restoration had been identified as a goal of the Cape Florida Project early on. Through local foundation grants, the American Littoral Society hired a project director to oversee nonprofit operations and public outreach. The society also provided start-up funding to the FPS for a restoration ecologist and partial funding for a horticulturalist. The project began with a map of plant communities, an on-site plant nursery, an approved species list, a small restoration staff, and, later, restoration guidelines.

A needs assessment determined that volunteers would primarily focus on invasive plant control, nursery operations, and out-planting native species. An inventory of community resources identified audiences to target for volunteer recruitment, and programs were developed that served as vehicles for involving a broad cross-section of Miami's multicultural community.

Restoration Leadership Program

Restoration Leadership was the first program developed and was central to the success of all that followed. The aim of the program was to develop a core group of committed, highly skilled individuals who could perform at the level of staff and who would lead groups of less experienced, more transient volunteers in restoration activities. As with any volunteer program, ongoing recruitment, nurturing, recognition, and evaluation were crucial to coordinating the program, but it was the extensive training in plant identification and restoration techniques that made for effective restoration work.

Recruitment tools such as news releases and feature articles, posters and brochures, presentations in the community and attendance at volunteer fairs, and postings on the websites of local colleges, universities, civic groups, and volunteer clearinghouses were used continuously. Inquiries were fielded, applications filled out, and orientations scheduled. During orientation, new volunteers learned about the Cape Florida Project, the relevance of the native plant communities being restored to the greater ecosystem, and the types of volunteer tasks available. They were given a handbook that included an overview of the restoration project and its volunteer and educational programs. Park rules and program policies, volunteer job descriptions, and record-keeping forms were also included. After orientation, volunteers were interviewed and placed appropriately within the program according to their interests, skills, and time availability.

Volunteers who could commit less than six hours per month to the project were welcome to participate, either in the nursery or in the field removing invasive species, but the focus was on individuals who were able to commit to weekly or biweekly schedules. For these rare individuals, intensive training was provided that transformed them into restoration leaders. Training was provided by the Institute for Regional Conservation. Volunteers were given a copy of the restoration guidelines and attended workshops. With more than one hundred invasive species and over three hundred native species, some listed as endangered, plant identification was critically important. Exotic control techniques, out-planting methods, and nursery operations were also covered extensively. Once completed, volunteers were able to supervise less skilled volunteers.

Earth Day Every Day

A broad spectrum of the Miami-Dade community participated at Cape Florida through the Earth Day Every Day Program, from local schools, inner-city church groups, and synagogues to Fortune 500 companies. Using the slogan "Every Day is

Earth Day," businesses and civic groups were recruited through direct marketing flyers and articles in newsletters. Referrals came in from Hands on Miami, a volunteer clearinghouse. Human resources, public relations, and corporate affairs departments of local corporations and businesses were solicited, and employees would sign up for employer-sponsored workdays.

Workdays would begin with a fifteen- to twenty-minute presentation. The goals of the project were discussed and brochures were handed out. Participants were then divided into groups of ten and assigned a volunteer from the Restoration Leadership Program to take them to their work site. Trained volunteers would answer questions about the project and lead groups in restoration activities.

The efforts of Earth Day Every Day volunteers were centered on coastal strand restoration, installing the dominant plant—saw palmetto (*Serenoa repens*). Work sites were prepared in advance and mostly cleared of invasive species. Plots would be delineated and the appropriate number of saw palmetto would be delivered, determined by the project's density specifications and a random numbers table. Shovels, water barrels, buckets, and fertilizer would be laid out ahead of time. First-aid kits, drinking water, and, in areas of no shade, umbrellas were also put into place.

Group size varied with a typical range of twenty-five to one hundred. The size of the group was only limited by the number of Restoration Leadership volunteers available to supervise. A one to ten ratio of trained volunteer to inexperienced volunteer was ideal. One hundred unskilled volunteers could clear and plant an acre of coastal strand in a three-hour work shift. Three hundred people could plant an acre in an hour. The program proved to be one of the most effective means for restoring the park and educating the public about the importance of the project. It also provided a model for an annual event on a larger scale.

Field Day and Weed Toss

The American Littoral Society and Cape Florida State Park hosted an annual event called the "Field Day and Weed Toss" in conjunction with Earth Day. The quirky event grew in popularity each year. The Field Day portion of the event was exactly like group workdays held throughout the year, but with added benefits from sponsors, such as free T-shirts and ice cream. Civic groups and company employees would gather at the park and be led in restoration activities by trained volunteers (fig. 3.2). The event would conclude with a highly anticipated contest where one person from each team would throw an exotic plant stalk for the greatest distance, like a javelin. The winner received a unique trophy, a colorful statue of a bird made out of recycled farm tools with a plaque around its neck simply stating "Weed Toss Winner" and the date. Borrowed from the rural North Florida tradition of mullet-tossing, the Weed Toss added a county fair atmosphere to the day. The event always attracted media attention and helped raise the project's profile in the community. Just as important, with three hundred to five hundred restoration volunteers participating, it accomplished in a day what would otherwise have taken months to do.

Figure 3.2. The winning group of volunteers at the annual Field Day and Weed Toss.

High School Restoration Ecology Program: Nature's Hope

The Restoration Leadership formula of training a handful of select individuals to lead groups of inexperienced volunteers in restoration activities proved effective in the Earth Day Every Day program and the annual event, and it also served as a model for educational programs. The same approach was used to develop a program to engage area high school students in the park's restoration. Originally called the High School Restoration Ecology program, the students themselves quickly renamed the program Nature's Hope (fig. 3.3).

Three to six area high schools, representing roughly nine to twelve teachers and 150 to 300 students annually, were instrumental in Cape Florida's restoration. The program was launched each year with a teacher workshop. Teachers received a forty-eight-page curriculum guide that helped integrate restoration activities with classroom science lessons (Garcia, Westervelt, and Reposa 1996). Teachers identified students from each class who had the greatest potential for leadership. Student leaders then participated in extensive training on weekends for extra credit. In October, the Institute for Regional Conservation conducted workshops for thirty to fifty student leaders and their teachers. Like the project's Restoration Leadership volunteers, students learned about the goals of the Cape Florida Project, plant identification, exotic plant control methods, and other restoration techniques.

Students, teachers, and parent chaperones attended monthly field trips from November through April. The first portion of the day was a service component where student leaders supervised their peers in restoration activities. Restoration plots were delineated and exotic plants removed. Once the land was prepared for planting, saw

FIGURE 3.3. High school students in the Nature's Hope Program.

palmettos were installed, watered, and fertilized. Student leaders determined planting densities using Cape Florida's restoration guidelines and a random numbers table. They also documented the number and species of exotic plants removed and the native plants installed. After a picnic lunch, students and teachers would perform field activities that related to their science lessons such as seining, vegetation analysis, and soil moisture experiments.

On the last field trip in April, students led a business group in restoration activities to celebrate National Youth Service Day. Coordinated annually by Youth Serve America, public service events were scheduled in ten cities throughout the country, including Chicago, Dallas, Denver, Detroit, Los Angeles, Miami, Newark, New York City, San Francisco, and Washington, D.C. The American Littoral Society hosted the Miami event at Cape Florida with each of the high schools participating in Nature's Hope and a local sponsoring company, such as AT&T. Students led company employees in exotic plant removal and out-planting while teaching them what they had learned from the program throughout the year.

Service Learning in the Environment

Over the years, the Cape Florida Project benefited from the close proximity to several local colleges and universities. Service learning opportunities and internships were heavily publicized in student activity centers, and relationships with key professors and department heads were cultivated. As a result, the Cape Florida Project benefited from a stream of students working on the project annually while receiving credit toward their degrees.

Like all of the project's educational programs, the Service Learning in the Environment Program combined academic studies with volunteerism. Miami-Dade Community College, Florida International University, and University of Miami students gained firsthand experience in natural resource management and ecological restoration. Natural science majors worked in the field with volunteers and biologists while preparing a paper about the restoration effort for their class. The fieldwork gave them practical experience while the project's library provided research materials needed to complete the reflective component of class requirements. Through participation in the program, students were given ample opportunity to validate their career choices, or probably just as often, change their minds.

Not all of the college students that participated at Cape Florida were on a natural sciences track. One of the most fruitful alliances was with a professor of creative writing at Miami-Dade Community College, Carlos Gonzalez, who would bring his students to Cape Florida for monthly workdays in exchange for classroom credit. In addition to restoration work, students kept journals and completed writing assignments about Cape Florida's role in the community and their own personal sense of place in nature.

Plant-A-Seed

Cape Florida's youngest volunteers participated through the Plant-A-Seed Program. Five hundred children from ten elementary schools grew plants in their classrooms during the year and then planted them at the park each spring. The program was a favorite with the local media and was fully funded through foundation grants, due in part to the nature of the targeted audience.

Schoolchildren with the least amount of opportunities were recruited. These students hailed from at-risk neighborhoods throughout Miami-Dade County. Schools were selected based on the percentage of students enrolled in the federal lunch program. Representing a wide variety of ethnic backgrounds, all were economically disadvantaged and rarely went on school field trips. Most of these students had never been to a state park or natural area; had never encountered wildlife beyond the backyard variety; and, sadly, had never seen the Atlantic Ocean, although most lived within five miles. Although restoration was the primary goal of the program, reaching minority students underrepresented in the natural science fields was an added bonus.

The program was launched annually with a teacher workshop before the beginning of the school year. Teachers were given a tour of the park and the park's nursery where plant propagation, care, and maintenance were demonstrated. Teachers received ten continuing education credits for participating in the workshop that helped them with their recertification requirements. A teaching guide was provided to help implement the program in the classroom.

To help teachers meet academic goals, *Dade County's Competency-Based Curriculum* was used to develop a teaching guide that showed how to meet forty-two learning objectives in language arts, mathematics, science, and social studies. The *Plant-A-Seed Teaching Guide* contained a description of the regional ecosystem, the history of Cape Florida, an overview of the restoration project, horticultural descriptions of the plants to be grown, and student activities. The horticultural sections included instructions for growing plants and described the characteristics and maintenance requirements of each species being grown. The learning objectives needed for teachers to meet their requirements across the curriculum were integrated into the student activities sections. Student activities included journal keeping, word puzzles, various experiments, and measurement taking (Miley and Westervelt 1994).

Throughout October and November, students, teachers, and parent chaperones attended field trips on buses provided by the American Littoral Society. At the park, students learned about the different plant communities being restored. They visited the beach dune community, maritime hammock, and coastal strand. At each station, students were given an activity. They searched for seeds in the wrack on the beach, performed leaf rubbings in the hammock, and planted saw palmetto in the coastal strand. At the park's nursery, students were shown how to grow native plants from seed. They had a picnic lunch under the park's pavilions and played games before returning to school at the end of the day.

In the first year of the program, American Littoral Society staff visited each classroom twice during the school year. The first visit occurred after the initial field trips. Staff gave horticultural demonstrations to reinforce lessons from the teacher workshop and tours of the park's nursery. Students were given containers, seeds, soil, and fertilizer. Teachers were responsible for developing lesson plans that directed students in plant propagation. They developed watering and fertilizing regimes based on information they received during training and in the curriculum guide. Students were asked to record plant maintenance activities in journals. In February, staff returned to each classroom to evaluate the progress of seedlings. Midcourse corrections to maintenance regimes were made, if necessary. In subsequent years, staff only needed to visit those teachers who had not participated previously.

The program concluded in May when students, teachers, and chaperones returned to the park to plant the natives grown in the classrooms and school yards (fig. 3.4). Afterward, students had a picnic lunch, played on the beach, and received T-shirts and certificates during an awards ceremony.

The Impact of Program Development on Community Engagement

Maintaining a good organizational structure and providing abundant, age-appropriate opportunities were the keys to broad-based community engagement. The variety of volunteer and educational programs developed to support the restoration project allowed individuals in the community to participate at any given point in their life, from childhood, through their academic years, into adulthood, and beyond. A high school student who took part in Nature's Hope went on to work in Burger King's charitable gifts department, steering company donations to the project. A volunteer participated in the annual event and returned as a restoration leader, committing hundreds of hours annually. An elementary school student enrolled in the Plant-A-Seed Program came back to contribute as a high school student.

Volunteer motives ranged from opportunities for social interaction to a sense of nostalgia, and from gaining a spiritual connection to nature to learning new or honing

FIGURE 3.4. The Plant-A-Seed Program gave elementary-age children a chance to get outdoors and get their hands dirty while helping to restore the park.

existing skill sets. In the end, motivations were personal, and programs were personalized to the largest extent possible. Impromptu gatherings after workdays, attention to each individual, group field trips, in-depth training, annual holiday and year-end parties, and public recognition of the commitment of volunteer leaders through personalized awards and media releases all provided cohesion, a sense of belonging to a big family, and a shared commitment to a special place.

Through its programs, the Cape Florida Project enjoyed a reciprocal relationship with the community, benefiting from its generosity, and for those who participated and cherished the park, giving back as much as it received.

Conclusion

The Cape Florida Project was born from extraordinary circumstances. A natural disaster struck a park of iconic stature in a community located in close proximity to a major urban center. Cape Florida's story resonated with people, and the community responded admirably with funding, volunteer support, and political backing. They shared a vision for a restored Cape Florida and provided the clout needed to raise restoration standards and make policy changes that made it possible to implement prescribed burning in an urban setting, change the designation of the site from a recreation area to a state park, and gain acceptance of what were regarded, at the time, as controversial restoration techniques.

There is, however, still evidence of a few early, contract-driven planting decisions. The commercially exploited and highly available green buttonwood (*Conocarpus erectus*) trees are growing in places they would not naturally occur, but the prescribed fire program implemented by the FPS as the project shifted into resource management mode may yet resolve those early miscues. Without the grassroots activism of the greater Miami-Dade community the project may have strayed further from its original mission.

The American Littoral Society oversaw community participation in the Cape Florida Project from 1993 through 2003. During those ten years, thousands of people committed tens of thousands of volunteer hours to the restoration. People from every conceivable walk of life were involved, from individuals, community groups, local businesses, and large corporations to students from elementary school through university. By the end of the project's first decade, more than three hundred species of native plants were represented in six distinct natural communities. There were roughly 165 species of birds listed for Cape Florida, with twelve known to use the site for nesting. Forty-two butterfly species, six native species of mammal, and sixteen native reptile and amphibian species called Cape Florida home. Cape Florida also provided refuge to fifty-two threatened or endangered species, including a North American crocodile (*Crocodylus acutus*) that had taken up residence in the restored mangrove forest (Westervelt 2003).

The community activism that initially established Cape Florida in the public domain ultimately became a part of its culture. Amid the social and human tragedy of Hurricane Andrew, the community united behind the restoration of its local park, setting the stage for long-term stewardship and a better conservation ethic. That, when all is said and done, could be the Cape Florida Project's most important legacy.

References

Clewell, A. F., J. Rieger, and J. Munro. 2000. *Guidelines for Developing and Managing Ecological Restoration Projects*. 1st ed. Washington, DC: Society for Ecological Restoration International.

Florida Department of Environmental Protection, Division of Recreation and Parks. 1994. "Bill Baggs Cape Florida State Park Unit Management Plan, Addendum 9." Unpublished report. Tallahassee, FL.

Gann, G. 1995. *Cape Florida Project: Volunteer Restoration Manual*. Report to the American Littoral Society. Miami, FL: The Institute for Regional Conservation.

Garcia, D., K. Westervelt, and B. Reposa. 1996. *Nature's Hope*. High school curriculum. Key Biscayne, FL: MAST Academy.

Landsea, C., J. L. Franklin, C. J. McAdie, J. L. Beven II, J. M. Gross, B. R. Jarvinen, R. J. Pasch, E. N. Rappaport, J. P. Dunion, and P. P. Dodge. 2004. "A Reanalysis of Hurricane Andrew's Intensity." *Bulletin of the American Meteorological Society* 85: 1699–1712.

McAllister, B. 1938. "A Study of the Flora of Key Biscayne, Dade County, Florida." Master's thesis, Duke University, Durham, NC.

Miley, J., and K. Westervelt. 1994. *Plant-A-Seed Teaching Guide*. Elementary school curriculum. Sandy Hook, NJ: American Littoral Society.

Westervelt, K. 2003. "Cape Florida Project Final Report." Unpublished report. Sandy Hook, NJ: American Littoral Society.

Chapter 4

Restoring Coasts and Connections on a Southern Australian Coastline

Matthew Fox

With coastal populations steadily increasing in Victoria, pressures on coastal landscapes and ecosystems continue to mount. Increased human and vehicular traffic threaten biodiversity values, while human settlements introduce pollutants to terrestrial, intertidal, and marine ecosystems. Meanwhile, coastal habitat is cleared and fragmented by residential and commercial development. There is some irony in the fact that these mounting human pressures threaten to undermine the very attributes people seek in their coastal lifestyle.

However, an opposing force has existed quietly for the past two decades, gathering on weekends in small groups on the reserves along Victoria's 1,250-mile coastline. Dedicated volunteers have braved the elements, struggled with red tape, overcome funding challenges, and taken on physically arduous tasks in order to restore and protect their local environs. The impacts of individual actions may be small in scale, but when considered collectively and over this extended time period, they constitute a very significant set of achievements. Indeed, a whole suite of Victoria's coastal ecosystems are now greatly improved, many in areas where they would otherwise not persist in the face of intensive human activity.

At the heart of the restoration movement is a direct relationship between the volunteer and the coast. These relationships differ from one person to the next, some offering hope for the future, others providing validation within the community. Regardless of the reasons behind volunteer actions, restoration can also provide for deeper engagement with ecology because restoring and improving ecological function places us back within the ecosystem.

A Long History of People on the Coast

Indigenous people have inhabited Victoria's coastline for tens of thousands of years. The continuous relationship between people and the coast is perhaps one of the longest running anywhere. At the time of European settlement, five main clan groups permanently occupied territories along the coastline we now know as Victoria. This section of southern shoreline was the most densely populated area of the continent at

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_4, © Island Press 2011

the time of European arrival. Up to one thousand generations of indigenous peoples may have lived here.

Active management of natural resources by indigenous communities included "firestick" management (controlled burning) of vegetation, and the trapping and on-growing of eels in weirs constructed of stone. Some marine species were "protected" by taboo systems—many coastal groups chose not to hunt the edible and abundant sharks and rays, for example. The apparently near-pristine condition of Victoria's coast impressed the first British explorers, who described an abundance of fish, mollusks, and crustaceans in the intertidal pools (Flannery 2000). Sparked by the 1850s gold boom, "Marvellous Melbourne" was soon one of the world's most prosperous cities. Within a few generations, the displaced indigenous inhabitants had lost much of their collected knowledge of the coast.

The 1898 declaration of Wilson's Promontory National Park was one of the first outward demonstrations of growing public appreciation of Victoria's coast. A century passed before a system of Marine Protected Areas was declared in 2002. Today's southern coastal ecosystems are biologically rich, but vulnerable. Two-thirds of marine species are considered endemic (Parks Victoria 2007). The coastal strip includes specialized plants and animals, but coastal land is in short supply due to housing pressure. Human pressures and invasive species degrade and fragment terrestrial ecosystems. Marine and intertidal ecosystems are susceptible to human pressures such as harvesting of resources and the discharge of pollutants. While our relationships with the coast are constantly redefined through social change (e.g., economic systems, local politics), the effects of these relationships continue to manifest in biophysical change.

"Sea Change"

Today, more than ever, more Australians are choosing to live by the sea. "Sea change," as first described by demographer Peter Murphy (2004), relates to the current wave of development affecting coastal towns in Australia. The term can be most simply described as *increasing population and diversity in coastal communities* and generally applies to movement to coastal areas *outside* the major cities on the coast, such as Victoria's capital, Melbourne. As a group, "sea changers" are on average younger than average Australians (Gurran, Squire, and Blakely 2005). Victoria's Surf Coast Shire clearly demonstrates the changes occurring in Australia's coastal areas. The Shire's population increased 46 percent between 1985 and 2001, or around 3 percent annually, compared with the national average of 1.2 percent (ABS 2007). The growth rate in the Surf Coast town of Torquay is currently around 5 percent annually, one of the highest in the country (www.surfcoast.vic.gov.au).

Rapid development places pressure on coastal resources and is likely to undermine the natural values that attracted people in the first place. Social unease has arisen about the issues of housing affordability for locals; the emergence of "social cleavages" between newer, wealthier residents and the existing residents; and concerns about town character and rapid changes in community structure. Gurran and colleagues (2005) observed declines in resource-sector (fisheries, forestry, agriculture) employment during the past five years. Tourism has replaced extractive industries but is largely seasonal in temperate Australia. Absentee owners cannot contribute as much to community service as permanent residents, and community organizations may struggle to maintain membership.

A Culture of Volunteering

Victoria is fortunate to have a strong volunteering ethic. Ubiquitous community institutions, including the Country Fire Authority (CFA) and the Country Women's Association, have traditionally provided important social frameworks and services to rural communities. The CFA is a volunteer-based, rural firefighting service responsible for the suppression of wildfire on private lands. With a statewide membership of about sixty thousand, the organization may be one of the largest volunteer organizations in the world. With most country towns facing the threat of wildfire at some time or another, the importance of the CFA's work is well understood and widely appreciated. Victorians understand the enormous contributions that volunteers can make, and this may provide conditions favorable to newer initiatives, such as volunteer-based conservation and restoration of coastal ecosystems.

About twenty thousand people engage at least annually in some form of coastal volunteering in one or more of about 120 groups. Groups include friends groups, Coast Action, and Coastcare groups, and various other local and regional networks, advocacy groups, and specialist naturalist groups (e.g., ornithologists or botanists). Research undertaken in 2007 (VCC 2007) revealed that three in ten Victorians were interested in volunteering in a coastal group, while half indicated that they would participate in a "one-off" event, such as an annual Clean-up Day. Females and younger Victorians (aged thirteen to thirty) showed the highest levels of interest in these events.

The economic contribution of volunteer efforts in Victoria is significant. A 2005 study prepared by the Department of Sustainability and Environment (DSE) found the net worth of environmental volunteering in Victoria was $180 million, while the value of volunteering across all sectors in 2002 was estimated at $10 billion, nearly 8 percent of gross state product (Department of Sustainability and Environment 2005). The economic contribution of coastal conservation volunteers alone is on the order of $20 million per year. As well as the social, environmental, and economic benefits, the government benefits through working in direct partnership with communities and by gaining direct feedback and guidance from the community about matters that concern them. Furthermore, as long as there are volunteers invested in improving coastal ecosystems, there will always be a conservation constituency to safeguard against the political process.

Organizing Action

Organized community-led conservation initiatives in Victoria have their roots in the twenty-year-old Landcare movement. In that effort, farmers and state land managers have teamed up to meet environmental challenges, including loss of biodiversity, erosion, and salinity, through voluntary improvement programs. Australia's Landcare movement is recognized internationally for its achievements in addressing environmental impacts of agriculture.

This community-led approach to solving environmental problems is now being applied to meet challenges in the coastal zone. The Jan Juc Coast Action Group began as an informal collective of concerned individuals and has operated as a formal body for more than a decade. The group's stated aim is to "maintain and reestablish biodiversity" in the coastal strip as well as to "protect and continue to provide access" to the coast (Spittle 2007). The group operates in the coastal fringe area between Jan Juc Creek and Bells Beach. There are other community conservation groups active in the area, too. For example, Surfrider Foundation, Surfers Apprectiating the Natural Environment, and others work on conservation projects, including revegetation, education, and access improvement.

It is the contribution of key individuals that will largely determine the success of community groups. The Jan Juc group has been led by one long-term resident for two decades. The group currently has a membership of around fifty active participants and plants about four thousand plants annually. Since its inception, the group has restored about three miles of the coastal reserve between the road and the cliff top. Actions have been funded through state and federal funding mechanisms. The group has delivered about a dozen projects in the past decade, with combined funding totaling around $100,000. As well as restoration, the group has delivered revegetation, pest plant control, access improvement, education and infrastructure development, and maintenance projects (DSE 2005).

Motivations for Volunteering

Put simply, a volunteer is somebody who provides a service to the community without expectation of payment. What then are the rewards for the thousands of Victorians who regularly volunteer? Motivations extend beyond altruism. For some people, it is linked to the social opportunities they derive from the activity. Others appreciate the opportunity to address particular issues that directly affect them and to make positive contributions to their community. Some people get involved to develop new skills and knowledge, while others take up the opportunity to use existing skills within a setting outside of the workplace. In my experience, many volunteers don't regard their volunteering as a "separate" activity; rather they see it as part of belonging to their community.

Motivations for volunteering may be viewed in the context of the constant tension between ecocentrism and anthropocentrism. The anthropocentric view elevates our role of command over other species, while the outcome may still be positive for the ecosystem. Ecocentrics consciously strive to put society back within the ecological context, and it is in small settlements so influenced by nature and the elements that this is more easily achieved. Murphy (2004) notes the presence of "alternatives" within the new coastal demographic—a group that is sometimes at odds with the original resource exploitation economies and cultures of coastal towns.

Social motivations may be seen as similar to those of any club member or organized social opportunities, the chance to meet new and like-minded people within the community. People are drawn to others with similar interests. Conservation volunteering offers many an alternative to the traditional pastimes of sports, or may suit a particular age bracket (such as recent retirees). Some may also see volunteering as a necessary step in career development, while others may have political or leadership aspirations in their communities. Of course, many volunteers will have volunteered for a multitude of reasons. Whatever people's motivations for coastal volunteering, it is necessary to understand and account for these motivations in supporting frameworks.

At the other end of the spectrum are the "ecocentrics"—those volunteers whose motivations are more aligned with ecosystem function. Such volunteers are likely to be naturalists and may sometimes have professional or academic links to their volunteering experience. Social motivations may be quite absent among these people, many of whom will work autonomously.

Recent studies indicate that the volunteering experience is changing, too (DSE 2005). There are now more volunteers than ever, but they are volunteering for fewer hours on average. These volunteers are more likely to volunteer for shorter-term commitments and are less likely to make ongoing commitments. Many workplaces now encourage volunteering by allocating volunteer leave, which represents a new resource of highly skilled people for community organizations. Many young adults see volunteering as a necessary step in career development, and school children make enormous contributions every year.

The Effects of Coastal Restoration

With modest means, coastal community groups have achieved significant results during the past fifteen years. The area of coastal land under the management of coastal volunteers is approximately 250,000 acres (100,000 hectares), comprising many small, unconnected parcels of the public land reserve. Within this, vegetation communities have been restored and maintained, access to coastal sites has been improved, and community-based ecological monitoring systems have been established.

Often the effects of individual actions are modest. The coastal zone is narrow and, therefore, susceptible to edge effects, such as invasive species infestations. Thus restoration projects usually require regular maintenance, the results of which may not be visible to the uninformed. However, when considered collectively, the ongoing actions of more than 120 groups are significant and valuable. Increasingly, volunteers are now managing contractors to undertake heavy works, including woody weed removal and earthmoving.

Ecosystems Restored

Individuals and small volunteer groups can also make significant local impacts. The rufous bristlebird (*Dasyornis broadbenti*) is listed as endangered under the Victorian Flora and Fauna Guarantee Act. The Jan Juc Coast Action Group noted the return of the rufous bristlebird to revegetated coastal-fringe heathland habitats around Jan Juc town. This reexpansion of the species range will help to ensure its long-term survival. Actions that have contributed to this result include replanting of indigenous vegetation and the control of introduced predators, including foxes and cats. Fifteen years of volunteer action to reverse the degradation and fragmentation of these fragile coastal heaths has been key to the turnaround of this species' plight.

Not far down the road, a group of surfers has been engaged in restoration on a larger scale. Surfers Appreciating the Natural Environment (SANE) was incorporated in 1988. At the time, the world-famous surf spot Bells Beach was highly degraded and bare, damaged by uncontrolled vehicular access and riddled with pasture species extending down to the rapidly eroding sandstone cliffs. Twenty years later, most of the 125-acre Bells Beach Surfing Reserve has been returned to its pre-European complement of coastal heath.

For two decades, SANE has promoted monthly working sessions. During this time, the group has developed a strategic and systematic approach to restoration. The group works according to a site plan, restoring discrete plots within the reserve. Restoration work usually begins with works to control human access and accompanying erosion. The removal of woody and pasture weeds has been achieved by mechanical and chemical means. Replanting with stock of local provenance follows. Mulching and brush-matting approaches are used to stabilize the new plantings. Maintenance (e.g., ongoing hand weeding) then follows, becoming required less often as vegetation communities mature. Restored plots connect, and the integrity of vegetation communities is consolidated. Future maintenance may require controlled burns, given the frequent, pre-European fire regime of southern coastal heathlands.

By focusing on a single management issue per working event (e.g., the hand pulling of a single weed species), the group can achieve scale and consistency with the human resources available. One or two knowledgeable group members can provide sufficient guidance for the whole working group, which often includes newcomers or occasional volunteers with limited knowledge. This strategy of a small, core group with many occasional members provides an opportunity for a large group of people to develop connections to the site throughout the restoration process. Many of these occasional volunteers are surfers who have built a connection to the site through their time in the water.

Today, the Bells Beach site again contains diverse and intact floristic communities, including threatened ecological vegetation classes such as coastal moonah woodland. Previously lost bird species, including the southern emu-wren (*Stipiturus malachurus*), have now returned to the site. It is assumed that the role of SANE will continue to transition from agent of restoration to one of maintenance.

Frameworks for Action

While it stands to reason that the community should be key partners in coastal management, there are inherent challenges in mobilizing volunteers. The coordination of ecological protection and restoration activities must occur within appropriate legislative and operational frameworks, at all three levels of government. While volunteer groups are by nature committed and passionate, their actions must be in step with broader management goals and objectives. Volunteer groups must, therefore, be kept well informed. Technical skills among group members may be lacking. Integration of effort presents significant challenges. Coastal ecosystems are unique and fragile, and must be well understood if community action is to be complementary. The planting of introduced or inappropriate tree species has occurred numerous times in the past. With more than ten thousand people volunteering annually in Victoria alone, there is a significant risk that the best of intentions will miss the mark in terms of desired ecological outcome.

Since 1995, the key supporting framework for the coastal volunteer movement has been the Coast Action/Coastcare program. During this time, the movement has grown from a handful of individuals working in one foreshore area to more than ten thousand individuals working across the entire state. The program supports more than one hundred community organizations and aims to maximize ecological and coastal management gains from the stewardship movement (while managing the risks outlined earlier). These aims are achieved by providing targeted support in key areas, including organization development, ecological restoration and management approaches, safety management, recognition, and awareness. Another important role of the program is to ensure proper coordination and alignment with other programs of restoration and conservation.

Nonprofit groups, such as Greening Australia and Conservation Volunteers, also contribute to this broad support framework. Often very successful in forging partnerships with the corporate sector, these organizations have created a framework for action parallel to those erected by government. Heavily influenced by funding priorities and the bottom line, these organizations may also bring in volunteers from afar to undertake works. While the long-term viability of the local stewardship may be questionable, the ability to conduct large-scale works quickly may be higher with these organizations.

Community networks, such as Conservation Management Networks and Landcare networks, are an emerging framework with significant potential to transform coastal works programs. Usually comprising a loose collective of like-minded groups and partner organizations, these networks represent a major development in stewardship during the last decade. Drivers for networks include the current investment focus on ecosystem and landscape management approaches and partnerships. The Conservation Management Networks have the potential to significantly boost restoration efforts by helping to articulate and share clear regional conservation goals and coordinate implementation of works by a multitude of governmental and nongovernmental players. To date, these networks have helped to coordinate and deliver works across thousands of acres. While these networks are yet to move into the coastal zone, the approach presents a clear opportunity to take coastal restoration projects to a new level.

Volunteer programs typically adopt the following types of approaches in order to maximize gains:

- Provide direction and strategic framework—ensures that the group's activities align and integrate with relevant coastal management programs, policies, and plans

- Support growth and development—building the skills and knowledge of volunteers to ensure that their on-ground impact is maximized and that they are able to operate
- Provide recognition—initiatives including awards programs, field days and appropriate acknowledgment of volunteer effort, particularly from government and the broader community, provide considerable motivation for groups, many of whom are quite isolated
- Ensure long-term viability—assist in succession planning and financial management; broker partnerships with private sector; target recruitment of new groups, including youth, indigenous participants, and those ethnic groups not traditionally associated with volunteering
- Manage safety and minimize risk—occupational safety training to ensure that volunteers operate safely and know how to manage and minimize risks associated with coastal volunteering, which may include injury from machinery, exposure to chemical herbicides, and falls in rugged coastal terrain

New Horizons for the Coastal Stewardship Movement

Since coastal volunteering emerged fifteen years ago, a number of factors have shifted. As coastal populations grow, the human demographic both ages and diversifies. This demographic change also includes a larger number of occasional or absentee residents. Extractive industries, including fisheries and forestry, are in decline, while tourism has increased. In the long term, these factors may lead to a decline in the very detailed local knowledge that older volunteers possess. While protected area and public land management improves, pressure on freehold coastal resources and ecosystems steadily increases, resulting in more concentrated patterns of land use. A trend of decentralized management has also seen communities charged with greater responsibility over natural resource management, while capacity within government for on-ground management and compliance is reduced.

It is also fair to say that our volunteers are better skilled due to the provision of capacity building, an increase in skilled volunteers, and practical experience gained during the past decade or more. The volunteer skills base is probably broader now with new skills including organizational development, strategy, and fund-raising entering the pool. Volunteering now has a higher profile within the community as evidenced by the uptake of volunteering days within corporate workplaces.

Increased knowledge and better skills can allow us to better develop strategic approaches to restoring and maintaining coastal ecosystems. Community groups are now producing five-year strategic plans and visions that prioritize works, outline their resourcing requirements and necessary partnerships, and identify sources of funding. This may allow for a greater emphasis on restoration as opposed to maintenance roles. Funding arrangements continue to change as well. Federal funding is increasingly linked to intended integrated, landscape-level environmental outcomes, which presents challenges for groups acting locally and in isolation. Some community groups may not always have the capacity to engage with the many players in an increasingly complex natural resource management structure. Regional community-based networks are increasingly stepping into this space, and this represents an opportunity to explore restorations on a larger scale.

Recent developments in reconciliation, including the federal government apology to generations "stolen" from family groups by welfare intervention, have moved the dialogue about indigenous involvement in land management. Environmental restoration has become a powerful and appropriate platform for social reconciliation. Healing the land can help heal the community. "Whitefella" is discovering that he can learn much about the land from its traditional custodians, although much effort is still required to encourage indigenous people to volunteer alongside nonindigenous people.

There is much to be gained by further enabling volunteering within an integrated response to coastal planning and management, particularly in the context of ecological restoration. Policy response to coastal issues needs to further integrate, rather than isolate, volunteer effort. The challenge is to develop an integrated sustainability approach within the multitude of planning systems and agencies. As long as land managers treat volunteering as an afterthought, it will suffer from duplication of effort and inefficiencies caused by poor communication and lack of planning around resources. When coastal communities can be meaningfully included in this approach long-term, successful change scenarios are more likely.

It is tempting to make generalizations about the movement and label the current era one of transition. Have all the "easy" jobs been done? Are we shifting from a nascent repair model to a more ambitious one of restoration? After nearly two decades of activity, the movement may now be in a state of consolidation, where the focus has shifted toward applying best practice approaches; sharing information across innovative, informal networks; and applying this expertise to bigger challenges, such as full-scale restoration.

Environmental volunteering will continue to be influenced by emerging concerns. Biodiversity is arguably better understood and more valued in the mainstream than it was fifteen years ago. For example, we have a much stronger notion of ecosystem services than before. This may emerge as a new driver for community-led restoration. Sea-level rise and increased storm events due to climate change are now also understood to be mainstream concerns, particularly among low-elevation coastal communities (see chap. 13, this volume). In the long-term view, one might surmise that such restorations will be more valued as emerging concerns gain validity in the broader community.

Benefits of coastal stewardship extend beyond the restorative outcomes. Active participation by locals in such groups contributes to community building in coastal towns, bringing social benefits and improving the quality of life for those participants. The engagement of local people can boost the resource protection efforts of enforcement agencies with additional "eyes and ears," such as in the case of poaching of marine life and removal or destruction of native vegetation. Community involvement in restoration projects may result in more people developing a deeper engagement with nature; a precursor to sustainable coastal townships.

Conclusion

Victoria's "sea change" has seen coastal human populations swell and impacts on coastal ecosystems compounded. More volunteers are now required to maintain the status quo, although a mainstreaming of environmental responsibility during the past two decades has seen environmental volunteering gain broader community acceptance. Restorative efforts that engage large numbers of people may stand a better chance of success in the future. We have seen that such efforts may be successful if driven by a small, but knowledgeable and committed, core group leading a less-skilled, occasional volunteer force. Following a restoration effort, the relationship between volunteer and ecosystem will grow and change. It will become more profound with time. The motivations of volunteers may also change over time. What once began as an exercise in giving back may change to a social reward. In order to meet the needs of the growing restoration movement, we have seen supporting frameworks develop from within and outside government. However, it is important to note that the movement developed from *within* coastal communities in Victoria—the first coastal volunteer organizers were concerned coastal residents, not bureaucrats.

Volunteering allows us to redefine relationships with the ecosystem. Restoration not only restores the coastal ecosystem but also rebuilds lost links to the ecosystem. It brings us back into the ecosystem. Restoring an ecosystem provides a pathway for us to develop links to an ecosystem and for new human populations to reconnect. A deeper appreciation of natural, cultural, and spiritual values is both the impetus and the outcome of volunteering. This feedback loop offers hope that we can achieve balance in our ecosystem relationship; hope that the maintenance of fragile coastal ecosystems is possible in the face of ever-present development and growth aspirations on our finite coastal lands.

References

Australian Bureau of Statistics (ABS). 2007. http://www.abs.gov.au.

CoastAction/CoastCare. 2007. "Coast Action Strategy 2005–2010." Department of Sustainability and Environment, Victorian Government.

Davidson, C. B. 2007. "Sea Change Taskforce." Presentation given by Surf Coast Shire councilor, Torquay foreshore. April 14, 2007.

Department of Sustainability and Environment (DSE). 2005. *Coastal Spaces Inception Report*. Melbourne: Victorian Government.

Flannery, T. 2000. *The Explorers: Stories of Discovery and Adventure from the Australian Frontier*. New York: Grove Press.

Gurran, N., C. Squire, and E. Blakely. 2005. *Meeting the Sea Change Challenge: Sea Change Communities in Coastal Australia*. Report for the Sea Change Taskforce. Sydney: University of Sydney.

Murphy, P. 2004. *Sea Change: Movement from Metropolitan to Arcadian Australia*. Sydney: University of New South Wales Press.

Parks Victoria. 2007. Marine Protected Areas website. http://www.parkweb.vic.gov.au/1process_content.cfm?section=94&page=28.

Squires, C., and N. Gurran. 2006, "Planning for Affordable Housing in Coastal Sea Change Communities." In *Building for Diversity*, edited by S. Darby, P. Faltau, and I. Hafekost. Refereed Conference Proceedings, National Housing Conference, October 26–28, 2005.

Victorian Coastal Council (VCC). 2007. *Victorian Coastal Strategy Review*. Victorian Coastal Council. Melbourne, Victorian Government.

Chapter 5

Inclusive Urban Ecological Restoration in Toronto, Canada

Allegra Newman

High Park is one of the largest green spaces within the city of Toronto, and it attracts people from all over the city with its beautiful lawns, attractive gardens, and oak savanna and pond restoration. Walking through the park on a sunny, summer day you encounter the diversity that is the city of Toronto—a city where about 50 percent of the residents are people who immigrated to Canada within the last ten years (Toronto Community Foundation 2004). In 2007, a park planning exercise was led by the park management and the volunteer park council to decide the direction of future park development, and specifically what role ecological restoration would play. Seventy people met on a Saturday morning to discuss the future of the park and gather input from various interest groups, including dog walkers, gardeners, cyclists, and restorationists. All seventy participants were white and seemingly of western European ancestry. They certainly did not reflect the diversity of the park's users. Looking around the room, I questioned why diverse cultures were not engaged in this process even though they had direct interest in what happened in the park.

This experience was the beginning of a research project in which I examined ecological restoration work in Toronto and looked at why certain voices, specifically those of racialized people,[1] were not being heard in the planning and decision-making processes. In this chapter, I examine why inclusive ecological restoration is important, critically analyze how Toronto organizations working on urban ecological restoration projects are moving toward being more inclusive, and investigate the challenges to and opportunities available for creating a more inclusive practice.

What Is Inclusive Ecological Restoration?

It is well known that urban ecological restoration is an important facet of ecological restoration and that it has its own unique challenges and opportunities (Kilvington et al. 1998; Gobster 2001). These challenges occur because there is a greater interaction between many people and the environment being restored in urban areas and, subsequently, a greater possibility of conflicting values and ideas about nature. Hull and Robertson (2000) see the battle over competing values as a competition where "some

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_5, © Island Press 2011

values and beliefs are held up and exalted, others are dismissed and ignored, and still others are left implicit and unnoticed" (114). In 1998, Leonie Sandercock, a professor of urban studies, argued, "If we want to foster a more democratic, inclusionary process for planning, then we need to start listening to the voices of difference" (109). Inclusive urban ecological restoration, as I contend in this chapter, provides opportunities for "voices of difference" in our communities to be heard within the restoration planning and implementation processes. Inclusive urban ecological restoration also means questioning current practices and participatory frameworks, and critically analyzing the accepted norms within ecological restoration. Inclusive practices, therefore, must be sensitive to power imbalances built into the historical framework of ecological restoration. The inclusive ecological restoration framework presented here opens space for dialogue around uneven access to resources and knowledge, and provides opportunity for discussions around race and urban green space within the field of urban ecological restoration.

Benefits of Inclusive Urban Ecological Restoration

Heavily settled urban areas benefit ecologically as well as socially from restoration work by introducing green spaces into landscapes focused on concrete, brick, and cement. Inclusive urban restoration, therefore, can provide many obvious benefits both to the restoration project and to the greater community. For example, urban ecological restoration projects provide an opportunity for *all* city dwellers to be involved in restoring nature within their local landscape and, thus, develop an increased appreciation for nature (Light 2003). There are also less obvious benefits from urban restoration projects that affect local communities and, in many cases, racialized people. For instance, practicing a more inclusive ecological restoration can also contest popular myths about how racialized people interact with green spaces. Sociologist Derek Christopher Martin (2004) argues that green spaces "are socially constructed as the exclusive domain of whites" by American media (530). Identifying racialized people as a "group" that is not interested in urban green spaces perpetuates the lack of interaction that racialized people have with urban ecological restoration projects. More inclusive restoration can help balance public perception and highlight the importance of public green spaces to all city residents.

Inclusive urban restoration also provides the possibility of linking newcomers to the landscape of their adopted neighborhood and creating relationships and networks that empower other local community development projects. Encouraging people to connect more deeply to their community is not only valuable for people who have been displaced from their place of birth, but it is also a way of exposing hidden community assets and expertise that will allow community change to occur from within. For Siemiatycki and Isin (1997), who were researching citizenship in Toronto, interaction with urban public space is increasingly being recognized as a way that racialized people, and especially newcomers, can become visible in the urban landscape. They argue that, "Who[ever] uses and occupies the public realm is an important indicator of community and citizenship" (Siemiatycki and Isin 1997, 102). Eric

Higgs (1997), in an article where he asks, "What is good restoration?" discusses how participation in restoration projects can foster a sense of community, create a connection with the natural environment, and help people form a sense of identity around the place where they live. Participants meeting regularly create linkages and relationships not only with the land but also with their neighbors and neighborhood, according to Higgs (1997). More recently, Forest Service social scientist Lynne Westphal (2003) found that community empowerment is not always an automatic result of a successful urban ecological restoration project, which suggests that a more inclusive ecological restoration approach can contribute to increased community activism and involvement.

Involving racialized communities in the planning, implementation, and monitoring of ecological restoration projects can also bring new perspectives and strategies to these projects. Diverse experiences and different ways of knowing nature as well as culturally specific values about living within a balanced system can be valuable contributions to urban ecological restoration. However, ecological restoration has historically been a practice of the upper-middle-class echelons of society and, in Toronto as elsewhere in North America, has developed from the policies and assumptions of earlier immigrants of western European heritage. As Roderick Neumann (2002) argues, nature is socially constructed, and European values of nature are still prevalent in many places worldwide, including North America. A dominantly held view is that nature is external to society and, therefore, social concerns and issues cannot be related to environmental or ecological issues. This perspective of nature and the concurrent nature/social divide is visible within urban ecological restoration in Toronto (Foster 2005). According to Desfor and Keil (2004), restorationists in Toronto strive to re-create the "romantic view" of the urban river systems within the city as "wilderness" as perceived by the first European settlers. Inclusive restoration can bring alternative ideas about connections between nature and society that are outside the current way of perceiving urban nature.

Although Toronto is a city of diversity, with almost 49 percent of residents born outside of Canada (Statistics Canada 2003), the City of Toronto Parks, Forestry and Recreation Department estimates that less then 10 percent of volunteer participants working on ecological restoration projects with the City of Toronto are from culturally diverse populations (Beth Cragg, pers. comm.).[2] Reflecting on a 2007 study by Statistics Canada, more than 40 percent of new or recent immigrants to Canada volunteer in their community, while only 2 percent volunteer for environmental organizations, such as those involved in ecological restoration projects.

Hull and Robertson (2000) state that every ecological restoration project is ecologically unique and "place-based." Inclusive urban ecological restoration, I suggest, is even more context and place specific because it emphasizes the relationship people have to local social and political issues as well as ecological challenges. The Toronto case study I present provides the background for a critical analysis of inclusive ecological restoration practices, and, although as a case study it is uniquely Toronto centered, the lessons and awareness revealed through this case study are applicable in other urban environments in North America.

A Toronto Case Study

I chose the city of Toronto for this case study because of the expanding cultural diversity of its population. Along with increasing cultural diversity, there is a transformation of values, goals, and beliefs away from those of the long-dominant culture of earlier European immigrants (predominantly English and French in eastern Canada) (Pestieau and Wallace 2003), and toward more globally inclusive perspectives. My following analysis looks at how inclusive ecological restoration is being practiced by prominent organizations through the following processes: (1) connecting urban restoration to traditional landscape practices, (2) forging new community connections, and (3) combining ecological restoration projects with community development work.

Connecting Urban Restoration to Traditional Landscape Practices

My interviews with restorationists working on projects in the city of Toronto revealed that local organizations are reimagining how to engage the population in urban ecological restoration to further strengthen and solidify connections between people and nature. For example, instead of examining the landscape through an exclusively ecological lens, the nonprofit organization Evergreen and the Toronto-based Hispanic Development Council are combining social, cultural, and educational programming alongside their grassroots urban ecological restoration work (Rebekka Hutton, pers. comm.).[3]

Evergreen is a nonprofit organization with the goal of restoring and creating urban green spaces in Toronto. Urban ecological restoration through Evergreen focuses on connecting a variety of urban greening activities with more traditional ecological restoration projects. Part of the Evergreen plan for connecting people to urban ecological restoration requires that they prioritize issues specific to urban areas, especially urban areas with diverse populations. Increasing tree canopy and plant diversity in green spaces within lower-income neighborhoods, while leaving areas for recreation and cultural activities, have been incorporated into Evergreen's programming in response to the organization's work with diverse communities (Rebekka Hutton, pers. comm.).

According to Rebekka Hutton, community development project manager with Evergreen, many people feel that the current idea of ecological restoration as a pursuit of "wilderness" does not fit with their ideas of how people interact with the natural world, especially in an urban setting. This leads to a disconnect between what people consider "real life" interactions and ecological restoration. Traditional urban ecological restoration programming and, in fact, the foundation on which Evergreen operates, is stewardship of the landscape, which involves teaching care of the land and helping to build pride and ownership of local green space through a network of volunteer stewards. Forming and reinforcing the connections between ecological restoration and other types of urban greening projects, such as community gardening, make the concept of urban ecological restoration more relevant and connect to issues that are vital parts of everyday life, such as food security and health (see chap. 15, this volume). Linking social and environmental aspects of urban greening makes ecological restoration more accessible to a broader range of urban residents.

Through its restoration work in Toronto, Evergreen has also discovered that the simple act of not labeling its work "ecological restoration" in public discussions and documents reduces the disconnect people feel with the language of ecological restoration (Rebekka Hutton, pers. comm.). The group has found that the undercurrents associated with the use of technical ecological restoration language discourage many people from becoming involved. This can be particularly relevant when working in neighborhoods with populations who speak English as a second language. By discussing and promoting opportunities and activities as "planting events," "harvest festivals," or "activity potlucks," a wider range of public engagement, particularly from nonexperts, becomes possible. Labeling ecological restoration work as a more accessible activity can, according to Evergreen staff, introduce people to a wider idea of what urban ecological restoration is about in their neighborhood and how it pertains to their lives, which encourages increased interest and involvement in local projects (Rebekka Hutton, pers. comm.).

Adapting our view of the natural environment to include the social, cultural, and environmental dimensions of urban living can make ecological restoration more accessible to diverse populations. The Hispanic Development Council's (HDC) Social Ecology project focused on "social work from an environmental perspective and vice-versa" (Alas 2005, 5). Through projects such as urban agriculture training for new Canadians and the creation of a native flower garden by senior tenants living in low-income housing, the HDC linked social and environmental issues and created community support for urban greening projects (Ramos 2005).

Forging New Connections to Promote Diverse Volunteers

Linkages between government, nonprofit organizations, and the community are important for attracting volunteers and creating energy and interest within the community for the project (Beth Cragg, pers. comm.; see chap. 2, this volume). In areas of Toronto where there is little community involvement, volunteers are often transported from other areas of the city to plant trees and steward the site, even though they were not involved in the project conception or planning and will probably not use the space after the project's completion (Beth Cragg, pers. comm.). Making connections with local community partners and involving them in the decision-making process from the beginning will assure longer-term benefit for the local community, which in turn increases the possibility of long-term success of the project. Partnering with diverse organizations right from the start of a project increases the influence of racialized people in decision making around the use of local urban green space and increases the likelihood that priorities specific to these populations will be identified and implemented (Shannon Thompson, pers. comm.).[4]

Lopez and Thomas (2006) suggest that when working toward equity it is important to provide racialized people with the tools and resources necessary to build capacity in their own communities so that they will have the ability to participate in decision-making processes. Spending time and resources to construct and maintain relationships with community members and local organizations before restoration work takes place leads to more stable, longer-term urban ecological restoration projects that have greater relevance to the local community. According to restorationists working in the City of Toronto's Parks, Forestry and Recreation Department, setting aside the time and resources for partnership building when constructing a restoration plan, is an important part of the development phase that is often missed and is difficult, if not impossible, to insert later when the project is already running (Kim Stratham, pers. comm.; see chap. 6, this volume).[5]

According to Lorraine Johnson, a restorationist working in Toronto, local organizations or community groups often have closer ties to the community around them and are able to communicate and share information through channels that are unavailable to larger agencies or groups (Lorraine Johnson, pers. comm.).[6] Creating partnerships and providing the resources for local groups to take the lead on projects allows more local people to become involved in the decision-making process within an urban restoration project. The Alex Wilson Garden, located in a high-traffic area of downtown Toronto, is a unique example of a community-driven restoration project where partnership with local people from diverse backgrounds led the way. Johnson, who documented the success of the garden, admits that, although the processes of creating and maintaining the garden were not always easy, the garden is thriving precisely because members were directly involved from the beginning. The ownership and responsibility that local residents felt about the garden resulted in a successful green space that is flourishing under the long-term stewardship of its neighbors. Johnson (2002) writes that the feeling of ownership and the responding care are direct results of the site representing the values and interests of the local caretakers.

Combining Restoration with Community Development

Combining restoration with community development allows for a participatory activity that positively influences both the social and the natural capital of a community (see chap. 15, this volume). Making community development an active part of urban ecological restoration has allowed Evergreen to work with the cultural and economic concerns of a community—the vital priorities that interact with a local, urban ecological restoration project (Kelly Krauter, pers. comm.).[7] Evergreen's programming connects community development with urban ecological restoration by offering space, resources, and opportunities to learn about the connection between food, the land, and larger environmental issues (Rebekka Hutton, pers. comm.). By working on issues that directly affect people's lives, such as food security, access to safe and clean green spaces for recreation and areas to meet, and connecting these issues to ecological restoration, Evergreen is able to increase the relevance of urban ecological restoration to people and encourages increased involvement, particularly from racialized people. For example, Evergreen discovered that many people in the Mount Dennis neighborhood of Toronto had grown up around one of the largest green spaces in the city, yet they had never spent recreational time in the park (Rebekka Hutton, pers. comm.). Having the perception that the park was unsafe, or unclean, residents stayed away and did not provide input in developing the uses of the park. Through a community garden project, Evergreen worked with the local residents to develop a portion of the park as a safe, social, outdoor meeting place where people can gather and interact, meeting their neighbors and taking ownership of this public space. Many local residents, through their work with the garden, became engaged in the weekly stewardship group restoring the neighboring Eglington Flats and Topham Pond (Kelly Krauter, pers. comm.). Providing the resources and funding for the creation of a community garden allowed the local residents to come together and realize what resources and priorities they had to contribute to developing their community. This created a hub for the community around which people became active participants in contributing to community pride and improvement. Evergreen has discovered through its work that, starting with the priorities of the neighborhood, a process can begin wherein local residents contribute to making the city greener and their neighborhood more livable (Rebekka Hutton, pers. comm.).

Challenges and Opportunities for Racialized Volunteerism in Urban Restoration

Toronto organizations working on ecological restoration projects are implementing strategies and programs to make their practice more inclusive. The results have been varied with some projects successfully involving a greater number of racialized people (Kelly Krauter, pers. comm.) and others struggling to become more inclusive (Beth Cragg, pers. comm.). The following sections look at some of the challenges of becoming more inclusive and highlight opportunities for increased inclusivity within urban ecological restoration in Toronto. The opportunities highlighted are (1) organizational and leadership structure, (2) improving the participatory framework, and (3) social justice in ecological restoration.

Organizational and Leadership Structures

The majority of leaders and decision makers within the Toronto restoration community's major organizations, including the City of Toronto, the Toronto Regional Conservation Authority, and Evergreen, appear to come from a western European background. The absence of racialized people in these leadership roles contributes to an imbalance of power that is reflected in the priorities and aesthetic values represented in the restoration projects as well as the locations selected for restoration (Newman 2008). It is almost impossible to be inclusive within a decision-making process if equality is not built into the framework, and the organizations leading the project do not have diversity within their leadership (Burayidi 2000). While they may understand this idea, most environmentally focused organizations in the Toronto region still struggle with the challenge of changing their organizational structure to include the voices of racialized people (Joanne Jeffery, pers. comm.).[8]

According to Shannon Thompson of the Toronto environmental group Greenest City, urban ecological restoration projects that do not involve racialized people at all levels of decision making miss out on the values, ideas, and support of a large portion of the community (Shannon Thompson, pers. comm.). Thompson also says that it is important for an organization to continually reevaluate and reexamine their relationships, practices, and strategies throughout a project to ensure that equity is preserved at every step (Shannon Thompson, pers. comm.). This includes reevaluation of hiring and promotion practices so that racialized people have significant positions of authority and the power to make decisions. Building equity into an already established organization can be challenging for everyone involved because engaging in organizational changes to restructure the balance of power and privilege will shift the existing power balance. However, when organizational restructuring for diversity is successful, it can lead to "strategies and processes designed to make sure that differences among workers do not diminish, but rather enhance organizational functioning" (Crosby and Stockdale 2004, xix).

Improving the Participatory Framework

The current participatory framework used to engage people in the city of Toronto's urban ecological restoration planning is lacking in inclusiveness. This framework depends on public meetings, roundtable discussions, and information nights to recruit volunteers and educate the public about how a restoration project will unfold. Even within organizations that are working toward a more inclusive practice, these traditional means of public engagement are standard practice.

A study commissioned by the U.S. Forest Service in 2003 looked at the underrepresentation of certain populations in urban community forestry initiatives. The authors of the study recognized that the current models of outreach were not effective at connecting with people who have previously not been engaged in urban forestry initiatives (McDonough, Burban, and Russell 2003). The public participation models often used to encourage public involvement in the planning of urban ecological restoration work are based on the idea that everyone can attend a meeting and that all who attend the meeting have an equal chance to express their values and views (Milroy and Wallace 2002). However, public meetings and open houses generally involve experts presenting their ideas to a group of concerned citizens. At these meetings, there is little room for community involvement in the planning of the site, and the people attending are generally those who already have knowledge and interest in ecological restoration. This format unintentionally excludes a disempowered portion of the population by not providing alternative ways of speaking out or participating in the planning of the project (Sandercock 1998).

Public meetings that use a single means of communicating and knowledge sharing limit the portion of the population that can contribute ideas and values to the project. Alternative ways of connecting with the public, accessing local knowledge, and allowing opportunities for knowledge transfer are necessary within an inclusive ecological restoration framework. Using language that is accessible and approaching community outreach creatively through storytelling sessions, community arts, or community mapping workshops allows the message to reach a much broader slice of the community. Residents of the city of Victoria and the Common Ground Community Mapping

Project, for example, are using community mapping to develop a Greenways Plan for the city. Through this project, racialized people have access to an "inclusive and graphic framework for people to affirm and pool their experiences and knowledge about their home place" (Common Ground Community Mapping Project 2008). Incorporating community mapping and other alternative public engagement techniques into urban ecological restoration projects could shift the power balance, allowing for both experts and community members to contribute to designing local green space (see CUP. 21).

Examining and understanding why some people are not participating in urban ecological restoration can lead toward the establishment of more inclusive practices. As mentioned earlier, a deep-seated mythology within the Canadian environmental community portrays new Canadians as being disinterested in urban ecological restoration and other environment-related issues (Gosine 2003). A more inclusive urban ecological restoration framework needs to work with the alternative proposal that *all* people have significant concerns about the environment (Jones and Rainey 2006; Ramos, pers. comm.) in order to reveal the true and hidden reasons for lack of involvement. If an organization works under the assumption that there is chronic disinterest from racialized people, its strategies will be aimed at increasing interest and educating populations about the importance of urban ecological restoration rather than working with racialized people to remove barriers to participation.

One barrier to participation that was identified through this study was ecological restoration organizations' reliance on volunteerism. Volunteering is the backbone of urban ecological restoration and, admittedly, is an important source of labor for on-the-ground restoration work. However, as mentioned earlier, much smaller numbers of racialized people volunteer in ecological restoration projects than in other areas, such as the arts. Krauter hypothesized that the reason may be that not everyone has the resources to commit the time and energy to volunteer for projects as labor and time intensive as those in urban ecological restoration (Kelly Krauter, pers. comm.). Papillon (2003) also claims that it can be challenging for new immigrants, even those with ecological restoration or kindred experience, to share their skills and valuable experiences because they are also pursuing networking and skill-building opportunities. To encourage more involvement, volunteer organizations can offer something that new immigrants may find useful, something that will help them get ahead. For example, according to Ramos (2005), providing education and networking opportunities to volunteers is an incentive for more people from diverse populations to become involved in ecological restoration work.

Social Justice in Restoration Work

A study of urban ecological restoration in New Zealand by Kilvington and colleagues (1998) revealed that green social stratification is occurring within cities and that racialized people have less access to local green spaces and therefore urban ecological restoration projects. From interviews I conducted with members of the Toronto Regional Conservation Authority (TRCA) and the Parks, Forestry and Recreation

Department of the city, I learned that urban ecological restoration sites in Toronto are selected primarily on their ecological value and the amount of visible interest for the project within the community. Joanne Jeffery, with TRCA, revealed that many of the TRCA sites are selected through public suggestion and political pressure (Joanne Jeffery, pers. comm.). Many high-budget, high-profile projects in Toronto (e.g., the Don Valley Brick Works and High Park restorations) take place in areas where vocal, affluent residents already have access to green space (Foster 2005). Engaging only those members of the population who are already aware and active in ecological restoration practices and who live in areas where green space of high ecological value already exists perpetuates the lack of involvement by people from diverse cultural backgrounds and limits who benefits from the projects (Joanne Jeffery, pers. comm.; Beth Cragg, pers. comm.).

Designating a portion of resources to community-driven ecological restoration projects in specific areas of the city that have been identified as low income and vulnerable will provide urban green space where it is most needed. Selection sites that provide the greatest social impact will benefit people, many of them racialized, who live in low-income areas with less access and greater need for green space. Brownfield sites and degraded landscapes in areas of the city with low-income and highly racialized populations should be the focus and direction of funding for ecological restoration projects in the city. This can be done by introducing social and community development goals as added criteria for site selection. It must be noted, however, that additional resources (i.e., funding and staff time) need to be set aside at the outset of a project to initiate a project and build capacity in communities where there are fewer social resources (Kim Stratham, pers. comm.). Including skill-building exercises, leadership training, and community support services can create links between ecological restoration and the social responsibilities of a city. For example, the organization Sustainable South Bronx, located in the low-income South Bronx neighborhood of New York City, trains environmental stewards from local neighborhoods where high poverty and unemployment are rampant. Through training, people acquire the skills required for planning and implementing ecological restoration projects in their own landscape that in the last century became littered with brownfield sites (Sustainable South Bronx 2007). This program, based on community development through environmental amelioration, is forging a new generation of locally based restoration workers with diverse values and ideas to contribute to ecological restoration projects in their own neighborhoods (Sustainable South Bronx 2007). Looking at the Sustainable South Bronx model would be useful for Toronto's restoration community for developing a framework that further incorporates racialized people into the process from the outset.

Conclusion

Implementing an inclusive urban ecological restoration framework can be both challenging and rewarding. Nevertheless, in the current situation of globalizing cities, it is vital that organizations take steps to make ecological restoration more inclusive to racialized people in their communities. Opening doors to a broader and more diverse urban ecological restoration community can create linkages with local nature and encourage a greater sense of community that may lead to other local community development projects. Inclusive ecological restoration will challenge the myths that racialized people are not interested in ecological restoration, and provide opportunities for restorationists and the community to access a greater local knowledge base of diverse values and ideas about nature. Providing opportunity for the inclusion of more diverse values surrounding the connection between nature and culture can, and will, create conflicts and increased work in planning and developing urban restoration projects. However, the benefits to the project and the community should not be ignored and should instead inspire organizations to continue to strive for greater inclusiveness.

Organizations in the city of Toronto are taking the first steps toward a more inclusive ecological restoration field. Combining ecological restoration with other urban greening projects, such as community gardens, linking ecological restoration with community development activities and partnering with local community organizations have encouraged increased community participation, specifically from racialized people. However, these strategies only begin to address the systemic issues that prevent racialized people from being included in the field of ecological restoration. Prioritizing restoration projects in low-income neighborhoods, providing learning and skill-building opportunities for restoration volunteers, incorporating alternative methods of knowledge sharing and communication, and restructuring organizations to include culturally diverse people in leadership roles are all necessary. It is important that restoration practitioners acknowledge the need for change, that these changes will require continual action and steadfast resolve, and that small, first steps, such as those being implemented by Toronto restorationists, are vital to long-term success.

Notes

1. I use the term *racialized* in this paper to identify people and populations who are subjected to negative and unequal social behaviors because of the societal categorizations based on perceived differences, such as skin color and cultural heritage (Lopez and Thomas 2006). Racialized, I believe, is a more accurate term in this context than ethnic or culturally diverse, and is commonly used in antiracism literature.

2. Beth Cragg (formerly with the City of Toronto Parks, Forestry and Recreation), interview by Allegra Newman, May 2007, Toronto, ON.

3. Rebekka Hutton (Evergreen), interview by Allegra Newman, April 2008, Toronto, ON.

4. Shannon Thompson (Greenest City), interview by Allegra Newman, May 2007, Toronto, ON.

5. Kim Stratham (City of Toronto Parks, Forestry and Recreation), interview by Allegra Newman, May 2007, Toronto, ON.

6. Lorraine Johnson, interview by Allegra Newman, May 2007, Toronto, ON.

7. Kelly Krauter (Evergreen), interview by Allegra Newman, May 2007, Toronto, ON.

8. Joanne Jeffery (Toronto Regional Conservation Authority), interview by Allegra Newman. April 2007, Toronto, ON.

References

Alas, B. 2005. "Practicing Social Ecology: A Guide for Members of Our Immigrant Communities." http://www.hispaniccouncil.net/id6.html.

Burayidi, M. A. 2000. "Urban Planning as a Multicultural Canon." In *Urban Planning in a Multicultural Society*, edited by M. Burayidi, 1–15. Westport, CT: Praeger.

Common Ground Community Mapping Project. 2008. http://www3.telus.net/cground/aboutus.html.

Crosby, F., and M. Stockdale. 2004. *The Psychology and Management of Workplace Diversity*. New York: Wiley-Blackwell.

Desfor, G., and R. Keil. 2004. *Nature and the City*. Tucson: University of Arizona Press.

Foster, J. 2005. "Restoration of the Don Valley Brick Works: Whose Restoration? Whose Space?" *Journal of Urban Design* 10 (3): 331–51.

Gobster, P. H. 2001. "Visions of Nature: Conflict and Compatibility in Urban Park Restoration." *Landscape and Urban Planning* 56 (1–2): 35–51.

Gosine, A. 2003. "Myths of Diversity." *Alternatives* 29 (1): 12–14.

Higgs, E. 1997. "What Is Good Ecological Restoration?" *Conservation Biology* 11 (2): 338–48.

Hull, R. B., and D. P. Robertson. 2000. "The Language of Nature Matters: Toward a More Public Ecology." In *Restoring Nature: Perspectives from the Humanities and Social Sciences*, edited by P. H. Gobster and R. B. Hull, 97–118. Washington, DC: Island Press.

Johnson, L. 2002. *Tending the Earth: A Gardener's Manifesto*. Toronto: Penguin.

Jones, R., and S. Rainey. 2006. "Examining Linkages between Race, Environmental Concern, Health, and Justice in a Highly Polluted Community of Color." *Journal of Black Studies* 36 (4): 473–96.

Kilvington, M., J. Rosier, C. Wilkinson, and C. Freeman. 1998. "Urban Restoration: Social Opportunities and Constraints." Paper presented to the Symposium on Restoring the Health and Wealth of Ecosystems, September 28–30, 1998, New Zealand.

Light, A. 2003. "Urban Ecological Citizenship." *Journal of Social Philosophy* 34 (1): 44–63.

Lopez, T., and B. Thomas. 2006. *Dancing on Live Embers: Challenging Racism in Organizations*. Toronto: Between the Lines.

Martin, D. C. 2004. "Apartheid in the Great Outdoors: American Advertising and the Reproduction of a Racialized Outdoor Leisure Identity." *Journal of Leisure Research* 36 (40): 513–35.

McDonough, M., L. Burban, and K. Russell. 2003. "Dialogue on Diversity: Broadening the Voices in Urban and Community Forestry." http://www.na.fs.fed.us/spfo/pubs/uf/diversity_rpt/diversity_rpt.htm.

Milroy, B., and M. Wallace. 2002. "Ethnoracial Diversity and Planning Practices in the Greater Toronto Area." http://ceris.metropolis.net/Virtual%20Library/housing_neighborhoods/WK18_Milroy_Wallace.pdf.

Neumann, R. 2002. *Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa*. Berkeley: University of California Press.

Newman, A. 2008. "Inclusive Planning of Urban Nature." *Ecological Restoration* 26 (3): 229–34.

Papillon, M. 2003. "Immigration, Diversity, and Social Inclusion in Canada's Cities." Ottawa: Canadian Policy Research Networks. http://www.cprn.org.

Pestieau, K., and M. Wallace. 2003. "Challenges and Opportunities for Planning in the Ethnoculturally Diverse City: A Collection of Papers—Introduction." *Planning Theory and Practice* 4 (3): 253–58.

Ramos, D. 2005. *Social Ecology Project Newsletter: Awakening Consciousness to Revive Our Health*. http://www.hispaniccouncil.net.

Sandercock, L. 1998. *Towards Cosmopolis*. New York: Wiley & Sons.

Siemiatycki, M., and E. Isin. 1997. "Immigration, Diversity, and Urban Citizenship in Toronto." *Canadian Journal of Regional Science* 20: 73–102.

Statistics Canada. 2003. "Ethnocultural Portrait—2001 Census." http://www12.statcan.ca/english/census01/products/analytic/companion/etoimm/contents.cfm.

———. 2007. "Caring Canadians, Involved Canadians: Highlights from the 2007 Canada Survey on Giving, Volunteering and Participating." http://www.givingandvolunteering.ca/.

Sustainable South Bronx. 2007. "B.E.S.T. Project." http://www.ssbx.org/best.html.

Toronto Community Foundation. 2004. "Toronto's Vital Signs 2004." http://www.tcf.ca/vital_signs/index.html.

Westphal, L. M. 2003. "Social Aspects of Urban Forestry: Urban Greening and Social Benefits: A Study of Empowerment Outcomes." *Journal of Arboriculture* 29 (3): 137–47.

PART II

Participation: Collaboration

Increasingly common in natural resource and ecosystem management, collaboration is a process that requires an ongoing relationship between trusting partners who are willing to surrender their own positions, if necessary, to reach shared goals. It is participatory in a deeper sense than volunteering, networking, coordinating, or even cooperating because it demands more from the partners and the partnership. While not easily achieved, collaboration is often the basis for moving forward in otherwise intractable or litigious situations (i.e., “wicked problems”) as well as in settings where people from various disciplines (e.g., ecology and social sciences) come together to solve a common problem.

Javier Escalera Reyes introduces the collaboration theme with a theoretical discussion of collective identification and building social group resilience. He then compares two case studies—a failed participatory process from the Andalusia region of Spain and a successful collaboration at a cooperative in rural Costa Rica. In these cases, the key differences were style and scale of governance—the first being controlling and hierarchical, the second inclusive and heterarchical. Escalera Reyes concludes, “the participation of local citizens is a critical factor in creating a sense of territory and, ultimately, in increasing the resilience of the system as a whole.” Next, Nils D. Christoffersen of Wallowa Resources, a local, nonprofit organization in northeast Oregon, shares his experiences in collaborative, community-based restoration in a case study of public land watershed restoration within a transforming rural region. This chapter highlights the importance of trust and constructive relationships to successful restoration under socially divisive circumstances. Christoffersen wraps up his case study with an excellent list of lessons learned and keys to successful multiparty collaboration. Mark S. Andre describes how citizens of the small town of Arcata, California, are engaged in the restoration of community-owned redwood forests. He shows how a unique tenure arrangement provides opportunities to build new relationships between people and degraded lands in need of restoration. Karen Hardigg’s concluding chapter explores the possibilities of a community-driven transition from wood fiber extraction to ecological restoration in Alaska’s Tongass National Forest. Because the Tongass has long been a flashpoint for conflict over natural resource management, the progress she describes provides hope for the promise of public involvement, dialogue, and compromise to advance ecological restoration in complex social and political environments.

Chapter 6

Public Participation and Socioecological Resilience

Javier Escalera Reyes

Social Participation, Collective Identification, and Socioecological Resilience

The following lyrics by the old Costa Rican calypso singer Walter "Gavitt" Ferguson express with wonderful Caribbean irony and wit the feelings toward politicians and conservation agency personnel when the areas that people live in become the object of official protection because of their "natural" value:

> National Parkers are going around
> into my farm they sit and walk
> telling everybody all around the town
> "This is National Park."
> They want get full details
> "How long I owned this piece of land?"
> No tell no lie or you going to jail!
> That's what they made me understand.
> *Walter "Gavitt" Ferguson*

This is particularly true of areas that boast such natural value precisely because of the relationship the local population has maintained with the land for generations, making such lands "national park material" or eligible for other types of protected status. Local residents' feelings of exclusion and even alienation from a territory that had been their world until it was declared a protected space are a logical consequence of the ways in which politicians, civil servants, scientists, and technicians typically view the "human element" of these areas (see chaps. 18, 19, 20, this volume, for more discussion of this phenomenon). Even today, many of these agents continue to perceive the local population as a problem if not an outright hindrance. Many still believe that the best way of conserving important spaces is to keep people as separate from them as possible, based on the assumption that people are not aware of the heritage value of the space in which they live and to which they belong. However, it is becoming increasingly apparent that areas of high environmental value cannot be properly

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_6, © Island Press 2011

conserved, or sustainable socioeconomic development achieved, without the effective participation of the local population in management and decision making.

Public engagement and active participation are even more important in ecologically and environmentally degraded areas in which attempts at restoration or regeneration are under way. Without the active involvement of the local population, it might be possible to achieve a superficial level of restoration, for example, by conducting a cleanup of contamination, mitigating visible physical impacts, or reintroducing native plant and wildlife species, but a complete and comprehensive regeneration of the ecosystem as a whole will never be achieved. Even if scientists, technicians, and politicians were to accept the need for social participation, this participation does not occur automatically without the existence of political resolve to foster it. Participation is not an instinctive action for most members of "modern" societies. Quite the opposite, in fact; nearly all aspects of modern society conspire to promote passive and individualistic attitudes contrary to fostering participation. Participation is a learned form of collective behavior; like everything in human nature, it is a cultural phenomenon. Therefore, if political resolve really exists, the first task is to spread and reinforce the learning of participatory forms, habits, values, and practices; in short, to contribute to the development of a participatory culture.

Yet politicians, technicians, and scientists, in spite of their possible isolation from citizens, are a part of society itself and are affected by the same factors that discourage participation. As a general rule these agents do not tend to be overly eager to initiate a participatory process. The result is a feedback loop: the more alienated the population feels in relation to the environment in which it lives, the greater the development of selfish and individualistic attitudes that put private interests and personal benefit before the conservation or restoration of the environment. A participatory cultural exchange cannot be fostered and achieved with words and goodwill alone; resources are required, at least in an equivalent measure to those used for the repopulation of species, decontamination, research, and monitoring. Assuming that all the political and material requirements are met, a key factor for ensuring real and effective participation is the existence of a collective identification of people with a particular place (Ospina 2001a, 2001b, 2003).

Collective Identification

Identification turns space into territory, understood as a culturized geographical space and, therefore, acts as one of the most important reference points in the common recognition of members of a collective as the constituents of a "community." The greater the degree and depth of identification of the population with its territory, and the greater this identification is shared among its members, the more effective their participation will be. Conversely, the disjointedness and detachment of a group of individuals as a collective and their disconnection from the geographical setting in which they live, with which they do not identify collectively, is a factor that renders ineffective any attempts at participation. This is particularly important when it comes to restoring socioecosystems affected by disasters of natural origin or of our own human actions.

I use the term "identification" and not "collective identity," in spite of how deep-rooted this latter term is in social science, with the intention of highlighting that this is a continuous process of symbolic construction that creates a sense and feeling of belonging. Clearly, for processes of identification to acquire consistency they must be based on "objective conditions of existence" shared by a significant proportion of the members of the collective. If groups of people fail to find their collective identity, then they either become disorganized individual entities or they act in accordance with the particular strategies and interests of outside agents rather than pursuing their own collective development.

Given the crucial importance of a strong sense of belonging and identification as a fundamental factor in the resilience of a human group, it is clear that that participation, beyond its specific effects, is able to increase and intensify the resilience of the group and the ecosystem in which it resides. Following Carl Folke and Per Olsson, among others (Olsson 2003; Olsson and Folke 2004; Olsson, Folke, and Hahn 2004), the idea of resilience[1] can be understood in a global, integral, and socioecological sense. The original definition of "resilience" derives from engineering and refers to the capacity of a structure (e.g., a bridge) to return to its initial shape after bearing a load. Both its mechanical conceptualization (understood as a material's capacity to return to its original state after having been deformed) and its psychological concept (which tends to focus on the resilience of the individual and to highlight the capacity to overcome negative impacts) are only partial understandings of the idea of resilience, which do not exhaust the potentiality of the concept. Resilience can also be understood as the capacity to take advantage of opportunities that emerge as a consequence of traumatic changes or of favorable circumstances that appear under normal conditions.

From these ideas flows the concept of socioecological resilience, which implies that social vulnerability and/or strength affects ecological vulnerability and/or strength, and vice versa. In their definition of social group resilience, Brenson-Lazan and Sarmiento Diaz (2003) understand it as the ability to cope with internal or external crises and not only resolve them effectively but also learn from them, gain strength through them, and emerge transformed, both as individuals and as a group. Living systems not only resist sources of stress, they also learn and are capable of projecting into the future creatively. The search for a wider definition of resilience reveals that it is a property of systems. Individual resilience does not exist in a strict sense, although it is an implicit potentiality in each individual; it can only be manifested in relation to the ecological and social environment. It is not an essence but rather a characteristic that requires complex relations in order to exist. From a systematic perspective, resilience could be defined as the capacity of a social system subjected to some form of stress to regenerate itself along the lines of its original forms or new forms, as a kind of creative conservation.

Furthermore, the idea of crisis, which is always implicit in the concept of resilience, can be understood in a broader sense that expands it beyond its usual negative or catastrophic connotation. Rather than being seen as exceptional events, crises should be thought of as permanent components of ecological and social systems; they are not merely destructive but can also foster opportunities for growth, learning, and adaptation. The idea of crisis can be viewed as a type of conflict producing qualitative changes that, in turn, promote transformations in natural and sociocultural systems and have at least the potential to make these systems more resilient. In this sense, resilience is connected with the idea of coevolution (Norgaard 1994, 2002), viewed as a key factor in understanding the process of natural selection in the field of natural sciences. It likewise aligns with processes of diffusion and acculturation in the field of social science, used to analyze and understand the development of socioeconomic and cultural change from a systemic perspective. This approach pays attention to internal processes and relations between individuals and groups in the socioecosystem, not just to genetic and exogenous factors.

As observed by Boisier (1994), cultural identity and identification with territory, along with the resilience of the social fabric (i.e., the capacity for reconstruction following damage caused by external agents), are critical factors for an area to be considered territory. All of the above highlights the critical role played by collective identification and popular participation in advancing conservation, restoration, regeneration, and management of the sustainable development of a territory. From this perspective, collective identification and social participation are processes that are intrinsically linked with the ecosystem that the human collective in question inhabits. The strengthening role of resilience described previously is not limited solely to the human sphere but, rather, spreads to the entire ecosystem of which people are a part. The greater and more in-depth the social participation and identification of the collective with the structural elements of its specific existence, such as territory, the more resilient that ecosystem as a whole will be. Given the crucial importance of a strong sense of belonging, of identification, as a fundamental factor in the resilience of a human group, participation must be seen as a strategy that is able to increase and intensify the resilience of that group and, by extension, of the whole socioecosystem to which it belongs. Nowhere is this more apparent than in ecological restoration processes.

The Case of the "Green Corridor," Andalusia, Spain

In 1998, the Aznalcóllar mine waste reservoir ruptured, flooding a large part of the Guadiamar River basin with a torrent of toxic sludge, more or less up to where it meets the Doñana marshlands, one of the most important and valuable natural spaces in Europe (Escalera 2003, 2008). The mines of Aznalcóllar are located 25 miles (40 km) northwest of Seville and 28 miles (45 km) north of the Natural Space of Doñana, an extensive territory including a number of protected areas, most notably Doñana National Park (fig. 6.1). The mines have been exploited for their deposits of pyrite, copper, silver, gold, lead, sulfur, and zinc for centuries, and ownership of the mines has changed frequently during this time. In 1987, the Swedish-Canadian company Boliden Limited took ownership of the mines and was in control at the time of the disaster. The toxic flood occurred on the morning of April 25, 1998, when the failure of a reservoir meant to hold mining residues sent six million cubic meters of acidic, heavy

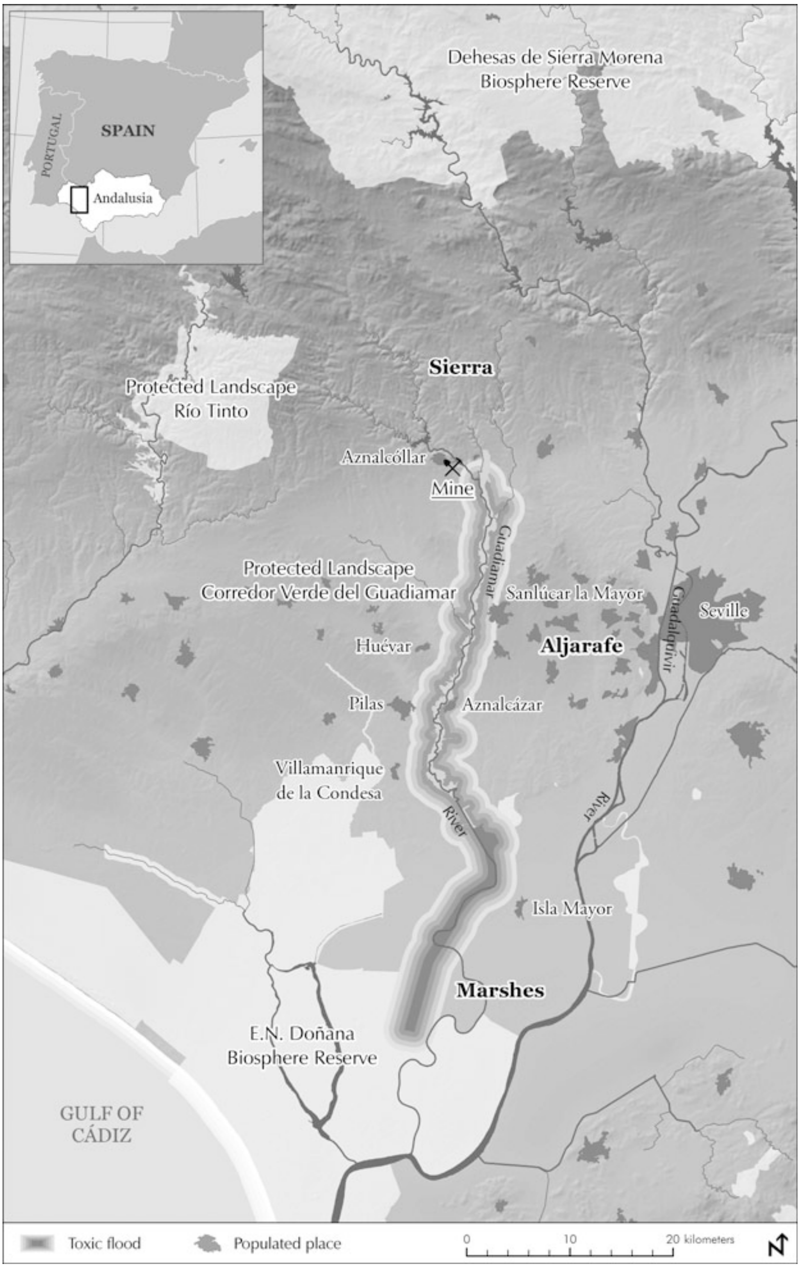

FIGURE 6.1. Location of the Guadiamar River corridor in Andalusia, Spain.

metal–laden water into the Guadiamar River. The Guadiamar overflowed along 39 miles (63 km) of its riverbed, with toxic effects occurring over 11,450 acres (4,634 ha). Sixty-four percent of the surface area affected was in the Natural Space of Doñana. Aquatic vegetation was practically eliminated along the watercourse, and more than thirty-seven tons of dead fish and crabs were collected in the river following the disaster. Cropland near the river was impacted as well, affecting the ability of farmers throughout the area to sell crops and livestock due to public fear of contaminated farm products.

In the wake of the mine disaster, public agencies took almost sole charge of cleaning, restoration, reforestation, and recovery. These tasks were primarily led by the Andalusian government via the Department of Environment and Department of Agriculture and Fishing, and the Spanish government via the Department of Environment and the Hydrographic Confederation of the Guadalquivir. The Spanish administration and the autonomous administration of Andalusia were tasked with recovering the area not only ecologically but also socioeconomically, a project addressed through the expenditure of over 66 million euros for acquisition and expropriation of land and over 22 million euros for restoration. In addition to cleanup operations and the environmental restoration, the government authority most directly responsible for this process, the Regional Department of the Environment in Andalusia, proposed that an ecological passage be created to link the Doñana marshlands in the south to the Sierra Morena's mountains in the north through a "Green Corridor."

The process of restoration of the Guadiamar's riverbed included an extraordinary deployment of human, material, and economic capital that marks it as an unprecedented milestone in the remediation of an environmental disaster. In the first phase of the mud's withdrawal the economic investment, overseen by the central and Andalusian governments, was of more than 43 million euros, utilizing almost five hundred trucks and nine hundred workers. The second phase had an approximate cost of 14.5 million euros. The agile, fast planning and execution of the cleaning set a precedent in the history of mining accidents, becoming a reference point for future actions. The first phase of cleaning was initiated eight days after the spill and was completed in just seven months, during which time seven million cubic meters of contaminated mud and land were withdrawn. The purification of toxic water was initiated two months following the spill and was finalized in less than three months. Finally, the second phase of cleaning (in the extreme north and south of the flooded zone) was prolonged from the end of 1998 to the year 2000, eliminating 99 percent of the contaminants released (Garrido 2008). In 2005, this space was declared a "protected landscape," becoming one of the few known cases in the world in which a highly degraded space has become the object of protection and conservation.

The participatory process carried out as part of the implementation and development of the Green Corridor project, in which my colleagues and I were involved as analysts and facilitating technicians, highlights the issues raised earlier. It is a good example of a process of environmental restoration in which the lack of involvement on the part of the local population undermined the possibilities for conservation and sustained restoration of the territory. The characteristics and conditions of this process have not fortified the resilience of the space. It has been "restored" from a physical point of view, but it continues to possess a high level of vulnerability due to the estrangement of the population from their local environment. The two-and-a-half-year delay between the technical cleanup and restoration work (April 1998) and the start of the participatory process (November 2000) is significant. Not only does it show just how little the politicians prioritized the active participation of the local population, but it also constituted a handicap in terms of involving the population in actions and projects that were already defined and under way before they were given the chance to participate. This difficulty was further exacerbated by the fact that the participation offered was restricted almost exclusively to "consultations," with practically no capacity to intervene in the decision-making and management processes—a far cry from authentic participation.

However, I do not merely intend to criticize the politicians in charge of this project for their lack of a determined willingness to promote real and effective citizen participation, nor of the highly restricted understanding they have of this concept. Similarly, I do not wish to overemphasize the attitudes of the technicians, who were not particularly open to participation, or the insufficient resources devoted to the participatory process. These factors are, of course, very important for social participation to take place and develop as such, but the focus of this chapter is on the factors that affect the capacity for participation among those who theoretically should have been leading the Green Corridor participatory process, namely, the local populace. Several conditions prevented (and continue to prevent) the local population from identifying with the Green Corridor as a consequence of the geographical, socioeconomic, and cultural characteristics of the area; this lack of identification works against the resilience of the space in terms of overcoming future crises.

Lack of Territorial Identity and Unity

The first issue is precisely the lack of territorial unity in the space of the Green Corridor, and in a broader sense of the Guadiamar River, which acts as its axis. The Guadiamar runs from north to south through three clearly defined areas, not only geographically and ecologically speaking, but also sociologically, which is of greater interest to us here. This separation is not a new phenomenon; it originated a long time ago, although these differences have been accentuated in recent times. The protected landscape of the Green Corridor is limited to the area affected by the toxic spill, but this space and its development cannot be considered in isolation from the territorial context in which the boundaries of this protected area are inscribed. From a human perspective, there are three structural unities within the Guadiamar River basin, based on the uses and affective bonds established by the local population with the river. The Green Corridor contains fifteen municipalities, some of which have only a very weak bond with the river. Of the total 797-square-mile (2,065–km^2) area, 386 square miles (999 km^2) are located in the southern sector, a transition space between Aljarafe and the Guadalquivir Marshlands, acting as a nexus with the Doñana marshes. This sector constitutes almost half the total area. A further 284 square miles (736 km^2) corresponds to the northern sector around the upper course of the Guadiamar, a transition area between the Sierra Morena and Aljarafe, linking the Sierra de Aracena y Picos de Aroche Natural Park and the Sierra Norte Natural Park in Seville, and more closely connected with another peculiar protected landscape, the area of

Río Tinto.[2] This sector has been marked historically, geographically, and socioeconomically by the presence of mining, an activity that is currently in decline, and by livestock and forestry activities, which occupy over a third of the area.

Finally, the central sector, corresponding to the central-western part of the district of Aljarafe, spans an area of 127 square miles (330 km^2). Although it occupies slightly more than one-sixth of the whole area, it has the highest population density and the greatest physical proximity to the Guadiamar, although, paradoxically, its population has the weakest bond with the river. Its traditional agricultural character is undergoing a major and rapid change as it is increasingly absorbed by the urban sprawl of Seville's second outer ring. Furthermore, as the east–west axis grows stronger, due to the Seville–Huelva motorway, the north–south orientation of the Guadiamar is broken, and the central section is becoming increasingly detached from both the northern and the southern sectors of this area.

The total area has a population of 85,337 inhabitants (data from the 2007 Electoral Register). However, it is still a relatively important population that represents significant population growth (12.4 percent in comparison with the 1996 Electoral Register[3]), in spite of the apparently rural nature of a large part of the area. This fact clearly reflects the trend toward urban development in the area, particularly in its central sector, corresponding to the western edge of Aljarafe, within the aforementioned urban sprawl of Seville's second outer urban ring. Here, demographic growth was 17.5 percent over the 1996–2007 period. In this sector, the 2007 population was 44,919, which accounts for over half the total population in the area. This gives an idea of the weight and importance of the participation of this population for the consolidation and development of the Green Corridor specifically and as a means of strengthening the resilience of this territory as a critical link in the Mountain–Aljarafe–Marshland system.

Another figure that accentuates the detachment of much of the population from the territory in which they live—in general and, more specifically, regarding the Guadiamar River—is the comparatively low percentage of people who are native to the municipality where they currently reside. Native residents, by this definition, represented just 54.7 percent of the total (data from the 2007 Electoral Register), which, even though it is over half of the current resident population, still represents a decline of over five percentage points in just eight years. This figure reflects the arrival of a significant number of people born outside the territory and, therefore, arriving without a material or affective bond with the area or the Guadiamar. This is confirmed by the fact that the highest reduction in the native population between 1996 and 2007 was found in the central sector, Aljarafe.

In addition to the foregoing, another factor that is indicative of the disconnection of the local population from the territory in which they live, and specifically from the river, is the change in economic activity. The economies in most of the municipalities included in the area are rapidly losing their agrarian nature, with agriculture, livestock, and fishing activities currently employing more than half the population in just two of the fifteen municipalities. In the other municipalities, the population engaged in nonagricultural/livestock/extractive activities varies between 52 and 89 percent, averaging 71 percent. In five cases, the percentage of the population working in agricultural/livestock/extractive sectors does not exceed 25 percent of the total (Carrasco et al. 2003). Bearing in mind that the data available are from 2001, the current situation is even more marked.

These aspects are some of the factors that prevent the local population from identifying with the territory and are, therefore, major obstacles blocking effective participation. However, there is another factor that causes disjointed relations between populations included in each of the three sectors and, especially, between the three sectors. If the area of the Guadiamar ever constituted a connected, structured territory in the past, this certainly has not been the case for some time. The specific ecological, socioeconomic, and cultural characteristics of each of the three sectors have acted in the past and continue to act as obstacles to the establishment of social relations sufficient to generate a territorial identity. Sadly, the development planning that currently dominates the corridor area does not favor the correction of this trend and, indeed, exacerbates it. This is happening in all three sectors, although most significantly and profoundly in the sector corresponding to the region of Aljarafe.

In addition to the incapacity, inefficacy, limitations, and lack of political will for substantive public engagement on the part of those responsible for the creation and development of the Green Corridor project, there is another crucial explanatory factor. Opinion surveys conducted by Andalusia's Department of Environment and our own interviews and discussion groups demonstrate the detachment and disinterest displayed by most of the current population around the Green Corridor in relation to the Guadiamar River. For at least thirty years prior to the catastrophe, the Guadiamar and subsequently the corridor have meant (and continue to mean) very little to most of the population. It should be noted that the environmental condition of the river was highly degraded even before the mining spill, as nearby towns, agricultural and livestock farms, and industries used the Guadiamar as a kind of sewer. For example, waste from olive processing operations was dumped in the river. This indifference to the river as a system is now combined with an influx of new residents who have a very limited, although potentially transformative, relationship with the river and the corridor concept.

One decisive factor that explains this lack of a connection is the process of unsustainable development that has characterized the area in recent years, particularly in the sector corresponding to Aljarafe. This sector is feeling the full force of urban sprawl spreading around the Seville–Huelva motorway, a new axis that breaks the traditional north–south structure of the region and has provoked the exponential acceleration of changes in both population and land-use patterns. A large portion of the current population in the central zone moved there only recently; their activities and interests, like most of the native population, are increasingly oblivious to the environment of the river.

Although this indifference in the population is notable in relation to the particular stretch of the river corridor that runs through each of the three sectors defined in the area, it is magnified in relation to the protected space as a whole. The level of awareness among the populations in each of these areas that they are part of a single ecological/cultural territory, an area of a transition and connection between the mountains and the marshlands, is minimal. This attitude should undoubtedly be viewed as one of the factors that gave rise to the mining catastrophe, not in terms of direct responsibility but rather in the sense that a lack of interest in the river could have influenced the general lack of social concern regarding the state of the Guadiamar and the accumulation of risk factors.

All these aspects undoubtedly create very powerful obstacles to the active involvement of the vast majority of the local population. Individuals do not get involved or participate—even though verbally they might defend their right to do so—in something they do not consider their own, something they live apart from or actively turn their back on. This attitude may also have been fueled by the intervention of the authorities following the catastrophe, which, perhaps in an attempt to justify their role in an event for which the media and political repercussions increased exponentially because of its proximity to Doñana, assumed total responsibility and prominence in their actions. The scientists, politicians, and technicians never asked for the collaboration of social agents or local institutions, thereby possibly nourishing the passiveness of the latter, giving them reasons to neglect their own responsibilities and attribute all the problems to the actions of the authorities.

The case of the Guadiamar River is a good example of a space that has been "restored" from a physical point of view but continues to be highly vulnerable due to the estrangement of the population. The ecological functioning of the Green Corridor and the viability of the strategy to recover the function of the Guadiamar basin as a nexus between the ecosystems of the mountains and the marshlands depend fundamentally on the construction of a broad and solid identification between the population as a whole and the space it inhabits. Put simply, the task at hand is to construct a territory in the global and integral sense of the term. This is not something that can be achieved overnight from outside local society, or through propaganda and image alone. Yet it is crucial to promote participation as a strategy to develop the social framework and produce collective identification with the territory and its ecosystems. Without a heightened level of socioecological resilience, the Guadiamar basin remains susceptible to continued ecological degradation. A case of a more resilient socioecological system, the Coopesilencio farming cooperative, is presented in box 6.1. While the social, economic, and political contexts of Coopesilencio are vastly different than those in the Guadiamar basin, this case is highlighted as an example of a space that is strongly territorialized, where the connection between people and their environment is both robust and flexible enough to create a high level of resilience.

Conclusion

The examples presented here demonstrate the fundamental importance of the sense of belonging and the identification of the local population with the territory in which they live. This is especially true in cases where this connection plays a role in restoration efforts following catastrophes, whether they are of natural or human origin. Thus the participation of local citizens is a critical factor in creating a sense of territory and,

Box 6.1
Coopesilencio, Costa Rica: An Example of Community Participation

The land surrounding the Savegre River in the central Pacific area of Costa Rica is subject to periodic Caribbean hurricanes and Pacific cyclones as well as flooding of the river and its tributaries—natural phenomena that cause a high degree of uncertainty for the region's socioecosystem. After a flood in the 1950s destroyed the United Fruit Company plantations and convinced the corporation to pull out of the area, a group of workers and small farmers led a struggle to acquire the abandoned property. Their efforts culminated in 1973 when forty-two farming families permanently occupied the estate previously known as El Silencio, and established the Coopesilencio farming cooperative (Sobrado 1998; CEPAL 1999; Marín Hernández 1999; Gertler 2001; Cordero Ulate 2006). The cooperative's main activity has been the cultivation of African palms for the production of oil, a crop that currently occupies 1,310 acres (530 ha) of the 2,471 acres (1,000 ha) owned by the cooperative. This area also includes 741 acres (300 ha) of forestland and other acreage that is used as pasture to feed the cooperative's eighty cows, to grow agrobiological fruit and vegetable crops, and for other farming usages, most of which are for the cooperative's own consumption. The cooperative, which was originally set up with the support of the Costa Rican Institute of Agrarian Development (IDA), currently has forty-two members, whose families, along with another forty families that are not members of the cooperative, make up the four hundred people who live in the community. Work is shared among the members in accordance with the needs, preferences, and qualifications of the individuals.

In 1998, Hurricane Mitch destroyed a large part of the palm plantations. This disaster interrupted the supply of drinking water and electricity and destroyed the bridge across the Guabo River, which led to major communication difficulties and posed a serious problem in terms of product exports. However, it also led to the development of a community agroecotourism project that, with time, has become an important factor in stemming the exodus of cooperative members and has even revitalized the cooperative, creating job opportunities for a growing number of women and some of the younger members who find tourism more appealing than working in the fields. Even though this group represents a small percentage of the younger population, without their interest the youth exodus would be practically total. In 2005, Hurricane Rita destroyed a significant part of the palm plantations, depleting production of Coopesilencio's main economic resource and also destroying what represents for any Costa Rican community the center of its social life—the main square/football pitch. Instead of giving up, the community once again rallied and worked together to drive its tourism project forward, renegotiating debts that were impossible to repay, and working collectively to recover their square/football pitch, which they missed as a symbol of their identity.

The catastrophe not only had a strong impact on agricultural production, but additionally the damage caused to the small eco- and agro-tourism infrastructure all but convinced the cooperative to give up on this activity and transfer management of their resources to an external operator. However, community leaders decided not

Box 6.1
Continued

to renounce control of tourism and instead boosted this activity, expanding the facilities by constructing cabins and a bar-restaurant to accommodate visitors, supporting specific training for some of the younger members of the community and women to provide better service to visitors, and launching a tourist package through which visitors stay with families in the community. This initiative has prevented, for the time being, the loss of control of the ecotourism activity.

At the same time, the cooperative has attempted to develop other activities in order to diversify its sources of income and increase its resilience in the face of its strong dependence on the palm oil industry. The community developed the Savegre River Wildlife Rehabilitation Center, which runs programs to rescue, rehabilitate, and reintroduce wild species, in particular the endangered great scarlet macaw (*Ara macao*), with the support of entities, such as the Costa Rican Ministry of Nature and Energy, as part of the payment for environmental services program. The community has also initiated the conservation of areas of primary forest, and reforestation of damaged areas with species such as teak, eucalyptus, gamhar, or cedar for the sustainable production of timber, in collaboration with national and international organizations, including the Spanish International Cooperation and Development Agency (AECID) and Dutch and Japanese cooperation organizations. With the support of the AECID and the Regional Government of Galicia in Spain, the cooperative built the Center for Environmental Education and Training. There, it runs training, educational, and research activities as another line of diversification.

All of these actions were carried out with the aim of restoring the environment in which the members of Coopesilencio live. The case of Coopesilencio is an example of a spontaneous process of "restoration" in that there was no political entity centralizing control over their efforts. Unlike the case of the Guadiamar, Spain, where public participation was weak, the example of Coopesilencio shows how people became involved without any invitation from the government to participate in the restoration process. The will of the people to overcome the catastrophe, combined with their dedication to hold on to the land they won through their struggle, and their determination not to renounce community organization by dividing the shared ownership of the land (which has happened in other cases), has enabled them to provide a decent life for a significant number of families self-sufficiently. In addition, community actions, such as cleaning the destroyed palm plantation and reforestation, have had a positive influence on the conservation and regeneration of an area that would otherwise have become the victim of deforestation, outmigration of the local population, and socioecological degradation as a consequence of the spreading agricultural frontier. The cooperative nature of Coopesilencio has contributed to the restoration of the socioecosystem in which it is located and has strengthened the resilience of the whole system.

ultimately, in increasing the resilience of the system as a whole. In the case of Coopesilencio it was not necessary to invite the local population to participate in the restoration; rather, the local people themselves initiated action in response to the devastating effects of crises, even in the absence of state action. In the Guadiamar River, conversely, the scant offerings of participation on the part of the government to the local population have not aided citizens' identification with the river that runs through their backyard. In cases such as the Guadiamar, the technocratic model of restoration must be replaced with a more public and participatory approach in order to increase system resilience and improve the prospects for long-term sustainability of restoration actions. This may mean starting with the scientists, technicians, and politicians themselves to foster a new culture wherein people are seen as active and important components of the system, and not merely as bystanders or constituents. Encouraging the territorialization of a region such as the Guadiamar basin, characterized by rapid demographic and economic change, will require the construction of new relationships between people and place.

Notes

1. The term resilience comes from the Latin *resiliere*, spring back or rebound.

2. The Protected Landscape of the Tinto River, a zone highly transformed by the mining activity, was declared as such in the year 2005, after suffering a devastating fire in the summer of 2004 that destroyed more than 61,776 acres (25,000 ha) of bush and forest.

3. Growth that is also clearly accelerating if we compare this figure with the growth registered between 1987 and 1996, which was 9.74 percent. The comparison with growth registered in the city, which was practically static between 1996 and 2007 at just 0.24 percent, is highly revealing. Furthermore, the statistics do not reflect real growth, since much of the new resident population in this area is not registered in the official census for each municipality and, therefore, their presence is not officially recorded.

References

Boisier, S. 1994. "Post-modernismo territorial y globalización: Regiones pivotales y regiones virtuales." *Ciudad y Territorio y Estudios Territoriales* 102: 597–608.

Brenson-Lazan, G., and M. M. Sarmiento Diaz. 2003. *Facilitating Psychological Reconstruction: A Manual for Crisis and Disaster Intervention*. St. Paul, MN: International Association of Facilitators. http://www.globalfacilitators.org/virtual%20library/FacPsyReconMasterMBRJune2003.23358.pdf.

Carrasco, F., I. Contreras, C. Correa, E. Fedriani, J. M. González, F. M. Guerrero, M. A. Hinojosa, M. C. Lima, M. Lozano, M. C. Melgar, J. A. Ordaz, V. Pérez, E. Romero, J. M. Rueda, C. Usabiaga, and E. Velásquez. 2003. "Análisis económico y desarrollo sostenible en los municipios de la cuenca del Guadiamar." In *Ciencia y Restauración del Río Guadiamar: Picover 1998–2002*, edited by J. M. Arenas, F. Martínez, A. Mora, C. Montes, and F. Borja, 538–58. Sevilla: Consejería de Medio Ambiente de la Junta de Andalucía.

CEPAL. 1999. "Centroamérica: Cambio Institucional y Desarrollo Organizativo de las Pequeñas Unidades de Producción Rural." Puerto España: CEPAL. http://www.eclac.org/publicaciones/xml/8/9598/l406.pdf.

Cordero Ulate, A. 2006. "Territorio, economía y sociedad en Quepos-Manuel Antonio." In *Nuevos Ejes de Acumulación y Naturaleza: El Caso del Turismo*, edited by A. Cordero Ulate, 133–56. Buenos Aires: Consejo Latinoamericano de Ciencias Sociales.

Escalera, J. 2003. "Investigación Participativa para el Desarrollo Sostenible del Corredor Verde del Guadiamar." In *Ciencia y Restauración del Río Guadiamar: Picover 1998–2002*, edited by J. M. Arenas, F. Martínez, A. Mora, C. Montes, and F. Borja, 528–37. Sevilla: Consejería de Medio Ambiente de la Junta de Andalucía.

———. 2008. "La experiencia de la participación social en el Corredor Verde del Guadiamar." In *La Restauración Ecológica del Río Guadiamar y el Proyecto del Corredor Verde: La Historia de un Ecosistema Emergente*, edited by F. Carrascal and C. Montes, 437–50. Sevilla: Consejería de Medio Ambiente de la Junta de Andalucía.

Garrido, H., coord. 2008. Guadiamar Ciencia, Técnica y Restauración. Madrid: CSIC Consejo Superior de Investigaciones Científicas.

Gertler, M. 2001. "Pathways to Sustainable Resource Management: Coopesilencio." In *Rural Co-operatives and Sustainable Development*, edited by M. Gertler, 21–23. Saskatoon: Centre for the Study of Co-operatives, University of Saskatchewan.

Marín Hernández, J. J. 1999. "La creación de Coopesilencio y la contribución de las mujeres campesinas en su edificación." *Diálogos: Revista Electrónica de Historia* 1 (1). http://historia.fcs.ucr.ac.cr/articulos/1999/vol1_n1/silencio.pdf.

Norgaard, R. B. 1994. *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*. New York: Routledge.

———. 2002. "Una sociología del medio ambiente coevolucionista." In *Sociología del Medio Ambiente: Una Perspectiva Internacional*, edited by M. Redclift and G. Woodgate, 167–78. Madrid: McGraw-Hill.

Olsson, P. 2003. Building Capacity for Resilience in Social Ecological Systems. Doctoral dissertation, Department of Systems Ecology, Stockholm University.

Olsson, P., and C. Folke. 2004. "Adaptive Comanagement for Building Resilience in Social-Ecological Systems." *Environmental Management* 34 (1): 75–90.

Olsson, P., C. Folke, and T. Hahn. 2004. "Social-ecological Transformation for Ecosystem Management: The Development of Adaptive Co-management of a Wetland Landscape in Southern Sweden." *Ecology and Society* 9 (4): 2. http://www.ecologyandsociety.org/vol9/iss4/art2.

Ospina, P. 2001a. *Migraciones, Actores e Identidades en Galápagos*. Quito, Ecuador: Instituto de Estudios Ecuatorianos. http://edufuturo.com/imageBDE/EF/17253.galapagos.pdf.

———. 2001b. *Identidades en Galápagos: El Sentimiento de una Diferencia*. Quito, Ecuador: Trama ediciones.

———. 2003. "Ética Ambiental y Actores Sociales en las Galápagos." *Ecología Política* 25: 111–25.

Sobrado, M. 1998. "Coopesilencio: A un Cuarto de Siglo." In *La Construcción de un Sueño*, edited by V. Barrantes, 125–47. San José de Costa Rica: FELOPA-Universidad Nacional de Costa Rica.

Chapter 7

Collaboration: A Catalyst for Restoration

Nils D. Christoffersen

The Joseph Creek watershed, in remote and rural Wallowa County, Oregon, begins in the rolling hill country north of the county's main agricultural valley before dropping through deeply dissected canyon terrain on its way to the Grande Ronde River. Once an important fishing site for the Wallowa Band of the Nez Perce, and later the setting for extensive homesteading, agricultural development, livestock grazing, and commercial logging operations by Euro-American settlers and their descendants, Joseph Creek today is the site of innovation in community-based ecological restoration. This chapter describes how rural community members responded to sudden changes in their ability to access and benefit from local lands by taking a lead role in gathering information about, and setting priorities for, ecological restoration needs. Doing so required extensive collaboration across traditional jurisdictional boundaries as well as across traditionally adversarial interests. The case of the Upper Joseph Creek Watershed Assessment demonstrates that national interests in ecological restoration can be constructively met through the active engagement of people at the local level. Aligning restoration goals with local benefits helped to foster community engagement, creative problem solving, and sustained interest and dedication in achieving restoration outcomes.

Background

For thousands of years prior to white settlement of the interior Northwest, the people of the Nez Perce and allied Plateau tribes depended on the region's runs of anadromous salmon and steelhead as the key component of their diets and livelihoods (Marshall 1977; Walker 1967). The Imnaha and Grande Ronde subbasins, in the region now known as Wallowa County, Oregon, were particularly important fisheries for the Nez Perce; in fact, the name "Wallowa" refers to a kind of instream trap the Nez Perce used to catch fish returning to the county's waterways to spawn. By the end of the twentieth century the county's historically abundant salmon runs had all but vanished as a result of habitat loss stemming from dam building on the Columbia and Snake Rivers, dredging and filling of the Columbia River estuary, and effects higher in the

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_7,

watershed related to timber harvesting, grazing, floodplain conversion, channel straightening, fire suppression, road construction, and the installation of associated fish passage barriers (National Research Council 1996).

Ecological, social, and political dynamics collided with the listing of spring, summer, and fall Chinook salmon runs in 1992 through the Endangered Species Act (ESA), followed by summer steelhead runs in 1997 and bull trout in 1998. Social and economic impacts of the listings were sudden and dramatic, altering land uses in a county where agriculture and wood products accounted for nearly half of all employment. The 1992 ESA listing of Chinook salmon resulted in a nearly two-year cessation of timber sales on national forest lands in Wallowa County. Prior to the anadromous fish protection, federal timber sales accounted for 60 to 70 percent of the county's annual harvest. The loss of this supply led to closure of three sawmills, the county's largest private sector payroll providers, in 1995. Two of the three sawmills reopened in 1996 on one shift and struggled for several years before closing permanently in 2001 and 2007. Wallowa County's unemployment rate trended at or near the state's highest level for years following these changes.

Fish habitat restoration in Wallowa County meant taking on numerous complex challenges, including the provision of county-level leadership for addressing basin-scale ecological degradation and a national-level policy response; integrating the needs and values of the local county population with those of the Nez Perce tribe, which retained treaty rights to local fish and game populations, as well as with those of various nonlocal interest groups and agencies; and finding ways to operate across a patchwork of private and public lands to address restoration needs at a watershed scale. Wallowa County and the Nez Perce tribe, working with private landowners, local organizations, and state and federal agencies, responded to fish habitat concerns in advance of the Chinook ESA listing. They produced a Salmon Habitat Recovery Plan in 1992 (updated in 1999) that outlined management options for forests and grasslands designed to maintain and improve fish habitat. This plan is formally adopted within the County's Comprehensive Land Use Plan and is referenced in the permit approval process for any new construction or renovation projects. It was hoped that this preemptive effort to address fish habitat restoration would create more flexibility from the federal regulatory agencies and a stronger partnership working toward anadromous fish recovery. This was not achieved.

The effort invested in the Salmon Habitat Recovery Plan, its goals, process, and initial results were the subject of research on collaboration in the late 1990s (Waage 2001). The work concluded that institutional, socioeconomic, and ideological pressures limited the collaborative's impact on resource management decisions and action. However, the relationships formed in this process have sustained collaborative restoration and stewardship over time, and the Salmon Plan continues to guide land use decisions within the county. Wallowa County's experience with the Salmon Plan and with subsequent management planning demonstrates community-led restoration in a contentious social, economic, ecological, and policy context, with on-the-ground progress building from a framework of collaboration, trust building, and a shared vision for land stewardship.

Development of the County Planning Process

With the loss of the county's sawmills in the mid-1990s, there was considerable social disruption, fear, and polarization across the community. In the midst of this crisis, the local community united under a proactive county government to explore options to regain hope and influence over its future. A multi-stakeholder board, the Natural Resource Advisory Committee (NRAC), was formed in 1994 as a means of providing collaborative local leadership on natural resource issues, some of the most pressing of which surrounded forest management on the Wallowa-Whitman National Forest (WWNF). The WWNF, along with a small section of the Umatilla National Forest, accounts for nearly 58 percent of the land in Wallowa County as well as a substantial portion of anadromous fish habitat. In the wake of the ESA listings, nearly all management activities on these lands ground to a halt, in part due to the influence of regional environmental advocacy organizations that resisted most attempts to intervene in the trajectory of heavily altered ecosystems. In 1996, local citizens, with assistance from Sustainable Northwest and the U.S. Department of Agriculture Rural Communities Assistance program, formed the nonprofit organization Wallowa Resources. The founding mission was a clear commitment to sustainability—providing equal weight to forest, watershed, and community health; job and business creation; and increased social understanding of the links between the health of our lands and waters and the health of our community.

After years of gridlock characterized by legal appeals and lawsuits against proposed action on the WWNF, county commissioners, the U.S. Forest Service (USFS), Wallowa Resources, natural resource agencies, environmental advocates, and representatives of the NRAC discussed ways they could "fit together" and enhance their collective influence over local natural resource issues. There was widespread agreement that there was good communication, coordination, or collaboration once management projects had been initiated by private landowners or management agencies. However, there was concern about the lack of a shared vision of land stewardship or restoration priorities across the landscape. The assembled stakeholders also felt a sense of urgency based on various needs for forest and rangeland restoration and the employment opportunities that such projects could generate in a county with one of the highest unemployment rates in Oregon.

By 1999 it was increasingly recognized that the WWNF and the wider Blue Mountains region in which it is situated would benefit from more active management to address forest health issues that were impacting watershed conditions. Critical indicators supporting this consensus included the increased frequency and severity of wildfire and pest events between 1986 and 1999 and alarming annual tree mortality rates, which exceeded new tree growth by 30 percent in the WWNF,[1] as established by the 1993–1998 vegetation surveys. Diverse interest groups recognized that decades of fire suppression had altered forest stand conditions, reducing the diversity in stand structure and species distribution, and in turn their resilience to endemic disturbance events. Inspired by national dialogue on "stewardship contracting" initiated by the Pinchot Institute for Conservation, among others, these groups also recognized that targeted investments in restoration could generate new economic opportunities for the local workforce.

This public consensus in Wallowa County took shape as the local USFS field office capacity declined with budget and staff reductions. Extended analytical, planning, and consultative processes consumed scarce resources and demoralized the agency and community. Management information pertaining to the public lands in Wallowa County was outdated—with most watershed-specific information based on aerial photos and stand exams conducted in the 1980s. Building on relationships developed in small pilot restoration projects,[2] the NRAC outlined a plan for larger landscape-scale restoration in 2000–2001. The approach targeted the significant delays occurring locally in consultation associated with ESA and the National Environmental Policy Act (NEPA) processes, which hampered the community's ability to respond to critical forest health concerns and to support the transition to a restoration and stewardship economy. The design sought resource and time efficiencies by scaling up planning and management to a larger landscape scale—fifth-level watershed over five-year cycles. This larger landscape scale was also deemed more appropriate for evaluating critical ecological issues such as wildlife habitat (including riparian areas, old growth, snags, and downed woody debris), corridors and fragmentation, forest stand structural diversity, threatened and endangered species, and invasive plants.[3]

The NRAC decided that a collaborative and interdisciplinary approach to establishing restoration project priorities and developing initial project proposals would enhance the current level of collaboration between citizens, local government, tribes, and state and federal agencies. They wanted to generate agreement around the most important places to initiate further restoration and land stewardship in Wallowa County. In addition, they conscientiously sought to explore efficiencies in the federal planning process, as well as implementation and monitoring that involved citizens in the management of their public lands, by using a variety of contracting methods and agreements. The Wallowa County Board of Commissioners formally approved this new collaborative watershed planning and management process in January 2001.

Upper Joseph Creek Watershed Assessment

The Upper Joseph Creek watershed was selected as the first area to develop and test this approach. The program was designed to achieve the following:

- Ensure that planning and collaborative relationship-building is done on a watershed basis (fifth-level watersheds) to facilitate cumulative effects analysis and address management actions over multiyear cycles
- Improve the efficiency of consultation processes for NEPA and ESA
- Generate local benefits, including employment opportunities in all facets of planning, analysis, implementation, and monitoring, as well as a sustainable flow of forest products and recreational opportunities
- Maintain and enhance watershed conditions to provide a variety of long-term benefits to the ecosystem

- Establish a practical and sustainable multiparty monitoring system that combines local and scientific knowledge, and contributes to effective adaptive management of the watershed

More than seventy citizens and personnel from various agencies and the Nez Perce tribe provided ideas and expertise for the watershed assessment. The community-sponsored process started out by establishing a set of stewardship principles (box 7.1). These principles were developed to guide the collaborative process. They provided a common reference point to sustain consensus as the diverse group of stakeholders worked to generate a mutually agreed-upon assessment of current conditions and, more critical, recommendations for management. They contributed to building trust within the new relationships central to the collaborative group and helped maintain confidence that the investment in time and effort would lead to action acceptable to all parties.

As these stewardship principles were taking final shape, the NRAC established four subcommittees to assess the condition of range, forest, road and recreation, and riparian systems across the Upper Joseph Creek watershed. Where existing management information was deemed inadequate, the groups selected (and sometimes modified[4]) assessment protocols, secured funding, and contracted field surveys. More than

Box 7.1
Upper Joseph Creek Watershed Stewardship Principles

These principles have been developed to guide the collaborative public land management process within the Upper Joseph Creek watershed. With time and experience, it is anticipated that agreement will be reached on principles to guide management across the watershed.

The ecological systems in the Upper Joseph Creek watershed are disturbance-adapted systems. Competition within and between species, and natural disturbance regimes of fire, insects, disease, wind, flood and herbivory, create mosaics of vegetation cover and structure that change over time and space. The native biological diversity of our landscape is adapted to these dynamics.

Thus, in our context, habitat diversity is important. The alteration of disturbance regimes (through the control of disturbance or resource use) can lead to a simplification of vegetation patterns and riparian systems, which may impair watershed functions and jeopardize the persistence of many native species. Processes that lead to simplification increase the risks for larger-scale disturbances (such as uncontrolled fire, insects, and disease occurrences).

These principles provide a framework in which to exercise our continuing responsibility for maintaining and enhancing our watershed conditions. In some areas, restoration is needed to reestablish both structure and function within the watershed. These principles guide the development of specific management recommendations and facilitate the collaborative efforts already taking place in our community.

Box 7.1
Continued

Stewardship efforts should do the following:

- Begin with analysis of the current and historic ecological conditions at the watershed level—ridge top to ridge top
- Incorporate the social, cultural, and economic dynamics of the local community
- Maintain spatial and temporal patterns of species composition, structure, and seral stages that are within a resilient range for the landscape
- Address not only the symptoms but also the causes of habitat loss and modification that exceed normal ranges and cycles for these disturbance-adapted systems
- Avoid strategies likely to entail recurring high maintenance costs
- Define clear, achievable, and measurable management objectives
- Use adaptive and flexible management, supported or modified by feedback from monitoring, with multiparty monitoring being an important tool for collaborative processes on public lands

Stewardship should draw from passive and active management strategies that address specific issues and conditions within the watershed. A broad range of resource management tools needs to be available, including, but not limited to, prescribed burning, precommercial and commercial logging, revegetation using both native and nonnative plant species, managed grazing, restoring channel morphology and structure, use of herbicides and pesticides, riparian and rare plant community protection as well as permanent and temporary road closures.

$200,000 was invested in the forest and range surveys alone. Each of these subcommittees was formed from a diverse group of citizens and agency representatives under the invitation of Wallowa County. The subcommittees soon recognized the need for further information about wildlife habitat to allow for consideration of the full range of species within the watershed. The subcommittees jointly conferred with a variety of wildlife specialists and wildlife-based interest groups, as well as the Nez Perce tribe. Along with subcommittee representatives, this conference included representatives from federal agencies (the U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration–Fisheries, and USFS), the State of Oregon (Oregon Department of Fish and Wildlife), conservation organizations (Hells Canyon Preservation Council, The Nature Conservancy, and Defenders of Wildlife), and local entities (Wallowa Resources and the Wallowa County Soil and Water Conservation District). Key issues resulting from the workshop were incorporated into the integrated recommendations.

The forest vegetation subcommittee built a methodology for assessing forest conditions based on the existing USFS vegetation database. In addition to the aforementioned entities, collaborators included Joseph Timber Company, Wallowa Forest Products, RY Timber, Oregon Department of Forestry, and private landowners. The methodology focused on gathering information regarding stand structure, function, composition, and disturbance agents. The forest survey was designed to generate stand condition information in a format compatible with (and easily transferable to) the USFS vegetation database. The forest condition working group conducted quality control together, randomly selecting sites for remeasurement. This contributed to broader understanding of, and confidence in, the forest stand data.

The range survey was more complicated. It was designed to sample grassland sites using both modern and historic range protocols and generate a reference point to correlate past trend data with a new baseline and future trend monitoring. The range survey also tested the diagnostic capabilities of high-resolution satellite imagery. As the range assessment involved surveys on private grassland, hosting most of the headwaters of this watershed, innovative new agreements were developed between Oregon State University's Extension Office and private landowners that secured the confidentiality of individual property information while allowing for public use of the larger range condition assessments. The rangeland vegetation subcommittee initiated inventories in the summer of 2002 to create a baseline inventory of important biological components, including plant species, plant associations, terrain, and soil types. Plant community vegetation was sampled on grass and forest steppe rangeland within and adjoining the Upper Joseph Creek watershed. Additional collaborators included the Nez Perce tribe, Oregon State University Extension Service, and private landowners. Local range scientists representing the International Center for the Advancement of Pastoral Systems were contracted to conduct the fieldwork and preliminary analysis. A vegetation map defining watershed vegetation by plant communities and seral stage accompanied by descriptive and quantitative information was developed from this information.

The road and recreation subcommittee updated existing road records to represent the current road system on public lands and the county road system on private lands. Additional collaborators included the Nez Perce tribe, Wallowa Valley Trail Riders Association, Grande Ronde Model Watershed, and Oregon State Off-Highway Vehicle Advisors. Each road segment was subject to interdisciplinary analysis on its costs (ecological and maintenance), benefits (commercial and recreational use), and management needs—including regular management and response to wildfire. Group site visits were used to reach agreement on those segments where the cost/benefit ratio was neutral. If fully implemented, the group recommendations would reduce the road network well below the road density thresholds in the WWNF Forest Plan.[5]

The riparian subcommittee compiled existing information and completed additional riparian condition surveys with assistance from the Grande Ronde Model Watershed, the USFS, Wallowa Resources, Oregon Department of Fish and Wildlife, and the Nez Perce tribe. This information covered all publicly managed and some privately owned stream reaches. Landowner permission was secured for access to collect information on private stream reaches. This work summarized and prioritized fish passage and sediment transport issues and contributed to forest and range management project identification and design.

Cultural resource issues were addressed through subcontract with a retired USFS archaeologist, and by outreach from Wallowa County to the Nez Perce tribe's

Council of Elders. Once the background report was completed by the archaeologist, it was sent to the Nez Perce tribe for review. This was followed by an invitation from Wallowa County to the Nez Perce Council of Elders to tour the Upper Joseph Creek watershed and provide additional feedback to the process. Wallowa County provided funding to support this tour and consultation by the Council of Elders.

The recommendations that flowed from these assessments focused on improving the health of terrestrial and aquatic systems, and were targeted at specific locations within the watershed. Activities to improve the watershed included the following:

- Promotion of late-seral and old-growth structure in forests
- Understory thinning for forest health, wildlife habitat, and fuel reduction
- Protection of wildlife travel-ways and key habitat
- Reductions in open road mileage
- Road maintenance and removal of fish passage barriers
- Noxious weed prevention and treatment
- Several types of range and grassland improvements, including upland water developments

The activities were scheduled over a period of five years with the USFS. Those activities with the greatest need and strongest level of agreement were scheduled first. With respect to forest management, these areas were in the hot-dry ponderosa pine (*Pinus ponderosa*) and warm-dry ponderosa pine and Douglas fir (*Pseudotsuga menziesii*) stands, which showed the greatest degree of variation from historical conditions due to overstory removal and fire suppression.

A strong theme of the effort was the blending of landscape and watershed health needs with the needs and health of the community. Initial benefits to the local economy were generated by contracts for data collection and assessments. Following completion of the assessment, the recommendations for the WWNF lands were studied by the USFS on a more site-specific basis through the NEPA and public involvement process. Investments in riparian restoration to remove fish passage barriers, such as culverts, log weirs, and rock gabions, began in 2005. Many of the restoration contracts were awarded to local contractors on a best-value basis available through stewardship contracting authorities.

Prior to being finalized, the watershed assessment was subject to peer review. Individuals from the University of California–Davis, The Wilderness Society, and Northwest Connections reviewed the complete final draft, submitted written comments, and participated in a facilitated workshop in the summer of 2005. The workshop was designed to identify the strengths and weaknesses of both the collaborative process and the watershed assessment, and to generate lessons for future collaborative assessments. The written comments were made available to all members of the collaborative group and posted online for public access. In addition to securing external recommendations for process improvement, this review process helped secure broad public confidence in the assessment and recommendations.

The WWNF's administration of priorities identified in the assessment included some actions implemented under guidelines allowing for an expedited environmental review process, and others subject to Environmental Assessments or Environmental Impact Statements. Importantly, the Nez Perce tribe and Wallowa County government acted as "cooperating agencies" with the WWNF in their development of NEPA analysis and alternatives. All analysis was supported by the common watershed analysis, biological evaluations/opinions, and cumulative effects analysis for optimum efficiency. This approach helped reduce time spent in the NEPA process and generated local benefits, including capacity building and employment. Based on market assessments, including local contractor capacity, the USFS worked with the NRAC to recombine NEPA decisions into optimum bundles of work and issue multiyear, multitask contracts using pilot stewardship contracting authorities. Where possible, receipts accrued in implementation were retained as baseline financing for monitoring and subsequent watershed planning. Between 2005 and 2009, more than $1 million was invested in watershed restoration projects that have opened 38 miles of riparian habitat for all life stages of native steelhead, reduced the risk of stream sedimentation with 11.6 miles of road work, rehabilitated twenty-five upland water sites for off-stream livestock use, and conducted 14,312 acres of forest management, including commercial thinning (6 million board feet removed and 6.5 million board feet sold in July 2009), precommercial thinning, biomass removal, and prescribed burning. From the initial collaborative investment of $370,000 (cash and in kind) to complete the watershed assessment, the local economic benefit from all restoration projects to date (including the value of saw logs removed and milled) exceeds $5 million.[6] Other benefits realized include the following:

- Restoration efforts are more coordinated and less random, resulting in greater impact
- Improved partnerships have benefited other collaborative processes such as Wallowa County's Community Wildfire Protection Plan
- The local USFS office is more competitive for regional and national USFS restoration funds
- A second watershed assessment, in the Lower Joseph Creek watershed, was initiated in 2007

Keys to Local Watershed Collaboration and Lessons Learned

The Upper Joseph Creek Watershed Assessment was a step forward in the evolution and progression of collaboration for natural resource restoration and stewardship in Wallowa County. Collaboration moved from a focus on planning (e.g., Salmon Habitat Recovery Plan) to a focus on landscape assessment, implementation, and ongoing monitoring. It represented a conscientious decision by Wallowa County and members of the NRAC to pursue collaborative processes to advance the pace and scale of restoration. The decision was motivated by broad recognition that recent trends in management activity and investment were insufficient to address the scale of restoration needs, evident in, for example, the miles of fish passage barriers within riparian systems and the acreage of forest at risk from wildfire. The parties also recognized that significant local social and economic benefit could be generated by increased investment in restoration.

Work at the Appropriate Scale

The fifth hydrologic unit code (HUC) watershed was selected as the appropriate spatial scale. It was the scale most relevant to some of the critical environmental issues being addressed (including salmonid spawning and rearing habitat, as well as habitat for cavity-nesting wildlife), and it was a scale at which field assessment data could be collected within desired time frames and budgetary constraints. This scale also allowed for the collaborative to focus on a landscape unencumbered by too many overlapping environmental restrictions, including Wilderness or National Recreation Area designations or terrestrial wildlife ESA listings.

Invest Time Up Front

The time spent building consensus on the stewardship principles proved critical to maintaining collaborative support through the analysis process and the generation of specific management recommendations. In particular, this helped the collaborative manage transitions in representation from different participating organizations and to address issues lacking up-front alignment in values between the participating organizations. It did not always work. For example, the collaborative failed to reach agreement on a designated area for all-terrain vehicle (ATV) use, but a five- to seven-year restoration plan, representing a significant increase in management activity and investment, was developed and agreed upon.

Collaboration processes that are open, inclusive, and transparent lay the foundation for rational discussion of the conditions and trends of the watershed and the management opportunities that are mutually perceived as beneficial. If collaboration works, the group moves to a greater alignment in values. This is critical since the other imperative within a collaborative is to reward the collective investment in time and effort with action and outcomes deemed significant to each participant. In recognition of the importance of this incentive to sustain broad participation, the NRAC and Wallowa Resources moved forward with fund-raising and implementation of the simplest, least controversial, and most broadly supported projects, even before the final publication of the watershed assessment. These projects included the removal of fish passage barriers and understory thinning of ponderosa pine stands. Confidence, trust, and excitement within the collaborative expanded with successful results. Continued investment in the collaborative discussions allowed the group to tackle more difficult projects, such as road closures and management within the cool-dry mixed conifer stands.

Use a Transparent, Collaborative Information-Gathering Process

Current and site-specific science was critical to the assessment. The initial investment in firsthand data about resource conditions proved invaluable to collective social learning, relationships, and an improved alignment of values. Maintaining the integrity, transparency, and collective ownership of scientific information and analysis helps sustain the collaborative. Within the Upper Joseph Creek watershed this was achieved by collective agreement about the sources of existing information, as well as the protocols for collecting new information and the group process for revisiting and measuring field plots as part of the quality control system of the assessment. This latter process was particularly important in building broad ownership and understanding of the forest condition assessment, and it helped sustain collaborative support for specific silvicultural treatments.

Consider the Interests, Strengths, and Challenges of All Relevant Entities

Maintaining open, inclusive, and transparent collaboration requires both commitment from the group to these values and leadership and investment by a mutually trusted convener or facilitator. Within the Upper Joseph Creek Watershed Assessment, Wallowa Resources played this role and, therefore, bore the highest transaction costs. In addition to planning for and facilitating NRAC full committee discussions and some of the working groups, Wallowa Resources maintained direct communications with several groups that were not initially fully invested in the process, including local environmental watchdogs, the Nez Perce tribe, Oregon Department of Fish and Wildlife, and the Wallowa Valley Trail Riders. As this collaboration had significant implications for the USFS in terms of their program of work and the expectations built by the collective investment, Wallowa Resources also maintained a very close relationship with local USFS staff to ensure the end result was something that would facilitate their work and align with existing laws, policies, and internal agency direction. Wallowa Resources, as a community-based nonprofit, was also able to raise external funding to help pay for the assessment and contract initial restoration projects.

Create Expectations of Shared Responsibility and Accountability

Ultimately, the success of any collaborative rests in the shared investment, risk, and accountability by all participants. There is no requirement for equity in investment, but all must be fully committed to the process and invest what they can (even if this is limited to their time to participate). They must also be willing to take risks: risks based on the common vision and the recognition that more can be accomplished through group effort than can be accomplished by individual parties working without coordination or in direct conflict with each other. Finally, each party must also be accountable to the collaborative. If representatives commit to recommendations and action within the group, they need to be certain that they speak for their organizations and constituents. By being part of the collaborative, they necessarily agree to work toward new, creative group solutions and not be limited by any narrow, interest-based positions they pursue outside the collaborative.

Conclusion

Across landscapes in the western United States, conservation needs have accelerated with the pace of technological change, population growth, and species translocations. Public capacity to address these needs has declined with the loss in public agreement on the role of public lands and rural communities. These are "wicked problems" as described by Rittel and Webber (1973): problems with no clear solution, no undisputable public good, and no objective definition of equity. Science alone and professionals in various relevant fields cannot solve these wicked problems. Every wicked problem is essentially unique; solutions designed for one location, one context, will not "solve" the problem in any other context. These challenges require place-based capacity to build local consensus as to the nature of the challenges and the appropriate response strategies, and to mobilize available resources for investment and action.

Natural resource management is complex, and our understanding of ecological components, processes, and interactions is incomplete. Furthermore, different interest groups place different values on the goods and services provided by any landscape. Varying forms of democratic processes, including existing legal and policy frameworks, shape the ultimate priorities. Therefore, science, at best, only informs and guides the analysis and planning. Within a collaborative process, varying forms of science are legitimate in the eyes of each participant. Typically, members of the collaborative have local knowledge and experience that help fill gaps in the site-specific scientific data and help interpret broader conditions and trends. The NRAC openly invited this local contribution through specific meetings with interest groups, including the Nez Perce tribe, private landowners, permittees, forest contractors, and others.

With the crafting of the Salmon Plan, Wallowa County began its present-day journey down the path of community-based natural resource management, defined as the management of landscapes for community benefit. Community benefit is an aggregation of local social, economic, and ecological values. Where public lands, listed species, or fundamental ecological services or function are involved, community benefit must also reflect larger national and, sometimes, international values. Some level of local community participation in management decisions is a central operating principle. Community-based natural resource management is never the same in any two communities; it is a complex suite of activities, projects, and organizations that have different goals based on local conditions. They are organized at different scales, in different geographies, and within a variety of community cultures and conditions. They operate within diverse institutional and legal frameworks, and they represent various stages in organizational development.

Wallowa County has been, and continues to be, a pioneer in collaborative and community-based resource management and restoration. Much of the initial work done here centered on building a common foundation among a diverse and oftentimes divisive set of stakeholders, including establishing a common understanding of collaborative principles, a common set of data and knowledge, and a common vision for restoration and stewardship. The place-based and collaborative efforts pioneered in this rural corner of Oregon have shown promise for achieving restoration goals in the face of the kind of uncertainty that has come to characterize contemporary land management.

Notes

1. The vegetation survey established that the Wallowa Whitman National Forest has the highest total volume of annual mortality in Region 6, and the second-highest differential between mortality and new growth.

2. Including aspen (*Populus tremuloides*) and wetland restoration, wildland–urban interface fuel reduction around Wallowa Lake, and the Buck Stewardship pilot project.

3. See also the concept of a "minimum dynamic unit" as expressed by Pickett and White (1985).

4. For instance, the forest assessment drew from the existing USFS protocols but modified them to focus on stand conditions versus timber volumes, and to reduce costs. The result was successful. Extremely useful information was generated at less than $2 per acre, significantly less than the USFS typically spent for stand exams.

5. Implementation of these recommendations was superseded by the nationwide review of USFS roads and the preparation of new travel management plans for each national forest. This top-down policy and planning initiative undermined local collaboration on travel management issues.

6. The total local benefit calculation uses local economic multipliers against the value of each service contract and the value of saw logs removed and processed in mills in Wallowa and Union Counties.

References

Marshall, A. G. 1977. "Nez Perce Social Groups: An Ecological Interpretation." PhD diss., Washington State University, Pullman.

National Research Council, Committee on Protection and Management of Pacific Northwest Anadromous Salmonids. 1996. *Upstream: Salmon and Society in the Pacific Northwest*. Washington, DC: National Academies Press.

Pickett, S. T. A., and P. S. White. 1985. *The Ecology of Natural Disturbance and Patch Dynamics*. Orlando, FL: Academic Press.

Rittel, H. W. J., and M. M. Webber. 1973. "Dilemmas in a General Theory of Planning." *Policy Sciences* 4: 155–69.

Waage, S. A. 2001. "(Re)claiming Space and Place through Collaborative Planning in Rural Oregon." *Political Geography* 20: 839–57.

Walker, D. E. 1967. *Mutual Cross-Utilization of Economic Resources in the Plateau: An Example from Aboriginal Nez Perce Fishing Practices*. Washington State University Laboratory of Anthropology Report Investigations. Pullman: Washington State University.

Chapter 8

Community-Based Forest Management in Arcata, California

Mark S. Andre

The Arcata Community Forest, established in 1955, comprises 2,150 acres of second-growth redwood (*Sequoia sempervirens*) forest near Humboldt Bay in Humboldt County, California (fig. 8.1). While redwood is the iconic northern coastal California tree, the community forest also contains other conifers such as Douglas fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and Sitka spruce (*Picea sitchensis*). Management for the community forest is guided by the City of Arcata (population 16,900) government leaders, the City's technical advisory committee, and local citizens, all of whom have expressed commitments to a sustainable management program that serves as a model of a managed forest for demonstration and educational purposes. Through volunteer activities, the citizenry is involved in an adaptive management approach to increase biodiversity, accelerate old-forest conditions, provide late-successional forest habitat, and sequester carbon while providing revenue. Timber harvest revenues fund forest operations, habitat restoration, and open space and parkland acquisitions. Community forestry in Arcata is designed to provide local residents the opportunity and responsibility to manage their natural resources. In environmentally minded Arcata, manipulation of the forest by various means, including timber harvesting, has been socially acceptable due to the ecological soundness of the project goals, confidence in the Forest Management Committee, and the visible results of almost thirty years of treatments.

History and Context

Lands within the community forest were originally claimed by Euro-American settlers through the patenting—or privatizing—of public domain land. Most of what is now the community forest was initially logged during the 1880s when trees were felled with axes, wedges, and crosscut saws and skidded by oxen teams to Humboldt Bay. Large trees with defects and many smaller-diameter trees were left following logging and were often consumed in the slash fires that regularly occurred in the wake of early logging operations. Most of the trees that remain on the forest today naturally

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_8, © Island Press 2011

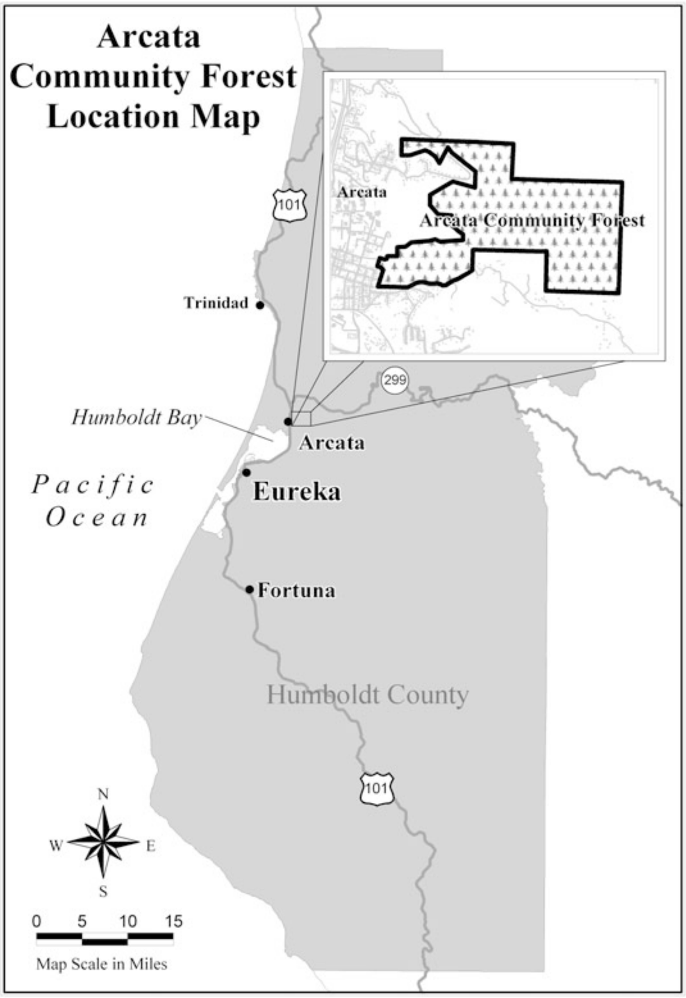

FIGURE 8.1. Map of Arcata Community Forest in northern California, USA.

regenerated from the stumps and seeds of the pre-European-settlement forest. Following early logging, lands within what is now the community forest were used for grazing and water supply, but it was not until the 1930s and 1940s that the citizens of Arcata gained title to the property for the purpose of providing water supplies to the town (Van Kirk 1985).

The Arcata Community Forest was dedicated in 1955 as the first municipally owned forest in the state of California and was envisioned to be "managed for the benefit of all the citizens of the city, with attention to watershed, recreation, timber management and other values" (*Humboldt Times* May 15, 1955). Much of the community forest was selectively logged in the 1960s. At that time, second-growth redwood was not a desired species, and redwoods were spared in favor of Douglas fir, grand fir, and Sitka spruce, resulting in a simplified system of homogeneous, even-aged redwoods. Current-day restoration activities are designed to remedy the ecologically deleterious effects of these past management practices.

Humboldt County and Arcata have a rich tradition of natural resource stewardship and ecological restoration dating back to the late 1970s. At that time, Redwood National Park was expanded by 48,000 acres during a period of community divisiveness. Part of the expansion legislation provided $33 million for watershed restoration within the Redwood Creek drainage (Belous 1984; Keith 1984). Since that time, there has been a consistent and concerted effort, supported by state and federal government, to reverse the ecological damage that had devastated the region's old-growth forests and salmonid fisheries. As Redwood National Park is not close to population centers, the extensive restoration work there has taken place in isolation without the locally based public involvement that Arcata has enjoyed by proximity to the resource. Moreover, unlike the Arcata Community Forest, sale of merchantable logs from forest thinning to offset treatment costs is not allowed in the federal and state parks.

Today, restoration-related work represents a significant component of the local economy, and Arcata is home to several private consulting firms and agencies that are deeply involved in the field (see chap. 16, this volume). Most of the restoration efforts in the region have focused on restoring salmonid habitat through in-stream work as well as work in upland areas and coastal estuaries. The community forest includes the headwaters for five salmon-bearing streams that flow to Humboldt Bay through state, federal, and local wildlife areas. The quality of those areas is influenced by management activities in the community forest. Revenue from timber harvests has been used to purchase wetlands, creekside conservation easements, and parkland that have benefited the Humboldt Bay area ecosystem and local recreational users. City restoration activities have included urban stream "daylighting," coastal salt and brackish marsh enhancement, and riparian restoration work in the streams that flow from the community forest to Humboldt Bay.

Arcata is home to Humboldt State University and its School of Natural Resources. Like many college towns, the population demographics are in constant flux; Arcata is like a migratory path funneling thousands of college students into its environs for a few years before they disperse to other regions. For many of these young people, their Arcata years are formative ones as they achieve or expand their ecological awareness. The Arcata Community Forest provides one of the opportunities for these students to connect with a small, but influential, restoration experience.

Governance

The Arcata Community Forest is managed by the city's Environmental Services Department. A volunteer Forest Management Committee advises staff and the city council on forest policy matters. The committee consists of seven members with backgrounds and expertise in botany, forest ecology, wildlife, fisheries, geology, recreation, and forestry. All committee meetings and field trips are open to the public, and community members are encouraged to attend and participate. The committee members, whose tenure on the committee averages eighteen years, are respected in the community and, thus, provide credibility to the city's forestry program. The current operation of the community forest is tied to a 1979 voter-approved parkland bond initiative to manage the land as a working forest using "ecological principles" with a portion of the net revenue derived from timber harvests to be used for parkland and open-space acquisition. Much of the city's park and open-space system was purchased under a park bond funded by timber harvest revenues. Because of its leadership, the Arcata Community Forest was the first municipal forest in the United States to receive sustainability certification under the Forest Stewardship Council (FSC).

The city council approved a forest management plan with the following goals:

1. Maintain the health of the forest system, specifically, maintain the integrity of the watershed, wildlife, fisheries, and plant resources; their relationships; and the process through which they interact with their environment
2. Produce marketable forest products and income to the city in perpetuity, balancing timber harvest and growth
3. Provide forest recreational opportunities for the community
4. Serve as a model of a managed redwood forests for demonstration purposes

The goals were refined into a mission statement that was adopted following a public visioning process:

> The Community Forest is managed whereby:
> - Biological and physical elements of the forests, specifically wildlife, aquatic and plant species; plant and animal communities; and watershed processes are maintained
> - Forest stewardship, including timber harvest, maintains forest integrity while generating public benefits
> - Forest stewardship is fully supported by the community
> - Community and visitors enjoy the forest setting and recreate in a respectful manner
> - Public land ownership extends to include watersheds and headwater areas as well as corridors to neighboring communities
> - Forests serve as outdoor laboratories for local schools and the university; research and other academic studies are fostered

Arcata has adopted the definition of community-based forestry as developed by the Aspen Institute in its report on community-based forestry (Wycoff 2005):

> Community-based forestry (CBF) is a participatory approach to forest management that strengthens communities' capacity to build vibrant local economies—while protecting and enhancing their local forest ecosystems. By integrating ecological, social, and economic components into cohesive approaches to forestry issues, community-based approaches give local residents both the opportunity and the responsibility to manage their natural resources effectively and to enjoy the benefits of that responsibility.

Management and Restoration Approach

Management priorities include watershed functioning, wildlife habitat, recreation, carbon sequestration, and timber harvest revenue. The desire for large trees and late-successional habitat as a future condition drives the silvicultural prescriptions. The maximum allowable annual harvest is half of the annual growth increment on the "working landscape" portion, excluding the reserves that comprise 35 percent of the land base. The main threats to the ecological integrity of the Arcata Community Forest are urbanization on the forest edge, invasive plants, and potential severing of ecological corridors that link the community forest to other intact forest areas to the south and east.

The Reference Condition

A reference ecosystem is an actual or historically known ecosystem that is used in setting goals and planning a restoration project, and later in the evaluation of project success (Egan and Howell 2001; Gann and Lamb 2006). Fortunately, there are reference stands of old-growth redwood in the region that can serve as blueprints for the Arcata Community Forest. In fact, many of the missing ecological qualities can be found in nearby Redwood National Park and local state parks where recent research has documented redwood's ability to increase wood production through old age (Sillet et al. 2010). Using tree spacing as a reference indicator, forests with tree densities of 120–200 trees per acre would need to be slowly thinned to achieve a relative tree density of 20–35 trees per acre as found on nearby old-growth stands. This could happen naturally through competition and mortality. It can also be stimulated through mechanical thinning because second-growth redwood has the ability to dramatically increase basal growth following thinning (Jameson, Reuter, and Robards 2005). Recruiting the structural elements commonly found in older forests is recognized as an important management objective in younger forest stands to address issues of biological diversity and forest integrity (Spies et al. 2002).

In an old-growth forest, natural disturbances in the form of landslides, fire, and wind create and maintain gaps in the canopy. The gaps, allowing light to hit the ground, give young seedlings and saplings the chance to grow and, thus, provide variety in the age and physical structure of a forest's trees. Thinning and group or "gap" cuts in a second-growth forest are attempts to mimic natural disturbance. They relieve the forest's unnatural, uniform growth created by the initial clear-cut operation. Single-tree selection with a focus of thinning from below and group selection with green tree retention are the main disturbance regimes used in Arcata. City staff has employed a blend of adaptive restorative treatments: variable retention (Franklin et al. 1997; Mitchell and Beese 2002), group selection, group selection with green tree retention, and single-tree selection. This has allowed them to learn from new information and key ecological indicators when designing new interventions. The forest is a shifting mosaic of patches, thinned areas, and gaps with the goal of allowing for tree ages in excess of one hundred to three hundred years. The development of a multilayered forest canopy with a shade-tolerant, shrub- and tree-dominated understory provides an indicator of the shift to an uneven-age condition (fig. 8.2). Efforts to increase species diversity have also included underplanting of shade-tolerant conifer species using transplanted stock from stands nearby. Other restoration projects include road decommissioning, erosion control, and improving fish passage opportunities at stream crossings.

Figure 8.2. The benefits of shifting from even-aged to uneven-aged forest conditions include larger and more vigorous trees, abundant understory vegetation, and proportionally greater redwood (*Sequoia sempervirens*) composition.

For monitoring purposes, the Arcata Community Forest hosts an array of permanent continuous forest inventory plots that were installed in 1985. The 0.2-acre (0.08-ha) plots are remeasured every five years. Measured ecosystem components include downed logs, snags, seedlings, tree diameter height and decay class, soil condition, live and dead carbon pools, lichens, fungi, bryophytes, wildlife use, and understory vascular plants. Plots in the old-growth reference stands are contrasted with the data in the community forest as part of a monitoring strategy.

Engaging the Community

Volunteer participation in on-the-ground restoration work is a key component of Arcata's community-based forestry. Volunteer efforts include planting trees and native plants, constructing trails, and removing invasive plants, such as English ivy (*Hedera helix*), cotoneaster (*Cotoneaster pannosus*), Scotch broom (*Cytissus scoparius*), and pampas grass (*Cortaderia jubata*) (fig. 8.3). The city draws on a strong and diverse volunteer pool that includes individuals, civic service groups, businesses, university clubs, nonprofit groups, and elementary and high school students. The community forest program sponsors an annual fall lecture series that includes presentations about forest ecology and restoration, and allows the public to interact with researchers from

FIGURE 8.3. Volunteers removing invasive plants.

the region. Citizen stewards who work on community forest projects are often motivated to work on other restoration opportunities within Arcata's coastal watersheds. Typically, city-sponsored volunteer workdays result in more than five thousand hours of volunteer work per year.

People have an amazing capacity to respond when invited to participate. The spark of volunteer involvement is much more likely when there is a strategic conservation plan that articulates the desired future outcomes of the restoration activity. In Arcata, years of effort by many to assemble protected lands will be well served by providing frequent opportunities to involve the public in stewardship efforts and creating a constituency that will have the investment and passion to protect Arcata's environmental assets. Participation in restoration projects helps bring the community members together and creates a social identity, sense of place, and local pride. However, not all restoration activities are ideal for public participation, for example, the operation of heavy equipment to remove roads. Moreover, many restoration projects in Arcata do not use community participation as much as they could due to logistics, liability, and lack of volunteer expertise in critical areas.

There are times when staff would consider it much easier to forge ahead on a restoration effort without involving community members. For example, the use of available conservation corps crews or in-house labor involves less logistical preparation, and those crews can typically perform tree planting and other tasks more rapidly than citizen volunteers. Nevertheless, the considerable long-term payback for providing citizens with a legitimate way to become "vested" in the forest has outweighed the logistical complications that sometimes accompany public involvement in restoration projects.

Community-owned forests are relatively rare in the western United States, but recently there has been increasing interest and effort to establish community forests. This has allowed Arcata to reach out and become not only an example of success but a participant in the larger community. Indeed, recent community-based forestry efforts around the country have expanded Arcata's network of partners as well as our capacity to communicate and learn from other community forest projects. This has been refreshing because for years Arcata's community-based program existed in relative isolation without comparable programs. Each restoration project provides an opportunity to link the public with the forest and create a constituency devoted to the protection of the forest environment.

Looking Ahead to 2020: Old Issues and New Opportunities

Restoring forest ecosystems is a process of recovery requiring a long-term, future-oriented approach, and success depends on sustained public and political support as well as investment of labor and capital. As with any long-term strategy requiring 50–100 years of effort, there are numerous challenges to overcome as well as opportunities that arise.

Ecological Challenges and Opportunities

Collaboration with conservation biologists and ecologists must be continually nurtured in order to provide information and maintain the credibility of the restoration program. This can best be accomplished through a monitoring program that has clear goals and indicators of success. Climate change presents a particular challenge because it changes everything about our previous assumptions. We must be prepared to challenge previous assumptions in order to plan treatments to prepare forest ecosystems to be as resilient as possible. Sharing data with others and documenting recovery efforts may allow Arcata's small-scale efforts to fit into the larger landscape level in terms of lessons learned and the observation of regional trends. Efforts to date have helped the City of Arcata obtain public and financial support for expansion of the forest, prevention of potential future fragmentation, and maintenance of existing habitat connectivity.

Social Challenges and Opportunities

Educating the public about the complexity of forest restoration, especially using timber harvest to mimic episodic disturbance, is a continuing challenge that requires educational outreach. It is important to approach this with a degree of humility. The selective harvesting regime implemented during the past thirty years has visibly altered the forest. Larger, more widely spaced trees and a "parklike" appearance have, more than anything else, led to continued public support for the forest management program. The public has also supported using a portion of the net timber revenue to leverage other funding sources in order to purchase additional forest land and protect and restore urban streams and wetlands (box 8.1).

Educating and preparing community volunteers is a fundamental part of community-based forestry. Volunteer stewards engaged with land managers become a constituency that is better informed and prepared to accept the responsibility that is a community-owned forest. Maintaining the credibility and trust of the Forest Management Committee is critical for the city to maintain the social license to continue tim-

Box 8.1
Conservation-Based Collaboration

A recently acquired 175-acre addition to the Arcata Community Forest brought together a diverse group of funders, all with a desire to see the parcel remain intact as a working forest and with the goal to manage for late-successional habitat, like the core Arcata Community Forest.

The acquisition was made possible by assistance from the Trust for Public Land and the funding support of the federal Forest Legacy Program, State Wildlife Conservation Board, California Transportation Commission, California Coastal Conservancy, and Save the Redwoods League. The City was able to leverage $100,000 in donations from local residents with $40,000 in City funds to obtain the additional grants necessary for the $2,750,000 transaction.

ber operations with the goal of creating "old-growth-like" stands over a long period of time. Members of the committee provide an important access point for public involvement. The members are well known and respected in the community, which has helped the program weather political and economic shifts. Fortunately, in Arcata there is a wealth of local professional expertise to draw upon to fill committee vacancies when they do occur.

There is an opportunity to increase citizen participation through interactions with the Forest Management Committee. Recently, the committee has invited the public to attend preharvest field trips to discuss the ecological goals of a particular timber harvest project. They have also begun to invite the public on postharvest evaluations and provide attendees with scorecards to rate particular attributes of a harvest operation, including damage to residual trees, soil compaction, stump height, riparian and wetland protection and implementation measures, and ground disturbance variables. We need to continue to involve youth in the forestry program and provide opportunities for them to learn how well-managed forests provide clean water, protect biodiversity, and mitigate climate change.

Continued certification by the Forest Stewardship Council, annual audits, and transparent third-party monitoring of the forestry operations provide additional opportunities for individuals to be involved in their community forest. Third-party certification has given the public and the city council a level of confidence that the forest resources are being managed in accordance with ecological principles. Recent modeling of the city's forest resource base now includes carbon accounting, which is consistent with the city's Greenhouse Gas Reduction Plan. There is an opportunity for Arcata to provide a regional demonstration site to show the economic and environmental benefits of managing redwood forests to increase terrestrial carbon storage.

Economic Challenges and Opportunities

Currently, the community forest generates about $500,000 of revenue per year from commercial timber harvesting, which is more than is needed to be self-supporting. No tax revenues are used for the forest management and maintenance activities. Nonetheless, maintaining sufficient funds for proper management of the forest is a challenge for the city during periods of poor market conditions for timber. This can be minimized somewhat by attempting to synchronize timber harvests with market peaks and developing a reserve account for the forest that cannot be used for other purposes. Additionally, the regulatory environment for forestry and restoration in California is a particularly burdensome process, even for management systems such as Arcata's relatively light-touch harvest regime. More often than not, responding to a multiagency permitting process diverts resources that would otherwise be directed toward restoration, recreation, or monitoring efforts. Many people involved in forestry in California, from industrial timberland managers to environmental groups, recognize that this problem is especially onerous for small forest landowners and community-based forestry programs.

By expanding the community forest and developing a regional trail system, increased tourism and use of the forest as a recreational asset will provide local economic benefits. The city has planned a four-mile-long trail that will connect several scattered tracts and be a regional asset. With the increased demand for green building services, there is a market opportunity for the development of local branding of the sustainably certified lumber produced from the forest. This would allow for consumers to purchase locally grown and milled lumber from local small businesses (fig. 8.4).

FIGURE 8.4. Locally available lumber from the Arcata Community Forest is certified, giving it more market value.

Conclusion

The success of the ecosystem approach in managing Arcata's public forests depends on the community's interest and involvement as well as a degree of ecological awareness and understanding by the citizenry and elected officials. For the past thirty years, Arcata has been fortunate in that its citizens and elected officials have had a high level of ecological knowledge and environmental ethics. Moreover, in Arcata and the Humboldt Bay watershed, enough of the ecological parts remain, and the connections to the larger forested landscape are still there (although the window of opportunity is closing) to allow for serious conservation efforts and complementary restoration work to move forward. It is important to stress humility in our restoration efforts, as our knowledge base remains very low compared to what we do not know. Still, we must remember that the state of the art of ecological forestry in 1980, when Arcata began in earnest to develop a sustainable forestry model, has changed considerably and will continue to evolve.

Success will be defined by assisting the recovery of the forest structure, composition, and ecological processes to more closely approximate reference conditions. Another measure of success will be when the ecological integrity of the forest is such that future interventions are not necessary. Surrogate old-growth species, such as the northern spotted owl, Pacific fisher, northern flying squirrel, and red tree vole, are examples of indicators used in Arcata to demonstrate a positive trajectory. Even if not fully successful from an ecological perspective, the process of attempting to reverse past environmental impacts will have a lasting and profound impact on the people who choose to be involved and make the effort. The act of removing invasive plants, repairing a trail, planting a tree, or monitoring improving water quality in a creek allows for hope and an optimistic vision of the future to flourish.

References

Belous, B. 1984. "Restoration among the Redwoods." *Restoration & Management Notes* 2 (2): 57–65.

Egan, D., and E. A. Howell, eds. 2001. *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems*. Washington, DC: Island Press.

Franklin, J. F., D. R. Berg, D. A. Thornburgh, and J. C. Tappeiner. 1997. "Alternative Silvicultural Approaches to Timber Harvesting: Variable Retention Harvest Systems." In *Creating a Forestry for the 21st Century: The Science of Ecosystem Management*, edited by K. A. Kohm and J. F. Franklin, 111–39. Washington, DC: Island Press.

Gann, G. D., and D. Lamb, eds. 2006. *Ecological Restoration: A Means of Conserving Biodiversity and Sustaining Livelihoods (version 1.1)*. Tucson, Arizona, and Gland, Switzerland: Society for Ecological Restoration International.

Jameson, M., E. Reuter, and T. Robards. 2005. "Growth of Redwood and Douglas-Fir Leave Trees Using Variable Retention." *California Forestry Note No. 119*. Sacramento, CA: California Department of Forestry & Fire Protection.

Keith, S. L. 1984. "Redwood Creek Estuary." *Restoration & Management Notes* 2 (2): 66–67.

Mitchell, S. J., and W. J. Beese. 2002. "The Retention System: Reconciling Variable Retention with the Principles of Silvicultural Systems." *The Forestry Chronicle* 78 (3): 397–403.

Spies, T. A., J. Cissel, J. F. Franklin, F. Swanson, N. Poage, R. Pabst, J. Tappeiner, and L. Winter. 2002. *Summary of Workshop on Development of Old-Growth Douglas-Fir Forests along the Pacific Coast of North America: A Regional Perspective*. November 7–9, 2001. Blue River, OR: H. J. Andrews Experimental Forest.

Sillett, S. C., R. Van Pelt, G. W. Koch, A. R. Ambrose, A. L. Carroll, M. E. Antoine, and B. M. Mifsud. 2010. "Increasing Wood Production through Old Age in Tall Trees." *Forest Ecology and Management* 259 (5): 976–94.

Van Kirk, S. 1985. "A History of the Arcata Community Forest." Unpublished research paper. Arcata, CA: Humboldt County Library.

Wycoff, B. 2005. *Growth Rings: Communities and Trees*. Aspen, CO: The Aspen Institute.

Chapter 9

Ecological Restoration as the Zone of Agreement in Southeast Alaska

Karen Hardigg

The Tongass National Forest (hereafter, the Tongass) is the largest national forest in the United States, covering nearly seventeen million acres. Stretching nearly five hundred miles along the Pacific Ocean, it encompasses almost the entire panhandle of southeast Alaska. The Tongass is at the center of one of the most contentious, long-standing environmental conflicts in the country, with the timber industry, conservation groups, local communities, and the U.S. Forest Service enmeshed in a protracted battle over forest management (Nie 2006). From the height of the pulp mill era, when hundreds of millions of board feet of lumber were annually cut and processed on the Tongass, to the present day, when only a fraction of that amount is harvested, stakeholders have vehemently disagreed about what is best for the land and its human inhabitants (Nie 2006).

The Tongass, adjacent forest-dependent rural communities, and a broad range of participants influencing forest management are tentatively transitioning out of a management paradigm based on resource extraction. With similar management transitions having already occurred on other public forests in the United States, the Tongass is well positioned to apply the lessons learned from the communities and people involved. However, a medium is needed to encourage and focus collaborative efforts in order to transition to more sustainable forest management that meets multiple values. This medium is ecological restoration. It is a vital strategy to build on the positive management changes already occurring.

Ecological restoration presents a unique opportunity to provide value to all stakeholders, something that prior forest management on the Tongass failed to accomplish. Restoration can provide considerable social and economic benefits on a localized level and can help reduce long-standing, resource-based conflicts. Restoration can provide these benefits while enhancing ecological function, unlike the traditional resource extraction management that has been the status quo on the Tongass—a management model that provided limited social and economic benefits at the cost of ecological health. Perhaps most important, restoration can serve as a model for a different way of doing business on the forest. To date, management of the Tongass has been dominated by large-scale, old-growth timber harvest. As this resource becomes in-

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_9, © Island Press 2011

creasingly scarce and uneconomical to harvest, and as local communities realize they stand to gain little from business as usual, a collective interest in alternative ways of managing forest resources is taking place. This collective interest is catalyzing a more holistic ecosystem management paradigm. In this case study, I describe the social, political, and ecological conditions that are making restoration the zone of agreement among various stakeholders in southeast Alaska, highlight some of the challenges with transitioning to restoration, and recommend strategies for capitalizing on emerging opportunities.

Background

The Tongass lies at the northern end of the coastal temperate rainforest that stretches from northern California up along the coast of British Columbia into Alaska. An archipelago with more than one thousand islands, the Tongass is an international icon and home to five species of salmon, black and brown bears, wolves, whales, and rare birds. Although commonly associated with rainforest characteristics, including towering Sitka spruce (*Picea stichensis*) trees, dense vegetation, heavy rainfall, and biological richness, less than 4 percent of the Tongass actually contains the large, old-growth trees such descriptions often conjure (Schoen and Dovichin 2007). Both environmentalists and the timber industry use this statistic to rally support for their position—either to call attention to the rarity of the resource or to claim only a fraction of the Tongass is truly affected by timber harvest. The Tongass also contains diverse habitats, including glaciers, rock, muskegs, estuaries, and forests of smaller, less commercially valuable old-growth trees.

Southeast Alaska is largely under federal management, either as a national forest or as a national park; only about 11 percent of the region is state or private land (Albert and Schoen 2007). Extensive federal land ownership plays an important role in the identity of local communities and the management of forest resources.

Resource Management

The recent history of the Tongass is intertwined with timber harvesting. Since the advent of Russian settlement in the late nineteenth century, natural resource management decisions focused on removing big trees. After the Tongass was established as a national forest in 1907, the U.S. Forest Service focused heavily on providing old-growth timber for potential pulp mills, but it wasn't until the 1947 Tongass Timber Act and the development of two long-term, fifty-year contracts, that large-scale harvesting began in earnest (Nie 2006; Sisk 2007). The guaranteed supply and accompanying subsidies provided by the long-term contracts were critical to overcoming the forest's inherent disadvantages (e.g., long distance from markets, challenging terrain for logging and transportation, and lower-value trees)—disadvantages that originally stymied large-scale harvest, investment, and local economic development (Morton, Phillips, and Gore 2007; Sisk 2007).

Beginning in the 1970s, a series of legislative and administrative decisions divided stakeholders and, combined with extensive logging, led to bitter conflict about how the resources of the Tongass should be managed. The Alaska Native Claims Settlement Act of 1971 created twelve regional Native corporations across the state to settle landownership disputes. In addition to Sealaska (the regional Native corporation), several smaller village corporations were created and given land entitlements. The allocation of 500,000 acres of some of the best old-growth timber in the region led to corporations creating their own timber programs, which largely involved exporting unprocessed logs overseas and significantly increased the overall regional timber harvest (Chadwick 2007). Almost all of the corporations quickly liquidated their timber, adding to a growing expanse of clear-cuts.

In 1980, the Alaska National Interest Lands Conservation Act set aside more than 104 million acres as designated wilderness, national parks, and other protected designations across the state, including 5.4 million acres on the Tongass. As part of a political compromise for achieving these protections, a provision was added by Alaska's congressional delegation mandating 450 million board feet of Tongass timber harvest annually and an accompanying $40 million in federal appropriations. The ensuing, rapidly expanding clear-cuts and road building began to influence both local and national consciousness (Durbin 1999). Environmental groups subsequently initiated a lengthy campaign to remove the harvest and funding provisions, resulting in the 1990 Tongass Timber Reform Act, which repealed the 1980 provisions, added more wilderness areas, and required more stringent environmental protections for timber harvesting (Nie 2006). The region's two pulp mills closed within the next few years. While environmentalists are frequently a scapegoat, the decline of the export market and federal subsidies, along with environmental pollution violations by Ketchikan Pulp Company, were significant factors in the pulp industry's demise.

While legislative direction has affected forest management, revisions to the Tongass Land Management Plan have also been a routine source of conflict. Within a span of eleven years, the U.S. Forest Service produced four different management plans (in 1997, 1999, 2003, and 2008), each of which drew the ire of almost all sides. The multiple iterations of the Tongass Land Management Plan, legislative fixes, and lawsuits have all led to a deep mistrust among stakeholders. Coupled with the long saga of whether the Tongass should be included in the Roadless Area Conservation Rule implemented in 2001 by the Clinton administration, it is little wonder people are tired and naturally questioning the best path forward.

Current Conditions

The natural resource, extraction–based economy that once dominated southeast Alaska has fundamentally shifted in recent decades (Mazza 2004), and the timber industry has been in steady decline for the last twenty years. The collapse of the export market for Tongass timber, the closure of the pulp mills, competitive disadvantages, and the fact that Alaska is a high-cost producer of low-value timber have all contributed to this decline (Crone 2005). Today, tourism and recreation are the region's fastest-growing industries (Colt, Dugan, and Fay 2007) due to the natural beauty, abundant wildlife, and outstanding recreational opportunities on the Tongass.

Residents currently face rising energy costs, decreasing job opportunities, and significant outmigration from communities. According to 2009 data from the Alaska Department of Labor, southeast Alaska has the state's largest rate of population decline (5.6 percent loss) since 2000, and no area in the region has had long-term population growth during that time. A lack of jobs and economic opportunity is the common culprit for the outmigration trend. Although logging jobs represent a very small percentage of the regional workforce, the dominant cultural role of timber cannot be overstated. While some residents pin their hopes on a revival of the industry, others are more circumspect and recognize that not only is old-growth timber harvest highly controversial, supply is rapidly dwindling and increasingly uneconomical to process. The regional economic trends and the transitioning timber industry represent an opportunity for innovative forest management activities that meet broader stakeholder values.

Ecological Effects of Past Management

There is a profound need for ecological restoration on the Tongass. Decades of large-scale old-growth, clear-cut timber harvest have left a degraded landscape, including failing roads and unnaturally dense stands of second-growth forest (Tongass National Forest 2006). Thousands of miles of roads and damaged culverts affect watershed quality and fish habitat and impair watershed functions through erosion and preventing the migration of anadromous fish. Early timber harvests targeted trees lining stream banks, removing critical supplies of future large woody debris. Instream restoration efforts are directed at decommissioning roads, repairing culverts, and adding large woody debris to restore structural complexity for fish habitat.

In addition to affecting streams, past timber harvest has left more than 430,000 acres of young forest on the Tongass (U.S. Forest Service 2008), much of it in dire need of management. After clear-cutting, forests pass through three phases before returning to late-successional, old-growth conditions: stand initiation, stem exclusion, and understory reinitiation. In the temperate coastal rainforests of southeast Alaska, the stem exclusion phase begins about thirty years after initial harvest, when dense stands of young trees crowd together, create a closed canopy, reduce light, and significantly affect forage availability for a wide variety of wildlife, particularly key species, such as Sitka black-tailed deer (*Odocoileus hemionus sitkensis*). Unlike many areas of the North American continent, fire is not the dominant natural disturbance in southeast Alaska, therefore restoration treatments in young forest stands are not designed to reduce or modify wildfire risk, but rather to increase forage for deer and improve habitat for other wildlife species. Thinning for restoration purposes in nondevelopment land use designations remains experimental on the Tongass and includes several techniques such as variable spacing, gapping, girdling, and individual tree selection (Harris 2009). Gaps and variable spacing are intended to mimic natural disturbances, such as windthrow. Responses to date have shown increased forage for more than twenty years following such treatments (Alaback 2010).

Ecological Restoration as the Zone of Agreement

As Kim and Hjerpe (chap. 14, this volume) argue, pressing social or economic impacts of degraded landscapes often drive landscape-scale restoration projects, such as water availability in the Everglades or unnatural and catastrophic wildfire threatening human communities in the American Southwest. Many areas of the Tongass clearly suffer from degraded streams and wildlife habitat, but impacts to human resources, such as drinking water, have been minimal and dispersed. Detrimental effects to local deer populations from dense, second-growth forest are a growing concern and, ultimately, will affect subsistence living, hunting, and, perhaps, wolf populations, but to date the effects are highly localized (Porter 2007). In the absence of wildfire, which is the immediate community threat that often creates a sense of urgency in other western states, the focus on ecological restoration on the Tongass may be surprising.

The critical need for restoration on the Tongass addresses more than just ecological degradation. It flows from the need to establish more beneficial ways of managing the landscape and natural resources that meet the social, economic, and ecological needs of multiple stakeholders. The increasingly unpalatable practice of old-growth timber harvest, combined with a rapidly diminishing supply of economically harvestable timber due to years of unsustainable high-grading and poor markets, assure a tenuous future for logging as usual. Furthermore, the rapid depletion of old-growth timber is putting long-term ecosystem services at risk for generations to come. Changing economic and demographic conditions in southeast Alaska are providing the impetus for developing a new model of doing business on the Tongass. Ecological restoration is emerging as the zone of agreement that brings both timber and nontimber values into account.

Example Projects

To better understand the management changes already taking place on the Tongass, it is useful to look at several example projects. Three restoration projects—Starrigavan, Sal Creek, and Harris River—demonstrate the types of restoration treatments, ecological need, unique partnerships, and local economic opportunities afforded and created by restoration (fig. 9.1).

Starrigavan

The Starrigavan River watershed, in the northern Tongass near Sitka, was logged in the early 1970s. Hundreds of acres of dense, second-growth stands are currently in the stem exclusion stage, with little light penetration and poor vegetation. Identified as a high-priority restoration site by multiple partners, the U.S. Forest Service, Sitka Conservation Society, Trout Unlimited, and other partners initiated an integrated

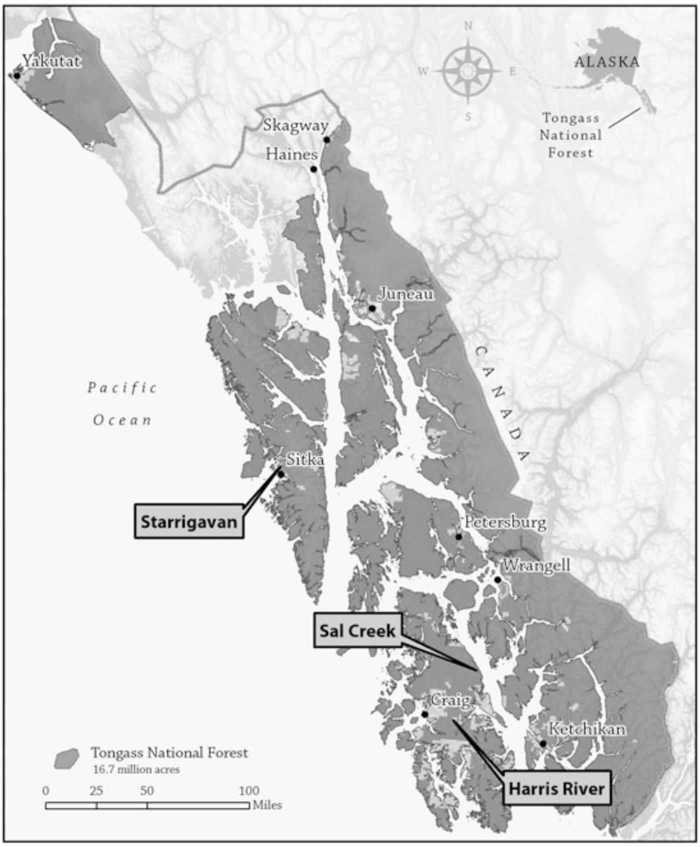

Figure 9.1. Location of ecological restoration projects in southeast Alaska. (Map courtesy of Melanie Smith, National Audubon Society, Alaska State Office)

restoration project in 2007. The project improved watershed function and enhanced fish and wildlife habitat values by thinning riparian tree stands to promote understory vegetation and accelerate the forest toward productive, old-growth conditions. Many of the thinned trees were used as firewood and to construct a recreation cabin within the Starrigavan campground, which is part of a demonstration project for utilizing second-growth timber. Two miles of tributary streams were also restored by adding large, woody debris to improve fish habitat.

The project benefited the adjacent community by creating employment opportunities for local contractors, recreation opportunities for residents and visitors through a public-use cabin, and educational opportunities by building the cabin as part of a university class. It also demonstrated how restoration efforts can provide second-growth forest products, benefit from collaboration and leveraging resources, and reduce the costs of thinning and slash removal by having local citizens use some of the restoration by-products for firewood.

Sal Creek

Sal Creek is a small coastal watershed on Prince of Wales Island that supported heavy timber harvest in the late 1960s. Effects of this past management include landslides, widespread red alder (*Alnus rubra*) regeneration along streams, erosion and sedimentation from roads in the floodplain, culverts that block fish passage and stream flow, and poor winter range for deer. The watershed supports more than eight miles of perennial streams that historically provided productive habitat for salmon and trout. A landscape-level analysis completed by the U.S. Forest Service identified sixteen thousand acres of second-growth forest and more than thirty miles of road that were degrading fish habitat. The watershed analysis, in combination with several erosion events, led partners, such as The Nature Conservancy and Trout Unlimited, to support a restoration project that serves as a good example for coordinating government and nonprofit partners. The restoration project reconnected twenty-seven streams blocked by one and a half miles of abandoned logging roads, removed deteriorated culverts, restored fish passage, thinned one hundred acres of red alder, and added large, woody debris to rehabilitate stream processes. The project resulted in improved habitat complexity for fish, the results of which will be monitored and applied to future projects (fig. 9.2). Important factors in the success of this project included the

FIGURE 9.2. Searching for juvenile coho salmon (*Oncorhynchus kisutch*) as part of a restoration monitoring procedure in the Tongass National Forest. (Photo courtesy of Bob Christensen)

leadership of local Forest Service personnel and the ability to leverage financial resources with partners.

Harris River

The Harris River watershed on Prince of Wales Island was once one of the most productive streams on the island for salmon and trout. The watershed and its tributaries, including Fubar Creek, suffered from heavy timber harvest to support the pulp mills. In the Fubar watershed, the entire riparian floodplain forest was logged and more than four miles of road were built in the 1950s. The loss of riparian forest, coupled with increased sediment from roads, broadened the stream and made it shallower. In 1993, eleven landslides released significant amounts of sediment into the headwaters, burying natural structures important for fish habitat. The stream also abandoned the original channel, flowing into side channels that did not have proper culverts for fish passage. An analysis by The Nature Conservancy, in combination with U.S. Forest Service analyses, identified the entire Harris River watershed as having high biological value and likely to respond to restoration treatments.

By leveraging private funding, The Nature Conservancy partnered with the U.S. Forest Service to implement a multiyear restoration project in the Fubar tributary (fig. 9.3). The project restored roads to reduce sediment release and improve fish passage, reconstructed several thousand feet of upstream channel to return flow to the main stem, removed culverts, and added large logs and engineered log jams to increase stream complexity. As a result of these efforts, spawning salmon have returned to the

FIGURE 9.3. U.S. Forest Service hydrologists monitoring water depth at Kennel Creek, Tongass National Forest. (Photo courtesy of Bob Christensen)

main stem channel for the first time in more than a decade. A local contractor completed the work, providing economic opportunities for the small island communities.

The Starrigavan, Sal Creek, and Harris River restoration projects are the best examples on the Tongass of projects that approached restoration on a watershed scale, included diverse partners, and applied a variety of restoration techniques, from road closures to stream restoration to restorative thinning for wildlife. Each one had a champion within the U.S. Forest Service, committed partners, and assessed restoration opportunities from a watershed level. The partners supported the agency with funding and provided outside pressure to encourage implementation. Other ecological restoration projects have been completed across the forest, but most were discrete upland, instream, or road closure projects that achieved site-specific benefits but did not integrate social, economic, and ecological values, nor holistically assess and prioritize improving the overall condition of a watershed. While beneficial, small-scale projects will do little to transform forest management at a scale that provides value to all stakeholders.

Opportunities

The current conditions on the Tongass present an excellent opportunity for restoration to become a management priority for the U.S. Forest Service. The regional office recently announced intentions to diversify local economic opportunities beyond old-growth timber harvest while conserving natural resources. The region contains a workforce that is both experienced and generally willing, and an existing wood products industry potentially capable of utilizing by-products of restoration treatments. There is a clear ecological need, experimental treatments are in place (U.S. Forest Service 2006; Alaback 2010), and local communities and collaborative partners are already seeking alternative forms of forest management that meet multiple values (e.g., Starrigavan and Harris River restoration projects).

The U.S. secretary of agriculture, Tom Vilsack, has made ecological restoration one of the primary goals of forest management for the national forest system (Vilsack 2009), a policy direction that, through the chief of the U.S. Forest Service and the regional forester, is clearly influencing management decisions on the Tongass. Several visits from Washington, D.C., representatives have reinforced this shift in focus. As a result, Beth Pendleton, the regional forester, announced a transition framework at a collaborative meeting in 2010. The framework is intended to help communities "transition to a more diversified economy by providing jobs around renewable energy, forest restoration," and other activities.

Despite the rapid market decline in the last two decades, a small forest products industry remains in the region. A recent Wilderness Society assessment of local contractors' capacity and interest in restoration revealed that more than half of respondents are interested in retooling for small-diameter wood utilization. Retaining this local knowledge, expertise, and experience with logging will be an essential component of a transition to restoration. Ecologically, there is a clear need and opportunity for applying a diversity of restoration treatments. Public land management agencies, such as the U.S. Forest Service, Alaska Department of Fish and Game, and the U.S. Fish and Wildlife Service; conservation partners, such as the Sitka Conservation Society, The Nature Conservancy, Trout Unlimited, and The Wilderness Society; local watershed councils; and others have a strong understanding of the ecological context and treatment options. The U.S. Forest Service and three conservation groups have developed publications documenting and prioritizing restoration opportunities on Prince of Wales Island and in Sitka (e.g., Albert et al. 2008). The impacted ecosystems are resilient and likely to respond to treatment, and most stakeholders generally agree on the restoration needs, although not always on the prescription.

Collaborative venues, like the Tongass Futures Roundtable, have done much to lessen the historical, acrimonious relationship between the timber industry and environmentalists. Although appeals and litigation still play an important role in resource management decisions, collaborative priorities are increasingly common in shaping project-level decisions. For example, several conservation partners have actively raised money and encouraged the U.S. Forest Service to implement restoration projects (Jacobson and Bosworth 2007). The relationships fostered through these projects have led to additional partner and stakeholder involvement (e.g., the Forest Service now often solicits partner input about projects early on). Joint field trips to future restoration sites and rural, forest-dependent communities in the other western states have encouraged on-the-ground learning, rich debate, common ground, and a commitment to further partnerships.

These emerging relationships between the government, nonprofit organizations, and community members have inspired interest in developing watershed-level projects that integrate a diversity of restoration treatments and values, and demonstrate the potential for integrated, sustainable forest management. For example, The Nature Conservancy, in partnership with the U.S. Forest Service, recently completed a yearlong process involving more than fifty individual partners on the Staney Community Forest on Prince of Wales Island—a process that led to a Collaborative Forest Landscape Restoration proposal that was submitted for national funding by the regional forester.

Challenges and Recommendations

It is unrealistic to expect the Tongass to simply end its old-growth logging program. The acrimony following the Northwest Forest Plan and the abrupt changes to logging in the Pacific Northwest region can serve as an instructive lesson. Any transition to a new model of forest management will require both the U.S. Forest Service staff to produce the projects and the industry capacity to perform the work. Ceasing current logging practices would have immediate, detrimental effects on the agency's budget and staff and could result in operators simply shutting down and leaving the wood products industry, idling infrastructure that could be used to support restoration through utilization of smaller-diameter trees. Furthermore, timber has long been a way of life in southeast Alaska, and the region can ill afford more divisive conflict that further polarizes already weary stakeholders.

The Tongass and participating stakeholders have begun to transition out of a model of forest management that benefits a few at the expense of many by focusing on ecological restoration as common ground. Yet, like any region or national forest facing the need for restoration, expensive treatment costs combined with a lack of funding, declining agency budgets, insufficient staff capacity, and complex policies and procedures all make implementation challenging. While many challenges lie ahead, two significant barriers are institutional and community capacity. The transition to forest management that prioritizes management of second-growth stands, restoration, and sustainable forest management will require the institutional capacity and commitment from the U.S. Forest Service to develop a program of work that uses new tools, such as stewardship contracting (Moseley and Davis 2010), and new collaborative venues that build the community capacity (both business and social agreement) to implement model projects and apply them to a forestwide strategy of landscape restoration.

Institutional

As the principal land manager in the region, the U.S. Forest Service must make the necessary adjustments to prioritize ecological restoration as a management direction. The policy statements to date are a step in the right direction, but they should be followed with a program of work that reflects this shift in priority, an investment in staff capacity, and a focus on stewardship contracting. The current Tongass Land Management Plan remains problematic in its focus on large, traditional timber outputs and a new plan will ultimately be necessary. Absent a new plan, the U.S. Forest Service should develop a schedule of active forest management activities (thinning of dense, second-growth stands, instream habitat restoration, road decommissioning, and small-scale, old-growth timber harvest) that is both predictable and socially acceptable. Without a long-term supply and predictable program of work, the local workforce cannot make the necessary investments to retool. Collaborative partners must also work closely with the agency to develop environmental analysis documents that reflect shared priorities and are scientifically, ecologically, and legally sound.

In addition to a program of work, the U.S. Forest Service must invest resources to retrain and encourage existing staff to use mechanisms other than traditional timber contracts. While the top-down directives are encouraging, the historical and cultural influence of old-growth logging remains embedded in agency culture; at the district and staff level, restoration is not necessarily accepted as a management priority. Stewardship contracting (see chap. 12, this volume), a U.S. Forest Service authority that typically involves community collaboration, exchanges goods for services, and awards contracts based on best value, has been underutilized on the Tongass and can provide a catalyst to implement landscape-scale demonstration projects.

For example, while there are thousands of acres of second-growth forest on the Tongass, very little is ready for commercial timber harvest and won't be ready for another twenty years. In the meantime, stands need thinning treatments to improve forage and connectivity for wildlife. Stewardship authorities may allow operators to use the by-products of these treatments to offset costs, saving critical U.S. Forest Service dollars, providing local economic opportunities, and supplying the needs of small-scale, renewable energy projects. To date, two small stewardship contracts have been awarded on the Tongass. Partners are already considering additional opportunities, including a stewardship contract near Kake on Central Kupreanof Island, the Staney Community Forest on Prince of Wales Island, and the Peril Straits project in the Sitka area.

Community

The other significant gap to advancing restoration and sustainable forestry in the region is the capacity of local communities and individuals to act on the U.S. Forest Service's new policy direction. Currently, partners meet on an ad hoc basis as restoration projects or other reasons present an opportunity—a lurching process that often leaves challenges unmet. A collaborative organization designed to coordinate the collective restoration efforts of the public land management agency, local communities and workforces, and conservation partners is critical.

To date, the primary collaborative venue to discuss regional forest management issues has been the Tongass Futures Roundtable. Established in 2006, it is a unique attempt in the region to bring together stakeholders from diverse standpoints: the timber industry, environmentalists, U.S. Forest Service, local communities, businesses, and tribal representatives, among others. The roundtable has been instrumental in establishing relationships among stakeholders who might never have met in person or had incentive to speak with each other. The collaborative process has helped break down long-standing barriers between stakeholders. The process has also sent a clear message to the U.S. Forest Service that there is broad interest in transitioning out of old-growth logging and diversifying sustainable economic opportunities to better support rural community health.

Collaborative processes offer the opportunity to engage, inform, and empower citizens at an early stage, reducing the distrust of agency actions (Wondolleck and Yaffe 2000). They also provide partners an opportunity to understand and identify shared values. For example, while roundtable participants generally agree on the need, they have highly variable perspectives of what restoration means, what the treatments and prescriptions restoration might include, and, most important, the end goal for the treated landscape. Attempts to agree on a universal definition have been unsuccessful. A strong collaborative process focused on restoration would lead to better problem definition, leverage resources in an era of declining budgets and capacity, encourage learning across boundaries, and support development of landscape-level decisions (RVCC 2007).

While the Tongass Futures Roundtable has been groundbreaking, it is not the appropriate place to approach collaborative restoration and stewardship projects. If the U.S. Forest Service is to truly transition from the unsustainable practice of old-growth logging to a model that promotes ecological health and local economic resilience, a durable collaborative entity with a shared vision that demonstrates the social and political will for such a transition is essential. Place-based collaborative forums, including one on Prince of Wales Island, should be established in order to better coordinate efforts, encourage peer-to-peer networking, develop a shared vision and ownership, and foster innovation and learning. Similar models from elsewhere in the country, such as Wallowa Resources in Oregon (see chap. 7, this volume) or the Watershed Research and Training Center in California, present excellent models.

Conclusion

Decades of large-scale, old-growth timber harvest have left thousands of acres across the Tongass in need of ecological restoration to improve fish and wildlife habitat as well as landscape connectivity. Long-standing conflict over management of southeast Alaska's natural resources has also left a legacy of deep mistrust among stakeholders, creating the need to restore social capital and transition land management priorities to better meet current ecological needs and the needs of adjacent rural communities. Collaborative restoration and stewardship contracts represent a tangible, near-term opportunity to begin making this transition. Participants involved in Tongass National Forest management are in a position not only to capitalize on the clear ecological need but to develop restoration projects and forest management activities that also meet social and economic needs. Furthering the existing momentum will require institutional efforts to prioritize restoration, encourage learning, and use stewardship authorities through model projects. In addition, there is a need for a durable, collaborative forum that increases community capacity and builds an integrated approach to sustainable forest management.

References

Alaback, P. 2010. *An Evaluation of Canopy Gaps in Restoring Wildlife Habitat in Second Growth Forests of Southeastern Alaska: Final Report*. Anchorage, AK: The Nature Conservancy.

Albert, D., L. Baker, S. Howell, K. V. Koski, and R. Bosworth. 2008. *A Framework for Setting Watershed-Scale Priorities for Forest and Freshwater Restoration on Prince of Wales Island*. Juneau, AK: The Nature Conservancy.

Albert, D.. and J. Schoen. 2007. "A Conservation Assessment for the Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest." In *The Coastal Forests and Mountains Ecoregion in Southeastern Alaska and the Tongass National Forest*, edited by J. Schoen and E. Dovichin, chap. 2.1: 1–46. Anchorage, AK: Audubon Alaska and The Nature Conservancy.

Chadwick, D. 2007. "The Truth about the Tongass." *National Geographic* July. http://ngm.nationalgeographic.com/2007/07/tongass/chadwick-text.

Colt, S., D. Dugan, and G. Fay. 2007. *The Regional Economy of Southeast Alaska*. Report prepared for the Alaska Conservation Foundation, Anchorage.

Crone, L. 2005. "Southeast Alaska Economics: A Resource-Abundant Region Competing in a Global Marketplace." *Landscape and Urban Planning* 72: 215–33.

Durbin, K. 1999. *Tongass: Pulp Politics and the Fight for the Alaska Rain Forest*. Corvallis: Oregon State University Press.

Harris, S. 2009. *Tongass Groundtruthing Report: Restoration Thinning*. Sitka, AK: Sitka Conservation Society.

Jacobson, S., and R. Bosworth. 2007. "Fubar Stream Restoration Is All About 'Effective Sediment Transport, Better Habitat, and More Fish!'" *Oncorhynchus: Newsletter of the Alaska Chapter of the American Fisheries Society* 27 (4): 1–4.

Mazza, R. 2004. *Economic Growth and Change in Southeast Alaska*. Gen. Tech. Rep. PNW-GTR-611. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Morton, P., S. Phillips, and A. Gore. 2007. *Déjà vu on the Tongass: How Overestimating Timber Demand Prevents Responsible Stewardship*. Washington, DC: The Wilderness Society.

Moseley, C., and E. J. Davis. 2010. *Stewardship Contracting for Large-Scale Projects*. Ecosystem Workforce Program Working Paper Number 25. Eugene, OR and Flagstaff, AZ: Ecosystem Workforce Program and the Ecological Restoration Institute.

Nie, M. 2006. "Governing the Tongass: National Forest Conflict and Political Decision Making." *Journal of Environmental Law* 36: 385–480.

Porter, B. 2007. "Unit 2 Deer." In *Deer Management Report of Survey and Inventory Activities 1 July 2004–30 June 2006*, edited by P. Harper, 30–40. Juneau: Alaska Department of Fish and Game.

Rural Voices for Conservation Coalition (RVCC). 2007. "Collaboration Issue Paper." http://www.sustainablenorthwest.org/resources/rvcc-issue-papers/Collaboration%202007.pdf.

Schoen, J., and E. Dovichin, eds. 2007. *The Coastal Forests and Mountains Ecoregion in Southeastern Alaska and the Tongass National Forest*. Anchorage, AK: Audubon Alaska and The Nature Conservancy.

Sisk, J. 2007. "The Southeast Alaska Timber Industry: Historical Overview and Current Status." In *The Coastal Forests and Mountains Ecoregion in Southeastern Alaska and the Tongass National Forest*, edited by J. Schoen and E. Dovichin, chap. 9.6: 1–20. Anchorage, AK: Audubon Alaska and The Nature Conservancy.

U.S. Forest Service. 2006. "Investing in Habitat Improvements Vital for Ecological Sustainability, Local Economies, Subsistence Users." *Alaska Region Newsletter*, June.

———. 2008. *Tongass Land and Resource Management Plan: Final Environmental Impact Statement Plan Amendment*. Ketchikan, AK: Tongass National Forest.

Vilsack, T. 2009. "National Vision for America's Forests." Speech in Seattle, WA. August 14.

Wondolleck, J. M., and S. L. Yaffe. 2000. *Making Collaboration Work: Lessons from Innovation in Natural Resource Management*. Washington, DC: Island Press.

PART III

Power: Politics, Governance, and Planning

John C. Bliss and A. Paige Fischer set the stage for thinking about the ways that members of the broader society can participate in ecological restoration, through their roles in civil society, as landowners, as laborers, and as community members. Central to their discussion is the concept of tenure, and the formal and informal arrangements that control people's access to land. While often invisible, tenure, nevertheless, influences the opportunities people have to interact with land and, ultimately, affects the possibilities for human involvement in restoration. As David Brunckhorst next explains, restoration takes place within a context of policy (formal rules governing the interactions between people, land, and resources), politics (informal and formal contests and negotiations about power), and property (legal title to land). In many cases, ecological restoration is stymied due to the barriers created by the interplay of these three power arenas. Nonetheless, Brunckhorst argues that innovative policy, political, and property arrangements can actually aid the development of ecological restoration at larger scales and longer time frames than is possible under traditional settings.

The policy context for restoration of federally owned forestlands is the focus of Jesse Abrams's case study. In it, Jesse examines the emergence of new policy mechanisms that allow local communities to more meaningfully engage in ecological restoration on local public lands. This example from rural Arizona illustrates the changing role of both public land managers and traditionally resource-dependent communities in crafting new relationships between people, communities, and public forests. In the concluding chapter, Mark Buckley and Ernie Niemi examine how climate change will affect the future work of planners and restorationists. Using the example of the Puget Sound Partnership, a Washington State agency dedicated to restoring the Puget Sound by 2020, they discuss the risks and uncertainties that climate change presents and suggest ways to plan restoration projects that will be successful and sustainable into the future.

Chapter 10

Toward a Political Ecology of Ecosystem Restoration

John C. Bliss and A. Paige Fischer

Ever since humans emerged on the grassy plains of Africa, *Homo sapiens* has demonstrated a special affinity for mixed, open-canopy woodland and savanna landscapes. With their abundance and diversity of game and edible plants, fuel for cooking and warmth, protection from weather and wide-open views of predators, these landscapes provided everything hunter-gatherers needed. It has been hypothesized that humans prefer canopied, open-floored landscapes for these biological reasons (Appleton 1975; Bourassa 1991). Woodland and savanna landscape structures also appear to embody widely shared cultural values for coherence and exploration—the well-spaced trees appear orderly and the open floor can be accessed, while distant areas of trees remain undiscovered (Kaplan and Kaplan 1989). Over the millennia that humans coevolved with these systems, the landscape imprinted on us, compelling us to seek stands of widely spaced trees over prairie grasses in which to live. In turn, we imprinted our will on the landscape through pervasive, deliberate, and sophisticated management to fulfill human needs. A growing body of evidence points to the formative interactions between humans and these landscapes (Penn and Mysterud 2007). In this chapter we explore these interactions, using the Oregon white oak ecosystem as a case study, to provide some considerations for ecosystem restoration. Specifically, we discuss the cultural values, social practices, and tenure arrangements that influence how humans have altered landscapes in the past. We explore the dynamic, interdependent relationship between human communities and landscapes, and draw attention to power relations relevant to restoration. We close with a checklist of questions to guide practitioners in integrating social and ecological considerations.

An illustration from Oregon

Oregon's Willamette Valley is bordered by isolated remnants of the oak savanna and woodlands that once dominated the entire basin from the lower slopes of the Coast Range on the west to the Cascade Mountains on the east. These ecosystems, appealing to the human eye and rich in biodiversity, are among the state's most endangered, covering only a few percent of the area they occupied at the time of Euro-American

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_10, © Island Press 2011

settlement in the mid-1800s (Oregon Biodiversity Project 1998; Oregon Department of Fish and Wildlife 2006). The story of Willamette Valley oak savannas and woodlands provides dramatic illustration of the complex interplay between ecological dynamics and evolving human values, preferences, needs, and constraints.

The history of oak savanna corresponds to the history of human presence in the Pacific Northwest; both date back more than six thousand years to the end of the most recent dry period in North American climate (Stein 1990). Carbon and pollen studies reveal no natural baseline for Oregon white oak habitat conditions. Instead, it appears the habitat assumed a range of ecosystem functions and disturbance patterns throughout its history (McShea and Healy 2002). For example, tree core data from several sites in the Pacific Northwest indicate Willamette Valley oaks burned frequently by low-intensity fires, but only between the mid-1700s and 1900 (Agee 1993). This lack of consistency suggests that oak may have conformed more to variations in human activity than to other ecological processes.

Kalapuya and other local Native American groups were some of the first people to shape Willamette Valley ecosystems to meet their needs. Prior to European settlement they used fire as a management tool to maintain gardens of camas (*Camassia quamash*), a native prairie plant whose starchy bulb was a food staple, and to foster the growth of tarweed, grasshoppers, nut and berry plants, and bracken fern rhizomes (Agee 1993; Boyd 1999). They also set fires to herd deer for hunting. Oregon white oak (*Quercus garryana*) is adapted to fire in ways that other species are not. Its thick bark protects the delicate cambium, and dormant buds are located low on the root collar below the soil surface so they can sprout even after fire (Tveten and Fonda 1999). The fires the Kalapuya set thinned the understory of the oak woodlands and savannas, maintaining the stands' open structure, enhancing tree vigor and seedling regeneration, and increasing mast crops for consumption by both humans and game (Agee 1993, 1996; Boyd 1999; Peter and Harrington 2002; Van Lear and Brose 2002). The fires also limited infestations by invasive plants and acorn-boring insects (Anderson 2005). The net effect of Kalapuyan management was to create an overstory of widely spaced, large-crowned Oregon white oak trees with an understory of shrubs and perennial native grasses (Agee 1990).

Euro-American pioneers in the Willamette Valley also burned the land (Boyd 1999). Yet these settlers who displaced the Native Americans also brought with them a set of values, preferences, needs, and constraints that stood in stark contrast to those of their predecessors. Where Kalapuyans saw prime camas grounds, settlers saw potential pastures and crop fields. In open oak woodlands they saw cabin logs, lumber, and well-drained agricultural fields. And in wildfire they saw a threat to their homes and settlements. As a result, camas fields were ditched and drained, wooded savannas were cleared and plowed, and, in the absence of fires, oak stands developed thick understories and conifers, such as Douglas fir (*Pseudotsuga menziesii*), encroached on and outcompeted oak in the canopy.

As the region became the nation's timber basket during the twentieth century, landowners cultivated and encouraged Douglas fir anywhere it would grow, converting oak-canopied pastures, fields, and woodlands to timber plantations. Farmers shifting to more lucrative crops, such as rye grass, may also have removed savanna oaks that cast shade onto their fields on the valley floor. In the foothills, residents viewed woodlands, open meadows, and savannas primarily as candidate areas for conversion to other uses, such as residential areas, timber and Christmas tree plantations, and vineyards, often with assistance from natural resource professionals (Fischer and Bliss 2009).

The Willamette Valley is now home to the cities of Portland, Eugene, Salem, and Corvallis, and to 70 percent of the state of Oregon's population. On sites with better soils, dense stands of Douglas fir are managed for timber production on industrial ownerships, habitat and water on public ownerships, and mixed objectives on family ownerships. Pure oak stands remain only on marginal sites where other species cannot thrive and for which people have found no other use or value. One legacy of Euro-American settlement that has had a dramatic effect on essentially all Willamette Valley oak sites is the introduction of nonnative species, notably Himalayan blackberry (*Rubus discolor*) and false brome (*Brachypodium sylvaticum*).

The forest and human landscapes of the Willamette Valley coevolved; as human needs and culture changed, so did landscape structure. Through their use of fire, the Kalapuyans had, in effect, shaped the ecosystems of the valley to suit their needs; the needs of people living at low population densities in scattered communities moving seasonally across a dynamic landscape. Euro-American settlement, elimination of fire, and shifts in forestry and agriculture further changed the landscape. A century and a half later, subsequent generations of residents are continuing to transform the landscape, shaping it to reflect prevailing values, needs, preferences, and constraints.

In the 1990s, a movement emerged to protect remnant oak stands and restore oak to the valley. Catalyzed by the recognition of oak woodlands and savannas as two of the most threatened habitats in the state of Oregon (Oregon Biodiversity Project 1998), the Oregon Oak Communities Working Group formed to support the conservation and restoration of oak. Composed of scientists, extension foresters, landowners, and representatives of conservation organizations, the group focused their initial efforts on the Willamette Valley, where oak savannas historically dominated the landscape. The lack of accurate statistics on the historical range of oak woodlands and savannas in the valley hampered establishment of restoration goals; consequently target conditions have been the focus of some debate (Fischer and Bliss 2009). Furthermore, invasive species are so ubiquitous, persistent, and resistant to control in the region that some land managers have accepted "structural" rather than comprehensive ecological restoration as their goal; that is, failing to successfully replace false brome with native grasses, they have settled for a target of oaks over grass—any grass (Fischer 2006). Nonetheless, the working group has guided landowners and managers throughout the Willamette Valley in the restoration of Oregon white oak woodlands and savannas, removing invasive species, thinning oak stands to favor growth on dominant stems, and, in some cases, reintroducing fire.

What can we learn from the story of these Willamette Valley ecosystems? First, oak woodlands and savannas are "anthropogenic" ecosystems; that is, human interaction is integral to their establishment and maintenance. While not all ecosystems are anthropogenic, humans and the landscapes they inhabit all over the planet have coevolved. Indeed, coevolution might be a useful way to think about the relationship between humans and ecosystems that we should strive for through ecological restoration. It implies the possibility and necessity of evolving new human values and behaviors in our relationship to the landscapes we inhabit.

Second, humans don't have some generic impact on these landscapes; we imprint them with remarkable detail, reflecting specific values, preferences, needs and constraints, just as their conditions affect human culture. Extensive theories and data support biological bases of landscape preference (Daniel and Vining 1983; Bourassa 1991; Kellert and Wilson 1995). But shared cultural values, perceptions, and cognitive processes are also at work in landscape preferences (Kaplan and Kaplan 1989; Gobster 1999). Landscapes themselves are enduring reflections of cultural values. Furthermore, because they embody unexamined cultural conventions, they are also resistant cultural artifacts, reflecting past values and beliefs (Nassauer 1995). Everywhere that Europeans settled throughout the New World, they imposed their values on the landscape in attempts to fashion it into something useful and familiar. Generations later, the cultural values and practices of early European settlers can be detected in the conditions of the landscapes they inhabited. For example, in Wisconsin the woodlots of second- and third-generation German Americans display the "tidiness" of the woodlots of their ancestors in Germany (Bliss 1992). Norwegian American woodlots suggest the frugality of their immigrant forbearers, while the open-canopied hardwood stands of eastern European settlers reflect their primary use as sheep pasture. In the glacial outwash landscape of northern Wisconsin, Finnish Americans re-created the "system of fields and forests" they had known in their home country. Each of these immigrant groups held tightly to their cultural definitions of what constituted a resource and what constituted an obstacle to overcome (Bliss 1992). Thus, we should be cautious in discussions of baseline or reference conditions when we generalize how humans have impacted the land. We should ask, Which humans? At what point in history? In response to what values, needs, or constraints?

Third, determining target conditions for restoration, then, necessarily involves consideration of the behavior and culture that created or maintained the desired ecological condition. Target conditions inescapably reflect and privilege particular patterns of human activity, and the associated values and constraints, over others. Beginning with the claim that an ecosystem is in need of conservation or restoration, one is engaging in choices based upon (often competing) human values, preferences, and cognitive constructs about naturalness (Hull, Robertson, and Kendra 2001), biodiversity (Takacs 1996), wilderness (Cronon 1995), wildlife (Scarce 1999), sustainable development (Peterson 1997; Peterson et al. 1997), restoration (Gobster and Hull 2000), stewardship (Peterson and Horton 1995), and whether humans are a part of or separate from nature (Katz 2000). Decisions about which ecosystems to restore might be considered as a sort of triage. Some landscapes have been so thoroughly transformed by intense human use over extended periods of time that the social as well as the biological challenges of restoration are overwhelming. In some such landscapes, strong and enduring cultural and aesthetic ties to the altered landscape have developed. In the British Isles, for example, landscapes have been devoid of trees for so many generations that reestablishing forest cover is popularly viewed as destroying the landscape patrimony (Carroll et al. 2009, but see chap. 19, this volume).

Fourth, all questions of land use, including restoration, involve issues of tenure; the formal and informal system of rules and practices that govern rights to access, use, and disposal of land and land resources (see chap. 11, this volume). When Euro-American settlers took up residence in the Willamette Valley, they imposed an entirely different tenure system on the land from that of the Kalapuyans that limited communal rights and defended individual rights. This shift in tenure may have circumscribed the use of fire from management of a common resource on a landscape scale to clearing discrete parcels for private farmsteads, and the compulsion to protect these farmsteads from fire probably made settlers much more conservative about its use. Since settlement, those individual rights have been continuously renegotiated as social norms for land use have evolved—from homesteads, to timber and agricultural crops, to amenities—and each renegotiation has affected oak differently. The dominance of private land in the Willamette Valley that once constrained oak systems now may benefit them. Tenure rights share the dynamism we observe in human values and ecological conditions.

Fifth, relationships between humans and landscapes are dynamic. They evolve together in response to changing biophysical and social conditions. At the same time that restoration ecologists select ranges of ecological trajectories to guide their work, social trends should also be considered. Given current developments in technology, cultural values, and social structures, how might society interact with ecosystems in the future? What kinds of products and services will be desired? Where will people want to live, work, and recreate? What kinds of benefits will they need from ecosystems to sustain the health and livability of their communities? While both ecologists and social scientists recognize the folly of pursuing some vision of a static "restored" state, they need a shared vision of the desired range of target conditions or trajectories. The dearth of accurate, unbiased, reliable data on historical conditions hampers development of such a vision. As we will examine in the following section, our understanding of past ecological conditions has sometimes been built upon incomplete, ahistorical, selective, and misleading data. In this sense, the very premise of restoration to some historical or natural condition is problematic. Constructive management of socioecological change might be a more realistic goal for restoration.

A Political Ecology of Restoration

Having established ecological restoration as a values-based human endeavor, let us now consider a useful lens through which to examine its ecological and social dimensions. Political ecology provides a framework for critically examining ecological restoration within its contemporary social, political, and economic context (Blaikie and Brookfield 1987; Peet and Watts 1996; Robbins 2004). Nygren and Rikoon

(2008, 773) define political ecology as the examination of the “complex intersection of cultural perceptions of environment, and changing ecological conditions and political-economic interests.” These authors observe that “efforts targeted at environmental conservation are intrinsically interwoven with questions of power and political authority” (Nygren and Rikoon 2008, 775). Harvey (1996, 185) is unambiguous in situating restoration squarely in the realm of political-economic activity: “Ecological arguments are never socially neutral any more than socio-political arguments are ecologically neutral.”

From a political ecology perspective, then, questioning the power relations embedded within or implied by ecological restoration activities is imperative. The conscientious restorationist must ask such questions as: Who determines what ecosystem is in need of restoration? Who determines the target condition, and which ecological structures, processes, and components are to be valued? Whose values, histories, and traditions are privileged, and whose are not? For whom is restoration initiated? Who benefits from restoration? Who loses? Who pays? Who has rights or claims to the land to be restored? How will local or traditional access and use patterns be affected? Who will do the work of restoration?

Each of these questions merits serious consideration and opens up whole webs of interrelated questions, problems, and potential conflicts. To illustrate with one important example, consider the questions, Who determines target conditions for ecological restoration, and how? In their encyclopedic analysis of deforestation in West Africa, Fairhead and Leach (1998) illustrate how a selective reading of history, flawed ecological reasoning, and ingrained colonial prejudices combined to form the dominant—but highly erroneous—paradigm regarding the region’s forests. In the dominant view, widely accepted by forest ecologists even today, the West African coast was, until the relatively recent past, covered by “primeval” forest, largely untouched by humans. Serious forest degradation and deforestation commenced only in the past century, as farmers and pastoralists migrated into the forested coastal region from savannas to the north. As the population swelled, forests were felled until only tiny relic forests remained as islands in the encroaching, human-induced savanna. Building upon this telling of regional history, colonial as well as postindependence governments established forest reserves, restricted indigenous peoples’ tenure rights, and usurped much of the remaining forest. Moreover, conservation policy in Africa, in general, sprang from the underlying philosophy that growing human populations cause deforestation (Fairhead and Leach 1998).

Fairhead and Leach’s (1998) reappraisal of the region’s history reveals that early estimates of “original” forest cover were based on very limited and selective empirical data, and wildly exaggerated. Subsequent estimates of deforestation rates built on these inflated guesses. What’s more, in many cases, ecologists misread not only the causes but the direction of forest change. Many forest “relics” have been shown not to be the remains of a formerly vast “natural” forest, but rather anthropogenic forests established to buffer human settlements from the surrounding savanna! These authors do not claim that all human–forest interactions are similarly favorable to maintaining ecosystem integrity. However, they emphasize the need to critically interrogate historical narratives and to carefully examine data quality, assumptions, and prejudices before prescribing ecosystem restoration target conditions. Indeed, "forestry statistics in international circulation are the epiphenomena of power relations with long historical roots. Their reiteration is far from neutral, but serves to reinforce those power relations in ways, and with effects, from which their proponents might prefer to be dissociated" (Fairhead and Leach 1998, 197). The myth of primeval ecological stability, an ahistorical ecological account of vegetation change, and a jaundiced view of local people's knowledge and behavior all served the interests of forestry and conservation institutions anxious to control valuable forestland and resources.

It might be particularly difficult for Western scientists to apply these lessons to situations within their own countries, where they have a comfortable but perhaps superficial or biased familiarity with cultural and ecological patterns. In his research about conflicts between environmental and property rights advocates in the western United States, McCarthy (2002, 186) observed a tendency among social scientists to undervalue the ecological knowledge of the latter group: "(A)nglo-American social scientists sometimes find it easier to study, recognize, and valorize only the environmental knowledges and practices of third world peoples." If local residents and landowners are to become constructively engaged in ecosystem restoration, their experience, perspectives, and ways of knowing the landscape must be recognized, respected, and reflected in restoration initiatives.

Returning to the oak example, consider the other important questions: Who benefits? Who loses? Who pays? In oak restoration, where ownership is largely private, yet the goods produced are both public and private, weighing the obligations of the landowner against those of society involves complex value judgments. The work of restoration is expensive; thinning and removing invasive brush and trees from oak stands can cost thousands of dollars per acre. Opportunities are limited to offset the costs of restoration activities, much less profit from them. Many landowners are concerned that if their habitat improvements result in increased populations of protected species, their lands may become subject to the Endangered Species Act and local land use restrictions, along with associated compliance costs (Ellefson 2000; Raedeke, Rikoon, and Nilon 2001; Brook, Zint, and Young 2003; Mehmood and Zhang 2005; Matta, Alavalapati, and Mercer 2009).

Considering these potential costs, should landowners pay for restoration? If not, how should society subsidize restoration on private land? For some, landownership is an indicator of relative privilege. For others, especially those who depend on the land for their living, poorly performing natural resource sectors may cause them to live at the margin. In the administration of technical and financial assistance programs from such taxpayer-funded policies as the Farm Bill, rates of pay are generally fixed. When conservation easements are used outside these programs to ensure that restoration is maintained over time, land values set the price; people who own more valuable properties receive higher rates of payment for conservation easements. The social dialogue about conservation and the line between public and private goods is rife with these and other issues of equity. In addition to economic opportunity costs, social measures of need, capacity, and resilience should be taken into consideration. Ecological restoration and stewardship require community resilience and capacity.

Restoring Ecosystems and Social Systems

If, as has already been argued here, ecosystems and social systems are inextricably intertwined, might it follow that restoring one would be restorative of the other? Several theoretical concepts are useful in exploring the relationships between restoration of ecological and social systems: capital, community, and resilience.

First, the concept of *capital* is useful beyond its common application in economics. Social scientists, for example, refer to natural, social, and human capital. Natural capital represents the stock of natural resources available to produce goods and services into the future (Hawken, Lovins, and Lovins 1999; see chaps. 14, 15, this volume, for further discussion of this concept). Social capital refers to the informal and institutionalized relationships, social norms, and levels of trust required for cooperation between people (Bourdieu 1977; Coleman 1990; Fukuyama 2002). Human capital reflects the capacity of individuals to pursue personal goals and objectives, and is enhanced by good health care, education, and training. Every human community has some stock of economic, natural, social and human capital, and these strongly influence the community's character and capacities.

Second, the social science concept of *community* is as essential to restoring ecosystems as its ecological counterpart. Two types of human communities are relevant. Since ecological restoration occurs at specific places, *communities of place* are involved. These are the communities of everyday language; the towns, suburbs, cities, and rural neighborhoods in which most of us live and work. Communities are fields of interaction where investments in physical, human, and economic capital are made, and where social capital is built through volunteerism, engagement in civic life, and membership in religious and secular organizations (Wilkinson 1991). The work of ecological restoration takes place in and near such communities, mobilizing their stocks of human and social capital. Restoration also involves *communities of interest*; associations of individuals with shared concerns, objectives, or interests (Webber 1970; Wellman 1979; Pavey et al. 2007; see parts 1, 2, this volume). This type of community may or may not be place based and may converge or dissipate as issues emerge and fade. The Oregon Oak Communities Working Group represents one such community of interest. Landowners might be another, to the extent that they hold attitudes, beliefs, or opinions in common. Like communities of place, communities of interest require human and social capital to thrive. To be engaged or supportive, communities of interest must see their interests reflected in restoration efforts.

Resilience is the ability of a complex ecological or social system to cope with, adapt to, and shape change by maintaining function (Holling 2001). Resilience is related to the amount of disturbance a system can absorb and the degree to which a system is capable of self-organization, learning, and adaptation (Carpenter et al. 2001). This capacity to adapt is partly related to biological diversity (i.e., the diversity in genetic and species composition as well as in stand and landscape structure) (Wilson 1988). It is also related to the diversity of social institutions and networks that can learn, store knowledge and experience, create flexibility in problem solving, and balance power among interest groups (Berkes and Folke 1998; Scheffer, Brock, and Westley 2000; Folke et al. 2002).

Integrating the concepts of capital, community, and resilience may yield a useful conceptual framework for restoration. This integrated socioecological framework considers the stocks of social and natural capital that foster socioecological systems' adaptive capacity. Numerous works provide context and foundation for integrating these concepts (e.g., Adger 2000; Carpenter et al. 2001; Folke at al. 2002; Gunderson and Holling 2002; Janssen et al. 2006; Olsson et al. 2006; Brand 2009). However, despite their usefulness as theoretical constructs, the concepts of resilience and capital have proved difficult to operationalize. Even though the terms sound positive, as concepts they are value neutral; polluted water and dictatorships may be highly resilient (Carpenter et al. 2001), and abhorrent social movements, such as the Ku Klux Klan, may be rich in social capital. Resistance, an aspect of resilience referring to the amount of external pressure needed to bring about a given amount of disturbance (Carpenter at al. 2001), can be found in weedy lots. Measurement of social resilience and social capital is also unrefined. Is resilience also determined by the amount of disturbance a social system can absorb while still self-organizing and functioning? Can social capital be quantified like economic capital (i.e., number of networks, membership in networks, strength of networks) (Fukuyama 2002)? Donoghue and Sturtevant (2007) describe several ways large-scale assessments of ecosystems have measured social capital and resilience using expert opinion and self-evaluations by community members. They point out that communities draw on a constellation of assets in order to adapt to change, assets that are difficult to quantify with single scores or ratings. Furthermore, some physical assets, such as infrastructure and natural resources, can only contribute to resilience if they are mobilized through social capital, that is, through leadership and collective action.

Although relationships between social and ecological resilience have been examined empirically in natural resource-dependent communities (e.g., Blaikie and Brookfield 1987; Peluso, Humphrey, and Fortmann 1994), the nature of these relationships is far from understood. Just as ecological systems that rely on single niches and processes can easily be undermined by drastic change, social systems that rely on single resources may be undermined by exogenous perturbations (e.g., collapses in commodity markets, blights in monoculture cash crops) (Adger 2000). But do systems that are more ecologically resilient foster social resilience and vice versa? For example, coastal regions support multiple ecological niches and processes that increase their self-regulating regenerative and absorptive capacity. Many also support multiple social and economic niches (e.g., fishing, tourism, shipping, transportation). These niches may facilitate stable socioeconomic conditions that foster technological innovation and long-term investment in institutions (Adger 2000). However, it is unknown whether the resulting social structures that result foster learning and adaptation.

Work is also needed to develop models of governance suited to restoring social and ecological systems. Treating restoration as a social as well as an ecological endeavor implies that the systems in need of restoration are integrated and function at multiple spatial and temporal scales. Many scholars claim that interdisciplinary and cooperative approaches are needed for addressing such complex systems (Holling and Meffe 1996; Folke et al. 2005). They argue that the governance and management of socio-ecological systems—that is, the interaction between user groups and ecosystem goods and services—must necessarily be participatory, equitable, and accountable (Lebel et al. 2006).

Regardless of their weaknesses, integrating the social and ecological concepts of capital, community, and resilience may yield a useful conceptual framework for restoration. These concepts help describe relationships between ecosystem restoration and community development. They have utility in that they may direct research agendas to address human values, equity, power, access, and control in relation to decision making and distribution of the benefits of ecological restoration. Such a framework would make it possible for restoration initiatives to consider the stocks of social and natural capital that foster the adaptive capacity of the ecosystems they are working with. Practical applications that could foster social capital and socioecological resilience could include hiring community organizers on restoration projects to conduct community trainings or coordinate networks, or building collaborative planning or applied education components into restoration projects.

Conclusion

In our view, ecological restoration is a value-driven social process. It requires not only a firm foundation of sound ecological science but also a critical understanding of the dynamic interactions and relationships among people and between people and the landscapes they inhabit. Its success depends on being compatible with social as well as ecological realities, and on effective mobilization of human and social capital. It might follow that through such mobilization, socially conscious ecological restoration could promote development of greater stores of human and social as well as natural capital.

We close with a brief checklist of questions and considerations to help the practicing ecological restorationist apply the lessons of this chapter when contemplating ecological restoration:

1. Question received wisdom about local ecological history. Critically analyze available historical data. Ask, who is privileged in this telling of history? Who is left out? Whose interests are served? Whose are not?
2. Consider how changing human use has shaped the existing landscape. What cultural values are evident in the landscape?
3. Question prevailing assumptions about the existing landscape and its current use. In addition to considering the ownership pattern, what patterns of access and use can be detected? Who is making use of various landscape elements? What is valued by whom?

4. Consider how proposed restoration activities and outcomes could alter existing cultural representations. What cultural components of the landscape might benefit from restoration? What components might be degraded?
5. Critically assess the proposed restoration process. What communities of place and of interest are involved? What communities are not? Who will pay, directly or indirectly, for the activity? Who will and will not benefit? How will access and use be affected?
6. Consider local stocks of human and social capital. What capital is available locally? What will be required to restore the site? To steward it into the future? What investments in social and human capital are required, possible, and strategic? What investments could be made to enhance both social and ecological resilience?

References

Adger, W. N. 2000. "Social and Ecological Resilience: Are They Related?" *Progress in Human Geography* 24 (3): 347–64.

Agee, J. K. 1990. "The Historical Role of Fire in Pacific Northwest Forests." In *Natural and Prescribed Fire in Pacific Northwest Forests*, edited by J. D. Walstad, S. R. Radosevich, and D. V. Sandberg, 25–38. Corvallis: Oregon State University Press.

———. 1993. *Fire Ecology of Pacific Northwest Forests*. Washington, DC: Island Press.

———. 1996. "Fire in Restoration of Oregon White Oak Woodlands." In *The Use of Fire in Forest Restoration*, edited by C. C. Hardy and S. F. Arno, 72–73. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Anderson, K. 2005. *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources*. Berkeley: University of California Press.

Appleton, J. 1975. *The Experience of Landscape*. New York: John Wiley & Sons.

Berkes, F., and C. Folke, eds. 1998. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge: Cambridge University Press.

Blaikie, P., and H. Brookfield. 1987. *Land Degradation and Society*. New York: Methuen.

Bliss, J. C. 1992. "Evidence of Ethnicity: Management Styles of Forest Owners in Wisconsin." *Forest and Conservation History* 36 (2): 53–72.

Bourassa, S. C. 1991. *The Aesthetics of Landscape*. London: Bellhaven Press.

Bourdieu, P. 1977. *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.

Boyd, R. 1999. "Strategies of Indian Burning in the Willamette Valley." In *Indians, Fire and the Land*, edited by R. Boyd, 94–138. Corvallis: Oregon State University Press.

Brand, F. 2009. "Critical Natural Capital Revisited: Ecological Resilience and Sustainable Development." *Ecological Economics* 68 (3): 605–12.

Brook, A., M. Zint, and R. D. Young. 2003. "Landowners' Responses to an Endangered Species Act Listing and Implications for Encouraging Conservation." *Conservation Biology* 17 (6): 1638–49.

Carpenter, S., B. Walker, J. M. Anderies, and N. Abel. 2001. "From Metaphor to Measurement: Resilience of What to What?" *Ecosystems* 4 (8): 765–81.

Carroll, M., Á. Ní Dhubháin, and C. Nugent. 2009. "Afforestation and Local Residents in County Kerry, Ireland." *Journal of Forestry* 107 (7): 358–63.

Coleman, J. S. 1990. *Foundations of Social Theory*. Cambridge, MA: Harvard University Press.

Cronon, W. 1995. *Uncommon Ground: Toward Reinventing Nature*. New York: Norton.

Daniel, T. C., and J. Vining. 1983. "Methodological Issues in the Assessment of Landscape Quality." In *Behaviour and the Natural Environment*, edited by I. Altman and J. Wohwill, 39–83. New York: Plenum Press.

Donoghue, E. M., and V. E. Sturtevant. 2007. "Social Science Constructs in Ecosystem Assessments: Revisiting Community Capacity and Community Resiliency." *Society and Natural Resources* 20: 899–912.

Ellefson, P. V. 2000. "Has Gifford Pinchot's Regulatory Vision Been Realized?" *Journal of Forestry* 98 (5): 15–22.

Fairhead, J., and M. Leach. 1998. *Reframing Deforestation: Global Analysis and Local Realities: Studies in West Africa*. Global Environmental Change Series. London: Routledge.

Fischer, A. P. 2006. "Private Forests, Public Policy: Oak Conservation on Family Forests in Oregon's Willamette Valley." PhD diss., Oregon State University, Corvallis.

Fischer, A. P., and J. C. Bliss. 2009. "Framing Conservation on Private Lands: Conserving Oak in Oregon's Willamette Valley." *Society and Natural Resources* 22 (10): 884–900.

Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, C. S. Holling, and B. Walker. 2002. "Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations." *AMBIO: A Journal of the Human Environment* 31 (5): 437–40.

Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. "Adaptive Governance of Social-Ecological Systems." *Annual Review of Environment and Resources* 30: 441–73.

Fukuyama, F. 2002. "Social Capital and Development: The Coming Agenda." *SAIS Review* 22 (1): 23–37.

Gobster, P. H. 1999. "An Ecological Aesthetic for Forest Landscape Management." *Landscape Journal* 18 (1): 54–64.

Gobster, P., and R. B. Hull, eds. 2000. *Restoring Nature: Perspectives from the Social Sciences and Humanities*. Washington, DC: Island Press.

Gunderson, L. H., and C. S. Holling, eds. 2002. *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington DC: Island Press.

Harvey, D. 1996. *Justice, Nature, and the Geography of Difference*. Cambridge, MA: Blackwell.

Hawken, P., A. B. Lovins, and L. H. Lovins. 1999. *Natural Capitalism: Creating the Next Industrial Revolution*. London: Earthscan.

Holling, C. S. 2001. "Understanding the Complexity of Economic, Ecological, and Social Systems." *Ecosystems* 4 (5): 390–405.

Holling, C. S., and G. K. Meffe. 1996. "Command and Control and the Pathology of Natural Resource Management." *Conservation Biology* 10 (2): 327–28.

Hull, R. B., D. P. Robertson, and A. Kendra. 2001. "Public Understandings of Nature: A Case Study of Local Knowledge about 'Natural' Forest Conditions." *Society and Natural Resources* 14: 325–40.

Janssen, M. A., Ö. Bodin, J. M. Anderies, T. Elmqvist, H. Ernstson, R. R. J. McAllister, P. Olsson, and P. Ryan. 2006. "A Network Perspective on the Resilience of Social-Ecological Systems." *Ecology and Society* 11 (1): 15.

Kaplan, R., and S. Kaplan 1989. *The Experience of Nature: A Psychological Perspective*. New York: Cambridge University Press.

Katz, E. 2000. "Another Look at Restoration: Technology and Artificial Nature." In *Restoring Nature: Perspectives from the Social Sciences and Humanities*, edited by P. H. Gobster and R. B. Hull, 37–48. Washington, DC: Island Press.

Kellert, S. R., and E. O. Wilson, eds. 1995. *The Biophilia Hypothesis*. Washington, DC: Island Press.

Lebel, L., J. M. Anderies, B. Campbell, C. Folke, S. Hatfield-Dodds, T. P. Hughes, and J. Wilson. 2006. "Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems." *Ecology and Society* 11 (1): 19.

Matta, J. R., J. R. R. Alavalapati, and D. E. Mercer. 2009. "Incentives for Biodiversity Conservation Beyond the Best Management Practices: Are Forestland Owners Interested?" *Land Economics* 85 (1): 132–43.

McCarthy, J. 2002. "First World Political Ecology: Lessons from the Wise Use Movement." *Environment and Planning* A 34 (7): 1281–1302.

McShea, W. J., and W. M. Healy, eds. 2002. *Oak Forest Ecoystems: Ecology and Management for Wildlife*. Baltimore: Johns Hopkins University Press.

Mehmood, S. R., and D. Zhang. 2005. "Determinants of Forest Landowner Participation in the Endangered Species Act Safe Harbor Program." *Human Dimensions of Wildlife* 10 (4): 249–57.

Nassauer, J. I. 1995. "Culture and Changing Landscape Structure." *Landscape Ecology* 10 (4): 229–37.

Nygren, A., and S. Rikoon. 2008. "Political Ecology Revisited: Integration of Politics and Ecology Does Matter." *Society and Natural Resources* 21: 767–82.

Olsson, P., L. H. Gunderson, S. R. Carpenter, P. Ryan, L. Lebel, C. Folke, and C. S. Holling. 2006. "Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems." *Ecology and Society* 11 (1): 18.

Oregon Biodiversity Project. 1998. *Oregon's Living Landscape: Strategies and Opportunities to Conserve Biodiversity*. Portland, OR: Defenders of Wildlife.

Oregon Department of Fish and Wildlife. 2006. *Oregon Conservation Strategy*. Salem: Oregon Department of Fish and Wildlife.

Pavey, J. L., A. B. Muth, D. Ostermeier, M. Davis, and M. L. E. Steiner. 2007. "Building Capacity for Local Governance: An Application of Interactional Theory to Developing a Community of Interest." *Rural Sociology* 72 (1): 90–110.

Peet, R., and M. Watts, eds. 1996. *Liberation Ecologies: Environment, Development, Social Movements*. New York: Routledge.

Peluso, N. L., C. R. Humphrey, and L. P. Fortmann. 1994. "The Rock, the Beach and the Tidal Pool: People and Poverty in Natural Resource Dependent Areas." *Society and Natural Resources* 7: 23–38.

Penn, D. J., and I. Mysterud. 2007. *Evolutionary Perspectives on Environmental Problems*. New Brunswick, NJ: Transaction Publishers.

Peter, D., and C. Harrington. 2002. "Site and Tree Factors in Oregon White Oak Acorn Production in Western Washington and Oregon." *Northwest Science* 76 (3): 189–201.

Peterson, G., G. Alessandro De Leo, J. J. Hellmann, M. A. Janssen, A. Kinzig, J. R. Malcolm, K. L. O'Brien, S. E. Pope, D. S. Rothman, E. Shevliakova, and R. R. T. Tinch. 1997. "Uncertainty, Climate Change, and Adaptive Management." *Conservation Ecology* 1 (2): 4.

Peterson, T. R. 1997. *Sharing the Earth: The Rhetoric of Sustainable Development*. Columbia: University of South Carolina Press.

Peterson, T. R., and C. C. Horton. 1995. "Rooted in the Soil: How Understanding the Perspectives of Landowners Can Enhance the Management of Environmental Disputes." *Quarterly Journal of Speech* 81 (2): 139–66.

Raedeke, A. H., J. S. Rikoon, and C. H. Nilon. 2001. "Ecosystem Management and

Landowner Concern about Regulations: A Case Study in the Missouri Ozarks." *Society and Natural Resources* 14 (9): 741–59.

Robbins, P. 2004. *Political Ecology.* Malden, MA: Blackwell.

Scarce, R. 1999. "Who—or What—Is in Control Here? Understanding the Social Context of Salmon Biology." *Society and Natural Resources* 12: 763–76.

Scheffer, M., W. Brock, and F. Westley. 2000. "Socioeconomic Mechanisms Preventing Optimum Use of Ecosystem Services: An Interdisciplinary Theoretical Analysis." *Ecosystems* 3 (5): 451–71.

Stein, W. I. 1990. "*Quercus garryana* Dougl. ex. Hook." In *Silvics of North America*, Volume 2, *Hardwoods*, edited by R. M. Burns and B. H. Honkala, 650–60. U.S. Department of Agriculture Forest Service Agricultural Handbook 654. Washington DC: U.S. Department of Agriculture Forest Service.

Takacs, D. 1996. *The Idea of Biodiversity: Philosophies of Paradise.* Baltimore, MD: Johns Hopkins University Press.

Tveten, R. K., and R. W. Fonda. 1999. "Fire Effects on Prairies and Oak Woodlands on Fort Lewis, Washington." *Northwest Science* 73 (3): 145–58.

Van Lear, D. H., and P. H. Brose. 2002. "Fire and Oak Management." In *Oak Forest Ecoystems: Ecology and Management for Wildlife*, edited by W. J. McShea and W. M. Healy, 269–79. Baltimore, MD: Johns Hopkins University Press.

Webber, M. M. 1970. "Order in Diversity: Community without Propinquity." In *Neighborhood, City and Metropolis*, edited by R. Gutman and D. Popenoe, 792–811. New York: Random House.

Wellman, B. 1979. "The Community Question: The Intimate Networks of East Yorkers." *American Journal of Sociology* 84 (5): 1201–31.

Wilkinson, K. P. 1991. *The Community in Rural America*. New York: Greenwood.

Wilson, E. O. 1988. *Biodiversity*. Washington, DC: National Academy Press.

Chapter 11

Ecological Restoration across Landscapes of Politics, Policy, and Property

David Brunckhorst

Humanity—society and its institutions—plays a key role in the future viability of the biosphere. Only by managing ourselves, our resource consumption, our waste, our economies and environment as a whole, can we hope to "manage" the environment and its abundant resources toward a sustainable, healthy, and restorative future. Unfortunately, political reelections and the politics of environmental restoration often seem to be at juxtapositions. The fast-moving variables of economics and reelection generally reign supreme over their slower, foundational, and interdependent ecological components (Carpenter and Turner 2001). The scales of time and space and the constituency of voters generally don't line up, and, as a result, political and ecological concerns are often misinterpreted as rivals rather than essentials.[1] Similarly, planning for the development of land and other resource use often conflicts with maintaining ecosystem services, biodiversity conservation, and ecological restoration requirements. To make matters more confusing, the policies and programs of different government agencies appear to contradict each other.

In this chapter, I offer a "big picture" view of politics, policy, and property (the "3Ps") as they relate to ecological restoration based on a brief discussion of theory and practice stemming from the fields of regional landscape ecology, complex systems, and institutional design. As I see the situation, the challenges for ecological restoration in the social dimension are caught up in the complexities of entwined social-ecological systems operating across not just multiple spatial and temporal scales but also multiple operational scales of human institutions of politics, policies, and property.[2] Despite these complexities, I believe that environmental restoration and stewardship at all scales are demonstrably possible across the boundaries of politics, policies, and property rights. What is required is a better understanding of how these socioeconomic institutions and practices work in our everyday lives.

Politics is all about the formal and informal contests and negotiations of power in, or over, various circumstances, and how and what power or decisions might be shared or not. The realm of politics entails the building of coalitions, the mobilization of power, and the management of public perceptions, opinions, and actions (including voting behavior) as means of achieving strategic objectives. Property is the institutionalized

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_11,

concept of owning something, inferring exclusivity in that nonowners lack a right of access to or use of that thing (Ostrom 1990). There are a variety of types of property ownership and rules that affect the rights of access and use of resources. In this chapter, for ease of readability, I use the term "property" to refer to a landholding (of some tenure type), in the colloquial sense that the word "property" tends to be used in general conversation (see Freyfogle 2003; Brunckhorst and Marshall 2007). Private ownership or tenure of a land resource (such as my home's backyard) is often referred to as private property in general conversation. In this book, we are reminded that, because restoration activities are very much an integral component of ecosystem management, the tenure of land and natural resources directly influences ecological restoration planning and action, indeed as much as tenure affects the exploitation of natural resources.

Policies are formal or informal decisions about a course of action or the way to accomplish some goal. Policy is generated at all social levels from family to federal and global governments. Local residents in their familiar locality—their landscapes of "home"—might be said to represent a policy community for making decisions for action about ecosystem restoration in that place (Shannon 1998; Parisi et al. 2004; see chaps. 5, 20, this volume). The constituency or "community of interest" and representation of other bona fide stakeholders are important together with an understanding of the most appropriate and efficient levels at which decisions can be made and responsibility for action taken (Cheng, Kruger, and Daniels 2003; Brunckhorst et al. 2008).[3] Local to regional examples of successful community-based action and comanagement that incorporate ecological restoration into sustainable resource use and conservation are not just increasing, but increasingly are directing substantial activity and resources to ecological restoration (Knight and Landres 1998; Williamson, Brunckhorst, and Kelly 2003; Knight and White 2009; also chaps. 15, 16, this volume). The lessons from the social and institutional design and operational experience of these on-the-ground restoration models are essential for building and linking further ecological restoration and stewardship efforts. There is an evolving array of experiential knowledge-building and brokering of public–private collaborations as well as comanagement efforts in conservation, restoration, and ecological resource management. The collective, international civic action to curb chlorofluorocarbons for restoration of the planet's atmospheric ozone layers, although still ongoing, has been a great achievement at a global level. It remains to be seen whether nations and corporations can respond as well to managing the more complex chemistry and politics of greenhouse gas emissions currently inducing rapid climate change. Successes in broader landscape to regional scales of integration of ecological management and restoration remain exceptions rather than the norm at this time.

The 3Ps provide part of the important context for landscape-scale alteration that is currently creating both challenges and opportunities for restoration. Increasingly, linked social-ecological systems interactions shape change in ecosystem capacity and health. The need for defined resource access or property rights, policies, regulation, resource governance, and collective action for ecological restoration and resource management derives from the fact that one person's use of natural resources affects other people (Ostrom et al. 2002). The 3Ps are essential for managing natural resource access, resource use, and distribution of benefits; minimizing detrimental effects on other resource users and the environment; and conserving ecosystems and their services. Political, policy, and property institutions are also likely to contain some key solutions and directions for ecological restoration and environmental stewardship. Such novel remedies or adaptive capacities will emerge from social-ecological interactions with the 3Ps.

Evolving arrangements of property and tenure concepts and land and resource use policies are major influences on ecological change at multiple landscape scales. In order to build more resilient and sustainable social-ecological systems, one major challenge is to raise the focus and quality of holistically integrated policy development. This will involve the planning and management of human interactions with the environment from local to regional landscape scales, and across institutionally embedded property rights and departmentally narrow policies of government agencies (Gunderson, Holling, and Light 1995; Johnson et al. 1999; Brunckhorst 2000). Many efforts to focus at broader scales of ecological management have been less than effective because of a narrow focus of science and policy, blockages in communication, and a lack of cohesive integration at appropriate scales and context of social-ecological systems interactions. For example, a multitude of government regulations implemented by many nations have achieved little in protecting soils, water quality, ecosystems, and species on private land. Similarly, public land–based conservation (e.g., national parks, state parks) is often compromised by geography (scale, context, connectivity) and negative environmental externalities from adjoining tenures (i.e., cross-boundary influences; Schonewald-Cox et al. 1992; Agrawal and Ostrom 2006; Brunckhorst 2010). Likewise, ecological restoration initiatives usually operate in the same institutional milieu of policy and organizational issues, linear control efforts, and disengagement from key players. For example, watershed management approaches, while representing downstream effects, often do not represent the context of soils, vegetation, land uses, and human communities at a local level that are important in restoration actions (see chap. 6, this volume). Such conservation and restoration actions might need to be scaled up across the landscape, not using the watershed boundaries, but by "nesting" broader scales of collective community and ecological representation relevant to the task (Brunckhorst 2010).

Working across the dimensions of the 3Ps might offer insights helpful in understanding lessons from ecological restoration models and in designing collective action for collaborative or comanagement institutions for future success. Efforts to increase the scale and effectiveness of ecological sustainability might need to focus more on innovative institutional arrangements that enhance cross-boundary, cross-jurisdictional collective action. A landscape systems view of the 3Ps is offered as an interdisciplinary meld that is important, but sometimes forgotten (or avoided) in attempts to develop more integrative, cross-scale ecological restoration and management. A landscape ecology view provides for planning integration of restoration efforts across the 3Ps (e.g., across different land or resource tenures that otherwise interrupt or fragment restoration efforts). Systems theory and landscape ecology can contribute novel, practical approaches to cross-jurisdictional ecological management and restoration.

Landscapes as culturally and institutionally derived ecological systems have capacities for self-organization and emergent conditions emanating from property and policy constructs. A systems view of landscape social–institutional interactions can contribute a useful interdisciplinary meld for innovative, reflexive policy and practice that leads to a more sustainable resource management. A landscape systems view of property and policy can increase the scale and effectiveness of ecological sustainability, systems resilience, and adaptive capacity. It contributes to practice through identification of novel options for reorganization of institutional arrangements that enhance cross-boundary (tenure) and/or cross-jurisdictional (agency) collaboration.

Institutions and Landscapes

Broad scale and rapid biophysical changes to ecosystems, landscapes, and regions in recent history have been driven by human societies' interactions with ecological resources. This structuring of landscapes and regions through social-ecological systems interactions also creates "place identity" in the mind of local community residents (see chaps. 5, 6, 18, 23, this volume). Such local to regional spaces appear to be useful operational contexts in which to integrate cross-scale interactions of resource use, property rights, agency jurisdictions, and ecological patterns and processes. Regional landscape contexts of social-ecological interactions provide the stage for the adaptive dance between actors from different sets of jurisdictions of property and policy on which ride many crucial elements for sustainability.

Landscapes internalize many of the interactions among ecosystem elements. Patterns or processes that develop out of interdependent interactions occurring across landscapes are uniquely different from the individual ecosystem elements that created them. Systems scientists refer to these as "emergent properties" of systems (not to be confused with property institutions that confer rights of access and exclusion[4]). Emergent properties of social-ecological systems interactions are often at the heart of sustainability issues. A subtle synthesis of systems interactions might lead to manifestation of "surprises." Such unexpected crises are often emergent conditions due to fast-moving variables (e.g., economic expediency encouraging agricultural chemical use) affecting slow-moving variables (e.g., long-term contamination of land and water leading to ecosystem and production collapse). Social-ecological systems also possess self-organizing capacities that are responsive to pressures of change. Reorganization of resource management and conservation across multiple jurisdictions and tenures can contribute considerable efficiencies and benefits to regional landscape sustainability.[5]

While landscapes synthesize human and ecological interactions, they are also a social construct, whether imagined or understood (as patterns and/or processes), constructed inadvertently or deliberately (Crumley and Marquardt 1987; Greider and Garkovich 1994; Stedman 2003). Institutions and landscapes evolve together over time; that is, change begets change. Landscape constituents and patterns ebb and flow, or change in shape and proportions. Social responses to landscape change are reflected in new policies, planning, resource management, and activity that generate new landscape change (fig. 11.1). Reactions can include land and resource tenure ad-

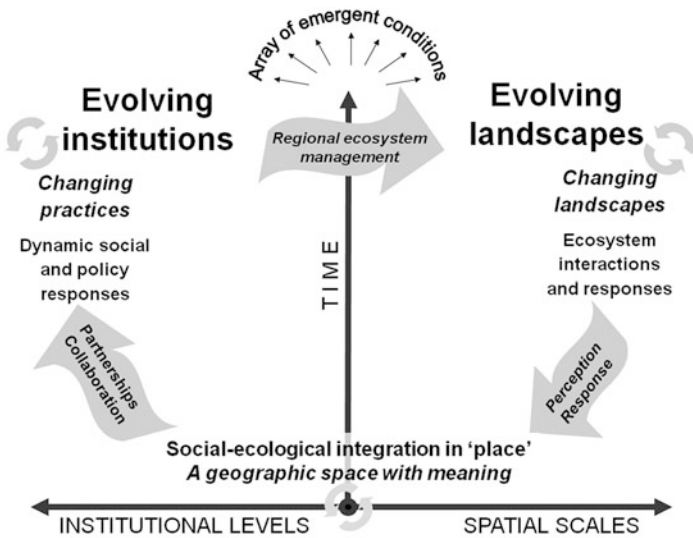

FIGURE 11.1. Social-ecological systems interactions and interdependencies operating across spatial and institutional scales influence the coevolution of future landscapes and institutions along with the emergence of conditions conducive to integration and collaboration for novel ecological management and restoration (after Brunckhorst 2010).

justments (e.g., urban development, ecological conservation, or restoration initiatives) and policy decrees that have a considerable influence on social-ecological systems resilience. Various forms of property and resource rights (private, public, common) are a key influence on landscape change and the degradation (or potential resilience) of ecological resources and ecosystem services. With time, feedback and feed-forward loops drive the (nonlinear) coevolution of landscapes and institutions within and across geographic spaces, producing an array of emergent conditions (see fig. 11.1). These interactions and responses cause changes to social-ecological systems that are then assessed as positive or negative. They also influence "sense of place" contexts that, in turn, provide frameworks to forge collaboration and integration of governance,[6] policy, and community comanagement initiatives for ecological management and restoration. The brief examples provided in the next section follow this pattern of coevolution of institutions and landscapes through communities, collaborations, and their restoration activities within socially and ecologically meaningful contexts.

Landscapes of People, Property, and Policy in Restoration

Policymakers, planners, landscape ecologists, and conservation scientists are increasingly finding themselves at odds with property and policy systems that create barriers to effective ecological management and restoration. Rather than fighting such embedded institutions, innovative approaches to circumvent such barriers might be a more efficient and effective means for "scaling-up" landscape planning and management. Novel institutional reconfiguration might include using existing property institutions, but knitted in a different way to facilitate cross-boundary ecological management; nested arrangements of institutions, organizations, and ecological scales; or novel institutional redesign toward "common property" resource management approaches (Berkes and Folke 2000; Armitage et al. 2009).

The relevance of the science–policy dialogue to human communities is important (Gobster and Hull 2000). To develop effective interaction between science and policy, the scientific information provided must be salient, credible, and considered legitimate by stakeholders (Shannon 1998; Cash et al. 2003). Circumstances facilitating civic engagement, interactions building trust and empowering collaboration, return to the importance of community identity with a place. Empowerment, especially at local community levels, includes equity of distribution, decentralized to appropriate levels of information, knowledge systems, decisions, risks, and benefits (see chaps. 5, 7, 13, 17, this volume). Local economies, rural towns and communities, land use, and ecosystem health are emergent properties of social-ecological systems interactions that, to resident stakeholders, define a place—local people having a collective identity with a definable territory (see chap. 6, this volume). To understand a regional landscape context for institutional design integrating decentralized empowerment at appropriate levels for resource and environmental governance, three basic conditions are considered important (Cheng, Kruger, and Daniels 2003; Parisi et al. 2004; Brunckhorst et al. 2008). First, the combination of biophysical features of the landscape spatial context must possess a relatively high level of homogeneity (often reflected, for example, in similar vegetation community composition). Second, the regional boundaries maximize the area that residents consider important for civic engagement and reflect their local to regional communities of interest. The third condition is a nested, multiscaling capacity for dealing with externalities of resource use by optimizing decision making at the lowest levels for which decisions can be implemented and accounted for. These principles have been applied to the definition of nested spatial frameworks for natural resource management, planning, and government administration that would provide appropriate ecological and institutional geographies—nesting local to regional contexts—for cross-jurisdictional integration of policies and programs (McGinnis 1999; Cash et al. 2003; Brunckhorst, Coop, and Reeve 2006; Marshall 2008). The approach has wider applications at different institutional levels and geographic scales, for example, for understanding the social-ecological geographies of the European Union (EU), to provide insights into regionalism, and spatial and institutional design options for resource governance across EU international jurisdictions (Brunckhorst et al. 2008).

At finer levels of local management, redesign of institutions and interactions across various types of land tenure boundaries can also create incentives for cross-jurisdictional collaboration (see chap. 12, this volume). Cross-property resource management of private and public land or resource tenure, such as within and across farm holdings, conservation reserves and other public land, need a clear understanding of incentives, benefits, and responsibilities (Ostrom et al. 2002). These must be developed on top of an understanding of the ecological landscape linkages, characteristics of place attachment, and trust and reciprocity among the community of owners and managers (Plummer and Armitage 2007). Some learning laboratory experiences are contributing insights. These include private conservation trusts, common property institutions, and comanagement arrangements (between individual private landholders and/or public land management agencies), and more complex, nested institutional design and resource management across multiple tenures and resources.

A biosphere reserve model established in the salt-ravaged, endangered Mallee ecosystems of south Australia grew to a regional landscape scale to include an area of some 3,500 square miles (9,000 square kilometers), across more than thirty properties representing nine different tenure types of public and private land (Brunckhorst et al. 1997; Diamond 2005; Pfueller 2008).[7] Another landscape-scale model is the Tilbuster Commons, which involved rotational grazing of a single herd of cattle across several adjacent ranches, each having and retaining individual private land title (Brunckhorst 2003; Williamson, Brunckhorst, and Kelly 2003). The cattle were collectively owned by the landholders who set up a company to manage the resource enterprise across their properties with profits distributed through share holdings proportional to their landholding and contributions. Rotational grazing of cattle provided the tool for native grassland, pasture, and ground cover restoration. Multiple benefits of the cross-property collaboration included the ability to set aside conservation areas; stream restoration and improved water quality; risk management; improved biodiversity, land, and pasture, including native grassland restoration; drought resilience; and good financial returns. A highly valued benefit was the freeing up of time for farm families.

An ambitious extension of these lessons is being tried in some quite different social-ecological contexts across public and private landholdings managed by the U.S. Forest Service, Bureau of Land Management, and several ranchers in Idaho and Montana. One group of collaborators, the Lava Lake Land and Livestock group in southern Idaho, manage almost 760,000 acres (307,561 ha) of public and private land for sheep and cattle ranching, conservation, and river and wetland restoration.[8] The main enterprise is production of boutique, organic-certified lamb. A component of the conservation and the riverine wetland restoration has included reintroduction of wolves along with experimenting with new ways to manage sheep grazing to improve and sustain native rangeland pasture (fig. 11.2). The wolves keep the large, native herbivores, such as elk, from "camping" on and degrading wetland and stream vegetation, which allows for natural rehabilitation. The location of wolves can be tracked, and contact with domestic livestock can be avoided to a large extent. Using a variety of different grazing management techniques, including grazing rotations and temporary electric fencing of stock at night on summer mountain ranges, livestock losses have generally been no more than average yearly losses. Some of the keys to success include good communication across ranches and agencies, short-term to long-term planning, and clear rules of engagement designed and upheld by all the collaborating parties. There are also incentives for land management, conservation, longer-term permits, and access to public lands by ranchers. Ranchers and other land managers are also able to plan and negotiate more flexible conditions, collectively building greater social-ecological resilience for multiple resource use, profitability, and conservation and restoration goals and objectives.

FIGURE 11.2. In Idaho, USA, a regional rangeland landscape encompassing public and private lands has provided an appropriate social-ecological context for the systems integration of collaborative ranching, conservation, and restoration of wetlands and wolves. (Photos by D. Brunckhorst)

Chapters 6, 7, 9, and 12 explore the potentials and pitfalls of various locally driven comanagement schemes. Implementation of comanagement is considered difficult, but it can be facilitated or can emerge through local institutional design or evolution consistent with principles of participation, process and power sharing, and, again, is often geographically consistent with a particular social-ecological context of place (see fig. 11.1). The emergence of comanagement in such contexts as these authors describe builds trust through collaboration, partnerships, and evolving (often novel and transformative) institutional arrangements.[9] The result should not be stagnant, but a continuing adaptive dance—learning by doing—that builds not only resilience for social and ecological elements, patterns, and processes in the landscape but also increases transformative adaptive capacity, that is, the flexibility to deal with the unknown challenges of the future (see chaps. 13, 17, this volume).

Conclusion

The short-sighted shuffle of many of our politicians and policy makers must gain rhythm and purpose to dance to a faster, upbeat tune. The local to global environmental policy and action must be bipartisan and apolitical—for the good of all, including the economy. There is hope, optimism, enthusiasm, and growing capacity for what, together, we can do. A future echo will not be hollow, but a resounding, "Together, we can fix the environment and that will make for a healthy economy and society."

Ecological restoration is embedded within natural resource management and conservation actions that occur in land tenure, policy, and politics, which, in turn, are subsets of spatial and institutional contexts of interdependent social-ecological systems that shape the emergent patterns of landscapes and regions. Many developed countries, such as Australia, Canada, the United States and some European countries, seem to have overemphasized an entrenched, narrow, and individualistic view of property rights (especially individual tenure of land and resources) and related policies at the expense of other forms of tenure and resource rights that might facilitate multiscale, sustainable resource governance and environmental restoration. Government agencies and sectoral interests tend to reflect similarly narrow jurisdictional approaches. Conservation strategies have also tended to be constricted to an individually bounded, public- or private-tenure approach. However, social-ecological systems operating across landscapes of ecosystem processes, various land tenures, and policies produce patterns and processes (slow and fast) reflecting complex systems properties, including emergence. For sustainability purposes in the long term, continuing emergence of resilience and reflexive reorganizing capacity is required to maintain essential ecosystem services and support institutional adaptation within and across social-ecological scales of context—spaces with social and ecological meaning for human and institutional engagement. Experiences related in this book demonstrate that we can be innovative; we can redesign current institutions and create new institutions to operate across boundaries and jurisdictions to restore and adaptively manage social-ecological systems.

Policies for secure property rights are crucial for sustainable resource governance and environmental management, but they also create problems for the management of externalities. Our systems of property rights, administrative jurisdictions, policy, and resource management institutions need to be more seamlessly integrated at various levels of resource governance and institutional arrangements to match landscape scales of social-ecological interdependencies. In addition to the "operational rules" for successful resource governance institutions, several other principles are considered essential for the successful design of ecologically sustainable, cross-scale interactions of social-ecological systems. An increasing number of "reality" projects—on-the-ground, learning-by-doing trials by collaborators—demonstrate novel arrangements for cross-scale, cross-boundary resource management and ecological restoration. Building flexible adaptive capacity from novel, on-the-ground, cross-tenure, and cross-jurisdictional, collective action will also provide transferable and adaptive solutions with appropriate incentives to enhance multiple scales of resource management.

Power-sharing built on growing relationships of trust is required for successful collaboration or comanagement of resources and the environment. The power of politics, or the politics of power, will only promote adaptive sustainability outcomes if all key players can genuinely influence the definition of context, circumstances, options, decisions, and action. To be most effective and efficient, the powers of stakeholding actors should be congruent with the smallest scale (most local) of civic-social and ecological context and policy. Power sharing is not the starting point but emerges from the process, often in itself an institutional evolution or rearrangement including development of new (or reconfiguration of) formal and informal rules, organization, responsibilities, and structures.

Place and community are important in policy development, cooperation, and observance of formal and informal rules. Regional landscape contexts are shaped by social-ecological interactions and interdependencies from which emerge identity with a place and respect that subsequently produce meaningful civic participation. This creates the backdrop and stage for the adaptive dance between actors from different sets of jurisdictions of property and policy on which ride many elements required for successful ecological restoration and resource governance. There are ecological and socioeconomic advantages in using landscape ecology in designing "landscapes of property" applications for the design and practice of ecological management that are effective at multiple scales. Applying systems theory in practice is assisted by using landscape ecology principles that contribute practical design elements for overcoming the erosion of resilience produced by narrow, linear applications of property tenures and policies. More interdisciplinary research is needed to guide cross-scale integration of landscapes of people, place, policy, and property into practice—trials of new dance steps that can adapt to a changing beat. Innovative, creative minds can connect across tenures and jurisdictions toward specific environmental and social outcomes beneficial to all actors. As experiences from case studies in this book testify, this might best be achieved by forging a greater number of deliberative, on-ground trials and learning-by-doing experiments within *and* across landscapes of politics, policy, and property—novel dance steps adapting to the tune of changing landscapes.

Notes

1. Complex systems theory provides valuable insights on social-ecological systems interactions, nonlinear interdependencies, fast and slow variables, emergent properties, and resilience. See Pattee (1973), Costanza (1996), Folke, Holling, and Perrings (1996), Carpenter and Turner (2001), Walker and Salt (2006).

2. Institutions are sets of formal and informal rules and norms that shape interactions of humans with others and with natural resources. Property is an institution that is the concept of "owning something," inferring exclusivity, in that nonowners do not have a right of access or use of that thing, and common property is a thing or right of use that is collectively owned by a defined group. Open access is a situation of nonproperty where property or resource rights have not been defined and inevitably leads to overuse and degradation of the resource (open access is Garrett Hardin's (1968) publication "Tragedy of the Commons"). There are a variety of kinds of property in relation to rights of access and use of natural resources. In this chapter, for ease of readability, my use of the term "property" refers to a landholding (of some tenure type), in the colloquial sense that the word "property" tends to be used in general conversation (see Ostrom 1990; Freyfogle 2003; Brunckhorst and Marshall 2007).

3. There is an increasing dialogue and knowledge building about the importance and spatial representation of the contextual characteristics of social-ecological interactions in terms of defining "communities of interest," "place," and identity influencing local civic interest and engagement in natural resource management and restoration (see Altman and Low 1992; McGinnis 1999; Stedman 2003; Cheng, Kruger, and Daniels 2003; Parisi et al. 2004; Brunckhorst, Coop, and Reeve 2006; Brunckhorst et al. 2008).

4. See note 2.

5. See notes 1 and 3.

6. Governance is the capacity of self-organizing systems to govern themselves. It includes not only formal government authorities and agencies but also an array of private sector and nongovernmental organizations as well as communities. Stewardship is the expression of this capacity in the form of "responsible custody" of human ecosystems and, therefore, requires competence, vigilance, and ethics of responsibility and accountability for the sustainability of ecological resource systems on which human social systems depend (see Cash et al. 2003; Shannon 1998).

7. Although the collective program is referred to as the Bookmark Biosphere project—recognized under the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere (MAB) program—Jared Diamond (2005) refers to some elements of it supported by the Australian Landscape Trust.

8. I was fortunate enough to visit this inspiring landscape-wide project in 2006, per M. Stevens (Lava Lake Ranch, www.lavalakelamb.com), M. Scott (U.S. Fish and Wildlife, and University of Idaho, College of Natural Resources), and K. Launchbaugh (University of Idaho, Rangeland Management and College of Natural Resources).

9. For a current overview on theory and practice of transformative comanagement arrangements in ecological and resource management, see Berkes and Folke (2000), Pinkerton (2003), Brunckhorst (2005), Plummer and Armitage (2007), Armitage et al. (2009), Sandström (2009).

References

Agrawal, A., and E. Ostrom. 2006. "Political Science and Conservation Biology: A Dialog of the Deaf." *Conservation Biology* 20 (3): 681-82.

Altman, I., and S. Low, eds. 1992. *Place Attachment*. New York: Plenum Press.

Armitage, D. R., R. Plummer, F. Berkes, R. I. Arthur, A. T. Charles, I. J. Davidson-Hunt, A. P. Diduck, N. Doubleday, D. S. Johnson, M. Marschke, P. McConney, E. Pinkerton, and E. Wollenberg. 2009. "Adaptive Co-management for Social-ecological Complexity." *Frontiers in Ecology and the Environment* 7 (2): 95–102.

Berkes, F., and C. Folke, eds. 2000. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge: Cambridge University Press.

Brunckhorst, D. J. 2000. *Bioregional Planning: Resource Management Beyond the New Millennium*. London and Amsterdam: Taylor and Francis.

———. 2003. "Forming Common Property Resource Management Institutions." *Journal of Ecological Management and Restoration* 4 (1): 72–73.

———. 2005. "Integration Research for Shaping Sustainable Regional Landscapes." *Journal of Research Practice* 1 (2): Article M7. http://jrp/icaap.org/index.php/jrp/article/view/16/28.

———. 2010. "Landscapes Shaped by People and Place Institutions Require a New Conservation Agenda." *BioScience* 60 (8): 569–70.

Brunckhorst, D. J., P. Bridgewater, and P. Parker. 1997. "The UNESCO Biosphere Reserve Program Comes of Age: Learning by Doing, Landscape Models for a Sustainable Conservation and Resource." In *Conservation Outside Reserves*, edited by P. Hale and D. Lamb, 176–82. Brisbane: Center for Conservation Biology, University of Queensland.

Brunckhorst, D. J., P. Coop, and I. Reeve. 2006. "Eco-civic Optimisation: A Nested Framework for Planning and Managing Landscapes." *Landscape and Urban Planning* 75: 265–81.

Brunckhorst, D. J., and G. Marshall. 2007. "Designing Robust Common Property Regimes for Collaboration towards Rural Sustainability." In *Sustainable Resource Use: Institutional Dynamics and Economics*, edited by S. Larson and A. Smajgl, 179–207. London: Earthscan.

Brunckhorst, D. J., I. Reeve, P. Morley, and K. Bock. 2008. "Strategic Spatial Governance: Deriving Social-Ecological Frameworks for Managing Landscapes and Regions." In *Landscape Analysis and Visualisation: Spatial Models for Natural Resource Management and Planning*, edited by C. Pettit, B. Cartwright, I. Bishop, K. Lowell, D. Pullar, and D. Duncan, 253–76. Berlin: Springer-Verlag.

Carpenter, S., and M. Turner. 2001. "Hares and Tortoises: Interactions of Fast and Slow Variables in Ecosystems." *Ecosystems* 3 (6): 495–97.

Cash, D. W., W. C. Clark, F. Alcock, N. M. Dickson, N. Eckley, D. H. Guston, J. Jager, and R. B. Mitchell. 2003. "Knowledge Systems for Sustainable Development." *Proceedings National Academy of Sciences (USA)* 100 (14): 8086–91.

Cheng, A. S., L. E. Kruger, and S. E. Daniels. 2003. "'Place' as an Integrating Concept in Natural Resource Politics: Propositions for a Social Science Research Agenda." *Society and Natural Resources* 16: 87–104.

Costanza, R. 1996. "Ecological Economics: Reintegrating the Study of Humans and Nature." *Ecological Applications* 6: 978–90.

Crumley, C. L., and W. H. Marquardt, eds. 1987. *Regional Dynamics: Burgundian Landscapes in Historical Perspective*. San Diego, CA: Academic Press.

Diamond, J. 2005. *Collapse: How Societies Choose to Fail or Succeed*. New York: Viking Penguin.

Folke, C., C. S. Holling, and C. Perrings. 1996. "Biological Diversity, Ecosystems and the Human Scale." *Ecological Applications* 6: 1018–24.

Freyfogle, E. 2003. *The Land We Share: Private Property and the Common Good*. Washington, DC: Island Press.

Gobster, P. H., and R. Hull, eds. 2000. *Restoring Nature: Perspectives from the Social Sciences and Humanities*. Washington, DC: Island Press.

Greider, T., and L. Garkovich. 1994. "Landscapes: The Social Construction of Nature and the Environment." *Rural Sociology* 59 (1): 1–24.

Gunderson, L., C. S. Holling, and S. S. Light, eds. 1995. *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. New York: Columbia University Press.

Hardin, G. 1968. "Tragedy of the Commons." *Science* 162: 1243–48.

Johnson, K. N., F. Swanson, M. Herring, and S. Greene, eds. 1999. *Bioregional Assessments: Science at the Crossroads of Management and Policy*. Washington, DC: Island Press.

Knight, R., and P. Landres, eds. 1998. *Stewardship across Boundaries*. Washington, DC: Island Press.

Knight, R., and C. White, eds. 2009. *Conservation for a New Generation: Redefining Natural Resources Management*. Washington, DC: Island Press.

Marshall, G. 2008. "Nesting, Subsidiarity, and Community-Based Environmental Governance beyond the Local Scale." *International Journal of the Commons* 2 (1): 75–97.

McGinnis, M., ed. 1999. *Polycentric Governance and Development*. Ann Arbor: University of Michigan Press.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.

Ostrom, E., T. Dietz, N. Dolsak, P. C. Stern, S. Stonich, and E. U. Weber, eds. 2002. *The Drama of the Commons*. Washington, DC: National Academies Press.

Parisi, D., M. Taquino, S. M. Grice, and D. A. Gill. 2004. "Civic Responsibility and the Environment: Linking Local Conditions to Community Environmental Activeness." *Society and Natural Resources* 17 (2): 97–112.

Pattee, H. 1973. *Hierarchy Theory: The Challenge of Complex Systems*. New York: Braziller.

Pfueller, S. 2008. "Role of Bioregionalism in Bookmark Biosphere Reserve, Australia." *Environmental Conservation* 35: 173–86.

Pinkerton, E. 2003. "Towards Specificity in Complexity: Understanding Co-management from a Social Science Perspective." In *The Fisheries Co-management Experience: Accomplishments, Challenges and Prospects*, edited by D. C. Wilson, J. R. Nielsen, and P. Degnbol, 61–78. Dordrecht: Kluwer Academic.

Plummer, R., and D. Armitage. 2007. "Crossing Boundaries, Crossing Scales: The Evolution of Environment and Resource Co-management." *Geography Compass* 1 (4): 834–49.

Sandström, C. 2009. "Institutional Dimensions of Co-management: Participation, Power and Process." *Society and Natural Resources* 22: 230–44.

Schonewald-Cox, C., M. Buechner, R. Sauvajot, and B. A. Wilcox. 1992. "Cross-Boundary Management between National Parks and Surrounding Lands: A Review and Discussion." *Environmental Management* 16 (2): 273–82.

Shannon, M. 1998. "Understanding Social Organizations and Institutions." In *River Ecology and Management: Lessons from the Pacific Coastal Ecoregion*, edited by R. Naiman and R. Bilby, 529–551. New York: Springer.

Stedman, R. 2003. "Is It Really Just a Social Construction? The Contribution of the Physical Environment to Sense of Place." *Society and Natural Resources* 16: 671–86.

Walker, B., and D. Salt. 2006. *Resilience Thinking*. Washington, DC: Island Press.

Williamson, S., D. Brunckhorst, and G. Kelly. 2003. *Reinventing the Commons: Cross Boundary Farming for a Sustainable Future*. London: Federation Press.

Chapter 12

The Policy Context of the White Mountain Stewardship Contract

Jesse Abrams

The White Mountains region of Arizona consists of the high-elevation, forested terrain roughly encompassed by the Apache-Sitgreaves National Forests (fig. 12.1) and White Mountain Apache tribal lands (the Ft. Apache Reservation). Conditions in the ponderosa pine (*Pinus ponderosa*) forest that predominates here reflect those throughout much of the western United States. These historically frequent-fire forests, once characterized by open stands, an abundance of larger trees, and a rich ground cover of grasses and forbs, are now more commonly overstocked with small-diameter pines and lack a productive grass layer; such conditions leave them susceptible to uncharacteristic, stand-replacing fires (Cooper 1960; Johnson 1994; Covington 2003). The White Mountains region also resembles much of the western United States in that it was recently the scene of divisive social and political conflict regarding public land management, endangered species, timber harvesting, and wildlife. Conflicts took the form of legal challenges to federal timber sales, the intervention of federal courts in management decisions, and accusations and finger-pointing as activity in the woods ground to a halt and local mills closed down (Nie 1998; Abrams and Burns 2007).

The communities of the White Mountains are unique, however, in the manner in which they ultimately addressed these forest dilemmas. A catalyst for community action was the Rodeo-Chediski Fire, which burned through nearly a half-million acres of tribal, federal, and private lands in 2002, forcing the evacuation of more than thirty thousand people and incinerating vast swaths of forest (Wilmes et al. 2002). On federal lands (the focus of this case study), national forest managers and local communities worked together in the wake of this devastating fire in an attempt to proactively restore forests that had long since departed from their historic structures and functions. The community looked to stewardship end-results contracting policy, a suite of land management tools designed to meet ecological restoration and community development objectives simultaneously, to address their particular restoration challenges. The Apache-Sitgreaves National Forests were not the first in the country to use stewardship contracting authorities, but they were the first to apply them over large areas (tens to hundreds of thousands of acres) and long time frames (ten years, the maximum allowed contract length) (Sitko and Hurteau 2010). The story of this

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_12, © Island Press 2011

Figure 12.1. Location of the Apache-Sitgreaves National Forests in Arizona, USA.

stewardship contracting experiment contains important lessons about both the promise and the challenges of this emerging model of community-based forest restoration.[1]

Policy Background

In order to understand the significance of stewardship contracting and the importance of policy in public lands restoration, it is important to briefly review the history of national forest management in the United States. The National Forest System, a patchwork of federally owned land covering more than 190 million acres nationwide (Nelson 1995) began as a series of "forest reserves" (areas of public land reserved from disposal to private ownership) established in the late nineteenth century as a means of protecting against fire, deforestation, and watershed damage (Steen 1991). In the last decade of the nineteenth century and the first decade of the twentieth century these reserves were expanded through presidential proclamations and acts of Congress. They became known as national forests in 1907, two years after the U.S. Forest Service was established (Robbins 1985). The U.S. Forest Service, tasked with managing national forestlands, was forged from a Progressive Era vision in which the expert application of scientific principles to forests was believed to be capable of creating stable, predictable flows of resources, resulting in the "greatest good" for both local forest–proximate communities and the nation as a whole (Hays 1959; Wilkinson 1992).

The federal forests that were later to become the Apache-Sitgreaves National Forests, like many national forests in the American West, were carved out of public domain lands that had already experienced significant environmental impacts, particularly from the overgrazing of domestic livestock and the exclusion of naturally occurring fire (Cooper 1960; Scurlock and Finch 1997). These impacts set the stage for an explosive growth in tree populations in what had previously been largely open, savanna-like forests with rich, grassy understories (Covington 2003). Ecologists have recently recognized the detrimental effects of increased tree densities in these semiarid forests and have recommended ways of restoring forests to more resilient conditions (Moore, Covington, and Fulé 1999; Allen et al. 2002). For much of the twentieth century, however, the Forest Service's activities in the Southwest centered on the continued suppression of wildfire, afforestation of grassy openings, and the institution of a timber harvesting schedule that would replace slower-growing, older forests with stands of faster-growing, younger trees.

Under the policy model that prevailed until recent decades, national forests were assumed to meet their obligations to nearby communities by providing natural resource–based economic activity. Federal forest managers engineered national forests to optimize commodity outputs; these outputs supplied raw material for rural industry, and industry provided steady employment for rural residents (Kennedy, Thomas, and Glueck 2001). Even passage of the Multiple Use–Sustained Yield Act in 1960, which recognized watershed, wildlife, and recreational values on the national forests, did not fundamentally alter the model of federal forests as producers of "outputs," whether these were measured in board feet of timber, tons of forage, days of recreation, numbers of wildlife, or cubic feet of water (Hirt 1994).

In the years following World War II, several developments set the stage for what would later entail a dramatic shift in the way national forests were managed across the United States. On the one hand, national forest managers were tasked with providing wood fiber to industry to support a surging postwar national economy. This represented a major change from the Forest Service's largely custodial role in the prewar years (Hirt 1994). At the same time, a growing body of scientists began to raise alarms about the unintended consequences of America's attempts to engineer a better world through alterations of the natural environment. These concerns were reflected in public activism within the burgeoning environmental movement and took political form in federal policies such as the Wilderness Act (1964), the National Environmental Policy Act (1969), and the Endangered Species Act (1973), among others (Brunson and Kennedy 1995). Also concurrently, rapid population growth in the West spurred sprawling residential development that increasingly bumped up against national forest boundaries. These patterns of demographic and land use changes altered the economies of many rural (or formerly rural) communities in ways that diminished the importance of traditional natural resource industries. The location and layout of new exurban developments, in what would later come to be called the wildland–urban interface, created new hazards in fire-prone forests, including the ponderosa pine and dry mixed conifer types of the Southwest (Marzluff and Bradley 2003).

By the 1990s and early 2000s, the trajectories of these various strands of influence—the conversion of dynamic forest ecosystems into engineered output-producing systems, the growing legal power of environmental interests to alter land management practices on federal lands, and the continued residential development of private lands on the boundaries of federal forests—began to collide. In the Southwest, as in much of the country, policy battles over national forest management centered on whether particular areas of forest would be "set aside" for preservation (e.g., as wildlife habitat) or "opened up" for resource extraction. In 1995, environmental advocates won a court ruling that led to a sixteen-month injunction on federal timber harvesting in order to plan for Mexican spotted owl (*Strix occidentalis lucida*) protection, and outputs of wood fiber from federal lands declined rapidly (Nie 1998; Lenart 2006). This change was followed by a series of active wildfire years that tested the suppression capabilities of Forest Service firefighters. These fires also highlighted the dangers of both overstocked forest conditions and the pattern of dispersed residential development that came to typify exurban sprawl in the Southwest. By the time of the Rodeo-Chediski Fire in 2002, it was clear to many in the Southwest that the old model of the relationships between the federal agencies, the lands they manage, and the communities that live nearby was out of date and in need of an overhaul. Significantly, these events took place during a time when traditional patterns of top-down governance of public lands were beginning to be called into question nationwide (Baker and Kusel 2003; McCarthy 2006). Stewardship contracting policy represented one step in the direction of a more community-centered approach to public land governance.

Policy Constraints on Ecological Restoration

The policies that influenced management of federal forestlands for most of the twentieth century included many that provided direction for the production of commodities (e.g., the Organic Act of 1897) and others that provided for the preservation of environmentally valuable lands and resources (e.g., the Wilderness Act of 1964). Active ecological restoration of degraded forestlands, however, has rarely appeared as a management option in the tomes of laws and regulations guiding national forest management. Contracting policy represents a specific example of the limited options available for restoration of federal forestlands (Moseley 2002). Under traditional arrangements, the U.S. Forest Service could accomplish resource management objectives in one of two ways: if the primary purpose of a project was harvesting valuable timber, the agency offered a contract for the sale of that timber "on the stump" to private harvesters and sold logging rights to the highest bidder. Alternatively, if a project represented some kind of environmental improvement, including the harvesting of lower-value trees, the agency offered a service contract whereby it paid a private contractor to perform the service. Prevailing policy arrangements offered federal land managers few options when it came to integrated contracts that included restoration thinning, fuel reduction, or other work entailing the removal of both salable and nonsalable material. This policy gap was addressed in the 1990s when the U.S. Forest Service and Bureau of Land Management received congressional authorization to experiment with stewardship contracting mechanisms on a limited basis (Ringgold 1998), allowing the agencies to integrate commercial and noncommercial activities into a single contract and to include local community development into overall project goals. In 1999, the Forest Service was given authority to pilot twenty-eight stewardship contracts nationwide. In 2003, Congress expanded these authorities to allow for an unlimited number of stewardship contracts and increased the maximum contract duration from five to ten years.

The White Mountain Stewardship Contract

The White Mountain Stewardship Contract (WMSC), a plan to restore 150,000 acres of overstocked forest in wildland–urban interface areas of the Apache-Sitgreaves National Forests, was announced on August 10, 2004, just two years after the last flames of the Rodeo-Chediski Fire had been extinguished. The ten-year project was envisioned as a shift of focus from commercial timber sales, the traditional emphasis on the Apache-Sitgreaves and most other national forests, to the removal of smaller-diameter trees in unnaturally dense stands as a means of altering fire behavior and leaving treated forests in a more resilient condition. This kind of activity is widely considered a necessary, if not entirely sufficient, component of an overall restoration program for southwestern ponderosa pine forests (Moore, Covington, and Fulé 1999; Allen et al. 2002).

The model of federal land management prevalent since the 1970s assumes that land managers periodically seek public input into a largely internal planning process. The WMSC, however, was planned and implemented with the active involvement of local, multistakeholder community forums. Community-based restoration planning for federal lands in the White Mountains had been under way since the mid-1990s when a small group of local leaders and stakeholders, including traditional adversaries representing environmental and wood products interests, worked to develop and test a series of forest density reduction prescriptions on a parcel of national forestland known as Blue Ridge, located near exurban housing developments in a high fire hazard area. The seven-thousand-acre demonstration project was one of the early successes of the community forum that came to be known as the Natural Resources Working Group (NRWG) (Lenart 2006). This evolving collaborative organization would act as the voice of the community on issues such as the creation of Community Wildfire Protection Plans and the WMSC. A key component of the success of this collaborative group was local national forest managers' willingness to redefine their role vis-à-vis the local communities, as explained by an Apache-Sitgreaves forest manager:

> During all the time that we did any work on the Blue Ridge Demonstration Project, I used the Natural Resource Working Group as, they're my boss. So I went to them, I made presentations and said, "Here's a decision that needs to be made, now which way do you want me to go?" So it wasn't the Forest Service

> approaching them saying, "This is the decision that we went ahead and made, and this is why we made it." [That's] a big difference.

In the intervening years between the Blue Ridge Demonstration and the start of the stewardship contract, the White Mountains community (including both agency managers and nonagency stakeholders) invested considerable time in building the kind of capacity that would allow them to undertake a project as ambitious as the stewardship contract. This capacity building centered on increasing both physical and social capital. Physical capital, in the form of wood utilization businesses that could add value to restoration by-products, was needed to transition the local wood products infrastructure so it could accommodate smaller-diameter logs of more variable quality. This was addressed through a number of initiatives, including projects associated with the federal Economic Assistance Program that supported small, local wood products businesses through grants and technical assistance (Abrams and Burns 2007). Social capital, the "networks, norms, and trust that facilitate coordination for mutual benefit" (Putnam 1993, 1), was built over many years as an outcome of ongoing dialogue and collaboration between the various stakeholders active in forest issues, both through the NRWG and through more informal relationship building. The building or rebuilding of physical and social capital involved deliberate attention and planning by local community members over more than a decade, and progress was sometimes slow.

Legislation, administrative regulations, and executive orders encouraging local collaboration and capacity building in the context of public lands have all been advanced in recent years (Van De Wetering 2006), but the realization of these goals is ultimately dependent on the agency staff and local citizens in each particular community. The enhanced capacity built in the White Mountains, along with the tools provided by stewardship contracting authorities and other national policy changes, allowed communities there to address some of the thorny social and economic issues related to public lands restoration—issues such as treatment costs, identifying and building markets for restoration by-products, finding consensus on a stakeholder "zone of agreement," and project monitoring.

Project Costs

Per-acre costs in ponderosa pine restoration efforts are often considerable because the initial mechanical interventions that constitute a major part of the work usually focus on the removal of smaller trees in overstocked stands (Hjerpe, Abrams, and Becker 2009). Taking into account costs associated with the harvest and hauling of small-diameter trees, restoration thinning treatments in southwestern ponderosa pine forests can cost several hundred to well over a thousand dollars per acre for initial entries (Larson and Mirth 2001; Pinjuv, Daugherty, and Fox 2001). In addition, internal agency costs for site preparation, planning, administration, and postharvest cleanup can run into the millions of dollars annually for a project the size of the WMSC (Sitko and Hurteau 2010). One-time funding is sometimes available to pay for pilot or demonstration restoration projects, such as those undertaken in the Blue Ridge Demonstration, but managers and stakeholders in the White Mountains were faced with a major financial obstacle when planning for long-term treatments across tens to hundreds of thousands of acres. One policy mechanism used to address this issue was the use of "goods for services" authorities (for a description of specific stewardship contracting authorities, see Moseley and Davis 2010), which allowed the revenues generated from the sale of merchantable trees removed (generally those at least twelve inches in diameter) to be used as an offset against the costs of removing nonmerchantable material. While this arrangement lowered per-acre costs compared to restoration thinning treatments conducted under traditional policy arrangements, it still left a significant gap averaging $550 per acre.

Two mechanisms were envisioned to help pay for restoration costs associated with the WMSC. First, because the stewardship contract represented a long-term agreement rather than a fixed, short-term project, the Apache-Sitgreaves National Forests were able to immediately apply monies remaining in the National Forest System at the end of each fiscal year to on-the-ground projects. This allowed them to obtain funds that other forests would have difficulty using because of the time and preparation required to set up a new service contract (Sitko and Hurteau 2010). Second, the long-term nature of the WMSC provided impetus for local businesses to invest in capital improvements, which were expected to drive treatment costs down over time as markets for restoration by-products expanded.

While average per-acre costs for restoration have remained stable during the first years of the contract (GAO 2008), Sitko and Hurteau (2010) point out that in many cases this represents a greater amount of restoration work for the money invested. This is an impressive gain considering this period coincided with an almost unprecedented downturn in the national wood products market. The first years of the contract also coincided with major cost overruns in the Forest Service's fire suppression duties at the national level, which were paid for partially by spending money from other programs, including those that would have supported treatments under the WMSC. Personnel changes within the Forest Service bureaucracy after the initial years of the project resulted in declining internal agency support for the project, which meant that less and less of the potentially available funding was allocated to the WMSC. More than any other factor, a lack of adequate funding has limited the Apache-Sitgreaves National Forests' ability to realize the large-scale restoration vision articulated in 2004.

Building Markets

The WMSC was designed with the idea that forest restoration activities and local economic development could support one another in a synergistic relationship. While White Mountains communities retained a small proportion of their wood processing capacity through the tumultuous years of the 1990s, they also made sustained investments in building local capacity for small-diameter wood utilization. This local capacity—in the form of integrated networks of sawmills, post and pole plants, and a heating pellet manufacturer—provided the means to add value to otherwise unmerchantable restoration by-products, thereby providing both local employment options and economic support for activities in the woods. This local capacity didn't emerge in response to the WMSC; it was built over a number of years prior to 2004 through a combination of federal grant programs and local community organizations, such as the Arizona Sustainable Forests Partnership, the Little Colorado Plateau Resource Conservation and Development Area, and the Northern Arizona Wood Products Association, all of which worked together to foster and support local businesses capable of adding value to small-diameter material. The WMSC allowed the Apache-Sitgreaves National Forests to take advantage of the groundwork already laid by these community-based initiatives by tapping into the community's capacity to process restoration by-products. According to one active member of the local wood products community:

> We've had a lot of people visit us from other areas, wanting a stewardship contract, and what we've decided is most of them don't understand that a stewardship contract itself is not going to solve their problem. If they haven't put the time and effort into rebuilding their infrastructure, the collaboration, a stewardship contract isn't the magic answer. There had been a lot of work done prior to the stewardship contract ever coming here.

Zone of Agreement

One of the most significant features of the WMSC is the fact that it was built on, and continues to receive, widespread public support in a region that was recently characterized by social divisiveness and conflict over forest issues. Much of the credit for this transformation goes to the NRWG, which made an explicit effort to bring all of the major stakeholders together to work toward viable solutions (Lenart 2006), as well as to several individuals who personally worked to build relationships with those representing different interests. The demonstration restoration project at Blue Ridge in the late 1990s was the first tangible manifestation of a "zone of agreement," within which all major parties were willing to work. The WMSC represented the growth of this zone of agreement, moving from the demonstration to the landscape scale. Significantly, the WMSC met most of the major concerns held by local leaders and stakeholders: (1) for wood products businesses, the contract assured a baseline level of activity, allowing them to secure loans to make capital investments; (2) for local communities, most restoration activities would take place in the wildland–urban interface where the risk of catastrophic fire brought with it the threat of harm to life and property; and (3) for environmental organizations, there were assurances that the focus of woody material removal during treatments would be the smaller and younger trees, with trees over sixteen inches in diameter being removed only under unusual circumstances. Some environmental advocates were initially apprehensive at the prospect of a large corporation entering the picture to provide for wood utilization, but apprehension turned to support when it became clear that a network of smaller, local businesses would act as the utilization component of the project. One local wood products businessperson described the zone of agreement this way:

> It all boils back to partnering, collaboration, and coming to the table and being able to walk away and say, "I didn't get what I wanted but it's better than nothing." That has to come from private [industry], Forest Service, environmentalists . . . foresters. Do we [in the industry] believe in the 16 inch size cap? I know we don't. But should we go fight that battle when we're getting something done? No.

Monitoring

A unique aspect of the stewardship contracting authorities calls for multiparty monitoring of stewardship contracting outcomes. In the White Mountains, this was accomplished by convening a monitoring board consisting of a cross-section of local interests, many of whom were involved in other local forums, such as the NRWG (Sitko and Hurteau 2010). The board was tasked with making recommendations to the forest supervisor regarding how to monitor the ecological, economic, and social effects of the WMSC. A small, but significant, portion of the stewardship contract budget was dedicated to monitoring. The monitoring aspect was considered particularly important by conservation and environmental advocates involved in the stewardship contract, some of whom said they would have been less comfortable supporting the contract had it lacked a strong community-based monitoring component.

Other Policy Mechanisms

It is important to note that stewardship contracting authorities are not the only recent policy changes that have helped to encourage restoration of public lands in the White Mountains. The Economic Assistance Program (a U.S. Forest Service–administered rural development program that has remained unfunded in recent years), a series of federal biomass utilization grants, and other state and federal grant programs played major roles in supporting some of the initial business development in the White Mountains that helped create wood utilization options for small-diameter material. The Healthy Forests Restoration Act (HFRA), which became law in 2003, and the administrative Healthy Forests Initiative (HFI) both provide streamlined bureaucratic processes for implementing projects that are collaboratively designed and/or meet fuel-reduction goals. Perhaps just as important, both HFRA and HFI provide explicit direction to land managers to engage in forest restoration activities, something that has largely been lacking in previous public land policy. Despite national controversy regarding HFRA and HFI (Vaughn and Cortner 2005), these policies have been used extensively and largely without conflict in the implementation of the WMSC.

Implementation

As of this writing, the WMSC has been under way for five and a half years, just more than half of its ultimate duration. In this time, approximately thirty-eight thousand acres of forest, mostly in the wildland–urban interface, have been treated to restore resiliency and to move these forests closer to historical conditions (fig. 12.2). While

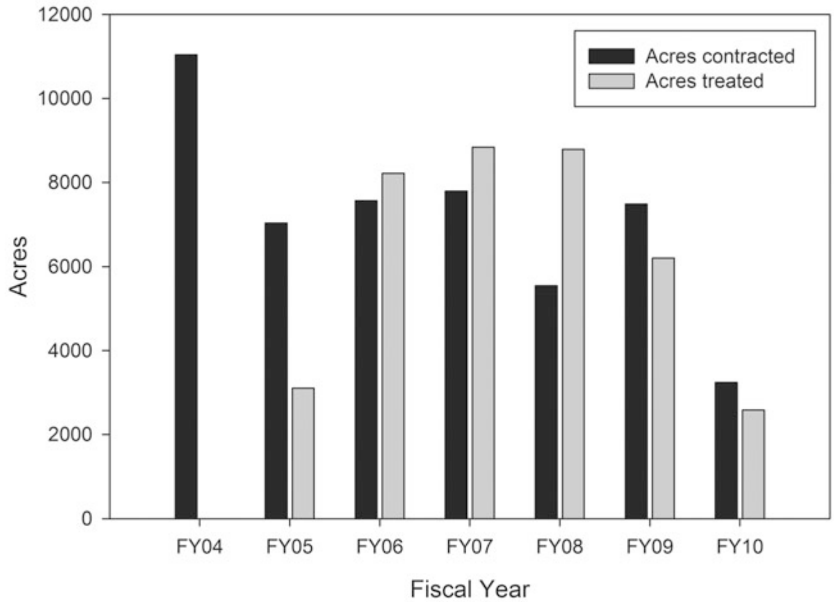

Figure 12.2. Number of acres under contract and number of acres with completed treatments by fiscal year for the White Mountain Stewardship Contract (Note: WMSC began in fall 2004, figure runs through spring 2010).

impressive, this figure is much less than halfway to the 150,000-acre goal set at the beginning of the contract. The relatively modest progress to date is not due to legal actions seeking to halt the project or to community resistance to forest activities; indeed, the project has maintained a high level of support from both the local communities of place and the communities of interest (e.g., sporting and environmental groups). The primary limitation has been a lack of funding to pay for administrative costs and to fill the gap between treatment costs and the value of salable wood products removed. While federal policy makers have begun to recognize the potential of community-based restoration on public lands, they have not been as willing to provide the funds needed to plan, administer, and implement these projects. This stands in contrast to the heavy federal subsidies provided to southwestern national forests when their management activities were focused on commercial timber production (Hirt 1994).

The restoration progress made in the White Mountains to date has been substantial, but the fact that it has fallen short of expectations indicates the challenges faced by communities throughout the country attempting to redefine both how local public lands are managed and the community's role in managing them. Hjerpe, Abrams, and Becker (2009) highlight the fact that it is often social and economic challenges, rather than scientific uncertainty, that impede restoration progress in Southwest forests. In the case of the White Mountains, a once sharply divided community has made great progress in working together toward common goals and building a local infrastructure to support restoration activities, but the process of turning ecological liabilities into economic assets has been harder to achieve. As one member of the wood products community put it, “I can’t get past the fact that one-third of everything I touch is piled and burned, it’s valueless.” An Apache-Sitgreaves forest manager related that building an industry around the processing of small-diameter trees “has been more difficult than one can imagine.”

The experience of the WMSC raises questions of how the trend toward devolved governance of natural resources intersects with declines in public funding for management activities (McCarthy 2005), particularly in cases where ecological restoration is needed to remedy degraded conditions. After several decades in which the ecological costs of commodity-oriented public forest management were passed on to local communities, those same communities are now increasingly expected to bear the financial costs of restoring damaged ecosystems. While innovative contracting mechanisms and economic development based on restoration by-products can close the funding gap to some extent, in the White Mountains, as elsewhere across the arid West, ecological restoration is still not a break-even proposition.

Conclusion

In recent years, U.S. federal forest policy has made tentative steps toward a shift from a bifurcated model in which lands either produced commodity outputs or were set aside as no-touch preserves to a model in which restored, functioning ecosystems provide a variety of market and nonmarket benefits (Kelly and Bliss 2009). Rural communities, with their diverse populations and interests, are now expected to play a more substantial role in setting management direction and supporting restoration activities, and federal forest managers are expected to engage in collaborative, participatory decision making with a range of communities of interest and communities of place (Carr, Selin, and Schuett 1998). And, as noted earlier, all of this is occurring during a time of dwindling public funding for land management activities.

Changes to contracting policy have resulted in new tools that agency managers can use to meet the social, ecological, and economic goals of restoration. This new suite of contracting options means that managers are no longer reliant on the antiquated timber sale system, or on traditional service contracts, to meet multifaceted goals and objectives. These tools are especially significant in light of policies, such as HFRA and HFI, that direct agency managers to engage local communities and to make restoration of degraded lands a priority. The experience of managers and stakeholders in the White Mountains demonstrates that restoration and community needs can be met in constructive and even synergistic ways. However, this case also indicates that declining federal funding for agency staff and implementation costs can prevent community-based restoration efforts from achieving their full potential.

The experience of the White Mountain Stewardship Contract illustrates that national-level policy changes can provide space within which local communities work to achieve improved forest conditions. But, at least in this case, policy changes were merely one component, and the greater part of the achievements of the stewardship contract came from the years of sustained capacity building that occurred at the community level. Federal forest managers would not have been able to embark on a ten-year restoration project were it not for the existing networks of local businesses, nonprofit intermediary organizations, and constructive social forums in forest-proximate communities. Neither would the contract have been possible without significant community engagement, as well as a fair amount of risk taking, on the part of Forest Service staff at the local and regional levels.

Policy changes associated with stewardship contracting and "healthy forests" are necessary, but by themselves insufficient, elements of fostering community-based restoration on public lands. To the extent to which policies such as these represent a new direction for national forests, they also highlight a number of challenges that lay ahead for rural communities in the midst of the transition from commodity extraction to restoration and stewardship. Communities currently lacking the capacity to craft a zone of agreement and add value to restoration by-products will likely have to give sustained attention to these aspects before large-scale restoration is a possibility, and even those with high levels of capacity will have to navigate the challenges of rebuilding both social and physical infrastructure, the sometimes conflicting directions set by overlapping resource policies, and an atmosphere of declining public funding for restoration on public lands.

Afterword

The Wallow Fire, exceeding the 2002 Rodeo-Chediski Fire in terms of acres burned, is raging through much of the terrain included in the WMSC as this book goes to press. While it is too early to say with any certainty how contract-related treatments affected fire behavior or prevented the loss of houses and other structures, the Wallow Fire is certain to cast a spotlight on restoration projects already completed and on the unmet potential of the contract.

Note

1. Methods for this case study included semistructured interviews with twenty-one key informants (agency staff, representatives of nongovernmental organizations, wood products businesspeople, etc.), discussions with the WMSC multiparty monitoring board, reviews of internal and public documents, and participation in/observation of collaborative processes and restoration work. See Abrams and Burns (2007) for more detail on methodology.

References

Abrams, J., and S. Burns. 2007. *Case Study of a Community Stewardship Success: The White Mountain Stewardship Contract*. Flagstaff, AZ: Ecological Restoration Institute.

Allen, C. D., M. Savage, D. A. Falk, K. F. Suckling, T. W. Swetnam, T. Schulke, P. B. Stacey, P. Morgan, M. Hoffman, and J. T. Klingel. 2002. "Ecological Restoration of Southwestern Ponderosa Pine Ecosystems: A Broad Perspective." *Ecological Applications* 12 (5): 1418–33.

Baker, M., and Kusel, J. 2003. *Community Forestry in the United States: Learning from the Past, Crafting the Future*. Washington, DC: Island Press.

Brunson, M. W., and J. J. Kennedy. 1995. "Redefining 'Multiple Use': Agency Responses to Changing Social Values." In *A New Century for Natural Resources Management*, edited by R. L. Knight and S. F. Bates, 143–58. Washington, DC: Island Press.

Carr, D. S., S. W. Selin, and M. A. Schuett. 1998. "Managing Public Forests: Understanding the Role of Collaborative Planning." *Environmental Management* 22 (5): 767–76.

Cooper, C. F. 1960. "Changes in Vegetation, Structure, and Growth of Southwestern Pine Forest since White Settlement." *Ecological Monographs* 30: 129–64.

Covington, W. W. 2003. "The Evolutionary and Historical Context." In *Ecological Restoration of Southwestern Ponderosa Pine Forests*, edited by P. Friederici, 26–47. Washington, DC: Island Press.

GAO (General Accounting Office). 2008. *Federal Land Management: Use of Stewardship Contracting is Increasing, but Agencies Could Benefit from Better Data and Contracting Strategies*. GAO-09-23. Washington, DC: General Accounting Office.

Hays, S. P. 1959. *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890–1920*. Cambridge, MA: Harvard University Press.

Hirt, P. W. 1994. *A Conspiracy of Optimism: Management of the National Forests since World War Two*. Lincoln: University of Nebraska Press.

Hjerpe, E., J. Abrams, and D. R. Becker. 2009. "Socioeconomic Barriers and the Role of Biomass Utilization in Southwestern Ponderosa Pine Restoration." *Ecological Restoration* 27 (2): 169–77.

Johnson, M. 1994. "Changes in Southwestern Forests: Stewardship Implications." *Journal of Forestry* 92 (12): 16–19.

Kelly, E. C., and J. Bliss. 2009. "Healthy Forests, Healthy Communities: An Emerging Paradigm for Natural Resource–Dependent Communities? *Society and Natural Resources* 22 (6): 519–37.

Kennedy, J. J., J. W. Thomas, and P. Glueck. 2001. "Evolving Forestry and Rural Development Beliefs at Midpoint and Close of the 20th Century." *Forest Policy and Economics* 3 (1–2): 81–95.

Larson, D., and R. Mirth. 2001. "Projected Economic Impacts of a 16-inch Tree Cutting Cap for Ponderosa Pine Forests within the Greater Flagstaff Urban-Wildlands." In *Ponderosa Pine Ecosystems Restoration and Conservation: Steps Toward Stewardship*, compiled by R. K. Vance, C. B. Edminster, W. W. Covington, and J. A. Blake. April 25–27, 2000; Flagstaff, AZ. Proceedings RMRS-P-22. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Lenart, M. 2006. "Collaborative Stewardship to Prevent Wildfires." *Environment* 48 (7): 9–21.

Marzluff, J. M., and G. A. Bradley. 2003. "Ecological Restoration in the Urban–Wildland Interface. In *Ecological Restoration of Southwestern Ponderosa Pine Forests*, edited by P. Friederici, 353–70. Washington, DC: Island Press.

McCarthy, J. 2005. "Devolution in the Woods: Community Forestry as Hybrid Neoliberalism." *Environment and Planning* A 37 (6): 995–1014.

———. 2006. "Neoliberalism and the Politics of Alternatives: Community Forestry in British Columbia and the United States." *Annals of the Association of American Geographers* 96 (1): 84–104.

Moore, M. M., W. W. Covington, and P. Z. Fulé. 1999. "Reference Conditions and Ecological Restoration: A Southwestern Ponderosa Pine Perspective." *Ecological Applications* 9 (4): 1266–77.

Moseley, C. 2002. *A Survey of Innovative Contracting for Quality Jobs and Ecosystem*

Management. General Technical Report PNW-GTR-552. Portland, OR: U.S. Department of Agriculture, Pacific Northwest Research Station.

Moseley, C., and E. J. Davis. 2010. *Stewardship Contracting for Large-Scale Projects*. Ecosytem Workforce Program Working Paper Number 25. Eugene, OR and Flagstaff, AZ: Ecosystem Workforce Program and the Ecological Restoration Institute.

Nelson, R. H. 1995. "The Federal Land Management Agencies." In *A New Century for Natural Resources Management*, edited by R. L. Knight and S. F. Bates, 37–59. Washington, DC: Island Press.

Nie, M. A. 1998. "Green Sagebrush: The American West, Political Culture, and Environmental Politics." PhD diss., Northern Arizona University, Flagstaff.

Pinjuv, G., P. J. Daugherty, and B. E. Fox. 2001. "Cost/Effectiveness Analysis of Ponderosa Pine Ecosystem Restoration in Flagstaff, Arizona's Wildland–Urban Interface." In *Ponderosa Pine Ecosystems Restoration and Conservation: Steps Toward Stewardship*, compiled by R. K. Vance, C. B. Edminster, W. W. Covington, and J. A. Blake, 149–53. April 25–27, 2000; Flagstaff, AZ. Proceedings RMRS-P-22. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Putnam, R. 1993. "The Prosperous Community: Social Capital and Public Life." *American Prospect* 13 (Spring): 35–42.

Ringgold, P. C. 1998. *Land Stewardship Contracting in the National Forests: A Community Guide to Existing Authorities*. Washington, DC: Pinchot Institute for Conservation.

Robbins, W. G. 1985. *American Forestry: A History of National, State, and Private Cooperation*. Lincoln: University of Nebraska Press.

Scurlock, D., and D. M. Finch. 1997. "A Historical Review." In *Songbird Ecology in Southwestern Ponderosa Pine Forests: A Literature Review*, edited by W. M. Block and D. M. Finch, 43–67. General Technical Report RM-GTR-292. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Sitko, S., and S. Hurteau. 2010. *Evaluating the Impacts of Forest Treatments: The First Five Years of the White Mountain Stewardship Project*. Phoenix, AZ: The Nature Conservancy.

Steen, H. K. 1991. *The Beginning of the National Forest System*. FS-488. Washington, DC: U.S. Department of Agriculture, Forest Service.

Van De Wetering, S. B. 2006. *The Legal Framework for Cooperative Conservation*. Public Policy Research Institute. Missoula: University of Montana.

Vaughn, J., and H. J. Cortner. 2005. *George W. Bush's Healthy Forests: Reframing the Environmental Debate*. Boulder: University Press of Colorado.

Wilkinson, C. 1992. *Crossing the Next Meridian: Land, Water, and the Future of the West*. Washington, DC: Island Press.

Wilmes, L., D. Martinez, L. Wadleigh, C. Denton, and D. Geisler. 2002. *Apache-Sitgreaves National Forests Rodeo-Chediski Fire Effects Summary Report*. Springerville, AZ: Apache-Sitgreaves National Forests.

Chapter 13

Climate Change Implications for Ecological Restoration Planning

Mark Buckley and Ernie Niemi

Climate change alters the biophysical and socioeconomic context for ecological restoration efforts in a multitude of ways, some of which are known, others anticipated, and still others unknown. These climatic variations will likely cause multiple and cascading effects to ecosystem structures, functions, and compositions, and bring into question how best to approach ecological restoration planning and implementation. For example, regional-scale coastal restoration efforts in places are more difficult due to these changes, although they will be more important than ever. In this chapter we discuss how planners, restorationists, and others will have to work together in an atmosphere of adaptive management in order to meet ecological and social demands in the face of climate change. We start with an example from the state of Washington, where collaborative efforts are under way to maintain and restore the natural capital and functional landscape of the Puget Sound basin.

Climate Change and Planning for Restoration in the Puget Sound Basin

In 2007, the Washington State Legislature created the Puget Sound Partnership (PSP), a collaboration-minded state agency with the mission of restoring Puget Sound by 2020. The PSP coordinates actions across local, state, and federal agencies to restore ecosystem structures and functions, and has developed the Action Agenda to prioritize and implement the most cost-effective projects (PSP 2008). As defined by the PSP (2009a, 7), "The Puget Sound ecosystem spans the terrestrial, freshwater aquatic, and marine systems in the area from the crest of the Cascades and Olympic mountains, down through the Puget lowlands, and into the estuarine and marine inland waters of Washington state. The Puget Sound ecosystem is the southern portion of a larger system that extends into Canadian lands and waters: the Puget Sound–Georgia Basin ecosystem." This large ecosystem is currently experiencing declines in ecological function, water quality, habitat availability, and wildlife populations (PSP 2009b).

The PSP has three top priorities:

- Protect intact ecosystem processes, structures, and functions that sustain Puget Sound

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,

The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_13,

- Restore ecosystem processes, structures, and functions that sustain Puget Sound
- Prevent water pollution at its source

These strategies guide landscape-scale and local project selection and funding, and focus on protecting the large remaining riparian, estuarine, and nearshore areas; reducing water pollution sources, such as stormwater; and reducing shoreline armoring and impervious surfaces.

Population growth, increasing urbanization, and transportation behaviors exacerbate these challenges. Indeed, this restoration effort takes place in the socioeconomic context of the Seattle metropolitan area, the largest urban area in the Pacific Northwest with a dense human population and high economic activity. The Puget Sound region has roughly four million residents as of 2010 and is expected to grow to five million by 2030 (Washington State Office of Financial Management 2007). Including the Canadian portions of the overall Puget Sound–Georgia Basin increases these population numbers by more than 40 percent (U.S. EPA 2010). Given the situation, the PSP recognizes the impracticality of restoring the region to some historical condition, and instead focuses on restoring natural capital and ecosystem processes to resilient levels.

Further complicating the challenge are the ongoing and anticipated effects of climate change on the region. Already, average annual temperature has increased, with the greatest increases during the winter months, snow water equivalent as of April 1 has declined, and peak runoff is earlier (Mote et al. 2003; Stewart, Cayan, and Dettinger 2005). The Climate Impacts Group at the University of Washington projects that temperatures in the Pacific Northwest will increase across all seasons, with summer (June–August) temperatures increasing the most. They also foresee relatively constant total annual precipitation, although more of the precipitation will be concentrated during the winter, with decreasing summer precipitation (Elsner et al. 2010). Much of this is due to a projection that calls for less overall snowfall and faster snowmelt. The Washington Climate Change Impacts Assessment concluded that these temperature and precipitation patterns would substantially decrease the quality and quantity of salmon habitat and increase the area burned by wildfire by 100 to 250 percent (Miles et al. 2010).

Sea-level rise has numerous driving global and local factors, and the estimates for Puget Sound are for a 21.7–inch (55–cm) increase by 2050 and a 50.4-inch (128 cm) increase by 2100 (Lettenmaier and Milly 2009; Mote et al. 2008). With the focus on protecting and restoring estuaries and nearshore environments, as well as de-armoring shorelines, sea-level rise reduces the expected lifespan and overall benefit of restoration projects in the nearshore/estuarine zone and increases the uncertainty of targeting appropriate locations for restoration projects designed to provide critical habitat to juvenile salmonids. Acquiring and restoring property in floodplains and the nearshore region might not be targeting areas most appropriate for those systems a hundred years from now. It can also become more costly, as the focus must shift from areas intermittently flooded and with relatively little development to higher elevation, more valuable, and more developed areas. While the PSP identifies stormwater runoff as the primary source of pollutants to the Puget Sound ecosystem and a primary threat (PSP 2008), the Climate Impacts Group has noted the increasing difficulty of stormwater infrastructure to handle new extremes and erratic frequencies (Rosenberg et al. 2010). In addition, nutrient runoff combined with rising atmospheric and ocean temperatures is leading to declining dissolved oxygen levels that threaten aquatic life in Puget Sound (Roberts et al. 2009).

The PSP follows an adaptive, science-based approach, with input from a science panel and scheduled, peer-reviewed updates on conditions, strategies, and progress. The scale of the problem and the responsibility of shepherding hundreds of millions of state and federal dollars require an approach with a high probability of success. The confluence of declining ecological conditions with intensive use and negative impacts combine to create a restoration challenge that is costly in terms of financial demands and resource opportunity costs. The confounding forces of climate change exacerbate the forces driving ecological decline and increase the uncertainty of success for restoration project options.

While still in its infancy, the Puget Sound project exemplifies the kind of regional-scale restoration planning efforts that will likely be needed in coastal areas around the world as climate changes and sea levels rise. In many ways, this sort of restoration and the planning behind it will be working in situations modern humans have never faced—situations with high levels of risk and uncertainty. In the remainder of this chapter, we explore how to understand and navigate these possible scenarios.

Planning Implications for Restoration

Climate change can lead to conditions whereby once-rational planning and implementation rules are no longer useful. These rules must be updated, but how? The precautionary principle is a frequent and appropriate policy recommendation when considering the risks, uncertainties, and ambiguities associated with situations such as those presented by climate change. This particularly holds for ecological restoration projects. For example, given the uncertainty about future climatic conditions, it is now appropriate for restorationists to choose reversible decisions that employ incremental, flexible approaches (Millar, Stephenson, and Stephens 2007). While this would ideally always be the case, this approach is now more justifiable because of the societal costs involved with taking no action or embarking on a restoration action with a diminished chance of success. These approaches also require explicit identification and communication of changes to risks, uncertainties, ignorance, and ambiguities about natural phenomena that restoration projects can address. Generally, climate change will increase the need for adaptive management-based mechanisms so changing conditions and demands do not excessively stifle restoration efforts.

However, planners typically work within a context that is time limited, often conventional in terms of its approach, and adverse to the cost and risk associated with testing new rules. A common challenge facing restoration planners—one that climate change will exacerbate—involves motivating changes to decision rules. Now that we are beginning to see the effects of climate change, this might become easier. For example, while climatic conditions are now less stationary, trends are still noticeable. Flood severity and frequency are changing, leading to alterations of floodplain designations. Timing of flowering, bird migration, and lake freeze-up are also changing according to noticeable trends. Identifying this evidence can be important for demonstrating and communicating the necessity of efforts to restore rare ecosystems and ecosystem services that become scarcer under changing conditions and more crucial to society. For example, restored floodplains and their floodwater storage and conveyance become more important as flood severity and frequency increase.

Climate Change and Varying Levels of Understanding

From a restoration planning and implementation perspective, climate change is problematic because we have varying levels of understanding about its timing, frequency, and severity. Different levels of understanding about future conditions require different approaches. We can categorize these levels of understanding by considering the terms: risk, uncertainty, ignorance, and ambiguity (fig. 13.1). *Risk* refers to conditions where the full range of possible outcomes and their probabilities are known. People often use the term to focus on the share of outcomes seen as undesirable, but both potential positive and negative outcomes should be included in a full evaluation of risk. *Uncertainty* refers to conditions under which the range of possible outcomes is known, but their probabilities are not (Knight 1921). Because it is rare to have sufficient information to know the probabilities of outcomes under unprecedented conditions, uncertainty is common for climate effects, particularly for local considerations. *Ignorance* refers to situations where we do not know the possible outcomes. Conditions of risk and uncertainty have known unknowns, while conditions of ignorance involve unknown unknowns (Farber 2010). A situation can be described as *ambiguous* when there are multiple models of the realm of possibility, potentially with varying levels of information between them that yield differing predictions of future events (Camerer and Weber 1992). For climate change the wide array of models attempting

	Definition	Example
Climate Risk	Probability that climate change will lead to undesirable outcomes	Projected increases in the probability of future drought severity and frequency
Climate Uncertainty	Possible outcomes of climate change without known probabilities of occurrence	Unknown future river flooding severities and frequencies
Climate Ignorance	Unknown possible outcomes of climate change	Unknown future effects on ecosystem interactions
Climate Ambiguity	Conflicting predictions of climate change outcomes or probabilities	Climate models with strongly differing future temperature predictions

FIGURE 13.1. Restoration planners face varying degrees of information availability regarding future impacts of climate change. The variation can be categorized by whether or not probabilities of events are known, whether or not the set of possible outcomes is known, and whether or not there are conflicting predictions.

to predict the relationship between carbon dioxide emissions and global temperature generate differing predictions, leading to ambiguity. Uncertainty, ignorance, and ambiguity all make for difficult decision making.

People, including planners, obviously prefer to make decisions in situations with known probabilities rather than in situations of uncertainty. However, when confronted with uncertain situations, like those that will likely occur due to climate change, people often behave in one of two ways. First, they try to avoid making decisions under such conditions, and they tend not to make decisions consistent with the principles of rational behavior (Fox and Tversky 1995). Second, they will make decisions as if they have probabilistic estimates of the outcomes (i.e., as if it were a risk calculation). Moreover, they typically develop these probabilistic expectations themselves and may not use information, even scientific information, correctly to do so (Ellsberg 1961). These are behaviors that must be recognized and overcome in order to meet the challenges we will face as climate change modifies our social and ecological environment.

Investment in financial capital provides lessons we can use for planning investments in natural capital through restoration and conservation. For instance, with perfect knowledge of the future, an investor would focus solely on the investment with the greatest return. However, when confronted by an uncertain future an investor may diversify her investments in order to reduce the overall level of uncertainty (Markowitz 1991). A similar approach would be appropriate for restoration planning. Just as an investor would like to focus on one risk-free option, restoration planning would be less expensive with one certain future scenario. Without this certainty, restoration planners must be prepared for some investments to fail and target investments across a range of most likely future scenarios. This approach is already in effect in water-scarce areas, such as Australia and California, for maintenance of water quantity and quality (Lempert and Groves 2010; Marinoni et al. 2011). As consensus develops among predictive models about the effects of climate change on ecosystems, appropriate portfolio elements will become more apparent, such as habitat for species most susceptible to identified climate-driven changes (Pereira et al. 2010).

Successful restoration planning requires identification of known risks to project implementation and long-term viability, and testing to explore the likely outcomes of new strategies that will be needed to address these unprecedented conditions. Climate change also introduces challenges in terms of planning and weighing risks and outcomes across expanding time frames. While it might have been sufficient to consider time frames ten or twenty years into the future, restoration planners must now consider demands on, and anticipate conditions for, projects out fifty or more years. In addition, they must recognize the potential for different and unprecedented environments due to tipping points and irreversible thresholds triggered by climate change (Lenton et al. 2008). Since people have more difficulty evaluating distant risks, particularly if they might be borne by future generations, coordinating local and current cooperation for truly long-term restoration projects will require more explanation and education.

Communicating the complexity associated with the risk, uncertainty, and ignorance associated with climate change and natural systems can present additional challenges for restoration by altering public confidence in restoration planning, particularly when they involve efforts to incorporate new approaches based on climate science. New information (e.g., new observations, advancements in scientific inquiry) may aid restorationists and restoration planners in terms of convincing the public and public officials about the need for flexible restoration approaches because it will provide a better understanding of the risks involved. New information, for example, might move certain effects or complex feedbacks from the realm of ignorance into the realm of uncertainty, and may even provide probabilistic estimates of risk that can be calculated and quantified. As we learn more about complex biophysical responses to climate change, the range of possible future conditions changes, decreasing ignorance, although increasing uncertainty about the implications of the newly acquired knowledge. For example, some new pests, invasive plants, and other cascading effects enter the realm of possible challenges for restoration projects that would not have occurred but for climate change, while the probabilities of these effects and their consequences remain unknown. Including the possible human adaptive and mitigating responses does not make the effort to predict probabilistic future scenarios any easier.

Demand for Restoration

Climate change is likely to reduce or impair critical habitat, ecosystem services, species, populations, and ecosystems. As a result, restoration practitioners will be important members of conservation efforts to maintain or improve this changing environment. Climate change will play a role in reducing the availability of certain habitat types that are already scarce, such as salmon habitat. This, in turn, will increase the demand for habitat restoration but under less suitable conditions and, therefore, with a greater risk of failure (Battin et al. 2007).

One important role for restoration projects is to maintain and strengthen the availability of biodiversity. The range of potential future conditions under climate change, for specific sites as well as generally, requires a diverse set of available plant and animal species to ensure continuity of functional ecosystems. Restoration projects no longer need simply to be sustainable under stable conditions; they must also be resilient to changing conditions over the long term. Climate change increases the demand for genetic diversity in restoration projects, particularly for species capable of surviving under expected future climatological, ecological, and socioeconomic conditions.

Certain ecological functions are uniquely capable of protecting societies and economies from extreme storm, flood, and fire events—all of which are expected to increase in frequency and severity under climate change (e.g., Westerling 2006; Parry et al. 2007). Restoration projects can buffer coastal communities from future storm events, for example, by expanding coastal wetlands as has been proposed near New Orleans in the wake of Hurricane Katrina (Farley et al. 2007). Analogous motivations can underlie restoration of functional floodplains, wetlands, and marshes so that they are able to absorb storm surges elsewhere. Similarly, restoration efforts are needed worldwide to make forests less prone to catastrophic wildfire. Many crucial ecosystem services, such as water supply, are already at scarce levels due to human degradation (e.g., Baron et al. 2002). And the likelihood of droughts and increased general aridity will probably increase as a result of climate change (Dai 2010). Restorationists will be asked to find ways to reverse or moderate these losses.

There are also increasing demands on restoration projects to provide carbon sequestration as a way to mitigate human activities that contribute to climate change and reduce future societal costs in terms of flooding, extreme weather events, fires, droughts, and other impacts. With the high social cost of carbon, demand for carbon sequestration services from restoration projects can supersede other ecosystem process targets that would have more direct local benefits, such as water quality improvement. Restoration planners and restorationists need to remember that, while carbon sequestration is important, prioritizing carbon sequestration above other restoration goals can have other, unintended consequences in terms of biodiversity and water quality, for example.

There are many other challenges and dangers as well. Uncertainty exists about how species and ecosystems will adapt to climate change (Thomas et al. 2004; Hulme 2005). Consequently, systems might require restoration activities to help with that transition, which will not be an easy task either scientifically or in terms of implementation. In addition, restorationists will face pressure to protect certain charismatic and rare species in their current locations, even if climate-induced changes in habitat make those environments no longer well suited to supporting their populations. Restorationists should also expect new conflicts with other land and resource uses to arise. For instance, corridors or new habitats might need to be established to prevent extinctions and maintain ecosystem functions, although agricultural interests may take precedence over natural resources in order to feed an ever-expanding population on a shrinking arable land base. In addition, shifting ecotones will either make on-site restoration projects more difficult to meet species-specific demands or trigger new conflicts over areas for transition that are already in use. With uncertainty concerning the specific areas that will be suitable in the future for specific species or ecosystem functions, there will be some incentive to wait and see before undertaking large restoration projects. However, with evidence that changes in ecosystems may evolve more rapidly than current planning processes, there won't be time to wait and see, particularly for scarce and fragile ecosystems.

Promoting Ecological Restoration in a World of Climate Change

When public funds are scarce and restoration projects become more expensive and less likely to be successful, restoration planners and restorationists must understand what to do, including developing new goals, designs, and approaches that increase the benefit of a project to society and the environment. For instance, with increased flood risk due to sea-level rise and reduced stream flows, society will have increased demand for functional watersheds and floodplains (e.g., New Orleans, Puget Sound, coastal marshes in England and elsewhere). Moreover, finding ways to achieve and communicate the benefits of restoration projects in terms of mitigating the effects of carbon emissions on climate and adapting to the unavoidable effects of climate change will be increasingly useful, if not necessary, to justify restoration projects. While in the short term these benefits typically do not constitute high priorities for most restoration education efforts, climate change relevance will increasingly be a driver for the political and financial success of future projects. To highlight the climate mitigation and climate adaptation benefits of future projects, restoration project managers and planners should do the following:

- Understand the potential regional contributions to carbon sequestration
- Identify the ecological threats changes in climate pose for the region
- Determine the socioeconomic importance of these threats
- Identify the potential ecological structures and processes that can buffer these threats
- Determine the socioeconomic importance of these structures and processes
- Design projects that are resilient to climate change and make the surrounding human communities more resilient to climate change
- Select implementation and management approaches that are flexible and frequently incorporate new research and observations about changing climatic and ecological conditions
- Communicate the future risks and uncertainties and how the restoration project can address them

Climate change presents new risks and uncertainties for efforts to restore ecosystems, as well as expanding the costs and benefits for these efforts (fig. 13.2). The outcomes of restoration efforts are less predictable due to changing conditions while the costs of achieving desired ecological outcomes are increasing. Nevertheless, the value and importance of successful restoration outcomes are also increasing. Ecological restoration efforts face new demands to provide resilient conditions to support ecosystems, social systems, and economic systems.

	Climate Risk and Uncertainty	Climate Outcomes
Restoration Costs	•Locally unprecedented project targets •Adaptive management •Unknown frequency and magnitude of disruptive events	•More resilience necessary for restored ecosystems •More extreme growing conditions •Less available resources and supporting services
Restoration Benefits	•Less certain project outcomes •Increased demand for ecosystem services •Increased demand for natural buffers to extreme conditions	•Greater challenges for achieving restoration goals •Increased demand for scarce resources and habitat •Less likely long-term benefits without maintenance and adaptation

FIGURE 13.2. Climate change introduces new risks and uncertainties for restoration projects. In addition, as research reveals likely outcomes, climate change increasingly presents new costs and benefits for restoration efforts. Generally, costs increase and benefit uncertainty increases. At the same time, demand for restoration outcomes increases and the value of successful projects rises.

Conclusion

Ecological restoration in multiuse landscapes requires successful ecological planning and socioeconomic coordination. With the likelihood of climatic changes, restoration planners must make decisions that consider when, how much, and in what way climatic conditions will change during the life of a restoration project and beyond. Understanding the implications of climate change on society and the costs of meeting society's demands on restorationists requires a systematic approach. First, restorationists must understand the biophysical implications of climate change. Next, they need to understand how these effects influence restoration planning. Concurrently, they will need to recognize how people think about the types of challenges presented by climate change. Finally, restoration planners will have to identify techniques that remain appropriate as well as develop new restoration approaches that meet new climatic, social, and economic conditions.

References

Baron, J. S., N. L. Poff, P. L. Angermeier, C. N. Dahm, P. H. Gleick, Nelson G. Hairston Jr., R. B. Jackson, C. A. Johnston, B. D. Richter, and A. D. Steinman. 2002. "Meeting Ecological and Societal Needs for Freshwater." *Ecological Applications* 12: 1247–60.

Battin, J., M. W. Wiley, M. H. Ruckelshaus, R. N. Palmer, E. Korb, K. K. Bartz, and H. Imaki. 2007. "Projected Impacts of Climate Change on Salmon Habitat Restoration." *Proceedings of the National Academy of Sciences* 104: 6720–25.

Camerer, C., and M. Weber. 1992. "Recent Developments in Modeling Preferences: Uncertainty and Ambiguity." *Journal of Risk and Uncertainty* 5: 325–70.

Dai, A. 2010. "Drought under Global Warming: A Review." *Wiley Interdisciplinary Reviews: Climate Change*. First online 19 October 2010. DOI: 10.1002/wcc.81.

Ellsberg, D. 1961. "Risk, Ambiguity, and the Savage Axioms." *Quarterly Journal of Economics* 75: 643–69.

Elsner, M. M., L. Cuo, N. Voisin, J. Deems, A. F. Hamlet, J. A. Vano, K. E. B. Mickelson, S. Y. Lee, and D. P. Lettenmaier. 2010. "Implications of 21st Century Climate Change for the Hydrology of Washington State." *Climatic Change* 102 (1–2): 225–60.

Farber, D. A. 2010. "Uncertainty." University of California Berkeley Public Law Research Paper No. 1555343. February 18. http://ssrn.com/abstract=1555343.

Farley, J., D. Baker, D. Batker, C. Koliba, R. Matteson, R. Mills, and J. Pittman. 2007. "Opening the Policy Window for Ecological Economics: Katrina as a Focusing Event." *Ecological Economics* 63: 344–54.

Fox, C. R., and A. Tversky. 1995. "Ambiguity, Aversion, and Comparative Ignorance." *Quarterly Journal of Economics* 110: 585–603.

Hulme, P. E. 2005. "Adapting to Climate Change: Is There Scope for Ecological Management in the Face of a Global Threat? *Journal of Applied Ecology* 42: 784–94.

Knight, F. 1921. *Risk, Uncertainty, and Profit*. New York: Houghton Mifflin.

Lempert, R. J., and D. G. Groves. 2010. "Identifying and Evaluating Robust Adaptive Policy Responses to Climate Change for Water Management Agencies in the American West." *Technological Forecasting and Social Change* 77: 960–74.

Lenton, T. M., H. Held, E. Kriegler, J. W. Hall, W. Lucht, S. Rahmstorf, and H. J. Schellnhuber. 2008. "Tipping Elements in the Earth's Climate System." *Proceedings of the National Academy of Sciences* 105: 1786–93.

Lettenmaier, D. P., and P. C. D. Milly. 2009. "Land Waters and Sea Level." *Nature Geoscience* 2: 452–54.

Marinoni, O., P. Adkins, and S. Hajkowicz. "Water Planning in a Changing Climate: Joint Application of Cost Utility Analysis and Modern Portfolio Theory." *Environmental Modelling and Software* 26 (1): 18–29.

Markowitz, H. M. 1991. "Foundations of Portfolio Theory." *Journal of Finance* 46: 469–77.

Miles, E. L., M. M. Elsner, J. S. Littell, L. C. Whitely Binder, and D. P. Lettenmaier. 2010. "Assessing Regional Impacts and Adaptation Strategies for Climate Change: The Washington Climate Change Impacts Assessment as a Case Study." *Climatic Change* 102 (1–2): 9–27.

Millar, C. I., N. L. Stephenson, and S. L. Stephens. 2007. "Climate Change and Forests of the Future: Managing in the Face of Uncertainty." *Ecological Applications* 17: 2145–51.

Mote, P., E. Parson, A. Hamlet, W. Keeton, D. Lettenmaier, N. Mantua, E. Miles, D. Peterson, D. Peterson and R. Slaughter. 2003. "Preparing for Climatic Change: The Water, Salmon, and Forests of the Pacific Northwest." *Climatic Change* 61: 45–88.

Mote, P. W., A. Petersen, S. Reeder, H. Shipman, and L. C. Whitely Binder. 2008. *Sea Level Rise in the Coastal Waters of Washington State*. Seattle and Lacey, WA: Climate Impacts Group, Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere and Oceans, University of Washington, Seattle; and the Washington Department of Ecology.

Parry M. L., O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson, eds. 2007. *Climate Change 2007: Impacts, Adaptation, and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

Pereira, H., P. Leadley, V. Proença, R. Alkemade, J. Scharlemann, J. Fernandez-Manjarrès, M. Araújo, P. Balvanera, R. Biggs, and W. Cheung. 2010. "Scenarios for Global Biodiversity in the 21st Century." *Science* 330: 1496.

Puget Sound Partnership (PSP). 2008. "Action Agenda." http://www.psp.wa.gov. Olympia, WA: Puget Sound Partnership.

———. 2009a. *Ecosystem Status and Trends: A 2009 Supplement to State of the Sound Report*. Olympia, WA: Puget Sound Partnership.

———. 2009b. "2009 State of the Sound Report." http://www.psp.wa.gov. Olympia, WA: Puget Sound Partnership.

Roberts, M., S. Albertson, A. Ahmed, and G. Pelletier. 2009. *South Puget Sound Dissolved Oxygen Study*. Olympia: Washington State Department of Ecology.

Rosenberg, E. A., P. W. Keys, D. B. Booth, D. Hartley, J. Burkey, A. C. Steinemann, and D. P. Lettenmaier. 2010. "Precipitation Extremes and the Impacts of Climate Change on Stormwater Infrastructure in Washington State." *Climatic Change* 102 (1–2): 319–49.

Stewart, I., D. Cayan, and M. Dettinger. 2004. "Changes in Snowmelt Runoff Timing in Western North America under a 'Business as Usual' Climate Change Scenario." *Climatic Change* 62: 217–32.

Thomas, C. D., A. Cameron, R. E. Green, M. Bakkenes, L. J. Beaumont, Y. C. Collingham, B. F. N. Erasmus, M. F. De Siqueira, A. Grainger, L. Hannah, L. Hughes, B. Huntley, A. S. Van Jaarsveld, G. F. Midgley, L. Miles, M. A. Ortega-Huerta, A. Townsend Peterson, O. L. Phillips, and S. E. Williams. 2004. "Extinction Risk from Climate Change." *Nature* 427: 145–48.

U.S. Environmental Protection Agency. 2010. "Puget Sound Georgia Basin Ecosystem—

Population Health." http://www.epa.gov/region10/psgb/indicators/population_health/what/index.htm.

Washington State Office of Financial Management. 2007. *Final Growth Management Act Population Projections (RCW 43.62.035)*. Olympia, WA: Forecasting Division.

Westerling, A. L., H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam. 2006. "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity." *Science* 313: 940–43.

PART IV

Power: Restoration Economics

Ecological restoration and economics have always been linked at the project scale by costs and the perceived benefits of each project. Traditionally viewed as a necessary evil and a social barrier, economics is now merging with restoration at a larger scale as restorationists and others are championing the ideas of restoring natural capital and ecosystem services (e.g., water quality and supply, raw materials, climate regulation), while providing "green" jobs and improving regional economies. However, this intellectual move brings ecological restoration into a deeper connection with the metatheme of power and power relations where our contemporary culture values of work, profit, and growth are increasingly balanced with the need to protect and restore the environment that makes economic development possible. The authors in this section discuss and analyze this new movement and provide unique perspectives about how ecological restoration is being reshaped in light of these new goals.

To start the section, Yeon-Su Kim and Evan E. Hjerpe introduce a broad framework to analyze the integration of ecological economics and ecological restoration. In addition to providing the basic tenets of ecological economics, they suggest that combining restoration and economics will lead to more efficient project outcomes and greater cultural synergies. In the next chapter, James Blignaut and his colleagues examine the socioeconomic impacts of a short-lived restoration project in the rural and developing region of Greater Giyani, South Africa, a project that was designed to alleviate poverty and improve the land. Findings from a survey they administered to restoration participants are used to determine the extent of economic contributions and lessons learned.

A necessary first step in the nascent integration of economics and ecological restoration is the gathering of baseline information to shed light on how restoration projects can provide economic outputs and contribute to regional economies. J. Mark Baker and Lenya N. Quinn-Davidson supplement this knowledge gap with their analysis of the socioeconomic contributions and organization of restoration work in Humboldt County, California. They identify constraints that hinder the growth of restoration sectors and address the type of institutional infrastructure that develops with restoration activities as a largely government-supported restoration economy matures.

The final chapter, by Mark Buckley and Karen Holl, illustrates how quantitative economic tools can help resolve stakeholder conflict and, thereby, maximize net ecological gains in restoration efforts. To do so, they apply game theory modeling to riparian forest restoration scenarios along the Sacramento River in California, and demonstrate how these innovative methods can be used to strategically locate restoration projects and minimize negative feedback caused by stakeholder conflicts.

Chapter 14

Merging Economics and Ecology in Ecological Restoration

Yeon-Su Kim and Evan E. Hjerpe

The late Kenneth Boulding contended, "Mathematics brought rigor to economics. Unfortunately it also brought mortis." Although it would be fair to say that economics is not the only discipline suffering from this type of rigor mortis, the public's disappointment with mainstream economic theory has been more pronounced because of mainstream economic failures in solving real-life problems (Blag 1998; Wilson 1998; Gowdy 2000). Even the 1996 Nobel Laureate of Economics, William Vickrey, dismissed his prize-winning 1961 paper as "one of my digressions into abstract economics. . . . At best, it's of minor significance in terms of human welfare" (Cassidy 1996, 50). Is the future of the dismal science that dismal? We argue not, precisely because of the earlier self-reflections prompted by the chorus of critics. "Those scholars working on the frontiers of economics have firmly put behind them the inward-looking reductionism" and, as a result, economics is enjoying a "remarkable creative renaissance" refocusing its efforts to help solve real-life problems (Coyle 2007).

The emergence of ecological economics in the late 1980s is a good example of this renaissance. Its clear focus is to help answer the questions that really matter, such as, How can we humans, as a species, have a long and happy life? Currently, many problems that humans encounter, and which we try to repair through efforts such as ecological restoration, have been attributed to past management actions that have dramatically altered ecosystems. For example, ponderosa pine ecosystems were rapidly changed by livestock grazing, high-grade logging, fire suppression, and some forms of recreation during the last 120 years in the American Southwest (ERI 2008). Many unintended ecological consequences of these altered ecosystems have been well documented (e.g., Covington and Moore 1994) and, as in numerous other degraded landscapes, ecological restoration has been proposed to help return these ecosystems to a healthier, more natural trajectory. However, the public and even many conservationists view ecological restoration as "an expensive self-indulgence for the upper class" (Kirby 1994, 240) or "a diversion, a delusion and . . . a waste of money" (Aronson et al. 2006a). If advocates of ecological restoration are to convince their critics and gain broader support, they need to better incorporate socioeconomic and political

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_14, © Island Press 2011

perspectives as well as greater scientific foundations in restoration projects (Jordan 2003; Choi 2007; Temperton 2007). In other words, ecological economics has much to contribute to, and learn from, restoration ecology and ecological restoration.

This chapter introduces the lessons learned in the field of ecological economics to advocates of restoration in order to bring greater effectiveness to our collective actions. In this chapter, we critically review various concepts from neoclassical and ecological economics, explain why they would prove to be useful in understanding the socioeconomic and political contexts of ecological restoration, and suggest the key areas of social research interests for postnormal ecological restoration studies. To illustrate the interface between highlighted economic concepts and on-the-ground restoration efforts, we provide examples from forest restoration in the western United States and detail why these connections are applicable to broad ranges of restorative actions.

Is Ecological Restoration a Rational Choice?

Ecological restoration is our effort to mediate past mistakes and reestablish the ecological integrity of an ecosystem while protecting human interests. According to the Society for Ecological Restoration, "Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER 2004, 3). One would be hard pressed to argue against the "recovery of damaged ecosystems," in principle and, indeed, both ecological restoration and restoration ecology experienced astonishing growth in the past decades (Choi 2004, 2007; Davis and Slobodkin 2004). Although significant research efforts help settle the public concerns for biological and ecological consequences of most forms of restoration, the majority of restoration-related management action to date has been either mitigation required by law (Holl, Crone, and Shultz 2003) or as a response to protect social and economic interests threatened by degraded ecosystem functions and processes. For example, most forest restoration efforts in the western United States have primarily been fuels reduction treatments within or near the wildland–urban interface. Likewise, large restoration projects in the Florida Everglades, Denmark's Skern River, and the San Francisco Bay delta were all catalyzed only when degradation caused by development began severely impacting social and economic interests, typically in the form of reduced water quantity or quality (Weisskoff 2000; Mitsch and Jorgensen 2004).

Currently, capital and property, along with the associated ecosystem services necessary for the inflation of their economic value, need to be at risk in order to galvanize the social, political, and economic will to undertake large restoration projects. However, anticipating future risks combined with the economic and ecological gains that come from proactive management certainly justify ecological restoration of degraded areas prior to their impingement on society's lifestyle. We believe that a basic understanding of economic efficiency and its limits can help us answer the question of whether or not ecological restoration is a rational choice, and can provide an exploration of a new role for economics in ecological restoration—one that does not throw the baby out with the bathwater.

Neoclassical Economics and Ecological Restoration

The basic premises of neoclassical economics include methodological individualism, rationality, and marginalism (Venkatachalam 2007). In other words, individuals acting as economic agents are only interested in their own utility and are able to make rational choices that provide maximum utility to them by comparing marginal utility with marginal cost. Although these premises have proven useful for gaining sharp analytical focus in economic studies, ecological economists have been questioning the limits of their usefulness. These perspectives, which we will discuss, can be summarized as follows: (1) methodological individualism, (2) neoclassical rationality, (3) marginalism, and (4) reactivity and proactivity.

Methodological Individualism

Economic theory posits that the optimal choices we make in a perfect market as individual consumers result in the best outcome for society—the most economically efficient outcome. The market will guide us like "the invisible hand" to the allocation where marginal cost meets marginal benefit, and where collective net benefit is maximized. Mark Sagoff (1988) has effectively argued that this is a flawed assumption because individuals have different and conflicting "preference maps" as citizens and as consumers. In other words, even if we accept that the neoclassical economics perspective of a consumer having a complete and continuously ordered sequence of wants and needs is correct, we cannot deny that the same individual, when acting as a citizen in a community, may have an entirely different set of ordering. These often incompatible preferences cannot be combined in any logical order. An individual is a parent, citizen, and consumer, and employs different sets of preference maps for different purposes. The preference ordering that we use when we shop is not the same one we express when we vote. Like Sagoff, we dislike having smoke from prescribed fires and long-lasting slash piles on our favorite hiking trails. Nonetheless, we fully support the public policy that would encourage more smoke and slash piles for the "recovery of damaged ecosystems." Basing our ecological restoration decisions on economic methods, such as cost-benefit analysis (a sum of our wants and desires as individuals), may not result in what we think we should do collectively.

Neoclassical Rationality

Rationality is another basic premise in neoclassic economics. It presumes that individuals and institutions always make rational choices when deciding about economic matters. Ecological economics see it differently. For example, Gary Snider and his colleagues (2006) showed that the cost of fire suppression itself exceeds the cost of proactive thinning treatments in the American Southwest. Assuming one-third of the forests in Arizona and New Mexico require thinning treatments, these researchers estimated that treating just 5 percent of the required acreage (163,000 acres) annually would reduce fire suppression costs by $600 million over time. Thus, they concluded that the current policy of continuing fire suppression with limited treatments is both ecologically and economically irrational.

Why are we behaving so irrationally? We can attribute some of the irrationality of public policy to institutional barriers and politics of interests that prevent us from acting rationally as a group. Additionally, behavioral economists have long argued that the unbounded rationality assumption is at odds with empirically observed human behavior (Gowdy 2004). In laboratory and field experiments, individuals demonstrate "targeting" or "satisficing" behaviors (choosing an option that is good enough) instead of "maximizing" behaviors (choosing the option that would give maximum satisfaction). There are many possible reasons for this bounded rationality. Mainstream economists tend to attribute the observed behavioral anomalies to cost-effective strategies for minimizing the costs of information gathering, transaction and commitment, resulting from uncertainty, irreversibility, and limited learning opportunities. However, many behavioral economists argue that there are fundamental biases in the human psyche that place bounds on rationality. For example, individuals place greater value on preventing the loss of what they already have than on potential gain (endowment effects). Humans also tend to prefer the status quo over change (status quo bias or inertia in behavior) and respond to a kindness or meanness of others with matching acts (reciprocal behaviors) (Venkatachalam 2008). The concept of bounded rationality helps us understand irrationality (and resistance toward ecological restoration), and suggests ways to counteract our collective inertia.

Marginalism

Marginalism is another premise of neoclassical economic analysis. In many situations in life, decisions are not about having all or nothing, but about making small incremental changes. Comparing marginal benefits and marginal costs helps us evaluate the trade-offs of having one more widget. The intensity of wants and needs for each good declines as we acquire more units of the good, which is the economic principle of diminishing marginal utility. In this framework, the economic value of each good is determined by its utility and abundance/scarcity. Thus, the classic paradox of economic value was born: water versus diamonds. This means that until a valuable ecosystem service hits a critical threshold, its economic value is determined by its scarcity rather than its innate importance in sustaining our lives.

However, because substitutability is assumed, scarcity is only evaluated in relative terms. If we can ignore the limits of economic activities imposed by ecosystems (i.e., absolute scarcity), evaluating marginal benefits and marginal costs based on relative scarcity would be perfectly valid in deriving important decisions in our personal or collective lives. Anyone with an anthropocentric view could agree nothing should be wasted and everything should be used to maximize our utility. Nobel Laureate economist Robert Solow once stated, "If it is very easy to substitute other factors for natural resources, then there is in principle no 'problem.' The world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe" (1974, 11). Ecological economists have been arguing that the concept of scale and limits should be fundamental in evaluating the benefits and costs of our economic activities. Absolute limits of our economic activities need to be recognized if humans are going to have a long and happy life, rather than a short and eventful one. Georgescu-Roegen put it succinctly in 1975 when he wrote, "Every time we produce a Cadillac, we do it at the cost of decreasing the number of human lives in the future" (Georgescu-Roegen 1993). In this sense, the economic principle that "rational people think at the margin" (Mankiw 2001) is only valid when the context and scale of the decision are clearly predefined. Unfortunately, the context and scale of decisions have the most clarity when one's livelihood is imminently threatened (e.g., wildfire is approaching, water is too polluted for use, etc.); they are often less clearly defined in the postnormal world we inhabit.

Reactivity and Proactivity

In a capitalistic society, land management often boils down to the collective will of self-interested, rational individuals operating at the margin with the purpose of maximizing their own utility. This often translates into the necessary *reactive* action when we finally have all the information after the fact. Putting out a wildfire becomes clearly rational, both individually and collectively, once the fire threatens life and property. The rationality of a more *proactive* approach to reduce fuel loading in the neighboring forests is not always so clear to individuals with imperfect information. Investigating the role and value of improved information has been an active research area in agricultural and forest economics. Amacher et al. (2005) estimated that forest owners who underestimate both fire risk and efficacy of fuel treatment can double their expected rent by having more accurate information. Indeed, lack of information for individual decision makers can lead to substantial private and social losses from forest fires (Amacher et al. 2006). Likewise, game theory applied in economics can provide an analytical framework to predict collective outcomes when interactions among individual decisions determine the outcomes. Chapter 17 in this volume presents an analytical model for applying game theory in ecological restoration projects.

Certainly it is an important policy goal to gather reliable information, improve access, and provide incentives for individuals to incorporate better information and cooperate with others. However, we also need to recognize that a complete set of information for any given decision is often an unattainable goal, especially when we are faced with a high degree of uncertainty and irreversibility in decisions with far-reaching and long-lasting consequences. A proactive approach is useful when trying to anticipate the inevitability and fix the root problems that cause and exacerbate the impacts to social and economic interests stemming from degraded ecosystems. This notion of ecological restoration requires a shared vision among community members that can prompt action, even without full, complete information and strategies, to deal with an inherently unpredictable future. Unfortunately, the fundamental differences between risk, uncertainty, and inherent ignorance (radical uncertainty) have not been well understood in economics and other decision sciences (Ludwig 2001).

To the question, Is ecological restoration a rational choice?, we can only offer a typical answer from economists: It depends. Supporting an ecological restoration project may or may not be a rational choice for individual consumers, depending on perceived marginal benefits and costs to each person. However, one could wonder if the question itself is rational. Borrowing from Daly's nautical plimsoll line analogy (Daly and Farley 2004), if your ship's weight is such that your ship is sinking below the plimsoll line, the collectively rational question to ask is: How can we rearrange and get rid of some of the cargo now? It is not: Will marginal benefits from one more load exceed marginal costs? Ecological economics is a paradigm shift from neoclassical economics because its first action is to ask: What are the rational and prudent questions to ask when in pursuit of sustainability? For example, if ecosystem conditions and processes have been damaged to a critical point, the rational choice beyond marginalism is to promote the "recovery of damaged ecosystems." The Millennium Ecosystem Assessment (2005) concluded that approximately 60 percent of the world's ecosystem services are in decline and are being used unsustainably, which, in turn, causes significant harm to human well-being. The imminent problem is known. The question to ask is: How can we effectively go about solving it?

Ecological Economics for Ecological Restoration

The ecological path that advocates of restoration nearly everywhere are trying to correct was set by past management and development paradigms. For instance, in the United States ideas and practices were driven by the utilitarian philosophy of the Progressive Era. To the Progressive Era conservationists, like Gifford Pinchot, Theodore Roosevelt, and Stephen Mather, resources are for use. Thus, their primary concern was to set policies and build public institutions to reduce waste and inefficiency in the use of natural resources (Hays 1959; Cortner and Moote 1999). Under the "gospel of efficiency," the scientific management of forest fires translated into the effective protection of resources against fire, later characterized as the policy to wage war on the forces of nature (Nelson 2000). Neoclassical economics, along with other reductionist disciplines, provided the theoretical and political base for the scientific management of efficiency, where management decisions are based on "objective science" that can transparently evaluate trade-offs among multiple uses of ecosystems. But, as Einstein duly noted, "We cannot solve the problems we have created with the same thinking that created them." Our current problem of degraded ecosystems cannot be solved by simply adding more ecosystem state variables to the same old framework of sustained yields and economic efficiency.

Indeed, Norgaard (2004), among others, argued that modern science, compartmentalized within various epistemic communities, is "neither fit nor organized to address the whole and inform collective action." In an earlier paper, Norgaard (1989) illustrated that methodological diversity and cultural adaptation need to be consciously maintained for ecological economics to effectively work within a range of answers. Others went a step further and argued that the mode of scientific inquiry itself has to be different if we are to offer effective solutions to the most urgent problems in the face of inherent uncertainties and the value-laden nature of science and policy making (Funtowicz and Ravetz 1993, 1994). "Post-normal science," a phrase coined by

Funtowicz and Ravetz, is so termed because its scope goes well beyond the puzzle-solving nature of normal disciplinary science (Müller 2003). Postnormal science implies a qualitative change in how we gain knowledge and formulate public policies. Instead of the expert professionals paradigm that has held sway since the Progressive Era, postnormal science holds that engaging stakeholders in the process is critical to making better, more socially acceptable decisions, given the complexity and uncertainty of issues (Frame and Brown 2008).

Ecological economics is the science and management of sustainability (Costanza 1989), where knowledge gathering should be directly linked to informing the course of necessary actions in a normative manner. Perhaps, the most distinguished feature of ecological economics is its transdisciplinary exploration of human–economy–environment interaction (Venkatachalam 2007). As in the field of ecological economics, the focus of ecological restoration is on increasing the chance of restoration success rather than pursuing precision in scientific and technical details. For instance, William Jordan III, founding editor of the journal *Ecological Restoration* and a founding member of the Society for Ecological Restoration, argued that restoration of nature needs to be explored as an experience and a performing art as well as a technology (Jordan 2003). Many restoration ecologists argue that restoring an ecosystem is a value-laden statement and urge researchers and practitioners to explicitly recognize the importance of social, economic, cultural, and political factors in defining the goals and scope of projects (Choi 2004, 2007; Hobbs et al. 2004). In recent years, restoration ecologists have called for greater recognition of the transdisciplinary nature of restoration and have acknowledged that collaboration among all stakeholders is the current challenge for both ecological restoration and restoration ecology (Temperton 2007). In this section, we establish the need to link ecological restoration to economic decisions for regional economies by explaining why and how ecological restoration makes perfect economic sense if we look beyond the basic premises of neoclassical economics. Some of the developments in ecological economics can help us improve our institutional and organizational settings to encourage people to express their preferences as citizens when collective choices and actions are necessary. We also suggest ways to reduce the chance of decision failures due to bounded rationality when dealing with a high degree of uncertainty or inherent ignorance (i.e., we do not know what we do not know).

Why Ecological Restoration Makes Economic Sense: Investing in Natural Capital and Resilience

Although the environment has been abstracted out of the standard view of economics, the concept of sustainability has been recognized and incorporated into the definitions and distinctions between capital and income. Capital is essentially a stock that generates flows (income) of goods and/or services. As long as one does not deplete the level of stock and survives on the flows yielded, wealth can be sustained. Ecological economists apply this concept to operationalize the pursuit of sustainability and to clarify what needs to be sustained (Daly and Farley 2004; Farley and Gaddis 2007).

Total capital (our total assets) is divided into natural capital and humanmade capital. Natural capital is defined as ecosystem services that are "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life" (Daily 1997, 3). In this sense, there are many functions *of* natural capital that support and enrich our lives in addition to providing various functions *for* humans (De Groot et al. 2002; Ekins et al. 2003). Natural capital has two dimensions: nonrenewable and renewable. Although humanmade capital (e.g., technology or machinery) may reduce some of our needs for natural capital, ecological economists contend that natural and humanmade capitals are ultimately complementary to each other. Ecological economists termed this view as "strong sustainability," and called the conventional assumption of substitutability between natural and humanmade capitals "weak sustainability" (Daly and Farley 2004). To wit, a house cannot be built without land and lumber, no matter how many carpenters and hammers we employ.

These concepts of natural capital and strong sustainability clarify where we should seek solutions for sustainability. If humans as a species are going to have a long and happy life, the level of natural capital must be maintained over time. By definition, the stock of nonrenewable natural capital is being depleted with our economic activities. The only way to maintain or even improve the level of natural capital is by developing renewable substitutes for nonrenewable natural capital while restoring and increasing the stock of renewable natural capital. When faced with this reality, investing money into the "recovery of damaged ecosystems" makes perfect economic sense.

Natural capital is a major extension of the concept of "land" from the classical economic analysis where three types of stocks (land, labor, and humanmade capital) were identified (Ekins, Folke, and De Groot 2003). Adam Smith viewed the flows of values derived from these three types of stocks (rent, profit, and wages) as the original sources of exchange value (Farber, Costanza, and Wilson 2002). With limited substitutability among the different types of stocks, the value of a final product is primarily determined by the most scarce production input. In Adam Smith's time (the eighteenth century), labor was the scarce factor, and he suggested a labor theory of exchange value. Currently, it is the stock of natural capital that is being depleted and, as a result, the availability of natural capital is increasingly the limiting factor in production that will drive up the value of final products in the future. Restoring natural capital would also make perfect economic sense in the eyes of the father of modern economics. This point was elaborated further in detail by Aronson et al. (2006b) and Farley and Daly (2006) in their dialogues advocating ecological restoration as an economic problem (i.e., restoration of natural capital is restoring the limiting factor of production).

Another way that ecological restoration makes economic sense is as insurance. Despite the fact that rationality based on predictability is a basic tenet of neoclassical economics, most of us understand the future is inherently unpredictable. Some of the largest expenditures for a household in the United States are payments for various insurance premiums to reduce the chance of financial downfall due to future risk and uncertainty. Inherent unpredictability of events has been recognized even in financial trading where predicting uncertain futures is the core of the field. Taleb (2007) argued in his bestseller *The Black Swan: The Impacts of the Highly Improbable* that most of human history has been shaped by rare events having far-reaching consequences and retrospective predictability (see also chap. 17, this volume). Likewise, ecologists have long recognized that ecosystem changes are rather episodic and brought on by sudden release and reorganization after slow accumulation of slow-moving factors. Since the 1970s, the dynamic nature and multiple stable states of ecosystems have been recognized to be the result of interactions between slow-moving and fast-moving processes and between large-scale and localized processes (e.g., Holling 1973). Slow-moving factors are impossible to predict and control. Management of ecosystems to achieve efficiency (e.g., fire suppression) tends to focus on control of fast-moving factors to achieve constancy and predictability, which often ends up with counterproductive results (e.g., lost resilience) (Holling and Gunderson 2002). Unnatural future events spurred by past management, which may permanently alter the stable state of that ecosystem, are unavoidable consequences of increased system rigidity and lost resilience. Ecological restoration that recovers damaged ecosystem functions and processes should then increase resilience, allowing small cycles of releases and reorganizations of fast-moving factors and promoting ecosystems' ability to persist and adapt. Just as buying an insurance policy, ecological restoration is a sound economic decision.

These concepts of ecological economics help us translate ecological problems into terms directly relevant to human economies and promote urgently needed actions. Comprehensive ecological restoration of large ecosystems for its own sake may be appealing ethically to restoration ecologists but has little chance for implementation. We argue that, to be effective in promoting collective actions, we need to stop seeing the world through "humans versus nature" lenses (Woodworth 2006), and find ways to promote social-economic development while restoring ecosystem health. Human systems cannot exist without functioning ecosystems, and the current state of ecosystems requires our conscious efforts for restoration. What look like two birds (economic sustainability and ecological sustainability) are really two different reflections of a single bird (sustainability). Thus, ecological economists need to make a conscious effort to catch two birds in one hand, because it is the most effective way of assuring our collective actions and their success. The ARISE Program (African Rural Initiatives for Sustainable Environments) in South Africa provides a perfect example of how ecological restoration projects can provide opportunities for economic development and poverty reduction (box 14.1). The case study by James Blignaut and his colleagues (ch. 15, this volume) presents an interesting look at how the South African government attempted, with mixed results, to help both the people and the environment of a densely populated rural village.

Back to the Future: Making Rational Collective Choices as Citizens

Throughout human history, people have shared knowledge and made collective actions in order to survive. It is only in the last half century that we lost that collective understanding (Norgaard 2004). As we argued earlier, human beings are self-interested consumers, but at the same time they are also citizens who are interested in

Box 14.1
Ecological Restoration and Poverty Reduction

The Working for Water (WfW) program in South Africa, which started in 1995, is a public works program that aims to address three immediate challenges with one intervention: removing invasive plants, especially South American pompom weed (*Campuloclinium macrocephalum*), from riparian areas to improve the country's scarce water resources while providing jobs and economic empowerment to rural areas.

The WfW has grown into the single largest natural resource–based poverty relief and public works expenditure in a country where one out of every four adults is unemployed (Turpie, Marais, and Blignaut 2008). In 2005, the program employed thirty-two thousand people from diverse backgrounds (60 percent women, 20 percent youth, 2 percent disabled) on a budget of $66 million, and became one of the most often cited examples of restoration-oriented poverty relief by advocates of ecological restoration (Woodworth 2006). Restoration of natural ecosystems involves long-term investments in repeated removals of invasive species and reseeding of native species, which may not be sustainable if the program relies solely on government funding. To remain effective in this "ultralong distance race," the WfW compelled landowners to participate and share the costs by generating revenues and indirect benefits (Koenig 2009). The program also made possible the production of "eco-coffins" and school desks from the removed biomass, further generating economic opportunities in rural areas. By offering the "poorest of the poor" stable jobs manually clearing invasive plants in riparian areas, the program overcame the perception that ecological restoration is a middle-class endeavor and attracted broader support for conservation in the country (Woodworth 2006).

doing what is best for society. One of the fundamental principles of economics, "people respond to incentives" (Mankiw 2001)—may prove to be useful here. We argue that at least some of the difficulties in carrying out collectively rational actions today are due to our current institutional setting that encourages us to behave as consumers. Understanding the social contexts of collective actions helps us design institutional and organizational settings that promote collective rationality as citizens and reduce the chance of unexpected decision failures. It also suggests the key areas of social research interests for postnormal ecological restoration studies.

Extensive literature about resource governance suggests that the motivation and success of collective actions when managing common-pool resources involves three dimensions: ecological sustainability, social equity, and economic efficiency (e.g., Hanna and Munasinghe 1995; Agrawal 2001). Although it is difficult to generalize the factors that promote success, in their meta study of community forest management, Pagdee, Kim, and Daugherty (2006) determined that the factors discussed most frequently as necessary for success were (1) well-defined property rights, (2) effective institutional arrangements, and (3) community interests and incentives. Decentralization, in which local communities are given management responsibility, authority and recognition, also improves success through the development of clear ownership and tenure security. Farber et al. (2002) reviewed the case studies of environmental and government administration in Germany and suggested some necessary (although not sufficient) conditions that aid collective actions as citizens: (1) a functioning public with control over their government, that is, a public who forces all political actors to be advocates of justice and public interests; (2) individuals and groups who persistently work toward sustainable development; (3) a decentralized decision-making structure; and (4) an ethos of justice and the public interest. These studies showed that the success of collective action is possible when the institutional and organizational settings are set up in a way that provides benefits to participants, guarantees their rights, and facilitates responses to changing conditions (see chaps. 5, 6, 11, this volume, for discussion of these ideas).

Social relationships that enable learning and adaptation can be viewed as a type of asset (social capital) that includes associational activities, social relations, trust, and norms of reciprocity (Rudd 2000). Although social capital can be viewed as a byproduct of voluntary or informal associations (i.e., through a heterarchy) (Crumley 1995), institutions and organizational structures can promote the development of trust and cooperation by increasing access to information and resources and by coordinating collective actions. As the concept of natural capital operationalizes the pursuit of sustainability, the concept of social capital can help us operationalize collective actions. One of the key structural variables of collective action is the existence of a socially constructed shared vision (Rudd 2000; also see chaps. 6, 16, this volume). In the absence of an omnipotent dictator, a shared vision must be constructed collaboratively, which is a slow process. As in ecological systems, social systems are sustained by conservative and slow-moving variables dynamically interacting with fast-moving factors. For sustainable management of both systems, we should focus our attention on the changes in slow variables while actively experimenting with fast ones (Holling, Gunderson, and Peterson 2002). In other words, iterative and aggressive social learning enabled by the shared vision is necessary for adaptive management (Lessard 1998).

On the other hand, when management focus is on increasing efficiency, social-economic systems can also accumulate slow-moving factors (e.g., centralization of decision-making power) and experience increased rigidity (e.g., conservatism and bureaucracy). Within a concentrated power structure, an erroneous course of actions can persist even after the negative consequences are realized and avoidable (Chermack 2004). Under these regimes, management tends to focus on maintaining constancy of the power structure while ignoring any signals to the contrary, rather than promoting adaptability in the face of unpredictable external changes. As in ecological systems, human organizations that are preoccupied with short-term gain and seek a series of easy "quick-fix" solutions tend to fail, while those that can learn and adapt to the external changes survive and proliferate in the long term (Makridakis 1991). In the business world, the leadership and integrity of a visionary CEO may guide a firm through uncertain times. In ecosystem management, there is no omnipotent dictator who can incorporate diverse, often conflicting values and guide us through a high degree of uncertainty and irreversibility in decisions with far-reaching and long-lasting consequences. The decisions have to be made collectively.

Collaborative social learning is also a way of reducing bounded rationality. There have been significant research efforts to develop participatory techniques and tools to overcome bounds in individual rationality and reach consensus through "futuring" (Frame and Brown 2008). For example, scenario planning is one of the social learning tools developed in management science. Scenario planning has gained credibility as an effective tool to prepare for an uncertain future, and the demand for such a tool has exploded in recent years (Peterson, Cumming, and Carpenter 2003; Chermack 2005). It is "a process of positing several informed, plausible and imagined alternative future environments in which decisions about the future may be played out, for the purpose of changing current thinking, improving decision making, enhancing human and organization learning and improving performance" (Chermack 2004). In other words, scenario planning is a process of asking a series of "what if" questions to reach an "Aha!" moment collectively. Each scenario as a story can hold vast information, help us identify and communicate the forces that shape our future, and learn about the weaknesses and strengths of our institutions. Through collective scenario-building exercises, we can dream effectively as a group to envision the future. In this context, planning is viewed as an iterative process where the goal is learning, rather than a one-time activity to make a rational and comprehensive decision.

There are varying degrees of reluctance among scientists and resource managers to accept or be open to the idea that we cannot have complete information about the very system we exist in (Ludwig 2001). The dynamic nature of ecosystems does not allow us to optimize around a single objective with predicted consequences of our management actions (Holling and Gunderson 2002). However, the urgency of the problems demands action now. Ecological economics and other social sciences can contribute significantly to the success of ecological restoration by clearly aiming to enable actions under high uncertainty. If failure is an inevitable natural process in both ecosystems and social-economic systems, the question to ask is: How can we design institutions and organizations to anticipate failures and minimize the negative consequences while learning from our collective mistakes and conserving the capacity to change? Ecological economists, by identifying incentives that motivate individuals to act as citizens to pursue collectively rational actions for ecological restoration, also have much to add to the already extensive literature about collective actions for managing common-pool resources. Moreover, they can help restorationists and stakeholders develop better techniques and tools for collective futuring and construction of a shared vision.

Conclusion

To generate broader support for ecological restoration and promote restorative actions, we need to openly acknowledge the uncertainty of the human situation and our inherent ignorance while emphasizing the need for a shared vision and continuous adaptive management based on social learning. In this chapter, we have made a case for ecological economics as a normative, postnormal science. Although ecological economics has made substantial contributions to the developments of postnormal sustainability technologies (Frame and Brown 2008), people still have a long way to go before accepting postnormal science as an effective way of gaining knowledge and crafting public policy. According to Müller (2003), ecological economics itself is still at the crossroads between normal and postnormal science. We agree with Müller that the main strength of ecological economics is its focus on seeking solutions to imminent problems. If ecological economics is to remain as a revolutionary paradigm shift from neoclassical economics and not be absorbed into the mainstream economics as a branch, researchers must consciously examine the broader social relevance of their research questions and be clear about their aims and responsibilities.

References

Agrawal, A. 2001. "Common Property Institutions and Sustainable Governance of Resources." *World Development* 29 (10): 1649–72.

Amacher, G. S., A. S. Malik, and R. G. Haight. 2005. "Forest Landowner Decisions and the Value of Information under Fire Risk." *Canadian Journal of Forest Research* 35 (11): 2603–15.

———. 2006. "Reducing Social Losses from Forest Fires." *Land Economics* 82 (3): 367–83.

Aronson J., J. N. Blignaut, S. J. Milton, and A. F. Clewell. 2006b. "Natural Capital: The Limiting Factor." *Ecological Engineering* 28 (1): 1–5.

Aronson, J., A. F. Clewell, J. N. Blignaut, and S. J. Milton. 2006a. "Ecological Restoration: A New Frontier for Nature Conservation and Economics." *Journal for Nature Conservation* 14 (3–4): 135–39.

Blaug, M. 1998. "Disturbing Currents in Modern Economics." *Challenge* (May–June): 11–34.

Boulding, K. E. 1986. "Proceedings of the 7th Friends Association for Higher Education Conference," Malone College, 1986, p. 4.

Cassidy, J. 1996. "The Decline of Economics." *New Yorker* 72 (37): 50.

Chermack, T. J. 2004. "Improving Decision-Making with Scenario Planning." *Futures* 36 (3): 295–309.

———. 2005. "Studying Scenario Planning: Theory, Research Suggestions, and Hypotheses." *Technological Forecasting and Social Change* 72 (1): 59–73.

Choi, Y. D. 2004. "Theories for Ecological Restoration in Changing Environment: Toward 'Futuristic' Restoration." *Ecological Research* 19 (1): 75–81.

———. 2007. "Restoration Ecology to the Future: A Call for New Paradigm." *Restoration Ecology* 15 (2): 351–53.

Cortner, H., and M. A. Moote. 1999. *The Politics of Ecosystem Management*. Washington, DC: Island Press.

Costanza, R. 1989. "What Is Ecological Economics?" *Ecological Economics* 1 (1): 1–7.

Covington, W. W., and M. M. Moore. 1994. "Southwestern Ponderosa Forest Structure: Changes since Euro-American Settlement." *Journal of Forestry* 92 (1): 39–47.

Coyle, D. 2007. *The Soulful Science: What Economists Really Do and Why It Matters*. Princeton, NJ: Princeton University Press.

Crumley, C. L. 1995. "Heterarchy and the Analysis of Complex Societies." In *Heterarchy and the Analysis of Complex Societies*, edited by R. M. Ehrenreich, C. L. Crumley, and J. E. Levy, 1–5. Archaeological Papers of the American Anthropological Association no. 6. Washington, DC: American Anthropological Association.

Daily, G. C. 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington, DC: Island Press.

Daly, H. E., and J. Farley. 2004. *Ecological Economics: Principles and Applications*. Washington, DC: Island Press.

Davis, M. A., and L. B. Slobodkin. 2004. "The Science and Values of Restoration Ecology." *Restoration Ecology* 12 (1): 1–3.

De Groot, R. S., M. A. Wilson, and R. M. J. Boumans. 2002. "A Typology for the Classification, Description and Valuation of Ecosystem Functions, Goods and Services." *Ecological Economics* 41 (3): 393–408.

Ecological Restoration Institute (ERI). 2008. "Ecological Restoration Institute—ERI FAQ." http://www.eri.nau.edu/joomla/content/view/28/67/lang,en/.

Ekins, P., C. Folke, and R. De Groot. 2003. "Identifying Critical Natural Capital." *Ecological Economics* 44 (2–3): 159–63.

Ekins, P., S. Simon, L. Deutsch, C. Folke, and R. De Groot. 2003. "A Framework for the Practical Application of the Concepts of Critical Natural Capital and Strong Sustainability." *Ecological Economics* 44 (2–3): 165–85.

Farber, S. C., R. Costanza, and M. A. Wilson. 2002. "Economic and Ecological Concepts for Valuing Ecosystem Services." *Ecological Economics* 41 (3): 375–92.

Farley J., and H. Daly. 2006. "Natural Capital: The Limiting Factor: A Reply to Aronson, Blignaut, Milton and Clewell." *Ecological Engineering* 28 (1): 6–10.

Farley, J., and E. J. B. Gaddis. 2007. "Restoring Natural Capital: An Ecological Economics Assessment." In *Restoring Natural Capital: Science, Business, and Practice*, edited by J. Aronson, S. J. Milton, and J. N. Blignaut, 17–27. Washington, DC: Island Press.

Frame, B., and J. Brown. 2008. "Developing Post-normal Technologies for Sustainability." *Ecological Economics* 65 (2): 225–41.

Funtowicz, S. O., and J. R. Ravetz. 1993. "Science for the Post-normal Age." *Futures* 25 (7): 739–55.

———. 1994. "The Worth of a Songbird: Ecological Economics as a Post-normal Science." *Ecological Economics* 10 (3): 197–207.

Georgescu-Roegen, N. 1993. "The Entropy Law and the Economic Problem: Selections from 'Energy and Economic Myths.'" In *Valuing the Earth: Economics, Ecology, Ethics*, edited by H. E. Daly and K. L. Townsend, 89–112. Cambridge, MA: MIT Press.

Gowdy, J. M. 2000. "Terms and Concepts in Ecological Economics." *Wildlife Society Bulletin* 29 (1): 26–33.

———. 2004. "The Revolution in Welfare Economics and Its Implications for Environmental Valuation and Policy." *Land Economics* 80 (2): 239–57.

Hanna, S., and M. Munasinghe. 1995. *Property Rights and the Environment: Social and Ecological Issues*. Washington, DC: World Bank Publications.

Hays, J. P. 1959. *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement 1890–1920*. Pittsburgh, PA: Pittsburgh University Press.

Hobbs, R. J., M. A. Davis, L. B. Slobodkin, R. T. Lackey, W. Halvorson, and W. Throop. 2004. "Restoration Ecology: The Challenge of Social Values and Expectations." *Frontiers in Ecology and the Environment* 2 (1): 43–48.

Holl, K. D., E. E. Crone, and C. B. Shultz. 2003. "Landscape Restoration: Moving from Generalities to Methodologies." *BioScience* 53 (5): 491–502.

Holling, C. S. 1973. "Resilience and Stability of Ecological Systems." *Annual Review of Ecology and Systematics* 4: 1–23.

Holling, C. S., and L. H. Gunderson. 2002. "Resilience and Adaptive Cycles." In *Panarchy: Understanding Transformations in Human and Natural Systems,* edited by L. H. Gunderson and C. S. Holling, 25–62. Washington, DC: Island Press.

Holling, C. S., L. H. Gunderson, and G. Peterson. 2002. "Sustainability and Panarchies." In *Panarchy: Understanding Transformations in Human and Natural Systems*, edited by L. H. Gunderson and C. S. Holling, 63–102. Washington, DC: Island Press.

Jordan III, W. R. 2003. *The Sunflower Forest: Ecological Restoration and the New Communion with Nature*. Berkeley: University of California Press.

Kirby, J. L. 1994. *Gardening with J. Crew: The Political Economy of Restoration Ecology*. Minneapolis: University of Minnesota Press.

Koenig, R. 2009. "Unleashing an Army to Repair Alien-Ravaged Ecosystems." *Science* 325: 562–63.

Lessard, G. 1998. "An Adaptive Approach to Planning and Decision-Making." *Landscape and Urban Planning* 40: 81–87.

Ludwig, D. 2001. "The Era of Management Is Over." *Ecosystems* 4: 758–64.

Makridakis, S. 1991. "What Can We Learn from Corporate Failure?" *Long Range Planning* 24 (4): 115–26.

Mankiw, N. G. 2001. *Principles of Microeconomics*. 2nd ed. Fort Worth: Harcourt College.

Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington, DC: Island Press.

Mitsch, W. J., and S. E. Jørgensen. 2004. *Ecological Engineering and Ecosystem Restoration*. New York: John Wiley & Sons.

Müller, A. 2003. "A Flower in Full Blossom? Ecological Economics at the Crossroads between Normal and Post-normal Science." *Ecological Economics* 45 (1): 19–27.

Nelson, R. H. 2000. *A Burning Issue: A Case for Abolishing the U.S. Forest Service*. Lanham, MD: Rowman & Littlefield.

Norgaard, R. B. 1989. "The Case for Methodological Pluralism." *Ecological Economics* 1 (1): 37–57.

———. 2004. "Learning and Knowing Collectively." *Ecological Economics* 49 (2): 231–41.

Pagdee, A., Y.-S. Kim, and P. J. Daugherty. 2006. "What Makes Community Forest Management Successful: A Meta-study from Community Forestry Throughout the World." *Society and Natural Resources* 19 (1): 33–52.

Peterson, G. D., G. S. Cumming, and S. R. Carpenter. 2003. "Scenario Planning: A Tool for Conservation in an Uncertain World." *Conservation Biology* 17: 358–66.

Rudd, M. A. 2000. "Live Long and Prosper: Collective Action, Social Capital and Social Vision." *Ecological Economics* 34 (1): 131–44.

Sagoff, M. 1988. *The Economy of the Earth: Philosophy, Law, and the Environment*. Cambridge: Cambridge University Press.

Snider, G., P. J. Daugherty, and D. Wood. 2006. "The Irrationality of Continued Fire Suppression: An Avoided Cost Analysis of Fire Hazard Reduction Treatments versus no Treatment." *Journal of Forestry* 104 (8): 432–37.

Society for Ecological Restoration Science and Policy Working Group (SER). 2004. *The SER International Primer on Ecological Restoration*. Version 2, October, 2004.

Solow, R. M. 1974. "The Economics of Resources or the Resources of Economics." Papers and Proceedings of the Eighty-sixth Annual Meeting of the American Economic Association, May 1974. *American Economic Review* 64 (2): 1–14,

Taleb, N. N. 2007. *The Black Swan: The Impact of the Highly Improbable*. New York: Random House.

Temperton, V. M. 2007. "The Recent Double Paradigm Shift in Restoration Ecology." *Restoration Ecology* 15 (2): 344–47.

Turpie, J. K., C. Marais, and J. N. Blignaut. 2008. "The Working for Water Programme: Evolution of a Payments for Ecosystem Services Mechanism That Addresses Both Poverty and Ecosystem Service Delivery in South Africa." *Ecological Economics* 65: 788–98.

Venkatachalam, L. 2007 "Environmental Economics and Ecological Economics: Where They Can Converge?" *Ecological Economics* 61 (2–3): 550–58.

———. 2008. "Behavioral Economics for Environmental Policy." *Ecological Economics* 67 (4): 640–45.

Weisskoff, R. 2000. "Missing Pieces in Ecosystem Restoration: The Case of the Florida Everglades." *Economic Systems Research* 12 (3): 271–303.

Wilson, E. O. 1998. *Consilience: The Unity of Knowledge*. New York: Knopf.

Woodworth, P. 2006. "Working for Water in South Africa: Saving the World on a Single Budget?" *World Policy Journal* Summer: 31–43.

Chapter 15

The ARISE Project in South Africa

James Blignaut, Jotte van Ierland, Travor Xivuri,
Rudi van Aarde, and James Aronson

Most of southern Africa's rural people depend on natural biomass as their primary fuel source, and on ecosystems as the primary source of their livelihood (Wessels et al. 2004; Geerken and Ilaiwi 2004; Lawler et al. 2006). Given the relatively high rate of population growth across the subcontinent, the use of biomass for fuel could deplete natural resources and degrade biodiversity. This renewable natural capital, in the idiom of ecological economics, can only be reversed through ecological restoration that coincides with revised, adaptive resource management activities based on a collective will and vision (Blignaut 2009). This chapter provides a critical assessment of a project that aims to restore natural capital at a village scale in a region of dire poverty and joblessness near Giyani, in the northeastern corner of South Africa. The project aimed to improve living conditions and the socioeconomic well-being of local participants, and to sustainably improve the environmental conditions that provide the basis for human life. In this case, ecological restoration actually becomes an integral component of a broader economic development package.

We focus on the socioeconomic and immediate environmental impacts of the restoration project, the African Rural Initiatives for Sustainable Environments (ARISE). We used a semistructured questionnaire to obtain information from the participants to address the following questions: First, what can be learned from an innovative restoration project in a poor rural region in South Africa? Second, to what extent does ecological restoration contribute to socioeconomic development?

We first introduce the terminology so that socioeconomics and ecology can be combined in a single analysis. Then we describe the ecological restoration activities that were conducted at Giyani and present the results of the questionnaire.

Restoration of Natural Capital

Restoration of natural capital (RNC) is the replenishment of natural capital stocks to improve human well-being and ecosystem health (Clewell and Aronson 2006, 2007; Aronson, Milton, and Blignaut 2007; http://www.rncalliance.org). Natural capital consists of all stocks of natural resources as they occur in natural and managed

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_15, © Island Press 2011

landscapes and from which flow natural goods and services (Costanza and Daly 1992; Millennium Assessment 2005). From an economic perspective, RNC builds on the idea that natural capital is a stock variable that operates like all other stock variables, including financial, manufactured, social, and human capital stock. RNC is, therefore, any investment in maintaining and augmenting the stock of natural capital that produces flows of goods and services. Just as governments express economic development through investment in the built environment and the development of built infrastructure, so too should an investment in natural infrastructure be seen as an investment to further economic development and well-being for present and future generations (Blignaut 2009). This could provide a paradigm shift in an era where natural capital limits economic development (see also chap. 14, this volume; Costanza and Daly 1992; Daly and Farley 2005; Aronson et al. 2006; Dresp 2006; Farley and Daly 2006).

Restoring natural capital focuses on achieving both the replenishment of natural capital stocks and the improvement in human welfare, and is, therefore, a broader concept than ecological restoration, which is defined as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER 2004, 3). Ecological restoration can bring about economic growth in the sense of an increase in financial or in-kind income since replenishment of natural capital stocks will increase the flow of goods and services that accrue from it. From here on we focus on the ARISE program as a restoration project.

The ARISE Program

ARISE (http://eoi.co.za/) was conceived in 1999 as a program consisting of a multitude of site-specific projects with the purpose of investing in natural capital restoration on communal land. The program was intended to contribute to (1) job creation, (2) economic empowerment of rural Africans, and (3) ecological restoration of degraded landscapes. It was seen as an opportunity to facilitate the transition from the "second" (informal) to the "first" (formal) economy (Jahed et al. 2006) by providing alternative energy, improving land management, inducing ecological restoration, maintaining restored areas, creating labor-based infrastructure, and inducing nature-based tourism (Jahed et al. 2006). Of these only the ecological restoration component was initiated through an implementing agency under contract to the Department of Environmental Affairs and Tourism (DEAT). Under the terms of the contract, the company that won the bid had to report on its activities every three months. One of the main criteria for evaluation was the number of jobs created by the project. Other criteria included whether standard financial procedures had been followed, whether the administration was informed about progress, and whether such progress was in line with the stated business plan. Since ARISE was considered a poverty-alleviation program, strict procedures had to be followed, including allocation of 70 percent of the program budget to wages for the villagers.

The ARISE program commenced in November 2004 with two pilot projects that lasted until March 2007, one in the greater Giyani area in the northeastern part of the Limpopo Province (South Africa's northernmost province) adjacent to Kruger Na-

FIGURE 15.1. Limpopo Province of South Africa.

tional Park (fig. 15.1), and one in the greater Port St. Johns area in the Eastern Cape region, about 1,553 miles (2,500 km) to the south of the former site. The two pilot sites were selected on the basis of their accessibility and a unilateral decision by the national government that the pilot phase should be done in those two areas from a sociopolitical perspective. This chapter discusses the results of the ARISE program at the Giyani site.

The Socioeconomic Context at Giyani, South Africa

In 2001, about 239,000 people lived in the 1,153-square-mile (2,985–km^2) area known as the Greater Giyani municipality (Demarcation Board 2003), resulting in a population density of 207 people per square mile (80 people/km^2). This is relatively high as compared to mean figures for South Africa and Limpopo Province, which are, respectively, 96 and 111 people per square mile (37 and 43 people/km^2) (SSA 2006). Such a high population density means there is a high demand for natural resources. The municipality is also largely rural, with 89 percent of the population residing in the rural areas and only 11 percent in the town of Giyani (SSA 2006).

In the Giyani area, 93 percent of the rural households use wood as their primary source of fuel for cooking, at a rate of approximately 3.3 pounds (1.5 kg) of wood per person per day (Yunga 2007). This translates to an annual harvest of about 121,500 tons of wood. The impact of harvesting is aggravated by the demand for construction timber. This demand, along with intensive grazing, have contributed to environmental and ecological degradation, including the loss of basal cover, the formation of erosion gullies, and the impoverishment of biota.

The rural population is also very young, with half of the people less than fifteen years old (SSA 2006). It is also a female-dominated society, with women representing 55 percent of the population between the ages of fifteen and thirty-four and 65 percent of the population between the ages of thirty-five and sixty-four. One reason for this is that adult men often migrate to the big cities in search of employment. Agricultural activities, such as cattle and goat keeping and subsistence crop production, play an important role in the local economy. Only 20 percent of people older than twenty have completed secondary school, and 64 percent have had no schooling at all or else completed just a few years of primary school education. Unemployment is estimated at 60 percent, and only 2 percent of the population earns more than US$100 per month (Demarcation Board 2003).

Restoration Activities Near Giyani

The ARISE project near Giyani used several different techniques to restore patches of degraded land, including the following:

1. In discussion with the tribal council, five patches of land, varying in size from 59 to 203 acres (24 to 82 ha), and totaling 628 acres (254 ha), were set aside to be fenced in and declared off limits from further utilization for the duration of the project. This passive form of restoration was intended to control fuelwood collection and livestock grazing, to provide pioneer plants an opportunity to colonize and establish, and to initiate revegetation through ecological succession. The return of vegetation cover was expected to reduce the likelihood of surface erosion and allow tree and shrub seedlings to grow, provided sufficient seeds were available nearby.
2. A 164-foot (50–m) buffer zone was established on both sides of the Klein Letaba River. It was not fenced in. Erosion gullies were repaired in this zone using gabions constructed with wire and stones collected near the restoration sites. These gabions were constructed in both the fenced-in restoration sites (see item 1) and the buffer zone. Gabions varied in size from 25 cubic feet to 318 cubic feet (0.7 to 9 m^3).
3. Furrows were made in soil denuded of all vegetation and then fertilized with cow and/or elephant dung (from elephants that escaped from the adjacent Kruger National Park) to enrich soils and promote vegetation recovery. This was done in both the fenced-in restoration sites and the buffer zone.
4. Seedlings of fifty species, but mainly twenty-seven so-called useful indigenous tree species, were propagated from seed collected locally. Usefulness was defined as species that can contribute to food, fodder, shade, or other amenity or use value. During the last six months of operation, the ARISE nursery produced 1,694 trees per month. This resulted in a stock of 7,957 trees at the end of the project in March 2007. Between January 2007 and March 2007, workers transplanted 654 saplings in the fenced-in restoration sites. Since the project came to a standstill on April 1, 2007, no further transplantation was done, and we have no information about the survival of the transplanted saplings.

All activities were carried out by village members with support from the local traditional leadership, and guidance from an informed restoration manager.

Determination of the Socioeconomic Impact

The purpose of this study was to determine the extent of socioeconomic contributions derived from ARISE restoration projects and to examine the lessons learned.

Method

To evaluate the impact of job creation on the employees of the ARISE project, a survey using a semistructured questionnaire was conducted among ARISE employees in four villages at four of the restoration sites. These villages (Hlomela, Ndindani, Mapayeni, and Vuhehli) employed 84 of the 323 ARISE employees in the greater Giyani area. Forty-nine of the 84 (58 percent) were randomly selected to participate in the survey. While all possible measures were taken to ensure the reliability of the response, the following are some real constraints faced during the interviews: (1) illiteracy of many of the respondents, which created problems when estimating amounts of any sort; (2) respondents influencing one another; (3) unwillingness to answer sensitive questions; (4) a prevailing perception that it is honorable to provide socially accepted answers or the answers the respondent thinks the enumerator wants to hear; and (5) problems with interpretation. In cases of uncertainty about the reliability or interpretation of the data, the person who had compiled the information was asked for clarification and the questions were rephrased until an understanding was reached.

Most of the survey was conducted during February 2007 when numerous visits to the homes of the employees were made to improve the understanding of the system and the interpretation of responses to the questionnaire. Based on these interviews, observations, and interviewee responses, a list of lessons learned was compiled.

Results

The ARISE employees were asked questions about how the program was functioning and how the program could be improved. Responses from these two categories are provided in the following section.

Direct Impacts on the ARISE Employees

To gain an understanding as to the socioeconomic impact of ARISE, respondents were asked to reflect on how their lives changed as a result of ARISE. Some of the most frequently mentioned problems highlighted by the respondents before they joined ARISE were as follows (because many respondents mentioned two or more problems, the numbers do not add up to 100 percent):

- Forty-nine percent mentioned some kind of social problem, such as feeling lonely and having a lack of confidence.
- Forty-seven percent mentioned a shortage of some kind of resource, such as a lack of money, food, and the ability to support themselves.

TABLE 15.1

Benefits of ARISE as identified by the ARISE employees

Use of additional income			Changes in social well-being		
Item	No. respondents	%		No. respondents	%
More and better food	42	86	Take care of family	14	29
Acquire new/better clothes	35	71	Gained self-respect	4	8
Pay school fees	26	53	Improved health	3	6
Furniture and household equipment	20	41	Changes in friends since ARISE:		
Building house	10	20	—Unchanged	25	51
TV/DVD player	4	8	—Gained new friends and lost none	21	43
Burial society	3	6	—Lost friends and have new friends	3	6

- Thirty-one percent complained of being dependent on others, mostly family.
- Twenty-nine percent cited a shortage of money.
- Ten percent complained of not having a job.

The respondents were also asked to indicate how ARISE had changed their livelihoods and general well-being for better or worse. More than 50 percent of the respondents indicated that they benefited from ARISE by being able to buy more and better food and clothes, and that the income obtained from ARISE enabled them to pay their children's school fees (table 15.1). Twenty-nine percent of the respondents indicated that their social well-being had improved since the income obtained enabled them to take care of their family. Only 6 percent of the respondents indicated that they have lost friends due to the project since they now work and earn an income while their friends do not. By contrast, 43 percent indicated that they had gained new friends as a result.

Other indirect benefits included the availability of vegetables—these were produced by ARISE employees and on sale from the nursery. The respondents indicated that their average monthly family income, that is the salary received from ARISE and all possible other revenues, mainly subsidies from government and income from family members, was R1,550 (US$155). This translates to an average daily income of $5.30 per household; prior to ARISE, the average was $2.20. ARISE, therefore, increased average household income by 130 percent. Because every household has an average of six and a half members, the per capita income of R236 (US$23.60) per person per month or $0.79 per day after ARISE began was still low, but it was nearly double the per capita income before the program began. Although income levels remained very low in absolute terms, the relative contribution of ARISE was meaningful. This is highlighted by all respondents indicating that they were satisfied with their daily work and by 89 percent indicating that they would like to work for ARISE until retirement. ARISE also contributed to the training of employees, thereby improving its own performance and the likelihood of employees finding alternative employment (table 15.2).

TABLE 15.2

Formal training courses offered to the ARISE employees

	Number of employees attending	% of employees attending	Number of working days spent in training
Health and safety	31	10	62
First aid	32	10	64
Basic Condition of Employment Act awareness	323	100	323
Introduction to rehabilitation	129	40	129
Basic ecology	129	40	129
Pest control	321	99	321
Herbicide	321	99	321
Vegetable propagation	44	14	440
Transplanting seedlings	128	40	640
Seedling production	128	40	640
Nursery practice	44	14	1320
HIV and AIDS awareness	321	99	321
Malaria control awareness	321	99	321
HIV and AIDS counseling	321	99	321
Life orientation	321	99	321
Fire fighting	321	99	321
Supervisory course and leadership	18	6	180
Computer skills	18	6	180
Ecotourism/cultural	18	6	180
Conflict management	18	6	180
Registering of a company	14	4	140
Contract development	14	4	14
Totals	3,335		6,868

The respondents indicated that they benefited from these courses by gaining practical knowledge and a greater understanding of a range of subjects. These included the practical use of organic fertilizers, gabions, and fences; prevention of soil erosion; irrigation; planting of trees and crops; fire control; and the use of selective herbicides. Respondents also confirmed that they had gained useful information about health (including HIV/AIDS and TB) and safety.

Potential Improvements of the ARISE Project as Indicated by the Respondents

The respondents were asked how they thought ARISE was actually functioning. They were also asked how and what they thought about the future of ARISE after the pilot phase. The employees raised various issues about the design and operation of the project, which we then divided into two categories—working conditions and income, and productivity. The results are presented in table 15.3. Note that this section of the questionnaire was, like most other sections, an open section wherein the respondents were asked to express their personal views. The relatively low percentages do not indicate that other respondents disagree with the statement. In fact, it may be that they did not think of that specific improvement at the moment they were asked the question.

TABLE 15.3

Plausible project improvements according to ARISE respondents

Respondents' suggestions about ways for ARISE to improve working conditions and income		Respondents suggestions about ways for ARISE to improve productivity	
% of respondents	Comment	% of respondents	Comment
39	Requested higher wages	31	Indicated the need to increase materials, especially fencing material
14	Suggested that the company be enlarged	16	Indicated the need for an increase in equipment
10	Requested more training for skills not directly related to the tasks	6	Indicated the need to plant more trees
6	Suggested that the project provide sanitation and shelter with fresh water on the restoration sites (something that was absent during the lifetime of the project)	6	Suggested that ARISE workers could also be used to clean the streets during idle hours
4	Suggested the need to improve the means of transportation to and from the worksites	4	Indicated that each village and restoration site should have its own nursery to employ and engage more people
4	Suggested that the company should raise outside funds to continue and to improve on its work		

Discussion

The ARISE project aimed at creating employment opportunities, the economic empowerment of rural Africans, and ecological restoration of degraded ecosystems. The information presented here suggest that the program did succeed in providing employment, albeit temporarily, and resulted in some economic empowerment while the project ran. We have not yet determined the success of the restoration effort.

The program also contributed to the financial income and apparent well-being of its employees. Before ARISE, some of the respondents depended on their relatives, friends, neighbors, or government transfers for their daily needs. They became less dependent on their relatives, friends, and neighbors since they were earning their own income due to ARISE, but that does not imply a reduction in their exposure to government support since ARISE was fully funded by the government. A fundamental flaw within the public works program is that no single employee may be employed for more than twenty-four months within a sixty-month period in the program. While the stated goal is to create permanent jobs, using the public works program as a platform, the program itself does not provide scope for such. Permanent job creation should happen outside of, but as a consequence of, the program. Clearly such a goal is unattainable within a pilot program since it means that ARISE workers had two years to gain sufficient experience and training to be able to find a job in the commercial sector after leaving the program. However, since ARISE workers were selected among the least advantaged people in their communities, it was very difficult, even impossible, for ARISE to provide them with sufficient education for that purpose in such a short time. Government would be well advised to rethink the goals and implementation methods since the ARISE experience carries with it an expensive lesson about why not to formulate impossible goals.

Not only were the employees of ARISE vulnerable to changes in government policy; the implementing agent was placed in an awkward situation as the interface between the government and the workers. The program provided a very specific service, namely the restoration of natural capital and a revised land-use management system. To achieve this, however, requires sustainable and reliable funding for an extended period.

It would be of great benefit to all concerned if the program could become less dependent on government funding. It was envisioned by the originators that this would be done by linking with the commercial sector to provide goods and services to markets for which they receive a payment in return, as is done through tourism (Jahed et al. 2006). The ARISE employees, however, had no experience in tourism, which requires another kind of training and knowledge. A more logical strategy would be to specialize in, for example, agriculture. There is much more synergy between the training required for ecological restoration and agriculture than there is between ecological restoration and tourism. One of the perceived concerns raised by the employees is that the project suffered from a lack of materials and equipment (see table 15.3). This was the result of the agreement between the implementing agent and the government that a fixed percentage (70 percent) had to be spent on wages. Although such labor-intensive production methods might not be optimal from a business point of view, they could indeed be considered optimal when including the avoided social costs of unemployment as benefits from the ARISE project.

In the short-term, the ARISE project was effective in starting various aspects of ecological restoration and job creation, although it was not efficient from a business perspective. Even though it makes sense in an area with high unemployment to downplay efficiency and simply create more jobs, this, by no means, implies that the working hours available should not be used productively. An innovative way should be sought to engage proactively with the community to involve as many people as possible as cost-efficiently as possible. One way to improve productivity and to benefit other community members than those working for ARISE was suggested by some of the respondents, who indicated that ARISE workers could clean the streets. This would increase overall efficiency since the same number of workers would be doing more work. This change would also improve effectiveness because one of the goals had been to obtain benefits for other community members.

The ARISE employees had access to limited credit facilities given that they (and for many it was the first time in their lives) had an employment contract. While this is potentially beneficial if used wisely to enable the employees to link up with the formal economy, this was not the case. In reality the increased income, to some extent, but more importantly the employment contract, provided the workers with access to credit for the first time. Instead of seeking or obtaining credit to produce products that can be traded, the workers, in most cases, sought credit from large commercial chain stores selling consumables. These consumables do not generate revenue, and an unknown but sizable number of people who took advantage of these chain store credits were not able to repay their debts once the project came to an end in March 2007.

With regard to recruitment policy, the village leaders selected the participants. While this approach allowed for maximum community participation and engagement in the total process, it also provided opportunity for some abuse, whereby strong and influential individuals advanced their own interests and those of their close associates, not necessarily complying with the accepted norms and conditions of the project. In principle, however, we regard this approach to be preferable to an outside entity hiring people in an unorganized or impersonal manner. What was missing was an appropriate mechanism to prevent the abuse of power.

Ideas for a Development Package with a Successful Restoration Component

In the short term, management actions to limit human activities dramatically improved basal vegetation cover within the fenced-in restoration sites. However, it is highly likely that villagers cutting fuelwood and cattle grazing will undo the results of ARISE once the fence is removed. To retain the fence is also unrealistic, in particular for a larger area, since it would jeopardize people's livelihood opportunities. This clearly highlights the fact that sustainable restoration projects in rural and economically deprived contexts need to be incorporated in a development package with an alternative energy source for fuelwood and an alternative grazing policy as core components. The original ARISE plan did make provision for alternative sources of energy and the active development of tourism, but these components were never funded. The implementation of the restoration project—carried out in isolation from the other complementary activities recommended for funding—thus failed to have the desired developmental impact. This provides an important lesson for those drafting or conceiving such projects in South Africa or elsewhere in future.

All of that said, it should be noted that it is not easy to implement an alternative energy strategy. It requires dedicated attention. Madubansi and Shackleton (2006) concluded that fuelwood consumption had not decreased even a decade after electrification of the villages a few hundred kilometers south of Giyani. Biogas produced by a local utility organization may be a suitable alternative for fuelwood for cooking purposes. The establishment of such a utility organization has been proposed for the villages where ARISE is located (Van Ierland 2008) and a few biogas digesters have since been constructed. The organization is, however, still short of funds needed to become fully operational.

The biogas project and ARISE together would form a more coherent development package than ARISE alone. By reducing fuelwood use, the biogas project would contribute to support natural vegetation recovery both within the restoration sites and outside those sites. Furthermore, more community members will benefit from this joint project because biogas consumers and the biogas project could contribute to the creation of at least a few permanent jobs for the ARISE workers. These jobs would (after a certain period) not depend on the availability of government subsidies but on the monthly fees to be paid by the households for the biogas produced.

This development package could further be extended by adding other activities such as sustainable tourism and crop and vegetable production using the organic fertilizer that is a by-product of the biogas generation process (Blignaut 2009). To augment the funding stream, the development of markets for ecosystem goods and services should also be considered, especially that of carbon, despite all the difficulties that such efforts currently entail (Jahed et al. 2006; Turpie, Marais, and Blignaut 2008; Wunder, Engel, and Pagiola 2008).

Conclusion

The ARISE project, the first of its kind in South Africa, was run by a private company that was tasked by the government with community-based natural resource restoration. From the results presented here, such an approach obviously has the potential to provide both social and environmental benefits. In so doing, ARISE was at least effective in the short run in starting various aspects of an ecological restoration project and, as shown, temporarily improving the income of its employees.

For the program's restoration efforts to have long-lasting ecological effects, ARISE should focus on fundamental solutions that remove the drivers of ecological degradation, rather than treating only the symptoms, which can only lead to short-term effects. Supplying households with biogas could be helpful should biogas, based on its physical characteristics and price, be accepted by the community members as a suitable alternative to fuelwood. Such acceptance of biogas would reduce or eliminate the demand for fuelwood, which is one primary driver of environmental degradation.

Other serious shortcomings were revealed in respondents' comments about ways in which the project could be improved. While appropriate and adequate training was provided for the restoration tasks, it does not seem as if the project design succeeded in fulfilling one of the stated goals, namely to prepare its employees for a future job in the commercial sector. Furthermore, ARISE failed to let community members other than those employed benefit from the project, and it lacked efficiency in a strict business sense and from a project perspective. The shortcomings may well partly be the result of the arrangement with the government that almost forces the implementing agent to act as a governmental organization. Future programs should be designed to develop a multiple number of income streams, both private and public, to harness the strength of each of these income streams to the betterment of the project as a whole.

The limited successes of ARISE show that the lowest income groups can benefit from ecological restoration and that they are very capable of contributing to such efforts. However, the program's problems and weaknesses make it clear that such an ecological restoration project on its own, in a context like that of Greater Giyani, is little more a Band-Aid, from both an environmental and a human perspective. For a fundamental solution, an alternative energy strategy, as a minimum requirement, is also needed. Such a strategy could have additional socioeconomic benefits for rural communities as it provides permanent jobs and reduces time spent on fuelwood collection for those not employed by the program. Training in agriculture could lead to the changes in land use needed to prevent overgrazing. The ecological recovery that will be the result of these fundamental solutions could then attract commercial activities, like nature-based tourism, which could further improve the socioeconomic circumstances. We conclude that there are many synergies between ecological restoration and socioeconomic development, and that, in theory, it should be possible to put these synergies into practice.

Acknowledgments

The ARISE management sanctioned and supported our work. Finky Mashimbye assisted with the surveys, and Christelle Fontaine and Evan E. Hjerpe made very helpful comments on earlier drafts of the manuscript.

References

Aronson, J., J. N. Blignaut, S. J. Milton, and A. F. Clewell. 2006. "Natural Capital: The Limiting Factor." *Ecological Engineering* 28: 1–5.

Aronson, J., S. J. Milton, and J. N. Blignaut, eds. 2007. *Restoring Natural Capital: Science, Business, and Practice*. Washington, DC: Island Press.

Blignaut, J. 2009. "Fixing Both the Symptoms and the Causes of Degradation: The Need for an Integrated Approach to Economic Development and Restoration." *Journal of Arid Environments* 73: 696–98. doi:10.1016/j.jaridenv.2009.02.004.

Clewell, A. F., and J. Aronson. 2006. "Motivations for the Restoration of Ecosystems." *Conservation Biology* 20: 420–28.

———. 2007. *Ecological Restoration: Principles, Values, and Structure of an Emerging Profession*. Washington, DC: Island Press.

Costanza, R., and H. E. Daly. 1992. "Natural Capital and Sustainable Development." *Conservation Biology* 6: 37–46.

Daly, H. E., and J. Farley. 2005. *Ecological Economics: Principles and Applications*. Washington, DC: Island Press.

Demarcation Board. 2003. Municipal Demarcation Board Database. http://www.demarcation.org.za.

Dresp, B. 2006. "Restoring Is Believing." *Ecological Engineering* 28: 11–13.

Farley, J., and H. E. Daly. 2006. "Natural Capital: The Limiting Factor. A Reply to Aronson, Blignaut, Milton, and Clewell." *Ecological Engineering* 28: 6–10.

Geerken, R., and Ilaiwi, M., 2004. "Assessment of Rangeland Degradation and Development of a Strategy for Rehabilitation." *Remote Sensing of Environment* 90 (4): 490–504.

Jahed, M., R. Mirrilees, and D. Modise. 2006. "Facilitating the Transition from the Second to the First Economy in South Africa's Rural Areas." *South African Journal of Economic and Management Sciences* 9: 393–99.

Lawler, J. J., J. Aukema, J. Grant, B. Halpern, P. Kareiva, C. Nelson, K. Ohleth, J. D. Olden, M. A Schlaepfer, B. R. Silliman, and P. Zaradic. 2006. "Conservation Science: A 20-Year Report Card." *Frontiers in Ecology and Environment* 4 (9): 473–80.

Madubansi, M., and C. M. Shackleton. 2006. "Changing Energy Profiles and Consumption Patterns Following Electrification in Five Rural Villages, South Africa." *Energy Policy* 34: 4081–92.

Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington, DC: Island Press.

Society for Ecological Restoration (SER) Science and Policy Working Group. 2004. *The SER International Primer on Ecological Restoration*. http://www.ser.org.

Statistics South Africa (SSA). 2006. *Provincial Profile 2004*. Report No. 00-91-09. Limpopo. Pretoria: Statistics South Africa.

Turpie, J. K., C. Marais, and J. N. Blignaut. 2008. "Evolution of a Payments for Ecosystem Services Mechanism That Addresses Both Poverty and Ecosystem Service Delivery in South Africa." *Ecological Economics* 65: 788–98.

Van Ierland, J. 2008. *Greater Giyani Biogas Project: Description of the Village-Scale Biogas System*. Wageningen, Netherlands: Stichting Innovative Development Solution.

Wessels, K. J., S. D. Prince, P. E. Frost, and D. van Zyl. 2004. "Assessing the Effects of Human-Induced Land Degradation in the Former Homelands of Northern South Africa with a 1 km AVHRR NDVI Time-Series." *Remote Sensing of Environment* 91 (1): 47–67.

Wunder, S., S. Engel, and S. Pagiola. 2008. "Taking Stock: A Comparative Analysis of Payments for Environmental Services Programs in Developed and Developing Countries." *Ecological Economics* 65: 834–52.

Yunga, C. T. 2007. "Livelihood Dependence on Ecosystem Goods and Services of Villagers of Greater Giyani (South Africa) and Options for Development." Unpublished MSc thesis, University of Wageningen, Wageningen.

Chapter 16

Jobs and Community in Humboldt County, California

J. Mark Baker and Lenya N. Quinn-Davidson

During the last three decades, ecological restoration has grown from a locally rooted, community-based movement into a widespread practice, diverse in meaning, application, and scale. During this period, restoration has become institutionalized as an important activity within a multitude of national, state, and local government agencies and programs. Restoration now represents a legitimate form of scientific inquiry and scholarship, supported by university research and teaching programs, professional associations, and journals. Perhaps most important, private and public sector funding for landscape-scale and other restoration efforts has steadily increased. Yet the phenomenal growth of the restoration movement, along with the increasing legitimacy accorded particular forms of restoration, has raised the stakes of debates about restoration's purpose and rationale. Growing demand and esteem for restoration have illuminated its dynamic meaning—it ranges from a site for the productive engagement of communities and environments to a science-based practice that allows for the efficient and large-scale restitution of damaged ecosystems.

Restoration has many meanings and applications, the fundamental values and goals of which vary greatly. It is this subjectivity that has time and again compelled restorationists to identify elements of "good" restoration. For Eric Higgs (1997), "good restoration" involves ethical, social, cultural, and political considerations in addition to ecological fidelity. William Jordan (2003) similarly stresses a vision of restoration that integrates both ecology and community in the creation of new environmental and social values. These conceptions offer a powerful restoration ideology, yet as restoration ecology and practice grow more complex, so does the process of integrating science and culture. Higgs (2005) argues that as restoration expands there is an inherent tendency for it to conform to our society's dominant forms of rationality, which emphasize efficiency and technocratic forms of expertise and knowledge. The danger of this shift toward a more narrow reading of the meaning and purpose of restoration, as Higgs and others persuasively demonstrate, is the potential loss of the broader sociocultural values and benefits that restoration could provide, and the undermining of its ability to engage people in activities that simultaneously produce healthier watersheds and communities. Higgs also alerts us to the concern that the increasing

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_16,

emphasis on science, technology, and efficiency, which tends to generate large-scale, technical restoration projects (Clewell and Aronson 2006), may jeopardize participatory, community-based restoration and the unique values that it engenders.

How do these different interpretations concerning the meaning and purpose of restoration manifest in a particular region? Through an empirical analysis of the growing restoration sector in Humboldt County, on California's northern coast, we explore the dynamic tensions between different modes of ecological restoration. We provide a longitudinal perspective on the socioeconomic contributions of restoration in Humboldt County, as garnered through two complementary studies, one in 2003 and the other in 2008. We describe the size of Humboldt County's restoration sector, as characterized by the amount of money that it brings into the county and the number of jobs that it generates. We analyze recent changes within Humboldt County's restoration system—changes that influence the tensions already discussed between community-oriented and efficiency-oriented forms of restoration. Dwelling on these changes and what they mean for different participants in the county's restoration sector provides opportunity for reflection on the relative merits of these different conceptions of restoration and the challenges and opportunities inherent to an integrated approach.

Humboldt County: An Ecological and Economic Overview

Humboldt County is located in the heart of California's redwood region (fig. 16.1). Its 2.3 million acres—80 percent of which are forested—include thousands of acres of coastal redwood forest. Other important forest types are Douglas fir, Douglas fir–tanoak, western hemlock, and oak woodlands. Of Humboldt County's forested area, about 490,000 acres are nonindustrial private forestlands, 608,000 acres are industrial forestlands, and 650,246 acres are federal, state, or tribal lands (Reichard 1998). Coastal dunes, estuarine environments, and coastal and mountain grasslands are also important ecosystems in the area. The coastal portion of Humboldt County experiences moderate temperatures and considerable precipitation due to the influence of the cold Pacific Ocean. Interior regions tend to be drier with greater seasonal variation.

The county's population in 2008 was 132,821, the majority living in cities around the Humboldt Bay region, where most of the area's jobs are concentrated. The cities of Eureka, Arcata, and Fortuna are the largest in the county with populations of 26,000, 16,900, and 10,900, respectively. The unemployment rate in 2008 was 7.2 percent, although by February 2009, it had climbed to 11.4 percent. The per capita personal income in 2006 was $28,885—73 percent of the California average and 79 percent of the national average that year (California Employment Development Department 2009).

The lumber and wood products industry, along with the fishing industry, have historically dominated the county's economy and still represent an important, though declining, sector of economic activity. In 2008, natural resources, mining, and agriculture accounted for 1,700 jobs or 3.5 percent of the county's total industrial employment of 49,200 (California Employment Development Department 2009). Re-

Figure 16.1. A map of California with Humboldt County highlighted.

cent job growth has been concentrated in sectors such as education, trade, transportation and utilities, government, and health care. These sectors are also the county's largest employers. Job growth in these areas has offset the declines in natural resources, mining and manufacturing jobs, although it can be argued that job quality—measured in terms of wages, benefits, and job satisfaction—within the growing service sectors is less than in the area's declining natural resources and manufacturing sectors.

Restoration activities included in this study fall under the general rubric of salmonid, watershed, and ecosystem (e.g., coastal dune, estuary, meadow, forest) restoration projects whose primary purposes are to restore or enhance ecological conditions. We do not consider restoration activities and practices embedded within resource management and extractive regimes, such as forestry or agriculture, nor do we include studies of watershed and ecological processes that are not directly related to restoration project implementation. Inclusion of these activities, investments, and studies, which are certainly restoration related, would have diluted this chapter's focus on ecological restoration as an independent field of economic, social, and institutional activity.

Restoration Organization and Employment Generation in Humboldt County—Steady Growth with Time

Ecological restoration represents an increasingly important part of the Humboldt County economy. In 2002, restoration provided a total of 300 jobs or 208 full-time equivalents (FTEs); by 2007, restoration employment had grown to 549 jobs or 247 FTEs. Restoration employment is distributed across three primary sectors—public, private, and tribal. These sectors are characterized by the programs they administer, the lands they restore, and the jobs they generate.[1] The sectors themselves reflect the historical evolution of restoration work in the area, the existing patterns of landownership and settlement, the array of federal and state public lands management agencies as well as regulatory agencies in the region, and the robust civic culture of the North Coast. The web of relationships that binds people and organizations involved in restoration provides cohesiveness as well as flexibility to the restoration sector. Although distinct sectors exist, they are by no means mutually exclusive; financial resources, technical capacity, scientific expertise, heavy equipment, labor, regulatory oversight, coordination, and local environmental knowledge are some of the elements that flow within and between them. This section describes each sector's nature, structure, and contribution to restoration employment in Humboldt County.

Public Sector

There are two primary ways of organizing restoration work on public lands. The first way involves the public land management agency taking full responsibility for all tasks related to a restoration project, except for project implementation, which may be contracted out to a private contractor. Although there are some important exceptions, restoration work in Redwood National Park, the Six Rivers National Forest, Humboldt Redwoods State Park, and U.S. Fish and Wildlife Service units in Humboldt County is generally carried out in this manner. This approach is extremely staff intensive and generally does not involve extensive collaboration with other nodes on the restoration network, except for the private contractors who are hired to implement the projects.

The second primary way of organizing restoration work is for the public agency to enter into a multiyear, cooperative agreement with a nonprofit organization in which separate task orders are drawn up for each individual restoration project. The Bureau of Land Management (BLM) has embraced this approach. Since the mid-1990s, the BLM has entered into multiyear cooperative agreements, under the authority of the Cooperative Assistance Agreement Act of 1977, with the Mattole Restoration Council, the Mattole Salmon Group, and the Redwood Community Action Agency. These cooperative agreements stipulate that local community partners participate in the decision-making and planning processes related to restoration. Project implementation is carried out as specified in individual task orders and is often contracted out by the nonprofit. The partnerships that have been built through the use of the cooperative agreement approach, which requires matching funds from the agency partner as well as community participation and involvement, have helped to develop the institutional capacity of these area nonprofits as well as the strength of the overall restoration network.

The nature of funding for public sector grant management and project implementation renders it relatively stable. Funding often comprises an annual allocation for specific positions and types of projects, and it is not as sensitive to the fluctuations in restoration funding priorities and competition as is the private sector. This relative stability is confirmed with public sector employment data, which exhibits only moderate change during the last five years. In 2002, the public sector provided fifty jobs (or a total of thirty-seven FTEs), and in 2007, it provided sixty-seven jobs (or a total of thirty-four FTEs). The total number of jobs did vary with time, yet this may be a result of reporting differences, as the FTE counts are similar for both years.[2]

Private Sector

The types of collaboration that emerge in private lands restoration projects illustrate the complexity and the density of the restoration network. Typically, restoration projects are identified and prioritized through watershed assessments or inventories, and they are often designed and proposed by one of the local nonprofit organizations. State and federal funding sources generally support such projects, which a local contractor implements under the guidance of nonprofit staff. The landowner often provides in-kind and cash contributions. This is a lengthy process—it is not at all uncommon for more than two years to elapse between initial project proposal development and project completion.

Given the complexity of restoration activities in the private sector, practitioners must have the capacity to navigate and adapt to numerous pressures and changes. Of the challenges that Humboldt County restoration practitioners often face, funding instability and permitting are perhaps the most important. In our phone surveys, practitioners consistently referred to the volatility of restoration funding. One practitioner discouragingly called restoration the "land of diminishing funds," while another referred to it as a roller-coaster ride. Others expressed concern about the sustainability of the restoration sector, emphasizing the importance of diversifying funding and prioritizing local businesses, contractors, and projects over those from out of the area. Another key challenge for restoration work on private lands (and on public lands, although to a lesser degree) concerns the permitting requirements for restoration projects. Almost invariably, an array of permits or consultations from a variety of agencies must be obtained before a restoration project can be implemented. These can include permits from the Army Corps of Engineers, the California State Water Resources Control Board, the California Department of Fish and Game, the California Coastal Commission, and other state and county agencies. Consultations are often also required with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

The restoration system in Humboldt County has long been characterized by funding instability and bureaucratic hurdles, and recent trends toward funding fewer, larger, and more technologically complex restoration projects have further challenged the ability of small, community-based watershed organizations to continue their work. One nonprofit organization that has perhaps bucked this trend is the Mattole Restoration Council (MRC). The Mattole River watershed has an unusual blend of ecological and sociocultural qualities that contribute to the success of the MRC. The watershed is home to Coho salmon (*Oncorhynchus kisutch*), a species that has drawn increasing attention from funders in recent years. It is also home to many Humboldt County restoration pioneers, including Freeman House, author of *Totem Salmon* (House 1999). These local restorationists have firmly established a culture of community-based, participatory restoration; one that underlies the hard work and success of the MRC. Foresight and careful planning, purposeful growth strategy, and capacity building have all positioned the MRC well to successfully compete for recent flows of bond and other funding. Throughout this process, the MRC has continued its commitment to a broadly defined notion of ecological restoration, simultaneously diversifying restoration goals and funding sources. Their projects range from in-stream habitat enhancement to upslope watershed improvement to education, and their funding portfolio includes over forty different agencies and foundations. It is this combination of attributes that has allowed the MRC to grow more in recent years than any other entity in the Humboldt County restoration system—from five FTEs in 2002 to almost thirty-nine in 2007.

The growth of the MRC accounts for most of the increase in private sector restoration employment in Humboldt County since 2002. In 2002, the private sector provided 240 jobs (or 160 FTEs), and in 2007, those numbers had grown to 447 jobs (or 187 FTEs). Employment within the MRC increased by thirty-four FTEs between 2002 and 2007, whereas the entire private sector only increased by approximately twenty-seven FTEs. Thus, apart from employment growth within the MRC, private sector employment has seen a minor *decrease* in FTEs since 2002. Although the number of jobs in the private sector has increased, the total employment that those jobs provide (as represented by FTEs) has changed little in the last five years. The increasing gap between jobs and FTEs may point to a shift in the nature of private sector restoration employment—from many small organizations with year-round (though limited) staff to fewer, bigger entities with relatively high seasonal subcontracting capacities and needs.

Tribal Sector

The Yurok tribe and the Hoopa Valley tribe have both been extensively involved in watershed restoration efforts in Humboldt County. Beginning in 1994, watershed assessments and restoration work on the Hoopa Valley Indian Reservation were funded to a large extent by the federal Jobs-in-the-Woods program. The program played an important role in building in-house capacity for watershed analysis and restoration project planning and implementation. During the 1980s and early 1990s, most of the watershed assessments and some of the restoration project implementation work were contracted to outside professional geologists, hydrologists, and equipment contractors. However, by the mid-1990s, this work began to shift in-house, using the growing skills and expertise of the tribe's own employees. Currently, the tribe does its own watershed assessments, roads-related restoration work, and monitoring.

Most of the Yurok tribe's restoration efforts are organized through the Yurok Watershed Restoration and Fisheries Departments. The Watershed Restoration Department's planning, assessment, and project implementation work occurs primarily on land owned by the Green Diamond Resource Company (formerly Simpson Resource Company), which owns the majority of the Yurok ancestral territory. The Watershed Restoration Department integrates restoration training with project planning and implementation. Currently, the Yurok tribe is working to secure funds for a land purchase from Green Diamond Resource Company. If the deal goes through, the tribe will purchase about forty-seven thousand acres of ancestral territory in two phases; these lands will offer innumerable opportunities for watershed restoration and conservation.

Some tribal restoration-related work also takes place on adjacent public lands. The Yurok tribe and Redwood National and State Parks have signed a memorandum of understanding (MOU) for government to government relations to facilitate these efforts. The tribe and the National Park Service have also signed Self-Governance Annual Funding Agreements. Both the MOU and the Annual Funding Agreements are designed to foster collaborative management of cultural and natural resources within Redwood National and State Parks. While the MOU and Annual Funding Agreements cover a wide variety of issues ranging from the application of traditional ecological knowledge to the provision of employment opportunities, they also provide the basis for collaboration between these entities for the purposes of watershed restoration. The Karuk tribe has also performed restoration work on public lands in collaboration with the U.S. Forest Service. Project costs were split between the tribe and the Forest Service, who received Department of Fish and Game funding to complete the work.

Employment in the tribal sector appears to have grown significantly since 2002, when it provided eleven jobs (or eleven FTEs) in Humboldt County. In 2007, it provided thirty-five jobs (or twenty-six FTEs). The Yurok Fisheries Department is responsible for much of this growth, as they implemented significantly more restoration projects in Humboldt County in 2007 than in 2002 (much of their work in 2002 took place in neighboring Del Norte County). County lines aside, the tribal sector represents an increasingly robust and important element of the North Coast restoration system.

Restoration Funding in Humboldt County—Increasing Administrative Efficiency?

Approximately one dozen federal and state agencies—using a much larger number of programs, initiatives, ballot measures, and legislation—support the natural resources restoration system described in the prior section. Private foundations and the Humboldt County Department of Public Works also support restoration activities. The great majority of funding for restoration comes in the form of grants to local nonprofit organizations, businesses, landowners, tribes, municipalities, and, in some cases, to public land management agencies. To develop a credible estimate of the money that comes into Humboldt County for restoration, we contacted the primary state and federal agencies and foundations that provide support for salmonid, watershed, and ecosystem restoration projects. We focused on projects whose primary purposes are to restore or enhance ecological conditions. From each entity we obtained detailed information about the kinds and amounts of restoration support they provided between 1995 and 2007 (table 16.1). This information was analyzed carefully to ensure a comprehensive, credible, and accurate estimate of county-level investment patterns.

The information we gathered shows that between 1995 and 2007, the restoration sector brought almost $135 million into Humboldt County for within-county restoration work. From 2000 to 2007, restoration-related work brought more than $107 million into the economy, averaging more than $13 million per year. From any perspective, this represents a significant contribution to the county's economy. Moreover, both table 16.1 and figure 16.2 provide what we feel to be conservative estimates of restoration funding in Humboldt County, as they do not reflect all contributions to restoration-related activities. Excluded contributions either fit our definition of restoration but are too diffuse to capture, or they are outside the realm of our definition but surely contribute to restoration efforts in the county.[3]

As our data portray, ecological restoration represents a burgeoning sector of the Humboldt County economy. In 2006 restoration brought well over $18 million into the county, and in 2007 restoration funding totaled just under $18 million. Such amounts are unprecedented. In fact, funding amounts in 2006 and 2007 were more than $7 and $6 million higher, respectively, than the average of the five previous years. Thus, it came as a surprise when, during our research, restoration practitioners repeatedly referred to a severe decline in restoration funding during the last several years. The perception that public funding for restoration was drying up, which the overall increase in funding levels contradicts, led us to analyze the funding patterns of the primary public agencies that fund restoration. Could agency-specific variations in funding patterns account for this apparent contradiction?

Two entities that have significantly influenced restoration funding in Humboldt County are the California Department of Fish and Game (DFG) and the State Water Resource Control Board (SWRCB). The DFG has long been a pillar of ecological restoration funding in the state and in Humboldt County. Much of its funding is administered through the Fisheries Restoration Grants Program, which supports a wide range of restoration activities, from habitat enhancement to watershed education. By contrast, the SWRCB has become a primary source of restoration funding only in recent years as the 2002 passage of Propositions 40 and 50 dramatically increased funding contributions for restoration from the SWRCB. Both propositions provide bond funding for projects that improve and/or protect water resources in California. Such funds, in addition to baseline statewide funding provided by the Clean Water Act

TABLE 16.1

Spending on restoration projects by various government agencies, Humboldt County, California, 1995–2007

	Bureau of Indian Affairs	Bureau of Land Management	National Fish and Wildlife Foundation	National Park Service	US Fish and Wildlife Service	US Forest Service*	Department of Water Resources	Coastal Conservancy
1995	$311,329	$943,500	$40,000	$527,197	$280,490	$191,410	$63,624	$450,000
1996	$275,666	$539,924	$0	$167,870	$158,820	$323,700	$0	$0
1997	$293,708	$837,308	$20,000	$621,130	$211,297	$236,517	$0	$0
1998	$510,934	$366,000	$380,876	$1,120,057	$109,849	$318,155	$0	$0
1999	$235,774	$421,746	$46,210	$1,793,258	$199,155	$465,507	$0	$75,000
2000	$248,149	$1,435,762	$128,992	$2,443,216	$370,214	$189,951	$158,826	$185,000
2001	$363,795	$1,284,340	$157,350	$1,345,986	$108,254	$217,512	$1,918,402	$680,000
2002	$346,010	$1,976,183	$20,000	$1,383,050	$262,533	$51,020	$502,209	$1,036,000
2003	$396,226	$874,605	$0	$1,689,708	$209,378	$0	$0	$1,000,000
2004	$392,198	$1,107,484	$3,000	$666,141	$292,884	$0	$95,500	$0
2005	$581,124	$838,987	$0	$705,000	$1,167,159	$0	$0	$1,283,272
2006	$840,053	$863,112	$0	$2,382,000	$470,858	$0	$0	$1,016,000
2007	$170,000	$645,120	$0	$3,240,000	$954,452	$0	$0	$493,000
Agency Total	$4,964,966	$12,134,071	$796,428	$18,084,613	$4,795,343	$1,993,772	$2,738,561	$6,218,272

TABLE 16.1

Continued

	California Conservation Corps	State Water Resource Control Board	California Department of Parks and Recreation	California Department of Fish and Game	Wildlife Conservation Board	Humboldt County Dept. of Public Works	Year Total All Sources
1995	$1,000,000	$0	$68,000	$472,170	$288,197	NA	$4,324,588
1996	$1,000,000	$0	$146,849	$570,628	$234,581	NA	$3,418,038
1997	$1,000,000	$402,504	$540,806	$2,320,444	$93,650	NA	$6,577,364
1998	$1,000,000	$419,315	$99,990	$1,039,850	$0	NA	$5,365,026
1999	$1,305,646	$248,751	$705,186	$1,980,911	$159,388	NA	$7,636,532
2000	$1,301,120	$158,826	$848,856	$4,818,131	$99,700	NA	$12,386,743
2001	$2,115,109	$330,534	$317,148	$2,295,063	$24,090	$464,833	$11,622,416
2002	$1,685,591	$52,209	$329,785	$6,652,388	$0	$199,775	$14,496,753
2003	$906,247	$1,589,653	$120,620	$3,943,715	$0	$133,889	$10,864,041
2004	$906,246	$1,745,325	$0	$4,374,860	$0	$55,701	$9,639,339
2005	$692,132	$990,876	$0	$4,510,016	$893,000	$129,345	$11,790,911
2006	$1,700,000	$10,197,339	$85,956	$1,248,129	$0	$0	$18,803,447
2007	$2,420,403	$6,376,933	$300,402	$2,960,496	$335,000	$90,000	$17,985,806
Agency Total	$17,032,494	$22,512,265	$3,563,598	$37,186,801	$2,127,606	$1,073,543	$134,911,004

*The US Forest Service did implement restoration projects between 2003 and 2007, for which the CA Department of Fish and Game provided most of the project funds. Projects funds are, therefore, included in the DFG column and not in the USFS column.

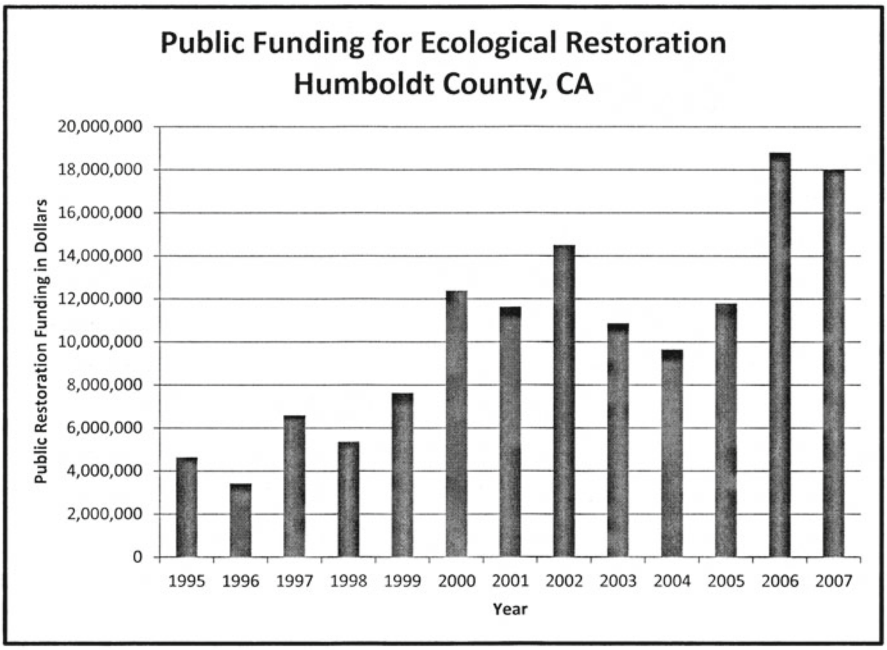

FIGURE 16.2. Public funding for ecological restoration, Humboldt County, California, 1995–2007.

(Section 319[h]), are administered by the SWRCB and its regional counterparts. Changes in patterns of restoration funding within these two agencies provide insights into changes within the overall restoration system in Humboldt County.

As table 16.1 indicates, annual DFG funding for restoration has decreased since its peak years of 2000 to 2005, while SWRCB funding has exploded since 2002. Despite the overall decline in DFG funding levels for restoration, the average amount funded per project has dramatically increased during the last fourteen years, as figure 16.3 shows. For example, DFG funding for restoration in 2006 was less than one-third of what it was in 2005, yet the average amount funded per project dropped only slightly from $140,000 to slightly more than $120,000. This amount is still significantly higher than the average per project funding level of between $20,000 and $60,000, which prevailed throughout the 1990s. These shifts imply a significant change in the overall pattern of DFG restoration funding toward fewer, larger, more technically and ecologically complex restoration projects. Practitioners we interviewed also expressed concern about what they perceive to be a decreasing emphasis within the DFG on watershed education. Our data support this perception. The agency funded three education and outreach projects in 2003, three in 2004, two in 2005, and one in both 2006 and 2007.[4] Overall, current patterns of DFG funding favor larger restoration firms and contractors with the requisite skills and capacity to manage large-scale projects.

The SWRCB has adopted a similar pattern of funding fewer, large-scale restoration projects. In part, this is a response to the dramatically increased amounts of restoration funding that Propositions 40 and 50 generated, which the SWRCB was

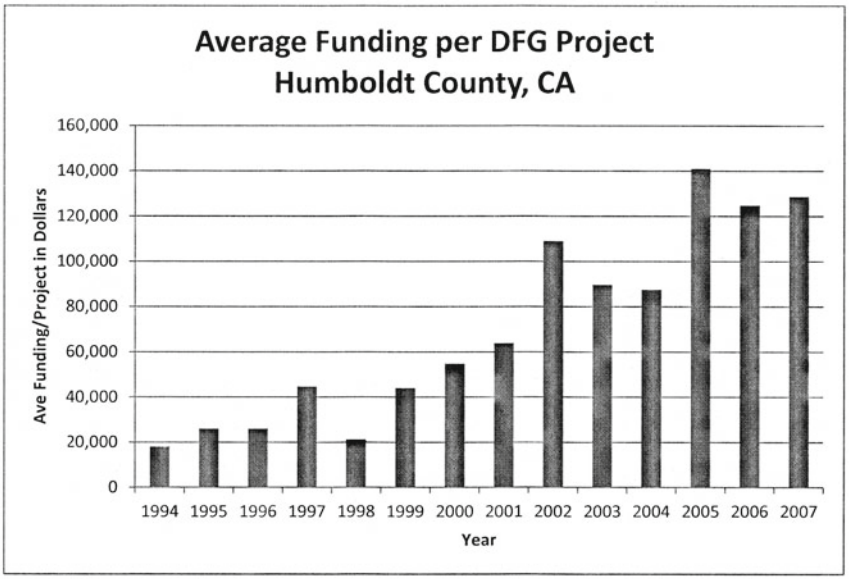

Figure 16.3. Average funding per DFG project, Humboldt County, California, 1994–2007.

charged with administering. Prior to 2002, the agency managed only annual Clean Water Act funding—approximately $5 million for the entire state. Since 2002, agency staff, whose number of positions has not increased, also manages millions of dollars of bond funding for restoration. For instance, in Humboldt County alone, SWRCB funding was greater than $10 million and $6 million in 2006 and 2007, respectively. Although the SWRCB previously used Clean Water Act funds to make small grants to restoration practitioners, they now rarely give grants less than $250,000. From the standpoint of those who administer restoration funds, making large grants for a few projects is a much more efficient way to spend bond money than making many grants for smaller projects. In the case of the SWRCB, staffing constraints have driven the trend toward fewer, larger projects. Administrative efficiency, driven by the exigency of managing larger grant portfolios with limited staff support, seems to be driving at least some of the current shifts in restoration funding.

Perceptions about current restoration challenges among agency staff further legitimize these shifts. In our interviews, it was not uncommon for agency staff who manage restoration funding to express the opinion that much of the remaining restoration work in the North Coast area requires large-scale, more technically complex projects. One public agency grant manager explained how funds are becoming concentrated in the hands of progressively bigger restoration practitioners, as small groups lack the technical expertise, subcontracting capabilities, and statewide competitive edge to secure grant funds. Another grant manager asserted, referring to the shift from smaller to larger projects, that "all the easy stuff has already been done." The implication of these views is that in order to successfully address the remaining restoration challenges, work must be packaged into large, technically and ecologically complex units.

Such packages generally rely more on heavy equipment and less on labor-intensive restoration methods and techniques.

While we are not in a position to evaluate the relative ecological effectiveness of large and small restoration projects (an important research question in its own right), we can make some observations about the community effects of the shift toward larger, more technologically complex restoration efforts. Restoration practitioners, for example, commented on the negative effects on small restoration businesses and organizations. Indeed, some practitioners argued that small restoration projects could produce more efficient restoration outcomes than larger projects. One interviewee noted that currently there "is a shift from many small, very efficient grants, such as the CDFG Fisheries Restoration Grants Program, towards large, very inefficient [grants] to a few groups/agencies that can absorb the high overhead of such projects" (phone survey 2008). In contrast to the administrative efficiency of packaging funding into fewer large bundles, this perspective highlights a different form of efficiency, one that emphasizes the selective ability of smaller restoration organizations to minimize administrative overhead and direct a greater proportion of a restoration grant to achieving restoration objectives "on the ground." This perspective surfaced often when interviewees described the DFG Fisheries Restoration Grants Program's historic support for a diverse array of small and large restoration projects, in contrast to the "mega" restoration projects funded by the SWRCB, which were sometimes characterized as inefficient or even cumbersome.

Not all restoration nonprofits and businesses in Humboldt County have been able to successfully adapt to these changing funding priorities and requirements. Shifting priorities and funding criteria exert a not-so-subtle influence on the meaning of restoration itself. Several small watershed-based groups have struggled unsuccessfully to maintain steady levels of funding support. One local heavy equipment operator, who has been involved in restoration in Humboldt County since 1979, rightly noted that the decline in contracts for restoration work for smaller operators is due to distributional issues rather than declines in overall funding levels. As support for smaller, community-based restoration organizations dwindles, the restoration system in Humboldt County may begin to resemble a more traditional business sector. If this happens, the ideology of stewardship that connects communities to their places through environmentally engaged action will exert a diminishing influence on the restoration sector. One practitioner explained it as follows:

> It seems that restoration funding was more widely available to smaller outfits at the beginning of the "restoration bubble." Now most of the funding is allocated through larger nonprofits or more corporate entities that can do larger, multi-site projects and deal with the huge overhead involved. Not necessarily a terrible transition, but somewhat lamentable that small watershed organizations are looked upon less favorably today. (phone survey 2008)

These shifts in funding patterns away from smaller watershed organizations toward larger nonprofits and corporate entities are consistent with Higgs's predictions that as restoration becomes more popular, efficiency and technological complexity will trump participation and community as guiding principles (2005, 161). Such shifts also account for the apparent contradiction, discussed earlier, between the perceptions among some practitioners that support for restoration was diminishing while the actual overall funding levels were increasing. The move toward fewer, larger, more technologically complex projects suggests that an efficiency-oriented system is gaining prominence over more integrative forms of ecological restoration. Is this a desirable pattern of change? What trade-offs and differing conceptions of the meaning of restoration are entailed by these shifts? As the Humboldt County restoration system continues to grow, such questions will be of increasing interest and concern.

Restoration and Community

Restoration contributes significantly to the North Coast economy. However, restoration in Humboldt County represents much more than jobs and money. A vibrant element of community and personal activism has been woven into the restoration system since its inception in the early 1970s. For many of the people involved, commitment to restoration springs from a passionately held vision of healthy watersheds, reinvigorated salmon runs, and well-stewarded working landscapes. This vision often emerges from a deeply rooted sense of place, from a desire to have a meaningful relationship with the natural environment, and from close connections with other like-minded restoration practitioners and conservationists. These very ideals inspired those who, during the 1970s, pioneered many of the restoration practices and techniques that are commonplace today in Humboldt County and the surrounding region. Often working on shoestring budgets or sometimes on a volunteer basis, these individuals were the early innovators of community-based fish-box hatcheries, in-stream restoration techniques, and monitoring methods and technologies. For many, the idea of actually earning a living from restoration work came as an afterthought.

While restoration in Humboldt County has become institutionalized in the last thirty years, the early visions of communities working toward a more harmonious integration of people, watersheds, and working landscapes can still provide a powerful ideological and practice-based anchor for the restoration system. Community engagement with the restoration process serves to build community, as well as connections between people and the natural environment, while simultaneously enhancing ecological conditions. Freeman House, writing about community, place, and restoration in the Mattole River watershed in southern Humboldt, conveys this notion in the following manner: "Engaging the lives of wild salmon in a single watershed has created a situation wherein the peoples of our place have begun to experience themselves as functional parts of the place itself. Engaging the lives of any part of the wild in any self-defined natural area will lead to the same experience" (House 1999, 198). This approach is rooted in the understanding that environmental stewardship entails active engagement with ecosystems and landscapes. Carol Vander Meer, executive director of Friends of the Dunes, an important restoration nonprofit organization in Humboldt County, echoes this sentiment when she writes that, "By participating in restoration I find a way to actually be a positive part of the ecology of the dunes. . . . Joining together with other community members who care about this place completes my sense of connection and belonging" (Vander Meer 2001,1). These sentiments evince a strong commitment to integrative forms of restoration, but are they at odds with recent and current transformations within the North Coast restoration sector?

Theoretical debates about the meaning of restoration come to life in Humboldt County, where tensions and transitions between small-scale, community-based efforts and large-scale, technical efforts are increasingly manifest. Current funding structures and priorities favor the latter mode of restoration over the former. How are we to make sense of these changes, and what are their implications for the future course of restoration in Humboldt County? Is science eclipsing community, as argued by Higgs (2005), or do the two complement each other, as suggested by Clewell and Aronson (2006)? On the one hand, we see critical changes in funding structures and priorities through which efficient, technical, science-based restoration is gradually supplanting models of integrative restoration that produce both community and ecological values. Yet on the other hand, we see that the Mattole Restoration Council, one of the most successful nonprofit restoration organizations in Humboldt County, has crafted an approach that draws on community vision and strength while simultaneously building administrative, scientific, and technical capacity and expertise. This unified approach, which successfully conforms to and indeed takes advantage of the current restoration funding structure, is also able to remain true to restoration practitioners' earlier commitment to community-based stewardship and restoration practice.

Conclusion

How do we ensure that ecological restoration, and the desirable ecological and community values it produces, grows with the restoration economy? Part of the answer involves acknowledging the diversity of potential meanings and purposes of restoration, and encouraging forums in which those meanings and purposes can be rendered explicit, discussed, and debated. Acknowledging the important role of choice as it influences the who, what, why, when, and where of ecological restoration is an important part of this process (Allison 2007; see chaps. 5, 6, 10, 11, this volume). Identifying the actual and potential trajectories of restoration, as this study has done for Humboldt County's restoration system, can provide the basis for informed discussion about which forms of restoration should be supported and why. Unparalleled in both complexity and potential, ecological restoration requires unprecedented deliberation in approach—efficiency-based and community-based forms of restoration may be compatible, but integration entails considerable cognizance and reflection on the part of all involved.

Acknowledgments

This research would not have been possible without the generous financial assistance provided by the Ford Foundation, the William and Flora Hewlett Foundation, the

Sierra Institute for Environment and Community, and Humboldt State University. We are grateful to the many members of the North Coast restoration community whose willing participation made this study possible. State, federal, and local agency staffs were also invariably supportive of this project and contributed toward it in many ways.

Notes

1. Employment information was collected in 2003 and again in 2008. Phone surveys with more than seventy Humboldt County organizations, businesses, agencies, and tribes provided the original data set for 2002, and the same methods were used to collect updated data for 2007. Information gathered in the phone surveys was used to determine the number of restoration jobs and to calculate the full-time equivalents (FTEs) these jobs represented for each employment sector. There are three categories of restoration jobs: full-time, part-time, and seasonal. Seasonal jobs are short duration (usually two months), full-time positions. Full-time and part-time jobs are year round. Phone survey information concerning restoration job category, duration, and number of hours was used to determine FTEs. For consulting firms and non-profit organizations, we assumed that one FTE is the equivalent of forty-eight 40-hour weeks (fifty-two weeks minus two weeks paid leave and two weeks holiday) or 1,920 hours. Definitions of full-time work (the amount required in order to qualify for an annual pension credit and health benefits) for construction and trade workers varies from 1,200 hours per year for the Carpenters Union to 1,320 hours per year for the Operating Engineers Union. Due to the seasonality of heavy equipment work in this region (restoration and otherwise), most operators consider 1,300 hours of work to be a good year (Brian Bishop, pers. comm.). Accordingly, we converted the estimates of time spent on restoration work by equipment contractors into FTEs at the rate of 1,300 hours per FTE. Full-time, part-time, seasonal, and temporary positions were included in our job estimates. We did not include any volunteer or other unpaid work.

2. These numbers do not include employment provided by the California Conservation Corps and the Americorps Watershed Stewards Program. These two programs, which contribute greatly to restoration activities in Humboldt County, provided close to fifty-four FTEs in 2007. They were not included in the public sector employment figures because Conservation Corps and Americorp participants receive stipends, not wages.

3. Excluded contributions may include grants from small foundations and other funders that we were not able to capture; in-kind contributions from landowners, such as materials, heavy equipment, and labor; and restoration work embedded in extractive resource management regimes, such as forestry.

4. Decreases in funding for watershed education are attributable in part to decreases in total DFG funding, as the pattern of education funding roughly parallels that of total DFG funds.

References

Allison, S. K. 2007. "You Can't Not Choose: Embracing the Role of Choice in Ecological Restoration." *Restoration Ecology* 15 (4): 601–05.

California Employment Development Department. 2009. "Labor Market Information." http://www.labormarketinfo.edd.gov.

Clewell, A. F., and J. Aronson. 2006. "Motivations for the Restoration of Ecosystems." *Conservation Biology* 20 (2): 420–28.

Higgs, E. 1997. "What Is Good Ecological Restoration?" *Conservation Biology* 11 (2): 338–48.

———. 2005. "The Two-Culture Problem: Ecological Restoration and the Integration of Knowledge." *Restoration Ecology* 13 (1): 159–64.

House, F. 1999. *Totem Salmon: Life Lessons from Another Species*. Boston: Beacon Press.

Jordan, W. 2003. *The Sunflower Forest: Ecological Restoration and the New Communion with Nature*. Berkeley: University of California Press.

Reichard, N. 1998. *Financial Incentives for Stewardship of Nonindustrial Private Forestland in Humboldt County*. Eureka, CA: Redwood Community Action Agency.

Vander Meer, C. 2001. "Developing a Sense of Place." *Dunesberry, Newsletter of Friends of the Dunes* 20: 3.

Chapter 17

Game Theory Tools for Improving Ecological Restoration Outcomes

Mark Buckley and Karen Holl

Successful restoration and maintenance of ecological functions often requires understanding local decision making and behavior, as discussed in the introductory and subsequent chapters of this volume. Furthermore, successfully completing and maintaining most restoration projects requires participation and cooperation from a range of stakeholders, including local and state government agencies and officials, and local businesses and neighboring landowners.

Several fields of human and social analysis consider decision making and behavior. The field of economics usually starts from a set of assumptions based on limited resources, trade-offs, and rational (self-interested) actors. Some uses of limited natural resources, particularly consumptive uses, preclude ecological functions and processes that, among other things, provide ecosystem goods and services to society (Daily 1997). Due to new awareness and potentially new value from these ecosystem goods and services, some communities decide the losses of these goods and services are no longer justified. These reversal decisions leading to restoration projects are not always unanimously supported throughout the community, and conflicts can arise. Understanding individual decision making and behavior that runs counter to restoration goals can help to identify restoration strategies that account for these dynamics and avoid unintended consequences.

Game theory, in its application as a field of economics, provides quantitative analytical techniques specific to individual decision making, particularly for situations in which decisions by individuals interact and determine outcomes. Many insights have come from analyzing very simple situations, such as deciding where to eat or how to meet up with someone (without cell phones), that have been usefully applied to much more complex problems. Game theory research intensified during the Cold War in attempts to understand international conflicts, particularly those potentially involving nuclear weapons (Schelling 1960). Game-theoretic analyses have since expanded to consider situations in business, politics, sociology, biology, and more (e.g., Casson 1994; Gintis 2000). Thomas Schelling, winner of the 2005 Nobel Prize in Economic Sciences and close adviser to several U.S. presidents during the Cold War era, has said his recommendations for perilous situations, such as the Cuban Missile

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_17, © Island Press 2011

Crisis and a direct telephone hotline between the White House and the Kremlin, came from observing interactions within his family (Schelling 1966). The United States and the Union of Soviet Socialist Republics each preferred to avoid nuclear war, but several plausible scenarios could have led to such an outcome. While this is obviously an extreme and the stakes for avoiding the worst-case scenario were of incalculable value, lessons for avoiding outcomes that are undesirable to all parties can provide benefits for restoration planning.

Insights from game theory have informed natural resource management for decades. The prisoner's dilemma (described later in this chapter, Rapoport and Chammah 1965) explains the socially inefficient tragedy of the commons (Hardin 1968) that hinders management of fisheries, forests, and other limited open-access resources. Ostrom and others have studied communities that deal with common-property issues (e.g., Ostrom 1991) and have modeled such interactions using game theory to develop improved management rules (Ostrom, Gardner, and Walker 1994), such as for irrigation systems (Weissing and Ostrom 1993). Lessons from game theory have generally permeated the practice of economics, and its application to ecological restoration planning is increasing.

Restoration Projects and Social Conflict

Subsets of stakeholders may oppose restoration projects for a variety of reasons. In the most general sense, they can be seen to expect to incur costs or lose benefits as a result of restoration. For example, farmers in the Sacramento River Conservation Area in north-central California opposed large-scale forest restoration on former farmlands due to concerns about loss of prime farmland as well as transboundary effects of restoration on farming, such as small mammals predating nut crops and increased flooding due to slowed water flow in areas with forest trees (Langridge, Buckley, and Holl 2007; Buckley and Crone 2008). This opposition from farmers has reduced funding, the areas open to restoration, and local government support. It has also motivated on-farm behaviors that work against ecological restoration goals such as rip-rapping streambanks, building fences, or removing vegetation buffers. Restorationists in turn have responded by working to better quantify and minimize the transboundary impacts of restoration (Golet et al. 2009).

In some cases, differences of opinion arise over target ecological composition. Ecological restoration efforts in Chicago, Illinois, have met opposition from area residents against restoration methods that involve removing trees, using prescribed fires, and removing nonnative hedges that have become important resources for bird watchers (Gobster and Barro 2000; Gobster 2001). Resolving conflict between these stakeholders led to a compromised management plan that included both native and nonnative species. A survey of Chicago residents found strong correlation between expectations of restoration outcomes and attitudes (Bright, Barro, and Burtz 2002).

Many studies (including several in this volume and in Gobster and Hull 2000) have attempted to understand and make recommendations to resolve these conflicts in a qualitative manner. Game theory tools provide a potentially quantitative approach to understanding how stakeholders can potentially positively or negatively affect restoration outcomes, why they make decisions that are counter to or supportive of restoration goals, and how restoration can be planned and implemented to achieve the desirable outcomes. Yet, game theory has rarely been employed in a restoration context.

In this chapter, we briefly describe a game theory approach using examples to illustrate how it can aid restoration planning. Within game theory, there are two branches of analysis: noncooperative (more commonly used) and cooperative game theory. We begin by describing noncooperative situations, which are common in restoration, and later briefly discuss the process for moving to cooperative situations. We conclude by reiterating what can be learned from game theory that is applicable to restoration projects generally, as well as in specific situations. We draw on a range of examples to illustrate points but refer repeatedly to large-scale efforts to restore riparian forest on agricultural lands along the Sacramento River, the largest river in California. These efforts are described in more detail in several other publications (Golet et al. 2006; Buckley and Crone 2008; Golet et al. 2008, 2009). Many of our examples are general situations rather than specific case studies for illustrative purposes, and the reality is that real-world situations always include confounding factors that must be weighed as well. Following introduction of the tools and concepts, we will describe some of our own experience applying these principles for restoration projects.

Game Theory Concepts

Using game theory as a framework begins with organizing the people, relationships, and available information. Analysis of likely outcomes, and ways to improve outcomes, builds from the structure described in this section.

Overall Approach

The basic approach of game theory for analyzing a situation can provide previously unconsidered information that can improve restoration outcomes. The basic steps for analyzing a restoration decision scenario entail the following:

- Identify all parties (groups or individuals) that can affect the restoration outcome.
- Identify the choices facing these parties that might affect the restoration outcome.
- Map the relevant decisions that might affect the restoration outcome.
- Identify the individual trade-offs for each party for their decisions.
- Identify the impacts on other parties for each possible decision.

In reality, the number of possible decisions and interactions facing a restoration project is typically too great to practically map and consider them all at once. Large general strategies and small pieces of the overall decision process can be approached much more readily. Limiting any particular analysis to less than approximately six parties and preferably two or three is more manageable and makes for more accessible conclusions. This process can be useful on its own to help bring focus to the more important issues and conflicts.

Individual Preferences

Understanding the decision-making process of other parties affecting restoration outcomes in a systematic way can identify similarities and dissimilarities among individual preferences. Two individuals or groups might have different priority rankings for outcomes. For example, two people who both want to restore native vegetation and native animals to a park, but each prioritizes one over the other. It is a more difficult situation when preferences are directly opposed, such as revegetating with nonnative plants versus native plants or a more manicured design altogether.

Issues of consistent preferences among stakeholders (e.g., unanimity that water quality should be the top management target for a stream) provide low-hanging fruit for early success. Working on such goals can establish important communication channels and accepted implementation protocols that can help with later, more contentious decisions.

Decision Trees

Decision trees or game trees (also called the extensive form) provide a visual mapping of the players, decisions, and outcomes for a particular scenario (see textbooks such as Osborne 2003 or Fudenberg and Tirole 1991). At each decision node, a party has a set of options. Early decisions will determine the decision nodes, and, thus, possible choices and outcomes of subsequent decision makers.

Expected Outcomes

Once the players, decisions, outcomes, and preferences are identified, one can begin to assess likely outcomes for various scenarios. The standard approach that works for most situations of sequential (rather than simultaneous) decisions involves backward induction. In the example scenario shown in figure 17.1, it is apparent that the restoration planner would prefer to choose Plan A and receive the support of an opposing stakeholder (which could be a variety of groups with interests competing with restoration, such as farmers, businesses, or local governments concerned about their property tax base), resulting in a 90 percent rate of restoration success. The backward induction process begins at the last set of decisions and considers what that player would do for each scenario, collapsing the payoffs expected for earlier decisions. In figure 17.1, the stakeholder expects reduced losses if it opposes Plan A, while it expects increased benefits if it supports Plan B. The restoration payoffs thus collapse to 50 percent success under Plan A and 70 percent success under Plan B. This is the Nash equilibrium, defined as a stable outcome where no party would be better off with a different decision, given everyone else's decision (Nash 1951). Therefore a Nash equilibrium is not necessarily the best-case scenario for each party, but simply the result of

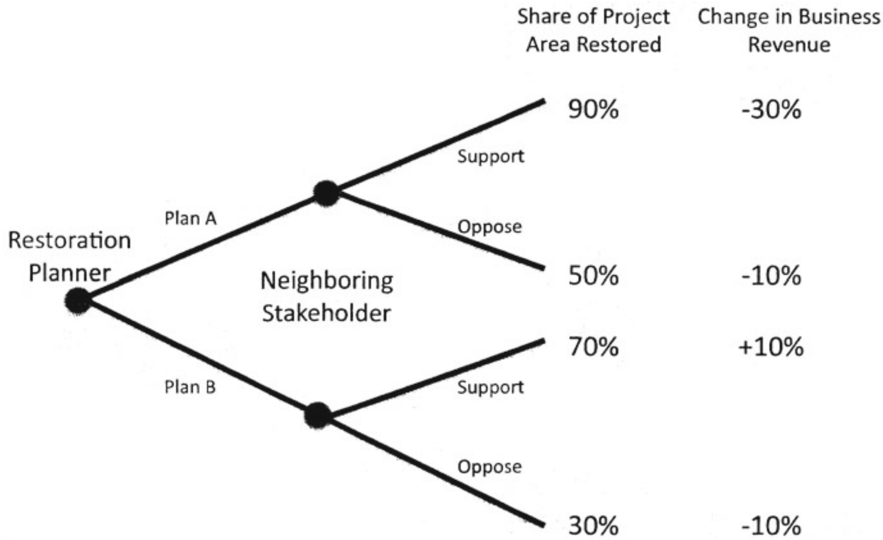

FIGURE 17.1. Example decision tree by a restoration planner between two plans (A or B) followed by a decision of a neighboring stakeholder to support or oppose the restoration plan. The outcome payoff for the restoration planner is shown in terms of total area or function restored, whereas the payoffs to the stakeholder are represented by change in the stakeholder's revenue. While the highest share of restoration is possible under Plan A, the stakeholder will oppose Plan A because the stakeholder expects less total loss. Plan B, which would be unopposed, would actually lead to a greater share of restoration than a choice of Plan A.

each individual acting in his or her own self-interest, based on expecting that everyone else is doing so as well.

One can envision a scenario described in figure 17.1 using the example of a farmer (as the stakeholder) and restorationist on the Sacramento River, briefly described earlier. For example, the restorationist's preferred choice might be to plant many species of tree seedlings densely to achieve the greatest success in restoring a riparian forest ecosystem, which was the dominant ecosystem in this region prior to extensive agriculture (Vaghti and Greco 2007). But this action might substantially increase the farmer's expectations of flooding on his lands (Buckley 2007). This could lead farmers to engage in the local political process to block the restoration entirely. As a compromise, the restorationist might plant trees less densely mixed with native grasses creating more of a savanna habitat, which would have minimal impacts on flooding (Efseaff et al. 2003; Golet et al. 2009), and might also provide habitat for beneficial insects, which could control insect damage to farmers' crops. Savannas were likely historically patchily distributed in this region in locations with shallow soils.

The reasoning in the backward-induction process might seem natural and recognizable as part of strategic thinking in games, such as chess, or even as part of a bargaining or compromise process. You look at your options and imagine what others will subsequently decide given the scenario you leave them with. The more rounds of decisions the more difficult and the less certainty you are likely to have for your guess, but these uncertainties can be factored into your decision probabilistically. These same techniques can be extended to more complex, less immediately understood situations. In addition to more players or decisions, there are possible differences in information availability and risk aversion that can impact outcomes and decisions.

Information

Information plays a central role in game theory for identifying and achieving preferred outcomes. The lack of specific pieces of information presents challenges as well as explanations for suboptimal behaviors and outcomes. A situation with "perfect information" means that all possible knowledge about outcomes and preferences is available to all parties. This state includes "common knowledge" among parties, whereby they all know what each other knows, and know each other has this information.

The simplest deviation from perfect information is imperfect information. Imperfect information describes the situation where the outcome that will result from a particular set of decisions is not known with complete certainty. Examples include uncertainty as to whether a particular streambank revegetation project will or will not increase flooding, or whether a transition from exotic to native plant species will still attract a certain bird species. If there is disagreement about the most likely outcome for a particular set of decisions, conflicts can arise. For example, if neighboring farmers expect restoration projects to generate weeds but restoration planners do not, discussions or additional safeguards might be necessary to alleviate concerns.

The situation is considered one of incomplete information if one party does not know the preferences or intentions of another party. If residents in an area think that a particular restoration project is actually intended to capture water rights or crowd out a particular land use rather than to restore habitat, unnecessary conflict and opposition might arise. Again, in many cases, simply identifying that certain information is lacking can identify low-cost solutions.

The approaches to situations of incomplete and imperfect information are somewhat similar and begin with assignment of probabilities to possible scenarios. This is done by adding branches to the decision tree, probabilistically weighting trees, and conducting backward induction as before. An example shown in figure 17.2 demonstrates a situation where a neighboring farmer expects that by supporting Plan B, there is a 50 percent probability of seeing an increase in revenue (e.g., pest control benefits) and a 50 percent probability of seeing a decrease in revenue.

If stakeholders have incomplete information about outcomes and restoration goals, alleviating those uncertainties can prevent probabilistic estimations that would lead to undesirable behaviors. Identifying situations where stakeholders fear undesirable outcomes, even when science suggests such outcomes are unlikely, provide important opportunities for targeted education and outreach. Or if science is inconclusive regarding the effect, the process can help identify important targets for research that can yield tangible impacts on project outcomes via behavior changes and cooperation. For example, on the Sacramento River farmers were concerned about voles

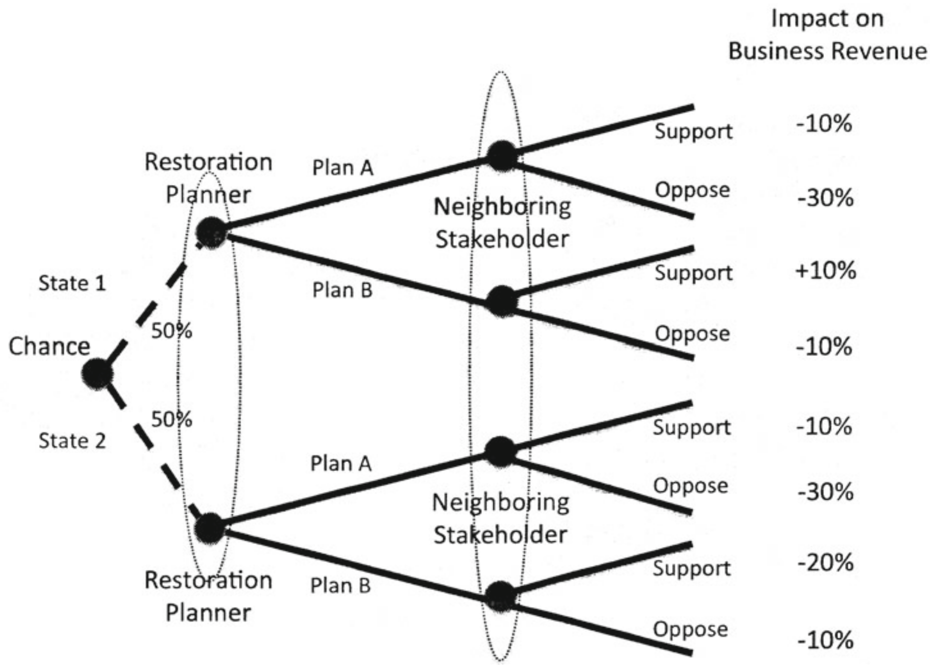

Figure 17.2. Example of a decision tree with probabilistic outcomes, in which a stakeholder believes two possible states exist and does not know which he faces. State 1 and State 2 are two alternatives that are not controlled by the restorationist or the stakeholder, such as whether a river will or will not flood in each of the next ten years. The neighboring stakeholder, when she faces her decision, knows whether the restoration planner selected Plan A or Plan B, but does not know whether State 1 or State 2 will be active and, therefore, does not know which set of payoffs she faces. The dotted ovals represent this lack of perfect information when one must make decisions. A risk-neutral stakeholder will weigh outcomes based solely on probabilities, but a risk-averse stakeholder will shy away from those probabilistic outcomes with the worst-case scenarios.

(an agricultural pest) colonizing agricultural lands from recently restored sites. Targeted research confirmed that voles were abundant in recently restored sites, so owl boxes are now routinely installed on new restoration sites because owls consume large numbers of voles (Golet et al. 2009). We are also finding similar differences of opinion between biologists and downstream agricultural water users for watershed restoration projections utilizing beaver reintroduction in Utah.

When individuals are not sure what to do because they are unsure what outcome is in their best interest, first moves or decisions can be highly influential. If a number of individuals all face the same decision and no one is sure what to do, they will look to others. If someone makes a decision, others will assume they must have had a reason to do so and will become more likely to make the same decision. These processes generate positive feedbacks. If, for example, a segment of a community is unsure of how to respond to a new restoration plan, the first responses can generate momentum and influence the decisions of other residents with similar interests.

Risk Aversion

The level of risk and uncertainty any particular player is willing to accept will influence how he or she responds to scenarios with imperfect or incomplete information (see chap. 13, this volume). Risk is the probability of undesirable outcomes, while uncertainty refers to a lack of probabilistic estimations of outcome likelihoods (e.g., Faucheaux and Froger 1995). Ignorance is often used to describe the condition in which the full set of possible outcomes is not known. For the purposes of risk aversion, when uncertainty and ignorance can encompass undesirable outcomes, an increase in any of these is undesirable for a risk-averse party.

The more concerned a party is about risk, the more likely he or she will avoid choices that have possible undesirable outcomes, even if the probabilistic weighted value is better than the alternatives. Consequently, if restoration stakeholders are highly risk averse, and they see some chance of an undesirable outcome from restoration activities and have means to move the process toward a set of outcomes they see to involve less risk, it will be particularly important to address their concerns. For example, a highly risk-averse rancher might consider restoration efforts that have an extremely small probability of increased predator traffic on his property as unacceptable. In the Sacramento River Conservation Area, one group in opposition to some restoration activities went so far as to claim on its website that restoration can increase flooding resulting in human fatalities.

Returning to figure 17.2, the stakeholder, if faced with a choice by the restoration group to pursue Plan B, has a probabilistically weighted expected loss of 5 percent with support and 10 percent with opposition. A relatively risk-neutral neighbor would choose to support Plan B. However, a risk-averse neighbor will see the potential 20 percent loss as too much and would prefer to contain losses to a maximum of 10 percent with opposition. This example shows the importance of recognizing and addressing expected worst-case scenarios, even if they have a low probability.

Systematically reducing ignorance, uncertainty, and perceived risk can be an important step for avoiding decision making that counters restoration efforts. Adaptive management processes can be designed to focus on these issues, particularly those driving decision making. Identifying important areas of imperfect information can help to prioritize research. Promoting dialogue among stakeholders with different priorities, such as coordinated research management and planning, can help to reduce situations of incomplete information. Risk and liability sharing mechanisms, such as agreements to help bear costs or burden, can potentially reduce perceived risk to a point of achieving cooperation.

Cooperative Solutions

Noncooperative game theory is considered by game theorists to be the appropriate framework for analysis because cooperative outcomes can be achieved within a noncooperative framework if the necessary communication and binding contract options are available (Myerson 1997). In fact, it is necessary to recognize that noncooperative outcomes are possible and that parties can walk away from the table, to understand what produces a stable cooperative solution. The approach described up to this point has been noncooperative. The best way to think about the process for identifying a cooperative solution is to first go through the process of identifying the likely noncooperative solution, identify that better outcomes exist, and then proceed with the approach to identifying a stable bargaining solution described following here.

Although noncooperative game theory is more commonly used, cooperative game-theoretic analyses are used for situations when individual decision making does or will lead to an outcome that is not socially optimal, and might not even be individually optimal. A common example of this situation is the prisoner's dilemma (Rapoport and Chammah 1965), a stylized model that has been applied to various problems of public goods and common property resources. The key element is that decisions that are good for the individual, all else equal, are not good for the group as a whole. If everyone makes the individually advantageous decision though, everyone is worse off. Simply, a prisoner's dilemma is a situation where parties acting in their own self-interest lead to a worse outcome than what would be available otherwise. The basic story is that two suspected coconspirators in a crime with some evidence against them are each separately offered the opportunity to confess and, by doing so, lower their individual punishment (fig. 17.3). If one confesses and the other does not, the confessor receives a more lenient punishment. Therefore, both have an incentive to confess, whereas their best-case outcome is for neither to confess. If the two suspects had the ability to communicate and form a binding agreement not to confess, they would both be better off than otherwise.

While the actual legal scenario might not be terribly likely, such incentives do

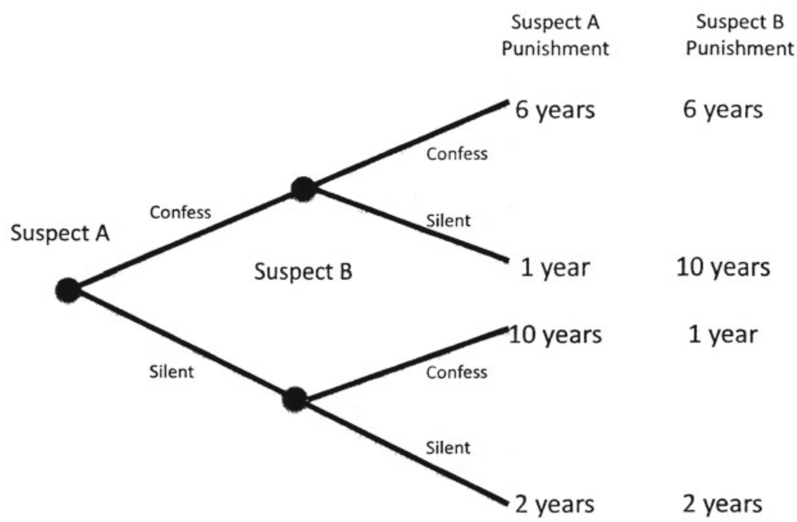

FIGURE 17.3. A prisoner's dilemma game involves a situation wherein the Nash equilibrium (individual self-interested behavior) leads to an outcome that is worse for both players than another available outcome. Cooperative techniques are designed to avoid such inefficient, undesirable outcomes. The social problem is caused by the fact that whether one player chooses to cooperate (silent) or not (confess), the other player is better off not cooperating (confess).

arise commonly for natural resources. If two people share a pond, both have an incentive to take fish, while hoping the other doesn't. For a restoration project that has the potential to benefit many but will be costly and require effort to maintain, incentives might encourage individuals to try to free ride on the effort of others.

Cooperative game theory solutions rely upon the ability of parties to communicate, make binding agreements and, in some cases, conduct transactions such as making side payments or trading valuable resources. The most basic solution concept, the Nash bargaining solution, involves finding an outcome (set of individual decisions) for which all parties are better off than they would be without cooperating (Nash 1950). While this sounds obvious, oftentimes there are winners and losers, and if losers are not compensated or provided for, they will opt out.

An example based on general hypothetical common units of benefit is shown in table 17.1. With no cooperation, the net benefits would be those in the first line, under the noncooperative Nash equilibrium. A more socially optimal solution with greater net benefits is identifiable, however (row 2). To achieve it, no one can have an incentive to opt out, so both parties must be better off. The net gains from cooperation (70 – 60 = 10), rather than the gross payoff, are shared equally for the Nash bargaining solution (row 3). The counterfactual, the state of the world that would occur without agreement, is the reference point from which to measure and distribute cooperative benefits. Typically, the counterfactual is the noncooperative Nash equilibrium.

A key insight of the Nash bargaining solution is that a stable cooperative agreement does not mean a uniform distribution of net benefits, but a uniform distribution of net benefits relative to what would occur without cooperation (in general the Nash equilibrium). So a party who would do very well under the noncooperative outcome must first be made as well off before net benefits can be distributed. While some might not see this as fair, it shows the importance of respecting individual incentives for social goals.

For example, imagine a scenario where a stakeholder is concerned that predators will take livestock and, therefore, wants to use fences and traps to prevent this. A restoration group might make a binding agreement to compensate for any losses in exchange for the stakeholder agreeing not to take these measures. The restoration group now has added costs, and might help maintain a land use that is not necessarily the most ecologically desirable, but is a better option than being without the agreement and without large predators in the landscape.

TABLE 17.1

Example of a Nash equilibrium (row 1), a net socially superior possible outcome (row 2), and a cooperative distribution via the Nash bargaining solution to achieve net gains (row 3).

Scenario	Party A net benefit	Party B net benefit	Total net benefits
1. Nash equilibrium	20	40	60
2. Social optimum (greatest sum net benefits)	35	35	70
3. Nash bargaining solution	25	45	70

For restoration projects, if broader landscape-scale ecological benefits are identifiable with cooperation, and cooperation has been difficult to achieve, restoration planners should consider how bargaining-type, cooperative solutions might allow achieving previously unattainable outcomes. The ecological functions on areas of low-intensity agriculture have been considered justification for efforts, potentially including payments, to prevent escalation to high-intensity agriculture with fewer ecological functions (Bakker and Berendse 1999). Bargaining approaches can be used to identify the types and level of compromise necessary to achieve outcomes better than the alternative.

Quantitative and Qualitative Applications

Methods from game theory can be most readily applied when measures of costs and benefits are quantified, but they can also be applied when impacts are ranked. Backward induction can typically be applied as long as preference rankings at each decision node are available. When information is incomplete and a probabilistic treatment is necessary, but quantitative values are not available, more judgment might be necessary to assess impact on preferences of relative weightings. This should not preclude the application of systematically assessing decision interactions with game-theoretic methods. In reality, this sort of qualitative application of methods and general lessons is a useful and frequently applied aspect of game theory for restoration.

While not explicitly described as game-theoretic methods, several processes for management of ecological restoration involve elements described in this chapter. Adaptive management systems are now commonplace in restoration (e.g., Murray and Marmorek 2003), and while the iterative process might not necessarily begin with a strategic perspective, learning over time allows anticipation of opportunities for improved social interaction. Decision analysis involves similar structuring of decisions to game theory, but with moves limited to nature rather than other decision makers, at least not in terms of interactive decision making. Decision trees and probabilistic assessment of choices have informed restoration efforts (e.g., Cipolini, Maruyama, and Zimmerman 2005), and the extension to multiple decision makers is natural.

One of the authors (M.B.) is involved in applying game theory to various restoration efforts to avoid unintended consequences from certain stakeholder groups. For example, in southern Utah, efforts to restore certain watersheds are attempting to reintroduce beavers (*castor canadensis*). Beavers were extirpated and had their dams removed in part because of the belief that they capture water and reduce downstream flow. The reintroduction efforts must determine the actual effects on stakeholders, find ways to communicate those effects when they are net positive, and find ways to avoid undesirable outcomes, such as beaver dams in irrigation ditches. In Portland, Oregon, we have worked to identify strategies to restore water quality through residential stormwater capture. Residential stormwater capture systems must be designed for individual homeowners that provide private benefits (including feelings of civic duty) sufficient to justify the private costs in order to elicit the public water quality benefits.

Lessons from Game Theory for Restoration

Economics has made substantial and increasing strides toward identifying how and why people make decisions and behave under real-world conditions when traditional assumptions of rationality suggest different strategies. These insights have improved understanding of decision making under risk and uncertainty, the impact of time delays, responses to inequities, the real-world constraints of human computational ability, the importance of context, and effects of emotions. Recognizing behavioral realities is important to understanding human decision making for restoration, and prescribing strategies that will be successful.

Game theory provides a systematic and comprehensive approach to considering, evaluating, and responding to human decision making and behavior that impact restoration project success. This discussion is an introduction, and numerous textbooks and entire journals are dedicated to the subject and methods. While the method of evaluating decisions can be useful in and of itself, a number of general lessons from game theory can be incorporated into restoration project planning.

Avoiding Losses Is More Important than Achieving Gains

People weight the impact of a loss greater than the equivalent gain (Kahneman and Tversky 1979). When risk includes potential loss of existing benefits, risk aversion is exacerbated by loss aversion, also known as the endowment effect, which is the phenomenon of a cost being valued more heavily than an equivalent gain (chap. 14, this volume). This loss aversion means that losing $2,000 has a greater absolute (positive or negative) impact on welfare than gaining the same amount of money. The impact of an equivalent loss continues to increase with the amount of losses. One implication is that neighbors who believe they have a right to a certain landscape condition might seem irrational in their opposition, or they may regard the severity of a loss of productivity as being particularly important, especially if production or revenues have already been in decline. This phenomenon has also been applied to help understand why, in some cases, outcomes with very low probability of occurrence are weighted more heavily than rationality would dictate. It can also be used to understand preferences for maintaining the status quo (chap. 14, this volume).

Relative Costs and Benefits Matter

An outcome might be acceptable that involves a low (or negative) payoff if others do not do better. Similarly, equitable distributions of gains can be so important that individuals might be willing to choose an outcome where they are worse off than to permit an outcome where one party achieves far greater gains, particularly if they are seen to achieve such gains unfairly. This means that individuals will, at times, be willing to bear private costs in order to prevent or punish perceived cheating. This has been observed in governance of common property resources such as forests and water supplies (Ostrom 1991).

Decisions Are Often Made by Rules of Thumb

The cost and burden of assessing each decision are such that, for many situations, if not most, people use rules of thumb that they have been taught, have observed, or have developed. Updating and revising a rule when new techniques or new information becomes available can be particularly difficult, especially if the rule has been used for a long time and/or generally performs well. For example, if multiple generations of farmers have cleared adjacent noncrop vegetation, it might be more difficult to convince them that adjacent natural areas could provide benefits such as pollination and pest predation. Risk-averse individuals will be reluctant to try new actions, or accept new, untested conditions. Trial or demonstration projects can play important roles in the early alleviation of uncertainty and establishment of expectations.

Identifying Stakeholders, Their Preferences, and Their Beliefs Is Necessary

The first step toward understanding other stakeholders is important for anticipating and avoiding conflicts and targeting education, compromises, and potential bargaining situations. Determining and addressing areas of incomplete and imperfect information that underlie beliefs may affect restoration outcomes.

Communication and Transparency Can Prevent Undesirable Expectations

Under conditions of uncertainty, stakeholders will be wary of worst-case scenarios regarding possible restoration outcomes. Stakeholders might be unsure of the goals of the project or the outcomes. A nonconfrontational set of goals that does not directly counter local livelihoods can be necessary to avoid opposition.

Expectations Matter More than Science for Individual Decision Making

If individuals believe there will be a particular outcome, they will behave accordingly, regardless of what the scientific evidence shows. When these behaviors are detrimental, outreach can be most important. It is essential to assess what sources of information stakeholders consider most credible. For example, farmers may be more likely to listen to agricultural extension personnel with whom they have a long-term relationship than to scientists employed by restoration organizations that farmers view as having conflicting goals.

Conclusion

Game theory provides a valuable tool for understanding and resolving potentially noncooperative restoration project contexts. Doing so can save time, money, and ecological and economic outcomes that are irreversible or costly to reverse. It can also lead to increased benefits to society and better long-term stewardship and sustainability. Short of explicitly employing game theory, iterative processes over time can bring neighbors and stakeholders to game-theoretic equilibria and cooperative solutions as well.

References

Bakker, J. P., and F. Berendse. 1999. "Constraints in the Restoration of Ecological Diversity in Grassland and Heathland Communities." *Trends in Ecology and Evolution* 14: 63–68.

Bright, A. D., S. C. Barro, and R. T. Burtz. 2002. "Public Attitudes toward Ecological Restoration in the Chicago Metropolitan Region." *Society and Natural Resources* 15: 763–85.

Buckley, M. 2007. "The Problem of Restoring Natural Systems among Social Systems: Strategic Considerations and the Sacramento River." PhD diss., University of California, Santa Cruz.

Buckley, M., and E. Crone. 2008. "Negative Off-Site Impacts of Ecological Restoration: Understanding and Addressing the Conflict." *Conservation Biology* 22: 1118–24.

Buckley, M., and B. Haddad. 2006. "Socially Strategic Ecological Restoration: A Game-Theoretic Analysis." *Environmental Management* 38: 48–61.

Casson, M. 1994. *Economics of Business Culture: Game Theory, Transaction Costs, and Economic Performance*. New York: Oxford University Press.

Cipollini, K., A. Maruyama, and C. Zimmerman. 2005. "Planning for Restoration: A Decision Analysis Approach to Prioritization." *Restoration Ecology* 13: 460–70.

Daily, G. C., ed. 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington, DC: Island Press.

Efseaff, D. S., J. G. Silveira, F. T. Griggs, F. L. Thomas, and J. Carlon. 2003. "Incorporating Native Grass Planting into Riparian Restoration on the Sacramento River." In *California Riparian Systems: Processes and Floodplains Management, Ecology, and Restoration*, edited by R. E. Warner and K. M. Hendrix, 315–22. Sacramento, CA: Riparian Habitat Joint Venture.

Faucheux, S., and G. Froger. 1995. "Decision-Making under Environmental Uncertainty." *Ecological Economics* 15: 29–42.

Fudenberg, D., and J. Tirole. 1991. *Game Theory*. Cambridge, MA: MIT Press.

Gintis, H. 2000. *Game Theory Evolving*. Princeton, NJ: Princeton University Press.

Gobster, P. H. 2001. "Visions of Nature: Conflict and Compatibility in Urban Park Restoration." *Landscape and Urban Planning* 56: 35–51.

Gobster, P. H., and S. Barro. 2000. "Negotiating Nature: Making Restoration Happen in an Urban Park Context." In *Restoring Nature: Perspectives from the Social Sciences and Humanities*, edited by P. H. Gobster and B. Hull, 185–207. Washington, DC: Island Press.

Gobster, P. H., and B. Hull, eds. 2000. *Restoring Nature: Perspectives from the Social Sciences and Humanities*. Washington, DC: Island Press.

Golet, G. H., B. Anderson, R. A. Luster, and G. Werner. 2009. "Collaborative Planning Fosters Multiple-Benefit Restoration Projects on the Sacramento River." *Conservation Biology* 23: 1634–37.

Golet, G. H., T. Gardali, C. A. Howell, J. H. Hunt, R. A. Luster, W. Rainey, M. D. Roberts, J. Silveira, H. Swagerty, and N. Williams. 2008. "Wildlife Response to Riparian Restoration on the Sacramento River." San Francisco Estuary and Watershed Science 6 (2): 1. http://repositories.cdlib.org/jmie/sfews/vol6/iss2/art1.

Golet, G. H., M. D. Roberts, R. A. Luster, G. Werner, E. W. Larsen, R. Unger, and G. G. White. 2006. "Assessing Societal Impacts when Planning Restoration of Large Alluvial

Rivers: A Case Study of the Sacramento River Project, California." *Environmental Management* 37: 862–79.

Hardin, G. 1968. "The Tragedy of the Commons." *Science* 162: 1243–48.

Langridge, S. M., M. Buckley, and K. D. Holl. 2007. "Strategies for Overcoming Obstacles to Restoring Natural Capital: Large-Scale Restoration on the Sacramento River." In *Restoring Natural Capital*, edited by J. Aronsen, S. Milton, and J. Blignaut, 237–48. Washington, DC: Island Press.

Kahneman, D., and A. Tversky. 1979. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 47: 263–91.

Murray, C., and D. Marmorek. 2003. "Adaptive Management and Ecological Restoration." In *Ecological Restoration of Southwestern Ponderosa Pine Forests*, edited by P. Friederici, 417–28. Washington, DC: Island Press.

Myerson, R. 1997. *Game Theory: Analysis of Conflict*. Cambridge, MA: Harvard University Press.

Nash Jr., J. F. 1950. "The Bargaining Problem." *Econometrica* 18: 155–62.

———. 1951. "Non-cooperative Games." *The Annals of Mathematics* 54: 286–95.

Osborne, M. 2003. *An Introduction to Game Theory*. New York: Oxford University Press.

Ostrom, E. 1991. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.

Ostrom, E., R. Gardner, and J. Walker. 1994. *Rules, Games, and Common-Pool Resources*. Ann Arbor: University of Michigan Press.

Rapoport, A., and A. Chammah. 1965. *Prisoner's Dilemma*. Ann Arbor: University of Michigan Press.

Schelling, T. 1960. *The Strategy of Conflict*. Cambridge, MA: Harvard University Press.

———. 1966. *Arms and Influence*. New Haven, CT: Yale University Press.

Vaghti, M., and S. Greco. 2007. "Riparian Vegetation of the Great Valley." In *Terrestrial Vegetation of California*, edited by M. Barbour, T. Keeler-Wolf, and A. A. Schoenherr, 425–55. 3rd ed. Berkeley: University of California Press.

Weissing, F., and E. Ostrom. 1993. "Irrigation Institutions and the Games Irrigators Play: Rules Enforcement in Government- and Farmer-Managed Systems." In *Games in Hierarchies and Networks: Analytical and Empirical Approaches to the Study of Governance Institutions*, edited by Fritz W. Scharpf, 387–428. Boulder, CO: Westview Press.

PART V

Perspective: Eco-cultural Restoration

Whether indigenous or not, eco-cultural practices (i.e., the activities and practices of a given people in a given space and time) have a tremendous influence on the environment and culture (i.e., they create a sense of place). In this section, the authors cover a range of eco-cultural activities, including restoration efforts by indigenous peoples (Robin Kimmerer, Michelle Stevens), the use of eco-cultural history to help direct landscape-level restoration in England (Ian D. Rotherham), and the creation of eco-art to engage public discussion and arouse the public imagination (Lillian Ball and her colleagues).

Robin Kimmerer, drawing on her indigenous heritage and work with various Native American tribes, opens this section with a discussion of reciprocal restoration, which she describes as "the mutually reinforcing restoration of land and culture such that repair of ecosystem services contributes to cultural revitalization and renewal of culture promotes restoration of ecological integrity." She also makes the case that traditional ecological knowledge (TEK) is particularly useful in identification of reference ecosystems, as a repository of detailed species information, and as a source of guidance in understanding the role of human disturbance in landscape management. Kimmerer also points out that ecosystem restoration is often coupled with cultural restoration in indigenous communities, which means that TEK is actively engaged as people reclaim their heritage and responsibility for land.

Ian D. Rotherham's contribution looks at case studies in the English Midlands where "rewilding" and "renaturing" projects are either in place or being planned. While he understands the goals of many of these projects (e.g., landscape-scale demands of plant and animal species responding and moving in the face of rapid changes in climate, desire to offset carbon emissions, and the increasing need to mitigate and moderate flood risk), Rotherham argues that these projects are unsustainable because they fail to take an eco-cultural perspective into account—a perspective that would reintroduce or emulate former ways of sustainably interacting with the land and serving the local economy.

Michelle Stevens provides an exciting case study of TEK with her report from Iraq where efforts are under way to restore the *al Ahwar* or Mesopotamian marshlands as well as culture of the indigenous Marsh Arabs or Ma'dan. Her case study includes her personal experiences in Iraq as well as those of Iraqis still in that country and in the United States. These accounts demonstrate how hope remains alive with a people and their land despite the tragedy of war and conflict.

The final chapter in this section introduces the reader to the eco-art of Tim Collins and Reiko Goto, Betsy Damon, and Lillian Ball. These environmental artists work with scientists, landscape designers, community groups, and public officials in order to produce public art that betters the environment and captures people's imaginations and helps them reconnect with their natural surroundings. Their works represent contemporary forms of becoming indigenous to a place.

Chapter 18

Restoration and Reciprocity: The Contributions of Traditional Ecological Knowledge

Robin Kimmerer

Carol Crowe, an Algonquin ecologist, tells the story of explaining to one of her elders that she was traveling to a conference about sustainable development. The term was not familiar to him, so she explained the notion of managing resources in such a way that future generations would be able to obtain the same ecosystem services that are provided today, without impairment to the land. He was quiet for a time. The idea was hardly new to him. He then asked her to carry a message to the conference. He said, "This idea of sustainability sounds to me like the same old formula by which people simply continue to take from the earth. They just want to keep taking. You can't just take. Tell them, that among our people our concern is not what we can take from the land, but what we can give."

Restoration and Reciprocity

The idea of reciprocity with land is fundamental to many indigenous belief systems. Indeed, such beliefs serve as the foundation for what have been described as "cultures of gratitude." In such cultures, people have a responsibility not only to be grateful for the gifts provided by Mother Earth, they are also responsible for playing a positive and active role in the well-being of the land. They are called not to be passive consumers, but to sustain the land that sustains them. Responsibilities to the more-than-human world are simultaneously material and spiritual, and, in fact, the two are inseparable. Ecological restoration can be viewed as an act of reciprocity, where humans exercise their care-giving responsibility for ecosystems (Egan 1988; Oeschlager 1996; Kimmerer 2000; Martinez, Salmon, and Nelson 2008). The traditional ecological knowledge (TEK) of indigenous peoples is rich with prescriptions, both philosophical and pragmatic, for this practice of giving back to the land. This chapter engages TEK as a partner to contemporary restoration science, in a symbiosis based on intellectual pluralism. "We're going to need the enduring knowledge of indigenous science as well as the best of leading edge western science. It's high tech meets high TEK." (Ausubel 2008).

Among my Anishinaabe people, we share a teaching known as "the prophecy of the seventh fire." This teaching relates that, with the coming of strangers to our shores,

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_18,

many changes will befall our people. It is said that the land will become fragmented, plants and animals will be lost, that the people will be scattered and divided from their homelands, and that the language spoken for millennia will nearly disappear. As we know, these things have come to pass. Our peoples live on tiny remnants of their original homelands, and our language and culture face many threats. The prophecy explains that the plants and animals will become diminished, the waters undrinkable, and the air itself changed. This, too, we know has come to pass.

We are also taught that in the time of the seventh fire, there will be a fork in the road. The people remaining on Earth must make a choice either to continue on the path that leads to destruction of life as we know it or to choose a different future—one of renewal. It is said that should the remaining people choose the path toward life, they will turn back along the road from which they have come and begin to pick up the pieces that have been scattered along the road—remnants of language, the old stories and songs, seeds and ragged patches of plants, wandering animals and birds, and together they will begin to put the world back together again. The people will reclaim their responsibilities for taking care of the land, and thus heal the land and the people. The prophecy of the seventh fire speaks, I think, of reciprocal restoration (box 18.1).

In the dominant materialistic worldview, humans are understood as standing outside nature, as exogenous forces whose interactions with nature are generally considered negative. Jordan (2003) laments that humans can take from a bountiful landscape, "but we can never give anything back," despite that "our conscience demands

Box 18.1
Reciprocal Restoration

Reciprocal restoration is the mutually reinforcing restoration of land and culture such that repair of ecosystem services contributes to cultural revitalization, and renewal of culture promotes restoration of ecological integrity. Based on the indigenous stewardship principle that "what we do to the land we do to ourselves," restoration of land and culture are inseparable. This approach arises from a creative symbiosis between traditional ecological knowledge (TEK) and restoration science, which honors and uses the distinctive contributions of both intellectual traditions. Reciprocal restoration recognizes that it is not just the land that is broken, but our relationship to it. Reciprocal restoration encompasses repair of both ecosystem and cultural services while fostering renewed relationships of respect, responsibility, and reciprocity. All flourishing is mutual.

Reciprocal restoration is grounded in the positive feedback relationship between cultural revitalization and land restoration. Revitalizing language and culture protects and disseminates TEK, and builds relationships of reciprocity and respect, all of which are good for the land. What's good for the land is good for the people.

The fate of the land and the consequences for culture are much more strongly linked for Native peoples than for those in the dominant culture. Thus, ecological restoration in indigenous communities takes on a special depth and dimension.

it and our imaginations yearn for it." Higgs (2003) likewise ponders, "Are our imaginative capacities diminishing so that we are less and less able to conceive of positive encounters with real nature?" He states that our great challenge is to imagine a "new" relationship between people and nature. What is "new" to Western science often has antecedents in indigenous knowledge, articulated millennia ago. This chapter reveals the contributions of TEK to our thinking about restoration.

Expanding the Vision and Goals for Ecological Restoration

Explicit definition of the goal is a fundamental first step in restoration design (Meffee and Carroll 1994). Because indigenous peoples live within the tradition of reciprocity, they may prioritize restoration goals rather differently, with outcomes based on a more broadly imagined vision. Goals manifest in restoration projects undertaken by indigenous peoples span the entire range of recognized restoration practices and motivations (Clewell and Aronson 2006), and often extend well beyond the goal-oriented restoration described by Cairns and Heckman (1996).This expanded vision of restoration encompasses not only repair of ecosystem structure and function, but cultural services as well. Traditional ecological knowledge is valuable to restoration, not only for the wealth of biological information it contains but for the worldview of respect, reciprocity, and responsibility in which it is embedded (Kimmerer 1998; Pierotti and Wildcat 2000). Restoration of reciprocal relationships with land is central to the indigenous vision of restoration, which may also include the following:

- Restoration of subsistence-use activities
- Focus on cultural keystone species
- Restoration of traditional indigenous diets
- Revitalization of TEK, language, and culture
- Exercise of spiritual responsibility
- Development of place-based, sustainable economies
- Restoration of traditional land management for the benefit of nonhuman relatives (i.e., biodiversity)

What these expanded goals have in common is the priority given to restoration of relationships to place that may be manifest in subsistence activities, spiritual responsibility, language revitalization, and other cultural practices. These goals are more inclusive than the science- and conservation-oriented goal of creating a self-sustaining ecosystem, free of human intervention. Nonetheless, the indigenous ethic of participatory responsibility does not preclude the goal of maintaining landscape areas free of human use. For example, the Klamath forest restoration plan (Wolf 2004) identifies resource utilization areas as well as those set aside as reserves substantially unaltered by human activity. Likewise, the Salish-Kootenai tribes in Montana protect tribally designated wilderness areas. A guiding principle that emerges from numerous tribal restoration projects is that the well-being of the land is inextricably tied to the well-being of the community and the individual.

Restoration of Subsistence-Use Activities

For many indigenous groups, restoration goals may include regenerating the capacity of the landscape to support traditional subsistence activities—hunting, fishing, gathering. The ethic of reciprocity embodies the idea that the land provides for the people and the people, in turn, must care for the land. A landscape is seen as whole and healthy when it can provide enough to share with the people. The goal of restoring subsistence raises the standards for ecological integrity. It is not sufficient to restore a fish population and then issue an advisory against eating those fish due to contamination. In the restoration of Onondaga Lake, one of the most chemically polluted lakes in the country, the Onondaga Nation's vision statement states that restoration is not complete until people can once again eat the fish (Onondaga Nation 2010). This goal actively resists the slide of baseline expectations for ecosystem integrity and places additional, higher expectations on a restored landscape.

Indigenous-led restoration projects all over the world call for a return to subsistence-capable landscapes with viable populations of plants and animals. Such projects include salmon restoration in the Pacific Northwest, restoration and protection of walleye fisheries by the Red Lake Ojibwe (Dokken 2010), the return of traditional berrying grounds, and the restoration of basket-making resources and hunting grounds, as well as places for gathering nontimber forest products (see chap. 19, this volume, for a discussion of cultural severance).

Restoration of subsistence is tied to restoration of indigenous cultural identity, language, health, and also to the vitality of the restored "resource" itself. Appropriate harvest is understood as a benefit to the land. There is considerable evidence for human subsistence activity providing the disturbance regime and stimulus for regenerating many culturally significant plants. For example, ethnobotanist Kat Anderson has documented that the indigenous harvesting of root food plants in California grasslands maintains the vigor of the population through a suite of practices she calls "tending" (Anderson 1996; Anderson and Rowney 1999). Traditional harvest and tending practices have been shown to maintain the productivity and diversity of subsistence plant communities, including camas meadows, basketry plants, acorns, and others (Turner 2005). In experimental restorations of the culturally significant sweetgrass (*Wingaashk*, *Hierochloe odorata*), we observed that plots harvested according to traditional practices exhibited a significantly higher rate of recruitment and lowered mortality than the unharvested controls, which actually declined in vigor (Reid 2005; Shebitz and Kimmerer 2005). In this case and others, subsistence practices actually stimulated the success of the plant species. These experiments uphold the indigenous principle that, "If we use a plant respectfully, it will stay with us and flourish. If we ignore it, it will go away." These findings suggest that in order to successfully restore some keystone species, one must also restore the mutually beneficial subsistence relationship with them.

In the indigenous view, an authentic landscape incorporates human participation in ecological flourishing. A beautiful meadow of blue camas (*Qém'es*, *Pa-siko*, *Camassia quamash*) is not an authentic landscape until people engage in reciprocity with that meadow by harvesting and feasting with that traditional food. Higgs (2005) describes the restoration of neglected camas meadows that began when the Lekwungen First Nation, in British Columbia, reinstituted traditional harvesting practices. The care-giving practices of weeding, dividing, and sowing that accompany harvest, coupled with selective burning, promote the regeneration of camas as well as regeneration of the reciprocal relationship.

Focus on Cultural Keystone Species

In addition to biodiversity as a whole, indigenous restoration projects may focus on restoration of desired species that are understood as "cultural keystone species" (Garibaldi and Turner 2004) because of their vital roles in both material and nonmaterial aspects of a culture (i.e., they provide food, medicine, and materials for spiritual and ceremonial practice).

Of course, many species that indigenous peoples seek to restore play overlapping roles as cultural and biological keystone species. Examples include the marsh reeds and water buffalo of the Marsh Arabs (see chap. 20, this volume), red cedar (*Q!we'le*, *Lata'wi*, *Thuja plicata*) in the Pacific Northwest (Garibaldi and Turner 2004), and salmon (*Oncorhynchus* spp.) along the Pacific Coast of California (House 2000). Stumpff (2003) describes the important leadership role American Indian nations are playing in the restoration of such keystone species as the wolf (*mahigan*, *Canis lupus*) and bison (*Tatanka*, *Bison bison*). Her findings indicate that these restoration programs were implemented using contemporary science, but were guided by TEK, for cultural goals. Likewise, Garibaldi and Turner (2004) argue that by prioritizing restoration of cultural keystone species, indigenous peoples address the linked goals of social and ecological well-being.

It has often been articulated that indigenous peoples view their fates as linked to that of their nonhuman relatives. For example, the wolf and bison of North America have shared a common trajectory with the continent's indigenous people—people with whom they share a landscape, a history, and kinship. Like the native peoples who depend upon them, all were dispossessed from their homelands, driven nearly to extinction, and yet have had the resilience to persist and now rebound in the face of great ecological and cultural change. The renewal of these animals and other cultural keystone species inspires, and is inextricably connected to, the revitalization of indigenous communities. Their restoration is regarded as a human responsibility that is simultaneously material and spiritual. These species are understood as elders, teachers, and sources of knowledge.

Restoration of Traditional Indigenous Diets

Landscape restoration may also be motivated by issues of public health, including a suite of illnesses associated with dietary dislocation from traditional, land-based diets to store-bought, commodity foods. For example, the epidemic of diabetes in indigenous populations has been linked to replacement of traditional foods with high sugar and fat-laden diets of mainstream society (LaDuke 2005). Restoration of traditional diets demands a landscape that supports the plant and animal species with which a culture coevolved. Among the best-known initiatives to restore native foods is the widespread effort to revitalize the harvesting and consumption of wild rice (*Manoomin*, *Zizania aquatica*) among the Anishinaabe of the Great Lakes (LaDuke 1993). Restoration of this cultural keystone species simultaneously benefits human health, ecosystem integrity, water quality, and wildlife. It also aids economic development and language revitalization—an exemplar of the way that consideration of indigenous perspectives can significantly transform the way we understand the scope and power of restoration.

Revitalization of Language and Culture

Many indigenous restoration projects are holistic in nature by integrating land, language, ethics, and religion into the restoration of relationship with a cultural landscape. In a worldview where everything is connected, restoration of language is vital to land restoration, as the intact cultural landscape is the matrix in which language resides (Battiste 2000). Language revitalization and land restoration provide a powerful example of reciprocal restoration. A case in point is the White Mountain Apache word "*ni*," which is their word for "land" *and* for "mind" (Bray 1999). Relationship to land and the teachings contained there are held in the language (Abrams 1996).

The links between restoration of land and restoration of language may be very direct. For example, indigenous place names are often descriptive of ecological features and encode information as to the nature of potential reference ecosystems (Davidson-Hunt and Berkes 2001; Nabhan 1997). Anthropologist Keith Basso eloquently documents how Apache place names reference stories and events that have teaching value and may be prescriptive of right relationship (Basso 1996). Likewise, indigenous taxonomies are often rich in biological insights. Plant names are frequently derived from observed relationships between species. Gary Nabhan details numerous examples of plant names among southwestern indigenous peoples that describe pollination and dispersal interactions, habitat preferences, and human uses (Nabhan 2000). He recounts how Tohono O'odham plant names proved valuable to conservation biologists when defining critical habitat for the endangered desert tortoise (*komik'c-ed*, *Gopherus agassizii*). In collaboration with indigenous linguists, they identified a tortoise reserve area rich in a plant species known in the Tohono O'odham language as "desert tortoise eats it."

Other connections between land and language restoration are less direct but no less valuable. The structure of language, indeed its very grammar, reflects the underlying set of assumptions regarding relationships to the natural world. For example, in my Anishinaabe language, the complex verb forms are rooted in what I refer to as "the grammar of animacy" (Kimmerer 2011). In English, where all beings in the nonhuman realm are referred to with the pronoun "it," personhood is reserved for human beings. Everything else is an object; a thing. English dramatically constrains how we think about other species. But in Anisuinaabemowin, we refer to trees and birds and water with the same pronouns we use for human beings. There is no "it" in the living world, everyone is a "subject," a person, and, thus, deserving of the same respect and compassion that we extend to the human family.

This grammar reflects a fundamentally different orientation to the natural world, which would be lost forever if endangered languages, like endangered species, become extinct. Revitalization of language allows us to imagine and potentially implement different visions of sustainability.

Exercise of Spiritual Responsibility

The cosmologies of many indigenous peoples include what are called Original Instructions or guidance about how to live in the world. In return for the gift of life on a generous earth, humans are called to a covenant of spiritual and material reciprocity, to care for the land and water that care for them. This moral responsibility is manifest in religion and ceremony as well as in material lifeways, such as subsistence activities and land management (DeLoria 1992). Ecological restoration provides an opportunity for indigenous people to exercise their spiritual responsibility of caregiving and reciprocity toward the land and the more-than-human world. A statement from Dennis Martinez (1992a) captures this added dimension to restoration, which is absent from the strictly materialist views of restoration science:

> Cultural survival depends on healthy land and a healthy, responsible relationship between humans and the land. The traditional care-giving responsibilities which maintained healthy land need to be expanded to include ecological restoration. Ecological restoration is inseparable from cultural and spiritual restoration, and is inseparable from the spiritual responsibilities of care-giving and world-renewal. Collectively and individually, these indigenous spiritual values must be central to the vision of community ecological restoration. Western science and technology, is a limited conceptual and methodological tool—the "head and hands" of restoration implementation. Native spirituality is the "heart" that guides the head and hands.

Ceremony is a powerful means to articulate moral responsibility, enter into spiritual reciprocity, and promote group cohesion and reinforce shared values. In the watershed restoration work described by Dennis Martinez (1992b) for the Sinkyone Intertribal Project, the restoration began not with shovels in the ground, but with the restoration of an ancient ceremony to welcome the salmon back home. In the lands called the "sacred ecosystem," healing of the spiritual relationship with the salmon came before engineering of the hydrology and set the stage for the work to follow.

In the indigenous paradigm, it is said that we don't understand a thing until we understand it with all dimensions of a human person—mind, body, emotion, and spirit (Cajete 1994); Western scientific education gives privileged status to objective information only and specifically excludes emotional and spiritual dimensions. Traditional ecological knowledge recognizes the different strengths of these multiple understandings and explicitly incorporates the cultural experience of the observer into interpretation of the natural world. Traditional ecological knowledge is highly rational, empirical, and pragmatic, while simultaneously integrating cultural values and moral perspectives. With its worldview of respect, responsibility, and reciprocity with nature, TEK does not compete with science nor detract from its power, but extends its scope into additional human interactions with the natural world (box 18.2).

Development of Place-Based, Sustainable Economies

The interdependence of ecosystem services and cultural services means that restoration may also serve the goal of development of sustainable, place-based economies. Such economies are characterized by a reliance on local resources and short commodity chains in which the labor, value-added, and economic benefits remain largely in the local economy. Emery (1994) suggests that these human ecological systems are regulated by four elements: resource availability, access to resources, knowledge of resources, and economic demand. Ecological restoration and TEK may enhance the critical factor of resource availability, while biocultural restoration augments elements of demand, access, and knowledge of the resource and its use.

Restoration of sustainable, place-based economies can also serve to stem the outflow of young people from an indigenous community to seek employment. Such migration can pose a significant risk to cultural integrity because opportunities for intergenerational knowledge transfer, language fluency, and other cultural ties are weakened. Sustainable economies encourage caretakers of the land to continue their stewardship practices. Thus, restoration that encompasses revitalization of both ecosystem and cultural services becomes a priority.

The White Earth Land Recovery Project of the White Earth Ojibwe provides an outstanding example of reciprocal restoration of a place-based economy in practice. Concomitant with the recovery of tribal lands lost in illegal land takings of the past century, the White Earth community has worked to create a sustainable, local economy tied to simultaneous restoration of land and culture. Recovery of title to a portion of the historic land base has enabled restoration of access to ecological resources. The TEK of the community has been engaged to develop the local economy through harvest and processing of local nontimber forest products—maple products, preserves from wild-gathered fruits, wild rice, and traditional agriculture—for local consumption and for sale. These activities simultaneously promote ecological well-being of the landscape through traditional caregiving practices, community health through restoration of the traditional diet, and revitalization of TEK and language.

Restoration of the "Remembered Forest" of the Klamath peoples similarly represents the goal of reciprocal restoration of a forest-based economy (Wolf 2004). The Klamath people of southern Oregon were made landless by disastrous federal policies of Termination in 1954 (Hood 1972), followed by intensive forest exploitation as the lands they had tended sustainably for centuries were overharvested by the U.S. Forest Service. Even without title to their own ancestral lands, the Klamath Tribe developed a forest restoration plan designed to regain a tribal homeland and subsistence base where forest management was driven by tribal values of permanence, collaboration,

Box 18.2
What Is Traditional Ecological Knowledge?

Traditional ecological knowledge (TEK) refers to the knowledge, practices, and beliefs about the relationship of living beings to one another and to the physical environment that are held by peoples in relatively nontechnological societies with a direct dependence on local resources (Berkes 1993). Traditional ecological knowledge exists around the world, independent of ethnicity. It is born of long intimacy and attentiveness to a homeland and can arise wherever people are materially and spiritually integrated with their landscape (Kimmerer 2000). Traditional ecological knowledge is a form of rational and reliable information developed through generations of intimate contact by Native peoples with their lands (Mauro and Hardison 2000). The United Nations Environment Programme (1998) has recognized TEK as having equal status with scientific knowledge, and Vine DeLoria Jr. (1995) termed TEK the "intellectual twin to science." This long intellectual tradition exists in parallel to Western science's scientific ecological knowledge (SEK), yet it has been historically marginalized by the scientific community (Salmon 1996).

Traditional ecological knowledge has much in common with SEK, which is not surprising since both traditions derive from the same source—systematic observations of nature. Both knowledge systems yield detailed empirical information about natural phenomena and relationships among ecosystem components. Both SEK and TEK have predictive power, and in both intellectual traditions, observations are interpreted within a particular cultural context.

Traditional ecological knowledge encompasses a wide range of biological information and has significant overlap with the content of a mainstream course in ecology or conservation biology. The scope of TEK documented by scientists includes detailed empirical knowledge of population biology, resource assessment and monitoring, successional dynamics, patterns of fluctuation in climate and resources, species interactions, ethnotaxonomy, sustainable harvesting, adaptive management, and manipulation of disturbance regimes (Berkes 2008). Case histories of the utility of TEK in conservation biology span a range of biomes from the tundra to the tropical rainforest (Williams and Baines 1993; Berkes, Folke, and Gadgil 1995; Fernandez-Gimenez 2000; Gadgil, Seshagiri Rao, Utkarsh, Pramod, and Chhatre 2000).

However, TEK differs from SEK in a number of important ways. Traditional ecological knowledge observations tend to be qualitative, and create a diachronic database (i.e., a record of observations from a single locale over a long time period). In TEK, the observers tend to be the resource users themselves (e.g., hunters, fishers, and gatherers) whose harvesting success is inextricably linked to the quality and reliability of their ecological observations. In contrast, scientific observations made by a small group of professionals tend to be quantitative and often represent synchronic data or simultaneous observations from a wide range of sites and frequently lack the long-term perspective of TEK. Additional differences between SEK and TEK are described in Berkes (1993).

Moreover, SEK is conducted in an academic culture where nature is viewed objectively, and the data collected are "value-free." In this aspect, TEK diverges

Box 18.2
Continued

significantly from SEK (Pierotti and Wildcat 2000) because TEK is much more than collecting and analyzing the empirical information concerning ecological relationships. Indeed, TEK is woven into and inseparable from the social and spiritual context of the culture. Traditional ecological knowledge includes the ethic of reciprocal respect and obligations between humans and the nonhuman world that I discuss throughout this chapter. In TEK science, nature is subject, not object. Such holistic ways of understanding the environment offer alternatives to the dominant consumptive values of Western societies (Hunn 1999; Berkes 2008). Embraced as an equal partner to the power of SEK, TEK offers not only important biological insights but a cultural framework for environmental problem solving that incorporates human values.

As Gadgil and colleagues (1993) write, "Modern scientific knowledge, with its accompanying worldview of human beings apart from and above the natural world, has been extraordinarily successful in furthering human understanding and manipulation of simpler systems. However, neither this worldview nor scientific knowledge has been particularly successful when confronted with complex ecological systems. . . . It is in this context that traditional ecological knowledge is of significance."

In terms of ecological restoration, TEK is useful when defining reference ecosystems because Native languages and artifacts of material culture are a living library of species composition (Alcoze and Hurteau 2001). Ethnographic data including linguistic analysis, material culture, and the oral tradition can provide detailed compositional data for the reference state. Unfortunately, few ecological scientists are trained to access these valuable data sources.

Traditional ecological knowledge can also provide an alternative way of approaching the restoration process. The dominant metaphor in this approach is not nature as machine with humans in control, but nature as a living community, populated with nonhuman persons, all contributing to the integrity of the system. Just as healing an individual relies on the resilience and vitality of the patient, who is an active participant in his or her own recovery, healing of the land is understood as offering support to its return to health in which humans play a subsidiary role. Because the process is understood as directed by nature, the practitioners adaptively change the plan as the land responds to treatments. The stated goal of the restoration is to help a site evolve through cyclical changes, rather than establishing a linear trajectory (Long, Tecle, and Burnette 2003). A similar framework formed the basis of the Karuk tribal forest restoration model (Martinez 1992b, 1995), which also conceived of restoration as a partnership with natural processes rather than an imposed formula.

Consistent with a call to incorporate TEK into ecological restoration is the recognition that this integration should be inseparable from a serious discussion about protection of traditional knowledge from exploitation. Traditional ecological knowledge represents the collective intellectual contributions of indigenous people, accumulated and systematized over millennia. The identity of the practitioners, informants, and the community should always be fully referenced and acknowledged with the same diligence that scientists apply to the contributions of their academic colleagues.

sense of place, ecological health, balance, and healing. The restoration plan includes restoration of ecosystem structure and function as well as subsistence income and enhancement of spiritual and cultural values (Wolf 2004).

The ability of indigenous peoples to exercise their stewardship roles with the land is central to the principle of reciprocal restoration, and also inextricably linked to legal title to the land. However, land title is a serious problem for many aboriginal peoples, like the White Earth Ojibwe, the Klamath, and countless others. Such is the case for the Onondaga Nation of upstate New York. Their homelands include the sacred site of Onondaga Lake where the Iroquois Confederacy was founded and now, unfortunately, thirteen Superfund sites. The Onondaga Nation has filed a historic land rights action to regain aboriginal title, not with the intent to seize property, but to regain the ability to exercise their responsibilities for the watershed and to restore both land and people. Their "Vision for a Clean Onondaga Lake" articulates the synergy between restoring a landscape and cultural restoration (Onondaga Nation 2010).

Restoration of Traditional Land Management for Biodiversity

Especially in the Americas and Australia, the notion of the presettlement state is problematic because it is frequently tied to the "myth of the pristine" (Denevan 1992), which supposes that the landscape encountered at the time of European settlement was in a "state of nature" and free from human disturbance. In the Americas, this perspective ignores at least twelve thousand years of human history of land management and an even longer period in Australia (chap. 4, this volume). There is now abundant evidence that the pre-European settlement landscape was the product of indigenous natural resource management, such as prescribed fire (Kimmerer and Lake 2001). Therefore, it may not be possible to restore the presettlement landscape without also restoring the traditional land management practices.

Traditional resource management methods share several goals with contemporary restoration efforts, including manipulating the patterns and processes of ecological succession to produce the desired species composition and structure. Indigenous management practices were effective in creating and maintaining species assemblages that produced a sustained yield of food and subsistence materials for humans, while also generating shifting mosaics of high productivity and biodiversity. The ethnographic literature is rich with descriptions of highly site-specific land care practices designed to produce a given vegetation composition (Mann 2005; Berkes 2008). These may be of significant value to restoration ecologists.

Kat Anderson (1996, 2001, 2006) provides an excellent review of the wide array of indigenous land management practices in California that ensured a sustainable harvest of culturally significant plant materials. Such practices mirror the definition of ecological restoration offered by Allen and Hoekstra (1992) as "gardening with wild species in a natural mosaic."

It is beyond the scope of this chapter to review the myriad ecosystem management practices employed by indigenous peoples. However, if, as Robinson and Handel (2000) suggest, ecological restoration is essentially facilitated succession, then it is important to recognize that TEK is rich with examples in which indigenous peoples modified the successional trajectory to produce distinctive ecological communities that meet cultural goals.

Restoration of Kincentric Relationships

Why restore relationship? Relationship is key to the sustainability, authenticity, and longevity of restored ecosystems. It likewise provides important cultural feedback about dynamic restoration outcomes. Relationship between humans and place can be the most enduring connection of all (Martinez, Salmon, and Nelson 2008), surviving and deepening even as ecosystems evolve and change. This is particularly true in the face of climate change. The structure and function of "Nature" becomes a moving target, while long-term relationships to nature represent a long-term resource for resiliency and adaptation. Second, we all know that socioeconomic and political pressures along with complementary resource shortfalls undermine the success of restoration projects. An engaged public, committed to the success and stewardship of a restored ecosystem, can generate the political will and economic pressure to support restoration policy and implementation. Regeneration of healthy relationships with land is a key component of landscape authenticity. Perhaps most important, restoration of relationship offers the opportunity for cultivation of a "moral center" called for by Higgs (1997)—an idea that is beyond the scope of purely science-driven restoration. Traditional indigenous viewpoints recognize that we live in a moral landscape governed by relationships of mutual responsibility, which are simultaneously material and spiritual. A focus on restoration of relationship guided by TEK moves us away from an anthropocentric relationship to land, into the realm of a "kincentric" relationship (Salmon 2000) in which our moral responsibility extends to all of our nonhuman relatives.

A focus on kincentric relationships underpins a wide range of tribal restoration projects. For example, the Seminole Nation has undertaken a restoration of Everglade habitats of the Florida panther (*kowechobe*, *Puma concolor*), through removal of invasive species and return of water flows. Nonhuman species are the prime beneficiaries of the restoration; what conservationists call "biodiversity," traditional peoples call "kin."

Another key element of reciprocal restoration and building kincentric relationship with the land is the importance of intergenerational knowledge sharing and education (part 6, this volume). Youth camps that involve environmental education on the land and in school are focal components of the restoration process. The Kaibab Environmental Education Network in northern Arizona is an excellent example of a restoration model for indigenous communities because it links tribal students and educators in projects that incorporate traditional and contemporary restoration strategies (Thom Alcoze, pers. comm.).

The Role of TEK in Defining the Reference Ecosystem

Traditional ecological knowledge is useful when defining reference ecosystems because Native languages and material culture are a living library of species composition (Alcoze and Hurteau 2001). Ethnographic data including linguistic analysis, material culture, and the oral tradition can provide detailed compositional data for the reference state. Unfortunately, few ecological scientists are trained to access these valuable data sources.

Martinez (1995) reports that presettlement plant inventories can be derived from the plant names in the indigenous languages of the region. Likewise, species composition of lands with uninterrupted indigenous management regimes can provide invaluable information as to the composition of the presettlement vegetation. For example, the tallgrass prairies of Walpole Island First Nation in eastern Canada are regarded as among the most species rich on the continent. These intact ecosystems are regarded as exemplars of the presettlement state, in large part because the "natural" disturbance regime that generated these prairies is also intact. The high ecological integrity of these grasslands stems in part from an uninterrupted history of prescribed burning by the Potawatomi, Ojibwe, and Ottawa peoples responsible for these ancestral lands. Thus the ideal of "Nature" as a state free of cultural influences is called into question, when we recognize some of our most cherished landscapes as artifacts of indigenous management. It may not be possible to restore "presettlement" landscapes without consideration of TEK and, indeed, without restoration of the cultural practices by which indigenous peoples sustained them.

The Role of TEK in the Restoration Process

Traditional ecological knowledge can also provide an alternative way of approaching the restoration process. The dominant metaphor in this approach is not nature as machine with humans in control, but nature as a living community, peopled with human and nonhuman persons, all contributing to the integrity of the system. This process of restoration stands in sharp contrast to the mechanistic view of restoration "as an attempt to force transitions toward the desired state" (Hobbs and Norton 1996). In indigenous land management, humans play a subsidiary role. As one elder advises, "Go slowly. Listen to the land, it will tell you what to do." Because the process is understood as directed by nature, the practitioners adaptively change the plan as the land responds to treatments. The stated goal of the restoration is to help a site evolve through cyclical changes, rather than establishing a linear trajectory (Long, Tecle, and Burnette 2003). A similar framework formed the basis of the Karuk tribal forest restoration model (Martinez 1995), which also conceived of restoration as a partnership with natural processes rather than an imposed formula. It was understood that plants that arrived as volunteers did not need to be removed to correspond to the end design. Rather they were carefully observed and understood as bringing something of value needed by the developing community. The practitioners were receptive to the potential contributions of unintended species, consistent with the worldview of plants as carriers of knowledge. The restoration team looked for feedback of mutual learning between the land and the people.

Likewise, the experience of the White Mountain Apache Nation tribe demonstrates how cultural traditions and TEK can act as guiding forces for restoration. Their lands in eastern Arizona had been degraded by federal mismanagement.

Compensatory funds were devoted to watershed restoration to repair the damage. The tribal strategy is to "take care of the land so that the land can, once again take better care of the people" (Welch and Riley 2001). Their approach to the restoration process is grounded in the wisdom of their creation stories and powerful cultural metaphors that remind people to safeguard the life processes that link the human and nonhuman communities. Elders and knowledge holders were vital participants in the design and implementation of restoration plans. The techniques used in riparian zone restoration were derived from traditional land caregiving methods practiced by the people for millennia, including methods for streambank erosion control methods, selective burning, and transplanting vegetation (Long, Tecle, and Burnette 2003).

From Function to Fidelity or Evolving Definitions of Ecological Restoration

Until recently, the many definitions of ecological restoration in the literature were mostly limited to considerations of ecosystem structure and function in a fairly narrow, materialistic sense—reflecting the scientific paradigm (National Research Council 1992). The U.S. Forest Service (2010) definition is broadly representative of this perspective: "Ecological restoration is the process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged or destroyed. Restoration focuses on establishing the composition, structure, pattern and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient and healthy under current and future conditions." This is mirrored in the basic definition of ecological restoration provided by the Society for Ecological Restoration: "Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed" (SER Primer 2004).

It is noteworthy that these definitions fail to incorporate human relationship or cultural resources into restoration goals or practices. Restoration, although a profoundly human endeavor, is conceptualized within a worldview that places human beings outside of natural systems and prioritizes repair of structure and function above restoration of relationship. However, a broken relationship with land is at the root of the ecological degradation that restoration seeks to repair. Restoration of relationship to land would, therefore, seem to require equivalence, if not a priority focus, as a restoration goal.

Coincident with the formulation of the functional definitions of ecological restoration, a definition of restoration was also being formulated from the indigenous worldview, in which nature is viewed not as a collection of objects but as a community of subjects that includes human beings as members of the democracy of species. Within this paradigm, colleagues in the Indigenous Environmental Network conceptualized ecological restoration as *inseparable from cultural and spiritual restoration*.

In the past few years, the terms used to define the boundaries of ecological restoration have subtly shifted from a focus primarily on structure and function of ecosystems to a broader consideration that includes concepts of human relationship to place. Indeed, the Society for Ecological Restoration has broadened its definition to include human interactions in those ecosystems they define as cultural by saying, "The restoration of such [cultural] ecosystems normally includes the concomitant recovery of indigenous ecological management practices, including support for the cultural survival of indigenous peoples and their languages as living libraries of traditional ecological knowledge" (SER Primer 2004). While this is an important recognition of indigenous cultures within the context of restoration, it fails to address how the mainstream society might use ecological restoration practices to reengage with nature and move beyond the idea of nature as other and into the worldview of reciprocal restoration. See the chapters 19 and 21 in this volume for other perspectives about more mainstream eco-cultural practices.

A Gradient of Terminology

Terminology is important in the way it frames the discourse, and several terms have been used to express varying levels of integration between cultures and land restoration. Here I discuss and compare three terms that have been used to describe this relationship—"biocultural restoration," "eco-cultural restoration," and "reciprocal restoration." The term "biocultural restoration" was first used by Dan Janzen to describe his initiatives to involve local cultures as allies in the restoration at Guanacaste National Park in Costa Rica (1988). Cairns (2000) uses the term to categorize restoration projects that have a significant input and support from citizen groups and take place in a cultural landscape. In a number of cases, the approach to integrating culture and restoration has been decidedly top-down, and cultural participation appears limited to restorationists cultivating social support for their projects. Biocultural restoration has become associated with this important, but potentially superficial, approach to cultural engagement.

Some authors have replaced "biocultural" with "eco-cultural" (Higgs 2003; Martinez 2003). In examining the pattern of use of this term, it seems to be applied to restoration projects that are substantially guided and informed by the cultural goals and knowledge of the inhabitants of a cultural landscape, where the humans are active participants in the restoration. Eco-cultural restoration represents a much deeper level of cultural engagement of an indigenous culture, as in the case of the Sinkyone Intertribal Wilderness Project (Martinez 1992).

If we use the indigenous worldview to frame the relationship of restoration, what language might we use? Among the primary tenets of indigenous environmental philosophy is reciprocity. Thus I propose that we need a new term to describe that to which we might aspire; a new term wherein we recognize and act from the essential interconnectedness of land and people, where all flourishing is mutual. That new/old term is "reciprocal restoration" (see box 18.1).

Becoming Indigenous to Place

In addition to its significance for indigenous cultures, reciprocal restoration has the potential to occur within mainstream society by reengaging people with land, renewing the human–place connection, and enabling people to reclaim their responsibility for sustaining the land that sustains them. Higgs (2005) notes that "restoration is successful only to the extent that the life of the human community is changed to reflect the health of the restored ecosystem." Traditional ecological knowledge is vital to support this new direction in restoration ecology, as a model for restoration of relationship grounded in the worldview of humans participating in the well-being of land.

Reciprocal restoration also offers the opportunity for an immigrant culture to start becoming "indigenous to place" by healing relationships with land and history. This does not mean appropriating the culture of indigenous people, but generating an authentic new relationship. It means throwing off the mindset of the immigrant, including the frontier mindset of "take what you can get and move on." It means becoming involved with the "language" and dynamics of the place you live—learning its landforms, weather patterns, animals, plants, waterways, and seasons. Being indigenous to place means to live as if we'll be here for the long haul, as if our children's future mattered. It means taking care of the land as if our lives, both spiritual and material, depended on it. It involves entering into a covenant of reciprocity with the land, which includes restoration. That's what it means to become indigenous to place (see chapters 19, 22, 23, this volume). This can be done in a variety of ways (e.g., eco-cultural restoration, the restoration of traditional practices and cultural landscapes, ecological art) as the three case studies in chapters 19, 20, and 21 illustrate.

Conclusion

- It is not the land that is broken, but our relationship with it. Thus, the work of ecological restoration must be to restore human–land relationship.
- Traditional ecological knowledge can contribute to both the philosophy and the practice of ecological restoration by expanding our vision of what restoration can entail to include eco-cultural and reciprocal restoration.
- Traditional resource management practices provide insight into tools for restoration through manipulation of disturbance regimes.
- Indigenous concepts of right relationship include respect, reciprocity, responsibility, and relatedness.
- Relationship can include active participation in the well-being of land.

References

Abrams, D. 1996. *The Spell of the Sensuous: Perception and Language in a More-than-Human World*. New York: Pantheon Books.

Alcoze, T., and M. Hurteau. 2001. "Implementing the Archaeo-environmental Reconstruction Technique: Rediscovering the Historic Ground Layer of Three Plant Communities in the Greater Grand Canyon Region." In *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems*, edited by D. Egan and E. A. Howell, 413–24. Washington DC: Island Press.

Allen, W. H. 1988. "Biocultural Restoration of a Tropical Forest." *BioScience* 38 (3): 156–61.

Allen, T., and T. Hoekstra. 1992. *Toward a Unified Ecology*. New York: Columbia University Press.

Anderson, M. K. 1996. "Tending the Wilderness." *Restoration & Management Notes* 14 (2): 154–66.

———. 2001. "The Contribution of Ethnobiology to the Reconstruction and Restoration of Historic Ecosystems." In *Historical Ecology Handbook*, edited by D. Egan and E. A. Howell, 55–72. Washington, DC: Island Press.

———. 2006. *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources*. Berkeley: University of California Press.

Anderson, M. K., and D. L. Rowney. 1999. "The Edible Plant *Dichelostemma capitata*: Its Vegetative Reproduction in Response to Different Indigenous Harvesting Regimes in California." *Restoration Ecology* 7 (3): 231–40.

Ausubel, K. 2008. "Remembering the Original Instructions." In *Original Instructions: Indigenous Teachings for a Sustainable Future*, edited by M. K. Nelson, xxi–xxv. Rochester, VT: Bear and Company.

Basso, K. 1996. *Wisdom Sits in Places*. Albuquerque: University of New Mexico Press.

Battiste, M., ed. 2000. *Reclaiming Indigenous Voice and Vision*. Vancouver: University of British Columbia Press.

Berkes, F. 1993. "Traditional Ecological Knowledge in Perspective." In *Traditional Ecological Knowledge: Concepts and Cases*, edited by J. T. Inglis, 1–9. Ottawa: International Program on Traditional Ecological Knowledge and International Development Research Centre.

———. 2008. *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. 2nd ed. Philadelphia: Taylor and Francis.

Berkes, F., C. Folke, and M. Gadgil. 1995. "Traditional Ecological Knowledge, Biodiversity, Resilience and Sustainability." In *Biodiversity Conservation*, edited by C. Perrings, K.-G. Maler, C. Folke, C. S. Holling, and B.-O. Jansson, 269–87. Dordrecht, Netherlands: Kluwer Academic.

Bray, D., ed. 1999. *Western Apache-English Dictionary*. Tempe, AZ: Bilingual Review Press.

Cairns Jr., J. 2000. "Setting Ecological Restoration Goals for Technical Feasibility and Scientific Validity." *Ecological Engineering* 15: 171–80.

Cairns Jr., J., and J. R. Heckman. 1996. "Restoration Ecology: The State of an Emerging Field." *Annual Review of Energy and Environment* 21: 167–89.

Cajete, G. C. 1994. *Look to the Mountain: An Ecology of Indigenous Education*. Skyland, NC: Kivali Press.

Clewell, A., and J. Aronson. 2006. "Motivations for the Restoration of Ecosystems." *Conservation Biology* 20 (2): 420–28.

Davidson-Hunt, I., and F. Berkes. 2001. "Changing Resource Management Paradigms, Traditional Ecological Knowledge, and Non-timber Forest Products." In *Forest Communities in the Third Millennium*, edited by I. Davidson-Hunt, L. C. Duchesne, and J. C. Zasada, 78–92. U.S. Forest Service North Central Research Station General Technical Report NC-217. St. Paul, MN: USDA Forest Service.

———. 2003. "Learning as You Journey: Anishinaabe Perception of Social-Ecological Environments and Adaptive Learning." *Conservation Ecology* 8 (1): 5. http://www.consecol.org/vol8/iss1/art5/.

DeLoria, V. 1992. "Spiritual Management: Prospects for Restoration on Tribal Lands." *Restoration & Management Notes* 10 (1): 48–50.

———. 1995. *Red Earth, White Lies*. New York: Harper and Row.

Denevan, W. M. 1992. "The Pristine Myth: The Landscape of the Americas in 1492." *Annals of the Association of American Geographers* 82 (3): 369–85.

Dokken, B. 2010. *A Tale of Two Lakes*. St. Paul: Minnesota Department of Natural Resources. http://www.dnr.state.mn.us/volunteer/marapr00/red_lake.html.

Egan, D. 1988. "Our Heritage of Landscaping with Native Plants: A Hermeneutical Study of Texts from 1919–1929." Master's thesis, Landscape Architecture Department, University of Wisconsin–Madison.

Emery, M. 1994. "The Search Conference: State of the Art." Unpublished paper, Center for Continuing Education. Australian National University.

Fernandez-Gimenez, M. E. 2000. "The Role of Nomadic Mongolian Pastoralists' Ecological Knowledge in Rangeland Management." *Ecological Applications* 10: 1318–26.

Gadgil, M., F. Berkes, and C. Folke. 1993. "Indigenous Knowledge for Biodiversity Conservation." *Ambio* 22: 151–56.

Gadgil, M., P. R. Seshagiri Rao, G. Utkarsh, P. Pramod, and A. Chhatre. 2000. "New Meanings for Old Knowledge: The Peoples Biodiversity Registers Program." *Ecological Applications* 10: 1307–17.

Garibaldi, A., and N. Turner. 2004. "Cultural Keystone Species: Implications for Ecological Conservation and Restoration." *Ecology and Society* 9 (3): 1. http://www.ecologyandsociety.org/vol9/iss3/art1/.

Higgs, E. S. 1997. "What Is Good Ecological Restoration?" *Conservation Biology* 11 (2): 338–48.

———. 2003. *Nature by Design: People, Natural Process and Ecological Restoration*. Cambridge, MA: MIT Press.

———. 2005. "The Two-Culture Problem: Ecological Restoration and the Integration of Knowledge." *Restoration Ecology* 13 (1): 159–64.

Hobbs, R., and J. Norton. 1996. "Towards a Conceptual Framework for Restoration Ecology." *Restoration Ecology* 4: 93–100.

Hood, S. "Termination of the Klamath Tribe in Oregon." *Ethnohistory* 19 (4): 379–92.

House, F. 2000. *Totem Salmon: Life Lessons from Another Species*. Boston: Beacon Press.

Hunn, E. 1999. "The Value of Subsistence for the Future of the World." In *Ethnoecology: Situated Knowledge/Located Lives*, edited by V. D. Nazarea, 23–36. Tucson: Arizona University Press.

Janzen, D. H. 1988. "Tropical Ecological and Biocultural Restoration." *Science* 239: 243–44.

Jordan III, W. R. 2003. *The Sunflower Forest: Ecological Restoration and the New Communion with Nature*. Berkeley: University of California Press.

Kimmerer, R. W. 1998. "Intellectual Diversity: Bringing the Native Perspective into Natural Resources Education." *Winds of Change* Summer, 14–18.

———. 2000. "Native Knowledge for Native Ecosystems." *Journal of Forestry* 98 (8): 4–9.

———. 2011. "Learning the Grammar of Animacy." In *The Colors of Nature: Culture, Identity, and Natural World*, edited by A. H. Deming and L. E. Savoy, 167–77. Minneapolis, MN: Milkweed Editions.

Kimmerer, R. W., and F. K. Lake. 2001. "Maintaining the Mosaic: The Role of Indigenous Burning in Land Management." *Journal of Forestry* 99: 36–41.

LaDuke, W. 1993. "Voices from White Earth Gaia—Waabaabiganikaag." Thirteenth Annual Schumacher Lecture, Yale University, New Haven, CT.

———. 2005. *Recovering the Sacred: The Power of Naming and Claiming*. New York: South End Press.

Long, J., A. Tecle, and B. Burnette. 2003. "Cultural Foundations for Ecological Restoration on the White Mountain Apache Reservation." *Ecology and Society* 8 (1): 4; http://www.consecol.org/vol8/iss1/art4.

Mann, C. 2005. *1491: New Revelations of the Americas before Columbus*. New York: Knopf.

Martinez, D. 1992a. Presentation at the Indigenous Environmental Network "Protecting Mother Earth" Conference, Celilo Falls, Oregon, USA.

———. 1992b. "Northwestern Coastal Forests: The Sinkyone Intertribal Park Project." *Restoration & Management Notes* 10 (1): 64–69.

———. 1995. "Karuk Tribal Module of Mainstem Salmon Watershed Restoration: Karuk Ancestral Lands and People as Reference Ecosystem for Eco-cultural Restoration in Collaborative Ecosystem Management." Unpublished report. On file with U.S. Department of Agriculture, Forest Service, Klamath National Forest, 1312 Fairlane Rd, Yreka, CA 96097.

———. 2003. "Protected Areas, Indigenous Peoples, and the Western Idea of Nature." *Ecological Restoration* 21 (4): 247–50.

Martinez, D., E. Salmon, and M. K. Nelson. 2008. "Restoring Indigenous History and Culture to Nature." In *Original Instructions: Indigenous Teachings for a Sustainable Future*, edited by M. K. Nelson. 88–105. Rochester, VT: Bear and Company. 88–105

Mauro, F., and P. D. Hardison. 2000. "Traditional Knowledge of Indigenous and Local Communities: International Debate and Policy Initiatives." *Ecological Applications* 10: 1263–69.

Meffee, G., and C. Carroll. 1994. *Principles of Conservation Biology*. Sunderland, MA: Sinauer Associates.

Nabhan, G. P. 1997. *Cultures of Habitat: On Nature, Culture, and Story*. Washington, DC: Counterpoint Press.

———. 2000. "Interspecific Relationships Affecting Endangered Species Recognized by O'Odham and Comcaac Cultures." *Ecological Applications* 10: 1288–95.

National Research Council. 1992. *Restoration of Aquatic Ecosystems: Science, Technology and Public Policy*. Washington, DC: National Academy Press.

Oeschlager, M. 1996. *Caring for Creation: An Ecumenical Approach to the Environmental Crisis*. New Haven, CT: Yale University Press.

Onondaga Nation. 2010. "The Onondaga Nation's Vision for a Clean Onondaga Lake." http://www.onondaganation.org/lake_vision.html.

Pierotti, R., and D. Wildcat. 2000. "Traditional Ecological Knowledge: The Third Alternative." *Ecological Applications* 10 (5): 1333–40.

Reid, L. 2005. "The Effects of Traditional Harvesting Practices on Restored Sweetgrass Populations." MS thesis, State University of New York College of Environmental Science and Forestry, Syracuse, New York.

Robbins, J. 1997. "The Return of the Wolf." *Wildlife Conservation* 100: 44–48.

Robinson, G., and S. Handel. 2000. "Directing Spatial Patterns of Recruitment During an Experimental Urban Woodland Reclamation." *Ecological Applications* 10 (1): 174–88.

Salmon, E. 1996. "Decolonizing Our Voices." *Winds of Change* Summer, 70–72.

———. 2000. "Kincentric Ecology: Indigenous Perception of the Human–Nature Relationship." *Ecological Applications* 1 (5): 1327–32.

Shebitz, D., and R. Kimmerer. 2005. "Re-establishing Roots of a Mohawk Community and a Culturally Significant Plant: Sweetgrass." *Restoration Ecology* 13(2): 257–64.

Simpson, L. 2002. "Indigenous Environmental Education for Cultural Survival." *Canadian Journal of Environmental Education* 7 (1): 13–25.

Society for Ecological Restoration (SER) Science and Policy Working Group. 2004. *Society for Ecological Restoration International Primer on Ecological Restoration*. Washington, DC: Society for Ecological Restoration.

Stumpff, L. 2003. "Protecting Restorative Relationships and Traditional Values: American Indian Tribes, Wildlife and Wild Lands." In *Science and Stewardship to Protect and Sustain Wilderness Values: 7th World Wilderness Congress Symposium*, compiled by A. Watson and J. Sproull, 63–71. USDA Forest Service Proceedings RMRS-P-27. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Turner, N. J. 2005. *The Earth's Blanket: Traditional Teachings for Sustainable Living*. Seattle: University of Washington Press.

United Nations Environment Programme (UNEP). 1998. *Report of the Fourth Meeting of the Parties to the Convention on Biodiversity*. Nairobi, Kenya: United Nations Environment Programme.

U.S. Forest Service. 2010. *Forest Service Manual 2000 National Forest Resource Management, Chapter 2020 Ecological Restoration and Resilience*. Washington, DC: U.S. Forest Service National Headquarters.

Welch, J. R., and R. Riley. 2001. "Reclaiming Land and Spirit in the Western Apache Homeland." *American Indian Quarterly* 25 (1): 5–12.

Williams, N. M., and G. Baines, eds. 1993. *Traditional Ecological Knowledge: Wisdom for Sustainable Development*. Canberra: Australian National University, Centre for Resource and Environmental Studies.

Wolf, E. 2004. *Klamath Heartlands: A Guide to the Klamath Reservation Forest Plan*. Portland, OR: Ecotrust.

Chapter 19

Implications of Landscape History and Cultural Severance for Restoration in England

Ian D. Rotherham

There is increasing concern about the severance of land and land use from its cultural past. British responses include landscape-scale attempts to "re-create" extensive conservation areas like the Cambridgeshire fenland, with Britain's largest-ever, lottery-funded conservation project. Such efforts are undertaken because people recognize landscape-scale projects are needed for plants and animals to respond to climate change, to meet national obligations to offset carbon emissions, and to mitigate and moderate flood risk. These major restoration projects are also intended to help economic development, especially in postindustrial and depressed rural areas. Such restoration projects go far beyond 1970s and 1980s reclamation efforts in Britain and aim to regenerate sustainable landscapes. The intention is to embed these landscapes in the regional environmental matrix and to reinvigorate the regional economy and communities.

Yet there are serious flaws in the approaches embodied in these projects because they are undertaken with little knowledge of local cultural history. The driving forces that shaped and manipulated these ecosystems for centuries or millennia are mostly overlooked, undermining ecological, social, and economic sustainability. This chapter examines recent projects and their shortcomings and suggests how they could be more successful. It highlights the need to link culture and ecology, history and economy, in bold landscapes larger and more dynamic than (with a few exceptions) anything previously attempted in British or European conservation. Projects must be economically robust and sustainable. Furthermore, in order to effectively deliver the desired outputs of biodiversity, these need to at least mimic the original landscape conditions. Most projects do not.

Cultural Landscapes and Conservation

The traditional and "cultural" uses of natural resources and the consequent impacts on landscapes and their ecology are generally overlooked (Agnoletti 2006, 2007). Even major landscape-scale effects, like the formation of England's Norfolk Broads by medieval peat cutting to supply Norwich and other areas with fuel, went

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_19,

unrecognized until recently (Rotherham, Egan, and Ardron 2004). Ancient woodlands are among Britain's most highly valued conservation sites, but former management strategies, such as coppice for fuelwood and charcoal, often go unnoticed, and the historic drivers of change that determine the contemporary ecology are frequently ignored. These drivers are the dynamic forces of politics, economics, and society at local and, frequently, subsistence levels. Such landscapes and associated ecologies are often mistakenly considered to be "natural" (Lambert et al. 1961). This lack of historical context is troubling because medieval woods, heaths, commons, and bogs across western and Mediterranean Europe supplied most people with fuel, building materials, and food for many centuries. Local landscapes provided community needs in traditional agrarian, early industrial, and subsistence societies. Most people depended on limited land resources, often held in common, for arable pasture, fuel, and building materials. Understanding the implications of historic land use and its impacts, both drastic and subtle, on soils, water, and vegetation is important in informing future management. Many sites now managed for conservation are unrelated to former cultural uses. Others are intensified or abandoned; in all situations the original ecology, altered, slips away or is destroyed outright.

Changing Values and Cultural Severance

Human resource use in landscapes is a fundamental driver of ecosystems, interacting with ecology and other environmental factors through complex social, legal, economic, and political mechanisms that facilitate and constrain usage. Almost all European landscapes, and many others elsewhere, are cultural palimpsests that were managed in traditional ways for millennia (Crumley and Marquardt 1987; Agnoletti 2006).

Traditional cultural practices, not always sustainable, generated many landscapes we now value highly. The mechanisms or drivers of this relationship are complex, ranging from direct environmental impacts (e.g., lowering nutrient levels and microdisturbance) to indirect effects through social and economic impacts (e.g., resource abundance that allowed people to remain in an area). With modern agricultural and industrial revolutions came "cultural severance," the break between local people, nature, and landscape (Rotherham 2009). Communities and supplies of food, fuel, and building materials or other needs have been separated so each has become a commodity often produced outside the local or regional ecosystem. As industry and agriculture became increasingly technological and driven by cheap fossil fuels, previously used resources and solutions to subsistence needs were largely abandoned. Local landscapes from which they came have been radically altered; transformed economically, politically, socially, and ecologically. There was also a shift from rural to urban populations; for those left behind, their traditional environment becomes disputed space. Eventually squeezed out, the former landscapes are abandoned to become backdrops to tourism and weekend recreationists, and the leisure grounds of the wealthy. It is widely recognized that traditional rural economies may be replaced by leisure and tourism. Indeed, these changes are welcomed by many British conservationists who see farming use as twentieth-century techno-exploitation. Critical actors change from subsistence peasants and landlords to recreational or tourism visitors and residential postindustrial commuters. Few, if any, of these people practice traditional resource management. In the United Kingdom, in particular, farmers of the late-twentieth century have been seen as the enemies of conservation, and it is only recently that the pendulum has begun to swing back to farmers as custodians of a healthy countryside.

Tourists and new urbanite residents may celebrate history and seek to touch the past, but their lives do not depend upon local natural resources. Farmers may also become conservationists, but they differ fundamentally from their forebears in their relationships with nature. Conservation is seen as a desirable add-on, but not as a fundamental part of sustainable subsistence and survival.

This transition in land use is a problem and, perhaps, one of the most serious threats to environmental sustainability and nature conservation. With abandonment of traditional uses and practices, many sites have been lost or fragmented. Those remaining receive little or no management and quickly pass through successional change. Not "natural" but "eco-cultural," these landscapes have ecologies that evolved for centuries with locally distinct and generally predictable exploitation driven by economic need. Attempts to conserve and manage remaining fragments are too little and too late. Moreover, these landscapes lack long-term economic viability and are disconnected from land management processes. Economy and landscape, once linked through cultural tradition and subsistence, are replaced by "sticking plaster" approaches of targeted grant aid and land management plans. Laudable and, in the short term, essential if sites, species, and traditions are not to be totally lost, it is not a long-term solution, and regarding it as such may be dangerous.

The concept of re-wilding or re-naturing has recently emerged (Taylor 2005; Buissink 2007; Fraser 2009), offering huge possibilities for rural landscapes. In Europe, this approach is often based on Frans Vera's ideas about the origins and nature of European landscapes (Vera 2000). Yet most of the concepts, visions, and projects overlook the cultural links between Vera's landscape and the early modern period—a fundamental error. Furthermore, there is a danger that projects for re-wilding and reintroduction of large grazing herbivores fail to understand the ecosystem carrying capacity, landscape cultural history, or likely economic impacts of so-called eco-tourism. There is a widespread myth that release from farming leads to landscape re-wilding or re-naturing and is inherently good for wildlife. It is true that some species benefit from abandonment and ebb and flow with successional change. However, in many cases, abandonment of cultural or working landscapes is dereliction, as seen across the Mediterranean where rural areas depopulate with resulting social and environmental problems (Agnoletti 2006). Favorably located landscapes may acquire veneers of tourism affluence or commuter-belt sophistication, but most go into steep decline. With derelict landscapes, no working rural community, degraded ecology, and abandoned cultural heritage, these regions discourage tourism or leisure visitors (Doncaster et al. 2006; Rotherham 2008a, 2008b).

Severance between past and contemporary cultural landscapes, with consequent implications for conservation and restoration, is mostly overlooked. However, the issues are now being addressed by both academics (e.g., Hodder and Bullock 2005; Peterken 2005; Agnoletti 2006) and policy-making bodies, such as Natural England and the Forestry Commission in the United Kingdom. In 2003, for example, the European Union Ministerial Conference in Vienna addressed the issue of forests and forest history. They took the decisive step to include social and cultural values in sustainable forest management in the "Vienna Resolution 3" (Agnoletti 2007). Following work by supporting organizations, such as the United Nations Educational, Scientific, and Cultural Organization (UNESCO), signatory states committed themselves to "preserving and enhancing the social and cultural dimension of sustainable forest management in Europe."

Overcoming Cultural Severance through Traditional Management Practices

Cultural severance has major impacts on large-scale restoration projects. For maximum success in sustainable outcomes, and to embed projects in regional cultural history, knowledge of former landscapes and their history should inform site restoration. Techniques considered in this long-term study included site restoration and recovery through reinstatement of sympathetic and traditional management at such sites as Woodhouse Washlands and Wharncliffe Heath. Additionally, new sites can be developed within landscape creation schemes wherever possible using seed and materials from regional donor sites. Case study examples include an opencast coal mining site at Tankersley and a wetland nature reserve at Blackburn Meadows.

In 2006, I wrote about four case studies with specific sites and groups of sites, all in northern-central England (Rotherham 2006). These included dry heathland and ancient woodland (Wharncliffe Heath and Wood), riverine meadow landscape (Woodhouse Washlands), acidic grassland and relict woodland (Westwood), and ancient coppice woods (Ecclesall Woods, Gleadless Valley Woods, and Owler Carr Wood). These studies generated broad conclusions and common threads, the areas reflecting inextricable links between landscape history, site utilization, and subsequent abandonment. Recognition by conservationists was followed by a desire to restore or re-create in part the former ecological character as perceived by the stakeholders. However, this raised key issues about economic history and the relationships between environmental resources and local people. It posed questions about how people value and use sites, both now and formerly. These landscapes were once exploited but conserved because they were essential to sustainable local living. Today, they are valued for leisure, recreation, and conservation but are not necessarily managed. If they are managed, it is radically different from in the past. The individual projects helped demonstrate huge potential for landscape recovery but also identified concerns and tensions.

Heath, Common, Fen, and Bog

Much of Europe's northwestern seaboard was formerly characterized by heathland vegetation with peat, turf, gorse (*Ulex* spp.), broom (*Cytisus* spp.), and ling or heather

(*Calluna* spp.) harvested from heath and common. Gorse was important fodder for cattle and horses, particularly in winter when other crops were scarce, and large areas were set aside for its cultivation. Many commons yielded underwood and timber for building, bracken fern (*Pteridium aquilinum*) or "fern," and heather for fuel and building.

Unfortunately, these landscapes have been changed dramatically by agricultural intensification and land "improvement." Lee Chadwick (1982) in her book *Our Vanishing Heathlands* suggested the following: "At present one might say that the whole future of our heathlands is in the melting pot and there is a danger that unless citizens are sufficiently stimulated to sit up and take notice, the particularly British institution of the common may be in greater danger, despite the recent spate of legislation, than at any time since the Enclosure Acts." Chadwick highlighted cultural and traditional uses of heaths and commons, and rights of usage as key factors in preservation and conservation; suggesting that utilitarian community attachment was vital. Heathlands, commons, fens, and bogs remain the Cinderellas of British conservation, particularly northern heaths and commons. Unlike woodlands or wetlands, they still await their conservation-minded Prince Charming to put on the glass slipper.

Chadwick and others, such as Webb (1986, 1998), raised awareness about the plight of southern English lowland heaths but largely ignored the formerly more extensive northern heathlands. Due to the impacts of the Enclosure Acts (1750–1860) and expanded industrialization/urbanization, once extensive upland moors became separated from lowland heaths and commons, the latter reduced to isolated pockets abandoned to neglect and ecological succession—islands in a sea of "improved" land. Ecological change was further exacerbated by massive precipitation of smoke, grime, and nutrients; a process that continues today with nitrogen fallout from car fumes.

In 2006, I described the heaths and commons across the North Midlands and northern England as being in poor condition, mainly because their traditional uses have ended. The nature and scale of associated changes in these landscapes are fundamental to their present-day condition. For instance, long-term, subsistence farming has been grossly underestimated in terms of its importance. Indeed, without this type of farming, plagio-climax communities, abandoned heaths, commons, and other areas succeed rapidly to tall herb, scrub, and woodland. Ironically, grant-aided tree planting to create plantation woodlands (ostensibly for conservation) speeds the decline of heaths, commons, and similar plant communities.

My colleagues and I also studied approaches to heathland restoration at Wharncliffe (Rotherham, Rose, and Percy 2000) where there is archaeological evidence of a substantial Romano-British quern-stone factory about 1,700 years ago. The removal of encroaching scrub and secondary woodland in addition to controlled heather burning and cutting, bracken spraying, and grazing by rare breeds of livestock helped to restore this heathland.

We also studied restoration efforts in the riverside meadows and marshes of the lowland River Rother, which has a two-hundred-year legacy of intensive industry and pollution. Restored sites were subject to agreed conservation management plans with restoration strategies for reestablished traditional hay cutting and grazing by rare breeds of livestock (sheep and cattle) suited to rough, wet conditions. Restoration was used rather than intervention with habitat creation—a typical approach to such sites in England. Existing site drainage was reduced to increase wetness, and site recovery was monitored (Handley and Rotherham 2000; Rotherham et al. 2000).

Woodland Management: Coppice and Fuelwood

Traditional British woodland management varied from production, harvesting, and use of small wood for domestic fuel consumption to much more intensive industrial coppice wood production. The former occurred for centuries from the earliest periods of human settlement in the region several thousand years ago; the latter predominated from late medieval and early industrial periods with massive landscape impacts. The two demands on wood supply coexisted for several hundred years. Perlin (1989) described interactions between industrial and domestic demands for fuelwood, charcoal, and coal and their effects on forestry and land use. This intensified with the Industrial Revolution, and as industry and the swelling population of city dwellers increasingly demanded coppiced wood and coal to supply energy, rural populations turned to the main fuels of the common people—peat, turf, and furze (gorse)—supplemented by small wood and heather. The nature and intensity of exploitation affected many British landscapes. Coppice and pollard materials were used for fuel and for leaf fodder, while hedgerow trees were also utilized and are still "worked" in parts of Europe. Some examples of these activities are well documented (mostly where commercial exploitation and marketing were involved), although much more went undocumented and were simply the customs and practices of a largely illiterate, rural population (Perlin 1989; Fowler 2002; Warde 2007).

We assessed three woodlands (Ecclesall Woods, Gleadless Valley Woods, and Owler Carr Wood) that were restored using traditional coppice work and creation of conservation glades. These are ancient woods (known as "wooded" since before 1600), managed by local traditional methods for centuries. By the late 1900s, these woodlands were abandoned or replanted in part as "high forest," and later used as recreational (i.e., amenity) woods after their commercial value decreased. Because of this long history of human exploitation, and associated diverse impacts on landscape and site ecology, there was potential for tension between stakeholders in conservation efforts. Woodlands mix relict ecology and cultural landscapes of former management, so balancing restoration and recovery to conserve different aspects is problematic. Some wooded landscapes present palimpsests over three thousand years, so deciding which period to conserve or enhance raises issues. Limited understanding of interactions between wooded sites and other landscapes, and of the importance of "antiquity" in woodland conservation, causes problems. These issues are ongoing as ecologically driven restoration blends into delivery of amenity and recreational access, with little understanding of ecological processes or conservation commitments.

Another study site at Westwood was a restored former opencast coal mine that included relict ancient grassland and woodland that were allowed to "seed" into the reconstructed landscape. This project was remarkably successful with few conflicts of interest, being ultimately managed by a tenant farmer and having public access. Importantly, much of the restoration was determined by local people through their elected parish council.

The Drainage of the Great Wetlands

South Yorkshire's lowland fen was once 1,900 square miles (3,000 km^2) of bogs, fens, and carrs—an area teeming with wildlife, including hundreds of thousands of birds (De La Pryme 1870). These wetlands provided fish, reed and rushes (for thatching, flooring, and candles), peat fuel, brushwood from the carrs for fuel and light constructional work, and pasture for cattle. They were important hunting lands, with seventy thousand low-lying, and often inundated, acres of Hatfield Chase, which was the private forest of the de Warennes of Conisbrough, before reverting to the Crown in 1347. This was land valued for the hunt by local overlords and for fishing and hunting birds and small game by peasants and tenants. Peat and withies (i.e., willow coppices) were cut, and animals were grazed here. Importantly, this "ownership" of the landscape ensured its long-term survival, and the human use created microdisturbances that generated a diverse ecology. Most of the fenland survived until 1600 but was ultimately lost to intensive farming and drainage. Once England's third largest fenland, this landscape was transformed during three centuries from heath, moor, woodland, unimproved pasture, marsh, and fen into flat intensive, and mostly uniform, arable farmland. By 1900, almost all of this once great wetland, having lost its local community functions and ownership, was drained and plowed. Small areas remained but were stripped for peat mining, fragmented and isolated within the agricultural landscape (Rotherham and Harrison 2006; Rotherham 2010).

Campaigns in the 1980s led to programs for conservation restoration with work centered on the Humberhead Peatlands and Potteric Carr. The Yorkshire Wildlife Trust, for example, created extensive additions to the Potteric Carr Nature Reserve, investing £2,000,000 from the Heritage Lottery Fund and European Union. This created 185 acres (75 ha) of bittern (*Botautus stellaris*) reed bed habitat.

Further south, in East Anglia, even more common fen was destroyed between 1650 and 1950, including more than 2,486 square miles (4,000 km^2) that were reduced to a few hectares using newly acquired American farming technology in the 1940s. Today, ambitious fen restoration plans exist around Woodwalton and Wicken Fen. The Great Fen Project at Woodwalton plans to restore 7,410 acres (3,000 ha) of farmland to new wetland and other habitats to protect the National Nature Reserves of Woodwalton and Holme Fens). At Wicken Fen, former arable land was returned to meadow or wetland and there were experiments to reintroduce lost plant species from seeds at core relict sites.

Despite this, conditions for successful restoration remain uncertain because the environmental context has changed dramatically. Loss of traditional uses is hugely problematic. The National Trust tries to mimic former management to create conditions for key target species, but this is very difficult. As local resident and author James Wentworth-Day (1954) pointed out, the Fens were at the heart of village life even in the 1940s, and subsistence use made them what they were. Today, planners and conservationists have wrestled with the need to both restore sustainable landscapes and justify their existence, socially and economically. One approach has been to recognize the output of restoration in providing ecosystem services; essentially the benefits that ecological systems provide to society (see chap. 14, this volume). This is relevant to fenland because it produces socioeconomic and environmental goods, including floodwater storage, carbon sequestration, leisure and health benefits, and opportunities for tourism and recreation.

Some of these provide direct economic benefits to both indigenous local people and newcomers. However, while businesses and employment are linked to habitat creation, few engage directly in managing the created ecology. Thus they differ fundamentally in their relationships with nature and natural resources from the close dependence of earlier communities. Indeed, it is often the case that leisure, recreational, and tourism uses are effectively parasitic on the landscape, putting little or nothing back into maintenance (Rotherham 2008b). Some new habitat creation projects and restoration initiatives try to engage local people by linking creation and conservation to local enterprises. Conservation bodies, such as the Royal Society for the Protection of Birds, the Yorkshire Wildlife Trust, and the National Trust, attempt to relate their conservation efforts for key target species to local people and their economy.

Conclusion

A key issue is the balance between "restoration" (i.e., return to ecologically sympathetic management through reestablishing traditional land uses) and "creation" (i.e., establishing new landscapes on former industrial or intensive agri-industrial land). I conclude that initiatives need both resonance with local communities and economic viability to maintain long-term sustainability. Across diverse sites and situations, the studies highlight potential for restoration and recovery of historic landscapes once managed traditionally by local people. Some projects were particularly successful with remarkable recovery or reappearance of rare and once extinct species.

However, some projects had serious difficulties and lacked holistic approaches with problems identified in recovery and restoration of cultural landscapes. These sites are *not* natural since human impacts are deeply etched in their fabric, but are "eco-cultural landscapes." This raises questions about what we restore and why. How can we address conflicts between contemporary, sustainable landscapes and ecology, and recognize and conserve the unique historic archives of these resources? The studies help inform debates, raising issues and questions about key difficulties in restoration and creation programs. In particular, there has been catastrophic rapid loss of local cultural knowledge about the origins of these landscapes, so decisions about approaches to restoration and creation by local people and experts are not based on firm understanding of the resource. This means expected outcomes differ significantly from reality. The visual impact of management, such as woodland coppicing, can upset local people who expect an untouched "natural" area.

Even at regional scales the unique cultural heritage that drove former ecology and forms vital links to future heritage tourism may be lost. A fundamental problem is that gross changes are driven by economic "progress," while most conservation initiatives are cosmetic, not economic. A more meaningful conservation response would be to record local cultural knowledge and then rebuild and celebrate local connectivity with nature, valuing local traditions and uses. It may be neither possible nor necessarily desirable to return to subsistence living, but long-term solutions must be economically sustainable. To maintain important traditional landscapes, and in particular their threatened biodiversity, requires that creation, restoration, and subsequent management must produce ecological conditions that mimic the original. In most ecosystems with traditional cultural management this means lowered biomass and nutrients (especially nitrogen), regular microdisturbance, and effective movement of propagules to regeneration niches. Many sites are isolated and fragmented within the landscape, which causes dispersal and connectivity issues, and the sites are generally desiccated compared to their original condition. This means that approaches must be more ambitious and radical than anything yet achieved. Webb (1986, 1998) considered the conservation of European heathlands, landscapes typical of some of the study sites, and was not optimistic. The fenland restoration projects consider these issues but have not found long-term solutions for all the problems. The new fens will be wonderful wildlife sites and will attract huge numbers of visiting tourists. However, they will neither look like nor function like the original fens. Taken across the broad sweep of restoration projects, in a diversity of British environments, I was unable to find any that effectively bind restoration to long-term cultural and economic utilization. Without this reconnection, projects will achieve environmental reconstruction but will neither achieve nor maintain restoration of the former landscapes and ecologies.

References

Agnoletti, M., ed. 2006. *The Conservation of Cultural Landscapes*. Wallingford, Oxon, UK: CAB International.

———, ed. 2007. *Guidelines for the Implementation of Social and Cultural Values in Sustainable Forest Management: A Scientific Contribution to the Implementation of MCPFE—Vienna Resolution* 3. IUFRO Occasional Paper No. 19 ISSN 1024-414X. Vienna, Austria: International Union of Forest Research Organizations.

Buissink, F. 2007. *Wilderness in Europe: What Really Goes On between the Beasts and the Trees*. Dreibergen, Netherlands: Staatsbosbeheer.

Chadwick, L. 1982. *In Search of Heathland*. Durham, England: Dobson Books.

Crumley, C. L., and W. Marquardt, eds. 1987. *Regional Dynamics: Burgundian Landscapes in Historical Perspective*. New York: Academic Press.

De La Pryme. 1870. *The Diary of Abraham De La Pryme, the Yorkshire Antiquary*. London: Whittaker and Co. for the Surtees Society.

Doncaster, S., D. Egan, I. D. Rotherham, and K. Harrison. 2006. "The Tourism Economic Argument for Wetlands: A Case Study Approach." In *Proceedings of the IALE Conference,* *Water and the Landscape: The Landscape Ecology of Freshwater Ecosystems*, edited by B. Davies and S. Thompson, 296–300. Oxford, UK: International Association of Landscape Ecology, UK Edition.

Fowler, J. 2002. *Landscapes and Lives: The Scottish Forest through the Ages*. Edinburgh: Canongate Books.

Fraser, C. 2009. *Rewilding the World: Dispatches from the Conservation Revolution*. New York: Metropolitan Books.

Handley, C., and I. D. Rotherham. 2000. "Woodhouse Washlands: A Major Urban Nature Reserve." In *Abstract Proceedings of the South Yorkshire Biodiversity Conference, March 2000*. Sheffield, England: Sheffield Hallam University and the South Yorkshire Biodiversity Research Group.

Hodder, K. H., and J. M. Bullock. 2005. "Naturalistic Grazing in Present and Future Landscapes." *Landscape Archaeology and Ecology* 5: 43–45.

Lambert, J. M., J. N. Jennings, C. T. Smith, C. Green, and J. N. Hutchinson. 1961. *The Making of the Broads: A Reconsideration of Their Origin in the Light of New Evidence*. London: John Murray Ltd.

Perlin, J. 1989. *A Forest Journey*. Cambridge, MA: Harvard University Press.

Peterken, G. 2005. "Ecological Crises in the Lower Wye Valley." *Landscape Archaeology and Ecology* 5: 62–64.

Rotherham, I. D. 2006. "Historic Landscape Restoration: Case Studies of Site Recovery in Post-industrial South Yorkshire, England." In *The Conservation of Cultural Landscapes*, edited by M. Agnoletti, 211–24. Wallingford, Oxfordshire, England: CABI International.

———. 2008a. "Lessons from the Past: A Case Study of How Upland Land-Use Has Influenced the Environmental Resource." *Aspects of Applied Biology* 85: 85–91.

———. 2008b. "Tourism and Recreation as Economic Drivers in Future Uplands." *Aspects of Applied Biology* 85: 93–98.

———. 2009. "The Importance of Cultural Severance in Landscape Ecology Research." In *Landscape Ecology Research Trends*, edited by A. Dupont and H. Jacobs, 1–18. Hauppauge, NY: Nova Science Publishers.

———. 2010. *Yorkshire's Forgotten Fenlands*. Barnsley, England: Pen & Sword Publishing.

Rotherham, I. D., D. Egan, and P. A. Ardron. 2004. "Fuel Economy and the Uplands: The Effects of Peat and Turf Utilisation on Upland Landscapes." *Society for Landscape Studies Supplementary Series* 2: 99–109.

Rotherham, I. D., and K. Harrison. 2006. "History, Ecology, and Economics as Drivers for a New Nature in Reconstructing the South Yorkshire Fens: Past, Present and Future." Paper presented at Restoring or Renaturing? The Presence of the Past in Ecological Restoration: A Transatlantic Workshop. Zurich, Switzerland: Institute of Environmental Sciences, University of Zurich, July 9–11.

Rotherham, I. D., J. C. Rose, C. Handley, and K. Goodman. 2000. "Restoring Urban Wet Meadows: Five Years of Recovery of a Major Floodplain in Urban South Yorkshire, UK." In *Abstracts of the Proceedings of the Society for Ecological Restoration 2000 Conference, Liverpool, England*. http://www.ser.org/pdf/ser2000abs.pdf.

Rotherham, I. D., J. C. Rose, and C. Percy. 2000. "Linking Past and Future: The Dynamic Influence of History and Ecology on the Restoration of a Major Urban Heathland at Wharncliffe, South Yorkshire. UK." In *Abstracts of the Proceedings of the Society for Ecological Restoration 2000 Conference, Liverpool, England*. http://www.ser.org/pdf/ser2000abs.pdf.

Taylor, P. 2005. *Beyond Conservation: A Wildland Strategy*. London: Earthscan Publications.

Vera, F. W. M. 2000. *Grazing Ecology and Forest History*. New York: CAB International.
Warde, P. 2007. *Energy Consumption in England and Wales 1560–2000*. Naples, Italy: Consiglio Nazionale delle Ricerche, Istituto di Studi sulle Società del Mediterraneo.
Webb, N. R. 1986. *Heathlands*. London: Collins.
———. 1998. "The Traditional Management of European Heathlands." *Journal of Applied Ecology* 35: 987–90.
Wentworth-Day, J. 1954. *History of the Fens*. London: George G. Harrap.

Chapter 20

Eco-cultural Restoration of the Mesopotamian Marshes, Southern Iraq

Michelle Stevens
with Dr. Hamid K. Ahmed

If there is hope for restoring the Mesopotamian marshes of southern Iraq and Iran, it lies with two key elements: the indigenous Marsh Arabs and the availability of water. The supply of consistent water is largely a political issue between the various countries within the Tigris-Euphrates watershed. For their part, the Marsh Arabs have a long and intimate connection between a functioning marsh ecosystem and their own cultural identity. This deep bond is expressed well by the Iraqi poet, Dr. Rasheed Bander al-Khayoun:

> The people of al Ahwar need water in the marshes. . . . Their spiritual need surpasses the material need, since draining the marshes means putting the boats out of service and an end to regional poetry specific to al-Ahwar, and to singing, which can only be performed in that theatre of water and reeds and rushes. Indeed, draining the marshes means the death of a way of life that people have practiced for tens of centuries. There is no doubt that the people desperately want their environment to return to its natural state. . . . All the people dream of is the marshes full with fishes, birds, cows, and buffalos with modernized passageways and islands, because it is this vision that is in harmony with their spiritual heritages as found in their songs, poems, and tales. (as recorded by Stevens 2009)

During ethnographic interviews I conducted in 2002–2003 with expatriate Iraqis in San Diego, California, I found that the marshes are considered a cultural icon, similar to the Statue of Liberty (Stevens 2004, 2009). Everyone I interviewed wants the marshes to continue to exist and thrive. Ninety percent of the people interviewed in San Diego would want to go back if they had autonomy and their own way of life. One Iraqi said, "We grow like a bird in the marsh. Everything is in front of us. We canoe inside the marshes for reeds for the animals and for fish." They expressed a great desire to have the marshes restored, saying "The marshes are like our body, our blood. You cannot miss one part. It all should stay as marsh." People also want clean water, health care, education, transportation, modern housing with electricity, cell phones,

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_20,

computers, and televisions, and women want to have access to disposable diapers and other child care amenities.

History, Importance, and Current Condition of the Mesopotamian Marshes

The *al Ahwar*[1] marshes of southern Iraq and Iran encompass the largest wetland ecosystem in the Middle East and western Eurasia, historically covering 5,790–7,770 square miles (15,000–20,000 km^2) of interconnected lakes, mudflats, and wetlands within what is now Iraq and Iran. Often called the Mesopotamian marshes, the area is considered by Muslims, Christians, and Jews as the site of the legendary Garden of Eden. The marshes are a cultural heritage center of global importance, having supported the traditional lifestyles of approximately 500,000 indigenous people—the Marsh Arabs or Ma'dan—and the important agricultural production of rice, wheat, millet, and dates. A major haven of regional and global biodiversity, the marshes provide habitat for significant populations and species of wildlife (Iraq Foundation 2003). For instance, two-thirds of western Asia's wintering waterfowl, estimated from one million to ten million birds, are believed to winter in the marshes. The marsh ecosystem also sustains an economically important local and regional fishery, providing spawning habitat for migratory fin fish and penaid shrimp species that use the marshes for spawning migrations to and from the Persian Gulf.

Unfortunately recent history has not been kind to the marshes or the people that inhabit them, as the area has been the scene of three military conflicts—the Iran–Iraq War (1980–1988), the Gulf War (1990–1991), and the 2003 invasion of Iraq led by the United States and Great Britain. For thirty-five years the Iraqi people and marshes have been in the middle of a war zone. As Hassan Partow reported to the United Nations concerning the fate of the Marsh Arabs: "With the outbreak of the Iran–Iraq war in 1980, their homeland was transformed into a frontline combat zone. Subsequently, they were faced with cultural genocide and the drainage and destruction of their marsh home that ultimately shattered their society and way of life" (UNEP 2001). After the Gulf War ended in 1991, uprisings against the Iraqi regime of Saddam Hussein broke out. A period of genocide and ecocide began, during which the Hussein regime drained more than 90 percent of the marshes to obtain access to rebels taking refuge in the marshes (H. K. Ahmed from discussion with author, December 14, 2008).

Abdul Imam Hatab and Abu Kusai al Helfy, Ma'dan leaders from the Salien Marshes south of the Al Hammar Marshes, used to have very fertile land and were well off (H. K. Ahmed from discussion with author, December 14, 2008). Following the 1991 uprising, the Republican National Guard committed genocide and ecocide in the marshes, and initiated engineering work that desiccated the marshes. The men described it as a "tsunami hurricane" passing through their villages, and none survived apart from those who managed to escape the country. They felt jubilant and happy to see the toppling of Saddam for what he had done to the Iraqi people. Hatab and al Helfy said, "What has happened so far is only personal initiatives such as breaking dams by local Marsh Arabs, amending the irrigation networks around the marshes, limited electricity services, limited fishing, harvesting reeds, raising buffalos, and boat manufacturing. We hope that the . . . government will start strategic development projects for the marshes as promised. We urge the government to help the marshes and the Marsh Arab, not only because it would bring sustainable development, unique ecosystems and potential eco-tourism to the Marshes, but also to acknowledge the sacrifices and suffering of the people under the previous regime" (H. K. Ahmed from discussion with author, December 14, 2008).

With the demise of Saddam Hussein and the Baathist regime in 2003, and with good water years from 2003 to 2005, water returned to about 60 percent of the former marshland area (Richardson et al. 2005). Some areas rejuvenated beautifully, with lush growth of reeds and rebounding fish populations. The Ma'dan people who lived as environmental refugees throughout the 1990s were returning to the marshes with their water buffalo. However, despite the rehydration of such a large area of the marshes, much of the marsh ecosystem is in poor condition. According to a paper in *Science* (Richardson et al. 2005), less than 10 percent of the original marshes in Iraq remain fully functioning wetlands (also Reiss et al. 2003; Stevens 2006).

Water, air, and land pollution is still extremely severe in many parts of Iraq, including the Mesopotamian marshes (Bowman 2005; Nature Iraq 2009). Iraq's environmental problems include (1) water resource pollution (including groundwater); (2) ecosystem and biodiversity degradation; (3) waste and sanitation disposal; (4) oil and other cement, fertilizer, and pesticide industry pollutants; and (5) the direct impacts of military conflicts (Bowman 2005). Reduced flows have exacerbated water quality problems. While in Basra, I was left with the impression that this area has highly polluted air, land, and water. With low flows, salinity in the Shat al Arab River (the river formed by the confluence of the Tigris and Euphrates Rivers) had increased from one part per thousand to four to five parts per thousand (Marine Science Center, Basra University, unpublished data, 2009). Flows are significantly reduced. In 1977–1978, flows in the Shat al Arab ranged from 990 to 1,277 cubic meters per second; in 1993–1994, flows ranged from 550 to 1,100 cubic meters per second; in 2005–2006, flows were as low as 204 cubic meters per second; and in 2008–2009, flows reached a low of less than 100 cubic meters per second. Shad (*Alose hilsa*) populations have declined 75 percent. Many other invertebrates are also declining, and the salty turbid water with warmer temperatures is adversely affecting fish production and biodiversity in the Persian Gulf. In Basra I saw shattered buildings and rivers so polluted with algae (*Dunaliella* spp.) that the water turned bright pink. Garbage was everywhere and stray dogs snuffled through it, well fed but in ill health. Heavy particulates from dust caused the air to appear sepia toned, with a visibility similar to dense fog.

Cultural Heritage: Basis for Eco-cultural Restoration

The *al Ahwar* marshes are the homeland of a distinct cultural group—the mostly Shi'ite Muslim Marsh Arabs. They consider their ancestral territory and cultural identity to straddle the present Iraq–Iran border, and there are strong kinship ties between marsh dwellers in both countries. According to Partow, "The marshlands have been home to ancient human communities for more than five millennia. The area's inhabitants are known as the Ma'dan, Marsh Arabs or Marsh Dwellers, whose population is estimated to range from 350,000 to 500,000. . . . The Marsh Arabs have evolved a unique subsistence lifestyle that is firmly rooted in their aquatic environment. Most of the Ma'dan are seminomadic, but some of them are settled in villages. . . . Water buffalos play a pivotal role in Marsh Arab existence" (UNEP 2001, 15–16).

Traditionally, Marsh Arabs lived in a flat watery landscape, sleeping in reed homes that are built on humanmade islands in the marsh, traveling in their boats or *mashoofs*, and welcoming travelers in their *mudhifs*, which are large structures woven of reeds in a style that dates back to the Sumerian culture, roughly the third to fourth century BC. Water buffalo (*Bubalus bubalis*) have played a role in their culture similar to that of the camel in Bedouin Arab culture (Maxwell 1957; Thesiger 1964). Life in the marshes centered around gathering reeds in the marshes, caring for water buffalo, fishing, hunting for birds, and seasonal work in date palm plantations and rice fields.

The marshes were sustainably managed by Marsh Arab tribes for thousands of years. Traditional management of the marshes included selective harvesting and burning of reeds on a seasonal and phenological basis, multiple-species management (reeds, fish, waterfowl, bird eggs, rice), burning senescent vegetation to stimulate new growth, spatial and temporal restriction of fish harvest during spawning, and landscape patch management. These management practices were beneficial for reed growth and biomass production, to maintain diverse patch dynamics, and to increase microhabitat diversity. The only anthropological study specifically devoted to a part of the Mesopotamian marshes was published in Shakir Salim's *Marsh Dwellers of the Euphrates Delta*. After spending two years (1954–1955) living with the Ma'dan, Salim classified the inhabitants occupationally into cultivators, reed-gatherers, and buffalo breeders (Salim 1962). According to Salim, 82 percent of households fished, 49 percent hunted, 66 percent farmed, 58 percent cultivated crops for food, 75 percent used reeds, 78 percent kept animals or birds, and 2 percent worked for a wage. Salim observed that traditional Marsh Arab society burned and cut reeds and bulrushes periodically to obtain fodder for the water buffalo. The Marsh People burned the old reeds every year, around January, to stimulate the growth of young reeds. Reeds were used for animal fodder; building boats and rafts, houses, and mosques/public places; and weaving mats and baskets for sale. The most important use for reeds was mat weaving. Salim (1962) estimated that about forty thousand mats were used for huts, twelve thousand for guest houses, and ten thousand for annual export. These qualitative data are indicative of the extensive ecological impact of reed harvesting and traditional management on marsh culture and ecology.

As a result of this long history of human management, the marshes are a culturalized landscape, formed over thousands of years by agricultural and traditional management practices such as the selective harvesting of more than eight different sizes and textures of reeds, the use of fire, and hunting and fishing. These intermediate-scale disturbances have long been the key to ecosystem structure and function. These traditional activities are important to the local economy and have brought in more than $7.3 million per annum (Maltby 1994; Nicholson and Clark 2002).

One cannot discuss the Ma'dan without talking about their use of water buffalo. Water buffalo are both an umbrella species and a cultural icon, and they represent the well-being of indigenous Ma'dan people. They are also a keystone species in the marsh ecosystem. "Water buffalo are widespread throughout the marshes in the south of Iraq" (Stevens 2009). "There are no houses in the marshes without a water buffalo. They are the main source of livelihood of people in the marshes. In fact, water buffalo are considered indicators of the quality of marsh life and restoration of the Iraqi marshes. The Ma'dan depend on their herds of water buffalo; they are valued for their dairy products, and are part of the family. I expect that the absence of water buffaloes will lead to the disappearance of people in the marshes."

Through extensive interviews, I discovered that the Iraqis who lived in the marshes had a great wealth of biological knowledge about culturally significant resources, such as reeds, water buffalo, and fish. This traditional ecological knowledge is an important source of information for emerging models of ecological restoration and ecosystem management of the marshes. Because the marsh ecosystem is adapted to human management, any effort to restore the ecosystem must also be an effort to reestablish Marsh Arab culture and make use of their traditional management practices. Thus maintaining the integrity, identity, and culture of the Marsh Arab society must be preeminent in restoration planning, and this must include encouraging the sustainable livelihoods of Marsh Arabs who have returned to the area. "The future of the 5,000-year-old Marsh Arab culture and the economic stability of a large portion of southern Iraq are dependent on the success of this restoration effort" (Richardson et al. 2005), however, the converse is equally true, the success of the restoration effort depends on the actions of the Marsh Arab culture and the economic stability of a large portion of southern Iraq.

Iraqi Perspective on Healing the Marshes and Helping the Ma'dan People

In 2008, I attended the International Congress on Biodiversity in the Middle East in Jordan. The following year, I was the invited keynote speaker at the Third Scientific Conference on the Rehabilitation of the Southern Iraq Marshes in Basra, Iraq. Being invited to visit the marshes was a dream come true. After six years of studying the marshes and traveling internationally, I was very excited (and scared) about visiting Iraqi scientists and the Ma'dan people, and about visiting the Mesopotamian marshes themselves.

I conducted more than twenty hours of interviews with Nature Iraq (www.natureiraq.org) biologists while attending the biodiversity conference (Stevens 2009). According to Dr. Azzam Alwash, director of Nature Iraq, an Iraq nongovernmental organization accredited by the United Nations Environmental Program and affiliated with Birdlife International, "The security situation is making it harder to do the work (in the marshes), but our teams of young scientists are determined to keep the work going despite the rough conditions and continuing violence. . . . Teams are still taking monthly trips to the marshes to collect scientific data to . . . understand the state of the restored marshes" (Stevens 2009).

Nature Iraq is sponsoring the prioritization, identification, and monitoring of Key Biodiversity Areas (KBAs), as defined by the International Union for Conservation of

Nature (IUCN). These are sites of global significance for biodiversity conservation (Nature Iraq 2009). The Nature Iraq KBA Project is the largest and most comprehensive study in this highly volatile region in more than twenty-five years. Biological indicators were sampled at more than one hundred sites with birds as the primary focus of survey work, especially those species of “conservation concern.”

Korsh Ararat is a field biologist specializing in ornithology. He told me, “It was my dream to work in the marshes. I collected everything we could find on the marshes” (Stevens 2009). He worked as a translator for the British, then for Nature Iraq. “I love the marshes,” Ararat said. “Nature compensated me and gave me things. I love it. I consider it my mother. I want to give back.” When he first began studying birds in the marshes, he had to make his own binoculars and collected all the books and magazines he could find about natural history. Ararat said, “I found no one in Iraq who could write about birds, so I started to write a book.” Since then, he has helped complete both the *Field Guide to the Birds of Iraq* and a *Children’s Guide to the Birds of Iraq* (Ararat and Porter 2008; Fadhel, Salim, and Ararat 2008).

Botanist Muzhir Shibil said, “Each time I go to the marshes, I learn more. And the life in the marshes is amazing. The marshes are a very natural location to the world. Part of it could be used for ecotourism, and to help the locals. This would help conserve the marshes, to save them. Ecotourism would be friendly for the environment and can provide benefits for people and the marshes. I think it can help people to be in contact with the people from other countries and see the other traditions. But without change, these traditions need to be maintained. We want to keep this special” (Stevens 2009).

Nature Iraq also conducted socioeconomic surveys of older people, or *Sherch*, as they called them, people who lived in the marshes and have many experiences and stories to tell. Botanist Muzhir Shibil said, “We talked with them about their lives and what their lives are like now, compared with before the marshes were drained. They said that before the marshes were drained their life was easier and generated more income, because fishing was always good in the area” (Stevens 2009). According to Ibrahem Abed, Nature Iraq fisheries biologist, economically important fish are almost completely absent from the marshes, particularly the species that require good water quality. These fish have only been recorded at a few sites and in small numbers, despite the fact that Iraq’s southern marshes have always been considered an important spawning and nursery ground for them.

Currently, some people have a generator and electricity, which were not available before, and almost everyone has a cell phone. Even in urban areas, electricity is intermittent and undependable; people who can afford generators turn them on when the electricity cuts out. Most people in the marshes have low incomes, and jobs are few and far between. Educational and training opportunities for people in the marshes are in high demand and short supply. People want better education for their children and more schools; like people everywhere, they want their children to have a better life than they have had. In Basra, I saw young boys on busy and dangerous street corners running into the street to sell trinkets to people in idling cars. Education used to be mandatory, and exploitation of children would have been forbidden. There are also many widows after so many years of war; they stand on street corners wearing black *abayas* and *niqab* (black traditional Arabic dress with a face veil covering all but the eyes). They raise their outstretched hands to people in idling cars, begging, sometimes with small, often dirty children beside them. The water, air, and environment are highly polluted. However, conditions are more stable and less dangerous; people are out at night, shopping and visiting. Parks are beginning to be replanted, and public art of dolphins and water vessels has replaced statues of soldiers pointing guns across the Shat al Arab at Iran.

Nature Iraq has been helping people through construction of aquaculture. The first hatchery in the al Chibayish District hatched two and a half million fingerlings to reintroduce native fish into the marshland and provide income and food. The Marine Science Center at Basra University is also working on restoring fish to the marshes. According to Nature Iraq surveys, even if the fish come back in the same amount, people in the marshes are now more dependent on the government for jobs (Nature Iraq 2009). Many don't want fishing jobs because there are not enough fish for a decent income. Both Nature Iraq and the AMAR Appeal (www.amarappeal.com) have provided reverse osmosis units to supply fresh water to people in the south. Nature Iraq has adopted a new project that reduces technical water quality information down to a simple description of a specific site's water quality. Development of a simple description of a specific site's water quality, called a Water Quality Index, will help simplify water quality information. This will help prioritize and formulate remedies for water quality problems (Nature Iraq 2009).

Korsh Ararat said, "I'm so happy to work with Nature Iraq. I can help my country, help my people, and develop knowledge" (Stevens 2009). Mohammed al Saffar told me, "We are fighting for Nature Iraq to accomplish something. We work on our reports. Nature Iraq is developing the Twin Rivers Institute at the American University in Sulaimaniya, Iraq, to educate Iraqi scientists and government officials."

Ibrahem Abed, fisheries biologist, said, "Nature Iraq has increased my experience and knowledge, and helped me achieve my dreams. Now I can help to make something good for Iraq" (Stevens 2009). When asked if he would like to add anything else, Abed said, "I would like to thank the American people and Nature Iraq for all they have given me, given the Iraqi people, and given the marshes" (Steven 2009).

The Dwindling Supply of Water and the Eco-cultural Restoration of the Mesopotamian Marshes

The story of how the Mesopotamian marshes have become desiccated is a story of nation-states operating without respect to the needs or rights of their neighbors, the well-intentioned use of American and British engineering technology to build dams, and the use of dictatorial powers to crush an indigenous people.

The Tigris and Euphrates Rivers, which supply much of the water for the Mesopotamian marshes, have their headwaters in Turkey, Syria, and Iran. Unfortunately, the proliferation of dams and irrigation schemes along these rivers has disrupted natural flows and choked off much of the water supply to the marshes. Moreover, while Iraq has water-sharing agreements with Syria, Turkey, and Iran, the treaties are not effective, and there is a continuous loss of water quality, water supply, and marshland ecosystem functions and cultural services. Iran's damming of the Karkheh River, which feeds directly into the marshes, and its construction of a barricade along the border running through the Hawr al Hawizeh Marsh, is resulting in the desiccation and destruction of Iraq's most pristine remaining marsh—a wetland that in 2008 at the Ninth Meeting of the Ramsar Convention Conference of the Parties (Ramsar COP9) was designated a Wetland of International Significance and Iraq's first Ramsar site (Ramsar Convention on Wetlands 1982).

When the marshes were rehydrated in 2003, aquatic vegetation rapidly colonized much of its former area. For example, reeds were growing at sufficient height, density, and areal coverage to meet the needs of the Marsh People within a fairly short time frame. Unfortunately, reeds became stunted or killed by current drought conditions, which produced higher salinities, increased temperatures, increased eutrophication, anoxic conditions, and lower pH.

Today, besides the urgent need for water in the marshes, the main challenges for resource management issues include the following: (1) reduced flood pulses, (2) formation of salt crusts, (3) uncontrolled burning of marsh vegetation, (4) overharvesting of reeds, (5) overfishing through nonsustainable fishing methods (electrocution, dynamite, and chlordane), (6) invasion of exotic species, and (7) overgrazing by water buffalo on submerged plants and by camels on grassland and patchy shrubs.

Water Rights and a Call for Social Justice

With good water years since 2003, water returned to approximately 58 percent of the marshland area. Unfortunately, there was a severe drought in 2007 and 2008 (UNEP 2009). Now the Mesopotamian marshes are once again drying up, and the Iraqi people who depend on them are desperate to maintain their marshes and traditional lifestyle. The picture is grim: less than 30 percent of the marshes remained hydrated in February 2009; the water levels of the Tigris and Euphrates Rivers continue to drop; marshes recede; and the fish, reeds, and water buffalo that embody the marshes die (Muir 2009; Nature Iraq 2009). After persecution and genocide under Saddam Hussein, the Ma'dan came home to the marshes hoping to regain their traditional lifestyle. With their marsh homeland disappearing into a salt-encrusted wasteland, they are once again a people dispossessed. The Ma'dan are now becoming urban refugees, squatting on lands they do not have ownership or rights to, attempting to eke out an existence with their water buffalo. The fragility and vulnerability of the vast marsh ecosystem is also jeopardized by a weak Iraqi government, without the political will or influence to demand riparian water rights from upstream users in the Tigris–Euphrates watershed.

Despite all these socioecological tragedies, the Mesopotamian marshes are loved by the Iraqi people, especially the people of the south. They are anxious to see the marshes restored, even though the restoration could be difficult given the extent and magnitude of the degradation. What seems apparent is that without intervention from powerful outside countries to broker water rights in the Tigris–Euphrates watershed, the marshes will die and the people will be dispossessed of their lifestyle, their cultural heritage, and their beloved marshes.

Jassim al-Asadi, Nature Iraq, put it this way: "There is drought, the water levels are getting lower, and water quality has worsened; the marshes are continuously shrinking. This leads to great suffering, especially for the water buffalo breeders and fishermen. We must put pressure on decision makers to implement temporary solutions to provide marshes with water from the rivers. Please help us in writing and demanding water from Turkey and Iran, providing us with our fair share of water required to revive the marshes" (Stevens 2009). To this end, more than five hundred Iraqi scientists and researchers have appealed to the Iraqi government, other governments in the Tigris–Euphrates watershed, and scientific organizations for help to ensure maintained flows of water for the Iraqi Mesopotamian marshes. Their signed petition, which was approved at the Third Scientific Conference on the Rehabilitation of Southern Iraqi Marshes in 2009 in Basra, states the following: "For over 5,000 years the cultures and ecosystem of the *al Ahwar* marshes have flourished and been sustained through life-giving waters; we request enough water to restore and preserve the biodiversity and long-lasting cultural heritage of this region." The Iraqi scientists have asked for help to make the world aware of the tragedy of the losses in the marshes and to help apply pressure on adjacent countries in the Tigris–Euphrates watershed (i.e., Syria, Turkey, Iran) to allow bypass flows into the system. This is a regional issue affecting all of the Middle Eastern countries in one way or another. There needs to be a just and equitable distribution of the water resources and improved efficiency of usage. Additionally, there needs to be some sort of basinwide planning or third-party negotiation for this to occur.

Conclusion

The Mesopotamian marshes are an acknowledged, internationally significant wetland, have outstanding cultural antiquity and heritage value, and provide an ecological and cultural experiment at a scale never before considered in eco-cultural restoration. *Incha Allah* (as God wills it), international negotiation will result in ensuring flows of water to the marshes to sustain the ecosystem and human lives. Narmeen Othman, Iraqi minister of environment, says, "There are two places in Iraq—the high places in the north's mountains and the southern marshland—where you are speaking with God. When I was alone in the mountains, I took my strength from nature, from the grasses and flowers and trees, from the waterfalls and rivers. The same pieces of water that come from our mountains, they end up in the marshes, and they are a gift to Iraq" (Stevens 2009).

Notes

1. The term *al ahwar* is derived from Aramaic and means "whiteness" or "the illumination of sun on water."

References

Ararat, K., and R. Porter. 2008. *Field Guide to the Birds of Iraq*. Cambridge, UK: Birdlife International and Sulaymaniyah, Iraq: Nature Iraq.

Bowman, R. E. 2005. "Global Cornerstones for Environmental Recovery in Iraq: A Comparative Law and Policy Analysis of Lessons in Environmental Response and Remediation." *N.Y.U. Environmental Law Journal* 13: 501–60.

Fadhel, O., M. Salim, and K. Ararat. 2008. *Bird Life for Iraqi Children*. Cambridge, UK: Birdlife International and Sulaymaniyah, Iraq: Nature Iraq.

Iraq Foundation. 2003. *Building a Scientific Basis for Restoration of the Mesopotamian Marshlands*. Findings of the international technical advisory panel restoration planning workshop February 2003 convened by Eden Again Project The Iraq Foundation. Washington, DC: Iraq Foundation. http://www.iraqfoundation.org/edenagain/publications/pdfs/bldgscientificbasis.pdf.

Maltby, E., ed. 1994. *An Environmental and Ecological Study of the Marshlands of Mesopotamia*. Draft Consultative Bulletin. Wetland Ecosystems Research Group, University of Exeter. London: AMAR Appeal Trust.

Maxwell, G. 1957. *A Reed Shaken by the Wind: A Journey through the Unexplored Marshlands of Iraq*. Harmondsworth, England: Penguin.

Muir, J. 2009. "Iraq Marshes Face Grave New Threat." BBC News, Middle East, Iraq, February 24, 2009. http://news.bbc.co.uk.

Nature Iraq. 2009. http://www.natureiraq.org/Eng/home.html.

Nicholson, E., and P. Clark. 2002. *The Iraqi Marshlands: A Human and Environmental Study*. London: The AMAR Appeal International Charitable Foundation.

Ramsar Convention on Wetlands. 1982. Convention on Wetlands of International Importance Especially as Waterfowl Habitat. http://www.ramsar.org/key_conv_e.htm.

Reiss, P., C. Richardson, A. Alwash, and D. Pool. 2003. *Strategies for Assisting the Marsh Dwellers and Restoring the Marshlands in Southern Iraq: Interim Status Report*. FORWARD Task Order, Bureau for Asia and the Near East, Integrated Water and Coastal Resources Management IQC, U.S. Agency for International Development.

Richardson, C. J., P. Reiss, N. A. Hussain, A. Alwash, and D. J. Pool. 2005. "The Restoration Potential of the Mesopotamian Marshes of Iraq." *Science* 25: 1307–11.

Salim, S. M. 1962. *Marsh Dwellers of the Euphrates Delta*. London: Athlone Press.

Stevens, M. L. 2004. "Restoration of the Mesopotamian Marshes of Southern Iraq: Synthesis of Current Restoration Activities." *Canadian Reclamation* Summer/Fall, 7–11.

———. 2006. "Healing the People and the Land: Restoring the Mesopotamian Marshes and Rejuvenating Culture in Southern Iraq." In *Healing a Hurting World: The Role of NGOs*, edited by F. Z. Swartz, 149–64. St. Paul, MN: Paragon House.

———. 2009. "Unpublished Field Notes, 2002–2003 and 2008–2009, from San Diego, CA; Aqaba, Jordan; and Basra, Iraq."

Thesiger, W. 1964. *The Marsh Arabs*. Harmondsworth, England: Penguin.

United Nations Environment Programme (UNEP). 2001. *The Mesopotamian Marshlands: Demise of an Ecosystem*. Early Warning and Technical Assessment Report. UNEP/DEWA/TR.01-3 Rev.1, Division of Early Warning and Assessment. Nairobi, Kenya: United Nations Environment Programme. http://www.grid.unep.ch/activities/sustainable/tigris/marshlands/.

———. 2009. "Support for Environmental Management of the Iraqi Marshlands." http://marshlands.unep.or.jp/.

Chapter 21

Environmental Art as Eco-cultural Restoration

Lillian Ball with Tim Collins, Reiko Goto, and Betsy Damon*

Many artists concerned with the environment have created interventions dependent on the restoration of ecosystems. These artists not only comment on environmental issues, they also intercede to halt degradation and nurture environmental health. They are passionately involved in processes that restore a variety of ecosystems worldwide. They question assumptions about what is possible, and they work with scientists, government officials, and planners to bring their visions to fruition. These works aim to escape the confines of the "white box" to implement sustainable principles and actually influence policy. This chapter presents three projects that invited public interaction by initiating community projects. All have significant human dimensions of creativity and interaction within a restoration setting.

Although I have been an artist for thirty years, when I started activist efforts for wetland preservation and restoration seven years ago, art just seemed superfluous. It gradually dawned on me that the only artwork one could make had to concentrate on environmental issues. I had become an eco-artist, joining others who had been working this way, in many cases, for decades. The underlying concepts of science and community values had become indispensable to the success of any visual object. Quoting from the ecoartnetwork.org, this type of work "focuses attention on the web of interrelationships in our environment—the physical, biological, cultural, and historical aspects of ecological systems." These working methods reflect principles of "Social Sculpture" established by Joseph Beuys, an artist and one of the founders of the German Green Party in the 1970s. His ideas about community involvement and activism used art as a vehicle—a concept now echoed by many eco-artists worldwide.

In 2007, I curated an exhibition entitled, "Called to Action: Environmental Restoration by Artists" at ArtSites Gallery in Riverhead, New York (Ball 2008). The exhibit included the work of twelve artist teams, collectives, or individuals. That exhibition and the roundtable discussion on opening day presented a wonderful opportunity to

*Lillian Ball introduces this chapter, which describes three projects wherein artists interact with the environment and the community in a restoration setting. Project authors are Tim Collins and Reiki Goto (Project I), Betsy Damon (Project II), and Lillian Ball (Project III).

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_21,

see and acknowledge the restoration work done by other artists and to learn what strategies have been most effective.

Tim Collins and Reiko Goto's work from the 3 Rivers 2nd Nature project in Pittsburgh, Pennsylvania, was included in that exhibition. They showed a series of photos of a temporary "sand painting," done in the manner of Tibetan monks, from painstaking application to the final return of the sand to the river. Tim and Reiko created aerial views of the 3 Rivers area with colored sand in exquisite, minute detail. The artists spent five years on the project, working to reveal the forgotten realities and to redefine the emergent ecological values of the region. The result was a unique preservation, conservation, and restoration plan, prepared with, and developed for, citizen action.

While I was unaware of Betsy Damon's work when I was planning the exhibit, I soon heard how she had designed six acres of wetlands to restore the urban water quality of the Fu-Nan River in Chengdu, China. Her Living Water Gardens are remediation systems that restore polluted rivers and canals using a concept called solar aquatics. Her designs incorporate wetland plants to clean the water, while sculptural forms aerate it. Her works also include public participation to educate local citizens.

In my own work, the GO ECO and GO Doñana interactive installations about wetland restoration engage players with informational videos that address issues in coastal areas around the world. While the WATERWASH™ prototype presented here is designed specifically for the Mattituck Inlet, its ecological principles of stormwater remediation can also apply to many waterfront locations.

A quote by Herbert Marcuse (1979) seems apropos here: "If art can't change the world, it can change the consciousness and drives of the women and men who would change the world." The very fact that the projects showcased here were accomplished with the cooperation of government entities establishes that these artistic processes do work, and they result in an engaging format. Although the path to completion may not be easy, the specific gifts of some artistic personalities lend themselves to this way of working. Tenacity is built in for those accustomed to a life choice requiring substantial sacrifices. With determined artists as the lead agents in these collaborative endeavors, there is extra value added—both in improved visual form and in enhanced ecological function.

PROJECT I: 3 RIVERS 2ND NATURE

Intent

The plan of 3 Rivers 2nd Nature (3R2N) was to focus on the idea of green infrastructure as a subject of a research-based, public art practice. The question was, Could artists bring about change in a postindustrial landscape? The methodology focused on aesthetics and integrated, interdisciplinary analysis, and public discourse that would lead to a restored "green" infrastructure. Expanding on our specific interests, we focused on how artists can contribute to the recovery of a complex aesthetic of health and vitality. This is an exploration of an aesthetic sense of landscape health following

Nassauer (1997) and Eaton (1997). This extends ideas of integrated subject–object relationships that have been explored by the philosopher of environmental aesthetics, Arnold Berleant (1992).

Aesthetics

The 3R2N team decided to work from the principle that value and care are generated in direct relationship to experience, perception, and the potential for common interest. Our primary approach to experience was through an outreach and River Dialogue program. As part of this program, we would take thirty to fifty people out on the river in large, comfortable, glass-bottomed catamarans, which are used throughout the region as water taxis. We hired two to three boats for every event, typically twice a year. We also decided to address conceptualization through our expert scientific field reports and innovative maps. It was our hypothesis that these activities had the potential to reconfigure the community's aesthetic perception and valuation of the three rivers that are major features of the Pittsburgh, Pennsylvania, landscape—the Monongahela, Alleghany, and Ohio. The goal was to provide people with "on-the-water" experiences that they may not have had before. The view from any one of these rivers reveals the recovery of the natural landscape at the level of the floodplain and on the surrounding steep slopes that line the river valleys. While the view from the roads adjacent to the rivers remains predominantly postindustrial and architectonic, it is an aesthetic experience that overwhelms the river.

The Public Realm

As we began this initiative we had to develop an understanding of the regulation and oversight of infrastructure and land use, as well as have some familiarity with the individuals that had a vested interest in that regulation. Through work with the scientists, the project team developed a collective understanding of the failure of that infrastructure and its effects on the river ecosystems. We were most interested in the definition of the problem and the range of solutions. Two things were clear. First, there were very few data publicly available to inform decision making. Second, the advocacy and support for clean water and recovering ecosystems in the region were relatively nonexistent despite the fact that the Allegheny County Sewage Authority was in a protracted legal battle with the U.S. Environmental Protection Agency to address decades of illegal sewage discharges into the three rivers (Hopey 2007). Furthermore, land-use regulation was not taking into account the recovering landscape ecologies and the area's long-term environmental and aesthetic potential. These were the fundamental points of public realm engagement for the project team.

Strategic Knowledge

The 3R2N Project (following the earlier Nine-Mile Run model) was designed to address environmental questions through strategic knowledge and platforms for discourse. Strategic knowledge is information that was previously missing from public discussions; in this case, about land use and environmental protection. Carefully chosen strategic knowledge can transform the operative value systems that inform decision making. When publicly distributed, it has the potential to reinforce democratic process.

The work on 3R2N involved the development of platforms for discourse, in this case, "River Dialogues" with partners. We planned and organized four- to six-hour days, where citizens and decision makers assembled to participate in expert seminars about the rivers, then boarded a boat to experience and discuss the rivers. Upon returning to the dock, we would all eat together and then assemble around working tables for protracted, recorded, and illustrated conversations about a particular stretch of riverfront (fig. 21.1). Each table had a facilitator, an artist, a planner, a note taker, and one or more "drawers" (i.e., people who encouraged everyone to pick up pencils, pens, and markers) to unpack the day's experience and record the opportunities and constraints connected to postindustrial use of our regional waterways and waterfront. The record from those sessions appeared in our yearly reports. They became the basis for a regional river trail plan.

Process

In the process of developing this body of work, we discovered that intimate proximity and sustained relationships with rivers, land, and natural systems was an essential pre-

Figure 21.1. A promotional postcard for 3R2N eco-art project by Tim Collins and Reiko Goto. (Photo courtesy of the artists)

cept for aesthetic interest and value. For those who enjoyed intimate and regular experience, the opportunity and its aesthetic condition are easily understood; at the same time there is limited understanding of the complex problems that affect these systems. We would argue that problems of natural systems in an urban setting cannot be defined by science alone. Elements of the water problems (e.g., fecal coliform counts as a sewage indicator or benthic organisms as indicators of ecological health), can be defined by science. To define the larger systems problems, the cause of these effects requires an interdisciplinary effort. To visualize it or conceptualize an issue like this, and its positive and negative effects, is a challenge worthy of an art and science collaboration. The questions are: In whose interest shall we labor on these questions? Who pays? Who benefits from the output? For those that manage the systems as infrastructure (water source, coolant, sewer, or sink) for industrial or municipal interest or for the intrinsic value of ecosystems and biodiversity? How about the subordinate recreational users and advocates of the natural elements of the system?

Product and Outcome

The 3R2N project was defined by evolving cultural research programs, the Monongahela Conferences and Residencies. It culminated in the “Groundworks: Environmental Collaborations in Contemporary Art” exhibition and catalogue, curated by Grant Kester (2005). There was also an evolving environmental research and planning program with numerous reports on various ecological issues related to water and land. This concluded with a published study of recovering ecosystems and the policies that constrained them: “Ecology and Recovery—Allegheny County” (Collins et al. 2006).

Critical Evaluation

Many of our friends and colleagues have offered us critical appraisal of the project. Some say that art isn’t intended to “do” anything. Others ask: Why abandon one discipline-specific context for another? Other colleagues felt that we were too far within the system, too deeply invested in the useful when the proper domain of the arts is the antithesis of utility. Indeed, many would claim that the intrinsic value of art is unto itself. Within this critical framework, there isn’t much room for issue-specific environmental art practice. However, Suzanne Lacy (1995) and Grant Kester (2004) do provide essential directions for an emergent critical consciousness that sees the aesthetic in dialogic exchange and discourse.

Conclusion

Our interactions were oriented toward the artistic development of an effective public realm through strategic knowledge and unique platforms for democratic discourse. The work demanded attention to the intellectual vulnerabilities that occur when citizens, decision makers, and art and science researchers come together. The challenge was defined by a need for shared openness that can only come from strength and confidence in a discursive setting. Art, deeply invested in self-expression, has developed a range of practice that is moving away from the interests of the individual author toward shared creative authorship. This is significantly different in that it distributes responsibility, interest, and effort—at least in theory. Throughout this project, we understood that interest and effort are sustained through the rewards of meaningful experience and a sense of efficacy in participation. Responsibility was tied to a shift in values and care. The history, form, and function of contemporary art remain a mystery to many people today. In *Art's Claim to Truth*, Gianni Vattimo writes that the meaning of art is "the heightening of vital feelings" (Vattimo 1985, 40). The work that we have done on 3R2N is focused on the experiential and conceptual components of an aesthetic/environmental change and its effect on ideas of well-being—one of the many changes to come in this new century. A full set of reports and plans from 3 Rivers 2nd Nature is available for review at http://3r2n.collinsandgoto.com.

PROJECT II: LIVING WATER GARDEN

During the 1970s, when the possibility of sustainable design was in the air with Buckminster Fuller's geodesic domes and the *Whole Earth Catalog*, I was in the thick of the New York art world as a performance artist. I saw the performance art I was doing as a way to get people out of the gallery, into the street, and involved with and connected to community. In 1995, my desire to engage the public eventually led to my directing the first public art event for water quality in China. Local artists and I created a large-scale, public effort in Chengdu, Sichuan, to clean the Fu-Nan River. This led to an unexpected opportunity to design a six-acre (2.4-ha) Living Water Garden in Chengdu on the Fu-Nan River. Designed and built between 1996 and 1998, the garden serves as a model for integrating water cleaning, education, and entertainment, and is also an example of the wisdom of Lao Tze, who wrote, "The wise leader solves the problems of water first." It consists of a seven-stage cleaning system in which sculptural forms aid the cleaning process and fill the park with running water and the motion of water. The form of the garden is a giant fish. In stage one, the eye of the fish is the settling pond, with a thirteen-foot (4-m) diameter, organically shaped, concrete fountain that disperses living water from the pupil. In the next stage, flow forms move the water in a vortex motion, providing aeration and regeneration. For stage three, the "wetlands" (fish scales), which consist of seven plants, microbes and snails, and three filtering ponds, which are the fish's interior, polish the water before it goes through the tail and back to the river. Completing the sculpture, the steps into the river can be seen as the fish's fins.

My involvement with China began as a tourist in 1989. A biologist I met told me that a water site with strong curative powers would soon be sold. It was called the God Water. In 1993, I returned to China as the director of the nonprofit Keepers of the Waters, and I was determined to visit the God Water site. While visiting the God Water, I learned what water to drink for my heart, liver, or kidneys; where to wash; and where not to drink. During this trip, I also happened upon an international environmental conference where the Chinese taught me that living water is water that goes up and down the mountain 10,000 times, which means it is highly activated by vortices, filtered, and oxygenated. I was told, for example, that the best water for your heart comes from the center of bamboo. We hatched the idea to do a Keepers of the Waters event on the Yangtze River.

I had no budget, as no foundations would fund a project done in China, but fate intervened in the form of an anonymous phone call that yielded $15,000. With additional fund raising I returned in 1995 with my new assistant, Kristen Caskey. All of my money—$23,000 in cash and traveler's checks—was in a money belt around my waist as China did not yet have a banking relationship with the rest of the world. Although I had no official invitation or sponsor, within one week of arriving in Chengdu I was engaged in discussions about the project.

Chengdu had evolved from a quiet city of two million, where remnants of ninth-century Tang Dynasty culture could be found, into a pulsing, urban center of nine million. The air was heavy from the increase of automobile exhaust and factories spewing pollutants. With unchecked sewage spills and larger piles of garbage, the river's stench was unbearable. All fifty-three species of fish had disappeared from the river.

While directing the event, I was contacted by the planning bureau. On a sweltering afternoon in late July, I was picked up at the university guesthouse where we were staying and taken to a quiet street. On the sidewalk outside an old Tang Dynasty pagoda, as a willow tree moved in a gentle breeze over putrid waters, I learned about the plans for Chengdu and the river revitalization—which were exceptional in light of the ecologically destructive design that was, and still is, pervasive in most of the world. The Green Necklace, as they called it, was executed from 1992 to 1997 and included creating twelve miles (19 km) of park along both sides of the rivers, rebuilding the flood walls, moving 100,000 citizens to better housing, and installing the infrastructure for treating the waste of two million people. I suggested that they make a park to show citizens how water could be cleaned using natural means. To my surprise, they asked me if I could do that. To my surprise, I said, yes. I was asked to abandon the public art event and design the park.

I returned to China in 1996 to present ideas for the park. We started with a meeting of fifty people sitting around a long table with the Chinese flags and flowers flowing down the middle. Present were academics, representatives from government bureaus, advisers, and the people's council. Shaking, I sat down next to this patrician-type engineer whom I had met in 1993. He whispered in my ear, "Don't worry, Betsy, you're among friends!" Knowing that there were no landscape architects in Chengdu who would understand my concepts, I had invited Margie Ruddick, a landscape architect, who generously agreed to come help. I had been imagining work like this but had never done anything on this scale. The meeting lasted three hours, then, after a large banquet, we visited a number of potential sites. We were dismissed and told that the bureau would get back to us in a week. Indeed, a week later, they said they would give us the largest piece of inner-city land they had for our Living Water Garden.

Next, the officials asked what kind of professional help I needed. I responded that I needed a bioengineer/wetlands person, a landscape design company, and an artist to help me make the sculptures. They appointed the needed people and gave us food and housing but no salaries. The landscape design group assigned to us was the same group that had created a previous, but unaccepted, design. Unfortunately, but understandably, they had a little bit of resentment toward me.

Nonetheless, it turned out to be a collaborative process every step of the way. Haung Shida, the bioengineer, told us that a water cleaning process needed seven steps. Margie and I walked and walked the park site until in the third week she blurted out, "FISH!" and then began to rough out the size of the seven features. I stayed ten weeks, completing the conceptual design and making a model that was sent around the city for citizen response. Our design to remove the floodwalls to create places for fish to feed and to give people access to the river met with great resistance from the senior engineer. Nevertheless, after a very lengthy public and private approval process, I learned through e-mail that the park would be built. Quickly abandoning everything I was doing, I set off for Chengdu. There, I discovered that the blueprints were based solely on the concept plan with few or no accurate details. A two-month trip became a year as we designed the details in weekly meetings. We were the first foreigners to work within the government, and it was not easy. My son, Jon, worked as project director with me and a dedicated staff of four bilingual Chinese. Many Chinese wanted this park to be perfect, and an exceptional dialogue had been initiated with the public. Many people participated in the design, including a forester who persuaded the planning bureau to make a forest with more than one hundred species of plants and trees from nearby Mount Emei.

Construction began in February 1997 and was finished in April 1998. Five different Chinese companies worked together on the project. Halfway through the construction, when I asked directors of the companies if they knew what they were building, unbelievably, they said, "No." This precipitated a twelve-hour meeting that finished with food and dancing. The garden was built without any high technology. The head of construction said to me, "Look, Betsy, we are going to build this park so it works; we do not have money to make beautiful buildings, but we can make a plan that will be good for two hundred years."

There were only two bioengineers in China. Miraculously, one, Huang Shida, was in Chengdu. He tested the wetlands plants and set up a lab overlooking the site to direct the construction for one year. He tested the garden's effluent for a year after completion, finding that the filthy river water was indeed returned to a drinkable quality. I learned after the garden was complete that he had written thirty-four letters to the mayor urging that the garden become a real biological system. I also learned that Zhang Jihai, the special assistant to the mayor, had said that he would risk jail to build the park, although the mayor said that he would not risk jail. That is how the park was built (fig. 21.2).

When we tested the system and it worked, everyone breathed audibly. Yu Guan Yuan, an eighty-three-year-old, revered intellectual and director of the Academy of Social Science in Beijing, asked to be carried around the park because he couldn't walk.

FIGURE 21.2. A portion of Betsy Damon's six-acre (2.4–ha) Living Water Garden in Chengdu, China—an urban space on the Fu-Nan River. (Photo courtesy of Betsy Damon)

He said, "Most people come to make money or take our culture. You've given China a future, now you have to do it in Beijing." I burst into tears. The park was visited by most mayors of major cities and has been copied in various ways around the world. It demonstrates an integrated park design that serves the environment by cleaning water. Kingfishers returned to the site, it is cool and quiet inside the park, and many species have taken up residence in the trees and plants. For ten years it was the center of a national discussion about technology and nature. Now that discussion has changed, and wetlands are promoted, as are eco-solutions. The Beijing Olympic Forest Park has a complete biological water system that Margo Young of the Canadian landscape design company EDM and I designed from 2003 to 2005. Chengdu has become the greenest city in China.

Great generosity and cooperation from many people created the Living Water Garden. A person can now walk along the Fu-Nan River under cooling trees—where a gentle breeze follows the river for miles—finding tea houses, and people practicing tai chi, relaxing, and jogging.

Keepers of the Waters (www.keepersofthewaters.org) invites everyone to learn the principles of integrated living systems design and initiate projects in their community.

PROJECT III: WATERWASHING

Working to have a positive effect as an environmental artist and activist, I have thought long and hard about potential ways to make a difference. How can an appreciation of place engender public involvement? What kind of visual strategies reinforce the scientific values protecting natural spaces? The need for restoration and revitalization of areas challenged by stormwater issues is widespread on Long Island's North Fork and in waterfront areas worldwide. The WATERWASH™ concept occurred to me nearly full blown during a conversation with Mark Terry, principal town planner for Southold, which is a small town in northeastern Long Island, New York. I envisioned a vegetated swale with native plants, permeable pavement, and educational signage explaining the need for non-point-source stormwater management in private and public places. I felt the transformation of neglected spaces into public outreach parks could inspire community involvement with stormwater issues.

Mark called this merger of functional restoration and aesthetics my brainchild, suggesting I trademark this name. This brainchild was not easy to bring to life, however, especially with an artist as the lead agent. The first effort in Mattituck was a continuous learning process, taking more than two years to complete. Two more challenging projects will likely take much longer: WATERWASH™ ABC on the Bronx River is beginning construction in summer 2011 after 18 months of development, and another project at Goldsmith Inlet continues in the planning stages.

Initially, I had planned to focus on Great Pond and its wetlands, a maritime freshwater interdunal swale area near my home in Southold. In 2005, I led a successful community effort to preserve the area and prevent further development. Subsequently, I was appointed to serve on the town's land preservation committee. Harper Preserve, a twelve-acre site near Great Pond, was the subject of "Leap of Faith," an ecological video installation and my first body of artwork with serious environmental content. The native cranberries (*Vaccinium* spp.) and threatened slender blue iris (*Iris prismatica*) found there provided source material for GO ECO, an interactive, educational tool based on the ancient Asian game of Go. Preservation and restoration processes also helped structure another "serious learning game," GO Doñana, about the UNESCO wetlands south of Seville, Spain (see chap. 6, this volume).

However, the worst stormwater spots around Great Pond were on private property and were not widely accessible for outreach opportunities. I met with the stormwater committee and visited many sites before settling on a town-owned boat ramp on the Mattituck Inlet, which feeds into Long Island Sound. It had a serious grading problem that allowed County Route 48 road runoff to scour ditches alongside the boat ramp, flowing directly into the inlet and washing out the smooth cordgrass (*Spartina aterniflora*) growing there. Common reed (*Phragmites australis*) was overtaking the disturbed shoreline, further degrading the area.

I approached many local scientists and stormwater experts with the WATERWASH™ concept and found solid response to my ideas. Previous projects using the ecological restoration approach had proven the validity of low-tech solutions carefully applied to specific stormwater problems. Scientists from Cornell Cooperative Extension, the Natural Resources Conservation Service, and the New York State Department of Environmental Conservation (DEC) Restoration, Stormwater, and Shellfish departments all contributed to developing the site plan and interpretive signage.

Many meetings with town officials and the stormwater committee resulted in only lukewarm reception because there were places with more serious stormwater problems. But there was enough support from the town board to approve our application with its educational component for a matching grant from the Long Island Sound Study. When we actually received the grant, the challenges intensified. Eventually, the town admitted it could not fulfill its matching obligations in the midst of economic meltdown. Fortunately, Group for the East End (GEE), an environmental advocacy organization for eastern Long Island, was willing to take over as fiscal sponsor. They were included in the grant proposal originally to provide the native plants and volunteer coordination. They planned to cover costs from nearby Glover Perennials, growers of the native plants, some even from locally collected seed. With a mountain of paperwork and help from the National Fish and Wildlife Foundation assistant regional director, Lynn Dwyer, we were able to switch the federal grant from the town to the GEE. The permitting process was one that challenged my abilities, since the skill to negotiate bureaucracy is rarely found in an artist's toolbox. In addition, I spent a long time researching permeable pavement options and meeting installers to find a company on a similar wavelength. Bob Govenale, owner of Excav Services, has a degree in geology and experience with environmental restoration, so he was not the usual "earth mover." He followed through enthusiastically with all our challenges and agreed to do it, "just this once," for the funds we had budgeted, far less than his usual fee. He also discovered a new permeable pavement—a recycled glass material that appealed to us both for several reasons, including the fact that it would allow more varied design opportunities than porous pavers and because it uses glass that would otherwise be landfilled. At a preapproval meeting, the DEC asked us questions about the suggested yearly vacuum maintenance and the flow-through rate that was lower than usually required. Allowances were made considering the entire scope of WATERWASH™. After all, it is a total system with three buffer zones beyond the parking area: the vegetated swale, a steel weir adequate to distribute overflow evenly in a five-year storm, and the sizable strip of common reed that would be harvested quarterly. When we actually submitted the paperwork, asking for speedy processing due to grant scheduling, the DEC permit was obtained in record time.

The five-member Southold Board of Trustees, which owns the park and has jurisdiction over all construction within one hundred feet of the waterfront, also had to issue a permit. Trustee president Jim King, a lobsterman residing on the inlet, was initially skeptical, thinking it would contribute little to water quality improvement. Although he had seen the drawings and engineering plans, he seemed to have a hard time visualizing the proposal until it was nearly finished. But I persisted in calling him to discuss progress and eventually provoked his participation by incorporating his suggestions into the "Wildlife Habitat" sign. This was one of three filmstrip-format signs (along with "Stormwater Solutions" and "Native Plants") designed to engage viewers who might not normally be drawn to reading interpretive signage. In the end, Jim's incredible knowledge about the local fishery helped draw a contrast between an area widely recognized in the nineteenth century as a prime source of the tastiest oysters and an area that has been closed to shellfishing in recent decades.

After convincing the trustees, we had to gain final permission from the town board who still had reservations about liability and other issues even though the project would actually cost them nothing. I came prepared with a letter from the DEC designating WATERWASH™ as the first MS4 federally compliant project in Southold. With the support of supervisor Scott Russell, the town board greenlighted the project.

The area was graded and some of the resulting clean sand was used to restore the ditch beside the boat ramp and the scoured spot behind the swale. Both saltmeadow cordgrass (*Spartina patens*) and smooth cordgrass were planted there within the jute and hay netting, and secured by substantial chinked bluestones. Swale planting was rushed into action in early July, with the native plant survival courtesy of neighboring Mattituck Park District's water (the boat ramp had no facilities). Although it was a bit late for planting warm-season grasses, like switchgrass (*Panicum virgatum*) and little bluestem (*Schizachyrium scoparium*), they went in at the top of swale. For the bottom of the swale, rosemallow (*Hibiscus moscheutos*) was used since it thrives in our freshwater wetlands along with contrasting white turtlehead (*Chelone glabra*). Volunteers from Mattituck High School helped with the plantings and cutting common reed. Community support became even more apparent: a site survey was donated; Woodwrights, a local business, offered us wood for the Leopold benches; and free dumpsters appeared from Mattituck Sanitation (fig. 21.3).

We continued developing the final buffer zone plans and curvaceous wave form with the contractors. I wanted every detail curved to look more natural, which was novel for the installers, who are used to angular engineering designs. Great care was taken to engineer adequate uptake across the site with specific pavement percolation through the sand substrate and upper layer of local pea gravel. The mixture of recy-

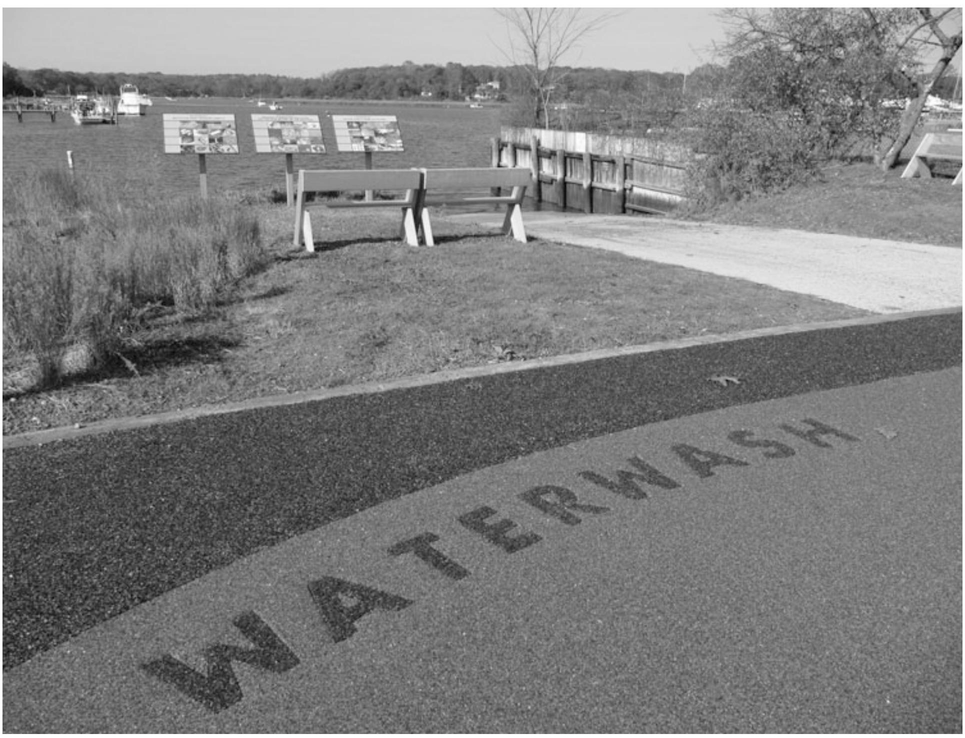

FIGURE 21.3. The boat ramp area, complete with Leopold benches and native plantings, at Lillian Ball's WATERWASH™ project in Southold, a small town in northeastern Long Island, New York, USA. (Photo courtesy of Lillian Ball)

cled glass and urethane was applied in several sections by a crew working with it for the first time. In subsequent months, the material spalled or shed loose glass for a variety of reasons. Fortunately, the technology improved and it was reinstalled and agreed to redo it. The original wave design was finally executed with glass trucked from Albany, NY, well within the five-hundred-mile requirement for Leadership in Energy and Environmental Design (LEED) certification. A new method of tinting the urethane allows for more uniform color control and actually improves the reflective qualities that contribute to less carbon dioxide absorption.

The final piece of the puzzle has not been easy to implement. Water-quality testing is integral to gauging the success of the stormwater remediation. Prior to construction, the DEC Shellfish Unit tested two locations in southern Mattituck Creek and will continue to test after significant storms. Their samples are collected within twenty-four hours of the rain event and test for fecal coliform only. At this point, it is too early to expect much improvement. Lorne Broussard, water quality expert from Cornell University, and John Bredemeyer, Suffolk County Health, concluded that the boat-ramp area is too diffuse for effective testing. Subsequent designs with a budget for stormwater-in/filtered-water-out testing will result in more accurate data. The WATERWASH™ ABC on the Bronx River and subsequent grants are structured to include this type of monitoring.

The opening press event on November 9, 2009, attended by more than seventy people, was a satisfying finale to the saga. Public officials applauded the progressive nature of WATERWASH™ and asked if we would work on several other very difficult sites. Interest remains high, but the cost-benefit questions we answered from visitors on-site still continue long after completion. I realize the actual investment in time and energy means future sites must be carefully chosen. So many of the predicaments we are asked to look at arise from unsuccessful previous attempts, engineering miscalculations, or landscaping that masks real problems. Final impacts cannot be assessed without considering cultural relationships or until ecological processes are truly embraced.

How can we possibly measure a place's value to the inhabitants inspired by it? When I watch the schoolchildren reading the WATERWASH signs, or see a boat returning with happy fisherfolk, or catch kayakers lunching on the benches adapted from Aldo Leopold's plans, I see the landscape in action. There, between form and function, lies an opportunity for artist and scientist alike to involve the community in restoring natural resources. For more information , see www.waterwash.info.

Postscript

The reality is that many artists are uniquely prepared to follow through in the face of adversity. Given their sensitive position as cultural innovators, artists have the right personality type for facing complex challenges, not to mention their ability to think creatively outside the box. Without an artistic blend of tenacity and mental agility, I wonder how anything can be accomplished when working in the web of bureaucracy that surrounds green infrastructure and public restoration projects.

References

Ball, L. 2008. "Called to Action: Environmental Restoration by Artists." *Ecological Restoration* 26 (1): 27–32.

Berleant, A. 1992. *The Aesthetics of Environment*. Philadelphia, PA: Temple University Press.

Collins, T., J. Kline, K. Vallianos, and C. Fox. 2006. *Ecology and Recovery: Allegheny County*. Pittsburgh, PA: Carnegie Mellon University.

Eaton, M. M. 1997. "The Beauty That Requires Health." In *Placing Nature: Culture and Landscape Ecology*, edited by J. I. Nassauer, 85–105. Washington, DC: Island Press.

Hopey, D. 2007. "Consent decree 'best deal' possible, Alcosan says." *Pittsburgh Post-Gazette*, May 23. http://www.post-gazette.com/pg/07143/788219-113.stm.

Kester, G. 2004. *Conversation Pieces: Community and Communication in Modern Art*. Berkeley: University of California Press.

———, ed. 2005. *Groundworks: Environmental Collaboration in Contemporary Art*. Pittsburgh, PA: The Regina Gouger Miller Gallery, Carnegie Mellon University.

Lacy, S. 1995. *Mapping the Terrain: New Genre Public Art*. Seattle, WA: Bay Press.

Marcuse, H. 1979. *The Aesthetic Dimension: Toward a Critique of Marxist Aesthetics*. Boston: Beacon Press.

Nassauer, J. I., ed. 1997. *Placing Nature: Culture and Landscape Ecology*. Washington, DC: Island Press.

Vattimo, G. 1985. *Art's Claim to Truth*, translated by L. D'Isanto. 2008. New York: Columbia University Press.

PART VI

Perspective: Restoration-Based Education

Educating people about ideas and practices is essential in order to ensure the success and longevity of any human endeavor. Moreover, education provides critical personal and cultural perspective to practices such as ecological restoration, for young and old alike. In recent years, some educators have promoted eco-literacy in schools through the use of interdisciplinary and experiential activities. In such situations, ecological problems and problem solving are integrated throughout the curriculum, and students and teachers experience hands-on interaction with the natural environment. Fortunately, ecological restoration is ideally suited for this type of education, and restoration-based education has increasingly found its way into schools throughout the United States and elsewhere. The chapters in this section describe the progress being made in this area.

In the lead chapter, Elizabeth McCann presents an overview of basic considerations when planning and implementing restoration-based education initiatives. She describes various learning styles, short- and long-term program planning, community involvement and evaluation, and how they enhance the quality of restoration education efforts. Her coverage of these topics is comprehensive and informative for teachers, school administrators, and parents who are concerned about raising the eco-literacy of their children and communities.

McCann's chapter is followed by a case study from the prairies of Middle America, where William S. Whitney and the Prairie Plains Resource Institute have used ecological restoration efforts, hikes on lands entrusted to them, and the Summer Orientation About Rivers program to involve and educate their community and regional leaders about their Platte River environment and its ecological importance. Whitney's experiences provide an excellent example of the kind of local-level education that is being provided by nonprofits throughout the world, and how ecological restoration fits into that picture.

Kern Ewing and Warren Gold continue this exploration of education in their discussion of a college-level education program that is based on ecological restoration. This program, known as the University of Washington Restoration Ecology Network, offers students a unique learning experience by offering pertinent classes and hands-on experience working on real-life projects for local governments, Native American tribes, nonprofits, and others. This program is one model among many other university-level programs found in the United States and throughout the world.

The final chapter of the section, by Rick Hall and Cheryl Bauer-Armstrong of the University of Wisconsin–Madison Arboretum, looks at the arboretum's Earth Partnership for Schools program and why it has been so successful in educating teachers and administrators about ways to integrate ecological restoration into the K–12 curriculum.

Chapter 22

Restoration-Based Education: Teach the Children Well

Elizabeth McCann

Opportunities to "dig the earth" have become increasingly critical during this age when young people often spend more time in front of a computer screen or video game than outside. A corollary to this increasing interest in indoor activities is a decrease in the general public's ecological literacy, even as public participation in natural resource management issues has increased and the scientific complexity of such concerns has magnified (Orr 1992; Bingle and Gaskell 1994; Nelkin 1995; Miller 1998). Understanding about the environment is declining, and a recent survey found that adult environmental concern in the United States is at the lowest point in two decades (Jones 2010). Although more than three in four Americans report they reduce energy use, recycle, and buy environmentally friendly products, these numbers have barely changed from a decade earlier (Morales 2010). Indeed, despite increased media and political attention focused on climate change, U.S. citizens are no more concerned about that issue than they were ten years ago; only a very few consider the environment the most important concern facing the nation (Newport 2010). A National Environmental Education and Training Foundation /Roper Survey (Coyle 2005) also found America's environmental knowledge to be poor, with an alarming number of adults believing outdated and erroneous environmental myths.

If our society desires an ecologically literate populace, conservationist and educator David Orr (1992) contends that interdisciplinary, firsthand experiences advanced by environmental education (EE) professionals are key. He defines an ecologically literate person as someone who "has the knowledge necessary to comprehend interrelations, and an attitude of care or stewardship . . . [with] the practical competence required to act on the basis of knowledge and feeling" (92). Orr's definition is comparable to that held by proponents of "scientific literacy"—a concept that empowers all people "to make better civic decisions, better personal decisions, and better decisions on the job" (Eckman 1998, 7; see also Ramsey 2005). The American Academy for the Advancement of Science's Project 2061 reflects these concerns. This initiative has supported efforts to make science relevant to K–12 learners through educational approaches that move beyond textbooks to more hands-on approaches to science, such as inquiry-based learning (Freedman 1998).

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_22,

This chapter discusses the value of connecting humans with nature, particularly young people, and explores how restoration-based education (RBE) has the potential for creating learning landscapes to enhance biodiversity and engage learners in significant ways where they live. Using multiple examples, the chapter highlights essential planning considerations for RBE, including authentic youth and stakeholder participation, effective partnerships, curricular integration, and research and evaluation. Through RBE, we can offer opportunities to enhance public understanding of scientifically complex issues, support environmental protection, and value outdoor experiences at all ages—experiences that are rooted in restoring native habitats for educational and ecological purposes.

The Benefits of School Greening and Interacting with Nature

Programs that emphasize meaningful outdoor experiences, such as the use of schoolyard habitat areas for ecological restoration and learning, allow young people to connect with the natural world and, as Coffey (2001) writes, "There can be no better place than our schools for beginning humanity's greatest task—that of reconnecting ourselves to the natural world." With seventy-six million nursery school to college-age students enrolled in more than 125 million public and private schools in the United States and many more around the globe, we are fortunate to have systems that afford opportunities to bring environmental education (EE) to many students and, thereby, have the prospect to develop a more ecologically literate public. Such opportunities can also help avoid what Pyle (1993) describes as the "extinction of experience" with natural settings (147). For, as Nabhan (1994) observes, "We need to find ways to let children roam beyond the pavement, to gain access to vegetation and earth that allows them to tunnel, climb, or even fall. And because formal playgrounds are the only outdoors that many children experience anymore, should we be paying more attention to planting, and less to building on them?" (9).

Research suggests that interacting with nature enhances memory and attention among young adults (Tennessen and Cimprich 1995; Hartig, Kaiser, and Bowler 2001) and older adults (Ottosson and Grahn 2005) in various contexts. Research by Berman, Jonides, and Kaplan (2008) found that brief interactions with nature result in marked improvement in cognitive functioning, while Wells (2000) discovered that the cognitive functions of urban youth are improved by "greenness" at home. Indeed, some researchers argue that depriving young people of intimate interactions with the natural world can have detrimental intellectual, biological, emotional, and developmental effects (Kellert and Wilson 1993; Kellert 1997, 2002; Pyle 2002; Taylor and Kuo 2006; Bell and Dyment 2008).

Hartig and colleagues (2003) concluded that public health strategies should include a natural environment component, particularly in an ever-increasing urbanized world that includes mounting health care costs and escalating environmental degradation. Other research suggests landscape features affect motor development and physical play among youth (Fjørtoft and Sageie 2000; Fjørtoft 2004; Dyment and Bell 2008; Lucas and Dyment 2010). All this research suggests there is a critical need to

FIGURE 22.1. Indiana University–Purdue University Indianapolis (IUPUI) undergraduate students participating in an environmental service learning project with the IUPUI Center for Earth and Environmental Science and Indy Parks and Recreation. Project activities included installing native trees as part of a reforestation effort in Town Run Trail Park, Indianapolis, Indiana, USA. (Photos courtesy of Kara A. Salazar, Education Outreach Coordinator, Center for Earth and Environmental Science, Indiana University–Purdue University Indianapolis)

enhance children's[1] access to diverse vegetation, and open space is increasingly important amid rising levels of obesity, inactivity, and lack of unstructured play time among youth (fig. 22.1).

Ozer's (2007) review of the literature indicates that school garden programs show promise in terms of positively affecting the emotional, social, physical, and intellectual development of students, even when these programs differ significantly in terms of scale, level of participation, and integration into the curriculum. Other studies indicate school gardens or "greening" have a positive impact on students' behavior and academic achievement (Blair 2009) and are more socially inclusive with regard to gender, ability, race, and class than asphalt or turf (Dyment and Bell 2006; Lucas and Dyment 2010). Other potential advantages of green school grounds include teacher recognition of unique curriculum development opportunities (Moore and Wong 1997), reductions in classroom management issues (Lieberman and Hoody 1998), enhanced interaction with nature (Harvey 1989, 1993; Nabhan and Trimble 1994; Bell 2001), and increased diverse, formal, and nonformal learning opportunities (Barlow and Crabtree 2000; Raffan 2000; Bell 2001; Grant and Littlejohn 2001; Malone and Tranter 2003).

Unfortunately, not all schools provide the same level of education. For example, research by Dyment (2005a) raises the concern that schools with higher socioeconomic status (SES) may have access to more resources and hold different perceptions of the schoolyard spaces than lower-SES schools. The potential impact of this trend should not be underestimated. For young people living in areas with little outdoor space, green school grounds may be the only place to be with friends. Other factors beyond SES (e.g., increased safety concerns, decreased access to natural areas, development and urbanization) also limit the access youth (and adults) have to the out-of-doors (Malone and Tranter 2003; Louv 2008). Given this perspective, programs that meet their educational mandates while providing relevant and meaningful outdoor experiences for all youth are essential.

Another factor to consider is that researchers have discovered some natural environments can be alienating, at least for some young people. In the United Kingdom, for instance, Milligan and Bingley (2007) found that, while woodland areas can be restorative and therapeutic for some young adults, perceptions of closed, dark woodland environments can create stress for other youth. These researchers suggest that more research is needed to untangle the variety of influences on young people's relationship with woodland sites and warn that we must not uncritically accept that natural environments are beneficial and restorative.

Restoration-Based Education: A Starting Point for Understanding

Restoration-based education is embedded within the larger field of EE.[2] For the purposes of this chapter, RBE refers to ecological restoration efforts that are intentionally designed to include an educational purpose. Like ecological restoration, RBE is a *process* that occurs over a lifetime and includes both ecological and social components (Jordan 1995; Clewell and Aronson 2007).[3] The challenge for learners of all ages is gaining the skills, knowledge, awareness, and motivation to seek solutions and understand causal relationships and dynamics needed to make wise decisions in their personal lives and their communities. The depth of understanding required cannot be expected to occur in response to one-time events or mass-media informational snippets. In the following sections, a variety of issues integral to RBE, including ecological literacy, biological diversity, and instilling a culturally relevant sense of place are discussed. Planning considerations for a successful RBE program are considered later.

Intersections of Learning Landscapes and Conserving Biodiversity

Concerns raised about ecological literacy come at a time when there is tremendous need to restore natural habitats being lost to development and other sources of environmental degradation (Noss and Cooperrider 1994; Noss, LaRoe, and Scott 1995; Hails 2008). Restoration-based education offers learners an opportunity to contribute positively to reversing these trends, which, in turn, creates empowering learning experiences. As one elementary-age student put it, "The habitat in the world is getting lower and lower, and just by planting one tiny seed, it can make a big difference in the world" (Earth Partnership for Schools 2006).

Issues of environmental protection and ecological restoration can be positively addressed in diverse educational settings using hands-on/minds-on approaches. This requires examining the science and art of ecological restoration in a coherent fashion that maximizes its ability to restore ecosystems, enhance biodiversity, meet learners' needs, and be rewarding for students and teachers alike.

More than two decades ago, Jordan, Peters, and Allen (1988) put forth strategies for using restoration as an avenue for conserving biodiversity. Although research and evaluation are scant regarding the environmental advantages of RBE efforts, there are indications that such initiatives can benefit biodiversity and ecosystem health. For example, Tedesco and Salazar (2006) describe how restoration efforts in Indianapolis, Indiana, that emphasized service learning and civic engagement in a higher-education context led to enhanced wetland, terrestrial, and riparian habitats; university and community partnerships; and programmatic growth. Preliminary data suggest positive effects in terms of student behavior and environmental stewardship as well. Other evaluations of schoolyard restoration projects indicate that they result in environmental and educational impacts for students and teachers alike (Cline et al. 2002; Clifford 2003a, 2003b, 2004; McCann 2003). Anthonison's 2005 study of four school restorations in Wisconsin determined that, while the sites lacked ecological integrity, they had more animal and plant life—and teacher and student engagement—on schoolgrounds than their previously monotonous landscapes offered. In urban contexts, two researchers (Krasny and Tidball 2009; Tidball and Krasnay 2009) contend that civic ecology practices and other EE programming may cultivate resilience by enhancing biological diversity and ecosystem services, integrating various forms of knowledge, and emphasizing participatory approaches to natural resource management. They propose expanding EE research and evaluation to assess the effects on innovation, social capital, adaptive learning, and ecosystem services (Walker and Salt 2006). One example of these new directions is Kudryavtsev's (2009) exploration of restoration efforts in the Bronx, New York City.

Restoration-based education allows students to learn ecological concepts and investigate the natural and cultural history of a piece of land that is important and relevant to them. Involvement at all levels of the restoration project allows students to feel a sense of ownership, competence, and connection to their community. This engagement, in turn, could result in students viewing themselves as part of a larger system, rather than removed from the natural world or thinking that they live in a world without solutions. Case study research indicates that through students' active involvement in restoration projects, they "became attuned to the living world in ways that the lawn-and-asphalt landscaping more typical of schoolyards simply will not allow" (Bell 2001, 153). Thus RBE projects turn a visit to the schoolyard into a field trip, inviting students to explore the wonders of the natural world just outside their classroom. Meanwhile, teachers can use a small plot of ground to teach science, math, art, geography, natural history, and many other subjects.

Using RBE approaches better ensures that issues of environmental protection and ecological restoration are addressed in K–12 schools. Doing so can address the long-standing support among parents and adults (96 percent and 95 percent, respectively) for EE in schools, which dates back to 1997. For example, a 2001 survey suggested that 75 percent of adults believed the interdisciplinary field of EE is as important as English or math (Coyle 2005). Through RBE initiatives, students have opportunities to positively affect their local school landscape while learning about multiple disciplines and life skills, such as collaboration, decision making, and scientific knowledge. In addition, having open spaces, water, and life—trees, flowers, grasses, animals, and other diverse life-forms—fosters innate human creativity and imagination among children, according to architect Simon Nicholson's theory of "loose parts" (1971). Likewise, Harvey's (1993) study of 845 eight- to eleven-year-old students' experiences in British schools suggests that students from schools with more vegetation and complexity in their school landscape features had greater botanical knowledge and environmental dispositions. Such biological diversity can enhance opportunities for learners to explore the natural world, reconnecting in ways that some argue is biophilic or having an inborn human affinity to connect with life and lifelike processes (Wilson 1984; Kellert and Wilson 1993; Kellert 1997, 2002). Future lines of inquiry should continue to explore the ecological and educational effects of engaging learners in restoration processes, as these arenas seem inextricably intertwined.

Connections to Place and People

Situated in the heartland of the North American prairie, the Prairie Plains Resource Institute's whole-systems, community-based, integrated approach to ecological restoration, education, community, nature, and agriculture is grounded in a particular geographic place (see chap. 23, this volume). Their programming for youth and adults offers integrated perspectives of nature, and their hands-on experiences to connect with the outdoors are designed to instill a "sense of place" for the people they interact with in Nebraska. Other programs, such as Environmental Concern's Wetland Learning Center (http://www.wetland.org/educationhome.htm), Britain's Learning Through Landscapes (http://www.ltl.org.uk/), and the Canadian nonprofit Evergreen's School Ground Greening (http://www.evergreen.ca/en/programs/schools/index.sn), bring nature, education, and sense of place together for children and their teachers to explore.

Sense of place is a complex idea studied in a multitude of disciplines because it relates to the biophysical as well as the psychological, sociocultural, political, and economic dimensions (Ardoin 2006; Chalquist 2009). Given its inherent interdisciplinary dimensions, sense of place is a concept that environmental educators can embrace, especially since EE is intended to explore the natural, social, economic, and cultural aspects of the built and nonbuilt environment (UNESCO/UNEP 1978).

An educational approach to engaging learners in a local "place"—as RBE does—must be culturally responsive and allow for broad perspectives about what is meant by "environment." Educators must be culturally competent, acknowledging the interconnectedness of place and culture, have an acute sensitivity to learners' personal experiences in their total environment, and realize that such experiences often entail oppression across race, class, gender, and other cultural contexts (Gruenewald 2008; chaps. 5, 20, this volume). Being culturally responsive and embracing the lived experiences of learners allows for locally relevant, multidisciplinary inquiry, with greater potential for democratic participation (Gruenewald 2008). Similarly, Lambert (1999) contends that RBE must be interdisciplinary, embrace other ways of knowing beyond scientific models, and ensure culturally embedded conceptions of place (see also Nabhan and Trimble 1994).

We can also consider how engagement in RBE can affect learners' view of themselves and their "place," however they define it. For instance, there is some evidence that engaging teachers in school restoration sites affects their connection to their workplace (fig. 22.2). An Earth Partnership for Schools' teacher-participant explained it this way: "[School] is pretty cold and sprawling, pretty sparse . . . the prairie brings a little humanity" and "I feel closer to the place I teach than I did before" (McCann 2003). While more research is needed, this teacher's experience illustrates how "place" can range from a physical workplace to a person's impressions of the human experience on a broader scale.

Planning Considerations for Successful Restoration-Based Education

Planning is important in any endeavor, and in the case of a successful RBE program there are several key considerations. These include the following: (1) authentic participation and stakeholder involvement, (2) partnership development, (3) youth as stakeholders, (4) adult and youth learning and development, (5) integrating RBE into

FIGURE 22.2. Elementary students from Mary Collins School at Cherry Valley in Petaluma, California work with their parents and teachers to restore the habitat near a San Francisco wetland. (Photo courtesy of Laurette Rogers, STRAW)

the rest of the curriculum, and (6) incorporating research and evaluation. The following sections discuss these considerations in greater detail.

Authentic Participation and Stakeholder Involvement

Active, authentic public participation lends itself to the long-term viability of restoration projects (Light 2002; Miller and Hobbs 2002; Phalen 2009). There is growing recognition that interdisciplinary approaches to integrate social sciences into the work of ecological restoration are needed (Grimm et al. 2000; Helford 2000; Ryan 2000; Redman et al. 2004). Public participation requires meaningful involvement of stakeholders beyond the traditional, one-way communication structure of public hearings.

Today's level of environmental complexity calls for innovative and inclusive processes that promote learning and creative problem solving. A recent development in this area is the Reasonable Person Model (Kaplan and Kaplan 2003), and it can be used to address restoration processes and public engagement (Phalen 2009). Informed by environmental psychology, the Reasonable Person Model operates under the assumptions that when a person's cognitive map-building ability is engaged in meaningful action, the individual tends to respond more cooperatively and reasonably. While more research is needed to test this (and other) models of participation, the premise of authentically engaging the public while enhancing their understanding of complex environmental issues is a reasonable assumption to make in light of inadequate research. Better to err on the side of education.

Other researchers and educators are exploring civic ecology practices and resilience attributes as they pertain to community greening, particularly in urban areas. As one approach to EE, civic ecology practices include participatory action and emphasize democratic processes while exploring environmental issues (Light 2002). Community-based restoration projects can fall within this framework, as do other practices, such as watershed restoration, community forestry, and community gardens (Tidball 2008). Resilience attributes of cultural diversity, ecosystem services, diverse knowledge and experience, adaptive learning, social learning, self-organization, and social capital all contribute to resilient social-ecological systems. More participatory, action-oriented approaches lend themselves to moving beyond instrumental purposes of behavior change toward more democratically oriented approaches. Doing so would more fully realize the participation ideals in the United Nations Educational, Scientific, and Cultural Organization's guiding documents about environmental education and education for sustainable development (UNESCO 1978, 2005).

Encourage Partnerships

There are exciting partnerships taking place across the United States and internationally to support RBE in formal and nonformal (non-school-based) settings. A variety of natural resource agencies, organizations, museums, and other nonformal educational institutions recognize the importance of environmental education and science education as avenues to address issues of environmental and scientific literacy (Ramey-Gassert, Walberg III, and Walberg 1994). For example, the U.S. Fish and Wildlife Service is working with middle school students and teachers in the Midwest to restore native tallgrass prairie while integrating science, math, and writing into the curriculum through hands-on, field-based experiences (Ernst and Ellis 2005). A study by Cline and colleagues (2002) of elementary schoolyard ecosystem restoration sites found that broad-based community support and diverse stakeholder involvement were better indicators of success than either administrative or pervasive teacher support. Jablonski and Banker (2001) describe how an Ohio EE center partnered with university students through a service-learning restoration project. Sample experiential learning activities included designing studies, conducting a population census, interviewing resource managers, creating a localized resource binder, mapping a pond site, and measuring submerged vegetation to form part of a long-term database. Finally, the National Science Foundation's Long-Term Ecological Research project sites are collaborating with K–16 teachers and students to teach about ecological principles and engage students in hands-on restoration activities, among other purposes (Banks, Elser, and Saltz 2005).

The University of Washington Restoration Ecology Network (UWREN) (see chap. 24, this volume) also illustrates the power of community partnerships and actively engaging university students in restoration processes. This program addresses learners' and community clients' interests, completing more than thirty projects for local government, schools, EE facilities, nonprofits, and private landowner clients. One of the successful curricular elements of this initiative is the interdisciplinary, collaborative approach that has a long-term vision for engaging partners (Gold et al. 2006). Indeed, the UWREN is but one example of college/university programs worldwide in which students learn both the scientific and the social aspects of ecological restoration (Lavendel 1999, see http://www.globalrestorationnetwork.org/education/).

Such partnerships at the community level have garnered attention on an international scale as well. For instance, Kobori (2009) describes two restoration case studies in Japan, illustrating their educational, ecological, and communal benefits as well as the essential need for authentic community partners to ensure success. One strategy Kobori specifically mentions is the need to implement community-based initiatives through partnerships among nongovernmental agencies, local government and citizens, and university stakeholders and researchers.

The Bronx River Restoration project in New York City developed government and not-for-profit partnerships to engage schools, community groups, and businesses in restoration projects along a twenty-three-mile (37–km) stretch of the Bronx River. Tanner et al. (1992) anecdotally describe the educational opportunities and benefits of engaging intermediate school students, teachers, college educators, and Boy Scouts in various aspects of the restoration process. Others highlight this multidecadal restoration initiative as exemplary in addressing environmental concerns, while involving citizens and enhancing opportunities for ecological citizenship (Light 2006). In doing so, Light (2006) contends this project offers opportunities for citizens along the riverbanks to forge links across communities by focusing their civic interests on a common project. On the other hand, chapter 6 in this book describes a multijurisdictional river restoration project that went badly in social terms due to a lack of public participation.

Authentic partnerships are not without challenges and require long-term commitment to relationship building. To be successful, there must be a pervasive willingness to move outside one's comfort zone and seek out unlikely partners. Stone and Barlow's (2009) descriptions of the social learning reflected in the Students and Teachers Restoring a Watershed (STRAW) initiative in California is one such example. Their experiences illustrate the critical importance of mutuality, high-quality communication and information flow, and an ability to think beyond "us versus them" mentalities to build trust, learn from experience, and have participants engage in restoration in meaningful ways. Likewise, Tomblin (2009) outlines the risks of community-based ecological restoration, of which education is often a part, when restorationists alienate disadvantaged people and neglect issues of social justice (see chap. 5, this volume). We must find effective ways to bridge these gaps by enhancing our cultural competency and connecting RBE to social and environmental justice issues in meaningful ways. Doing so must involve having diverse voices—including those of young people—enter the conversations and authentically participate in the process.

Youth as Stakeholders: Beyond Tokenism

Children are key stakeholders in environmental concerns at local and global scales. Despite research indicating their marginalization in participatory processes, children do have legitimate concerns about the present and future state of the environment and should be considered key stakeholders in environmental decision making (Hacking, Barratt, and Scott 2007). For example, Rottle and Johnson (2007) describe Seattle inner-city sixth graders' active involvement in charrettes for the design of a park-based, outdoor learning laboratory. Their findings suggest students made gains in their own ecological literacy, particularly in areas of understanding, caring, and competence regarding habitat creation and restoration.

An all-too-common practice in various public participation processes is tokenism and a lack of authentic engagement in democratic processes (Hart 1992, 1997a). In terms of children's involvement with school garden projects, Wake (2007, 2008) contends that adult discourses and agendas continue to dominate, which reduces opportunities for children to become empowered and learn about nature in ways that meet their needs. Similarly, Malone and Tranter's (2003) findings suggest that, while schoolyards promote field-based learning opportunities, school culture and adult values predominate. Dyment's research (2004, 2005b) indicates that students were involved in the design, planting, and maintenance of schoolyard greening projects, but they had little opportunity in terms of identifying the problem and visioning phases. Such trends must be reversed if children are to be authentic participants who share in decision making and whose ideas are valued in environmental concerns.

Consider Adult and Youth Learning and Development

When planning RBE programs, educators must consider aspects of human development and learning that affect program effectiveness. For example, taking into account an adolescent's need for social support and autonomy may make opportunities to engage in ecological restoration projects more meaningful and relevant to their lives, both developmentally and evolutionarily. As Kaplan and Kaplan (2002) write: "Awareness of youth's sensitivity to autonomy, social concerns and competence needs are certainly important, but they are not enough. It is essential to take the time and effort to find out 'where they're at'—what activities in nature would be perceived as meaningful and satisfying to the potential participants" (252).

This holds true for all learners because we each develop at different rates. In fact, children learning in various cultures, environments, and social classes will have access to different experiences, resources, and teaching, resulting in different competencies at various times (Hart 1997b; Hart et al. 1997). Sensitivity to these differences must be accounted for when planning educational experiences. The North American Association for Environmental Education's (NAAEE) *Excellence in Environmental Education Guidelines for Learning* (K–12) (revised 2010) provides guidelines to support quality EE and highlights such considerations as age appropriateness and meeting state standards (see http://www.naaee.org/programs-and-initiatives/guidelines-for-excellence/materials-guidelines/learner-guidelines). Their *Nonformal Environmental Education Programs: Guidelines for Excellence* publication offers design suggestions for comprehensive, non-school-based EE programs (see http://www.naaee.org/programs-and-initiatives/guidelines-for-excellence/materials-guidelines/nonformal-guidelines).

Ensure Curricular Integration

The Earth Partnership for Schools (EPS) Program (see chap. 25, this volume) challenges more traditional forms of education and teacher professional development by encouraging a collaborative interdisciplinary, experiential approach to learning and teaching while using the natural world as a context for learning. The program emphasizes diverse learning styles, particularly by integrating elements of Gardner's (1993) theory of multiple intelligences. Such interdisciplinary teaching and teacher collaboration are still relatively new educational approaches for many schools and continue to be difficult to implement in more traditional, hierarchical school structures. This type of EE program presents more learner-centered, experiential approaches to teaching and learning and encourages teachers to infuse EPS activities throughout the school curriculum.

Throughout the United States, teachers are being asked to expand their repertoire of professional practices to include more hands-on, student-centered, and experiential techniques (Zemelman, Daniels, and Hyde 1998). Teachers are also faced with meeting required professional development demands, addressing state learning standards, raising state test scores specifically in science and math, and incorporating EE in meaningful ways into their daily curricula. Any RBE program should provide teachers with curricular guidance and support that helps invigorate these subject areas. Doing so will help teachers infuse new pedagogical techniques grounded in the context of ecological restoration and environmental inquiry into the teaching of science, math, language arts, and other core subject areas. Teachers gain experience using inquiry-based methods of teaching and learning science, receive activities aligned with state standards, and learn new strategies for student assessment. The NAAEE's *Guidelines for the Preparation and Professional Development of Environmental Educators* offer support and recommendations for teacher education and curricular integration (see http://www.naaee.org/programs-and-initiatives/guidelines-for-excellence/materials-guidelines/educator-preparation).

Incorporate Research and Evaluation

Researchers and educators have emphasized the need for additional systematic long-term, larger-scale evaluation of schoolyard greening initiatives (Ozer 2007; Blair 2009). The need for thoughtful evaluation is also present for RBE projects. The EE field has a strong interest in evaluation of program effectiveness, which has led to creation of higher-education evaluation courses, online evaluation tools and resources (e.g., http://meera.snre.umich.edu/), and research and print materials to enhance the practitioners' capacity to gauge their programmatic and organizational impacts (e.g., Jacobson et al. 2006; Powell, Stern, and Ardoin 2006; Ernst, Monroe, and Simmons 2009). Given that ecological restoration is a relatively young field, there is also vast research potential for RBE initiatives to inform our practice. As mentioned previously, there is limited research regarding the educational efficacy of RBE approaches. Likewise, there is potential of RBE to affect ecosystem services beyond learning outcomes, which offer additional lines of inquiry.

There are various reasons why evaluation is a critical component to any RBE initiative. Depending on the approach taken, evaluation processes can provide greater understanding, reinforce an effective program approach, provide for organizational development, support empowerment and a sense of ownership among participants (Patton 2008), help administrators make decisions about programs and personnel (Wentling and Lawson 1975), and offer information to stakeholders and other interested audiences (Guba and Lincoln 1983).

Understanding formative and summative evaluation approaches provides another perspective as to why evaluations are conducted. Summative evaluation identifies and elaborates on program outcomes and is typically viewed as an "end-product" approach to prove what a program has achieved upon conclusion. In contrast, formative evaluation implies that the primary purpose of designing and using evaluation is to improve an instructional program, particularly by providing feedback to planning staff involved. It focuses on the process rather than just the product (Baker 1974; Shadish, Cook, and Leviton 1991). There is often a need and appropriate time for both summative and formative evaluation, and neither approach is mutually exclusive. Ideally, program planners, evaluators, and other various stakeholders view evaluation as an ongoing learning process, recognizing the potential role both formative and summative evaluation can play in better understanding and strengthening an educational process.

Conclusion

Restoring landscapes at any scale—whether in a backyard, schoolyard, vacant lot, or large-scale ecosystem restoration—has the potential to restore the earth and ourselves, as individuals and communities. When conducted on school grounds, learners have unique opportunities to study diverse ecological communities, conduct scientific research, and celebrate a new personal relationship with the land. The restoration process can profoundly affect individual and community relationships to nature and provide an opportunity for positive environmental actions. Restoration-based education can nurture a respect for nature at a time when children are forming their view of the world, as well as invite parents, teachers, volunteers, and others to strengthen their own commitment to the land and their community. When done well, such educational efforts bridge the gap between the natural and humanmade environments through year-round curricula that synthesize the interconnectedness of all living things.

This chapter outlined some of the benefits of connecting with nature, particularly among young people. It highlighted how RBE can create learning landscapes with the potential to enhance biodiversity while engaging learners in their "place" in personally relevant ways. To be most effective, RBE efforts must incorporate the interests of learners of all ages as well as partnering organizations, which takes time and thoughtfulness to do well. Youth are key stakeholders who can bring fresh ideas and energy to the process. Considerations of developmental appropriateness, curricular integration, cultural relevance, and sensitivity to the interests of youth are critical to success. In all cases, we must consistently consider RBE evaluation and research, as only then can we demonstrate the educational and ecological benefits of our efforts.

Restoration sites turn out to be outdoor learning laboratories for a new generation of learners to become both ecologically literate and better equipped to deal with complex environmental and cultural issues. Unfortunately, our past includes dramatic human degradation of the natural world across the globe. Thankfully, RBE offers limitless opportunities for current and future generations to learn from that past and add something better to it. As Mohandas K. Gandhi (1956) reminds us, "To forget how to dig the earth and to tend the soil is to forget ourselves."

Notes

1. "Children" are defined by the United Nations as anyone under eighteen, while fifteen- to twenty-five-year-olds are defined as "young people" or "youth." Under these definitions, this demographic accounts for more than 50 percent of the population of a given city or town in developing countries (Chawla 2001). This chapter will consider youth and young people, especially in the K–16 contexts and nonformal community-based contexts.

2. Restoration-based education overlaps with other educational approaches and techniques, such as community-based environmental education (Andrews et al. 2002), service learning (Furco 1996), science education, experiential education, project-based learning, place-based education, citizen science, educating for sustainability, civic ecology education, and conservation education, among others. It goes beyond the scope of this chapter to distinguish these various terms and fields of study, although this piece draws on several of these terms and related research as appropriate to expand on our understanding of restoration-based education.

3. Restoration-based education reflects local, national, and international trends to enhance/restore natural areas while actively involving participants in *learning*. Associated terms and potential areas of overlap include "community gardens" (Ferris, Norman, and Sempik 2001), "naturalization" (Raffan 2000), and "community greening," to name a few. Specific to school settings, there are a variety of terms used to describe schoolyard-based landscape transformations, such as "schoolyard greening," "school ground restoration," "schoolyard habitat," "school ground gardening," and "outdoor classrooms," among others. "Green care" and "social farming" are terms used primarily in European countries and focus on multifunctional aspects of agriculture, combined with public health and social services, to serve therapeutic, educational, and employment aspects of social farming. "Ecotherapy" is an umbrella term for various treatments that include the natural environment for healing and growth, and is considered a type of applied psychology (Buzzell and Chalquist 2009). Such terms can be viewed as interchangeable and/or overlapping in content and process. Likewise, a given green space or garden might have more than one function, restoration being only one of many options. It goes beyond the scope of this chapter to attempt to define these terms in detail. Suffice it to say that there is tremendous interest in offering students and entire communities opportunities to restore native habitats.

References

Andrews, E., M. Stevens, and G. Wise. 2002. "A Model of Community-Based Environmental Education." In *New Tools for Environmental Protection: Education, Information, and Voluntary Measures*, edited by T. Dietz and P. C. Stern, 161–82. Washington, DC: National Academies Press.

Anthonison, E. C. 2005. "Use and Status of Ecological Restorations in Schoolyards in Dane County, Wisconsin." Masters thesis, University of Wisconsin–Madison.

Ardoin, N. M. 2006. "Toward an Interdisciplinary Understanding of Place: Lessons for Environmental Education." *Canadian Journal of Environmental Education* 11: 112–26.

Baker, E. L. 1974. "Formative Evaluation of Instruction." In *Evaluation in Education: Current Applications*, edited by W. J. Popham, 533–85. Berkeley, CA: McCutchan Publishing.

Banks, D. L., M. Elser, and C. Saltz. 2005. "Analysis of the K–12 Component of the Central Arizona–Phoenix Long-Term Ecological Research (CAP LTER) Project 1998 to 2002." *Environmental Education Research* 11 (5): 649–63.

Barlow, Z., and M. Crabtree, eds. 2000. *Ecoliteracy: Mapping the Terrain*. Berkeley, CA: Learning in the Real World.

Bell, A. C. 2001. "Engaging Spaces: On School-Based Habitat Restoration." *Canadian Journal of Environmental Education* 6: 139–54.

Bell, A. C., and J. E. Dyment. 2008. "Grounds for Health: The Intersection of Green School Grounds and Health-Promoting Schools." *Environmental Education Research* 14 (1): 77–90.

Berman, M. G., J. Jonides, and S. Kaplan. 2008. "The Cognitive Benefits of Interacting with Nature." *Psychological Science* 19 (2): 1207–12.

Bingle, W. H., and P. J. Gaskell. 1994. "Scientific Literacy for Decisionmaking and the Social Construction of Scientific Knowledge." *Science Education* 78 (2): 185–201.

Blair, D. 2009. "The Child in the Garden: An Evaluative Review of the Benefits of School Gardening." *Journal of Environmental Education* 40 (2): 15–38.

Buzzell, L., and C. Chalquist. 2009. *Ecotherapy: Healing with Nature in Mind*. San Francisco: Sierra Club Books.

Chalquist, C. 2009. "A Look at the Ecotherapy Research Evidence." *Ecopsychology* 1 (2): 353–72.

Chawla, L. 2001. "Putting Young Old Ideas into Action: The Relevance of Growing Up in Cities to LOCAL Agenda 21." *Local Environment* 6 (1): 13–25.

Clewell, A. F., and J. Aronson. 2007. *Ecological Restoration: Principles, Values, and Structure of an Emerging Profession*. Washington, DC: Island Press.

Clifford, M. 2003a. *Long-Term Restoration and Curricular Activities among EPS Participants: A Summary of Survey Responses*. Madison, WI: Springboard Training and Evaluation.

———. 2003b. *Earth Partnership for Schools Institute A and B, Summer 2003 Evaluation*. Madison, WI: Springboard Training and Evaluation.

———. 2004. *Earth Partnership for Schools Institute A and B, Summer 2004 Evaluation (Draft Report)*. Madison, WI: Springboard Training and Evaluation.

Cline, S., L. Cronin-Jones, C. Johnson, M. Hakverdi, and R. Penwell. 2002. "The Impact of Community Involvement on the Success of Schoolyard Ecosystem Restoration/Education Programs: A Case Study Approach." Paper presented at the annual meeting of the American Educational Research Association, April 2002, New Orleans, LA.

Coffey, A. 2001. "Transforming School Grounds." In *Greening School Grounds: Creating Habitats for Learning*, edited by T. Grant and G. Littlejohn, 2–4. Gabriola Island, BC: New Society Publishers.

Coyle, K. 2005. *Environmental Literacy in America: What 10 Years of NEETF/Roper Research and Related Studies Say about Environmental Literacy in the U.S*. Washington, DC: National Environmental Education and Training Foundation.

Dyment, J. E. 2004. "At That Age, You Just Accept What You Have . . . You Never Question Things: A Case Study of Student Participation in School Ground Greening Projects." *Children, Youth and Environments* 14 (1): 130–52.

———. 2005a. " 'There's Only So Much Money Hot Dog Sales Can Bring In': The Intersection of Green School Grounds and Socio-economic Status." *Children's Geographies* 3 (3): 307–23.

———. 2005b. "Green School Grounds as Sites for Outdoor Learning: Barriers and Opportunities." *International Research in Geographical and Environmental Education* 14 (1): 28–45.

Dyment, J. E., and A. Bell. 2006. " 'Our Garden Is Colour Blind, Inclusive and Warm': Reflections on Green School Grounds and Social Inclusion." *International Journal of Inclusive Education* 12 (2): 169–83.

———. 2008. "Grounds for Movement: Green School Grounds as Sites for Promoting Physical Activity." *Health Education Research* 23 (6): 952–62.

Earth Partnership for Schools. 2006. *Earth Partnership for Schools*. Promotional video. Madison, WI: University of Wisconsin–Madison Arboretum.

Eckman, A. 1998. "Making Science Popular: Inquiry-Based Instruction Sparks Students' Interest." *Association for Supervision and Curriculum Development Curriculum Update* Fall, 7.

Ernst, J., and D. Ellis. 2005. "The Prairie Science Classroom: Blazing a Trail in Interdisciplinary Learning." *Sciencescope* 28 (7): 16–19.

Ernst, J., M. Monroe, and B. Simmons. 2009. *Evaluating Your Environmental Education Programs: A Workbook for Practitioners*. Washington, DC: North American Association for Environmental Education.

Ferris, J., C. Norman, and J. Sempik. 2001. "People, Land and Sustainability: Community Gardens and the Social Dimension of Sustainable Development." *Social Policy and Administration* 35 (5): 559–68.

Fjørtoft, I. 2004. "Landscape as Playscape: The Effects of Natural Environments on Children's Play and Motor Development." *Children, Youth and Environments* 14 (2): 21–44. http://www.colorado.edu/journals/cye/.

Fjørtoft, I., and J. Sageie. 2000. "The Natural Environment as a Playground for Children: Landscape Description and Analyses of a Natural Playscape." *Landscape and Urban Planning* 48 (1–2): 83–97.

Freedman, D. 1998. "Science Education: How Curriculum and Instruction Are Evolving." *Association for Supervision and Curriculum Development Curriculum Update* Fall, 1–3, 6, 8.

Furco, A. 1996. "Service-Learning: A Balanced Approach to Experiential Education." *Expanding Boundaries: Serving and Learning* 1 (1): 2–6.

Gandhi, M. K. 1956. *The Gandhi Reader: A Sourcebook of His Life and Writings*, edited by Homer Jack. New York: Grove Press.

Gardner, H. 1993. *Multiple Intelligences: The Theory in Practice*. New York: Basic Books.

Gold, W., K. Ewing, J. Banks, M. Groom, T. Hinckley, D. Secord, and D. Shebitz. 2006. "Collaborative Ecological Restoration." *Science* 312 (5782): 1880–81.

Grant, T., and G. Littlejohn, eds. 2001. *Greening School Grounds: Creating Habitats for Learning*. Gabriola Island, BC: New Society Publishers.

Grimm, N. B., J. Morgan Grove, S. T. A. Pickett, and C. L. Redman. 2000. "Integrated Approaches to Long-Term Studies of Urban Ecological Systems." *BioScience* 50 (7): 571–84.

Gruenewald, D. A. 2008. "Place-Based Education: Grounding Culturally Responsive Teaching in Geographic Diversity." In *Place-based Education in the Global Age: Local Diversity*, edited by D. A. Gruenewald and G. A. Smith, 137–53. New York: Routledge.

Guba, E. G., and Y. S. Lincoln. 1983. *Effective Evaluation: Improving the Usefulness of Evaluation Results through Responsive and Naturalistic Approaches*. San Francisco: Jossey-Bass.

Hacking, E. B., R. Barratt, and W. Scott. 2007. "Engaging Children: Research Issues around Participation and Environmental Learning." *Environmental Education Research* 13 (4): 529–44.

Hails, C., ed. 2008. *Living Planet Report 2008*. Gland, Switzerland: WWF/ZSL/Global Footprint Network. http://assets.panda.org/downloads/living_planet_report_2008.pdf.

Hart, R. A. 1992. *Children's Participation: From Tokenism to Citizenship*. Florence, Italy: UNICEF International Child Development Centre.

———. 1997a. *Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care*. New York and London: UNICEF and Earthscan.

———. 1997b. *Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care*. London: Earthscan.

Hart, R. A., C. Daiute, S. Iltus, D. Kritt, M. Rome, and K. Sabo. 1997. "Developmental Theory and Children." *Social Justice* 24 (3): 33–63.

Hartig, T., G. W. Evans, L. D. Jamner, D. S. Davis, and T. Gärling. 2003. "Tracking Restoration in Natural and Urban Field Settings." *Journal of Environmental Psychology* 23 (2): 109–23.

Hartig, T., F. G. Kaiser, and P. A. Bowler. 2001. "Psychological Restoration in Nature as a Positive Motivation for Ecological Behavior." *Environment and Behavior* 33 (4): 590.

Harvey, M. R. 1989. "The Relationship between Children's Experiences with Vegetation on School Grounds and Their Environmental Attitudes." *Journal of Environmental Education* 21 (2): 9–15.

———. 1993. "Learning about Ecology through Contact with Vegetation." In *Ecology in Education*, edited by M. Hale, 99–121. New York: Cambridge University Press.

Helford, R. M. 2000. "Constructing Nature as Constructing Science: Expertise, Activist Science, and Public Conflict in the Chicago Wilderness." In *Restoring Nature: Perspectives from the Social Sciences and Humanities*, edited by P. H. Gobster and R. B. Hull, 119–42. Washington, DC: Island Press.

Jablonski, L. M., and M. Banker. 2001. "Service Learning Program Provides Hands-On Experience in Restoration Ecology (Ohio)." *Ecological Restoration* 19 (3): 190–91.

Jacobson, S. K., M. D. McDuff, and M. C. Monroe. 2006. *Conservation Education and Outreach Techniques*. Oxford: Oxford University Press.

Jones, J. M. 2010. "In U.S., Many Environmental Issues at 20-Year-Low Concern." *Gallup* March 16, 2010. http://www.gallup.com/poll/126716/Environmental-Issues-Year-Low-Concern.aspx.

Jordan III, W. R. 1995. "Good Restoration." *Restoration & Management Notes* 13 (1): 3.

Jordan III, W. R., R. L. Peters, and E. B. Allen. 1988. "Ecological Restoration as a Strategy for Conserving Biological Diversity." *Environmental Management* 12 (1): 55–72.

Kaplan, R., and S. Kaplan. 2002. "Adolescents and the Natural Environment: A Time Out?" In *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*, edited by P. H. Kahn Jr. and S. R. Kellert, 227–57. Cambridge, MA: MIT Press.

Kaplan, S., and R. Kaplan. 2003. "Health, Supportive Environments, and the Reasonable Person Model." *American Journal of Public Health* 93 (9): 1484–89.

Kellert, S. R. 1997. *Kinship to Mastery: Biophilia in Human Evolution and Development*. Washington, DC: Island Press.

———. 2002. "Experiencing Nature: Affective, Cognitive, and Evaluative Development in Children." In *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*, edited by P. H. Kahn Jr. and S. R. Kellert, 117–51. Cambridge, MA: MIT Press.

Kellert, S. R., and E. O. Wilson, eds. 1993. *The Biophilia Hypothesis*. Washington, DC: Island Press.

Kobori, H. 2009. "Current Trends in Conservation Education in Japan." *Biological Conservation* 142: 1950–57.

Krasny, M. E., and K. G. Tidball. 2009. "Applying a Resilience Systems Framework to Urban Environmental Education." *Environmental Education Research* 15 (4): 465–82.

Kudryavtsev, A. 2009. *Urban Environmental Education and Restoration: Nurturing Environmental Stewards in the Bronx*. Community Forestry and Environmental Research Partnerships. Final report. Ithaca, NY: Cornell University.

Lambert, A. 1999. "Shifting Paradigms: The Heart in Restoration Education." *Ecological Restoration* 17 (3): 126–35.

Lavendel, B. 1999. "Ecological Restoration in Academia." *Ecological Restoration* 17 (3): 120–25.

Lieberman, G. A., and L. L. Hoody. 1998. *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning: Results of a Nationwide Study*. Poway, CA: Science Wizards.

Light, A. 2002. "Restoring Ecological Citizenship." In *Democracy and the Claims of Nature*, edited by B. Minteer and B. P. Taylor, 153–72. Lanham, MD: Rowman and Littlefield.

———. 2006. "Ecological Citizenship: The Democratic Promise of Restoration." In *The Humane Metropolis: People and Nature in the 21st-Century City*, edited by R. H. Platt, 169–81. Amherst: University of Massachusetts Press.

Louv, R. 2008. *Last Child in the Woods: Saving Our Children from Nature Deficit Disorder*. 2nd ed. New York: Algonquin Books.

Lucas, A., and J. Dyment. 2010. "Where Do Children Choose to Play on the School Ground? The Influence of Green Design." *Education 3–13: International Journal of Primary, Elementary and Early Years Education* 38 (2): 177–89.

Malone, K., and P. Tranter. 2003. "Children's Environmental Learning and the Use, Design and Management of School Grounds." *Children, Youth and Environments* 13 (2). http://colorado.edu/journals/cye.

McCann, E. P. 2003. "Passion and Persistence: A Study of Communities of Practice in Schools." PhD diss., University of Wisconsin–Madison.

Miller, J. D. 1998. "The Measurement of Civic Scientific Literacy." *Public Understanding of Science* 7: 203–23.

Miller, J. R., and R. J. Hobbs. 2002. "Conservation Where People Live and Work." *Conservation Biology* 16 (2): 330–37.

Milligan, C., and A. Bingley. 2007. "Restorative Places or Scary Spaces? The Impact of Woodland on the Mental Well-Being of Young Adults." *Health and Place* 13 (4): 799–811.

Moore, R. C., and H. H. Wong. 1997. *Natural Learning: The Life History of an Environmental Schoolyard*. Berkeley, CA: MIG Communications.

Morales, L. 2010. "Green Behaviors Common in U.S., but Not Increasing." *Gallup* April 9, 2010. http://www.gallup.com/poll/127292/Green-Behaviors-Common-Not-Increasing.aspx.

Nabhan, G. P. 1994. "A Child's Sense of Wildness." In *The Geography of Childhood: Why Children Need Wild Places*, edited by G. P. Nabhan and S. Trimble, 3–14. Boston: Beacon Press.

Nabhan, G. P., and S. Trimble, eds. 1994. *The Geography of Childhood: Why Children Need Wild Places*. Boston: Beacon Press.

Nelkin, D. 1995. "Science Controversies: The Dynamics of Public Disputes in the United States." In *Handbook of Science and Technology Studies*, edited by S. Jasanoff, G. E. Markle, J. C. Peterson, and T. Pinch, 444–56. Thousand Oaks, CA: Sage.

Newport, F. 2010. "Americans' Global Warming Concerns Continue to Drop." *Gallup* March 11, 2010. http://www.gallup.com/poll/126560/Americans-Global-Warming-Concerns-Continue-Drop.aspx.

Nicholson, S. 1971. "Theory of Loose Parts: How Not to Cheat Children." *Landscape Architecture* 62: 30–34.

North American Association for Environmental Education. 2010. *Excellence in Environmental Education Guidelines for Learning (K–12)*.

Noss, R. F., and A. Y. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Washington, DC: Island Press.

Noss, R. F., E. T. LaRoe, and J. M. Scott. 1995. *Endangered Ecosystems of the United States: A*

Preliminary Assessment of Loss and Degradation. Biological Report 38. Washington, DC: USDI Biological Services.

Orr, D. 1992. *Ecological Literacy: Education and the Transition to a Postmodern World*. Albany: State University of New York Press.

Ottosson, J., and P. Grahn. 2005. "A Comparison of Leisure Time Spent in a Garden with Leisure Time Spent Indoors: On Measures of Restoration in Residents in Geriatric Care." *Landscape Research* 30 (1): 23–55.

Ozer, E. J. 2007. "The Effects of School Gardens on Students and Schools: Conceptualization and Considerations for Maximizing Healthy Development." *Health Education and Behavior* 34 (6): 846.

Patton, M. Q. 2008. *Utilization-Focused Evaluation: The New Century Text*. 4th ed. Thousand Oaks, CA: Sage.

Phalen, K. B. 2009. "An Invitation for Public Participation in Ecological Restoration: The Reasonable Person Model." *Ecological Restoration* 27 (2): 178–86.

Powell, R., M. Stern, and N. Ardoin. 2006. "A Sustainable Evaluation Framework and Its Application." *Applied Environmental Education and Communications: An International Journal* 5: 231–41.

Pyle, R. M. 1993. *The Thunder Tree: Lessons from an Urban Wildland*. Boston: Houghton Mifflin.

———. 2002. "Eden in a Vacant Lot: Special Places, Species, and Kids in the Neighborhood of Life." In *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*, edited by P. H. Kahn Jr. and S. R. Kellert, 305–27. Cambridge, MA: MIT Press.

Raffan, J. 2000. *Nature Nurtures: Investigating the Potential of School Grounds*. Toronto: Evergreen.

Ramey-Gassert, L., H. J. Walberg III, and H. J. Walberg. 1994. "Reexamining Connections: Museums as Science Learning Environments." *Science Education* 78 (4): 345–63.

Ramsey, J. 2005. "The Science Education Reform Movement: Implications for Social Responsibility." In *Essential Readings in Environmental Education*, edited by H. R. Hungerford, W. J. Bluhm, T. L. Volk, and J. M. Ramsey, 405–22. 3rd ed. Champaign, IL: Stipes.

Redman, C. L., J. M. Grove, and L. H. Kuby. 2004. "Integrating Social Science into the Long-Term Ecological Research (LTER) Network: Social Dimensions of Ecological Change and Ecological Dimensions of Social Change." *Ecosystems* 7 (2): 161–71.

Rottle, N. D., and J. M. Johnson. 2007. "Youth Design Participation to Support Ecological Literacy: Reflections on Charrettes for an Outdoor Learning Laboratory." *Children, Youth and Environments* 17 (2): 484–502.

Shadish, W. R., T. D. Cook, and L. C. Leviton. 1991. *Foundations of Program Evaluation: Theories of Practice*. Newbury Park: Sage.

Stone, M. K., and Z. Barlow. 2009. "Social Learning in the STRAW Project." In *Social Learning: Towards a Sustainable World*, edited by A. E. J. Wals, 405–18. Wageningen, Netherlands: Academic.

Tanner, M. J., D. Hernandez, J. A. Mankiewicz, and P. S. Mankiewicz. 1992. "Restoration-Based Education on the Bronx River." *Restoration & Management News* 10 (1): 14–17.

Taylor, A. F., and F. E. Kuo. 2006. "Is Contact with Nature Important for Healthy Child Development? State of the Evidence." In *Children and Their Environments: Learning, Using and Designing Spaces*, edited by C. Spencer and M. Blades, 124–40. Cambridge: Cambridge University Press.

Tedesco, L. P., and K. A. Salazar. 2006. "Using Environmental Service Learning in an Urban

Environment to Address Water Quality Issues." *Journal of Geoscience Education* 54 (2): 123–32.

Tennessen, C. M., and B. Cimprich. 1995. "Views to Nature: Effects on Attention." *Journal of Environmental Psychology* 15 (1): 77–85.

Tidball, K. G. 2008. *Bringing People Back In: Civic Ecology in Urban Social-Ecological Systems*. Presentation at the 2008 Summer Joint Session of the Northeast Agricultural Experiment Station and Cooperative Extension Directors, and the Council for Agricultural Research, Extension, and Teaching. Washington, DC, July 2008. www.sci-links.com/files/SAES.ppt.

Tidball, K. G., and Krasny, M. E. 2009. "From Risk to Resilience: What Role for Community Greening and Civic Ecology in Cities?" In *Social Learning: Towards a Sustainable World*, edited by A. E. J. Wals, 149–64. Wageningen, Netherlands: Academic.

Tomblin, D. C. 2009. "The Ecological Restoration Movement: Diverse Cultures of Practice and Place." *Organization and Environment* 22 (2): 185–207.

UNESCO/UNEP. 1978. "The Tbilisi Declaration." *Connect* 3 (1), 1–8.

———. 2005. "Decade for Sustainable Development United Nations Decade (2005–2014): Vision and Definition of ESD." http://portal.unesco.org/education/en/ev.php-URL_ID=27279&URL_DO=DO_TOPIC&URL_SECTION=201.html.

Wake, S. J. 2007. "Children's Gardens: Answering 'the Call of the Child'?" *Built Environment* 33 (4): 441–53.

———. 2008. "'In the Best Interests of the Child': Juggling the Geography of Children's Gardens (between Adult Agendas and Children's Needs)." *Children's Geographies* 6 (4): 423–35.

Walker, B., and D. Salt. 2006. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Washington, DC: Island Press.

Wells, N. M. 2000. "At Home with Nature: Effects of "Greenness" on Children's Cognitive Functioning." *Environment and Behavior* 32 (6): 775.

Wentling, T. L., and T. E. Lawson. 1975. *Evaluating Occupational Education and Training Programs*. Boston: Allyn and Bacon.

Wilson, E. O. 1984. *Biophilia*. Cambridge, MA: Harvard University Press.

Zemelman, S., H. Daniels, and A. Hyde. 1998. *Best Practices: New Standards for Teaching and Learning in America's Schools*. Portsmouth, NH: Heinemann.

Chapter 23

Great Plains Environmental Education: A Personal Reflection

William S. Whitney

While many people in my Great Plains landscape are sustained by the bounty of wheat, corn, and soybeans, the Prairie Plains Resource Institute (aka Prairie Plains or the Institute), a nonprofit organization that I cofounded in 1980 with my wife, Jan, and two other friends, has been sustained by a vision that includes additional possibilities for the region. The roots of Prairie Plains are grounded in rural, small-town agrarian values, but its foundation rests firmly upon nature, specifically the native prairie ecosystem, and upon the view that conservation is about service to people. Although the majority of our work is presently focused on central and eastern Nebraska, our goal for the near future is to share our experiences with more people, increase the program activity at our new education center, and expand our scope of activity beyond Nebraska to the rest of the Great Plains and beyond.

We are centered in Aurora, Nebraska, a small farm community of roughly 4,500 people along Interstate 80, about 120 miles west of Omaha. The Institute is an educational land trust with an interdisciplinary approach to nature and culture. We promote sustainable management of human and natural resources, preservation of plains natural areas, and educational development. By its original charter, Prairie Plains is really about bringing people together; nature provides the stage on which we act. This has always presented us with an enormous and vexing question. How do we involve more people in meaningful ways, weaving new and colorful threads of subject matter into the mainstream fabric of an aging and lackluster agrarian culture, particularly in a conservative and sparsely populated region of the country?

It is easy to forget now, during the Institute's thirtieth year, how challenging it was to actually turn an idealistic, if not vague, set of founding purposes into a functioning institution, molding dreams and ideas, administrative protocols, technical processes, and financial details into an integrated whole. Conventional logic in 1980, often expressed emphatically by friends and family, maintained that (1) A young couple cannot survive trying to change or save the world by creating an organization in Nebraska (Why don't we get a job?); (2) Nobody cares much about prairie (What good is it?); and (3) A small town is the wrong place to do such a thing, and you will waste your education (Why not go where the money is?).

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_23,

Fortunately, Jan and I did not follow convention. We were both college graduates in biology, and I had a master's degree in limnology. Due to family issues, upon graduating in 1977 we moved back to my hometown of Aurora without jobs. Impetuous, stubborn in our ways, and energetic in our mid- to late twenties, we liked where we were and felt we could survive doing any number of things for money, including my college summer mainstay—house painting. Perhaps, I thought, a local professional job would eventually materialize in conjunction with Platte River sandhill crane conservation issues. After struggling through a horrifically cold and snowy first winter with only sparse work, we were able to create a grant-funded project at the Stuhr Museum of the Prairie Pioneer in nearby Grand Island, interpreting prairie natural history with respect to the Great Plains post-1870 settlement era. This project concluded a year and a half later with mixed success (we were paid!). More important, however, during this project we learned about, and became a part of, a budding movement in the Midwest and Plains states concerned with the almost-vanished prairie ecosystem.

Well into the museum project by the fall of 1978, I traveled east on a fact-finding mission to see what other people were doing. I visited with Ray Schulenberg at the Morton Arboretum in Lisle, Illinois, and Dr. Virginia Kline at the University of Wisconsin Arboretum in Madison. I toured all of their restored prairies, which are famous for being some of the earliest attempts at ecological restoration (Schulenberg Prairie at the Morton Arboretum; Curtis Prairie and Greene Prairie at the UW–Madison Arboretum). I was intrigued, for example, by my discussions with Mr. Schulenberg, whom I later discovered was a living legend to prairie enthusiasts, about how he created his prairie from scratch. I was astonished when I saw the restored prairies in their late summer grandeur—tall, colorful, diverse, and perpetually undulating with the wind. Such exposure to outstanding people, the concept of prairie restoration, and examples of restored tallgrass prairie left an indelible impression on me. In eastern Nebraska it was difficult to find many places with tall prairie grass, much less native wildflowers. Upon returning home I began to collect prairie seed on a few local roadside remnants I had discovered along the Platte River earlier in the summer. While I've long forgotten her name, I cannot forget the advice of a conservation consultant who worked for a prominent national organization. She advised me against pursuing high-diversity prairie restoration. "It is too difficult and time consuming," she said. I altogether ignored her advice because I had found something I liked.

Once the museum project ended, Jan and I again worried about our future and money. Again, due to a recessionary economy, winter work was slow to nonexistent, but I was able to bring in some money from a temporary construction job. Hopes were lifted in late winter as I heard about an ecologist position opening up with the newly formed Platte River Whooping Crane Habitat Maintenance Trust. I applied, but our hopes were dashed when I was rejected. We must have had supreme faith when I convinced my father, an attorney in Aurora, to incorporate a nonprofit organization in April 1980. The result was little more than a stated intention—some words of purpose on official-looking paper. Nonetheless, Prairie Plains Resource Institute was born.

Running parallel to the aforementioned events was an energy that proved very instrumental in the early development of Prairie Plains, as well as our own personal development. In many ways this was largely responsible for us staying in Aurora. Shortly after moving back, we met a number of new friends and embraced some old acquaintances who shared many of our eccentric interests. Among this eclectic group of 1960s kids there existed a strong, alternative-minded bent toward revitalizing small-town and rural life with new ideas pertaining to nature, philosophy and religion, art, agriculture and food preparation, renewable energy, and design and building. This was not unusual in America in the 1970s. Young people were moving back to the land, experimenting with new educational models, and new organizations were popping up to preserve land and promote sustainable agriculture and appropriate technology. What was unusual was not that our group shared interests in these things, but that it was happening in a small farm town in the Great Plains. My hometown was not only familiar because of my long memory of the place; now, because of the diversity of people and interests, it became intellectually exciting to me in a way that college never had been. Thanks to lots of good coffee and tea, food, friends, family, cooperative work efforts, and many late nights deep in discussion (before kids), Jan and I made it through those rough financial times. We became fulfilled, albeit in noneconomic terms, and were motivated by our passion for the new life we had found in Aurora. Without this foundation of people, moving back to my hometown would certainly not have proven to be a permanent, and for the most part, satisfying choice. We ultimately became rooted more deeply in the community than ever before, and through the agency of Prairie Plains we sought to create certain changes.

But back in 1980, having no track record, credibility, or funding, our concept of the fledgling Institute was, of necessity, very parochial and basic. It was inconceivable to think we could really do much. It made sense to us that a county-based conservation and education approach might work best in such a pragmatic agricultural region where things do not change quickly, and where personal bonds and trust are best built at a local level, usually one on one. We wanted to do educational programs with local schools as well as the general public. Both Jan and I enjoyed life-changing field biology experiences at the University of Minnesota's Lake Itasca and the University of Nebraska's Cedar Point biological field stations. These experiences greatly affected our thinking about full immersion, hands-on education for teaching science and history pertaining to the land, the beauty and scientific wonder of nature, as well as awareness of place. We also believed that it could be possible to preserve and manage a few prairie remnants around Aurora; we felt we could use them as educational sites and as places to demonstrate stewardship principles and techniques new to the area. Due in large part to my trip to Chicago and Madison, I could easily envision a world of potential for Prairie Plains in ecological restoration, both as a means to pursue personal interests in ecosystem science and to involve people in central Nebraska in fascinating work. Still, this great potential was quite small in my mind in terms of the extent to which we might impact the process. I could never have imagined the scale that our role in restoration would attain in two decades.

Full-time employment for Prairie Plains seemed like a far-off dream through the 1980s. In addition, full-time work on other jobs made it difficult to attend to Institute work. I was able to work for myself, thanks again to house painting, thus enabling me to break off from work and head to the field as often as possible. As I began to collect seeds for high-diversity, local ecotype prairie restoration, I also began to become a better botanist and all-around naturalist—noticing more of interest close to home, and falling in love with the Great Plains. My main subject matter became my home county. I dedicated my efforts to rediscovering the natural history of central Nebraska as a scientist traipsing through some of the same places I had frequented along the Platte River as a kid growing up. I found out we had real prairies—in hay meadows and native grazing lands and along roadsides. I was able to piece together a fairly comprehensive working list of plant species for the county, in a range of soils and moisture conditions. I not only came back home and discovered a new and fulfilling social setting, I came back and learned my natural history—becoming native to my place. What I was exposed to along the Platte as a young person exploring the river and sandpit lakes now had deeper scientific and cultural meaning to me. I learned the local plants, birds, fish, ecological communities, hydrology, and history—things I never noticed or studied as a child—and they became beings and ideas I could now place into a new holistic context. This seemed quite profound at the time, as did the fact that I had a community of friends to share it with. It is important to understand that the roots of Prairie Plains Resource Institute go deep into the purposeful exploring, thinking, and talking that went on during this period. It happened when I was alone in the field, or with Jan, or with friends on road trips, or late at night around the dinner table.

My pondering of nature and prairie ecology was also attended by thoughts about the local farm culture, which was under tremendous stress at the time, and the subtle and complex interplay between nature, agriculture, community, and agrarian ideals. We were searching for ways to be relevant to people—ultimately to make environmental awareness and action a part of the living culture as opposed to a form of activism, which is ineffectual in our region. Core principles pertaining to thrift, self-reliance, generous service to community, the value of good work, stubbornness in striving toward goals—definite attributes of our midwestern farming culture critical to survival on the land—became extremely important, fundamentally informing most everything Prairie Plains stood for and accomplished. We took pride in being called a bootstrap organization, learning how to do more with less and do it pretty well. We layered onto these agrarian values some others less often associated with the traditional ones, such as the quest for acquisition of contemporary knowledge and new skills, the need to stay connected outside of the local community, the need for beauty and diversity in our lives, the vital importance of becoming awakened to nature, and thinking globally. It occurred to me during these stressful early years with no money that these ideas were really all that we had; there was not much meat on the organization's bones. However, thinking about such things led to certitude regarding the value of our mission, which would prove later on to help us immensely. I observed frequently over the years that if we had had lots of money in the beginning, Prairie Plains may never have developed in the deliberate and fundamental ways that it did. Money would have made some things easier in the beginning, but it may have been our downfall.

Prairie Preserves

Within three years of its beginning, Prairie Plains was given two gifts of land, including a six-acre property along the muddy Lincoln Creek just a half mile from home (Lincoln Creek Prairie), and a 320-acre pasture and cropland dedicated to the Pearl Harbor Survivors Preserve, ninety miles west of Aurora in the Nebraska Loess Hills. Both of these properties offered potential for restoration of existing degraded prairie and new prairie plantings in existing croplands. In addition, both were potential education areas, one in Aurora and easily accessible, the other near a college (University of Nebraska at Kearney) and access to students. These two acquisitions were critical in a number of ways. Ownership is a serious responsibility, along with managing land. It comes with costs, while also providing certain benefits and opportunities for programming. We used the opportunity of being landowners to learn how to safely conduct prescribed burns, experiment with different planting techniques, and return degraded pastures into more diverse and productive prairies again. "In America owning land gives you power," a friend of mine used to say, and it holds true (see chap. 11, this volume). In our case these two properties gave us credibility as a land trust. We were now recognized as worthy to receive such significant gifts, and we began to build a track record by which others could begin to measure our efforts. Through the 1980s, we became more proficient in burning parts of these properties. (Prairie Plains was one of a small group of prescribed burning pioneers in Nebraska in the early 1980s. We discovered that showing up in the driveway with a piece of equipment paved the way for lasting partnerships with landowners who wanted to burn.) We also conducted field trips on occasion. Small-scale prairie restoration work was progressing at the Lincoln Creek area.

In 1989 another gift of land materialized, a high-quality, thirty-acre virgin tallgrass prairie, also in our home county. It was dedicated as the Marie Ratzlaff Prairie Preserve. This site added to our management responsibilities, but again it offered educational raw material and native seed. The true significance of Ratzlaff Prairie was that it fulfilled our early dream of having local county preserves. This was followed a few years later by two even larger gifts—significant for their size, scenery, history, and natural diversity. One of these was a five-thousand-acre ranch in Nebraska's western panhandle, dedicated as the Guadalcanal Memorial Prairie Ranch. The other, Olson Nature Preserve, was donated by a community group specifically for development as an educational natural area for local schools and Scouts. Finally, in 2001 and 2002, we acquired two more properties. One, the 390-acre Griffith Prairie and Farm, with its scenic river bluff prairie fronting the Platte River, was also near our headquarters in Aurora (we received a grant to purchase this one—still a gift!), and another virgin tallgrass prairie with adjoining restorable cropland, the Frank L. and Lillian Pokorny Memorial Prairie near Schuyler, Nebraska. Our holdings had quickly grown to seven properties totaling 5,800 acres. All but one was donated (fee simple title), and many are truly spectacular, classic Plains landscapes. All contain unique native plant communities, two include considerable stretches of major Nebraska prairie rivers (Platte and Niobrara) and two smaller creeks (Boone County's Beaver Creek and Hamilton

County's Lincoln Creek). Ecological restoration, stewardship, and educational potentials are far from realized on each of these properties; the future offers enormous opportunity. More than once I felt that the prairie gods were really smiling on us, though I attributed it mostly to steadfastness in our core principles, passion, a lot of difficult work, and a little luck. Success requires long-term commitment to a place. No doubt a universal truth, most certainly it is how things always get done on the wind-blown Plains.

Ecological Restoration

Since my formal ecological education included elements of terrestrial and aquatic ecology, I could envision myself early in my professional life somehow working on a watershed—particularly on a river corridor, with the stream and associated wetlands, and the adjacent valley land. When I learned about ecological restoration, especially from my arboretum visits, I wanted to bring that emphasis to Nebraska and place it into a stream corridor context. Our first Prairie Plains property along Lincoln Creek in Aurora was where this began to happen, in a small, but highly visible, greenway project where people could enjoy a stroll along a trail. In order to consolidate a diverse assemblage of prairie species closer to home, where I could monitor them and conveniently collect their seeds, I spent the first years of Prairie Plains harvesting and planting prairie seeds from local prairie remnants to plant at Lincoln Creek. A string of successful plantings followed, none larger than a half acre. These small-scale efforts in the 1980s grew in the 1990s, fulfilling another long-term goal to apply high-diversity prairie restoration techniques along a major corridor, the Platte River, as Prairie Plains undertook the restoration of mesic to wet-mesic (subirrigated due to a high water table) lowland prairie. This began in 1992 and marked the beginning of my full-time employment by Prairie Plains. Collecting seeds from more than 150 species each summer, I was able with intern help to increase from thirty-five acres planted in 1992 to more than one hundred acres in 1995. The overall process led to many insights about harvesting techniques, seed mixes, seed quantities, planting methods, seedling development, and plant community evolution in the new prairies. At this time, working with The Nature Conservancy, we also had excellent luck organizing volunteer crews of as many as twenty-five people to hand sow areas of up to fifty acres in size.

Yet another large growth in restoration happened in 1999 and through the 2000s, starting with projects for Nebraska's Rainwater Basin Joint Venture and major funding from the Nebraska Environmental Trust to expand high-diversity plantings to many new counties in eastern Nebraska. By this time many state and federal agencies were buying into the idea of local ecotype seed and much higher levels of diversity. With added staff we soon developed the capacity to plant in excess of five hundred acres per year. In addition to more staff we shared high school interns with the local Nature Conservancy project office in Aurora. This additional labor greatly enhanced our ability to harvest seeds and was an exceptional educational work opportunity for the young people. One ended up working for us through college, and about half of them pursued natural resource or science studies in college. During this last era we have been able to acquire more and better tools for harvesting seeds, processing, and planting, and to acquire our Griffith Prairie property, which includes excellent buildings to house equipment and huge piles of seed. Ensuing from this capacity-building Environmental Trust grant we began to do extensive contract work still in process today, which has developed into a significant service niche benefiting state and federal agencies and nongovernmental organizations. Since its inception Prairie Plains has pushed the physical limits of a small staff. Restoration is no exception as we have planted more than seventy sites, including six thousand acres of high-diversity prairie in thirty Nebraska counties, often with only two or three people doing the majority of the harvesting. Progressing from tiny sites in 1980 to many hundreds of acres each year, on individual sites from a couple to five hundred acres in size, we have recorded a geographic information system (GIS) database of planting sites and species lists, learned basic floristic information and compiled a Global Positioning System (GPS) database of roadside species occurrences in eastern Nebraska, developed higher efficiencies of harvest, and informed and involved many people in the restoration process. Once again our core values of thrift, resourcefulness, adaptability, and service have led to success.

Educational Program

In my estimation it is not enough to acquire natural areas and conduct stewardship and restoration activities on these properties. The reasons to do conservation work are ultimately defined within a human context and, as such, education is necessary to promote and sustain conservation activity by deepening its values within the cultural fabric of society. Because nature education is time consuming and demands focused attention, effective teaching methods, and good outdoor locations, it is often left to others. This was true in 1980; it is still relatively true today even though there have been significant gains in thirty years. The result is that, despite abundant verbalization and writing regarding its critical importance, such as Richard Louv's *Last Child in the Woods*, few schools and few organizations do it at all, much less effectively (see chap. 21, this volume). Most institutions that customarily do nature education, for example, nature centers and a few public schools with motivated teachers, rarely do so within a real-world context in conjunction with natural and working lands preservation, management, and restoration activities.

We have endeavored to re-create in others an awakening to nature that Jan and I experienced in our own formal education and in the process of rediscovering our roots in the prairie. Education was a major aspect of our thought processes before discovering the concept of restoration. Seeing what others were doing at the Morton and University of Wisconsin arboreta only strengthened our belief that we should become more involved with outdoor education along the Platte River in central Nebraska, since very little nature-based education was going on in rural Nebraska in 1980.

Subsequently, education, like restoration, became a pillar in the Prairie Plains mission. Over the years we have led many hikes on Prairie Plains lands and other natural areas in central Nebraska. These attracted a fairly limited audience but were fun and

Figure 23.1. Two SOAR students dip netting for invertebrates in a constructed wetland at Bader Memorial County Park, which is located along the Platte River, about ten miles east of Grand Island, Nebraska, USA. (Photos courtesy of the Prairie Plains Resource Institute)

effective in familiarizing participants with prairie natural history, Nebraska Sandhills, the Platte River, and central flyway sandhill crane and waterfowl migrations. The Institute's educational direction took a quite novel approach in 1992, and with a direct lineage to our college field station days at Itasca and Cedar Point. Prairie Plains began to conduct two weeks of a grade school field day camp called Summer Orientation About Rivers (SOAR) (fig. 23.1). In 2010, SOAR is still conducted at two locations, with both programs capitalizing on the Platte River. The SOAR program features an integrated curriculum of field science, writing and art activities, history, archaeology, fun in the shallow Platte River, and the simple exultation of being outdoors in beautiful natural settings. A joint planning effort by Prairie Plains staff and local public school teachers, the idea for SOAR seemed to us like something every child should—and could—experience in their home surroundings if only someone would create the institutional mechanism for it to happen. The ultimate point is to give children a basic understanding and enjoyment about where they grow up and about nature in general.

What is good for children is also good for adults. Like a great field station experience, SOAR still affects me after many years. One recent year I related to groups of SOAR campers the Loren Eiseley story in *The Immense Journey*, in which he talked about floating in the shallow Platte River of western Nebraska—sliding down the face of the continent with his fingertips reaching up into the cold mountain stream and his toes in the warm Gulf waters. After walking a ways against a stout current, we turned and floated down the Platte on our backs. It was memorable and I'm sure not just for me. A graduate student volunteer mentioned that at SOAR we "enforced a sense of beauty" about place, something she had never heard in her entire educational experience in rural Nebraska or in architectural studies at the University of Nebraska and MIT. I have also seen the impact that restoration work has had on young interns. It is very similar to the SOAR experience. The future holds great potential to cultivate land knowledge and sense of place in all age groups in similarly soul-uplifting educa-

Figure 23.2. Shadowing the program to learn how it is done, a middle school teacher is assisting with the SOAR fish and crawdad release.

tional adventures (fig. 23.2). Moreover, there is a need to educate people about pressing technical and social issues, like understanding and managing groundwater. We also like to explore deeper cultural issues, for example, provoking thought about the perceptions and realities of our region's history and natural bounties.

Granted, little of the foregoing narrative specifically addresses the subject of ecological restoration. We do incorporate activities with seeds and prairie planting in SOAR when possible, and we discuss restoration ideas with adults on many field trips, but restoration concepts and methodologies are not yet fully integrated into our education program. The fact that this is presently our functional reality does not belie the strong connection between education and restoration nor our intent to build more restoration/education program structure in the future. I submit that there is no point doing restoration without a strong educational component. But, perhaps the converse is also true—that there is no point, given present global realities, in doing nature education without including restoration. Of course, this may beg questions of the term "restoration" itself. What are we restoring? What is the our target for success? What is our human role? To me the term "restoration" is very inclusive; in addition to restoring nature and natural processes, it can also include human and spiritual components. It requires a holistic view. We may be restoring a bit of ourselves, so to speak, as we kindle a new relationship to life on Earth, or a region we are attached to and wistfully hope becomes a better place for our children. And what is education if not a gateway to always renewing our mind with new ideas—or at least having the discussion?

We see the future of restoration and education as a unified whole—positive and proactive, dynamic, involving sense of place and knowledge about ecosystems derived from experiencing them up close. We must develop a restorative culture around nature, agriculture, and community, essentially making a map in people's heads that includes neat places with interesting things in them like wild plants and animals (biodiversity), noticeably beautiful places, vibrant towns surrounded by vibrant farms, places

FIGURE 23.3. Thanks to SOAR, young people have a chance to see, and even hold, a live, wild bird native to their area.

that create strong emotional and cultural connections in the people who experience them (fig. 23.3).

The Future: Integration of Restoration and Education

When I reflect on the almost thirty years of Prairie Plains Resource Institute, I think of the assets we have been fortunate to pull together: incredible preserves representing Great Plains ecosystems; a well-crafted field education prototype that can be adapted to any age and knowledge level or site; a large-scale, high-diversity ecological restoration process and infrastructure tied to effective ways of working with groups of people on planning and execution of projects. We have accumulated and synthesized a strong foundation of interrelating parts—a mix that is unusual among small and rural conservation organizations—and we've done so in an agricultural area where such conservation and education did not exist prior to 1980. These parts, if integrated more deeply, can allow us to do much more in the future, with respect both to works on the land and to many-layered involvement with more people. This is especially the case if we remain true to our core values that helped us persist like the proverbial nonarrogant tortoise, keeping us focused on small, but important, details. Institutional memory of the early years is important as it reminds us of the reasons we are doing the work.

The 2002 grant from the Nebraska Environmental Trust that funded our purchase of the Griffith Prairie and farm, one of the largest and highest-quality upland prairies in east-central Nebraska, also set in motion our plan to build an educational center on this land. An amazing barn within five miles of the property provided the idea for a building design. We began the planning necessary to move and transform the barn into a functional and architecturally beautiful center, and the primary facilitation building of an evolving campus on the prairie. In 2007, the barn was moved onto its new foundation, marking the beginning of construction, and is now nearing completion. The Prairie Plains Board dedicated it as the Charles L. Whitney Education Center in honor of my father for his many years of service to the Institute. Barns were always traditional places of childhood learning in agrarian societies. Borrowing from that idea, our recycled barn will still be a place of learning, as much about the wonders of nature and how people can restore the earth as about calves being born or the art of stacking hay.

Intended program use of the Center brings full circle the philosophical and program integration of all Prairie Plains activities: ecological restoration and preserve stewardship, land education, and ways for people to participate in activities. We wish to continue expanding all of these activities in many ways yet to be determined. One critically important aspect of this integration is an idea to bring new ideas and faces—and youth—to our Center. We plan to train college and graduate student interns, forming a cadre of ecological restorationists to go out into the world. To us, as alluded to earlier, the term "restoration" is an inclusive and flexible term defined by context and individual situation, connoting a whole system approach including nature and biodiversity, the human environment, culture, and agriculture. We will adopt a farm school model based on curriculum study of land stewardship and ecological restoration around the globe in this inclusive sense, while doing our time-honored process of restoring hundreds of acres of regional prairie and wetlands. What an opportunity—to learn by practicing the art and discipline of restoration on the wide open Great Plains of North America! Not only will student interns learn about restoration, they will also be involved in the education of others at the Center, acting out our educational motto of *Come to Learn—Go Teach*, they will be exposed to a large piece of the central Plains landscape and will learn about the agriculture, economics, and communities of the region.

Upon completion of the Charles L. Whitney Education Center, Prairie Plains Resource Institute's formative era will essentially be complete; the founding purposes expressed in its charter will be fulfilled. We will enter an era that will be radically different from its three formative decades. By all appearances global warming, resource competition, biodiversity loss, and economic stress, among a host of other topics, will dominate society's concerns. In the middle of North America's breadbasket, the global situation has alarming connotations for the sustainability of water and soil resources, the sustainability of a perennially stressed rural population, as well as the vitality of the native grassland ecosystems.

To face these challenges, in beginning the next chapter of Prairie Plains we are envisioning two new programs. Ribbons of Prairie through the Great American Breadbasket is a fifty-to-one-hundred-year program enlarging upon our early interest in restoring stream corridors to high-diversity prairie in cultivated agricultural areas, such as eastern Nebraska. An obvious benefit to Prairie Plains from Ribbons of Prairie, provided that we can encourage ongoing restoration funding, is that we will increase our restoration acreage. On a visionary societal level, stream corridor restoration offers an interesting multifaceted way to get serious about soil erosion and groundwater and surface water quality and quantity in Nebraska, tying into existing soil and water management policies as well as agency programs. In addition there can be enormous biodiversity and wildlife habitat benefits. And there are numerous other social, economic, and quality of life benefits to be gained after the land work is done—places for recreation, urban/rural integration, new ways to incorporate sustainable agricultural practices on cropland between the streams, and vast opportunities for human involvement, including a lot of educational activity.

The second program envisioned is called the Prairie Plains Conservation Corps. This will consist of a mobile stewardship and restoration crew working on Prairie Plains lands and project areas as well as private land and doing public community service projects. Both of these programs will become major platforms for intern and volunteer action, and they will be deliberately educational in their goals. Outcomes, in addition to the work accomplished in the field, will include building knowledge, skills, and character in the interns and Corps members.

Conclusion

Our ecological restoration and education role in the Great Plains is critical, and the times will certainly beg for new types of social organization, educational ideas, and human involvement in this region and globally. I feel that society will have to return to fundamentals, many on a local level, such as with food production. With a broad scope of concern Prairie Plains, though vulnerable to its own set of nonprofit survival concerns, is poised to take advantage of opportunity that may come as a result of societal change, contributing to the evolutionary process of adapting creatively to the future. Our strategy is to hunker down and do what we can for the benefit of the global commonwealth—encouraging people to work with nature.

Chapter 24

Realizing the Educational Potential of Ecological Restoration

Kern Ewing and Warren Gold

As individuals it is easy to feel overwhelmed by the continuing media coverage of environmental problems, such as climate change, species loss, and overpopulation. As a result it is often profoundly difficult to imagine ways to contribute meaningfully to environmental solutions. Ecological restoration, however, provides hands-on opportunities for everyone, from the general populace to experts, to come together, forging solutions, and making a difference. Ecological restoration empowers people.

Ecological restoration has the potential to do things beside motivating people to coalesce behind environmental issues, such as changing the way they think about their relationship to the land, and making them want to learn about their surroundings. With its ability to unleash the energy and interest of people, ecological restoration is a perfect vehicle for education because it engages people in ideas and subjects they find innately interesting and personally important.

History of Ecological Restoration Education at the University of Washington

As ecological restoration developed in North America through the twentieth century, it became clear that long-term successful efforts were an inherently multidisciplinary endeavor, including knowledge and practices from the arts and humanities as well as the natural and social sciences. During this time, interest in restoring damaged ecosystems arose in many different academic programs at the University of Washington (UW). Landscape architecture faculty and students applied design and construction principles from their field, those in biology and forest resources used ecological principles to craft solutions, civil engineering and aquatic scientists combined interests in restoring degraded streams, and so on. In the late 1990s a group of UW faculty began to look for ways to knit these interests together, strengthening educational opportunities for students from across the academic spectrum that were interested in applying their expertise to restoration.

These efforts coalesced with the formation of the University of Washington Restoration Ecology Network (UW-REN) in 1998. The development of UW-REN was

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_24, © Island Press 2011

initially supported with a grant from the UW Tools-for-Transformation program, whose charge was to foster efforts that would change the intellectual landscape of the university. The three-year grant supported the development and linkage of restoration interests across and within the three UW campuses (Seattle, Tacoma, Bothell). In recent years, the UW has promoted the opportunities that undergraduate students have to make a difference by taking hands-on, applied courses that solve real problems and address community needs. Restoration ecology seemed to be an area in which the promise of this premise could be realized.

With the initial funding, UW-REN supported a variety of activities, including the development of restoration courses (including online delivery), the establishment of a certificate in restoration ecology, and the development of student activities and organizations in restoration. The certificate in restoration ecology was offered to undergraduate students upon the completion of a basic course in restoration ecology, two advanced restoration-related courses, and a restoration Capstone course. Many of the lessons we highlight in this chapter come from this unique Capstone course, which actually consists of three sequential courses lasting over an entire nine-month academic year. The restoration courses developed by UW-REN were institutionalized into established academic units and remain supported by those departments to this day. Initial funding ceased in 2002, and UW-REN focused its activities into its core educational mission of the restoration ecology certificate and its underlying courses.

The Capstone Course

The key element of the restoration certificate is a collaborative course sequence that came to be called the Capstone. In undergraduate education, capstone courses in general are project-oriented activities that allow students (usually seniors) to integrate the various areas of disciplinary knowledge that they have accumulated in school to work on an applied problem. The UW-REN Capstone was designed to go a step further in integration, by creating teams of students from different disciplinary backgrounds to collaboratively address restoration needs in the surrounding community. Capstone students meet on one campus for lectures and discussions, but spend most of their time on a team field project. The UW-REN faculty works with community partners to identify restoration projects that would benefit the local community while meeting the educational goals of the Capstone. During the summer preceding the academic year, the community partners ("clients") prepare a Request for Proposal (RFP) that forms a starting point for students' work on their restoration project.

Because of the diversity of academic and personal backgrounds UW-REN students bring from their home departments, we begin the Capstone with some basic skills training in autumn. This includes lectures and demonstrations on topics ranging from horticulture and soils to grants and volunteer management. Also during the autumn, student teams of five to six individuals are assembled by the faculty and matched to projects. This process balances the geographic constraints of student location and mobility, student project preferences, and the desire to promote disciplinary diversity within each team.

Student teamwork on the Capstone projects begins in the late autumn and early winter and proceeds through the remainder of the academic year, ending in early June. Most of the student effort is focused in the field and on the development of a series of sequential required elements. These elements include (1) a proposal in response to an RFP, (2) a work plan, (3) an as-built report, (4) a monitoring and maintenance plan, and (5) a monitoring and maintenance training session held on-site for their community partner. The student team conducts a structured site assessment of the physical and biological features, as well as potential constraints, to facilitate their development of a proposal in response to the community partner's RFP. The proposal and work plan are reviewed by peers and faculty before they are submitted for community partner feedback. The detailed work plan is based upon design principles that derive from a variety of areas of knowledge (e.g., ecological theory), connecting students' academic experience to these hands-on projects. Following any necessary revisions, student teams negotiate formal agreement of these documents with the community partner. These agreements allow the team to begin actual restoration work on the site.

The student team undertakes site preparation (e.g., invasive plant removal, soil and slope modifications), procures plant material, and installs the plants along with other required elements (e.g., constructed habitat elements, slope stability features). Student teams encounter a variety of project-specific experiences, such as volunteer management, solicitation of material donations, bioengineering, and grant applications. Presentations to neighborhood groups, planning commissions, city councils, and other groups are also common. At the end of each academic year, student teams present posters at the annual UW-REN project symposium to which we invite former, future, and current community partners, students, administrators, interested neighbors, media, and faculty (fig. 24.1).

Projects that students undertake are usually small (less than a half acre), though larger projects have been accomplished with large volunteer bases or by Capstone teams in sequential years restoring adjacent areas. Since its start in 1999, we have completed forty-eight projects. Community partners have included schools, private citizens, municipalities, Native American tribes (fig. 24.2), counties, nongovernmental organizations, a public utility, and various institutions of higher education, including the UW (table 24.1).

Community partners are required to actively engage the student groups, providing feedback and assistance on documents, plans, and project implementation. Our experience has been that most community partners are happy to provide much more than minimal feedback, and an ongoing and creative interaction between the community partner and the student group generally develops. This is not to say that the process is free of setbacks, and improved communication skills and dispute resolution are often some of the lessons that are learned in the process.

In a professional setting, nearly all restoration projects are accomplished by groups of individuals working together. Students have often found teamwork one of the greatest challenges in their project. They find themselves in teams with colleagues from an array of different academic backgrounds (table 24.2). As in real-life projects, they are

Figure 24.1. University of Washington Restoration Ecology Network Capstone students present their projects to members of the community, university, and fellow students in the year-end project symposium. (Photos courtesy of the UW-REN Program)

Figure 24.2. Native American tribal ceremony following the completion of a student restoration project.

forced to communicate across disciplinary boundaries and rely upon one another's strengths, while learning to communicate and contribute effectively to a team project and overcome interpersonal issues that are frequently encountered. The group nature of these projects also presents grading challenges for the faculty. Assessment of individual contributions to group efforts in educational settings is always challenging. In

TABLE 24.1

UW-REN restoration ecology Capstone community partners (2000–2010).

Community partner type	Number of projects	Examples
Local government: Municipalities	20	Cities of Bothell, Kirkland, Redmond, Seattle, Shoreline, Woodinville
Regional government	3	King County, Snohomish County, Port of Seattle
Public utilities	1	Tacoma Power
K–12 schools/environmental education	2	Evergreen School, Islandwood facilities
Colleges and universities	10	Tacoma Community College, Pierce College, University of Washington
Community organizations	10	Friends of Licton Springs Park, Madison Valley Neighborhood Association
Nonprofit organizations; private landowners	10	The Nature Consortium, Earth Sanctuary

TABLE 24.2

Student participation in the UW-REN senior Capstone from different academic disciplinary areas at the University of Washington (2000–2010).

Major or department	Number of students
Biology and biochemistry	25
Forest sciences/conservation	91
Environmental science	95
Environmental studies	53
Geology/earth science, geography, and engineering	9
Social sciences, arts, and humanities	10
Fisheries and oceanography	3
Landscape architecture, architecture, and urban planning	25
Education	8

the Capstone all of the required elements and project implementation are team efforts. Thus each student in a team receives the same score for each element. Variations in individual contributions are accounted for through a peer assessment process. Peer grading has a significant impact on the grade a student receives in the Capstone. In our peer grading process, the students are asked to evaluate the performance of every member of their team, including themselves. Scores are averaged, and students scoring above the average have their grades adjusted up, while those scoring below the average have their grades adjusted down. This grading method discourages team members from riding on the coattails of their classmates. While it does not eliminate lack of effort, it acts as a deterrent.

We have seen students mature and work their way through a number of challenges during the course of the nine-month Capstone. For the first few weeks of the course, students are not eager to commit themselves to the perceived complexity and potential time demands of the course; they are also timid about all of the interpersonal interactions that are going to be required (with community partners, teammates, faculty, teaching assistants, volunteers, donors, public officials, nurseries, practitioners, etc.).

By the time they have finished the academic year, they almost always express pride in their accomplishments and demonstrate confidence in their abilities. The nine-month project duration fosters a sense of ownership and project/community engagement that we rarely see in typical classes spanning just an academic quarter or semester. A number of students have continued involvement in their projects and the surrounding community even following graduation. Such students have been more than happy to assist us in fostering continuity in the course by presenting their projects to students in the course the following year. This exchange is also intended to show the current-year students that students from prior years made it, so they too should be able to. Although taking a demanding course that requires nine months to complete and involves considerable commitment outside the classroom is both a workload burden and a scheduling problem, students have continued to enroll in it. The Capstone has clearly worked well for students on several levels.

The Capstone is also good for the university because it does precisely what the catalog promises. It involves students in applying their academic knowledge to hands-on, meaningful work that produces solutions to environmental and social problems. It also constitutes a technology transfer to the local restoration community. Neighbors are pleased by the idea that the university has reached out to help them solve some of their problems, and they are inspired by the energy of hard-working and idealistic students.

EXAMPLE OF A PROJECT

One of our Capstone groups of six students worked with a community partner (City of Shoreline) to start the restoration of Saltwater Park. Saltwater Park had been a sand and gravel mine on the shores of Puget Sound; material removal had ceased by the early 1920s. The beach (Richmond Beach) continued to be a popular recreation area. The forty-two-acre area was a county park, and then became a city park after the incorporation of the city of Shoreline. Over time, the droughty, southwest-facing slopes became infested with invasive Scotch broom (*Cytisus scoparius*). The city wanted to replace the invasive vegetation with a native plant community and control slope erosion, while maintaining the dramatic views of Puget Sound.

The students proposed the sequential removal of broom, which was to be replaced immediately with American dunegrass (*Leymus mollis*) and native shrubs and forbs capable of establishing in the droughty site conditions. They chose an initial site on the main entrance road and near a playground to increase visibility of the project and increase interactions with park users. Scotch broom was removed with weed wrenches (fig. 24.3), and because it was seed-free in late winter, it was tied into fascines, which were pinned into the slope along contour lines to stabilize the sandy soils. Organic mulch was backfilled behind the fascines, and plant material was installed. WoodStraw, a waste wood product that is excellent for stabilizing slopes, was scattered over the finished installation.

FIGURE 24.3. University of Washington Restoration Ecology Network capstone students remove Scotch broom (*Cytisus scoparius*) at Saltwater Park, Shoreline, Washington, USA.

Part of the Capstone class requires working with volunteers and participating in the political framework that supports restoration. The city of Shoreline had been incorporated for more than a decade when the Saltwater Park project began, and it wanted to develop a system of "friends" groups to encourage volunteer participation in the maintenance of restoration projects. Students attended community meetings to encourage volunteering at the park, and they also recruited at local schools and churches. They presented progress reports to the planning commission and the city council.

The installation was accomplished over a period of six weeks. There were a number of working days, mostly on weekends. Large work parties with thirty to forty volunteers (mostly from a neighborhood church) took place on two weekends. Donations of food and coffee were obtained from Seattle grocery and coffee chains.

Restoration Certificate

As described earlier, UW-REN offers a twenty-five-credit certificate in restoration ecology that may be taken by undergraduates, graduate students, or nonmatriculated students. The Capstone course (ten credits) is a required part of the twenty-five credits, as is Introduction to Restoration (five credits). Introduction to Restoration is taught at each of the three UW campuses. The remaining ten credits may be earned by taking restoration or associated courses that are available at each campus. Thus, the certificate represents both academic and applied experience in ecological restoration in addition to the depth of academic expertise in their major field of study. Well over a hundred certificates were granted in the first seven years of the program. Students see the certificate as valuable in helping them get jobs in natural science, management, or design professions. This encourages them to take restoration courses, which allows us to offer a wider variety of courses for their training.

Introduction to Restoration Course

Restoration ecology is an integrative practice, requiring basic background knowledge of science and ecology. For that reason the introductory course in restoration ecology is offered to junior-level students who have taken a number of lower-level courses. In this course we introduce the history and philosophical underpinnings of restoration. The theoretical basis of restoration in ecological science is developed through concepts such as succession, nonequilibrium response to disturbance, and competition. The importance of horticulture and other applied approaches is presented. We strive to have students recognize that implementing and understanding effective restoration in urban, rural, and even wildland settings goes beyond the scope of the natural and applied sciences. There is also a community element of restoration, since it is done by people and very often depends on the political support of people. Politics are important, and so are the cultural and spiritual relationships that often exist between humans and the land. Further, the course examines legal requirements for restoration, and this allows us to illuminate the differences between mandated restoration and voluntary restoration. Critical analyses of the outcomes of past projects are used to focus students' attention on potential obstacles to successful restoration.

EXAMPLE OF A PROJECT

The introductory class is attended by students with a range of backgrounds but not necessarily a history of experience in restoration projects. The class has a lab section, in which we read and discuss papers, visit restoration project sites, and do a restoration installation. The installation is done at the UW Natural Area; it is done as a project by the entire class, and usually takes place during two or three lab sessions (fig. 24.4).

The most recent project was along a drainage channel that is flooded by the backwaters of Lake Washington. The channel runs among sports fields and parking areas,

FIGURE 24.4. Students install plantings inside tree shelters at the UW Natural Area.

and has the normal assortment of invasive riparian species, the most bothersome of which is Himalayan blackberry (*Rubus armeniacus*). Historically, a stream ran somewhere near the current channel, but the stream was disconnected in the 1960s and directed into the sanitary sewer system a mile upstream. In 2006, the stream was reconnected, improving the water quality and igniting interest in improving the riparian zone as habitat. Salmon do use the stream.

We asked the students to clear the site of Himalayan blackberries and dispose of the brush. The canes were cut with loppers, and the root systems were dug out with shovels. Once that was accomplished, students hauled wood chip mulch to the site using wheelbarrows and covered the soil with four to six inches of mulch. We then went to a willow thicket and harvested three-foot sections of willow for live stakes. The live stakes were immediately installed at the site along with a few container plants from the nursery.

Wetland Restoration Web Course

Course delivery using distance technologies has blossomed in recent years. These approaches can provide pedagogical advantages (e.g., integrating students from a wider geographic area into a single course) as well as practical benefits (e.g., reduced student travel time, urban traffic congestion, and transportation emissions). Furthermore, the recent growth in the number of older, nontraditional students as well as traditional students with jobs has created a need for the delivery of courses that are flexible in terms of time and place. In response to such needs, UW-REN developed a wetland restoration course using distance learning technologies.

The intention of this course was to allow students greater access to a popular restoration topic using distance learning technology. It was set up as one component of an online restoration curriculum, but limitations of institutional support have prevented the further development and delivery of online restoration courses at the University of Washington. The course is now taught as part of the University of Idaho online restoration certificate program (http://www.cnrhome.uidaho.edu/certificates).

The wetland restoration web course was set up as a series of modules, with each module covering one major subject area: wetland science, restoration ecology, freshwater wetland restoration, coastal wetland restoration, and monitoring and maintenance. Each self-paced module includes informational lectures, required readings, assignments, and a study guide, all accompanied by online discussions. Students are directed in a review and critical analysis of at least one wetland restoration project in their vicinity, through site visits, interviews, and collection of available documentation, and they must make a site visit to assess the success of the restoration. The culminating online examination challenges students with various aspects of a retrospective design of an installed restoration problem that has not met its goals. This exam includes traditional individual analyses of the problems and potential solutions, and includes online group discussion and analyses.

Online teaching is beneficial because class information can be delivered to anyplace that has Internet access. A problem, however, is the lack of face-to-face interaction. Telephone conversations or Internet chats make up some of the deficit, but it is still difficult to assess whether a student is keeping up with assignments in work modules until the student has taken the test at the end of each module.

Other Courses

To do restoration effectively, it would be helpful to have some background in plant identification, soils, invasive species management, horticultural practices, project management, and plant ecology. It would also be a near-fatal flaw if one did not also have a good feel for politics, volunteer management, government, and business. In the courses that we have crafted to complete our palette of restoration education, we have tried to include many of these elements. Courses that employ team projects are exceptionally adaptable for allowing integration of social and cultural components of restoration. Three examples of broad courses that have been developed include Native Plant Production, Restoration Design, and Ecosystem-Based Restoration.

Native Plant Production

This course teaches students low-cost and adaptable nursery techniques for producing native plant material. Plant material is actually produced by the class; in any given year students are collecting seeds, processing and planting them, growing them in the nursery, transplanting or upsizing potted material, and holding material that is large enough to be used in restoration projects. The goal is then to take the native plants produced in this class and use them in other classes that are doing restoration installations. We have a fifty-six-acre natural area (a former landfill) on the Seattle campus, and much of the plant material that is produced is used by classes that install several restoration projects a year in the natural area.

EXAMPLE OF A PROJECT

Students perform a series of assignments that mirror what would be done in a restoration nursery to produce a crop. In fact, they do produce a crop of container plants that is held in the nursery for other classes to use in restoration installations. Seeds or cuttings are collected in the wild; to augment the selection, seeds are purchased from native seed collectors. Seeds and fruits are processed, treated for dormancy, and stored or planted. Part of this process involves library and online research for horticultural information about native plant propagation. Treated seeds are planted in nursery flats and germinated, then placed into small containers. Containers are placed in a drip irrigation nursery area. Students learn to maintain hoop houses and container crops in them. They set up drip irrigation systems and program timers. They maintain wet beds and capillary beds and use them to increase wetland plants. Plant material initiated by previous classes is upsized and made ready for transport into the field.

Restoration Design

The restoration design course allows students to work in teams and gives students the opportunity to go through the design experience that is inherent in the Capstone class, with the difference being that there are nine different projects presented to the class teams, and each team must wrestle with a design problem each week for nine weeks. This course is organized by disturbance types, so that there are case studies and design projects that deal with restoration of agricultural and forestry land, of brownfields, and of landscapes compromised by transportation corridors, recreation, and water storage. In addition we present design problems in urban areas, and in freshwater and coastal wetlands modified by dredging or filling. The restoration design course uses a formal design structure to break down the solution of restoration problems into a hierarchy of functional requirements, constraints, and design parameters. It further adds elements of project management, looking at the sequencing and timing of tasks and the identification of the critical path of tasks that control the duration and potentially the cost of projects.

EXAMPLE OF A PROJECT

The restoration design course does not have an actual field component, but we use all available site information for real sites and require students to create design solutions for restoration problems that they are presented. The class is divided into groups of about six students, and after the first week, each group stays together to produce a design document each week. The draft document is returned with comments, then the group revises all draft plans to produce a portfolio of designs at the end of the course.

There are many Internet sources available that provide reasonably current aerial mapping, at a good resolution, of much of the landscape we use for class projects. Ground-level images are also becoming more common on the web. Environmental

Impact Statements and environmental management documents are also accessible. Sitting in class with laptop computers and an Internet connection, student groups are able to compile a substantial amount of information that is pertinent to restoration design.

The projects presented in one year included the following restoration problems (disturbance type): a salt marsh diked for farming (agriculture), shrub-steppe that contains vernal pools (grazing), a filled lacustrine wetland (wetland dredge and fill), a gravel pit in a reservoir riparian zone used by elk (water storage), a capped fifty-six-acre landfill (brownfields or solid waste disposal), old camping sites at a five-thousand-foot mountain pass (recreation), and sites along a seventeen-mile urban creek (urban).

As in the other team-based courses in this program, student projects are given a juried grade, but student teams are allowed to assess a peer grade for each member of their group, including themselves. Based upon the peer grade, the project grade is adjusted up or down depending upon the deviation from the mean grade for each student. This method was introduced at the UW in the Health Sciences Department; before its introduction there was a great deal of complaining about team members who did not carry their weight. Now the underachieving team members are usually the ones complaining at grade report time.

Ecosystem-Based Restoration

This course is taught in winter and has always had a field restoration component in the university natural area. During the last fifteen years we have started about fifteen acres of the former landfill on the road toward restoration. The lecture component of the course is much like a survey of North American ecosystems, except with examples of typical restoration projects added to each of the ecosystem types. Because of interest in tropical systems, and because there is quite a bit of student and faculty research being done in the tropics, examples of tropical moist and dry forest restoration are also included. Ecosystem types covered include grasslands, woodlands, coastal and freshwater wetlands, eelgrass and kelp marine beds, arctic, alpine, aridlands, thornscrub, savanna, and riparian systems. A serendipitous element in this course is that students are taught that restoration is local, but they can begin to see techniques that might be transferable among similar climatic regimes, or even across climate types. Lectures include images of typical locations, a discussion of climate and species makeup, and a review of restoration case studies in each system. Historical and cultural elements are also discussed.

EXAMPLE OF A PROJECT

This is the oldest restoration course that is taught at the university, and it has been the initial taste of team project work that many students have encountered. The course lecture component touches on restoration in many different North American and tropical ecosystem types. The field component is designed to allow students to work with a team, be given a restoration problem and come up with a solution, become familiar with restoration field methods, and learn about local plant material (species, forms, time limitations, costs, ease of planting, likelihood of success). The class has done grassland, oak woodland, wetland, and forest restoration projects. Because it is taught in the winter quarter, it also functions as a kind of restoration boot camp; students must work together to meet a deadline, out of doors, in lots of cold, rainy, windy weather. Many of the projects are adjacent to a major neighborhood walking trail, so there has been abundant opportunity for interpretive signage and interaction with community members. The consensus of community opinion about our management of the natural area has gone from one of suspicion about what we were doing to total support. This past year a group of students from the class was invited to make a short presentation at the annual meeting of the community association of the adjacent residential neighborhood. The neighborhood meetings generally discuss community problems, but they said they wanted us there because they wanted one good thing on the agenda.

Facilities: Campus Natural Areas

Like many universities in the United States, the University of Washington owns and manages largely undeveloped areas that are used for teaching, research, and recreational purposes. In this section, we describe two such areas—Union Bay Natural Area and the North Creek Floodplain Wetlands—and how they have become part of the UW-REN educational effort.

Union Bay Natural Area

The University of Washington was given the responsibility of managing what at one time was a fifty-six-acre landfill adjacent to the Seattle campus. Closed and capped in 1968, the old landfill seemed like a good place for further development of the university infrastructure of parking lots and playfields. Several characteristics of the site, however, made it less suitable for these purposes: it began subsiding rapidly (the landfill sat on a substrate of clay and peat), it produced methane (which still accumulates under buildings around it), and it became the finest birding location in the city, making it a very popular spot for that recreational use. Because of a near-prohibition of building on the site, its development as a teaching and research area, and its evolution into a community amenity were more easily conceived than might otherwise have been the case had the land been valued as a building site.

Development into a natural research and teaching area for ecological restoration has been a slow process, but a good learning process for both the land managers and the neighbors. Because there was no initial budget to improve or manage the site, the UW was not initially perceived as a good manager, nor was it trusted. Initial forays into restoration on the site were seen as being "counter to natural development" by the neighbors and by the birders who were frequent visitors. Initial restoration was in increments and did not look like traditional landscaping, which also did not allay the mistrust of neighborhood users. Persistence and time have carried the day, however, as the student groups doing restoration and the staff maintaining the site have aggressively offered information to other users of the site. Every class has placed signs describing their projects. Every maintenance activity has been explained using interpretive signs. Students have been encouraged to talk to people walking the trails by their sites. Managers and students have gone to neighborhood community meetings to explain projects. Every opportunity to publish an article in a newsletter, the local newspaper or any other mass media outlet has been pursued. This has been effective in building support for restoration of the site, as well as a great learning experience for students who have found that there is a whole social dimension to restoration that they may not have considered.

At the site we have created prairie ecosystems on old, gravel parking lots (local prairie is found on gravelly glacial outwash), we have done wetland restoration (since the site is sinking, wetlands form continually; there are currently twenty-seven wetlands, not including the shoreline of Lake Washington). We are continually confronted with the problem of a massive infestation of our worst invasive species, Himalayan blackberry, and with a stressful environment. The landfill cap is thin, and Northwest summers are dry and even hot for a couple of months; die-off of restoration plantings is common. Bare root materials are very flexible and inexpensive, so our native plant production output usually augments bare root shrubs and trees that we order from local nurseries.

The common mode of teaching at the site is to create teams of five or six students from our restoration classes, and then assign to each team a specific plot of land in the natural area to be restored. Student teams must remove invasives, mulch the site, order plant material, install the material, then add any surface obstructions, wildlife habitat elements, shade structures, or other finishing features, such as signage. This work is always done in fall and winter, so it is often cold and raining. In general, students may start out not really liking the prospect of all of this work, but they become very attached to the site and their work. It is common to encounter former students in the natural area, looking for their old restoration plots to see how they are doing.

North Creek Floodplain Wetlands at UW Bothell

In 2000, the UW completed the initial construction and opening of a branch campus in Bothell, Washington, fifteen miles northeast of the Seattle campus. This campus is located in a rapidly urbanizing zone of the Seattle metropolitan area and is home to many industries related to science and technology. The campus site was a 127-acre ranching and farming operation along North Creek, a salmon-bearing stream. The stream had been highly altered, with its course straightened, its channel dredged, and flood-control dikes constructed along its banks. The floodplain had been plowed for planting with invasive grasses and ditched to control surface water.

The UW and the State of Washington undertook a major ecological restoration of the fifty-eight-acre stream channel and floodplain portion of the campus, while the campus buildings themselves were constructed on the hillside above. At the time, it was one of the larger floodplain restoration projects in the region, and it was unique in the degree to which hydrogeomorphic principles and theories of ecosystems and restoration ecology were used to guide the work. It was a bold attempt to restore highly altered pastureland to a sustainable, functioning floodplain ecosystem within an urbanizing watershed.

Ecological recovery at the North Creek wetland site has been dramatic. It provides a living laboratory for our students to observe and study the elements and mechanisms of restoration success and failure, as well as the opportunity to interpret such features for the public in surrounding communities. The restoration of North Creek has proven an excellent educational and scientific resource.

Conclusion

In a rational world, students would take Introduction to Restoration, then Restoration Design, then the Capstone sequence. They would find time, before the end of their stay at the university, to take courses on plant production, invasive species, landscape plant management, or plant propagation. After the Capstone, they might take the Ecosystem-Based Restoration course to see how the work they have done in one ecosystem might translate to another ecosystem. In reality, however, students take courses when they can be fit into their schedules. They often take the introductory course simultaneously with the first quarter of the Capstone. They may take the restoration design course at the end. Graduate and undergraduate students from a variety of academic departments are together in the same classes. Because of all of these confounding conditions, we have found that all of these courses need some built-in overlap, a little review, and considerable generality. Each course needs to stand on its own because there will be someone in the course for whom this is the introduction to the field. This means that there will be students of different skill levels in most courses; the team approach to problem solving turns this into an experience in mentoring and division of responsibility rather than hindering group effort. The team approach involving students from across academic units fosters interdisciplinary learning in students through peer exchange and mentoring rather than through contact with numerous faculty in each specialty area.

Chapter 25

Educating Teachers and Increasing Environmental Literacy

Rick Hall and Cheryl Bauer-Armstrong

Earth Partnership for Schools (EPS) emerges from the University of Wisconsin–Madison Arboretum's long involvement with ecological restoration and from Aldo Leopold's land ethic, which sees human beings as "plain members and citizens" of the ecological community. Along with its national outreach program, Restoration Education Science Training and Outreach for Regional Educators (RESTORE), EPS creates partnerships with teachers, schools, natural resource agencies, environmental organizations, nature centers, master gardeners, volunteers—in short, with anyone willing to collaborate in restoring the natural ecology of school grounds and nearby natural areas. In the process, respectful relationships are restored with other human beings and "the land." In this new education paradigm, children and adults are not only learners but citizen-scientists actively investigating and restoring ecological functions. They are caring for nature and becoming stewards of their own communities. From a young person's perspective, this kind of experience is essential, as an EPS teacher from Milwaukee, Wisconsin, noted: "Kids need to feel important, to care about something, to feel that they make a difference in this world. . . . Earth Partnership provides ways to give kids a sense of purpose and build competency."

Earth Partnership Institutes are experience-based and use ecological restoration as a context for science, technology, engineering, and mathematics (STEM) learning across discipline, age, learning style, culture, and place. Participants directly engage in the multidisciplinary activities. Our research shows that teachers are more likely to use activities they have experienced. Since 1991, EPS and RESTORE have helped 1,600 teachers in twenty states to incorporate ecological restoration into their curricula, directly reaching more than 600 schools, 1,200 community partners, and 160,000 students.

Earth Partnership for Schools and Environmental Literacy

As children spend more time plugged into electronic media (Rideout, Foehr, and Roberts 2010), concerns about their ecological literacy have increased, especially as

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_25, © Island Press 2011

the scientific complexity of issues, such as climate change and habitat loss, have magnified (Magntorn and Helldén 2007; McBeth et al. 2008; Balgopal and Wallace 2009). Schoolyard outdoor experiences can help avoid what Pyle (1993) described as "extinction of experience," and Nabhan and Trimble (1994) call the "the loss of wildness where children play." Similarly, Louv (2005) describes the effects of depriving children regular contact with nature as "nature deficit disorder." Many environmental education researchers fear the trend toward less fieldwork and less time outdoors will contribute to environmental illiteracy (see chap. 22, this volume). Stephen Kellert (2005) and others argue that depriving young people of intimate interactions with the natural world can have detrimental intellectual, biological, emotional, and developmental impacts.

Earth Partnership for Schools/RESTORE schoolyard, riparian, and natural area restorations provide a powerful context in which students can engage in learning that is relevant, not only to these global issues, but to their everyday lives. In EPS activities, students get to know individual plants and animals and how they fit into ecological concepts such as biological diversity, adaptation, and the "web of life." Moreover, students experience science, math, language arts, social studies, art, and music within the context of nature. The EPS restoration process builds a mental and physical space for learning that makes sense to students. They study site history, measure physical and observe aesthetic features, analyze soil, and learn the biology of native species and communities. They read literature, write journals and poetry, and incorporate species and structures—benches, stepping stones, water features—into areas that are used for restoration, research, and pollution prevention as well as for play.

Because it operates in this way, EPS appeals to a wide range of learning styles and reaches kids who are considered at risk or in need of new educational strategies, which, as many educators know, is a growing part of the school-age population. Here is but one example from an EPS-trained teacher:

> On a beautiful July morning under hazy sky, ideal for flower photography, I was standing in a lovely prairie when a beat-up car pulled over, and a somewhat scruffy-looking young man climbed out. He leaned into the backseat, pulled a professional-looking camera over his head and with a wide grin, began stepping carefully across the prairie towards me. "Hey! Remember me? I'm Pete, remember?" Many years before, I had hiked with Pete and his special education teacher to this very spot from our elementary school. It was the first of many restorative walks here with this nature-loving, observant boy. The calming woodland trail ending at this vibrant prairie was Pete's favorite classroom. This young man was now a nature photographer, on assignment for university professors who needed specific photographs to illustrate academic papers or books. "I still don't read that well," he confessed, "Just enough to get by, but if somebody needs a photograph of a swallowtail on marsh milkweed or something, I know where to find it for them." Pete may never sit in a university classroom, but his literacy in nature's book is enabling him to have a productive life. (Georgia Ibaüez Gomez, unpublished, 2009)

Earth Partnership for Schools and RESTORE Leadership Institutes

Earth Partnership for Schools originally held the majority of its teacher training sessions at the University of Wisconsin Arboretum in Madison. These sessions were quite successful and demonstrated that the program could do even more. One weakness we wanted to overcome was the limited number of people who could benefit from the experience. More recently, we have been holding ten-day RESTORE leadership institutes to train lead teams of teachers, natural resource professionals, and citizens. These lead teams, in turn, conduct one-week EPS institutes for additional teachers and community partners in their respective regions throughout the United States. These Earth Partnerships create a comprehensive, inquiry- and place-based approach, including sustainability, biodiversity, climate change, cultural diversity, and STEM.

The Earth Partnership curriculum guide contains more than one hundred activities keyed to academic standards. All EPS activities include clearly defined curricular goals and student learning assessment ideas, and they are adaptable to regional ecosystems. Special supplements focus on phenology, woodland restoration, rain gardens, and stormwater in the context of climate change and watershed ecology.

Restoration Education Steps

The curriculum guide, like all parts of the EPS program, is grounded in ten basic restoration education steps that frame the EPS/RESTORE professional development institutes and the implementation plan for students:

1. *Study species, habitats, and ecosystems*—Students visit remnant or restored ecological communities, identify species, record observations in journals, and imagine and plan what their restored schoolyard site can become. Our goals for students are to cultivate their sense of wonder, help them create a mental model of the ecosystem or habitat to be reconstructed, and get them excited about the possibilities!
2. *Investigate school site history*—Students review General Land Office surveyors' notes, historical maps, written and oral histories, and other primary sources to make some educated guesses about the ecological and human history of their place. Local literature, old letters, and interviews with elders add additional clues.
3. *Analyze*—Students and teachers explore the current site conditions to determine the suitability for different species and restoration strategies. This can include analyzing soil, measuring water infiltration rates, calculating slope, and mapping existing features such as buildings, paths, sun/shade, existing vegetation, and signs of wildlife.
4. *Connect*—Students appeal to school and community partners through presentations, interviews, and articles for school and local media describing the project and needs. Resource professionals, neighbors, and parents welcome the opportunity to share their expertise and resources and connect with the school.

5. *Design*—Working in small groups, students create designs, choose and combine favorite elements, lay out the final design on the ground, develop a budget, and select appropriate plant species. Native plant nursery catalogs and regional lists provide good starting points. Some design considerations include access, existing land uses, safety and maintenance concerns, plant height, plant phenology, plant size, plant placement, habitat value, drainage, and aesthetics.
6. *Prepare the site*—Students research alternative methods for preparing the site, including cultivation, mulching, and sod removal. Parents and community volunteers can be helpful here. A well-prepared site will result in a better project and less maintenance.
7. *Plant*—As many students as possible engage in seeding and planting, and then celebrating the "birth" of the site. Adding a small area or creating a new site each year with additional students increases the number of stakeholders for the restoration project.
8. *Manage*—Students learn to identify and control invasive plants, and keep track of the health of their restoration. Master gardeners and other community volunteers are important assets to help students maintain restoration sites during vacations and assist with long-term maintenance.
9. *Research*—Data are gathered throughout the restoration process. Seed mixes, site preparation, and management techniques can be compared. Data can be collected and analyzed about insect and animal population dynamics, for example. Most important, students learn to observe and ask their own questions, and to use their own creativity to find the answers.
10. *Learn*—Opportunities abound once students, teachers, and community partners have restored a native habitat on their school grounds. Students participate in creating a living legacy at their schools and learn how to be citizen stewards of their local communities.

This ten-step foundation has proven its worth many times. For example, in 1999, teachers at the Kickapoo Area Schools in southwestern Wisconsin partnered with a local conservation trust, EPS, and others to transform their school grounds and restore a natural area along the Kickapoo River. Since then, students annually raise and sell native plants to expand their restorations and finance their projects. In 2009, Kickapoo lead teachers hosted a regional EPS institute for neighboring school districts. Karla Dunham, one of the Kickapoo lead teachers reflected on the meaning of the event:

> This week has been a truly wonderful experience. After ten years of working on the natural areas, it was exciting to share our special place with other educators. I felt a great sense of pride in our land stewardship team and our school as I led the grounds tour on the first day. We have created such an amazing place to work and teach. This ten-year milestone could be a launching point for renewing our efforts to educate our school and community about the restoration areas. We could plan a celebration with the students in high school now who helped to create these spaces. This would remind them and others of the im-

> pact their efforts have made. It is their legacy to the school, a giving back to the land . . . an accomplishment that deserves celebration! (Karla Dunham, unpublished, 2009)

The idea of using restoration to advance environmental education is also alive in Heston, Kansas, where, from 2005 to 2010, the Dyke Arboretum of the Plains has involved more than one hundred teachers from thirty schools. Brad Guhr (unpublished, 2009), education coordinator for the arboretum, writes, “Children delight in planting and watching prairie plants grow. Teachers say that EPS feeds their soul. Administrators report that EPS energizes their staff. And the butterflies don’t seem to mind either . . . and agree that prairie plantings are good for school grounds—a movement that is gaining momentum in south-central Kansas.”

An example of a regional effort is the Great Lakes Earth Partnership—a program building on the environmental education opportunities of Lake Superior, Green Bay, and the Milwaukee River. In Phase I, lead teams from all three locales canoed the Milwaukee River; mucked for macroinvertebrates; visited green and conventional sewerage and water treatment operations, farms, and living roofs; mapped schoolyards; visited and designed rain gardens; tested water; participated in a beach cleanup; kayaked two of Lake Superior’s String of Pearls estuaries; boated through the Kakagon River wild rice sloughs hosted by the Bad River Tribe; visited fish hatcheries and farms; tested soils at three watershed elevations; learned aspects of Ojibway language and culture; and experienced a fish count on Bay City Creek. Hosts and collaborators include the Chequamegon National Forest; Apostle Islands National Lakeshore; Bayfield, Washburn, Ashland, and Milwaukee school districts; the Great Lakes Alliance; Discovery World; Riveredge Nature Center; and the Milwaukee Metropolitan Sewerage District. Teachers are implementing activities, and teams meet in Green Bay during the winter to share experiences and plan three, five-day teacher institutes for the following summer. Phase II, funded by EPA Great Lakes Restoration Initiative, includes a ten-day leadership institute at Indiana Dunes National Lakeshore involving watershed, conservation, and environmental education organizations and agencies and schools in Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York. Several partnerships are adapting Great Lakes Earth Partnership in coastal watersheds in Delaware, Maryland, California, Oregon, Washington, and Puerto Rico.

The Chicago Area Earth Partnership, which includes the Chicago Botanic Garden, DuPage County Forest Preserve, and McHenry County Conservation District, has conducted three EPS institutes with seventy-two teachers from twenty-three schools, including many from densely populated, urban neighborhoods. A veteran schoolyard educator had these thoughts after attending an institute:

> I have made my living (and passion) designing, building, and teaching about outdoor classrooms for the last 15 years. . . . EPS is very much the “next generation.” Back in the “old days” we had to convince parents and school administrators that these ecological gardens are important and germane to the educational experience in America today. . . . [The] supporting evidence was not available ten years ago . . . the psychological and brain-based data that backs up

> our intuition about the importance of getting kids outdoors and connected to the natural world. We were flying on faith and our love of the natural world. I am grateful for EPS because there is finally an organization to support schoolyard native gardens. (Caron Wenzel, unpublished, 2010)

What Participants Experience

Participants in EPS/RESTORE sessions are required to keep a reflective journal in order to earn graduate credits. We have found the journals a rich source of information about what participants experience. The following are some experiential themes that emerge during or soon after the institutes for most participants:

- Ignites or rekindles a passion for personal experience with nature. Many participants report that the institutes have a "life-changing" effect on their personal and professional lives.

  > This was a new adventure for me. While I've always had an appreciation for nature, I've never had the opportunity to explore plants and the environment up close. The Institute reintroduced the fun of childhood play and exploration. We learned through a myriad of experiential activities that created an interest in finding out more. . . . This has proven to be a wonderful and enlightening journey. My life has been enriched through the mutual passion and interest that have been expressed in so many different ways. (Linda Kunilius, unpublished, 2008)

- Develops a sense of camaraderie, "finding like-minded people," joining a movement

  > During the Institute we were learning about plant communities. . . . it dawned on me that I was surrounded by dynamic communities of people. . . . amazing and like-minded people. I know that in Oklahoma, Puerto Rico, Maryland, Michigan, and Wisconsin there is a whole network of support. The Institute certainly helped to restore my faith in teaching and learning, and that we are much more alike than different from one another. (Guy Galante, unpublished, 2009)

- Builds self-confidence; develops a purpose, mission

  > How am I going to use the experience provided by this institute? I plan to start simply, family first. My three young sons need opportunities to experience nature the way I did in my youth. I will provide them structured and unstructured time to connect with the natural world and develop a land ethic of their own. . . . I believe this firsthand experience of creating a rain garden and prairie plot on my own property will give me the background knowledge to be successful at school. (Ernie Luedke, unpublished, 2008)

- Builds capacity in terms of acquiring knowledge (both content knowledge and process knowledge); facilitating experiential, place-based learning; providing the motivation for positive actions; and integrating the curriculum

While studying multi-digit multiplication, decimals, and area, students will calculate the drainage area for our rain garden and the size of rain garden needed. They will lay out sample scale designs of appropriately sized rain gardens given a map of the area with correctly scaled grid paper. Students will also calculate the area and amount of seed required for a cover crop outside of the playground fence, and will put together a budget. (Kimi Ishikawa, unpublished, 2008)

I am excited by the phenology wheel and will be able to incorporate it into the 4 Hills of Life philosophy and other aspects of Ojibwe culture. We'll teach phenology while reading *The Birchbark House* by Louise Erdrich, a book divided by the four seasons. My students will start phenology journals in our outdoor classroom overlooking Lake Superior, recording *single-spot* observations on cards for a book art journal. (Sandy Kucinski, unpublished, 2008)

What Is Important for Success?

Wonder is the place to start and end, but in between come the work and the learning. So what is needed? We find there are six essentials for a successful restoration-based environmental education program: (1) teams and teamwork, (2) partnerships, (3) ongoing support of teacher teams, (4) funding, (5) remaining inquiry based and student centered, and (6) cultural diversity.

- *Teams*—Teams and teamwork are essential for full implementation of a restoration-based curriculum across disciplines and grade levels. The tasks and challenges can best be met with a team that draws on many resources and talents within the school community, including the administration and custodial staff.
- *Partnerships*—Partnerships with environmental organizations and agencies, master gardeners, universities, parents, and local businesses and citizens bring credibility and resources to the restoration project. Mentors can be helpful.
- *Ongoing support of teacher teams*—Supporting teacher teams will help ensure the infusion of restoration-based activities into the curriculum. Continuing education and renewal are key to adding new people to the teams and the long-term use of schoolyard restorations. Linking with curriculum priorities and standards is a necessary strategy. Most teachers are able to adapt EPS activities to accomplish many of their district's curricular goals.
- *Funding*—In-kind resources, materials, and donations of time and money are available in every community. Recognition of the need to involve young people with nature is growing exponentially. Sparked by Richard Louv's documentation of "nature deficit disorder," the movement has grown to include the Children and Nature Network (C&NN, www.childrenandnature.org/) and the No Child Left Inside (NCLI, www.cbf.org/Page.aspx?pid=956) coalitions in almost every state. Virtually every local, state, and regional organization and agency has a program to connect people with nature, and most are more than happy to partner with schools.

- *Inquiry based, student centered*—Students are the principal actors in this process. Allow them to participate in every aspect of the restoration process; resist the temptation of having contractors, partners, and/or staff "put in the restoration." Inquiry is integral to the restoration process and the process is the curriculum. The more students participate in the various aspects of the process, the better they will be at asking questions and finding answers. Teachers and others need to provide guidance but must understand that inquiry-based, experiential education is a new type of teaching format that places the student learner in the lead role.
- *Cultural diversity*—Our challenge remains to reach a broader, more inclusive population of educators and students, both culturally and economically. To that end, EPS/RESTORE promotes place-based, culturally inclusive practices, informed by traditional ecological knowledge (see chap. 18, this volume). We have worked in inner-city environments in Milwaukee and Chicago, and with Native American tribes in Wisconsin. We have also worked with partners in Puerto Rico (USFWS National Wildlife Refuges, El Yunque National Forest, universities, botanic gardens, land trusts, and others) to translate EPS into Spanish and Caribbean ecological and cultural contexts. These efforts not only create opportunities for individuals from underrepresented groups to enter environmental fields but also enrich our common practice of environmental literacy and stewardship with other ways of knowing.

Gilda Pimentel from Vieques, Puerto Rico, reflected on her experience with EPS: "Since we arrived from Wisconsin, we look at nature in a different way. . . . Recognizing the value of native plants and distinguishing them from invasives . . . our respect for our own native flora is enhanced as is our sensitivity to nature" (Gilda Pimentel, unpublished, 2010).

What We Still Need to Learn

Program evaluation indicates that EPS has built a strong track record of providing satisfying teacher professional development experiences that spark changes in the way educators think about their teaching. Research on student learning is needed to bolster anecdotal evidence of student achievement. We "know" that students are learning and highly motivated, but how can we demonstrate this with data? Action research by teachers is beginning to address this gap, but more is needed. We are particularly interested in the effects on school-aged students' and participating adults' beliefs about environmental issues, actions with respect to environmental stewardship, and how participation in EPS across different learning settings affects beliefs, actions, and ecological literacy.

Research indicates that teachers are hampered in using the innovative practices learned in professional development programs by competing initiatives in their schools, such as standards-related curriculum changes, school consolidation, and block scheduling (Clifford 2003). Systemic and schoolwide efforts could address these issues by creating a climate for environment-based education as a basis for educational reform. Addressing the following key needs gleaned from our experience during the last twenty years could result in more widespread adoption of restoration-based education strategies in both formal and informal contexts:

- Enhancing STEM content connections
- Including multicultural perspectives and ways of knowing
- Building the capacity of informal and formal K–16 educators, including natural resource and conservation practitioners, volunteers and citizen scientists, to boost experiential, place-based, learner-centered, restoration-based education
- Assessing learning outcomes and effects for students, teachers, informal science educators, and community partners

Conclusion

The potential for restoration-based education is unlimited and so are the motivations to enact it on a broader scale. Oil spills, melting glaciers, altered bird migrations, loss of crucial habitat, species loss, and geophysical events underscore the need for eco-literate responses for prevention, mitigation, and restoration.

At the very time we most need a generation with an acute awareness and practical knowledge of the natural world, we face losing young people to a mostly virtual experience of that world. In fact, a recent study by the Kaiser Foundation found that young people are spending almost all of their waking hours (seven and a half hours daily, seven days a week) consuming electronic entertainment media—television, computers, print, and other media for viewing, reading, listening to music, or gaming—and another two hours talking or texting on cell phones. If you count media multitasking, using more than one medium at a time, the average jumps to ten and a half hours a day. This does not count time using devices for schoolwork (Rideout, Foehr, and Roberts 2010).

Earth Partnership for Schools offers an alternative to enhance ecological and STEM literacy, efficacy, and civic engagement. We can hope that as children and their adult learning partners become more intimately reengaged with nature, their natural tendency toward affiliation with other living things (or biophilia as described by Kellert and Wilson 1995) will be strengthened, and their sense of obligation to protect and restore living systems engaged. EPS teacher Peter Senti put it this way:

> The natural world is as exciting and as interesting as any video game. The problem is that it takes patience, hard work, and creativity to foster this excitement. We have such amazing natural resources within a five-minute walk from our school doors, and yet our school has only scratched the surface of taking educational advantage of them. Research has strongly indicated that positive childhood experiences in the natural environment are the single most influential indicator of environmental sensitivity (Sivek 2002; Chawla and Cushing 2007). Higher levels of environmental sensitivity correlate with responsible environmental behaviors (Sivek and Hungerford 1989–1990). If we as parents,

> educators, and community members fail to engender this sensitivity in our youth, then what implications will this have for the natural world and ultimately the sustainability of the human species? (Peter Senti, unpublished, 2009)

Aldo Leopold had a similar thought, "Obligations have no meaning without conscience, and the problem we face is the extension of the social conscience from people to the land. No important change in ethics was ever accomplished without an internal change in our mental emphasis, loyalties, affections, and convictions" (Leopold 1949). Seeing ourselves as partners in restoring and sustaining the functionality and beauty of natural ecosystems constitutes such an internal change. Earth Partnership for Schools can foster this change in present and future generations.

***

Roots Go Deep

Sandy Kucinski, unpublished, 2008

The red pines stand tall
while Nina speaks of their planting.
The others listen intently
with thoughts of teaching.
"Don't rest," says Nina.
"Don't rest," say the others.
Let the roots go deep.

A plaque stands where
the burr oak stood.
Do the roots intertwine
deep underground?
"Rest," says the sawyer.
"Don't rest," say the others.
Let roots stay deep.
Plant young, plant strong.
Plant prairies, trees and children . . .
. . . let the roots go deep.
"Rest," says the sawyer.
"Don't rest," say the others.
Let the roots run deep.

***

Written during the RESTORE Institute in honor of a visit with Nina Leopold Bradley at the Leopold Shack near Baraboo, Wisconsin, on July 16, 2008. Inspired by "The Good Oak" essay in *A Sand County Almanac* (Leopold 1949). Poem reprinted with the kind permission of Sandy Kucinski.

References

Balgopal, M. M., and A. M. Wallace. 2009. "Decisions and Dilemmas: Using Writing to Learn Activities to Increase Ecological Literacy." *Journal of Environmental Education* 40 (3): 13–26.

Chawla, L., and D. F. Cushing. 2007. "Education for Strategic Behavior." *Environmental Education Research* 13 (4): 427–52.

Clifford, M. 2003. *Long-Term Restoration and Curricular Activities among EPS Participants (1994–2002): A Summary of Survey Responses*. Madison, WI: Springboard Training and Evaluation.

Coyle, K. 2005. "Environmental Literacy in America." National Environmental Education and Training Foundation (NEETF). http://www.neefusa.org/resources/publications .htm#neetfpubs.

Kellert, S. R. 2005. "Nature and Childhood Development." In *Building for Life: Designing and Understanding the Human–Nature Connection*, 63–89. Washington, DC: Island Press.

Kellert, S. R., and E. O. Wilson, eds. 1995. *The Biophilia Hypothesis*. Washington, DC: Island Press.

Leopold, A. 1949. *A Sand County Almanac and Sketches Here and There*. Oxford University Press.

Louv, R. 2005. *Last Child in the Woods. Saving Our Children from Nature-Deficit Disorder*. Chapel Hill, NC: Algonquin.

Magntorn, O., and G. Helldén. 2007. "Reading Nature from a 'Bottom-up' Perspective." *Journal of Biological Education* 41 (2): 68–75.

McBeth, B., H. Hungerford, T. Marcinkowski, T. Volk, and R. Meyers. 2008. *National Environmental Literacy Assessment Project; Year 1 Final Research Project*. U.S. EPA: Grant # NA06SEC4690009.

Nabhan, G., and S. Trimble. 1994. *The Geography of Childhood: Why Children Need Wild Places*. Boston: Beacon Press.

Pyle, R. M. 1993. *The Thunder Tree: Lessons from an Urban Wildland*. New York: Houghton Mifflin.

Rideout, V. J., U. G. Foehr, and D. F. Roberts. 2010. *Generation M^2: Media in the Lives of 8 to 18 Year-Olds*. Kaiser Family Foundation Study. http://www.kff.org.

Sivek, D. J. 2002. "Environmental Sensitivity among Wisconsin High School Students." *Environmental Education Research* 8 (2): 155–70.

Sivek, D. J., and H. Hungerford. 1989–1990. "Predictors of Responsible Citizen Behavior in Members of Three Wisconsin Conservation Organizations." *Journal of Environmental Education* 21 (2): 35–40.

Chapter 26

Synthesis: Participation, Power, Perspective

Dave Egan, Jesse Abrams, and Evan E. Hjerpe

In this book, the authors have revealed aspects of their faith, hope, and love for nature and the countless varieties of beings, including humans, who inhabit it. From our vantage point, the ideas of these authors suggest that there are three general fields restoration practitioners must take seriously if they hope to foster success in the complex realm of real-world restoration:

1. Embracing *participation* as integral in the process of moving our relationship with the land and others forward.
2. Acknowledging, recognizing, and working within the *power* interactions inherent in our relationships to the land and each other.
3. Recognizing the importance of creating respectful space for multiple *perspectives* of restoration, nature, and people's roles in both.

In this concluding chapter, we examine each of these points as expressed by the words "participation," "power," and "perspective."

Participation

Participation is a metatheme that runs throughout the chapters and, indeed, throughout the practice of ecological restoration. Nearly all the case studies, and a number of the theoretical chapters, emphasize the role of participation for integrating ecological restoration into the social fabric of communities and ecosystems. This participation takes a multitude of forms: the setting of restoration goals and priorities through a collaborative process (Abrams, Bliss and Fischer, Christoffersen, Escalera Reyes, Hardigg); local community ownership of restored land (Andre, Brunckhorst, Whitney); volunteer participation in restoration projects (Fox, Lee and Hancock, Newman, Westervelt); and place-based education, art, and eco-cultural actions (McCann, Whitney, Ewing and Gold, Hall and Bauer-Armstrong, Kimmerer, Stevens, Rotherham, Ball). In other words, there are a multitude of ways people can and do participate in ecological restoration.

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2_26,

Participation of this type suggests public participation (i.e., the participation of stakeholders) in the participatory design, implementation, and management of restoration projects, in particular, and community resources, in general. Participation might also include the interdisciplinary restoration work of individuals or groups trained in a certain practice or discipline. Lastly, it may be viewed from the perspective of the individual participation of a restoration practitioner as she hones her skills and builds her consciousness of the restoration experience on a daily basis. As there are many ways of participation in ecological restoration, so are there many levels of participation in a restoration context. The chapters in this book provide insights into many of the ways and levels of our participatory practice.

However, while no practice can exist without participation, being open to and encouraging public participation forces restoration practitioners and others to confront some serious issues. There are, for instance, the fundamental questions about participation: Who participates? Which perspectives are welcomed? Who decides? In many cases, these are tied to questions of equity, influence, and justice: Where does restoration funding originate and who controls it? Who controls access to land and water? Whose interests are represented by existing or proposed policies? What incentives exist for bureaucratic or otherwise rigid decision-making processes to open to a broader set of interests? Beyond this, more difficult questions arise from participatory processes: How can multiple, and sometimes contradictory, perspectives about restoration be accommodated and resolved in practice? How can ecological restoration work resist—rather than reproduce—existing power inequalities (Wilmsen 2001)? What will it take for restoration to be a transformative process for both the land and the people?

Participation can be powerful, as many authors in this book point out. It can also be problematic when people are forced to participate, as is the case for some land managers from agencies who have mandated collaboration with the public for restoration projects. Similarly, people who have strong beliefs or thoughts about how a restoration project should be structured or proceed sometimes have trouble working in group settings with a slow-moving, consensus-based structure. Likewise, scientists often find that appeals to scientific objectivity tend to gain little traction, and those expecting public deference to "expert opinion" are typically disappointed. Moving beyond such expectations requires, at the very least, an open, transparent, and accountable process in which nonscientists, land managers, and scientists are able to share their perspectives, influence restoration management, and engage in restoration activities (Andre, Ewing and Gold, Westervelt). Such participatory models provide opportunities for learning about ecosystems, cultures, and economies among "experts" and "nonexperts" alike (Gross and Hoffmann-Riem 2005).

Power

People have fundamental relationships to other people (i.e., culture) and to the environment they live in (i.e., nature). By their very essence, these relationships include/embody power relationships (Bliss and Fischer, Buckley and Holl, Brunckhorst, Kimmerer). It is not surprising, then, that power, defined as the measure of an entity's ability to realize its goals (i.e., "power to") as well as the ability to control the behavior of other entities (i.e., "power over"), reveals itself in the chapters of this book and, indeed, within the practice of ecological restoration, generally. Surprisingly, however, discussions about ecological restoration practices and projects rarely speak directly to the issues about power relations (although see Light 2007). It is often the elephant in the room, looming large but seldom acknowledged. Indeed, to many restorationists, power is a concept germane only to the "social realm," not to the world of "objective" science and its technical applications that are thought to lie at the heart of ecological restoration. Yet any act of intervention in one's social or ecological environment is an exercise of power, and any act that includes or affects multiple people, such as a restoration project, implies social power relations. Indeed, an intimate understanding of, and respect for, how power and power relationships work is a significant part of being a successful ecological restorationist.

Power Structures

Humans have always lived within formalized social structures with recognizable power relationships—families, clans, tribes, kingdoms, corporations, nation-states, multination organizations—and within less formalized social structures of networks and webs. Naturally, restorationists and restoration projects operate within both of these power structures, and we suggest that understanding these structures and how they affect the flow of matter, energy, and information (Stepp et al. 2003) is crucial to understanding the context of many restoration efforts. This conceptualization is necessary if we want to have a full perspective of ecosystems in which humans play an integral part. The two social organizational structures we examine here are heterarchy and hierarchy.

A heterarchy is variously defined as "a partially ordered level structure implicating a rapid, interactional capacity" (Kontopoulos 1993) and as "biophysical and cultural systems in which the elements have the potential of being unranked relative to other elements or ranked in a number of ways, depending on systematic requirements" (Crumley 1979). Schematically, heterarchies resemble networks or webs with nodes. Heterarchical arrangements have existed since the earliest humans and are still in use today (Crumley 1987; Stephenson 2009). In this sort of structure, power is inclusive and information flows more or less openly. Indeed, heterarchies recognize and embrace the power of information. There are leaders within heterarchies, but their power is based on their wealth of information and ability to transmit it rather than any given authority.

Hierarchies are common today because there is an increasing need to maintain complex human ecosystems through the control of matter, energy, and information. Hierarchies are structured around strong, "vertical" power relations that allow a relative few at the upper echelons to control the decision-making process. Examples of hierarchical structures include military, corporate, and government organizations. The hierarchical structure is characterized by a clear chain of command, well-defined roles and responsibilities, and differential access to information based on position within the hierarchy (Casagrande 2004). In addition, hierarchies often value exclusivity, social distinction, and the status quo (Crumley 2001).

Heterarchies and hierarchies should not be viewed as antagonists—we need them both, with hierarchies providing matter and energy, and heterarchies providing information to the human ecosystem. In fact, heterarchical networks often exist within or among hierarchical structures, where they provide the necessary level of information (i.e., participation) that keeps information-controlled hierarchical organizations from becoming rigid and nonresilient. Case studies in this book detailing where participatory collaboratives are working with federal and state agencies on large-scale restoration efforts (Abrams, Baker and Quinn-Davidson, Christoffersen, Hardigg) illustrate this point. Other studies examine how a small, nonprofit organization (Whitney) and a college-level education program (Ewing and Gold) have successfully used networks and partnerships to navigate the hierarchical power contexts they reside within. Meanwhile, Buckley and Niemi's discussion about the effect climate change will have on restoration planning serves as a timely reminder that our hierarchical and heterarchical power structures will need to be jointly engaged to grapple with our uncertain future.

There are various chapters within this book where authors have come face to face with the rigid and unresponsive decision-making processes of hierarchical organizations, notably Javier Escalera Reyes in his report about a restoration effort along the Guadiamar River in Seville, Spain; Allegra Newman's case study of racialized minorities in Toronto; and James Blignaut and his colleagues' study from South Africa. In each of these cases, governmental bodies made decisions within their own framework of information and without much, if any, participation from the people who actually live in and use the areas being restored. We might also argue that the education-focused chapters (McCann, Hall and Bauer-Armstrong) aim to break through the hierarchically organized American K–12 educational system. Finally, eco-artist Lillian Ball demonstrates how she successfully navigated various hierarchical government bureaucracies during her restoration/art installations.

Power and Social Justice

Ever since the Indigenous Peoples Network emerged in 1995 at the Society for Ecological Restoration Conference in Seattle, Washington, the role of ecological restoration as an agent for social justice has been gaining momentum. While restoration always had a small element of advocacy for social change, the idea of social justice was not the main interest of people more concerned with restoring plants and animals than improving conditions of degraded or damaged human communities. Chapters in this book (Blignaut and colleagues, Newman, Kimmerer, Stevens, and Ball) demonstrate how that perspective is changing. Perhaps not surprisingly, interest in social justice is coming from indigenous people, urbanites, minorities, people concerned about the well-being of underdeveloped countries, and artists. As a result of their efforts, they are expanding not only the role, but the definition, of ecological restoration by highlighting the potential for ecological restoration to provide basic resource needs for people.

Power relationships are extremely important in such efforts (Boyce, Narain, and Stanton 2007) because in nearly all cases these people are pushing back against oppression and exploitation of local resources by others, attempting to improve their situation, and using ecological restoration (as they define it) as one of their tools to do so. Being able to participate and find ways into avenues of power ("democratizing access") that allow such efforts to move forward is key and often requires restorationists to act as conduits between the disenfranchised and those in power. In addition, restorationists can work with local groups to find alternative, and often traditional, ways to restore their lands and livelihoods (Kimmerer, Stevens, Rotherham).

Power, Economics, and Natural Capital

Economies, because they are the intersection of human needs and natural resource supplies, are also the nexus of politics, power, and wealth. As ecological restoration has become a mainstream activity, its practitioners have felt the effects of this power center. Indeed, at least one optimistic account describes the emergence of a "restoration economy" (Cunningham 2002). The chapters in the economics section, as well as the chapters by Abrams, Baker and Quinn-Davidson, and Rotherham, provide several perspectives about how this "economy" works in the United States, England, and South Africa. Largely promoted and supported by government policies and subsidies, the current "restoration economy" is often dependent on the support of powerful interests, politicians, and bureaucracies for activities such as wetland restoration, urban restoration, and forest restoration. As Baker and Quinn-Davidson note in their case study from northern California, this dependence of government power and money has led small restoration businesses there to consolidate or go extinct; to adapt their original goals and change their organizational size or lose economic support. Abrams outlines similar concerns about scale in his depiction of the White Mountain Stewardship Contract in Arizona. Meanwhile, Blignaut and colleagues report on a largely unsuccessful government attempt to bring better economic conditions to a poor, rural population in South Africa. Buckley and Holl take a more theoretical, although quite useful, approach to such matters in their discussion of game theory tools and restoration scenarios. Each of these accounts suggests that these economic power relationships are often ephemeral and subject to swings in market conditions, and they may create, rather than resolve, tensions between local interests and government entities. That said, efforts of this type should still be encouraged, and ways to make them more sustainable should be found.

In addition to being a nexus of power, economies are designed to increase wealth. Political systems, because they are intricately tied to economies and power, have the ability to distribute wealth and, ultimately, power. In theory, democracies should be politically about sharing power, whereas socialist structures are tuned so as to share wealth. As many democracies (e.g., United States, western Europe, Australia) are also tied to so-called free market economies, they fail to share either power or wealth because centers of concentrated wealth tend to thwart democratic processes (Brunkhorst; Boyce, Narain, and Stanton 2007). To that end, land trusts (Brunckhorst, Whitney) and other private land holdings provide some of the best opportunities for focused, largely uncomplicated restoration projects. Common land projects, on the other hand, are often more difficult because (1) there are numerous stakeholders, some of whom will use litigious actions to get what they want; (2) properties are managed by government agencies and are subject to entrenched bureaucratic cultures; and (3) landscape-scale restoration projects (e.g., Everglades Restoration in Florida, Bay-Delta Project in California, Natura 2000 in Europe, Four Forest Restoration Initiative in Arizona) require organizational and political skills unknown to most restorationists. Such projects also require effective and authentic means of public participation (i.e., necessary public feedback; Abrams, Escalera Reyes) to ensure a representative process that will be as equitable as possible.

Mainstream economists' failure to acknowledge ecosystem services/natural capital is another power issue noted by authors of this volume. In particular, Kim and Hjerpe make the case for ecological economics, and its full-cost accounting of externalities (i.e., natural capital), as an essential element of ecological restoration. They also argue for an economics that recognizes the need for collective management of lands held in common and suggest that "the success of collective action is possible when the institutional and organizational settings are designed in a way that provides benefits to participants, guarantees their rights, and facilitates responses to changing conditions" (201).

Like the movement toward social justice, connecting ecological economics with ecological restoration pushes the practice further into the social context and away, at least in many cases, from its original intent of restoring only plant associations and animal populations, and into restoring full ecosystems, including human communities.

Perspective

When working in human-influenced ecosystems where participation and power are in constant tension and flux, it is important to keep things in perspective or, as the American civil rights movement saying reminded its adherents: "Keep your eyes on the prize!" Working in the expanded scope of ecological restoration, it is very easy to become drawn into the emotions of working with others in complex situations or to withdraw into the objectivity of scientific studies and lose touch with the social reasons for that work. Having a framework of reference becomes important to working through issues (both technical and social) without losing your integrity and good judgment. We offer, here, such a framework—one based on the integral theory of contemporary philosopher, Ken Wilbur, and made more accessible by the book *Integral Ecology: Multiple Perspectives on the Natural World* (Esbjörn-Hargens and Zimmerman 2009).

The Wilbur/Integral Ecology framework, which has been reviewed previously in a restoration context by Clewell and Aronson (2007), provides a quadranic approach to capturing reality. The quadrants are (1) individual-subjective (I), (2) individual-objective (It), (3) collective-subjective (We), and (4) collective-objective (Its). While these quadrants have a multitude of dimensions within and among them, we will describe them respectively as personal emotions/feelings/experiences (I), behavior of the "Other" (It), cultural rules/norms/worldviews (We), and patterns/systems (Its). These four perspectives of reality are present in every restoration project but are especially pronounced in those projects that are more complex due to their size, funding source, or the number of stakeholders involved.

The "I" quadrant encompasses how you feel about and how you cope with the reality you perceive. The mere fact that you believe in the value of ecological restoration is in itself personally healing and transformative because it expresses hope for the future in the face of overwhelming odds. However, no one is perfect and we all have doubts and fears to cope with (e.g., Why do I dislike participating in this collaborative process? Will this public event actually persuade people to volunteer? Is it all right to intensely dislike this invasive species I am trying to control?). It is vitally important to continue searching into the psychological aspects of the practice through means such as art, meditation, contemplation, and community service in order to understand the root causes of the emotions and attitudes that underlie both environmental degradation and repair.

The "We" quadrant encapsulates how people as a group (i.e., a cultural entity) collectively feel about, view, or place values on any given situation. For example, as a subculture, restorationists have a worldview that sees the environment as "degraded, damaged, or destroyed" and, as a corollary, that humans are capable of repairing such environments as well as our connection to nature and our own communities through restoration activities. We need to be aware that we hold such a worldview because we will encounter people who share our belief and those who do not. This realm or terrain of culture is the area in which disputes emerge, and depending on motivations and/or access to political or economic power, these collective values and ideologies can support or, as restorationists in Chicago found out several years ago (Gobster and Hull 2000), derail restoration activities. Recognizing these value sets and learning how to work with them is, therefore, key to making a restoration project sustainable; ignoring them is not an option. Indeed, we need to be aware of all the various cultures and subcultures involved in any restoration project, be they indigenous, corporate, bureaucratic, religious, or any other.

The "It" quadrant, like the "Its" quadrant, is the terrain of third-person, objective perspective; the realm of observation, data collection, and analysis. This is the domain of restoration ecology (i.e., the theoretical, scientific basis for the practice of ecological restoration). It is also the quadrant for all scientific endeavors that focus on individual behaviors, including individual psychology. Unfortunately, and despite the efforts of restoration leaders (e.g., Bill Jordan, Eric Higgs, and Andre Clewell) to expand the discussion and scope of ecological restoration, this science-based perspective remains the main focus of ecological restoration work. There must be greater efforts made to integrate this vital area with the other three quadrants, and efforts must be made by all parties. Such a multiperspective/multidisciplinary approach will only serve to strengthen ecological restoration projects *and* change behaviors so that we, as a species, move toward a more reciprocal relation with the environment we live in and pass on to the next generations (Kimmerer).

The "Its" quadrant represents the collective, structural components of reality—social factors, economic patterns and trends, institutions, political dynamics, ecosystem components and variables, and the like—and the relationships that bind them. Nearly all conservation efforts are aware that they are part of this structural terrain, but few, including ecological restoration and restoration ecology, are equipped or designed to integrate them into their efforts. The chapters in this book about collaboration, eco-cultural restoration, ecological economics, environmental education, and public policy attempt to move that much needed discussion forward.

It is important to remember that we live in a multiperspective world in which the hiker, when looking at a stand of redwood trees, sees their majestic beauty; the logger counts the number of board feet; the environmentalist sees the need for protection; and the ecologist calculates the amount of carbon dioxide transpired. The world can be engaged in a multiperspective manner by various means, including by asking and contemplating this question: In what ways am I, the cultural values, and the sociopolitical structure enabling or inhibiting this restoration project? The answers will be intriguing, deep, and, hopefully, transformative.

Finally, the chapters in this volume make it clear that "ecological restoration" is a multidimensional concept. The influences on individual and group perspectives about what restoration entails—including the stories we tell about what ecological degradation is, what and who is responsible, and what our current role is in the healing process—are multiple and complex. Cultural influences play a strong role (Kimmerer, Newman, Rotherham). The learning process, either through formal education, hands-on restoration experience, or confronting the experiences of others, also affects the ways that restoration is conceived. Additionally, the power of particular individuals or groups to define restoration priorities and narratives can be an important consideration. Scientists are not exempt from analyses of such restoration perspectives because, despite their appeals to a more refined means of knowledge generation, scientists—like other actors—construct and propagate their own narratives. Their narratives and the narratives of nonscientists deserve to be critically analyzed (Bliss and Fischer).

Conclusion

The authors in this book, and untold others not included but doing similar work, have pushed the boundaries of ecological restoration beyond what most would have imagined when the Society for Ecological Restoration began in the late 1980s. Indeed, because of the Society's ongoing attempts at inclusivity and because restoration, in the broad sense, is needed virtually everywhere, ecological restoration has emerged with more potential than its early, biologically minded proponents had in mind. Today, a more mature, participatory perspective of ecological restoration has developed—one that recognizes the human engagement with it as a practice, a science, a performance, and an experience.

References

Boyce, J. K., S. Narain, and E. A. Stanton, eds. 2007. *Reclaiming Nature: Environmental Justice and Ecological Restoration*. London: Anthem Press.

Casagrande, D. 2004. "Bateson, Festinger, and the Recursive Role of Cognitive Dissonance in Social Organization." Paper presented at the Annual Meeting of the American Anthropological Association, December 15–19, 2004, Atlanta, GA.

Clewell, A. F., and J. Aronson. 2007. *Ecological Restoration: Principles, Values, and Structure of an Emerging Profession*. Washington, DC: Island Press.

Crumley, C. L. 1979. "Three Locational Models: An Epistemological Assessment for Anthropology and Archaeology." *Advances in Archaeological Method and Theory* 2: 141–73.

———. 1987. "A Dialectical Critique of Hierarchy." In *Power Relations and State Formation*, edited by T. C. Patterson and C. W. Gailey, 155–68. Washington, DC: American Anthropological Association.

———. 2001. "Communication, Holism, and the Evolution of Sociopolitical Complexity." In *Leaders to Rulers: The Development of Political Centralization*, edited by J. Hass, 19–33. New York: Plenum.

Cunningham, S. 2002. *The Restoration Economy*. San Francisco: Berrett-Koehler.

Esbjörn-Hargens, S., and M. E. Zimmerman. 2009. *Integral Ecology: Uniting Multiple Perspectives on the Natural World*. Boston, MA: Integral Books.

Gobster, P., and R. Hull. 2000. *Restoring Nature: Perspectives from the Social Sciences and the Humanities*. Washington, DC: Island Press.

Gross, M., and H. Hoffmann-Riem. 2005. "Ecological Restoration as a Real-World Experiment: Designing Robust Implementation Strategies in an Urban Environment, *Public Understanding of Science* 14 (3): 269–84.

Kontopoulos, K. M. 1993. *The Logics of Social Structure*. New York: Cambridge University Press.

Light, A. 2007. "Ecological Citizenship: The Democratic Promise of Ecological Restoration." In *The Humane Metropolis: People and Nature in the 21st Century City*, edited by R. Platt, 169–82. Amherst: University of Massachusetts Press.

Stephenson, K. 2009. "Neither Hierarchy nor Network: An Agreement for Heterarchy." *People and Strategy* 32 (1): 4–7.

Stepp, J. R., E. C. Jones, M. Pavao-Zuckerman, D. Casagrande, and R. K. Zarger. 2003. "Remarkable Properties of Human Ecosystems." *Conservation Ecology* 7 (3): 11. www.consecol.org/vol7/iss3/art11.

Wilmsen, C. 2001. "Sustained Yield Recast: The Politics of Sustainability in Vallecitos, New Mexico." *Society and Natural Resources* 14 (3): 193–207.

CONTRIBUTORS

Jesse Abrams, visiting assistant professor at Whitman College, is an environmental resource sociologist whose work focuses on issues of land tenure, rural communities, and human–environment relationships. After graduating from New College of Florida, Jesse worked as a preserve steward, restoration coordinator, and prescribed fire crew member. More recently, he has worked on community-based forest restoration projects in New Mexico and Arizona, and researched private landownership transitions in northeast Oregon. He received his MS and PhD in forest resources from Oregon State University. When not involved in academic pursuits, Jesse can be found exploring the diverse landscapes, ecosystems, and human communities of the Pacific Northwest. jesse.b.abrams@gmail.com

Mark S. Andre lives in Arcata, California, where he works as environmental services director for the City of Arcata. He has been involved with forest and watershed restoration for his entire career, mostly in northwestern California and the eastern Sierra. In his off time he enjoys hiking with his family in wild inland areas that are away from the coastal fog—areas that have intact natural disturbance regimes and a notable lack of invasive species. mandre@arcatacityhall.org

James Aronson is a restoration ecologist at the Center of Functional and Evolutionary Ecology in Montpellier, France, and co-coordinator of the RNC Alliance, whose hub is at the Missouri Botanical Garden, USA. He has worked on restoration and rehabilitation of degraded ecosystems for more than twenty-five years, in many parts of the world, and written extensively on these and related subjects. He is editor of the book series Science and Practice of Ecological Restoration, published jointly by Island Press and the Society for Ecological Restoration. james.aronson@cefe.cnrs.fr

J. Mark Baker is an associate professor at Humboldt State University in northern California. At HSU he coordinates the Environment and Community MA in Social Science graduate program and teaches courses about water politics, environmental and natural resource policy, political ecology, and social science research. His research

D. Egan (eds.), *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*,
The Science and Practice of Ecological Restoration, DOI 10.5822/978-1-61091-039-2, © Island Press 2011

interests focus on rural community–environment interactions, with a particular emphasis on collective action, common property resource management, and the role of the state in regimes of water and forest management. j.mark.baker@humboldt.edu

Lillian Ball is an artist and environmental activist working in New York and internationally. Water imagery has been a constant subtext of her work, but recent subject matter focuses specifically on environmental concerns. She has received numerous awards, including a New York State Foundation for the Arts–Fellowship in Computer Arts, a John-Simon Guggenheim Foundation Fellowship in Visual Arts, and a National Endowment for the Arts Grant in Sculpture. http://www.lillianball.com/index.html

Cheryl Bauer-Armstrong works at the University of Wisconsin–Madison Arboretum where she is the director of the Earth Partnership for Schools Program. cherylbauer@uwarb.wisc.edu

James Blignaut is director of ASSET Research and professor of economics at the University of Pretoria in South Africa. For the last fifteen years his research has focused on the restoration of natural capital, payments for ecosystem goods and services, and economic development. He is especially interested in the linkages between restoration and food, water, and energy security on a local level. www.assetresearch.org.za; www.jabenzi.co.za

John C. Bliss is Starker Chair in Private and Family Forestry at Oregon State University, where he conducts research on the social and cultural dimensions of small-scale forest management. John is coeditor in chief of the international journal, *Small-Scale Forestry*. He is active in the International Union of Forestry Research Organizations (IUFRO) and an Honorary Professor in the School of Integrative Systems at the University of Queensland, Australia. He is currently engaged in research about forestland tenure change in Oregon and about forest access and household vulnerability in the Ethiopian highlands. John is passionate about music and active in the Corvallis, Oregon, avant-garde music scene. john.bliss@oregonstate.edu

David Brunckhorst lives on a small ranch near Armidale, New South Wales, Australia. Putting his “money where his mouth is,” Dave has restored native pasture, creek bed, and riparian native vegetation and has facilitated the same with several neighbors. He also enjoys kayaking, surfing, mountain biking, and exploring landscapes. Working in the federal government, he established the Australian government’s National Reserve System Program and, with private sector partners, several Biosphere Reserve projects. He has authored numerous books, book chapters, and scientific papers. He is currently a professor and the director of the Institute for Rural Futures and the UNESCO Centre for Bioregional Resource Management at the University of New England, Australia. dbrunckh@metz.une.edu.au

Mark Buckley currently resides in Portland, Oregon, and is a senior economist at ECONorthwest. Mark develops economic models and analytical methods for policy and behavior involving water resources and land management. His work addresses urban and rural restoration and conservation, ecosystem services, and climate change. He holds a PhD from the University of California–Santa Cruz and is an adjunct professor for environmental economics at Portland State University. Mark spends any available time in the mountains on rivers and snow. buckley@portland.econw.com

Nils D. Christoffersen lives in Enterprise, Oregon, where he is the director of Wallowa Resources, a community-based nonprofit that promotes collaborative partnerships, economic innovation, and research to advance land and community stewardship. He cut his teeth in community-based natural resource management in southern Africa with the International Union for Conservation of Nature. With his wife, Anette, and children, Silje and Nikolai, he enjoys Wallowa County's bounties: the Eagle Caps, Hells Canyon, the Zumwalt Prairie, and the great people who make up their community. nils@wallowaresources.org

Tim Collins is an artist, educator, and theorist with interests in ecological restoration and working on postindustrial public space. He is currently the associate dean for Research and Development; director of the Centre for Art, Design, Research and Experimentation; and director of the Creativity, Media and Technology STUDIO at the School of Art and Design, University of Wolverhampton, UK. He holds a PhD from the University of Plymouth, Plymouth, UK, an MFA from the San Francisco Art Institute, and a BFA from the University of Rhode Island–Kingston. He resides in Wolverhampton with his partner and fellow artist, Reiko Goto.

Betsy Damon, founding director of the Keepers of the Waters, has been involved in water-related discussions and projects for more than twenty years in communities across the United States and in China. elizabeth.damon@gmail.com

Dave Egan has been involved in ecological restoration since the mid-1980s as both practitioner and writer/editor. He formerly worked on the journal *Ecological Restoration/Restoration & Management Notes*, and is coeditor of *The Historical Ecology Handbook*. Dave currently resides in the southwestern United States and serves as the writer/editor for the Ecological Restoration Institute at Northern Arizona University. dave.egan@nau.edu

Javier Escalera Reyes is professor of social anthropology at the Pablo de Olavide University in Seville, Spain. He is the director of the Social Research and Participatory Action Group, the master's degree program in applied social research on the environment, and the PhD program in environmental studies. He is interested in participatory research on the relations between people and urban and "natural" ecosystems, with a focus on environmental conservation/planning/management of urban and "natural" areas, local sustainable development, governance, socioecological resilience, cultural/natural heritage, and collective identity in Andalusia, the Mediterranean, Costa Rica, and Nicaragua. He received his PhD from the University of Seville. fjescrey@upo.es

Kern Ewing is a professor of plant ecology at the University of Washington in Seattle. In addition to playing a pivotal role in the UW's Restoration Ecology Network (http://depts.washington.edu/uwren/), his research interests include the restoration of a number of different ecosystem types in the western United States—freshwater wetlands, coastal wetlands, prairie, shrub-steppe, aridlands, oak woodlands, oak savanna, montane, and thornscrub vegetation types. kern@u.washington.edu

A. Paige Fischer is a research social scientist with the Pacific Northwest Research Station of the U.S. Forest Service in Corvallis, Oregon. Paige's research interests include how sociocultural influences affect people's conceptualizations of environmental problems and their adaptations to environmental changes. Her work has focused on private landowners and biodiversity loss, wildfire risk, and climate change. Paige received her BA in anthropology from Hampshire College in Amherst, Massachusetts, and her MA, MS, and PhD from the College of Forestry at Oregon State University in Corvallis. She and her family live on a farmette in the country, where they like to hike, ride horses, and chop firewood. paigefischer@fs.fed.us

Matthew Fox has spent the last fifteen years working on community-based conservation in Australia and Southeast Asia. A long stint in postconflict Cambodia saw Matt working on community-based resource management reforms, the establishment of protected areas, and the conservation of a critically endangered mountain crocodile, among other things. Currently with state government, Matt leads the Coastcare effort in Victoria. Matt lives in Melbourne, and most of his free time is spent on the coast in pursuit of surf and photographs. matthew.fox@dse.vic.gov.au

Warren Gold is the codirector of the Restoration Ecology Network and an associate professor at the University of Washington. His present research includes studies of the ecology and restoration of plant species of cultural importance to Northwest Native American tribes; the ecology and physiology of native and nonnative species involved in ecological restoration; and alpine ecology, including recreational impact and restoration and links between cryptogamic organisms, vascular plants, and ecosystem processes. wgold@u.washington.edu

Reiko Goto was born and raised in Tokyo. She received a BFA from the Tokyo Women's College of Arts and an MFA from the San Francisco Art Institute, where she also met her partner, Tim Collins. They currently reside in Wolverhampton, UK.

Rick Hall works at the University of Wisconsin–Madison Arboretum, where he is the RESTORE project specialist for the Earth Partnership for Schools Program. rdhall@uwarb.wisc.edu

Paul Hancock lives in Bellemont, Arizona, where he is employed by the Kaibab National Forest as a National Environmental Policy Act coordinator for the Williams and Tusayan ranger districts. A graduate of Northern Arizona University, he has had an ongoing interest in the social/human dimensions of public land management and ecological restoration. When not at work, Paul enjoys hiking, skiing, and simply exploring the world with his family and four dogs. phancock@fs.fed.us

Karen Hardigg lives in Anchorage, Alaska, where she works for The Wilderness Society on national forest restoration issues, particularly in southeast Alaska. After graduating from Vassar College with a degree in environmental studies, she studied wildlife in various national forests and parks, ultimately returning to graduate school. A master's in environmental management from the Yale School of Forestry and Environmental Studies has allowed her to combine her passion for the outdoors and biology with important policy skills for finding common ground when dealing with challenging natural resource management problems. When not working, she enjoys exploring the wonderful wilds of Alaska—whether fishing, hiking, or skiing—with her husband and young son. karen_hardigg@tws.org

Evan E. Hjerpe lives outside of Anchorage, Alaska, where he is an ecological economist for The Wilderness Society. He has taught forest economics and forest management at Northern Arizona University and maintains a research focus on the economics of ecological restoration. Evan enjoys all backcountry exploration whether by boots, skis, boats, or bikes. evan_hjerpe@tws.org

Karen Holl is a professor of environmental studies at the University of California-Santa Cruz, where her research focuses on understanding how local- and landscape-scale processes affect ecosystem recovery from human disturbance, and using this information to restore damaged ecosystems. She has studied restoration ecology in a range of ecosystems, including tropical rain forests, eastern hardwood forests in the United States, and chaparral, grassland, and riparian systems in California. She advises numerous public and private agencies about land management and restoration, is an Aldo Leopold Leadership Fellow, and is the associate editor for the Island Press Science and Practice of Ecological Restoration series. kholl@ucsc.edu

Yeon-Su Kim lives in Flagstaff, Arizona, where she is an associate professor of ecological economics in the School of Forestry at Northern Arizona University. Recognizing the great opportunities to improve the process of environmental discourses by translating ecological problems in economic terms, Kim decided to specialize in economic valuation of ecosystem services and regional economic impact analysis. Her overall vision is to promote ecosystem health while enhancing the viability of human community in the landscape by identifying and cultivating regional economic and social factors that promote the coevolution of social-ecological systems. Yeon-Su.Kim@nau.edu

Robin Kimmerer is an associate professor in the College of Environmental Studies and Forestry at the State University of New York–Syracuse. Her research interests include the ecology of mosses, restoration of culturally significant plants to Native American communities, environmental partnerships with Native American communities, traditional ecological knowledge, and disturbance ecology. A Potawatomi by heritage, she is the recipient of the 2005 John Burroughs Medal for her book, *Gathering Moss: A Natural and Cultural History of Mosses*. rkimmer@esf.edu

Marty Lee lives in Flagstaff, Arizona, where she is a professor of wildland recreation in the School of Forestry at Northern Arizona University. She conducts research and teaches courses about public perceptions of resource management, recreational visitor behavior and management, wilderness management, and environmental education. When not at work, she enjoys gardening, quilting, and spending time with her husband and their horses, dog, and cat. Martha.Lee@nau.edu

Elizabeth McCann is director of Environmental Education in the Department of Environmental Studies at Antioch University New England. She received her PhD in adult education, with an emphasis in environmental education, from the University of Wisconsin–Madison. At the UW–Madison Arboretum, she directed Earth Partnership for Schools. Libby's childhood on a farm in Kentucky was foundational to her current interest in land restoration, farming, environmental protection, and education. emccann@antioch.edu

Allegra Newman is a PhD student in geography at Carleton University in Ottawa, Ontario. Her interests in the connection between social issues and urban nature led her to research the social dimensions of urban ecological restoration in the city of Toronto. Following on her work in urban planning research and connecting to her passion for public spaces and social justice, Allegra's current research focuses on community-based resistance within urban green spaces. allegra.newman@gmail.com

Ernie Niemi lives in Eugene, Oregon, where he is a vice president and a senior economist specializing in natural resource economics at ECONorthwest (econw.com). His work focuses on applying the principles of benefit-cost analysis to examine the efficiency and equity consequences of alternative management strategies for water, wetland, forest, range, and marine resources. Outside the office, he enjoys being outdoors and working with families in East Africa to encourage better and more extensive education for girls and young women. niemi@eugene.econw.com

Lenya N. Quinn-Davidson is a lifelong resident of northern California and has lived in Humboldt County for more than three years. She had her first experience in restoration when she was twenty-one years old, dragging willows and wrestling boulders for a stream restoration company in Mendocino County. Since then, her interest and experiences in restoration have extended beyond the creek; she spent the last couple of years at Humboldt State University researching impediments to prescribed fire in northern California landscapes. Lenya currently works for California state parks, where she gets the chance to work in many of Humboldt County's diverse ecosystems, from streams and beaches to prairies and old-growth redwoods. lenyaqd@gmail.com

Ian D. Rotherham is a reader in the Tourism and Environmental Change Department at Sheffield Hallam University in Sheffield, England. He is an ecologist and landscape historian with more than thirty years of experience in research and education. He has been published widely, and chairs the Biodiversity and Landscape History Research Institute at the university. i.d.rotherham@shu.ac.uk

Michelle Stevens is an associate professor in the Environmental Studies Department at California State University in Sacramento. In addition to her work at CSUS and in the Mesopotamian marshes, she is also interested in the historical ecology of the Sacramento–San Joaquin Delta, wetland and riparian ecology and restoration, traditional resource management and traditional ecological knowledge, and establishment of peace parks and transboundary conservation areas. stevensm@csus.edu

Rudi van Aarde is director of the Conservation Ecology Research Unit and professor of zoology at the University of Pretoria, South Africa. For the last nineteen years his research has focused on ecological restoration and conservation planning. He is actively researching approaches to restoring natural processes to maintain populations and communities. http://www.ceru.up.ac.za

Jotte van Ierland studied general economics at the University of Amsterdam (the Netherlands) and is founder and director of Mpfuneko Community Support, a nongovernmental organization that runs a community biogas project in Giyani, South Africa. He is also involved in applied research on the socioeconomic benefits of development projects, especially in relation to biogas in combination with improved farming practices and rainwater harvesting. jotte_v_ierland@hotmail.com

Kellie Westervelt has worked within the conservation community for the last twenty years, first with the Florida Park Service and later with the American Littoral Society overseeing the Cape Florida Project. She has also served as habitat director for the Delaware Estuary Program and development director for the Wildlands Network. She is currently a consultant to nonprofit conservation organizations, where she continues to advocate for community engagement in restoration and nature protection. kwest01@earthlink.net

William S. Whitney is a prairie enthusiast, educator, and visionary. Along with his wife, Jan, he directs the Prairie Plains Resource Institute in Aurora, Nebraska. When not out collecting or planting prairie seeds, or making plans for next year and beyond, Bill might be found deep in discussion at the local coffee shop or playing his guitar at home or with friends. ppri@hamilton.net

Travor Xivuri lives in Lulekani Village near Phalaborwa, South Africa. He was a project manager for the African Rural Initiatives for Sustainable Environments, an ecological restoration program, in the villages near Giyani. There he enjoyed bringing change to the environment and working with the program's stakeholders, which included traditional authorities, villagers, local municipalities, and community organizations. He was instrumental in starting the ecological restoration program by doing grass roots consulting with these stakeholders. He was also responsible for the employment of the beneficiaries and running the program. To date he maintains contact with the people in Giyani and is currently working as a manager for the Working for Water program in Western Cape Province.

INDEX

Figures/photos/illustrations are indicated by an "f" and tables by a "t."

THE SCIENCE AND PRACTICE OF ECOLOGICAL RESTORATION

Wildlife Restoration: Techniques for Habitat Analysis and Animal Monitoring, by Michael L. Morrison

Ecological Restoration of Southwestern Ponderosa Pine Forests, edited by Peter Friederici, Ecological Restoration Institute at Northern Arizona University

Ex Situ Plant Conservation: Supporting Species Survival in the Wild, edited by Edward O. Guerrant Jr., Kayri Havens, and Mike Maunder

Great Basin Riparian Ecosystems: Ecology, Management, and Restoration, edited by Jeanne C. Chambers and Jerry R. Miller

Assembly Rules and Restoration Ecology: Bridging the Gap between Theory and Practice, edited by Vicky M. Temperton, Richard J. Hobbs, Tim Nuttle, and Stefan Halle

The Tallgrass Restoration Handbook: For Prairies, Savannas, and Woodlands, edited by Stephen Packard and Cornelia F. Mutel

The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems, edited by Dave Egan and Evelyn A. Howell

Foundations of Restoration Ecology, edited by Donald A. Falk, Margaret A. Palmer, and Joy B. Zedler

Restoring the Pacific Northwest: The Art and Science of Ecological Restoration in Cascadia, edited by Dean Apostol and Marcia Sinclair

A Guide for Desert and Dryland Restoration: New Hope for Arid Lands, by David A. Bainbridge

Restoring Natural Capital: Science, Business, and Practice, edited by James Aronson, Suzanne J. Milton, and James N. Blignaut

Old Fields: Dynamics and Restoration of Abandoned Farmland, edited by Viki A. Cramer and Richard J. Hobbs

Ecological Restoration: Principles, Values, and Structure of an Emerging Profession, by Andre F. Clewell and James Aronson

River Futures: An Integrative Scientific Approach to River Repair, edited by Gary J. Brierley and Kirstie A. Fryirs

Large-Scale Ecosystem Restoration: Five Case Studies from the United States, edited by Mary Doyle and Cynthia A. Drew

New Models for Ecosystem Dynamics and Restoration, edited by Richard J. Hobbs and Katharine N. Suding

Cork Oak Woodlands in Transition: Ecology, Adaptive Management, and Restoration of an Ancient Mediterranean Ecosystem, edited by James Aronson, João S. Pereira, and Juli G. Pausas

Restoring Wildlife: Ecological Concepts and Practical Applications, by Michael L. Morrison

Restoring Ecological Health to Your Land, by Steven I. Apfelbaum and Alan W. Haney

Restoring Disturbed Landscapes: Putting Principles into Practice, by David J. Tongway and John A. Ludwig

Intelligent Tinkering: Bridging the Gap between Science and Practice, by Robert J. Cabin

Making Nature Whole: A History of Ecological Restoration, by William R. Jordan and George M. Lubick

Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture, edited by Dave Egan, Evan E. Hjerpe, and Jesse Abrams