

Schooling for Sustainable Development 3

Margaret Robertson *Editor*

# Schooling for Sustainable Development

A Focus on Australia, New Zealand,  
and the Oceanic Region

 Springer

# Schooling for Sustainable Development

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## Volume 3

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### *Series Editors*

John Chi-Kin Lee

Michael Williams

Philip Stimpson

This book series addresses issues associated with sustainability with a strong focus on the need for educational policy and action. Current attention and initiatives assume that Education for Sustainable Development (ESD) can be introduced successfully and gradually into schools worldwide. This series explores the issues that arise from the substantial and sustainable changes to be implemented in schools and education systems.

The series aims to counter the prevailing Western character of current research and enable cross-cultural comparisons of educational policy, practice, and project development. As a whole, it provides authoritative and comprehensive global coverage, with each volume providing regional/continental coverage. The volumes present data and insights that contribute to research, policy and practice in ESD-related curriculum development, school organization and school-community partnerships. They are based on ESD-related project experiences, empirical studies that focus on ESD implementation and teachers' perceptions as well as childhood studies that examine children's geographies, cultural characteristics and behaviours.

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Margaret Robertson  
Editor

# Schooling for Sustainable Development

A Focus on Australia, New Zealand,  
and the Oceanic Region

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*Editor*

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ISBN 978-94-007-2881-3                      e-ISBN 978-94-007-2882-0  
DOI 10.1007/978-94-007-2882-0  
Springer Dordrecht Heidelberg New York London

Library of Congress Control Number: 2012933120

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Printed on acid-free paper

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## Series Editors' Introduction

Education for sustainable development (ESD) has rapidly become part of educational discourses worldwide. Within its global attractiveness lie both its strength and its weakness. Its strength lies in its capacity to alert educationists, broadly defined, to a shared concern for the future of both the planet and local communities. Its weakness lies in its lack of shared meaning and, stemming from this, the enormous difficulties encountered in trying to bring ESD into the mainstream activities of educational institutions.

In designating the period 2005–2014 as the International Decade of Education for Sustainable Development the United Nations sought to bring to the fore the need for politicians, policy-makers and practitioners to seek ways by which ESD can become part of the fabric of formal and informal education. At the heart of the numerous initiatives that have been stimulated by this designation is the assumption that ESD should be introduced and can be introduced successfully into schools world-wide. It is assumed that children, older students and adults can be educated formally to act now in the interests of a sustainable future and to act internationally.

What is evident is that different nations, and indeed sometimes different authorities within nations, have adopted different approaches to ESD, sometimes interchanging the term with environmental education, another term subject to a wide range of interpretations. These differences are evident in educational practice in regions, districts and individual schools as well as in academic studies and commentaries. Obviously, this is not to say that there is some common ground in policies and practice, it is simply to keep to the forefront the recognition that, even when nations make pronouncements about aspects of ESD, these should not be treated as authoritative statements about what is happening at the school and classroom levels. Broad statements have a value in highlighting issues and trends but they need to be treated with caution. The same caution needs to be applied to pronouncements emanating from academic sources. Academics have their own agendas and care must be taken when reading what appear to be authoritative statements about developments in ESD occurring within their own communities and nations.

Our series addresses the array of issues arising from attempts made to convert assumptions about, and definitions of, ESD into substantial and sustainable changes principally in schools. Underpinning the series is a concern for identifying those cultural forces that impact on national, regional and local adaptations to approaches to ESD that have international currency. In this, the editors of the books in the series, each based on experience in a single continent or extensive region, seek to counter the strong Western (Australian, North American, European) character of much research and writing in the broad field of ESD. Research and scholarly studies are commonly underpinned by values and assumptions derived from Western culture, broadly defined. The design of the series as a set of broadly continent-scale books seeks to bring together experts from various countries in each continent. The books bring out contrasting experiences and insights with a range of explanations of policies and practice.

Within the broad cultural contexts of the continents and regions included in the series authors provide evidence of policies, formal curriculum developments and innovations and informal school-related activities. Some authors have paid close attention to policy making at various levels, others have addressed whole school organisational issues and others have provided detailed case studies of localities and individual schools.

Children and young people live in distinct worlds of their own. They have very distinctive cognitive and affective characteristics that vary from one culture to another, at whatever scale that culture is defined. They are also often targets for environmental campaigns that wish to promote particular behavioural changes. ESD is often construed as an attempt to change habits, to encourage children and young people to “think globally and act locally”. This series demonstrates how this and other phrases are translated in education systems and schools world-wide.

For this volume *Schooling for Sustainable Development: A Focus on Australia, New Zealand and the Oceanic Region*, the editor Margaret Robertson has brought together an array of chapters highlighting the recent developments and issues related to ESD in parts of Australasia. In the opening chapter she provides the backcloth against which the following chapters are set. Society, economy and the natural environment are usually seen as the foundations underpinning the concept of sustainability and she demonstrates the enormous variety in all three in Australasia. Indigenous communities are prominent in all of the places studied in this book and the post-colonial inheritance continues to be a powerful force in determining their contemporary economies. Whilst, the Great Barrier Reef, the fjords of South Island New Zealand and the rainforests of Papua New Guinea illustrate the iconic landscape features that are subjected to various pressures and threats the major issues for sustainability in the region relate to climate change especially rising sea levels, and natural disasters including fire, drought and seismic movements. A central feature of this volume are critical discussions of the extent to which these issues are addressed within curricula and specifically with particular groups of students.

John Chi-Kin Lee  
Michael Williams  
Philip Stimpson

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# Chapter 1

## Introduction and Regional Overview

Margaret Robertson

### The Region and Its Place in the Global Context

What is global and what is local? The duality of living in a place and belonging to an interconnected global cosmos is our Achilles' heel. We pursue our daily lives and enjoy the heritage of our forebears through our language and literature, architecture and road systems, our gardens and farms, and our love of sports and landscapes. At the same time our intellectuals and politicians as well as the media and international neighbours are urging us to change and behave in ways that appear to take away the lifestyle gains of recent history. As Nossal<sup>1</sup> explains science can appear as “the enemy of the parochial” but somehow “loyalty and commitment, regional culture, neighbours and neighbourhood must ... be made to co-exist with academic culture, [which is] seen as international” (1997, p. vii).

This is a book about people and places in differing landscapes scattered throughout Australia, New Zealand and Papua New Guinea. The contrasts in local lifestyles showcase the differing climates, geology and soils, the flora and fauna, and the

---

<sup>1</sup>Sir Gustaf Nossal was made Commander of the Order of the British Empire in 1970 for contributions to medical research most notably immunology and global health. His active work with Aboriginal people is one of the many contributions made to public debate in Australia and through international bodies encouraging inclusive health practices. Named in his honour the Nossal Institute for Global Health conducts research designed to better equip future leaders for better health outcomes globally (see: <http://www.ni.unimelb.edu.au/>). Gustaf Nossal is a Patron and former Chair of the Advisory Committee of the Global Foundation. The Foundation is based in Australia and designed to bring together diverse community voices to help shape policy for Australia's future in the global context (see <http://www.globalfoundation.org.au/>). The purpose of the foundation he states is to “encourag[e] Australia's sustainable national development in a global context”.

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population diversity. At the same time the differing activities of the people reflect their historical past. The dominant legacy of European colonisation has largely shaped the past 300 years. We see an identity development strongly influenced by the traditions of British law and justice, values, education and moral decision making. These “young” democracies have flourished and grown in wealth and expectations. Their citizens have also grown in confidence and learnt to question the acts of the past. Coming to terms with their indigenous heritage and more recent changes in the policy arrangements regarding migration are characteristic virtues of an increasingly well-educated and articulate population.

As the most developed economies in the Australasian Region Australia and New Zealand have experienced a small migration shift away from Europe to Asia. Each year new settlers arrive from troubled countries in South and Central Asia and Africa. Many commence their new lives as refugees in the country in offshore migration centres. However, in total the numbers of refugee settlers are small and more likely to find their places of work and settle in major cities. Australia and Bureau of Statistics (ABS 2010) reported that: “Of the estimated resident population (ERP) of Australia at 30 June 2009 (22.0 million people), one quarter were born overseas (5.8 million people)”. British born residents remain the largest group with significant cross-Tasman Sea movements from New Zealand residents. Added to this observation the ABS reports that: “At 30 June 2010, more than 14.30 million people, close to two-thirds of Australia’s population, resided in a capital city Statistical Division (SD). The combined population of capital city SDs increased by 257,800 in the 12 months to June 2010”. What is even more interesting is that of the total population of 22.33 million at 30 June 2010, 67.5% of people resided in the two major cities of Melbourne and Sydney.

Figures for New Zealand show that as of March, 2011 the resident population was 4.40 people. The New Zealand Department of Labour reports people of British/Irish Republic descent to be the largest cohort of immigrants with small numbers from Asia and the Pacific Islands (Masgoret et al. 2009). The larger cities of Auckland, Christchurch and Wellington are the major recipients of new settlers. Auckland is by far the fastest growing city and shares similar challenges linked with urban sprawl that exist in Melbourne and Sydney. Planning for this population dynamic is a major challenge for both New Zealand and Australian governments.

Smaller nations in the region such as Papua New Guinea and the Pacific Islands struggle for their independence in economic terms and rely on the two major nations for their support. Chapter 10 in this book highlights many of the relevant issues faced in their quest to compete for better conditions and the setbacks that can occur without the backing of a robust economy. Elsewhere in the Pacific small island atoll communities struggle to survive as their traditional sea-based livelihoods are threatened by changing sea patterns and sea-level rise that locals link to atmospheric warming.

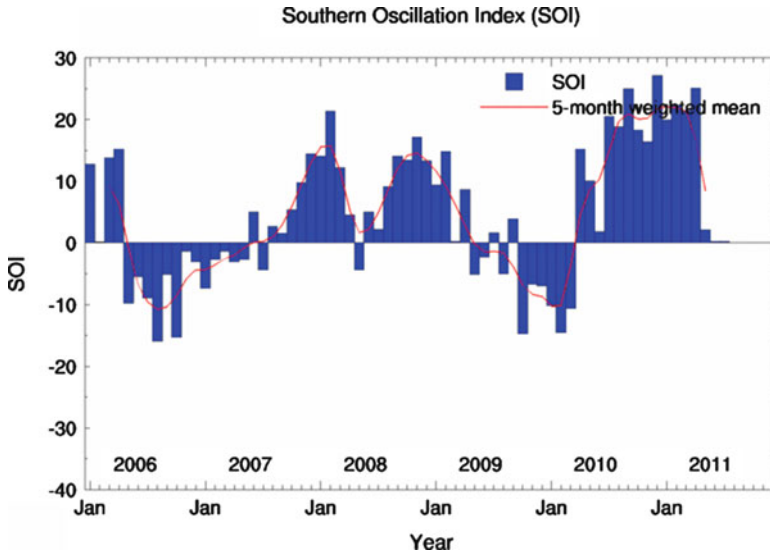
In geographic terms this mixture of people, landscapes and lifestyles lies in “the south”. Somewhat disparaging this term has been used to distinguish the economically wealthy nations of the northern hemisphere from those largely considered less developed. However, as the economists are recognising this distinction is increasingly irrelevant as recognition is given (in this region) to the wealth of Australia and New



**Fig. 1.1** Map of the region (Printed with permission of Geoscience Australia © Commonwealth of Australia (Geoscience Australia) 2011)

Zealand. Australia, in particular, has largely avoided the full impact of the Global Financial Crisis of recent history. Its strong economy has strengthened its monetary system globally. Why? The nation has significant mineral wealth which rapidly developing Asian nations, notably China, need. As Fig. 1.1 illustrates the connections with Asia and the Pacific Rim are geographically close. Given the resource wealth of Australia in particular it is not surprising that the focus of business and commerce has shifted away from the older economies of Europe to the burgeoning new economies of Asia. Likewise people movements for temporary visits and education for young people especially have added to the traffic of communication within the region and its near neighbours. Tourism in both directions is one of the growth industries.

In summary, the focus of this book on schooling for sustainable development within the Australasian Region is timely for a number of intersecting arguments. Rather than providing simple solutions for students, teachers and educators interested in learning about the region we try to focus on bringing evidenced based arguments to the fore. Perhaps in so doing we raise more questions. If that is the case then the book will have achieved another of its purposes which is to raise the level of critical debate about living our lives sustainably within the region and the wider global context.



**Fig. 1.2** “The Southern Oscillation Index (*SOI*) is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin. Sustained negative values of the *SOI* often indicate El Niño episodes and positive values are associated with La Niña episodes” (Source: Australian Bureau of Meteorology. <http://www.bom.gov.au/watl/enso/>. Accessed 16 June 2011)

To pursue this argument and give meaning to the subsequent sections in this chapter we need the context.

At the time of writing it is mid-way through 2011. This has been a significant year in global terms. The climate warming debate has taken on a new reality in the region with floods across most of the Australian state of Queensland and many parts of the states of New South Wales and Victoria. The cause has been linked to a La Niña atmospheric effect including increased cloud cover resulting in cooler temperatures and added rainfall. Figure 1.2 shows the pattern that has dominated the region during the 2010 and 2011 period. It follows a period of prolonged drought caused by the opposite effect of El Niño or excessive warming. Compounding these atmospheric effects has been prolific seismic activity. The Pacific Ring of Fire or the seismic belt that falls to the east of Australia includes New Zealand, Papua New Guinea and the Pacific Islands comprises deep oceanic trenches, volcanoes and the ongoing potential for earthquakes. Whilst the scientific measures of change in the tectonics can provide indicators of sudden movements there appeared to be little warning of the February, 2011 earthquake that all but destroyed the city of Christchurch. Located in the South Island of New Zealand the devastation including loss of life has highlighted the fragility of human existence and provided a terrifying reminder of the power of our natural systems.

We live in a region prone to natural disasters and the potential for human tragedy. In 2011 the full impact of this statement was to follow the Christchurch disaster.

Beaming into the households of families around the globe have been the devastating images of perhaps the worst “natural disaster” in recorded history. The earthquake and subsequent tsunami to strike the coast of Japan in March of this year have been equated in impact with the World War Two bombing of Japan with nuclear weapons. A sad and ironic link lies in both tragedies. Whilst the loss of life from the natural disasters may not ever be fully recorded the likely impact from subsequent nuclear radiation leakage from overheated reactors is unknown and unquantifiable. The weaponry impact may have been quelled by international agreements and pressure on rogue nations. It is more sobering to consider the impact of peaceful uses of this previously considered “green” energy source with its relatively low greenhouse gas emissions.

How we make sense of all these events is part of the learning process we face in our journey with our planet. There can be no firm solutions. As Ball describes the dilemma we face is to explore the interface between science and morality. He puts it simply: “Without the science, morality is blind; but without the morality, science is useless, pointless, and paralytic” (p. 479).

## Key Issues

The remainder of this chapter explores in more depth the issues raised in this introduction and concludes with a summary overview of the book chapters that follow. Topics considered deliberately omit a more focussed discussion of sustainability definitions and education responses including curriculum content. Each of these is a key matter considered in the various chapters that follow. This chapter aims to set the widest possible parameters for considering the issues of sustainability that govern all of our lives. They are not simple and need to be revisited regularly in any localised debate or decision regarding everyday practices, policy decisions and citizenship futures. Key issues raised are:

- Land and landscape traditions – the importance of history
- The importance of understanding geography – regional and rural versus global cities
- Economy, wealth and progress
- Mobilities and communication
- People, wilderness and survival

The list is not conclusive and as the debates on society and climate that surround sustainability are unfolding we can expect that more dimensions to human existence may be impacted and require critical analysis. Interactions between people and place are interactive. The rate of technology development is changing our behaviours at an unpredictable rate of change. In Massey’s view, the solution for this state of our place lies in our ability to work with this change dynamic and rather than assume a particular outcome or behavioural change learn to accept that: “This vision of global space, then, is not so much a description of how the world is, as an image



in which the world is being made” (2005, p. 84). Ball (2004) summarises this as recognition that we now live in a world of “scale-free webs”. Interactions no longer confined by mostly known pathways in the physical sense are liberated sources of exchange. The trick is to consider how the laws of society can provide what he terms “conscious and intentional intervention” where moral dilemmas occur such as the current global debates on climate change (p. 579).

### ***Land and Landscape Traditions – The Importance of History***

Civilisation has shaped a unique heritage in the region that is complex, multilayered and drawn from indigenous, European and more recently Asian and African traditions.

Arguably, where indigenous cultures have largely retained their sovereignty and new arrivals from other traditions are not so pronounced the people seem to retain their customary links with the sea, the land and the resources they provide. Perhaps this applies most in Papua New Guinea where the economy remains largely based on crops, like the cocoa bean that have long been part of the subsistence economy (see Chap. 10 for a detailed account). Elsewhere in the Pacific Islands the traditional fishing industries are now threatened with diminished access to stock largely associated with rising sea levels. A pattern of young people moving to local cities and migrating to bigger centres, especially in New Zealand, is disturbing to the older residents who see their traditional skills being lost. Rather than finding a better life many of the young people are finding themselves with poor alternative employment prospects and dependent on welfare payments from governments “at home” or in their newly adopted country.

In the largest land areas of Australia and New Zealand the indigenous people largely lost that battle of self-sufficiency with the arrival of European settlement in the late 1700s.

In Australia the British colonial occupation and subsequent spread of settlement effectively marginalised the indigenous people and removed their rights to their traditional landscape. Aboriginal people were and remain the ancient people of the land. In appearance they have more connection with neighbouring indigenous people of Papua New Guinea and it can be assumed that with close physical connection in the far north of the continent of Australia there were exchanges as there were with the Torres Strait Island people who are now considered members of the Aboriginal people of Australia. Archaeology, artefacts including cave and rock paintings provide clues to their arrival time but no definitive answer. Estimates suggest around 40,000 years ago they arrived “by accident” from land and sea links that existed with Asia (Berndt and Berndt 1996). However, existing tenure was not recognised by the invaders of their lands. The system of government developed under instructions from the British colonial office led to the vast lands of the continent including Tasmania being carved up into states. Initially they were independent colonies each with their own system of government but were bound together by the British Parliament’s Act creating the Federation of Australia in 1901.

Aboriginal numbers declined rapidly through direct confrontation, abuse, illness through direct contact with the settlers as well as failure on the part of the authorities to recognise the people as having any rights of their own. More than 200 years later Aboriginal people have gained limited access to their lands through the parliamentary act of Native Title of 1993 which granted recognition of Aboriginal Title.<sup>2</sup> However, it was not until 1967 that Aboriginal people were granted the right to vote in Australian parliamentary elections (Australian Electoral Commission 2006). Made up of multiple nations each with their language and customs the remaining indigenous people remain the demographic cohort that most disturbs humanitarian watchers. They have the lowest life expectancy and infant mortality rates and participation in education and the formal workplace are also low by comparison with other cohorts within the Australian population. These findings defy the standards expected by other Australians and raise many issues associated with Human Rights. However, there is always optimism and non-Aboriginal people are slowly learning how to interact with the indigenous elders who represent their people and this is well highlighted by Jenni Webber and colleagues teaching in what is known in Australia as “the Far North” (see Chap. 8). Their observations are based on teaching experiences with indigenous children in the far north of Arnhem Land.

To the east across the Tasman Sea in New Zealand the Maori people are the first people of the land. Their history differs significantly from that of indigenous Australians and links directly with the Polynesian islands to the east. They are thought to have arrived in Aotearoa (Maori name for New Zealand meaning “land of the long white cloud”) in the 1300s. From the beginning of occupancy they established a culture of settlements built on a shared language and customs based on their Polynesian roots. Their social practices were rich with mythology including rituals around a warrior past and continuing battles to retain land and resources for survival. Tattoos are often worn as part of this symbolism.

As could be expected the arrival of the Europeans in the 1830s was met with resistance. The conflict was partially resolved through their independence as a sovereign state followed by the Treaty of Waitangi in 1840 which ceded sovereignty to the British. The Treaty remains the core document in negotiation of lands rights and agreements with Maori people. The history of the Maori and Europeans is mixed with troubled times in the early days being largely resolved but with a continuing lag for many Maori families in terms of general health and well being indicators. Nevertheless, today Maori and generations of European heritage plus people of many different nations all call New Zealand home. Intermarriage and cultural intermingling and assimilation have created what appears to outsiders as a sophisticated co-sharing of resources. Maori people represent approximately 15% of the total estimated population of 4.4 million (Statistics New Zealand 2011). Today they can be found represented in all walks of life including the Parliament.

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<sup>2</sup>Refer Commonwealth of Australia Acts. See [http://www.austlii.edu.au/au/legis/cth/consol\\_act/nta1993147/](http://www.austlii.edu.au/au/legis/cth/consol_act/nta1993147/). Accessed 20 June 2011.

Whilst the identity of both Australia and New Zealand is deeply connected to the land, including the indigenous people and their customs it has to be acknowledged that the history of this recent period of sovereignty is strongly European. The official language is English, the Parliamentary and judicial systems are founded on the Westminster system of democratically elected governments and leaders all of whom are held to account by an independent judiciary. Hence, any legislative changes have to be considered in the context of the governing systems. This is no more clearly evident than in the current debates on the issue of responses to climate change including the Australian government's policy of imposing a carbon tax as a way of changing behaviours away from the high emitting gases to more sustainable sources in line with global treaties (including the Kyoto Treaty). The minority government has to rely on public opinion to sway the voters in favour of the legislative changes.

In New Zealand the changes have been partially met. Their Emissions Trading Scheme is already in place and meeting the climate change policy challenges with much of the detail for energy users including industry, business and the community already in place.<sup>3</sup>

In brief, the history of both nations is relatively brief in terms of current sovereignty arrangements and retains the British monarchy as the official Head of State. Perhaps more of a figurehead role and somewhat anachronistic in terms of the day to day politics the structure of their respective constitutions are a reminder of their embeddedness in European and especially British traditions. This must surely change in the future. Significant numbers of new dwellers from Asian countries, trade with each other and their economies are strongly linked with those of China, Japan, and the Republic of Korea.

### ***The Importance of Understanding Geography – Regional and Rural Versus Global Cities***

To ignore geography in the region can be fatal. Historians have played on this fact with their titles that include Robert Hughes' *The Fatal Shore* (1987), Geoffrey Blainey's *The Tyranny of Distance* (1966), Donald Denoon's *Getting under the Skin: The Bougainville Copper Agreement and the Creation of the Panguna Mine* (1996), and James Belich's *The New Zealand Wars* (1988). In each of these accounts there is recognition of the hardship faced to make a living and get ahead in life. There are also references to the yoke of repression and the need to be free of the oppressors. For Australia and Australians this may have linked directly to the convict period of the first half of the nineteenth century. These were convicted men and women sent from England to serve out their custodial sentences in colonial

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<sup>3</sup>For details on the New Zealand Emissions Trading Scheme see Emissions Trading Scheme.

prisons mostly located in the colonies of New South Wales and Tasmania. Once served many of the convicts made good use of the vastness of the landscape and through hard work and access to the wealth of the land were able to create new identities linked with success including property. Farmers producing wool tapped into the export wealth of the early period of expansion into the western plains of the eastern states and along the river flats reaching inland from coastal settlements. Major settlements became the trading ports and linked the colonies by sea. In the early days of European settlement to attempt such links by land was almost beyond human reach – until the settlements were linked by rail mostly in the latter half of the nineteenth century. Rail, sea and river links especially along the Murray River were to bring the vast land together into some kind of unified whole. The transport links also enabled the movement of the much needed mineral wealth between the states and to international export markets that provide the basis of economic wealth for the nation today.

In brief, it was nation building based on equalitarianism but not without its divides. The English Protestant “haves” or well educated nobility who initially ruled the colonies were soon to face unexpected social and political challenges from a rapidly learning Irish Catholic “have-nots” some of whom had been sent to the colony because of political dissonance (Hughes 1987, p. 193). As Hughes states the political affiliations were to dominate the power politics of Australia for much of the twentieth century. At the same time and recognising the differences the vastness of the land meant that there was little likelihood of rebellion based on too few resources. After the crowded islands of England and Ireland this was a paradise meant to be enjoyed. Excluding the Great Depression of the 1930s for the most part they did enjoy, prosper and change the “face” of politics.

Economic wealth and progress in the nineteenth century created the need for public buildings and services. The public face of the nations of Australia and New Zealand were born during this latter part of the nineteenth century. The cities and towns that served often vast hinterlands in area contain an extraordinary assortment of architectural gems linking classical with a unique “federation” or “contemporary” style to reflect the rising status. At the same time the need for access to deep sea water ports concentrated the settlements into the capital cities. The lamentable result has been a decline in direct access to essential services in many rural towns and “forced” movements to the bigger cities of young people particularly for education and jobs.

### ***Mobilities and Communication***

The geography of the region includes one continent (Australia); a large island nation (New Zealand); difficult and complex mountain terrains (New Guinea) and many island communities. The patterns of settlement reflect both challenges posed by the terrain and the arrival points of early European settlement. Not surprisingly, the largest cities have coastal locations and good external access for bulk sea cargo and passenger

vessels which in turn can offload onto the national land travel grids. International air links provide the other element in the transport communication systems.

The Australian and New Zealand histories of European colonisation of the interiors out from fairly sparsely arranged sea access points help explain current and ongoing sustainability dilemmas. From these initial landing points nineteenth century rail networks laid by the British settlers helped the respective colonies to move goods from key points. However, the vastness of the distances between settlements generally made it difficult for governments to maintain the supply lines and/or establish the requisite routes. In Australia this was compounded by each colony (or states as they became after Federation in 1901) having different rail gauges. Hence, as settlements spread into the arable land areas mostly along the rivers and/or people flocked to minerals and energy sources land transport became the practical means of moving people and goods. Today the major means of moving goods on land is by road. In Australia road “trains” sometimes consisting of three and more trailer trucks are the largest and heaviest in the world. Whilst restrictions apply within the zones of city limits the prevalence of road transporters plays havoc within metropolitan areas. Restrictions exist but still allow for trucks with two trailers. Needless to say this road flexibility mixed with normal suburban street traffic is a cause of frustration for all drivers and a major issue for control of emissions including noise.

The other side of this problem is mobility access for resident populations. Rapid immigration to the major cities of Australia and New Zealand places severe pressure on infrastructure. Suburban rail, bus and tram networks struggle to maintain basic needs. The result is that people have largely come to rely on privately owned vehicles. Indeed, there appears to be a perception in Australia and New Zealand that private car access to wherever you need to go is the only option. Any attempt by governments to change behaviours to rely more on public transport and “get back in on the bus” in the short term at least is likely to meet with stiff opposition. The less than perfect public transport system helps to entrench the cultural reluctance to shift “back” to public transport. Point to point driving in the comfort of one’s own vehicle is perceived as “convenient” and less frustrating in terms of public transport delays. The flip side of this is people seem more prepared to ignore the traffic jams, long queues at traffic lights and difficulties with parking!

The dilemmas are not easily solved. An upgrade to the rail and road system in a land area the size of a continent is a budgetary requirement of staggering proportions. Unlike small compact land area nations such as those in Europe there is not the revenue base in the population to meet this challenge without a lot of financial pain and realignment of employment for families and taxpayers. Similarly, equivalent land masse nations like the United States and to a lesser extent Canada have the population numbers to spread the cost.

Arguably, the inherent difficulties which people associate with declining quality of public transport infrastructure also colours attitudes to policy change including the probability of a tax on carbon emissions. Whilst, the consensus view appears consistent with the belief that we need to change our habits for our children to inherit a sustainable planet there is less willingness to forgo current behaviours that all too often appear as “rights” rather than privileges. Public re-education is facing down the barrel of 200 years of history and expectations regarding lifestyle and entitlement.

## *People, Wilderness and Survival*

The people of the Australasian region are as diverse in identity as the region itself. Imagine, hundreds of populated islands complementing the larger land areas all with locally linked economies and lifestyles and often separated by large expanses of waterways and hostile landscapes. Indigenous people throughout the region have survived for thousands of years on the fruits provided within their adopted lands. To gain an overview of the hundreds of land/people relationships some form of simplification is to consider the South Pacific island groupings as a cohort of nations and then a brief return to the major economies of Australia and New Zealand as separate studies.

The major subregion groupings of islands within the region are distinguished ethnically as Melanesian (Papuan speaking people including the Solomon Islands); Micronesian (island atolls including Nauru to the north of Papua) and Polynesian (including Samoa, Cook Islands and Maori people). In Papua New Guinea, for instance, shifting cultivators produced tropical crops such as sweet potatoes and relied on pigs and fish along the coastal regions. Similarly people on the tropical islands of the South Pacific have survived on agriculture and the sea. Importantly, in this brief reference, it needs to be noted that every island economy developed distinct cultures and traditions all of which can be a separate and fascinating study of struggles for survival, human dignity and perhaps in more recent times an element of human tragedy. As forces of nature through rising sea levels, volcanic activity and the impact of western expectations on young people has tested the resilience and foundations of identity in each of these many small nations.

Compounding this reality is that the last 200 years of colonisation of the hundreds of islands in the region has shifted sovereignty to many distant powers including Britain, France, US, Australia and New Zealand. Each has capitalised on the tropical locations and their “protectorate” vantage points dotted across the Pacific Ocean. Tropical crops such as coffee production in Papua New Guinea; sugar in Fiji; mining; tourism and recreation and lifestyle attractions have all provided incentives to experience and occupy these small nations. Missionaries too have played a significant role in the histories of many of the nations. The result over time has led local economies into a dependent role often with distant powers which have not necessarily helped local people to secure their futures. Some, however, are striving to succeed as independent sovereign states. Once under the protectorate of Australia and still “helped” by Australian expertise, Papua New Guinea is a particular example of a nation taking back its sovereign power and seeking economic independence for its people. Today its wealth includes commercial agriculture and minerals that attract investment from foreign owned companies willing to invest in infrastructure and employment – admittedly largely to suit their needs. Nevertheless, the new skills and wages help create a consumer economy and demand for services in settlements to match.

Where the new wealth is used to provide better health and education for local people this can be rewarding. Larger economies developing in Fiji and Papua New Guinea have a better chance of securing a sustainable future and maintaining independence. At the same time for these and other developing economies heavy

dependence on foreign investors can create its own problems. Perhaps the most controversial “use” of these often fragile island atoll economies is connected to exploitation by the larger powers. Most recently this has included establishing refugee “offshore” processing centres to control migration movements seeking to relocate to Australia, in particular.

To summarise so far, sustainability of the hundreds of small islands within the region is caught between the realisation that climate change may see the end of their low lying atoll lifestyles and the pull of bigger nations for investment, jobs and a future. Beyond these somewhat gross generalisations which overly simplify the issues the complexity of the island regions means that providing adequate coverage of their economies is far beyond the scope of this book. Relevant references for further study on identity and development issues in the Pacific include publications by experts who have focussed their research in the region like Donald Denoon, Professor of Pacific History, The Australian National University (see Denoon 1997; Denoon et al. 2000).

Turning attention now back to the largest island economies of Australia and New Zealand connects to the earlier section in this chapter related to the population history of the region. Unlike the smaller island economies of the South Pacific both these nations are considered to be rich modern economies. New Zealand’s wealth is strongly agriculturally based with a heavy reliance on primary production for its Gross Domestic Product (Statistics New Zealand n.d.). So too is Australia where the biggest export earners are minerals. Coal, iron ore, aluminium, natural gas and petroleum as well as agricultural products are the major monetary earners (Australian Department of Foreign Affairs and Trade 2010). In both nations the land has served the people well in recent times and helped sustain their respective markets. As noted in the beginning section of this chapter minerals and energy commodities especially for industrialising needs continue to attract high needs markets like China, the United States and Japan. Added to this is the live export trade of cattle and sheep to South Asian countries as well as processed primary produce.

It could be argued that the “wilderness” encountered by the European colonisers has helped the people in these neighbouring countries attain their high standards of living. The stories of survival in tough times of natural disaster as well as the more hostile lands away from the coastal plains are chronicled in the works of poets, writers, film producers and artists. Oral traditions remain of core importance in the rituals and traditions of Aboriginal people as they are for the Maori people. In their respective nations of Australia and New Zealand their need to survive is relived in celebrations with non-indigenous people as well as cultural rituals within their own people. The other great tradition is the oral histories of settlers best heard around the camp fires of remote communities and in the bars of the hundreds of pubs. Public education encourages the mix of Indigenous voices with those of more recent arrivals. The folklore is that the close bond comes from their shared history in the region. Known to their colonisers as “the new world” and peopled by arrivals often fleeing poverty or persecution and mostly from England, Scotland and Ireland in the nineteenth century Australia and to a lesser extent New Zealand are viewed as lands of opportunity or as Donald Horne (1964) once described of Australia, *The Lucky Country*.

Arguably, successful integration of the different cultures is increasingly shaping a blended society with people all seeking their share of the wealth. To be sustainable the new arrivals like their indigenous co-citizens all have to survive in what remain as landscapes that still need to be conquered and perhaps most of all still dictate the terms of what can be achieved for future generations.

## The Chapters

The chapters that follow all contribute to our broadening understanding of the region. Their unifying focus on schooling for sustainability has been to deliver evidenced based case studies and reference materials of particular localised regions and to better inform our decision making regarding educational resources and strategies for learning. There are materials for schools and higher education all of which challenge our current knowledge.

The chapter order reflects our view that we first need to describe the region and existing practices that might be relevant for more specialised study. In Chap. 2 by Allan Harrison and Ken Purnell and Chap. 3 written by Pamela Williams the respective contexts of sustainability or environmental education are outlined for Australia and New Zealand respectively. Complementing these overviews, in Chap. 4 Alaric Maude provides considerable critical insight to the materials available to teachers both in the form of curriculum guides and text book supplementary support materials. His views are further supported in Chap. 6 in which Robbie Johnston shows how curriculum limitations impact on teacher decisions. She suggests strategies for enquiry based learning and less rigid approaches to teaching. Similarly Alison Lugg in Chap. 7 is able to show how allowing for student voices in pre-service education or teacher training programs permits a growing confidence in learning how to be a teacher of sustainability. This guidance is developed further in the approach taken by Richard Le Heron and colleagues in Chap. 5 in the context of schools in Auckland. Both these chapters lend support to the inclusion of more opportunities for student or practitioner voices the curriculum design.

To ground the reality of all the advice in the beginning six chapters Jenni Weber and colleagues describe the practicalities of delivering the content in a primary school located in the Gove Peninsula which is in the far north of Australia. Here the children are predominantly Aboriginal and the curriculum created needs to blend the formal advice with the local perceptions and indigenous knowledge.

Rounding off the overview of practice based learning about sustainability is a set of chapters (Chaps. 9, 10, 11, 12 inclusive) on research based case studies. Trevor Budge and Andrew Butt (Chap. 9) and Nigel Tapper (Chap. 11) focus on complementary perspectives related to urban landscapes. The former relates to urban planning and the latter to water management in the large metropolitan zone of Melbourne. Better planning decisions are evolving from the research evidence related to water harvesting and management. Innovative new projects in the inner city redevelopments reflect these decisions. Complementing the urban research



studies has been developments in spatial technologies and modelling techniques. Chapter 12 outlines these developments and includes cases studies of applications to teaching in schools and higher education. The final chapter in this group (Chap. 10) by George N. Curry, Gina Koczberski, Joachim Lummani, Sean Ryan and Veronica Bue combines field based findings into the crop production of coffee in Papua New Guinea with insights to the changing practices of traditional landowners. The outcome of a landscape in tradition highlights the flow on effect of education, consumerism and an economy in the early phases of transition.

Chapter 13 provides summary comments and some recommendations from the region that can assist readers both within the borders represented and as interested learners from other regional landscapes.

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# Chapter 2

## Sustainability Education in Classrooms: Developing Teacher Expertise

Allan Harrison and Ken Purnell

### Introduction

The long awaited Murray-Darling Basin Plan was released in October 2010. The plan changes the way water is supplied and used in the Basin and is lauded by environmentalists as a revolution in the way we share water between industry and nature or it is billed as a disaster by agriculture and commerce. Whether one laughs or cries is based on one's values and investments. Irrigators and ecologists seem unable to see or understand the other's interests much less integrate them into a solution. So who decides the competing economic and environmental claims? Science or business? If people in the Basin decide water's ultimate use, whose voice will be heard? And if the contest is decided in national markets and government, people in the region need convincing that the decision is the right one.

The simple answer is to demand quality data and robust analysis of data and evidence. But who decides which data count as evidence; how the data are interpreted and which evidence has the higher status? These questions underpin the way we validate knowledge and reach conclusions; and, because these questions involve the way we think, deriving sustainable practice is about epistemology or thinking about thinking. Science and geography provide us with sound ways to evaluate and interpret quantitative data and sociology and psychology show us how to think critically and resolve conceptual conflicts. Modern science and statistics are mostly reliable but frequently education programs seem to emphasise

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rote and instrumental learning over meaningful and relational thinking (Ausubel 1968; Perry 1970; Skemp 1976). Relational thinking and meaningful learning is needed if science and geographical education is to empower students so that they can resolve some of the conceptual conflicts that permeate environmental debates. Both preservice and inservice teachers should lead the way in promoting thinking about knowledge and this means that some teachers need a crash course in epistemology.

An environmental dispute that highlights the epistemological issues is climate change is global warming (Miles and Purnell 2005). Is global warming a natural phenomenon or anthropogenic? If it is anthropogenic, how much of the change is due to human activity? How we understand climate change and its causes does affect our conclusions and actions. Skeptics say climate change is a natural cycle that we should accept and turn our energies to other projects and enterprises. If climate change is a natural cycle, there may little we can do to limit or reverse changes like temperature and sea level rises. Conversely, if human activity is a major contributor to global warming, then there is much we can do. It does matter how we understand global warming because knowing how the underlying processes work affects how and what we teach students and citizens. In Box 2.1 an example of ozone layer depletion is provided.

### **Box 2.1** An Environmental Example: Ozone Depletion

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Science is acutely aware of the causes and effects of environmental damage; but scientists have rarely been effective change agents. The politics and power of industry and commerce ensures that much research sits on shelves gathering dust. A classic example was Dow Chemical's successful suppression of the ozone depleting effects of CFCs and halons (used in refrigerators, air conditioners and fire extinguishers). Rowland and Molina publishing their stratospheric mechanism in *Nature* in 1974 yet it took 15 years for the 1989 Montreal Protocol to emerge. They were awarded the 1995 Nobel Prize for their work. As far back as 1930; however, Chapman theorised the cyclic synthesis and destruction of ozone in the upper atmosphere yet the processes underpinning the ozone hole went unheeded for 60 years! More recently, there has been an environmental awakening as scientists from "cool" cosmologist Paul Davies through to "hot" environmentalist David Suzuki argue that we must protect planet-ark Earth. While science provides the evidence and argument, education has the epistemological tools to achieve conceptual change in the face of skeptical lobbyists, political donors and simple ignorance. A full account of the ozone story is found in John Gribbin's (1988) book, *The hole in the sky*.

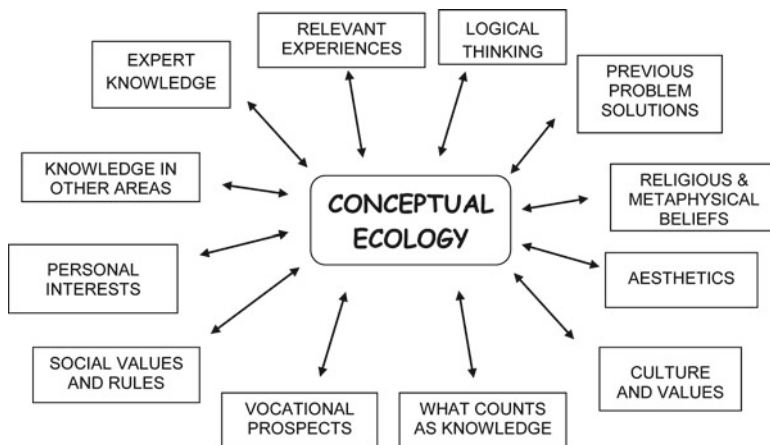
## ***The Magnitude of the Problem***

So, why do teachers and education systems struggle to identify the dubious data and arguments presented by different interests? One reason is the education consumer's preference for "tell me what to do, not how". Relational knowledge is superior to instrumental knowledge and Ausubel (1968) showed the benefits of meaningful learning over rote; yet rote methods dominate many classrooms. Vygotsky's (van der Veer and Valsiner 1994) social constructivist strategies are a useful way to enhance learning when discussion and argumentation occur; namely, situating the debate in the *zone of proximal development*. Yet Vygotsky's work is still poorly understood and not widely used by teachers. This chapter sets out to describe and explain the barriers to learning that constrain conceptual growth and change. We start by examining thinking (epistemology), the history of conceptual learning and the tools available to educators.

The immediate difficulty in environmental study lies in reliably interpreting data and deriving trends from data. This presupposes that we understand the basic concepts underpinning the science and this is where the problems begins. We cannot assume that because we live in the natural world, we intuitively understand how it works. Science is hampered at many levels of the spectrum of intuitive or alternative conceptions. A surprising finding is that alternative conceptions are consistent across most cultures (Vosniadou 1994). Almost every alternative conception in science has now been reported and described in detail (for example, Carey 1985; Chi et al. 1994; Driver et al. 1994; Harrison and Treagust 1996; Novick and Nussbaum 1981). There is little value in finding more alternative conceptions, changing the way we teach and learn is of far greater benefit. First, we should remember that conceptual change research shows that initial conceptions (and intuitive conceptions are of this kind) are amazingly resilient. Similar findings are evidenced in geography (Lane 2009; Ozturk and Alkis 2010). Personal conceptions resist change because they are part of who we are and they are quickly reinstated once people leave instruction and return to their everyday lives (Posner et al. 1982; Schmidt et al. 2007; Strike and Posner 1992). The reason? Personal conceptions exist in a person's conceptual ecology.

## ***The Conceptual Environment***

Stephen Toulmin (1972) introduced the idea of conceptual ecology. Just as an environment comprises many interconnected producers, consumers and decomposers, thinking can also be seen as an interactive web of related ideas, processes and commitments. Concept maps look very much like a food web and at a simpler level, the thinking environment's many forces can be pictorially presented as shown in Fig. 2.1.



**Fig. 2.1** Some components in a person's conceptual ecology (After Strike and Posner (1985) and Toulmin (1972))

We do not suggest that all these items are logically related, just that they exist. You can probably think of further influences that affect a person's conceptual ecology; what is not in dispute is that the way we think is constrained by multiple influences, not the least of which is our experiences. This makes the task of conceptual change harder because we must act on multiple fronts when teaching for conceptual growth and change. It also seems reasonable that not all of these forces act with all people nor do all act at any one time (Strike and Posner 1985). Teachers need to be aware of the multiple sets of epistemological constraints that populate their classrooms. In Box 2.2 ideas on how people view the ways in which the world works from intuition is examined.

### **Box 2.2** Intuitive Ideas on How the World Works

Students bring many intuitive ideas to instruction (Driver et al. 1994; McDermott 1993; Pfundt and Duit 1994) and much classroom research was devoted to developing conceptual change learning models that address these views (Duit et al. 1992; Nussbaum and Novick 1982; Posner et al. 1982). Some high achieving students complete science courses with many of their intuitive conceptions intact (Champagne et al. 1985; Yager 1991) indicating that their intuitive conceptions are not changed by the received instruction, and progress in synthesising an effective model of conceptual change teaching is slower than expected. It was thought that discrepant events highlighting differences between students' and experts' conceptions would change intuitive

(continued)

**Box 2.2** (continued)

ideas (for example, Cosgrove and Osborne 1985). Students may simply allow the “new” science to co-exist alongside their intuitive views (Scott 1992) and rote learn the desired concepts for the duration of the topic and return to their intuitive views after the test, or “explain away” the obvious differences. Some investigators argue that conceptual change learning is an incremental process (Duschl and Gitomer 1991) that is driven by a range of hot, irrational, social and motivational forces (Pintrich et al. 1993) as well as the rational forces. Solomon (1987) found that social factors were as important as rational arguments in learning and knowledge construction. Other studies suggest that conceptual change is successful when the social milieu of the classroom supports the construction of the desired concepts (Yager 1991). The point is that learning is a social enterprise that draws on multiple factors.

## A Theoretical Framework for Changing Conceptions

We now discuss the origin and persistence of intuitive and alternative conceptions (Strike and Posner 1992; Vosniadou 1994). Competing conceptions on environmental issues are remarkably similar to the experience of geography and science educators. This makes sense when we realise that people are constantly constructing “theories” that fit their experiences (Tobin 1993) and their thinking on new phenomena is always in terms of what they already know (von Glasersfeld 1995). It is reasonable that students will spontaneously construct explanations of environmental changes when these changes affect their perceptions. To develop pedagogies that redress the dissonance between students’ environmental theories and the accepted geography and science explanations of phenomena like weather, geology and pollution (to name just three topics), we need to understand how and why students think the way they do (see, for example, Hewson 1981, 1985; Posner et al. 1982). This is not easy given the difficulties in determining how and what people think about theories that are themselves developing or are hotly debated. Environmental issues like climate change, water in Australia and jobs versus the environment do not make this easier. Also, many people are reluctant to tell researchers what they think and less so why they think the way they do. Community pressures can inhibit open discussions; and for this reason we look to less emotive research areas like mathematics and science for clues.

Early conceptual change education recommended first generating dissatisfaction with a person’s current (alternative) conception followed by enhancing the status of the desired geographic or scientific conception (Cosgrove and Osborne 1985). Conversely, subsequent research such as Hewson’s (1981, 1982, 1985, 1992, 1996) prioritised raising the status of the new conception at the expense of the old conception, arguing that conceptual change should occur when preference for the new

**Table 2.1** Summary of types of conceptual change proposed by various authors

Author	Information addition	Easy conceptual change	Difficult conceptual change
Kuhn (1970)		Normal science	Revolutionary science
Lakatos (1970)		Protective belt changes	Hard core changes
Posner et al. (1982); Strike and Posner (1992)		Assimilation	Accommodation
Hewson (1981, 1982)		Conceptual capture	Conceptual exchange
Carey (1985)	Simple accretion	Weak restructuring	Strong restructuring
Vosniadou (1994)	Simple accretion	Weak restructuring	Radical restructuring
Chi et al. (1994)	Implied accretion (added information)	Branch jumping (new classification)	Tree swapping (ontological change)
Duschl and Gitomer (1991)		Incremental or evolutionary development of new conceptions	
Thagard (1992)	Adding an instance	Continuum	“Tree switching”

conception generated sufficient dissatisfaction with the prior conception. In summarising the literature, we argue that there are at least two conceptual change levels (easy and difficult). Some of the popular conceptual change models are summarised in Table 2.1.

Table 2.1 shows that most writers see conceptual development or knowledge restructuring as occurring at two or more levels. The first, *weak restructuring*, involves the addition of new facts and the generation of new relations between existing concepts. Assimilation and conceptual capture are examples of weak restructuring and this type of conceptual change is less dramatic and easier to achieve because people simply capture or add new information to their conceptions in unproblematic ways. As Hewson and Hewson (1992, p. 61) concluded: “Much of what students do is learning things they didn’t know by making connections to what they already know; this is not a problem when their present views can be reconciled with what they learn”.

The second level in Table 2.1 of *radical (or strong) restructuring*, involves changes to core concepts, conceptual structure and the phenomena that can be explained by newer theory. Chi et al. (1994) see radical restructuring of conceptions in ontological terms meaning that students change the way they view a phenomenon; for example, heat changes from a material fluid to a flow of energy. Thagard (1992) also describes the strongest conceptual change in ontology-like terms, but suggests that there is a continuum of conceptual changes ranging from adding a new instance of a conception (weak) right through to ontological change (strong). Examples of this type of conceptual change are accommodation and conceptual exchange (notice the Piagetian influence in several theories). At this level of conceptual change, the status of one conception can only rise at the expense of the competing conception; that is, the two conceptions are incommensurable (Hewson and Hewson 1984; Kuhn 1970). The more *intelligible, plausible* and *fruitful*

conception succeeds, at least for the time being, because conceptual status is fluid. Posner et al. (1982) predicted that some people will regress to their prior conceptions if the stimulus for change is not sustained or anomalous evidence is placed before them. This is common in environmental discussions! Lastly, the notion that prior conceptions become *extinct* is untenable because all people remember, to some degree, their previous ideas. Reinforcement of learning of conceptual growth and change in student learning experiences is critical to improved conceptual understanding (Lane 2009; Purnell 2010).

While theories describing the cognitive processes involved in conceptual change have been well-articulated, what actually happens in learning and thinking is less clear. For example, people's "conceptual frameworks" may not necessarily change in the expected manner during learning even though a sound argument is presented (see Lane 2009; Linn and Songer 1991). Moreover, Solomon (1987) showed that learning is strongly influenced by social contexts, which mediates the changes that take place during thinking. Pintrich et al. (1993) challenged the notion that conceptual change is a cold, rational process (Strike and Posner 1992) by arguing that a wide range of hot, irrational, social and motivational factors mediate knowledge restructuring in everyday classrooms. Again, the relevance to environmental discussions is obvious with often highly emotive input.

People's conceptual development therefore consists of a variable mix of: introduction of new facts and concepts; weak restructuring of existing conceptions; and strong restructuring of existing conceptions. Working from this base, and bearing in mind the importance to learning of motivation, interest and social factors, concept substitution (Grayson 1994, 1996) seems useful when dealing with sustainability conceptions. Rather than aiming for across-the-board dissatisfaction with inappropriate conceptions, concept substitution involves probing a person's ideas to expose the current understanding of the topic (Lane 2009; Ozturk and Alkis 2010). During learning or debate, the acceptable aspects of the person's alternative conception(s) are identified and reinforced so that they realise that these ideas are correct. Hashweh (1986) recommended that teachers should "show students that their preconceptions are not wrong but limited ... that their preconceptions ... are indeed special cases of the post-conceptions and could be derived from these preconceptions" (pp. 245–246). In this way, a student's correct ideas function like Clement et al.'s (1989) anchoring conceptions. The correct aspects of the alternative conception are used as anchors in reforming the incorrect aspects of the alternative conception. This process appears to utilise the key elements of Ausubel's "meaningful learning" theory (Novak 1984).

We therefore believed that Ausubel's (1968) theory of meaningful learning is particularly useful for interpreting changes in student conceptions that occur during constructivist learning episodes. The central idea in Ausubel's theory is that of *meaningful learning*, which he defines as "nonarbitrary, substantive, nonverbatim incorporation of new knowledge into cognitive structure" (Novak 1984, p. 608). Nonarbitrary incorporation of new knowledge means that the new knowledge is always related to prior knowledge and that the *learner* makes a conscious, deliberate effort to harmonise the two. This sits well with Grayson's (1994, 1996) concept substitution. Ausubel saw that each person's "cognitive structure is unique, and



subsumption of new knowledge produces a cognitive *interaction product* that is dependent both on what concepts or misconceptions the learner already has and the material presented” (Novak 1984, p. 608). In meaningful learning, pre-tests and formative discussions that expose and revisit students’ prior conceptions in light of where they now are, provide effective ways to monitor and mentor cognitive growth. These techniques also identify inappropriate interaction products, or synthetic models (Vosniadou 1994) that arise when past and present conceptions interact (Strike and Posner 1992).

In the context of sustainable environmental education, Ausubel’s (1968) notion of *progressive differentiation* of concepts is especially useful because most students do not differentiate natural changes from human changes. Indeed, the plethora of environmental data may seem, to students, like a fog with no clear forces or relationships. The media have obfuscated data and patterns to the point where the way forward is like driving in a fog. Not only must students first differentiate competing concepts, they must learn to *reconcile* each in an *integrative* way so that they can tease out cause-and-effect relationships. Only then can sustainable strategies be identified for dealing with climate, water, energy or waste management problems. Learners also need real-world opportunities in which they can apply their new-found concepts in a mutually constructive manner. For example, the Energy Efficiency in Schools project (see Purnell 2004; Tabert and Purnell 2007) had as a major outcome the reduction of school electricity accounts by at least 15% in the year following participation in the 7 day residential program for students. Over the 5 years that the program ran, all participating schools were able to utilise expertise developed by their students to significantly reduce electricity costs – in one case by 50% (see Purnell 2004; Purnell et al. 2004). This required students to develop concepts associated with energy production and usage that were then integrated to develop an action plan to reduce energy usage at their schools. Contextualised within that research was another project in which 78 participating schools across Queensland had solar photovoltaic power systems installed. In this latter project the impact on student conceptualisations of energy use and impacts upon greenhouse gas emissions was found to not be robust (Tabert and Purnell 2007). The importance of aligning curriculum, learning experiences and assessment was clear as was the notion of having an “emotional hook” that appealed to students in their learning. Also a commitment to making changes that has been shown to be instrumental in influencing behaviours and conceptual understandings (Burns 1991; McKenzie-Mohr 2000; Woods and Skumatz 2004). In the Energy Efficiency project it included lived experiences associated with energy efficiency that involved students from other schools and the students who participated with the project had as a goal upon their return to their schools the reduction of energy use by at least 15% within a year. This required the development of robust concepts associated with energy production and use as well as social and emotive work with fellow students and teachers to achieve outcomes. The importance of changing behaviours in addition to thinking was evidenced too in a review of the literature by Gralton et al. (2004). That interplay between cognitions and behaviours and the reinforcement of those for quality learning is important to teachers as we seek to develop robust student conceptions based upon evidence.

Ausubel (1968) observed that students often engage in *superordinate learning* where, as a consequence of conceptual differentiation and reconciliatory integration, they generate new relationships between their old and new knowledge. The use of concept mapping is particularly useful for consolidating new hierarchies and new connections between propositions and concepts. It is worth noting that Novak (1984) derived concept mapping from Ausubel's theory. Ausubel also proposed the use of *advance organisers* as a pedagogical strategy. This device, often an analogy, is more general and more inclusive than usual learning episodes and points forward to new knowledge and may be "perceived by the learner to act as a cognitive bridge between what he or she already knows and what is to be learned" (Novak 1984, p. 608). Box 2.3 provides an overview of meaningful learning.

Carey's (1991) work, with basic science concepts, found that children consistently fail to distinguish between entities like mass and density. To make sense of scientist's science, she argued that students need to *differentiate* incompatible concepts (for example, mass/density, heat/temperature) and *coalesce* separate concepts that belong together (for example, humans are animals). There seem to be

### **Box 2.3** Summary of Meaningful Learning

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*Progressive differentiation* of ideas identifies things that are the same from those that are different. Environmental example: greenhouse and ozone depletion are often treated as the same phenomenon. They are quite different concepts with the rider that ozone and chlorofluorocarbons are minor greenhouse gases. Differentiation of students' ideas that are acceptable from those that are wrong reveals a commonality between *meaningful learning* and *concept substitution*.

*Integrative reconciliation* is the process of recombining conceptual elements in acceptable ways. An environmental argument's structure after reconciliation will look quite different to the argument before differentiation. Example: Greenhouse's global warming effects may manifest as temperatures rises due to increased atmospheric heating or it may be less dramatic due to enhanced albedo of more clouds.

*Superordinate learning* is the process of assigning new titles and concept names to the parts of a cause-and-effect explanation. This accompanies integrative reconciliation and reveals itself in the process of changing the parts of the explanation that were wrong (concept substitution of desired for unacceptable concepts happens here). In a concept map, it is the addition, removal or reassignment of a key process.

*Advance organisers* emerge as teachers and students see analogies that that are powerful summaries of the reorganised knowledge and help both parties remember the new conceptual structure. Analogies, mnemonics, stories, songs and diagrams (concept maps are the pinnacle here) as aides-to-memory are advance organisers.

strong similarities between Ausubel's and Carey's differentiations and between *integrative reconciliation* and *coalescence*; however, Ausubel's theory of meaningful learning is more comprehensive and seems more useful in sustainable education. As elements of a theory of thinking and learning then, *subsumption*, *progressive differentiation*, *integrative reconciliation*, *superordinate learning* and *advance organisers* all contribute to meaningful learning and make it the antithesis of rote learning.

The learning-thinking theories espoused by Hewson and Hewson (1992), Strike and Posner (1992), Novak (1984) and Duschl and Gitomer (1991) all emphasise the centrality of the student consciously examining his/her understandings and knowledge structures. These perspectives also are important in environmental learning. Hewson and Thorley (1989) saw in Posner et al.'s (1982) conceptual change model a hierarchical status for knowledge. They proposed that knowledge (or better, understanding at its higher levels) is first *intelligible* (non contradictory statements of acceptable facts); with repeated use it becomes *plausible* (i.e., practical and useful, it solves problems) and when mature, it becomes *fruitful* (it raises new questions and expands the thinker's horizons). Earlier work by Perry (1970) involving undergraduates at Harvard, found that most 18 year-old students enter college as dualist (ideas are right/wrong, good/bad, black/white). The student's task is to discern from all the information that teachers present to them, the right answer. Some students, faced with repeated cases of multiple (often contradictory) ideas and theories, become multiplist (they realise that there are many answers to a problem, but still believe that their task is still to work out which answer is "right"). Repeated experience with multiple ideas can have a more mature outcome: in time, students realise that multiple ideas and theories are contextually bound – that different contexts endorse different conclusions. This sounds familiar to people interested in the environment!

With this realisation that knowledge is contextually bound, people become relativists (each idea/theory is appropriate in its natural context). Continued experience with plural ideas and theories leads the learner to understand that knowledge is not just right or useful, it involves responsibility; consequently, the relativist adds ethical commitments to knowing and acting. Knowledge takes on a whole new meaning; knowledge is not just right or wrong, it is appropriate in its context and often has an ethical dimension. Knowledge can be right but unethical, knowing must fit the context and be responsible. This has a clear application to environmental issues.

The tension between what is right and what is ethical permeates Latour and Woolgar's (1986) analysis of the search for thyrotropin release factor (RTF) in the Salk Laboratories. The constraining context went beyond finding RTF. The Guillemin—Schally competition involved a Nobel prize which they eventually shared; still who would receive the prize was the very essence of ethical knowledge. Latour and Woolgar (p. 121) point out that "[t]he epistemological qualities of validity or wrongness cannot be separated from the sociological notions of decision-making". We reach this point where conceptual growth in sustainability learning involves rational data, agreed logical and social means for evaluating the data, recognising that answers are bound up in people's conceptual ecologies (not all are the same);

and that there are ethical consequences in our environmental decisions. Kuhn (1970) closed his famous work, *The structure of scientific revolutions*, with the conclusion that sociologists and not scientists will unravel the nature of scientific thinking. The same conclusion is appropriate here: sociology, psychology and science together stand the best chance of reforming environmental education. It will likely be an irrational as well as rational process because we are dealing with people with disparate conceptual ecologies. In Box 2.4 the issues in conceptualising environmental information as “war like” is overviewed.

#### **Box 2.4** Argument Is War! Is This a Barrier to Understanding?

Data interpretation in school and communities is more about how we discuss and argue than it is about what we discuss. Environmental debates quickly become *wars*. Environmental issues become battlegrounds in the minds of protagonists (and for those somewhere in between). Lakoff and Johnson (1980) successfully argued that the dominant “conceptual metaphor [is] ARGUMENT IS WAR” (p. 4, their emphasis). They demonstrate that most political, religious and scientific arguments are couched in the aggressive language of “battles”. “[A]rgument is war metaphor is the one that we live by in this culture; it structures the actions we perform in arguing” (Lakoff and Johnson 1980). We talk like warriors and take no prisoners; this disposition may account for the lack of progress in the frequent environmental debates in our media. People are so deeply involved in winning that they lose sight of the goal and the ability to argue rationally; indeed, they can become so irrational that even the emotive argument that works well in social settings loses its power.

We claim that our chosen methods of argumentation are critical to sustainable environmental education. The “ARGUMENT IS WAR” metaphor is especially inappropriate in schools because the subliminal message is “we must win” and this aim often loses sight of the need to make sense of the mountain of environmental data. Our aim is to promote credible, dependable and transferable ways to collect, analyse and respond to environmental data patterns (Guba and Lincoln 1989). Essentially, the way we handle data and derive conclusions from it sits somewhere near the middle of the paradigm wars that have simmered in science for close on 30 years: the contest is not between positivist and constructivist notions of knowledge; neither cold rationalism versus hot irrational nor is it objective versus subjective. How then, should we deal with diverse environmental conceptions? Passion is acceptable provided it avoids “ARGUMENT IS WAR”, that we tease out what students and teachers correctly know, preserving that and applying conceptual change strategies to the concepts that are not appropriate; and always teaching from what students know and agree on. And with environmental issues, ethics are always near the surface because the decisions we take affect people’s lives. Relativism is a good approach but ethical relativism is better. And when married to meaningful learning pedagogies, can make this country a sustainable environment for our children.

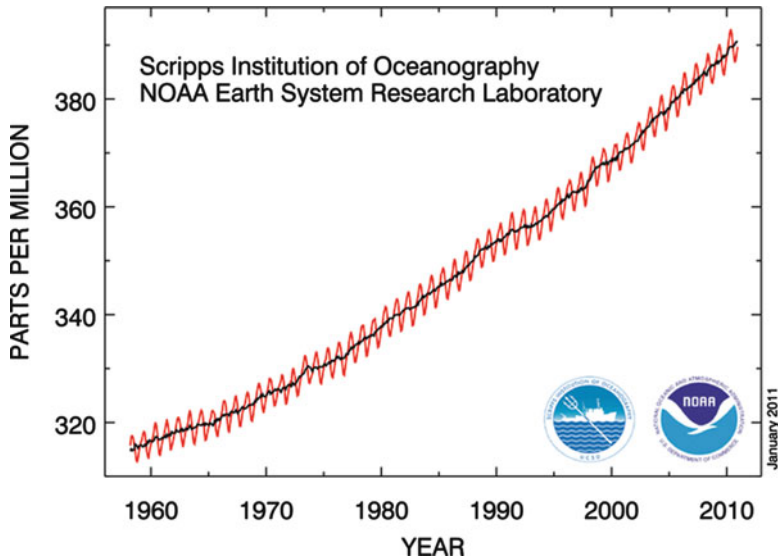


Fig. 2.2 Atmospheric CO<sub>2</sub> at Mauna Loa (Source: <http://www.esrl.noaa.gov/gmd/ccgg/trends/>)

For certain sections of the Australian population, environmental issues are prominent; however, concern for our environment and the local and global forces that may be at play is not universal. On one side, the scientific community warns of the consequences of global warming while the other side, often now nicknamed “skeptics”, claim that the apparent climate changes are merely the result of natural cycles. The issue at point here is whether anthropogenic factors, that is, human behaviours, are responsible, or not, for climate changes. These arguments are significant. If anthropogenic factors contribute strongly to climate change through carbon dioxide emissions, then continuing to burn fossil fuels is not an option. No action will worsen the problem. The result will be sea level rise and adverse economic and social consequences. The remedies offered by environmental scientists also have economic and social consequences, therefore, we seek the outcome that offers the world the best result. The “skeptics” argue that acting on uncertain data and predictions from these data will be so detrimental to our life-styles and gross domestic product that taxing carbon emission (the current buzz phrase) is foolhardy. Who wants to cut off their personal prosperity and the opportunities for their children? There are two key ways to address these issues as we have argued: Using robust evidence for decision making and education.

As an example of robust evidence on carbon dioxide emissions, the Scripps Institution of Oceanography NOAA Earth System Research Laboratory (2011) has collected and reported data on levels at Mauna Loa in Hawaii. These are shown in Fig. 2.2.

Such a steady growth in carbon dioxide emissions as human activities have increased over the last 50 years provided compelling evidence of human contributions

to greenhouse gases. Skeptics hinder environmental education by either denying climate change per se or insisting that no climate change is anthropogenic in origin. Unless we acknowledge and reverse the stresses we have imposed on oceans and atmosphere, catastrophic climate events will likely increase. Science and geography thrive on arguments and explanations derived from robust and reliable data. The best data for human caused change to the atmosphere – almost a smoking gun – is the atmospheric carbon dioxide concentrations measurements taken since at the Mauna Loa observatory (Fig. 2.2).

Critics admit that carbon dioxide levels are rising but charge that the source is natural, namely, volcanism. If the volcanic hypothesis for rising carbon dioxide is valid, then there will be spikes in the Mauna Loa carbon dioxide graph corresponding with major eruptions like PInatubo in 1991 and Mt St Helens in 1980. No spikes exist in the graph; therefore, the volcanism hypothesis collapses.

A further example of robust data confounding skeptics is the accurate measurements of solar activity. 1998, 2005 and 2010 were the three hottest years on record world-wide. The skeptics' said, "it's all due to increased solar activity" and some even claim the Earth was closer to the Sun. But solar radiance data show that we have just exited an 11-year solar minimum and the Sun is ramping up its activity and solar radiance is rising. If we experienced the three hottest years on record in a solar minimum (the full cycle is 22 years), what can we expect in the coming maximum? Hotter times still. These are but two examples of hard evidence. The challenge for sustainability education is placing these data in the hands of teachers and students in a form that makes easy sense. We claim that the single largest barrier to learning in this domain is the communication of robust data. The data and evidence are there, the challenge is putting it in the hands of teachers and interested citizens.

Having considered the significance of approaches to teaching and learning on sustainability and using robust evidence, we now examine the importance of this in terms of requirements in the national curriculum for Australian school students.

## **Sustainability in Australia's School Curriculum**

The United Nations Decade for Education for Sustainable Development (2005–2014) states that:

Education for sustainable development is a life-wide and lifelong endeavour which challenges individuals, institutions and societies to view tomorrow as a day that belongs to all of us, or it will not belong to anyone. This educational effort will encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations (UNESCO 2005).

In Australia, schools and their students have been involved in environmental sustainability projects that include the national initiative of the Australian Sustainable Schools Initiative (Australian Department of Sustainability, Environment, Water, Population and Communities 2010). At the state and territory level there have been a number of initiatives such as the Queensland Environmentally Sustainable Schools

Initiative (Queensland Department of Education and Training 2010) and the NSW (New South Wales Government 2010) that date back for several years.

More recently the development of the *Melbourne Declaration on educational goals for young Australians* (MYCEETYA 2008) has guided the development of the new national curriculum for Australian schools developed by the Australian Curriculum and Reporting Authority (ACARA 2010). The *Melbourne Declaration* commits “to supporting all young Australians to become successful learners, confident and creative individuals, and active and informed citizens”, and to promoting equity and excellence in education. The *Melbourne Declaration* (p. 14) emphasises that “a focus on environmental sustainability will be integrated across the curriculum”. In addressing this, ACARA state that the national curriculum will “equip all young Australians with the essential skills, knowledge and capabilities to thrive and compete in a globalised world and information rich workplaces of the current century”. ACARA identified three cross curricula perspectives – one of which is specific on sustainability: “A commitment to sustainable patterns of living which will be reflected in curriculum documents.” In curriculum areas such as science and geography this is particularly relevant in the curriculum documents being developed by ACARA.

The importance of sustainability in living patterns is being developed in the ACARA curriculum documents. Irrespective of the specifics of knowledge and skills to be developed in learners, of critical importance is the approach of teachers to lead students’ conceptual growth and change. Also, teachers assisting students to determine the quality and robustness of evidence on sustainability issues and then come to conclusions based upon quality analysis of that evidence.

## Conclusion

Sustainability has become a highly emotive and politicised area of debate and human activity. As educators there is much that we can do to contribute towards creating a preferred, sustainable future. This is particularly so in the national curriculum as sustainability is integral to the learning of all Australian school students. There is a commitment in the curriculum to sustainable patterns of living that is one of the three cross curriculum perspectives (ACARA 2010). Science and geography are compulsory subjects for all Australian students to study in the national curriculum. This will not only involve the design of learning experiences but also student assessment and reporting on this.

In this chapter we have argued that *decision-making on environmental issues must be based on quality evidence and robust analysis of that evidence*. Compelling evidence abounds and it is a matter of teachers and students seeking that quality information to inform their analyses. What matters too is the epistemological issues that teachers need to address as they approach the cross curricula perspective of sustainability. Critical to this is student development of sustainability concepts. As argued here, central to sustainability education is teachers with knowledge and skills

to identify barriers to learning that constrain conceptual growth and change and affect ways to address these.

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# Chapter 3

## Educating for Sustainability in New Zealand: Success Through EnviroSchools

Pamela Williams

### Introduction

At the 2002 World Summit for Sustainable Development, in recognition that education for sustainable development had *not* become the educational focus envisaged at the 1992 Earth Summit, a proposal was forwarded to the United Nations initially requesting a decade of ‘education for sustainability’, to draw attention to the need for countries to develop and implement strategies for sustainable development. Resulting debate and discussion in the United Nations noted that the ‘sustainable development’ term was being used by UNESCO and members agreed that it appeared a better ‘fit’ with the global Millennium Development Goals.

Consequently, on the 20th of December 2002 the United Nations Assembly adopted Resolution 57/254 – for a United Nations Decade of Education for Sustainable Development (UNDESD) from 2005 to 2014. The designated lead agency is UNESCO (2004), which promotes and advocates for improved quality of teaching, including, as one of the four main objectives of the UNDESD to ‘Foster an increased quality of teaching and learning in education for sustainable development’.

Clearly there is international recognition of the critical role of teaching and learning for moving towards more sustainable development. Educating for sustainability can take place in all formal and informal learning areas, and the initial focus will depend on ‘student’ learning needs, social and cultural expectations and local issues. More than halfway through the UNDESD some significant progress has been made in New Zealand’s formal education sector, in many primary schools, especially in schools enrolled in the independent EnviroSchools Program. Sadly, only limited progress is evident in the secondary and tertiary educational sectors.

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In this chapter I will primarily use the terms ‘education for sustainability’ and ‘learning for sustainability’. I mean that student learning for a sustainable future is the preferred outcome, whether using formal education pedagogies or enabling individual student learning through informal means.

## The Situation

In Aotearoa New Zealand there are a wide range of sustainability learning initiatives across many sectors of society. Many are organised and supported by non-governmental organisations, for example World Wildlife Fund for Nature New Zealand (WWF NZ) and the Royal Forest and Bird Protection Society (New Zealand), which have extended their programs to include broader sustainability issues in relation to conservation concerns. The Ministry for the Environment continues to provide limited support for community programs that have an environmental focus, including providing some guidance and resources for raising awareness of waste disposal and global warming issues. Recently, the New Zealand Department of Conservation (DOC) has extended the scope of conservation and biodiversity education programs by partnering with specific school-based experiential programs, including EnviroSchools.

Many regional authorities and city councils promote and manage a wide range of environmentally focused programs that are usually theme- or topic-based and aimed at all rate-payers. Examples are water, waste and recycling programs that have the potential to be linked to wider sustainability issues, and this is increasingly possible as more schools and more communities become engaged in finding solutions to local and regional unsustainable practices. In addition, many councils (for example Auckland Regional Council, Environment Canterbury, Environment Waikato and Greater Wellington) employ educators to assist school teachers and citizen groups to integrate learning, through involvement and action for sustainability issues that affect local citizens. Examples include waterways polluted by industry or dairying effluent, forest clearance (especially in river catchments), and storm water management. Most regional councils and many local councils also directly support the EnviroSchools Foundation school programs, as will be discussed.

A small number of programs are holistic and wide-ranging in their sustainability learning intent, for example the Sustainable Living Program, with a focus on community and school learning and The Natural Step Foundation, Aotearoa New Zealand (TNSFANZ), which works with business and organisations to learn about and adopt more sustainable operational practices (Nattrass and Altomare 1999). There are a few professional bodies including the New Zealand Society for Sustainability Engineering and Science (NZSSES), and national support networks including the New Zealand Association for Environmental Education (NZAEE), the New Zealand Business Council for Sustainable Development (NZBCSD), the Sustainable Business Network (SBN) and the practitioner network Sustainable Aotearoa New Zealand (SANZ), that provide learning opportunities in and across

specific sectors. This is achieved through conferences and seminars aimed at raising awareness and seeking solutions for sustainability issues. Most of these initiatives are relatively small, and depend on membership levies and securing contestable funding to fulfil their goals.

Concurrently, in response to growing societal concern and the desire to adopt more sustainable practices there are steadily increasing numbers of debates and reports featured in the New Zealand media. These appear on television and radio, in magazines and daily papers and focus on how we should be acting to reduce the impacts of sustainability issues, particularly those linked to global warming and climate change. Some examples, initiated during 2007, included the TV3 series “Wa\$ted”, the *New Zealand Listener’s* introduction of and continuing monthly “Ecologic” page, regional newspaper *The Dominion Post’s* weekly “Green Zone” page, the launch of the magazine “Good” in 2009 and Radio New Zealand National’s broadcasts of environmental programs and a number of sustainability focused forums.

During the 1990s, the New Zealand Association for Environmental Education advocated for the development of New Zealand guidelines for environmental education. Following the 1995 release of the Environment 2010 Strategy (by the then National Party Government), came the Ministry for the Environment’s national strategy for environmental education “Learning to Care for Our Environment” (1998). The *Guidelines for Environmental Education in New Zealand Schools* (Ministry of Education 1999) followed, and stated in the preface that any environmental education teaching in schools is dependent on the governing body of the school, the elected Board of Trustees. Consequently environmental education struggled for acceptance, because there was no actual Ministry of Education mandate for environmental education for sustainability.

Despite the lack of government leadership for school education for sustainability, initiatives slowly increased, as the Enviroschools Program developed and continued to reach more schools and some local government bodies and organisations such as DOC and WWF employed educators to provide biodiversity and conservation learning programs for school groups. In 2001, the increasing societal concern amid increased acknowledgment of looming environmental and social issues was used as leverage by the Green Party to secure contractual financial support, through the Ministry of Education, for initiatives supporting learning for sustainability. Then, during the UNDESD, due to funding leveraged by the Green Party in return for politically supporting certain policies of the Labour Government, the Ministry of Education established, in 2002, a contract to train a national team of school advisers for “environmental education”, later called “education for sustainability”. These 18 advisers were based in colleges and faculties of education within universities and provided teachers with professional development for Education for Sustainability (EFS), as well as working with teachers in schools, and other environmental education providers, to assist them in integrating education for sustainability into their class programs.

Further political leverage in 2006 resulted in the Ministry of Education increasing funding for the National Education for Sustainability (NEFS) contract, for 3 years, providing start-up funding for Te Mātauranga Taiao, the new Te Reo/Māori

education initiative for sustainability, and providing, for the first time, contractual support for the well established EnviroSchools program. Continued advocacy for EfS, examples of good learning-centred teaching practice and positive community feedback resulted in many more schools seeking support from EnviroSchools and the NEFS coordinators.

With the release of the revised *The New Zealand Curriculum* on November 6, 2007, it was anticipated that both secondary and primary schools would respond to the improved guidance and increasing opportunities presented in the curriculum for integrating learning for sustainability into school programs. The curriculum presents eight key principles to underpin all school decision-making (Ministry of Education 2007, p. 9). These include a “Future focus”, encouraging “students to look to the future by exploring such significant future-focused issues as sustainability, citizenship, enterprise and globalisation”. The revised curriculum includes ecological sustainability, equity, community and participation and globalisation as explicit values to be encouraged, modelled, explored and expressed in student learning (Ministry of Education 2007, p. 10).

Furthermore, in 2008 six Education for Sustainability (EfS) Level Two Achievement Standards, then five Level Three EfS Achievement Standards were developed, by members of the NEFS team, for use and assessment in Senior Secondary schools, within the New Zealand National Certificate of Educational Achievement (NCEA) system. These EfS Achievement Standards offer secondary schools assessment specific teaching and learning modules with a context of sustainability, to complement the integrated opportunities already developed by relatively few secondary schools (Bolstad et al. 2004).

However, there was and is still no indication of any Ministry of Education initiatives to encourage opportunities for sustainability education training for pre-service or in-service teachers. The election of the National Party Government in late 2008 resulted in the short-sighted and damaging cancellation of any funding support linked to education for sustainability. Since the end of 2009, there has been no Ministry of Education funding to support any teaching and learning for sustainability initiatives within schools, and since July 2010 no support from the current government for any aspects of sustainability education, including no support for the national coordination and training needs of the EnviroSchools Program.

Across the education sector sustainability teaching and advisory expertise has been lost and a previously growing momentum in learning for sustainability halted due to greatly reduced or lack of support for those teachers not teaching in a school affiliated with the EnviroSchools program. Consequently the possibilities for student engagement with a future-focused curriculum have become greatly diminished.

### ***What Is Happening in New Zealand Schools?***

Currently the implementation of education for sustainability differs considerably between primary, secondary and tertiary educational institutions. With the exception

of Otago Polytechnic, the lack of substantive coherent sustainability learning initiatives in tertiary education is a topic of separate discussion. The reasons for the relatively low, though slowly increasing numbers of tertiary courses with comprehensive sustainability contexts and learning pedagogies are explored in my dissertation “University Leadership for Sustainability: an active dendritic framework for enabling connection and collaboration” (Williams 2008).

Currently, a small number of secondary schools are attempting to integrate some aspects of sustainability into existing programs, through topics or units of work within current curriculum boundaries, offering senior level NCEA Achievement Standards in Education for Sustainability and slowly increasing numbers of cross-curriculum projects are being implemented in junior school levels (ages 13–15). Secondary schools continue to face a number of barriers to changing the way teaching is “delivered” and successful progress is very dependent on individual motivated teachers. Some of the challenges to change are time-table requirements, lack of support for individual teacher initiatives, lack of teacher expertise and lack of access to appropriate professional development. Despite these, there are a relatively small number of secondary schools that are moving to cross-curricula learning through integrating learning for sustainability initiatives into their programs. Most of these schools have had support from external facilitators, through either Enviroschools or the now disbanded NEFS advisory team.

The most substantive national school-based initiative is, as mentioned earlier, the Enviroschools Program. This holistic sustainability learning program operates with trained educational facilitators who work with classroom teachers (and school management and community) to focus on learner-centred pedagogies that encourage students to choose issues that concern them, then take appropriate actions for a more sustainable future.

### ***What Is the Enviroschools Program?***

The Program had its beginnings in 1993, as a Hamilton City Council initiative, prompted by recommendations outlined in Agenda 21 from the 1992 Earth Summit at Rio and by increasing requests from students, teachers and their communities for information about environmental and sustainability issues. Agenda 21 points out the need for indigenous and cultural perspectives to be part of the development of environmental education initiatives and Te Mauri Tau, a team of Maori educators were closely involved in the development of Enviroschools to help produce an inclusive environmental education program. This participation resulted in different cultural perspectives becoming an integral and important part of the Enviroschools Program.

From the initial stages the value of having a dedicated person to drive the development of the program and the need to involve key people in program development was recognised as essential to the future of Enviroschools. In addition, the support of organisations who were prepared to take a risk and engage in providing opportunities

for learning in a different way was hugely important, otherwise the result could have been just another booklet providing students with discrete items of information in response to specific, usually environmental, questions aiming to get students carrying out environmental actions suggested by that teachers.

The question of “how can we integrate environmental education into students lives”, became the driver for development of the whole-school program. Trained Enviroschools facilitators help teachers use the Enviroschools Kit, which includes a wide range of carefully selected curriculum-linked, scaffolded and coherent learning modules. Schools form an Envirogroup, make a vision map and work through locally relevant projects. Enviroschools resources assist schools to develop learning initiatives, usually project-based in five theme areas: Living Landscapes, Healthy Water, Ecological Buildings, Precious Energy and Zero Waste.

Five Guiding Principles underpin the learning process. These are summarised here as:

- *Empowered Students*, that are enabled to participate in meaningful ways,
- *Learning for Sustainability* teaching and learning that fosters sustainable outcomes,
- *Maori Perspectives* that value indigenous knowledge, enriching learning,
- *Respect for Diversity of People and Cultures*, reinforcing participatory decision-making
- *Sustainable Communities* acting in ways that maintain viability now and in the future.

An action learning process encourages students to enquire, investigate, practice cooperative decision-making, take action, reflect and evaluate. This learning process can be employed with any issue and therefore assists students to engage in learning that is relevant to their area. Through the Enviroschools process students make decisions about the sustainability of their school – where they spend much of their time – and also become involved in community projects.

A whole school approach integrates four key areas of school life:

- *Physical Surroundings* – Ecological and participatory design,
- *Operational Practices* – Sustainable conservation practices in the day-to-day running of the school,
- *Organisational Principles* – Participatory and democratic school management,
- *A Living Curriculum* – Integrating the hidden and informal curriculum of different areas of school life to enrich the formal curriculum.

More detail about aspects of the Enviroschool Program can be accessed on <http://www.enviroschools.org.nz>.

Increasing numbers of schools, from three in 1993 to over 700 in July 2010, are now part of the Enviroschools Program, either through whole school facilitated sustainability programs or, until recently, along a linked pathway – the Enviroschools Awards, which has now been reviewed and reorganised. The latter (developed by Auckland City Council with the Enviroschools Program) was often a first step towards more in-depth learning. The “awards” outline is still available for schools



to use as a source of ideas, for planning and strategising future projects and to check how they are progressing with their coverage of the key principles of Enviroschools. During 2010 the focus has moved from “assessing” how well a school is progressing against a number of criteria to engaging all members of the school community in a holistic “reflection process”, affirming their progress in integrating the core principles and strategising their actions to move further towards a more sustainable school and community life.

Facilitated program numbers are restricted only by the number of regional and local councils who see the need and appreciate the value of supporting learning for sustainability, of having sustainability-literate rate-payers and who have the financial capacity to employ trained facilitators. Most facilitated Enviroschools are smaller schools (less than 500 students) and the great majority are primary schools. Each Enviroschool is supported by a facilitator, a regional coordinator, a national team, a governing trust board and over 50 partner organisations nationwide.

Secondary schools usually used the Enviroschools Awards as a way to grow understanding of sustainability issues within the school. Enviroschools’ figures show that similar percentages (20–25%) of primary, middle and secondary schools are enrolled as Enviroschools. However, these figures do not distinguish between the in-depth and more holistic nature of the program in primary, middle and composite schools compared to the struggling, ad hoc and fragmented nature of the program in many of those secondary schools trying to develop their learning for sustainability. Typically secondary schools have one or a few committed teachers who provide support for student groups involved in environmental and social sustainability issues and provide formal learning for sustainability issues through assessed NCEA Level 2 and Level 3 Education for Sustainability courses.

## **Benefits of the Program**

Enviroschools advocates a whole school approach where the curriculum encompasses the school’s physical environment, operations and management practices. It has been shown that the design of the school grounds and physical environment has a significant effect on children’s attitudes and behaviour, and that students become confused when classroom learning about the need to care for the environment is not mirrored in their immediate environment (Titman 1994). In environmental terms the Enviroschools Program creates or improves the conditions that Titman identified as important to children in their interaction with nature, while enhancing biodiversity, reducing waste, saving energy, protecting waterways and creating healthier learning environments for students (Enviroschools Foundation 2004).

The multiple benefits of the program have been progressively recognised by researchers, teachers and the wider community as comprehensive, both for the educational needs of students and the delivering of sustainability-focussed initiatives into families and their communities. Research undertaken for the Ministry of Education (Bolstad et al. 2008; Eames et al. 2006, 2010) has recognised the social

benefits for students involved in the Enviroschools Program, noting increased leadership taken amongst peers and in the community as well as reduced bullying and vandalism. Informal discussions with teachers suggest that some of these social benefits are due to cooperative learning practices and student ownership of projects. In addition, increasing anecdotal evidence indicates there are many positive flow-on effects from these social interaction opportunities, to benefits for the wider community through increased community awareness and participation in environmental sustainability issues.

A wide range of other educational benefits have been observed, directly by parents, Enviroschool facilitators and through action-research (Eames et al. 2006). These include improved knowledge of environmental and social sustainability issues, improved project skills, decision-making, planning experience, critical evaluation skills and an increasing sense of place and understanding of one's own unique heritage. The sustainability activities and new initiatives that students develop in the Enviroschools Program contribute to financial savings through wiser resource management within school and family units.

A further benefit arising for Enviroschools' students is the opportunity to affirm and be involved in learning activities that acknowledge and celebrate diverse knowledge and viewpoints. This is increasingly relevant as the numbers of immigrants arriving from the Pacific Islands and Asian countries to settle in New Zealand continue to rise. Initial research undertaken by the Enviroschools Foundation exploring literacy and numeracy outcomes in Enviroschools found clear relationships between the Enviroschools action learning approach and good literacy outcomes (Wilson-Hill 2010).

Highly successful Enviroschools Foundation national "YOUth Jam" events were held in 2007 and 2008, leading to the development, in 2009, of a youth empowerment program called "ReGeneration". This community focused program was developed by and is run by young people, to provide ongoing opportunities for those leaving school to continue to network, learn through skills workshops, be involved in team building and continue youth action for change for improved social and environmental outcomes now and in the future. ReGeneration brings together groups of young leaders for 4 days of skills workshops, team building and action planning for projects in their schools and their communities. The name ReGeneration was chosen to describe an approach to supporting change that is holistic, positive and intergenerational. Currently, this new and expanding nation-wide program is supported financially by philanthropic grants and the New Zealand Council for Educational Research and has recently become independent from, but retains a very close partnership role with The Enviroschools Foundation.

The Enviroschools Program is also supporting students with technological innovation partnerships in the built environment, energy and agriculture sectors, in order to involve students in real-life innovation projects that have the commercial potential to become employment opportunities for young people. Examples include a partnership between the Enviroschools Foundation and the Building Research Association of New Zealand (BRANZ) to work with three secondary colleges to collect data on the trial performance of newly designed solar walls. This awareness

of the need for economic benefits within a context of sustainability is an important part of students' developing understanding of the complexity and interconnectedness of changes needed for a more sustainable future.

In short, it is becoming apparent that the learning achieved through this transformational Enviroschools learning program will enable students to become more resilient in the face of predicted rapidly changing climate, water and resource situations and more empowered and better able to create their preferred sustainable future. Despite this, the challenge remains of how to engage even more teachers, schools and their communities into transformational learning for sustainability. Educating students for fitting into and contributing to an industrial and consumptive twentieth century society that focused on "development" in terms of economic growth related to consumption and destruction of natural resources is NOT an option in this rapidly changing twenty-first century, if we care about intergenerational equity.

## Transformation of Learning

Many educationists (Orr 1992; Sterling 2001) argue strongly that there is an urgent need to re-design schooling away from the old transmission of knowledge to students, that encourages learners to act simply in a "business as usual" manner, to transforming educational institutions with sustainable schools that enable learners to achieve a more sustainable future. There are also many planners and designers now advocating for sustainable school buildings (Malone and Tranter 2003; Weiss 2000; Scott et al. 2000) and some believe that environmental education curriculum reform without the reform of the school's physical environment "may not be effective at all" (Scott et al. 2000, p. 3).

If we accept that a changing world is a constant feature of life today, compared to the incremental change in previous centuries, it follows that educational methods for learning in such a rapidly changing world do need to be altered. According to Sterling (2004, p. 59) "new ways of learning" need to be transformational and they need to be planned, supported and integrated into all existing educational institutions, if we are to meet our obligations to our children and future societies. Bloland (2005, p. 122) suggests it is at best difficult to use conventional means of educating higher education students when we are experiencing "...extraordinary and rapid changes taking place in our society". It appears sensible to ensure that compulsory schooling includes more transformational learning, in order to empower those students who do enter higher education to seek more appropriate education and learning to better deal with the increasingly complex environmental and social issues that young people will face this century. They will need to be resilient, capable of (amongst many things) coping with continual change, adapting to changes in resource use and empowered to re-design their own preferred future, one that in 30 years is likely to be very different to our current life-styles.

In educational literature there is increasing debate exploring both the nature of education, and those modern teaching methodologies that result in an imposed

“education in change” (that is, for example, transfer of information), compared to using methodologies enabling “education for change” (Sterling 2001). Sterling (2001) argues that “sustainable education is essentially transformative, constructive and participatory” (p. 35) and points out that to achieve “education for change” there needs to be corresponding and sympathetic changes in those education practices that are currently instructive and transmissive in their methodology.

A critical limiting factor, and one that directly affects the ability of students to become environmentally or eco-literate, is the current predicament that many teachers are not eco-literate themselves. If this basic understanding eludes teachers then there need to be life-long learning opportunities to encourage adult ecological literacy (Orr 1992), so that teachers can guide students to this fundamental knowledge of how their world works. Furthermore teachers themselves will need to become continual learners and active collaborators in this rapidly expanding knowledge arena of complex and connected sustainability issues and impacts.

McKeown and Hopkins (2002) list a number of barriers to re-orienting teacher education towards sustainability, namely:

- lack of awareness that re-orienting to achieve sustainability is essential,
- lack of clarity of what re-orienting entails,
- the limits of the traditional disciplinary boundaries that reward teachers for work within the confines of the discipline only,
- inadequate financial and general resource support for change and lack of support for innovative change.

The problem of low levels of pre-service teacher training in learning for sustainability pedagogies is discussed by many researchers, including Bolstad et al. (2004), Fien and Tilbury (2002), Law (2003), McKeown and Hopkins (2002), and Williams (2008). To date, there is only limited literature referring to how universities *are* providing learning in teaching pedagogies that are appropriate for education for sustainability teaching. A recent report titled “Sustainability in the NZ Tertiary Sector”, prepared by Packard (2010) from the ReGeneration Network team, does not address the question of teacher education within the tertiary sector, and in New Zealand there are very few coherent courses for education for sustainability in pre-service training and teacher professional development programs. Sadly, well established and popular courses at University of Canterbury College of Education were dis-established in 2008, indicating an alarming lack of understanding, by those administrators with the responsibility for retention and inclusion of different courses, of the importance of educating for a more sustainable future.

Fortunately, there are environmental education papers available for teachers studying at the University of Waikato, and some initial efforts are being planned in teacher training programs at other New Zealand universities, for example at Victoria University of Wellington. However, the overall lack of actual development of interdisciplinary courses and minimal focus on the pedagogical processes needed for learning for sustainable development reflects the continuing lack of university leadership for sustainability (Williams 2008). This may well reflect the lack of a New Zealand national policy for sustainable development, and the Tertiary Education

Commission and Ministry of Education's lack of strong support for learning for sustainability, however, this reflects poorly on universities who are charged with being a critic and conscience for society.

In some countries, for example Japan, Australia, the Netherlands, Scotland and England, the vision of a sustainable future (or sustainable development) provides the framework for education and learning statements as well as the context and compass for teachers to consider how they can orient their programs for learning for the future. The current New Zealand National Education Goals (NEGs) (Ministry of Education 2004) include NEG 3 which states "Development of the knowledge, understanding and skills needed by New Zealanders to compete successfully in the modern, ever-changing world". The New Zealand Government's over-arching educational vision, Strategic direction 1.1, is stated as: "To build an education system that equips New Zealanders with 21st century skills" (Ministry of Education 2010). The questions arise, what sort of education system (more of the same?) and what skills – new or more of the same, and if new – why?

In Barnett (2004), the uncertainty of the world we live in is put forward as a good reason we should be focusing on new ways of learning, "knowing-in-and-with-uncertainty" (p. 251), rather than accepting knowledge and skills as being the answer to preparing students for the twenty-first century. Barnett raises the concept of "supercomplexity" as being the reality that learners now face and Hipkins (2005, p. 74) further discusses the challenge this argument brings, pointing out that "schooling practices from the 19th and 20th centuries, still prevalent today, do not stand up well in the face of this formidable challenge". The Enviroschools Program offers a way to help learners address this complexity issue and develop the confidence and skills needed to prepare themselves for a probably rapidly changing and uncertain future.

## **Transformational Learning Through the Enviroschools Program**

Enviroschools are involved in exciting transformations of learning and teaching using trained Enviroschools facilitators to work with teachers and students, helping them create unique whole-school student-centered, extensive curriculum-linked learning programs that provide positive and real life opportunities for schools and their community's learning for sustainability. Often the first cross-curricula initiatives chosen by students are simple – activities such as recycling, restoration of landscape and improving biodiversity – and these learnings are used and built upon to progress to understanding the complexity of ecological systems and our social interactions with our environment and each other.

In Taiwan, the benefits of a similar program, the "Taiwan Greenschool Partnership Program" and the "Taiwan Sustainable Campus Program" are regarded as being so substantive and important that the Taiwan Government, through the Ministry of Education, actively encourages and financially supports all schools who engage in this learning for sustainability (Su and Chang 2004). The Australian Government

provided federal funding for education for sustainability and state funding is available for supporting schools involved in programs such as the Australia Sustainable Schools Initiative. In the United Kingdom, the Strategy for Education for Sustainable Development highlights the key role education must play in enabling people to lead more sustainable lives (DEFRA 2002).

In New Zealand teachers and school personnel could play an important role in changing the current situation. Teachers in schools, teacher colleges and universities, across all areas of the curriculum, could be asking for appropriate learning and training opportunities to help them provide their students with the learning we all need for a more sustainable future. In the PCE report (2004, p. 133), under section 7.2: “Areas for action”, the statement that “it will also be essential to ensure that there is adequate professional development for teachers to enable them to implement education for sustainability in schools” provides a challenge for all teachers to seek the support required to enable their students to achieve the learning outcomes essential for their future quality of life.

However, given there is no government support, nor active leadership for sustainability education within New Zealand universities (which through downward influence can influence the focus of school curricula), individual requests for support are unlikely to elicit any response, outside the Enviroschools Program. As societal awareness for the need for transformational learning increases, school requests to become affiliated as an Enviroschool continue to rise, and there is now a waiting list of over 200 schools. This then places The Enviroschools Foundation in the difficult position of needing to seek even more funding to enable the National Team to operate an expanding Enviroschools Program as more facilitators require training, professional development and access to the resources being developed and updated.

The national Enviroschools Program was launched officially in July, 2001 and The Enviroschools Foundation, with a Board of Trustees, was established in 2003 (Enviroschools Foundation 2010). Initially funding to run the national office was sourced, with support from NZAEE, from contestable sustainability management funds managed by the Ministry for the Environment. Currently The Enviroschools Foundation operates as a charitable trust, partnering with local government councils who fund Enviroschools facilitators to work alongside teachers within schools in their respective regions. The Foundation secures funding from philanthropic grants and business sponsorship to operate the national office. As mentioned earlier, from 2007 the Foundation operated with assistance from a 3-year contractual grant from the Ministry of Education, which was then withdrawn in 2009. The Ministry for the Environment, in response to political pressure, then provided some interim funding until July 2010, as the Foundation coped with the negative impacts of the contract cancellation.

Currently, in a climate of budget cuts and retrenchment, The Enviroschools Foundation remains confident and focused on providing more opportunities for transformational learning for sustainability. While developing and seeking support for the programs, a key lesson has been the importance of spending time and energy in establishing good relationships with a range of partners who share the same vision for a more sustainable life-style for future generations. The Enviroschools

focus on developing strong relationships between facilitators, teachers, students and their school community provides a model example of using collaborative practice (Edwards 2005, p. 180). Relationships with all those involved in learning are regarded as key to the success of Education for Sustainable Development, or Education for Sustainability and the close relationships developed and nurtured between Enviroschools and the NEFS team of advisers (from 2003 to 2009) reflects Edwards discussion about the role of relational agency in involving resourceful use of all those who can contribute towards successful outcomes for an individual, community or societal need.

Developing good relationships with those organisations, businesses, funders, practitioners and advocates who understand the benefits of transformational learning for sustainability remains a key reason for the ongoing success of Enviroschools (Mardon and Williams 2005). Building a respectful understanding of the varied viewpoints and needs of a range of communities that make up the fabric of the diverse society that resides in Aotearoa New Zealand has been both rewarding and empowering for all those involved. There has also been the realisation that when there is a lack of understanding of, and leadership for, sustainability within the political system, then government changes may bring about funding changes, despite growing societal awareness of the need to support education for sustainability (Williams 2008).

## **A Possible Future Focus for ESD in NZ**

The continuing success of the New Zealand Enviroschools Program shows there is a well-recognised pathway for progressing learning for a more sustainable future, through schools and their communities, despite the recent withdrawal of political support and central government funding. There are a number of other mainstream schools who are engaged with single-issue programs, and opportunities could be designed to encourage such schools to widen their focus and approach, by using the pedagogies and learning initiatives more likely to build student resilience to meet predicted challenges and be involved in actions for a more sustainable twenty-first century.

As students from primary sector Enviroschools move into secondary schools they carry with them a positive attitude towards improving their current physical and social environments and expect to be involved in decisions about their learning needs. Such expectations can influence more secondary schools to engage with the pedagogies and initiatives that empower students to learn for sustainability outcomes. Furthermore, as students enter tertiary institutions there is increasing evidence of their desire to learn across disciplines, while seeking involvement in real-life initiatives for improving social equity and safe-guarding resources for future generations.

A recent report titled “Sustainability in the NZ Tertiary Sector”, prepared by Packard (2010) from the ReGeneration Network team, notes some universities and

polytechnics have some courses that are including a focus on sustainability, but most of these are still disparate and lack inter-connectedness with other initiatives in New Zealand universities. In the investigation no question was asked to elicit what universities are doing to include pedagogies more suitable for learning for sustainability for their teachers and pre-service teacher training courses. It is time that such questions were asked of all educational institutions, by society as well as concerned educators.

Many of today's students are well informed about global issues and have a wider understanding of the connectedness of all aspects of their lives, some as a result of their schooling and most through media and social networking sites that discuss emerging issues. There is a huge challenge to create the opportunities to meet the learning needs of young people, with their aspirations to use technologies and live less consumptive lives in ways that contribute to a society that is better for all citizens. Enviroschools programs and their recently developed and expanding youth and community-based projects are proving to be examples of successful and essential ways of learning for sustainability in New Zealand.

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# Chapter 4

## Defining and Explaining Sustainable Development and Sustainability: A Review of Curriculum Guides and School Texts

Alaric Maude

### Introduction

Sustainable development and sustainability are concepts that are found in many school geography curriculums. This chapter reviews the ways that they are described and explained in official guides for curriculum writers, advice for teachers and textbooks for geography students, mainly in Australia. It identifies some problems in these definitions and explanations, argues for much greater conceptual clarity, and suggests alternatives that may give students a better understanding of these two vitally important contemporary ideas. It also argues for a deeper exploration of the causes of unsustainability, which may lead to a better understanding of the changes required to achieve sustainability.

The review is based on an analysis of the documents listed at the end of the chapter. These consist of:

- five official guides for curriculum writers and schools
- three chapters in books that teachers might use as guides
- ten secondary school geography textbooks, although several of these are essentially the same book adapted to meet the requirements of another state.

### Defining Sustainable Development and Sustainability

What young people are likely to understand about sustainable development and sustainability depends on how these terms are defined, whether in the textbooks they use or in the guidelines and advice their teachers might use in constructing

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learning activities. By far the most common definition in the documents analysed is in words based on the report of the Bruntland Commission (World Commission on Environment and Development and Commission for the Future 1990). Examples taken from different documents are:

[Sustainability is defined as] being able to meet the needs of the present without compromising the needs of future generations. (Parker et al. 2008b, p. 163)

[Sustainable development is defined as] development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (Berry 2006, p. 320)

[Sustainable is defined as] meeting current needs without harming the environment for future generations. (Gerlach et al. 2008a, p. 40)

[Sustainable development is defined as] development that meets the needs of present users—using resources in a careful way—so that resources will be maintained for future generations. (Gerlach et al. 2008b, p. 99)

Sustainable development is defined as “Development that meets the needs of the people today without compromising the ability of future generations to meet their needs.” (Australian Government, Department of the Environment and Heritage 2005, p. 28)

These definitions can be criticised on several grounds. First, they do not differentiate between sustainable development and sustainability, using the same words for each, yet these are different concepts. Sustainability is the state or condition of being sustainable,<sup>1</sup> while sustainable development is a process of change. In Porritt’s view sustainability is the end goal or final destination, while sustainable development is the process by which we reach this goal (Porritt 2005, p. 21). Sustainability is the ability of something, such as a fishery, a small town, a way of life, a society or the life support systems of the planet to be sustained indefinitely into the future. Sustainable development, on the other hand, is a construct devised by the Bruntland Commission to reconcile economic and environmental objectives. It is a way of growing economically (in order to remove world poverty rather than to make the rich countries richer), while at the same time preserving the ability of the world’s environmental resources to meet future needs (World Commission on Environment and Development and Commission for the Future 1990, pp. 8–9). There may also be an ideological difference between the two terms, with environmentalists viewing sustainable development as putting the emphasis on development and economic growth, and sustainability as more about the environment (Dresner 2008, p. 71).

This view of the difference between sustainability and sustainable development is similar to that in the first sentence of the extract below from a New Zealand report on education for sustainability:

Sustainability in this report is the goal of sustainable development—an unending quest to improve the quality of people’s lives and surroundings, and to prosper without destroying the life-supporting systems that current and future generations of humans (and all other species on Earth) depend on. Like other important concepts such as equity and justice,

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<sup>1</sup>Sustainability is a noun formed from the adjective sustainable, which has the meaning of being able to be sustained. The suffix –ability gives the noun the quality of the adjective.

sustainability can be thought of as both a destination (something worth aiming for) and a journey (that has no preordained route). (New Zealand, Parliamentary Commissioner for the Environment 2004, p. 14)

The second sentence unfortunately detracts from the clarity of the first, by giving sustainability two meanings.

A second criticism is that the definitions, and any explanation accompanying them, do not explain clearly what is to be sustained. Some definitions have no statement at all on this matter. Others, like two quoted above, talk of “not harming the environment” or of “using resources in a careful way”, but these statements are not accompanied by any explanation of what harming means or what would be a careful use of resources.

A third criticism is that almost the only test of sustainability that these definitions provide is in terms of the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. “Compromising” refers to the depletion of environmental resources handed on to future generations. One drawback of this test of sustainability is that it is only about future generations, yet sustainability is already a problem for the present generation. To focus only on future generations, important though that is, is to risk ignoring the very real problems of the present. Getting people interested in sustainability is also likely to be easier when the issues are visible now and not limited to ones based on projections, often contested, about some time in the future. A further problem is that the inter-generational test is not one that can be made operational. We do not know the needs of future generations or the technologies that may be developed to help them meet those needs, so we cannot determine what environmental resources they will require other than through subjective judgments about present and future needs, and about the durability of environmental functions. As Jacobs wrote some years ago:

It is impossible to impute interests to future generations without specifying what those interests are, and the choice cannot but express the chooser’s view of what level of environmental protection is morally right. (Jacobs 1991, p. 78)

## Other Definitions of Sustainability

Government guides to education for sustainability define the concept in a rather different way, as illustrated in the examples below. Here sustainability is described as:

... individuals, groups, and society as a whole adopting ways of thinking and patterns of behaviour that will enable them to meet their needs and aspirations without compromising the ability of future generations to meet theirs. (New Zealand Ministry of Education 2011)

[being] about reducing our ecological footprint while simultaneously improving the quality of life that we value—the “liveability” of our society. (Australia, Department of the Environment, Heritage and the Arts 2010, p. 4)

... the quest for a sustainable society; one that can persist over generations without destroying the social and life-supporting systems that current and future generations of humans (and all other species on Earth) depend on. (Australian Government, Department of the Environment and Heritage 2005, p. 27)

The first definition combines a Bruntland Commission inter-generational concept of what sustainability means with a statement of what is needed to achieve it. It therefore combines a statement about the goal with a statement about how to achieve that goal, and so gives sustainability two different meanings. I don't think this will help student understanding.

The second definition says nothing about how to define what is sustainable; it is only a statement about what is needed to achieve sustainability, which it says depends on reducing our ecological footprint. However, the ecological footprint is a measure of how much of the Earth's environment (measured in land area) a person, a city or a nation is estimated to be using to produce what they consume and to dispose of wastes. It doesn't measure the sustainability or unsustainability of that production and waste disposal. It is also not a measure of the actual land area used but a calculation of a hypothetical area of land based on a number of assumptions. It has been widely criticised for basic methodological weaknesses, for the way it aggregates quite different environmental problems, and for having no policy value. Critics have also questioned the educational value of the online footprint calculators. As a guide to how to achieve sustainability the footprint is of limited value other than in demonstrating to students the hypothetical extent of their use of the earth's environment, and the global inequalities in this use. It also encourages students to think that the answer to unsustainability is to reduce their consumption rather than make it more sustainable.<sup>2</sup>

The third definition adds social systems to life-supporting systems as systems that must not be destroyed because future generations will depend on them. This is somewhat confusing. The document from which this definition is taken is about environmental education, but the wording of the definition adds the goal of sustaining social systems to that of sustaining life-supporting systems. Sustaining social systems may be necessary as a means of sustaining life-supporting systems, but that is very different to making it a goal of environmental education. And if sustaining social systems is important, why aren't economic and political systems included as well, as they would complete the four systems identified earlier in the report? All this definition does is to send a deeply confused message to students.

Other writers also extend the concept of sustainability beyond the environment to the economy, society, culture and political systems. Noble, for example, writes that in addition to ecological sustainability, sustainability can also be conceptualised as:

- economic sustainability—people have livelihoods that are underpinned by appropriate and sustainable development and resource use
- sociocultural sustainability—diversity of social and cultural norms and traditions are respected with harmony
- political sustainability—there are societal processes that encourage good governance, social participation and active citizenship (Noble 2009, pp. 115–116).

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<sup>2</sup>See Fiala (2008), Franz and Papyrakis (2009), van den Bergh and Grazi (2010) and Venetoulis and Talberth (2008). For a more sympathetic review see McManus and Haughton (2006).

In each of these the concept of sustainability is used in ways that change its meaning. It is no longer about sustaining something into the future, but about some other desirable outcome. For example, economic sustainability is not about sustaining the industries and jobs that people depend on but about being based on a sustainable pattern of development and resource use; sociocultural sustainability is not about sustaining society but about respecting diversity; and political sustainability is about a desirable form of governance. There are perfectly good terms for these objectives, and rebadging them as sustainability adds nothing to their understanding—it simply muddles the meaning of the concept.<sup>3</sup>

Fien (2004, pp. 186–187) also broadens the scope of the concept when he writes that “education for sustainability encompasses a vision for society that is not only ecologically sustainable but also one which is socially, economically and politically sustainable as well”. This broadening is seen in the Australian Government’s statement on environmental education, for example in the inclusion in the list of characteristics of an effective environmental education for sustainability teacher statements like “Values diversity and acts for a just and equitable society” and “Considers social justice issues when reflecting on classroom and school practices” (Australian Government, Department of the Environment and Heritage 2005, p. 19). In environmental education I believe we need to differentiate between environmental sustainability as the goal and the economic, social, cultural and political conditions that may be needed for that goal to be achieved. We should not make these conditions additional sustainability goals in their own right. This would fit the way that environmental policies are debated in our societies. Proposed policies are examined for their economic viability and the fairness of their impacts on different groups, and making good decisions about these questions requires “political systems through which power is exercised fairly and democratically” (Fien 2004, p. 185). Occasionally is it contended that the maintenance of environmental functions will be of long term economic benefit, but we don’t demand that environmental policies contribute to social justice or cultural diversity or good governance. On the other hand, finding ways to achieve sustainability may be helped if they are seen as fair, and cultural diversity may help the generation of new ideas. Poverty may need to be eliminated to reduce environmental degradation, although the view that poverty causes environmental degradation has been widely challenged.<sup>4</sup> Political processes that enable our society to reconcile the often conflicting views of different interest groups are also clearly vital, but making economic, social and political objectives also sustainability goals risks diluting the fundamental priority that many environmentalists believe should be given to environmental sustainability (Porritt 2005, p. 22).

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<sup>3</sup>Philip Sutton (2004, p. 4) describes this problem as resulting from people who try to make one term or family of terms mean everything. He writes: “if people create a movement to try to achieve an all-round better society and world and they label that movement the Sustainability movement then they will tend to try to define sustainability as everything that is good and desirable, thus obscuring the core meaning of the word.”

<sup>4</sup>See, for example, Duraipapp (1998), Gray and Moseley (2005) and Whitehead (2007).

A final example of an extension of the concept of sustainability is a statement in a New South Wales Government document on learning for sustainability that “personal, family and community wellbeing is a foundation and an aspiration of sustainability” (New South Wales Department of Education and Training 2009, p. 6). It is preceded by the question: “What foundation do I need for contributing to sustainability?” The statement is confusing because it implies that wellbeing is needed before one can contribute to sustainability, yet wellbeing is also an outcome (aspiration) of sustainability. If wellbeing is required first then it has already been attained and cannot be an aspiration, whereas if wellbeing is an aspiration then it does not already exist and cannot be a foundation. The statement seems to be again a device to include additional objectives under the umbrella of sustainability, at the risk of destroying the meaning of the concept.

## An Alternative Definition of Sustainability

Something is sustainable if it can be sustained into the future.<sup>5</sup> If this idea is applied to the environment then an appropriate definition might be:

[Environmental] sustainability is the maintenance into the future of the environmental functions that support human life and human welfare. (Based on Ekins 2000; Jacobs 1991; Lowe 1990; Porritt 2005)

This definition is about the essential meaning of the verb to sustain, as explained by Sutton in his insightful discussion of ways of defining sustainability (Sutton 2004). It is also a definition that identifies what is to be sustained, which is a set of environmental functions that can be analysed and specified. These functions can be grouped into four types. One is the production of raw materials from the natural resources of soil, water, forests, minerals and marine life (the earth’s “source” function). Another is the safe absorption (through breakdown, recycling or storage) of the wastes and pollution produced by production and human life (the earth’s “sink” function). A third is the provision of the environmental services that support life without requiring human action, such as climatic stability, biodiversity, ecosystem integrity and protection from ultraviolet radiation (the earth’s “service” function). A fourth is the intrinsic recreational, psychological, aesthetic and spiritual value of environments (the earth’s “spiritual” function) (adapted from Ekins 2000, pp. 53–54; Jacobs 1991, pp. 3–5).<sup>6</sup>

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<sup>5</sup>One textbook does define sustainable as “able to continue indefinitely”, but provides no explanation or application of this definition.

<sup>6</sup>Standard descriptions of these functions group the third and the fourth together as the earth’s service function. However, I think there is a considerable difference between the life support functions of the environment and what I have called the spiritual functions. The first group of functions exist independently of human thought, and are the same for all people. For example, the ozone layer was not discovered until 1913, but it had been protecting all humans from ultraviolet radiation for tens of thousands of years. The second group of functions only exist because of human thoughts, and these thoughts vary from person to person, from culture to culture, and over time.



## Sustainability Principles

This definition identifies what is to be sustained—the four environmental functions—and points to ways of assessing sustainability and unsustainability through statements of principles about what is required to maintain an environmental function into the future. Some principles can be assessed by proxy measures of sustainability while others are more subjective and depend on people’s ideologies and world views.

The following sustainability principles have been adapted from Ekins (2000, pp. 95–97) and Jacobs (1991, pp. 86–100).

1. Renewable resources should only be exploited at or below their rates of renewal.

This principle has been used for a long time in the management of fisheries, forests and groundwater, originally expressed as the principle of sustainable yield (Wiersum 1995), and students can readily discover practical examples of how it works. It can also be seen in traditional shifting cultivation communities, where the length of the fallow period was designed to renew soil fertility, and in hunting and gathering communities that move from place to place to avoid damaging the regeneration of the environmental resources on which they depend. There are opportunities here to study both western and Aboriginal and Torres Strait Islander methods of renewable resource management.<sup>7</sup> There is also scope to explore how decisions about which renewable resources should be sustained and why vary between places and cultures, and over time (Gale and Cordray 1994).

2. Biodegradable wastes should not be added to the environment faster than they can be broken down and recycled.
3. Non-biodegradable wastes should not be added to the environment at levels that threaten ecosystem and/or human health.

Principles 2 and 3 are about maintaining the “sink” functions of the environment, but Principle 3 adds ecosystem and human health as indicators of unsustainable practices. These principles are the subject of a growing body of environmental regulation, and can again easily be investigated by students. They can also involve some issues for which there is no consensus, such as the arguments for and against nuclear energy, and these provide wonderful opportunities for students to debate difficult questions.

4. Non-renewable resources should not be exploited faster than the rate at which they can be maintained through reuse and recycling, or substituted by other non-renewable or renewable resources.<sup>8</sup>

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<sup>7</sup>See Clarke (2003) and Sveiby and Skuthorpe (2006).

<sup>8</sup>A subsidiary principle that could be used in debates over the replacement of non-renewable by renewable resources is:

The use of renewable resources to replace non-renewable ones must satisfy the criteria of environmental impact, economic costs and benefits, and social justice.

Source: Written after reading an airline magazine article on biofuels.

This principle is more difficult to quantify, but it is still possible to evaluate the changing availability of individual non-renewable resources and discuss the implications of the rates at which they are being exploited. The topic of peak oil, for example, is an excellent issue for students to investigate through this principle.

5. The life support and ecosystem services<sup>9</sup> functions of the environment should be protected.

Principle 5 is about environmental functions ranging from protection from ultraviolet radiation to pollination and climatic stability. Scientific understanding of these functions varies considerably, as does public agreement on the causes and consequences of changes in these functions. Some are therefore difficult to evaluate precisely, but the principle is important in that it draws attention to aspects of sustainability that are sometimes neglected.

Student understanding of Principles 1–5 must be based on a sound understanding of the environmental processes involved in maintaining each function, and of the effects of human actions that result in their degradation. The principles therefore need to be taught in conjunction with the relevant elements of physical geography, and not on their own.

6. The recreational, psychological, aesthetic and spiritual value of environments for people should be protected.

Principle 6 cannot be turned into objective measures, because it relates to human perceptions, feelings, beliefs, values and world views. It is important because it takes the evaluation of environmental functions beyond those that support human life and the economy to more subjective functions that are often central to arguments about environmental protection and conservation. The survival of other forms of life could be included in these functions. The principle also provides an opportunity for students to explore different environmental ideologies or world views, including those of Aboriginal and Torres Strait Islander communities.

At least two more principles are needed for a comprehensive evaluation of sustainability. These are:

7. An assessment of the environmental sustainability of a place or country must take into account the effects of its production and consumption on the environments of other places.

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<sup>9</sup>Ecosystem services not already included under another principle are purification of air and water, regulation of hydrological flows, retention and storage of water, generation and renewal of soil and soil fertility, pollination, control of agricultural pests, dispersal of seeds, cycling of nutrients, maintenance of the genetic resources of biodiversity, protection from ultraviolet radiation, partial stabilisation of climate, and moderation of temperature extremes (adapted from Costanza et al. (1997) and Daily (1997)).

8. Global sustainability depends on an equitable sharing of global environmental functions.

These two principles are essential to a global view of sustainability. Principle 7, known as the principle of trans-frontier responsibility (Selman 1996, p. 11), says that cities, regions and countries cannot be sustainable if their production processes and consumption patterns are responsible for environmental unsustainability somewhere else. This could be because commodities imported from other places were produced by unsustainable practices, as in the case of some timber imports into developed countries, or because wastes were exported by water or through the atmosphere to other places.

Principle 8 reminds students that any strategy to manage the total pressure of humans on global environmental functions requires an equitable sharing of these functions. This is the same as the intra-generational principle associated with the Bruntland Commission's definition of sustainable development.

The precautionary principle could be added to this list. It is not so much a separate principle as one that can be used to guide decision making on Principles 1–6, because it calls for caution when there is uncertainty about whether there is a serious threat to human or ecosystem health. It can be used to argue for a cautiously low rate of exploitation of a renewable resource when its rate of renewal is uncertain, or to ban the use of a new product. The inclusion of this principle will enable teachers and students to explore the complexity of environmental decision making and the contestability of the evidence on which decisions are based. However, the precautionary principle is difficult to apply in practice, because it lacks precise definitions of key terms like “serious”. There is also the problem that arguments to ban a substance because it is a threat to human or ecosystem health often ignore the benefits of the use of that substance. If the precautionary principle is taught in schools students should understand these issues (see Deville and Harding (1997) and Goklany (2001)).

The advantage of these principles is that they provide a framework for applying the concept of sustainability to specific situations, which a Bruntland-type definition does not, and they enable students to develop an analytical approach to assessing sustainability, because assessments can be made for each type of environmental function. Without these principles as a guide students may well decide that any change to the environment as a result of development is a sign of unsustainability, or that sustainability is about the preservation of environmental resources for future generations rather than the maintenance of their use.

There is very little specific discussion of these principles in the guides or textbooks examined. Two of the documents do describe some of the principles adequately (Kleeman et al. 2008b; Noble 2009), and one also includes the precautionary principle but without noting its complexity (Kleeman et al. 2008b, p. 46). The concepts underlying some of the principles are described in those textbooks that discuss renewable and non-renewable resources and the problems of waste management, and this discussion is often linked to the theme of sustainability, but the principles themselves are not mentioned. None of the textbooks discuss the ideas underlying Principles 5, 6 and 7.

## The Causes of Unsustainability

The guides to education for sustainability analysed for this chapter are very good at identifying ways that students can research and respond to environmental sustainability issues. They are also very good at identifying the “repertoires of practice” or capabilities that students need to contribute to sustainability. These include an understanding of their world views and values, skills in systems analysis, and the ability to think about and design futures (New South Wales Department of Education and Training 2009, pp. 9–19). On the other hand, they have much less to say about the underlying causes of unsustainability. For example, the Australian Government’s *Sustainability curriculum framework* (Australian Government Department of the Environment, Water, Heritage and the Arts 2010), written as a guide for sustainability education, describes the sustainability action process as involving:

- making a case for change—exploring a sustainability issue, assessing the current situation, investigating sustainability concepts and ideas, and stating a case for change;
- defining the scope for action—exploring options for making a change, identifying available resources and constraints, seeking consensus, and developing a statement of the agreed direction for action;
- developing a proposal for action—generating and selecting ideas, developing and modifying these to make them ready for implementation, and preparing, communicating and agreeing upon the proposal;
- implementing the proposal—turning the proposal into action; and
- evaluating and reflecting—assessing the degree of success of the action and the efficiency of the processes used, identifying possible future directions and the learning that has resulted from the action.

None of these steps require students to think about the causes of the sustainability issue they are investigating, yet without an understanding of these causes it is impossible to identify answers that are based on a sound knowledge of the origins of a problem. The nearest they are likely to get to causes is through a systems analysis of relationships. This will identify the immediate or proximate causes of an environmental problem, but is unlikely to uncover the underlying economic, psychological, social and political causes that lie beyond system boundaries. These include population growth, life styles and materialism, technology, attitudes and values, capitalism, and our apparent inability to manage an economy without needing constant growth. Some of these are listed as factors in the geography textbooks, but only in the case of population growth is there any discussion or explanation. Consumption patterns and lifestyle expectations are discussed in one textbook, but without any reference to environmental sustainability.

An alternative approach to understanding causation is illustrated by the Conachers’ book on rural land degradation in Australia (Conacher and Conacher 1995), which explains land degradation through direct causes such as vegetation clearance and cultivation, and underlying causes such as people’s attitudes, lack of

knowledge, economic pressures and government policies.<sup>10</sup> The direct causes are well explained in the geography texts that have a section on land degradation, but the underlying causes are only listed as factors and are not explained. As the Conachers write, “Understanding the reasons for a problem is a prerequisite to doing something effective about it” (Conacher and Conacher 1995, p. 82), yet the depth of the Conachers’ approach is hard to find in the guidelines for education about sustainability and is missing from the textbooks.

The textbooks also fail to tell students about the different ideologies that influence their own and other people’s views on the causes of unsustainability and on what may be needed to reduce it. In particular there is no discussion of anthropocentric and ecocentric environmental ideologies or world views. These provide a framework for integrating views about the relationships between humans and nature, the meaning of development, the role of technology and science, resource constraints, limits to growth, the need to control population growth and the extent of change needed. An awareness of these ideologies would help students to understand their own views, and why other people may have a different opinion.<sup>11</sup>

## Sustainable Development

This chapter has argued that for conceptual clarity and understanding sustainability should be defined as a goal and sustainable development as one way of achieving it. It has also criticised the addition of economic, social, cultural and political sustainability to the objectives of environmental education. However, these objectives do belong in the concept of sustainable development, because this is now about development, and development has economic, social, cultural and political goals (Baker 2006).

In the textbooks examined the most common definition of sustainable development is one based on the Bruntland Commission report, as in this example:

sustainable development [is] development that meets the needs and aspirations of the present generation without compromising the capacity of future generations to satisfy their needs and aspirations. (Kleeman et al. 2008a, p. 9)

Some of the problems with this type of definition were discussed earlier. Its main failing is that it is a political statement that gives a student no idea of what should be done to achieve sustainable development. A better statement from the Bruntland Commission would be:

... sustainable development is a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. (World Commission on Environment and Development and Commission for the Future 1990, p. 90)

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<sup>10</sup>See also Beresford (2001).

<sup>11</sup>See Dryzek (2005) and Williams and Millington (2004).

Even better might be one from the Forum for the Future:

Sustainable development is a dynamic process that enables all people to realize their potential and to improve their quality of life in ways that simultaneously protect and enhance the Earth's life-support systems. (Porritt 2005, p. 22)

All of these definitions are adequate provided that what they mean is explained to students, so that they have a full understanding of the concept. This explanation is largely missing from the documents examined, with the exception of the texts by Kleeman et al. In relation to the first definition, students will not learn from their texts that the Bruntland Commission's interpretation of sustainable development was one which gave priority to meeting the needs of the world's poor, acknowledged that there were ultimate environmental limits on economic growth (although they suggested that these could be overcome by better technology and social organisation), recognised the need to stabilise the size of populations, called for consumption standards in the rich countries that recognised ecological limits and could be aspired to by all people, and argued for growth that was less material- and energy- intensive as well as more equitable in its outcomes. These are ideas that many today would consider quite radical, 24 years after the Commission's report was first published. Most textbooks take a rather technological view of what is needed to reduce unsustainability, and do not explore ideas about the more fundamental changes that sustainable development might require.

## Conclusion

This chapter has reviewed the way the concepts of sustainable development and sustainability are described and explained in curriculum guides, advice to teachers and school geography textbooks. Most definitions do not distinguish between sustainable development and sustainability, do not explain what is to be sustained, and do not lead to any tests of whether something is sustainable. Some of them also extend the idea of sustainability in conceptually confusing ways. An alternative definition of sustainability was proposed, based on the contention that sustainability is about a preferred state in which the functions of the environment that support human life and welfare are maintained into the future, while sustainable development is about the process of achieving this state. This definition identifies what is to be sustained, and leads to a set of principles that students can use to evaluate whether an environmental function is sustainable. The chapter also argued for students to be guided into much deeper thinking about the causes of unsustainability, and about the changes in our society and their way of life that may be required if unsustainability is to be significantly reduced.

**Acknowledgments** The author wishes to acknowledge the contributions of Jonathan Noble and Nick Hutchinson to this chapter, and the insights provided by Philip Sutton in the paper listed in the references.

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# Chapter 5

## Contradictory Practices and Geographical Imaginaries in the Rolling Out of Education for Sustainability in Auckland New Zealand Secondary Schools

Richard Le Heron, Nick Lewis, and Amy Harris

### Introduction

This chapter examines the grounded practices and institutions of teaching sustainability education in New Zealand (NZ). The chapter is organised as a response to the findings of a survey of geography teachers in Auckland secondary schools conducted in late 2009 and early 2010 that showed a strong, almost universal ideological commitment by geography teachers to the idea of sustainability, but a very low level of take-up of EfS as a formal teaching program. The timing of the survey is important. It took place shortly after the introduction of Education for Sustainability (EfS) in NZ secondary schools with equal curriculum status to subjects such as geography and Science. For many in NZ education and NZ geography this is a significant step in New Zealand's contribution to the United Nations Decade of Education for Sustainable Development (2005–2014). It also took place in the context of the first review of the geography curriculum in 20 years. Two dimensions of this review are important for EfS: the elevation of concepts relative to settings in the structure of the curriculum and understandings of how it should be taught and assessed; and the introduction of an explicit sustainability framing for the core human geography assessment standard in the senior school. We contend in the chapter that for these reasons and multiple others to do with the messy details of teaching geography the realities of introducing EfS are much more complex than simply declaring that EfS should be part of the NZ secondary school curriculum.

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To tackle and unravel this complexity we address sustainability both in conceptual terms as a political project and also in empirical terms as a project that can be investigated from its inception. We see EfS as connected to a political project about what relationships are fundamentally important in organising NZ economy, society and territory. Like all political projects, the political project of sustainability is fraught with ambiguities (Larner et al. 2007; Le Heron et al. 2011), and one that is being reconfigured even as EfS is being rolled out. Against the background of this political project we ask what work EfS is expected to perform and investigate the ways in which it is being implemented, and what contradictory practices and imaginaries are at work as EfS works out and becomes reshaped in schools. The chapter argues that if the political project is the promotion of sustainability through certain geographic imaginaries or implicit expectations about what the landscape of NZ economy, society and territory should look like, then this will need to be achieved in the context of institutions and practices already on the ground in NZ schools. This will mean giving priority to (1) the interplay of pedagogy and curriculum in the classroom and in the field and (2) the organisational practices in a number of settings, around pedagogy and curriculum.

The Auckland geography secondary school teaching survey explored the likely imaginaries of sustainability and education practice that are held by Auckland geography secondary teachers. This is the group of teachers who are already organising, teaching and advocating the new sustainability curriculum. The survey establishes the broad school and instructional constraints and opportunities with which these secondary teachers are dealing. As a result it reveals the start up conditions and backgrounds of the primary actors delivering the sustainability intervention of EfS. This allows us to address the gap between the world of sustainability politics, where claims are made about what should be done, and the actual institutionalised practices of education in schools, made in the name of sustainability. The chapter thus provides information about the genesis of an educational intervention, in a manner possibly unique in the international literature.

## **From Geographic Imaginaries to Geographic Imagination in Sustainability Education – Identifying the “Big” Challenge Ahead**

EfS is a major development in NZ’s secondary school curriculum. This was accompanied by a shift from what was known as the Resources standard to the Sustainability standard. It was rolled out before other recent curriculum changes, in a curriculum that has not seen modification of such magnitude for some time. Such a development has the potential to greatly alter how NZ secondary students come to know their country, how they live and reflect upon how this bears on their livelihood prospects. Because of this transformative potential there is considerable national benefit in seeking to understand possible cumulative effects of an EfS experience. We argue that the availability of the Auckland evidence allows us to write a chapter that

situates the practicalities of the “how” and “where next” of EfS in-the-school, in-the-classroom and in-the-field, to make the most of an unprecedented opportunity to gift new insight to future generations.

To develop the chapter’s analysis and argument we proceed through several steps of inquiry. Our first step was in fact very fortuitous, and became the rationale for the chapter. Our 2009/2010 survey was originally designed to establish what geographic imaginaries about how NZ and the world works could be discerned from formal decisions and actual activities in NZ’s school geography. We were taken aback to find as part of this investigation that hardly any Auckland school had embarked on EfS, and moreover, that according to geography teachers, it was largely assumed in schools that geography teachers would do much of the EfS teaching, when a commitment was made. This set us thinking about the significance of EfS, not only as a unique government intervention in education in NZ, but also as a unique educational investigation that could be followed from the outset, on multiple levels (e.g., teachers, pupils, parents, school administrators) and multiple scales (e.g., in the classroom, schools, regions, internationally). Suddenly our initial proposition that knowledge of geographic imaginaries taught in schools was important for geography as a discipline in NZ, turned into a serious realisation that imaginaries more generally, were actually very central to what EfS becomes, but in hitherto unknown ways.

What do we mean when we speak of imaginaries, and why do we put a premium on understanding the effects of imaginaries? The answers to these questions take us into one of the mega-issues of twenty-first century knowledge production – whether knowledge that represents the world (almost invariably the past, because of time lags) is enough to change the world, or, whether, in addition, there has to be knowledge that shows how the relationships and interactions of different worlds might be made. If we consider imaginaries in the light of this distinction, we would argue, they are representations of the world, and as a result, are insufficient thought tools to assist change that is transformative. Where do imaginaries come from? They are abstractions that say something about the world, which is often useful background to know. They do not, however, tell us anything about *how* the world might be made, differently, which seems to be one of the major drivers of sustainability as an inspiring idea and ideal. Rather imaginaries represent an already made world.

There is an additional problem with imaginaries. They are there, whether academics or others have represented them in some form or other, and possibly even subjected them to critique. This situation gives urgency to knowing about imaginaries, which was partly why we were interested in finding out about geographic imaginaries that Auckland secondary students have been exposed to. Imaginaries become narratives and metaphors, or mind frames, that we live by and find difficult to say good bye to.

We risk much when we uncritically accept imaginaries. How do we break away from the purely representational way of thinking about things? Geographers, especially through their field work emphasis, have a head start on this (Le Heron and Lewis 2011). Field work involves action – conceptualising on-the-move, interacting on-the-move, reflecting on-the-move. In a sense all field work is arguably action in search of existing imaginaries and new imagination, and a commitment to situated

understandings that are the basis of action. The distinction between imaginaries and being imaginative or developing the geographic imagination is a crucial one to explore. Imaginaries summarise what is, and can be easily interpreted as definitive statements that remove any necessity to explore why and how the “what is” of the world has been made to happen, by whom, for whom and with what wider consequences. Imaginaries work in a special way – they do what educationalists and social scientists refer to as subjectifying. That is, they condition who and how people are. They are the almost Matrix-like code that prefigures reconnections back into pre-existing arrangements of knowledge and power and the expression of these arrangements in the world. Imaginaries, without an institutionalised driver to imagine differently, thus simply reinforce the status quo. This is the trap of representational knowledge. Imagination in contrast does not pre-judge. Instead it opens up possibilities because it can be rooted in critical issues. Later in the chapter we make suggestions about developing imagination. Suffice to say at this stage, despite the best of intentions and the most energetic of efforts, sustainability initiatives and interventions could easily assist development as we know it. In this way we can say development is sustainability’s opposite! This tension and its realisation of course becomes the material of politics.

Sustainability as an issue, topic, ideology or whatever, is highly politicised. That is, sustainability attracts or summons advocates and detractors of many kinds, with many points of view and perspectives. These actors collide over what the world should look like, or be, and the identification, allocation and mobilisation of resources to achieve these visions. They are arguing over ideas and ways of doing things, with the hope that the debate will influence decision makers and their decision taking. They aspire to qualitatively and quantitatively different outcomes and patterns and processes leading to outcomes and patterns. What better educational experience could be envisioned than actually addressing issues that count, and the ways in which they count?

There is much value to asking where sustainability as an idea came from, why it is conflicted as a concept, and why it is so politicised. These questions point directly to what makes politics. Politics arises when those interests and those with some stake in particular situations disagree about the direction and content of change. Where sustainability is distinctive as a focus for politics is that it is about two things – how the nature of life and how we live on the planet (and in NZ) become either opportunities or constraints for future generations. These are big, structural, species, issues. A quarter of a century ago, Redclift (1987) wrote a famous book called *Sustainable development: Exploring the contradictions*. He drew attention to tensions that will continue to arise because of the juxtaposition of sustainability and development in the wording Sustainable Development. The couplet tames the critique of the sustainability idea by incorporating it as a positive agent of development. The value of the sustainable development idea, contrary to instrumental readings of it, is precisely the tension. In NZ the tension enlivens the work of, for example, the Parliamentary Commissioner for the Environment (see <http://www.pce.parliament.nz/publications/all-publications/>) and the Environmental Defence Society (see <http://www.eds.org.nz/>). Redclift’s work highlighted the need to always

incorporate wider structural analysis relating to the economy, society and territory in focus, when considering sustainability, as *by implication, sustainability is also about what is happening to growth*. When the way the world and NZ are working is affecting, or is perceived to affect, many people, places, plants and animals, and things are not changed, interests and stakeholders are increasingly and more openly protesting in a variety of ways. This often involves contesting how the issue is framed, contesting who is able to decide on how framing is done, contesting what processes are being used to give authority to certain experts and expertise, and so on. Framings are not self-evident truths, or free of politics. They are the products of politics. Politics then, in simple terms, is about expanding the scope and nature of decision making so that outcomes and the state of affairs, experiences and processes shown to be unfair for different life are ameliorated in some manner. This must be a key focus of any twenty-first century educational experience.

The big questions of any politics are not only how to enrol others to a view and ensure continued commitment once enrolled, but also to contest resource allocations and the content of imaginaries. These are dimensions of the proverbial “who shall rule” problem, which has been tackled by a great many academics. An especially helpful set of ideas, bundled in the international literature under the heading of “governmentality”, lays emphasis on competition amongst political projects. This literature addresses the historical experience that some ideas about how the world “ought to” work gather strength and momentum from enrolling supporters who, through their actions, may gradually make an appreciable difference to how things are done, and to the nature of outcomes and patterns. Political projects are distinguishable because they are contentious and contested. Sustainability as it has developed internationally (opposition to development) and nationally (carefully positioned during the period of the Labour government in relation to a Growth and Innovation Framework) is one political project. That sustainability should be deployed by government in the secondary education sphere, invites careful scrutiny of how it might play out. Now that EfS has been gazetted it must be examined in terms of how it is arriving or not arriving in NZ schools and classrooms. This is where imagining and imagination re-enter the picture.

EfS as an educational intervention cannot be separated from the particulars of NZ’s trajectory of sustainability experience. Here again, NZ geographers have taken the lead in attempting to expose how sustainability has been institutionalised in NZ, from a mix of overseas and NZ influences. We can draw on several articles, especially Le Heron et al. (2011, Table 1), Le Heron (2006, 2009), Chapman et al. (2006) and Lerner and Le Heron (2004), to show that in NZ sustainability has been institutionalised in government since the early 1990s (in response to Rio) and during the 2000s, under Labour, as a companion to a Growth and Innovation framework. Thus EfS is not independent from contextual roots. From the moment of its first discussion and planning in government circles, and in community and business circles, it has been open to shaping by other initiatives and interventions as it in time may come to shape new initiatives and interventions. The oppositional positioning of sustainability and growth must not be overlooked, though many would deny there might be important connections.

Discussion so far has emphasised the bigger work of sustainability ideas in NZ. This enables the intervention of EfS to be situated more adequately. We turn now to what geographical imaginaries are being taught in Auckland secondary schools from school and teacher selection, actual developments so far in the rollout of EfS, critical constraints associated with trying to imagine innovative content to curriculum and innovative pedagogic practice, and suggested strategies to enliven the EfS project in the face of now known constraints.

## **Geographic Imaginaries and Geographic Teaching**

Imaginaries, then, are discursive frames that shape our knowledge of the world and being in it, and guide practices of knowledge production, resource allocation and subjectification. Geographical imaginaries about places and the interactions among people and environments that constitute places are integral to living in a changing world and changing planet. This explicitly geographic framing of inquiry into matters of fact and concern draws deeply from the reservoir of geographic approaches to producing knowledge. It foregrounds questions such as how powerful geographically inflected ideas come into existence, how they are understood and put to use by different populations groups, interests and individuals, and how and why some ideas but not others have had huge impacts on people's perceptions, attitudes, motivations and behaviours. These questions and the geographical insight that both underpin them and emerge from them have special saliency in the mobile worlds of globalising processes, where the tools of thought one learns in one context shape how one approaches living in other contexts. The pivotal role of geographical imaginaries in knowing, being, and acting in the world, gives the teaching and learning of geography a heightened significance that is not always recognised. Curriculum and pedagogy are embedded in political frames, whilst working within them to generate and mobilise geographical imaginaries is a political act and requires a politics of engagement.

Recent debates in New Zealand about the attitudes of urban citizens towards rural practices and ventures are an important example of how geography might shape national futures. The way that the dairy industry is constructed as dirty, environmentally destructive, and poorly regulated in lessons on sustainable development in urban classrooms may shape the future political, consumption, and investment decisions of students as well as their understandings and performances of nation. Similarly, the different ways that geography students are exposed in their geography classrooms to the sustainability of tourism will frame and normalise public understandings of the social and environmental economies of New Zealand's second biggest industry. These effects are not simply a function of formal curriculum but about its interpretation by teachers, their backgrounds (disciplinary and otherwise) and the geographical imaginaries through which they read geographical process and settings, the resources available to them in schools, the organisation of field trips undertaken, the relations between school curricula and wider

disciplinary trajectories, and of course the geographical imaginaries brought into classrooms by students (who are also often vigorously “informed” by their parents). The performance of geographical imaginaries in these classroom and field learning settings is just as complex as the processes by which they arise and circulate in other social settings.

## Geography in the New Zealand Secondary School System

New Zealand secondary education is comprised of core subjects in Years 9 and 10 (students aged 13–15) and a system of optional subjects offered to seniors in their last 3 years of school (Years 11–13, students aged 15–18). Geography has been a highly prominent senior school subject in New Zealand’s secondary schooling and a highly visible discipline in New Zealand’s universities. Estimates suggest that since the 1950s as many as 2,000,000 school pupils have taken School Certificate–Higher School Certificate or Years 11–13 geography. In the post-war era, geography was, along with history, almost foundational knowledge, a pivotal contributor to citizenship education and national development (see Jobberns 1945). It has been taught as a senior school engagement with nature and society and their interplay in place, with a regional studies emphasis that followed the teaching of geography in universities (Cumberland and Fox 1958). Geography occupied a strategic position in New Zealand’s secondary education system and played a vital role in introducing students to place, nation, nature, and social and environmental change, and to the challenges and dilemmas of their times. Understandings of this potential were recognised in the national curriculum, and a role for geography in national development was formally crafted across different governments and changing political, social and economic times (Chalmers 2005). The curriculum development process that captured geographical imaginaries and understandings of their values included education officers and other bureaucrats, curriculum design units, school inspectors, tertiary level educators, and teachers (especially in the years following the formation of the New Zealand Board of Geography Teachers (NZBoGT) in 1970).

In the last 20 years, the teaching of geography in schools has been dominated by the separation between curriculum and assessment inscribed into the organisation of New Zealand’s national education system by the new public management reforms of the late 1980s. Curriculum development is managed by the Ministry of Education, which sets a national curriculum that schools must deliver. A separate body, the New Zealand Qualifications Authority (NZQA), oversees the operation of the National Certificate of Educational Achievement (NCEA), the predominant “national” assessment system and one that is available in all state schools (Fastier 2001).<sup>1</sup> Schools may, however, prepare students for different examinations. The more elite and competitive urban schools tend to offer the internationally oriented

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<sup>1</sup> Importantly, the overwhelming majority of New Zealand students attend state schools.



and recognised Cambridge examinations, which are based on a prescriptive curriculum and involve a comprehensive series of end-of-year exams. State schools offering Cambridge examination classes will ensure that they cover the New Zealand curriculum within the Cambridge requirements and offer weaker students NCEA.

Introduced in 2002, the NCEA has come to dominate the teaching of geography in Auckland secondary schools. The NCEA is credit based, allowing senior students to accumulate credits in order to gain the NCEA at Levels 1–3 of the National Qualifications Framework (NQF) (Fastier 2007). “Achievement Standards” help set in place a required standard against which students undertake a combination of internal and external assessment in order to gain credit. In addition, assessment allows for the recognition of merit and excellence grades to be awarded above the achievement level (Fastier 2007). In addition credits can also be gained towards NCEA certificates at all levels by the completion of “unit standards”. These are internally assessed and are graded as either a pass or a fail, rather than graded on a scale of achieved, merit or excellence like achievement standards.

We emphasise NCEA and assessment here for four reasons. First, the division between curriculum and assessment is reflected in a facilitative, as opposed to prescriptive, curriculum. The curriculum is organised and taught from a focus on settings under distinct Achievement/Unit standard assessment units (resources, urban settlement, disparities, natural processes, and so on), out of which learning about geographical process is teased. The existing syllabus allows schools considerable scope to select settings from which to teach important geographic ideas and freedom to explore ideas in directions of their own choosing.

Second, in practice, the NCEA Achievement Standards became taught largely through individual settings for each achievement standard. For teachers, this approach is brought into stark relief by the contrast with the Cambridge system which emphasises weaving together different geographic ideas and the application of conceptual learning to multiple case studies from around the world. Some of those whom we have interviewed favour instead a pedagogic strategy of teaching concepts separately and more or less prior to settings. A recent curriculum review of geography has sought to redress the emphasis on setting-centred learning in response to concerns that it has restricted both the geographic coverage of the discipline to particular settings (often New Zealand cases) and the development of deeper understandings of key concepts. This is to be achieved by a new emphasis on process and an increased number of unit standards relative to achievement standards (Fastier, phone conversation, 19 January 2010). In an explanation of the new curriculum, the Ministry of Education observes that “...key concepts sit above context but find their way into every context” (New Zealand Ministry of Education 2010). It emphasises that “...students need time and opportunity to explore these concepts, to appreciate the breadth, depth, and subtlety of meaning that attaches to them, to learn that different people view them from different perspectives, and to understand that meaning is not static”. One of the key vehicles of this change in emphasis in geography is Year 11 Resources Achievement standard, which has been redeveloped around the notion of sustainability and changed from an externally assessed achievement standard to an internally assessed unit standard that encourages

teachers to adopt local research and to choose from a wider range of more relevant case studies.

Third, despite, or perhaps even because of this openness, teaching and learning in geography classrooms have tended to become assessment-driven (Fastier 2009). School geography has been guided by often conflicting interpretations of the requirements of the NCEA by schools, department heads, teachers, moderators, and officials from NZQA. When introduced at the end of the 1990s in the midst of a new culture of continuous assessment, the NCEA Achievement Standards were interpreted as a guide to an updated curriculum after a decade without curriculum review. The NCEA has come to circumscribe the openness of the curriculum, whilst the potential freedoms of internal assessment have been overwhelmed by proceduralism and audit culture.

And fourth, geography as a subject has been disaggregated and redistributed across standards, and in some schools across teaching departments. The NCEA standards are designed to be taught independently of one another as individual units, enshrining an imaginary that discrete educational experiences can sum into a coherent understanding of emerging geographies. Whilst our research has demonstrated that some schools offset this by using one setting for two or three different achievement standards so as to encourage students to see the links between different concepts, issues and geographical imaginaries, the effect is to fracture the discipline. It also means that geography's privileged position in the senior school curriculum has been undermined and it must now compete on fractured ground for students, status and place with social studies (now a senior school subject with a popular and populist suite of standards) in a crowded timetable of assessment units. The arrival of EfS threatens to extend that competition into geography's core of nature-society relations.

These factors have meant that in practice, as Auckland geography teachers in our survey concede with regret, teachers tend to focus on preparing students for assessment (mainly NCEA, and thus 3 years of continuous internal and external assessment exercises). In order to offer the best possible chance at achievement they tend to teach to the assessment requirements and to cover only the minimum required breadth of curriculum, albeit in depth. Ironically, our research suggests that teaching under the prescriptive curriculum of the Cambridge system, allows teachers to teach a wider range of geographical thought across a wider range of cases. Although the Cambridge curriculum emphasises concepts over settings and the students in these classrooms are commonly selected as brighter or are better prepared in the home to deal with a broader set of concepts and national and global settings, this finding from our research field is an important reflection on the restrictions imposed by NCEA on the potential of geography classrooms to foster novel and/or transformative geographical imaginaries.

Importantly, however, the field and field work as teaching practice and learning experience remain defining features of geography's organisation, curriculum, and pedagogy, as well as its place in the wider curriculum and its appeal to students. So too does its potential to shape and generate imaginaries that change worlds. The links between studying geographical imaginaries at large in the world, the ways that

new imaginaries are forged through teaching and learning in classrooms, and the work that altered imaginaries might and will perform in the world makes geography just as socially and politically formative as it has always been. What happens in geography classrooms shapes students and makes our worlds in important ways.

While several dimensions of this complexity have received some attention in the literature (Keown and McPherson 2004; Roche and Mansvelt 1997), surprisingly little research has been conducted from disciplinary perspectives on what has and is being delivered in New Zealand geography schooling. This chapter builds on some preliminary research into what is taught in Auckland secondary school geography departments. The research is survey based (a questionnaire followed-up by interviews), and does not address what is learned in geography classrooms, what imaginaries circulate into and out of geography classrooms other than via the formal curriculum, or how geographical imaginaries are forged in classrooms. However, it does give us a platform to think about how these processes work and insights into how EfS and sustainability education within the geography curriculum are framing and being framed by geographical imaginaries.

## **Researching Geographical Imaginaries in Auckland Schools**

At the end of 2009 as part of a summer studentship, Amy surveyed and interviewed geography teachers and heads of department in 29 of 48 secondary schools, asking in effect “what geography was taught to whom, by whom, where, and how”. The aim was to establish a profile of the delivery of geography in Auckland’s secondary schools. The 29 schools included a range of state, integrated and private schools with rolls ranging from 516 (Dilworth School) to 2,932 students (Rangitoto College). Summaries were compiled of the units taught and settings used in the teaching of geography at different stages of NCEA. We focused attention on achievement standards, which comprise the large majority of what is taught to students in Auckland secondary schools. Our research also looked at the teaching examples employed to illustrate the Cambridge syllabus where this was taught. We collected data on the numbers of geography classes in schools and the backgrounds of teachers of geography. The numbers collected were restricted to the 2009 school year in order to gain a snapshot of what was taught in the schools during one particular year. Whilst it gave us an unambiguous set of results, this did leave us undercounting the extent to which some settings were taught in the significant number of cases where schools alternate between teaching different geographical settings from year to year, and thus the prevalence of particular geographical imaginaries.

Auckland has a diverse ethnicity. According to the 2006 census 37% of the 1.25 million Aucklanders were born overseas, and roughly 45% of its population come from minority ethnicities. These include 18.9% of Aucklanders who identify as “Asian”, 14.4% who identify as being of Pacific origin, and 11.1% who are Maori. The city is becoming increasingly cosmopolitan in these terms, and far more diverse than other parts of the country. Some schools claim to make efforts to select

geographical settings for enquiry that take into account the diversity of their students, while others clearly make little use of such possibilities within the curriculum. One school in south Auckland teaches tropical cyclones with a South Pacific focus in order to engage their largely Pacific Island student population, but opportunities to address health problems prevalent among particular ethnic communities are overlooked.

## **“Settings” and Geographical Imaginaries in Auckland Secondary Schools**

The teaching of geography in Auckland schools is dominated by teaching to particular external standards and the choice of certain key geographical settings (Table 5.1). Nine out of every ten schools chose to study tourism as a key cultural process in the very open options of the marquee Year 13 90701 standard, and to use Rotorua as a case study. Similarly two thirds of schools chose to study beach processes at Muriwai beach in Auckland for the equivalent Year 13 physical geography paper. Of the schools that taught the Year 11 Resources topic (nearly three out of every four), all bar one used dairying in the Waikato or North Island as the setting. All schools taught a Year 12 Natural Landscape, with the vast majority using the example of the Amazon tropical rainforest. Table 5.1 reveals a startling convergence in selection of standards and settings taught in Auckland schools, and in turn points to a similar reduction of the geographical imaginaries being generated. Despite the non-prescriptive curriculum, teachers cover a narrow band of topics and settings.

In our interviews, we probed the reasons for this convergence. Teachers and heads of department pointed to patterns of school-wide and standard-wide selection, limitations on access to effective and trusted teaching resources, and the impact of assessment requirements on the energy, imagination and creativity of teachers. Teaching resources in particular were held to establish path dependencies in teaching, as were familiarity with and access to field sites. It is easier and safer in terms of securing good student grades to stick to trusted resources, known field sites, established standards, settings, and approaches. Sharing resources across teachers and collective teaching approaches restricted choice and the development of different sites across teachers, while the ability to use the same setting to teach several different achievement standards in the same year level (and with the same field trip) made settings such as tourism in Rotorua favourites.

The geographical imaginaries at work in classrooms are often framed within and circulate via teaching resource. Here again, the availability of templates from the Ministry-sponsored TKI website (Te Kete Ipurangi [www.tki.org.nz/](http://www.tki.org.nz/)) and the Auckland Geography Teachers Association (AGTA), were both held to lead to convergence, although teachers claim to modify, revise and update these routinely. The involvement of the AGTA points also to the importance of sharing of resources across schools, informally among professional and friendship networks as well as

**Table 5.1** Most popular standards and settings in Auckland geography classrooms

Achievement standard	Percentage of schools teaching standard	Most popular setting	Percentage using setting
Year 11			
90202 Extreme natural events	100	Volcanoes: Ruapehu and/or Tarawera	51.7
90203 Population	66	Migration: New Zealand	84.2
90204 Resources <sup>a</sup> – Farming	72	Dairy: Waikato/North Island	95.2
90204 Resources <sup>a</sup> – Mining	72	Gold: Martha’s Mine, Waihi	57.1
90206 Research	100	Traffic flow: local to school	27.6
90207 Contemporary issue	100	Geothermal bores in Rotorua “Bubble Trouble”	31.0
90208 Global topic	90	Earthquakes	42.3
Year 12			
90331 Natural landscape	100	Tropical rainforests: Amazon	86.2
90332 Urban settlement	59	Auckland and Singapore	70.6
90333 Disparities between countries			
More developed	69	United States	30.0
Less developed	69	Tanzania	25.0
Disparities within a country	69	Tanzania	30.0
90335 Research	100	Auckland: population flow, land-use	44.8
90336 Contemporary issue	100	Urbanisation: Mexico City	27.6
90337 Global topic	97	Tropical rainforests	32.1
Year 13			
90701 Analyse natural processes	100	Coastal: Muriwai	65.5
90702 Analyse a cultural process <sup>b</sup>			
New Zealand	93	Tourism: Rotorua	88.9
International	93	Tourism: Bali	44.4
90703 Geography in planning <sup>c</sup>	62	Local issue: student’s own choice	44.4
90705 Research	97	Coastal: Muriwai/Omaha (to complement 90701 field trip)	32.1
90706 Contemporary issue	100	New Zealand issue: student’s own choice	79.3
331.654 pt	100	Tourism development	58.6

<sup>a</sup>Two schools did the related unit (not achievement) standard, also using Rotorua as the setting

<sup>b</sup>One school did the related unit (not achievement) standard, not included in the total of schools

<sup>c</sup>Of the schools doing Hampton Downs, many offered this standard only to the top students and had one or two students take it up, so a set topic was used to teach it

formally via the AGTA. Textbooks were also identified as influential when they provided easy, informative case studies such as the Van der Heyden's farm in the Waikato, used for Year 11 90204 Resources Achievement Standard both by schools who went on field trips to other nearby farms. Resources provided by outside organisations such as World Vision proved popular, with topics such as HIVAIDS and Landmines used regularly at the Year 12 level, and UNICEF. In some cases, the same setting and information sets were used by different schools for different achievement standards. For example, a local traffic flow and parking study was used by Mt. Roskill Grammar to teach Year 11 90207, but by other schools to teach Year 11 90206.

Field trips were highlighted in interviews as crucial sites and moments for the production and circulation of geographical understandings among students. Again, certain field sites were popular (visiting a dairy farm or the Waihi gold mine for the Year 11 resources standard, trips to Tongariro for natural landscape studies and Rotorua for cultural processes, and unsurprisingly urban Auckland for Year 12 urban settlement and Muriwai beach for Year 13 natural processes). Teachers sought wherever possible to teach two or more standards through the same field trip. Not all field experiences were identified as positive, while field trips for some topics were not possible due to limited time, funding, lack of approval from senior management or sheer organisational difficulties. In these cases, the teachers usually used textbook examples and virtual explorations to give students access to the field. In one innovative school quality video footage was taken during a visit to a dairy farm a number of years ago and used subsequently to teach the Year 11 resources topic. This determination to give students field experiences confirms not only their centrality to teaching practices, but also to the production of geographical imaginaries among students and the understandings of discipline and its values held by teachers (see Hovorka and Wolf 2009).

Table 5.1 describes a convergence of the curriculum towards a restricted geographical imaginary. Other dynamics are at work that will restrict this offering further. Teachers report moves to address the assessment burden on teachers and students by reducing the number of achievement standards on offer or replacing an external achievement standard with a unit standard (internally assessed) in the same field and using the same setting. Many teachers expressed regret at these moves and the limitations they place on the breadth of student understandings of geography, but again cited success in externally examined standards to legitimate their decisions. Importantly, schools were tending to drop the same standards, notably 90203 Population, 90204 Resources, 90332 Urban Settlement, and 90333 Disparities. Notably, these standards are those that might introduce the varied imaginaries and traditionally involved the widest range of settings.

Some 118 geography teachers across the 29 schools were surveyed. Those interviewed pointed clearly to the significance of assessment considerations around the interplay of pedagogy and curriculum as responsible for the learning of a narrow and narrowing set of geographical imaginaries in Auckland classrooms. These play out in relation to resource availability, access to field sites, and the aim of the curriculum to draw upon and develop local understandings and address meaningful

local issues. Other systematic effects were also identified, although we are less clear as to how exactly they are reflected in the specifics of the learning experience. These include the backgrounds of students (socio-economic status, ethnicity, language ability) and of teachers (where, when and how they were trained in both teaching and geography, whether or not they were brought up in New Zealand, and the extent of their geographical imaginaries). There is clearly a complex landscape of social difference in Auckland (Lewis 2001) and related geographies of geographical knowledge and wider learning possibilities and requirements, including the qualities of schools and schooling. The levels of convergence in standards and settings taught suggest to us the need for more ethnographic forms of research to capture the relationship between geographical education and geographical imaginaries in Auckland schools.

We were able to capture interesting patterns about the geography teacher workforce. In all we gathered information about 129 teachers and found that the majority had studied in New Zealand, with more than 50% gaining geography degrees from The University of Auckland. By the same token, a sizeable proportion of teachers (27.2%) had studied in geography departments overseas, mainly in the U.K. and South Africa. Whilst 15% of teachers had graduated more than 30 years ago, more than 50% graduated after 1996 and will have no or very limited knowledge of teaching geography prior to the NCEA and will have had experienced their geography training after the influence of the cultural turn in academic geography. Over 70% of the teachers had not studied at post-graduate level and more than 60% of teachers were Arts graduates. With the University of Auckland providing the option for a geography student with a social science program to graduate with a BSc and with geography located firmly in social science departments of schools, this gives us a sense of a workforce trained in liberal arts and influenced by socio-cultural imaginaries of geography. All 118 geography teachers included in the research teach Social Studies as well as geography (mainly at a junior level, but also senior Social Studies), confirming that this imaginary of discipline is reproduced in school organisation and in the minds of students and teachers. With geographers teaching “Travel and Tourism” in Social Studies (locked down by the Ministry of Education requirement that Tourism teachers must have a Geography degree) and tourism settings in geography standards, geography is clearly positioned in this way.

When put to teachers in interviews, the question as to how they understood geography in light of their disciplinary backgrounds yielded some interesting answers and a range of concerns about their capabilities in different parts of geography. Many spoke of how they felt more comfortable teaching human geography and that physical geography was more of a challenge, so they carefully selected settings for the natural processes achievement standards that they felt most able to teach. Others spoke of the low level of content knowledge communicated as part of their formal teacher training, and how this has restricted their confidence to do things differently and choose other settings. While the interviewing process revealed that teachers’ own personal interests and background played a role in the selection of topics and settings offered to students, we are unable to make definitive statements about their effects on the generation of imaginaries. As with the case of student experiences, we need to conduct

more ethnographic forms of research to capture these effects. In so-doing, we might also want to consider how the work of geography teachers in other subject areas is also putting particular geographical imaginaries into circulation.

## **EfS and Emerging Sustainability Imaginaries in Auckland Schools**

Our survey coincided with both the introduction of EfS and the initial responses of teachers to the review of the geography curriculum. This gave us the opportunity to gain insight into the initial “translations” of the arrival of EfS as teachers tried to fathom its implications alongside the new landscape of choice presented by the wider, altered curriculum. The most telling finding was that only 3 of the 29 schools surveyed currently taught EfS or had plans to introduce it in the near future. Two schools had implemented EfS achievement standards either as a stand-alone course or as standards within geography, and one school had planned an EfS program to begin in 2010, with 25 students already enrolled (Table 5.2). This slow start was in spite of all HODs having a familiarity with EfS and expecting the geography department to be its natural home, and several having been on a course to learn how to teach it. It also flew in the face of support for the program from a significant number of teachers.

Of the three schools, Auckland Girls Grammar School is the most developed in its offerings of EfS. It has 64 students enrolled in classes at both Year 12 and 13 levels, with roughly ten students focussing on their own portfolios across the 2 year levels, and about 50 students studying sustainable initiatives and policies. Onehunga High School was scheduled to begin teaching EfS in 2010, with the program firmly in place and students enrolled. The St. Dominics case illustrates an additional hurdle in the development of new programs. It offered one achievement standard as part of their course for 1 year level in 2008. Developed by an enthusiastic teacher to take advantage of a field trip that they were running, it represented the earliest adoption of EfS in Auckland. However, when the teacher involved left the school it was discontinued. The networks and passions of individual teachers are important factors in adoption of new standards.

Why such a slow start? HoDs pointed to fears over the dilution of geography as a subject and the loss of students to another subject, the context of curriculum review and the need to assess how that would impact on geography and the potential for EfS, and the pressures on staff time and energy to develop a new program and set of resources. Other concerns cited included uncertainty over assessment schedules, examination questions and moderation, low levels of student interest at schools where it had been introduced, and worries about the narrowness and/or lack of clarity of EfS as both a subject and a disciplinary pathway.

The slow start, however, does not imply a rejection of the program. HoDs were considering the possibility of picking up EfS as a subject within their programs. They regarded the decision as to whether to introduce EfS as a departmental debate,



**Table 5.2** Early adopters of EfS in Auckland secondary schools

School	When begun	Department	No. students
Auckland Girls Grammar School	2008	Science and geography	64
Onehunga High School	2010	Geography	25
St. Dominic's College	2008	Geography	1 class

and committed teachers conveyed the impression that they were in a position to force it onto a school's teaching program. The political and ethical stance towards sustainability of younger, more recently trained staff confirmed support for EfS as a subject. Indeed, nine schools expressed plans/hopes to implement some EfS achievement standards. Several had considered replacing one or two geography achievement standards with EfS standards, but remained uncertain as to the value of doing so. Three schools claimed to see potential for establishing a whole new course based around EfS achievement standards if it were organised by and linked closely to geography and taught by a combination of teachers from the science and geography departments. These schools saw in EfS an opportunity for genuine interdisciplinary learning. Several teachers interviewed identified opportunities to use EfS to develop dimensions of physical geography while others saw opportunities for human geography. Two teachers saw it as an opportunity to assist students struggling with elements of physical geography to gain a stronger understanding of nature-society relations.

## Challenges of Opportunity and Strategies to Enliven EfS

Our study on geography teaching in Auckland schools gives us confidence that *what* geography is taught to students and the *way* it is taught (particularly influenced by *who* is teaching it) shape student ideas of geography and their geographical imaginaries. It points to the significance of who is in the classroom and their backgrounds, the availability of resources, and how standards and school teaching programs are organised and interpreted. These same considerations are also clearly significant for how sustainability imaginaries may be forged in and circulate through school classrooms. Three dimensions of our account of geography teaching in Auckland schools have a particular significance for teaching EfS: the organisation of Achievement Standards in schools; resource availability; and teacher backgrounds. The geography experience demonstrates that teachers are conservative when it comes to exploring new settings and are unlikely to seek to develop entirely new teaching programs without appropriate resourcing and assurance that their students will not be disadvantaged in assessment. On the other hand, the age and educational backgrounds of geography teachers suggest that they bring with them to schools a strong grounding in sustainability studies and openness to a political project of EfS. The growing influence of environmental management and environmental science in university

geography programs (especially Auckland), we can expect new teachers to become increasingly sympathetic to the notion of EfS and to incorporating it into geography teaching programs in schools.

The introduction of EfS into NZ secondary schools is an unparalleled opportunity for NZ geographers in schools and universities and the New Zealand Geographical Society though it's Board of Geography Teachers to re-imagine and re-tool the practice of how geography teaching is conceived and done. We note for example our concern that the failings of a system that teaches to assessment around a convergent suite of settings and a conservative set of resources should not be overturned by a knee-jerk switch to a "process" educational strategy in "pure" form. That is it is important to guard against sedimenting an imaginary that the pursuit of geographical knowledge is de facto a search for a single geographical imaginary. While a failed over-emphasis on pre-defined settings can restrict innovation, diversity and creativity in teaching and learning, the danger of a "pure process approach" is that concepts that have been made stable, by defining them a priori, will become used to construct geographical imaginaries that are fixed. In this situation understanding is known as finding and detailing different perspectives of the conceptual object, rather than sensing how lines of difference in geographical processes are what make up the content of the relations of living with "natural" and "cultural" processes in a context.

We ground our concluding remarks in the now much more clearly understood institutional realities of these educational sites. Being able to be forward looking and thinking is an exciting prospect.

This final section finishes with reference to four concluding matters. They are:

1. A statement about the geographic imaginaries
2. A statement about framings and constraints that will actively affect efforts
3. Comments on the risks of doing nothing
4. Recommendations on initiatives

### ***From Stock Taking Geographical Imaginaries to Restocking with Imagination***

The data allows us to say something about the geographical imaginaries being developed in Auckland. In short, this is a restricted list for exciting the geographical imagination. At worst it gives our students a view of the world as composed of Auckland, volcanoes, tourists, geysers, cows, tropical rainforests and high energy, iron sand beaches. Missing from dominant sustainability tropes and concerns that we might have to tell the world about what it is to be NZ, are topics such as tectonic and seismic activity (including tsunamis), urban and rural flooding, housing, biophysical variability, agricultural and drought, aquaculture, human vulnerability and resilience. Also missing are iwi, Pasifika and gender. Whilst these are clearly present in social studies classrooms, their absence in geography classrooms misses an opportunity to develop alternative and potentially disruptive starting points for

engaging with sustainability and demonstrating its saliency and significance. However, even these restricted imaginaries offer a potentially rich platform for developing a sustainability education, named or unnamed or formalised through assessment or otherwise. In what follows, we argue that to realise this potential we need to recognise the potential of NZ imaginaries, we need to shift the politics, and we need to be creative in classrooms and in avoiding and stepping around the institutionalised constraints of schools/classrooms/curricula and so on.

### ***Doing Geographical Imaginaries Aware of Framings and Constraints***

The new NZ geography curriculum is a move from settings to processes. In this regard, the Auckland data captures a settings based curriculum emphasis. But always in any curriculum there are inevitably tensions between settings and process centred approaches and many other such divisions, such that the world of practice is not either/or but rather a series of “this” and “that” and “that” and so forth.

The concern is that settings and processes both shape curriculum orientation. A commitment to one emphasis or the other pre-conditions what is then performed in the class room or field. This is an enduring and ever present tension in designing any educational program and there are no easy answers. In a recent reflection on the contribution of the discipline (Le Heron and Lewis 2011) we returned to the old dictum, that ‘geography is what geographers do’. To update this dictum and to give a new sense of direction we focused it clearly on the “do” part of the dictum. Following on from this discussion we would argue that the settings is crucial but not as a neutral descriptive plain. The real issue is how we perform in the setting and how we come to know the setting. This inevitably means we have to bring to bear concepts, which of course brings in process, but with recognition that process can only ever be situated in settings. For a geography teacher or a teacher of EfS, what does this mean?

We believe this takes us back to “why” questions and strategies for generating answers to the why questions. For example, when Kathie Gibson was speaking on “Sustaining places: disclosing new development pathways” at the 2011 Institute of Australian Geographers conference in Wollongong she stressed that the immediate priority is to recognise the complex interactions among economy, culture and environment that are performed in daily life. The language of sustainability gives us a frame for talking about the critical “why” issues that affect our relationships to ourselves and the planet simultaneously. This is a substantive matter for both curriculum and pedagogy. In the complexities of teaching geography in Auckland secondary schools the existence of this potential is difficult to grasp. Our data shows that the administrative messiness of delivering geography in schools is overwhelming attempts by teachers to develop imaginative responses. The question is “what might be achieved within these constraints and to relax these constraints”. She also made it very clear that it is not enough to simply instruct students to behave in a particular way in respect to the environment. Dispositions to economy and environment need

to be modelled and crafted, and seen as a long term and ongoing collective experiment. This leads us to suggest that one of the things that teachers might do is to bring people into the class room to talk about the doing of alternatives. This both releases imagination in the class room and allows the teacher to see how constraints might be dealt with creatively, rather than be debilitating of classroom experience and imaginative interaction.

These tensions were vividly highlighted at the 2010 New Zealand Geography Society mini-conference on “Positioning Geography” in Hamilton when as delegates we had to make a choice between two concurrent sessions on approaches to teaching sustainability. The choice was between a “hands on” workshop that looked at teasing process out of settings and an open reflexive discussion of sustainability teaching that began with the political and pedagogic potentialities of the concept. Just like hard pressed teachers we compromised, and split our time by shuffling between sessions! The former was about field craft from the very mechanical practice of getting access to farms, organising the trip, to measurements of the experience in Achievement Standards, including intense debates over the meanings of particular key words in the curriculum and the points of difference between “achieved”, “merit” and “excellence” in assessment. A significant discussion was held over what a resource could now be, in keeping with the challenge posed by adding the word “Sustainable” into the title of the Unit Standard. The latter was free of the thought-disabling work of such details and the on-ground considerations with departmental time tables, processes of moderation and so on. The EfS project was subjected to a different situated politics of performance of sustainability, from a positioning in the academy. It produced a discussion that opened up new ways of knowing and acting in the world and the moves that teachers might make in this regard.

The experience reminded us as academics how curriculum is developed and taught is negotiated into the teaching plans. It will involve an assemblage of both strategies to teach settings and strategies to teach processes. This will always be complex and dependent on organisational demands and framings of the school administration, department, who teaches, how they teach, when they teach, the class room, the class, the field area, interpretations of parental pressures.

So saying, we were also impressed at the IAG by the Institute’s proactive politics to confront institutional framings of geographical practice. This was exemplified by a panel on “Population in Australia” that was broadcast from the conference to Australia via the ABC Radio’s Bush Telegraph (see website <http://www.abc.net.au/rn/bushtelegraph/>). The lesson of this exercise is that it begins to engage with the shaping of big imaginaries about territory. In NZ the new curriculum and EfS may have templated broad options but they have not prescribed the performance of the options. This is firmly in the hands of the educators. We would suggest a more creative politics is possible around the school geography curriculum and assessment practices, and in particular institutional understandings of settings and processes. We find it absurd that discussions about how to imagine sustainability for teaching purposes are held to ransom by debates about what constitutes merit or excellence in achievement. Teachers must be freed to imagine, with their students, and must act themselves to secure this freedom.

### ***What If We Don't Make Changes?***

Briefly we would identify four risks associated with ignoring the potential of the current moment. These are:

- Sustainability could be framed out of old imaginaries and class room and field resources
- Sustainability could be reduced to a focus on a part, and not approached holistically
- Sustainability could be studied independent of the trajectories leading to current issues, and thereby stripped out of context
- Sustainability could be declared to be apolitical, so hiding who is choosing not to act, who is acting with identifiable adverse effects, who is obstructing new initiatives at different geographical scales, and so on

These risks might be talked about as “shut down” procedures. Behind every action, of course are actors and the profiles of their wider responsibilities and the attendant frameworks of accountability, are integral to an education for sustainability.

### ***Recommendations***

In the light of the intimate entanglement of geography and EfS we contend that EfS needs geography and geography needs EfS. Geography's strength as a place for EfS to be taught is that it doesn't privilege one of economic, cultural or biophysical processes. Geography teachers ordinarily start from an integrated position. This minimises a reduction to purely economic, cultural or biophysical perspectives. Moreover geography can draw on its institutional strengths, especially NZGS and the Board of Geography Teachers and its links to Australian geography, to mobilise a range of initiatives. We would argue that amongst the priorities must be the following:

- Taskforces to develop new resources. The membership of these needs to be a mixture of secondary and university teachers, with input from a range of actors including pressure groups
- Heightening the imaginative experiences of learning. Options include deploying ICT to generate creative pairing of NZ and international settings (e.g., Auckland and Mexico City for a topic such as urbanisation, or NZ and Turkey for earthquakes/seismic activity, or NZ and Philippines for volcanic processes, or NZ and Denmark for dairying), bringing engaged experts into the classroom, and developing new Setting resources across several countries.
- Building on the university-school links such as over preparation of students for the Cambridge or NCEA Scholarship examinations and re-invigorating local NZGS branch lecture programs around EfS

- Using the biennial conference cycle of NZGS to host special sessions designed to expose teachers to new material and thinking that prioritises new resource preparation ahead of updating old resources designed for different times and curriculum.
- Teacher trainees. Again the universities have a special responsibility to provide leadership from the international literature and also from research in NZ and abroad.
- Seeking out new relationships with Australian colleagues in each of the fields of teacher training, resource preparation, graduate teaching and field trip development.

For any of these initiatives to gain purchase we will need to work with teachers to dislodge teaching geography for assessment. Here we see the introduction of EfS as an opportunity to redefine the norms and conventions of the interplay between curriculum and pedagogy in geography classrooms. These sorts of connections and initiatives will allow a political project of knowledge production like EfS to avoid being naive in its development.

**Acknowledgments** We acknowledge the assistance of the geography teachers in Auckland schools to whom we talked in the preparation of this chapter; June Logie, Mary Flaws, and the Auckland Geography Teachers' Association for discussions about geography in Auckland schools over many years; and the Science Faculty of The University of Auckland for funding the data collection through a Summer Scholarship for Amy Harris.

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# Chapter 6

## Fieldwork, Schooling, Sustainability: A Tasmanian Case

Robbie Johnston

### Introduction

In the Australian island state of Tasmania, and in particular in the Tamar Valley in northern Tasmania, matters to do with development and the environment are highly contentious. Young people live within a highly contested environment at the local level and at the same time are not isolated from heated Australian national and global debates about sustainability and issues connected with the climate. Widespread flooding in Queensland and Victoria, bushfires in Western Australia and a category five cyclone in Far North Queensland in a 2010–2011 summer of disasters in Australia have ramped up the level of public debate about sustainability and related issues of climate change. Commentators, academics, cartoonists, and politicians along with community members – all have had their say. A Petty cartoon (Petty 2011) juxtaposed a banner with the words “Flood of climate change evidence” (p. 12) with an image of a miner (representing the “coal lobby”) in denial and calling for “more sandbags” (Petty 2011, p. 5). All of these events have occurred against a backdrop of publicity surrounding the Copenhagen and Cancun climate conferences about which public opinion as well as expert advice were sorely divided. “Green politics” and community passions go “hand in hand” in Tasmania, notably and most recently, in relation to the proposed pulp and paper mill of Gunns Limited at Bell Bay near the mouth of the Tamar estuary – as the local newspaper, in a time line of pulp mill decisions and resistances, reminds its readers (“Pulp Mill” 2011).

For almost a decade, the Tasmanian State Government and Gunns Limited have been in close communication. State government/Gunns Limited conversations raising the prospect of a pulp mill for Tasmania began in 2003 and resulted in a series

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of protest rallies, one of which attracted a crowd of more than 10, 000 people protesting “the mill approval process” (“Pulp Mill” 2011, p. 5). The interplay of power politics and community agency connected with the pulp mill raises issues of sustainability and civics and citizenship, both key concerns for teachers in Tasmanian schools. Within the Tasmanian curriculum and nationally, Civics and Citizenship is a mandated area of study (Department of Education [DoE] Tasmania 2007) and, at State level, “sustainability” is described as “an important cross-curricular perspective” (DoE Tasmania 2008a, para. 1).

This chapter considers education for sustainability at this highly contentious local level as well as within local, national and global policy contexts – and draws on Tasmanian research exploring society and environment curriculum within teacher education. Readers may feel that the issues facing teachers relate only to managing contentious issues in the classroom. Yet others may ask, what are some of the interacting forces shaping what happens in classrooms and what does it all mean for teacher educators? As a teacher educator, I find that such matters are a concern to many pre-service teachers (PSTs): they want to know how to manage contentious issues in the classroom. Before discussing these questions in more detail, I focus on the meanings of sustainability, education for sustainability and civics and citizenship education and outline the research study that informs later discussion. As demonstrated by the Tasmanian pulp mill case, issues of sustainability are closely aligned with civics and citizenship, particularly in relation to community action.

## **Meanings of Education for Sustainability (EfS) and Civics and Citizenship Education (CCE)**

This section discusses both of these terms along with the interconnections between them. As this section indicates, the interconnections between these curriculum areas of EfS and CCE, as well as tensions within each of them, present educators with challenges in implementing education for sustainability in the classroom. As I argue in this section, one of the ways in which civics and citizenship is implemented in the classroom is through issues of sustainability and sustainable development. Tudball and Gordon (2011) describe sustainability as one of the “pathways” for civics and citizenship education with children involved in “‘green teams’ and environmental clubs”, and “campaigns such as rubbish free school lunch weeks, Make Poverty History, Lights Out and recycling” (p. 418).

Later in the chapter I discuss some of the sustainability initiatives implemented as part of the Australian Sustainable Schools Initiative (AuSSI) project. Many align with the kinds of activities associated with civics and citizenship through sustainability.

## *Education for Sustainability (EfS)*

Australian and Tasmanian policy documents include sustainability as a key dimension of the school curriculum (Commonwealth of Australia 2005; DoE Tasmania 2007, 2008a; Ministerial Council on Education, Employment, Training and Youth Affairs [MCEETYA] 2006, 2008). Notably, the recent Australian Curriculum initiative acknowledges sustainability as a cross-curricular perspective (Australian Curriculum, Assessment and Reporting Authority [ACARA] 2009, 2010, 2011), as does the Tasmanian curriculum (DoE Tasmania 2007). However, EfS – along with the closely related area of environmental education – has a long history in Tasmania and in Australia.

Education for Sustainability (EfS) or “environmental education for sustainability”, the term in current usage in educational blueprints has superseded the area of learning previously known as “environmental education” (Commonwealth of Australia 2005; Cutter-Mackenzie 2011). The area of learning known by these various terms has evolved over several decades, largely from the impetus of global pressures and agreements. Hart (1997), for example, highlights the influence of the World Commission on Environment and Development (WCED), commonly called the Brundtland Commission, and the United Nations Conference in Rio de Janeiro in 1992 which shifted the focus from the natural environment to considerations of social justice and economic development, globally.

Many recent curriculum initiatives within Australia have stemmed from the United Nations Decade of Education for Sustainable Development 2005–2014. *Tasmanian Curriculum* (DoE Tasmania 2008c) cites the Brundtland Commission definition of sustainability as “useful”: sustainability is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Commission UN 1987, cited by DoE Tasmania 2010). It could be argued that the Brundtland Commission definition for sustainability cited by the *Tasmanian Curriculum* is not particularly helpful when it comes to thinking about issues of sustainability and CCE in schools. There are many viewpoints about what will meet “the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Commission UN 1987, cited by DoE Tasmania 2010) – therefore, this definition as cited is likely to be the subject of debate.

The very term, Education for Sustainability (EfS) is complicated by tensions surrounding the meaning of “sustainability”, “sustainable” and “sustainable development”. Finding agreement about the meanings of these terms is challenging. Woollorton et al. (2010) argue that users of the terms “sustainable” and “sustainability” do not always imply “what is being sustained” (p. 22). Hart (1997) uses the term “ecological sustainability” which he considers underpins social and cultural sustainability. Interestingly, the term ecological sustainability was the one used in curriculum documents that are now superseded by various alternative blueprints – see for example, the

Statement and Profile (Australian Education Council 1994a, b). There seem subtle differences between this term, ecological sustainability, and that of sustainable development. At times the term sustainability appears synonymous with “sustainable development”. However, it is argued that sustainable development tends to be aligned strongly with notions of development – and associated implications for economic growth and expansion (Wooltorton et al. 2010). Likewise, Hart (1997) argues that development tends to be “equated ... with the word growth” (p. 6).

According to Cutter-Mackenzie (2011), the two terms, EfS and environmental education, reflect different philosophical positions on a continuum of environmental perspectives. Cutter-Mackenzie (2011) questions whether it is possible to find “a balance” between the most ecocentric and technocentric ends of an environmental perspective continuum as is suggested in recommendations to weigh up environmental, economic and social costs of development. Further, Cutter-Mackenzie (2011) argues that the meaning of sustainability and what it means for education “have become highly politicised, with sustainable development dominating responses” (p. 360). Understandably, tensions about the meaning of sustainability, along with EfS, present challenges for educators, particularly as EfS tends to be closely aligned with Civics and Citizenship Education (CCE) in schools. Given the depth of community passions about environmental decision making in Tasmania, it is understandable that local teachers and pre-service teachers may see such issues as “too hot to handle” in the classroom or seek to implement them in anodyne ways.

### *Civics and Citizenship Education (CCE)*

As indicated earlier, sustainability is described as one of the “pathways” for implementing civics and citizenship in schools (Tudball and Gordon 2011, p. 418). Thus, EfS is seen as one of the ways in which schools introduce civics and citizenship initiatives, notably with students participating in community initiatives connected with care of the environment and stewardship. Tudball and Gordon (2011) indicate that many of these initiatives are valuable for children’s learning, “particularly ... sustainable development initiatives that have been developed and run by students, who can then see the authenticity of these programs for their own lives and future” (p. 418). However, as with EfS, in practice, CCE is highly varied with learning ranging along a continuum from the transmission of knowledge to more critical engagement with issues that matter to children and which involve them as authentic citizens working with adults on “child initiated, shared decisions” (Hart 1997, p. 41). Thus, civics and citizenship initiatives also span a continuum with perspectives and approaches, this time described as ranging from “minimal” to “maximal” (McLaughlin 1992, as cited in Tudball and Gordon 2011, p. 406).

Very broadly, civics is associated with the knowledge of political institutions and formal political processes. For example, within Australia students learn about the electoral process and the various roles and responsibilities of governments at various levels, local, state and federal. According to Tudball and Gordon (2011),

McLaughlin's minimal approach to CCE is aligned with "civics education" (pp. 406–407) with its focus on knowledge building.

In contrast, citizenship education is aligned with McLaughlin's maximal approach, which encompasses knowledge as well as willingness for individuals to participate actively "in democratic processes" and societal decision making (Osler and Starkey 2005, p. iii, as cited in Tudball and Gordon 2011, p. 407). The most substantial citizenship programs are seen to be those in which students or young people are active participants in making decisions rather than participants of projects designed for them by adults (see for example, Hart 1997). These more substantive approaches move beyond cultural immersion and inculcation in projects with taken for granted value and involve participants in the critical evaluation of projects and forms of participation. As Kennedy (2008) suggests, one of the objectives of CCE is "to contribute to critical thinking and problem-solving skills" (p. 389). Other objectives of CCE outlined by Kennedy are "to build social cohesion, inclusion and trust" and "to develop respect for diversity and tolerance" (p. 389).

Increasingly, these aims are global as well as local (Cogan et al. 2000; Kennedy 2008; Tudball and Gordon 2011). As Kennedy (2008) states, young people's citizenship "cannot help but be affected by the global context. Young people must understand global issues as well as local issues, and they must be able to see the relationship between local and global" (p. 391). Others take a similar view and argue for *multidimensional citizenship* (Cogan et al. 2000, p. 50). According to Tudball and Gordon (2011), "multidimensional citizenship" encompasses "the personal, social, economic, temporal, spatial, ecological and values elements of CCE" (p. 408). Kennedy's argument for global citizenship is oriented to the geo-political realities of international conflicts, including terrorism. While Kennedy's (2008) argument for global citizenship does not explicitly extend to issues of sustainability or sustainable development, the Tasmanian pulp mill case highlights the importance of global/local influences and interconnectedness.

Given the arguments put forth by scholars in relation to the pulp mill case in Tasmania (see, for example, Gale 2011), a sense of global citizenship seems as important for CCE through the pathway of sustainability and sustainable development, as through a more obviously geo-political aspect of it. Further, the pulp mill issue is subject to political and cultural influences and is far more complex than implied by everyday discussions that pit forest workers against so-called "greenies". Gale (2011) suggests that the forest industries in Tasmania have experienced "momentous change" due to a range of interconnecting influences such as an unstable economic climate and changing market forces along with pressures for companies to meet internationally agreed requirements for sustainable forest management and certification of forest products – combined with the "globalisation of environmental and community action" (p. 305). Gale (2011) highlights the way activists are mobilised to gain support for their views, globally as well as locally, in order for their efforts to be successful in bringing about change. Despite these interconnecting global forces, it is argued, too, that environmental assessments for the development of a pulp mill at Long Reach in the Tamar Valley ignored the Indigenous community's strong place attachments to the pulp mill site (Miller 2011).

These various global and local considerations, including the complex, interconnected economic, political and cultural dimensions stand in stark contrast with more technical and direct matters of sustainability such as the potential impact of a pulp mill on air quality. Notably, the Tamar Valley experiences airborne pollution due to confluences of meteorological conditions and its topography (Aitken 2011). It could be argued that the impact of wood heater and industrial smoke during the winter months, when an air-shed inversion layer is experienced, is a much easier matter to observe and understand – and easier to introduce to a curriculum on sustainability for children. However, even this way of approaching the issue of sustainability is likely to raise strongly held and different viewpoints. The issue is likely to be controversial. Yet, there is considerable evidence that teachers and pre-service teachers (PSTs) desire to avoid controversy and difficult issues in the classroom, in Tasmania (Johnston 2003) as well as elsewhere (see for example, Apple 1990; Holden and Hicks 2007; James 2008; Levstik 2000; Nelson 1991).

### **Pre-service Teachers in Tasmania: Some Curriculum Choices**

In this section, I refer to longitudinal research conducted with PSTs in Tasmania. The research did not aim to investigate sustainability or sustainable development directly. However, the findings of the research highlight some tensions for PSTs in making curricular and pedagogical decisions for children’s learning in relation to sustainability through the society and environment curriculum area: Studies of Society and Environment (SOSE), as outlined in curriculum blueprints in use at the time of the study.

The PhD research study emerged from an investigation of PSTs’ choices of field sites for children’s learning (Johnston 2003). For the purposes of a compulsory second year assignment, students had been asked to select a site for children’s learning through fieldwork. Students were invited to participate in formal phases of the research in which they were asked about these choices in a survey and in interviews. The research aimed to investigate the explicit and implicit curricular and pedagogical understandings embedded within PSTs’ choices of field sites for children’s learning in Studies of Society and Environment. These curriculum documents were used as reference points for teachers in Tasmania at the time of the study, and included the nationally constructed Studies of Society and Environment Statement and Profile (Australian Education Council 1994a, b) as well as Tasmanian interpretations of them (Department of Education and the Arts 1995a, b). “Ecological sustainability” along with “civics and citizenship” were listed as core values of these curriculum documents, both the nationally constructed documents and the State interpretations of these materials (see Australian Education Council 1994a, b; Department of Education and the Arts 1995a, b). Thus the documents incorporated the topics of sustainability and sustainable development and recommendations for children’s investigation of them.

As I have indicated elsewhere (Johnston 2007b), the initial investigation of sites selected for children's learning fomented several "research questions about the teaching of SOSE in primary classrooms in Australia, both explicit and implicit, and in the frameworks provided by curriculum documents" (p. 352) and led to a discourse analysis of the curriculum blueprints to which PSTs referred in their curriculum planning for children's learning. In making these choices, the participants of the study drew upon three dominant discourses within the curriculum documents: discourses of history, the immediate environment and the local community (Johnston 2007b).

Findings from the research indicated that the pre-service teacher participants took their choices seriously (Johnston 2007a) and took into account many considerations in selecting sites for children's learning (Johnston 2007b). In making their decisions for children's learning, PSTs drew upon the discourses evident in the curriculum blueprints. Their decisions were shaped to a marked degree by discourses of schooling along with a keen awareness of contextual factors such as the long-standing and highly publicised tensions surrounding "green politics" in Tasmania. Findings suggested that participants were keen to avoid controversial issues, particularly environmental ones. Accordingly, the PSTs sought to take strong control over what children may learn and fostered a form of curriculum censorship. Some sites, such as those associated with issues of social justice or controversy, were excluded as places inappropriate for children to visit. In their desire to protect children, it appeared that the PSTs drew upon a Western, Enlightenment construct of childhood. As Luke and Luke (1995) discuss, dominant views of childhood originating during the Enlightenment are largely taken for granted and perpetuated in discourses of schooling.

Overwhelmingly, participants identified their selected field sites in terms of curriculum relevance, with history mentioned more often than other curriculum areas. The dominant mentioning of history is not surprising given the official curriculum privileging of history – or "time, continuity and change", as this curriculum strand was called in this curriculum iteration (Australian Education Council 1994a, b; Department of Education and the Arts 1995a, b). However, as emerged in exploring the focus on history, participants tended to take a particularly biased, untroubled, anodyne view of it. History was described by one participant as "less contentious": "I guess the greater emphasis on Low Head is on history. And maybe that is much less likely to be contentious" (Johnston 2007b, p. 360). Interestingly, this site of Low Head is a popular beach at the mouth of the Tamar River and the site of a pilot station developed in the nineteenth century – as well as being within close proximity to Bell Bay and the site of the proposed pulp mill. Although the prospect of a pulp mill in the Tamar Valley had not been raised at the time of this research, Bell Bay is an industrial location and as indicated earlier, significant to local Indigenous community members. For these people, the history of the area is highly unlikely to be non-contentious.

In the discourse of local community, CCE aims were evident. Participants of the research drew upon a strong "curriculum discourse of community cooperation and harmony" and again, "steered away from recognition of difference and attempted to

sidestep any potential for conflict or recognition of it” (Johnston 2007b, p. 357). The curriculum emphasis mentioned by participants in mobilising the discourses of these curriculum reference points was on students “carrying out the responsibilities of citizenship: following rules, cooperating, negotiating, taking turns, and carrying out roles and responsibilities as well as preserving and caring for the environment” (Australian Education Council 1994a, b, as cited in Johnston 2007b, p. 357). The curriculum documents emphasised responsibilities such as “recycling”, “disposing of litter”, “care of places in the community” and preserving places such as “buildings, parks and old mining sites” (Johnston 2007b, p. 357). On the one hand, participants selected natural field sites as places in which children may learn civic duties such as care of the environment. On the other hand, such locations were avoided for their potential to raise controversy in relation to community divisions and “green politics”. Furthermore, when participants talked of how they categorised the site selected, there was only one mention of politics and one of culture – and both these terms were used by the same participant. Therefore, by participants of this study, these areas of the curriculum would seem to be marginalised for their potential to raise controversy.

However, in their desire to avoid controversy in their teaching, it would seem that Tasmanian PSTs are not alone. As indicated earlier, there is considerable evidence that teachers and PSTs of the social studies elsewhere also step away from the challenges of managing differences and shy away from including controversial issues in their classrooms (Apple 1990; Holden and Hicks 2007; James 2008; Levstik 2000; Nelson 1991).

## Recent Curriculum Initiatives

Key documents in current use for the teaching of sustainability and civics and citizenship in Tasmania indicate a stronger emphasis on critical thinking and problem solving than previous curriculum documents in use at the time of the Tasmanian research discussed in the previous section. In this section of the paper, I briefly discuss these curriculum blueprints before discussing a recent initiative in the teaching of sustainability in Tasmania. I conclude the chapter with suggesting some approaches to build on this work in the teaching of sustainability in schools.

In my view, the key curriculum reference points for teaching sustainability and sustainable development in Tasmania in relation to society and environment curriculum are the *Tasmanian Curriculum* (DoE Tasmania 2010) and two nationally written statements: *Educating for a sustainable future: A national environment education statement for Australian schools* (Commonwealth of Australia 2005) and *Statements of learning for civics and citizenship* (MCEETYA 2006). For the purposes of this paper with its emphasis on teaching sustainability in society and environment curriculum, the relevant section of the *Tasmanian Curriculum* is the section Society and History (DoE Tasmania 2007). As indicated earlier in this paper, sustainability is a cross-curricula perspective in the Society and History curriculum

along with other areas of the Tasmanian curriculum (DoE Tasmania 2010) and is described as encompassing the “four pillars of sustainability” – environment, economic, governance and social (DoE Tasmania 2008a).

The Tasmanian curriculum is centred on the overarching goal for students to learn “how to be a responsible citizen” (DoE Tasmania 2007, p. 10) and in this sense is clearly oriented towards CCE, a mandated area of the curriculum. Thus, the Society and History document includes “Responsible Citizenship” as one of eight curriculum strands (curriculum organising themes) which range from “Identity, relationships and culture” and “Democratic values” to “Philosophical inquiry” and “Communication” (DoE Tasmania 2008b, pp. 8–9). Civics and citizenship are encompassed within two separate strands – Democratic Values and Processes and Responsible Citizenship. The civics related curriculum strand Democratic Values and Processes highlights knowledge of civic institutions. The curriculum strand of Responsible Citizenship incorporates “participating in the community [and] taking action” as two focus areas (DoE Tasmania 2007, p. 8). In this sense, the *Tasmanian Curriculum: Society and History* document seems to acknowledge McLaughlin’s maximal approach to CCE with its focus on knowledge as well as a willingness for individuals to participate actively in the democratic process and societal decision making (Osler and Starkey 2005, as cited in Tudball and Gordon 2011).

At the same time, the *Tasmanian Curriculum: Society and History* diagram (see DoE Tasmania 2007, p. 10, Figure 1) highlights the importance for students to critically examine information. The curriculum document highlights in its first sentence that students “live in an increasingly globalised world” (DoE Tasmania 2007, p. 5). The curriculum encompasses “multiple perspectives, including indigenous perspectives” (DoE Tasmania 2007, p. 5). Further, the strand of Responsible Citizenship indicates that students will be involved in evaluating “strategies that promote democracy, conflict resolution, environmental sustainability, equity and social justice” (DoE Tasmania 2007, p. 9). Thus, the Tasmanian blueprint for Society and History curriculum appears to foster the objective Kennedy (2008) outlined, for civics and citizenship education “to contribute to critical thinking and problem-solving skills” (Kennedy 2008, p. 389).

On the other hand, the naming of the strand as Responsible Citizenship suggests an emphasis on socialising young people as responsible citizens rather than as critically engaging them in contested societal and political debates. This emphasis is reflected to some degree in *Educating for a sustainable future: A national environmental education statement for Australian schools [National Environmental Education Statement]* (Commonwealth of Australia 2005) with its focus on developing students as “ethical and responsible” citizens (p. 19).

Both the *National Environmental Education Statement* (Commonwealth of Australia 2005) and the *Tasmanian Curriculum* (DoE Tasmania 2007) balance this citizenship of cooperation and responsibility by goals for deep thinking and engagement with societal issues. The national document talks of a key dimension to develop learners as “reflective and deep” thinkers (Commonwealth of Australia 2005, p. 19). Moreover, the same national document emphasises developing “autonomous” learners (p. 19) and recognises students as partners in what and how they learn, stating that,



“student empowerment and ‘voice’ is a strong feature within learning relationships both in negotiating the curriculum and the ways of learning” (Commonwealth of Australia 2005, p. 19). This latter emphasis on student voice and non-tokenistic participation in shaping curriculum is not stated as explicitly in the *Tasmanian Curriculum: Society and History* curriculum framework – but does emerge strongly in material made available in 2011 on the AuSSI website (DoE Tasmania 2011). Clearly, the Tasmanian curriculum in keeping with national curriculum developments is highly fluid; there is evidence that it is evolving to incorporate a more critical, participatory approach.

## Recent School Based Initiatives

Previous school based initiatives in the teaching of sustainability in Tasmania highlight some of the work being done in schools, notably through the Tasmanian implementation of the Australian Sustainable Schools Initiative (AuSSI-Tas). A 2008 showcase of the work done by schools involved in the AuSSI-Tas initiative highlights key elements of school based programs in 12 schools across Tasmania (DoE Tasmania 2008b). As already mentioned, various curriculum blueprints in current use in Tasmania indicate that there has been a move away from ecological sustainability and care of places towards greater recognition of fostering depth of thinking and engagement with more complex issues of sustainability. From the published information about the AuSSI-Tas programs, it appears that the whole school based programs were diverse and based on the four pillars of sustainability fostered by the AuSSI program model – “environment”, “social”, “economic” and “governance” (DoE Tasmania 2008b, p. 3). In this sense, the programs would appear to move away from environmental education programs that emphasised “education in the environment” with a focus on “care of places” – a sub-strand in earlier curriculum blueprints (Australian Education Council 1994a, b).

The AuSSI-Tas initiative is described as closely aligned with the Tasmanian curriculum and as providing “resources and the tools to embed sustainability into their everyday school life” (DoE Tasmania 2008b, p. 3) through a School Environmental Management Plan (SEMP) that has an educational purpose. It is stated that “the SEMP brings together teaching and learning to develop, explore, reflect, and consider understandings around the concept of sustainability” (DoE Tasmania 2008b, p. 3).

The programs perpetuate many of the trends from the past but also indicate a broader notion of sustainability; it appears that the United Nations Decade of Sustainable Development 2005–2014 has been the catalyst for a shift to focussing on the four pillars of sustainability. In addition, the *National Environmental Education Statement* (Commonwealth of Australia 2005) appears to recognise the students as authentic participants in their learning – and with a right to contribute their knowledge and points of view. In this sense, the *National Environmental Education Statement* has drawn in views of environmental education informed by

the United Nations Convention on the Rights of the Child (CRC) along with Hart's (1997) recommendation to involve students in their own child-initiated projects where they collaborate with adults as partners.

This more radical notion of children as participants in their own learning aligns with a shifting notion of the role of the young learner introduced from cultural studies. In referring to environmental education within geography, Slater and Morgan (2000) argue for "redrawing the social relations of schooling" (p. 272) so that student knowledge becomes "a central part" (p. 272) of the curriculum. Rather than inculcating students into particular notions of sustainable living, such an approach to EfS would shift the balance of power within educational institutions. Rather than being places of compliance, schools would be sites of empowerment – as reflected in the *National Environmental Education Statement* with its emphasis on student voice (Commonwealth of Australia 2005). This approach is akin to civics and citizenship programs that encourage students to question the status quo and actively address social disadvantage (Tudball and Gordon 2011). Such a curriculum for sustainability would be based most desirably on issues of particular concern to young people who would be involved in community based projects that matter to them.

A reading of the showcase of school based programs, overall, highlights the work schools are doing in developing kitchen gardens, saving resources such as water and power as well as conducting various recycling initiatives. This work seems to emphasise agreed upon action, in many cases with a view to meeting budgetary efficiencies and to inculcating students into agreed upon life skills. Students are described as being involved in "waste management and conservation, ... composting, recycling, waste management, and water and energy conservation" (DoE Tasmania 2008b, p. 9), learning "how to care for the local community and its environment" (p. 12), and being involved in initiatives such as tree planting and rubbish collections (DoE Tasmania 2008b). In many ways, the programs highlight student activity in hands-on programs, upholding values of frugality, and what are seen to be behaviours conducive to sustainable living.

It seems that behaviours schools have traditionally encouraged in their students are included now with a new rationale of sustainable living. While these school based initiatives do not appear to involve student voice and autonomy, they do foster learning in numeracy and literacy in authentic teaching and learning situations and build strong community linkages. The Rosetta Primary School showcase entry (DoE Tasmania 2008b), for example, indicates that students are involved in mapping energy usage within the home and that they participate in the Sustainable Street project, operating too in other parts of Australia. The work of other communities has indicated the reduction in energy and water usage and the eco footprint (Byron Shire Council n. d.). The showcase highlights a wide range of initiatives. There is evidence of students being involved as participants in a variety of projects, but much less evidence that they have been involved as decision makers and invited to have a voice in the kinds of initiatives introduced, in keeping with the spirit of the work by Hart (1997). The programs mention community partnerships and decision making but these decisions seem to have been unproblematic. It would seem that as a next

step, programs aiming to foster understandings of sustainability and sustainable development could be extended to encompass the difficult issues confronting communities in Tasmania.

## Conclusion: Some Pedagogical Alternatives

Two ways into more complex aspects of teaching and learning for sustainability are the use of drama and deliberation through philosophy for children. These approaches are seen to offer teachers and their students with an opportunity to explore complex and difficult issues to which there may not be a clearly defined answer. Collins (2010) argues that curriculum unavoidably includes questions about which there is no clear answer and “such genuine questions are many, wide-ranging and often controversial in nature” (p. 4). Collins cites examples that include issues related to environmental issues and resource use. Convincingly, Collins (2010) argues a case for “dialogic teaching” and offers suggestions for engaging children in whole-class discussions “about questions that matter” (p. 4) to them. Likewise, McNaughton (2010) argues the case for education for sustainable development through drama. McNaughton’s research findings (2010) suggest that drama “provided the teacher and children with meaningful contexts in which concepts in sustainable development could be explored” (p. 305). Moreover, McNaughton suggests that, as a pedagogy, teaching through drama, “supported the learners in their efforts and allowed environmental learning to take place in holistic, multi-faceted, engaging and meaningful ways” (p. 305). Such approaches would neither exclude students having a voice in their learning nor deny them the opportunity to be decision makers. However, in such approaches as the dialogic community of inquiry approach (Collins 2010) and learning through drama (McNaughton 2010) children would have the opportunity to explore contentious issues and questions that matter to them in situations in which they are supported pedagogically. Both Collins (2010) and McNaughton (2010) bring evidence from research with these approaches; it seems that such approaches may support PSTs in welcoming the opportunity to incorporate controversial issues of sustainability into their classroom teaching. In my view, the approaches discussed by Collins (2010) and McNaughton (2010) may have much to offer educators working within contested contexts such as the one in Tasmania, particularly with debates surrounding the pulp mill; such initiatives seem worthy of further exploration.

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# Chapter 7

## Navigating Through New Terrain: Pre-service Teachers' Journeys in Teaching 'Sustainability'

Alison Lugg

### An Introductory Vignette

... the trip gives the opportunity to chat and I found that the kids I conversed with learned about my passions and... I think they were more engaged with me through those discussions than with me standing there talking about other stuff... things like riding bikes, there were a few kids that talked to me about riding bikes for a long time and we had long discussions about eating food out of a bin and we spent half the camp talking about that with some of the kids – they loved it. (Jim, Post-program Focus Group 2009)

Here a pre-service outdoor education teacher reflects on his participation in teaching in a year 9 “sustainability” unit during a four-week teaching practicum in a school in north-central Victoria, Australia. He focuses on the benefits of the less formal context of an outdoor education camp for engaging students in learning about sustainable living practices through lived experience.

During previous classes Jim and his peers had worked with the year 9 students to design the camp activities and to build sustainable practices into the structure of the camp so that they were modelled and experienced rather than just talked about. For example, the year 9 students and their teachers chose to ride bikes to the campsite (approximately 30 km) rather than taking a bus, as a way of minimising their greenhouse gas emissions (see Fig. 7.1). Meals were cooked from foods that the classes had collectively decided were more “sustainable” (for example; kangaroo bolognaise, vegetables grown locally and bread baked with organic flour). Rather than pay for the use of the camp facilities, the students and staff worked for a morning on maintenance of the garden and buildings as a reciprocal arrangement benefiting both parties. After the camp, classes were dedicated to exploring year 9 students'

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**Fig. 7.1** Students cycling back from camp in the SOIL program

learning from their experiences of the “sustainability” camp and issues arising from that. Students then made group presentations on their learning about sustainability from the unit of work.

Jim clearly enjoyed being able to share his passions with students in an informal (and possibly more authentic) way than is possible in the classroom. What is less obvious from this quotation is the dilemma he and some of his peers experienced when considering whether to tell students about their “dumpster-diving” habits. In saying “eating food out of a bin” Jim is referring to the fact that he and some of his peers regularly obtain their household food from local bins (or dumpsters), outside food stores. Much of the discarded food is still within its use-by date but packaging may be slightly damaged so Jim and others retrieve the food from the bins (“dumpster diving”) and call it “freegan” food! Initially the pre-service teachers did not talk about this with students because it could be negatively construed, but during the camp they were observed discussing and eating their “freegan” food. This led to interesting discussions with the year 9 students about the environmental and social impacts of dumping food that is still fresh and the ethics of retrieving it from bins once discarded.

Jim’s comments here relate to his experiences in teaching in the Sustainability through Outdoor Integrated Learning (SOIL) program which is the focus of this chapter. His insights are used throughout the chapter to introduce some of the key issues arising from the practicum project and theoretical concepts framing the case study.

The chapter describes the SOIL program, its context, the research project and its theoretical framework. Some initial results are discussed and tentative issues emerging from the ongoing research are highlighted.

## Sustainability in Teacher Education

In the transformative work of sustainability education, skills in experiential, critical and participatory pedagogy are considered essential in teachers' repertoires. To this end teacher education is considered a critical site for future teachers to develop such knowledge and skills (Ferreira et al. 2009; Hopkins and McKeown 2005; Steele 2010). Hopkins and McKeown (2005) proposed a "reorientation" of teacher education to address ESD as "an essential part of a larger conversation regarding the quality of life for all the inhabitants of Earth" (preface). However a decade later, at the beginning of the UNESCO Decade for Education for Sustainable Development (2005–2014), little progress had been made on an international scale.

More recently, in a context of increasing public concern about issues such as climate change, there is a growing interest in sustainability education in Australian schools and, finally, universities (Ferreira et al. 2009; Steele 2010). Recent Australian Government support for sustainability education in schools is evident in the publishing of its action plan, "Living Sustainably" (2009). This plan recognises a need to "reorient education systems to sustainability" (p. 5) identifying undergraduate teacher training as a priority for Government support in educating the community (p. 15). The current Victorian Essential Learning Standards (VELS) P-10 curriculum framework identifies sustainability as one of the goals underpinning the framework and as a cross-curricular focus of study.<sup>1</sup> The SOIL program was developed within the VELS framework. The new Australian National Curriculum identifies sustainability as a cross-curricular priority, outlining how it can be addressed by teachers of the stage one subjects; english, maths, science and history (ACARA<sup>2</sup>).

Despite these policy initiatives, pre-service teachers in Australia are inadequately prepared for this emerging cross-curricular focus on sustainability education or for participation in whole school approaches such as the Australian Sustainable Schools Initiative (AuSSI). Pre-service teacher education programs are either not addressing sustainability education at all or adopting piecemeal approaches (Tilbury et al. 2005; Ferreira et al. 2009; Steele 2010). To address this situation, Hopkins and McKeown (2005), Tilbury et al. (2005) and Ferreira et al. (2009) recommended a focus on collaboration, partnerships and networking between teacher education institutions, schools and community stakeholders to build capacity for sustainability.

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<sup>1</sup>See <http://vels.vcaa.vic.edu.au/overview/values.html> and <http://vels.vcaa.vic.edu.au/support/crosscurricular/sustainability.html>

<sup>2</sup>See Australian Curriculum Assessment and Reporting Authority website: <http://www.australiancurriculum.edu.au/CrossCurriculumPriorities>.



Interdisciplinary or cross-curricular approaches to learning in ESD were advocated along with pedagogies that emphasise the *interconnectedness* between environmental, social justice and economic issues. In particular these reports recommended that student-teachers develop skills in *critical thinking*, *participatory* pedagogy and a capacity to critique their own values and lifestyle choices. Hopkins and McKeown (2005) suggested that teacher educators lead by example by trialling new programs, and pedagogical approaches to sustainability education.

## Outdoor Environmental Education

Jim's teaching in the SOIL program was conducted in the context of an outdoor education teaching practicum. While outdoor education practice is often not directly related to notions of "sustainability", a strong connection may be construed as Nicol (2003, p. 11) succinctly explains,

In theory the connection between outdoor education and sustainability is quite straightforward. Sustainability is an objective of environmental education (Smyth 1999) and environmental education is an objective of outdoor education...

Recent challenges to the personal development paradigm in outdoor education, suggest a shift towards ecological or "place-based" frameworks (see for example, Brookes 2002; Loynes 2002; Martin 1999; Nicol 2003; Payne 2002; Wattchow 2005; Wattchow and Brown 2011). An ecological framework sees humans as part of the "web" of nature and culture where human action both shapes the world and is shaped by natural and cultural characteristics (Blewitt 2006; Orr 2004; Sterling 2004). This ecological conceptualisation of people as interconnected with the "whole" earth system, suggests a pedagogical reorientation to learning *with* rather than *about* the world (Gough 1987; Orr 2004; Sterling 2004).

Outdoor environmental education has potential to contribute to sustainability education through holistic pedagogy in an ecological framework, by emphasising physical, cognitive and affective connections with natural systems (see Higgins 2009; Higgins and Kirk 2006; Lugg 2007, 2009; Martin 2008; Nicol 2003; Nicol and Higgins 2008). As Higgins and Kirk (2006) point out, the emphasis in such a framework is on *relationships* and the notion of "ecology" extends beyond the physical and biological to recognise social and cultural processes as an integral part of these systems. An underpinning assumption is the expectation that direct, sensory experience in outdoor environments may generate embodied, *affective* connections with particular places, possibly fostering environmental concern and action (Higgins and Kirk 2006; Martin 2005; Nicol 2003; Orr 2004). Wattchow and Brown (2011) suggest that a "sensorial presence" coupled with a deep understanding of the cultural and natural histories of places is necessary for developing "place responsiveness". Martin (1999) advocates developing affective relationships and critical pedagogy in outdoor education contexts as means of generating connections with places and critique of unsustainable "human-nature relationships".

## *Experiential Learning in Outdoor Environmental Education*

Experience in outdoor environments, wherever they may be, is fundamental to learning through outdoor environmental education. The nature of those experiences is, at least partially, determined by the educator as well as by the participants, and the place itself. As is evident in Jim's reflections on the SOIL camps, learning emanating from lived experience can make it memorable and, possibly, more meaningful, than a disembodied discussion about the same topics in a classroom. The outdoor education context described by Jim, afforded experiential pedagogy, seen by many as essential in sustainability education (see Tilbury et al. 2005; Ferreira et al. 2009; Steele 2010). The nature of the SOIL camp activities – riding bikes to the venue, eating lunch in the outdoors, cooking “sustainable” meals to share with others, weeding gardens and cleaning the facilities together – is essentially experiential within a sustainability framework. That is, the intent of the activities was to allow students to learn through collaboratively planning, implementing and evaluating sustainable lifestyle alternatives.

The nature of student participation in this context can be varied but includes elements of sensory engagement often unavailable through classroom learning. Wattachow and Brown (2011, p. 73) regard sensory experience as enabling “embodied” learning, a critical aspect of outdoor education in developing a “sense of place”,

It is the learner's bodies that remain the ultimate centre of their learning. Learning cannot be considered separate from their embodied interactions and connections with place. Thus there is the possibility of a mutualism of embodied and reflective/interpretive learning which establishes the pedagogical boundaries of an educational practice that occurs within a place. We might think of this as a pedagogical meeting ground of body, mind and place.

Orr (2004) and Louv (2005) argue that this meeting of mind, body and place is essential for affective engagement in environmental and sustainability education. Embodied experience in the outdoors can (but may not) enable students to develop more holistic understandings of the consequences of human interaction with ecological processes such as the water or carbon cycles (Higgins 2009). In this respect experiential learning in the outdoors is arguably, a distinctive contribution that outdoor education can make to environmental and sustainability pedagogy.

Importantly however, Higgins (2009) cautioned that experiential learning alone is *not* sufficient for understanding complex environmental and social issues. Additional knowledge and “critical reflection”<sup>3</sup> processes are essential for making informed judgements about issues and for recognising assumptions underpinning unsustainable discourses and practices. He proposed a “Five Cs” model (see Fig. 7.2) as a guide for developing the notion of “taking responsibility” in relation to citizenship, sustainability and health education. The model encourages outdoor education

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<sup>3</sup>Critical reflection is an additional “C” that Higgins acknowledges should be added to this 5 Cs model.

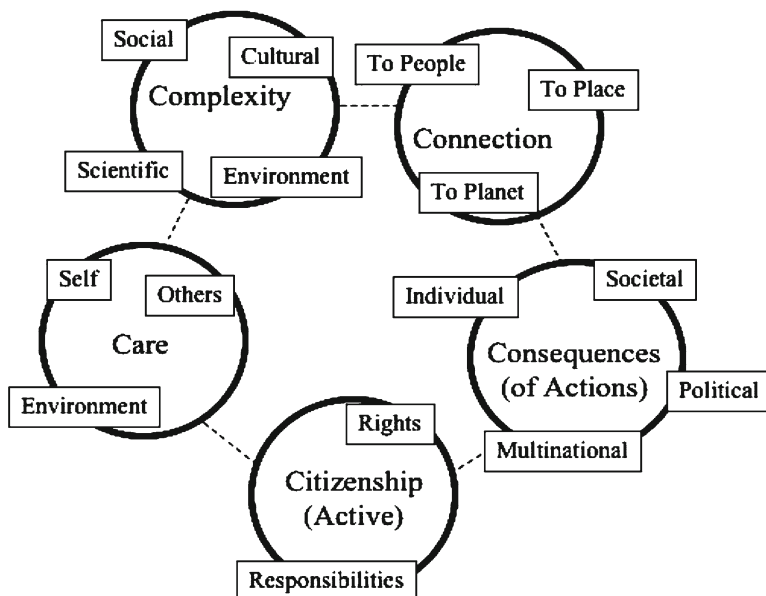


Fig. 7.2 Taking responsibility and the “Five Cs” (Source: Higgins 2009, p. 49)

teachers to develop their own critical reflection skills and students’ critical capacities to examine the relationships between their own attitudes and behaviours and broader environmental and social issues.

In Higgins’ (2009) Five Cs model, the nature of participation is complex and contingent on interacting social, cultural and environmental factors. For example, in the SOIL program, pre-service teachers’ experiences of teaching were variable, depending on multiple factors such as: the *relationships* they had with students, teachers and peers; *how* they participated in teaching and planning activities; *what* artefacts or “tools” were used; *how* they interacted with the physical environments they encountered; their past experiences and their attitudes and predispositions.

Knowledge in this context is clearly subjective and emergent. The teacher acts as a guide or facilitator of students’ learning. Unlike mechanistic “production line” models, *generative* approaches to experiential learning propose that there are no boundaries between “experience” and reflection. From this perspective embodied and tacit understanding are as important as cognitive interpretation and the learner cannot be separated from the social, historical and geographical context (Brown 2009; Loynes 2002; Seaman 2008; Wattoo and Brown 2011). Thus a *situated* approach to experiential learning emphasises socially negotiated meaning in relation to the physical and cultural “place” in which learning occurs (Brown 2009; Lave and Wenger 1991).

## *A Situated Perspective on Outdoor Learning*

In the example of Jim outlined above, any learning that occurred for himself and his students, could be seen as partly intentional and partly serendipitous, arising from the affordances of the outdoor experiential context. The physical environment and structures were significant in shaping the nature of the conversations in that the outdoor spaces, activities and dynamics of people moving in those spaces afforded different types of interactions and encounters than often occur in the classroom. As illustrated by Jim, encounters with other group members or with aspects of an environment, can precipitate conversations or debates about issues in an emergent rather than (necessarily) planned manner (Higgins and Kirk 2006; Nicol 2003).

In the SOIL program, the bike riding, “dumpster diving” episode provides an example of the significance of the social and cultural context in framing the conversations. In the slums of Mumbai for example, where such activities are more common and necessary for survival, the conversation may take quite a different turn or not even arise. In the Australian context however, bike riding is usually a recreational activity of choice, not the main mode of transport, and “scavenging” food from bins is often associated with homelessness or antisocial behaviour. By framing “dumpster diving” as a sustainable alternative in redistributing foods and reducing food waste, students’<sup>4</sup> ideas may have been challenged about what and how food should be consumed and what constitutes health or waste. Jim’s informal conversations about such issues with students, reinforced by his personal commitment to sustainable living practices, may precipitate change on some level (i.e., individual or collective questioning of personal/social values or changes in attitudes or behaviours). In this way learning can be seen as a *co-constitutive* activity, that is, it both shapes and is shaped by, social interaction and cultural values on these issues (Jarvis 2006; Rogoff 2003; Wenger 1998).

Similarly the context mediates the nature of the *relationships* and roles of the pre-service teachers, students and supervising teachers. For Jim, the outdoor education setting creates a fresh context for student learning and for establishing more positive relationships by disturbing some of the negative associations with school,

Our class is not a very academic one and lots of students... end up with detentions and things. So when these students are at school, their idea of what school is, is that. So when you put them in a classroom with four walls and a roof, that’s what they’ve got in their head. When you take them away from that and they don’t have these things hanging over their heads it changes them a little and ... it takes away some of those barriers and you can start again and actually have a relationship with these students beyond being a dictator. (Jim, Post-program focus group 2009)

Having a positive relationship with students is important to Jim and he clearly conceptualises his teaching role as one of a guide or facilitator rather than a didactic

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<sup>4</sup>Teachers’ and peers’ constructs about food may also have been challenged through these encounters.



**Fig. 7.3** Students, pre-service teacher and teacher working together on camp gardens and grounds during a SOIL camp

or managerial role (see Fig. 7.3 for example). In this respect we can see that his pedagogical preference is oriented towards practical, outdoor learning and responsive, informal relationships with students. He understands the power of the material and cultural context of the school in shaping students' attitudes towards teachers and learning and the potential of the outdoor education context to foster more personal and, possibly, transformative relationships. He is aware of ways in which social and cultural values are embedded in educational structures and practices. To this extent Jim's perspective on learning could be described as socio-cultural, situated and experiential. We will return to Jim later in the chapter. The next section will provide further context and explanation of the SOIL program and the associated research project.

### **Sustainability Through Outdoor Integrated Learning (SOIL) Program**

In this educational context, the SOIL program, central to this case study, provides an example of an innovative pilot program that was developed in partnership between a teacher education faculty and a local secondary college. The school-based

program intentionally integrated teachers from different discipline areas in a team teaching model, in an attempt to address sustainability issues through interdisciplinary approaches. As highlighted in the literature, the pre-service teachers (and teachers) involved in SOIL had only limited education or training relating specifically to sustainability pedagogy.

The pre-service teachers had all completed degrees in outdoor education and/or nature tourism and had a range of other teaching methods, the majority being physical education. They had minimal formal education in “sustainability” or sustainability education, but their outdoor education degree courses had a strong “green” orientation. Many of the subjects in this course included different aspects of environmental learning including; environmental ethics, naturalist studies, ecology and land management issues. Some had also studied science or geography as their other teaching discipline. Prior to participating in the SOIL program all had opportunities to attend professional development workshops on different aspects of sustainability education. Some attended as many as possible while others chose not to attend any. Two teachers from the school also attended one of these workshops but most of the teachers had no training in teaching about/for sustainability.

### *SOIL – Local Context*

The SOIL program was initiated in 2009 in the regional city of Bendigo in north-central Victoria in south-east Australia. Bendigo was established in the goldrush of the 1850s and is now a thriving regional city of over 100,000 people. The urban area is surrounded by bush reserves and national parks primarily of Box-Ironbark forests. Fresh water sources are limited in the Bendigo area so drought and water shortage are ongoing issues as the population increases.

Bendigo has a predominantly Anglo-Saxon and relatively low socio-economic demographic (Australian Bureau of Statistics 2006). It is well serviced with education facilities with 45 primary schools, 10 secondary colleges, a TAFE and 2 university campuses. The main university campus is that of La Trobe, which has 4,000 students across a number of schools and faculties. The Faculty of Education focuses mainly on primary and secondary teacher preparation and is the principal faculty located on this campus. The Department of Outdoor and Environmental Education offers degree and postgraduate courses within this faculty.

In 1995 the Bendigo Education Plan (BEP), established for Bendigo's government (state) schools, set out a long term plan for transforming secondary education in Bendigo to improve student learning and retention in school education. This was to be achieved through a student-centred focus on well-being, engagement and “personalised learning” (BEP 2005). Sustainability is one of the broad cross-curricular themes identified in the curriculum component of the plan. Bendigo's government schools organisational structure consists of one senior secondary college (years 11 and 12) and four year 7–10 colleges. As part of the BEP the year 7–10 colleges now have new, purpose-built learning spaces based on a flexible learning design.

Within the BEP teachers are expected to develop flexible and cooperative approaches to pedagogy including team-teaching and cross-disciplinary collaboration. A focus on joint professional learning, professional networks and research-based practice is also advocated in the plan. La Trobe University Faculty of Education is working in partnership with local schools to support the BEP innovations through collaborative teaching practicum programs.

### ***The SOIL Project***

In the context of significant change due to the implementation of the BEP, the SOIL project was developed in partnership between La Trobe University and one local year 7–10 co-educational secondary college. It involved 18 pre-service teachers of outdoor education working in teams with nine teachers of humanities or science to develop and teach a year 9 semester unit on “sustainability”. This was the first time the majority of teachers at the school had addressed sustainability in their teaching and the first time they had been asked to teach in teams. None of the teachers had any training or experience in outdoor education and held a range of perceptions about what outdoor education entails and what the pre-service teachers might know or be able to do.

The SOIL program was instigated as part of a year 9 Aspire program aiming to engage year 9 students actively in their learning through a range of cross-curricular activities. The school considered that the focus on “sustainability” would interest students and that, including an outdoor education component such as a camp, would enhance their level of engagement. By combining teachers in teams of two – one science teacher and one humanities teacher, the aim was to provide an interdisciplinary approach to learning about sustainability issues.

For the university the SOIL program offered an opportunity to trial a new, collaborative and interdisciplinary form of practicum for pre-service secondary teachers. For the pre-service teachers who elected to participate in the SOIL program, it provided an opportunity to plan, teach and evaluate an outdoor education program on a sustainability theme. It comprised their second and final teaching practicum which involved 4 weeks teaching in the school and 6 weeks of half-day visits prior to the 4 teaching weeks. This allowed the pre-service teachers to get to know the students and teachers in their year 9 classes.

### ***SOIL Planning***

Prior to the start of the program the author and the teaching practicum coordinator from the university attended several meetings with key school staff to conceptualise and plan the program. The information gleaned from these meetings was conveyed to the pre-service teachers in SOIL so that they could start working on their teaching plans.

The author was teaching the subject in which they prepared their plans so provided guidance and support for this process. The year 9 staff developed their sustainability units within the school and VELS<sup>5</sup> curriculum structures.

During the practicum program pre-service teachers taught classes in pairs with one teacher supervising each pair, both in the classroom and beyond. A 4-week teaching plan linked to the VELS curriculum framework was developed by each pair prior to the teaching practicum. For the “sustainability camps” two classes were combined thus planning and running the camps occurred in groups of four pre-service teachers with the support of two supervising teachers.

## The Research Project

This SOIL program comprised three main areas of interest to the author (who was also the researcher); sustainability education, outdoor education pedagogy and pre-service teacher professional development. Broadly the research project investigates how these three dimensions of the SOIL practicum intersected to enable and constrain the pre-service teachers' experiences of learning to become teachers. Questions underpinning the research project are:

- How did the pre-service teachers approach sustainability education through outdoor education practice?
- How did they conceptualise sustainability from an interdisciplinary perspective?
- How did they participate in a teaching program that is emergent and evolving in and through practice?
- How did their participation in the practicum program shape both the program and their learning to become teachers?

This case study investigates how 12 pre-service teachers conceptualised their participation in “real life” events in the complex process of *becoming* a teacher (Yin 2003). In this case study the participants' actions are contingent on the context (Lave and Wenger 1991). Their understandings of teaching, outdoor education and sustainability are culturally and socially co-constructed. Participation is shaped by school and university protocols as well as the affordances and constraints of the local community setting. The participants themselves form part of the context through their participation, so the boundaries between the phenomenon of investigation and the context are somewhat blurred (Yin 2003).

Participation from this perspective has been aptly described as a “choreography of participation” (Davis et al. 2008, p. 170), suggesting a creative “dance” between actors. Learning is seen as a participatory process of transformation *in relation* to

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<sup>5</sup>Victorian Essential Learning Standards – is the current Victorian P-10 curriculum framework.



other people and places. That is, learning occurs as individuals and groups *co-construct* identities in relationship with each other (Edwards and D'arcy 2004; Edwards 2005) and through participation in social and cultural activities (Wenger 1998). The relational and emergent nature of participation in the SOIL program necessitated a case study methodology to enable investigation of, "... uncertain, complex, messy and fleeting properties... of lived dimensions that are indigenous to each learning event" (Freebody 2003, p. 81).

### ***Research Methods***

Since the focus of the research is on pre-service teachers' perspectives of their experiences, semi-structured interviews and focus groups were the main methods of data generation. Surveys, field observation and document analysis were used to elicit different perspectives and information. Interviews and surveys were conducted pre and post-program with the final interviews completed just recently, a year after the program finished. Focus groups were conducted during and immediately after the program. By using a range of methods of data generation, both individual and collective (teaching group) perspectives were explored over a period of time, allowing for changing conceptualisations and levels of participation. Supervising teachers were also interviewed before and after the program to provide further context for the pre-service teachers' experiences. This data was based on a view that, in practicum situations, the supervising teachers can be significant resources for and mediators of pre-service teachers' learning (Edwards 2005). While data generation is now complete, data interpretation is ongoing. The thematic coding process is still in process so findings are limited and tentative at this stage.

### ***Juggling Multiple "Hats"***

The author's involvement in the SOIL program as part of her teaching work, provided a strong basis for a naturalistic enquiry. It enabled her to investigate phenomena with which she was familiar and in which she had multiple roles – researcher, Outdoor Education Method lecturer, SOIL convenor (La Trobe) and a practicum supervisor. This "insider" status enabled a "natural" legitimacy to her participation in both the university and school settings. It also afforded personal experience of the processes, structures and relationships involved in both the university and, to a lesser extent, the school.

It is perhaps unsurprising that these multiple roles were also problematic. The pre-service teachers were ultimately being assessed by the author/researcher for the Outdoor Education Teaching Method subject thus raising possible conflicts of interest. Also some SOIL participants chose not to engage in the research project and could

potentially have felt left out or discriminated against since the author's role as researcher involved more contact time with the research group. To minimise fear of discrimination through assessment, the author's lecturing role was separated from assessment in the Method subject and she did not do the practicum assessment for the research group. Another potential issue with the author's multiple "hats" was how she would be perceived when she visited the school – as practicum supervisor, SOIL convenor or researcher? Perceptual confusion of this kind was hard to avoid especially since the author sometimes needed to take on multiple roles in one school visit. This issue was managed where possible, by trying to be clear with teachers and pre-service teachers about the purpose(s) of the visit in each instance.

The other issue relating to the researcher's roles relates to the need for reflexivity in interpreting and reporting data. Given the nature of naturalistic enquiry, data interpretation is intentionally subjective. The researcher's perspectives and interests are necessarily involved in the entire research process. Critical reflexivity and openness are essential in this situation where the researcher forms part of the context of the study and therefore needs to position herself and identify a standpoint or point of view (Cresswell 2008). An outline of the author's relevant professional background is therefore provided below.

The author and researcher for this study has lived and taught in secondary schools, outdoor education centres and universities in Australia, Canada and Scotland for 28 years. Her teaching subject areas were Physical Education, English and Outdoor Education. She has lived and worked in Bendigo for 20 of those years. As an outdoor education lecturer she has been immersed for many years in the production of outdoor education curriculum frameworks and materials for Victorian schools and universities and has contributed to outdoor education discourse. She has also published papers that the pre-service teachers have read throughout their degree courses. Therefore in her roles as a lecturer she has possibly contributed to some extent to their conceptualisations of outdoor education and, to a lesser extent, sustainability education. As researcher, teacher and program convenor, the author had vested interest in the program's success and, primarily, an outdoor environmental orientation to conceptualising sustainability education. As in all ethnographic research, these interests and experiences inevitably shape the nature of the research questions, the research processes and interpretation of the data.

## **SOIL Program Outcomes**

Since the analysis of data from the research project is ongoing the findings discussed here are partial and merely indicative rather than conclusive. The first section is an overview of an evaluation of the SOIL program conducted by the school. This data obtained via an evaluation survey with year 9 students, was conducted by the school immediately after the SOIL program.

The second section considers summary findings from pre-and post-program surveys conducted by the researcher with the whole group of pre-service teachers

**Table 7.1** Year 9 student evaluation of the value of the SOIL camp

No value	Poor	OK	Good	Excellent
1%	3%	11%	47%	38%

participating in the SOIL program. The third and final section returns to the example of Jim, focusing on his process of becoming a teacher. This discussion points to some of the issues beginning to emerge from the principal research data but should not be interpreted as conclusive findings since data analysis is still underway. Other interview and focus group data is not discussed in this chapter.

### *Year 9 and Teacher Perspectives on the SOIL Program*

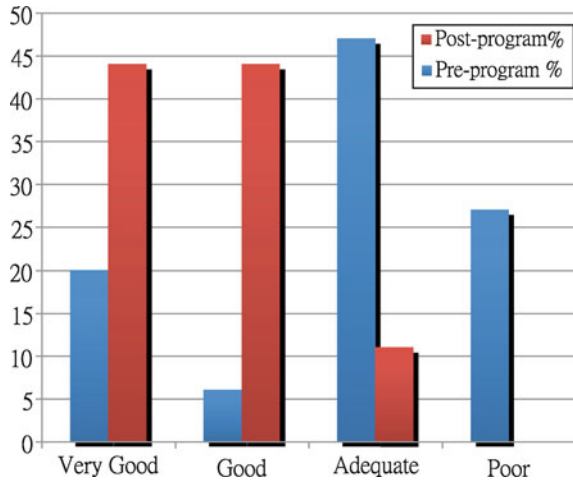
Although the case study research does not include year 9 student perspectives, the results of a school-based evaluation are discussed briefly to provide further contextual background for the discussion of pre-service teacher perspectives. One hundred and thirteen year 9 students completed the sustainability unit evaluation surveys. Of these 74% attended the SOIL camps since attendance was not compulsory. Those who did attend the camps were asked to assess their value. The results are shown in Table 7.1.

Clearly the majority (85%) of students who attended the camps found them valuable. The reasons given included: team building, fun, activities and location. Fourteen per cent said the two-day camp was not long enough. Some mentioned not enjoying discomforts such as using bush toilets and being cold. Evaluation of classroom learning was included in the survey but these data incorporated the lessons taught by the class teachers (which were not part of the SOIL program) so are not reported here. Since this SOIL program will continue in 2011, a detailed study of year 9 student learning would be warranted.

### *Learning to Teach Sustainability*

The following data are based on surveys of the whole group of pre-service teachers (including the research group) prior to the SOIL program and immediately after the program finished. The intention of the survey questions was to establish how the pre-service teachers conceptualised sustainability and sustainability education and how they felt about participating in the new SOIL program. The post-program survey was conducted to identify any changes in their perceptions. Participation in the survey was voluntary so the data represents the views of 15 out of 18 SOIL participants.

**Fig. 7.4** Personal knowledge of sustainability issues/principles



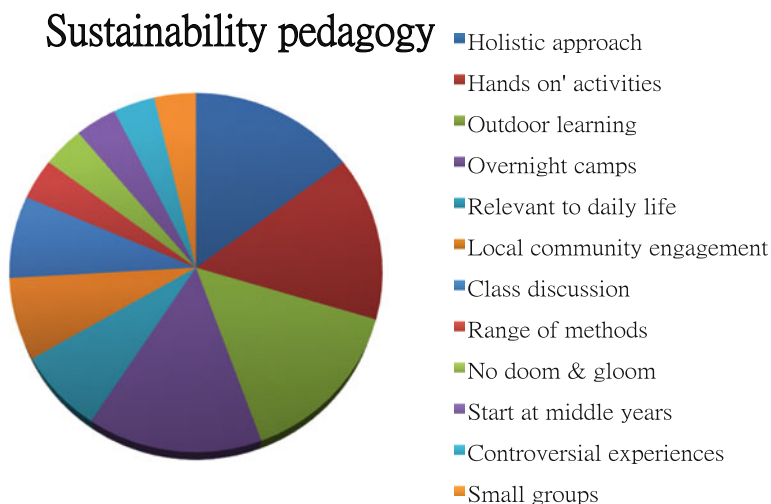
### Knowledge of Sustainability Concepts and Issues

The Pre-service teachers were asked to rate their knowledge of sustainability issues or principles before and after teaching in the SOIL program. Figure 7.4 indicates a marked increase in their *confidence* in their knowledge as a result of participating in the SOIL program. Comments on this improvement related to becoming better informed, undertaking research on different issues and “learning through teaching”. Two participants expressed uncertainty about whether they were teaching the “right thing”. This latter comment is interesting in that for these two, the uncertainty about what to teach and the opportunity to make their own decisions may have been a hindrance rather than the liberating experience reported by all members of the research group.

The SOIL participants were also asked in the initial survey to indicate the sources of their knowledge on sustainability issues. The results reveal that popular media are the most significant source of information for these pre-service teachers. University subjects and professional development seminars were the next most mentioned sources. The significance of the popular media is particularly interesting since there is such variation in what and how issues are reported. There is considerable potential here for the reader to be misinformed. That these are the principal sources of information on sustainability issues points to the need for pre-service teachers (and teachers) to develop some depth of knowledge on key issues and critical analysis skills to assess the information they obtain from popular media sources.

### Pedagogy for Sustainability Education

The data in Fig. 7.5 were derived from the post-program survey. The SOIL pre-service teachers were asked to identify whether their thinking had changed about *how* sustainability should be taught in year 9 in schools and also which teaching



**Fig. 7.5** Successful teaching strategies in the SOIL program

strategies they had found most successful. Since the survey method did not allow for interrogating the meanings of terminology such as “hands on” activities or “holistic” approaches, all key terms have been recorded thus there is likely to be some overlap between these terms. Clearly “active” pedagogies such as “hands on” and outdoor activities are highly valued by this group, hardly surprising given their backgrounds. It is worth noting however that the pedagogical approaches listed align with the recommendations from sustainability education research reports such as those by Alvarez and Rogers (2006), Hopkins and McKeown (2005) and Tilbury et al. (2005).

### Interdisciplinary Pedagogy

The widely recognised need for inter or cross-disciplinary approaches to sustainability education arises from the general agreement that sustainable development issues are complex and embrace three broad dimensions of human experience: *environmental*, *social* and *economic*. That all three dimensions are interconnected on local and global levels, coupled with the dynamic nature of each dimension, makes an *inter* or *trans* disciplinary<sup>6</sup> approach to curriculum and pedagogy seem necessary (Capra 2003; Orr 2004). Alvarez and Rogers (2006) for example, strongly recommend “real life” learning opportunities in local communities and environments to help tertiary students grapple with the multi-faceted dimensions of complex issues as well as the social and emotional impacts.

<sup>6</sup>Rather than drawing on knowledge from different disciplines this refers to new knowledge, not developed through any particular disciplinary “lens”.

**Table 7.2** Sustainability literacy for year 9 students in schools

Topic	No. of responses
Environmental knowledge & impacts	6
Sustainable energy use, issues & initiatives	5
Creating social change	5
What is sustainability?	4
Sustainable living	4
Learning/research skills	4
Community building	4
Climate change/global warming	3
Transport issues and options	3
Water saving/quality	3
Critical thinking & problem solving	3
Land management practices and cultural heritage impacts	2
Resources in local area	2
Food garden development	2
Waste management	2
Global trading issues	2
Food production	1
Consumerism – impacts	1
Soil testing	1
Flora/fauna identification	1

In the SOIL program the intention was to integrate humanities and maths/science with outdoor education as a way of addressing environmental and related social issues from different perspectives. In practice, the level of actual integration of the different disciplines varied, depending on the efforts of the teachers and pre-service teachers in each team. Table 7.2 shows the kinds of knowledge and skills that the pre-service teachers considered appropriate for developing year 9 students' sustainability literacy. The emphasis on environmental knowledge and impacts is not surprising given their prior outdoor environmental education backgrounds, however the range of knowledge and skills listed suggests perspectives coming from different disciplinary bases.

Since outdoor education is interdisciplinary by its very nature, the pre-service teachers might be expected to draw on different disciplinary skills, perhaps inadvertently, as we can see by Jim's comments;

... sometimes without noticing it... you'd realise they've been doing group team work there, now they're doing oral presentations and they've also ... had to calculate distances on a map. So the more you thought about it the more you could see that they were incorporating different subjects. (Jim, Post-program Focus Group 2009)

The pre-service teachers were able to intentionally integrate some aspects of science and humanities into their teaching by conducting activities such as water quality testing or traffic audits. However most found the notion of an integrated or interdisciplinary curriculum quite conceptually challenging as did the teachers.

Effective interdisciplinary curricula and pedagogy is an area that requires time for collaborative and considered planning and remains a challenge for the SOIL program.

## Becoming a Teacher – Jim’s Experience

Learning “how to be” is a process of identity formation or “subjectivity” that involves conscious decision-making about who or what activities to be involved in, what values are important and what roles one might undertake (Hart 2007). This notion of learning as identity formation draws partly on the work of Lave and Wenger (1991), Wenger (1998) and Rogoff (2003) who see learning as a process of participation in socio-cultural activity rather than of individual cognition. The notion of “becoming” is critical to an understanding of learning as identity formation since it underscores a lifelong process of changing relationships between what we do and with whom (participation), who we (and others) think we are (identity/belonging) and who/what we aspire to be (trajectory) (Jarvis 2006; Wenger 1998). As with sustainability education the notions of *participation* and *relationship* are central to this perspective on learning. Participation occurs *in relationship* with others and with cultural and material contexts without which it has no meaning (Rogoff 2003).

The relationship between learning and identity formation is relevant not only to the education of school students in sustainability but is particularly relevant to the development of pre-service teachers, on the cusp of “becoming” teachers. Pre-service teachers during practicum need to act professionally as a teacher without having the full responsibilities or authority of a teacher. In this “in-between” role they have to sensitively negotiate the values and ideals of students, staff, the school and the university as well as notions of professional conduct. This is a complex process, especially if their personal and/or professional values differ from any or all of these groups as was evident in Jim’s struggle,

I found it nice to develop my teaching, my pedagogical theories and what I believe in, in terms of teaching and I didn’t come up with any answers. I came up with a lot more questions for myself and it’s good to have that sort of program to be able to plan and implement and to be able to put your teaching philosophies in place to a certain degree. And to sit back and watch yourself do it and thinking, “hang on, am I doing this because (a) this is what I’ve been watching and this is what the school does, or (b) am I doing this because this is what I believe and this is how I want to teach? Sometimes it’s A and sometimes it’s B. I found it was more A... (Jim, Post-program focus group 2009)

Jim’s comments here are indicative of the tensions that often arise as pre-service teachers bridge multiple roles in different *communities of practice* (Lave and Wenger 1991). The authors’ theory of participation-based learning, which they refer to as *Legitimate Peripheral Participation* (LPP), is based on the idea that learning occurs as “newcomers” are inducted into the shared cultural practices of a particular community (Lave and Wenger 1991). Legitimate peripheral participation is not merely

about acquiring particular knowledge and skills but understanding the cultural norms, social expectations, roles, discourses and activities required to become a full member of a community of practice. Relationships of power, identities and individual trajectories will influence the LPP process and “newcomers” negotiate their way into full membership of a community (if that is their trajectory).

In this case study Jim’s professional roles bridge multiple communities of practice, each of which has shared understandings, repertoires and “tools”<sup>7</sup> of engagement. Jim is simultaneously, a university student, pre-service teacher, outdoor educator, member of a teaching team and sustainability educator. According to Lave and Wenger (1991) in each of these roles Jim participates with varying degrees of membership in each community of practice. He will identify more with some than others. For example, as a novice secondary teacher, Jim is learning to *become* a teacher, a concept he is not completely wedded to. He may choose to remain on the periphery or work towards full membership (Lave and Wenger 1991; Wenger 1998).

As a keen rock climber, outdoor educator and sustainability advocate, Jim’s favoured pedagogical approaches are practical, experiential and personal. To some extent these roles and attendant practices, conflict with his perceptions of teaching and learning in school contexts. He struggles with many of the conventions of schooling and questions its purposes and processes,

I have my own view that it is completely unproductive and ridiculous these students being in a school. But I suppose it depends on the school environment and their values and what they’re teaching. But it also depends on whether you’re looking at learning as cognitive learning and information or is learning about life and community and groups and people rather than just stuff. Maybe it’s got nothing to do with stuff but all to do with these other things in life. Maybe having that struggle in the classroom is part of that – so you need to have that struggle in life to move onto other things. (Jim, Post-program Focus group 2009)

From Wenger’s (1998) perspective Jim’s pedagogical struggles are part of the process of identity formation where identities are socially and culturally negotiated through membership of communities of practice. Wenger argues that we form our identities through a tension between investment in belonging to communities of practice (identification) and our abilities to negotiate the meanings of those relationships (negotiability). He describes these tensions and processes as a *social ecology of identity* and learning as a process of negotiating an identity in practice (Wenger 1998). Jim’s ability to align his identities may depend on the values he holds most highly and the degree to which he sees himself as belonging to each community of practice. At the time of interview this process appears to bring his personal and professional identities into alignment,

SOIL had a very large influence over the choices that I make, whether it’s hitchhiking to New South Wales or trying not to eat meat – there are environmental and sustainability things that I’ve found myself participating in - I was already that way inclined but doing the SOIL program “sold” it to me in a way. (Jim, Final interview 2011)

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<sup>7</sup>In this context “tools” refers to cultural artefacts such as language, methods, curriculum, texts, computers and other technologies.



## *Uncertainty and Ambiguity in Sustainability Education*

At the time of interview Jim related strongly to his roles as an outdoor educator, rock climber and a sustainability advocate and enjoyed the freedom and scope offered by these roles. In the SOIL program he was excited and sometimes overwhelmed by the complexity and immensity of the sustainability issues that need to be tackled by society. While experiencing these conceptual and identity struggles, Jim valued the freedom of being able to make curriculum decisions and the sense of breaking new ground in developing and implementing the SOIL program. He saw this as an exciting aspect of the uncertain trajectory of sustainability education and the potential for a teacher in this “new” curriculum area,

...part of this program is that you don't know what's going on because it's something new and that's how doing new things is and making a new path is ... that's what you have to do in life. People don't give you stuff to do, you don't get a bit of paper that tells you what they want for the introduction, conclusion and body and this is your topic and this is what you write about. It's like, here's a room, make of it what you want, it's yours. (Jim, post-program focus group 2009)

Jim's observation illustrates Wals (2007b, p. 43) view that educators are necessarily, “reflexively fumbling towards sustainability”. Wals (2007a, b) argues that uncertainty and emergence are inherent features of sustainability education since the concept of sustainability itself is ambiguous and contextually constructed. It is not a fixed entity that educators can work towards in a prescriptive or didactic manner,

While there is a constellation of ideas as to what a sustainable world might entail, the lack of consensus about the implication of an exact meaning – if this were at all possible – in variable contexts, should prevent global prescriptions. Instead contextual solutions are required that are, at least partly, co-created and co-owned by those who are to (want to?) live sustainably.... Social learning – albeit as a spontaneously emerging property of people interacting together or as an intentionally introduced and facilitated process of change – not only allows for commonalities and social cohesion to form, it also provides space for disagreement and “dissensus”. (Wals 2007b, p. 43)

Wals' argument that the ambiguous notion of “sustainability” implies a need for “social learning” processes, including collaboration and disagreement, is important for teachers and teacher educators. The notion of sustainability education (or education for sustainable development), suggests that teacher expertise and teacher preparation need to be reconceptualised in a more responsive, participatory and generative paradigm.

## **Conclusions**

The survey results, along with Jim's reflections on aspects of his experience in the SOIL program, illustrate the new “terrain” experienced by the pre-service teachers involved in this SOIL program. The program was new for those involved in almost

every respect – curriculum content (sustainability in a VELLS<sup>8</sup> framework), pedagogy (experiential learning), teaching arrangements (working in teams) and the involvement of pre-service outdoor education teachers working with humanities and science teachers. In this novel situation the goals and “rules of engagement” were often unclear and teachers and pre-service teachers alike needed to negotiate a context characterised by uncertainty, change and procedural or structural challenges.

Nevertheless Jim found these challenges ultimately rewarding in that he felt that he and his peers worked hard to make the program work and, according to Jim, “that’s what made it worthwhile – you don’t get nothing for nothing” (Final Interview 2011). On a personal level Jim admits that he likes to live life a little “on the edge” thriving on challenges of both a physical and intellectual nature. He has found that his involvement in the SOIL program has significantly influenced his decisions and his identification with living and teaching sustainably. In the future Jim wants to continue working with young people in the outdoors and to pursue higher degree study at some stage.

Although this chapter introduces only initial, tentative findings, they point to interesting issues relating to how the challenges of sustainability education can contribute to pre-service teachers’ professional and personal development. These initial findings seem to suggest that uncertainty and ambiguity can, under some circumstances, be strengths of a teaching practicum program rather than constraints. In “navigating” the “new terrain” of sustainability education, pre-service teachers and their supervising teachers may need to be adventurous and work together to generate new resources and pedagogies. The case study research process is ongoing and will examine the roles of collaborative work such as team teaching and peer support in the SOIL program and in the process of becoming a teacher.

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<sup>8</sup>VELLS – Victorian Essential Learning Standards – is the P-10 curriculum framework in Victoria, Australia.

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# Chapter 8

## Indigenous Perspectives on Sustainable Development: Children's Views from the "Top End"

Jenni Webber and Margaret Robertson

### Indigenous Perspectives Pose a Curriculum Challenge

Early in 2010 a Year 3 class (approximately 8 years of age) sat a Mathematics diagnostic test. One of the questions asked what seasons December, January and February were. The answers were varied and included:

- They are months
- The wet season
- Midawarr (a local Indigenous season)
- Summer

Which was the correct answer? Only 2 of the 22 students answered summer (the "correct" answer according to the test answers). The class was a primary school class in Arnhem Land in the Northern Territory of Australia. Could their location have had significant influence over their answers? The Top End of Australia as it is colloquially termed (see Fig. 8.1) does not experience the typical Mediterranean seasons of summer, autumn, winter and spring that are experienced in southern Australia. Most commonly the seasons are referred to as the "wet" or the "dry", with occasionally the "build-up" given local seasonal status. Some of these students have never experienced the seasons they were being tested on.

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**Fig. 8.1** Map of Australia indicating Arnhem Land (Author: Glen Dillon. Source: Wikimedia Commons)



## The Context

The construct of landscape in much of the literature assumes a perspective on meaning derived from western or non-Aboriginal thinking. On the related matter of environmental history and policy Rolls (2000) shows how we fall into the trap with the statement: “our culture made us unfit occupants for this country [Australia]” (p. 24). The assumption here is that settlement of Australia is based on a European mindset with no existing heritage worthy of taking seriously. As he further points out the first arrivals under the erstwhile leadership of Captain James Cook made several errors in their assessment of Aboriginals. Judged to be in need of protection from their observable “savagery” that included their naked appearance and warlike behaviours the Europeans largely assumed their rights to already occupied lands and appeared surprised at the aggression encountered as they forged their settlements further into the fertile interiors and along coastal plains (Blainey 1975). At the time of European arrival in the late eighteenth century (and progressive populating of the continent through the nineteenth century) Aboriginal populations numbered between one and two million people including multiple “nations” each with their distinct

dialectal language and customs; they were settled in houses and also practiced forms of locally adapted agriculture – all of which were not recognised by early European arrivals (Berndt and Berndt 1996). To make matters worse the ignorance was compounded by the severity of diseases like smallpox. Brought by the Europeans the diseases depleted the populations and all but wiped out some nations, perhaps most notably in Tasmania.

During the nineteenth century well meaning missionaries set up settlements or missions as a means of “civilising” the natives. Documentary evidence of the missions which crisscross the continent reveals the systematic pressures and weakening of traditional ties of Aboriginal people with their lands. Forced to learn English and adopt western style customs the stories today are of mixed accounts of abuses and struggles to adapt to new ways. Some adults reflect on their childhoods as happy times on the missions. However, forced removal from their lands and people is universally condemned throughout contemporary Australia as a failed and abhorrent policy.

Based on the 2006 census date 2.5% of the Australian population was counted as Aboriginal and Torres Strait Islander (Australian Bureau of Statistics 2007). In the Northern Territory alone the indigenous population counts for around 32% of the population. Of these people around 80% are considered to live in remote communities and speak local languages. To highlight this part of the nation's connection to Indigenous people the Australian Bureau of Statistics further reports:

The most widely spoken Indigenous language groups were Arnhem Land and Daly River Region Languages, reported by 16% of all Indigenous language speakers. The Torres Strait Island Language groups and the Western Desert Languages group were the next most widely spoken (both 14%).

Couple this with the fact that more than 40% of school age children in government schools are of Aboriginal and Torres Strait Islander background and there is a bigger picture of more than survival of indigenous people but resilience against the early pressures for integration into mainstream Australia.

In an analysis of Arnhem Land of the “Top End” John Altman (2003) estimated round 20,000 Aboriginal people and Torres Strait Island people living in the towns. The Yolngu people who belong predominantly to East Arnhem Land are generally recognised as representing one of the strongholds of Indigenous cultures in Australia. Further, the demographic model profile of the Indigenous population is younger than the general population. They constitute the largest proportion of school age children with enrolments exceeding 75% in some schools.

## **Northern Territory Schools: The Teachers' Challenge**

Many schools in the Northern Australia are in a valuable and unique situation to be able to interact with local Indigenous traditional owners who are willing to share their knowledge, understanding and connection with the local environment.

However, there are a number of issues that have been identified by teachers that impact on the successful development and delivery of units of work that incorporate local Indigenous knowledge. The opening “dilemma” is one illustration of the mismatch between context and centrally driven curriculum expectations. From reports collated anecdotally and from local knowledge other issues include:

- The high turnover of teachers in remote and regional teaching positions.
- Many teachers feel they are not providing relevant and meaningful Indigenous Studies programs for their students.
- Some teachers are not always including Indigenous Studies in their yearly program.
- Some teachers are often not confident in writing and developing an Indigenous Studies program.
- Some teachers can lack confidence in delivering Indigenous Studies to their class.
- Some teachers would welcome assistance in developing their Indigenous Studies program.
- Few teachers have sought support from Indigenous people or organisations.
- Many teachers are very keen to attend professional development in Environmental Education including working with local Indigenous people.
- Many teachers would welcome the relevant Indigenous knowledge such as the development of Bush Tucker and Calendar Gardens and would include their classes in the development of this project.

The outcomes are easily recognisable in national benchmark data for literacy and numeracy results. Children in remote schools do not fare well when compared with results around the nation. Notwithstanding this observation, this judgment should be interpreted. As the list of identified issues above suggest the programs available to teachers and the curriculum frameworks reflect the needs of the nation as a whole and not necessarily the extent of the special needs of minority communities. In the case of Indigenous children the Australian, and Northern Territory governments are well aware of the issues and have made attempts to better resource teachers to bridge the gaps.

The following sections of the chapter are illustrative of policy directions that directly attempt to meet the needs of children in the “Top End”.

## **Policy Directions**

Within the Northern Territory a review conducted in 2009 (Ladwig and Sarra 2009) sought answers to key questions one of which is particularly relevant to Indigenous education. “How might the structure of the Department of Education and Training better support the achievement of its aspirations and goals, particularly in producing high quality, equitable student outcomes?” (Ladwig and Sarra 2009, p. 3). The report highlighted the need for system level support for a “regional approach to



supporting schools” and included strategies to increase the voice of Indigenous people in the Department structures and its communities, as well as improving the quality of professional development for teachers of Indigenous children (Ladwig and Sarra 2009, pp. 8, 41). In their view the Department’s structural reforms required a focus on improvement of quality and provision of programs “especially for Indigenous students” (Ladwig and Sarra 2009, p. 8). The report was both critical and constructive in its endeavours to provide solutions for identified structural problems at the Education systems level. Subsequent actions suggest that the review had some impact.

The Northern Territory Government plan (2011) now boasts through its policy *A Working Future* “a strong vision for remote areas”. It promotes a vision of capacity building in “outstations and homelands” designed to promote independence of local people and traditional landowners. The underpinning belief is that through encouragement of self and community based responsibility for economic well being and employment the flow on need to support for improvements in educational outcomes will naturally occur. Changes are reflected in the Northern Territory Curriculum Framework (Northern Territory Government Department of Education and Training 2009). On Indigenous perspectives the Framework policy statement is quite specific.

Indigenous perspectives are an integral part of the NTCF. The study of Indigenous perspectives is essential for development learner’s understanding of Australian history, culture and identity as well as understanding contemporary society. (NT DET 2009, p. 5)

On the theme of sustainability the connections with local communities are further underlined with the following statement.

Effective environmental education for sustainability involves a whole school approach. Sustainable practices and environmental action are incorporated into all aspects of the school, including learning, decision making and resource management. (NT DET 2009, p. 6)

The Australian government through the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA) matched this vision through its policy document for Aboriginal and Torres Strait Islander Education Action Plan 2010–2014. The agreement is significant as all states are members of this body. The plan sets out targets to improve the health and education of Aboriginal and Torres Strait Islander people in the next 10 years. The plan calls upon agencies to collaborate to improve the quality of life for the First Australians. MCEECDYA’s aim is for “all Australians to have a high-quality, world-standard education to equip them for life in the twenty-first century” (MCEECDYA, p. 3).

Regardless of policy initiatives and funding levels the reality is always going to be more complex than anticipated. We can applaud the idealism in the policy rhetoric. However, reality at the implementation end is inevitably muddied by local issues. Much of the success depends on the will of the teachers and their skills to work within the traditional boundaries of local people and their communities.

The message in the opening “dilemma” is that reality for Indigenous children located in remote parts of Australia is far removed from that of most other Australians. For teachers to implement the policies there is need for empathy and a

willingness to work alongside local communities and their elders to gain trust that can overcome any resistance to change. Just as Paulo Freire in his book *The Pedagogy of Hope* (2003) observed this requires an ability to relinquish the teacher as expert role and learn to work in collaboration with indigenous ideas to forge improved understandings. Illustrative of this approach is rethinking how to understand “the seasons” from an indigenous perspective.

## Indigenous Seasons in the Classroom

Integrated units of work based on local seasons can be successful and engaging experiences for students and teachers in both primary and middle school classes. They are a way of interacting in the local environment and looking at their own backyard from a different cultural perspective. It is also an opportunity to introduce a more holistic concept of environment to students where they themselves are part of the landscape, not just the observer. By investigating Indigenous seasons students have the opportunity to discover that the land and the people are considered one in the same. In his book *Where the Ancestors Walked*, Philip Clarke states that “the land and the people who live upon it are deeply entwined, so much so that it would be wrong to simply treat the environment as a stage upon which people live” (Clarke 2003, p. ix). Indigenous cultural traditions are embedded in their lands. It is intrinsic through the plants and animals, their languages and the knowledge systems that link country with everything within it. John Ah Kit (former Member of the Northern Territory’s Legislative Assembly) refers to the Northern Territory as a landscape of language (Wijnjorrotj et al. 2005). Through language there are other ways of seeing and understanding country. Many indigenous place names are direct links to the plant and animals as well as the dreaming associated with that place.

Learning about the different calendar plants and animals of an area is a way to connect students with their environment. Having a nature table in the classroom where students can bring in evidence of seasonal changes provides for rich investigation. Watching for changes in the wind or the sea, the call of a cicada, an abundance of dragonflies on the wing, the flowering of a milky plum or the seeding of the spear grass are all opportunities to bring students closer to the natural environments. For illustration of the process see Fig. 8.2.

There is also a noticeable effect on the Indigenous students who find themselves in a position where they are able to share their local seasonal knowledge. This can result in:

- Indigenous students demonstrating high interest in the subject matter and becoming class “experts”.
- Improved attendance rates for Indigenous students during this period.
- High level of engagement of both Indigenous and non-indigenous students.
- Positive feedback from parents.



**Fig. 8.2** Learning songs about seasonal foods

- High support from Indigenous community members including assistance with resources and class visits.
- Indigenous community members saying that they want to see more of this kind of cultural engagement.

So why did so many students respond “Midawarr” when answering the question about the season that includes the months of December, January and February. Midawarr is one of the six Yolngu seasons recognised in North East Arnhem Land? Although it was not the season for those months, it was the current season that the class had been studying with the support of a local Traditional Owner. Students learnt that Midawarr is the time when many vegetable foods are becoming available for harvest. It is also a time for fishing and to hunt magpie geese. For the Indigenous people of the region, historically this meant a mostly sedentary life, living in big camps as the floodwaters restricted movement. The floodwaters also meant an



**Fig. 8.3** Student representation of the Yolngu season of Midawarr (2010)

increase in the presence of mosquitoes, something that all the students could relate to. It was also at this time that the Macassan traders left the region, using the south-east winds to sail back to Indonesia. The classroom came alive with colourful student depictions of the season of Midawarr with the features labelled in Yolngu matha, the local language (see Fig. 8.3 for representation).

## Challenging Students' Perceptions Through Indigenous Seasons

Australian Indigenous seasons differ to the fixed western calendar months as they start and finish at different times of the year and may vary in length from year to year. This can often be a challenging concept to some students who have only experienced, or been taught the Mediterranean seasons of summer, autumn, winter and spring with their fixed place in our Gregorian calendar. An interesting challenge to pose to students is to ask them to compare and contrast the local Indigenous seasons with the western perspective of wet, dry and build-up seasons, and the Mediterranean seasons. Ask them which seasons are more useful to them where they live? What can the seasons teach them?

In older students, the challenge can be made to them to comment on the role of the Indigenous seasonal knowledge in relation to sustainable hunting and harvesting practices. Species were often only exploited at the peak of their seasonal cycle when they were abundant, when hunting and harvesting did not have a negative impact on breeding and reproduction. Even early childhood students can engage with these concepts when they are presented in a relevant context. In the rural area just outside of Darwin, the relationship between the Bluetongue Lizard and the native grape vine

provides a context to explain the concept of calendar plants. How are the life cycles of a plant and an animal linked through the environment? Both the Bluetongue Lizard and the grape vine rely on the environment to survive and the students can compare and contrast what they both need from the environment to survive. They both need water and an appropriate fire regime, the lizard needs food and shelter, the grape vine soil to grow in and insects to help pollinate it. A food chain or web can also be created to demonstrate this. A comparison between a plant and an animal life cycle can be discussed and illustrated. At this stage a very “western” perspective has been used to understand their place and role in the environment. However, the grape vine is a calendar plant in relation to the Bluetongue Lizard. When the grape vine is flowering, you do not hunt the Bluetongue Lizard for food as the females are pregnant. By the time the grape vine is fruiting, the female Bluetongue Lizards have given birth and may be hunted again.

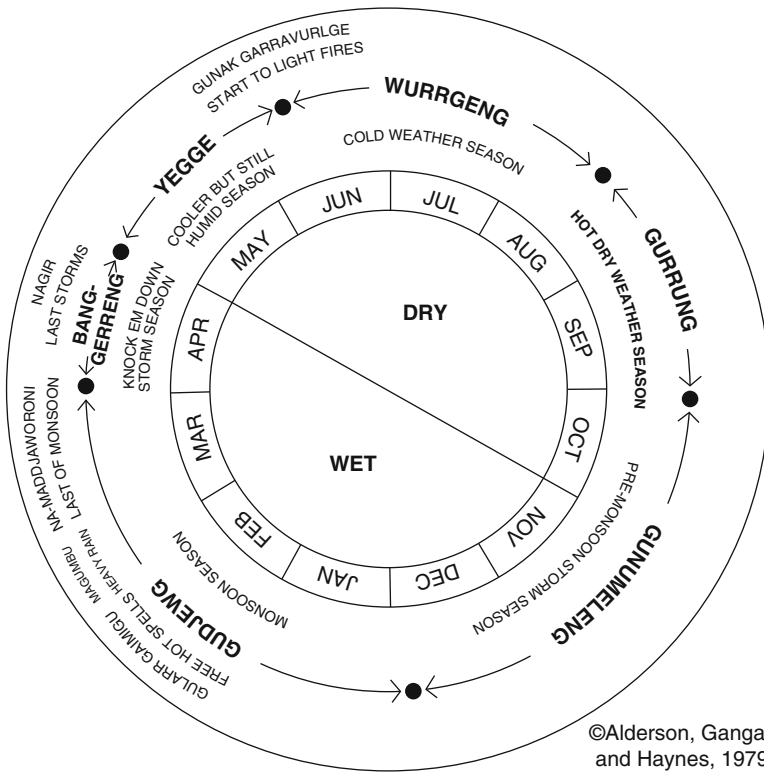
## Indigenous Seasons in Print

There is a growing number of resources available to support sharing the knowledge around Indigenous seasons for northern Australia. *Ernie Dances to the Didgeridoo*, by Alison Lester (2006), is a story about a young boy visiting Gunbalanya. Based on her time there, Alison tells of Ernie’s adventures against the backdrop of the local Indigenous seasons in Western Arnhem Land. Ernie’s exploits clearly show the dramatic changes in the weather and landscape as he moves through the different seasons and is a wonderful teaching resource for primary students. It also has application for use with older students, where a focus of season and landscape influence in art can be taken.

*Walking With the Seasons in Kakadu* is a title written by Di Lucas (2005) who has extensive knowledge having worked with local Indigenous people of Kakadu in the 1980’s and 1990’s as both a school teacher and as an ethnecologist. Her book shares both the rich language and seasonal knowledge of the landscape of the region. It is supported by comprehensive resources including teachers’ notes to support the development of rich integrated units of work incorporating English, the Arts (including songs, sheet music and a CD), Studies of Society and the Environment and Science.

Leonie Norrington through her Burrumbi series of children novels shares the richness of cross cultural living in the Top End. Her stories are rich with the seasonal changes of the landscape and are drawn from her own experience of growing up in Indigenous communities in the Katherine region. She is an author committed to sharing her experience in a literary world that tends to be Eurocentric in its approach, portraying the bush and outback environments as the extreme rather than the norm. Norrington (2010) states:

There are very few stories in which modern day black Aboriginal people from remote communities are the heroes, the sort of people who go through trauma and problems, are resilient and survive. Yet we all know that if we want children in remote communities to



©Alderson, Gangali and Haynes, 1979

**Fig. 8.4** Environmental seasons (Source: Alderson et al. 1979 as cited in Australian Government Department of Sustainability, Environment, Water, Population and Communities [n.d.](#))

understand themselves as potentially successful, they need stories in which people like them, are successful. Stories that affirm remote Indigenous identity and culture; stories that value family relationships and commitment; stories about success and resilience; stories that show success, upward mobility, happiness and therefore in a child’s mind, make success possible. (para. 11)

In his field guide, *Kakadu National Park*, Ian Morris (1996) provides a season by season narrative in which to explore the environments, flora and fauna of Kakadu. The six Gundjeihmi seasons take the reader through a year in the Park and the book shares a wealth of Indigenous knowledge in relation to the landscape, its management and care (Fig. 8.4).

The opportunity to present traditional knowledge management systems alongside Western scientific knowledge can be realised here. Science and geography education for Indigenous students is significant; in order to fulfill responsibilities for “caring for country” Indigenous people increasingly need to access and engage with Western knowledge systems (Ramsey et al. 2003). Access to appropriate

curriculum resources that are relevant and current to the environment in which the teachers and students live is also a considerable challenge (Crough et al. 2009). There is a variety of online resources to support bringing Indigenous seasons into the classroom. Designed for school use, the Environorth (n.d) website<sup>1</sup> introduces the Jawoyn seasonal calendar in the Savanna Walkabout section where students plan a virtual field trip to collect quolls. There is also a wealth of knowledge relating to caring for country in the Burning Issues section which investigates tradition burning regimes and carbon credits in North East Arnhem Land.

## Caring for Country

Many of the calendar plants and animals can be linked throughout the local landscape into food chains and webs. Through these investigations, the students' knowledge progresses in many cases to a concern and a respect for local environments. This now provides students with an opportunity to participate in a variety of projects ranging from care of local environments through Clean Up Australia Day, to active removal of introduced pests such as weeds and feral animals. Facilitated by the Weeds Management Branch of Natural Environments, the Arts and Sports Department in the Northern Territory government successful projects include breeding up Calligrapher beetles to control infestations of Sida weed in rural areas. Other activities have seen students investigate and develop strategies to reduce the impact of Cane Toads. This has included plans to Toad proof homes and school grounds and the running of Toad Busting Evenings to reduce local populations.

## Where to from Here?

Many schools are in a position to work with local Indigenous people and organisations to develop an integrated whole school teaching and learning plan that is based on the local seasons. In areas where this knowledge is not available, comparing and contrasting their local western seasons and weather patterns with Indigenous seasons from another region is still a rich task. This approach allows for teachers and students to engage with the local people and the environment at any time of the year. Resources like this could be appropriate to share throughout the region. Such websites as Environorth<sup>2</sup> provide a wealth of material to support teaching about the significance, history and current issues affecting the Top End savanna environments including information on Indigenous seasons.

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<sup>1</sup> See <http://www.environmentnorth.org.au>. Accessed 26 June, 2011.

<sup>2</sup> See <http://www.environmentnorth.org.au>. Accessed 25 June, 2011.

Addressing identified needs of staff, students and local community provides an opportunity to promote active, ongoing partnerships between local Indigenous and non-Indigenous people to share knowledge and culture, fostering a greater appreciation of the local environment. There is great potential to develop integrated Indigenous Studies/Environmental Education Programs across the schools. Key components could include a whole school integrated program from Transition to Year 6, supported by outdoor learning areas. These areas are only limited by imagination, but provide an environment where students can engage in hands on practical activities such as propagation and cultivation of native plants, bush tucker preparation and native plant art and craft activities.

A key concept in a whole school approach is to have a strong emphasis on Literacy and Numeracy and encompass an enterprise component to generate money to support the sustainability of the program. It has the potential to support teachers in the delivery of rich and relevant lessons and provide professional development to support teachers' delivery of this program. It would be hoped that through raising the profile of local Indigenous knowledge, that engagement of Indigenous students would improve and consequently see improvement in attendance levels and academic achievement. It would also provide an opportunity for greater involvement for family and community members to support Indigenous students at school. This would directly support actions required for identified Focus Schools in the Indigenous Education Action Plan Draft 2010–2014 (MCEECDYA n.d.) recently published by the Ministerial Council for Education, Early Childhood and Youth Affairs (MCEECDYA) as well as the Council of Australian Governments (DEEWR n.d.) National Aboriginal and Torres Strait Islander Education Action Plan.

## Positive Partners

Developing a collaborative approach to engaging students in local Indigenous studies of the environment depends on the support and enthusiasm of the school community (including teaching staff, students, leadership team and parents) and local Indigenous people who are willing to share their knowledge. Teachers need to embrace this kind of project with willingness for hands on approaches. Given appropriate support and materials, this can include engaging activities such as regular field trips to make onsite observations and collecting bush tucker and materials for seasonal craft activities, propagation of calendar and bush tucker plants as an enterprise exercise. These experiences have the potential to:

- Boost the planting around the school and community (students actively nurturing and caring for the plants are less likely to damage them).
- Generate money to ensure the sustainability of the program.
- Provide native plants to be grown in suburban gardens which often don't require as much water as exotics and could be food and roost sites for native wildlife.



- With support and guidance, students could.
- Design and develop focused plantings around the school and community.
- Plan, plant, harvest, prepare, cook, eat and sell both traditional western and indigenous fruit and vegetables they have grown.
- Learn to recognise the seasonal indicators, calendar plants and animals of Indigenous seasons.

Monitoring and evaluation of this kind of project could include photograph diaries to show the development of plantings and garden developments; student assessment, peer assessment and student self reflection, as well as financial reports produced for each class conducting enterprise activities.

A whole school approach to develop an integrated program that supports Indigenous Studies and Environmental Education has the potential for students, staff and families to:

- Connect with local Indigenous people and their culture and environment.
- Build on existing knowledge and practical experience.
- Provide the opportunity to engage in practical hands on activities that will provide the context to embed rich Literacy and Numeracy activities.
- Promote practical financial literacy skills in managing their own enterprise project.
- Value Indigenous students, having their knowledge and culture supported and recognised across the school.

The long term sustainability of these kinds of projects can be supported with:

- Developing existing infrastructure within the school and purchasing material and equipment dedicated to the project.
- Allocation of staff to manage and coordinate the project.
- Incorporating the plan into the annual operational plan of the school.
- Curriculum maps that monitor students' learning across the relevant curriculum areas.

Resources developed for these kinds of projects can be shared at a regional level and published for use in the classroom, in teacher training as well as for public awareness and education. There is also potential for these resources to support teacher professional development both locally and regionally, for ranger education and training and in public workshops and open days.

## Conclusion

The curriculum mismatch between western and Indigenous perspectives is a challenge for teachers and policy makers alike. However, the process of learning is one that can provide guidance of its own making. That is, for courageous teachers there are signals from which to construct understandings that are specific to local

communities and conveyed in the responses of children and their behaviours. Finding solutions to improve learning outcomes can be an exciting and rewarding process for all directly involved in the interactions that take place within schools and their communities. The processes outlined in this chapter are indicative of progress through whole of community approaches to education. These are readily transferable to other schools and communities around the country.

**Acknowledgments** Jenni Webber would like to acknowledge Mr Djawlpri Marika and Ms Bengitj Mununggurr for sharing Yolngu matha and culture and Ian Morris for showing her many ways of knowing our environment.

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# Chapter 9

## A Sustainability Agenda in Planning Education

Trevor Budge and Andrew Butt

### Introduction

A structured legal process to systematically plan the use and development of land in urban and rural areas is today seen as a rational and necessary process by governments at all levels in Australia, New Zealand and internationally. The reality is that this is a relatively recent turn of events and the legitimacy of planning as a profession and a body of defined knowledge and practice is essentially a creature of the second half of the twentieth century. For geographers, the description and analysis of human activity and natural processes have been at the core of activity for a long time. Planners often find themselves in a similar broad disciplinary setting as geographers, but with a focus on preparing plans and policy for the future and making consequent decisions. Herington (1989, p. 1) describes the relationship between geographers and planners as having a lot in common, “however there is one important distinction: human geography is concerned with the description and evaluation of human activity on Earth whereas planning must look to the future and be concerned with finding solutions to problems.”

Planning in Australia, which has always been a creation of the States because of the limitations of the Australian constitution, was not applied in any structured or orderly way till after the Second World War. Land use planning is a composite and integration of different approaches and priorities; social, economic and environmental against a balance of interests, short and long term, public and private. Each of these approaches and objectives is mindful of the need for integration but is overlaid with political and cultural considerations and all within a growing complexity

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of legal and administrative frameworks. For example, as the peak professional body for planners in Australia, the Planning Institute of Australia (PIA) (2010) states in their *Accreditation Policy for Recognition of Planning Qualifications (Urban and Regional Planning Chapter)*, “planning assumes and requires a range of capabilities and specific competencies [in such matters as] ... spatial thinking and application, strategic thinking, problem solving” (p. 9). Graduates are required to demonstrate that they can make “meaningful new connections between apparently challenging, contradictory or unlikely elements, think strategically and apply planning concepts, skills and knowledge in a range of spatial settings” (p. 10).

The term and concept of “spatial planning” is emerging as a defining practice element of the land use planning profession. Land use planning is seen as the exercise of the spatial application of strategy and policy through a consultative decision-making process within articulated and often competing priorities and objectives. Increasingly, the objectives of spatial planning in Australia and New Zealand, as elsewhere, have become intertwined with notions and ambitions of sustainability (and sustainable development). Similarly planning is increasingly being seen and expected to be accountable for environmental management outcomes in policy, practice, research and teaching.

Primarily, the political and community agenda around sustainability is pitched at national or broad scale levels such as whole-of-catchment, regional or metropolitan. While land use planning can be undertaken at the national or large scale regional level much of the practice of land use planning takes place at the very local level or at least this is where the impacts of planning decisions are felt most severely. Decisions on competing priorities and objectives are often more meaningful to people at the local level and are much more likely to impact specifically and directly on communities and different interest groups. It is therefore understandable that delivering any form of “genuine sustainability” at the large scale through planning initiatives and decisions is generally a fraught prospect. Delivering at the local level, where communities are much more aware of their rights and their stake in decisions and the likely outcomes of those decisions, often produces local level political decisions that compromise or are inconsistent with broader and longer scale sustainability objectives. The exact location of a new road, a housing estate or an industrial development and the conditions under which they will operate have a greater immediacy and the imagined impact will be more real to those in the immediate area. These are often the ways in which the community perceives the planning system, not as a process that delivers against bigger picture sustainability agenda.

Despite most planning activity appearing to be mired in day-to-day local decision making, planning systems and the broader planning project offer an increasingly important and often pragmatic opportunity and avenue for the delivery of sustainability and environmental management. That delivery can be not only at the local level but also at the regional and even at the national level. Further, planning education, both as a defined vocational exercise, and more broadly as an applied study of environment and society, offers a very real and tangible path to investigating processes, dilemmas, trade-offs, barriers and opportunities to achieving sustainability

in ways that have relevance in diverse community settings at a range of levels. In fact, for land use planning, similar to many other policy and legislatively based systems, to maintain legitimacy and traction with communities, governments and businesses, it must increasingly be seen and judged as being able to deliver on sustainability and an improved environment.

This chapter examines the meanings of sustainability in the context of spatial (land use) planning and how this may fit within an agenda of sustainability education. It will explore two specific examples of the expanding role of planning in respect to natural resource sustainability and environmental management processes with particular relevance to rural settings in Australia. The case studies examine the application of planning process and legal frameworks to assist in limiting and managing salinity, and the broader issue of protecting or minimising the loss of native vegetation to alternative land uses or new developments.

## **Planning as an Emerging Discipline**

Based on the Australian Bureau of Statistics (ABS) occupation data it is estimated that there are about 8,000–10,000 persons employed in Australia under the definition of “planners”. ABS and Statistics New Zealand both define the occupation in fairly broad terms “URBAN AND REGIONAL PLANNERS develop and implement plans and policies for the controlled use of urban and rural land, and advise on economic, environmental and social factors affecting land use” (ABS – Statistics NZ 2006). The emergence of increasing complexity and uncertainty in the scope of urban (and rural) systems and the comprehensiveness demanded by the community and governments have led to a seemingly ever-expanding remit and demand on planning knowledge and interest. Planners identify that they are being required to juggle an increasing demand for information on a wider range of topics within a political setting of competing demands by interest groups with greater access to their own information sources (Planning Institute of Australia 2004). The pathway of spatial planning over the past century reveals and reflects a growing and broadening range of agendas, policy regimes, responses and modes of governance and accountability to the public that have led to a constant expansion and adaptation to the field of activity for planning practice.

Reeves (2005, p. 39) describes a timeline of change in planning traditions that began with an exercise in purely physical design, most exemplified by production and reliance on the grand city master-plans of the late nineteenth and early twentieth centuries. Planning moved through an era of increased awareness of the role of social and economic outcomes, particularly in the urban reconstruction of the inter-war years to be followed by the frenzy of growth and development in the post Second World War period. More recently contemporary concerns with the state of the environment, cultural diversity, collaborative engagement, social equity and the broader issue of “sustainability” have been identified as leading drivers of planning, urban theory and planning strategies (Gleeson and Low 2000).

As a discipline, planning had its origins within an urban setting largely addressing the worst excesses of the industrial revolution of the nineteenth and early twentieth centuries and firmly within the goals of addressing public health issues and a socially distributive reform agenda. There was an underlying utopianism in the early planning project that drove much of its original vision and rationale. There was an expectation that the allocation of space and land resources and the separation of incompatible land uses could result in the delivery of a desired socio-economic future based on grand-scale master planning and the application and enforcement of a stronger regulation base. From that premise a whole literature emerged that saw practitioners and academics come together around the concept of the physical plan being central to outcomes (Abercrombie 1959; Keeble 1964). With growing recognition of the limitations of a master planning approach and the growth of cities planning focused more on understanding cities as complex systems and measuring and projecting population, transport and social and economic determinants (McLoughlin 1969; Chadwick 1978). However, this “rational” approach was found to be inadequate as it failed to account for a range of forces such as: the increasing dynamism of cities and regions, the sheer power of the private sector in mega-urban regions, the growing overlay of environmental issues and the emerging interest and imperatives of sustainability.

As well as these forces, there was a dramatic growth in a more educated, sophisticated and litigious population who quickly learnt how the planning process gave them rights and power. Consequently there emerged various communities of interest who quickly learnt how to assert their rights and conduct campaigns (Jacobs 1964). These transformations resulted in the process of decision-making becoming more protracted, complex and the controversy around the likely outcomes from decisions more divisive. The emergence of neo-liberal governance and their policy regimes and a consequent pragmatism in planning practice all questioned the legitimacy of planning as purely the domain of planners and elected governments (Goodman 1972). Governments were no longer seen as being able to make rational and fully objective decisions based on the purity of the “common good” that would deliver effective, responsive and responsible social and economic outcomes (Gleeson and Low 2000), let alone ones that exemplified sustainable development.

This growing complexity in process and anticipated and expected outcomes has occurred against a changing political environment where centralised control is increasingly being contrasted with the asserted capacity of the market to deliver. However it is the capacity of planning to make, implement and enforce decisions through legislation, despite the changing social and political environment in which this has occurred – from modernist *state-directed* futures, through to market dominated *neo-liberalism* – that has provided planning with the relevance and legitimacy to deliver an agenda of change. However, this has meant that planning has been required to be increasingly broad and more complex in its considerations, to embrace legal processes and to become more administratively based and increasingly dependent on legislation.

For much of the private sector, planning is seen as a “negative” regulative mechanism designed to curb the worst excesses of private land development practices, while the public sees it as facilitating development and profit. Despite these views there is still within planning, planning education and research a view that planning remains within a strong “public good” tradition, even though implemented through ordinance, regulation and legal decision-making. The embracing of sustainability by planning further reinforces that view. It is exemplified in Australia by each state mandating that all local government areas are required to have some form of statutory (legal) planning control over land use and development and that is cloaked in broad goals about sustainable outcomes, just as District Plans pursuant to the *Resource Management Act 1991* do in New Zealand. Depending on the jurisdiction these legal controls are known as planning schemes, development control plans, local environment plans etc. However, the implementation of them and the processes to manage them has required increasingly broad and more complex considerations, some imposed administratively and legislatively, some developing through the increasing awareness of the complexity of the interplay of spatial factors and the natural resource base, some resulting from the emerging politics of development within communities. All this has taken place within a rapidly pressing environmental agenda and the call for outcomes that can be assessed and judged as more “sustainable”.

## **Planning: The Environment and Sustainability – A Developing Agenda**

Spatial planning is a broad and complex area of policy and practice. Planning is primarily an exercise in the allocation of land and other (scarce) resources relevant to space and place within a framework of competing demands: short term versus long term, and private gain versus community benefit. Arguably, planning as practice often exhibits and tends to be accused of supporting less progressive outcomes (such as sustainability) by being seen and often portrayed to be primarily supporting, facilitating and administering systems of land investment and development. Even though regulation has been under attack from many quarters, governments have embraced the complexity of the interplay of the free market with increasing levels of control and the complexity of regulatory spatial and social systems. In turn, governments have framed expectations and requirements within a rapidly pressing environmental agenda and the call for outcomes that approach or at least can be labeled as “sustainable development” – still a hotly contested term.

The concept that planning was initially very much about the quality of the built environment, the reduction of pollution and disease and the creation of healthy places to live, work and recreate has long been a guiding principle (Hall 1975). To a very considerable extent these fundamental issues of urbanisation have been comprehensively and systematically addressed, or at least there is a raft of mechanisms and regulations now to deal with them in Australia, New Zealand and elsewhere. That a building is safe, structurally and in operation, that waste products and emissions



are managed and that the relationship between apparently conflicting land uses can be controlled are now generally accepted as being able to be dealt with by regulatory systems. Perhaps it was only natural that having dealt with these rather mundane issues in urban settings that the ambit of planning and the value of a regulatory mechanism on land use and development would increasingly be called upon to be extended to engage with broader environmental issues and values. Consequently matters such as the quality of land and habitat management in rural settings would be brought into the fold. In turn it is understandable that communicative engagement and broader notions of “sustainable development” would be brought into the agenda.

For most people and communities, the experience of planning is an administrative one involving property development at the neighbourhood level. The breadth of planning as experienced in the policy setting of government and in broader concepts of community interest typically involves notions of long-term and holistic strategy at the local and regional level. It is generally only when the impacts of these actions can be translated to local level impacts does the broader planning agenda impact. The recent potential impacts of decisions on water allocations across the Murray Darling basin in south-eastern Australia and their consequent impacts on agricultural land use and urban growth and development provide a case study. Large scale long term environmental policy based around the sustainable use and location of resources produced grass roots community action when the outcomes and impacts of the policy were translated to local level communities.

Reflecting this growth in the ambit and remit of land use planning in Australia is the recognition by the PIA; the professional institute for planners, that “environmental planning” is one of the five themes for knowledge, competency and practice for planners. The PIA policy for the accreditation of planners identifies that planners need to “take a collaborative role in the production and implementation of environmental plans” and that the performance outcomes that planners will need to demonstrate include; “knowledge of the main principles of sustainable development, ecological systems and key issues such as climate change, and capacity to practically and critically link plans into wider frameworks of environmental action and influence at a variety of scales” (Planning Institute of Australia 2010, p. 20). Planning and the role of planners now firmly include the protection and management of natural and cultural heritage and the conservation and sustainable use of resources such as water, vegetation, soils and agricultural productivity.

### ***The Environment in Planning***

Over several decades, research by geographers and scientists has documented the progressive decline in the quality of Australia’s environment and natural resource base. In some cases this has been simply loss or decline in fauna species, in the extent and quality of native vegetation, in water quality in creeks and streams and so on. In other cases it has been recording an increase in areas afflicted by features of the Australian landscape such as erosion, salinity or acid-sulphate soils. Documenting

and publicising these fundamental changes in the Australian landscape and the condition of the environment, the monetary cost to production, or the financial cost of restitution, has led to governments and agencies allocating resources to address them as part of national, state and regional policy initiatives. These programs have embraced broad scale community action such as Landcare and national strategies and policies such as an initiative like the Murray Darling Basin Authority capping water allocations.

One of the government responses has been to examine how land use and development strategies and development control measures could be used to manage land use change and development to deliver desirable outcomes particularly at the state and local level. Primarily this has involved calls for permit or development approvals for various impacting actions to be required under the relevant state and local planning controls. Vegetation removal, for example to enable agriculture or residential development is a change of land use and a development action. If state planning instruments define that land use change and development in such a way as to require approvals (permits) then these actions are subject to regulatory control through the planning system.

However any attempts to use the planning system to systematically manage actions such as vegetation removal at a national scale assume that there is a uniform system of regulation of land use change and development control across Australia. The reality is that due to the constitutional arrangements in Australia on land use change and development each respective state system manages these actions in different ways. Land uses and developments that require a permit in one state do not necessarily require an approval in another. For instance demolition of a building does not require a planning permit unless the relevant planning control requires it, buildings listed as heritage buildings are not automatically afforded similar protection from one state to another. Likewise converting agricultural use from dryland farming to irrigated pasture or production does not generally in itself require a planning permit because state governments choose to exempt that change from planning approval. However in some cases actions that would alter the speed or direction of floodwaters such as constructing or altering a levee bank may require planning approval. Each state constructs its planning regulatory system differently and within states controls vary between local governments. Whether vegetation removal requires a planning permission varies from state to state and if it does the triggers for a permit vary, and the approach taken through the specific provisions are different between states, or even within regions and local areas.

Each state in Australia has approached the issue of implementing environmental controls with different policy settings and imperatives; they have each used their planning system in different ways in respect to environmental management. While there are significant differences in the detail there are some broad overall widely agreed frameworks. For example, over the last two decades or so the Australian government has progressively signed up to a series of international agreements on environmental management. These in turn are binding on the states through the Intergovernmental Agreement on the Environment, which sets out key principles for environmental policy in Australia. Intergovernmental agreements are further

strengthened through the Council of Australian Governments (COAG) process. In time these initiatives have found their way through various expressions into respective state legislation and in many cases into land use planning arrangements and requirements at the local level. Examples include the international recognition of the habitat values of wetlands and wetland wildlife habitats that provides for migratory birds that are designated under the Convention on Wetlands of International Importance (the Ramsar Convention) or utilised by species designated under the Japan-Australia Migratory Birds Agreement (JAMBA) or the China-Australia Migratory Birds Agreement (CAMBA). Other Australia-wide agreements that have driven state planning responses include the National Strategy for Ecologically Sustainable Development, the National Greenhouse Strategy, the National Water Quality Management Strategy, the National Strategy for the Conservation of Australia's Biological Diversity, the National Forest Policy Statement and National Environment Protection Measures.

### *Sustainability in Planning*

The emergence of a sustainability agenda in planning education, research and practice is in part a confluence of the growth of local environmental concerns, both at a community level and as a political force in urban and rural Australia particularly from the 1970s. The long-standing traditions of designing and managing open or green spaces in the planning and design professions “collided” with the growing global awareness of policy and systems approaches to sustainability. This conjuncture was highlighted particularly after these perspectives were advocated in the *Brundtland Report* in 1987 (WCED 1987), in consequent global summits and in policy initiatives like Agenda 21.

Jepson (2001) outlines a basis for planning in sustainability that relates to the complex systems of spatial, social and economic interplay that concern planning. As well, he highlights the need to provide systematised approaches to meet the needs of both localised and global responses to the emerging sustainability agenda. In Australian and New Zealand jurisdictions, planning systems and legislation have increasingly adopted features (and the rhetoric) of sustainability. With this change there emerged an increasing breadth of planning action and required knowledge. Gurran and Phibbs (2008) describe a considerable body of policy and ordinance addressing sustainability in Australian local planning, but question how effective has been the implementation. Jackson and Dixon (2007) illustrate a mismatch between the language of environmental sustainability and the objectives of development, but nonetheless recognise the emergence of environment and sustainability within planning in New Zealand where the legislative framework is the Resource Management Act. In Australian states the title of the respective state planning legislation provides a clue as to direction and ambit; the Planning and Environment Act (Vic), the Environmental Planning and Assessment Act (NSW) and the Sustainable Planning Act (Qld) are terms used to describe planning legislation.

The legislative response and the processes associated with them are not without critique, both in terms of substance and the genuine capacity of planning action to achieve sustainable outcomes. Gunder and Hillier (2009) consider sustainability rhetoric in planning to be potentially one more *empty signifier*, meaning “everything yet nothing”, where precise meaning has given way to a broad and imprecise narrative. Campbell (1996) questions the capacity of the existing conflicts in planning, social justice, economic development and environmental protection to gain any tangible resolution through a sustainability metric. Despite the obvious limitations there is increasing recognition that there are potential substantive pathways for planning through a discipline like urban design, or by tackling fossil fuel energy dependency at a spatial scale by addressing planning at a regional (beyond metropolitan) scale.

Despite these critiques, planning as practiced does offer a chance to explore and take action on the dilemmas of sustainability at an understandable level (that of city, landscape or even neighbourhood scale). Moreover, planning has the capacity to offer responses for both mitigation of and adaptation to a changing climate – planning in climate change (Steele and Gleeson 2009) through new urban forms, new regional relationships and adaptive models of land use.

### ***Case Studies in Australia: Salinity and Native Vegetation***

In this section we explore two elements of Australia’s broader land management agenda; salinity and native vegetation. These examples have been chosen because they are wider issues than those of land use change and development alone. They are commonly seen as rural issues and therefore perhaps often outside of the planning system with its greater focus on urban development. The issues associated with them are also complex and yet in both cases the planning system has been drawn into providing processes around them. Managing the impacts of salinity and the impacts of salinity on development and establishing limitations on the clearance of areas of native vegetation have, in recent years, in many parts of Australia, become actions subject to restrictions established by planning controls. That the planning system has extended its purview to matters that have largely been traditionally related to rural land use and agriculture is indicative of the extent to which the regulatory basis provided by planning has been used to address a wide range of natural resource management issues.

There have been four major drivers that have produced this outcome. Progressively, planning controls were extended from their traditional urban base to cover rural areas. It became evident to governments that control was necessary and desirable over some elements of land use change and development in rural areas, particularly matters such as the subdivision of land to provide for low density residential development. Secondly, there has been a growing realisation of the interconnectedness of issues associated with environmental management; salinity and native vegetation are integrated with other environmental and land and water management issues.

Thirdly, the remit of planning was extended in terms of objectives and purposes to embrace environmental management and principles of sustainability and these swept up issues such as salinity and vegetation. Lastly, community pressure was placed on authorities to introduce systematic processes to require review for proposals that included actions that would impact on salinity or would be affected by vegetation clearance.

As a consequence the planning system, which had never been originally constructed in Australia to manage large scale environmental and natural resource management issues, found itself being the arbiter for applications with possibly profound impacts in settings and at scales for which it had little experience or capacity. Planning staff employed by local governments and local councillors have found themselves dealing with applications addressing complex environmental issues that have stretched their resources and capacity. In situations where applications become subject to third party input, issues and questions were raised that required experienced scientific input. In many cases specific applications treated in isolation are likely to have limited impact if approval is given, however there is an increasing realisation of the cumulative impact on an environmental resource of many decisions, such as the clearance of native vegetation. Not only does the cumulative impact significantly reduce habitat, but also in turn it could impact on ground water levels and in turn lead to salinity impacts many kilometres distant. These were issues and complexities that planning systems and those who administered them found politically challenging and often beyond their expertise and capacity to handle.

Salinity and vegetation management are just two examples of where goals around sustainability and environmental management intersect with the planning system and where the education base of planners was found to be insufficient. Most planning courses in Australia are (understandably) heavily oriented to dealing with urban planning issues and understanding the changing social and economic construct of cities. Equipping planners and the planning system to address more “nebulous” issues like sustainability, including in rural and agricultural settings, has now been embraced by many planning courses, but such changes are often derived from the state imposed policy base and related to more tangible issues in urban settings such as transport, energy and urban design,

### *Planning and Salinity*

Salt in soils is a naturally occurring phenomenon. In an Australian context large areas of the continent had previously been overlain by the sea. In parts of the land mass the levels of salt trapped within the soil is exceptionally high. Land settlement practices, vegetation clearance, irrigation systems and cropping techniques released large quantities of salt into the sub surface soils through the movement of underground water, raised level water table levels and changed evaporation regimes. By the late twentieth century this issue was becoming increasingly evident in many

agricultural regions of Australia (House of Representatives Standing Committee on Science and Innovation Report 2004). While there was initial scepticism of the scale of the problem, documentation of the current effects and projections of future impacts on the landscape and on agricultural production raised the issue to the level of a national crisis (Australian Government 2001). Large areas of irrigated land have been rendered as nearly useless for production while the full scale of the impacts on dryland areas is still being realised in many areas. While this outcome was initially seen as a rural problem affecting production and towns and communities dependent on levels of agricultural wealth, it quickly became evident that buildings and infrastructure such as roads and bridges were also susceptible to major damage from salt. Urban development (and therefore planning for towns) would have to consider salt. Regional centres such as Wagga Wagga and Dubbo in New South Wales were forced to confront major salinity issues impacting on residential development. To the surprise of many some outer edges of metropolitan areas were also found to be at risk through impacts on the foundations of houses, on sporting grounds and drainage systems.

While the capacity of the land use planning system to address large scale and interconnected hydrological systems would appear to be limited, it became evident that in its forward planning (strategic) role the regulatory planning system could limit or prevent urban development on areas that were likely to be affected in the future. Relating salinity to vegetation meant that vegetation clearance controls could be used to prevent clearing in areas where the removal of vegetation would result in the creation of or worsening of salt recharge and that controls on the type and siting of buildings could be linked to the presence of saline ground water systems. By the 1990s, salinity or salinity management was added in some states to the list of matters that planning decisions might need to address. From a legal standpoint it became evident that once a planning body, such as a local government, became aware of a risk or hazard that their land use decision making would need to take into account the impacts. Councils would need to seek to avoid a situation where in future years they might be held liable through development approval for either causing or substantially contributing to damage to homes through raised water tables with high levels of salt.

The identification and mapping of land impacted by salinity in irrigation and dryland areas assumed a substantial momentum from the early 1980s; by the 1990s the extent and scale of the problem was widely known and accepted across the nation. A range of restorative measures was progressively implemented as the seriousness and scale of the problem became evident. Questions were raised as to how did land use planning, with its powers to require permits for land use change and new development, relate to the issue especially where development was proposed in areas subject to salting or where developments or land uses were likely increase the severity of the problem. Many such actions in rural areas were not subject to the planning process in that they did not require a permit, such as converting from one agricultural land use to another or changing from dryland to irrigation farming, however many one-off developments and actions such as vegetation removal, which in some states required a planning or development approval, fell within the scope of planning processes and permit requirements. This raised a number of issues such as: how would

applications be handled, what matters would determine the outcome of applications and could measures be taken that would ameliorate the impacts of salinity or the impacts on land afflicted by salinity?

In the case of the Victorian planning system, with its capacity for the imposition of centrally driven controls, the state government provided what was known as a “Salinity Management Overlay” that could be applied by local government in their planning schemes. Essentially it operated by identifying areas on the planning scheme maps where there is saline affected land or where land needs to be managed because poor management, for example vegetation removal, may increase the likelihood of ground water recharge with salt. Once imposed the Overlay would mean that that planning permits were required for certain actions that may otherwise be exempt. Councils using the Overlay provisions were in the position of being much better able to defend a decision to prohibit a development or impose conditions. The presence of the designation “Salinity Management” on the planning scheme maps would also potentially alert a prospective purchaser or development proponent of the condition of the natural resource base. Once having mapped these areas then Council would need to give serious consideration as to whether these areas would be suitable for a range of urban or other uses and therefore the mapping might guide broad scale future land resource allocations and planning.

While this was initially seen as potentially applying to rural areas, mapping increasingly was applied to the edges of urban areas and in some cases built up urban areas where there was evidence of salinity impacting on building foundations and walls. In many cases the planning provisions called for suitable technical reports based on ground water testing and then requirements relating to the type of foundations and suitable treatment of walls slabs and structures to minimise risk. Across many parts of inland Australia urban Councils are now confronting the issue of having to factor into their planning that existing or prospective areas have been identified as subject to salinity. The City of Wagga Wagga in the Riverina of New South Wales is probably the most high profile example. Council has not only had to factor salinity into its planning processes but has embarked on a long term scheme of costly works to address sub surface drainage and remediation of areas that are salt affected.

In terms of planning and community engagement problems arise once land subject to salting is mapped. Firstly, there are limitations in the accuracy of mapping. Under detailed review the boundaries of areas mapped have proved difficult to establish precisely, in many cases using a precautionary principle approach land was mapped on the basis that it was suspected of being subject to salinity but could not be conclusively demonstrated. Secondly, the placement of a line on a map produced problems. The implication of the line was that on one side of the line there were salinity issues, but that on the other side there were not. Legal review of decisions found it difficult to accept such precision and expert evidence found it difficult to be so precise. Thirdly, there was a backlash from the community who owned land affected by these designations, although the designations merely acknowledged what in many cases was very evident, but the perception was raised in potential buyers that the land was afflicted by a serious impediment. This resulted in a lowered

property value. Landowners protested at being included in such mapped areas and Councils became reluctant to apply the designation in the light of such protest.

### *Planning and Native Vegetation*

Regulating the loss or destruction of native vegetation through a land use planning prism and applying the powers of “planning” controls to achieve specific outcomes largely arose in Australia in fringe urban settings. On the edges of the rapidly expanding metropolitan areas new residential development sought the enhanced landscape settings of areas of native vegetation or at least an interface with it. Those acquiring properties in such settings clamored for local governments to provide some form of “protection” for the vegetation that formed part of their residential, environmental setting and constituted an important element in the market value of their residential investment. As these controls were put in place they were extended to cover wider areas and to “protect” stands of highly valued vegetation. However it was the broader association of linking large-scale vegetation removal to issues such as loss of habitat, biodiversity and the emergence of dryland salinity and its links to vegetation clearance, that prompted national and state authorities to look to wider regulatory mechanisms. One of the choices for such an approach was to use the planning system with its powers to require a permit for a specified land use change or development. Not all states though sought to use the planning system to manage wholesale vegetation clearance through the planning system.

The clearing of native vegetation created much of the great expanse of Australia’s productive agricultural areas. Clearing native vegetation was seen as a right (and encouraged) particularly if it made land “productive”. However by the 1980s the scene had changed and policy was now reflecting new values. Illustrative of the dramatic turnaround in policy on native vegetation in Australia is the fact that even as late as the 1970s there were tax concessions for clearing native vegetation for agriculture, by contrast in the late 1980s and early 1990s there were moves to ban clearing and now there are government incentives to plant native vegetation. Some states began introducing regulatory controls that meant the clearing of vegetation required a permit and in some cases those were handled under the planning system.

During the 1980s and later there were growing concerns and calls for government intervention at all levels, local, state and national, to better manage the environment, to stop what were seen as an excessive destruction of native vegetation and wilderness. Actions that had once been seen as “normal” development such as land clearing, harvesting old growth forests, damming rivers and streams, diverting water for crops, were now being labelled as destructive and there was a large swing in the community to support legislation that would ban or at least control such processes. The calls had not emanated from a broad based concern about sustainability (that was to come later) but they were largely a practical expression of concern over lost



habitat, the low economic returns from marginal country, scenes of drought exposed country and the general calls of the growing conservation movement.

Concerns about apparent indiscriminate clearing of marginal country had already been raised in such cases as the Little Desert in north western Victoria in the late 1960s (Robin 1998). The exercise of some control over the clearing of native vegetation, particularly where the clearing was to open up more land for farming, was emerging as a controversial issue. It was alleged that such areas largely contained marginal cropping and grazing land and that controls on clearing unduly affected property rights. South Australia was the first state to act to protect native vegetation through legislative means. Following an electoral commitment to reduce native vegetation clearance, the South Australian government acted in 1983 by using regulations under the *Planning Act 1982*. Protests by landholders, particularly over the lack of compensation, culminated in a case that was decided in the High Court of Australia in the landholders' favour. Consequently, the state government removed the controls from the planning system and introduced the *Native Vegetation Management Act 1985* with compensation, payable for those refused approval for vegetation clearance (Department of Environment and Natural Resources 2011).

Victoria quickly followed suit and in 1991 used the provisions of the relatively new *Planning and Environment Act 1987* to introduce a state wide control over native vegetation clearance. Each state has addressed the control of the removal or clearing of vegetation differently. Partly reflecting the complexity of the situation and the local political scene. Generally the approach taken in Victoria and New South Wales has been to require a planning permit or development approval respectively to clear native vegetation. The exercise of this control is largely in the hands of the respective local government who administers the planning control but there is reliance on a system of referral to expert advice usually from the relevant state authorities. While this would appear to be a simple process it has become very complex and some would say convoluted. There is continuing confusion over a range of exemptions for quite practical purposes, and there is ongoing dispute about the scale, size and age of vegetation to be managed through permits.

## **Developments in Planning: An Expanding Breadth of Education and Practice – Pressures, Prospects and Proposals**

Engaging with environmental management and long term goals of sustainability in planning practice and education has become vexed due to the rapidly widening scope of planning and the growing recognition of the increasing complexities in planning and the decision making that flows from it. Increasingly, in Australia, New Zealand and internationally, the breadth of the demands on planning in research, education and practice has expanded into areas as seemingly diverse as biodiversity, water management, cultural regeneration, heritage management, indigenous

impacts and community engagement as means of and inputs to framing a broad sustainability agenda. This is in addition to those areas within a traditional planning focus such as housing, transport, urban form and “countryside” protection.

The growing exposure of the community to the regulatory planning system has largely come through increasing numbers of persons and households being drawn into the system through broad scale calls for community input to plans and strategies and for specific input when “third party” interests are potentially impacted by new proposals for land use change or development. Proposal for retrofitting existing residential areas with new multi unit development in the major cities has probably been the single most confronting activity that has drawn the average person into the planning system. But requirements for approval of large scale developments that impact on substantive environmental or natural resource management have generated very formidable activist organisations, whether they be part of the local planning system or linked to the use of formal Environmental Impact Assessments to deal with the complexity of large scale or high impact developments. Each state has now found that processes associated with major developments such as the location of new freeways, coastal developments such as marinas, wind turbine facilities, power stations, quarries, landfills and so on also link to questions of sustainability, resource use and competing views as to what constitutes sustainable development. Increasingly the land use planning process and the development decision-making procedure with its statutory requirements is becoming part of the manner in which governments and communities address sustainability and in turn how demands for sustainable outcomes are dealt with.

Much of the development of a planning agenda and the remit of planning in practice around urban change and environmental management has been informed by geographical knowledge, research, analysis and commentary. It is still the case that for many who embark upon a professional career in planning there is often a passion for geography as a discipline and with its focus on explanation for the observed phenomenon in the natural and built world. The two disciplines still intersect at key points, both deal with maps and plans and spatial data, both are driven by the data emerging from time series studies and both recognise the value of spatial representation of information and ideas. However as planning became progressively consumed by the politics of representation and the imperatives of decision making within increasingly complex statutory and legislative regimes the relationship between the two disciplines has declined. More recently, with the rise of a sustainability agenda and its imperatives the objective and comprehensive measurement of human activity provided by geographers has once again intersected with the practice and work of the planner. While this intersection has been most readily understood in large scale urban issues like transport, mobility, and the urban form of cities, all traditional elements of the planning project, as this chapter has shown it has now extended to emerging areas of environmental management normally associated with rural areas and agricultural systems. High profile issues like salinity management and native vegetation clearance that have been traditionally seen as rural issues have become enmeshed in objectives and policies that have also been driven by a sustainability agenda. The planning system has been increasingly utilised by

governments in an attempt to provide a legal framework and statutory process within which action can be taken to manage and regulate processes which were never envisaged as being within the realm of planning. The examples of salinity management and native vegetation clearance controls reveal the dilemmas for advancing planning regulation into new fields of activity. Technical, political and resource constraints are evident in these examples, despite an overarching desire for land use planning to apply an all encompassing approach of “sustainability” management and the pursuit of aspirational sustainable development goals.

Despite these logistical and practical demands, this development presents both challenges and opportunities for the education of planners and the continuing professional development of planners. More widely, it offers scope to utilise the planning project as a tool for sustainability education and engagement that has relevance in education at all levels: community, school, university and life-long learning.

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# Chapter 10

## Earning a Living in PNG: From Subsistence to a Cash Economy

George N. Curry, Gina Koczberski, Joachim Lummani, Sean Ryan,  
and Veronica Bue

**Dedication** Mr Scott Kimpton, who was a postgraduate student at Curtin, passed away on 2 July 2009. Scott, an enthusiastic fieldworker, was involved in data collection for the cocoa component of this chapter. He is fondly remembered by his colleagues and friends, and we dedicate this chapter to his memory.

### Introduction

This chapter addresses the question of how individuals and families in rural PNG respond to major livelihood threats as they make the transition from a subsistence mode of life to become increasingly integrated into the global economy through export cash cropping. Two case studies are presented: cocoa farmers on the Gazelle Peninsula of East New Britain Province (ENB) and oil palm migrant farmers residing on the Hoskins Land Settlement Scheme in West New Britain Province (WNB) (Fig. 10.1).

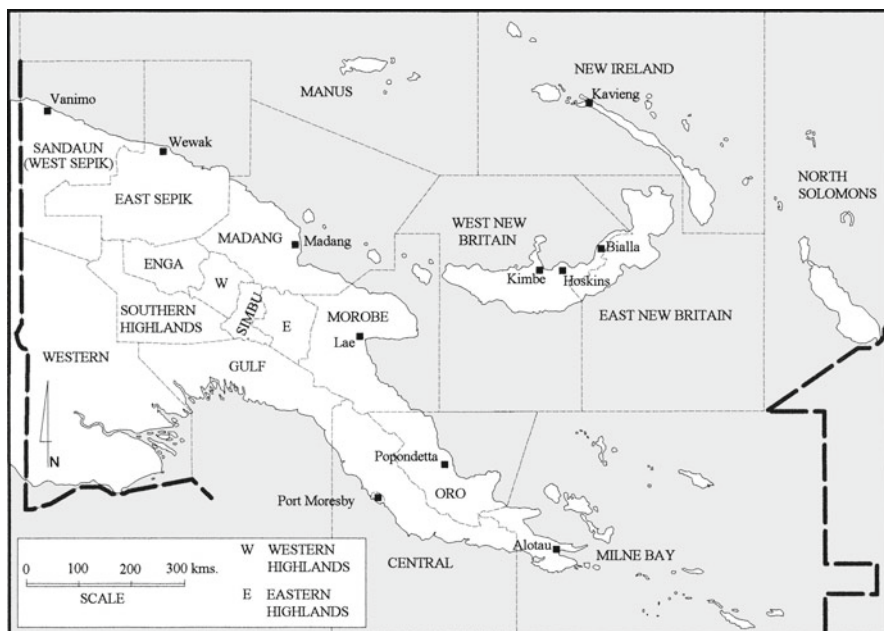
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**Fig. 10.1** Papua New Guinea

The cocoa farming community of Gazelle Peninsula began growing cocoa on their customary land in the 1950s with encouragement by the Australian administration. Since 2006 they have been confronted with an introduced cocoa pest, Cocoa Pod Borer (CPB), which is devastating their cocoa crop and livelihoods. The migrant oil palm farmers voluntarily took up State agricultural leases of 6 ha blocks in the late 1960s and early 1970s and are now experiencing population and resource pressures as their children marry and begin raising their own families on their parents' blocks.

Oil palm and cocoa farming communities in the two provinces (Fig. 10.1) share similar local economic conditions in that non-farm livelihood options are constrained, formal sector employment opportunities are limited and government services are difficult to access or non-existent. The case studies show that both communities have pursued various livelihood options in response to the challenges they face, although it is clear that food gardening for home consumption and sale at local markets is a critical livelihood activity. In this uncertain environment, food gardens are safety nets which, like kinship networks or cash savings, can be drawn upon when livelihoods are threatened by, for example, the vagaries of export cash crop production (falling yields or prices).

Despite food gardens providing a safety net, risks remain. For example, oil palm growers are experiencing land shortages for food crops and are now compelled to cultivate gardens on environmentally sensitive land or on land over which they have insecure tenure. Also, the local marketing of food crops by cocoa growers to offset

lost cocoa income is limited as CPB spreads and local markets become over-supplied with food crops. Moreover, the kinship networks which were once a dependable safety net for cocoa farmers are becoming less robust as entire communities across the province fall victim to the effects of CPB. The two case studies describe the various ways rural Papua New Guineans are responding to rapidly changing demographic, economic and environmental circumstances. The chapter shows that rural Papua New Guineans are not passive victims of change but are active in shaping their own destinies in what are sometimes severe economic and environmental stresses.

Before presenting the two case studies a brief overview is provided of PNG and export cash crop production.

## Papua New Guinea

PNG, which achieved political independence from Australia in 1975, lies to Australia's north, and is characterised by rugged mountain ranges, high rainfall, large rivers, swamps and many hundreds of islands. Its physical geography presents major constraints on the provision of basic infrastructure and services such as roads, health and education services, and shapes spatial patterns of agriculture, diets and nutritional status and income disparities in the country. Only a quarter of the country's landmass is suitable for agricultural production (Bourke et al. 2009), and cash cropping, one of the few opportunities to earn a regular income in rural PNG, for example, is generally unavailable to those living in remote, high altitude and high rainfall areas, where land quality is poor. Thus, spatial patterns of rural poverty are closely associated with environmental constraints (Allen et al. 2005).

The population of 6.5 m is culturally and linguistically diverse and the majority (81%) live in rural villages. While urbanisation is relatively recent, the country's annual urban population growth rate of 4.5% (Storey 2010) over the last decade has been amongst the highest in the Pacific and has outstripped national growth rates. Many of the growing urban population are migrants from remote, poorly serviced and disadvantaged rural areas and small islands.

Most of the rural population live on land held under customary tenure and rely on agricultural-based activities to meet their everyday needs. From 2002 to 2007, agriculture accounted for one-third of average annual economic growth (Warner and Omuru 2008). Whilst the mineral boom since 2002 has underpinned the recent strong performance of the national economy, for most rural villagers there are very few cash earning opportunities outside of agriculture. The formal sector employs less than 9% of the working age population (McMurray 2002).

## Export Cash Cropping

Nearly 90% of cash income in rural areas is from export cash crops and the local marketing of food crops and betel nut (Allen et al. 2001), with over two-thirds of this income from export cash crops. The three export crops of oil palm, coffee and

cocoa are the primary sources of income for nearly half the nation's population (Curry et al. 2009; Collett 2009; Orrell 2009).

The adoption of export cash crops has led to major agrarian, social, and economic changes and exacerbated pre-existing social and spatial inequalities in income (Finney 1973; Donaldson and Good 1988; Curry 1992; Allen et al. 2005). For example, when commercial smallholder agriculture was introduced into PNG, women experienced new forms of inequality as the new sources of wealth were captured largely by men (Strathern 1982; Sexton 1986; Johnson 1988; Overfield 1998; Koczberski 2007). Other studies have shown that the development of commercial agriculture in PNG has altered customary land tenure regimes. Evidence suggests that the introduction of perennial export cash crops has led to usufruct rights being vested in the same family or individual for much longer periods than was usually the case with subsistence food crops, with the result that individuals and households now claim exclusive rights of access to, and inheritance of, these crops (Salisbury 1964, 1970; Epstein 1968; Grossman 1984; Hooper and Ward 1995; Curry et al. 2007b; Koczberski et al. 2009). These changes to customary land tenure have been accompanied by changes in peoples' views and attitudes to land, with the commercial potential of land receiving greater recognition.

While there has been considerable change in rural society following the introduction of cash crops, there has also been an element of continuity as villagers seized opportunities to use the income from commodity crops to expand their participation in local indigenous exchange systems and processes of social reproduction (Strathern 1979; Gregory 1982; Nihill 1989; O'Hanlon 1993; Brison 1999; Koczberski 2002; Curry 2003). For example, traditional "big men" leaders directed money from cash cropping to traditional activities to further strengthen their status and prestige (Strathern 1979). Traditional, or indigenous socio-cultural activities continue to influence levels of cash crop production. As Curry (2003) observed for village cash crop producers in WNB and Oro provinces, many traditional cultural activities are now timed to the seasonal cocoa flush or oil palm cycle of payment, rather than the seasonal gardening cycle of earlier times. Thus the way smallholder producers engage with commodity production continues to be shaped by pre-existing socio-cultural frameworks and non-market exchange considerations.

## **Case Study 1: The Response to Cocoa Pod Borer in East New Britain Province**

Smallholders have been producing cocoa on the Gazelle Peninsula since the 1950s. Until the arrival of Cocoa Pod Borer (CPB) (*Conopomorpha cramerella*)<sup>1</sup> in the province in 2006, cocoa was the primary income source for over 23,000 smallholder

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<sup>1</sup>CPB has a lifecycle of about 1 month. The moth lays its eggs on immature pods and after 2–3 days the larvae hatch and burrow into the pods where they feed for about 2 weeks. Larval feeding causes



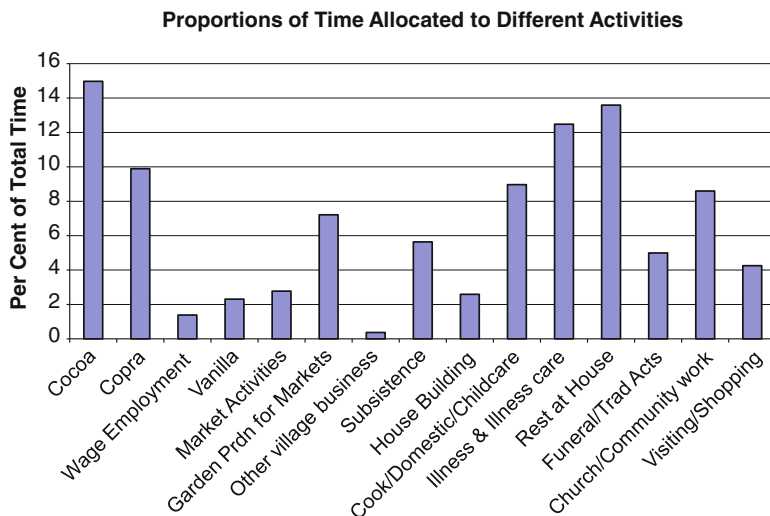


Fig. 10.2 Cocoa farmer livelihood sources

households, representing 70% of the province’s total households. It was the largest source of income for the province, generating K144 m in export revenue in 2007–2008 and accounting for almost half of national cocoa production. The cocoa farmers of ENB, like the oil palm growers in Case 2, pursue a range of livelihood strategies in addition to cocoa. While cocoa was by far the dominant income source prior to the CPB incursion, farm households also engaged in production of food crops for home consumption and sale at local markets, production and sale of vanilla and copra, and managing small village businesses such as poultry and village tradestores (Fig. 10.2).

Cocoa farmers, like most rural Papua New Guineans, also attach much importance to activities that are not directly related to earning cash income, but which depend on cash and are central to maintaining social and kinship networks and community cohesiveness. For example, villagers devote much time, labour and money to church, community, traditional activities and socialising (visiting friends and relatives). Thus, cocoa smallholders engage in a diverse range of livelihood and social activities that are important for maintaining the economic and social well-being of families, extended kinship groups and village communities, and these activities require cash for their fulfilment.

This case study draws on research undertaken in November 2008 in three council wards of Kareba, Tavilo and Vudal in the north-west of the Gazelle

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crop losses from several effects: clumping of beans making removal from the pod difficult or impossible; appearance of premature ripening so immature pods are harvested; and reduced weights and quality of beans (Day 1989 cited in Beevor et al. 1993, p. 134).

Peninsula, and examines how cocoa smallholders responded to this threat to their livelihoods.<sup>2</sup>

### *Impact of CPB*

CPB was first detected in ENB near Keravat in March 2006, and following a failed eradication program has since spread to most parts of the province.<sup>3</sup> The impact on cocoa yields and incomes was sudden and dramatic: of a sample of 152 family cocoa holdings there was over 90% loss of crop (with an average of less than one healthy ripe cocoa pod per tree available for harvesting). At the provincial level, cocoa production fell by over 60% to approximately 8,000 t in 2009. Preliminary data for 2010 indicate that this downward trend is continuing. CPB is the single largest threat to the economy and society of ENB, and is causing enormous hardship to families and communities by undermining people's capacity to earn a living, to meet their education and health needs and to maintain their general quality of life. It is contributing to crime, conflicts and anxiety in the family and community as villagers lose their main source of income.

For many smallholders, the initial response to the CPB incursion was one of bewilderment, and they were at a loss of what to do. As one farmer stressed:

We are like foreigners now [arriving in a new land] with CPB. We are starting again and surviving on garden foods. Our lives are finished now. We don't know what to do or what road to follow. (CPB-affected grower, Vudal, November 2008)

Village families have found it difficult to cover their living expenses and many have reverted to a cashless, subsistence-like way of life. Local village businesses that depended on patronage from the village community have struggled to remain viable, with around a 75% reduction in turnover and many of them closing. To cater to the greatly reduced incomes of villagers, most village tradestore proprietors had switched to selling goods in smaller quantities (Fig. 10.3).<sup>4</sup> With much higher levels of outstanding credit to customers, restocking became a major problem. Town businesses were not immune from the effects of CPB. Stores in the nearest town of Keravat reported a significant drop in the stocking requirements of village trade-stores in CPB areas, with more than a 50% reduction in the amount spent during

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<sup>2</sup> Interviews were conducted with 152 smallholder growers and their families. Each interview took between 30 and 45 min to complete, and questions covered such topics as the impact of CPB on harvesting, processing, cocoa block management and livelihood strategies. Interviews were also held with town business owners and operators, school teachers and principals, police and government and private sector stakeholders in the cocoa industry (see Curry et al. 2009).

<sup>3</sup> Since then, CPB has been detected in Poro, West Sepik Province (June 2006), Bogia, Madang Province (April 2008), Bougainville (2009), New Ireland (2009).

<sup>4</sup> One strategy is called "repack" whereby the store owner buys items in bulk (e.g. rice, sugar, salt) and repacks the goods into smaller quantities to meet the lower budgets of village families.

**Fig. 10.3** Tradestore proprietor showing “repacks” for rice and salt



each restocking trip and less frequent restocking trips. Wholesalers in Keravat estimated that stock purchases by village tradestores fell by 75%.

### *Cocoa Smallholders' Response to CPB*

Cocoa farmers and their families responded to the livelihood crisis brought about by the CPB incursion in a range of ways, including:

- Reducing household expenditure.
- Changes in cocoa production strategies, especially the abandonment of cocoa.
- Expanding production of garden crops for home consumption and sale at local markets.
- Establishing new livelihood activities such as the cultivation of new types of crops or the rearing of livestock such as pigs.
- Increased reliance on remittances from relatives living in non-CPB areas or working in town.
- Harvesting the cocoa of relatives in non-CPB areas.

Each of these responses is discussed below.

## **Reducing Cash Expenditure**

The most noticeable response to the drastic fall in cocoa income was a sharp reduction in expenditure. Consumption of store foods fell markedly with almost half (48%) of families saying they rarely purchased store foods; only 3% of families — those with a wage earner — reported not cutting back on store foods. All families interviewed said they were spending significantly less on travel to town, and 87% of families reported cutting back on medical services. Some farmers said that they increased their use of traditional bush medicines. On a more positive note, women reported less domestic violence and other crime associated with drunkenness because men could not afford beer, though other types of crime such as theft of garden foods and burglaries increased.

Although education is one of the highest priorities for parents, CPB has eroded the capacity of parents to educate their children. Eighty-one per cent of families with school-age children said they were struggling to pay school fees. All five schools visited in November 2008 reported higher levels of outstanding schools fees for students from CPB areas than for students from non-CPB areas. One high school reported that of the 285 Grade 9 students, 36% of them had not paid their 2008 school fees by November 2008 and a primary school reported that 60% of students enrolled in Grades 6–8 were in arrears. For most parents, education is seen as a route out of poverty and a path to advancement. The fact that so many of the school fees of children from CPB areas are in arrears indicates the financial stresses affecting these families. Undoubtedly, the economic futures of children from CPB areas will be compromised as educational opportunities are eroded.

Of considerable long-term social significance was the reduction in the amount of financial support given to the extended family to meet social and cultural obligations. Only 17% of growers were still striving to meet financial social obligations to the extended family while 61% claimed to have stopped supporting their extended families. Although these growers had ceased supporting their extended families, they still sought support from relatives in non-CPB areas (see below). The loss of cash income, therefore, not only affects the material aspects of life quality, but also the social aspects of life quality and well-being that are less amenable to measurement.

## **Changes in Cocoa Production Strategies**

Since the incursion of CPB many smallholders have either abandoned or partially abandoned their cocoa holdings, that is, they no longer harvest cocoa. The abandonment of cocoa production can be largely explained by highly labour intensive farm management techniques required to contain the pest. This new management system, which is currently being promoted among smallholders, requires weekly harvesting

of all mature cocoa pods, removal and burial of all CPB-affected pods, regular pruning and shade control, weed control and insecticide spraying.

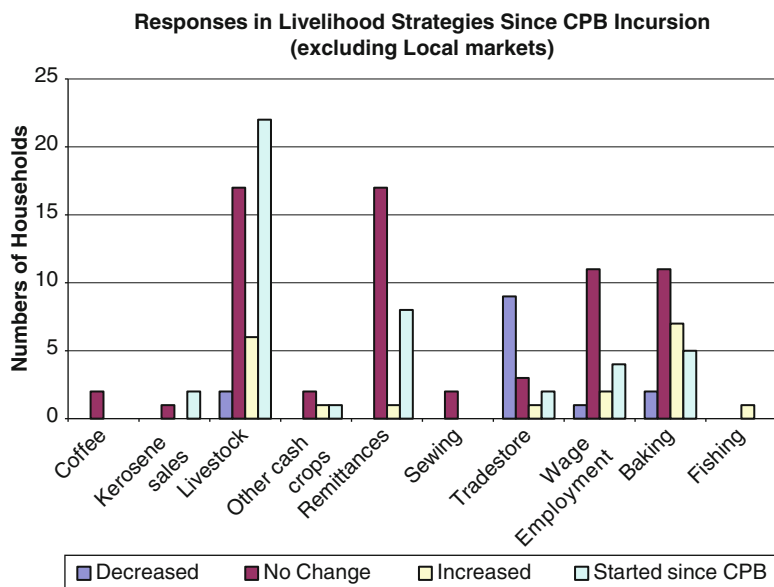
The high labour requirements of this intensive CPB management strategy is in sharp contrast to the low labour input system typically practised by smallholders. Low labour inputs into cocoa production, especially block management and maintenance, have been reported consistently since the 1980s (e.g., Nicholls 1989; Yarbrow and Noble 1989; Ghodake et al. 1995; Omuru et al. 2001; Curry et al. 2007a). In ENB, most family cocoa holdings are managed like a forest resource, or what could be labelled a “foraging” production strategy, whereby labour is largely limited to harvesting and some occasional weeding to improve access for harvesting. With the many and competing economic and social roles of village life, most smallholder families limit the time they spend on any one livelihood crop activity to avoid undermining other socio-economic aspects of their lives (see Curry et al. 2007a for further discussion). Whilst the low labour input system of cocoa production was sufficient to maintain satisfactory yields (though well below potential yields) to meet household needs and aspirations in the pre-CPB environment, it is now ineffective for controlling CPB.

For farmers who have abandoned or partially abandoned their cocoa blocks their capacity to implement more intensive cocoa production is constrained by household labour shortages, financial constraints, lack of access to training and information and a reluctance to make the lifestyle adjustments and labour investments required for more intensive management of their cocoa holdings (Curry et al. 2009). Most growers value highly the diverse range of social and economic activities in which they are engaged, and to cut back on these permanently would be seen as undermining their quality of life and the food and income security that an array of livelihood strategies offers.

A small proportion of growers have successfully made the transition to high input farming necessary for living with CPB. These farmers tend to be more business orientated, better educated, have access to other cash incomes and are more likely to embrace agricultural innovations earlier than other farmers. Some of these farmers have replaced their old cocoa with smaller, more manageable stands of high yielding hybrid clones, which gives them a higher return per unit of labour invested in their cocoa blocks (Curry et al. 2009, p. 53). Most farmers, however, have not made the transition to high input farming to control CPB, and it is likely that a significant proportion never will. Instead of intensifying cocoa production, these farmers have pursued other livelihood avenues in response to CPB.

### **Diversification and Expanding Production of Garden Crops**

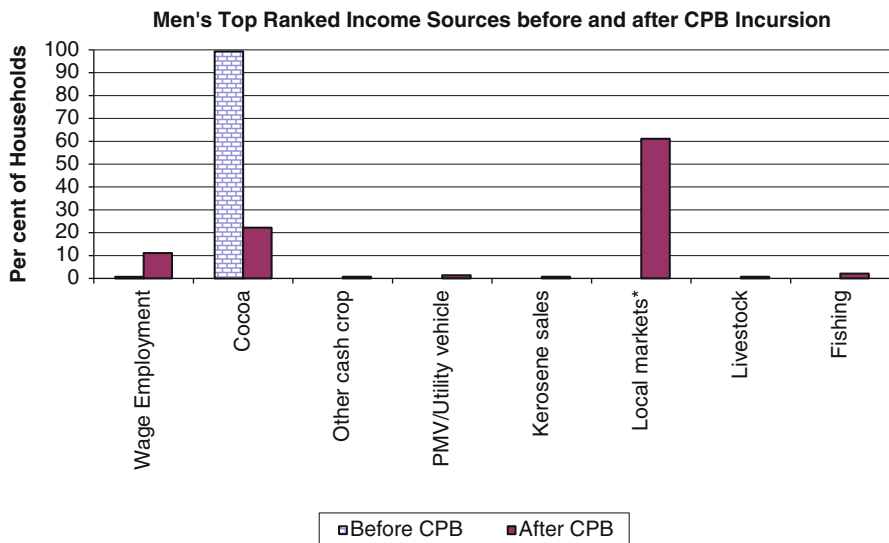
One fifth of farmers who had not switched to a more intensive cocoa management system were planning to replace all or part of their cocoa with new hybrid cocoa or with other cash crops such as coffee, balsa (*Ochroma lagopus*), galip nuts



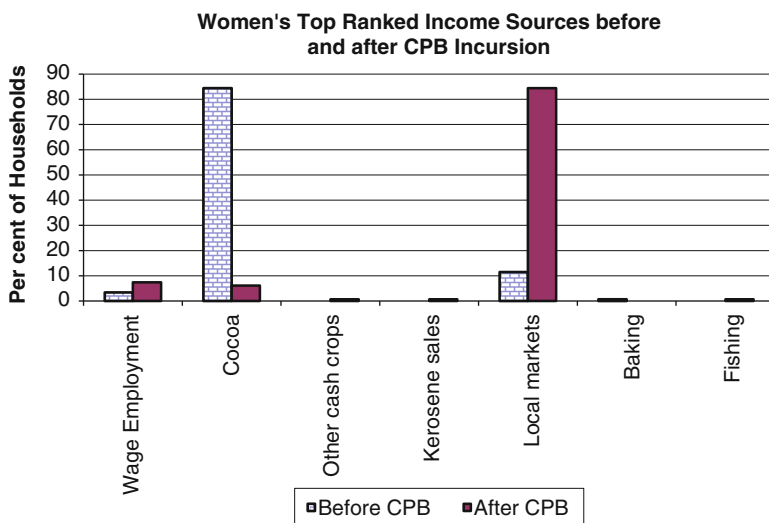
**Fig. 10.4** Changes in the relative importance of different livelihood activities following CPB incursion (excluding local markets)

(*Canarium ovatum*), coconuts, food crops and other unspecified cash crops (Curry et al. 2009, p. 53). Farmers were also expanding existing livelihood activities or developing new ones to try and recover some of the income losses from cocoa. These included intensifying garden production for sale at local markets, rearing livestock such as pigs and chickens, baking scones and bread for sale, and, to a lesser extent, seeking waged employment (Fig. 10.4). Sales of produce at local markets dominated livelihood activities and had increased greatly following the arrival of CPB. The main items sold at local markets which had increased since CPB were sweet potato (*Ipomoea batatas*), Chinese taro (*Xanthosoma sagittifolium*), pawpaw (*Carica papaya*), peanuts (*Arachis hypogaea*) and a variety of green leaf vegetables.

The rise in importance of local marketing of garden produce was revealed in the surveys. Before the arrival of CPB, cocoa was the highest ranked income source for both men and women; after CPB, both sexes reported local markets as their main income source (Figs. 10.5 and 10.6). Many growers were removing cocoa trees from sections of their cocoa blocks to make more land available for food gardening (Fig. 10.7). While income from local markets is now the top ranked income source for men and women, total household incomes are very much lower than when cocoa was the primary income source.



**Fig. 10.5** The top ranked source of income for men before and after the arrival of CPB. \*The vast majority of sellers at local markets are women. These items are produced by men but marketed on their behalf by female members of the family



**Fig. 10.6** The top ranked source of income for women before and after the arrival of CPB



**Fig. 10.7** Part of a cocoa block cleared for a food garden

### ***Increased Reliance on Remittances***

While farmers in CPB areas reduced their financial support to the extended family, in the initial phases of the infestation, these farmers drew on their social and kinship networks to maintain their incomes. Many farmers visited relatives living in CPB-free areas and were allocated cocoa harvesting rounds to assist them financially. However, this practice inevitably led to the rapid spread of the pest as new colonies of CPB became established away from the original infestation site. Other families, with kin in formal employment and living in urban centres, reported that they had become more dependent on relatives for remittances (Fig. 10.4). On the one hand, social networks provided an important safety net for CPB-affected growers, but on the other hand, these same networks facilitated the rapid spread of CPB to other areas of the province as growers inadvertently transported the pest in their clothes or baggage.

In summary, while farming families reduced cash expenditure (on store foods, travel, education and health), gave up on cocoa production and drew on social networks for resources, their most significant response was to increase food production for household consumption and local markets — a strategy they understood well



and had the land resources to implement. The income from local marketing was well below the level of their previous cocoa incomes which therefore induced a switch to a more subsistence based lifestyle.

## **Case Study 2: Oil Palm Land Settlement Schemes**

In 1968 the Hoskins oil palm land settlement scheme was founded on the nucleus estate-smallholder model that had proven successful in Malaysia (Hulme 1984). This entailed the establishment of private estate plantations and smallholder land settlement subdivisions serviced with a centrally located mill to process oil palm fruit from the company estates and smallholder settlement subdivisions. The estate company serviced smallholders by supplying oil palm seedlings, extension services and transport to cart smallholder fruit to the company mills.

The Hoskins land settlement scheme (LSS) was populated by farmers who were recruited voluntarily mainly from other provinces of PNG, especially densely populated regions (Curry and Koczberski 1999). Migrant families were allocated land holdings of about 6–6.5 ha under 99 year state agricultural leases to be planted with 4 ha of oil palm, with 2 ha at the rear of the block reserved for food gardening (Hulme 1984). Farmers were provided with oil palm seedlings, a permanent house, a rainwater tank, tools and a loan to tide them over until the oil palm came into production. As the industry expanded, customary landowners from surrounding villages were encouraged to join the industry by establishing 2 ha plots of oil palm as part of the Village Oil Palm (VOP) scheme.

Over the past 20 years, the 6 ha blocks allocated to settler families on the LSS are proving to be insufficient to support the livelihoods of the growing population. This case study explores how oil palm smallholders are adapting and responding to the various pressures associated with population growth. We examine these responses to population growth within the wider geographical context of limited opportunities for land-use change, lack of non-farm income sources and fluctuating prices for export cash crops.

### ***Population and Demographic Change***

When the LSS blocks were first settled, a 6.0–6.5 ha block was considered sufficient to meet the food and income needs of a nuclear family. However, over time the population of the LSS block has more than tripled from the early 1970s to an estimated 18.44 persons per LSS block in 2010 (Table 10.1) (Ploeg 1972; Curry et al. 2007b). Today, these blocks are typically occupied by two or more households spanning three generations as the offspring of original settlers marry and raise their own families on their parents' blocks. Now several households

**Table 10.1** Numbers of persons per LSS block and population density on Hoskins LSS from 1971 to 2010

Year	Population per LSS block	Population density per km <sup>-2</sup>
c 1971	5.9	97
1990	8.6	142
2001	13.3	219
2010	18.44	304

Adapted from Curry et al. (2007b)

rely on the available food gardening area and oil palm income earned from the block.

For second generation migrant families, long-term residential options beyond the LSS are limited. Settlers or their children are not able to move “home” either because their access rights to village resources have weakened during their long absences from the village (more than 40 years): their children were born in WNB and learned Melanesian Pidgin rather than their home languages, and many of the original settlers were recruited from land-short areas where land pressures have continued to build in their absence (Curry and Koczberski 1998, 1999; see also Carrier and Carrier 1989 on long-term urban migrants returning home). Provincial government opposition to informal urban settlements (Koczberski et al. 2001b; Connell 2003) and the lack of employment opportunities in urban centres also means that it is difficult for the adult offspring of settlers to establish themselves away from the LSS. Whilst some second generation settlers are acquiring “customary” land in WNB (see below), most depend on the resources of their parents’ 6 ha block.

The residents of multiple household LSS blocks are often under intense social and economic pressure, particularly when oil palm prices are low. Unlike oil palm farmers living on their own customary land in nearby villages where land is generally in adequate supply and can be put to a range of uses, opportunities for land use change on the LSS are limited. The agricultural leases of the LSS block are over fixed land areas (the leasehold block), and regulations specify the areas planted to oil palm (4 ha) and reserved for food production (2 ha), though as discussed below, this latter restriction has not been enforced in recent years. Compounding their situation, oil palm prices fluctuate significantly through time depending on world demand for palm oil. In response to such population and economic pressures and uncertain and fluctuating oil palm incomes, smallholders have developed several strategies to strengthen their livelihoods, including:

1. Diversifying incomes to reduce economic risk.
2. Maintaining food gardens as a safety net against fluctuating prices.
3. Expanding the area under oil palm production.
4. Seeking additional land for food gardens and oil palm.
5. Adopting new ways of managing and organising household labour in oil palm production.

The first three strategies are discussed below. The last two strategies are discussed elsewhere and so commented on briefly here. Under Strategy 4, some LSS families

**Table 10.2** Mean block population by numbers of non-oil palm income sources at Hoskins LSS

Number of non-oil palm income sources per block	Mean population per block
One non-oil palm income source	11.2
Two non-oil palm income sources	13.1
Three or more non-oil palm income sources	15.9

Source: Koczberski and Curry (2005)

have been given permission by customary landowners to establish food gardens on customary land bordering the LSS (Koczberski et al. 2009). Using Strategy 5, many densely populated blocks have established a monthly rotation of oil palm production and income amongst co-resident families, which gives each family a larger, but less frequent oil palm payment (Curry and Koczberski 2007).

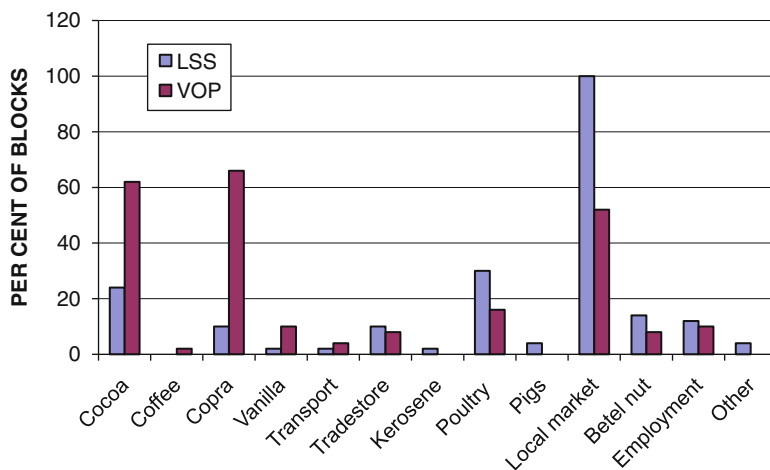
### *Income Diversification Strategies*

The economic pressure resulting from population growth on the LSS blocks is reflected in the strong association between number of livelihood activities and population (Table 10.2). The most common sources of non-oil palm income include the local marketing of garden produce, the cultivation of high value crops and trees (e.g. bananas and betel nut), small business enterprises, and, to a very limited extent, off-block employment. If LSS settlers are compared with village producers it is evident that the latter, with greater access to land and less restrictions on what they can plant, have more diverse income opportunities such as cocoa, coffee and copra which are not available to settlers (Fig. 10.8).

A limited amount of diversification of non-cash crop income is occurring. Commercial enterprises operated by smallholders vary in size and turnover, and include transport (small trucks and minibuses), small tradestores, kerosene sales and the raising and marketing of poultry and pigs (Fig. 10.8). However, like CPB-affected cocoa growers, the most important supplementary income activity is the production and local marketing of garden produce to which we now turn.

### *Maintaining Food Gardens*

Despite the importance of oil palm income, nearly all smallholder families maintain food gardens. When the LSS was initially developed it was envisaged that smallholders would reduce their reliance on food gardens as they became more integrated into the cash economy. Production of food crops contributes to livelihood security by providing both food and supplementary income because all or part of the crop



**Fig. 10.8** Non-oil palm income sources for Hoskins LSS and village oil palm growers (VOP) in 2000

**Table 10.3** Proportions of food gardens reported by smallholders to be for home consumption only, local marketing only, or both purposes in May 2010 (n=118)

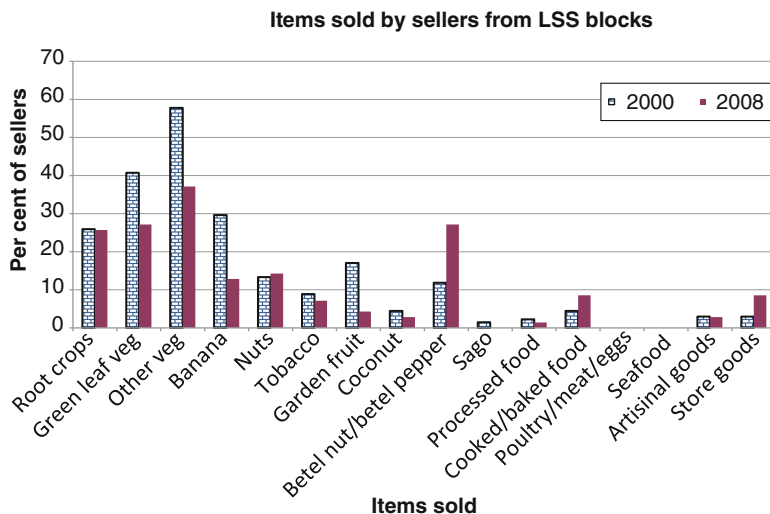
Purpose of garden	Per cent
Home consumption only	52
Local marketing only	29
Both home consumption and local markets	19

Source: Bue (unpublished data source)

can be sold at local markets. Many households, cultivating food gardens primarily for their own consumption, have established additional food gardens to generate cash incomes (Table 10.3). The latter are often planted as monocultures of high value crops such as peanuts and sweet potato. Fruits such as pineapples, pawpaw, watermelon and banana are also grown for sale at local markets (Fig. 10.9).

Food gardens continue to be an important safety net for families during low oil palm prices. Access to land for food gardens therefore reduces smallholders' vulnerability to fluctuating oil palm prices because they can increase food production during periods of low prices. In 2000 when oil palm prices were low, 100% of LSS blocks surveyed earned income from local markets and 62% of them reported another income source in addition to oil palm and income from local marketing. Oil palm farmers vary garden food production and local marketing depending on the price of oil palm. Two examples follow.

A labour allocation and dietary recall survey undertaken from September to November 2000 when oil palm prices were depressed (K50–70/tonne; K1 = US\$0.34, 18 October 2000) revealed the importance of subsistence production for food security (Koczberski et al. 2001a). Smallholders allocated more time to food production



**Fig. 10.9** The per cent of LSS sellers marketing various categories of items in October–November 2000 and in October–November 2008

than to oil palm-related work, especially women who allocated almost 2.5 times as much of their labour to food gardening than to oil palm (men allocated about equal amounts of time to each activity).

The dietary recall survey revealed that settler families on the LSS were much more dependent on household food production than neighbouring villages who had adequate access to land. Almost 80% of the ingredients of settlers’ meals were from food gardens compared with approximately 50% of meal ingredients at a nearby village. Furthermore, villagers tended to have a more varied diet than settlers and consumed more meat and fish and store bought foods (19% of all village meals contained either “fresh meat/fish” or “tinned fish”, compared with only 6% of settlers’ meals). The differences in diet quality between settlers and villagers partly reflect the latter’s greater access to land thereby allowing them to cultivate a wider range of export cash crops and thus generate higher incomes for the purchase of store foods. Settlers, by contrast, were confronted with falling per capita oil palm incomes resulting from very low oil palm prices, exacerbated by population growth which increased their dependence on food gardening.

Similarly, during the low oil palm prices of 2000, surveys were conducted at six local fresh food produce markets in and around the LSSs and the main town of Kimbe. The majority of LSS women sold food at local markets at least once a week, and 53% of women sellers at town and roadside markets were from the LSS scheme. In a repeat survey of local markets in 2008, Ryan (2009) reported that the proportion of market sellers from LSS blocks had decreased to 22% of the total number of sellers, but they remained the dominant group of sellers at the main town (Kimbe) market (approximately 47% of all sellers in 2000 and 2008). The decrease was most evident at the smaller, weekday markets rather than the large weekend food market of Kimbe,

suggesting that LSS sellers were not bothering with the weekday markets which have a smaller customer base. Ryan attributed the decline to the high oil palm prices (K200–220/tonne) prevailing at the time of his survey. Growers were putting more emphasis on oil palm to take advantage of the higher prices.

Income diversification and adjusting combinations of livelihood pursuits such as oil palm and food production demonstrate the adaptability and capacity of smallholders to modify their labour and land use strategies to respond to livelihood threats and to exploit economic opportunities as they arise. Despite the rigid institutional and commercial framework that governs the LSS, smallholders exhibit a considerable degree of agency in developing new combinations of livelihood strategies. However, as the next section reveals, for some smallholders their livelihood choices are constrained and they are sometimes compelled to adopt strategies that offer short-term gain at the expense of increased long-term vulnerability.

### ***Expanding the Area of Land Under Oil Palm Production***

To respond to the rising demand on the oil palm income by the growing number of co-resident families, an increasing number of blocks are establishing an additional 2 ha of oil palm (6 ha in total) in the 2 ha reserve food garden area. This trend has been encouraged by high oil palm prices during 2007. Over 90% of blocks at Hoskins now have 6 ha of oil palm, and Ryan (2009, p. 48) reported that 83% of LSS women selling food at local markets said their blocks were fully planted to oil palm.

However, the increased emphasis on oil palm production is not without risk, and may increase vulnerability as less land becomes available for food gardening. There is some evidence that such a situation is emerging. While garden items, especially staple root crops, green leaf vegetables and other vegetables, constitute the largest proportion of what sellers from LSS blocks sold in both 2000 and 2008, there was a significant decrease to 2008 in the proportion of LSS women selling green leaf vegetables, other vegetables, banana and garden fruit (Fig. 10.9). In contrast, there was a significant increase in the proportion of LSS women selling the non-garden items of betel nut/betel pepper, cooked/baked food and store goods, items that do not require much land for their production (Ryan 2009). For instance, betel nut palms (*Areca catechu*) are planted in dense stands around houses and therefore do not remove land from oil palm production (Fig. 10.10). Until recently, these palms were grown by settlers for home consumption. Betel nut is now viewed as another cash crop by LSS growers.

More importantly, the trend to planting 6 ha of oil palm is significantly reducing per capita land area available for food production and decreasing settlers' long-term food security. A 1975 study of the gardening practices of 140 LSS blocks reported that 0.42 ha of cultivated garden area per block was required to meet the needs of the resident population (Benjamin 1977). Gardens were cultivated for 12–18 months, with a fallow period of 6–9 years. Based on the mean garden area of 0.058 ha cropped per head in 1975, the cultivated food garden area per block required in 2010

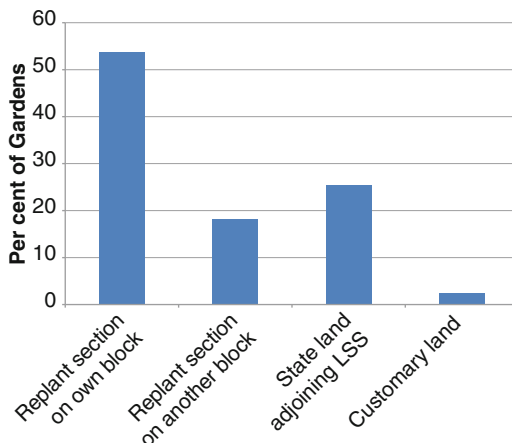


**Fig. 10.10** Dense stand of betel nut palms established near house site

to meet the needs of 18.44 resident family members is 1.069 ha. However, in 2010, with 6 ha of oil palm the norm, the effective area of gardening land available per block across the LSS has fallen to 0.61 ha per block.<sup>5</sup> This leaves a shortfall of gardening land of 0.459 ha per block (1.069 less 0.61 = 0.459).

<sup>5</sup> Smallholders practice rotational replanting of 2 ha sections of their oil palm every 22 years. Each 6 ha block has three 2 ha phases which are replanted when each stand reaches 22 years of age. For up to 2 years after replanting, sufficient light reaches the ground for intercropping of immature oil palm with food crops. This means that a typical family oil palm holding with three, 2 ha stands of oil palm has 2 ha of land available for food gardening for 6 years of 22 years. An average size block of 6.07 ha therefore has 0.61 ha of land available for food gardening per year (6 years/22 years = 0.2727 × 2 ha = 0.54 ha + 0.07 = 0.61 ha).

**Fig. 10.11** Garden Locations on LSS blocks (Source: Dewhurst 2007)



With staged rotational planting of each 2 ha stand of oil palm, 2 ha are available for food gardening for 6 of every 22 year cultivation round which is more than sufficient to meet the needs of smallholder families in the 2-year period after the poisoning and replanting of a stand of senile palms. For 16 of 22 years there is insufficient land on the block to meet the food gardening requirements of block residents and they therefore must rely on off-block access to land. Figure 10.11 shows that in 2006, 54% of 314 gardens belonging to 39 LSS blocks were located on 2 ha replant sections of smallholders' own blocks (Dewhurst 2007). This suggests a major replanting program was in progress (on a regular replanting schedule only 27% of blocks at any one time would have land available on their own blocks for food gardening). Land availability could be anticipated to contract sharply once the shade cover closes on new oil palm plantings and the replanting program slows.

Figure 10.11 also demonstrates the importance of social networks for accessing land. When land is unavailable on a smallholder's block for food gardening, gardens can be established in the replant sections belonging to other growers (18% of gardens as indicated by Dewhurst (2007), and 21% of gardens according to Bue's unpublished Ph.D. data collected in 2010). This is now a relatively common practice and highlights the importance of social networks for accessing resources.

It is likely that presently there is little if any fallowing of land after cultivation of food crops. During Benjamin's study in 1975, most gardens had a fallow of 6–9 years. With most blocks almost fully planted to oil palm, gardens in replant sections, have a life of 2 years after which they are succeeded by oil palm. Any remaining land on settlers' blocks not planted to oil palm would likely be under permanent cultivation or very short fallows. Indeed, during the 2000–2001 surveys, no growers reported the use of fertiliser on their food gardens but by 2010, instances were noted during surveys. Also, anecdotal evidence from settlers suggests that they are now planting less yams and sweet potato and relying more on bananas, taro and cassava, crops that can tolerate less fertile soils. Further evidence of land pressure is



the fact that settlers are now cultivating food gardens on state or private leasehold land surrounding the LSSs (Fig. 10.11). Twenty-five per cent of gardens were on state land bordering the LSS, some of which is environmentally sensitive buffer zones along creek lines. Also, some settlers (3% of gardens) are making arrangements with neighbouring customary landowners to cultivate food gardens on customary land. These tend to be informal arrangements but the cultivators may occasionally give gifts of food to the landowners or small amounts of cash as goodwill gestures. Usually the agreement is for the cultivation of food for household consumption only. Gardens for the sole or main purpose of growing crops for sale at local markets are generally not allowed.

Overall, almost half (46%) of all gardens were located away from the family oil palm block. Distant gardens means more travelling to and from food gardens, and for gardens cultivated on state or customary land, tenure security is lacking and theft of food crops is common. In a sense, the gardening strategies that are emerging on the densely settled LSS may be increasing the long-term vulnerability of the settler population as they become more dependent on off-block access to land for food gardening.

In summary, oil palm growers, like the cocoa growers in Case 1, have been able to increase food production for home consumption and sale at local markets during low oil palm prices. However, continuing population growth, limited off-block livelihood and resettlement options together with recent rises in oil palm prices have induced many settlers to expand their oil palm holdings to 6 ha thereby leaving less land available for food gardening. When the canopy closes on recent plantings of oil palm there will not be enough land available on-block to meet the food gardening needs of the resident population, and, if unable to access land off-block, many will have to intensify oil palm production to survive, a strategy requiring even greater engagement with the cash economy.

## **Discussion and Conclusions: Sustaining Livelihoods Among Smallholders**

Since the 1950s, the promotion and uptake of export cash crops like cocoa and oil palm have been viewed as the principal way to initiate rural development in PNG. Many rural people enthusiastically adopted export crops which they saw as the pathway to economic development. The strengthening engagement with the cash economy did not simply involve the introduction of new crops and farming practices, but also required changes in the lifestyles and values of the people themselves. New ways of managing and regulating access to resources such as land and tree crops have led to more exclusive forms of resource tenure such as the de facto excision from communal tenure of land planted to perennial cash crops. In addition, greater engagement with export cash crop production has introduced new livelihood threats and uncertainties as the two case studies have demonstrated. In response to such challenges, access to finance, social networks, land and local economic opportunities

have proven important in shaping the choices people make. Through all these changes, food gardening for household consumption and sale at local markets has remained a fundamental component of the diverse set of livelihood strategies pursued by the vast majority of PNG smallholders. It appears that until the urban and industrial sectors of the economy develop further in PNG, the long-term viability of the smallholder sector depends to a large extent on the food and income security provided by access to land for food gardening.

The intensification and expansion of food gardening for household subsistence and local markets by cocoa farmers following CPB incursion and by oil palm families during low oil palm prices in 2000, partly reflects the fact that smallholder families are familiar with food gardening and continue to have access to land for this purpose. For farmers, the most cautious and rapid way to respond to an income squeeze on export cash crops in such an unpredictable environment was to turn to food gardening which offered some security and certainty. Such a choice has created a degree of income stability, but is indicative of how few alternative income opportunities are available to PNG rural households, especially off-farm and non-agricultural opportunities. This is in contrast to the situation in some parts of Southeast Asia where rapid industrialisation has created attractive off-farm employment opportunities, especially for young people to the extent that labour shortages are emerging in the agricultural sector (Fold 2000; Kelly 2000; Rigg 2005). For the foreseeable future, most rural Papua New Guineas will continue to depend on various livelihood combinations based on agriculture and land-based resources.

However, the heavy reliance on local marketing as the dominant response to the challenging and unpredictable environment in which smallholders live may not provide them with long-term economic security. In the case of cocoa, the market for local garden produce is limited and is likely to become over-supplied as more cocoa farmers expand local marketing as CPB spreads. Income from local markets is already insufficient to sustain cocoa farmers' pre-CPB levels of engagement in the cash economy and as a result they have become more dependent on subsistence food production and other bush resources for their survival. Without a major intervention to tackle CPB or to promote alternative export crops, smallholders may have little choice but to move more firmly into a subsistence-like economy until viable new income opportunities emerge or CPB is controlled. Fortunately, the communal system of land tenure remains largely intact in ENB, so the majority of farming families still have this option.

For oil palm settlers with 6 ha of oil palm, the land situation is much more constrained. Growers responded to population pressure on income by opting for stronger engagement with the cash economy by planting an additional 2 ha of oil palm thereby reducing the area of land on the block available for food gardening. As the current oil palm replanting program is completed, the land available for food gardening will contract sharply forcing a greater dependence on oil palm income for their livelihoods. Growers have traded short-term income gain through expanding of oil palm production at the possible long-term cost of reduced food and income security. With almost all of their blocks under oil palm, another period of low oil palm prices, could have a significant impact on the food security situation of many

smallholder families. They may have little choice but to intensify production of oil palm through greater inputs of labour and other farm inputs.

There is limited acknowledgment in the cocoa and oil palm industries of the diversity of livelihood activities of smallholders. Indeed, extension strategies remain focused on the single cash crop like cocoa or oil palm with other livelihood activities typically viewed as distractions drawing smallholders' time and energy away from the main business of export cash crop production. Alternative livelihood strategies like food gardening provide a buffer against low prices or the failure of export cash crops, and add to food and income security during high price periods. Income from most export cash crops tends to be lumpy and earned during short seasonal flush periods, so the maintenance of other livelihoods can provide critical income during non-flush periods. Also, supplementary income such as local marketing tends to be women's income and is therefore more likely to be spent on family needs. So, there are strong arguments for maintaining a diversity of income sources (for examples from Africa see Francis (2002) and Whitehead (2002)). It is probable that as population and land pressures continue to rise on the LSS, and as new environmental threats emerge like CPB, perhaps induced by climate change, an increasing proportion of smallholders in the longer-term will be driven to intensify alternative livelihoods, both on and off-farm. Relevant provincial authorities can play an important role in facilitating this process.

The process of income diversification could begin by strengthening the informal economy and reinforcing livelihood diversification in extension messages as well as by promoting new forms of non-farm employment. Such strategies might include the upgrading of facilities at roadside markets, training in book keeping for small business, and, where appropriate, the intercropping of export cash crops with food crops and quick growing high value cash crops.

Finally, the transition to a modern market economy through export cash cropping is not an easy one, and requires an adjustment of people's values and social practices. What the two case studies reveal, however, is the resilience and adaptability of rural Papua New Guineans in responding to rapidly changing demographic, economic and environmental circumstances. The general picture that emerges is one of smallholders actively seeking solutions and finding new ways to maintain their livelihoods and well-being. The challenge for extension services and provincial development authorities is to develop innovative policies that facilitate and strengthen this process of diversification through, for example, appropriate extension, credit for farm inputs and improving market access.

**Acknowledgments** Numerous people assisted with fieldwork. In cocoa, research assistance was provided by Nick Mangu and Julai Walaun (both from NGIP-Agmark), Esley Peters, John Thomas, Jack Pundu, Andrew Roboam, Sharon Roberts and Simon Mele (all from CCIL), Joel Mormor and Kapinus Tande (both are cocoa farmers), Scott Kimpton (Curtin University), Mary Bongare and Joeashton Dauwa (both students from Vudal University).

In oil palm, research assistance was provided by Merolyn Koia and Pauline Hoare (both from PNGOPRA) and extension officers from the Oil Palm Extension Corporation.

The research would not have been possible without the many cocoa and oil palm growers and their families who gave their time to be interviewed.

Fieldwork was funded by the Australian Centre for International Agricultural Research.

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# Chapter 11

## Adapting Urban Environments to Climate Change: A Case Study of Melbourne Australia

Nigel Tapper

### Introduction

It is opportune for the discipline of geography in Australia that the critical matters of urbanisation, climate change and sustainability are central to the new national school curriculum, as indeed they are to many university geography curricula, including at Monash University. As an example, the new Monash University Foundation Year curriculum in geography has urbanisation and climate change as two of the major teaching themes, with the principles of sustainability embedded and woven throughout the curriculum.

Why is this opportune? Because currently there is a critical nexus occurring between observed global climate change and the process of global urbanisation that presents a clear issue for future health and sustainability of urban populations. At precisely the moment in time that the greater proportion of the global population is living in cities, those same cities are being impacted by climate change, producing significant problems, such as an unhealthful thermal environment for people and water scarcity.

Arguably Australian cities are being impacted more than most, as will be elaborated for the case of Melbourne below. This issue was brought into sharp focus during a four-day heat wave in Melbourne in January 2009 that resulted in 374 excess deaths, mainly in the older, more vulnerable population (Victorian Department of Human Services 2010). The critical nexus of urbanisation and climate change and the need to urgently develop appropriate urban adaptation responses has been recently recognised by United Nations Habitat (2011) in its Global Report on

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Human Settlements 2011 and by the Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup> as it prepares for its 5th Assessment Report (AR5). Indeed since the 4th Assessment Report (AR4), and with the clear knowledge that some climate change is now inevitable no matter what happens with future emissions, the focus of the IPCC has now clearly shifted to include adaptation as well as mitigation responses.

Considering the drivers of this unfortunate nexus in more detail; by the year 2009 for the first time in history, there were more people living in urban areas (3.42 billion) than rural areas (3.41 billion) globally, with the global urban population expected to increase by a further 84% by 2050 as more people take up residence in the heart of the industrial and commercial world (United Nations Department of Economic and Social Affairs 2010). Australia has always been among the most urbanised populations on earth, and populations of Australian capital cities, including Melbourne, continue to grow far more rapidly than rural Australia. According to the Australian Bureau of Statistics (2011), in the 2009–2010 year Melbourne's population grew by 2.0% (79,000 people – the largest growth for any Australian capital city) to reach a total of 4.08 million people, 73.5% of the State's population. The city is projected to grow by at least 25% in the next 10 years and to reach 6.4 million inhabitants by 2056 (Victorian Department of Sustainability and Environment 2011).

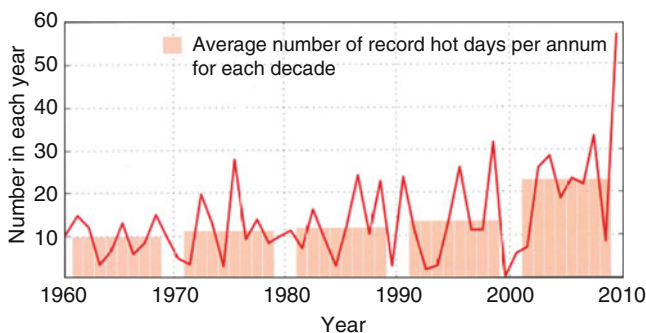
As the Australian population has urbanised over the last century, Australian average surface temperatures also have risen by about 1°C from 1910 to 2009, with the last decade being the warmest on record (CSIRO 2011). By comparison, average global temperatures have warmed during the same period by a more modest 0.7°C. Future warming projections vary for different parts of Australia. Within 800 km of the coast, an average warming of 0.1–1.3°C is likely by 2020, relative to 1990, 0.3–3.4°C by 2050, and 0.4–6.7°C by 2080 (Suppiah et al. 2007). In southern Australia, this translates to 1–32 more days/year over 35°C by 2020 and 3–84 more by 2050, with 1–16 fewer days/year below 0°C by 2020 and 2–32 fewer by 2050 (Suppiah et al. 2007).

For Melbourne the present day average temperature of 15.7°C is expected to increase to 18.5°C by 2070 under a high greenhouse gas emissions scenario (CSIRO 2011). The critical point to note here is that *urban warmth* (the so-called urban heat island or UHI) *is of similar magnitude to predicted greenhouse gas-induced climate change during the twenty-first century* and most worrying for the well-being of the majority of humans living in cities, *that urban warmth is superimposed on the climate warming that is already underway* (Coutts et al. 2010; Sturman and Tapper 2006). The characteristics of the UHI and Melbourne's UHI in particular are discussed in more detail in the next section.

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<sup>1</sup> Expert Meeting of WGII and WGIII on Human Settlement, Water, Energy and Transport Infrastructure – Mitigation and Adaptation Strategies, Calcutta, India, 22–24 March 2011. <http://www.ipcc-wg3.de/meetings/expert-meetings-and-workshops/em-infrastructure>. Accessed 24 June 2011.





**Fig. 11.1** The number of record hot days for each year from 1960 to 2010 across Australia and the average number of record hot days per year for each decade (From CSIRO 2011)

Of even more concern is the increasing evidence that climate extremes may be shifting more than climate averages (Alexander and Arblaster 2008) and that some of these shifts in extremes will have particularly large impacts in urban environments. For example, the work of Alexander and Arblaster suggests that for Australia there will be dramatic increases in warm nights and heat wave durations, but also increases in the number of consecutive dry days and heavy precipitation days (i.e., more drought, but also more heavy rain events) across much of Australia. These shifts alone have significant implications for both human health and for urban infrastructure. The historic trend in the average number of record hot days per annum for each of the last six decades is shown in Fig. 11.1, underscoring a shift in extremes that is expected to continue under climate change.

In some parts of the world there are at least two other uncomfortable realities relating to climate change that are impacting urban dwellers. In many parts of the developed world the urban population is aging rapidly, and that same older population is much more vulnerable to heat than a younger population (Loughnan et al. 2010a; Nicholls et al. 2007). Additionally, many cities around the world are experiencing increased water scarcity, partly as a result of climate change (shifts in precipitation patterns and higher temperatures reducing effective precipitation) and partly because of increased demand for water from rapidly growing urban populations.

## The Urban Heat Island

Fortunately for urban dwellers, the climate processes associated with urban warming are well understood scientifically (e.g., Coutts et al. 2007, 2008) and can be mitigated, potentially delivering some critical “head room” for urban dwellers against the future climate warming that is now unavoidable. Alterations to the natural environment due to the physical structure of the city and its artificial energy and

**Table 11.1** Causes of urban warmth

The urban modification	The nature of the process involved
Thermal characteristics and color of urban materials	Overall results in more energy storage in the urban environment
The complex nature of urban geometry	Results in trapping of more radiative energy within the urban environment
Presence of heat sources (cars, industry, space heating)	Waste heat contributes to energy available for sensibly heating the atmosphere
Surface waterproofing and removal of urban storm water	Results in much less evapotranspiration and much more sensible heat input to the atmosphere
Alterations in urban air quality	Increases terrestrial radiation to the surface, but may be offset by reduced solar radiation

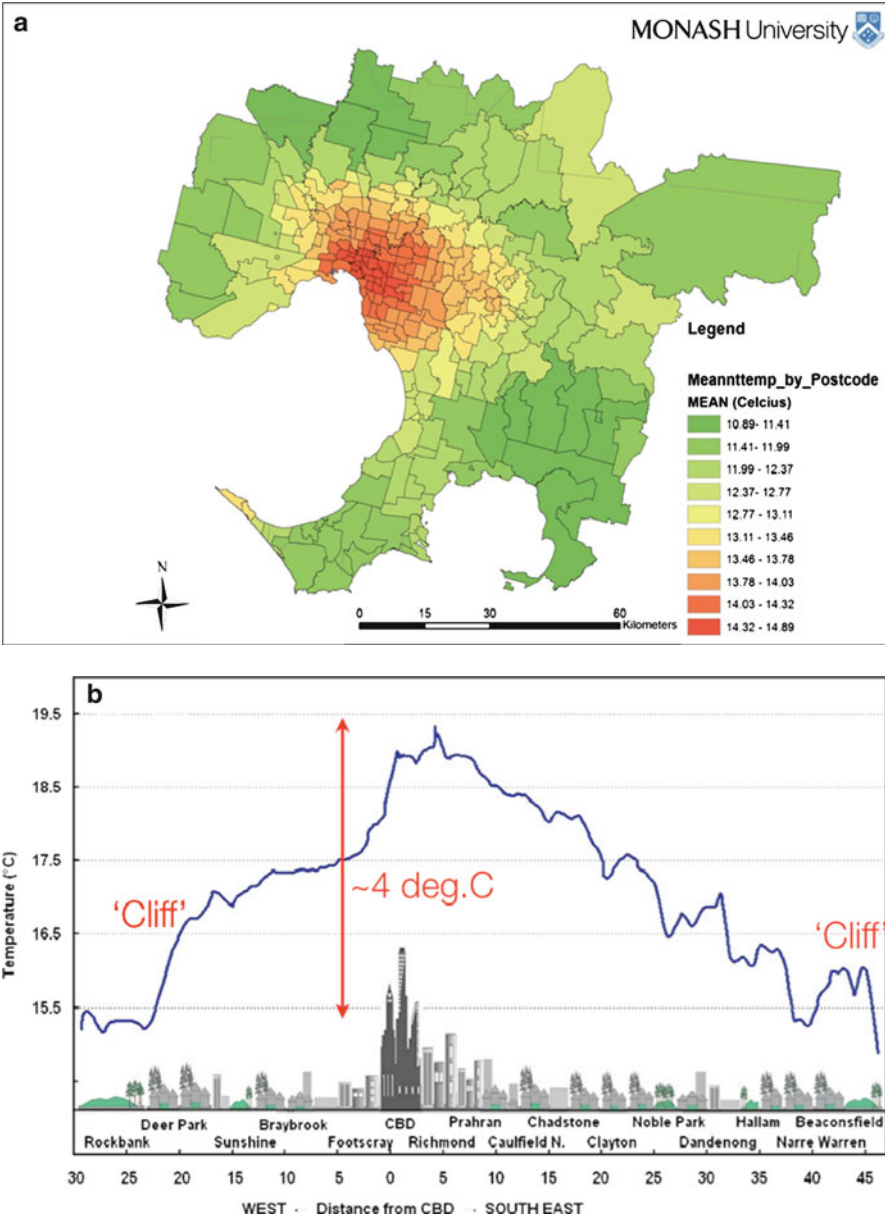
Adapted from Sturman and Tapper 2006

pollution emissions, interact to form distinct urban climates. UHI's are produced primarily from the high thermal capacity and heat storage of urban regions, the added sources of energy/heat from radiation effects and anthropogenic activities and reduced evapotranspiration. The processes responsible for the generation of the UHI can be expressed in terms of simple energy exchanges where the

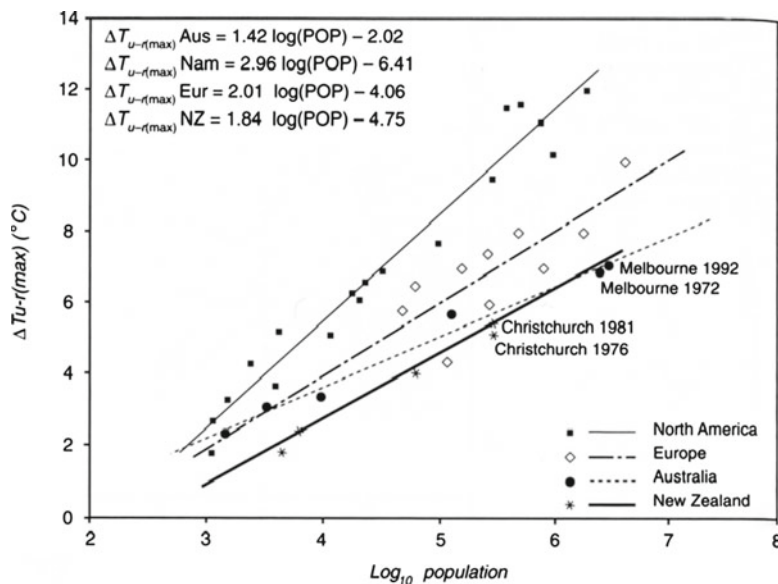
Available Natural Radiative Energy (from the sun and terrestrial sources)  
 + Artificial Heat Produced within the City (from industry, cars and home heating)  
 = (i.e., is balanced by) Energy Used to Heat the Air  
 + Energy Used to Heat Urban Materials and Soils  
 + Energy Used to Evaporate Moisture

Put even more simply, an urban area tends to maximise energy inputs from the sun/environment and energy from artificial sources, and minimise energy used in evaporating moisture (there are lots of waterproof surfaces in cities). As a result of these energy shifts there tends to be much more energy available for direct heating of the urban atmosphere and for daytime storage in urban materials, producing a much warmer urban environment, especially at night. Recent observational work using a network of micrometeorological towers across different urban landscapes in Melbourne, Australia, confirms these shifts, showing that storage in building materials increases by ~250%, evaporation reduces by ~50%, and heating of the atmosphere increases by ~30% simultaneously as one moves from a fully rural to a fully urban environment (Coutts et al. 2007). A list of the key factors responsible for the development of urban warmth is summarised in Table 11.1 and typical characteristics of the Melbourne nocturnal UHI are shown in Fig. 11.2. The UHI of ~4.0°C shown is typical for Melbourne and is an excess of warmth that is carried over a considerable part of the city.

In developing and developed nations around the globe continued urban population growth and resulting urban sprawl is of major concern. This concern stems from the development of unhealthy environments (associated with urban heat and



**Fig. 11.2** (a) The Melbourne summer nocturnal UHI (2000–2006) obtained from MODIS satellite imagery (From Loughnan et al. 2009). (b) Cross section of the Melbourne UHI for 0100 h, 23 March 2006 (From Coutts et al. 2010)



**Fig. 11.3** The relation between maximum observed UHI and population for selected settlements around the world (From Sturman and Tapper 2006)

air pollution), the consumption of productive land, the difficulty of provision of services in a dispersed urban landscape, and the need for transport/energy/carbon efficiency, to name but few of many issues. As a result urban consolidation (i.e., increased urban density) has become an important goal for urban planning worldwide, probably no more so than in Australia where urban densities have been characteristically very low. In 2002 the Victorian State Government released a long-term planning strategy for Melbourne known as the *Melbourne 2030 Plan*, now under review since a change of State Government in late 2010. The original plan aimed to create a more compact and sustainable city by setting an urban growth boundary, clustering development and increasing the density of existing residential infrastructure for a range of benefits, including reduced per capita greenhouse gas emissions and preservation of productive rural land.

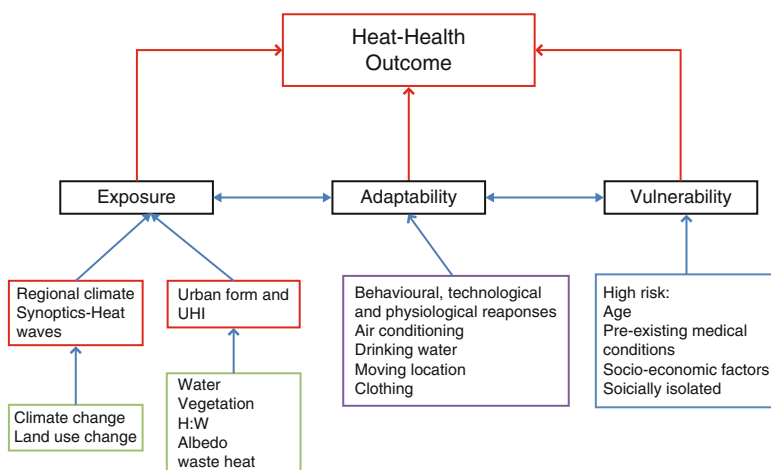
However work undertaken by Coutts et al. (2008) showed conclusively that such consolidation within a fixed urban boundary would exacerbate the magnitude and extent of the UHI through promoting the climate processes that lead to the development of urban warmth. This finding is supported by Fig. 11.3 that shows the relationship between settlement size, the maximum UHI observed, and the city type (North American, Australasian, or European). North American cities tend to have denser cores of high-rise buildings that lead to stronger UHIs, while European cities are characteristically much less dense, leading to weaker UHIs, for a given population.

Urban consolidation is inevitable and is required for sound sustainability principles. Therefore clearly it will be imperative under climate change to offset the excess warmth of urban areas as much as possible, including that produced by consolidation, by actively promoting building, urban design and planning approaches that can cool the urban landscape. If this does not happen the negative impacts of urban heat on human health and the built infrastructure are likely to worsen.

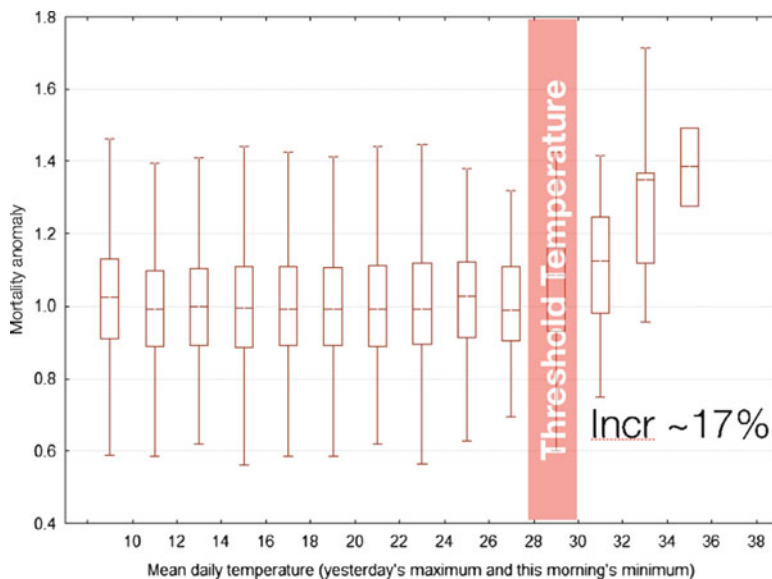
## Heat and Health Considerations

Catastrophic events such as the European heat wave that lasted over several weeks during the summer of 2003 resulting in tens of thousands of excess urban deaths, and the January 2009 heat wave in Melbourne that was discussed earlier have stimulated considerable research into the complex relationships between heat, human health and place. Figure 11.4 is a conceptual framework of the influence of urban heat on human health outcomes, illustrating the complex relationships among exposure, adaptability and vulnerability that result in increased risk. Clearly exposure that is a combination of regional climate synoptic conditions, climate change and urban form is an important component of negative heat-health outcomes.

For Melbourne, an Australian city with dry summer heat, Nicholls et al. (2007) were able to show a clear threshold for temperature alone, above which mortality in the elderly population (over 65 years old) jumped markedly (Fig. 11.5). For Melbourne that threshold was ~30°C for average daily temperature (e.g., 40°C by day and 20°C at night), or 24°C for daily minimum temperatures alone. These thresholds were



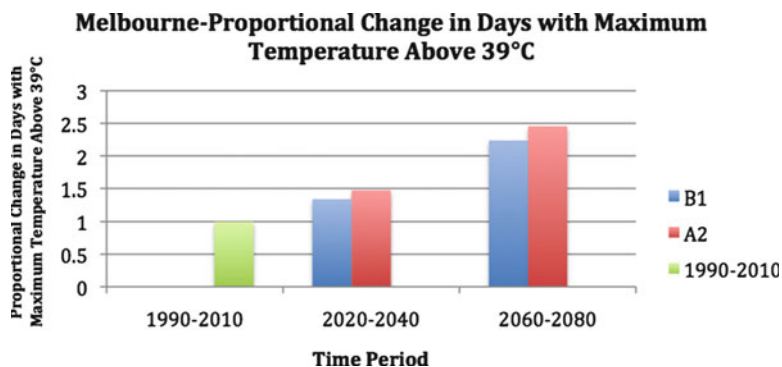
**Fig. 11.4** A conceptual framework of the influences of urban heat on human health outcomes. The outcomes are a function of three main factors: exposure, adaptability and vulnerability (From Wong et al. 2011)



**Fig. 11.5** Relationship between the mean daily temperature and the mortality anomaly in the population 65 years and older in Melbourne (Adapted from Nicholls et al. 2007)

subsequently used in conjunction with Australian Bureau of Meteorology forecasts to develop a Heat Watch Warning system for Melbourne for several days ahead that was first implemented in the summer of 2008–2009. Loughnan et al. (2011a) recently recalculated the thresholds for the entire population using an updated data set, setting the thresholds for increased mortality in Melbourne at 39°C for maximum daily temperature, 27°C for minimum daily temperature, 30°C for average daily temperature and 38°C for apparent temperature (calculated from the maximum temperature and the average dew point temperature for the day). Calculation of apparent temperature reflects the fact that for some cities with a more humid climate, heat-health relationships considering temperature alone may not be as useful as those that include the moisture status of the atmosphere. With daily mortality increasing/decreasing by up to 45% with temperature shifts of just a few degrees (Loughnan et al. 2011a; Nicholls et al. 2007), the potential to save lives with a relatively small mitigation of temperature is obvious.

Loughnan et al. (2010a, b) showed that the temperature threshold approach was also appropriate to the morbidity associated with acute myocardial infarctions (heart attacks) and that human susceptibility to heat was highly place-specific, related to a number of variables including age, socio-economic status, ethnicity, and type of housing (Loughnan et al. 2011b). Interestingly and also highly relevant to this chapter, that work shows that the populations most vulnerable to heat in Melbourne tend to live in the areas with the greatest urban heat island, this perhaps helping to guide where urban heat mitigation should be addressed first.



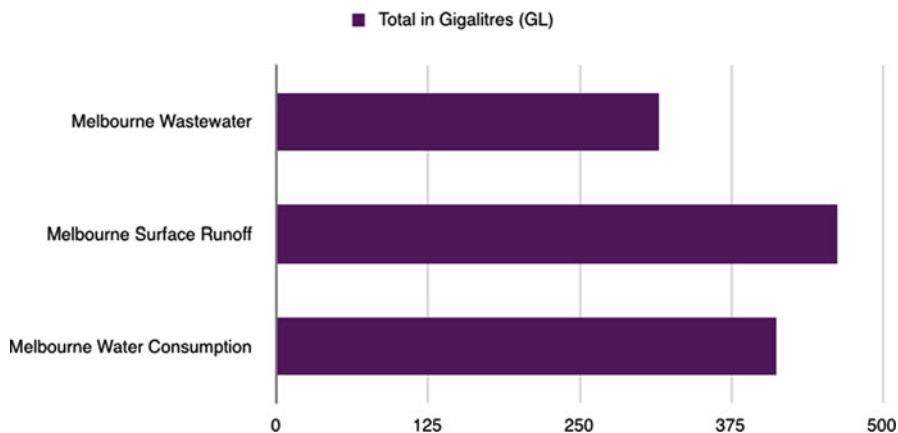
**Fig. 11.6** Projected proportional changes in days in Melbourne (against a baseline of 1 for the 1990–2010 period) with a maximum daily temperature above the 39°C heat-mortality threshold. Changes are for the 2020–2040 and 2060–2080 periods and for the *B1* and *A2* (high) emissions scenarios (From Lynch 2011)

Also disturbing and highly relevant to the present discussion is that Fig. 11.6, showing climate change projections for Melbourne, indicates that the number of days with maximum temperatures likely to lead to significant mortality (i.e., above the 39°C threshold maximum temperature discussed above) is likely to at least double by the latter part of this century (Lynch 2011). The impact of climate change on human health will in large part depend on the amount of adaptation and acclimatisation that occurs in the meantime. Acclimatisation is known to occur within populations in areas that are consistently hot (Keating et al. 2000), but highly fluctuating weather conditions that we know will accompany climate change (Alexander and Arblaster 2008) can put populations at particular risk (Gosling et al. 2009; Anderson and Bell 2011) and can make it more difficult to acclimatise.

## Mitigation of Urban Heat in Melbourne in the Context of Climate Change

The message from the preceding sections and from other relevant work around the globe is that a holistic approach needs to be taken to matters involving urban design. Those involved in urban development and design must incorporate a range of approaches known to reduce urban temperatures (green infrastructure, irrigation, smart building materials, etc.) at the same time as the urban consolidation process is occurring.

Various strategies are available to mitigate urban heat and these are relatively widely reported in the literature. Such approaches include radiation control (e.g., altered albedo or reflectivity of building materials), use of building materials of low thermal mass, the use of cool pavement materials, the promotion of ventilation through innovative building/urban design, and the innovative use of storm water and green



**Fig. 11.7** Broad Melbourne region water flows for 2010. Of 315 GL of wastewater and 463 GL of urban surface runoff, only 21 and 10 GL respectively are recycled/harvested to contribute to a total consumption of 412 GL (Adapted from Victorian Department of Sustainability and Environment 2011)

infrastructure to promote urban cooling. For cities with a relatively dry summer climate such as Melbourne, the latter is one of the most effective urban cooling mechanisms.

In Melbourne, adaptation to climate change and in particular UHI mitigation has been strongly linked to the concept of a Water Sensitive City (Wong and Brown 2009) that is the outcome of application of water sensitive urban design (WSUD) principles. The Australian governmental agreement of the National Water Initiative (Council of Australian Governments 2004) defines WSUD as the “integration of urban planning with the management, protection and conservation of the urban water cycle that ensures urban water management is sensitive to natural hydrological and ecological processes”. The key technologies of WSUD can include elements such as vegetated swales and strips, porous pavements, green roofs and walls, street trees/pits, constructed wetlands and vegetated bio-filters (Wong et al. 2011, p. 13)

There are three key principles for a Water Sensitive City (Wong and Brown 2009; Wong et al. 2011, p. 7):

- Cities as Water Supply Catchments: meaning access to water through a diversity of sources at a diversity of supply scales
- Cities Providing Ecosystem Services: meaning the built environment functions to supplement and support the function of the natural environment
- Cities Comprising Water Sensitive Communities: meaning socio-political capital for sustainability exists and citizen’s decision-making and behaviour are water sensitive

Briefly reflecting on these three principles. First, the Cities as Water Supply Catchment principle; Melbourne, along with all of Australia’s major cities has a traditional water supply reliant on piping large amounts of water from rural catchments/dam systems (Fig. 11.7). It can be seen that Melbourne’s total water



consumption is of a similar magnitude to the landscape runoff from the city and the wastewater generated within the city, both water resources that have been almost completely ignored until now. A sustainable city, resilient to climate change will have a diversity of water sources, harvesting high quality potable (drinking quality) water, as well as reusing wastewater and harvesting storm water wherever possible. A major new water source in the form of a desalination plant will become available to Victoria from 2012. Initiated by the Victorian State Government in 2008, the desalination plant project was a response to a long-term drought that threatened Melbourne's water security. Although it could be argued that the desalination plant may have been unnecessary had other water sources (e.g., waste water and storm water) been accessed in a timely fashion, in reality the government had little choice and the plant, once commissioned, adds to the diversity of water sources, albeit at considerable cost.

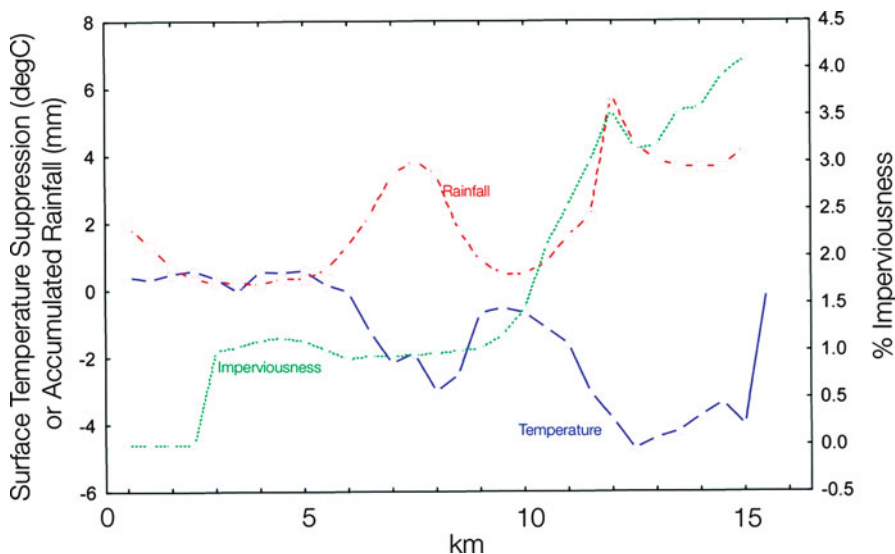
Second, the Cities Providing Ecosystem Services principle; in addition to providing water security, a Water Sensitive City returns the urban landscape to a more natural environment, providing a range of ecosystem services for its inhabitants. For example harvesting of storm water and retention of that water in the landscape provides significant opportunities for greening and cooling the landscape, with obvious benefits for aquatic ecosystems, urban biodiversity, carbon sequestration, and most importantly in the context of this chapter, providing a cooler and more comfortable environment for people. Third, the Cities Comprising Water Sensitive Communities principle; recognises that transitioning to a Water Sensitive City requires the active engagement of all levels of society/community, from government (national, state and local), industry, community and individual to shift structures (including governance) cultures and practices (Wong et al. 2011, p. 36).

A comprehensive research program has been initiated in the Centre for Water Sensitive Cities<sup>2</sup> to evaluate the potential of green infrastructure watered by urban storm water, to overcome water shortages, reduce the UHI and improve the healthfulness, livability and landscape of Australian cities. The program recognises that storm water falling across the urban landscape is a wasted resource, running off the impervious urban surfaces to be disposed of as efficiently as possible. Effective harvesting of that water has the potential to be both highly effective in reducing water scarcity, but also in providing evaporative cooling of the urban environment, especially through green infrastructure.

However the potential for cooling through evapotranspiration from urban surfaces is highly dependent on replacing impervious with pervious urban surfaces wherever possible. Figure 11.8, derived from satellite and rainfall observations across 3 days (two identical autumn days interspersed by a day of thunderstorms), shows the strength of the relationship between the availability of moisture (actual rain amount that fell in a particular location) and surface cooling across a relatively pervious landscape close to Melbourne. The indicative cooling across several thousand observations suggests ~0.6°C cooling per 1 mm of water applied to a pervious surface,

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<sup>2</sup>Centre for Water Sensitive Cities (<http://www.watersensitivecities.org.au/>).



**Fig. 11.8** The inverse relationship between accumulated rainfall and remotely sensed surface temperature along a relatively pervious (0–4% impervious) 17 km transect of the western plains of Melbourne. Measurements were made on identical warm (25–30°C) sunny days on 21 and 23 April 2010 with the rainfall occurring on 22 April 2010 (Source: Tapper et al. 2011)

with a lower rate of cooling for more impervious surfaces. The maximum cooling at the surface provided by the rain watering in this example was ~5°C. Clearly the cooling provided by freely evaporating surfaces such as these has the potential to save lives during heat wave conditions.

## Concluding Comments

Climate change poses particular problems in cities, places where a rapidly increasing majority of the global population now resides. It is critically important to find innovative, cost effective and sustainable approaches to mitigate the worst impacts of climate change in urban areas and in particular to solve issues around heat, human health and water scarcity. In Australia and around the globe researchers are working towards solutions for these problems. Inevitably some of these approaches will involve the innovative use of urban water, in particular wastewater reuse and storm water harvesting, both water sources that are currently largely wasted. By implication this will also involve dramatic increases in irrigated green infrastructure for many of our cities.

On a positive note some governments and policymakers around the world are beginning to deliver urban water and design approaches that advocate the use of storm and wastewater to produce cooler and more livable cities. A clear example of this is the new Victorian State Government's *Living Melbourne, Living Victoria*

*Roadmap for urban water* (Victorian Department of Sustainability and Environment 2011) that draws on much of the work mentioned in this chapter. Also on a positive note, *actively pursuing heat reduction strategies in urban environments, where most of the global population live, and where temperatures are already elevated, is likely to provide us with the critical “head room” to manage the increased temperatures associated with future climate change.*

I would argue strongly that issues such as those discussed in this chapter go to the heart of a sustainable society for the late twenty-first century. I would also argue strongly that geographers, with their fundamental understandings of space and time, environment and society and their interactions, are uniquely placed to provide scientific and educational leadership in the climate change – societal adaptation space. But this is more than just simply understanding the science and human and environmental dimensions of climate change; it is also about providing the curriculum and empowering educators to enable the necessary changes in society to cope with the impacts of climate change that are now inevitable. We need fundamental shifts in attitudes and behaviour at all decision-making levels in society, from government and industry to the individual and community. As geography and sustainability educators we must all take a large share of the responsibility for enabling this change.

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# Chapter 12

## Spatial Models as a Hub for Sustainability Education: Exemplifying the Transition from Producer to User-Defined Maps in the Classroom

Jim Peterson and Margaret Robertson

### Introduction

Of the many public policies referring to fair use of natural resources, many allow implementation under interpretations that favour long-term goals of the kind often discussed in terms of sustainability. Commentators and reporters on current affairs so often use the term “sustainability” that geography and environmental science teachers are seeking to reform the curriculum and re-vamp the syllabus so that the transition from content that once had its roots in accounts of the commercial geography of “empire” and referred to natural resource exploitation in a world of plenty, can refer to a model acknowledging that resources are either renewable or non-renewable. This curriculum development transition is evident in the policy directives and shape paper guiding the Australian Curriculum for Geography currently under development for all states and territories to use in schools (see Australian Curriculum, Assessment and Reporting Authority at <http://www.acara.edu.au/default.asp>). Education for Sustainability (EfS) in the new curriculum statements reflects this paradigmatic shift in how we visualise the landscape. This refocussing of thinking helps to emphasise what some might call the follies of European settlers, especially in their agricultural, mining and settlement practices. With the data gathering and storing tools now available much of the environmental damage to fresh water systems and coastal landscapes caused during the last 200 years in the Australian landscape could have been minimised.

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With regard to the finite nature of resources, geographical variation in the scope for recycling becomes relevant to accounts of regional economies. The changing nature of landscapes yielding renewable resources must also be monitored if over-exploitation is to be avoided. As rates of exploitation (and population) rise, so do the rates of change and need for more and better monitoring and more sophisticated decision support. Clear evidence of this direction in policy and changing practice can be seen in the Murray Darling River Basin (see Fig. 12.1).

During the expanding colonising phase of Australia's interior the Murray Darling River network provided both a source of transport as well as irrigation for farming. Vineyards, orchards and intensive farming led to communities along the rivers which have sustained their practices for over a century. However, the impact has been irreparable harm to the river system. Coupled with a decade of drought the ecological harm and long term sustainability of the system has precipitated drastic government action to stem the devastation and change the lifestyle practices that have and continue to threaten this system. The Murray Darling Basin spans three of Australia's states and is the largest in the nation. Its environmental significance is vast and the challenge ahead for governments is complex environmentally, socially and economically. Re-education of whole communities is part of this process. Each time this has been attempted, a range of governance issues emerged and much effort was spent trying to find agreement between agencies according to whether they answered to local, state or Commonwealth authorities. At present, the Australian Government has assumed control of this process through the Murray Darling Basin Authority (MDBA see <http://www.mdba.gov.au/>). The "Basin Plan" is legally binding on all states and its brief is as follows.

Australia is entering a new era in water management and environmental protection. For the first time, the surface water, groundwater and environmental resources of the national heartland, the Murray–Darling Basin, will be managed as a whole, according to a single, legally enforceable plan — the Basin Plan. This is planning at a scale and complexity that has never been undertaken anywhere else in the world.

The Basin Plan will seek to protect and restore key environmental assets and key ecosystem functions which are essential to the life of the rivers and their surrounding landscapes, human activities and cultural values.

The Basin Plan will provide the foundation for managing the Basin's water resources in a way that can be sustained through time and in the national interest.

(see <http://www.mdba.gov.au/>).

The MDBA can look back to the original surveyors' maps to reconstruct the spread of settlement and now overlay those with the multitude of data bases available in digital formats. The result is that past, present and future landscapes can be modelled for scientific analysis and planning. The coherence made possible through advances in the interoperability of data systems is staggeringly precise. However, the flip side of this observation is that the scientists' knowledge requires translation into the social practices of communities to ensure that lifestyle standards are sustained. This is well illustrated in the Victorian Mallee District where many families affected by drought in the first decade of the twenty-first century have been forced to abandon their holdings to relocate to central places and (formally or informally)



**Fig. 12.1** Murray Darling River Basin crossing three state borders of Australia – New South Wales, Victoria and South Australia (Printed with permission of Drainage Divisions, States, Rivers © Commonwealth of Australia (Geoscience Australia), for details see Department of Sustainability, Environment, Water, Population and Communities 2011. <http://www.environment.gov.au/>, accessed 8 July 2011)

retrain. The landscape impact is seen in land cover pattern change, as exemplified by comparing aerial photographs (Fig. 12.2a, b) in time series.

The light coloured areas in Fig. 12.2b are salt pans that occupy areas that were previously shallow lakes. To illustrate the effect more closely, Table 12.1 shows the



**Fig. 12.2** (a) Drought impact along the Murray River at Mildura, pre-drought 1993. (b) Drought impact along the Murray River at Mildura, drought 2003

land consolidation process that has taken effect. The larger holdings are largely owned by corporations with assets that buffer against the impact of variable seasonal patterns.

The larger owners are more likely to own more water access rights and undergo crop changes to suit the market. In the post-drought period the most recent noticeable change has been a decline in vine production and increase in citrus fruit plantings. Aerial photography and photomaps help capture the pattern of these events. For instance, with the impact of drought and of government intervention to curb water for irrigation use from the Murray River, saw many landholders, unable to sell their holdings, grubbed out their crops or “leave the farm”. The aging demographic cohort of family-held landholders is one with very few resources to fall back on after the loss of revenue and equity that follows such change of circumstances.



**Table 12.1** Victorian Mallee district property change 1997–2009 (properties irrigating less than 1 ha have been excluded from the analysis)

Property size (cropped area)	Number of properties				Change	
	1997	2003	2006	2009	1997–2009	2009 %
1–5 ha	700	699	685	696	–4	31%
5–10 ha	836	751	740	688	–148	30%
10–20 ha	551	537	501	457	–94	20%
20–40 ha	215	209	206	223	+8	10%
>40 ha	155	200	206	211	+56	9%
Total properties	2,457	2,396	2,338	2,275	–182	100%
Average property size (ha)	16.4	20.7	24.5	30.9		

Data have been taken from the *Mallee Irrigated Horticulture 1997–2009, Final Report, February 2010*, prepared by SunRISE 21 Inc. for the Mallee Catchment Management Authority and printed with their permission, see <http://www.sunrise21.org.au/Default.aspx>

Consolidation into larger holdings has provided limited compensation to enable some families to move away. Ironically, is that in that this year (2011) the decade of drought has been replaced by record rainfalls with widespread flooding. For some landholders the impact on productivity matches the devastation of the drought because of the onset of fruit and leaf mould, but for others, a surfeit of yield has brought a market glut. Thus variable weather patterns compound the complexity in the landscape and challenge the predictive power of the models.

Couple these data with social data and it is seen that the patterns of land use change mostly relate to water related problems and fluctuating seasons. At the same time the digital imagery provides a time series that adapts well for scientists and educational case studies. Where families cannot compete with the larger growers and their resources are diminished, selling out is one option but many choose to remain in the communities that have been their home for generations. With loyalty to the location that can be often traced back to the beginning of European settlement, re-direction or re-imaging lifestyle practices is difficult without calls on out-side resources. In this context, government agencies including schools and higher education institutions are essential agents of the landscape transition required to sustain the commercial side of their towns and of civic life along the rivers. New and sustainable activities that offer employment and the promise of healthy rivers are the key elements in this complex equation. All of these data can be monitored, tracked and modelled to give projections of need and lifestyle sustainability. In turn, the data feed into the national and global projections that now help predict changes in weather locally.

## Global Databases

It is not fortuitous that the concomitant call for more data coincides with the proliferation of global databases, the value of which grows in parallel with the length of record. Accordingly, the geography and environmental science teachers can

contemplate reference to time-series landscape coverage, the nature of which improves in parallel with data capture methods. A positive feedback can be identified in this: the better the data, the more market there is for it. Many such data collections start as international endeavours that will always need public support. Others started as national defence initiatives that were later passed over to commercial enterprise. Among the most popular of such data bases are the global digital elevation models over which are draped photomaps as with Google Earth. The photomaps themselves can be derived from archives, the most accessible of which are those from one of a range of Earth observing/orbiting satellites (See <http://edcns17.cr.usgs.gov/NewEarthExplorer/>). However, for areas with air photo coverage, higher spatial resolution photomap drapes may have been assembled. As the seasonal variability described in the context of the Murray Darling Basin, especially interesting for the geography student is the search for such coverages in time series. Nowadays, using freely available software such as Google Earth and Google Maps, tasks can be adapted for local school use with relative ease. Made possible with the adoption of air photography for mapping, this diffusion of the method into routine has had to wait until the enormous amount of work involved could be automated. As with so many methods for turning data into information, the automation came with the commodification of techniques made possible once the digital computer was widely adopted (e.g., see Peterson 2008).

The global databases represent international applications of science: “science without borders”. For the most part, the time series coverages that environmental scientists need for documenting the rates and magnitudes of many of the most important of global changes are now freely available and refer to records spanning two or three (in some case more) decades. Even the most secretive and dictatorial regimes administering the most closely guarded international borders may fail to hide anything that has an earth surface manifestation. Indeed, in some respects, we geographers have suddenly found ourselves swamped with data while at the same time formulating our research out of methodologies that evolved painstakingly over decades during which we were called on to provide answers to problems about which there was a distinct lack of data.

Nevertheless, it is not immediately obvious from school based observations and pre-service education courses that the time has come when teachers of Geography and Environmental Studies recognise the value of the data cornucopia, especially in terms of implementing, monitoring and building educational capacity. There is need of curriculum reform as indicated in the new Australian curriculum for Geography, and there is need for these reforms to be accompanied with professional development. Teachers require the skills to transform the science and the digital data opportunities into usable resources. In doing so, the paper-based cartographic traditions need up-dating with new information, education and training. The arguments to make this investment in training and retraining of teachers seem clear, but they can be made more appealing to practitioners with some reflection on what are quite fascinating traditions.

## The Revolution in Spatial Modelling

Essentially, monitoring changes on the face of the Earth is a mapping exercise. Our argument so far is that we've come a long way in recent decades. One hundred years ago mapping was defined in a school textbook with the following opening statement.

If a person in a balloon at a great height over any part of the earth's surface sketched in outline what he [sic] saw directly below, his sketch on a flat surface like this page would be called a *map* [italics added]. (Huxley and Gregory 1909, p. 1)

The simple metaphor reflects the difficulty of explaining the concept of a map and a belief embedded in the perspective of the Huxley and Gregory that "it is essential that the pupils should make precise observations of natural objects and phenomena" (p. viii). Their view that we learn from direct experience and that teachers need to start with some connection to "pupils" personal experience is laudable by contemporary standards. Whilst the strategy may seem quaint the principle for learning retains its validity. Mapping based on sea and land voyages as well as terrestrial navigation in some form of representation has existed throughout history. Visualising and interpreting our surroundings is an integral part of cognitive development. However, the accuracy of our perceptual observations can be misleading. This is where education becomes important.

Ideally the database from which the Earth surface changes are mapped will be detailed enough for the features that change their distribution to be represented at intervals frequent enough to constitute acceptable snap-shot intervals. Indeed, the best support in these terms amounts to the "holy grail" of thematic mapping: ideal, elusive and essentially unobtainable. Successive generations of geography graduates had to accept the fact that the decision support they could offer would be out of date upon delivery and would not communicate as much of the information as would be best. The classic English language example of this is the land use map of England and Wales: it refers to field work undertaken progressively from the 1930s (Stamp 1937, 1948; Coleman 1961). Although as much as could be expected at that time (and certainly offering more detail than the Domesday Book) the temporal resolution and contemporaneity of coverage offered by tagging mapped fields/polygons to a land use category may be inferior to more modern methods based on land-cover mapping.

The first of these refers to the interpretation of patterns on aerial photographs. The nature of recordable views that could be taken from aloft changed as the platforms changed from the balloons identified in the 1909 definition of mapping to aircraft, to orbiting spacecraft/satellites and as the cameras became more sophisticated. As opposed to photographs, by the time the first multispectral satellite images became available, air photo acquisition methods had long incorporated what was needed to offer the contiguous coverage and consistency needed for deployment in mapping, and a new profession had evolved: photogrammetry. The spatial resolution (~70 m: early 1970s) of the first earth surveillance digital images (as opposed

to photographic snapshots of target areas of strategic importance) was outclassed by the standard aerial photographs coverage, and so taking advantage of digital imagery had to wait until better spatial and spectral resolution could be offered.

Early aerial photographs depicted the earth surface in patterns and textures of tones of grey. Coloured aerial photographs offered standard visible spectral patterns or infrared patterns that could be rendered in a false colour. The nominal spatial resolution could be pre-determined by adjusting the flying height in reference to the focal length of the lens. The orbiting earth surveillance satellite like Landsat (see <http://edcsns17.cr.usgs.gov/NewEarthExplorer/>), for instance, on the other hand, scans the swath of earth surface in view such that the spatial resolution depends on the design of the scanner and speed with which the on-board computer can segment the scan line into picture elements. The spectral resolution is determined by the number of scanners: one for each nominated segment of the electromagnetic spectrum.

Accordingly, in many agencies, the field data for land cover mapping of field data continues to be applied, map sheet by map sheet in a very producer-defined way (see Fuller et al. 1994). Illustrative of this connection was the most recent of the British Land Use surveys. In 1996, children in schools throughout Britain conducted one kilometre field based land use surveys. The project was sponsored by the Geographical Association of the UK (Walford 1997). Their findings complemented existing photogrammetric maps and illustrated the opportunities for involving school children in functional exercises of ongoing significance. One additional element in this survey to add to the time specific data base is the Views and Visions of the young surveyors (Robertson and Walford 2000; Robertson 2000). Now published these findings provide a reference point for reviewing environmental perceptions as well as highlighting the contributions to be made to science through collaborative school and industry linked approaches.

Nowadays, the grand scale approaches are now more likely to be user defined approaches. As the satellite image libraries/archives accumulate over time, contiguous scene by scene, the need for the large ground surveys has almost been removed. Interpretation has become better as the spatial resolution continued to improve guided by ground truth and knowledge of phenology and spectral signatures. At present, the market offers scenes with image picture elements smaller than one square metre. Moreover, more thematic mapping teams now have access to the spatial data handling tools offered by digital image processing software packages and/or modules and fewer of them have a separation in their own minds of GIS and digital image processing.

The other dimension implicit in the shift has been the transition from analogue to digital image data coverages. It refers not only to scenes captured from orbiting platforms but also to those formerly acquired on light sensitive film. Indeed the incorporation of image data into mapping was based on deriving terrain measurement from stereo photographic models: so much so that when the digital survey-grade cameras were invented the new sales pitch had to very direct: "Film is dead". As with many innovations, it emerged at the time when the "old way" had reached new levels of perfection. Fortunately, the aerial photographs that date from analogue

photogrammetric practice have survived. They now constitute a priceless archive depicting the face of the Earth as we will never see it again. In terms of exclusive broad-scale coverage, they mostly refer to the period 1930 to 1970s.

Thanks to the digital camera and the success with which the mathematics involved in photogrammetry has been commodified, the cost of aerial photograph coverage is now low enough that regular up-dates of colour-image coverage can feature in local government decision support budgets, and thematic mappers can achieve accuracies hitherto confined to the (optico-mechanico-analogue) photogrammetric laboratory. As a result, a school might enlist the help of its local government planning and data officers in assembling a time series of coverages of the school and its catchments. The coverages would come as planimetrically corrected mosaics ready for import to GPS units with which photo-map up-dates can be achieved. Thus, a producer-defined map is converted into a user-defined map. Indeed, if the image mosaic arrived together with other specifically requested coverages, for instance roads, land parcels, and planning zone boundaries, the gift of data itself could be described as user-defined: the user can choose from among whatever coverages are made accessible from those sequestered awaiting display from the local government spatial database. The local government mapping team may have access to state spatial data under the same kind of arrangement if, as in Australia, a state digital spatial data infrastructure has been built. Case studies that illustrate these opportunities are outlined in the following and final sections of the chapter.

## **Consequences in Education and Training**

The commodification of digital mapping techniques helps define the expanding array of spatial science professions. These have been much changed by the digital revolution in mapping. Simultaneously, map making has become readily accessible to the general public. Freely available software such as Google Maps and low cost navigational tools for domestic usage have all helped to demystify the process of map making. For everyday use there is little need to acquire the high level technical skills needed by professional users. In brief, it is not only professional practice that can benefit from these developments. The commodification of digital mapping techniques is amongst the most powerful drivers of change in syllabus and, if extensive enough, in curriculum.

In terms of teaching Geography, the commodification offers a chance for the discipline to regain its core position in defining the spatial sciences because it is the thematic kind of mapping that is most called upon in decision support. Thus, the discipline of Geography is poised to regain a status it once enjoyed before its most immediately relevant branches from national strategic points of view became separate professions. A brief history of the relationship between Geography and Cartography serves to illustrate this argument. As Cartography has become more advanced the education and training needed to meet the evolving professional standards has taken more and more curriculum time. Failure to recognise this kind of

need brings separation from related disciplines as was the case for the teachers of cartography who had previously been linked with the discipline of geography. However, it is now possible to teach tertiary geography students enough in a few course units to make their own maps, and in a user defined as opposed to a producer defined way. Hence, it is commodification of technique in GIS that has seen the knowledge formerly transferred in cartography courses, delivered in units of the curriculum of related courses (e.g., “spatial science” or “land information”).

Much the same can be said for the commodification of photogrammetry. This change is also interesting to geographers. The change refers to the use of aerial photographs in thematic mapping, and the fact that many a geographer has had to become skilled at aerial photographic interpretation. Traditionally, the themes identified were plotted on base maps prepared by land surveyors. Unless the plotting was undertaken via photogrammetric plotter, boundaries of the land cover categories would be “eye-balled” onto the draft base map. The adoption of aerial photography and satellite imagery offered scope for greater planimetric or two dimensional accuracy in thematic mapping. Hitherto, the field data were the benchmark data used. However, as soon as remotely sensed imagery was adopted in land cover mapping, the fact that an image was not a planimetrically accurate map posed a challenge. If the images could be imbued with planimetric verisimilitude, or two-dimensional accuracy, the base maps upon which the field data were plotted could be automatically updated. The trends reflect parallel revolutions. Information on position identity and attributes about any or all lines and features on conventional paper maps could be recorded in a digital database adapted so that consequences of any line and polygon changes associated with the spatial database would be updated. The new way has spawned a new industry. Whereas mapping the “old way” was impossible to commodify and so must always have been a drain on the public purse, the new way is characterised by commodification and cost recovery. Significant investment has been made in software and hardware development and in data capture and data market expansion, and returns on investment are such as to ensure ongoing research and development.

Accordingly, as with all important commodifications of technique, the revolution in spatial data handling has forced changes not only in professional practice but also in education and training. About two decades of transition has seen the emergence of a new profession of spatial scientists from the merging of a range of formerly distinct disciplines that include: land surveyors, mining surveyors, hydrographers, cartographers, map librarians, geodemographers, photogrammetrists, digital image processors, to name the main ones.

In summary, 20 years ago, only the most perceptive of teachers would have been warning about the impending retraining needs for any of the recruits to these separate professions. Few would have thought of Geography as a fundamental building block for competence in the spatial sciences. What this means to those looking to keep the school curriculum relevant to the “real world” refers to both syllabus and curriculum. The “old way” (static displays designed with cartographic skill, but, essentially producer-defined) has been replaced by a new “user defined” way.

A stark contrast has emerged. In a pre-globalised world with little alternative to the producer-defined and associated static displays, the paper map had achieved such status as to discourage critical appraisal. Accordingly, regular references to *How to tell lies with maps* (Monmonier 1991) and words of caution in *Ground Truth* (Pickles 1995) needed to be noted by each successive generation of mappers. Some of the concerns to be noted by those adopting the new way are:

- The sciences behind the themes of thematic mapping are freed from the producer-defined constraints that have hitherto caused the Mapping tail to wag the science dog.
- An appreciation of the science behind the themes of thematic mapping is understood to be an essential pre-requisite to thematic mapping, especially of the kind expected by decision support managers from geographers and environmental scientists.
- Understanding of the relevance of the user-friendly face of the techniques behind the commodification of mapping tools becomes so ubiquitous that the naïve-user component of GIS users becomes dominant. In the meantime, teachers of Geography and Environmental Science will need to take special care in explaining how the data products can be judged fit for purpose. That is, for instance, satellite navigation used in the family car is both a virtue and a challenge. The former shares the technology with the wider community. However, the limitations in accuracy remain for teachers of the related disciplines to explain.

Teachers of Geography and Environmental Science will need to take special care in explaining how the new data products can and cannot (honestly, at least) be used. As usual when map composition is contemplated, fitness-for-purpose of the data at hand, especially in terms of spatial and temporal resolution, is paramount. In the professional mapping world, the necessary data are called for and its cost is built into the project budget. For the class-room teacher there is another option: open source.

The following illustrations of cooperation show how learning between the professionals and the learners in schools and higher education can be a two-way process.

## **Local Government Cooperation with Schools**

One of the simplest ways to build connections between schools, higher education and the world of business and commerce is through enquiry based learning focussed on local issues among topics of shared interest. Local governments now have substantial resources for spatial data collection and map displays. As well as the satellite imagery of localised boundaries their records relate to water, power, landscape, roads and household social data. The various layers of data are readily available within most local government communities of Australia. Our experience is that their employees are only too willing to assist educational programs with access to

spatial displays of public data and where possible, become involved in the knowledge sharing and building. The first step is simply to make contact and discuss the possibilities. Coupled with this is open access to GIS software provided by ArcGIS Explorer Desktop (see <http://explorer.arcgis.com/>) which can be downloaded or used online to “fuse” local data with its options. To help this process is the global GIS provided by ESRI which purports to provide “mapping for everyone”. Their website is comprehensive in its quest to provide users with common sense advice and easy-to-learn training (see <http://www.esri.com/>). In their online publication ArcNews Esri makes the claim that “Geographic Knowledge Leads to Geographic Intelligence” (ESRI 2011, headline 1). There is wisdom in the claim. Arguably, the use of GIS tools enables students and teachers to access information not previously available to their schools. This in turn delivers more power in the form of information that helps facilitate better decisions. Higher order thinking processes are able to act on the more detailed profile of landscapes under review. The following case studies illustrate the issues. The first relates to pre-service teachers in Northern Tasmania and the second to a primary school located in Northern Victoria on the edge of the Murray River. In both contexts local government and business enterprises worked in close collaboration with the students to facilitate their needs and their learning. The first step in each instance came from the teacher who approached the local government office for help with local maps. The rest evolved from the initial contacts.

### *Case Study 1: Northern Tasmania Pre-service Education Classes*

Initial contact with the local city council led to a fortuitous meeting with the Strategic Planning Manager. His reaction to the proposal for cooperation with the University provider of the pre-service education course was extremely positive. Over a period of successive years a program developed that started from an initial discussion of shared objectives. The council members were keen to have community engagement in planning and to hear the ideas of students. The publicity was good for the council and the students were given access to the skilled knowledge base of council planners and senior managers. Similar steps each year were part of the process.

1. Council Manager and lecturer meet to identify a disused council site up for tender. The students would be required to develop planning proposals for the site and submit their “tender” for review by the panel of experts within the council building.
2. To enable the students to acquire the prerequisite knowledge, planning experts presented a series of talks based on permits, traffic, noise and related pollution, safety and security issues, sustainability, land surveying and other matters that might relate specifically to site.
3. A site visit was the next part of the process where experts conveyed further tips for the student tenderers all of whom operated in small groups of no more than five students.
4. A period of 6 weeks was scheduled for the planning and students could make direct contact with council members for advice during that period. Criteria for





**Fig. 12.3** Lake Hawthorn and adjacent primary school in Northern Victoria (Source: Google Earth image 34° South, 142° East)

assessment included the need for a map based on GIS waypoints collected to best represent and market their plan and a presentation to the panel of experts.

The results each year reflected the varied talents of students. Some conveyed their plans with video, slogan, song and dance. Other adopted more targeted marketing approaches with their “brands”. Some could have been cleverer than others. However, none of these presenters failed to impress the panels of experts and lecturers with the imaginative and creative approaches taken. The other important outcome of this process was the application of their knowledge and acquired GIS and spatial mapping skills to an additional project which they themselves had to negotiate to complete. These second phase independent studies generally involved making contact with another local government office.

Whilst they were “forced” to find time to meet as a group and plan for their learning outcomes in their evaluation feedback, students were generous in their praise of the process. Connecting with authentic learning problems helps contextualise the skills and build confidence for further studies and guide further application of the newly acquired spatial “intelligence”.

### ***Case Study 2: Northern Victorian Primary School***

Funding from a Philanthropic Community oriented source in the state of Victoria enabled a partnership to be developed in a small primary school located near the city of Mildura and adjacent to a wildlife nature reserve including a natural catchment area subject to fluctuating effects of drought and floods (see Fig. 12.3).



Fig. 12.4 (a, b) Primary school children using GIS

To grasp the significance of this context imagine a group of 11 year olds paired with 8 year olds. The older children are the teachers in this scene (see Fig. 12.4a, b). Equipped with E-Trac GPS units for digital mapping they are teaching the younger children how to use the tool in the playground of their school.

The younger children in turn working with a partner next demonstrate they have the knowledge and skill to use the new tool by navigating to pre-programmed locations around the school's grounds. The teacher is very mindful of his/her duty of care and keeps a close eye on the children to see that they remain on task, do not get too playful and the older children are exercising their responsibility with great care. During the 90 minute period of observation of this process the teacher's role was close to being passive observer. Reassurance and feedback were observed. However, the major behaviour engaging the teacher appeared to be that of listener. The children were engaged, trouble shooting for each other when not sure of the GPS unit's menu operations, and appeared to be genuinely thriving on the peer-learning arrangement.

Collectively the students made a video presentation of their favourite places in the surrounding area. This included maps developed using the GPS units in the field and downloading field data into digital format using Google Earth back in the classroom. To these maps Google tools like "sketch-up" were used and other material linked included video clips, photographs, scanned imagery and text – any item perceived to be an enriching part of the profile for the location. The overview in turn provided the school and its learners with a visual-spatial representation of their surrounding landscape which can be monitored for environmental changes and learning about sustainability.

Importantly, in this exercise both teachers and students work collaboratively to create a product that could be shared with their wider community. The outcome is a source of pride which helps develop confidence to value their personal and collective knowledge about the places where they live. The learning experience is authentic; it helps to shape children's lifeskills for better using multiple data sources for meaning making. They are being well prepared to enter the world of complex spatial data handling.

## Conclusion

The quality of schooling for sustainability in part depends on the quality of the information available to students and teachers. Applications using spatial data are now freely available and form part of a much larger commodification process of digitised knowledge. Use of the technology can be at simple points of entry and progressively enhanced through teaching and applications of high end technologies. Importantly, the more technical end of GIS applications used in industry are generating spatial data of infinite detail and accuracy about the earth's surface. Scientists using these data fields can model alternate futures in the landscape which in turn provide advice to community services and government agencies on how best to prepare for each eventuality. Rather than scientists retaining exclusivity over the multitude of data applications and possibilities, increasingly digital mapping tools support our day to day living. Through introductory programs in schools the process

of learning is demystified and the process of capacity building can begin to shape related and much needed relevant graduate capabilities of learners in schools and higher education.

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# Chapter 13

## Concluding Comments

Margaret Robertson

### Knowing Our Place in the World

One of the failures of wealthy nations is losing touch with the most basic of all relationships and that is our dependence on the natural systems for our survival. Bio-security with its array of ramifications throughout the animal, plant and human populations is an obvious outcome of the separation between people and food production. Agencies linked to these acknowledged important tasks are charged with an incredibly important responsibility. Providing safe, secure and adequate food supplies for our increasingly concentrated populations is critical for our long term survival in the region. In this respect the region is similar to all other regions of the world. The issues are related. The big difference is in the mix of landscape territories and geographic position in relation to the natural systems of wind, water and seasons.

Australasia is predominantly located in tropical and warm temperate latitudes. The seasonal weather patterns bring strong onshore winds along most of the eastern coast of Australia and New Zealand. In Australia the Great Dividing Range which runs along the length of the Eastern part of the continent creates a barrier to inland rain and limits the quality of the landscape for agricultural production. The westerly winds bring rain to the south west of Western Australia and head across the Great Australian Bight to bring heavy rains to Tasmania and head further east across the Tasman Sea to bring heavy rains to the South Island of New Zealand. In turn the Southern Alps of New Zealand create something of a rain shadow effect to the east – especially in the South Island. However, for the south east of these land-masses the outcome is not necessarily aridity. Circulating winds around the islands

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bring rain to most parts and support significant agricultural production – as evident in the dairying producing region of the Canterbury Plains in the South Islands of New Zealand and the Gippsland Plains of the Australian state of Victoria. It is further inland and north in Australia that the vast stretches of arid lands restrict human occupancy and change the relationship between agricultural production possibilities and settlement patterns. That is, except where irrigation is possible such as along the Murray Darling Basin which is fed from the watershed off the Great Dividing Range.

Elsewhere the region is dotted with islands many of which are noted as being threatened by rising sea waters. The largest of these land masses is Equatorial/Tropical Papua New Guinea. In this nation the issues are more directly related to highland landscapes which when coupled with the dense vegetation make communications difficult.

Throughout the region threats from disasters are part of the annual cycle. The region runs along the periphery of the western Pacific Rim. Tectonic movements are always a possibility if not a regular event. More regular are disasters associated with annual seasonal patterns associated with heavy rains, floods and fires in the summer. As explained more completely in Chap. 1 the effects of cyclical events such as El Niño can be to exacerbate the effects of prolonged drought and/or wet periods. In summary, the effects from natural events are a continual reminder to the agricultural producers of the possibility of an irregular seasonal pattern that may lead to crop damage and loss of production. Their resilience and survival depends on their capability to adapt, or possibly accept a lesser more subsistence lifestyle and ultimately to walk away from the land to an alternate lifestyle.

The other major factor that impacts on lifestyle sustainability in the region can be attributed to European settlement. During the last 200 years the landscape in many parts of the region has been scarred and changed perhaps irrevocably by inappropriate land use practices and sprawling cities. The most obvious of these “invasions” is apparent in the basin of the Murray Darling Rivers. This is Australia’s major river system which provides water for hydro electricity in the high lands of the Great Dividing Range and then feeds the irrigation farms along the Murray in what is semi-arid and arid land. The result is a natural disaster that needs to be managed by governments prepared to legislate for corrective practices which inevitably means making lifestyle changes for dependent farmers and their communities.

Prior to the Europeans the Aborigines in Australia lived in a balance with nature. Their numbers were considered to be around half a million people speaking more than 200 languages most of which today are extinct or threatened. Today the residual of the languages survives through the oral cultures that have been passed down through the generations and live on with the remaining communities and their members scattered throughout the continent. Their relationship with the land is an important part of the heritage which has mostly been overlooked and certainly undervalued in the contemporary nation. Ironically the skills of the Aborigines as way finders with strong visual spatial skills are attracting renewed interest by researchers interested in understanding the cognitive processing patterns associated with geo-spatially linked new media.

This leads to the final point to be made that relates to the content of this book. All authors through their respective contributions have provided fascinating perspectives and overviews of their topics and themes. On the one hand there are overviews of curriculum developments in the major nations of Australia and New Zealand which are helping to shape new thinking related to environmental matters. They promote sustainability as a key construct for learners in schools and the community. Legislation for change is rather too slow for many but is happening. The chief hurdle is overcoming the lethargy of people who for generations have benefited from the best that nature can offer without due care for their custodial role for the planet. To help change opinions and support curriculum reform research based learning materials are of vital importance. Hence the relevance of chapters in this book that relate to urban climates, spatial data analysis and eradication of plant and animal diseases. There is need of science and case studies to complement the learning processes in our schools and institutions of higher education. Professor Suzanne Corry, President of the Australian Academy of Science stated in a recent press release related to climate change:

Science underpins an enormous range of the choices we make – from personal decisions about what to feed a child or whether to take a particular type of medication, to major national decisions about how to ensure water security, defend the country, or tackle climate change...Our choices must be based on proven understanding and scientific evidence, not on misinformation or uninformed assumption.<sup>1</sup>

**Acknowledgements** Sadly, Jim Peterson did not live to see this book in its published form. Chapter 12 is his last published work. He will be remembered for his passion for the discipline of geography and as a pioneer in the development of teaching and learning with spatial technologies. Geographical Information Systems have changed the way we go about our research data gathering. Jim enabled many young geographers to achieved expertise in this and related areas of scholarship.

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<sup>1</sup> See Australian Academy of Science media release dated 21 June 2011, *Academy urges Australia to "respect the science"*. <http://www.science.org.au/news/media/21june11.html>. Accessed 5 July 2011.

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