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## LIVES, LIVELIHOOD & CHANGING CLIMATE

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COVER PHOTOGRAPH  
MOTHER AND DAUGHTER  
TRAVELLING FROM ONE  
ISLAND TO THE OTHER  
IN THE THREATENED  
ECOSYSTEMS OF  
LAKSHADWEEP

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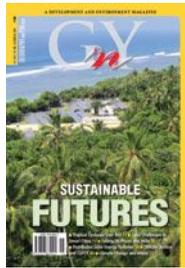
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**JAN-FEB 2016 ISSUE:** The latest issue of G'nY in its changed format is a great issue. It is full of information on different issues, GIS for avalanche mapping to climate change and its impact on wheat. G'nY has always been an authentic publication and now with the list of references given at the end of articles it has raised the bar high. I deeply appreciate the display of intellectual honesty. The 'In-Brief' section has many important one pagers which provide latest information on the subject. However, readers will miss the splendid double spread pictures. But I believe in the professional world people want value for their money. Keep it up. — SUNITA SHARDA, NEW DELHI

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**THE DECEMBER 2015** issue of G'nY, covered an article on heatwave in India. It was very enlightening to say the least. Heatwave conditions need urgent and meaningful ideas of mitigation. The state governments, especially that of Andhra Pradesh and Telangana need to put in more effort to people to warn their people who work out of doors. I have in many instances wrapped a wet cloth around my head and neck, to provide some relief and tried to remain indoors from 11am to 4pm. I also think water and grains for birds should be put out to help save the wildlife around us. —MONA DASGUPTA, VIA MAIL

**G'NY IS A VERY GOOD** initiative which has been till date providing detailed information on several aspects of environment and development. I would appreciate it if a section may be incorporated on reasons of geographical events to enhance the knowledge of the readers, at the same time making G'nY and exclusive journo-mag. —AMRITESH DINKAR, VIA WEBSITE

**PEOPLE DO** anything to achieve mining rights. It is simply outrageous to deprive the people of their forests and lands and resources. Yet the refrain is that the Ministry of Environment, Forests and Climate Change is safeguarding the interests of the tribal and underprivileged people. The country's resources are being plundered by a few the likes of which are Adanis and Ambanis. It would be good

if G'nY could carry stories and exposés related to this area of work  
—M A SIRAJ, VIA WEBSITE

**THE WORK DONE** by G'nY is really appreciable and you have an eminent panel of experts. I would like see some of our work in your journo-mag and would circulate information about it to our students and encourage them to submit manuscripts. —PROF. MALTI GOEL, VIA MAIL

**I AM THANKFUL** to G'nY for churning out knowledge enhancing works in the form of monthly magazines that enables us to analyse various socio-economic situations through the prism of geography. —AKSHAY SAXENA, VIA MAIL

**LANDFORM ARTICLES** I look up to G'nY for original articles on many geographical issues. With many disasters and extreme events, there has been landscape changes world over—flooding leading to submergence, evidences of sea-level rise and more. I will really appreciate if articles on landscape changes are printed in the coming issue of G'nY.—RAJIV DUTTA, MUZAFFARPUR

**BEING A REGULAR** reader of Geography and You, I recently came across the free edition of G'nY Climate. I would love to read all the older copies and thank the publishers for their wonderful research and publication. —R V CHAKRADHAR, VIA MAIL

**WRITE** Editorial Office: Geography and You, 1584, B-1, Vasant Kunj, New Delhi-110070. Letters may be edited for clarity and length. Include name, address and telephone. **PHONE** 011-26122789, 26892275, **FAX** 011-41775126, **EMAIL** editor@geographyandyou.com  
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**TO CONTRIBUTE AN ARTICLE:** Kindly send the abstract of your article in not more than 200 words to [editor@geographyandyou.com](mailto:editor@geographyandyou.com). The abstract will be reviewed by our guest panelists. Once selected we shall respond for the procurement of full article. The length of the final article may range from 1000 to 1500 words. Please also mention if you can contribute relevant high resolution photographs. *The Editorial Advisor.*

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## Dear Readers,

There are more old people now than ever before. Quickly burgeoning to a fourth of the population, India is aging fast. By the turn of this decade, we will likely no longer be the youngest nation in the world. Of the old persons, there are those that may be categorised as the oldest of old, much in the same way as poorest of poor. As per the newly released National Sample Survey Report No. 574, this segment is the most vulnerable to a plethora of diseases, dementia, terminal illnesses and disabilities. The marked rise of illnesses in the population above 70 is of increasing concern for a health care starved nation such as India. No facility, from infrastructure to social policies is senior-citizen friendly, highlighting the callous attitude of the nation-builders. With the rising number of old age persons, it is important that India makes a concerted effort to address health care at the outset, followed by re-employment/engagement possibilities of old age persons. This issue covers a great many issues, ranging from climate change to livelihoods. An article by Dr Akhilesh, Head, Climate Change Programme, DST is a must read. Also a section has been dedicated to health issues that plague the nation. Happy reading.

(Sulagna Chattopadhyay)

*An old relative of an affluent Lake Town, Kolkata, householder, being left back home with her cat, to take care of the premises, while the residents go visiting pandals (decorative temporary structure built for ceremonies etc.) during the festive season of Durga Puja.*

By **SUCHARITA SEN**

# Vulnerabilities in Women's Work and Land Rights

*Alienation from land and distress-driven shift towards agricultural wage work leave women particularly vulnerable. Although amended inheritance laws have increased the probability of daughters inheriting fathers' land, women's effective control over agricultural land, though relatively higher in the southern states, continues to remain abysmally low on an average in rural India.*

**L**and and its control are of fundamental importance in sustaining livelihoods in rural India. The relationship between land ownership and poverty has been well established in the past (Janvry, 2001). There are at least four major ways in which owning land has a more direct bearing on rural livelihoods than in urban areas:

- ◆ land quality is of crucial significance to agricultural production, while it is of no or little consequence to production in secondary and tertiary sectors that urban India specialises in;
- ◆ land ownership is intrinsically linked to the social status and local identity of an individual in rural India;
- ◆ it is a resource that is frequently mortgaged out in times of distress to avail credit in rural India;
- ◆ agricultural land is an indestructible resource that is passed on through generations; hence its perceived value is typically much more than its market price.

Agricultural livelihood dependent on land range from working on it as a labourer, as a tenant farmer, as an unpaid family worker on family-owned land, without or with some involvement in the process of decision making, and as an owner of the land with full managerial control.

Women's rights over agricultural land is poor across the globe, and even among countries that have a substantial proportion of people dependent on agriculture, India fares abysmally on this count (Agarwal 1995, Deere et al., 2013).

Despite women workers' share being higher in agriculture which is 65 per cent women vis-à-vis 49 per cent men as per India's 2011 Census (GoI, 2011), their dependence on agriculture takes more vulnerable forms as compared to that of men. For example, a far greater share of women work as unpaid family workers on their own farms with little say in decision making. In addition, women's participation in rural work has been declining sharply for the past two and half decades (Fig. 1).

Explanations for this decline range from withdrawal due to participation higher education and higher incomes earned by households and consequent withdrawal of women from the labour force due to patriarchal norms, on the one hand, and agricultural distress accompanied by inadequate labour demand in non-agricultural sectors, in both rural and urban areas, on the other (Abraham, 2013, Ghosh & Chandrashekhar, 2013).

Further, at the national level, it may be observed that in the last two decades, the category of cultivators, who are mostly workers that work on their own land, has declined both for men (only in the main category) and women (Fig. 1). This indicates distress among marginal and small land-holders who may have lost their land, either through sale or leasing out, or land acquisition by the state, while some may have voluntarily left agriculture for better prospects. Very often, however, such losses

of main cultivators; notably, these growth rates far exceed the rate of increase of rural male population in the working age group. Figure 2 reveals that men are forced to depend on agriculture as a part-time activity with high increases in marginal cultivators and agricultural labourers, presumably because of lack of regular work in the non-agricultural sector.

But what is relevant for our analysis here is that women seem to have been dispossessed of their engagement with their own land, both in main and marginal categories, and have taken to paid agricultural wage work. It could be argued by some that the wages received by women may increase their choices in relation to doing unpaid work on family farms, but given the general patriarchal environment prevailing in most of rural India, the most reasonable interpretation for this trend of moving to wage work on others' land is distress and not choice. In such a scenario, the advantages of

**Fig. 1: Declining work participation of women in rural India**



Source: NSSO Employment-Unemployment Rounds, 1977-78 to 2011-12

*Women work participation rate has been declining in the last 30 years, more sharply after 2004-05.*

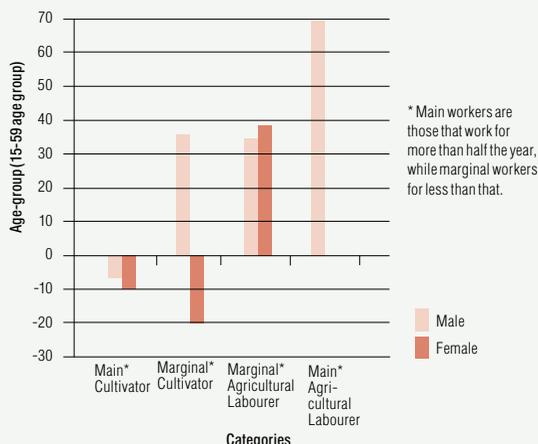
are driven by distress, and Figure 2 reveals that it has impacted women cultivators more than men, as decline for the former is observed both in the main and marginal categories. This is contrary to expectations and past experience, which was accompanied by male-selective out migration with women being left behind for agricultural work, unless the entire family had migrated.

The current change is indicative of a starkly different reality. Since non-agricultural wages are far higher than agricultural wages (Jatav & Sen, 2013), it appears counter-intuitive that the male workers have registered such a high rate of growth in agricultural work in all categories other than that

having access to income may largely be offset by the distress of being double burdened by both domestic activities and low paid, strenuous work.

The vulnerability of women in the work arena could be eased significantly by giving legal access to ownership of agricultural land in rural India. The amendment to the Hindu Succession Act in 2005 (Viswanathan, 2005) made compulsory legal provisions for a married daughter to be a coparcener along with her brother/s and widowed mother to her father's land after his death, which is a distinctly empowering status compared to what prevailed in most of the country till then as per the Mitakshara provisions (male inheritance). Though the amended

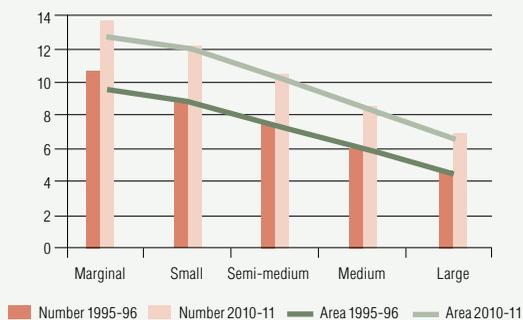
**Fig. 2: Growth rate of agricultural workers (15-59 age group), 2011 over 2001**



Source: Census of India, 2001 and 2011

An overall decline is observed in the number of main and marginal cultivators between 2001 and 2011, at a higher rate for the females than males. An accompanying increase in main and marginal agricultural labourers is also seen. By and large, such a trend is indicative of widespread rural distress, which has impacted women more than men.

**Fig. 3: Distribution of operational holdings among female cultivators (in percentage)**



Source: Agricultural Census of 1995-96 and 2010-11

The household level data indicates that despite constituting nearly 50 per cent of the population, women are the primary cultivator in as little as 5 per cent of India's cultivated land. Over time, there is a marginal improvement in the share of land of the households in which women are the primary cultivators. Interestingly, this share declines as the farm-sizes increase, in both periods under consideration.

inheritance laws have increased the probability of daughters inheriting fathers' land, scholars find that significant biases remain that prevent legal provisions getting translated into effective control of land by women (Deininger et al., 2012).

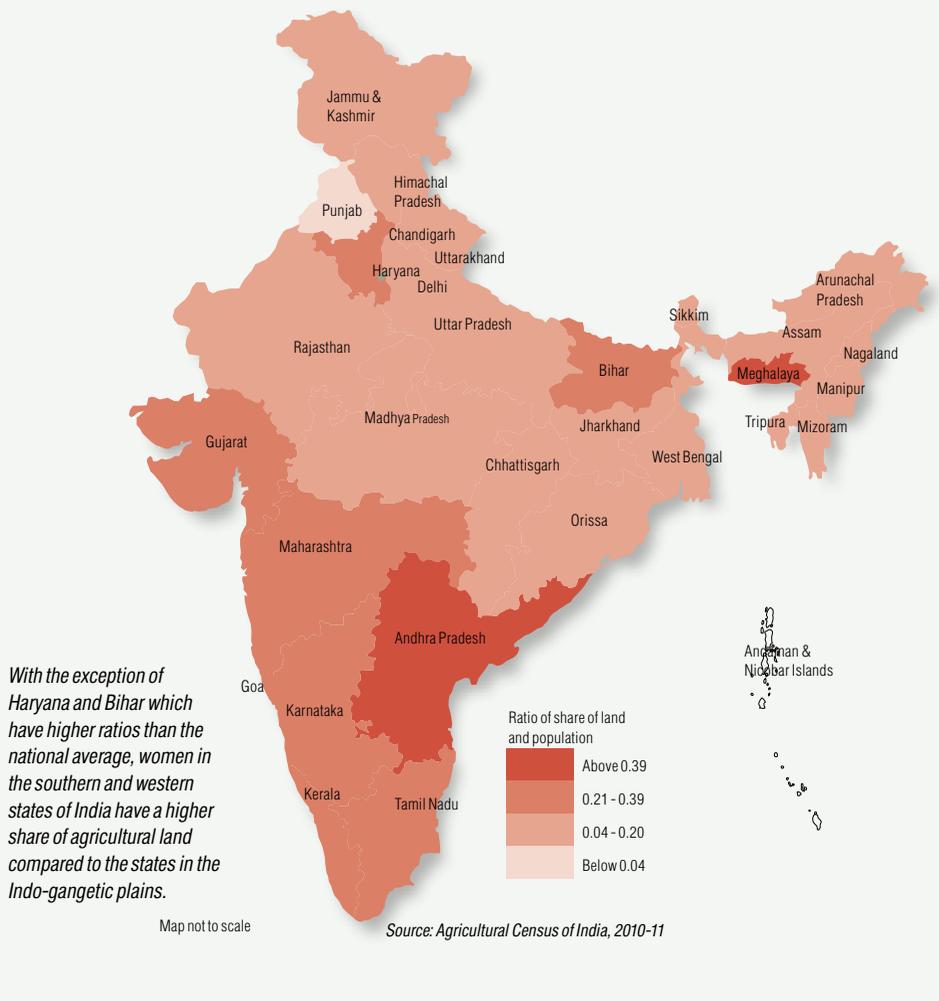
The published data that is closest to representing women's access to agricultural land is brought out by the Agricultural Census, and it enables us to understand whether the land is operated primarily by a male or a female within a household.

Figure 3 shows that there has actually been an increase in both the share of women operating land and the amount of land being cultivated by them in almost all categories over the 15 years in question. Even though this information appears to be

contradictory with the decline of women cultivators reported above from Census of India, a close look may reveal otherwise. While the Census data captures status of all individual workers, which could be recording more than one cultivator per household, the Agricultural Census does a survey of cultivating households, having one member reporting for the same. Also, the former records an individual status of work, and a worker working on own farm would be identified as a cultivator. Agricultural census, on the other hand, is broadly reflective of the person (male or female) that primarily oversees the cultivation of the household.

It is notable that as one moves from smaller to larger holdings, the share of women, both

**Fig. 4: Women's access to operational agricultural land 2010-2011**



in numbers and the land they operate, decline. This could be due to a number of reasons; there is a class-caste convergence in India, in the sense that most small and marginal holders are from lower order caste groups and marginalised ethnic groups. Systematic research has shown that, as one moves up in the class order, the patriarchal structures becomes more rigid (Chakravarty, 1983). Besides, men from poorer households are more likely to migrate out looking for better options outside villages, leaving behind women to tend to family holdings.

Irrespective of the enabling provision of the 2005 Act that is uniform across the country, women's access to agricultural land is shaped by

patriarchal norms that are cultural, and hence regionally rooted.

Figure 4 clearly indicates a north-south division in women's share of agricultural land as a ratio of their share in the population, barring a few exceptions like Haryana and Bihar that have higher ratios than the national average. In other words, in the southern and western states, the share of women as primary farmers in households is significantly higher than compared to states in the Indo-Gangetic plains. The southern and the western states, and particularly the former, are widely known to have more favourable gender relations, due to a wide range of cultural and historical reasons. The difference in marriage norms, one of expansion of

marriage ties and property accumulation through dowries in the north Indian Hindi heartland and that of consolidation within the kinship networks in southern India, among others, have known to empower married daughters with better status and effective rights over property, including land, in the southern region (Agarwal, 1994).

Unfortunately there is still a sharp division in the nature of work done by men and women. Much of the work related to tending of livestock and grading of seeds and finished horticultural and floricultural crops are done within the household premises, interspersed with domestic work. Time-use surveys are recently being used to exactly assess their contribution and overcome problems of underestimation (Hirway & Jose, 2011). The source of official data that publishes information about ownership of agricultural land, like the National Sample Survey Organisation (NSSO), provides it at the household level that blinds us to the intra-household disparities in distribution of agricultural land.

### Endnote

The way in which agrarian distress impacts women is still severely under-represented by the National Crime Records Bureau (NCRB) in its data on farmers' suicides, which discounts the possibility of suicide within such category unless the person has title to agricultural land. Women's vulnerability with respect to their position as workers, particularly in rural India and lack of effective control over agricultural land does not get the emphasis that it should, partly due to the ways in which official statistics under represent such problems in our country. Women's work in agriculture is also underestimated indirectly due to the lack of clear differentiation between the time and space in which domestic work and agricultural (and allied jobs) are done. ❏

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By SARASWATI RAJU

# SMART CITIES THROUGH THE GENDER LENS

*Smart cities are viewed essentially in terms of infrastructural facilities and 'e-amenities' aimed at improved governance, capital and investment. Although the improvement in overall governance and quality of life is laudable, understanding residents' attitudes and behaviour towards women is also crucial.*

The latest buzz with urban planners is the concept of smart cities. However, no concrete definition of what constitutes a smart city is available. According to the government official document, 'the conceptualisation of smart city varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of city residents. A smart city would have a different connotation in India as compared to say, Europe. Even in India, there is no one way of defining a smart city' (GoI, 2015).

The Smart City Mission statement (GoI, 2015) identifies adequate and assured water and elec-

tricity supply, sanitation including solid waste management, efficient urban mobility and public transport, affordable housing especially for the poor, robust IT connectivity and digitalisation, good governance especially e-Governance and citizen participation, sustainable environment, safety and security of citizens particularly for women, children and the elderly, health and education as the core concerns of a smart city.

Smart cities are thus imagined essentially in terms of infrastructural facilities and 'e-amenities' through heavy reliance on technology, capital and investment. Although the improvement in overall governance and quality of life through these means is a welcome gesture, it is also worth asking

as to whether smart cities would really be considered smart and modern if their residents continue to be bound by conventional norms and attitudes, especially towards women and the elderly.

### **The urban identity**

Urban living, particularly in cities, is identified with a certain sense of anonymity that helps people overcome their age-old practices, and triumph over socio-cultural barriers posed by caste, ethnicity, religion and gender in accessing opportunities. They are also perceived as spaces of transition between tradition and modernity. And yet, the linear trajectories of cities have long been questioned and contested. Most Indian cities are organically grown entities, embedded in their regional surroundings and retaining rural traces in their value systems. They continue to display an ambiguous mix of both, the so-called modern trends exist in close proximity with traditional behavioural norms.

In decoding this duality, the gendered lives in cities as cases in point have been studied. Cities can be smart and work as harbingers of social change and modernity provided socio-cultural constructs affecting women's lives are free from feminine and masculine stereotypes in society. One has to understand the socio-cultural confinements within which women continue to be framed in metro cities, thus curtailing the freedoms that could help realise their full potential for shaping truly smart cities.

### **Freedom and smart cities**

Amartya Sen, in his *Development as Freedom* (1999) provides a complex account of various kinds of freedom; one of which is women's freedom to participate in paid work outside their homes and its interconnections with other forms of freedom. Augmented access to employment opportunities, financial independence and progressive educational attainments witnessed in contemporary India should presumably enable women to exercise 'their reasoned agency' as Sen would argue. The question is does paid employment necessarily increase women's freedom and agency? Christine Kogge (2003) had grappled with this question almost a decade back.

Revisiting this rather old debate once again with particular reference to the information and

**Most Indian cities continue to display an ambiguous mix, all the while retaining rural traces in their value systems. Thus modern trends exist in close proximity with traditional behavioural norms.**

communications technology (ICT) and business process outsourcing (BPO) sectors will throw some light on the relationship between employment and women's freedom. These sectors are particularly referred to because at one point they heralded a whole 'new generation jobs' (Jose, 2009).

The female workforce therein consists largely of unmarried young women who are well-educated, and often technically trained. They come from urban areas, and they belong to the middle class and upper and middle castes. These combinations raise people's expectations, at least theoretically, as regards the empowered status of women. Ironically, ground realities belie such expectations.

Drawing upon a small but impressive array of literature in recent years, from metro cities in particular, it can be seen that despite the glamour and an invoked sense of articulate modernity (Tara & Ilavarasan 2011), women in information technology (IT) and BPO sectors continue to operate within a 'this far and no further' paradigm. That is to say, they can adopt certain practices but still remain confined to essentialised behavioural norms; the 'no further' limit being (re)constituted by persistent gendered constructs that continue to encode women's primary place within domesticity even as the confining vocabulary undergoes some cosmetic changes.

In Kolkata, about 450 women from the ICT and BPO sectors as well as traditional sectors such as teaching were surveyed by Tanusree Paul in her doctorate thesis *Gender and reconfigured urban*

*spaces: A case study of Kolkata.* According to her findings, more than half of the women surveyed from all sectors complained of the lack of freedom of physical mobility, as well as mobility between jobs, as a telling obstacle which hinges on their gendered identities. Marriage and the contingent array of responsibilities appeared to inhibit the careers of all women alike, particularly those working in the information technology enabled service (ITES) and retail sectors because of erratic shifts and limited weekly-offs.

Another doctorate thesis *Socio-spatial embeddedness of cities: A case study of Delhi* by Preetha Chatterjee, reaffirms how women's work is seen as a secondary source of income, and an emergency measure rather than ensuring economic returns for education and self-realisation. Academic or teaching jobs and home-based work are preferred since they can be easily combined with domestic responsibilities. Besides, they were also seen as 'safe' jobs for women as compared to jobs in ITES and media that involve free intermixing and unrestricted work schedules.

Observations on BPO services in Delhi, Bangalore, Mumbai and Chennai, which provide a broader view of the social landscape that women are anchored to in these metros, prove that the arrival of a 'new' middle class does not necessarily herald an era of unprecedented personal freedoms for women (Nadeem, 2009).

The above few examples give a glimpse of the interface between work and mobility as far as women in urban areas are concerned. What about violence against women in public places in India? A baseline survey was conducted by New Concept Information Systems (NCIS) on behalf of Jagori in 2010 (Jagori & UN Women, 2011) with respect to violence in public spaces; including the forms of harassment faced by women, the factors contributing to them, societal response, and the role of the police. This survey was conducted on 5010 men and women, cutting across class, age and profession through interviews in a variety of public spaces, including markets, parks, bus stops and residential areas. The perceptions and responses of men and by-standers are accounted too so as to gain an understanding of how the people respond to such blatant violations and not just the violations per se.

An overwhelmingly high percentage of

respondents in all categories were found to believe that sexual harassment of women was the single most important factor that rendered Delhi unsafe. Factors that contributed to lack of safety included absence of gender-inclusive and functional infrastructures. The findings revealed that buses were the most common public spaces where maximum sexual harassment occurred. The behaviour and conduct of men in public spaces, particularly on roads aggravated insecurity on the part of women.

A research study on women and public spaces in Mumbai (Phadke et al., 2013) which focused on infrastructure that facilitates access to public space for pleasure, observes that women who desire to be 'flaneurs' or 'flaneuses' (wanderers) is fraught with obstacles. Among these are ideological obstacles with regard to the 'proper' place of women as well as material obstacles such as the lack of adequate infrastructure which prevents easy wandering in the city. The researchers argue that the right to pleasure, by default, must include the right against violence which can be checked with adequate infrastructural provisions such as better transport, proper street lighting, public toilets and policies recognising people's fundamental right to access public space. It is the city administration's responsibility to provide these facilities. According to the researchers, public spaces and infrastructure are usually designed for an abstract generic user, which essentially is the male. Not just gender, but all manner of politics; class, caste, religious, sexual, physical ability, etc. are part of imagining this 'neutral' user.

Non-availability of adequate infrastructure for women is often justified by planners and decision-makers in terms of women's absence in public spaces. This argument can be turned on its head, if women users were to be asked this question. They may argue that the lack of public toilets makes it even harder to access and utilise public spaces at night. Attitudinal changes are often seen as time-consuming, but the provision of infrastructure can be a simple one-time administrative policy decision to facilitate legitimate access for women to public spaces (Phadke et al., 2013).

### **Plight of the Elderly**

India's metro cities are not unsafe just for women, but for the aged population too. According to National Crime Records Bureau (NCRB) data for

# Cities can be smart and work as harbingers of social change provided socio-cultural constructs affecting women's lives are free from stereotypes.

2014, Delhi is the most unsafe city as regards the overall number of crimes against senior citizens. It is estimated that 'with a rate of 89 crimes per 1 lakh elderly population, senior citizens in the National Capital are almost five times more likely to become the victim of a crime as compared to the rest of India' (Tiwari, 2015).

In a 2011 HelpAge India study (Mishra et al., 2013) conducted in 12 major Indian cities, different kinds of abuses against elderly people were recorded. It found that 60 per cent of the elderly are abused verbally, 48 per cent physically, and about 35 per cent emotionally and economically. Furthermore, the study added major types of crimes faced by the elderly are burglary, molestation and criminal acts.

## Endnote

For smart cities to be really smart, the vision of the Mission should embrace people and citizens at large. Women and the elderly, in particular, will have to be kept at the heart of the planning to totally wipe off all traces of an environment that facilitates crime, molestation and insecurity. It must be capable of inspiring confidence, and not fear among women, and senior citizens. Enhancement of technology can only add, but never replace such concerns. 

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By **SHAHNAWAZ**

# GEOSPATIAL CAREERS: Opportunities and Challenges

*The geospatial sector has grown sizeably in the past two decades. But its future seems bleak without enough trained personnel to fill new positions. Geospatial education may need to be revamped with flexibility in curricula design, enhancement of academia-industry interaction, with emphasis on a lifelong learning process to meet this challenge.*

India has experienced substantial expansion of the geospatial sector and the resultant job-market over the last two decades. With the help of the information technology (IT) sector and India's space programmes, the sector has experienced continual growth. In fact, the market share of geospatial based technologies in India is estimated to touch the 10 billion USD mark by 2019 (FICCI, 2013).

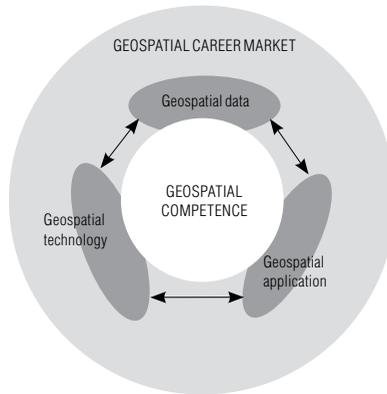
Several landmark policy changes by the Government of India have given a boost to this sector which, among others, include the National Map Policy

2005 (GoI, 2005), Remote Sensing Data Policy 2011 (GoI, 2011), and National Data Sharing and Accessibility Policy 2012 (GoI, 2012). India's far sighted vision regarding national geographic information system (GIS) has especially thrilled leading global players (ESRI, 2014) and earned accolades too.

## **Drivers of the Geospatial Job Market**

The geospatial career market is extremely dynamic and is largely influenced by three main drivers; geospatial data, geospatial technology and geospatial applications (Fig. 1).

**Fig. 1: Drivers of geospatial career market**



*The geospatial market is controlled by three drivers that have an interactive relationship with each other. The change in one driver affects the other two. And the overall competency is dependent on the efficacy of the drivers.*

These drivers continuously interact with each other, and hence, a change in any one of the three triggers a change in the other two. For example, availability of a new type of data requires new software capabilities for processing and analysis, and a combination of these two facilitates expansion in new areas of application. Similarly, emergence of a new area of application may require a new type of data and new software capabilities.

Of course, these changes may create a demand for 'ready-to-deliver' geospatial professionals with the required competencies. Where existing professionals are concerned, their readiness in taking on challenges will depend on how much they engage themselves in 'lifelong learning' to enhance their skills.

Opportunities in the geospatial sector for fresh graduates are dependent not only on what has been learnt in the course of their degree, but also on whether their skills acquired are suitable for their jobs or not. This implies that existing professionals as well as beginners need to continuously upgrade their geospatial competencies in tune with the changing dynamics of the job market.

### **Workforce Situation**

Realising the challenges of producing geospatial professionals, the Indian Government constituted the National Task Force on Geospatial Education in 2010 under the Ministry of Human Resource Development, which submitted its report in 2013 (GoI, 2013). The then availability of geospatial

workforce was assessed at between 22000 and 31000 persons, with additional demand for skilled personnel estimated to reach 7000 to 9000 persons per annum by the end of 2015.

There was some apprehension whether this additional demand for skilled personnel could be met suitably. The taskforce had observed that 'currently, the education system is not performing at the desired level for meeting the nation's needs' (GoI, 2013). The ramifications of this are reflected in the lack of confidence of the geospatial industry in the local professionals available and the acute shortage of 'fit-for-job' professionals. Although initiatives for extended geospatial literacy and basic disciplinary knowledge are already in place (Jain, 2011; Kumar et al, 2014) to attract aspirants toward this sector in future, the numbers of geospatial professionals required for taking the industry to the next level remains unfulfilled.

The situation draws attention to the role higher education institutions can play in imparting industry-oriented geospatial education so that fresh graduates can immediately 'jump-start' their career in the readily available geospatial career market.

### **Education Scenario**

Technology and engineering institutions in India had initiated geospatial courses and study programmes (such as GIS, remote sensing, geoinformatics, geomatics) far ahead of universities. However, such institutions and their students are

# The geospatial sector in India has achieved significant expansion. But, its future growth and progress will depend on the availability of competent geospatial professionals.

few in number. Universities continue to debate on whether GIS is a technology, science or a tool and whether its inclusion in the curriculum of a particular discipline is justified. Since geography is the closest to geospatial education, it could be the first discipline to incorporate geospatial education within its academic domain.

But the situation shows that “geography teaching and research in India has been facing innumerable internal and external challenges. Internal challenges pertain to a feeble response and preparation for introducing appropriate changes in the teaching curriculum at the school, college and university levels in the light of the changing nature of the discipline globally, and its relevance in addressing contemporary issues at the global and local levels” (Sinha, 2014).

Although this situation is definitely not progressive, it seems somehow better than that in universities which introduced the course. “The curriculum in most of the Universities was designed by diluting the technical aspects of geospatial science and not updated as per the current developments in the field” (Shekhar, 2014). As a result, fresh graduates who have acquired geospatial education remain confused about the availability of appropriate jobs. The real problem, though, is that such job seekers have none or very little ‘hands-on’ practical skills, which are essential in this field. This prevents them from landing geospatial jobs in keeping with the requirements of the job market.

We may thus question who is responsible for this

situation, students or higher education institutions or both. Of course the responsibility lies with the higher education institutions since the curricula are designed by them, and students have little choice in the matter except for learning what is offered.

## Possible Solutions

◆ **Flexible Curriculum Design:** There is no doubt that a large number of geospatial career opportunities are available in India, even as there are rapid changes observed in the skill level requirements. Updating curricula in keeping with the pace of change in the job market is near impossible. However, the curricula can be designed in a way that frequent revisions are not needed, and there is always some space for emerging topics to be incorporated. This could be done by grouping various courses under compulsory and elective subjects (Shahnawaz, 2010), wherein electives could be introduced in keeping with emerging needs. Apart from including practical exercises, at least one separate course should be focussed on enhancing job oriented ‘hands-on’ practical skills, wherein students could be asked to select a project based on the current requirements in the job market.

◆ **Responsible Academia-Industry Interaction:** Even as geospatial career opportunities multiply in India, there is little, if any, interaction between higher education institutions and the geospatial industry. Consequently, teachers and students remain largely unaware of current developments in the industry, preventing students from landing appropriate jobs. This problem can be overcome through enhancing academia-industry interaction for the mutual benefit of both the industry and teachers. This will also enable teachers incorporate necessary changes in their teaching process and equip students with the right skills for appropriate jobs.

◆ **Indulging in Lifelong Learning:** It should be remembered that there is hardly anything that can be termed an ‘end product’ in education and learning, especially in the IT-based sectors. The geospatial career market demands frequent enhancement of skills and qualifications, although this is rarely possible for ‘on-the-job’ professionals. Fortunately, the availability of internet has facilitated access to a wide range of resources and made ‘online distance learning’

# Universities continue to debate on whether GIS is a technology, science or a tool and whether its inclusion in the curriculum of a particular discipline is justified or not.

possible anywhere in the world. Learners can take advantage of various online distance education programmes conducted by reputed international institutions while continuing 'on-the-job' and 'with-the-family' (Shahnawaz, 2013, 2010). Such 'lifelong learning' can help professionals remaining 'fit-for-job' to climb up the professional ladder.

## Endnote

The geospatial sector in India has achieved significant expansion and growth. But, its future growth and progress will depend on the availability of highly competent geospatial professionals. For this, the higher education institutions will need to respond to the educational demands of this sector, along with students, professionals and employers playing their roles responsibly to take this sector to the next level. 

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By SARFARAZ ALAM

# Place of Geography in School Curriculum

*Epistemically, geography is an inclusive subject. It encompasses the entire observable domain of the earth's surface, and is practised as part of science, social science, arts as well as technology in universities worldwide. Unfortunately in India, it is mainly taught as a social science discipline in schools.*

**G**eography is an important school subject. However, considerable ambiguities persist in its exact position within academia. As an inclusive discipline, the content of geography is derived from various subjects in the sciences, social sciences and humanities. This is equally true about the geography syllabus in schools as well. As a result, geography is still dogged by questions of how the discipline is to be categorised; whether in the natural or the social sciences (Bhog et al., 2012).

The subject, hence, occupies an uncertain place in school curricula, with its academic location varying across various school boards and stages (i.e. primary, secondary and higher secondary) in education.

## Place of geography in school curricula

Globally, geography is taught either as an independent subject or within an integrated framework. In the secondary school stage, geography is mainly taught as one of a group of subjects called social science or as part of earth science or natural science. In the integrated curriculum, geographers are mainly concerned with the role

of geography in relation to other subjects.

According to Molly Long (1974) the following different types of integrated studies of geography are the norm:

- ◆ **Environmental Studies:** Geography is taught as part of environmental related curricula.
- ◆ **Social Studies or Humanities:** Geography is commonly combined with history or civics.
- ◆ **Inter-disciplinary enquiry:** This is an enquiry-based learning. Here subjects are studied in parallel, so that the relationship may be stressed, and differences preserved rather than blurred. The study may or may not be topic-based (Naish, 1972).
- ◆ **The core curriculum:** The proponents of this type of integrated curriculum insist that there be a central core or pivot around which to expand in ever-widening circles. Geography forms a bridge subject at the very hub of the curriculum, expanding outwards into mathematics, science, history and the fine arts.
- ◆ **'Nuffield science':** The resource material prepared in connection with this project is related to a few themes from which teachers choose items for their own syllabi and teach them with the degree of emphasis appropriate

**Table 1: Teaching of geography in Indian schools.**

Stage	Geography is taught			
	1	2	3	4
	Compulsory subject by incorporating in other subjects	Compulsory subject as a separate subject	As an integrated subject	Both (2 & 3)
Primary	√	X	X	X
Upper Primary (6-8)	X	√	√	√
Lower Secondary (9-10)	X	√	√	√
Secondary (6-10)	X	X	X	√
Higher secondary	X	√	X	X

Source: (Alam, 2015a)

to their own knowledge and interest. A few of these themes are designed for the geography teacher (the earth's crust, the earth's place in the universe, climate of the earth, etc.) and his expertise may well be called upon in tackling some other related issues as well (e.g. biosphere, energy, etc.). The boundaries between subjects are blurred, and the topics of greatest interest lie at the interfaces of the traditional science disciplines. The emphasis is on team teaching. Thus, topics pertaining to population explosion, environmental degradation, and poverty impose themselves upon every area of the science curriculum, and bring in possibilities of team teaching.

- ◆ **The multi-disciplinary approach:** Here material is fused around topics or ideas using a project approach in an attempt for 'integration'. Ideas, methods and concepts from a variety of subjects are employed, with no attempt to clearly distinguish between them (Naish, 1972).

### Place of geography in Indian schools

The place of geography in India is not uniform. It is also not fixed. *The Report of the Education Commission, 1964-66* (1966) had recommended the following methods for social study, of which geography is a part:

*At the lower primary stage, the integrated approach is desirable. Instead of giving the pupils miscellaneous and unrelated bits of information in history, geography and civics, it is far better to provide a coordinated programme of social studies centering around the study of man and his environ-*

*ment. In the upper classes of the primary schools, the content of social studies may still be organised as an integral whole in connection with the treatment of certain topics, but the pupils should be gradually introduced to an appreciation of history, geography and civics as separate subjects. In the secondary schools, these subjects will be treated as separate disciplines and form the basis of specialized studies in social sciences at the higher secondary stage.*

As mentioned earlier, geography is treated differently at different stages of school. At the primary level, geography is generally not taught, and is introduced only at the upper primary stage. In classes I to V, geography topics are taught as part of environmental studies under all school boards.

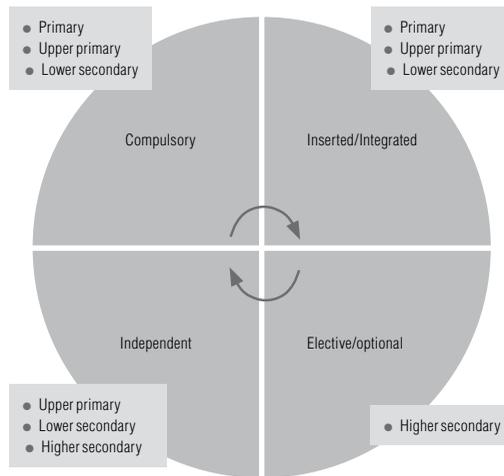
There is a notable exception, though. In textbooks prepared under the aegis of the *Saraswati Vidya Mandir* in Uttar Pradesh, geography is an independent subject. Separate textbooks for geography are prescribed for grade IV (*Hamara Uttar Pradesh*) and grade V (*Bharat Bhumi ka Bhugol*).

A study (Alam, 2015) shows the place of geography in school curricula under various Indian school boards. In the upper primary and secondary stages in various boards, geography is a part of social studies. It is only in the higher secondary level that geography is elevated into a separate optional subject in its own right. However, at all stages, it is imparted a relatively marginal position in school curricula.

Table 1 and Figure 1 clearly shows that geography is taught in the following combinations:

- ◆ **Compulsory but inserted:** In some school

**Fig. 1: Illustrative representation of teaching of geography in Indian schools**



**Table 2: Place of geography in school curriculum**

How should Geography be taught at school level?	Number	Percent
No Answer	8	4.7
Integrated with subjects of social science/studies	83	48.8
Integrated with science disciplines	13	7.6
Independently	64	37.6
Integrated with subjects of social science/studies + Integrated with science disciplines	2	1.2
<b>Total</b>	<b>170</b>	<b>100.0</b>

Source: (Alam, 2015a)

boards, the separate identity of geography is not recognised at the primary levels. Nevertheless, geography remains important. Therefore, compulsory lessons on geography are inserted within subjects, such as environmental studies or humanities.

◆ **Compulsory but integrated:** In most school boards of India, geography is taught as a compulsory subject in the upper primary and lower secondary stages. But it is not recognised as a separate subject, but taught instead as an integrated subject. Thus, we have geography integrated into environmental science (Bihar Board) or social sciences (Punjab Board). In Kerala Board, geography is a compulsory subject up to class X. However, it is taught as an integrated subject up to class VIII and thereafter, taught as social science. In many secondary schools, geography is integrated into social studies.

◆ **Compulsory and independent:** In most school boards of India, geography is taught as a compulsory subject in the upper primary and lower secondary stages. But it is taught as an independent subject, as a part of social science (e.g. CBSE, ICSE).

◆ **Independent but optional:** In higher secondary schools of all Indian school boards, geography is taught as an independent elective/optional subject. However, very few higher secondary schools actually offer geography as a subject.

### Place of geography

Hence, it is apparent that given its inclusive nature, the place of geography in school curricula has always been a debatable issue. About 170 school teachers (of as many secondary schools) teaching geography were asked as to how geography should be taught at the school stage (Table 2).

# There is an immediate need to introduce a subject-based national curriculum for geography in all secondary schools in India.

More than half of them (57.6 per cent) opined that it should be taught as an integrated subject. Of these, 48.8 per cent felt that it should be taught as a part of social science/studies. The outcome is no surprise, since most teachers who participated in the survey were arts and social science graduates. Only 7.6 per cent of the teachers felt that geography ought to be taught as a science subject. Only (1.2 per cent) felt that given its inclusive nature, geography could be taught both as part of social science and science. A very significant proportion of teachers (37.6 per cent) were of the opinion that geography is best taught independently. Eight teachers did not answer this question which could possibly be due to the fact that most of them are not geography graduates and therefore do not share an affinity to the subject

From the above discussion, it is clear that the place of geography varies considerably across different school boards and various stages of schooling (from primary to higher secondary). Some of the factors are:

- ◆ the nature of geography itself has not been made clear by geographers and curriculum planners. Therefore, its role in schools, even if well recognized, is not well defined;
- ◆ there is no easy consensus on the place of geography in school curricula.
- ◆ in some school boards, the significance of geography is marginalised by inserting geography topics into subjects such as world studies, environmental studies, and the like;
- ◆ due to lack of requisite training and resources, there is lack of rigour in integrated social science. The teaching of geography in particular suffers a lot;
- ◆ integrated social science means geography is also taught by teachers who may have gradu-

- ated in social science subjects such as history, political science or economics; and
- ◆ there is no academic justification in teaching geography as just a social science subject.

## Endnote

In order to address the place and significance of geography in academic curriculums clearly, geographers, planners and curriculum experts need to (re)define geography rightly and accurately. And there is also an immediate need to introduce a subject-based national curriculum for all secondary schools in the country keeping in mind such curriculum-related problems. ❏

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By STAFF REPORTER

# INITIATIVES to Reduce IMR and MMR

Various health care schemes of the Indian government are aimed at reducing the maternal mortality ratio (MMR) and infant mortality rate (IMR) in the country. Special focus is being given to states with poor public health indicators and high numbers of people living below the

**A**ccording to the Report of Registrar General of India, sample registration system (RGI-SRS), the maternal mortality ratio (MMR) of India for the period 2011-13 stood at 167 per 100,000 live births (Table 1), while the infant mortality rate (IMR) for 2013 stood at 40 per 1000 live births (Table 2).

Given the high rate of MMR and IMR, the National Health Mission (NHM) of the Indian government, has implemented certain programmes and schemes to tackle the problem. Special focus is on states with poor public health indicators such as Bihar and Odisha.

The various schemes and initiatives are:

- ◆ Promotion of institutional deliveries through Janani Suraksha Yojana (JSY) among poor pregnant women.
- ◆ Pregnant women delivering in public health institutions under the Janani Shishu Suraksha Karyakaram (JSSK) are entitled to absolutely free/no expense delivery, including caesarean sections. The initiative stipulates free diet drugs, diagnostics and blood, besides free transport from home to institution, or between facilities in case of a referral and drop back home. Similar entitlements have been put in place for ante-natal

and post-natal complications during pregnancy and all sick infants accessing public health institutions for treatment.

- ◆ Capacity building of bachelor of medicine and bachelor of surgery (MBBS) doctors in anaesthesia (LSAS) and obstetric care including C-section (EmOC) skills to overcome the shortage of specialists, particularly in rural areas.
- ◆ Capacity building of staff nurses (SN) and auxiliary nurse midwifery (ANM)

and skilled birth attendants (SBA) under the Dakshata programme to equip them for conducting normal deliveries, identifying complications and if needed, making referrals at the earliest to higher facilities.

- ◆ A new initiative for setting up of skill labs with earmarked skill stations for different training programmes in states with the necessary allocation of funds under NHM.
- ◆ Operationalisation of adequate numbers of primary health centres for round-the-clock basic emergency obstetric care services.
- ◆ Operationalisation of adequate numbers of first referral units (FRU) for round-the-clock comprehensive emergency obstetric care services.
- ◆ Establishing maternal and child health (MCH) wings at high case load facilities to improve the quality of care provided to mothers and children.
- ◆ Name-based web enabled tracking of pregnant women and new born babies for regular and complete services.
- ◆ Mother and child protection card in collaboration with the Ministry of Women and Child Development to monitor service delivery for mothers and children.
- ◆ Engagement of more than 9.15 lakh accredited social health activists (ASHAs) to

generate demand and facilitate accessing of health care services by the community.

- ◆ Village health and nutrition days in rural areas as an outreach activity.
- ◆ Health and nutrition education through information education communication (IEC) and behaviour change communication (BCC) to promote dietary diversifica-

**Table 1: Maternal mortality ratio: India and select state wise as per RGI (SRS) 2007-09<sup>1</sup>, 2010-12<sup>2</sup>, 2011-13<sup>3</sup>).**

States	MMR <sup>1</sup>	MMR <sup>2</sup>	MMR <sup>3</sup>
India Total	212	178	167
AS	390	328	300
BR	261	219	208
JH	261	219	208
MP	269	230	221
CG	269	230	221
Odisha	258	235	222
RJ	318	255	244
UP	359	292	285
UK	359	292	285
AP	134	110	92
KA	178	144	133
KL	81	66	61
TN	97	90	79
GJ	148	122	112
HR	153	146	127
MH	104	87	68
PB	172	155	141
WB	145	117	113

An overall decline in MMR is observed over the period from 2007-13. Assam records the highest MMR while Kerala shows the lowest. Maharashtra followed by Andhra Pradesh maps the highest decline in MMR. The other end of the spectrum is occupied by Odisha followed by Haryana which records the lowest decline in MMR. Under the Millennium Development Goals (MDGs), the MDG 5 target is to reduce MMR by three quarters between 1990 and 2015. This translates to reducing the MMR from 560 in 1990 to 140 in 2015. India is likely to reach an MMR of 140 if the current compound rate of annual decline continues. Source: Ministry of Health and Family Welfare, 2015.

tion, inclusion of iron and folic acid-rich food as well as food items which promote iron absorption.

- ◆ Distribution of long lasting insecticide nets (LLINs) and insecticide treated bed nets (ITBNs) to prevent the problem of anaemia in pregnant women due to malaria.
- ◆ Distribution of safe motherhood booklets to pregnant women to educate them on dietary diversification and consumption of iron and folic acid (IFA).
- ◆ Operationalisation of comprehensive abortion care services and reproductive tract infections and sexually transmitted infections (RTI/STI) at health facilities with a focus on 'delivery points'.
- ◆ Supporting of over 21,000 ambulances under NHM to interalia transport pregnant women to institution for delivery and also for referral.
- ◆ Newer operational guidelines prepared and disseminated to states for screening, diagnosis and management of gestational diabetes mellitus (GDM) and hypothyroidism during pregnancy, calcium supplementation during pregnancy and lactation, de-worming during pregnancy, maternal near miss (MNM) review, screening for syphilis during pregnancy, uterotonic use during labor and prevention and management of primary health centres.
- ◆ Facility based newborn care (FBNC) at different levels to reduce child morbidity and mortality, besides special new born care units (SNCUs), newborn stabilisation units (NBSUs) and newborn care corners (NBCCs) for sick

newborns at different levels.

- ◆ Home based newborn care (HBNC) through ASHAs at the community level and early detection and referral of sick new born babies.
- ◆ Launching of India Newborn Action Plan (INAP) to reduce neonatal mortality.
- ◆ Newer interventions to reduce newborn mortality using vitamin K injections at birth, antenatal corticosteroids for preterm labour, kangaroo mother care and injection gentamicin to young infants in cases of suspected sepsis.
- ◆ Observation of intensified diarrhoea control fortnight (IDCF) to focus on oral rehydration salts (ORS) and zinc distribution for management of diarrhoea.
- ◆ Launching of integrated action plan for pneumonia and diarrhoea (IAPPD) in four states with highest child mortality (Uttar Pradesh, Madhya Pradesh, Bihar and Rajasthan).
- ◆ Establishment of nutritional rehabilitation centres (NRCs) for management of severe acute malnutrition in children.
- ◆ Promotion of appropriate infant and young child feeding practices.
- ◆ Operationalisation of the Rashtriya Bal Swasthya Karyakram (RBSK) for health screening and early intervention services to provide comprehensive care to all children in the 0-18 years age group. The purpose of these services is to improve the overall quality of life for children through early detection of birth defects, diseases, deficiencies, and development delays, including disability.
- ◆ Implementation IFA supplemental programme under the national iron plus initiative

# The **Indian** government envisages to **engage** 9.15 lakh ASHAs to help communities to access **better health** care.

**Table 2: Infant mortality rate, India and state wise as per the SRS reports 2010-2013.**

State/UTs	2010	2011	2012	2013
India	47	44	42	40
Bihar	48	44	43	42
Chhattisgarh	51	48	47	46
Himachal Pradesh	40	38	36	35
Jammu & Kashmir	43	41	39	37
Jharkhand	42	39	38	37
Madhya Pradesh	62	59	56	54
Odisha	61	57	53	51
Rajasthan	55	52	49	47
Uttar Pradesh	61	57	53	50
Uttarakhand	38	36	34	32
Arunachal Pradesh	31	32	33	32
Assam	58	55	55	54
Manipur	14	11	10	10
Meghalaya	55	52	49	47
Mizoram	37	34	35	35
Nagaland	23	21	18	18
Sikkim	30	26	24	22
Tripura	27	29	28	26
Andhra Pradesh	46	43	41	39
Goa	10	11	10	9
Gujarat	44	41	38	36
Haryana	48	44	42	41
Karnataka	38	35	32	31
Kerala	13	12	12	12
Maharashtra	28	25	25	24
Punjab	34	30	28	26
Tamil Nadu	24	22	21	21
West Bengal	31	32	32	31

*As per Sample Registration System (SRS) Report 2013, nine states have already achieved Millennium Development Goals (MDG 4) target (to reduce IMR below 29)—Kerala, Tamil Nadu, Delhi, Manipur, Maharashtra, Nagaland, Tripura, Sikkim, Punjab. In all four years, Goa registers the lowest IMR and Madhya Pradesh registers the highest. Overall, there is a decline in IMR except in Arunachal Pradesh and Tripura which marked a slight increase during the given period. Source: Ministry of Health and Family Welfare, 2015.*

(NIPI), through a life cycle approach. Age and dose specific IFA supplementation programme is being implemented for the prevention of anaemia among vulnerable age groups such as under-5 children, children in the 6–10 years age group, adolescents,

pregnant and lactating women, and women of reproductive age.

- ◆ Training of doctors, nurses and ANMs for essential newborn care, early diagnosis and management of common ailments among children under the Navjaat Shishu Suraksha Karyakram (NSSK), integrated management of neonatal and childhood illnesses (IMNCI), facility based newborn care (FBNC), infant and young child feeding practices (IYCF).
- ◆ Reproductive maternal newborn child health + adolescent (RMNCH+A) interventions for achieving improved maternal and child health outcomes.
- ◆ Identification of 184 high priority districts (HPDs) for focused monitoring and supportive supervision for improved maternal and child health outcomes in low-performing areas.

## Endnote

The Indian government has embarked on a National Health Mission (NHM), assisted by various new and ongoing schemes, to bring down maternal and infant mortality in India. These cover the entire gamut of essential services to ensure a healthier new generation of Indians. However, it is important that there is continuum of care maintained, and the focus especially in low-performing regions is never lost. Only then can India repay the results of this initiative. 

*Inputs from Ministry of Health and Family Welfare, Government of India, March 2016.*

By STAFF REPORTER

# GOVERNMENT INITIATIVES FOR CANCER TREATMENT IN INDIA

**A**ccording to the Indian Council of Medical Research (ICMR), the number of patients suffering from cancer (prevalence) for all states in 2012, 2013 and 2014 (Fig. 1) has shown a steady rise. In keeping with this disturbing trend, the central and state governments have initiated several programmes and interventions right up to the district level to help individuals and families to cope with the problem throughout the length and breadth of the country.

## Government Initiatives

At present, the objectives of the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) are being implemented under

The central and state governments have been running several programmes to help cancer patients.

Subsidised treatment and palliative care for cancer are already in place. The AMRIT venture is a step in the right direction to make expensive medicines affordable for patients nationwide.

the National Health Mission (NHM). The components of the programme include awareness generation for cancer prevention, screening, early detection and referral to an appropriate institution for treatment. For cancer, the focus is on three common types of cancer; breast, cervical and oral cancer.

In 2013-2014, a 'Tertiary Care for Cancer' scheme was put into operation, under which state cancer institutes (SCI) and tertiary care cancer centres (TCCC) in different parts of the country are to be set up. The maximum assistance inclusive of state share for each SCI is up to INR 120 crore, for TCCC, it will be up to INR 45 crore, subject to eligibility as per scheme guidelines and availability of funds. Following the WHO Framework Convention on Tobacco Control

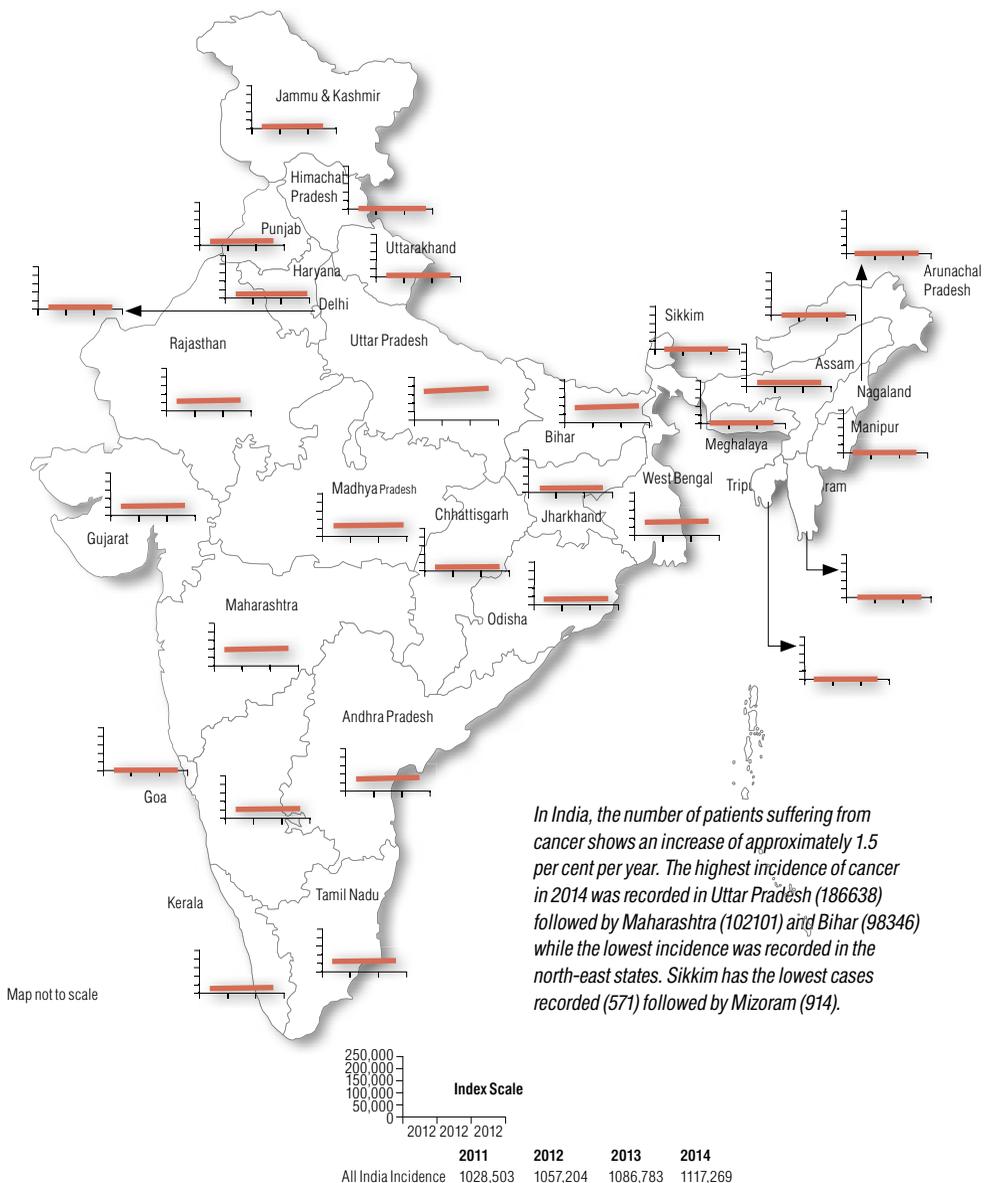
(FCTC), the government had also launched the National Tobacco Control Programme in 2007-08 to create awareness about the harmful effects of tobacco consumption, reduce the demand and supply of

tobacco products, and ensure effective implementation of the provisions under 'The Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply

and Distribution) Act, 2003' (COTPA) to help people quit tobacco through tobacco cessation centres.

To meet the financial demands for cancer treatment, financial assistance is provided to below

**Fig. 1: State wise estimated incidence of cancer cases in India (2011-2014)**



Source: Ministry of Health and Family Welfare, March 2016.

# The opening of more government-funded cancer hospitals may ease the burden of below poverty line patients.

poverty line (BPL) patients under the Rashtriya Arogya Nidhi (RAN). Besides this, the Health Minister's Cancer Patient Fund (HMCPF) within the Rashtriya Arogya Nidhi was set up in 2009 wherein 27 erstwhile regional cancer centres (RCCs) were provided with revolving funds to provide immediate financial assistance upto INR 2 lakh to BPL cancer patients.

Under the National Health Mission, assistance for palliative care is also provided for by the government. The state bodies can incorporate their proposals related to initiation/enhancement of palliative care services within their respective state project implementation plans in coordination with the Mission.

Moreover, amendments were effected in the Narcotic Drugs and Psychotropic Substances (NDPS) Act, 1985 in 2014, to remove the regulatory barriers for access to morphine and other opioids for medical needs such as pain relief and palliative care.

## Government institutes

Cancer treatment in government hospitals is either free or subsidised. In addition to cancer diagnosis and treatment by the state government health institutes, central government institutions such as the All India Institute of Medical Sciences

(AIIMS), Safdurjung Hospital, Dr Ram Manohar Lohia Hospital, PGIMER Chandigarh, JIPMER Puducherry, Chittaranjan National Cancer Institute (CNCI) Kolkata, provide facilities for diagnosis and treatment of cancer.

In AIIMS and many upgraded institutions under Pradhan Mantri Swasthya Suraksha Yojna (PMSSY), there are advanced facilities for oncology treatment. The Indian government has approved plans to set up National Cancer Institute at Jhajjar (Haryana) and set up a second campus of Chittaranjan National Cancer Institute, Kolkata.

The government has also set up an Affordable Medicines and Reliable Implants for Treatment (AMRIT) outlet at AIIMS, New Delhi to make generic medicines available for cancer and other treatment at affordable prices. Approval has also been accorded for opening of such outlets at six new AIIMS and major central government hospitals. Further, HLL Lifecare Ltd, a government owned public sector unit (PSU) under the Ministry of Health and Family Welfare, has been directed to contact all states interested in setting up AMRIT outlets in major state government hospitals/institutions. As per the approval accorded for setting up AMRIT, the prices of medicines at these outlets are to

be reasonable and significantly lower than the market price, an objective primarily aimed to help those suffering from cancer and cardiovascular diseases.

The list of medicines specified in the National List of Essential Medicines (NLEM) which are included in the First Schedule of Drug Pricing Control Order (DPCO), 2013 also contain drugs used for the treatment of cancer. NLEM (drug formulations) medicines for which ceiling prices have been notified under DPCO, 2013, includes 47 anti-cancer medicines. Such efforts have been made to cut down and regulate the prices of cancer related medicines which are generally too expensive for most patients to afford.

## Endnote

The rising numbers of those afflicted with cancer poses a major concern for the government, notwithstanding various initiatives and programmes directed to help patients and their families. Well-equipped government-funded cancer hospitals and institutes, with adequate numbers of trained staff are the need of the hour, if the battle against the dreaded disease is to be won. ■

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*Inputs from Ministry of Health and Family Welfare, Government of India, March 2016.*

By STAFF REPORTER

# Tuberculosis Cases: WHO Reports a Decline

**T**uberculosis (TB) is a major global health problem. It causes ill-health among millions of people each year and ranks alongside the human immunodeficiency virus (HIV) as a leading cause of death worldwide. According to the WHO Global TB Report 2015, there were an estimated 9.6 million new TB cases—5.4 million among men, 3.2 million among women and 1.0 million among children in 2014. There were also 1.5 million TB deaths (1.1 million among HIV-negative people and 0.4 million among HIV-positive people), of which approximately 890 000 were men, 480 000 were women and 140 000 were children. The number of TB deaths is unacceptably high. But timely diagnosis and correct treatment can easily cure TB.

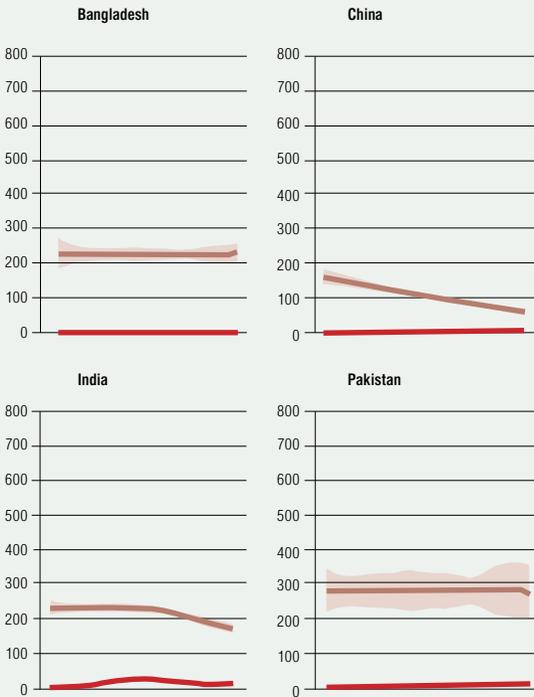
Despite advances in prevention, diagnosis and treatment tuberculosis remains one of the world's biggest threats with 1.5 million tuberculosis deaths in 2014. In India it has declined from 216 per lakh population per year in 1990 to 167 in 2014.

The burden of TB can be measured in terms of incidence, which is defined as the number of new and relapse cases arising in a given time period, usually one year. Prevalence of the disease is defined as the number of cases of TB at a given point in time; while mortality is defined as the number of deaths caused by TB in a given time period, usually one year.

## **TB Incidence**

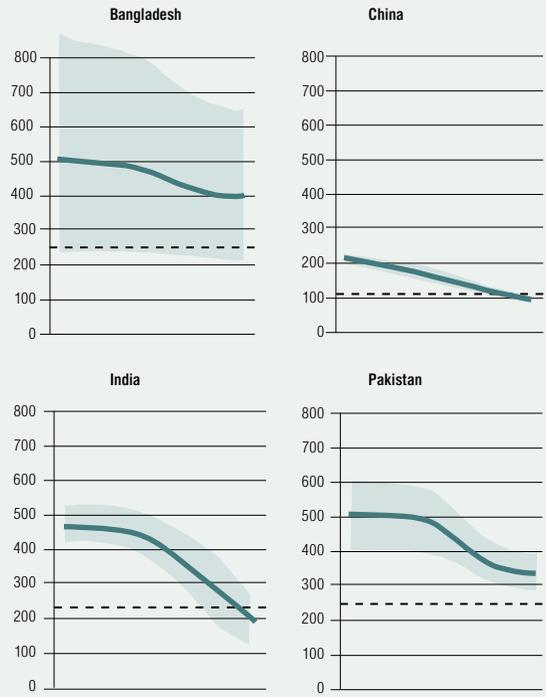
Notifications of TB cases provide a good proxy indication of TB incidence in countries that have both high-performance surveillance systems (for example, there is little under-reporting of diagnosed cases) and where the quality of and access to health care means that some cases may not be diagnosed. In several countries where these criteria are not yet met, better estimates

**Fig. 1: Estimated TB incidence rates of four high burden countries (HBCs), 1990–2014. Estimated TB incidence rates (brown) and estimated incidence rates of HIV-positive TB (red). Shaded areas represent uncertainty bands.**



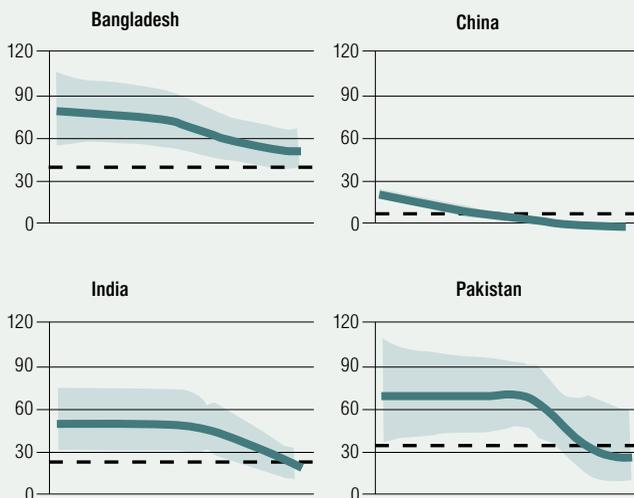
Among select Asian countries, China shows a deeper decline in incidence rate in the given period. India's TB incidence rate was high in 1990, though post-2005 marked slow decline. HIV positive TB rate increased from 2000 to 2009 and then started declining post-2009. TB incidence rates in Bangladesh and Pakistan remained high throughout the given period.

**Fig. 2: Estimated TB prevalence rates 1990–2015 of four HBCs. Shaded areas represent uncertainty bands. The horizontal dashed lines represent the Stop TB Partnership target of a 50 per cent reduction in the prevalence rate by 2015 compared with 1990.**



China shows a sharp and consistent decline in prevalence rate. It reached the 50 per cent reduction target in 2010. India's prevalence rate was initially high but gradually declined and crossed the 50 per cent reduction target in 2012. Both Bangladesh and Pakistan did not reach the 50 per cent reduction target, though they showed a gradual decline.

**Fig. 3: Estimated TB mortality rates 1990–2015 of four high burden countries (excludes TB deaths among HIV-positive people). The horizontal dashed lines represent the Stop TB Partnership target of a 50 per cent reduction in the mortality rate by 2015 compared with 1990.**



China's TB mortality showed a consistent decline. It reached the 50 per cent deduction target in 1999. India's mortality rate was high in the beginning but gradually declined and crossed the 50 per cent reduction target post-2010, ten years after China. Pakistan reached the 50 per cent reduction target in 2010 after a sharp decline post-2003. Bangladesh has shown a slow decline, although it is yet to achieve a 50 per cent reduction.

of TB incidence can be obtained from an inventory study which is a survey to quantify the level of under reporting of detected TB cases. If certain conditions are met, capture-recapture methods can also be used to estimate TB incidence.

The Millennium Development Goals (MDG) target to halt and reverse TB incidence has been achieved on a worldwide basis, in each of the six WHO regions and in 16 of the 22 high-burden countries that collectively account for 80 per cent of TB cases. Globally, TB incidence has fallen by an average of 1.5 per cent per year since 2000 and is now 18 per cent lower than 2000 levels. The incidence rates of Bangladesh, China, India and Pakistan are given in Figure 1.

### **TB Prevalence**

In countries with a relatively high burden of TB, the prevalence of bacteriologically-confirmed pulmonary TB can be directly measured in nationwide population-based surveys using sample sizes of around 50,000 people. Survey results can be used to produce a national estimate of TB prevalence that includes all forms of the disease.

There were an estimated 13 million prevalent cases (range, 11 million–14 million) of TB in 2014. By 2015-end, it is estimated that the prevalence rate will have fallen 42 per cent globally since 1990, missing the target of 50 per cent reduction. However, two regions met the target before 2015 (the Region of the Americas and the Western Pacific Region); while the South-East Asian Region reached the

target (according to the best estimate) in 2015. TB prevalence is falling in all the other three regions. Among the 22 high burden countries (HBC), nine are assessed to have achieved a 50 per cent reduction target, as compared to 1990 levels (Fig. 2). TB prevalence rates of Bangladesh, China, India and Pakistan are given in Figure 2.

### **TB Mortality**

TB mortality among HIV-negative people can be directly measured using data from national vital registration (VR) systems, provided that these systems have high coverage and causes of death are accurately coded according to the latest revision of the international classification of diseases (ICD-10). For the vital registration data of sufficient coverage and quality the WHO Global TB Report 2015, used 127 countries' survey data including India. The combined total of 129 countries accounted for 43 per cent of the estimated number of TB deaths globally in 2014.

Globally, the mortality rate (excluding deaths among HIV positive people) fell 47 per cent between 1990 and 2015, narrowly missing the target of a 50 per cent reduction. However, two WHO regions met the target about ten years in advance of the deadline (the Region of the Americas and the Western Pacific Region), and the Eastern Mediterranean and South-East Asia Regions reached the target (according to the best estimate) by 2015. The mortality rates of Bangladesh, China, India and Pakistan are given in Figure 3.

### **Tuberculosis cases in India**

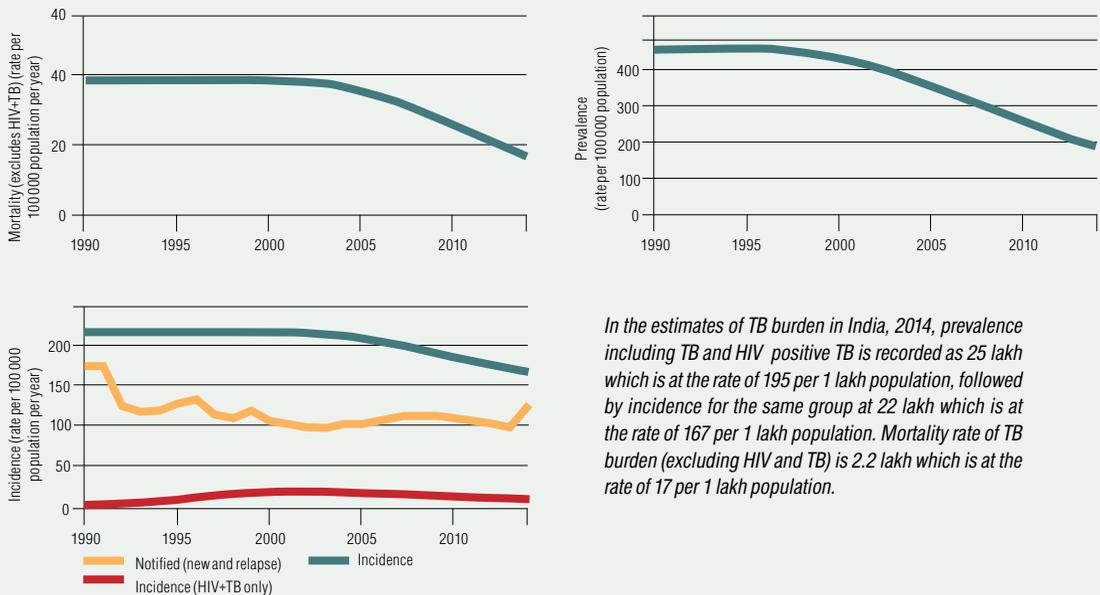
As per WHO Report, the estimated incidence of TB in India has declined progressively from 216 per lakh population per year in 1990 to 167 per lakh population per year in 2014. The estimated prevalence of TB has declined from 465 per lakh population per year in 1990 to 195 per lakh population per year in 2014. India achieved the MDG for TB to halt and start reversing the incidence to half the prevalence and mortality rates by 2015 as compared to the 1990 baseline. The estimated mortality due to TB has declined from 38 per lakh population per year in 1990 to 17 per lakh population per year in 2014. The decline in incidence, prevalence and mortality is estimated on an all India basis and includes the north-eastern states and Himachal Pradesh.

There has been an overall decline in the mortality, prevalence and incidence rate in India from 1990 to 2014. The Global Tuberculosis Report 2015 shows the detail estimates of TB burden of India in 2014 (Fig. 4). The Report also reveals the percentage of TB cases with multidrug-resistant TB (MDR-TB) in the same year. Out of the total TB cases 15 per cent have shown to relapse. And another 2.2 per cent new cases were registered according to the survey in 2014.

### **Measures**

The government has taken the following measures under the Revised National Tuberculosis Control Programme (RNTCP) which is supported under

**Fig. 4: Estimates of TB burden in India, 2014**



*In the estimates of TB burden in India, 2014, prevalence including TB and HIV positive TB is recorded as 25 lakh which is at the rate of 195 per 1 lakh population, followed by incidence for the same group at 22 lakh which is at the rate of 167 per 1 lakh population. Mortality rate of TB burden (excluding HIV and TB) is 2.2 lakh which is at the rate of 17 per 1 lakh population.*

the National Health Mission (NHM):

- ◆ More than 13000 designated microscopy centres have been established for quality diagnosis of TB.
- ◆ Treatment for drug sensitive TB is provided through a network of more than 400,000 directly observed treatment (DOT) centres, where a dedicated box containing a complete course of treatment is available for each patient.
- ◆ Most government hospitals, community health centres (CHCs), primary health centres (PHCs), sub centres function as DOT centres. Additionally, NGOs, private practitioners (PPs) community volunteers, anganwadi workers, women self-help groups also function as DOT providers/DOT centres.
- ◆ The programmatic manage-

ment for drug resistant TB (PMDT) services is provided in all 36 states/union territories of India.

- ◆ Diagnosis of drug-resistant TB is undertaken through quality assured drug susceptibility testing at 64 culture and drug susceptibility testing (C-DST) laboratories.
- ◆ Cartridge based nucleic acid amplification (CBNAAT) test machines have been installed at 121 sites for early detection of rifampicin resistance among TB cases, including 30 machines at anti retroviral therapy (ART) centres for detection of TB in people living with HIV AIDS.
- ◆ Diagnosis and treatment (including drugs) is provided free of cost under RNTCP.
- ◆ TB has been made a notifiable disease. This mandates all healthcare providers to notify

every TB case diagnosed or treated by them to local authorities. A total of 184,802 cases were notified from the private sector in 2015.

- ◆ RNTCP in collaboration with National Informatics Centre (NIC) has developed and implemented a web enabled and case based application named ‘Nikshay’ to improve TB surveillance, treatment and monitoring of TB cases.
- ◆ A “Call to Action for TB- Free India” campaign was initiated in 2015 to galvanise all stakeholders to commit themselves towards a TB- Free India.

### Endnote

Despite the worldwide decline in TB cases, detection and treatment gaps need to be addressed, funding gaps closed and new tools developed to bring an end to TB. 

By **STAFF REPORTER**

# PREVENTIVE MEASURES AGAINST TOBACCO

*Most cardiovascular diseases and lung disorders are caused by smoking of tobacco. Awareness, coupled with reduced production and supply are crucial measures to curb smoking.*

**T**obacco is the foremost preventable cause of death and disease in the world today, killing nearly half the people who use it, and endangering many others who passively inhale the smoke. As per WHO Report on the Global Tobacco Epidemic, 2015, smoking prevalence in India for males and females together stand at 14.6 per cent amongst the youth and 14 per cent amongst the adult population. Also as per the India Tobacco Industry Report - 2015, during 2010-13, central excise revenues from tobacco products grew at a compound annual growth rate of 21 per cent. This perhaps indicates tobacco use is on the rise despite tobacco killing nearly 6 million people, of which nearly 0.6 million premature deaths can be attributed to exposure to second-hand smoke (SHS), which is a mixture of the smoke given off by the burning end of tobacco products; side-stream smoke (SS) and the mainstream smoke exhaled by smokers (Operational Guidelines: National Tobacco Control Programme 2012).

If current trends continue, tobacco use will kill more than 8 million people worldwide each year by 2030. It is estimated in the 2012 Report that 80 per cent of these premature deaths will occur among people living in low and middle income countries.

Over the course of the 21st century, tobacco use could kill a billion people or more unless urgent action is taken. As per the report on Tobacco Control in India (2004), nearly 8-9 lakh people die every year in India due to diseases related to tobacco use. Furthermore, up to one in five deaths from tuberculosis (TB) could be avoided if TB patients did not smoke.

## **Harmful Effects of Tobacco**

Smokeless tobacco contains about 3095 chemicals; of which 28 are carcinogens (cancer causing substances). Studies have also demonstrated presence of high levels of heavy metals (lead, cadmium, chromium, arsenic and nickel) in tobacco products. The use of smokeless tobacco

is associated with cancers of the oral cavity, oesophagus, stomach, pancreas and throat. Likewise, tobacco smoke including SHS contains more than 7,000 chemicals; hundreds of which are hazardous, with at least 69 of these carcinogens. Most cardiovascular diseases and lung disorders are directly attributable to tobacco use. Besides these, tobacco use can cause stroke, cataracts, and peripheral vascular diseases. Moreover, there are studies which show that tobacco use also leads to impotence. Tobacco use by pregnant women leads to low birth weight babies, premature deliveries, still births and birth defects. Passive smoking or SHS is harmful and hazardous to the health of the general public and particularly dangerous to children. It increases the risk of serious respiratory problems in children, such as bronchospasm, asthma attacks, lower respiratory tract infections, as also middle ear infections. Inhaling SHS can even cause lung cancer and coronary heart disease in non-smoking adults.

### Global Youth Tobacco Survey

GYTS is a school-based survey, conducted by WHO and Global Tobacco Surveillance System, designed to enhance the capacity of countries to monitor tobacco use among youth and to guide the implementation and evaluation of tobacco prevention and control programmes. The Indian GYTS was conducted in grades 8, 9 and 10 for the 13-15 years age group. The third round of the survey was conducted in 2009 and included data on prevalence of cigarette and other tobacco use as well as information on five determinants of tobacco use: access/availability and price, exposure to SHS, cessation, media and advertising, and school curriculum.

As per the Indian GYTS, conducted by Ministry of Health and Family Welfare and WHO: Fact sheet of Global Youth Tobacco Survey 2009, it was found that one in five students live in homes where others smoke in their presence, and more than one-third of the students are exposed to smoke due to those who smoke in places outside the home. Besides, one-quarter of the students were found to have at least one parent who smokes. Exposure to SHS results in lung cancer and heart diseases among adults, and sudden infant death syndrome (SIDS), chronic respiratory infections, exacerbation/worsening of asthma, reduced lung

## Besides governmental measures wider awareness is crucial to check consumption and exposure to smoking.

function growth, middle ear diseases, and acute respiratory illnesses among children. Smoking in the house affects babies and young children as well as the elderly and other adults, especially women.

### Measures

The Government of India has taken measures including, inter alia, the following, to curb smoking:

- ◆ Enactment of Cigarettes and other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution) Act, (COTPA) 2003.
- ◆ Ratification of the WHO Framework Convention on Tobacco Control.
- ◆ Launch of the National Tobacco Control Programme (NTCP) in 2007-08, to:
  - create awareness about the harmful effects of tobacco consumption;
  - reduce the production and supply of tobacco products;
  - ensure effective implementation of the anti-tobacco laws; and
  - help people quit tobacco use through tobacco cessation centres.
- ◆ Notification of rules to ban smoking in public places.
- ◆ Notification of rules to regulate depiction of tobacco products or their use in films and TV programmes.
- ◆ Notification of rules on new pictorial health warnings on tobacco product packages.
- ◆ Launch of public awareness campaigns through a variety of media.

Government of India has banned certain kinds of smokeless tobacco products like *gutkha* and chewing tobacco through the notification issued under the Food Safety and Standards Act, 2006. Other tobacco products are regulated by the

COTPA 2003 which contains provisions, inter alia, relating to:

- ban on sale of tobacco products by/to minors;
- ban on sale of tobacco products within 100 yards of educational institutions; and
- ban on promotions/advertisements of tobacco products, etc.

The state governments/union territories of Uttarakhand, Punjab, Rajasthan, Haryana, Mizoram, Chandigarh, Uttar Pradesh, and Jharkhand have issued orders/notifications banning the sale of loose cigarettes.

### Endnote

The government has initiated several measures to check the use of tobacco. However, active and passive smoking continue to be a major health risk for both children and adults in India. To curb the use of tobacco, increased awareness among the wider public is absolutely essential to bring down the consumption and exposure to smoking in the better interests of public health. 

### References

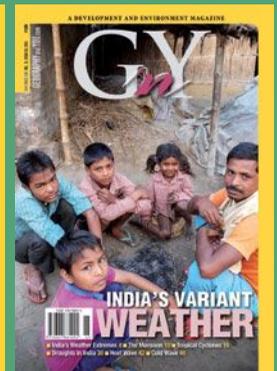
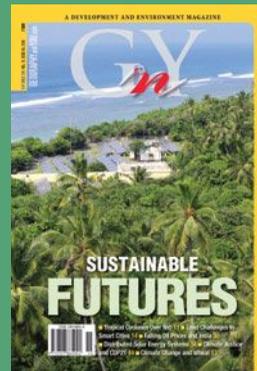
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By STAFF REPORTER

# North-east India Healthier than most States

Latest National Sample Survey Organisation survey records least number of ailments in the north-east India. Manipur is the most disease free state of India. The north-east states also opt for higher public health care services as compared to the other states of India.

**T**he National Sample Surveys Organisation (NSSO) is a governmental entity functioning for over six decades now, collecting all-India sample data primarily pertaining to the social sector. In its recent survey on 'Social Consumption: Health in its 71st round, Report 574' released on April 20, 2016 the NSSO came up with interesting results on health in India. The nation-wide rapid survey was conducted during May-June 2015 in order to generate basic quantitative information on India's health sector.

While analysing two interesting data sets of the NSSO data, fascinating results emerged. One data set measures the household-wise ailments reported in various age groups, and the other maps state-wise hospitalisation cases in rural and urban areas.

As is commonly understood, an older person suffers from a large number of chronic and intermittent or short-duration ailments (Fig. 1). The data conforms to that hypothesis and clearly shows the majority of

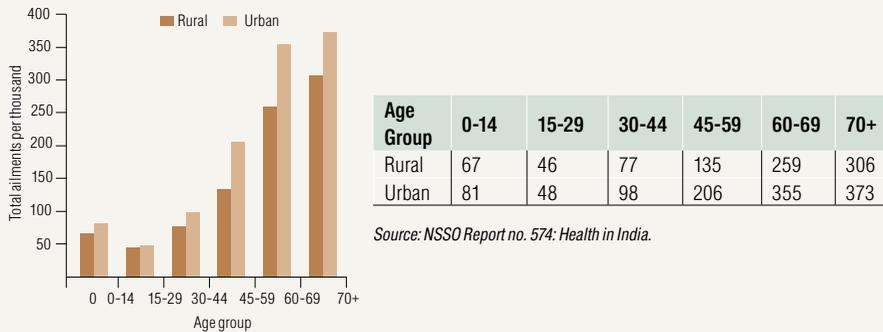
ailments are experienced in the 60 and above age groups as the all India figures indicate (276 in of rural areas and 362 in urban areas).

State-wise classification the data (Fig. 2) revealed that Kerala (310 in rural areas and 306 in urban areas) mapped the highest total number of ailments in both urban and rural areas, followed

by Goa and West Bengal (160 in rural areas and 194 in urban areas; 161 in rural areas and 179 in urban areas respectively) in the 15 days reporting period. The north-east mapped the least number of ailments (Manipur: 26 in rural areas and 4 in urban areas; Mizoram: 26 in rural areas and 31 urban areas; Nagaland: 31 rural areas and 19 urban areas) for the same period which would make it the choicest destination for health conscious people.

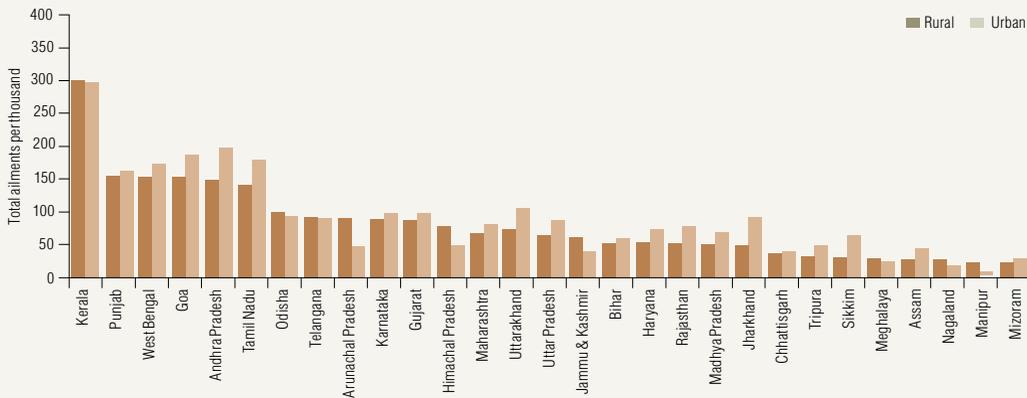
NSSO also reports that the chronic ailments are more frequent than short-duration ailments in urban areas of the country in both males and females. For the rural area it is the other way round. The figures 3 (a and b) indicate that, both for rural and urban areas, age patterns for short-duration ailments differ markedly from those for chronic ailments. For both rural and urban areas, ages specific patterns for short duration ailments show a distinct U-shape, while those for chronic ailments a positively-sloped pattern. Younger children are less likely to suffer chronic ailments, while older persons

**Fig. 1: All-India, total number of ailments reported per thousand persons during the last 15 days by age group.**



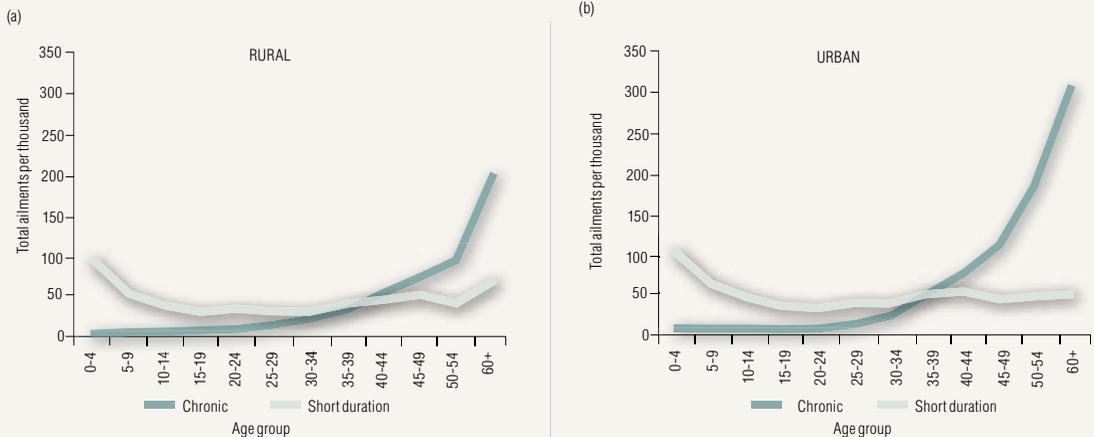
Source: NSSO Report no. 574: Health in India.

**Fig 2: State wise total number of ailments reported per thousand persons during the last 15 days.**



Source: NSSO Report no. 574: Health in India

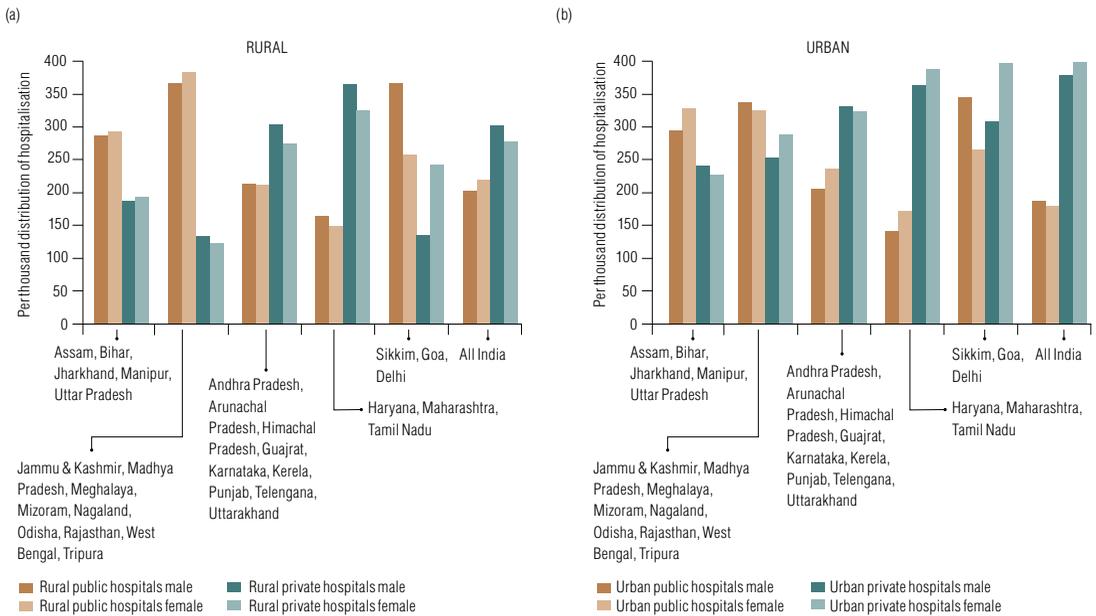
**Fig. 3: Proportion of ailing person per 1000 during last 15 days for different age group separately for chronic and short duration ailment.**



Source: NSSO Report no. 574: Health in India

Source: NSSO Report no. 574: Health in India

**Fig. 4: Per thousand distribution of hospitalisation cases during the last 365 days by type of hospital and gender separately for category of states classified as per 2014 per capita income (PCI).**



Source: Directorate of Economics and Statistics of respective State/UT, 2015 for per capita income and NSSO Report no. 574: Health in India for per thousand distribution of hospitalisation cases during the last 365 days.

are liable to experience a higher number of chronic ailments.

When the state wise data for hospitalisation record over 365 days is considered, an interesting pattern emerges (4 a and b). Juxtaposed against the state wise per capita income for 2014-15 by Ministry of Statistics & Programme Implementation, the data reveals that states with higher per capita income opt for private hospitals as opposed to the poorer states that opt for public hospitals, due to perhaps paucity of resources. As NSSO survey shows, more than 70 per cent (72 in rural and 79 per cent in urban) of ailments were treated in the private sector (consisting of private doctors, nursing homes, private hospitals, charitable institutions, etc.).

The Report also shows that the rural population spent, on an average, INR 5636 for

a hospitalised treatment in a public sector hospital and INR 21726 for that in a private sector hospital while the urban population spent on an average INR 7670 for treatment in public hospitals and INR 32375 in private hospitals. In the light of the dismal services extended by public health sector in India, it is perhaps not surprising that richer states, where purchasing power is higher, are turning away from public hospitals. This may place the services extended by public hospitals in a downward spiral whereby they will neither improve their services to meet global requirements, nor will the public repose faith in them and ensure a larger user base, effectively shutting down public enterprises in the long run. However, the over arching fact that still holds true for India as of now, is that a huge number

of people are still dependant on the public health systems.

The trend towards opting for private hospitals holds true for both urban and rural India although it is perceptible that the services of a private hospital is accessed in larger numbers in the urban areas. The only anomaly that shows up against the state-wise per capita discourse is in states like Delhi and Goa where public hospital seems to be the preferred mode of treatment. It may be due to the fact that these regions are highly urbanised, city-states, and may have been able to overhaul its public health services to a level that makes it sought after by the general populace.

The NSSO 71st data set is exhaustive and thus needs further probing to arrive at results that can uncover finer regional variations. 

By CHINMOYEE MALLIK

# SMALL HOLDERS AND BENGAL'S TEA INDUSTRY

*Recent data indicates that tea cultivation is becoming increasingly popular with small and marginal holders. However, small tea growers often face problems due to fluctuating prices, and hence, need to be supported technically and financially to deal with an unstable market.*

Since colonial times, the districts of Darjeeling, Jalpaiguri, Cooch Behar and North Dinajpur are well known for tea cultivation. Traditionally, tea was always grown in estates that were typically more than 10 hectares (ha). However, recent data in the Agricultural Census indicates that small and marginal holdings are increasingly changing their cropping pattern in favour of tea cultivation. It is an outcome of substantial government encouragement to prop-up large tea estates with the produce from small growers.

## **Pattern of tea acreage: 1995-96 to 2010-11**

Analysis of Agricultural Census data for the years 1995-96, 2000-01, 2005-06 and 2010-11 reveals the following trend:

- ◆ The concentration of area under tea crop continues to remain under estate farming, i.e., in land holdings above 20 ha where very little fluctuation is found across the years (Fig. 1).
- ◆ While there was no tea cultivation in land holdings of size below 20 ha in 1995-96, tea

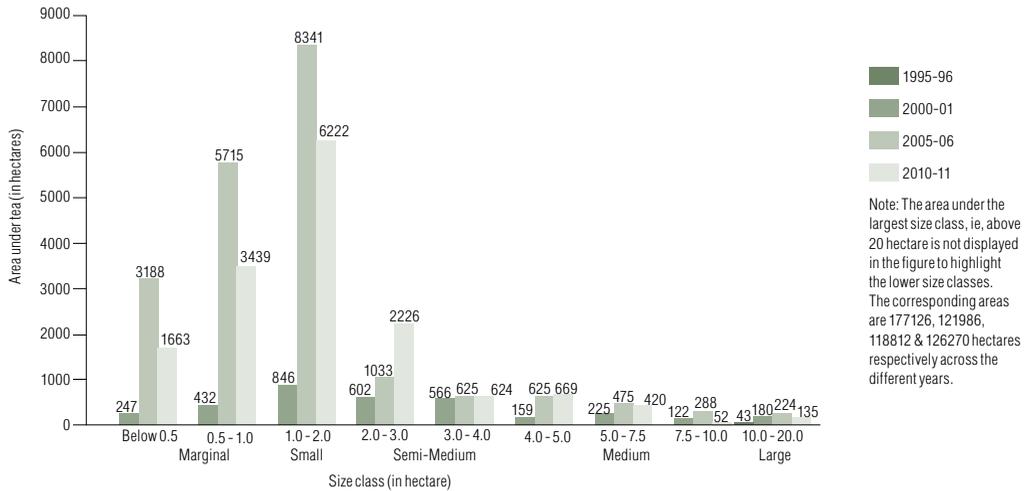
cultivation by small and marginal farmers took off from 2000-01 onwards. Tea cultivation by small farms reached around 8341 ha in 2005-06 (Fig. 2). Although in terms of share of gross cropped area, tea claimed less than 1 per cent of the total acreage; the trend is significant enough for us to examine what drives it.

- ◆ With respect to the number of holdings adopting tea cultivation, small holders were found to dominate since 2005-06 with more than 8000 holdings making the shift (Fig. 1). This highlights the labour perspective of tea cultivation which is typically female labour dependent, and in case of small holders, involve family labour. Table 1 further suggests that with respect to share of output, small tea growers produce more than 25 per cent of the total, nationally. Hence, it is important that the problems of small tea growers be adequately addressed.

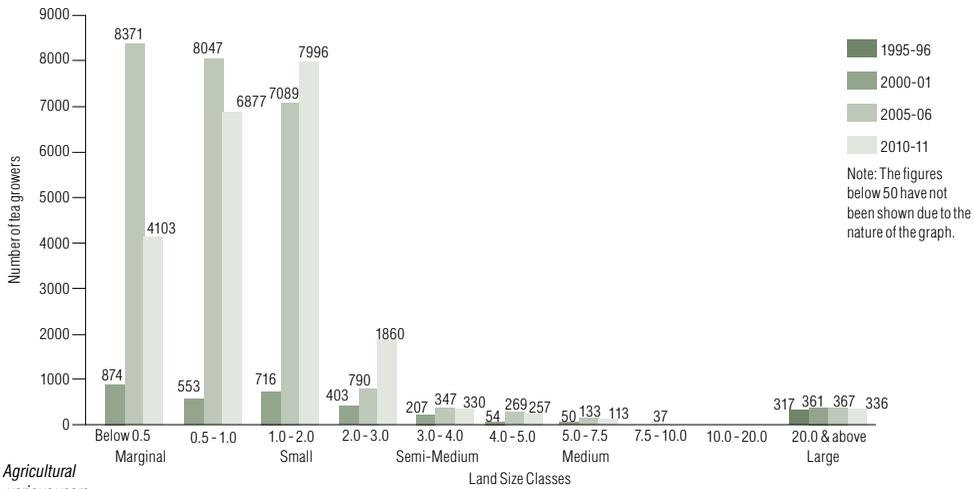
## **Emergence of small tea growers**

It was only in the 8th Five Year Plan that India formally adopted the idea of encouraging small

**Fig. 1: Area under tea cultivation West Bengal 1995-96 to 2010-11**



**Fig. 2: Number of tea growers West Bengal 1995-96 to 2010-11**



Source: Agricultural Census, various years.

**Table 1: Production of tea in India (million kg)**

	2007	2008
Small Growers (area upto 10.12 hectares)	257.46	257.46
Big Plantation (area above 10.12 hectares)	728.97	723.36
<b>Total</b>	<b>986.43</b>	<b>980.82</b>

Source: Tea Board of India (cited in Hazarika and Borah, 2013)

tea growers. This was a reaction to the persistent failure in rejuvenating tea estates despite doling out government subsidies for re-planting bushes and technological upliftment to augment production. The large tea estates were not interested in

expanding their area under cultivation, which was imperative to increase the output. Hence, to match the rising demand for tea in the national and international markets, the Tea Board of India sought to promote small tea growers. These growers were to be located around the periphery of the larger estates, such that leaves from the smaller growers would be entirely purchased by the nucleus estate's factory in lieu of a value declared by the Tea Board. This would thus, amount to a tie-up with the larger estates in terms of technology and sale of leaves. Besides, small tea growers would be entitled to a monthly subsistence allowance of INR 400 for the first three years (Bhowmick, 1991).

## Prospects of small tea growers

For a farmer with a small holding, growing tea offers a substantive opportunity for self-employment. As a modern form of cultivation with some government support, it can also emerge as a potent employment provider at the local scale. The Tea Board provides several incentives to encourage small tea growers:

- ◆ subsidies for purchasing vehicles, setting up leaf collection sheds, supplying fertilisers and other inputs are offered;
- ◆ a separate directorate with its headquarters at Dibrugarh (Tea Board Annual Report, 2012-13) has been set up. Also a separate initiative is proposed to be mobilised exclusively for small tea growers in North Bengal region;
- ◆ extending financial assistance towards training on improved methods of tea cultivation to enhance productivity;
- ◆ extending advisory support in non-traditional areas, and setting up of nurseries to provide good quality planting materials;
- ◆ encouraging and assisting small tea growers both financially and technically, particularly in the unorganised small growers sector.

Initiatives such as bought leaf factories to purchase green leaves from small tea growers exclusively, thereby reducing the uncertainty in an unstable market have also been put in place. This has contributed to paddy and potato fields being rapidly transformed into small tea gardens (Biswas et al., 2013).

## Problems faced by small tea growers

Firstly, absence of a processing unit within the tea garden of small tea growers and the arrangement of raw leaf purchase by bought leaf factories commonly deprive small tea growers from benefitting from high tea prices. Since prices are often dictated by the attached large estates or bought leaf factories, there are considerable fluctuations. Recently, there was a crash in tea leaf prices of small tea growers in the Dooars region of West Bengal bringing prices down to INR 6-7 per kg against the normal average of INR 15-16 per kg. Devoid of any security net, small tea growers severely suffered (Roychowdhury, 2015).

Secondly, small tea growers entirely depend upon individual financial initiatives as there is little available financial support. Hence, it

is challenging to maintain a capital intensive tea farm.

## Endnote

Similar to the small holder plantations in Southeast Asia, small tea farms in India have tremendous potential for growth. If adequate support is extended, small tea growers have the potential to emerge as significant players in the tea economy. Apart from their significant contribution in the total national output, they can serve as good avenues for labour/employment (for women) as tea is primarily a female labour intensive crop.

However, there remains some concern over the phenomenal outflow of paddy land into tea cultivation. Besides, the transformed labour relations that emerge from tea replacing paddy is a fascinating subject that calls for some serious research. The Tea Board, rather than encouraging small tea growers with an output-centric approach must take an all encompassing view to integrate its special provisions for the greater social good. ☐

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Shillong, Meghalaya, rapidly urbanising in the recent years.

## URBAN GROWTH AND FUTURE PROJECTS IN INDIA

As per the Census of India 2011, the growth rate of urbanisation during 2001-11 was 31.8 per cent which was higher than the total population growth rate of 17.6 per cent during the same period. By the year 2021, more than 432 million people will live in urban areas and this is likely to increase to 670 million by 2031. As per the report titled 'Indian Realty—through the looking glass', which is a joint initiative of Confederation of Indian Industry (CII) and Jones Lang Lasalle states, an estimated 843 million (84.3 crore) people in India will live in urban areas by 2050.

Urban development is a state subject and it is primarily the responsibility of state governments to provide basic amenities. However, government of India has launched various programmes to support the effort of state governments by providing financial assistance and capacity building. The government of India has recently launched the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) to support the efforts of states in improving urban infrastructure and governance. The thrust areas of the Mission are water supply, sewerage facilities, septage

management, storm water drains, pedestrian non-motorised and public transport facilities, parking spaces and creating green spaces. The Mission is to be implemented in 500 identified cities in the country.

The Smart Cities Mission has also been launched with the objective to promote cities that provide core infrastructure and give a decent quality of life to its citizen, a clean and sustainable environment and application of 'smart' solutions to improve infrastructure and services. The strategic components are area-based development plus a pan-city initiative in which smart solutions are applied city-wide. The Mission will be implemented in 100 cities in the country selected in phases. Heritage City Development and Augmentation Yojana (HRIDAY) offers strategic and planned development of heritage cities aiming at improvement in overall quality of life with specific focus on sanitation, security, tourism, heritage revitalisation and livelihoods retaining the city's cultural identity. The scheme is to be implemented in 12 towns—Ajmer, Amaravati, Amritsar, Badami, Dwarka, Gaya, Kanchipuram, Mathura, Puri, Varanasi, Velankanni and Warangal. —*Inputs from the Ministry of Urban Development, Govt, of India, March 2016.*

## WOMEN SUFFERING FROM ANAEMIA IN INDIA

As per National Family Health Survey (NFHS)-III (2005-06), prevalence of anaemia in women was 55.3 per cent. The steps taken by the government to prevent and treat anaemia amongst women are as follows:

- Ministry of Health and Family Welfare in 2013 launched the 'National Iron Plus Initiative' as a comprehensive strategy to combat the public health challenge of iron deficiency anaemia prevalent across the life cycle. There are age specific interventions with iron and folic acid supplementation and deworming for improving the haemoglobin levels and reducing the prevalence of anaemia for all age groups, that is children (6-59 months and 5-10 years), adolescent girls and boys (11-19 years), pregnant and lactating women and women in reproductive age group (20-49 years).
- Universal screening of pregnant women for anaemia is a part of ante-natal care and all pregnant women are

provided iron and folic acid (IFA) tablets during their ante-natal visits through the existing network of sub-centres and primary health centres and other health facilities as well as through outreach activities at Village Health and Nutrition Days (VHNDs).

- Every pregnant woman is given IFA, after the first trimester, one tablet daily for 6 months during ante-natal and post-natal period. Pregnant women, who are found to be clinically anaemic, are given additional tablets.
- The Indian government has given directions to the states to identify and track severely anaemic cases at all the sub centres and primary health centres for their timely management.
- Health and nutrition education through information education communication (IEC) and behaviour change communication (BCC) to promote dietary diversification, inclusion of iron folate rich food as well as food items that promotes iron absorption.
- To tackle the problem of anemia due to malaria

particularly in pregnant women and children, long lasting insecticide nets (LLINs) and insecticide treated bed nets (ITBNs) are being distributed in endemic areas.

- Health management information system and mother child tracking system is being implemented for reporting the cases of anaemic and severely anaemic pregnant women.
- Mother-Child Protection (MCP) card and safe motherhood booklet is being distributed to pregnant women for

educating them on dietary diversification and promotion of consumption of IFA.

- 184 high priority districts (HPDs) have been identified and prioritised for Reproductive Maternal Newborn Child Health and Adolescent (RMNCH+A) interventions for achieving improved maternal and child health outcomes.—*Inputs from the Ministry of Health and Family Welfare, Govt. of India, March 2016.* 

## HIGH INCIDENCE OF ANTI MICROBIAL RESISTANCE

It is generally believed that availability of antibiotics over the counter and lack of awareness about using antibiotic drugs only as prescribed by doctors, results in inappropriate use of antibiotics. As per a recent report (2015) released by Global Antimicrobial Resistance Partnership (GARP), it is reported that resistance among common pathogens is increasing worldwide though regional patterns of resistance vary.

Common bacterial pathogens becoming resistant to antimicrobials are *Staphylococcus aureus*, *Enterococcus*, *Streptococcus pneumoniae*, *Neisseria gonorrhoeae*, *Neisseria meningitidis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Typhoidal Salmonella*, *Shigella* species, *Vibrio cholerae*, *Mycobacterium tuberculosis* and in other diseases such as malaria, kala azar, HIV etc.

It is estimated that the prevalence of multi-drug-resistant tuberculosis (MDR-TB) in India is 2-3 per cent among notified new pulmonary tuberculosis (TB) patients and around 15 per cent for re-treatment pulmonary TB patients.

While separate data on disease burden of the Indian population caused by infectious diseases is not available, it is estimated that overall communicable diseases contribute to 37 per cent of the entire disease burden.

Indian Council of Medical Research (ICMR) is carrying out surveillance of drug resistance to antibiotics through its Antimicrobial Resistance Surveillance Research Network (AMRSN) in six pathogenic groups (i) Diarrhoeagenic bacterial organisms; (ii) Enteric fever pathogens; (iii) Enterobacteriaceae causing sepsis; (iv) Gram negative non-fermenters; (v) Gram positives including Methicillin-resistant *Staphylococcus aureus* (MRSA); and (vi) Fungal infections. Four nodal centers for collection of data are Christian Medical College (CMC), Vellore, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, Postgraduate Institute of Medical

Education and Research (PGIMER) Chandigarh and All India Institute of Medical Sciences (AIIMS), New Delhi. The significant findings from last two years indicate that *Salmonella typhi* multidrug resistance (MDR) to *ampicillin*, *chloramphenicol* and *trimethoprim-sulfamethoxazole* is showing a downward trend. However, more than 50 per cent of bacterial isolates of *Klebsiella spp.* and *E. coli* were found to be resistant to the currently used third generation *cephalosporins*, but they are sensitive to *carbapenams* and *colistin*.

To further regulate the sale of antibiotics, the government of India, in the year 2013, amended the Drug and Cosmetics Rules, 1945 to incorporate a new Schedule H1 containing 46 drugs which also includes third and fourth generation antibiotics and anti-TB drugs for a strict control over the sale of these drugs. The drugs falling under Schedule H1 are required to be sold in the country with the following conditions:

- The supply of a drug specified in Schedule H1 shall be recorded in a separate register at the time of the supply giving the name and address of the prescriber, the name of the patient, the name of the drug and the quantity supplied and such records shall be maintained for three years and be open for inspection.
- The drug specified in Schedule H1 shall be labelled with the symbol Rx which shall be in red and conspicuously displayed on the left top corner of the label, and shall also be labelled with the following words in a box with a red border - 'Schedule H1 Drug-Warning'. It is dangerous to take this preparation except in accordance with the medical advice. It is also not to be sold by retail without the prescription of a registered medical practitioner.

An insertion has been made in the Drugs and Cosmetics Rules, 1945 to specify the withdrawal period of antibiotics

in case of egg, milk, poultry and fish before these enter the human food chain. The Department of Animal Husbandry, Dairying and Fisheries has also issued advisories in 2014 addressed to all states and union territories regarding judicious use of antibiotics to prevent antimicrobial resistance (AMR).

A National programme for containment of AMR has also been initiated in the 12th Five Year Plan with the following objectives.

- To establish a laboratory based surveillance system by

strengthening laboratories for AMR in the country and to generate quality data on antimicrobial resistance for pathogens of public health importance.

- To generate awareness among health care providers and in the community regarding rational use of antibiotics.
- To strengthen infection control guidelines and practices and promote rational use of antibiotics.—*Inputs from the Ministry of Health and Family Welfare, Govt. of India, March 2016.* 

## DISEASES CAUSED BY POLLUTION

According to World Health Organization (WHO), 2012, ischemic heart disease and chronic obstructive pulmonary disease are top two causes of death in India. Air pollution is an important risk factor of both these diseases. As per data reported to Central Bureau of Health Intelligence, number of cases of acute diarrheal diseases and typhoid reported in the year 2014 were 11.67 million and 1.71 million respectively. As per WHO Report 2015, childhood diarrhoeal diseases contribute to 10 per cent of under five deaths in the country i.e. around 1.25 lakh children are lost due to diarrhoea annually in the country.

While health is a state subject, the central government supplements the efforts of the state governments for improving health care.

Under the National Health Mission, Ministry of Health and Family Welfare, the following steps are being taken by the government for prevention and control of diarrhoea in children:

- Promotion of early and exclusive breast feeding along with appropriate complementary feeding, is being undertaken through frontline health workers namely accredited social health activists (ASHA) and auxiliary nurse midwife (ANM) at community and facility level.
- Oral rehydration salt (ORS) packets and zinc tablets are made available free of cost.
- Vitamin A supplementation programme for children up to of five years of age.
- Awareness is being created amongst mothers on sanitation and hygiene and in the communities about the causes and treatment of diarrhoea through health education.
- Antibiotics for treatment of dysentery are made available

through the public health system.

- Capacity building of frontline workers and medical officers through the Integrated Management of Neonatal and Childhood Illnesses (IMNCI) and Facility Based Integrated Management of Neonatal and Childhood Illnesses (FIMNCI).
- Use of Mother and Child Protection (MCP) card for growth monitoring to track children for status of under-nutrition and timely intervention during village health and nutrition days (VHNDs)
- Surveillance activities to detect outbreaks of diarrhoea through Integrated Disease Surveillance Programme (IDSP) are also carried out.
- Intensified Diarrhoea Control Fortnight (IDCF) is being implemented as a campaign in last month of July and first month of August, since 2014, for control of deaths due to diarrhoea across all states and union territories. It includes massive awareness generation on use of ORS and zinc during diarrhoea, bringing together multiple departments to generate awareness and also reach to each under five child with one packet of ORS to be used when diarrhoea begins. Main activities include intensification of advocacy activities, awareness generation activities, diarrhoea management service provision, establishing ORS-zinc demonstration sites, ORS distribution by ASHA through home visitation, detection of undernourished children and their treatment, promotion of infant and young child feeding activities by home visits by ASHA and establishing infant and young child feeding (IYCF) corners.
- State and regional level workshops are being held for in-depth planning and review as per the Integrated Action Plan for Pneumonia and Diarrhoea (IAPPD) framework.—*Inputs from the Ministry of Health and Family Welfare, Govt. of India, March 2016.* 

By AKHILESH GUPTA, CHETNA JOSHI *and* NISHA MENDIRATTA

# The Indian Himalayan Region: Role of NMSHE

*Geological processes in the Himalaya that bring natural catastrophes are continuously in motion. Though the natural processes can never be completely controlled the impact can be minimised through sustainable use of natural resources and effective planning in tune with the terrain and geo-location.*

**T**he Himalayas have been frequently in the news in recent years, due to several major catastrophes. Be it the cloudburst in Leh (2010) or the tragic flash floods of Kedarnath in the Garhwal Himalayas (2013) or the floods in Srinagar (2015). The trail of cataclysmic incidents does not end here. The earthquake in Nepal (2015) and subsequent aftershocks led to a huge loss of lives and infrastructure.

The Himalayas are one of the youngest mountains in the world. Unlike other mountains, they are still in their formative age. Several geological processes are continuously in motion beneath this seemingly innocuous terrain. We can certainly never control these processes. But there is a lot we can do to minimise the adverse impact of natural hazards. The sustainable use of natural resources and effective planning in tune with the terrain and geo-location are among the necessities that can help us.

## Sustainable Development of the Himalayan Region

For sustainable development of the Himalayan

region, it is important to think of the Himalayas in their totality. This grand mountain chain covers an area of nearly 7,50,000 square km, spanning over 3000 km in length, 250-300 km in width, rising from less than 300 m to more than 8000 m above sea level (GoI, 2006). The Himalayas stretch from northern Pakistan on the west to the north-eastern regions of India, besides neighbouring Nepal and Bhutan. Starting from the Siwalik Hills in the south, the Himalayan mountain range extends to the Tibetan plateau in the north. The broad divisions of the Himalayas are the Siwalik, the lesser Himalayas, the greater Himalayas and the trans-Himalayas; extending almost uninterrupted throughout its length and separated by certain major geological fault lines.

The literal meaning of the Himalayas is the 'abode of snow' a store of enough snow and ice, to qualify as the 'third Pole of the earth' and the 'water tower of Asia', since its snows feed nearly all the major rivers of Asia. According to the Inventory of Glaciers of Himalaya published by the Geological Survey of India (GoI, 2008), the Indian Himalayan region alone houses 9575 glaciers, including the 75

km long Siachen glacier which is the biggest glacier in the world, outside the polar region.

The Indian Himalayan region covers an area of 5,33,000 square km which is approximately 16.3 per cent of the total geographical area of India. Stretching over 2,500 km from Jammu & Kashmir in the west to Arunachal Pradesh (GoI, 2006), the Indian Himalayan region spans the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Mizoram, Manipur, Meghalaya and Tripura, along with the hill districts of West Bengal and Assam (GoI, 2016).

Three major rivers; the Ganges, Indus and Brahmaputra have their sources in the Himalayas. The water through these rivers has not only fed civilisations down the centuries, but has also made the region a biodiversity hotspot, with some unique flora and fauna. In fact, the Himalayan biodiversity hotspot is recognised as one of the 34 global hotspots in the world (Moghe, 2011). The tough terrain and varied eco-climatic conditions of this region have supported several ethnic and socio-cultural groups, who have, over the years, developed their own distinct traditional knowledge and practices for conserving and nurturing their resources.

### **Challenges posed by climate change and sustenance of the Indian Himalayan Region**

Global warming and climate change are major threats for the already fragile Himalayas, since even the smallest of changes in glacier dynamics can affect nearly 1.3 billion people (GoI, 2010). Variability in the volumetric flow of water in the rivers, loss of biodiversity, unstable changes in ecology, or glacier recession can end up uprooting or dislocating many traditional societies and ethnic peoples. The effect of climate change is already conspicuous in the form of erratic and unpredictable weather conditions and changing rainfall patterns in the Himalayas.

To effectively address these issues, it is important to incorporate the concerns regarding glaciers, rivers, forests, wildlife and various other components of this precious eco-system into development policies and plans. The special vulnerabilities of this ecologically fragile region need to be recognised and adaptations to climate change must become an integral part of development strategies. To achieve this, it is required to have robust scientific data on

**We can certainly never control the geological processes which are continuously in motion beneath the seemingly innocuous terrain. But there is a lot we can do to minimise the adverse impact of natural events and hazards.**

various ecological and socio-economic components. Unfortunately, the Himalayan ecosystem is one of the least studied, rendering it extremely difficult, hence, to embark on a sustainable programme or policy for the Himalayas on the basis of reliable scientific data.

### **National Mission for Sustaining the Himalayan Ecosystem (NMSHE)**

Realising the need to create a strong scientific database for sustainable development of the Indian Himalayas, the Department of Science and Technology (DST), Government of India has been given the responsibility to coordinate and implement a NMSHE under the National Action Plan on Climate Change (NAPCC).

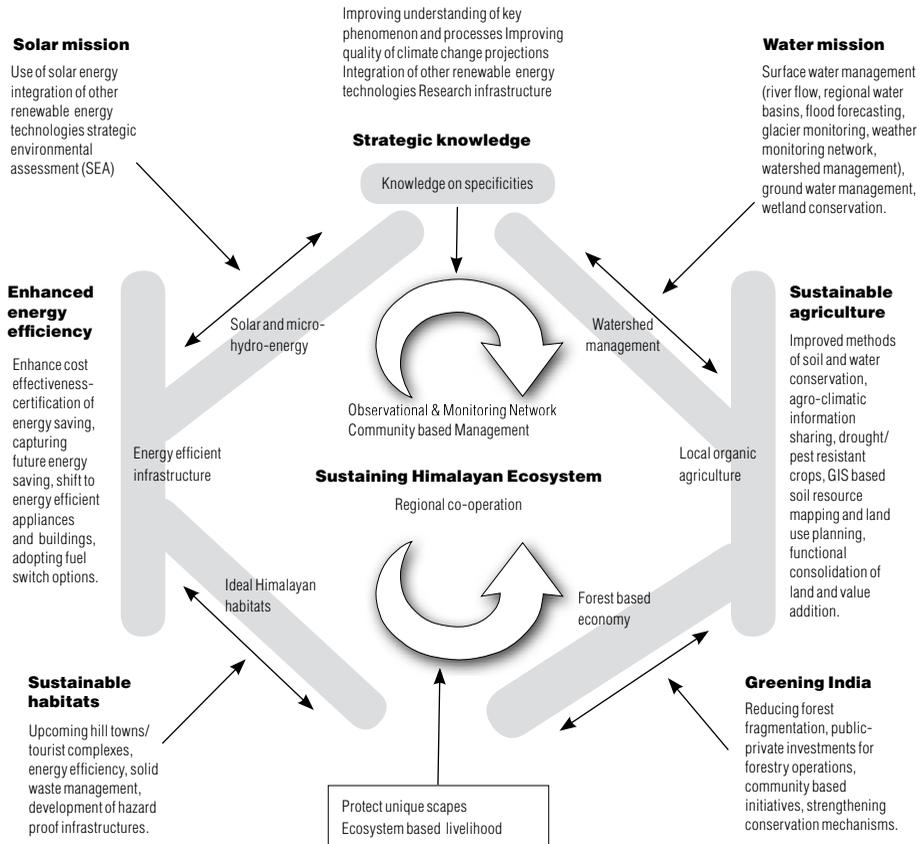
NMSHE is the only mission with a geographical focus as against the other national missions under NAPCC which are focused on sectors such as energy, water and agriculture. This is a reflection of the importance given to the Himalayan region in the NAPCC.

The broad objectives of NMSHE include understanding of the complex processes affecting the Himalayan eco-system to evolve suitable management and policy measures for sustaining and safeguarding the Himalayan eco-system (Fig. 1). The strong combination of science, policy and governance at the national and regional levels is meant to impart a holistic approach to NMSHE for protecting the Himalayan region (GoI, 2010).

### **NMSHE Programmes and Achievements**

■ **Scientific Capacity Building:** Under NMSHE,

**Fig. 1: Envisaged synergy of NMSHE with other missions of National Action Plan on Climate Change (NAPCC).**



Source: National Mission for Sustaining The Himalayan Ecosystem

several programmes have been initiated to fulfil the felt need for generating data on the Himalayas. To start with, NMSHE has identified six ecosystem areas, and constituted thematic task forces around each. These task forces will look after:

- ◆ natural and geological wealth,
  - ◆ glacier and water,
  - ◆ biodiversity,
  - ◆ Himalayan agriculture, and
  - ◆ traditional knowledge
- Each task force is being coordinated by one lead institution with a network of institutions supporting the effort as partnering institutions. The lead institutions for NMSHE are G.B.Pant Institute of Himalayan Environment and Development, Wildlife Institute of India, Indian Council of Agriculture Research, Jawaharlal Nehru University, National Institute of

Hydrology and Wadia Institute of Himalayan Geology. Altogether more than 60 research and academic institutions spread across the Himalayas are task force partners.

- An Inter-University Consortium on Cryosphere and Climate Change (IUCCCC) has also been initiated under NMSHE. It is a group of four universities which will bring in the field data for scientific studies on climate and cryosphere changes over time and space and evaluate societal needs and capabilities for adapting to such changes in the coming decades.
- An Indo-Swiss Capacity Building Programme on Himalayan glaciology (Exposure, 2014) was also launched to train students in glaciology. The programme has trained 52 Indian researchers, with 27 researchers having received advanced training.
- A state-of-the-art framework for integrated

vulnerability, risks and hazard assessment has also been developed, and studies related to glacial lake outburst floods (GLOF) are being conducted to deal with emerging glacial lakes in Sikkim. Detailed information about these programmes is available on NMSHE web portal.

- **Capacity Building of the Himalayan States:** No programme can be successfully implemented without the active participation of the Himalayan states. Hence, NMSHE plans to have state climate change cells in each of the Himalayan states, for effective implementation of policies at the local level, and generating awareness on climate change and global warming among communities.
- The state climate change cells have been constituted following several consultation workshops organised in Delhi, wherein all the Himalayan states participated, and submitted their proposals and suggestions. So far, these centres/cells have been established in seven states—Jammu and Kashmir, Himachal Pradesh, Meghalaya, Manipur, Sikkim, Mizoram and Tripura. Plans are underway to establish such Cells in the remaining Himalayan states (Gupta, 2016).
- **Policy Platforms:** The science policy disconnect is another major issue preventing sustainable development. To fill this gap, the NMSHE has provided for a Himalaya Sustainable Development Forum (HSDF) (GoI, 2010). This forum is meant to provide a platform for active cooperation and dialogue among decision makers, research institutions, governments of the respective Himalayan states, as also civil society organisations and individuals.

## Endnote

The strategic knowledge generated through the NMSHE can eventually be used for formulating suitable policies for the Indian Himalayan region. Although considerable progress has already been made since 2014, a lot more needs to be done, given the vast area the Indian Himalayan region covers, and the variety of micro-level and macro-level issues relating to climate change that must be dealt with.

Greater synergy within the various arms of the programmes and institutions, as also the central government and the respective state governments is the need of the hour. This can enable us move to the next level, and help deliver concrete and conclu-

sive results for the well-being of all our people. ■

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By **JAGABANDHU PANDA** and **SUNNY KANT**

# ATMOSPHERIC AEROSOLS

*Atmospheric aerosols are produced through natural and anthropogenic means. They modulate the microphysical properties of clouds and therefore, can govern weather and climate over a region.*

**A**tmospheric aerosols are one of the primary air pollutants within the troposphere and usually have an adverse influence on hydrological cycle, crops, plants, human health and visibility. They are capable of influencing weather and climate over a particular region though their role is highly uncertain and difficult to understand (Stocker et al., 2013). They can modulate the total radiation the earth is exposed to through several direct and indirect ways. Directly, they scatter and absorb solar radiation and cause a cooling effect in the atmosphere whereas indirectly, their effect involves modification of cloud microphysical properties including droplet size, lifetime and cloud height, to serve as cloud condensation nuclei for cloud formation (Tao et al., 2012). This process is depicted in Figure 1.

Since developing countries like India and China, are undergoing massive industrialisation and economic growth, anthropogenic aerosol content in the atmosphere is found to be increasing (Kaskaoutis et al., 2012; Du et al., 2015), and aerosols are expected to modulate weather and climate over India.

## How are aerosols produced?

Atmospheric aerosols are produced through natural and anthropogenic processes. Anthropogenic activities include fossil fuel and biomass burning, mining activities, modification of the natural land-use and cover, and changes in industrial and agricultural practices. Natural phenomena such as dust and sandstorms transport mineral dust particles to distant places from their source and contribute to atmospheric aerosol content. However, the contribution of anthropogenic aerosols far exceeds that of natural aerosols. Thus, the accumulation of aerosols over the northern hemisphere is largely due to industrial growth and agricultural practices (Satheesh & Moorthy, 2005).

In India, several regions such as the Indo-Gangetic Plain (IGP), eastern coastal areas and the western coast show significant variability in aerosol characteristics due to the presence of different types of aerosols. The IGP is among the most densely populated areas and heavily aerosol-laden regions of the world. Several satellite observations and ground based measurements have revealed

an overall increase in aerosol optical depth over India—particularly in the IGP region (Satheesh et al., 2002). This is because of the continuous increase in fossil-fuel and bio-mass combustion owing to the growing energy demands of a rapidly increasing population (Lawrence & Lelieveld, 2010). Convection induced winds, driving desert and sandy dust into the atmosphere during the pre-monsoon season also contribute to this problem (Gautam et al., 2011). The increased aerosol content in the atmosphere over IGP is assumed to cause considerable changes in monsoonal climate (Gautam et al., 2009; Ramanathan et al., 2001).

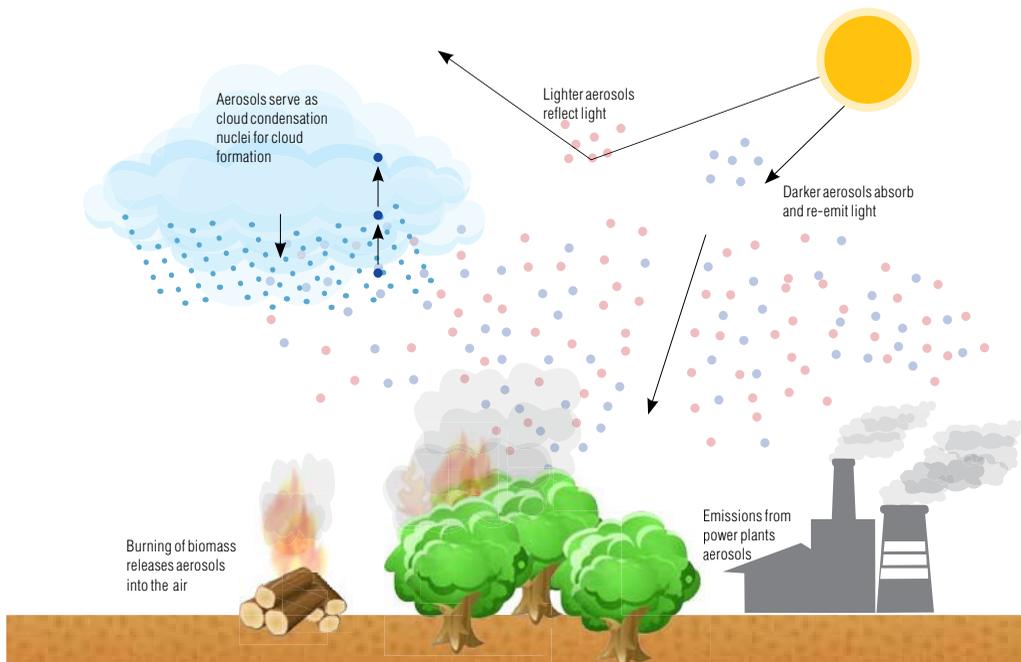
### Effect of aerosols over the Indian region

During a normal monsoon season, aerosols serve as a positive driving factor and help in strengthening the lower tropospheric zonal wind, resulting in a southward shifting of the monsoonal circulation during summer (Das et al., 2015). The increased loading of absorbing aerosols such as black carbon or dusts over IGP region during the pre-monsoon season increases the upper tropospheric heating, while a warm-core upper level anticyclone is

formed over the Tibetan Plateau in the months of April and May (Lau & Kim, 2006). The resulting feedback mechanism helps in increasing the upward motion over the core monsoon region, thereby encouraging cloud formation. The subsequent advance of the monsoon in the northern Indian region results in rains.

The carbonaceous aerosols over IGP, the adjacent Himalayas and the Tibetan Plateau can form brown clouds and haze in this part of the world and may also enhance lower atmospheric solar heating (Ramanathan et al., 2002, 2005, 2007). However, the resultant heating may be season dependent; that is the warming effect may be up to  $0.5 \text{ Wm}^{-2}$  during the pre-monsoon season and the cooling effect may be realised during winter up to  $-1 \text{ Wm}^{-2}$  (Arola et al., 2015). On the other hand, the prevailing local meteorological conditions and regional atmospheric flow processes could facilitate penetration of these aerosols throughout the Himalayan region (Cong et al., 2015) and impact the hydrological cycle or regional water budget, agriculture and health (Ramanathan et al., 2002, 2005, 2007).

Fig. 1: Schematic diagram illustrating role of aerosols in the atmosphere



# India and China are contributing to a massive accumulation of aerosols. It is imperative that studies are undertaken to assess the contribution of these particles to climate over the region.

Further, it may also play a role in enhancing the monsoonal rainfall over northern India (Lau et al., 2009). The loading of black carbon aerosols in May-June may serve as the desired elevated heat source in order to act like a heat pump. This helps strengthen the monsoonal circulation over the region by increasing the inflow of moisture to the atmosphere resulting in high cloud formation and enhanced precipitation.

A study by Panda et al., (2009) suggested that dust particles are transported (from Thar Desert or Arabian region) to north and central India during pre-monsoon seasons. The prevailing topography and land-surface features favour the formation of desired circulation pattern that is appropriate for the accumulation of atmospheric aerosols over the said region (Dey et al., 2004). Organic aerosols like black carbon produced by bio-fuel and burning of biomass dominate over the Bay of Bengal and eastern Indian coasts. Similarly, sulfate aerosols are transported to the southwestern coasts of India (Verma et al., 2008).

Since local and regional meteorological conditions govern the accumulation, distribution and transportation of aerosols (Panda et al., 2009; Gautam et al., 2011), which in turn play a vital role in cloud formation, the amount of rainfall during an extreme weather event or monsoon would be significantly modified due to aerosols (Vinoj et al., 2014) as described earlier.

It may be noted that there is little research done as far as the role of aerosols during extreme weather events such as pre-monsoon thunderstorms is concerned. However, it may be alluded that aerosols can have some positive impact on cloud formation during thunderstorms and thereby initiate rainfall over a particular region. On the other hand, the role of aerosols may be minimised during extremely heavy rainfall events. It should be noted, though, that such studies are yet to be carried out over the Indian region

## Endnote

Aerosols affect the weather and climate in several ways by controlling solar radiation, and affecting cloud formation. However, as yet, there are hardly any studies about their role and effects over the Indian region. Given that the rapidly industrialising economies like India and China are contributing to a massive accumulation of aero-

sols, it is important that studies are undertaken to assess the contribution of these particles to climate over the region.

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By **SANDEEP KUMAR BEHERA**

# ECOLOGICAL RESTORATION OF GANGA BASIN

*Ecology is the primary indicator of health for any river basin. Given the sorry state of the Ganga river basin, ecological restoration is urgently needed since river biodiversity is being rapidly lost.*

**I**ndian civilization flourished on the banks of the Ganga, nourished by her bounties for thousands of years. The Ganga river along with her many tributaries and distributaries provided material, spiritual and cultural sustenance to millions of people who lived in her basin and partook of her beneficence from time to time. To the traditional Indian, therefore, river Ganga was not just the holiest of rivers as a savior of mortal beings; she was also a living Goddess.

The Ganga river basin is the largest in India and covers a diverse landscape, reflecting the cultural and geographical diversity of India. It is also a fertile and relatively water-rich alluvial basin that hosts about 43 per cent of India's population. It is fitting, therefore, that the Indian government declared Ganga river as India's National River in the year 2008. But the declaration was none too early, the river having degraded rapidly since long, with her state having become a national concern in the twentieth century (Tare & Roy, 2015).

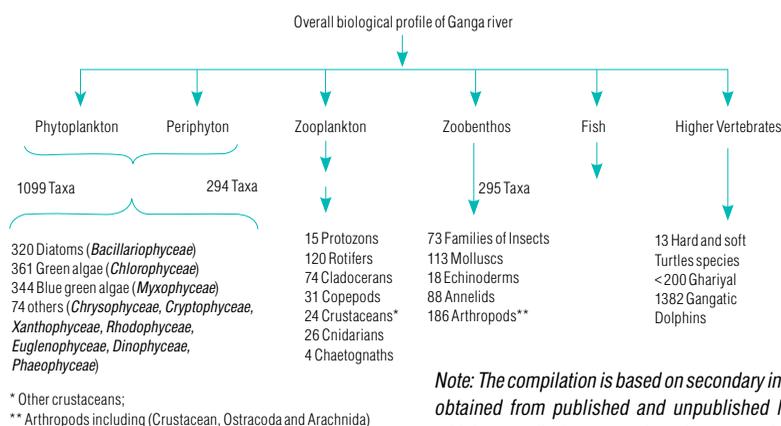
## **Status of Aquatic Biodiversity in River Ganga**

Ganga and her tributaries are home to a wide variety of aquatic organisms (from microscopic

flora and fauna to higher invertebrates and vertebrates) and visited periodically by many other creatures from far and near (Behera et al., 2014). The overall biological profile of Ganga is depicted in Figure 1. The biodiversity of Ganga is unique, as it synthesises three major eco-regions of India situated along different climatic gradients - the Himalayan mountainous region in the upper reach, the Gangetic plains in the middle reach, and the estuarine region in the lower reach. These regions apart from differing climatically also have different geological characteristics and evolutionary histories, thus contributing to the river covering a vast spectrum of biota which differs significantly in different reaches.

Significant loss of species biodiversity in the Ganga river network has been observed over the past many decades, with many important aquatic species (fishes, dolphins, ghariyals, turtles, etc.) having dwindled or disappeared from river stretches in recent history (Behera et al., 2013). A river ecosystem with its intrinsic biodiversity plays a crucial role in the functional health of the river basin and the ecosystem services provided by the river. A basic idea of the biodiversity loss in a part of the Ganga may be inferred from Figure 2

**Fig. 1: Biodiversity of river Ganga at a glance**



Source: Bashir et al., 2012.

*Note: The compilation is based on secondary information obtained from published and unpublished literatures which generally do not pertain to the present day river but to Ganga at different times and in different places.*

showing the progressive loss of fish catch at Allahabad since 1950. Figure 2.

In general, ecosystems can be assessed either in terms of the services (or goods and services) they provide to humans, or in terms of 'ecosystem structure' (i.e. measurable attributes of a least impacted or reference state of the ecosystem). However, as noted by Palmer and Febria (2012), the former as indicators of ecosystem health is an oversimplification of the ecosystem services concept; on the other hand, universally applicable structural metrics of river health are yet to be developed. Nonetheless, the latter approach is more prevalent, and the taxonomic composition of aquatic biota from microbes that influence decomposition to aquatic animals that shred leaf litter is an important structural metric for ecosystem health assessment (Palmer & Febria, 2012).

Since, the Ganga has a diverse landscape-scale ecosystem; it is not easy to decipher her ecology in detail. To start with, the river traverses three distinct climato-geographical zones - from the snow-clad and alpine Himalayan reaches to the tropical alluvial plains until it enters the estuarine zone and the sea.

Ecologically, the diversity of the basin even within each climatic zone plays an overarching role on Ganga. The saturated sub-surface zone under the river bed also forms a unique habitat termed 'hyporheic biotope' for a diverse group of fauna, which also provides temporary refuge for aquatic organisms in times of adversity and plays an important role in the processing of river nutri-

ents and interacting with groundwater (Gopal & Chauhan, 2013).

### Threats to the Biodiversity of National River Ganga and their Remediation

Many factors affecting the ecological integrity of Ganga have been identified. Of these eight main factors affecting the river habitat are discussed in the following section.

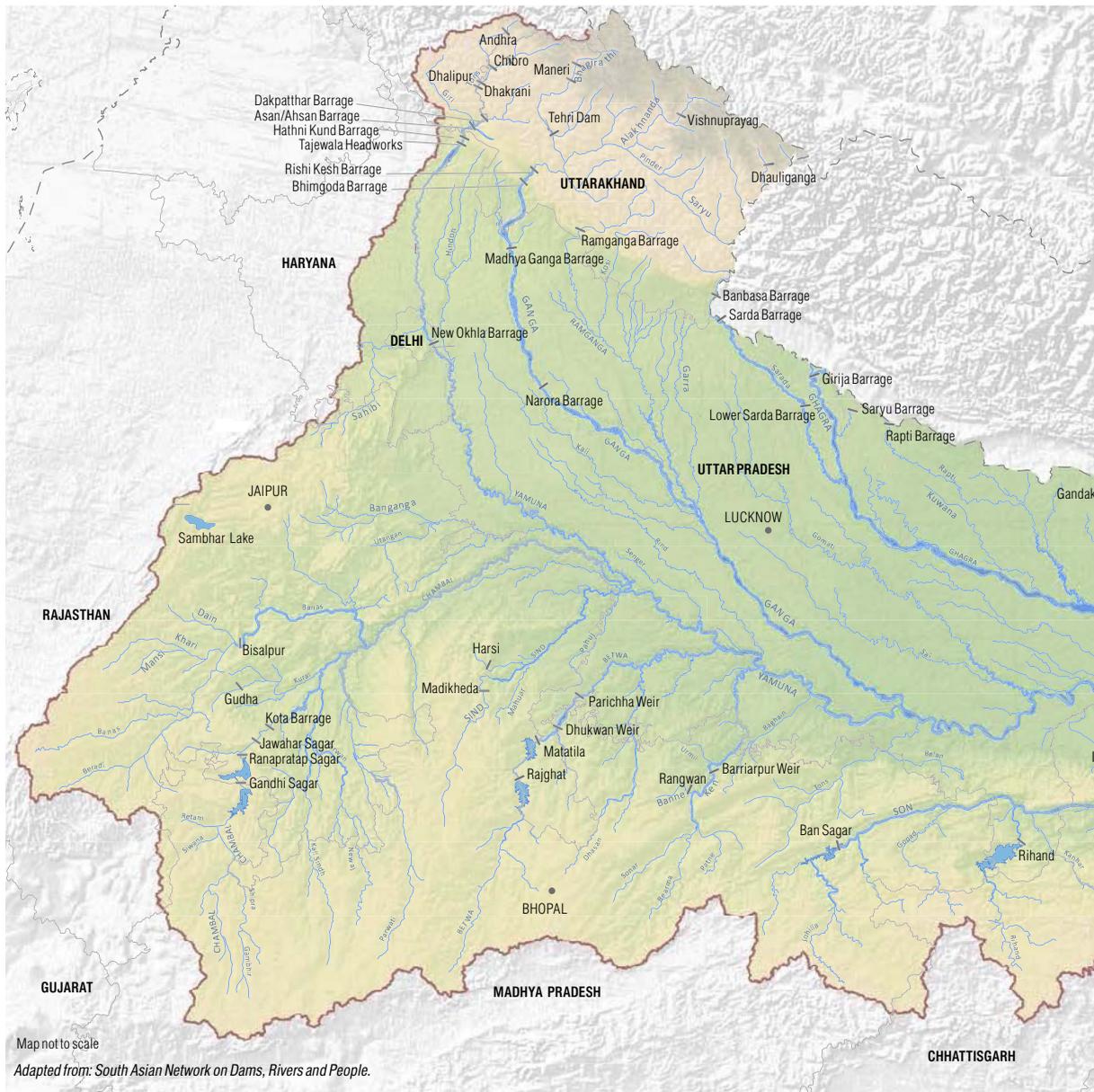
#### Habitat Fragmentation

Over the past two centuries, the Ganga river network has been considerably fragmented by dams and barrages. Figure 3 shows major dams and barrages erected in the Ganga river network. These obstructions slice the rivers into pieces, thereby interrupting the flow of water, sediments and aquatic species in the rivers.

More than 70 hydropower projects (large and small dams) have been conceived in the upper Ganga basin, many of which are still in the planning stage. It may be also noted here that, while many of these dams are small, the common notion that such small dams have relatively insignificant impacts on river ecosystems is a misconception. In some cases, the cumulative impact of small dams may be more damaging to river ecosystems than those of a single large dam.

For instance, the Pashulok barrage on Ganga near Rishikesh diverts nearly all the dry-weather flow of the river into the Chilla power station. The tail water of this power station joins the Ganga near Bhoopatwala. Thus, a distance of about 15 km from Pashulok Barrage to the junction of the tail waters

**Fig. 3: Major structural obstructions on river Ganga and her tributaries within India**



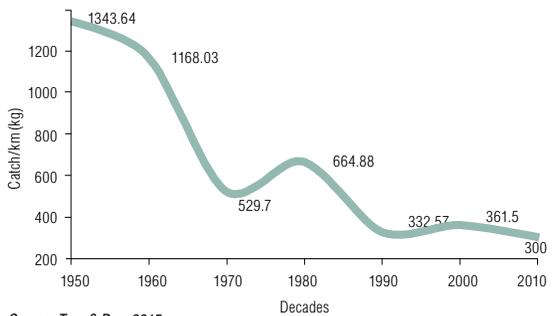
with the river has no flow. Further downstream, Bhimgauda Barrage, Madhya Ganga Barrage and Narora Barrage intersect the river successively to divert water into the upper, middle and lower Ganga canals. Further downstream, Ganga is again clipped at Kanpur by the Lav-Kush barrage. Finally, as the river heads for the estuarine reach, it is again bifurcated by the Farakka barrage in West Bengal, which diverts part of the flow into a canal to feed the Bhagirathi-Hooghly river.

Besides, the main Ganga river, major dams and barrages on her tributaries include the Ramganga Dam on Ramganga river in Uttarakhand, Asan, Dakpathar and Hathnikund Barrage (and the upcoming Lakhwar Dam) on Yamuna, Ichari Dam and Tons Barrage on Tons river, the Dhandhraul Dam on Ghaghra river, Gandhi Sagar Dam on Chambal, the Rajghat, Parichha and Matatila Dams on Betwa, the Rihand Dam on Rihand in Uttar Pradesh, the Bansagar,



Jawahar Sagar and Ruthai Dams on Kali Sindh, the Chandil, Tenughat, Maithon, Panchet and Tilaiya dams on the Subarnarekha and Damodar rivers in Jharkhand, and the Durgapur Barrage on River Damodar in West Bengal. Needless to say, the innumerable intercepts on the Ganga river network have fragmented the once unified river habitat into disjointed ecological stretches. Attempts to provide ecological connectivity by means of fish passages is also often ineffective.

**Fig. 2: Decline of fish catch per km at Allahabad between 1950 and 2010.**



Source: Tare & Roy, 2015.

Dams and barrages are also notable for trapping high quantities of river sediment, thereby converting the downstream river water into ‘hungry water’. The hungry water gradually consumes the bed and banks of the river below the dam, resulting in entrenchment and armoring of the bed. The long-term effects of this process are significant not only for river morphology, but also for the benthic and hyporheic biota as well as aquatic creatures that depend on river bed and bank sediments for spawning, shelter, scavenging or other needs.

In view of the above problems, it is necessary to ensure longitudinal connectivity along with adequate water and sediment flows throughout the Ganga river network.

### Habitat Shrinkage

Large anthropogenic water abstractions are being effected from the Ganga river network thereby considerably shrinking the aquatic space of river species. Dams and barrages on the rivers are being used to divert river flows, which includes the Tehri reservoir, the Bhimgauda barrage at Haridwar for the upper Ganga canal and thereafter at Bijnor and Narora to divert river water into the middle and lower Ganga canals respectively (Behera et al., 2011).

Abstractions of river waters also occur at different points for urban water supplies. In addition, there is water diversion into irrigation canals (such as the Yamuna, Sarada, Ramganga, Kosi and Sone canal systems). Thus, even after the confluence with Yamuna near Allahabad, the

Ganga river flow is low and significantly less than what it was a century or two ago. Large-scale water abstractions from the river network have milked the mighty Ganga to an emaciated stream during the lean season ever since the upper Ganga canal system was made operational in the mid 19th century (Behera et al., 2013).

While the effect of water abstractions from Ganga on her biota may not have been extensively studied, similar studies elsewhere indicate the serious threat they pose to riverine species. It may, therefore, be easily surmised that shrinkage of the Ganga river habitat due to river water abstractions may also have had dire consequences for various aquatic species (Behera, 2006).

Finally, it should be noted that river water abstractions are generally high during lean flow seasons but low (or nil) during the wet seasons. This results in the river channel carrying extremely low flows during the dry season but with the original high flows of the wet season almost intact. Restoring Ganga's flow to their original (undisturbed) flow is, therefore, an essential need for ecological revival.

### **Habitat Alterations**

While dams and barrages have much altered the Ganga river network, other anthropogenic alterations through unrestrained gravel and sand mining from river beds combined with the dumping of construction waste in rivers have always drastically affected the river in some parts. River constriction through levees, embankments, guide walls and even bridges have also adversely affected benthic flora and fauna, fish breeding sites and the egg laying sites of soft and hard shell turtles. A complete end to any further anthropogenic alterations to river habitat is therefore a prime requirement for ecological restoration of the Ganga river network (Smakhtin et al., 2007)

### **Habitat Pollution**

Pollution from domestic and industrial wastes is extensive in the Ganga river downstream of Haridwar, and assumes alarming proportions beyond Kannauj (after the confluence of Ramganga and Kali rivers) up to Varanasi. The discharge of treated and untreated municipal wastes from many towns into the river is rampant, resulting in high levels of organic pollutants and patho-

gens (like fecal coliforms). Adding to these are untreated or semi-treated industrial wastes from various manufacturing units (Sinha et al., 2001) along with residues of organochlorines including DDT (dichlorodiphenyltrichloroethane), HCH (hexachlorocyclohexane), endosulfan and their metabolites organophosphates and heavy metals.

These pollutants can be largely attributed to anthropogenic sources such as domestic waste, industrial waste and agricultural runoff. The high levels of such pollutants in the river have their own fatal effects on river biota.

### **Habitat Invasion by Alien Species**

Exotic species of fish, notably the common carp (*Cyprinus carpio*) and Tilapia (*Oreochromis niloticus*), have invaded the waters downstream of Allahabad, after having swamped the Yamuna river. These have largely displaced the Indian carps and other indigenous fish in the Ganga (Bashir et al. 2010 a).

In all, seven species of exotic fish have been reported in river Ganga including the Thai magur, (*Clarias gariepinus*) and Grass carp (*Ctenopharyngodon idella*). But it is not only the middle and lower reaches that have been invaded. The sighting of brown trout (*Salmo trutta fario*) downstream of Jhala is an important signal of the presence of invasive species reaching up to Bhagirathi.

The biogeography of alien fish invasions in rivers correspond to the impact of enhanced human activities in the respective river basins. Hence, habitat invasion of the Ganga river network by alien species is also essentially of anthropogenic origin. The adverse consequences of such invasions include the propagation of new diseases and parasitic organisms, and disruption of the river's ecological balance. It is, therefore, imperative that exotic species that have invaded the river network be eliminated and appropriate control measures be devised against introduction of any new alien species.

### **Habitat Encroachment**

Human beings have been encroaching upon rivers by occupying much flood of the plains and river banks for various purposes. Of late, the encroachments have become extensive with widespread construction activities on floodplains and even farming on river beds during lean flow seasons.

On the one hand, increased construction activity on flood plains have led to altered runoff patterns, increased pollution inflows with runoff, reduced groundwater recharge and, hence, decreased base flows in rivers, and curtailed ecological linkages between the river, its floodplains, and floodplain wetlands. River bed farming along with the use of chemical pesticides such as DDT and HCH, have polluted river beds, affecting the health of aquatic creatures, especially the hyporheic biota, and disturbing the breeding sites of higher aquatic animals (Bashir et al., 2010b). Hence anthropogenic habitat encroachments of the Ganga river network must be curbed at the earliest.

### Habitat Disturbances

Frequent disturbances of the Ganga river habitat by humans have received little attention. In particular, dredging and plying of noisy ships, especially in the Hooghly river stretch of the lower Ganga, have affected major aquatic animals such as the Gangetic dolphin so significantly that they have vanished from these reaches. With the possibility of increased commercial navigation in much of the middle and lower Ganga stretches in future, the issue is of considerable importance. Besides, frequent or intermittent dredging of the river bed (usually done to improve navigability in the river) is also harmful as it disrupts not only the benthic and hyporheic flora and fauna, but also aquatic animals that depend on the river bed and bank sediments for spawning, shelter, scavenging or other needs.

### Habitat Malnutrition

While anthropogenic pollution or increase of harmful substances in the Ganga river habitat is a matter of grave concern, the reverse phenomenon of anthropogenic nutrient deprivation in the river has received little attention. The general notion of anthropogenic effects on nutrient concentrations in rivers is that of nutrient enrichment, that is increased concentrations of nitrogen, phosphorous and other nutritional elements commonly present in agricultural, domestic and industrial waste waters. But the opposite phenomenon of nutrient depletion is often overlooked. In particular, dams, as noted earlier, trap large quantities of river sediments that may contain many mineral nutrients and the reduced sediment flux can

starve the downstream river stretches of essential nutrients. Thus, the effect of dams on nutrient availability in downstream reaches of rivers is of particular significance.

### Measures

The following essential actions are imperative to restore the ecological balance of the Ganga:

- ◆ restoration of longitudinal connectivity along with maintenance of environmental flows and sediments throughout the Ganga river network;
- ◆ maintenance of lateral and vertical connectivity across rivers and floodplains is to provide breeding sites of fish and other aquatic/amphibious animals as well as the periodic exchange of river biota with floodplain wetlands;
- ◆ restoration of unpolluted flow in the river by appropriate measures to control anthropogenic pollution;
- ◆ restrictions on anthropogenic alterations of river morphology owing to gravel and sand mining;
- ◆ elimination of alien invasive species in the Ganga river network and establishing norms to prevent future introduction of exotic species;
- ◆ control of habitat encroachment by humans for riverbed farming, riparian activities and permanent constructions in the floodplains;
- ◆ restrictions on anthropogenic disturbances of river habitat by frequent plying of vessels, or dredging of river bed;
- ◆ control of overfishing and fishing during spawning seasons, ban on commercial fishing, and protection of the spawning and breeding grounds of fish;
- ◆ assessment of essential nutrient elements available in different river stretches and in sediments trapped behind dams, and devising suitable means to release the trapped sediments into downstream river reaches;
- ◆ continuous bio-monitoring of the entire Ganga River and her important tributaries, and dissemination of information in public domain;
- ◆ synergising the eco-restoration measures proposed above with the Dolphin Conservation Action Plan initiated by Ministry of Environment & Forests in 2010 (GoI, 2010).

### Endnote

Implementing the rather long list of measures is

not going to be an easy task. And the condition of the Ganga is so very debilitating that even if we implement all the measures it is likely to take quite sometime to restore the ecological state of the mighty Ganga and its network. However, bringing back Ganga to its original state might be a dream far in the future and exceptionally difficult, considering the ways of the people. ☒

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# Health measurements

Here are some terms that could challenge your understanding on health and well being. Turn to page number 70 to find out how much you know about well-versed generic terms.

## 1. Life Expectancy

- a. The term indicates an average number of years that a newborn is expected to live if current mortality rates continue to apply.
- b. The term denotes an average number of years that a person can expect to live in 'full health' by taking into account years lived in less than full health due to disease and/or injury.
- c. It is a term depicting a Non-astrological prediction of the number of years a person will live for.

## 2. IMR

- a. IMR stands for international mortality rate.
- b. IMR stands for infant mortality rate.
- c. IMR stands for Indian medical register.

## 3. Prevalence

- a. The term is a measure of disease that allows us to determine a person's likelihood of having a disease.
- b. The term denotes a measure of person's likelihood of having a disease.
- c. The term measures the number of diseases present in a specific space over a specific time period.

## 4. Incidence

- a. The term refers to the number

of ethnic groups who develop a specific disease during a particular time period.

- b. The term infers to the number of individuals who develop a specific disease or experience a specific health-related event during a particular time period.
- c. The term denotes a number of individuals who develop a specific disease or experience a specific health-related event during birth.

## 5. CBR

- a. The term stands for crude birth rate.
- b. The term indicates common birth rate.
- c. The term is used to signify cumulative birth ratio.

## 6. NRHM

- a. The term denotes for National Report on Health Mission.
- b. The term is an acronym for National Rural Health Mission.
- c. The term stands for National Rubella Health Mission.

## 7. Malnutrition

- a. The term denotes lack of proper nutrition, caused by not having enough to eat.
- b. The term indicates lack of proper nutrition, caused by having carbohydrate deficiency.
- c. The term stands for lack of proper nutrition, caused by not having

enough to eat in the context of a female child.

## 8. Epidemic

- a. The term indicates slow spread of infectious disease to a small number of people in a given population in a long period of time.
- b. The term denotes fast spread of infectious disease to a large number of people in a given population within a short period of time.
- c. The term stands for the slow spread of infectious disease to a large number of people in a given population within a short period of time.

## 9. Endemic

- a. The term indicates that which is regularly found among particular people or in a certain area.
- b. The term denotes that which is regularly found among old age groups or in different areas.
- c. The term indicates that which is seldom found among particular people or in common area.

## 10. CDR

- a. CDR stands for crude death ratio.
- b. CDR stands for cumulative death ratio.
- c. CDR stands for crude death rate. 

By V SAMPATH

# MARINE LITTER: THREAT TO MARINE BIODIVERSITY

*Comprising plastics and other non-degradable solid waste, marine litter drifts around the global oceans posing a serious threat to marine habitats, as also human health and safety. Since legal mechanisms are not yet in place, existing mechanisms ought to be used as a framework to build on for protecting the oceanic realm.*

**M**arine and other aquatic litter/debris is the world's most pervasive pollution problem along shorelines, coastal waters, estuaries, and oceans throughout the world, affecting our seas and waterways. Marine litter consists primarily of plastics and non-degradable substances, which inevitably accumulate in the environment, causing an ever-growing problem. The threat and impact of marine debris have long been ignored. The trash that drifts around the global oceans and washes up on shores, can pose a serious threat to fisheries, marine biodiversity and human health.

Oceans are at the receiving end for solid waste generated over land as well as the oceans. Only a fraction of the solid waste generated is collected; while the rest gets dumped in open areas. Solid waste dumped into seas comes from shipping, commercial fisheries, and other offshore activities. According to United Nations Environment Programme (UNEP), ship-generated solid waste, especially marine litter, comprises 80 per cent of the total solid waste in coastal and marine areas (UNEP, 1995).

It is reported that about 44000 cum of domestic sewage and 440 cum of industrial wastes are discharged every year into the seas of India (GoI,

2016). The quantity of solid waste generated by the coastal population of India is about 2000 tonnes per day, an average of 0.5 kg/person/day for a population of 4 million living along the 7500 km coastline (SACEP, 2007).

Worldwide, as many as 8 million items of garbage, was reported to be entering the seas on a daily basis in 1995 (Benton, 1995). Another report claimed that 5.25 trillion pieces of plastic, weighing 269,000 tonnes, was getting distributed across the oceans (Howard, 2014).

Plastic debris originate from a wide and diverse range of sources. Much of what is found at sea originates on the land. It is 'estimated that over 13,000 pieces of plastic litter floats over every square kilometre of the ocean today' (UNEP, 2005). It is also estimated that the ocean receives between 5 and 12 million tonnes of plastics from land-based sources annually and constitute approximately 20.7 per cent of litter dumped in the marine environment (Ocean Conservancy, 2015).

The problem of marine litter is compounded further by river and storm water drains discharging garbage from the hinterland. Anthropogenic activities at sea such as commercial fishing vessels, recreational boats and cruise ships; cargo and research vessels and passenger ships also contribute to the growing litter at sea.

### **Status of Marine Litter in India**

From the available data, it could be inferred that the major sources of marine pollution including debris/litter are domestic/industrial waste, ports and harbours including fishing harbours and landing centres, ship-breaking yards, fish/food processing industries, tourist resorts/beaches, solid waste dumping, urban runoff, oil rigs, coastal aquaculture, fishing industry including fishing gear, shipping—including garbage from ships, recreational and leisure activities, marine mining and construction activities along the coasts (SACEP, 2007).

During the last 2-3 decades, there has been growing concern in the world due to an increase in the quantity of litter in the marine environment. Surveys have indicated that nearly 80 per cent of marine debris originate from land-based activities (UNEP, 1995). This increase is a result of the fast development of extensive and unplanned use of plastic materials. However, plastics are not the only

## **In the absence of laws to deal with marine litter, it is important to fall back on existing mechanisms and tackle the problem using local agencies at the ground-level.**

persistent material discarded into the sea. There are a variety of others too, such as metal, lumber, glass, rubber, styrofoam, cloth, and foam rubber.

The types of marine litter in India (SACEP, 2007) reported, include:

- ◆ Plastics (fragments, sheets, bags, containers)
- ◆ Polystyrene (cups, packaging, buoys)
- ◆ Rubber (gloves, boots, tyre)
- ◆ Wood (construction timber, pellets, plywood, fragments of both)
- ◆ Metals (drink cans, oil drums, aerosol containers, scrap)
- ◆ Sanitary or sewage related debris (tampons, diapers, condoms, faeces)
- ◆ Paper and cardboard
- ◆ Cloth (clothing, furnishings, shoes)
- ◆ Glass (bottles, light bulbs)
- ◆ Pottery/Ceramic
- ◆ Monofilament fishing line
- ◆ Waxed milk carton
- ◆ Fruit peel
- ◆ Cigarettes, cigarette fibre, lighters, cigar tips, and other tobacco related packaging/wrappers
- ◆ Used batteries,
- ◆ Building materials,
- ◆ Fishing lines, floats, marking buoys and abandoned cut pieces of used nets.

There is no information/data available on the trash flowing in the open oceans and submerged marine litter/debris, as no systematic monitoring/sighting of such debris has so far been undertaken in the Indian seas, although stray instances of entanglement of fish and endangered marine fauna are reported from Indian waters.

Even though periodical coastal clean-up operations are carried out in India, no effort has so far been made to either assess the costs involved in

such operations or damage to the ecosystem, tourism, public health and safety due to coastal and marine litter in our seas.

### **Impact of marine litter**

The threat and impacts of marine debris have long been ignored. Plastics are now found inside animals throughout the ocean food chain—from mussels to fish to sea turtles to whales (Ocean Conservancy, 2015). While marine debris is a global problem requiring international cooperation, many of its negative impacts are experienced at the local level and can easily be dealt with, through local involvement.

After assessing the report of the South Asian Co-operative Environment Programme on Marine Litter in the South Asian Seas Region, the following are the social, physical, biological and economic ramifications of marine debris (SACEP, 2007):

■ **Social:** Human health is affected in many ways. Broken glasses, ropes and lines dangling in the ocean can pose a threat to beach goers, boaters and divers. Disposal of biomedical waste into the seas causes outbreaks of cholera and hepatitis among coastal populations. Of late, outbreaks of cholera and infectious hepatitis are occurring with increasing frequency among coastal populations.

■ **Physical:** Litter in the seas can affect marine waters and sediment quality.

■ **Biological:** Marine debris can affect marine life, especially endangered species that thrive in coastal waters. Fish, turtles and sea birds can die through entanglement and ingestion.

■ **Economic:** Beach clean-up exercises are an expensive affair. However, every time a beach was cleaned by NGOs in Thoothukudi in Tamil Nadu, the same quantity of waste was dumped on the shore in a week's time. Lack of awareness on the part of people, and the indifferent attitude of local municipalities towards the collection and disposal of untreated/partially treated liquid and solid wastes in smaller towns have caused large-scale pollution of our marine coasts. This has destroyed fisheries, and resulted in the proliferation of deadly jellyfish which can attack those venturing into coastal waters. The repeated clean-up of the beach not only involves huge manpower but also sizeable expenditure

## **No effort has so far been made in India to either assess the costs involved in cleanup operations or damage to the ecosystem, tourism, public health and safety due to coastal and marine litter in our seas.**

is incurred in engaging people from the coastal community for collection and disposal of wastes/litter in an organised manner.

### **Legal Mechanisms**

Marine litter was identified as one of the nine categories that needed to be dealt with under the Global Programme of Action (GPA) for the 'Protection of the Marine Environment from Land-based Activities' (UNEP, 2005). Decision 59/22 of November 10, 2004 on 'Oceans and the Law of the Sea' had recommended that marine debris be included in discussions of the United Nations Consultative Process on the Law of the Sea (UNICPOLOS) as well as in the 2004 UN Secretary General's Report. The issue of marine litter and the destructive effects of abandoned fishing gear were further emphasised in resolution 59/25 of the United Nations General Assembly (UNGA) on November 17, 2004 on 'Oceans and the Law of the Sea'—'Sustainable Fisheries' (UNGA, 2005).

There is no legal mechanism/framework or policies specifically to deal with the management of marine litter. Existing mechanisms in place, however, are an umbrella framework for environmental protection and management.

Noting the lack of data on marine debris, UNGA Resolution A/60/L.22, 'Oceans and the Law of the Sea' of November 29, 2005 in articles 65-70 'encourages relevant national and international organisations to undertake further studies on the extent and nature of the problem, also encourages States to develop partnerships with industry and civil society to raise awareness on the extent of the impact of marine debris on the health and productivity of the marine environment and consequent economic loss' (UNGA, 2006). It also calls for

national, regional and global action to address the problem of marine litter. It 'urges States to integrate the issue of marine debris within national strategies dealing with waste management in the coastal zone, ports and maritime industries, including recycling, reuse, reduction and disposal; encourages the development of appropriate economic incentives to address this issue, including the development of cost recovery systems that provide an incentive to use port reception facilities and discourage ships from discharging marine debris at sea; and encourages States to cooperate regionally and sub-regionally to develop and implement joint prevention and recovery programmes for marine debris' (UNGA, 2006).

In response to the GPA call, UNEP (GPA and the Regional Seas Programme), took an active lead through its 'Global Initiative on Marine Litter' to address the challenge, by assisting 11 regional seas around the world (Baltic Sea, Black Sea, Caspian Sea, East Asian Seas, Eastern Africa, Mediterranean Sea, Northwest Pacific, Red Sea and Gulf of Aden, South Asian Seas, Southeast Pacific, and Wider Caribbean), in organising and implementing regional activities on marine litter.

Considering the magnitude and severity of the problem, and in line with the UNGA Resolutions, UNEP/Regional Seas Programme has been developing activities relevant to the marine litter issue in consultation and in co-operation with UN Agencies, such as the International Maritime Organisation (IMO); Intergovernmental Oceanographic Commission (IOC) of UNESCO; the Secretariat of the Basel Convention; the Mediterranean Action Plan and the Food and Agriculture Organisation of the United Nations (FAO). One such programme is a 'Feasibility Study on Sustainable Management of Marine Litter' (UNEP, 2005).

## Endnote

In the absence of laws to deal with marine litter, it is important to fall back on existing mechanisms and organise an international action plan to tackle the problem, using local agencies at the ground-level. A move has already been made through the UN agencies; sustained follow-up action at the regional and sub-regional level will be needed to protect local populations from the impact of marine litter on their health, general well-being and livelihoods. ☐

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By **A ANURAG DANDA**

# Climate Change Negotiations and Policy

*Everyone is accountable in the climate change discourse. So UN's divided framework of 'us' and 'them' blocs will fall short in tackling climate change. The Paris Agreement at COP 21 is currently under ratification. Immediate universal ratification is imperative.*

**D**o you recall the hullabaloo of the 1970s about the ozone layer? Is the ozone layer on the mend? It seems so. The amount of chlorofluorocarbons is now slowly diminishing. Equivalent effective stratospheric chlorine (EESC), commonly used metric for the atmospheric burden of ozone depleting substances is down at 3.45 parts per billion (ppb) in 2014 from 3.79 in 2000-2002. The aim is to see the value of EESC come down to its 1980 level of 2.05 ppb (WMO, 2015). This will take decades but we are on the road, together. How did we achieve this?

The 'Vienna Convention for the Protection of the Ozone Layer' served as a framework for efforts to protect the earth's ozone layer. The convention was adopted in 1985 and entered into force in 1988. Unlike any other convention before or after it, the Vienna Convention in 2009 achieved universal ratification (UNEP, 2015). The fair skinned, about 2 million of them have been spared the horrific prospect of skin cancer (UNEP, 2014) and others

have benefitted too by averting damage to human eyes and immune systems. Who paid for this? The fair skinned mainly.

The world got carried away, and when it came to fixing the climate change problem the ozone layer model with a framework convention and a protocol was replicated. Until the 21st Conference of Parties neither have we achieved universal ratification nor is the atmosphere on the mend. The world breached the 400 parts per million (ppm) mark of atmospheric CO<sub>2</sub> in 2015, and it is still rising (CO<sub>2</sub> earth, 2016). One has to ask how and why?

The fair skinned are not at immediate risk to global warming leading to temperature rise. Some are in fact looking out for more hospitable weather for longer durations in a year. Also, an economic consequence of mitigating ozone depleting substances and greenhouse gasses are vastly different across the world. But, the question still remains. Is the UN system failing us? Probably, it is.

The Vienna Convention of 1985 is an excep-

tion, not the norm. The UN was formed by 20 odd nations (India included) led by the United States and the United Kingdom. According to the UN 1942 Declaration a “complete victory over their [Allied] enemies is essential to defend life, liberty, independence and religious freedom, and to preserve human rights and justice in their own lands as well as in other lands, and that they are now engaged in a common struggle against savage and brutal forces seeking to subjugate the world” (UN, 1946-47). Does the incongruence stare at you? UN would wage war against savage and brutal forces to defend independence as if UK and a section of its population were not savage and brutal in their treatment of Indians and a country still to attain independence.

The UN system works best when we are in conflict with each other, ‘us’ versus ‘them’, the perceived good versus the bad and ugly. The problem with climate change is that we are all ugly, some more so than others. Possibly, due to the UN system’s reliance on conflict, the climate change debate has mostly been played out as if the conflict is between the more ugly and the less ugly, and not between earth systems and socio-economic systems. What then?

The Paris Agreement at the end of the 21st Conference of Parties to the UNFCCC (UN, 2015) is the first baby step to move away from the ‘us’ versus ‘them’ syndrome. It brought all nations into a common cause to commit to a common cause expressed through their intended nationally determined commitments (INDCs). However, if the baby steps do not gather momentum and become gigantic strides soon enough, there will be nothing left worth bickering about.

*There’s a Hole in the Bucket*, a famous song by Harry Belafonte and Odetta Holmes, is based on a dialogue about a leaky bucket between two characters, Henry and Liza. The song describes a deadlock situation. Henry has a leaky bucket, and Liza asks him to fetch water. Henry informs of the hole and Liza asks him to repair it. But to fix the leaky bucket, he needs straw. To cut the straw, he needs an axe. To sharpen the axe, he needs to wet the sharpening stone. To wet the stone, he needs water. However, when Henry asks how to get the water, Liza’s answer is “in a bucket”. Only the leaky bucket is available, which, if it could hold water, would not need repairing in the first place.

## **The Paris Agreement at the end of the 21st Conference of Parties to the UNFCCC (UN, 2015) is the first baby step to move away from the ‘us’ versus ‘them’ syndrome.**

The choice is between resolving the deadlock and drawing up bucket lists.

There is an urgency in trying to resolve the deadlock of climate change crisis. However, the governments of the world can do little if the constituents are unwilling or are indifferent. The climate change initiatives require absolute universal ratification and participation to even gain some momentum in the long struggle. ☞

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By P K CHANDRASEKHARA PILLAI, K DEEPA and A H JIJI

# PRE-TREATMENT FOR IMPROVED SEED GERMINATION

*Pre-treatment of seeds through various methods enables rapid and uniform germination. In short, it accelerates the natural processes and releases the dormant life force within.*

**P**re-treatment is a pre-sowing treatment carried to enable rapid and uniform germination of seeds sown in the nursery, field, or testing site. Even under favourable conditions viable seeds may fail to germinate due to dormancy. Pre-sowing treatment can terminate dormancy and speed up germination. It also helps in reducing toxic compounds present in the seed coat, which inhibit seed germination. Seed dormancy may be

of three types; physical (hard and impermeable seed coat/pericarp), mechanical (hard seed coat) and morphological (underdeveloped embryo). Morphological dormancy can be overcome through after-ripening process by storing seeds for a while (eg. *Tectona grandis*).

Seed germination trial of few forest species found in the Western Ghats region have been undertaken in the seed technology laboratory of the Kerala Forest Research Institute, Peechi,

Thrissur, Kerala. The results are given in Table 1.

The effect of de-coating on seed germination of *Dysoxylum malabaricum*, a tree species endemic to the evergreen forests of the Southern Western Ghats, belonging to the family *Meliaceae* was assessed in 2014-15. The mature fruits of *D. malabaricum* were collected directly from standing trees during June-August. Seeds were extracted from fruits and de-coated using a sharp knife. Removal of dark brown fleshy seed coat helped to avoid fungal infection and to remove chemical inhibitors present in seed coat that impede seed germination.

De-coated seeds were subjected to viability test in terms of germination (n = 100 seeds in 3 replicates) and compared to seeds with seed coat. A randomised complete block design (RCBD) was adopted for the study. After daily observations made from the commencement of seed germination till the culmination in order to assess germination parameters, mean germination per cent was calculated (germination per cent = number of germinated seeds/total number of seeds × 100).

Germination commenced 17 days after sowing (DAS) in de-coated seeds and continued up to 45

**Table 1: Pre-treatments and seed germination (per cent) of selected species.**

Species		Treatment	Treatment duration	Germination (Per cent)
Scientific name	Common name			
<i>Adenanthera pavonina</i>	Red bead tree	Control	-	30
		Hot water soaking	5 minutes in hot water and overnight in tap water	46
		Acid scarification	Acid scarification for 10 minutes followed by overnight tap water soaking	76
<i>Caesalpinia sappan</i>	Sappan wood	Control	-	32
		Hot water soaking	5 minutes in hot water and overnight in tap water	56
<i>Cassia fistula</i>	Indian laburnum	Control	-	25
		Hot water soaking followed by tap water	5 minutes in hot water and overnight in tap water	30
		Acid scarification	Acid scarification for 10 minutes followed by overnight tap water soaking	83
<i>Dysoxylum malabaricum</i>	White cedar	Control	-	17
		De-coating	-	97
<i>Embelia ribes</i>	Embelia	Control	-	19
		De-coating	Grinding using mortar and pestle	40
<i>Garcinia gummi-gutta</i>	Malabar Gamboge	Control	-	7
		De-coating	-	70
<i>Mimusops elenji</i>	Asian bullet wood	Control	-	65
		Water soaking	12 hours	75
<i>Phyllanthus emblica</i>	Indian gooseberry	Control	-	40
		Water soaking	12 hours	44
<i>Santalum album</i>	Sandal tree	Control	-	30
		Cow dung slurry	48 hours	63
		GA <sub>3</sub> (500 ppm)	16hours	70
<i>Simarouba glauca</i>	Paradise tree	Control	-	66
		De-pulping and water soaking	12 hours	71
<i>Spondias pinnata</i>	Indian hog plum	Control	-	40
		Clipping	-	60
<i>Tectona grandis</i>	Teak	Control	-	18
		Weathering	7 days	34

Note: Control = No treatment

# Pre-treatment enhances seed germination which is useful in the establishment of plantations, restoration and management of fragile and degraded areas across the country.

days with a high rate (97 per cent) of germination. However, in the case of seeds with seed coat, the germination period was 34 to 100 days with poor germination (17 per cent). Statistical analysis (independent-samples t-test) revealed that the treatment effect was highly significant ( $P < 0.05$ ). The study indicates that de-coating is the most effective pre-treatment for enhancing seed germination in *D. malabaricum*. A similar result was reported in *Garcinia gummi-gutta* (Chacko & Pillai, 1997) and *Osyris lanceolata* (Mwang' ingo et al., 2004).

Some common pre-treatments practised in our laboratory to break seed dormancy are given below:

- **Cold water treatment:** Soaking seeds in tap-water for 12 to 48 hours helps to soften seed coat and leach out chemical inhibitors. This treatment is applied to most medium sized dry seeds to overcome physical, mechanical or chemical dormancy (Chacko et al., 2002). About 10 per cent increased seed germination of *Swietenia macrophylla* was achieved under laboratory condition by water soaking treatment (Table 1).
- **Hot water treatment:** Soaking seeds in hot water (boiled, and then cooled for about 5–10 minutes to 80 °C) for 1 to 45 minutes (depending on the hardness of seed coat) and then soaking in tap-water for 12 to 24 hours. Seeds imbibe and swell as the water cools. It can overcome the physiological dormancy with hard, thick and waxy coated seeds by creating tension which consequently causes cracking of the macro sclereid layer or by affecting strophliolar plug (Schmidt, 2002). Hot water treatment tremendously improved seed germination of *Caesalpinia sappan* when compared to plain tap water soaking (Table 1).
- **Acid scarification:** Seeds with thick impermeable seed coat is scarified in concentrated  $H_2SO_4$  for 1 to 30 minutes depending on the nature of seed coat, and thereafter thoroughly rinsed under running water for 10 minutes to remove traces of acid. It is then soaked in water for 12 hours to enhance imbibition. Acid scarification increased seed germination of *Adenanthera pavonina* and *Cassia fistula* (Table 1). Acid causes wet combustion of seed coat, which results in disruption on the seed coat and increases permeability by lowering mechanical resistance (Schmidt, 2002).
- **De-winging:** It is the removal of dry seed appendages like wings, spines, hairs and arils. De-winging causes seed coat to crack and helps to imbibe water. Wings usually increase surface area of the seed, tend to accumulate moisture and promote fungal attack. De-winging helps to reduce bulk and ease in handling (Chacko et al., 2002), eg. *S. macrophylla*, *Butea monosperma*.
- **De-coating:** De-coating is the removal of fleshy or hard seed coat to promote germination, since the seed coat may set back seed germination due to the presence of chemical inhibitors. De-coating also helps prevent fungal infection in fleshy seeds (Chacko & Pillai, 1997). It was found that de-coating enhanced seed germination of *Embelia ribes*, *G. gummi-gutta* and *D. malabaricum* by about 3-10 times as compared to seeds with seed coat (Table 1).
- **Weathering:** Weathering means wetting and drying of seeds to soften the hard seed coat. Wetting of seeds in the night and drying them under the sun for seven days showed great improvement in seed germination of *T. grandis* (Table 1). It causes softening of pericarp (due to expansion and contraction) and helps crack the hard seed coat to help imbibe water and gas resulting in improved germination (Chacko et al., 2002).
- **Clipping:** Chopping at both the distal ends and micropylar end can crack the seed coat, through which moisture and gaseous exchange takes place and makes conditions suitable for germination (Chacko et al., 2002). Clipping enhanced

seed germination by 20 per cent in *Spondias pinnata* as compared to the control stock (Table 1).

- **Splitting endocarp:** This can enhance water imbibition and promote germination. (Chacko et al., 2002) as observed in *M. dubia*.
- **Abrasion treatment:** Mixing seeds with sand (either same or double the amount of seeds) and then grinding them gently in a mortar or scarification of seeds by rotating in drums lined with sand paper, followed by soaking in water overnight before sowing can improve germination several fold.
- **Mechanical scarification:** Tumbling in cement mixer with sand/gravel (as in *M. dubia*) has an effect similar to abrasion (as discussed above). However, it is time consuming and labour intensive.
- **Scorching or fire treatment:** A fire in the teak forests has been observed to stimulate germination. The teak seed is thus sometimes spread on ground on a layer of leaves and given a light burn. But it is now not being used as the method is difficult to control.
- **Stratification:** In this method, seeds are spread in layers altering with sand, or charcoal, in boxes or baskets to improve germination.
- **Cow-dung slurry treatment:** Cow-dung is mixed with equal quantity of water to form a slurry and seeds are soaked in it for 24 hours. Cow-dung contains growth hormones like indoleacetic acid (IAA), gibberillic acid (GA<sub>3</sub>), kinetin, and abscissic acid (ABA). This treatment helps overcome physiological dormancy. Soaking seeds in cow-dung slurry for 48 hours improved the seed germination of *Santalum album* (Table 1).
- **Biological scarification:** Seeds germinate quickly if they are passed through the digestive system of birds/animals, as in the case of *Acacia arabica*, and *S. album*. Seeds of *Acacia Senegal*, *Gmelina arborea*, *Acacia nilotica*, and *M. dubi*, show improved germination by the action of strong digestive chemicals in the guts of organisms. Termites are important agents for breaking down seed coat dormancy in *T. grandis* (Chacko, 1998).
- **Hormonal treatment:** Soaking seeds in gibberellic acid (GA<sub>3</sub>) solution promotes cell elongation and cell division, triggering

growth and development (Chacko et al., 2002). Soaking seeds in GA<sub>3</sub> solution (500 ppm) for 16 hours enhanced seed germination of *S. album* (Table 1).

## Endnote

From ancient times, dormant seeds have been coaxed into germination through a variety of methods. These range from a simple physical treatments—such as dousing with hot or cold water, to the complicated hormonal ones that trigger growth and development. Use of seeds as propagule is the cheapest and easiest method in agro-forestry system. Many tree species with economical value are propagated by enhanced seeds. Pre-treatment enhances seed germination which are useful in the establishment of plantations, restoration and management of fragile and degraded areas across the country. However limited research and lack of information is a stumbling block. ❏

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# Health measurements

Below are the answers and a brief description about the terms that were placed before you on page 59. Check how you fared from the chart below.

- 1 to 5 Correct - *Informed*
- 6 to 8 Correct - *Knowledge bank*
- 9 to 10 Correct - *Encyclopaedia*

## 1. Life Expectancy

Ans. **b**: Average number of years that a person can expect to live in 'full health' by taking into account years lived in less than full health due to disease and/or injury. The most commonly used measure of life expectancy is at birth (LEB).

## 2. IMR

Ans. **a**: IMR stands for infant mortality rate. IMR is the number of deaths of infants below one year per 1,000 live births. This rate is often used as an indicator of the level of health in a country. The rate for a given region is the number of children dying under one year of age, divided by the number of live births during the year, multiplied by 1,000.

## 3. Prevalence

Ans. **a**: Measure of disease that allows us to determine a person's likelihood of having a disease. It is a statistical concept referring to the number of cases of a disease that are present in a particular population at a given time. Prevalence estimates are used by epidemiologists, health care providers, government agencies, and insurers.

## 4. Incidence

Ans. **b**: Refers to the number of individuals who develop a specific disease or experience a specific health-related event during a particular time period. Incidence measures the rate of occurrence of new cases of a disease or condition. Incidence rates can be further categorised according to different subsets of the population—e.g., by gender, by racial origin, by age group or by diagnostic category.

## 5. CBR

Ans. **a**: CBR stands for crude birth rate. The CBR is the number of live births occurring among the population of a given geographical area during a given year, per 1,000

mid-year total population of the given geographical area during the same year.

## 6. NRHM

Ans. **b**: NRHM is the acronym for National Rural Health Mission. NRHM seeks to provide equitable, affordable and quality health care to rural population, especially the vulnerable groups. The goal of the Mission is to improve the availability of and access to quality health care by people, especially for those residing in rural areas, poor, women and children.

## 7. Malnutrition

Ans. **a**: A term that denotes lack of proper nutrition, caused by not having enough to eat. It occurs when the body doesn't get enough nutrients. Malnutrition is a term which refers to both undernutrition (subnutrition) and overnutrition.

## 8. Epidemic

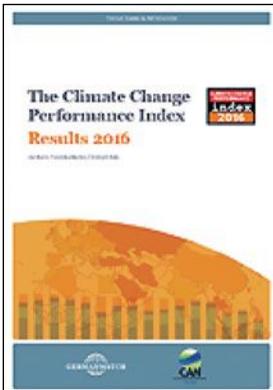
Ans. **b**: Rapid spread of infectious disease to a large number of people in a given population within a short period of time is known as an epidemic. For example, in 2003, the severe acute respiratory syndrome (SARS) epidemic took the lives of nearly 800 people worldwide.

## 9. Endemic

Ans. **a**: The term denotes that which is usually found among particular people or in a certain area. An infection is said to be endemic when that infection is maintained in the population without the need for external inputs.

## 10. CDR

Ans. **c**: CDR stands for crude death rate. CDR is the total number of deaths per year per 1,000 people. As of 2014 the crude death rate for the whole world is 7.89 per 1,000. 



## THE CLIMATE CHANGE PERFORMANCE INDEX - 2016

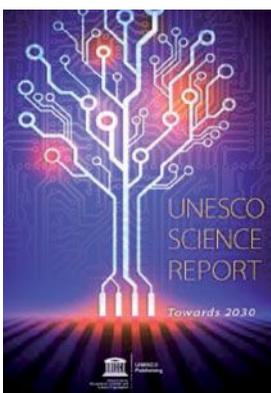
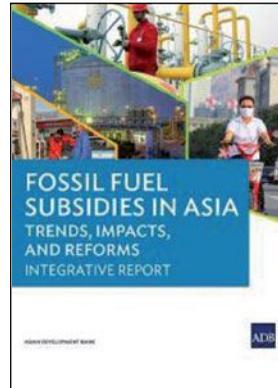
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**T**he Climate Change Performance Index is an instrument supposed to enhance transparency in international climate politics. Its aim is to encourage political and social pressure on those countries which have, up to now, failed to take ambitious actions on climate protection as well as to highlight countries with best-practice climate policies. On the basis of standardised criteria, the index evaluates and compares the climate protection performance of 58 countries that are, together, responsible for more than 90 percent of global energy-related CO<sub>2</sub> emissions. 80 percent of the evaluation is based on objective indicators of emissions trend and

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## Website



### FAOSTAT

[www.faostat3.fao.org](http://www.faostat3.fao.org)

The statistics division of Food Agriculture Organization has launched a new version of FAOSTAT. The new platform continues to offer free and easy access to data for 245 countries and 35 regional areas from 1961 onwards. Enhanced features include browsing and analysis of data, an advanced interactive data download, and enhanced data exchange through web services.

### ESCAP Online Statistical Database

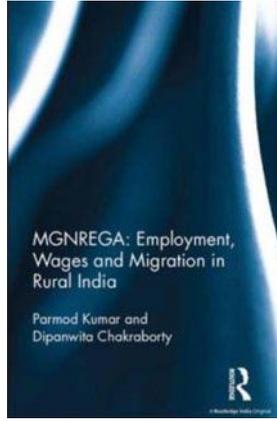
[www.unescap.org](http://www.unescap.org)

The database provides a regional perspective on development issues in Asia and the Pacific. The database, covering the 58 regional ESCAP member states and associate members, contains 900 data series on population, education, health, poverty and inequalities, gender, economy, environment and connectivity. The online database is updated twice a year.

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[www.envis.nic.in](http://www.envis.nic.in)

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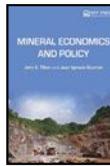
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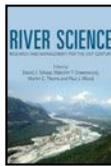
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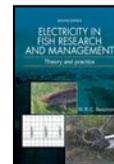
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- SWITCH OFF LIGHTS, FANS AND ACs WHEN NOT IN USE
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- USE LESS AND WASTE LESS WATER
- CARRY A JUTE OR COTTON BAG INSTEAD OF A PLASTIC ONE
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- WALK OR CYCLE SHORT DISTANCES
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