



POPULATION TRENDS: IMPLICATIONS FOR GLOBAL ENVIRONMENTAL CHANGE

BY RONALD R. RINDFUSS AND SUSANA B. ADAMO



Photo: Bernd Decker

Ibadan, Nigeria

► **Population growth affects global environmental change.** Other things being equal, an increase in the world's population will lead to more carbon emissions, more deforestation and less biodiversity; but arguments of this kind are too simplistic and other things are not equal. The effects can go in both directions: environmental change can influence population growth. As has long been recognized, e.g. the IPAT model (Ehrlich and Holdren 1971), it is not just adding people that matters, but also how those people produce and consume. To see this, imagine adding 10 hunter and gatherers to the world's population versus adding 10 men with chainsaws driving Land Rovers and living in 3,500 sq ft (325 sq m) houses. Furthermore, institutions (local, national and/or global) can mitigate or exacerbate the effects of population change (Dietz, Ostrom and Stern 2003). Finally, it also matters whether people are organized into a small number of larger households or a large number of smaller households.

To understand population-environment relationships, we need to link population change to consumption, production, and institutions. Before tackling this complexity it is important to understand basic population trends. This paper, painting with broad brush strokes, reviews recent trends and speculates about the future.

POPULATION GROWTH

The elements of population growth are conveniently summarized by the following basic equation:

$$\text{Pop}_{t2} = \text{Pop}_{t1} + (\text{Births} - \text{Deaths}) + (\text{In-migrants} - \text{Out-migrants})$$

► continued on page 2

FOCUS: POPULATION

CONTENTS

- 1 Population Trends : Implications for Global Environmental Change |**
By Ronald R. Rindfuss and Susana B. Adamo
- 2 Editorial**
- 4 Population and Environment Change: Fitting the data to the analysis |** By Alex de Sherbinin
- 6 Population and Environment Issues in China's Western Development |**
By Peng Xizhe
- 8 Global Environmental Change, Urbanization and Health: The case of rapidly growing Dhaka |**
By Bruce Caldwell
- 10 Conservation and Family Planning go hand in hand |**
Interview with Robert Engelman
- 11 Global Environmental Change: Variation in Impacts Across Regions and within Populations |**
By Suruchi Bhadwal, Shaleen Singhal, Rekha Krishnan and Ulka Kelkar
- 13 More People, More Trees? Examining Community Forestry in Nepal's Terai |**
By Harini Nagendra and Arun Agrawal
- 14 Trading Spaces: Following the Impact of Forest-Coffee Conversions on Honduran Livelihood |**
By Catherine Tucker, Darla Munroe, Jane Southworth, Harini Nagendra
- 16 Industrial Transformation is NOT (just) about the manufacturing industry... |**
By Anna Wiczorek
- 17 Argentina Inventory |**
By Elda Tancredi
- 18 In Brief**
- 19 Calendar/Books**
- 20 Adresses/Masthead**

EDITORIAL

Population is an integral part of global environmental change. Historically, population was regarded as the most important or even the only driver for global change. However, this notion has since been outdated – environmental change has many drivers that are closely interwoven in various ways, population being only one of them. Deforestation is, in general, closely linked with population growth. This being the case in some areas, it is not in others where big multinational wood companies are responsible for major deforestation. The local population only plays a minuscule role in this.

Environmental degradation and desertification often is the root of major population movements, namely rural-urban migration which in itself leads to urbanization. It is also the root of conflict. Another important issue that is closely linked with population is the globalization of life-styles. All of these are issues that we try to look at more closely, but not in separation from each other. For example, conflict will be dealt with in our third issue of this year, and we will produce one UPDATE on consumption relatively soon after the IHDW Institute on Globalization and Food Systems which will take place at the end of this year.

In this present edition of UPDATE, all scientific articles reflect the diversity of population issues. Ron Rindfuss and Susana Adamo give us a coherent and focused introduction into population trends – growth, fertility, mortality and migration – in the context of global environmental change. They stress the important link to consumption and production. Also Xizhe Peng's informative discourse on the population-related problems of China's western provinces takes up this matter – here the worry is more concrete: a still fast growing population, a deteriorating environment and soon-to-be-expected higher expectations of consumption! On the other hand, Bruce Caldwell's description of the poor and unhealthy living conditions of Dhaka's urban migrants reflects the close connection of population with urbanization.

Alex de Sherbinin offers a short historical insight into population research and then explains up-to-date analyses with the help of ever more sophisticated geographic information systems. He describes interesting findings on, for example, land-cover patterns in relation to livelihood strategies and size of households. Suruchi Bhadwal and her colleagues look at the variation in impacts from GEC across regions and also within populations – women and children suffer more from environmental change for a variety of reasons. Harini Nagendra, together with her co-authors, delivered two studies of which one highlights the interesting finding that effective forest conservation is possible despite a high population. Finally, the interview with Bob Engelman from Population Action Aid represents a more policy-oriented side of population and environment research. His work represents a good practical example of what many GEC researchers call for: the policy-science link!



THE EDITOR

The size of a population at time 2 is a function of its size at time 1 and the balance of births and deaths, in-migrants and out-migrants between the two time points. At the global scale, the migration term drops out.

We are approaching the end of the demographic transition, that is, the transition from high to low levels of fertility and mortality. Because mortality declined first, the world's population experienced significant growth during the transition, increasing from 2.5 billion in 1950 to 6.3 billion today. But the *rate* of growth has been declining since the late 1960s.

One legacy of our past rapid growth is a young age structure; 30% of the world's population is below age 15¹. As these young people enter childbearing age, their reproduction will increase the world's population even if they only average two children per couple. This is "population momentum." Developing countries have a younger age structure than developed countries, and if for no other reason, developing nations should grow at a faster rate than developed countries in the next two to three decades. Consider Italy, Egypt and Nigeria. They have 14, 36 and 45 percent of their population under age 15 respectively.

MORTALITY

Global life expectancy in 1950-55 was 47 years and today it is 65. Much of this gain resulted from the control of infectious and parasitic diseases, which frequently required only modest expenditures and limited behavioral change (e.g. vaccinations and improved sewage systems).

When a population has an increase in expectation of life at birth from 47 to 65, the largest proportional declines in age specific mortality occur in infant and child mortality. With a life expectancy of 47, only about three-quarters of infants survive to age 15; by the time life expectancy reaches 65, over 90 percent survive to 15. Thus children that might have died survive to an age when they themselves can have children. As such, increases in longevity when mortality was high mimic an increase in fertility. Now that mortality is moderate to low, further increases in longevity will have the largest impact on mortality rates for ages past the reproductive years.

The general expectation is that world mortality levels will continue to decline, but more slowly because declines will depend on increases in levels of living, a more even distribution of the benefits of medical science, and advances in fighting cancer and other degenerative diseases. But continued longevity growth is not guaranteed. Mortality can be responsive to economic downturns and regime changes. For example, for a variety of reasons, including increases in alcoholism and deterioration in the health care infrastructure, Russia has experienced a decline in expectation of life at birth from 70 in 1970 to 66 today.

It is also possible that new infectious diseases will emerge. AIDS is the best example. It was first recognized as an infectious disease in the 1980s and a true cure has yet to be found. The impact of AIDS is greater in the developing world, where 90% of those infected live (Stanecki 2002). Botswana, the country having the highest prevalence of AIDS, has seen its expectation of life at birth drop from 65 in 1990-95 to 56 in 1995-2000.

¹ Unless otherwise indicated, numbers in this article are from the U.N. (See <http://esa.un.org/unpp>)

FERTILITY

Concerns with environmental degradation in the late 1960s and early 1970s tended to focus on the fertility component of population growth, to argue that fertility was too high, and to contend that systematic measures needed to be taken to reduce fertility in high fertility countries. Since then a dramatic fertility transition has occurred. Today, only 16 of 187 countries do not show any evidence of a transition from high to low fertility (Morgan 2003).

The U.N. is projecting a global total fertility rate of 2.02 in 2050, which is just below replacement level. Forty-one countries, containing one-fifth of the world's population, already have below replacement fertility (Morgan 2003), and some have populations that are shrinking. We are now witnessing a shift to concern about low fertility.

How low can fertility go? Of course we cannot answer with certainty, but several factors suggest that fertility can go quite low. Effective fertility control methods are increasingly available world-wide, and it is difficult to imagine this being reversed. As educational attainment increases, the cost of children increases. As the transition from agricultural to non-agricultural jobs continues, more women are faced with the difficulty of combining worker and mother roles. Even in Nordic countries, with generous public programs designed to ease the worker-mother role conflict and to reduce the costs of child rearing, fertility is below replacement levels.

What are the implications for global environmental change? Populations will be aging, and the elderly tend to consume less. Second, if institutions, consumption patterns, and production processes are held constant, then as population size declines, population pressure on the environment could decline. But, institutions may change in reaction to declining population sizes.

MIGRATION AND URBANIZATION

At the local scale migration is the most dynamic of the three population processes. In addition to being a normal feature of people's lives in many countries, it is also the fastest demographic response to changes in social, economic, political and environmental circumstances.

Local migration processes can have environmental consequences that scale up to global environmental change. Movement of people into tropical forests is related to tropical deforestation which is related to global warming. Migration to coastal areas and small islands has increased, and this is related to the health of coastal wetlands, which is related to the health of the world's fisheries. Thus cumulatively, local population movements can have global consequences.

The volume of international migration has doubled since 1970, and the largest flow is from developing to developed countries, partly a response to the low fertility levels in developed countries. These migration flows produce a counter flow of remittances from migrants to their home countries. Today, remittances are an important part of the gross domestic product in countries like Albania, El Salvador, and Jamaica (United Nations Population Division 2002a), but the environmental consequences of remittances are not well understood.

Internal migration, particularly in developing countries, is dominated by rural to urban flows. The trend towards increased

urbanization is expected to continue. The U.N. is projecting that just over three-fifths of the world's population will live in urban areas by 2030, with the proportion in developed and developing countries being 84 and 57 percent respectively (U.N. Population Division 2002b).

Concentration of population in urban areas also means concentration of environmental impacts, positive and negative. On the positive side, concentrating people in urban areas reduces land pressure in rural areas. Also there are some economies of scale in such matters as waste treatment and fuel efficient transit. An example on the negative side is the transfer of water resources from distant sources as is the case for a number of cities in arid and semiarid climates such as Los Angeles and Mexico City. Pollution of air, water and land are frequently mentioned in connection with urbanization.

THE FUTURE

As we look to the future, the world's population will continue to grow for several decades, but the rate of growth will diminish. Increasingly population growth will be the function of population momentum inherent in the age structure, a legacy of previous high fertility, rather than due to underlying differences between mortality and fertility schedules. As population's age, the effect of momentum will diminish, as will growth rates.

Looking further into the future, say 2050 or so, there is a realistic possibility that, for the first time since reliable global population counts have been available, the size of earth's population will decline. This will most likely be the result of fertility reductions rather than increased mortality. If global population decline occurs it will occur within a context of expressed concern about this decline – just as we are now seeing such concern in Japan and several European countries. The extent to which such concern will trigger institutional responses that lead to higher fertility is, for now, an open question.

Locally, migration will continue to be the most dynamic population process affecting and being affected by environmental change. To the extent that the world's economies continue towards globalization and that rates of population growth continue to vary across nations, we can expect increases in international population movement. Similarly as agricultural operations gain efficiency requiring less labor input and new jobs are created in urban areas, increased urbanization will continue.

We end this article where we began. The impact of declining global population growth and increasing international migration and urbanization will depend on how people consume and produce, and how they are organized institutionally and into households. This is where the population-environment research frontier lies.



REFERENCES to this article are included on the IHDP website at www.ihdp.org/update0104/references.htm



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POPULATION AND ENVIRONMENT CHANGE:

Fitting the data to the analysis | BY ALEX DE SHERBININ

► Ever since Malthus published his *Essay on the Principle of Population* in 1798, researchers have looked for evidence that population dynamics (births, deaths, natural increase, and migration) are somehow linked to environmental changes. Malthus' famous hypothesis was that population numbers tend to grow exponentially while food production grows only linearly, and he provided ample statistical evidence from Europe, the United States and Latin America to support his case. Although the subject was periodically taken up again in the 19th and early 20th centuries, with for example Marsh's classic *Man and Nature*, it wasn't until the 1960s that significant research interest was rekindled. In 1963 the U.S. National Academy of Sciences published *The Growth of World Population*, a report that reflected scientific concern about the consequences of population growth, which was then reaching its peak annual rate of two percent. In 1974, Paul Ehrlich and Paul Holdren developed the well known IPAT formulation, in which environmental Impact = Population x Affluence x Technology (Ehrlich and Holdren 1974), an identity that has been used in a number of quantitative analyses (O'Neill *et al.* 2001, York *et al.* 2003). Around the same time the Club of Rome developed the World Model, which represented the first data-driven population-environment modeling effort (Meadows *et al.* 1972).

As these examples suggest, efforts to prove a causal relationship between population change and environmental change are not new. Indeed, an overlay of graphs depicting global trends in population numbers, energy consumption, carbon dioxide emissions, or land area deforested has often been used to "demonstrate" the impact that population has on environmental changes. However, such over-simplifications generally raise more questions than they answer. As the field has matured, researchers increasingly want to understand the nuances of population-environment relationships. Common research questions include: How do specific population changes (in density, or composition, or numbers) relate to specific changes in the environment (such as deforestation, climate change, or ambient concentrations of air and water pollutants)? How do environmental conditions and changes, in turn, affect population dynamics? How do intervening variables, like institutions or markets, mediate the relationship? And how do these relationships vary in time and space?

Many of these questions can only be answered in a satisfactory manner with rather well developed data and sophisticated methodologies. In the 1980s there were some incipient efforts at data-driven analysis using national-level data sets. For example, an early population and deforestation analysis was conducted by Allen and Barnes (1985), and Bilborrow (1987) examined the relationship between demographic processes, agricultural tendencies, and environmental trends in rural areas of developing countries. By the beginning of the 1990s, with the advent of geographic information sys-

tems (GIS) and a broader array of data sets, much more sophisticated approaches began to be developed. At local and regional levels, many social scientists began to experiment with the use of remote sensing based land-cover and land-cover change maps in conjunction with census and survey data (Liverman *et al.* 1998, Fox *et al.* 2003; for an overview see de Sherbinin *et al.* 2002). These methods have been employed with particular success in the Amazon and other heavily forested areas, and have led to a number of important conclusions (see Box 1).

Beyond these often labor-intensive data integration efforts, there has been a proliferation of case studies on population-environment interactions at scales ranging from local to sub-national regions using a variety of data and methodologies. Data collection approaches depend heavily on the disciplinary affiliation of the researchers, often yield-

Box 1. Selected findings from meso-scale population and deforestation studies

Wood and Skole (1998) used census data and forest change terms at the municipal level in the Brazilian Amazon to identify and rank in importance the socioeconomic and demographic variables associated with forest clearing. They found little correlation between population density and deforestation, but when they added a variable for the number of migrants in rural areas, the r^2 increased significantly. To overcome some of the limitations of using data aggregated to municipal levels, McCracken *et al.* (1999) developed a GIS that overlaid a grid of property boundaries onto Landsat scenes for 1985, 1988 and 1991. Analysis at the property level found patterns of land-cover classes that reflect differences in livelihood strategies of households. These data were supplemented with surveys of plots where unusual patterns were found. Through this work they were able to identify differences in land use patterns based on the life-cycle of the household (from young, nuclear families to older, intergenerational families). Younger families tend to clear land at higher rates initially, and to maintain more in annual crops, moving eventually into combinations of cropping and animal husbandry (grazing), whereas older, more established families have a more diversified portfolio of land uses. Furthermore, they found that there is an important interaction between the life cycle and the initial conditions of soil fertility, with the families on richer soils having a more diversified portfolio than those on very poor soils. Findings of this kind point to the complexity of population-environment relationships at the local level.

ing an unbalanced treatment of population, environment or mediating variables (Lutz *et al* 2002). A number of recent efforts have sought to establish interdisciplinary teams including demographers/sociologists and environmental scientists to address this deficiency, with varying degrees of success (e.g., de Sherbinin and Dompka 1998, Curran *et al.* 2002).

As this brief survey suggests, population-environment research – and particularly research at the global level – has been hampered by a lack of adequate data. Local or regional analyses generally rely on rich but idiosyncratic data sets, whereas global analyses typically use data aggregated to global or national levels in which spatial specificity is lost. CIESIN, a unit of the Earth Institute of Columbia University, has sought to bridge this gap by developing global spatial data sets that include sub-national detail which can be aggregated to any desired scale of analysis. The remainder of this article addresses a number of our data development efforts together with some research findings based on the application of these data.

CIESIN's flagship data product, the Gridded Population of the World (GPW; see Deichmann *et al*, 2001), allocates census-based population counts for the lowest level administrative units available for every country in the world to a standard 2.5 minute grid (equal to 16 km² at the equator). This enables re-aggregation of population data to any geography required, such as river basins, mountainous zones or other ecological units. GPW has been used in analyses of threats to biodiversity and for simple descriptions of population distribution vis-à-vis a number of geographic variables such as distance from the coast, altitude, and climate zone (Small and Cohen 2003, Cincotta and Engelman 2000). The map in Figure 1 was generated by dividing flow-accumulated water runoff by the population in 30 minute grid cells. As one might expect, northern and southern Africa show up as being water scarce, as signified by annual availability of less than 1,000 m³ per person. However, according to the data, large portions of the densely settled humid to sub-humid East African highlands, including parts of Uganda, Rwanda, Kenya and Tanzania, are also either facing scarcity or water stress (per capita availability of 1,000-1,7000 m³).

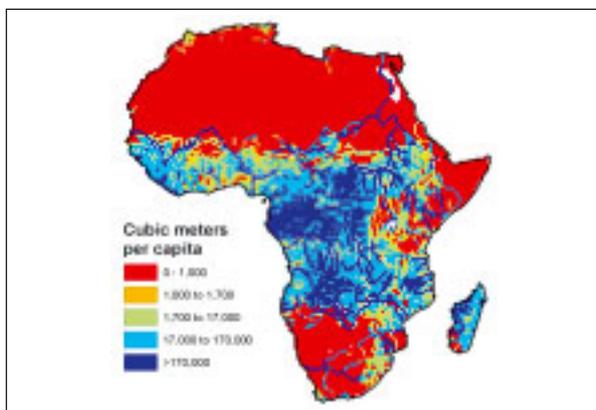


Fig. 1. Water Availability Per Capita in Africa
(Source Data: UNH/GRDC Composite Runoff Fields v. 1.0 and CIESIN/SEDAC Gridded Population of the World v. 3)

Utilizing GPW, national-level boundaries and a number of other spatial data sets, CIESIN developed a tabular data set called Population, Landscape and Climate Estimates (PLACE) (SEDAC 2003). The PLACE data set includes more than 300 variables that characterize each country's absolute and percentage territorial extent and population in various biome, climate zone, coastal proximity, elevation, and population density classes. These data are particularly useful for researchers who are more accustomed to tabular data for statistical analyses, or who do not have access to geographic information systems. As an example of the kinds of analyses that can be developed, we used a PLACE-style data set for Brazil's 4,500 municipalities to determine the best predictors of municipal-level Human Development Index (HDI) scores. We found that a combination of four variables – percent of municipal area in desert or xeric shrubland, crop constraints, proportion of population in urban areas, and the percentage of the municipality within 100 km of the coast – explain close to 60 percent of the variation in HDI ($p < .0001$). Such analyses can shed light on patterns of vulnerability to global change that are at least partially conditioned by geographical variables.

In recent work with the UN Millennium Development Project, CIESIN developed extensive sub-national data sets of development indicators in an effort to better understand the determinants of infant mortality, malnutrition, and access to improved water sources. Using the UNH/GRDC data set on water runoff together with data on malnutrition for sub-national units in Africa, we found that, controlling for GDP per capita, runoff levels explain 39% of the variation in the proportion of children who are underweight ($P < .05$), and that higher levels of runoff are associated with higher levels of surface water usage and lower levels of well and piped water usage.

The proliferation of globally gridded data and the development of ever more sophisticated GIS and spatial analysis packages have dramatically improved our ability to understand the interactions between population and environmental changes. Furthermore, the spatial specificity of the population data is improving. Both Oak Ridge National Laboratory's Landscan (Dobson *et al.*, 2000) and a soon-to-be-released urban population and extents data set developed by CIESIN and partners are on a 1 km grid. As more longitudinal data become available, it will also be easier to conduct research on the dynamics of population and environmental change at multiple scales over time. This bodes well for future population and global environmental change research.



REFERENCES to this article are included on the IHDP website at www.ihdp.org/update0104/references.htm



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DEVELOPMENT OF CHINA'S WEST: POPULATION AND ENVIRONMENTAL ISSUES

BY PENG XIZHE

1. CHINA'S WEST DEVELOPMENT STRATEGY

► The western region of China is made of 11 provinces and autonomous regions as well as a municipality, which have a total area of 6.85 million square kilometres, 71% of the country land area, and a population of 365 million, 29% of the national total. It is also the region in which most of China's minority nationalities live.

Natural resources are rich as more than half of China's identified natural resources are in this region. According to statistics for verified reserves, the region holds 36% of the nation's coal reserves, 12% of its petroleum and 53% of its natural gas reserves. 120 out of 140 categories of verified natural mineral resources are found in the western region, with some rare metal reserves among the richest in the nation if not the world.

The socio-economy of the western region is backward despite development over the past half century. Almost all of the 12 western provinces have the lowest ranking among China's 31 provincial units in China's Human Development Index (see References). The average per capita GDP there is only about 40 percent of China's more developed eastern coastal regions. Of the China's poor who lack adequate food and clothing, the majority live in this region.

The major obstacles to the development of China's western region include poorer infrastructure, fragile and degrading environment, continuous population growth, weaker human capital accumulation, and limited investment from the outside of the region as well as from overseas.

The Chinese government endorsed the Western Development Strategy in 1999 to reduce economic disparities between the western region and other regions, and to ensure sustainable natural resources management. In order to realize those objectives, the Western Development Strategy (WDS) focuses on five principal areas: infrastructure development, mainly the development of the highway network; environment, especially on forest protection and water resource management; development of local industries with a local comparative advantage; development of the science, technology and education sector; and increasing foreign direct investment into the region.

Large-scale infrastructure construction is one of the major parts of the WDS. Since its launch in 2000, a host of major infrastructure projects, including the huge Qinghai-Tibet Railway, the west-east natural gas pipeline project and south-to-north water diversion, have been started. In addition, big power companies have competed with each other to develop hydroelectric power stations in almost all of the river systems in West China where 36 major projects have been launched at a total cost of over 730 billion RMB Yuan (89 billion US dollars) from 2000 to 2003¹.

¹ Xinhua News, http://www1.chinadaily.com.cn/en/doc/2003-08/30/content_259699.htm

2. POPULATION PRESSURE IN THE WESTERN REGION

Mountainous and with a harsh and very dry climate, the major part of China's western region – the Tibet-Qinghai plateau, and the Gobi and Taklamakan deserts – can support only limited populations. Population density in China's western region at present is 52 persons per sq. km, far less than the national average of 130 persons per sq. km.

However, its rapid growth deserves attention. A total population increase of 140 per cent – mainly due to natural growth – took place there during the last half century. In the 6 northwest provinces, over the past one hundred years, the population increased from 14 million to almost 100 million. Recent statistics also show that the population in Western China grew at an average annual rate of 2.6 percent in the 1990s, doubling the national growth rate.

Fertility levels in China experienced a steady decline in the 1990s, and its total fertility rate (TFR) dropped from 2.29 in 1990 down to 1.8 in 2001. The TFR in a few eastern provinces/municipalities has been as low as just close to one since early 1990s. But, the TFR in most of the western provinces remains above 2.5. Two main causal factors are diversities in the local birth control policy and the level of socio-economic development.

China's birth control programme is a highly decentralized one. While majority couples in China's eastern regions can only have one child, most couples in the western regions, particularly those of ethnic minority families living in the countryside, are allowed two or even more children. This relaxed birth control policy certainly results in higher fertility rates and population growth. Meanwhile, the backward economy and poor coverage of social security strengthen the deep-rooted logic of "raising a son against old age" and encourage the big family.

Education attainment of population in western provinces is generally lower than the national average, particularly in Qinghai and Xizang where nearly half of the population is illiterate. In many western provinces, the average length of education is less than five years, far less than the national average. Life expectancy is around 65 years, 5 years shorter than the national figure. In maternal and child health and reproductive health, the West lags behind even more. About 80 per cent of the population in this region live in rural areas, while the national figure is about 64 per cent. On the whole, the population problems in China's western region can be characterized as: relatively rapid growth, lower education attainment and slower path of urbanization. In order to support the increasingly larger population, natural resources have been over-exploited extensively. A rapidly increasing population has become the top challenge China has to face in its ambitious strategy of developing the western regions.

3. FRAGILE ENVIRONMENT

Western China consists primarily of mountains and plateaus with an elevation of at least 1,000 metres and complicated topo-

graphical conditions. In addition, this region is badly short of water in the northwest and soil in the southwest, and suffers from severe land degradation including erosion, desertification, salinization, and pollution. Almost all of the 1.49 million square kilometres of China's deserts and desertified land are located in the West.

Compared with China's eastern regions, farmers of the western provinces in general have more arable land to cultivate. However, the productivity of this land is very low and much of the land is inherently vulnerable to erosion due to high slopes and sensitive soil. Continuous soil erosion has made the already unproductive agricultural lands on the loess plateau of China's northwest even less fertile. The major problems of agriculture and animal husbandry there are low input, low output and high resource consumption. In the northwest, arable land and water resources account for 18% and 19% of the national total respectively. However, this region only produces 8.8% of China's grain output and 6.7% of its meat. 64% of China's total grassland is located in this area, but the output value of stock raising only accounts for 7.5% of the national total. The productivity of China's grassland is about one third of the world average.

While water resources in China's southwest are abundant, there is scarcity in 6 northwest provinces where the per capita water resource was only 1781 cubic metres in 2000, about 80.5% of the national total. Some areas of the region, such as the Yellow River Valley in Ningxia and Wei River Valley in Shaanxi province, are facing serious water shortage. Moreover, water supply there is highly dependent on climate variability. In spite of the situation, the efficiency of water use in China's northwest is well below the national level. To produce 10 thousands RMB Yuan GDP, it consumes 1,736 cubic metres water – that is 1.85 times the national average. Water used on irrigation is about 10,065 cubic metres per hectare, which is 40% higher than the national level.

Under the backward production mode and increased population pressure, arable lands are over-farmed and other natural resources such as forests and grassland are poorly managed. Eroded areas in China's western region are estimated to make up 80 per cent of the country's total eroded land. Severe and frequent sandstorms have flown to the east of China and even reached Korea and Japan. In the southwest region, reservation of natural forests faces serious challenge from neighbouring human communities. The capacity of arable lands and grasslands to support animal and human population is indisputably decreasing, while demands are increasing due to increasing population and improved standard of living.

4. ENVIRONMENTAL CONCERNS OF THE WESTERN DEVELOPMENT PLAN

The western region development plan calls for intensive ecological improvement and environmental protection. Several concrete programmes have been launched to convert cultivated hillside back into forestry and pasture, to abolish the logging of natural forests in the upper reaches of major rivers, and to carry out comprehensive sandstorm prevention in the northwest. By the end of 2003, afforestation has already added a total forest area of 2.66 million hectares to the region. Among the total financial input of 270 billion RMB Yuan from the central government, 50 billion were allocated to ecological projects.

China's hydropower exploitation potential ranks first in the world, and more than 80 per cent of the country's hydroelectric sources are scattered in West China as several of the world's major rivers have their origins in the Tibetan-Qinghai plateau (the Mekong, Irrawadi, Ganges, Brahmaputra, Yangtze, Yellow rivers). But its utilization ratio is still very low at about 20 per cent. As hydropower is regenerative and much cleaner and has a bigger development potential, quite a few large-scale hydropower projects have been proposed and construction started.

Heated debates and campaigns argued that extra consideration should be given to possible environmental and ecological effects before any large hydropower projects are launched all over West China. Some of the proposed projects have been postponed as a result of these campaigns. Nevertheless, finding a way to balance the rapidly increasing demand to develop hydro-electric power with the need to preserve the local ecology and environment is a very difficult issue that will continue to challenge decision makers, hydraulic engineers, environmentalists² and the local population.

The enormous population already overwhelms the vulnerable ecosystem's capacity. Any slight changes in population dynamics, as well as in people's life style and consumption patterns, will have profound impacts on the sustainability of this region. Poverty and inequity are often considered to be driving factors in creating environmental degradation. While poverty alleviation will in the long run reduce the poverty-induced environment pressure, the ways of poverty alleviation are often debatable. In many localities of the western region, lack of economic opportunities and poor management cause over-dependence on the use of natural resources. This becomes even more alarming as an ambitious economic development plan feeds people's great expectations of being rich.

More recently, there has been talk of a massive "west-to-east" migration campaign to reduce the environmental stress of the western region, meanwhile speed up China's urbanization process particularly in the economically developed eastern region³. The volume of this migration could reach 100 million. Also, urbanisation strategies for the western region are being debated, i.e. concentrating on a few big cities to absorb more farmers from the vulnerable areas.

On the whole, it is certain that Chinese people and the government are more aware of the relationship between population, environment and development than ever before. Nevertheless, given China's current environmental situation and increasing population, it will be a daunting task for China to achieve a sustainable future, particularly in its western region.

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² "Projects' builders take environment seriously", China Daily 12/20/2003

³ China Daily 12/08/2003 page2

GLOBAL ENVIRONMENTAL CHANGE, URBANIZATION AND HEALTH

The case of rapidly growing Dhaka | *By BRUCE CALDWELL*

► The six decades since the Second World War have been marked by significant urban growth with the populations of the previously largely rural countries of Asia, Africa and Latin America being drawn to ever larger urban centres. Before this period only developed countries had highly urbanized populations, a consequence of nineteenth century industrialisation. The more recent urbanization in the developing world differs in that it has been largely driven by rapid population growth – while industrialization is a factor in urbanization in some countries, urban growth has occurred even in countries with very low levels of industrialization. High population growth has led to increasing



Photo: Bruce Caldwell

Bengali women

landless populations and surplus rural workers. Furthermore, in contrast to the situation of the nineteenth century where many cities grew through migration despite an urban population that was failing to replace itself, in the developing world the impact of migration is being compounded by a high urban natural growth. In nineteenth century urban mortality rates were extremely high, exceeding even the high birth rates of the time. Twentieth century urban areas are marked by low mortality levels because of the concentration there of health facilities and urban amenities such as water and sanitation.

RAPID URBAN GROWTH

Population growth is now slowing down in many parts of East and Southeast Asia and Latin America but urbanization is continuing, reflecting economic development and also the lack of opportunities in rural regions. Globalization and the associated reduction in economic barriers are propelling this process. They are also, in part, responsible

for another characteristic of the urbanization of the developing world, the high proportion that is taking place in very large cities, the so-called mega-cities. In 2002 it is projected that 19 out of 21 cities with over ten million inhabitants will be in developing countries.

Currently about 47.0% of the world's population live in urban areas, including towns and cities. In developing countries 39.9% do so. By 2030 it is projected that 60.3% percent will – 56.2% in developing countries. The impacts of GEC in rural and urban areas will differ because of the very different relationship that urban and rural populations have with the environment. For rural areas the most direct impact will be on people's livelihoods. In urban areas the livelihood impact will be more indirect. However, other impacts will be more direct, including that on health.

HEALTH IN CITIES

Historically urban health was worse than rural health. Urban areas suffered from severe environmental disadvantages associated with overcrowding, poor sanitation, lack of fresh air and sunlight, which led to diseases such as tuberculosis, diarrhoea and rickets. In western countries in the late nineteenth century and elsewhere in the twentieth century this situation changed radically. Urban mortality dropped below rural mortality. The reasons were two-fold. Especially in western countries the urban environment improved dramatically. Treated water and sanitation services were introduced and overcrowding was reduced with better housing associated with rising incomes. Secondly, particularly in developing countries, improvements in health services were most pronounced in urban areas. Nevertheless GEC is likely to provide a major challenge for urban health, especially in developing countries. Although access to health services is comparatively better in urban areas, much of the population cannot afford the services offered or they use them ineffectively. Moreover in developing countries the urban environment remains deficient, particularly for the poorer population. GEC is likely to add to these pressures to populations already often ill prepared to respond.

COMMUNICABLE DISEASE

A major impact on health, particularly in developing countries, is likely to be from communicable disease, both infectious diseases and vector-borne diseases. Many cities in the developing world continue to have large populations living in overcrowded environments with poor water supplies and worse sanitation. Poor sanitation and a generally

unclean environment lead to diarrhoeal disease while overcrowding and poor housing lead to diseases spread through the air such as respiratory diseases, tuberculosis and measles. Heavy population growth contributes to such conditions by encouraging over-concentration of population and overwhelming the resources of the urban authorities to provide proper housing and urban amenities such as water, sanitation and rubbish collection. Global environmental change may also contribute to increased communicable disease through warming and weather instability such as flooding. These conditions promote the spread of diarrhoeal disease. They may also encourage various vector-borne diseases, such as malaria and dengue.

DHAKA, BANGLADESH

An example of a city facing a potentially extremely difficult situation in terms of GEC is Dhaka, Bangladesh. Dhaka is a rapidly growing city of 12 million people. It has been projected that by 2015 Dhaka will have 21 million inhabitants. Population growth has slowed in recent years in Bangladesh but is still projected to increase from 140 million now to 210 million by 2025. Most of this increase will take place in cities, as there is already surplus labour in rural areas and a growing landless population. As the only true urban magnet in a very poor and overcrowded country Dhaka will take much of this growth. The city is flood-prone and its low-lying areas are subject to widespread flooding during the monsoon season, June to November.

The worst affected areas are the bostis, illegal shanty settlements. Those living in bostis do so because they cannot afford to live elsewhere and still be close to job opportunities. As illegal settlements bostis are located in areas not deemed suitable by planners for settlement or where no one else is willing to live. In Dhaka this generally means flood-prone areas. Bostis are not eligible for government services such as water, sanitation and rubbish collection. Where water is provided it is often through illegal connections, frequently contaminated with pathogens. Housing standards are extremely poor because, as illegal settlements, there are neither effective controls nor any incentive for people to improve their own housing conditions. As non-planned areas, planning controls are non-existent. This means, for example, that people build in what should be drainage ditches. To improve matters requires an acceptance of the rights of people to live in such settlements or alternative affordable living areas that are close enough to the city centre to have access to jobs or that have adequate transport. There is considerable resistance to regularising settlements because they are associated by the urban elites with crime, partly because there is little effective policing in the settlements.

Trained health services are provided either by overstrained hospitals, which provide minimal care, require the poor to wait endlessly in line, taking up time they can ill afford, or by private providers that the poor can ill-afford. The result is that the poor often do not receive care in a timely fashion or alternatively use untrained providers such as traditional healers or local untrained 'pharmacists'.

Overall health in Dhaka, as generally in the developing world, has improved in recent years because of greater immunisation cover and improved basic public health measures such as oral rehydration treatment (ORT) – which ensures that patients suffering from severe diarrhoea have enough liquid in-take to survive. However, mortality rates remain high among the least privileged and further falls may be difficult to achieve.

WHERE FROM HERE?

To overcome these problems will not be easy in very poor country. The Bangladesh Government has moved to reduce flooding in Dhaka by building a levee bank on Dhaka's western boundary and may build one on the eastern side. This will not solve the problem that once floodwaters are within the levee walls there is nowhere for them to drain. To really improve conditions in the bostis will require an acceptance of the rights of the inhabitants to a place to live preferably with tenure and their right to reasonable services. Improving housing will be difficult, but simply enabling people to improve their housing without the threat of demolition would be helpful.

Better access to health services is important. This means better hospitals, but above all better access to inexpensive basic services, whether these are provided by government, NGOs or private providers. These issues need to be addressed not primarily because of GEC but because they are already important to improving health generally.

Bangladesh is keen to discourage rural-urban migration but given the lack of employment opportunities in rural areas this may be unrealistic. It may be more practical to promote alternative centres -provided that these centres can avoid Dhaka's problems.

What Bangladesh has little control over are the factors leading to GEC. The industrial countries primarily cause the greenhouse affect. Flooding is exacerbated by deforestation in the region but again Bangladesh has only limited control over this.

GEC is only one factor affecting health in cities, but one that may be of increasing concern in the future. Moreover, it will add to already heavy health burdens, especially of the urban poor. Short of stopping the factors causing GEC the principal measures required are ones that should be implemented anyway to improve urban health.



REFERENCES to this article are included on the IHDP website at www.ihdp.org/update0104/references.htm



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CONSERVATION AND FAMILY PLANNING GO HAND IN HAND

Interview with Robert Engelman

► Robert Engelman is Vice President for Research at Population Action International (PAI), an independent policy advocacy group working to strengthen public awareness and political and financial support worldwide for population programs grounded in individual rights.

Q: Can you describe the research you and your colleagues do on population issues?

We are an advocacy organization that also does research. Our research is of two kinds. One kind seeks to make clear the impacts population growth has on human well-being, and that slowing that growth would be beneficial. The other side of our research looks at the policies themselves that are put in place in part to slow population growth, and tries to see if they are effective. Are they based in human rights, in human development, or are they coercive? These relate to the values we have about our work.

We have chosen the environment as a research area because it's probably the most demonstrable area of human experience where slower population growth can be shown to be positive. Recently we completed a report documenting connections between the demographic transition – the shift to longer lives and smaller families – and vulnerability to civil conflict.

Q: Can you pinpoint some of your most interesting findings?

We've quantified aspects of the relationship between population and the availability of certain key natural resources. We documented that water scarcity is likely to increase much faster than population growth itself, starting in about 1950 and then really accelerating in the 21st century, simply because so many countries have reached the end of their ample water supplies. And as a result of population growth they were passing into eras of scarcity. We identified the countries and areas that were most vulnerable to renewable fresh water scarcity.

We found similar results in cropland – scarcities of farmland were likely to increase exponentially and much more rapidly than population growth itself in the coming century. Again similar relationships could be found for forests, for fisheries, and even in climate. Although one does not think of climate as a natural resource, by simply looking at people's use of the atmosphere, we see that this use is going to become problematic in relation to population as well.

In these studies we established a series of both benchmarks and principles that help people understand the relationship of population to the environment. If you add thresholds or tipping points to the population picture you see much better how population growth can be a really important driving factor for pushing humanity past certain natural tipping points.

The other concept is to combine the idea of sustainability and equity. Equity complicates the the relationship between population and the environment. You may say: this

is not a problem of there being too many people for the world's water resources, it is a problem of some people using far too much water while others do not have enough for their basic needs. But if you imagine an equitable situation in which everybody essentially has the same quantity of the resource and you combine that with sustainability – that is you are trying to make sure everyone always has a sufficient amount of that resource for basic health and basic prosperity – you see that fairly quickly and in many countries in this century, you run into situations where even an equitably distributed resource will not be sustainable because of population growth. This is true in the case of water in certain countries, for example in the Middle East, and it is very true in the case of land in some countries in Africa, the Middle East and Asia.



Robert Engelman

Q: What kind of action do you take as a result to these findings?

All of our research feeds into our policy work. We support an international consensus in population and development, an agreement reached by the world's countries at the UN conference in 1994 in Cairo, the International Conference on Population and Development. Everything we do points towards the wisdom of supporting this work, which is focused on the rights and the development of women.

Our conviction is that one cannot control population, in the sense that we might control traffic or water flow in a river. What you have to do is allow people to succeed in their own reproductive intentions. The reality is that women around the world, for the most part, would have just two or maybe three children if they had their choice. And they would have them later in life and fairly healthily spaced. And population growth would eventually stop and maybe even reverse in some places just based on the choices that women make for their own lives. This approach stresses not just access to family planning services but access to education for girls and women, access to jobs and control over their own money. The higher the status of women in developing countries, the closer these countries will be to the demographic situation in more developed countries. This in itself will bring population growth eventually to an end, maybe by the middle of this century. What we found, by the way, is that the best indicator for where a society stands is the demographic transition, which takes into account not only birth rates but also death rates.

Q: Can you describe your Community based Environment Population Program?

The projects based on this concept integrate resource management with reproductive health. They take place in communities in developing countries where women in particular both manage their natural resources – their water, their soil, their forests, their fisheries – and also have better access to family planning and reproductive health^{1,2}. There is evidence that indicates there is a particular welcoming of family planning in the context of trying to work with natural resources. As men leave the villages to look for work in the cities, women run the farm. They need help and information – mainly offered by environmental NGOs or by relief agen-

cies – about new kinds of crops, how to keep their water clean, how to save their soil. These women are very interested in having planned pregnancies as they need to learn and master all this new material on top of having to work on the farm. There is a project in Ecuador², for example, where it was found that contraceptive prevalence, the proportion of women using family planning was significantly higher in the communities where the services were integrated.

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INTERVIEW BY ULA LÖW

- 1 Plan and Conserve, A Source Book on Linking Population and Environmental Services in Communities (Engelman, 1998)
- 2 in: Forging the Link, Accounts of Population and Environment Work in Communities (Gibb Vogel, Engelman, 1999)

GLOBAL ENVIRONMENTAL CHANGE: VARIATION IN IMPACTS ACROSS REGIONS AND WITHIN POPULATIONS

SURUCHI BHADWAL, SHALEEN SINGHAL, REKHA KRISHNAN AND ULKA KELKAR

► **The earth’s environment since its evolution has been** experiencing changes induced by both natural and anthropogenic factors. Of late, however, the role of human influence in aggravating conditions has gained momentum. Global environmental changes (GEC) have significant implications at the local level influenced by a gamut of social, economic and natural factors. To illustrate the

dynamics of these global and localized processes and their impacts with respect to vulnerability across regions, two TERI studies are reviewed here. One highlights the impacts of GEC at local level, discussing vulnerability in terms of variations in coping strategies to adverse weather conditions. The other analyses differentials in vulnerability to water related stress imposed by high rates of population

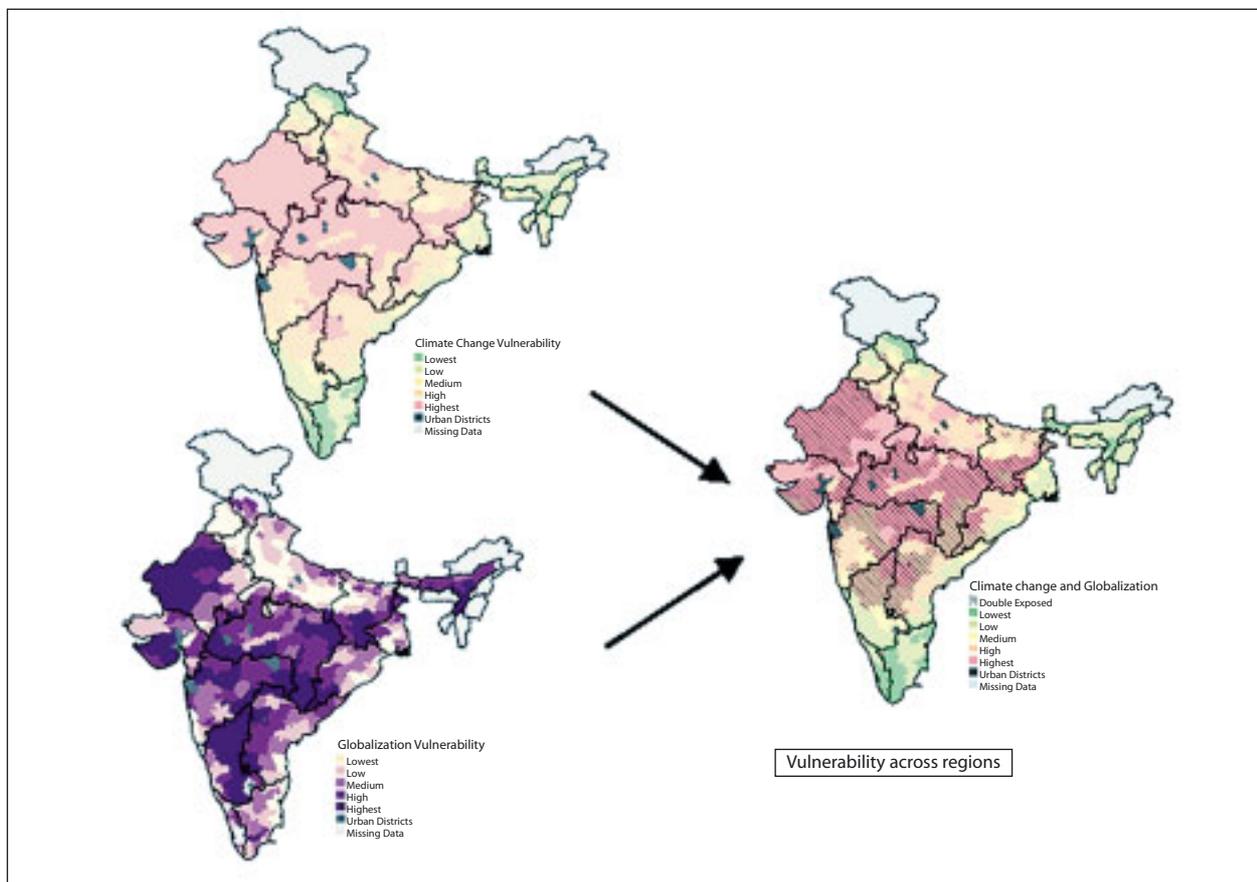


Figure 1 illustrates the methodology used in the CIDA study

growth impacting quality of life, particularly for women and children.



Photo: TERI 2003

Coping with global change – vulnerability and adaptation in Indian agriculture. Survey of farmers in Rajasthan.

Study 1 makes an attempt to map vulnerability of the Indian agricultural sector to climate and economic changes. This has been done based on the broad premise that climate change does not occur in isolation and there are other multiple stressors that might have influenced patterns of change in vulnerability. With underlying layers of adaptive capacity, climate and trade sensitivity, a mapping exercise was done to identify regions that are potentially vulnerable to the cause and effects of changes to these global processes. Identified “vulnerable regions/ hot-spots” take into account the reactive abilities across these regions stressing on the need for suitable interventions to enhance adaptive capacities.

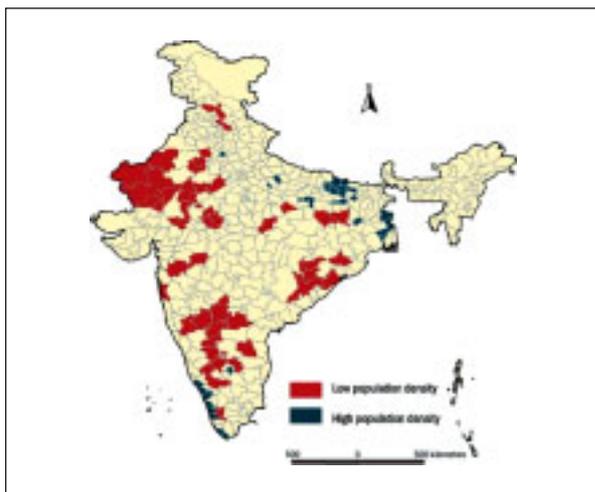


Figure 2 illustrates water stressed districts with low ground water availability and low and high population density

Field studies across the country clearly point to **variations in vulnerability within populations** as these populations have differential access to natural resources and facilities like banking, education and health services, infrastruc-

tural support for irrigation, access to markets, transport and communication linkages, asset ownership and the ability to diversify their cropping patterns.

Study 2 makes an effort to spatially analyse the degree of water related stress across districts in India and assess vulnerability within the rural population. UN predictions highlight that India is expected to be water stressed by 2025 and is likely to cross the water scarce benchmark¹ by 2050. Per capita availability of water across India varies considerably across regions depending on the natural availability of water in these regions. High rates of population growth have increased the pressure across some regions further, limiting the average availability of fresh water per person.

To unravel these linkages, vulnerability to water related stress across districts was analysed using GIS tools, taking into consideration the following parameters: low per capita ground water availability, high and low population density and growth, low utilizable flow of surface water/ unit catchment area and low ground water yields. The problem was found to be bigger in high-density areas where the per capita water availability is falling at higher rates than expected as the rate of withdrawal has far exceeded the rate of replenishment.

While at the national level, there are large regional variations in vulnerability to water-related stress, field studies highlight that in particular *women and children* who face the brunt by traveling long distances and investing more time for water collection are the most affected. There is also clear evidence of poverty as an aggravator of this stress and of poverty reduction as a provider of access to coping and mitigation mechanisms. Variation in vulnerability within populations is also shown *in terms of underlying abilities of people to cope with stressful conditions (e.g., by buying water due to low availability and access)*. In certain cases these complexities related to availability and degrading quality have translated into extreme conditions resulting in seasonal migration, health impacts and even water-related conflicts. Specific minority communities have also been found to be particularly vulnerable given the social context in which they are denied access to water.

The studies help establish the fact that, although GEC are large-scale processes, their impacts are evident at localized scales varying across regions and across population groups and depend on individual and collective capacities to cope with changes. Determinants of the nature and extent of the differential in vulnerability include natural/ geographic, socio-cultural, geo-political, economic factors as well as the policy/ institutional context.

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¹ hydrological benchmarks as defined by Falkenmark – Per capita freshwater availability between 1000 and 1700 cubic meters / year conditions of water stress; per capita freshwater availability less than 1000 cubic meters / year as water scarcity.

MORE PEOPLE, MORE TREES? EXAMINING COMMUNITY FORESTRY IN NEPAL'S TERAI

BY HARINI NAGENDRA AND ARUN AGRAWAL

► **South Asia supports some of the highest population densities** in the world, and has witnessed alarming levels of deforestation over the past several decades. There has however been considerable community engagement with forest conservation through much of the region, leading to very interesting situations such as in Nepal, where communities are able to protect the forest in the face of significant human pressure. Population levels are among the highest in Nepal's Terai plains, where large-scale migration over the past four decades has resulted in significant clearing in this formerly thickly forested, malarial frontier. The challenge for the Terai is to develop new institutions of forest management that will enable forest conservation in the face of these unprecedented levels of population pressure (Nagendra and Schweik 2004).

We compared population densities and forest conditions in the two predominant management systems found around the Royal Chitwan National Park (RCNP), Nepal's oldest protected area. The RCNP is surrounded by a population of nearly 300,000 and subject to frequent people-park conflicts. Buffer zone forests established around the park enable the communities to earn significant income from tourist revenues, thus attempting to provide a financial incentive for forest protection (Schweik et al. 2003). In the adjacent community forests, local communities manage the forests and earn some income from the sale of forest products (Nagendra 2002). Both regimes face pressure from restrictive governmental guidelines.

We analysed changes in forest cover for fourteen buffer zone forests and nine community forests using Landsat TM satellite images from 1989 and 2000, thus covering the period following the formal initiation of these programs. The spatial boundary of each of these forest patches was collected in the field, converted to digital form and overlaid onto the multi-temporal satellite images to follow the impact of changes in formal institutional arrangements on forest conservation over time.

For each of these institutions, a user group survey was conducted based on data collection instruments developed by the International Forestry Resources and Institutions Program at Indiana University (Ostrom 1998). These forms provided us with information on variables thought to affect the effectiveness of local institutions including: total area, user group size, income, monitoring activities, and ability to modify the rules. For each delineated forest patch, we then related these variables to the satellite information on forest cover change within the boundary of that patch, and to the institutional tenure type for that patch.

We found significant regeneration in the buffer zone forests, while there was a net loss in forest cover in the community forests. In part, this can be explained by the fact that buffer zone forests have the potential to generate higher income through tourist visits, which can be used for forest

maintenance and monitoring activities. In contrast, community forests were not able to access income from tourism, and respondents indicated that it was difficult to raise the resources required for monitoring and maintenance activities.

Changes in forest cover were further related to the age of initiation of forest protection, forest size, user group size, and people:forest ratio. Forest size ranged from 33 hectares to 1272 hectares, and the associated user groups contained between 450 to 8000 individuals. There was no significant correlation between the age of initiation of forest protection and the level of forest protection. The two management categories did not differ significantly in forest size or group size. However, the buffer zones have a higher people:forest ratio. This is a particularly interesting finding, since it goes against the conventional wisdom that higher population pressure is expected to accelerate degradation rather than promote conservation.

We have seen similar patterns in the past, where previous research in the Kumaon Himalayas of India (Agrawal and Goyal 2001, Agrawal 2000) has shown that medium-sized rather than small or very large forest groups appear to be more successful at managing forests. Middle-sized groups do better than very small groups because they can generate higher levels of resources to enable local monitoring and protection of forests. They also do better than very large groups because of lower level of conflicts and coordination problems. In Nepal, we speculate that the higher number of users allows for more participation in the highly labor-intensive forest management and monitoring activities, thus enabling better conservation in situations where income for hiring outside guards for management is limited. This research underlines the message that collective action in favor of conservation represents a very powerful positive force for the environment (Ostrom 1990). More people can indeed also mean more trees!

ACKNOWLEDGEMENTS

This research is supported by the National Science Foundation (USA) grant to the Center for the Study of Institutions, Population, and Environmental Change (CIPEC), Indiana University, and by the Society in Science: Branco Weiss Fellowship.

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TRADING SPACES:

Following the Impact of Forest-Coffee Conversions on Honduran Livelihood

BY CATHERINE TUCKER, DARLA MUNROE, JANE SOUTHWORTH, HARINI NAGENDRA

► Increasing attention is being given to the implications of land cover transformations for global environmental change, biodiversity, and human welfare (Geist and Lambin 2002). Establishing the relationships between land cover change, demographic growth and vulnerability represents a particular challenge. In Honduras as in many tropical countries, patterns of land cover change relate directly to human activity, resulting in complex changes across a suite of temporal and spatial scales. It is often assumed that changes in agricultural systems under conditions of population growth and poverty lead to general degradation of the landscape and increasing vulnerability. We have much evidence to suggest that the situation in western Honduras is more complex.

The research presented here looks at the relationships between market accessibility, landscape fragmentation and land cover change in western Honduras, and considers the implications for vulnerability. We developed a spatially explicit model of the returns to land use that postulates land use as a function of topographical variation and market access. We used both time-series satellite image analysis (Southworth and Tucker 2001, Southworth et al. 2002) and the results of detailed household surveys (Tucker 1996, 1999a, 1999b) in a representative portion of the study area. This enabled us to link observed changes in extent and spatial pattern of land-cover (Nagendra et al. 2003) to likely underlying land-use changes in an econometric model (Munroe et al. 2002). Fieldwork was central in allowing us to interpret the results of our analyses with respect to vulnerability and demographic change. This integrated, interdisciplinary approach has allowed us to follow the manner in which socioeconomic and biophysical forces have shaped the extent and configuration of land use in this region.

The study region comprises an area in western Honduras including the municipio of La Campa. As is the case with much of the country, both socio-economic and land cover transformations are occurring in this region, as interactions with world markets intensify. Between 1961 and 1988, the population of La Campa nearly doubled (Tucker 1996), and has since continued to grow. Increasing scarcity of prime land which is most suitable for agriculture and the introduction of chemical inputs have motivated farmers to abandon their more unproductive and marginal areas of cultivation and

establish more permanent agricultural fields. Land use transformations in the region are both mediated and shaped by relevant policy. Farmers in the study region have responded favorably to national initiatives and credit availability for export coffee production. Furthermore, municipal govern-

ments have reacted to a national subsidy by making road improvements in coffee producing areas.

All of this has had a noticeable impact on land cover change. Between 1987 and 1991, more accessible areas experienced greater deforestation and fragmentation, as we would expect. However, between 1991 and 1996 this trend reverses. Increased deforestation is found at higher elevations reflecting the recent expansion of shade

grown coffee for export, while forest regrowth becomes apparent in lower areas that are less suitable for coffee or more intensive agriculture (Southworth and Tucker 2001; Munroe et al. 2002, Nagendra et al. 2003). Land cover changes, population growth, and export coffee production have had varying implications for vulnerability. Coffee production has provided many households with income to invest in children's education. As a result, coffee has contributed to increasing levels of education and salaried employment, which may buffer risks related to agriculture. For most households, coffee has added a source of income to a diversified strategy of producing staples for consumption, pottery production, and wage labor (including coffee-picking). Some households reported that improved transportation and market linkages provided new options to survive the "hungry time" before the harvest. Out-migration may be increasing, thus reducing local population pressure and potentially providing remittances.

However, for some the expansion of coffee has actually had detrimental effects, increasing vulnerability. This is especially evident for land-poor households. First, it has led to the inequitable accumulation of wealth and land for those able to invest extensively in coffee, and undermined traditional relationships of reciprocity. Second, coffee price volatility has increased vulnerability to market shocks among the few households that have converted all of their land to coffee. If these processes of change continue, the economic advantages that coffee has brought for the majority of households may be undermined, resulting in increased vulnerability: particularly if, as predicted, global environmental changes result in a more variable climate and increased crop failures.



Photo: Jim Daniels

Young mother and child, Guatemala

ACKNOWLEDGEMENTS

This research is supported by the National Science Foundation (USA) grant to the Center for the Study of Institutions, Population, and Environmental Change (CIPEC), Indiana University



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IHDP-IAI 2004 Global Environmental Change Institute on Globalization and Food Systems Scientific Workshop and Science-Policy Forum



**October 24 – November 6, 2004
Costa Rica**



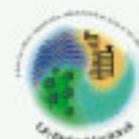
IHDP (International Human Dimensions Programme on Global Environmental Change) and IAI (Inter-American Institute for Global Change Research) announce the 2004 Global Environmental Change Institute on Globalization and Food Systems – Scientific Workshop and Science-Policy Forum.

The fourth International Human Dimensions workshop will focus on intersecting and interacting processes of globalisation and global environmental change, and the implications for food systems. Globalization is shaping economic, social, institutional and cultural changes that influence food systems in a myriad of ways. These changes are transforming the production and storage of food, the movement and trade of food, access to food, the reality and perceptions about food safety, and consumption patterns. At the same time, global environmental change is altering the physical and social conditions that underpin terrestrial and marine food systems. The transformation of food systems in a globalizing world has environmental and social impacts that are likely to interact synergistically with global environmental change. The goal of the workshop is to identify some of these critical interactions and consider the implications for both environment and society, particularly in areas characterized either by poverty and food insecurity or by growing per capita incomes and rapidly changing demands for food.

The Scientific Workshop aims to encourage systematic promotion of young scientists, particularly social scientists, from developing countries and countries in transition, and to initiate their future integration into the IHDP and IAI communities through the promotion of research on themes of the workshop. It will take place at the Centro Mesoamericano de Desarrollo Sostenible del Trópico Seco (CEMEDE) of the National University of Costa Rica (UNA).

The Science-Policy Forum will focus on the science-policy interface and the use of scientific information into the policy and decision-making processes. The Science-Policy Forum will be held in San José in collaboration with the Observatorio del Desarrollo of the University of Costa Rica (UCR) and the National Environmental Forum.

Please visit our webpage www.institutes.iai.int/2004GECL.htm for more details or contact Maarit Thiem at thiem.ihdp@uni-bonn.de



INDUSTRIAL TRANSFORMATION IS NOT (JUST) ABOUT THE MANUFACTURING INDUSTRY...

► ...and we have to emphasise this fact on every occasion, rather than change the title of one of the IHDP's core projects – argued its Scientific Steering Committee (SSC) at their annual meeting, which took place on 19 October 2003 in Montreal, Canada following the Open Meeting of the Human Dimensions research community.

The name of the IT Project has caused many misunderstandings despite efforts by the project office (IPO) and the SSC to clarify its real meaning. The word *Industrial* in the name of the Project was originally selected to describe and indicate the need for a transformation of ALL human activities defined as a chain of interrelated economic activities aimed at providing a specific societal need. *Industrial* Transformation has been defined analogously to *Industrial* Metabolism and hence refers to all processes reflecting economic activity instead of those of the industrial sector alone. *Industrial* Transformation could as well be called *Societal* Transformation but this word is confusing as it emphasizes changing norms, values and attitudes instead of transforming inputs into outputs (de Bruijn 1999). Under *Industrial* Transformation we advocate a non-incremental change in production and consumption systems as well as a revision of the incentive structures that shape the relation between the two. When we run out of easily achievable and cheap end-of-pipe options to solve our environmental problems and when *green* products do not seem to be sufficient to meet the challenges of global environmental change, the IT framework stimulates a more proactive type of approach. Approach based on research on systems change that will help us understand whether it is at all possible to decouple economic growth from its environmental burden.

As for now, there is enough scientific evidence that technological change can only contribute a part of a transformation; by itself technological change is insufficient to prevent ecological problems. There must also be parallel but mutually reinforcing changes in the institutional and socio-cultural dimensions. Due to lack of well-established and structured scientific knowledge in the field, these types of change can be considered *transformations* only from a time perspective. Moreover, not all transformations are alike. Societies are always in the process of change but the question is WHICH changes should be encouraged, in WHICH DIRECTIONS and in WHAT FORM? Some say we can establish these and influence the path of the socio-technical change, but with who and where does change start? When does experimentation stop and selection start? How can we handle the interests of numerous stakeholders? And finally, can we all agree on a common vision?

From this perspective, the existing IT research framework (the IT Science Plan) is still valid, with transition research as an essential part of GEC science. The IT SSC decided at its meeting in Montreal that most of the IT foci¹ are relevant, though some need revision to focus more on the *transformation* rather than the *industrial* part of the name.

¹ Energy and Material Flows (E&MF), Food, Cities with focus on transport and water, Information and Communication (I&C), Governance and Transformation Processes (G&TP).



Photo: Population Action International

Children in Madagascar

A workshop is planned for the end of 2004, during which the current IT agenda (IT Science Plan) will be critically evaluated and the above issues discussed. The starting point for the discussion will be a keynote paper prepared by the SSC members on both the most crucial as well as any missing elements in *Industrial* Transformation research.

The IT SSC also expressed hope that there could be more space in the next Open Meeting of the Human Dimensions Research Community in 2005 for continuation of this dialogue in a more international arena. For the next conference, the SSC emphasized the importance of reaching out and connecting with other international organizations, which also work on aspects of human dimensions of global environmental change. To have a better impact at a policy level it may be interesting to identify policy processes we can contribute to and to present our findings to relevant policy makers.

In the Open Meeting that took place in Montreal, papers presented in the four IT sessions originated not only from the IT endorsed projects. We were happy that scientists from outside the IT network joined us. Each IT session brought about 35-40 participants and was a forum for sharp discussion (see article on the IT sessions in the previous issue of IHDP UPDATE). It has been agreed by the IT SSC that the most interesting contributions will be invited for a special issue of the *Technological Forecasting and Social Change* international journal.

Finally, in Montreal we welcomed four new members of the IT committee: Frans Berkhout from SPRU², UK; Christian Azar from Chalmers, Sweden; Jose Moreira from CENBIO³, Brazil; and David Angel from Clark University, USA. We look forward to working with you! In the course of 2003 the membership term of Luis Vieira, Richard Rockwell, Stuart Hart and Hidefumi Imura came to an end. We would like to express our gratitude for your input and scientific guidance.

More information about the IT project, SSC members and the IPO activities can be found at the project website: <http://130.37.129.100/ivm/research/ihdp-it/>



REFERENCES to this article are included on the IHDP website at www.ihdp.org/update0104/references.htm



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² Science and Technology Policy Unit

³ The Brazilian Reference Center on Biomass

ARGENTINA INVENTORY

BY ELDA TANCREDI AND THE INVENTARIO WORKING GROUP

► Since 1998, after the First IHDP Workshop in Bonn, a close relation between researchers of the Social Sciences Department of Lujan National University (Argentina) and IHDP Community begun. In August, 2002 the initiative for “Capacity Building for National Human Dimensions Committees and Programmes in Developing Countries and Transition Economies” (Seed Grant Initiative-ISSC/UNESCO) provided funding to our working group to prepare a national inventory of relevant ongoing and planned research activities. In this context of the international scientific programme, we have worked on the proposal of a national inventory that systematizes institutions (universities, government provincial organizations and NGOs), research projects, publications and researchers in Argentina involved in the study of the human dimensions of environmental change. The aim was to establish bases for a future national scientific network that could define a National Committee in Argentina articulated with IHDP.

The inventory has been organized around three main ideas: revision of the experiences gathered in other countries, specifically in Latin American ones, which, also counting on the support of the IHDP, organized their National Committees; revision of the database and register available in the Secretary of Sustainable Development and Environmental Policy in its System of National Environmental Information – SIAN; research organized from the National Universities and related Research Centres, operating in the different provinces of Argentina territory, since not all of them are necessarily registered in the SIAN.

With all the information we gathered, we built a data-matrix which, due to the final goal of generating input for the definition of a national programme, was called: “Inventory-matrix of institutions, scientific projects and researchers towards the definition of a national programme”. As a result of the matrix-directories, we sent information presenting IHDP in our country, explaining the objectives of the Inventory and asking for collaboration filling a questionnaire. During five months, we have achieved 399 contacts with Universities and carried out 323 contacts with NGOs. We got a total of 221 projects developed with the support of, e.g., the provincial government organizations available in SIAN, from which we gathered information.

The information obtained was related to professional information and work experience of researchers; environmental issues on which they are or have been working and results of the projects they have been involved in. The Inventory Report includes a special analysis related to: 1. Projects list, 2. Scientists/researchers involved in the implementation of the projects, 3. Institutions, 4. Institutional Financing, 5. Possible relationship with the IHDP Projects, 6. Recommendations, 7. Identification of possible future lines of research.

Having analysed the information in the Inventory-matrix containing details of **762 projects related to human dimensions of environmental change**, we have reached the con-

clusion that there is a low average of projects per organization. The three frequencies carried out show that more than 90% of the organizations register less than 5 projects.

The theme relation of the projects to the four main IHDP research projects (IT, LUCC, GECHS, IDGEC) indicates that **University Organizations** give predominance to the areas Human Security and Industrial Transformation. Thus: Human Security registers 284 projects (53%); Industrial Transformation registers, 104 projects (19%); Land-Use and Land-cover Change accounts for 80 projects (15%); Institutional Dimensions, 71 projects (13%)

In the case of **Non-government Organizations** the most important area is Institutional Dimensions: Institutional Dimensions registers 21 projects (57%); Industrial Transformation accounts for 7 projects (19%); Land-Use and Land-cover Change registers 7 projects (19%); Human Security, 2 projects (5%)

As regards **Province Government Organizations**, in the relation projects per research area established from the IHDP we can notice: Land-Use and Land-cover Change registers 83 projects (44%); Institutional Dimensions registers 68 projects (37%); Human Security 19 projects (10%); Industrial Transformation, 16 projects (9%)

The research shows that 84% of the projects are developed with financing. As the origin of the financing corresponds 71% to the National Programme of Incentives for Research, which has suffered during the last years budget reductions, scientists finally finance their own research.

The Argentina Inventory Report is just the starting point. Future action intends to make a profile of the Argentine National Committee, counting on the participation of representatives from different organizations, in order to establish priority areas to deal with issues related to Human Dimensions of Global Environmental Change and to promote the establishment of a Latin-American regional network of national committees towards a sustainable future



A CD containing all database and matrix analysis is available (only in Spanish by now). If you are interested, please send an e-mail to inventario@mail.unlu.edu.ar and we'll send it to you.



BY THE INVENTARIO WORKING GROUP

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IN BRIEF

▶▶▶ **The Global Water System Project (GWSP)** – an interdisciplinary project sponsored by Diversitas, IGBP, IHDP and WCRP – has opened its International Project Office (IPO) on 2 February 2004 based at the Centre for Development Research in Bonn (see page 20 for address). The Executive Officer is Dr. **Eric Craswell**, who has extensive experience in research on tropical soil management and nutrient cycling, supported by **Lara Wever** as the Administrative Officer.



Eric Craswell

A Scientific Steering Committee will be established within the next couple of months by when the IPO should be moving from the initial start-up phase to a more project-oriented phase. First regional activities under the umbrella of GWSP are developing in China, India and possibly East Africa.

▶▶▶ **Land Open Science Conference, December 2003.** The Science Plan of the new Global Land Project entered the home stretch. It was reviewed and discussed by a broad community at the Land Open Science Conference in Morelia, Mexico, in December 2003, after having been modified during the Banff IGBP congress in July 03 to better integrate the research strategy. The expanded science plan is based on the outcome of the working groups formed at the Land OSC and extensive material has been incorporated in the latest draft during the past months. The research goal of the Global Land Project is to measure, model, and understand the coupled human-environmental system (“land system”) as part of broader efforts to address changes in Earth processes and subsequent human consequences.

The Global Land Project is supposed to be the successor of the IGBP core project “Global Change and Terrestrial Ecosystems (GCTE)”, which terminated last year, as well as the joint IGBP/IHDP core project “Land-Use and Land Cover Change

(LUCC)”, which is going to synthesize its results until the end of 2005. The science plan is currently undergoing a peer review and will be presented to the Scientific Committees of IGBP and IHDP in March 2004.

▶▶▶ **The 2003 Berlin Conference “Governance for Industrial Transformation”** analysed political strategies to limit the overuse of natural resources as well as emissions from industrial activities. The panel sessions were organized around five themes: 1. Multi-actor and multi-level governance; 2. Transition strategies; 3. Sustainable business; 4. Technologies for a sustainability transformation; 5. New generation of instruments. The papers are available at www.fu-berlin.de/fu/akumwelt/bc2003/. The Conference was organized by the Environmental Policy Research Centre at the Freie Universität Berlin in cooperation with the SUSTIME project lead by the University of Applied Sciences Lausitz, the international Global Governance Project GLOGOV.ORG and the German Association for Ecological Economic Research (VÖW). The conference was endorsed by the IHDP core project on Industrial Transformation. It has brought forward a systematic approach to sustainability transformation that could be a useful starting point for future research since it offers opportunities for combining different stocks of knowledge and broadening the perspective on useful points for intervention. The next conference with the title “Greening of Policies – Policy Integration and Interlinkages” is scheduled for 3–4 December 2004 in Berlin.

▶▶▶ **What are the important issues on sustainable development** from a social science research point of view? Who is doing what in this regard and what should be done in the future? To answer questions and discuss issues in this context, 48 social scientists from a broad range of disciplines met in the city of Cuernavaca, Mexico, on 1-2 December 2003. The workshop on “Social Science Perspectives on Sustainable Development” was organized by the International Social Science Council (ISSC) together with IHDP and the Centro Regional de Investigaciones Multidisciplinarias (CRIM) of the Universidad Nacional Autónoma de México (UNAM). A more fruitful and active dialogue and engagement between ISSC and IHDP has been started in this workshop. It was suggested that ISSC might focus on emerging issues and problem-oriented projects such as international public health; the information society and governance; disasters and risk; and minorities, ethnicity and globalization.

Besides the above mentioned conferences and the Open Meeting in October 2003, there were still other events in which IHDP actively participated. In November 2003, the Young Scientists’ Global Change Conference, organized by START, took place in Trieste (Italy). The IHDP Secretariat co-sponsored this event and was represented by Executive Director Barbara Göbel who was in the selection committee. In December, the French Ministry of Research organized a meeting on global change in Paris, France. IHDP was represented by researchers from all its four core projects. IHDP also presented its new urbanization initiative and the GECAFS joint project. Also in December 2003, the ‘Energy and Sustainable Science’ Conference, organized by the Science Council of Japan, and endorsed by IHDP, took place in Tokyo, Japan. Barbara Göbel gave a lecture on Industrial Transformation. Furthermore, IHDP took part in a meeting convened by the Institut National des Sciences de l’Univers in February 2004 in Paris. Called ‘Sociétés et Environnement’ this meeting concentrated on the coupled human-environment system.

Apart from organizing the Institute on Globalization and Food Systems in Costa Rica later this year (see advertisement on page 15), IHDP so far co-sponsors two more workshops: A Capacity Building Workshop on Global Change Research (organized by APN) in Islamabad, Pakistan, 12-14 April 2004 and the Advanced Institute on Vulnerability to Global Environmental Change (organized by START) in Laxenburg, Austria, 3-21 May 2004.

For more information on the Institutes and Workshops, please see our website: www.ihdp.org

PUBLICATIONS | NEW BOOKS

Transition towards Sustainable Development in South Asia

By Kaushik Deb and Leena Srivastava (Eds.), *The Energy and Resources Institute TERI, New Delhi, India*

This book identifies and documents the IT research being undertaken in South Asia, with the objective of furthering research imperatives that are critical to addressing concerns regarding such transformations. Built around four IT foci – (1) transformation towards sustainable energy systems, (2) agricultural sustainability and food security, (3) transition of urban energy and environment, and (4) governance for sustainable development – this publication provides an opportunity for the South Asian scientific community to engage in constructive dialogue and share research outcomes with others in the region, as well as globally.

TERI (www.teriin.org), New Delhi 2003
ISBN 81-7993-020-3, price 35 US \$

**Integrated Land-Change Science and Tropical Deforestation in the Southern Yucatán Final Frontiers**

By B.L. Turner II, Jacqueline Geoghegan, David R. Foster (eds.), *Oxford University Press, Feb. 2004*

ISBN 0-19-924530-4, price: £100.00
Hardback

This highly topical study of tropical deforestation in Mexico reports on the first phase of the Land-Cover and Land-Use Change in the Southern Yucatán Peninsular Region Project. The LCLUC-SYPR is a large, multi-institutional and team-based study designed to understand and project land changes in a development frontier that pits the rapidly growing needs of smallholder farmers to cut down forests for cultivation against federally sponsored initiatives committed to various international programs of forest preservation and complementary economic programs.

**Lesotho Atlas of Sustainable Development**

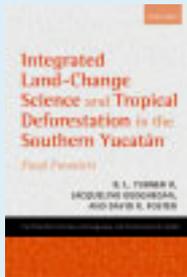
By D.M. Bohra

The Lesotho Atlas of Sustainable Development is an attempt to map the state of sustainable human development in the country. The Atlas portrays, through a variety of 213 maps with analytical text, three critical dimensions of sustainable development, namely longevity, education and the command over resources in terms of specific indicators at the levels of districts, geographical zones, rural and urban areas and at gender level during a specific period of time. Indicators of social development such as adolescents' health, child labour, violence against women etc. have also been mapped.

Order through: atlaslesotho@yahoo.com

Or: P.O. Box 2852, Santa Clara, CA 95055, USA

ISBN 99911-645-02; price US\$ 95 hardback



MEETING CALENDAR

➤➤➤ 1–3 April – Berlin, Germany

1st European Networks Conference on Sustainability in Practice
www.encos2004.net

➤➤➤ 12–14 April – Islamabad, Pakistan

Capacity Building Workshop on Global Change Research
www.apn.gr.jp/activity/capable/programme_announcements.html

➤➤➤ 26–28 April – Uppsala, Sweden

The Food 21 Symposium – towards sustainable production and consumption
www-conference.slu.se/food2004

➤➤➤ 2–6 May – Vancouver, Canada

World Fisheries Congress
www.worldfisheries2004.org/home.htm

➤➤➤ 10–14 May – Rome, Italy

2nd World Conference and Technology Exhibition on Biomass and Energy
www.conference-biomass.com/conference_Welcome.htm

➤➤➤ 17–19 May – Wageningen, The Netherlands

Towards sustainable protein supply chains
www.wau.nl/vlag/protein2020

➤➤➤ 19–23 May – Fairbanks, Alaska

5th International Congress of Arctic Social Sciences (ICASS V)
www.uaf.edu/anthro/iassa

➤➤➤ 23–25 May – Kloster Seeon, Germany

Innovation, Sustainability and Policy
www.riw-netzwerk.de/kloster-seeon

➤➤➤ 1–4 June – Bonn, Germany

International Conference for Renewable Energies
www.renewables2004.de

➤➤➤ 16–19 June – Honolulu, Hawaii

3rd Annual Hawaii International Conference on Social Sciences
www.hicsocial.org

➤➤➤ 15–18 June – Suva, Fiji

Pacific Island Training Institute on Climate and Extreme Events

Deadline for Application: 12 March 2004

www.apn.gr.jp/activity/capable/programme_announcements/institute-announcement.pdf

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> IDGEC

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> IT

• Industrial Transformation

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> LUCC

• Land-Use and Land-Cover Change

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> GECAFS

• Global Environmental Change and Food Systems

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> GCP

• Global Carbon Project

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> GWSP

• Global Water Systems Project

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> The IHDP UPDATE newsletter features the activities of the International Human Dimensions Programme on Global Environmental Change and its research community. ISSN 1727-155X
UPDATE is published by the IHDP Secretariat
Walter-Flex-Strasse 3
53113 Bonn, Germany.
EDITOR: Ula Löw, IHDP; loew.ihdp@uni-bonn.de
LAYOUT AND PRINT: Köllen Druck+Verlag GmbH, Bonn+Berlin, Germany
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