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BIODIVERSITY CONSERVATION: STUDIES IN ITS ECONOMICS AND MANAGEMENT, MAINLY IN YUNNAN, CHINA

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Biodiversity, Conservation and Sustainable Development: Challenges for North-East India in Context

by

Clem Tisdell

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Biodiversity, Conservation and Sustainable Development: Challenges for North-East India in Context[1]

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Clem Tisdell[2]

September 1995

[1] This is a background paper for a key note address to be given to the International Seminar on 'Environment, Biodiversity and Sustainable Development in North-East India' to be held at the North-Eastern Hill University, Mizoram Campus, Aizawl, Mizoram, India on 26th and 27th September, 1995

[2] School of Economics, The University of Queensland, St. Lucia Campus, Brisbane QLD 4072, Australia
Email: c.tisdell@economics.uq.edu.au

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Rural nature reserves can have negative as well as positive spillovers to the local region and policies need to be implemented to maximise the net economic benefits obtained locally. Thus an 'open' approach to the management and development of nature conservation (biodiversity) programmes is needed. The purpose of this study is to concentrate on these economic interconnections for Xishuangbanna National Nature Reserve and their implications for its management, and for rural economic development in the Xishuangbanna Dai Prefecture but with some comparative analysis for other parts of Yunnan

The Project will involve the following:

1. A relevant review relating to China and developing countries generally.
2. Cost-benefit evaluation of protection of the Reserve and/or assessment by other social evaluation techniques.
3. An examination of the growth and characteristics of tourism in and nearby the Reserve and economic opportunities generated by this will be examined.
4. The economics of pest control involving the Reserve will be considered. This involves the problem of pests straying from and into the Reserve, e.g., elephants.
5. The possibilities for limited commercial or subsistence use of the Reserve will be researched.
6. Financing the management of the Reserve will be examined. This will involve considering current sources of finance and patterns of outlays, by management of the Reserve, economic methods for increasing income from the Reserve and financial problems and issues such as degree of dependence on central funding.
7. Pressure to use the resources of the Reserve comes from nearby populations, and from villagers settled in the Reserve. Ways of coping with this problem will be considered.
8. The political economy of decision-making affecting the Reserve will be outlined.

Commissioned Organization: University of Queensland

Collaborator: Southwest Forestry College, Kunming, Yunnan, China

For more information write to Professor Clem Tisdell, School of Economics, University of Queensland, St. Lucia Campus, Brisbane 4072, Australia or email c.tisdell@economics.uq.edu.au or in China to Associate Professor Zhu Xiang, World Bank Loan Project Management Centre, Ministry of Forestry, Hepingli, Beijing 100714, People's Republic of China.

Biodiversity Conservation and Sustainable Development: Challenges for North-east India in Context

1. Introduction

Increases in human populations and in the intensity and breadth of human activities are making ever mounting inroads into natural environments and reducing biodiversity. Some of the environmental effects are now being felt on a global scale e.g. depletion of the ozone layer and the build-up of greenhouse gases such as carbon dioxide. Of course, mankind's transformation of nature has been going on for thousands of years (Goudie, 1990; Cunliffe, 1944) but the difference now is its accelerating scale and intensity made possible in large measure by new technologies and capital accumulation. The question is being more frequently asked of how much further this process can go without threatening the life-support systems of *homo sapiens*. We have been alerted to the possibility that the strategy of economic growth (by means of capital accumulation and technological progress) which has been touted by many for so long as the answer to reducing economic scarcity could itself become a source of scarcity for future generations or even cause ruin for present ones.) This can happen if the resource-depletion and environmental consequences of such a strategy are ignored.

In addition, it has become clear that if sustainable development is to be achieved, development projects must be assessed on a holistic basis. This involves taking account not only of their external economic consequences, but their wider environmental and socio-economic implications including those in the longer term. The biophysical, social and economic dimensions must all be taken into account and this requires a multidisciplinary approach to project evaluation.

The sustainability issue has also raised another question: namely, the ethical question of whether mankind is justified in continuing to eliminate other species solely for its own economic gain. In particular, in high-income countries, can the elimination of a species be justified for an extremely small increase in incomes which are already high? An example of this occurred in 1995 in Queensland. The mahogany-glider possum is a rare possum dependent on mahogany trees and is confined to a small geographical area in Queensland. This year some of its habitat began to be cleared for sugar-cane production. But Australia is

already the world's major exporter of sugar and any increase in Australian incomes (already high) as a result of growing sugar-cane in the area presently occupied by this glider would be miniscule. Many Australians were of the view that further changes of this habitat could not be ethically justified and clearing of it has now stopped.

In this paper, I shall consider the global historical, intellectual and policy context to which biodiversity, conservation and sustainable development in north-east India needs to be related and consider these matters within Asia, especially south Asia. Attention will then be given to specific sustainability issues in north-east India, including agricultural sustainability and sustainability of forests and of communities, and comparisons will be made with some localities in south Asia which face or have faced similar challenges and problems.

2. The Historical and Policy Context

Interest in sustainable development was it seems first sparked by the non-aligned countries, including India, in the early 1970s and was an issue at the 1972 United Nations Conference on Development held in Stockholm. Pandit Nehru was anxious to make it an international issue and concern about sustainability was enhanced by the oil crises of the 1970s. Both pollution and depletion of non-renewable resources, such as oil, as a result of economic growth and population increases became a major concern (e.g. Meadows *et al*, 1972). However, most economists rejected the neo-Malthusian point of view that limits to economic growth set by the environment and natural resources were being rapidly approached and remained growth optimists. Most believed that technological progress would overcome any apparent limits to economic growth, that (with economic growth) self-regulation of population would occur, that most environmental failures within economic systems can be overcome by appropriate market reforms and argued that if all else fails, mankind has tremendous capacity to respond socially to environmental dangers (cf. Tisdell, 1990, Ch.3). While such optimism may prove to be justified, it can breed apathy about environmental change and there is the problem that although society may respond to environmental deterioration, it may do so when the damage done is irreversible. Furthermore, there is no guarantee that technological will continue at a rapid rate or even always continue.

While earliest concerns about the sustainability of economic development were based on the occurrence of pollution from economic activity and the depletion of non-renewable inanimate resources such as minerals, concerns in the 1980s began to shift to the consequences of

degradation and depletion of living natural resources and loss of biodiversity. *The World Conservation Strategy* (IUCN, 1980) appears to have been a turning point. The importance of the conservation of natural biological resources and of biodiversity for human welfare and sustaining economic activity became to be stressed. This focus strengthened and is apparent in *Our Common Future* (World Commission on Environment and Development, 1987) and was a major theme of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. This Conference adopted Agenda 21 which calls upon all nations to develop strategies for sustainable development for the 21st Century. China has been one of the first developing nations to draw up such a strategy (State Council, 1994) but it is doubtful if its strategy, as currently stated, is operational.

Agenda 21, amongst other things, requires attention to be given to the conservation of biodiversity. While countries could not obtain agreement on an international convention or conservation of biodiversity at Rio de Janeiro, mainly because of the disagreement of the United States, the American position subsequently altered with the change of its President. An international convention, the Convention on Biodiversity Conservation, has now come into effect and places obligations on its signatories to conserve biodiversity in their own countries.

3. Sustainability in the Intellectual Context of Economics

From the early 1970s onwards a growing group of economists became interested in concepts of sustainability and sustainable development. The interest of virtually all was purely an anthropocentric one. The focus was on how conservation of natural resources and the environment might help satisfy the needs or wants of mankind. All of the value of conservation was to be determined by reference to humans with willingness to pay (or to accept payment) being an important part of the process of valuing nature and the concept of *total* economic value was introduced by Pearce and others (1989). It includes items like existence value of species in the evaluation of conservation, thereby signalling that economic evaluation need not be based solely on materialistic considerations. However, other species are provided with no rights in themselves but solely depend for their valuation on the total economic evaluation placed upon them by human beings.

On the question of sustainable development economists have been engaged in two broad areas of debate. These involve (1) the ethical or normative basis for sustainable development

and (2) the conditions that need to be satisfied to achieve sustainable development; a matter involving positivism. Debate is ongoing about both issues.

Most economists argue that the income of future generations (of human beings) should not be made less than that of the present generation(s) by actions taken by present generations. It is believed that present generations have an economic moral obligation to future generations. This is given some ethical underpinning by the Rawlsian principle of justice, that inequality in the income of individuals can only be justified if the inequality is to the detriment of none (Rawls, 1971). The principle relies On the 'veil of ignorance' assumption, namely that any individual could have been born into the shoes of any other and that if an original contract before birth could have been entered into all would agree to this principle of equality. I have pointed out its shortcomings elsewhere (Tisdell, 1993, Ch.9). In addition, note that it would require everyone to take a risk-averse attitude. It is purely man-centred. Furthermore, if carried to its logical conclusion, it requires equality between individuals in the current generation, unless inequality disadvantages no one.

The second contentious matter involves the conditions required to satisfy the above mentioned aim. At least two schools of thought have emerged in economics: (1) Those who argue that *weak* sustainability conditions are sufficient and (2) those who argue that *strong* sustainability are required. The argument basically is about what constitutes suitable bequests to future generations for the purpose of maintaining incomes (Pearce, 1993, Ch.2).

Advocates of weak sustainability conditions are optimistic about the future and suggest that substitution of man-made capital for natural resources and for environmental quality is acceptable and that accumulation of man-made capital (especially if combined with efforts to sustain technological progress and improve human capital through education) is a suitable bequest for maintaining the income of future generations. On the other hand, those favouring weak sustainability conditions claim that continuing substitution of man-made capital for natural environmental resources is no longer a suitable bequest for future generations. Man-made capital eventually perishes. Furthermore, natural resources and environmental stocks have already been severely reduced by economic growth. They may have been reduced to a *core* essential for the maintenance of life-support systems and economic production. Additional reduction is likely to imperil economic production because natural and environmental resources are essential ingredients of most production processes and directly provide services to human beings. In the view of those recommending strong sustainability

conditions, considerable effort should be made to *maintain the existing* natural resource/environmental stock. This does not mean that no economic change is permitted which uses natural environments, but that environmental offset policies should be instituted. For example, if a new coal-using power station is opened which would add to carbon dioxide emissions, these emissions may be required to offset by planting trees to act as sinks for the additional carbon dioxide. Or again, conversion of forested land to agriculture may only be permitted if additional forest is planted to act as an offset. Naturally there is room for argument about what constitutes a suitable offset.

The above arguments are about what is necessary to sustain the welfare of human beings. However, some believe that a wider ethical perspective is needed. Aldo Leopold (1966) argued that man has a responsibility to respect the web of life. Tisdell (1991, Ch.11) has suggested that some weight should be afforded to the conservation of other species independently of their value to humankind. Aspects of Hinduism and of Buddhism appear to support this view, and it may be that features of Taoism and traditional emphasis of the Chinese on harmony and balance between mankind and nature provides some support for this point of view. In any case, holders of this conservation ethic will be less inclined than economic man (as typically portrayed by economists) to forgo nature conservation even if it benefit future generations economically.

4. Development of Asia, especially South Asia, and the Rural Environment

Unlike sub-Saharan Africa, Asia continues to show considerable economic growth. While international emphasis e.g. by the World Bank, has been on the so called miraculous economic growth of East Asia, this should not be allowed to detract from the substantial growth achieved by south Asian countries. The GDP of the major south Asian economies grew at annual rates in excess of four per cent in the period 1980-92 (see Table 1). However, rapid rates of population increase in most (see Table 1) meant that the rate of increase in the income per head of their population was slower (see Table 2).

Table 1: Rates of Growth of Production and Population in Selected South and East Asian Economies.

	GDP Annual percentage increase		Population Annual percentage increase	
	1970-80	1980-92	1970-80	1980-92
South Asia				
Bangladesh	2.3	4.2	2.6	2.3
India	3.4	5.2	2.3	2.1
Pakistan	4.9	6.1	3.1	3.1
Sri Lanka	4.1	4.0	1.6	1.2
East Asia				
China	-	9.1	1.8	1.4
Indonesia	7.2	5.7	2.3	1.8
The Philippines	6.0	1.2	2.5	2.4
Thailand	7.1	8.2	2.7	1.8

Source: Based on World Bank (1994), Tables 2 and 25.

Table 2: GNP per capita in U.S. dollars 1992 for Selected Asian Economies, its Growth Rate 1980-92.

	GNP per capita	**Average annual growth (%) 1980-92**
South Asia		
Bangladesh	220	1.8
India	310	3.1
Pakistan	420	3.1
Sri Lanka	540	2.6
East Asia		
China	470	7.6
Indonesia	670	4.0
The Philippines	770	-1.0
Thailand	1,840	6.0

Source: Based on World Bank (1994) Table 1.

With the exception of Sri Lanka, south Asian countries seem to be a considerable distance away from completing their demographic transition to a stationary level of population. The population levels of Bangladesh, India and Pakistan are expected to at least double before they stabilise at a stationary level (see Table 3). Thus population increases plus aspirations for higher per capita increases can be expected to put great strain on natural environments in south Asia in the foreseeable future.

Table 3 Estimates and Predictions of Population Levels for Selected Asian Countries: Totals in Millions.

	1992	2000	2025	Hypothetical stationary level
South Asia				
Bangladesh	114	132	182	263
India	884	1,016	1,370.	1,888
Pakistan	119	148	243	400
Sri Lanka	17	19	24	29
East Asia				
China	1,162	1,255	1,471	1,680
Indonesia	184	206	265	355
The Philippines	64	77	115	172
Thailand	58	65	81	104

Source: Based on World Bank (1994), Table 25.

Already in rural areas in south Asia, land-use patterns have been affected. Between 1979 and 1991 forest and woodland areas in Bangladesh decreased by 13% and in India by 0.7%. The percentage of land allocated to crops increased in all south Asian counties in this period and that used for permanent pasture either declined slightly or remained stationary. These are all signs of intensification of rural land use for economic purpose. Actually the degree of intensification of such use (which normally has adverse consequences for biodiversity and the natural environment) is much greater than is apparent from the above figures because they do not factor in developments such as the increased incidence of multiple-cropping and rising use of artificial fertilisers, pesticides and irrigation.

As for biodiversity, south Asian countries are extremely well endowed. However, a large of their higher plants, birds and mammals are threatened with extinction. In each of Bangladesh and India over 2000 species of higher plants are believed to be threatened with extinction (World Resources Institute *et al*, 1994, Table 20.4). A large part and source of the unique biodiversity of India is located in north-east India. The area of India in protected (nature) areas is at 4% slightly b low the Asian average of 4.4% and well below that of Europe at 9.3% and the USA at 10.5% (World Resources Institute et al, 1994, Table 20.1). However, the situation in Bangladesh is much worse from a conservation point of view because only 0.7% of its land area is afforded protected status. In addition, none of its area has total nature protection.

5. North-East India – General Observations on its Economic Development and its Environment

North-east India is a region of tremendous biological and cultural diversity. It is an asset not only to India but to the whole world. However, as in many other areas in Asia, socio-economic change is threatening this diversity.

In general, the levels of per capita income in the north-east Indian states are lower than elsewhere in India but compare favourably with that of some other Indian states e.g. Bihar. For example, it is estimated (Ministry of Finance, 1994, Table 1.8, p.S-12) that for 1990-91 the per capita net state domestic product for Bihar was 2,650 Rupees, whereas for Manipur it was 3,893 Rupees, for Mizoram (in 1989-90) 4,135 Rupees, for Meghalaya 4,190 Rupees for Assam 3,932, for Arunachal Pradesh 5,046 and for Tripura 3,328. However, by contrast Delhi recorded a figure of 10,638 Rupees. Per capita incomes in the North-east are still considered to be low but are not dramatically below the overall level in India.

The rate of population growth in the North-east is rapid and overall is above Indian average. It ranged in 1981-91 from an average exponential growth rate of 2.17% for Assam to 4.45% for Nagaland. Mizoram recorded a 3.34% growth rate (Ministry of Finance, 1994, Table 9, p.S-115). Population densities in the North-east are low by Indian standards and range from 10 people per square km in Arunachal Pradesh to 286 in Assam. Mizoram had a low density of 33 people per square km (Ministry of Finance, 1994, Table 9. p.S-115). Nevertheless, with such rapid rates of population increase, population density is clearly rising rapidly and continuing to affect the region's natural environment.

Consequences for Agricultural Sustainability

Agriculture and forests are important .for economic welfare in North-east India where the vast majority of the people are engaged in rural pursuits. However, a number of the agricultural practices used in the North-east are becoming increasingly unsustainable and will continue to do so as population densities rise there and demands for higher incomes result in activities economic production.

As pointed out by Ramakrishnan (1992) and others, shifting agriculture (slash-and-burn agriculture, or *jhum* agriculture) which is practiced by a number of tribal groups is becoming less sustainable as cultivation cycles are shortened due to population pressures. Once this

cycle goes below 10-12 years it seems that it is no longer an economic form of agriculture compared to possible types of settled agriculture. This raises the question then of just how sustainable is settled agriculture in the North-east taking into account the monsoonal nature of the area, the prevalence of sloping lands and the nature of soils. Certainly *modified* forms of settled agriculture are likely to be called for in this region to improve agricultural sustainability e.g. mixed systems of cultivation as in permacultures, use of hedgerows for soil erosion control and so on. These are all matters worthy of investigation.

The above underlines the point that strategies for sustainable development must be based upon anticipation and that flexibility is needed. Given that population levels are going to increase in the North-east of India, then policies for sustainable development, including sustainable agricultural development, need to be designed *taking this into account*. A *dynamic* approach to planning for sustainability is required.

A reduction in the length of *jhum* cycles has a number of adverse environmental consequences. It reduces biodiversity and it increases the rate of soil erosion, apart from its unfavourable economic consequences for the cultivator. While the slash-and-burn technique appears to be relatively sustainable and not a major environmental danger when population densities are low, this is not the case for higher population densities.

Forest Sustainability

Inroad continue to be made into forested and woody areas in north-east India as population . pressures and desires for economic development increase.

Ramakrishnan (1992, p.386) reports:

> "In north-eastern India, large-scale disturbance of the rain forest ecosystem has resulted in varied levels of degraded arrested bamboo forests, with weed take-over or a totally bald landscape. During the last few decades, large-scale timber extraction for industrial purposes has cleared vast areas of land for invasion by exotic weeds..... Thus exotic weeds such as *Eupatorium* spp., and *Mikania micrantha* have taken over vast tracts of cleared land along with native weeds such as *Imperata cylindrica* and *Thysanolaena maxima*. Once this large-scale invasion has occurred, the jhum farmer is even more limited by the land area available for his jhum system of agriculture, as he prefers to avoid sites of high

> weed density. Because of this and increased population pressure, jhum cycle has dropped drastically in length from a more favourable 20 years or more, to an extremely short 5 years or even less. Having no other option, in the absence of an alternate agricultural technology that is viable from an ecological and social angle, the jhum farmer perforce had to resort to very short jhum cycles although the system operates below subsistence level and has caused further environmental degradation. Large-scale timber extraction and very short jhum cycles of 4-5 years have resulted in an arrested succession of weeds in north-eastern India."

In some cases, deforestation has led to desertification in north-east India. Ramakrishnan (1992, pp.386-387) suggests that desertification in Cherrapunji in Meghalaya has been rapid and sudden mainly due to past deforestation. Reforestation has been arrested. Furthermore, in other areas, reforestation has been attenuated e.g. by the growth of bamboo. Forested areas are trapped in a bamboo successional stage with "obvious adverse consequences for biological diversity in the region". Ramakrishnan, (1992, p.387) suggests that mixed plantation forests may be needed to re-establish forest succession and help in increasing biological diversity. There are clearly many other issues also that need to be investigated as far as the sustainability of forests in north-east India is concerned. Forests are especially important in north-east India because they play a substantial role in providing economic support for many tribal groups and are an important source of fuel. They also play a major role in maintaining biodiversity and in providing environmental services such as improving waterflows and reducing soil erosion

Sustainability of Communities in the North-East

It is often argued that sustainable development is not just a matter of achieving economic sustainability and that sustainability must be considered in relation to at least three dimensions. These dimensions are:

1. the biophysical,
2. the economic, and
3. the social.

For this reason, it is usually recommended that strategies for sustainable development be studied on a holistic basis employing an interdisciplinary approach. Sustainable development

strategies should ideally satisfy sustainability conditions for all of the above *three* dimensions.

Views differ about what constitutes social sustainability but it involves the maintenance of a sense of community and of cohesion in society. It also requires the continuing ability of the society to avoid disintegration and to respond effectively to changes which call for a communal response. Irrespective of the exact definition adopted, it is clear that the social dimension cannot be ignored in planning and implementing development strategies.

Ramikrishnan (1992, Ch.3) has described social patterns in north-east India as being ones involving economic mutualism between different tribal and ethnic groups, using somewhat different techniques of obtaining a livelihood and utilising different sets of resources so that competition between them is reduced and they are able to more easily retain their separate identities and communities. While some exchange occurs between groups, subsistence activities play a dominant role in the North-east. Ramakrishnan (1992, p.88) points out that although it is difficult to generalise about village organisation and formation in this region, "diverse communities often coexisting in the same area have evolved ways in which that are do so, sharing resources in a highly complementary manner".

However, the equilibrium of communities can easily be shattered by resource-depletion and increasing resource scarcity which can render some ways of life and some communities unsustainable. For example, with diminishing forest resources in the North-east, those communities heavily specialised in using these resources could find their communities endangered. Gathering from forests still plays a significant role in the subsistence of some tribal groups. One group, the Sulungs of Arunachal Pradesh, obtains almost half of its food requirements from hunting and gathering (Ramakrishnan, 1992, p.117). Hill tribes such as the Garos and the Khasis in Meghalaya and the Nithis, the Karbis, the Kacharis and the Chackmas all show significant dependence on forest resources for food and fuel, a dependence that rises during poor seasons. These societies are liable to be disrupted by loss of forest resources.

6. Comparison with Nearby Regions

Problems of sustainable development being experienced in north-east India are by no means unique. They appear to be widespread throughout the remoter areas of south-east Asia and

will become more apparent as economic growth in this region proceeds.

Similar conditions exist for example in Burma (Mynamar), although the economic growth there has been slow, in parts of Thailand, Laos, southern Yunnan (China), Indonesia, Malaysia (for instance in Sarawak) and in parts of the Philippines. Geographical conditions are similar and in all these cases and a variety of tribal groups are present. This means that any workable strategies for sustainable development discovered for north-east India are likely to have application in nearby regions.

To some extent there appears to be a shared historical background with nearby regions. For instance tribal groups in several nearby regions also have sacred forest groves or holy hills which are conserved in their natural state. These for example occur amongst the Dai people Xishuangbanna Prefecture, Yunnan and in some parts of Sumatra. Slash-and-burn cultivation is practiced by a number of the hill tribes in Xishuangbanna and appears to be quite common in Burma (Myanmar), in Indo-China and other parts of south-east Asia. Most of these areas are subject to population pressures and increasing demands are being made (or are likely to be soon made) upon their natural resources to foster economic growth. All of these regions face a common problem: how to permit or even encourage economic development and conserve their unique natural and cultural environments.

7. Concluding Comments

Globally concern has been growing about the possibility of not achieving sustainable development. Some argue that this concern represents a new form of imperialism fostered by high-income countries. Consider here the view of the Prime Minister of Malaysia. On the other hand, many in less developed countries believe sustainable development is important from their own viewpoint. Although Pandit Nehru is not likely to be regarded by many as a passionate environmentalist and conserver of nature, he was instrumental in fostering concerns to achieve sustainable development amongst the international community.

Although the environmental agenda of high-income countries does not always coincide with the wishes of lower-income countries and that of the centre does not always accord with that of the graphical periphery, it would be dangerous and short-sighted of any region to ignore the environmental consequences of its own socio-economic change. To do so can be a sure recipe for long-term economic and social disaster.

However, an interest in sustainable development does not imply that socio-economic systems have to remain in a frozen or static state. Ironically, it is often the case that attempts to do this will reduce sustainability. It is probably true to say that the use of a number of agricultural techniques and forestry practices in north-east India are becoming less sustainable today. There is a need to search, therefore, for more sustainable alternatives. It may even be that some communities will no longer be able to survive in their traditional forms because available natural resources will no longer sustainably support these societies. Acceptable ways need to be found to enable such communities to adjust to changed environmental circumstances, many of which are not subject to control or easily controlled, e.g. those arising from population growth. This is not to say that nothing can be controlled but to emphasise the need for realism in planning for sustainable development.

8. References

Cunliffe, B. (1994), *The Oxford Illustrated Prehistory of Europe*, Oxford University Press, Oxford.

Goudie, A. (1990), *The Human Impact on the Natural Environment*, 3rd edition, The MIT Press, Cambridge, Mass.

IUCN, (1980), *World Conservation Strategy*, IUCN, Glands, Switzerland.

Leopold, A. (1966), *A Sand Country Almanac: with Other Essays on Conservation from Round River*, Oxford University Press, New York.

Meadows, D. L., Randers, J. and Beherens, W. (1972), *The Limits of Growth: A Report for the Club of Rome's Projection on the Predicament of Mankind*, Oxford University Press, New York

Pearce, D., Markandya, A. and Barbier, E. B. (1989), *Blueprint for a Green Economy*, Earthscan Publications, London.

Pearce, D. (1993), *Blueprint 3: Measuring Sustainable Development*, Earthscan, London.

Ramakrishnan, P. S. (1992), *Shifting Agriculture and Sustainable Development: An Interdisciplinary Study for North-Eastern India*, UNESCO, Paris and Parthenon, Carnforth, U.K.

Rawls, J. R. (1971), *A Theory of Justice*, Harvard University Press, Cambridge, Mass.

State Council of the People's Republic of China (1994), *China's Agenda 21 - White Paper on China's Population, Environment and Development*, China Environmental Press, Beijing.

The Ministry of Finance, Economics Division (1994), *Economic Survey 1993-94*, Govt. of India Press, New Delhi.

Tisdell, C. A. (1993), *Environmental Economics*, Edward Elgar, Aldershot, U.K.

Tisdell, C. A. (1991), *Economics of Environmental Conservation*, Elsevier Science Publishers, Amsterdam.

Tisdell, C. A. (1990), *Natural Resources, Growth and Development*, Praeger, New York.

World Bank (1994), *World Development Report 1994*, Oxford University Press, New York.

World Commission on Environment and Development (1987), *Our Common Future*, Oxford University. Press, Oxford.

World Resources Institute, United Nations Environment Programme and United Nations Environment Programme and United Nations Development Programme (1994), *World Resources 1994-95*, Oxford University Press, New York.

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