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ECO-CULTURAL DIVERSITY EMBEDDED IN THE CULTURAL LANDSCAPE : AN APPROACH TO BIOSPHERE RESERVE MANAGEMENT

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Introduction

Human beings interact with the ecosystem through concrete practices, these practices being determined by changing cultural perceptions, both in space and time. There is wide recognition throughout the globe and across disciplines, that regions of ecological prudence exhibit a symbiotic relationship between habitats and cultures.[26] This explicates that culture and environment have held a symbolic relationship throughout human evolution, until the beginning of industrialization. The concept of the 'sacred' in a cultural sense, an intangible entity, has entered into the ecological paradigm, not only because human societies have traditionally looked at nature with awe and reverence, but also because of their strong dependence on nature to obtain their livelihood needs.[21,28]

The concept of culturally valued - sacred species, sacred groves (ecosystems) and sacred landscapes (landscapes) come under this category. With an exploitative viewpoint rapidly replacing the traditional value systems which determined ecosystem integrity, and the linked traditional management practices, understanding the drivers of this change is an interesting area of study from a historical ecology perspective.[7,32,19,10] Understanding the ecological history, therefore, becomes a strong basis for rediscovering the lost value system and for sustainable management of natural resources.

In the contemporary context of 'global change'[37] in an ecological sense, and 'globalization' in an economic context,[2,3] that are rapidly overtaking traditional approaches to ecological inquiries, there is an urgent need for interaction between the ecological, social and cultural dimensions of ecology and culture. Coping with biophysical uncertainties in the 'global change' context is becoming more and more a serious concern. Threatened social security, linked with access to food for marginalized sections of the society, and disruptions in human cultural diversity arising from imbalances in gender participation, socioeconomic divergence and polarisation (as suggested through a comparative case study on the impact of globalization between China and Sweden),[15] are social uncertainties that need to be addressed. Therefore, there is an urgent need to look into the wider context of how societal perceptions differ and how the same environmental issue, oftentimes, is

perceived differently by different cultural groups, which may form the basis for coping with uncertainties arising from 'global change' and 'globalization'.[24,26]

Eco-Cultural Diversity

Eco-cultural interactions: Humans are relative newcomers to a complex environment in which evolution driven by natural forces has shaped a complex set of constraints; understanding this set of complex interactions, and the responses by indigenous forest people, may help in understanding possible sustainable uses of forest resources.[1] The concept of domestication of the landscape, referred to as 'domiculture',[11] is an attempt by aborigines in Australia and many other indigenous societies elsewhere in Papua New Guinea,[6] in concentrating biodiversity of economic value to society as part of forest management, a necessary first step taken towards better organized agriculture of domesticated plant/animal populations. Such an attempt to domesticate the landscape around traditional societies is different from the intensified agriculture where the emphasis would be on modification of individual crop species and organization of crop species in agricultural plots. Whilst 'domiculture' may lead to more organized agricultural development,[14] this may not always happen.[38]

The move towards domestication of crop species and their cultivation as part of an organized system arising from 'domiculture' is not difficult to see. Trail-side plantings by the nomadic northern Kayopo Indians in Amazonia, as part of their nomadic agricultural practices, where food sources were made available as 'hidden resource islands' during war raids or during visits of long treks to distant villages is an attempt to provide small 'forest islands' filled with economic species needed for survival.[20] Domiculture is a well integrated land use practice, except for the aggregation of economically important species from the wild, found in the surrounding landscape itself.

The transition to casually managed shifting agriculture (Fig.1), where economically selected crop species and crop cultivars (as part of a multi-species complex agroecosystem) being concentrated in agricultural plots (as part of the overall landscape organization) is not difficult to visualize. The shifting agricultural system which is essentially based on 'farming the forest',[21] is the next important step in the socio-ecological evolution of 'domiculture'. Furthermore, cultural diversification could lead to more intensely managed multi-species complex agroecosystems (a variety of agroforesty systems, home gardens, compound farms, etc.), whilst still maintaining the overall integrity of the landscape unit.[33] All these traditional food production systems are less energy intensive, largely dependant upon resource recycling from within the surrounding landscape. In a sense, therefore, these complex agro-ecosystems are based on the background information that the surrounding landscape has to offer, although they are based on small but significant changes in the biotic composition or agricultural practice in response to local necessities or modified goals.

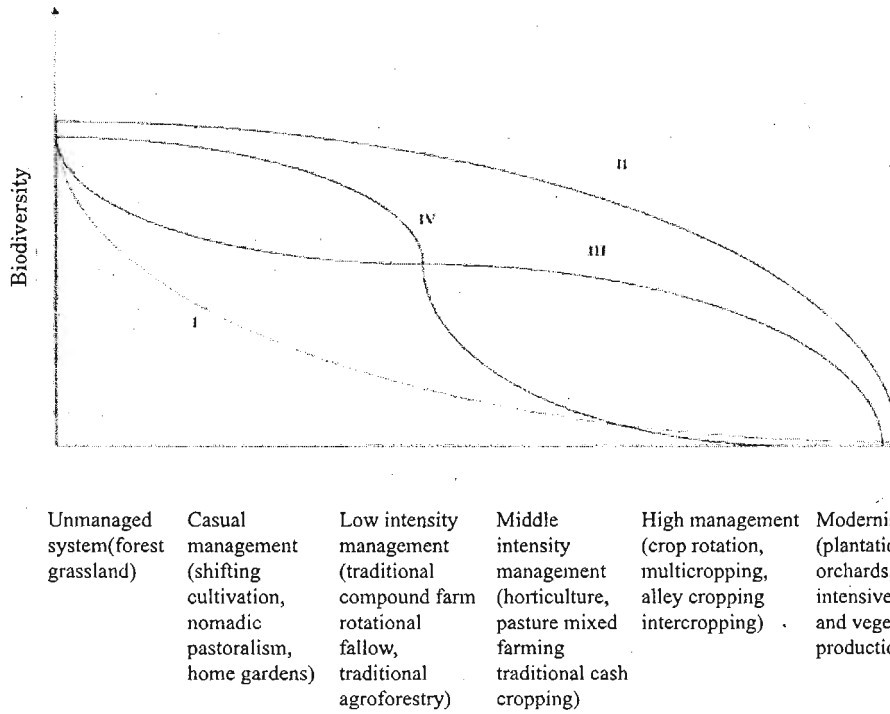

Figure 1: Biodiversity changes (four patterns) as related to agroecosystem types and intensity of management.

Curve I and Curve II represent two extreme possibilities that seem to be unlikely. Curve III is a softer version of the ecologists' expectations, whilst Curve IV seems to be more likely and is the most interesting from the point of view of biodiversity conservation. Efforts for sustainable development of these traditional agro-ecosystems should be based on conserving agricultural biodiversity within the system for resilience of the system with concerns for productivity.[33]

These modifications brought about in traditional agroecosystems imply that there is adaptive evolution in many of these agroecosystems. In this process, the interactions between proximal drivers of land use/cover change such as land degradation linked biodiversity loss and soil fertility decline, and more distant drivers such as governmental policies determining deforestation and market forces, play an important role.[26] All these agroecosystems that could potentially be of cultural concern to us, stand apart from high energy input modern agriculture, where a monoculture of a crop species or indeed of a given cultivar stands out as part of a highly homogenized landscape, almost irrespective of background ecological conditions.

The end-point in this scale of intensification of agriculture is high energy input modern agriculture where a monoculture of a crop species or indeed a given

cultivar stands out as part of a highly homogenized landscape of present-day industrial societies. Rather than building agroecosystem models based on the background information that the landscape could provide, these highly management intensive systems are based on a more regulated and planned approach to agriculture development, bringing in only those biological and chemical elements that the planner desires, almost irrespective of background ecological conditions.[33] This modern version is a product of intense industrialization of agriculture during the post-World War II period, extensively distributed in many parts of the world, and represents the ultimate reduction in biodiversity - the genetically uniform, continuous cultivation of a mono-crop, relying on mechanized tillage.

Recognizing that landscape level heterogeneity ensured until recent times in human societies, and is still prevalent in more remote areas of the world where traditional societies live, is crucial for sustainable management of natural resources. The issue that is of present concern is the options that are available to reverse the process of landscape homogenization that has lead to unsustainable land use practices.

Historical processes: These traditional societies are no longer immune to changes occurring all around, all the time. The predominant culture of over-consumption of natural resources is making a dent in these societies, resulting in erosion of their time-tested and value-based institutions. At present, when social fragmentation reaches the family level and individual interests get priority, community functions have taken a back seat. The decline in the eco-cultural units represented by 'sacred groves' in many parts of India could partly be attributed to this.[28] Out-migration of the youth for education and in search of better employment opportunities, has been suggested to be a threat for conservation of the culturally valued ancient 'rice terraces' and the linked spiritual values, beliefs and customs symbolizing economic deprivation of the 'Ifugao culture';[34] these terraces conserved by the local people of the Philippine Cordileras, is now inscribed in the World Heritage list of UNESCO, as a unique traditional agroecosystem. Closely linked to this, under different socio-ecological situations, community functions enforced through traditional common property regimes have broken down and have been replaced by private property systems imposed by governmental agencies, as in the Himalayan cultural landscape region of the Indian sub-continent,[12] or among the trans-human pastoralists of the Sahel region in Africa.

In the northeastern region, the traditional 'sacred grove' systems were once very common, sometimes with each village having one protected patch of the ecosystem, conserved for traditional anemistic religious reasons.[13] With the advent of Christianity into the region, these traditional value systems have either disappeared or have been considerably weakened. In a recent analysis of the sacred groves of the Karnataka part of the Western Ghat mountain region of southern India, two important factors seem to emerge for degradation of the sacred groves in

the region.[25] These are related to large-scale migration of people from the lowlands to work in coffee plantations, and inter-institutional conflicts, arising from a large number of institutions created by various governmental agencies.

There is now the danger of further erosion of this cultural diversity, in this era of information technology, and the on-going process of 'globalization' of economies.[24,26] Recognizing that landscape level heterogeneity ensured until recent times in human societies, and is still prevalent in more remote areas of the world where traditional societies live, is crucial for sustainable management of natural resources. The issue that is of present concern relates to options that are available to reverse the process of landscape homogenization that has lead to unsustainable land use practices, and how one could create institutional mechanisms in order to be able to conserve and manage the ecologically linked cultural heritage.

Knowledge Systems Linked to Ecosystem Attributes

Formal knowledge in ecology has largely been a prerogative of natural scientists who analyze natural phenomena through the hypothetico-deductive method, whereas social scientists, by contrast, deal with a subjective world, with obvious differences in the way they create knowledge. If we go by this argument, then, 'formal knowledge' could be viewed as that obtained through a hypothetico-deductive process, whilst the 'traditional' knowledge, though it has a strong element of the formal, is largely derived through societal experiences and perceptions accumulated by different traditional societies during their interaction with nature and natural resources; therefore, it is based on trial and error. This implies that whilst 'formal' emphasizes upon a certain degree of universality of the knowledge, created by the given methodology, 'traditional' knowledge' has a certain degree of location-specificity, with a strong human element attached to the same, with emphasis on social emancipation.[4] However, we need to move beyond this perceptional divergence and arrive at generalizations across locations, in order to integrate the two knowledge systems, and arrive at methodologies that establish connectivity between natural sciences and social sciences. What needs to be done immediately is to evaluate traditional knowledge to arrive at scientifically valid generalizations through a hypothetico-deductive process, which is important for integration into the 'formal' knowledge system.

Then there is the psychological dimension to knowledge. In the ecological context, anthropologists would perceive culture as determining human responses to the ecosystem, within socially defined situations, both in space and time. This adds a third dimension to traditional knowledge, a knowledge dimension that is the psychological, which is the basis for differential cultural perceptions to the environment, and the value system derived therefrom. Understanding this knowledge, in essence, is the cultural/spiritual dimension to the knowledge system,

and provides the protective impulse for many human societies for conserving natural resources and managing ecosystems in a given manner.[28]

Much of the information in the area of 'formal' knowledge arises from looking at the biophysical dimensions of ecosystems. Structural attributes of ecosystems, and functional aspects such as energy flow and biogeochemical cycling form the basis for the 'formal' knowledge base in ecology. The recognition of perturbation as an integral component of ecosystem functioning,[8] with implications for natural resource management. Inspite of all these developments in our understanding of ecosystem dynamics, there is an increasing realization today than ever before, that there is a worldwide crisis in resource management; it has been maintained by many ecologists that sustainability is neither a realistic goal nor a useful concept for ecosystem and natural resource management, and the concept of sustainable development has been called an oxymoron.[16,17] This perspective of 'sustainability science' arises largely from a 'reductionistic' approach to ecology and a viewpoint based on exploitation of a given resource, at the expense of others within a given ecosystem. Holling *et.al.*[9] argue that as continually evolving systems, ecosystems require policies and actions that not only satisfy social objectives but at the same time, also achieve a continually modified understanding of the evolving conditions and provide flexibility for adaptation to surprises. Combining this reductionistic perspective of knowledge with a more traditional 'generalized' perspective towards natural resource management is likely to yield better results, though the proportionality of these two elements may differ depending on the socio-ecological systems that one is dealing with.[26] For this, societal perceptions, which are often location- and issue-specific need to be integrated into an adaptive management strategy, for ensuring community participation in sustainable management of natural resources.[29]

The Biosphere Reserve Concept and Eco-cultural Diversity

When the Man and the Biosphere (MAB) programme was launched in 1971 by UNESCO, a natural consequence of it was to have BRs, as representative samples of biodiversity conservation, with a variety of natural and human-managed ecosystems as part of a larger ecological landscape unit. An 'Action Plan for Biosphere Reserves' which was formally endorsed by UNESCO[35] was initially somewhat of a loose concept. The BRs were suggested to have the following objectives: (a) a conservation role (conservation of biodiversity at all levels from sub-specific to landscape; (b) a research and monitoring role as part of a larger international network; (c) a development role for meeting with improved quality of life for the local communities living in and around the BRs. This, therefore, necessitated some degree of zoning, with a *core zone*, as distinct from a *buffer zone*, clearly delimited for management of the reserves. The buffer zone and a transition zone extending to the periphery, coupled with human interaction will be considered conservation linked with sustainable development. Though, ideally the core zone is left free of human

influences, in reality in the Asian region where population pressure often tends to be very intense, even the core zone may not be free from human interactions, though they take place at a reduced level.

Meanwhile, the concept of '*sustainable development*' was first articulated by the World Commission on Environment and Development, 1987, through the now well known Brundtland Report, entitled "*Our Common Future*", which has brought about a sharp shift in our thinking on the concept of economic development. Until recent times, industrial human societies had assumed that natural resources are inexhaustible and are available to be exploited for human welfare. Sustainable development is now seen as that process of development aimed at meeting 'the needs of the present generation without compromising the ability of future generations to meet their own needs'.

Arising out of these developments, what has now come to be known as the '*Seville Strategy*'[36] identified clear-cut criteria for BRs and their management, on the basis of experience. The BR concept became, in a sense, one of the significant testing grounds for linking conservation with *sustainable livelihood* needs of local communities in the short-term time frame, and *sustainable development* of the region as part of a long-term strategy. Meanwhile, there was a distinct shift in the ecological paradigm from a situation where ecosystem research kept out the humans and emphasized only the biophysical aspects, to a new situation where humans were looked upon as an integral component of a socio-ecological system.[21,23,26] Though the experiences in this direction, of linking natural science with social science research for sustainable management of natural resources, still remains somewhat patchy, we are better equipped today to integrate ecology in a biophysical sense with human ecology.

In the context of developing countries, the human population living within the BRs has always been a matter of debate; this is particularly so in the given context of the South and Central Asian countries. Perhaps these considerations were what prompted UNESCO[36] to move away from the initial perception of three concentric rings of core, buffer and transition zones, to a more flexible way of looking at them, depending upon the local needs and situations. This flexibility and creativity in the BR concept has simultaneously brought in even 'National Parks', 'World Heritage Sites', and other nature reserves, as an integral part of BRs.

As elsewhere in the developing world, humans living in forested areas have always been an integral part of the functioning of an ecosystem, living close to nature and the natural resources. Living within natural resource rich areas, traditional societies derived many of their livelihood requirements from the rich biodiversity around them. The South and Central Asian region is no exception. Ecosystems such as forests not only meet a variety of livelihood needs of forest-dwelling traditional societies, through products such as timber and non-timber forest products (NTFPs),

but also sustain traditional agricultural practices through resource flow between the two, thus contributing to the food security of the people within the BRs. All these forest-linked activities of traditional societies are mediated through a rich traditional ecological knowledge (TEK).

Apart from direct economic value such as that for medicine, food or other NTFP-linked uses, TEK has economical, ecological and socio-cultural dimensions, which often operate at the process level.[26,29] Since we are dealing with traditional societies which are at varied stages in their social evolution, building upon TEK with inputs from the modern scientific side, to the extent desired, becomes critical for ensuring community participation in managing BRs with concern for their sustainable livelihood needs.

Eco-Cultural Landscapes

The World Heritage Convention, 1972, is a unique international instrument for conserving cultural and natural heritage of outstanding universal value. This provided an opportunity for protecting natural sites and archaeological sites of outstanding universal value, from a historical, ethnobiological or aesthetic perspective. With the World Heritage Convention recognizing three categories of cultural landscapes, namely, (i) 'clearly defined landscapes designed and created intentionally by humans', such as gardens and parklands; (ii) 'organically evolved landscapes' that may still be organically evolving or relicts; and (iii) 'associative landscapes', by virtue of religious, artistic or cultural associations that are intangible,[31] the cross-cutting dimensions of ecology, economics and ethics,[22] spread across a variety of disciplinary realms, is becoming more and more relevant for natural resource management. The concept of the 'sacred' with socio-cultural values attached, and which operate at varied scalar dimensions, right from the species to landscape levels, and often contributing to the functioning of the cultural landscape as an integrated whole, is an intangible element. However, this psychological element is available for managing ecosystems. Further, in the contemporary context, these cultural entities provide not only intangible benefits that enable humans to arrive at a harmonious relationship with nature, which includes leisure, but also provide tangible benefits through biodiversity that is conserved and managed through human actions.

Conclusion

Much of the possible BR sites are often part of the mountain systems heritage of the world, since mountain systems are remotely placed, being often cut-off to a larger or lesser extent, from external pressures, with cultural landscapes (Box 1) having survived to this day in the developing tropical world.[18] The concept of '*cultural landscapes*' ('*sacred landscapes*'), often with food production systems embedded within, are spread across the mountains all over the world. They are an outcome of

the recognition by traditional societies, that human-nature interconnections are important for maintaining the landscape in a diverse and productive state, the tool used being locally evolved TEK. The guiding principles that regulate the use of natural resources, are embedded in the codified and often non-codified institutions that have evolved.[28] These sacred institutions were originally intended to boost social solidarity rather than promote environmental consciousness *per se*, but the conservation values, *ipso-facto*, also get fulfilled. We need many lessons to learn the way sacred landscapes are sustained through traditional institutions in the developing tropics. The problem of coping with uncertainties in the context of 'global change' is an issue that demands prudent management of natural and human-managed biodiversity in the mountains, for a sustainable future.

Mountain regions in the developed temperate world remain to a large extent heterogeneous in a biophysical sense, due to uneven topographical features; but the societies have been, largely if not completely, homogenized under the influence of industrialization and urbanization, unlike in the developing tropics where the socio-cultural heterogeneity is still being held on to. However, we in the developing tropics are struggling to sustain socio-cultural heterogeneity whilst aiming to provide a better quality of life for the mountain people.[27] In contrast, in the developed world, the local communities are struggling to rediscover their 'cultural landscape', with a desire to redevelop the 'organically connected agriculture', and retrieve their lost linkages with nature and natural resources. The overall objective remains the same, but the beginning for a common goal is being attempted from two opposite points, for obvious historical reasons.

The 'Biosphere Reserve' and 'Natural World Heritage site' concepts of UNESCO are indeed a rediscovery of the 'sacred landscape' belief system of traditional societies, and is an attempt towards an integrated management strategy to conserve natural resources for sustainable use, with inter-generational equity concerns. Natural and human-managed systems are often embedded within all these human endeavours. Therefore, such bio-cultural sites should be governed by landscape management principles. Landscape management should be based upon a management plan that demands flexibility, be capable of small-scale operations, information-sensitive, and composed of elements that are integrated and yet independent.[5] Such a strategy will ensure the desired level of location-specificity, with community participation ensured through appropriate institutional arrangements based on traditional values. In this situation and in all other similar landscape situations, maintenance of the overall sustainability of the systems demand a loosely coupled management, specifically designed to accommodate large variability in ecosystem complexity within a landscape mosaic, which includes natural and human-managed systems, for their long-term sustainability as part of an eco-cultural system.

Box 1: Examples of sacred mountain landscapes around the world (Source: Messerli and Ives, 1997; Ramakrishnan, 2000; Rodrmguez Navarro, 2000)

- Worshipped by the Hindus and Buddhists of the Asian region and tucked away in the folds of the Himalaya, the symmetrical Mount Kailas rises above the Tibetan plateau, and is the legendary Mount Meru or Sumeru, the 'Mandala' of the Buddhists (the cosmic axis around which the axis of the Universe is organized for both Buddhists and Hindus). This mythological interconnectedness belief system has even penetrated into the belief system of the distant Balinese of the Indonesian island complex. As the origin of all the major sacred rivers of Hindu mythology and these river systems being the basis for the human civilization in this part of the world, indeed plays a pivotal role in this part of the world; conservation of natural resources linked to the Himalayan mountain region could be linked to these belief and value systems of the people.

- Padmasambhava, who is worshipped by the Sikkimese Buddhists, is considered to have blessed Yoksum and the surrounding sacred land and water bodies in West Sikkim District in eastern Himalaya, and to have placed a large number of hidden treasures ('ter'). It is believed that these treasures are being discovered slowly and will be revealed only to enlightened Lamas, at appropriate times. Conserving these treasures and protecting them from polluting influences are considered important for human welfare. The area below Mount Khangchendzonga in West Sikkim, referred to as 'Demojong', is the core of the sacred land of Sikkim. The protective deities are made offerings to, but no meaningful performance of Buddhist rituals is possible if this land and water are desecrated. Village level activities on the land and water resources are permitted. Any large-scale human-induced perturbation in the land of the holy Yoksum region would destroy the hidden treasures (ters), in such a manner that the chances of recovering them sometime in the future by a visionary will diminish (the last such discovery was suggested to have occurred 540 years ago). Any major perturbation to the river system would disturb the ruling deities of the 109 hidden lakes of the river, thus leading to serious calamities. Indeed, the very cultural fabric of the Sikkimese society is obviously dependant upon the conservation of the whole sacred landscape. The uniqueness of this heritage site lies in the holism and interconnections between the soil, water, biota, visible water bodies, river and the lake systems on the river bed, all taken together with the physical monuments such as the monasteries.

- The Buddhist Dai (T'ai) tribe of Xishuangbanna in Yunnan Province in southwest China has many holy hills, 'Nong Ban' and 'Nong Meng', belonging to a village or a cluster of villages, spread over a large area, forming hundreds

of small or large forested reserves, with human-managed ecosystems and village systems interspersed throughout the region. This is another good example of a cultural landscape.

- For the Maoris of New Zealand, the mountains are sacred. Maori mythology holds that all life forms came from the sky and the earth and that humans are linked to the mountains. The sacred mountains of Tongariro, Ruapehu and Ngauruhoe were donated to the Government by the indigenous community way back in 1887, to be protected as a National Park.

- According to the local belief of the Kikuyu tribe, Ngai, the creator of all things, dwells on Kirinyaga, a high point in Mount Kenya. It is believed that humans were created at the summit of the mountain. East Africans traditionally bury their dead facing the sacred peaks like Kilimanjaro and Mount Kenya.

- Though the sacredness of Mount Olympus in Greece is no longer derived from the myths and divinities associated with it in the past, it stands out as a symbol of the cultural heritage of the Greeks. On the face of repeated threats from modern influences to this landscape, it stands as a transnational cultural symbol for the Europeans.

- For many traditional societies, mountains by themselves represent supernatural beings. Mount Fuji as the 'God Mysterious' in Japan, Kilauea representing the physical body of the Goddess Pele in Hawaii, Bear Bute-High ridge used by American Indians of South Dakota, U.S.A. used for vision quests, could be viewed in this category.

- The sacred forests in the Sierra Nevada de Santa Marta in northern Columbia is a sacred landscape for the indigenous Kogi, Arhuaco and Wiwa cultures. These are rich in biodiversity and they believe that there exists an equilibrium which might easily be disturbed by irresponsible human induced impacts on the natural resources; through an elaborate code of conduct considered to be in harmony with biological cycles, astral movements, climatic phenomena and the sacred geography of the land, they have traditionally conserved their natural resources.

References

1 Balee W. (1989). The culture of Amazonian forests. *Adv.* In: *Economic Botany*, **7**: 1-21.

2 Daly H. & Cobb J. (1989). *For the Common Good*. Beacon, Boston, U.S.A.

3 A.K. Dragun & C. Tisdell (Eds.) (1999). *Sustainable Agriculture and Environment: Globalization and the Impact of Liberalisation.* 308 pp. Edward Elgar, Cheltenham, U.K.

4 Elzinga A. (1996). Some reflections on post-normal science. In: *Culture, Perceptions and Environmental Problems: Interscientific Communication on Environmental Issues.* M. Rolen (Ed). pp. 32-46. Swedish Council for Planning and Coordination of Research. Stockholm, Sweden.

5 Ehrenfeld D. (1991). The management of biodiversity: A conservation paradox. In: *Ecology, Economics, Ethics: The Broken Circle.* F.H Bormann and S.R. Kellert (Eds.) pp. 26-39. Yale Univ. Press, New Haven.

6 Groube L. (1989). The taming of natural forests: A model for late Pleistocene forest exploitation in New Guinea. In: *Foraging and Farming - The Evolution of Plant Exploitation.* D.R. Harris and G.C. Hillman (Eds.) pp. 292-304. Unwyn Hyman, London.

7 Heer (1975). *Charlemagne and His World.* Macmillan, New York.

8 Holling C.S. (1995). Sustainability: The cross-scale dimension. In: *Defining and Measuring Sustainability: The Biophysical Foundations.* M. Munasinghe and W. Shearer (Eds.). pp. 65-75. U.N. Univ., Tokyo and The World Bank, Washington D.C.

9 Holling C.S., Berkes F. & Folke C. Science, sustainability and resource management. In: *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.* F. Berkes and C. Folke (Eds.) pp. 342-362. Cambridge Univ. Press, Cambridge, U.K.

10 Hughes J.D. (1998). Sacred groves of the ancient Mediterranean area: Early conservation of biological diversity. In: *Conserving the Sacred: For Biodiversity Management.* P.S. Ramakrishnan, K.G. Saxena and U.M. Chandrashekara (Eds.) pp.101-121. UNESCO and Oxford & IBH, New Delhi.

11 Hynes R.A. & Chase A.K. (1982). Plants, sites and domiculture: Aboriginal influence upon plant communities in Cape York peninsula. *Archaeology in Oceania,* **17**: 38-50.

12 Jodha N. S. (1998). Reviving the social system-ecosystem links in the Himalayas. In: *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.* F. Berkes and C. Folke (Eds.) pp. 285-310. Cambridge Univ. Press, Cambridge, U.K.

13 Kiewtam R.S. & Ramakrishnan P.S. (1989). Socio-cultural studies of the sacred groves at Cherrapunji and adjoining areas in northeastern India. *Man in India.* **69**: 64-71.

14 Lathrap D.W. (1977). Our father the Cayman, our mother the Gourd: Spinden revisited. Or a unitary model for the emergence of agriculture in the New World. In: *Origins of Agriculture*. C. A. Reed (Ed.) pp. 713-752. Mouton, The Hague.

15 C. Lindqvist & L. Wallenius (Eds.). (1999). *Globalization and its Impact.* 325 pp. Forskningsradsnamnden, Stochholm, Sweden.

16 Ludwig D. (1993). Environmental sustainability: Magic, science and religion in natural resource management. *Ecological Applications*, **3**: 555-558.

17 Ludwig D., Hilburn R. & Walters C.(1993). Uncertainty, resource exploitation and conservations: Lessons from history. *Science*, **260**: 17, 36.

18 Messerli B. & Ives J.D. (1997). *Mountains of the World*. Parthenon Publ., Carnforth, Lancs., U.K. 495 pp.

19 Ovsiyannikov O.V. & Terebikhin N.M. (1994). Sacred groves in the culture of the Arctic regions. In: *Sacred Sites, Sacred Places*. D.L. Carmichael, J.H.B. Reeves and A. Schanche (Ed.s) pp. 44-81. Routledge, London.

20 Posey D.A. (1985). Indigenous management of tropical forest ecosystems: The case of the Kayapo Indians of the Brazilian Amazon. *Agroforestry Systems*, **3**: 139-158.

21 Ramakrishnan P.S. (1992). *Shifting Agriculture and Sustainable Development: An Interdisciplinary Study from Northeastern India.* UNESCO-MAB Series, Paris, Parthenon Publ., Carnforth, Lancs. U.K. 424 pp. (republished by Oxford University Press, New Delhi 1993).

22 Ramakrishnan P.S. (1998). Ecology, economics and ethics: Some key issues relevant to natural resource management in developing countries. *International Journal of Social Economics*, **25**: 207-225.

23 Ramakrishnan P.S. (1999a). Ecology in developing countries: The emerging paradigms. *Proc. Indian National Sci. Acad.*, **65B**: 51-82.

24 Ramakrishnan P.S. (1999b). The impact of globalisation on agricultural systems of traditional societies. In: *Sustainable Agriculture and Environment:*

Globalization and the Impact of Trade Liberalisation. A.K. Dragun and C.Tisdell (Eds.) pp. 185-200. Edward Elgar, Cheltenham, U.K.

25 Ramakrishnan P.S. (2000). Sacred mountain forests and biodiversity. In: *Forests in Sustainable Mountain Development: A State of Knowledge Report for 2000.* M.F. Price and N. Butt (Eds.).pp.117-126. CABI Publ., Wallingford, U.K.

26 Ramakrishnan P.S. (2001a). *Ecology and Sustainable Development.* 198 pp. National Book Trust, India, New Delhi.

27 Ramakrishnan P.S. (2001b). Sacred/cultural landscapes in the Indian Himalaya. In: *Proceedings, UNESCO Thematic Expert Meeting on Asia-Pacific Sacred Mountains.* pp. 129-146. World Heritage Centre UNESCO, Agency for Cultural Affairs of Japan & Wakayama Prefectural Govt., Japan.

28 P.S. Ramakrishnan, K.G. Saxena & U.M. Chandrashekara (Eds.). (1998). *Conserving the Sacred: For Biodiversity Management.* 480 pp. UNESCO and Oxford & IBH Publ., New Delhi.

29 P.S. Ramakrishnan, R.K. Rai, R.P.S. Katwal & M. Mehndiratta (Eds.). (2002). *Traditional Ecological Knowledge for Managing Biosphere Reserves in South and Central Asia.* UNESCO and Oxford & IBH Publ., New Delhi.. 536 pp.

30 Rodrmguez Navarro G.E. (2000). Case study: Sacred forests in Sierra Nevada de Santa Marta, Columbia. In: *Forests in Sustainable Mountain Development: A State of Knowledge Report for 2000.* M.F. Price and N. Butt (Eds.) pp. 128-130. CABI Publ., Wallingford, U.K.

31 Rossler M. (2001). Sacred landscapes: New perspectives in the implementation of the cultural landscape concept in the framework of the UNESCO world heritage convention. In: UNESCO *Thematic Expert Meeting on Asia Pacific Sacred Mountains, Final Report.* pp. 27-41.World Heritage Centre, UNESCO, Paris, Agency for Cultural Affairs of Japan & Wakayama Prefectural Govt., Japan.

32 Sanders N.K. (1960). *The Epic of Gilgamesh.* Penguin Books, Harmondsworth. (Translated).

33 Swift M.J., Vandermeer J., Ramakrishnan P.S., Anderson J.M., Ong C.K. & Hawkins B. (1996). Biodiversity and agroecosystem function. In: *Functional Roles of Biodiversity: A Global Perspective.* H.A. Mooney, J.H. Cushman, E. Medina, O.E. Sala and E.D. Schulze (Eds.) pp. 261-298. SCOPE Series. John Wiley, Chichester, U.K.

34 Villalon A. (2001). Spiritual values versus the reality of physical survival at the rice terraces of the Phillippine Cordilleras. In: *UNESCO Thematic Expert Meeting on Asia-Pacific Sacred Mountains*. pp. 189-203. World Heritage Centre, UNESCO, Paris, Agency for Cultural Affairs of Japan & Wakayama Prefectural Govt., Japan

35 UNESCO (1984). Action plan for Biosphere Reserves. *Nature & Resources*, **20**: 11-22.

36 UNESCO (1996). *Biosphere Reserves: The Seville Strategy and the Statutory Framework of the World Network*. 18 pp. UNESCO, Paris.

37 Walker B. H., Steffen W. L. & Langridge J. (1999). Interactive and integrated effects of global change on terrestrial ecosystems. In: *The Terrestrial Biosphere and Global Change: Implications for Natural and Managed Ecosystems*. B. Walker, W. Steffen, J.Canadell and J. Ingram (Eds.) pp. 329-375. Cambridge Univ. Press, Cambridge, U.K.

38 Yen D.E. (1989). The domestication of environment. In: *Foraging and Farming: The Evolution of Plant Exploitation*. D. R. Harris and G.C. Hilman (Eds.) pp. 45. Unwin Hyman, London.