SOCIO-CULTURAL AND SPIRITUAL DIMENSIONS OF ECOLOGY: TOWARDS A NEW ECOLOGICAL PARADIGM

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Abstract

There is a gradual shift in ecological paradigm where ecology, which until recent times had been viewed largely from a biophysical viewpoint is getting integrated with the human dimensions of it, to address problems arising on 'global change' on the ecological front, and 'globalization' of economies, with implications for sustainability of the biosphere. Ensuring community participation in all this effort has been recognized to be important, and in this context social dimensions need to come in. Realizing that conserving the rich cultural diversity, that we have been losing so rapidly in the course rapid urbanization and industrialization of human societies, is important, we need to base our developmental strategies on a value system that a given society understands and appreciates. The new vision of reality is an ecological vision, which in a sense goes far beyond the immediate concerns for environmental protection. To emphasize this deeper meaning of ecology, scientists and philosophers make a distinction between 'deep ecology' and 'shallow environmentalism' Rather than having patches of protected biodiversity in the form of nature reserves, placed as islands in a vast ocean of monoculture, the objective should be to work for conserving and/or rehabilitating heterogeneity in our landscapes, as nature would like to have it for us. All this calls for a 'socio-ecological' system perspective where ecology, economics and ethics, all blend into a unified whole.

Keywords: Holistic ecology, cultural ecology, sustainable development, traditional ecological knowledge, landscape ecology.

INTRODUCTION

The rapid changes in global environment, linked to industrialization that has occurred all along, now commonly referred to as 'global change', and that is likely to be further accelerated through 'globalization' of economy, have far-reaching consequences to human survival on this planet (Ramakrishnan, 1999a). The impact of these changes are being felt at two different levels: ecological and social. In the ecological dimension, 'global change' represents a whole variety of assorted, though closely inter-connected, events such as: global warming, atmospheric pollution and alterations in the gaseous composition, pollution of soil and water bodies, land use alterations leading to land degradation and desertification, rapid depletion of biodiversity, accelerated biological invasion and take-over by exotic species, etc. Whilst we are still grappling with the environmental consequences of these ecological events, triggered by 'industrial revolution', the long-term consequences of more recent developments, such as 'globalization' of economy on the one hand, and that arising from life form related biotechnological alterations and intellectual property rights issues on the other, are even less predictable. In fact, in many of the policy related decision making processes, environmental consideration still tends to take a back

seat. In the social dimension, there is no doubt that all these events have contributed to possibilities of a 'better quality of life', though to a limited few. The plight of the marginalized majority of the world population speaks of a completely different story about their plight for day to day existence. Even these more privileged humans have already started realizing that though they have been able to apportion to themselves much of the world's available (but not inexhaustible) natural resources, their 'quality of life' cannot be sustained at the expense of the vast majority of the under-privileged. It is in this context which one needs to consider the role of ecology from a much broader perspective, the context for the present discussion.

HOW SHOULD WE PERCEIVE OURSELVES IN THE GLOBAL ECOSYSTEM?

All of us from an urban environment, with a distorted exploitative world view towards nature and natural resources, tend to agree with the traditional ecologists who generally tend to view an ecosystem strictly in a biological sense, keeping the humans outside its' structural/functional attributes. In this view of things, humans sitting outside the biological ecosystem boundary bring about ecosystem alterations through perturbations (Huntley *et. al*., 1991). The impact of human activities on the ecosystem and the effect of altered ecosystem properties on the humans are not viewed as an integrated whole. This view point is understandable in light of the fact that industrialized modern societies perceive unlimited developmental possibilities, through a vision of unlimited natural resource availability. It is only recently that the realization has set in that fossil fuel - coal, oil and natural gas - the principal sources of energy that drives the engine of industrialization, will soon be in short supply, and will be exhausted eventually; the economic and political impacts of this realization are already being felt. Even more significant is the increasing realization, though not matched by decisive actions, that the uncontrolled exploitation of nature and natural resources are robbing the global system of its resilience - the ability to bounce back to its natural state, in the face of a whole variety of polluting substances that are constantly being generated by the industrialized segments of the world community, and the environmental degradation that it brings about. Building bridges with nature has to be viewed from the perspective of ecological, social, cultural and spiritual dimensions.

TOWARDS A HOLISTIC ECOLOGICAL VIEWPOINT

Earlier, ecologists believed that the ecosystem is producer-controlled, both structurally and functionally, and hence predictable. The research emphasis then was on well protected pristine ecosystems. During the 1970s, the emphasis shifted somewhat with the conceptualization of predator-controlled or consumer controlled ecosystems. Still the emphasis remained on undisturbed study sites. With greater realization and emphasis placed on evolution as an ongoing active process, in more recent times, disturbance was seen as a driving force in the evolution of ecological systems. Perturbations, to a greater or lesser extent, became an integral element in ecosystem functioning. The research emphasis shifted from pristine, to human impacted ecosystems, with a desire to emphasize the human dimension of ecological processes.

What then is holistic ecology? The answer to this question has to be found in the way in which many 'traditional societies' see their role in ecosystem functions. Traditional societies, i.e.,

societies that live close to nature and natural resources - these include tribal societies/indigenous people - view themselves as an integral component of the ecosystem functions; this integrative view point is equally obvious at the landscape level too. The concept of village as an ecosystem, with all its ramifications, involving agriculture, animal husbandry and the domestic sector enmeshed with the forest and forest-related activities such as hunting and gathering of food, fodder, fuelwood and medicine and forest farming as done under shifting agriculture, is an example of integrated view point of humans within the ecosystem boundaries (Fig.1) (Ramakrishnan, 1992a). What is required then, is for us to appreciate the way traditional societies perceive the natural resource base around them and build appropriate mechanisms in order to harmonize our relationships with ecology and nature.

SUSTAINABLE DEVELOPMENT: A USEFUL CONCEPT FOR HOLISM IN ECOLOGY

Human Ecology as a discipline, until recent times, has largely been the concern of social scientists and geographers. Though biological ecology and human ecology started with a common base and remained closely linked conceptually, they now stand dichotomized, and have developed their own paradigms, over a period of time, with difficulties for building interconnections. With biologically oriented ecologists traditionally looking for undisturbed pristine ecosystems and the social scientists largely focussed on societal attributes, in a context where the natural resource base of these societies was not limiting until recent times, the ecological-social linkages got broken somewhere along the line. The biological models of ecosystem function could not be extended to handle more complex social systems. With a shift in ecology towards an understanding of rural and urban societies that exert greater pressure on a limited natural resource base, with 'global change' threatening human survival, and with rapid advances towards 'globalization' of economies, we are now faced with a situation where building bridges between ecological and social science paradigms has become crucial for environment and development. This has become difficult, if not impossible, due to divergence in approaches of natural and social sciences and the consequent paradigm shifts. Therefore, it is not surprising to find that, a vast majority of ecologists still operate in the biophysical realm alone. Human dimensions of ecology, with appropriate interconnections built between natural and social sciences still remain a far cry (Ramakrishnan, 1999b). Such an approach towards building interconnections demands ability on the part of the integrator to freely move back and forth between natural and social sciences (Fig. 2), rather than merely plastering together research from the two disciplines. In other words, it is obvious that the future of ecology lies in integrating humans into the biophysical dimensions of analysis. It is in this context that the whole issue of 'sustainable development', as a integrating concept, has to be viewed.

It is only during the last few years that 'sustainability' as a concept has started attracting the attention of a variety of actors in the area of economic development, when the World Commission on Environment and Development (1987) came up with their report on "Our Common Future". The whole issue of 'sustainable development' had to be viewed from a variety of different perspectives: population pressure on natural resources, problems of food security based on currently available agricultural technologies, energy choices for environment and development, and the need for institutional and legal changes. The problem of managing the 'commons', for global peace, security and development was recognized as a priority area for immediate action. The concept of 'sustainable development' has been a rallying point for many

writings on the human dimensions of ecology (Ramakrishnan, 1999b). True, much has been written on a theoretical plane, actual studies at the ground level still remains weak. Ground level studies have to happen, and eco-technological details have to emerge directed towards a concerted action plan. This is a challenge before both natural and social scientists, which is a difficult one, but not difficult to surmount.

No doubt, sustainable development has a whole range of viewpoints, depending upon the issues involved. Sustainably managing highly industrialized urban ecosystems would deal with a whole variety of different issues, compared to sustainable extraction of minerals from the soil for industrial use. The purpose here is not to enter into a discussion on all the ramifications of sustainably managing the biosphere, but to illustrate a range of options that may be visualized in the context of biodiversity linked to natural resource management, whilst mending the threatened linkages between traditional societies and nature and natural resources, of which they have always been a part. This has been elegantly illustrated through the case study from north-eastern India (Ramakrishnan, 1992). Here the survival of a large number of traditional tribal societies, who are involved in a variety of forest-linked farming practices including shifting agriculture, are threatened partly due to increased population pressure on the forest resources from within and much more from outside[1]. Their traditional agricultural systems are under threat; the productivity has steadily declined, due to land and forest degradation. Yet, the suggested alternatives for land use development have been neither ecologically and economically viable, nor socially acceptable. Therefore, it has now been well recognized that alternate pathways for agricultural development has to be explored.

PATHWAYS FOR AGRICULTURAL DEVELOPMENT

If we consider high input modern agriculture as only one of the possible pathways for agricultural development, one could have at least two more additional pathways for sustainable agriculture: (a) evolution by incremental change, (b) restoration through the contour pathway, apart from the auto-route which symbolises modern agriculture (Swift *et. al*., 1996).

The auto-route:

What these pathways imply in real terms, is best illustrated through some specific examples. The 'auto-route' pathway is well known, because this is the direction in which much of the research efforts of the agricultural scientific community has so far been focussed. An appropriate metaphor would be the engineer who plans an auto-route by drawing a straight line from place to place on a map and proceeds to build a straight and level road, regardless of the physical impediments. Such an agroecosystem type would stand apart, as an artificial entity from the rest of the landscape - an attempt to convert the natural ecosystem into one that contains only those biological and chemical elements that the planner desires, almost irrespective of the background ecological conditions. Here, narrow production targets are pursued; all that is asked of the background system is basic information about production potential. The shift from the more complex systems to monocultures has lead to increased intensity of use of the same land area and management interventions. Internal controls (largely biodiversity linked) determining agroecosystem function and reflected in high energy efficiency levels and yield, though low but sustainable (Gleissman, 1990; Ramakrishnan, 1992), are replaced by external controls based on energy subsidies (such as fertilizer and pesticides) and subsidies made

possible from other sectors of the national or regional economy (Pimental and Pimental, 1979) leading to high productivity on short-term considerations.

The 'contour pathway':

This pathway seeks to acknowledges and work with the ecological forces that provide the base on which the system must be built, while acknowledging the social, economic and cultural requirements of the farming communities. The approach of working with nature, rather than dominating it, would involve active planning with the nature of the background ecosystem fully in mind. Many agroecosystems types in the 'low' and 'middle' intensity management categories (Fig. 3) will come under this pathway.

A whole variety of agroforestry and alley cropping systems, for example, come under the 'contour pathway'. Thus, for example, in recent times there has been many attempts to design sustainable agricultural systems to meet with the specific needs of the mountain societies, through Sloping Agricultural Land Technology (SALT). developed by the Mindano Baptist Rural Life Centre in the southern part of the Phillippines (Tacio, 1993). It is based on the planting of field and perennial crops in 3-5 bands between double rows of nitrogen fixing trees and shrubs planted on contours for soil conservation. The objective here was to establish a stable ecosystem that would check soil erosion, ameliorate the chemical and physical properties of the soil and lead to increase in the income of the farmers. Whilst these objectives were realized in the initial experimental phase, attempts now being made to introduce this technology in other situations in Asia has met with limited success, for ecological, social or economic reasons. A variety of attempts are also being made to develop agroforestry models in the Central Himalayan region and north-eastern regions of India, by closely following the socio-ecological contours and taking cues from the traditional agroforestry practices of the local mountain communities. (NEPED and IIRR, 1999 , Gopinath, 1999).

Incremental change:

Many traditional agricultural systems need to be redeveloped through incremental, rather than quantum change, based on traditional ecological knowledge (TEK); anything drastic may not find acceptance by the local communities. In this incremental change towards sustainable development, one may have to consider a short-term strategy that may be constrained because of ecological, economic, social or cultural reasons, apart from a more ideal and perhaps desirable long-term strategy.

The most comprehensive study on the 'incremental pathway', as a route for agricultural development is available through the case study on the shifting agricultural system from north-eastern India (Ramakrishnan, 1992a), the conclusions of which has wider applications for this widely practiced land use system prevalent all over Asia, Africa and Latin America [2].

To elaborate one of the components in this developmental pathway, a keystone species such as the Nepalese alder (Alnus nepalensis) is extensively used by tribal societies for soil fertility management, under shifting agriculture in north-east India (Ramakrishnan, 1992a). This early successional tree species in the north-eastern hill region, which is traditionally conserved in the slash and burn plots conserve up to about 120 kg. nitrogen per ha. per yr. We have shown that under one cropping cycle, the system loses something like 600 kg. of nitrogen per ha. in one year of cropping. Under short agricultural cycles of 5 to 6 years, not more than 300 kg. per ha of soil nitrogen alone is put back into the system during the 5-year period. Recovery of all the 600 kg. would otherwise require a minimum of 10 years of recovery period through natural

fallow regrowth. In other words, introduction of Nepalese alder into the system under a 5-year agricultural cycle could stabilize the system, with adequate nutrient recovery. Apart from nitrogen fixation, the production of nitrogen-rich litter and mineralization also contributes to biological build-up of soil fertility. Thus, this species could be used for fallow management with community participation, since the people can identify themselves with a value system that they understand and appreciate, and therefore participate in the process of development.

APPROPRIATE INSTITUTIONS FOR SUSTAINABILITY

Linking appropriate technology with appropriate institutional arrangements are important. These considerations formed the basis for decentralized village development in one of the north-eastern hill states of India where, over a thousand villages in the state of Nagaland have been organized into Village Development Boards (VDBs). The highly distorted shifting agricultural systems, which indeed is basically an agroforestry system, but now operating at subsistence or below subsistence level, is now being redeveloped by strengthening the tree component that has been weakened due to extreme deforestation in the region. The entire basis for this incremental build up is the rich traditional ecological knowledge base of these hill societies (Ramakrishnan, 1992a)[3]. The project implementation by the Nagaland Government officials through Village Development Boards created by the Government of Nagaland (Anonymous, 1980) and being implemented now (Faminow, 1999) was thus to augment the traditional system of agriculture, rather than attempting to radically change it. The Nepalese alder based agroforestry systems, with planting of trees done both in space and time (during the cropping and fallow phases of shifting agriculture) and maintained for hundreds of years, by some of the local tribes like the 'Angamis' (Gokahle *et. al*., 1985); Ramakrishnan, 1992) formed the impetus for this initiative.

With reliance being placed on participatory testing, rather than being transplanted into the field site by the extension agents, about a dozen tree species are being tested in over 200 test plots. Currently, it is estimated that the agroforestry technology is being tested in 5500 ha. of replicated test plots. Farmers have adopted this, for local-based testing in 870 villages, covering a total area of 33,000 ha (38 ha per villages x 870 villages); in these plots, local adaptations and innovations for activities such as soil and water management seems to be the basis for ensuring community based land use development (Faminow, 1999).

LANDSCAPE MANAGEMENT AND MONITORING

'Incremental pathway', building upon the already available rich traditional ecological knowledge has been explored for landscape management/development in north-east India[3], taking into consideration all the interconnected activities. Inter-disciplinary research in the interphase area of ecological and social processes thus form the basis for 'sustainable development. This alone would ensure development of these traditional societies based on a value system that the people can understand and appreciate and therefore, participate in the process of development.

Viewed in this context, sustainable development has to be evaluated using three major currencies and a variety of indicators within each one of them. Monitoring and evaluation has to

be done using these diverse currencies (Ramakrishnan, 1992a, 1993) that may be : (a) *ecological* (landuse changes, biomass quality and quantity, water quality and quantity, soil fertility, and energy efficiency), (b) *economic* (monetary output/input analysis, capital savings or asset accumulation, and dependency ratio), (c) *social* (quality of life with more easily measurable indicators such as health and hygiene, nutrition, food security, morbidity symptoms; the difficult to quantify measures such as societal empowerment, and the less tangible ones in the area of social and cultural values). We have considered all these diverse currencies to arrive at a meaningful sustainable developmental strategy for north-eastern hill areas of India (Ramakrishnan, 1992).

Further, institutional arrangements have to ensure peoples' participation, through a bottom-up approach for their organization, ensuring that each household takes part in the decision making process at the lowest level in the hierarchy, nd with special dispensation for the weaker and vulnerable sections of the society. Village Development Boards (VDB) of Nagaland, in India is a case relevant to this discussion (Anonymous, 1980). Village based Institutions such as theVDBs of Nagaland are formed with due representation given to each family, taking into consideration gender sensitivities, and more importantly by allowing the formation of the local boards based on the local value system that they have always cherished and conserved. Such village level institutions could be successfully broadened with inputs from scientists, non-governmental players (NGOs), and governmental agencies, as has happened with joint forest management committees that have become so successful in many regions of the Asian tropics (Ramakrishnan, 1992b, Ramakrishnan, *et. al*., 1994a,b).

Local level institutional framework, should consider the following aspects: (a) identification and strengthening of local level institutions that are already available, such as those existing in the north-eastern region, (b) the representative nature of these bodies and the extent to which individual family interests are taken care of, (c) their role in decision making right from the project formulation stage through different levels of implementation, (d) flexibility in function so as to take care of the interests of all sections of the society, (e) education and human resource development that these institutions have been able to trigger, particularly for weaker and vulnerable sections of the society, (f) ability of these institutions to stand on their own through empowerment in terms of capability building. These were the considerations that formed the basis for developing socio-ecological guidelines for rehabilitation of degraded ecosystems (Ramakrishnan *et. al*., 1994a) and sustainable livelihood for local communities in the Asian tropics. In the ultimate analysis, sustainable development is indeed a series ofm compromises, made both in space and time, and depending upon the ecological, social, economic and cultural dimensions of the problem in hand.

SOCIO-CULTURAL AND SPIRITUAL INTERCONNECTIONS: MOVING BEYOND ANTHROPOCENTRISM

There is a wide recognition throughout the globe and across disciplines that regions of ecological prudence exhibit a symbiotic relationship between habitats and culture (Arizpe, 1996). This explicates that culture and environment are complementary in various stages of evolution. Traditional societies have co-evolved with their environment, modifying nature but actively maintaining it in a diverse and productive state based on their indigenous knowledge since antiquity, at the same time with their symbolic recognition of nature through socio-cultural

practices and/or religious beliefs (Ramakrishnan, 2000; Ramakrishnan *et. al*., 1998;). However, these traditional societies are no longer immune to the changes linked with over-consumption of natural resources and globalization of economies occurring in the world with time. There is, therefore, a need for revival of the traditional values which tend to take a non-anthropocentric view of nature and natural resources.

The concept of 'sacred species, sacred groves and sacred landscapes' belongs to this category. The guiding principles that regulate the use of natural resources are embedded in the codified and often non-codified institutions that they have evolved. Modern economic and scientific rationality, however, precludes these socio-cultural practices, sometimes even amongst these traditional societies. It, therefore, warrants an integrated approach to natural resource management subsuming cultural, economic, and ecological principles to redress developmental issues in a more holistic way. The present paper argues that emergence of sacred institutions were intended more to boost social solidarity rather than promoting environmental consciousness *per se*, in contrast to the contrary argument (Gadgil and Guha, 1992). The demarcation of 'sacred' and 'profane' in surplus natural resource background by many traditional societies (Durkheim, 1961) is a corroborative evidence to the above argument. However, while these religious norms explicitly foster social solidarity, their conservation value is incidental.

THE CONCEPT OF 'SACRED'

The social institutions linked to biological resource management are often linked to religious myths and socio-cultural belief system. Such a concept of 'the sacred' often has spatial dimensions and specificities. One could conceptualise a broader hierarchy of social institutions or sacred entities, i.e., spatially diffused sacred landscape, spatially defined sacred landscape or sacred groves and sacred species. The top most in this hierarchy has institutions that have least specificity but has the greatest zone of influence. Least specificity means lower number of prescriptions and prohibitions in terms of practising cultural norms. Next in this hierarchy would be spatially defined landscapes with well-defined institutional norms. The concept of sacred groves also falls in this category. Sacred species stand, as a class apart, though there may be restrictions on their usage.

From an evolutionary perspective, since the sacred groves are always linked with traditional forest dwellers, this could be viewed as the lowest in the social evolutionary scale (Ramakrishnan, 1996, Ramakrishnan et. al., 1998). Social evolution then could be viewed as moving in two different directions—towards further elaboration of the concept, namely the 'sacred landscape', or towards reductionism, namely the 'sacred species'; these two latter concepts are, therefore, part of more evolved societies. Such a conceptual framework forms the basis for the following discussions.

A *Diffused* landscape would have a set of interacting ecosystem types, wherein humans may be viewed as an integral component of ecosystem/landscape functions (Ramakrishnan, 1996, Ramakrishnan et. al., 1998). One of the guiding principles in demarcating the boundary for such a sacred landscape lies in the identification of the 'zone of influences', for not only the local people but also for the vast majority in the Indian sub-continent. An example of this level in hierarchy is represented by the Ganga sacred landscape encompassing all tracts from its origin in the upper mountain reaches of the northwest Himalaya going down eastwards to its submergence into Bay of Bengal. The land all along the river course is sanctified through holy cities like

Gangotri, Badrinath, Kedarnath, Rishikesh, Haridwar, Varanasi and Allahabad. As an ensemble, these represent a set of inter-connected ecological systems, bound together by the sacred river itself. All along, there exists a variety of natural ecosystems ranging from alpine meadows above the timberline, montane oak and pine forests lower down, low elevation moist deciduous forests to dry deciduous forests in the foothills, and a variety of human altered ecosystems, both natural and human-managed agroecosystem types. All of these ecosystems are tightly linked together and controlled by the flooding and silt deposition along the course of the sacred river and its tributaries. It may, however, be noted here that the argument of ecological prudence behind attributing sacredness to natural resources gets attenuated, as rituals of burning and dumping of human dead bodies in the Ganga goes against environmental ethics.

Here, diffused institutional arrangements are: for instance, a holy dip in the sacred Ganga for the believers; special festivals such as the 'Kumbh' (ceremonial holy bath), done once in twelve years; visit to the sacred temples along the course of the Ganga river system, etc. The diffused nature of the zone of influence could be exemplified using the situations prevailing in the holy cities like Varanasi. Its spatial sacredness is due partly to its closeness to the sacred river Ganga (Vidyarthi *et al*., 1979). Here, specific local institutional arrangements exist for different linguistic and cultural entities of the different regions of India.

Diffused landscape:

Next in the hierarchy is the 'diffused landscape' exemplified by the ‘Demojong’ sacred landscape in the west Sikkim Himalaya, linked to the Buddhist Tibetan belief system; this has well-defined boundaries and institution. Starting from the snow clad peak of Khangchendzonga, going through Alpine meadows and Rhododendron scrub jungle, passing through conifer and mixed evergreen forests and finally the sub-tropical rain forest systems, the landscape represents a whole variety. A number of glacial lakes exist in the alpine zone; Rathong Chu river runs down across the landscape. The local communities of diverse cultural backgrounds, who inhabit this mega-watershed, maintain a variety of agroecosystem types.

The air, soil, water and biota are all sacred to the people and any perturbation in this landscape is restricted due to the existing myth that could invite disaster. The general belief is that Padamsambhava, an incarnate of Buddha, highly revered and worshiped by the Buddhists is considered to have blessed this landscape and placed a large number of hidden treasures. It is believed that these treasures are being discovered slowly and will be revealed only to enlightened Lamas (spiritual leaders) at appropriate times. Conserving these treasures from polluting influences is considered important for human welfare (Ramakrishnan, 1996). Institutional arrangements are well defined [4].

Sacred groves are defined as small patches of native vegetation that are protected by traditional communities based on cultural/religious beliefs (Ramakrishnan, 1992a). This represents the third level in the hierarchy of sacred entities. They are widely distributed all over the world (Ramakrishnan *et al*., 1998). With a variety of nomenclature and equally diverse belief systems these groves are widely distributed in the Indian regions also. Understanding the functional attributes of these groves have much ecological value[5].

The institutional mechanisms that govern these groves also differ widely—e.g. Village councils or temple management committees, depending upon the location. These institutional arrangements have often started breaking down as in the north-eastern India. With the advent of Christianity and modernization, these groves have lost its religious and cultural importance

resulting in discontinuation of rituals and beginning of exploitation of resources contained therein by the tribals in north-east India (Khiewtam and Ramakrishnan, 1989). However, some of the sacred groves are still protected rigorously (Ramakrishnan *et. al.* 1998).

Sacred species:

The lowest level in the hierarchical organisation of the concept of sacred are the 'sacred species', a concept evolved with a mixture of conscious and unconscious decisions for its latent value; for example, basil, locally called in India as Tulsi (Ocimum sanctum) became sacred as part of conscious decision linked to its tangible value for its multipurpose medicinal properties. On the other hand, a Fig species (Ficus religiosa) became sacred as it has intangible benefits of supporting animal biodiversity and is valued both in Hindu and Buddhist religion belief systems, for varied reasons (Ramakrishnan, 1996). Attaching sacred value to species like oak, olive, apple, and fir by considering them to be gods/goddess's favorite was prevalent in Mediterranean region. In Iran, some 158 trees like walnut, plane-tree, willow, cypress, turpentine, spruce-fir etc. have been identified as sacred based on different faiths and belief (Khaneghah, 1998). Culturally valued species, such as oaks (Quercus species) in the central Himalayan region are important fodder and fuel species, but also perform not so obvious functions such as maintenance of soil fertility through efficient nutrient cycling, soil moisture conservation through extensive root system and thereby support biodiversity (Ramakrishnan, 1996). It may be mentioned in the conclusion that socially and culturally valued species are often also ecologically significant key stone species (Ramakrishnan, 1992).

TOWARDS A NEW VISION IN ECOLOGY

The emerging indications reflecting the current thinking in paradigm shifts in economics and ecology, leading to possibilities of developing new conceptual models for 'sustainable development', tend to lead us away from an anthropocentric view of nature and natural resources. This view point is further reinforced by a renewed interest in our cultural heritage, based on the concept of the 'sacred'. This emerging systems view of life, mind and consciousness and human evolution, are opening up new vistas which could have profound consequences to our social and political structures.

On the science and technology front, the rapid decline in the availability/accessibility of fossil fuels will mark a major transition from the non-renewable to the renewable energy sources, with profound consequences on global ecology - how we manage nature and natural resources. The realization that this depends on the totality of the human system, with strong mind-body interconnections, that mind as the causative factor for many chronic degenerative ailments, opens new vistas in the area of medicine and health care; the emphasis is gradually shifting towards alternative systems of medicine which take a more holistic view point of human health.

On the social front, the decline in the power of patriarchy, and in the belief system arising there from, that natural resources are to be exploited rather than to be used sustainably has been questioned in recent times. The gradual disintegration of patriarchy and emergence of gender related equity is an important milestone in the process of human evolution. This again, we believe, will have major consequences to the cultural values, and the ways in which people will relate with nature and natural resources, and the emergence of the new ecological paradigm.

On a spiritual dimension, a gradual change in the value system and cultural values, though slow, has already started happening. The traditional wisdom embedded in the concept of the sacred species, ecosystems and landscapes, and its revivalism in the contemporary context of biodiversity conservation is an example to note (Ramakrishnan *et. al*., 1998). Rather than merely taking a mechanistic view of the earth processes, where humans are continually struggling for unlimited material progress through economic growth mediated by technological innovations, a greater appreciation of the interconnectedness leading to an organic, ecological view of world, akin to the views of the ancient seers - the sages and mystics is emerging. The Chinese call it the 'Tao', which talks about the cyclical patterns, with polar opposites, the 'yin' (feminine aspects) and the 'yang' (masculine aspects), the two poles that set the limits for the cycles of change; the external manisfestations of the 'tao' being determined by the dynamic interplay between the two extremes. The concept of depicting the Hindu deity, Shiva as 'Ardhanarishwara' (half-male and half-female), in the Indian mythological writings, again is symbolic of finding harmony between the polar opposites, the cyclical changes within oneself, which when extended covers the global environment, and the universe itself.

The new vision of reality is an ecological vision, which in a sense goes far beyond the immediate concerns for environmental protection. To emphasize this deeper meaning of ecology, scientists and philosophers make a distinction between 'deep ecology' and 'shallow environmentalism' (Capra, 1982). The latter smacks of an anthropocentric viewpoint of nature and natural resources; the former demands a profound change in our role as humans, with respect for life in all forms that we encounter on this planet. We need to seriously reconsider our vision of landscape ecology. Are we satisfied with having patches of protected biodiversity in the form of nature reserves, placed as islands in a vast ocean of monoculture? Or, are we looking for more heterogeneity in our landscapes, as nature would like to have it for us, so that biodiversity is not merely restricted to nature reserves (Ramakrishnan *et. al*., 2000). We would consider that the latter approach will provide resilience by strengthening the internal buffering mechanisms against uncertainties in the environment. This would demand a rethinking on ethical dimensions of life itself; the current discussions on biotechnological modifications of genetic make-up of organisms at the species/sub-specific level, at one extreme, and those on sustainable landscape management, at the macro-level, on the other, are indicative of the path we need to follow.

Developments in a variety of other disciplines are also indicative of the search for new paradigms in ecological thinking. The concerns that are expressed from time to time for 'sustainable development', with all the varied connotations attached to it is an economic interconnection that one is looking for. Realizing that modern medicine, at best has been effective only to deal with emergencies, more and more people are already looking to alternate systems of eastern medical practices that emphasizes upon a holistic approach to human health. The mind-body interconnections that are emphasized in this alternate system for human health, based on the ancient wisdom of the eastern philosophical thoughts, is another dimension towards our move to a broad based ecology.

References

Anonymous, (1980), *Village Development Boards - Model Rules*, 1980 (Revised). Dept. of Rural Development, Govt. of Nagaland, New Delhi;

Arizpe, L. (1996), Culture and environment. Nature and Resources, 32: 1;

Capra, F. (1982), *The Turning Point*. Flamingo, London. 516 pp.;
Durkeim, E. (1961) The Elementary Forms of Religious Life. Collier Books, New York;
Faminow, M.D. (1999), Local knowledge and people's action to reduce deforestation: Slash and agriculture in Nagaland. *Proc. Internat. Workshop: Technology Change in Agriculture and Deforestation*, CIFOR, CATIE, Turrialba, Costa Rica;
Gadgil, M. and Guha, R. (1992), *This Fissured Land: An Ecological History of India*. Oxford Univ. Press, Delhi. 274 pp.;
Gliessman, S.R. (1990), Agroecology: Researching the Ecological Basis for Sustainable Agriculture. Ecological Studies 78, Springer Verlag, New York. 380 pp.;
Gokhale, A.M., Zeliang, D.K. Kevichusa, R. and Angami, T. (1985), Nagaland: The Use of Alder Trees. Education Dept., Kohima, Nagaland. 26 pp.;
Gopinath, L.R. (1999), Nutrient/Resource Management Relevant to Agroforestry Systems of Traditional Societies of Central Himalaya. Ph.D. Thesis, Jawaharlala Nehru Univ., New Delhi. 203 pp.;
Huntley, B.J., Ezcurra, E., Fuentes, E.R., Fugii, K., Grubb, P.J., Haber, W., Harger, J.R.E., Holland, M.M., Levin, S.A. Lubchenco, J., Mooney, H.A., Neronov, V., Noble, I. Pulliam, H.R., Risser, P.G., Sala, O., Sarukhan, J., and Sombrock, W.G. (1991), A sustainable biosphere : The Global Imperative. *Ecology International*, 20: 1 – 14;
Kiewtam, R.S. and Ramakrishnan, P.S. (1989), Socio-cultural studies of the sacred groves at Cherrapunji and adjoining areas in north-eastern India. *Man in India*. 69: 64-71.
Mishra, B.K. and Ramakrishnan, P.S. (1982), *Agric. Systems*, 9: 57-72;
NEPED and IRRR (1999), *Building Upon Traditional Agriculture in Nagaland*. Nagaland Environ. Protection & Economic Development, Nagaland, India & International Inst. of Rural Reconstruction, Phillippines. 235 pp.;
Pimental, D. and Pimentel, M. (1979), Food Energy and Society. Edward Arnold, London.165 pp.;
Ramakrishnan, P.S. (1992a), *Shifting Agriculture and Sustainable Development: An Interdisciplinary Study from North-Eastern India*. UNESCO-MAB Series, Paris, Parthenon Publ., Carnforth, Lancs. U.K. 424 pp. (republished by Oxford University Press, New Delhi 1993);
Ramakrishnan, P.S. (1993), Evaluating Sustainable Development with Peoples' Participation. In: F. Franz Moser (Ed.). *Proceedings of the International Symposium. Sustainability - Where Do We Stand?* pp.165-182. Technische Unive rsitat Graz, Austria;
Ramakrishnan, P.S. (1996), Conserving the sacred: From species to landscapes. Nature & Resorces, UNESCO,32: 11-19;
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;
Ramakrishnan, P.S. (1999a), The impact of globalisation on agricultural systems of traditional societies. In: A.K. Dragun and C. Tisdell (Eds.). *Sustainable Agriculture and Environment: Globalization and the Impact of Trade Liberalisation.* pp. 185-200. Edward Elgar, Cheltenham, U.K.;
Ramakrishnan, P.S. (1999b), Ecology in developing countries: The emerging paradigms. Proc. Indian National Sci. Acad., 65B: 51-82;
Ramakrishnan, P.S. (2000), Sacred mountain forests and biodiversity. In: Price, M.F. and Butt,

N. (Eds.). *Forests in Sustainable Mountain Development: A State of Knowledge Report for 2000.* pp. 117-126. CABI Publ., Wallingford, U.K.;

Ramakrishnan, P.S., Campbell, J., Demierre, L., Gyi, A., Malhotra, K.C., Mehndiratta, S., Rai, S.N., and Sashidharan, E.M. (1994a), *Ecosystem Rehabilitation of the Rural Landscape in South and Central Asia: An Analysis of Issues.* Special Publication, UNESCO (ROSTCA), New Delhi. 27 pp.;

Ramakrishnan, P.S., Purohit, A.N., Saxena, K.G. and Rao, K.S. (1994b), *Himalayan Environment and Sustainable Development*. Diamond Jubilee Publ., Indian Nat. Sci. Acad., New Delhi. 84pp.;

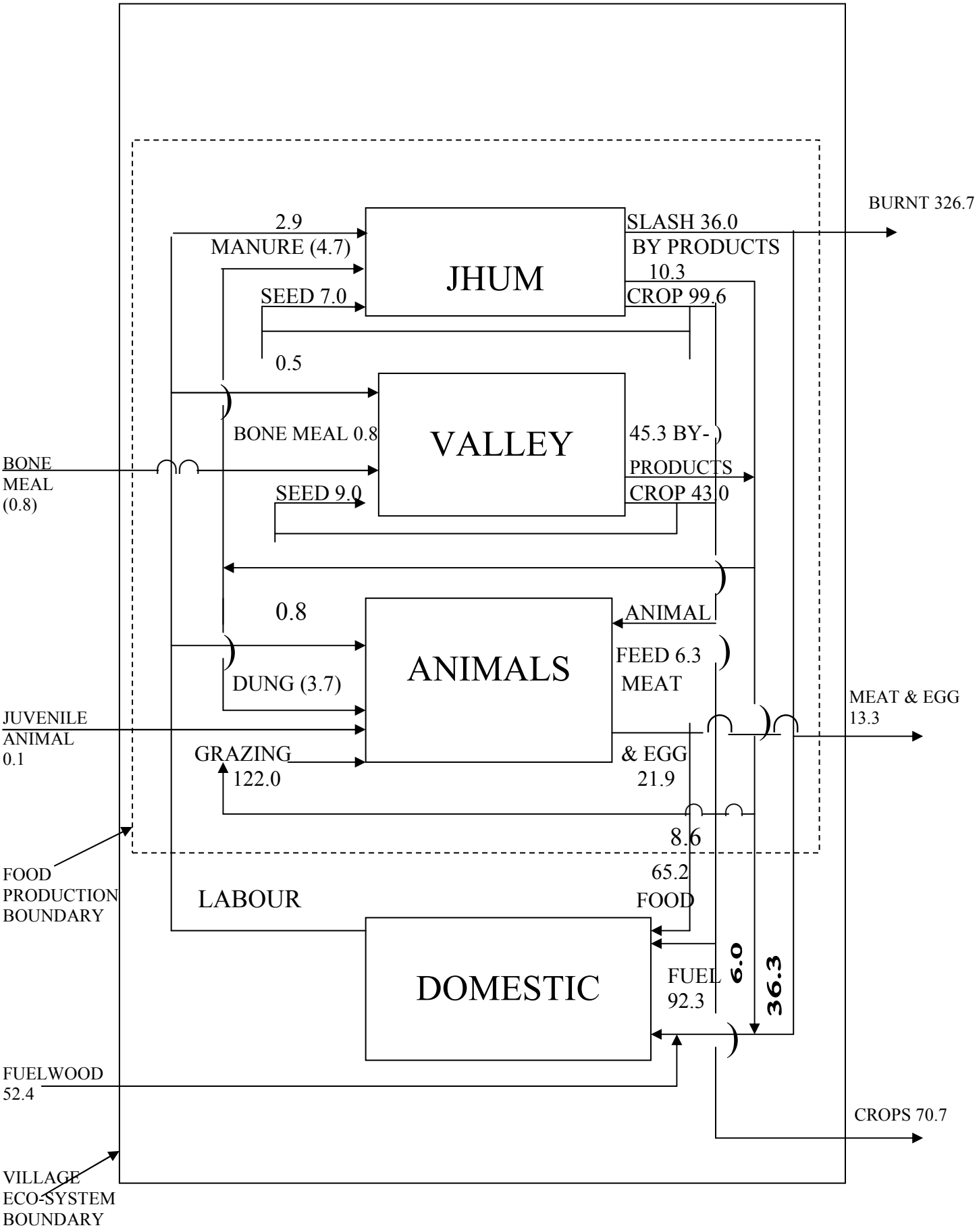
Ramakrishnan, P.S., Saxena, K.G. and Chandrashekara, U.M. (1998), *Conserving the Sacred: For Biodiversity Management*. UNESCO and Oxford and IBH Publ., New Delhi. 480 pp;

Ramakrishnan, P.S., Chandrashekara, U.M., Elourd, C., Guilmoto, C.Z., Maikhuri, R.K. Rao, K.S., Sankar, S. and Saxena, K.G. (2000), *Mountain Biodiversity, Land Use Dynamics and Traditional Ecological Knowledge*. UNESCO and Oxford & IBH Publ., New Delhi. 353 pp.;

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

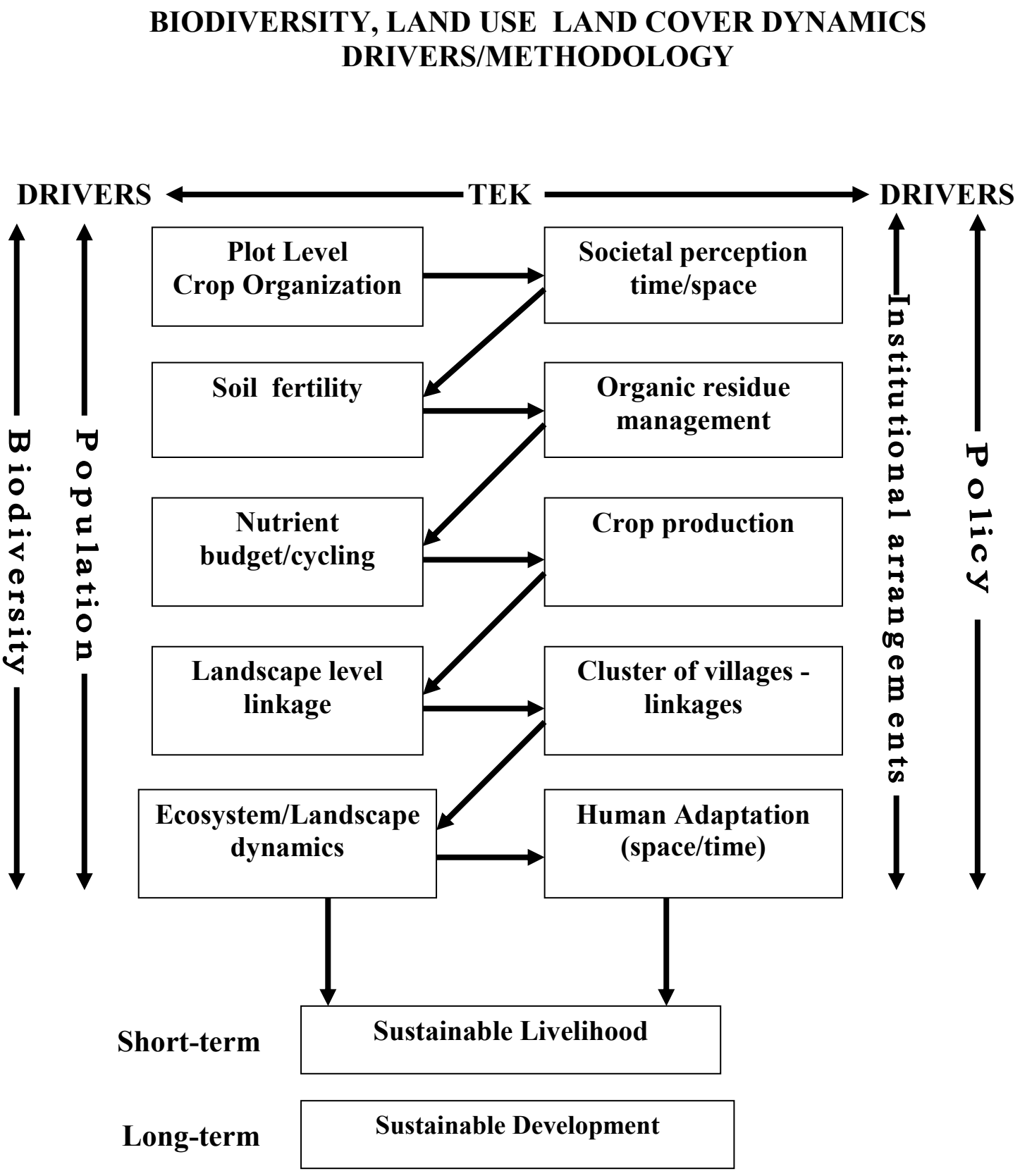
Tacio, H.D. (1993). Sloping agricultural land technology (SALT): A sustainable agroforestry scheme for the uplands. Agroforestry Systems, 22: 145-1

Figure 1



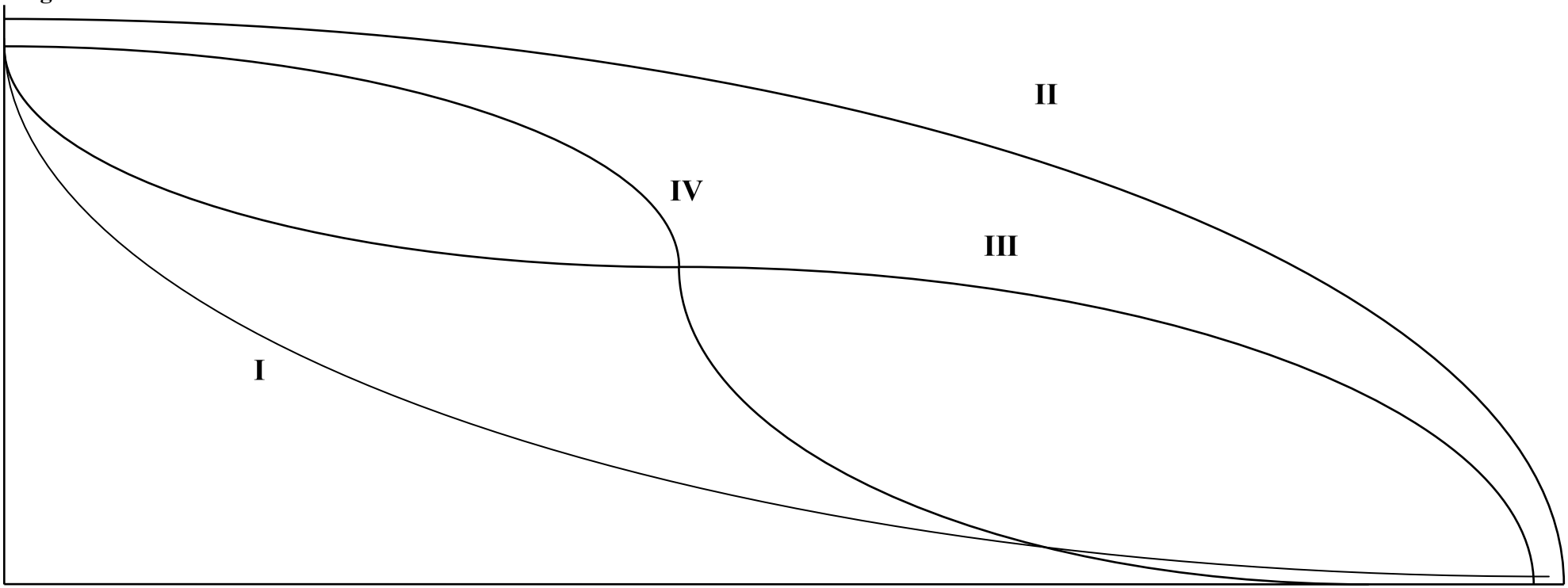
Interconnections that exist between agriculture, animal husbandry and domestic sectors, as indicated through energy flow (MJ x 10^3), a Khasi village ecosystem in Meghalaya, in north-east India (from: Mishra and Ramakrishnan, 1982).

Figure 2



An iterative process for building linkages between ecological and social sciences and analyses of land use dynamics from plot level to landscape level, leading to sustainable livelihood/development of traditional societies living in biodiversity rich areas (Ramakrishnan, 2001)

Figure 3



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 the ecologists' expectations, whilst Curve IV seems to be more likely and is the most interesting from the point of view of biodiversity conservation (from: Swift *et. al*. 1996).

Notes

[1] Shifting agriculture (jhum) in north-eastern India and social disruption (from Ramakrishnan 1992)

- North-eastern India has over 100 different ethnic groups linguistically and culturally distinct from one another; the tribes often change over very short distances, a few kilometers in some cases. Shifting agriculture (jhum), is the major economic activity. This highly organized agroecosystem was based on empirical knowledge accumulated through centuries and was in harmony with the environment as long as the jhum cycle (the fallow length intervening between two successive croppings) was long enough to allow the forest and the soil fertility lost during the cropping phase to recover.
- Supplementing the jhum system is the valley system of wet rice cultivation and home gardens. The valley system is sustainable on a regular basis year after year because the wash-out from the hill slopes provides the needed soil fertility for rice cropping without any external inputs. Home gardens extensively found in the region have economically valuable trees, shrubs, herbs and vines and form a compact multi storied system of fruit crops, vegetables, medicinal plants and many cash crops; the system in its structure and function imitiate a natural forest ecosystem. The number of species in a small area of less than a hectare may be 30 or 40; it therefore represents a highly intensive system farming in harmony with the environment.
- Linked on to these land uses are the animal husbandry systems centred traditionally around pigs and poultry. The advantage here is primarily that they are detritus-based or based on the recycling of food from the agroecosystem unfit for human consumption.
- Increased human population pressure in the jhum sites, and decline in land area resulting from extensive deforestation for timber for industrial use outside, has brought down the jhum cycle to 4-5 years or less. Where population densities are high, as around urban centres, burning of slash is dispensed with, leading to rotational/sedentary systems of agriculture. These are often below subsistence level, though the attempt is to maximize output under rapidly depleted soil fertility. Inappropriate animal husbandry practices introduced into the area, such as goat or cattle husbandry, could lead to rapid site deterioration through indiscriminate grazing/browsing and fodder removal, as has happened elsewhere in the Himalayas. The serious social disruption caused demands an integrated approach to managing the agriculture-forest-human interface.

[2] Shifting agriculture (jhum) and sustainable development for north-eastern India (from: Ramakrishnan,1992).

- For improving the system of land use and resource management in north-eastern India, the following strategies suggested by Ramakrishnan and his coworkers are based on a multidisciplinary analysis. Many of these proposals have already been put into practice.
- With wide variations in cropping and yield patterns under jhum practiced by over a hundred tribes under diverse ecological situations, where transfer of technology from one tribe/area to another alone could improve the jhum, valley land and home garden ecosystems. Thus, for example, emphasis on potato at higher elevations compared to

rice at lower elevations has led to a manifold increase in economic yield despite low fertility of the more acid soils at higher elevations.

- Maintain a jhum cycle of minimum 10 years (this cycle length was found critical for sustainability), when jhum was evaluated using money, energy, soil fertility biomass productivity, biodiversity, and water quality, as currencies) by greater emphasis on other land use systems such as the traditional valley cultivation or home gardens.
- Where jhum cycle length cannot be increased beyond the five- year period that is prevalent in the region, redesign and strengthen this agroforestry system incorporating ecological insights on tree architecture (e.g. the canopy form of tree should be compatible with crop species at ground level so as to permit sufficient light penetration and provide fast recycling of nutrients through fast leaf turnover rates). Local perceptions are extremely important in tree selection, for introduction into the cropping and fallow phases of jhum, as is being done in a major initiative in the state of Nagaland in north-east India.
- Improve the nitrogen economy of jhum at the cropping and fallow phases by introduction of nitrogen-fixing legumes and non-legumes. A species such as the Nepalese alder (Alnus nepalensis) is readily taken in because it is based on the principle of adaptation of traditional knowledge to meet modern needs. Another such example is the lesser known food crop legume Flemingia vestita, traditionally used by tribals as an important species when jhum cycles decline below 5 years.
- Some of the important bamboo species, highly valued by the tribals, can concentrate and conserve important nutrient elements such as N, P and K. They could also be used as windbreaks to check wind-blow loss of ash and nutrient losses in water.
- Speed up fallow regeneration after jhum by introducing fast growing native shrubs an and trees.
- Condense the time-span of forest succession and accelerate restoration of degraded lands based on an understanding of tree growth strategies and architecture, by adjusting the species mix in time and space.
- Improve animal husbandry through improved breeds of swine and poultry.
- Redevelop village ecosystems through the introduction of appropriate technology to relieve drudgery and improve energy efficiency (cooking stoves, agricultural implements, biogas generation, small hydroelectric projects, etc.). Promote crafts such as smithying and products based on leather, bamboo and other woods.
- Strengthen conservation measures based upon the traditional knowledge and value system with which the tribal communities could identify, e.g., the revival of the sacred grove concept based on cultural tradition which enabled each village to have a protected forest once upon a time although few are now left.
- In the ultimate analysis, have an integrated approach for land use development in a given ecological/cultural landscape; base short-term sustainable livelihood strategy on building upon traditional knowledge and technology; long-term sustainable development plan should based on larger ecologic/economic considerations should gradually built up to avoid social disruptions.

[3] Biodiversity linked traditional ecological knowledge (TEK) associated with jhum in north-eastern India (from: Ramakrishnan, 1992).

- Jhum system with over 40 crop species under longer cycles and at least 6-8 species under shorter ones, is a highly complex multi-species system. On the basis of their intuitive experiences, traditional societies of the north-eastern India place nutrient-use efficient crop species on the top of the slope and less efficient species along the bottom to match with the soil fertility gradient on a steep slope, thus optimizing productivity of the system as a whole.
- With shortening of the jhum cycle, the farmer tends to emphasize nutrient use-efficient tuber and vegetable crops, as compared to their emphasis cereals that are less efficient in nutrient use, under longer cycles, an adaptation to nutrient status in the soil under different cycle lengths.
- Operating under a mixed cropping system, where the species are sown at the same time soon after the first rain during the monsoon, crops are harvested sequentially as and when the crop matures over a period of a few months, a procedure which keeps inter-specific competition under check. After harvesting the economically useful component/s, the biomass is recycled into the agricultural plot, which decomposes rapidly making nutrients available for the remaining crops within the system. Weed biomass pulled out of the plots is also put back into the system for similar reasons.
- Rather than 'weed control', the jhum farmer practices 'weed management'. Irrespective of his socio-cultural background and ecological conditions under which he/she works, about 20% biomass of the weed biomass is left *in situ* without being pulled out from the plot. On the basis of our experiments in the farmer's fields, we have shown that this 20% weed biomass serves important nutrient conservation role on a hill slope, which otherwise could be lost through erosive/leaching processes. Indeed, this 20% weed biomass has no impact on crop yield, being the cut-off point when the weed stops competing with the crop for the nutrients from the common pool.
- Earthworms form an important component of many traditional agricultural systems, and the farmer as an indicator of soil fertility status often views one or more of them as keystone species.
- An example of a socially valued species like the Nepalese alder (Alnus nepalensis) is conserved within the jhum system, during the slash and burn operation, and forms part of the traditional fallow management practices. The ecological keystone value of this species lies in its ability to fix nitrogen in the soil, to the extent of about 125 kg $ha^{-1}yr^{-1}$. Similarly socially valued species like many bamboos (Dendrocalamus hamiltonii, Bambusa tulda and B. khasiana) have been shown to be able to conserve N, P and/or K depending upon the species, within the jhum system.
- In the ultimate analysis, building upon this rich TEK available with traditional societies has to be the basis for redeveloping jhum in the present case, and for redeveloping any traditional agroecosystems, if we are to build bridges between conservation and development.

[4] Demajong, the sacred landscape of the Tibetan Buddhists of Sikkim (Ramakrishnan, 1996)

- 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, having 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, protecting them from polluting influences is 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 are possible if this land and water is 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 sometimes 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 dependent 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.
- Traditional institutional arrangements, codified and often non-codified ensures that small-scale perturbations such as village-level human activities are permissible, whilst as large-scale perturbations are not. When the government in the landscape area tried to put up a hydro-electric project there were immediate protests from the local communities, leading to eventual abandonment of the project.

[5] Mawsmai sacred grove in Cherrapunji in north-eastern India (from Ramakrishnan, 1992)

- Sacred groves representing relict biodiversity rich ecosystem types standing out as islands of biodiversity has its value in natural ecosystem management. To cite an exxample, the Mawsmai grove in Cherrapunji in north-east India, which receives over 12 m of rainfall which could go up to 24 m in an exceptional year, is a highly fragile system due a highly leached soil on which the forest has developed. The tight nutrient cycling here is due to a fine root mat developed on the surface layers of the soil and that particularly located over the mineral soil, which short-circuits the nutrients released by the leaf litter before it could enter the mineral soil. Understanding the functioning of such a relict ecosystem has provided a wealth of information on ecosystem functioning, for designing meaningful ecosystem rehabilitation strategies with concerns for biodiversity.

- A substantial proportion of nitrogen, phosphorus and potassium conservation within the ecosystem is determined by four dominant tree species, namely, *Englehardtia spicata, Echinocarpus dasycarpus, Sysygium cuminii* and *Drimycarpus racemosus*; this critical for an ecosystem growing in a highly infertile soil, that is highly fragile

(Khiewtam & Ramakrishnan, 1993). These keystone species, through their nutrient cycling role in ecosystem function, contribute towards supporting biodiversity in these relict forests, often protected by local people for religious and cultural reasons.