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Local Community Knowledge and Practices: Implications for Biodiversity

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Introduction

The diversity of life-forms, estimated at anywhere between 5 to 50 million species of plants and animals and micro-organisms, is the cumulative product of a still ongoing evolutionary process. It is this biodiversity that performs most of the crucial ecosystem services indispensable for life on earth, and provides for the direct and indirect economic needs of humans. It also enriches our life both spiritually and intellectually.

Humanity, perhaps the most complex and evolved product of this evolutionary process has right from its emergence been dependent on biological diversity. Our continual interaction with and manipulation of nature has had variable impact on this diversity, ranging from enhancement, regeneration, and conservation to depletion, destruction and extinction of its elements. The impact of human activities on biodiversity in particular and nature in general has been conditioned by (i) the way human society perceives nature and (ii) the way we have organised our societies. Thus, the enormous range of organizational forms, socio-political systems and socio-economic relations, plays a decisive role in the way humans relate to and use resources, with the subsequent impact on biodiversity.

The social evolution of humanity has been paralled by the emergence of several modes of resource use, and each mode adopted by any society has been characterised by a definite set of ecological, ideological and technological features. Broadly summed up, the various modes of resource use, and the societies named after the most predominantly employed modes, are hunting, gathering, pastoral nomadism, shifting cultivation, and the present mode of industrialization.

While industrialization has been the hallmark of modern and 'developed' societies, traditional societies have employed the other modes with varying degrees of importance. In sharp contrast to the traditional modes, the industrial mode of resource use, within the short span of its existence, has had a devastating impact on nature and on biological diversity. Taking recognizance of this, in conjunction with the fact that the world's highest biodiversity areas overlap the habitats of indigenous and local communities, it has become increasingly clear that the conservation of biodiversity is closely tied to the protection and continued use of traditional and local community knowledge related to natural resources.

Being closely associated with and dependent on nature, traditional societies have largely (though by no means always) shared a symbiotic and sustainable relationship with nature. They relied heavily on the diversity of biological resources in order to meet their requirements; dependence on diversity helped lessen the pressures on any single component. Thus through trial and error aided by natural selection, these communities have continuously built on their knowledge systems on natural resources and have found several new uses for it. Apart from being an enormous resource base of biodiversity, these knowledge systems have been the basis for the regulation and control of exploitative pressures, that permit an ecosystem to maintain stability and regenerative capacity (Ruddle, 1993). Traditional ecological knowledge or the knowledge related to natural resources and their use, has thus been defined as representing a collective understanding attained over a long period of time, in particular places, of the relationship of a community and the Earth, encompassing spiritual, cultural and social aspects, as wee as substantive and procedural ecological knowledge (Doubleday, 1993).

However, regrettably, in the present times the interface between traditional/informal knowledge on the one hand and modern/formal knowledge on the other, shows a marked bias for the latter. Under the pervasive influence of modernization, either there has been significant usurpation of other knowledge bases, without due acknowledgement, or the

latter have been marginalised. Only very recently has the modern would recognised the inherent worth of, and need to respect, local community knowledge.

In this introductory paper to the theme session on biodiversity in the IInd National Congress on Traditional Sciences and Technologies, we have sought to analyse the characteristics of these knowledge systems, as well as look at the various contexts in which resource use has been institutionalised. We have very briefly looked at the specific implications of these knowledge systems for biodiversity. While looking at some instances where these systems of knowledge have suffered great deal of erosion, we have also cited instances where in the recent past local people have made attempts at reviving their traditional practices of resource management. In conclusion we have put together some common elements of a strategy for revival and perpetuation of these knowledge systems, which have been distilled from the various examples cited in the paper.

1. Characteristics of Local Community Systems

Local community systems(LCS) of resource use are generally defined within certain broad parameters and are characterised by certain distinctive traits. Analysed in the context of this paper, such LCS have both their advantages and disadvantages, impacting biodiversity both positively as well as negatively.

1-1 Advantages/Positive points

i. Located within socio-cultural milieu: LCS are deeply integrated within the social, cultural, and political milieu of the community, deriving their legitimacy and strength from this milieu. Thus, for instance, rules regarding restraints on resource use are embedded in cultural and religious systems which give them a legitimacy which goes beyond scientific/ecological prudence. Thus one may quite justifiably state that in most cases, resource management systems are an integral part of their tradition and culture.

ii. "Landscape" integration: LCS do not typically have hard and fast divisions between the various kinds of land/water use, but rather these form one continuum. Thus, from the point of view of usage and function, forests merge into agricultural fields which merge into wetlands, and so on. This gives rise to highly integrated resource use systems in which land use, for instance, does not militate against a wetland, or vice versa. Local communities can practice and manage a range of resources simultaneously.

iii. Conscious/unconscious restraints on use: LCS has several rules (usually unwritten , but codified in oral tradition) regarding the use of resources. These include seasonal, functional, geographical, or other restraints on the use of biological resources, rotational or restricted use of habitats, etc. While there is a limited technological capacity to exploit resources, as also limited demand on resources from typically small populations, conscious restraints on exploitation marks most LCS. Gadgil & Guha (1992) have classified, under various categories of restrained resource use practices, the judicious measures of resource use employed by traditional communities. These include community imposed restrictions on the amount harvested, subject to the density of the resource available, incidental conservation by according religious protection to species or patches of landscape, prohibiting hunting methods that were exhaustive or had a debilitating effect, protecting certain life stages critical to 'population replenishment' and disallowing certain groups on the basis of age, sex and social standing, certain methods of harvest, types of harvest and harvest from a particular area.

iv. Resource use and conservation integrated: No distinction is usually made between resources/habitats for conservation, and those for use; there is usually ; no concept of "wilderness". The only exception would be sacred landscape/landscapes/habitats/species which are off bounds for use. In all other cases, including agricultural fields, forests, wetlands, and pastures, both conservation and usage are integrated.

v. Use of high level of biodiversity: A high diversity on biological resources and resource use systems marks every part of the life cycle of local communities. Every species is used in many ways, several different species are used, and within species, genetic diversity is maximised.

vi. Relative self-sufficiency: Most (though often by no means all) essential needs of the community come from local resources; this includes food, shelter, clothing, household and agricultural implements, products for ritual use, etc.

vii. Dynamic/innovative (gradual): There is considerable dynamism and innovation in LCS, especially in the forms of resource use; this is best seen, for instance, in agriculture, where farmers' ingenuity in the use of habitats and species is remarkable. Typically, though, change is gradual in LCS, making them appear to be static.

viii Egalitarian: Many local communities, especially tribal, are marked by a high degree of egalitarianism in resource access and use, with everyone being assured of at least the basic needs. However, this does not necessarily hold in all communities, especially non-tribal ones (see below).

1.2 Weakness/Negative points

i. Inflexibility to sudden/large-scale changes: Though there is dynamism with LCS, there is generally an inability to cope with sudden on large-scale changes, for instance those introduced by the sudden entry of the outside market, or of government take-over of common lands. Local institutional structures, rules of resource use restraint, and so on, tend to break down in the face of such changes.

ii. Fragility due to complex web of linkages: Since all parts of the LCS are intricately linked, much like a rainforest, a change in one part can have a chain effect on others. The introduction of market mechanisms, for instance, or that of government-controlled institutions, will effect local traditional institutions, which in turn will effect the way resources are managed/used.

iii. Ignorance of certain elements of biodiversity: While a large range of biodiversity is used, there are also gaps in local knowledge; these relate especially to species which are not

in use or not in some way impinging on the lives of the villagers, such as small fauna or micro-organisms. Apart from agricultural pests that needed to be countered and insects of significant value (honey-bee etc.), there is little or no documentation of the plethora of insects and micro-organisms that are an equally critical part of biodiversity.

iv. Tendency, at times, to over-use: Resource use restraints are not always honoured, or do not exist at all, for certain elements of biodiversity. This could be true, for instance, of items used for ritual purposes. In Northeast India, for instance there is an overhunt of several species of hornbills as many tribal communities value the 'horned' beak of these species for their alleged medicinal property as well as use it as a part of their traditional headgear.

v. Socio-economic deprivation: In many local communities, especially non-tribal caste-based ones, considerable inequalities exist in access to resources, and in the ability to make decisions regarding the management and use of resources. Lower castes or economic classes, or women, may face deprivation in resource access and use.

Despite the above negative characteristics, overall, LCS display a high degree of sustainability and equity with regard to the use and management of biological resources.

2. Context of LCS Resource Use

LCS resource use occur within three larger contextual levels:

2.1 Belief Systems

Two kinds of belief systems form the context of resource uses: localised folk or tribal religious (e.g. animism), and widespread "classical" religions (in sociological literature, the "little" and "great" traditions). Complex ritual and cultural practices are codified within these belief systems.

Religions, dominant or tribal, have traditionally envisaged man as a part or as a subordinate of nature and in equal standing with all of nature's other living beings. Most world religions through various writings, exhortation and preachings have provided a system of moral guidelines towards environmental preservation and conservation. The Hindu religious scriptures professed the ethics of inter-connectedness, emphasizing on the total community of life in nature and the oneness of nature with the human race in order to preserve the biosphere and to enhance the evolution of all species and societies (Dwivedi, 1994). Hindu theology very prominently alludes to conservation of species by espousing a belief in the incarnation of god in various elements in nature. The ethic of non-violence propagated by Buddhism and Jainism entailed compassion towards all living creatures and a ban on killing animals, as well as protecting trees. Islamic tenets strongly conform to the belief that "Allah is Unity", the implications of which are held to reflect the man-nature unity in its several parameters. Serving human beings is only the part function of natural elements and thus not the only function. Sikhism too, in the Guru Sahib, proclaims the glory of god in nature and environment.

Spirits, the most predominant aspect of tribal religion, have been defined as "systems of religious beliefs and practices which regulate the relations of social organisation with that of the habitat and environment" (Vidyarthi, 1963). It was this spirit, that reside in their 'sacred geography', an integral part of their 'sacred complex'. The inexplicable acts of nature were inordinately attributed to the supernatural. Thus, in their cosmovision, nature is a seen as integral part of the sacred realm.

These precepts and injunctions of most religions thus provided a strong foundation for nature worship. Animals, plants and natural landscapes were accorded divinity either as abodes of or as incarnates of spirits. Once they were attributed sacredness they were neither harmed nor killed out of reverence or out of fear of incurring the wrath of the deities or spirits. These religious beliefs provided a framework within which protection were accorded to either patches of landscape or single species was legitimized.

Sacred groves, sacred ponds, sacred patches of grasslands, sacred animals and others are examples of traditions of conservation backed by religious sanctions. The preservation of biological resources by such traditions is of immense significance. Sacred groves are essentially tracts of virgin forests, preserved since time immemorial around sacred or temple structures, or have been set aside as abodes of the local deities or spirits. Thus there exists in the lexicon of traditional communities a plethora of forest deities known as Van devtas.

In terms of conservation they are analogues to the protected areas of today, except that it was a community based system of conservation, where in the absence of formal laws social fencing was effected by religious codes and sanctions. Transgression of sacredness or violation of sanctuaries were held in check by religious threats and were dealt with through community evolved modes of punishments. Found in various parts of India, these are variously known as Sarna (Bihar), Oraon (Rajasthan), Deorais (Maharashtra), Kavus (Kerals), and other terms.

According to M.D.Vartak, one of the pioneers of studies of the Deorais, these groves are important today because these are the best of forests that might have flourished in the region, housing rare and endangered plant species, many of which may have disappeared from the region outside the groves. They also serve as a community's medicine chest (Gadgil and Vartak, 1976).

In the Uttara Kannada region, the only remaining natural stands of *Dipterocarpus* and a large patch of *Mystica indica* persist in a sacred grove of goddess Karikannama (Gadgil, 1987a). The ambience of the natural climax forests allows for the process of speciation to continue; a new species of a genus of leguminous climber *Kunstleria keralensis* was found in a sacred grove on the coastal areas of Kerals (Gadgil, 1987b)

It is essential to note that in some cases, the predominant type of trees preserved in the sacred groves were of crucial importance to the particular ecosystem; for example, the Khejiri (*Prosopis cineraria*) trees preserved in the Oraons of western Rajasthan. Besides, the, Oraons accounting for 8 to 9% of the desert area are of considerable significance to a desert ecosystem. Similarly the groves found in Kodagu district of

Karnataka are a part of an intricate ecosystem of paddy wetland, grasslands and groves. The Kuthuvals, as the sacred groves are known, in the Madurai district are strategically positioned to act as wind shelters (Mitra and Pal, 1994).

Apart from sacred groves, certain fallow lands are also set aside for protection. These are exemplified by the Aands found in some parts in Rajasthan. Several waterbodies (village tanks, ponds, rivers and others) were attributed sacred qualities and were protected against overfishing or overextraction of any other resource available. Some of them existed within the bounds of sacred groves. Preserving them in their pristine condition, they allowed for the underwater lifeforms, even at the micro-level, to flourish undisturbed. The only surviving population of *Trionyx nigricans*, the freshwater turtle, is found in Bangladesh, in a sacred pond dedicated to a Muslim saint (Gadgil, 1995).

Certain species of plants and animals have been preserved on account of sacred qualities attributed to them by mythical tales or by identifying them with gods of the Hindu pantheon. The most common example is that of *Ficus religiosa*. Considered sacred in most parts of the country, these trees in the Uttara Kannada region served as a keystone species that support a whole range of insects, birds, primates and other organisms (Gadgil, 1987b). Identified with Lord Hanuman, Rhesus macaques abound in the Indian landscape. The religion of the Bishnoi community in Punjab has protected the blackbuck, an endemic species. The blackbuck is considered to be an incarnation of lord Shiva, and thus symbolises prosperity for them.

Plants and animals worshipped as totems symbolise the kinship ties of humans and nature. These totems, sacred to specific clans, are accorded full protection. This practice is mainly prevalent among the tribal populations and especially among those who undertake hunting and gathering in some form or the other. The practice of certain taboos with regard to resource extraction could be interpreted as conservation practices cast in religious idioms, as most of them allowed for regeneration and perpetuation of species. Among the Onges the religious regard for certain wild edible roots prevents them from uprooting the tubers, so that when they collect these roots from the scrub jungle, they ensure that they replant the top of the root left connected to the vine (Cipriani, 1996). Certain taboos enjoin protection to certain 'critical life history stages'. The Phasephardis, a endogamus group found in the semi-arid regions of western ghats, never harm pregnant does or fawns of antelopes or deer. The females of most species are less hunted as they are the progenitors. The taboos against hunting and fishing during particular seasons more often than not coincide with the breeding and spawning seasons. Aborting the conception of life was condemned by most religious injunctions. Thus, egrets, storks, herons, pelicans, ibises and cormorants, considered fair game in non-breeding seasons, were never targeted at their colonial nesting grounds (Heywood, 1995).

In contrast to these beliefs, there have been notions that have equally effectively degraded nature. The settled cultivators used religious idioms to justify the agrarian takeover of the forests for agriculture. Large patches of forests were burnt as an offering to the divine forces. This practice is still prevalent among some indigenous communities in Gujarat and Rajasthan. An instance of such a kind is mentioned in the Mahabharata. Arjun and lord Krishna, symbolising the custodians of the predominant agricultural communities, are known to have set fire to the entire Khandava forest at the behest of the fire god, who came in the guise of a brahman. The adivasis (tribals) living in the forests were termed as 'Rakhas', and anguishing them was symbolic of the victory of the good over the evil (Gadil and Guha, 1992). Animal sacrifice has been a dominant ritualistic practice among several communities.

2.2 Socio-political-economic Systems

In addition to the belief systems which condition the relations between humans and biodiversity, the social, political, and economic relations between humans themselves influence or control resource use. Thus the local community and wider institutional structures form the second context of resource uses. These include structures for the management of common property resources, customary tenure rights, customary laws/rules regarding resources, localised economics (such as village market or 'haat'), and so on. These structures exist at various levels, from a group of users of a particular resource, to the village as a whole, to a cluster of villages or an entire region and more widely to the nation and the globe. These structures enforce the actual rules for resource use, through social sanction against misuse, reward for compliance etc.

Traditional community based management of common property resources typically imposed restrictions on the indiscriminate use of resources and ensures some form of distribution of benefits and livelihood opportunities. The self managed village commons (water bodies, forests, pastures etc.) were often equitably managed, though by no means always. In community ventures for fishing among some of the fisherfolk of coastal Andhra Pradesh, irrespective of an individual's catch, the total harvest was divided in accordance to the need of each family. A similar instance has been documented by Haimendorf among the Bhotiyas of Himachal Pradesh (Haimendorf, 1985). The community-owned pasture lands to feed yak herds were managed in such a fashion that all families got equal opportunities to graze their herds on both good and bad pasture lands.

The traditional management system entailed 'resource partitioning', and diversification of resource use either in common areas or by territorial isolation. This checked overuse and intergroup competition. All the three nomadic groups, the Phasephardis, the Nandiwallas and Vaidu, that occupy the semi-arid regions of Maharashtra, indulge in hunting but each group has its own specialised techniques, and specific targets, and the extent to which they are dependent on hunting also differs. Phasephardis snare deer, blackbuck, antelope and game birds. The Vaidus trap small carnivores and other small, mammals and the third, the Nandivallas, hunt monitor lizards, wild pigs and porcupines with the help of dogs. Only the Phasephardis are specialist hunters, while the other two combined hunting with other occupations such as sooth saying and trade (Malhotra, Khomne and Gadgil, 1983).

Given the efficacy to resource management in some societies it may be alluded that these social forms may have evolved in response to certain ecological imperatives and later crystallized into organisational structures. In fact in some cases as among the Jenukurubas of Karnataka, the territorial division Jama, forms a basis for social groupings.

Both in terms of property ownership and social relations, the inter and intra-social relations directly or indirectly bolster conservation practices. In communities that were cohesive and had strong kinship leanings, the group interest takes precedence over individual interests. Thus, according to Alcorn (1994), "Traditional tenure is a partnership between individuals and the broader community to maintain the community's resource base". In the same vein, it can be hypothesized that the joint family system dominant in the Hindu agricultural societies was maintained to prevent the fragmentation of holdings into unviable units. Communal labour and cooperative ventures were an integral part of the traditional societies. Gadgil and Guha (1992) have asserted that the traditional hereditary occupational division in the caste system affects resource use by judicious partitioning of resource. However, it remains a contentious issue whether the ecological gains offset the social inequalities generated by this system, or whether in the long run the inequalities themselves could undermine sustainability.

Similarly, in the past, the economic valuation of trees rested on the intermediate product (Proffenberger and McGean, 1996) it provided, as against the commercial value of timber only, as done presently. The dependence on non-timber forest produce (NTFP) was for subsistence and not for trade. Thus their extraction and use was measured and regulated in accordance with the traditional tenurial system, both within and across defined territories. For example the Cholanaikans of Karnataka, have well defined principles allowing them to collect NTFP for self-consumption from within their respective territories, otherwise known as 'Chenam'. However there are rigid norms regarding such collection beyond one's own territory (Misra, 1980).

The political processes involved in the social enforcement of these measures/ practices of conservation remain a critical aspect of this system. The headmen of the 'Jamas' of the Jenukurubas ensure that there is no trespassing of territorial bounds; religious heads mediate cases involving the transgression of sacredness and the chiefs in the shifting cultivator's community regulate the appropriate allotment of land. There exists a structure that monitors the community evolved and community-sanctioned code of conduct, the violation of which merits penalties, including expulsion from the community. Quite aptly then writing about resource management in indigenous communities, Alcorn (1994) states: "Rules for using and protecting biodiversity are commonly backed by threat of religious sanction and social ostracism, but on a more pragmatic level, enforcement is often carried out by resource "bosses". appointed committees, and rotating forest-reef guards who regularly monitor resources and extractive activities".

2.3 Knowledge Systems:

Corresponding to the above distinction between local and larger belief systems, there are two kinds of knowledge systems which form the third context of resource uses: localised practical knowledge (e.g.tribal medicine), and widespread "classical" knowledge (e.g.Ayurveda). In the case of both, there is a high degree of knowledge of biodiversity. These knowledge systems are of profound significance to conservation as both these systems result in practices such as the conservation of sacred spaces and sacred species, and in resource uses (including agriculture) which are given ritual meaning. These knowledge systems maybe codified or non-codified, both of which are in a state of dynamic interaction and are mutually influential. In the discussions above and those that follow it becomes amply clear that most traditional practices and belief systems, especially in agriculture and medicine, emanate from or are contextualised in these knowledge systems.

3. Implications for Biodiversity

The impacts of local community resource uses on biodiversity are mixed in any given situation; they could help to maintain or conserve it, enhance it, or reduce it. An analysis of the overall impact is complicated by the fact that the same resource use might have different impacts on different elements or levels of biodiversity; for instance, agricultural practices might enhance diversity at the genetic level (e.g. by developing several landraces of a particular species), reduce it at the species level (e.g. by clearing forests for making fields), and enhance it at the ecosystem level (e.g. by creating a mosaic of micro-ecosystems). Hence we will now broadly analyse the implications that local community practices in forestry, agriculture, animal husbandry, ethnomedicine and fisheries, have had on biodiversity.

Forestry: The diverse types of forests in India are perhaps the richest assemblage of biodiversity. The dependence of the traditional communities on this forests resource is enormous, directly contributing to the survival of millions of tribal and rural communities. Being of such critical socio-economic importance, these communities tended to exercise self-restraint in the use of forest resources, thus conserving both the constituent biodiversity of forests as well as the diverse forest types as a whole. Besides, these communities are also vast repositories of forest related biodiversity knowledge. For instance hunting and gathering societies are said to have extensive knowledge of the immediate resources as well as a profound understanding of the local ecological inter-relations. Consequently their practices of prudence (as delineated by Gadgil and Guha, 1992) involving a qualitative and quantitative control on over-exploitation, seemed geared towards maintaining an ecological equilibrium. A simple instance of the Irula's mode of hunting clearly exemplifies this: "Irulas have no formal methods of assessing the sustainability of their uses of wild species, but their sensitivity to changes in habitat, changes in season and knowledge of the biology of these species allows them to be effective exploiters. They will not hunt depleted areas for the simple fact that it is not 'energy effective'" (Whitaker and Andrew, 1994).

Even among the settled cultivators, whose fields were removed from forests, customary regulation of people's access to land and forest produce checked the indiscriminate use of these resources. These primarily included a quantitative restriction on the amount harvested from the community owned village woodlots. Besides this, the extractive methods followed the same stipulation of prudent use, as delineated earlier. It is interesting to note that some communities restricted the lopping of branches during the rainy season as it inhibited growth (Gadgil 1992).

Though traditionally Indians have been great 'foresters', not all practices have been conducive to forest conservation. The development of agriculture and the spread of the agrarian society in the Deccan peninsula between 6000 to 1000 B.C. is known to have led to gradual deforestation in parts of Deccan. Forests have met with the same fate, wherever there has been an agrarian expansion (Gadgil and Guha, 1992). Shifting cultivation in many places is known to have destroyed the primary composition of natural forests, though, practiced traditionally, it allowed for regeneration of secondary forest cover. The nomadic pastoralists in places are known to have contributed to the gradual expansion of arid regions by allowing for overgrazing of pastures, though the assumption that all grazing is detrimental is invalid --- the areas grazed by Gaddis in the alpine meadow of the Himalayan landscape are known to have a high plant species diversity (Saberwal, 1994). The adverse effect of certain religious practices has already been mentioned. Although these and other traditional activities did bear down on the forests, the magnitude and impact were perhaps far less as compared to the modern means of forest use.

Agriculture: The Indian subcontinent is known as the Hindustan Center of Origin of Crops and Plant Diversity, so termed by Russian scientist N.I.Vavilov. At least 166 species of crops are known to have the total crop species in the world) and 320 species of wild relatives of crops are known to have originated here. Not only is the inter-species diversity so large, but the dimensions of intra-species diversity are equally impressive. For instance until the recent past at least 50,000 varieties of rice were grown in India, according to officials of the Central Rice Research Institute.

The crop diversity of such immense magnitude, is accredited to the ingenuity and skills of the traditional farmers. Operating within limited possibilities, these farmers with an aim to optimize production, have evolved sophisticated and complex agricultural systems and practices.

The diverse agro-ecosystems of the agrarian societies, included diversity over both time and space within the farm, and included practices like multiple cropping and intercropping of a mix of species variety, crop rotation, maintaining fallow periods, incorporating wild and weedy relatives of crops, experimental and deliberate selection for a variety of traits and also interspersing of trees and other non-crop species. The baranaja, an intercropping pattern practiced by farmers of Tehri Garhwal region of the Uttar Pradesh Himalayan foothills, involves the use of about 12 types of crops grown in a single field, each with a different growing cycle and nutrient requirement, and all combining into a highly productive sustainable system (Jardhari and Kothari, 1996). Documenting the varietal diversity of rice, scientists at the IARI are known to have collected several thousands of cultivars from the region between 1800 to 2700 meters in Meghalaya and Arunachal Pradesh (IIPA, 1994). Shifting cultivation as practiced in the past has been known to generate exceptional crop diversity. Predominantly practiced in the North-East, the shifting cultivators are known to use a mixture of a minimum of 4-5 crops, with a maximum of upto 35 crops.

So far as the technological inputs were concerned, the farmers were more or less self reliant, with most of inputs being drawn from their own farmlands and surrounds, entailing a recycling of the crop plant and preservation of natural nutrient cycles (Pereira 1993). 'Vrkshayurveda', the ancient plant science, dealing with all aspects of agriculture, embodies the basic tenets of this form of self-reliant and integrated system (Vijayalakshmi, 1994).

Apart from directly affecting crop diversity, traditional agricultural farms also supported an array of life forms: "weeds" and other plant species (either on the hedges or in the fields), innumerable species of micro-organisms, fishes, insects, birds and some mammals. Settled farming systems, constituting a part of the micro-ecological region, entailed a 'simultaneous preservation of diverse ecological regions' such as pastures and wastelands and other organisms therein, which may inadvertently affect agriculture (Pereira,1993).

Thus one can conclude that the maintenance and preservation of indigenous land races and farming practices, characterising the traditional systems, is the quintessence of sustained 'in-situ' conservation of biodiversity in a "human-made" landscape.

Animal Husbandry: Predating settled cultivation, domestica- tion of animals was an indispensable aspect of the local community economy and formed a crucial part of their technological inventory. Animals, primarily livestock, were kept and bred either for their individual traits or for them multipurpose value. Among the Rabaris of Rajasthan, the Gaddis of Himachal and dozens of other pastoral communities, livestock breeding forms a dominant part of the traditional culture and economy.

In the absence of any external inputs, traditional communities selected and domesticated breeds, that were best adapted to their micro-habitats, bearing an ability to resist the extreme and difficult environmental conditions. The varietal diversity is clearly attributed to such indigenous methods of selection and breeding. As a consequence, we find diverse breeds existing under different environmental conditions. The double humped camel, a distinct species, is found in the cold deserts of Ladakh, while some breeds of the single humped camel, like the Bikaneri breeds and Jaisalmeri breeds are found in the hot deserts of Rajasthan and Gujarat. Given the varying ecological imperatives, compounded by the necessity for these animals, the production goals were defined by 'social needs' rather than by 'economic productivity' alone. Ghotage and Ramdas assert that the Deoni cow of Ma-

harashtra, the Pungamur cow of Chittor, the Osmanabadi goat and the Deccani sheep, have all originated as best responses to their 'agri-ecozone', effectively meeting the production goals generated by 'social needs' (Ghotage and Ramdas, 1997).

Thus, the local communities (farmers, pastoralists and others) over the years have bred and maintained a tremendous diversity of livestock, poultry, and pet animals. In India, this genetic diversity includes 26 breeds of cattle, 8 breeds of buffaloes, 40 breeds of sheep, 20 breeds of goats, 8 breeds of buffaloes, 40 breeds of sheep, 20 breeds of goats, 8 breeds of camels, 6 breeds of horses and about 18 breeds of poultry (Sahai, 1993). The pastoralist, tribes and semi-pastoralist tribes of Northern Himalayas and the Northeast have domesticated breeds of yaks and mithuns. There exists a large a number of indigenous breeds of dogs, as well.

Ethnomedicine: India is known to have on of the richest ethnomedicine traditions in the world, with the largest use of local biodiversity for medicine (Shankar, 1994). The indigenous and traditional health care system that serves more than 70% of the population is based on the rich diversity of medicinal plants and associated knowledge. Most of the Materia-Medica of traditional communities dates to the Vedas. A Rig vedic hymn is known to mention 107 plant based cures for diseases. According to the medical treatise, Charak Samhita, all plants have a potential medicinal value. This is amply reelected in a myth, according to which, Brahma proclaimed sage Jivaka a great physician when, after 11 years of wandering, Jiaka expressed his inability to find a plant without medicinal qualities (Vijayalakshmi and Shyam Sunder, 1993).

Over 7500 species of plants have been used in Indian medical traditions. In the classical medical systems of Ayurveda, Unani and Siddha, over 2700 documented species of plants are used (Shankar, 1997). In terms of numbers something like 1800 plants are documented in various Ayurvedic tenets. There are approximately 400 in Unani and about 500 in the Siddha system. Similarly, there exist equally impressive localized knowledge and practices of plant based ethnomedicine. Practically every tribe or forest-based community documented is known to possess knowledge of a number of medicinal plants and their uses. Among the Gaddis of western Himachal Pradesh, at least 50 species of plants are used for curing different ailments, and are well-known to the local medicine-men, the Vedus (Lal, Vats, Singh and Gupta, 1994). The Madav Koli tribals of Western Ghats use 202 plant speoies for medicine and 109 for veterinary purposes (Shankar, 1994).

The traditional systems are not only known for the diversity of plants are administered. Each community within its cultural context makes an independent appraisal of its local resources and develops its own set of classification. For example the plant *Centella asiatica*, known both to the classical and folk traditions, is put to 33 different uses across different communities in South India (Shankar, 1994)

Fisheries: India has an approximately 8000 km long coastline, with a high diversity of marine biological resources supply about 13% of annual protein to the Indian population. This coast has been the lifeline of the large number of traditional fishing communities, who at present also control more than 50% of production of fish in the country. Fishery, both marine and freshwater, is an age-old tradition. The practices and technologies of these communities were geared towards a sustainable harvest and consequently its regeneration and conservation. According to Thomas Kocherry (1994) prior to the dawn of industrial fisheries development in the country in the middle of the sixties, the fishing communities in India with their traditional knowledge of the sea and its environment harvested the resources on a moderate scale. In this process, the fisherfolk were their own masters. The craft and gear deployed were the most appropriate to suit the environment and these were developed by the fisherfolk over centuries of experience and with skills learnt from parent to child. The catamarans, the small canoes, big canoes and different gears were all results of traditional innovations to meet the dynamics of tropical water, fish behaviour and changes in seasons. the fishermen almost never overfished the resources which they considered as their common property. Every fisherwoman and fisherman sees the sea as something very fundamental, as "mother sea". These technologies, unlike modern trawlers and purser-sieners, did not destroy marine ecology, nor harvest seedling by raking up the seabed.

Raychaudhuri (1980) describes how the fishermen of Jambudip (India) co-ordinate the complex variables of seabed topography seawater conditions and sequences of tide with fish behaviour, to ensure both successful catches and their safety at sea. In their selection of the appropriate seabed over which to conduct their activities, these fishermen are like the agriculturists who tend to classify the soil according to its relative fertility and the types of crops grown. The 'soil' of the seabed is classified by its capacity to support the net poles and by its fertility regarding the types and quantity of fish in the waters above it. Such practices have thus helped to conserve a considerable amount of marine diversity.

4. Erosion of LCS

In India, as in the rest of the world, local community systems have been severely eroded by a variety of factors, with adverse effects on biodiversity.

4.1 Factors Eroding LCS

i. Displacement/ devaluation of belief systems: Local communities have increasingly been made to believe that their own systems of belief (including religious and spiritual) are an anachronism in the modern age, and that they must accept modern 'scientific' systems. The trend towards "rationalisation" is a major negative influence on LCS, given the intricate linkages of resource use with culture and religion.

ii. Displacement/devaluation of knowledge systems: Simultaneous to the above, the introduction of the modern 'scientific' knowledge system erodes traditional systems, with the argument that the latter are not 'scientific' or 'rational'. This is the case, for instance, with local knowledge and practices of medicinal plant use, or of other non-timber forest produce, or of conservation; these are devalued and replaced by the modern allopathic system, and state-sponsored practices of

NTFP use and conservation respectively. In more recent times, local knowledge has even been appropriated by the state and private sectors in the form of intellectual property rights (such as patents) on products and processes derived from LCS. This is especially seen in the case of ethnomedicinal practices. Government - promoted healthcare measures almost always opt for the western medicine or allopathic systems, bringing about a significant devaluation of the local medical practices.

iii. Institutional take-over of resources by state/private sector: Common property resources like forests and wetlands have been taken over by the State or by private corporations, resulting in the alienation of local people and the breakdown of traditional management systems. Perhaps the largest such take-overs took place during the British colonial period, when a substantial part of the forests were declared protected or reserved and the Forest Department given control, and when village tanks and other waterbodies were brought under Irrigation and other government departments. Through this and other processes, including the nationalisation of political life, local social, political, and economic institutions have been largely eroded and replaced or infiltrated by institutions sponsored by the state or by private corporations. The Panchayats are infiltrated by political parties, local 'haats' have been sucked into the urban market system, common property management structures have been replaced by government departments, and so on.

iv. Other factors of erosion include the over-exploitation of resources by state or private sector; the diversion of resources from the rural to the urban sector; the physical displacement of communities by development projects (estimated by some people to be to the order of about 25 million in the last few decades); and factors internal to the community such as rise in population (of humans and livestock), inequities, and changes in lifestyle and aspirations.

4.2 Impacts of Erosion

The erosion of LCS directly leads to negative consequences on biodiversity, as well-tried systems of management and use and conservation break down. This can be especially seen in the case of common property resources; instead of a tightly regulated system of use by the community the system tends towards free-for-all use, turning the resource into an open property one. Forests, wetlands, pastures, all have suffered serious consequences. In the North-east Indian states of Nagaland and Arunachal, tribals own the vast majority of forests in a variety of communal or private property systems. Once well protected by these systems, the forests are now being sold off at alarming rates to outside timber and plywood markets, a process aided by corrupt and ecologically insensitive governments and the lack of alterative income generating livelihood sources for the villagers.

In the face of burgeoning population and expanding economy, local communities have subtly reoriented their worldview. Forced to adopt new technologies, which are external to their economic system, they are gradually moving away from technological self sufficiency to complete dependency. Incentives and systems of innovation, e.g. in agriculture, disappear with the increasing dependence on government agencies. Farmers addicted to chemical and technological inputs have opted for cash crops and emphasized on short-term productivity rather than variety and sustainability. The traditional fisherfolk communities have gone in for motorization of traditional crafts. This led to ring seining and mini-trawling both of which have had destructive impacts (Kocherry, 1994). Besides, according to a generalization drawn by the Global Biodiversity Assessment (Heywood, 1995), it is suggested that in the more over-populated regions, many of the fisherfolk are landless peasants who have taken to fishing as the resource of last resort. As recent entrants, they are not bound by tradition nor have significant experience of the aquatic environment, and are motivated by the need to survive. Many cannot afford to eat the fish they catch and all must be sold in order to purchase staple food.

Without secure tenure, rural communities can only afford to consider their short term interests. Without the security of realizing sustainable revenues, or returns from their investments, they are compelled to exploit resources for maximum immediate gains, regardless of the future consequences for themselves, the resource base or biodiversity (Heywood, 1995). Since they are no longer under control to ensure sustenance, instead of using resources for subsistence the people prefer to feed market demands and receive the benefits in financial returns rather than sustenance. (Kothari, 1994). Consequently, traditional systems have suffered a great setback due to commercialisation and industrialisation of agriculture, forestry and fisheries. This has led to unprecedented biotic impoverishment, by signaling the end of varietal diversity nurtured by traditional systems.

Dominance of intensive cereal production has led to significant reduction in the number of species, and of production systems. Large scale chemical based intensive farming has replaced the small scale organic farming. In the three decades of Green Revolution in India, there has been an enormous loss of biodiversity. A handful of High Yielding Variety seeds (HYVs) are now grown over 70% of rice land and 90% of wheat land in India; in the Godavari district of Andhra Pradesh an estimated 95% or rice varieties have been lost, according to Central Rice Research Institute scientists (Kothari, 1997). Possibly thousand of varieties of rice and other crops are no longer in use in farmers field. The past three decades of modern livestock breeding has taken a heavy toll on the indigenous breeds; an estimated 50% of indigenous goat breeds, 20% of indigenous cattle breeds, 30% of indigenous sheep breeds are today threatened (Balain, 1992). The greatest decline in the local livestock variety has been found in poultry. Almost 80% of the total population in use is now exotic.

Mechanised and industrial fisheries, have alienated the fisherfolk by their policies of centralised marketing systems located in the fishing ports (Heywood, 1995). Trawlerization and purse seining, has encroached upon the fish catch of the artisanal sector and posed a direct threat to traditional sector. The acquaculture projects in coastal parts of many states in India

have brought about large-scale displacement of fishing communities by enclosing of beaches by pumps and powerhouses.

Developmental programmes and conservation policies that essentially alienate the local population from their habitat have entailed mass-scale dislocation of traditional communities from their ancestral homes. Megapower projects, construction of power lines or roads for transport or communication have not only distorted the natural habitats but have disrupted the traditional life styles, that has resulted in a major loss in biodiversity. Most of the time these developmental programmes have been promoted at the expense of the survival needs of the traditional communities. For example, the construction of the Indira Gandhi Canal disrupted nomadic routes and allowed for outside settlers to take over. Pastures and scrublands were replaced by irrigated agricultural fields (D'Souza, Mukhopadhay and Kothari 1994).

Habitats and species once protected for their sacred qualities, are no longer revered, and become over-exploited. Many of the sacred groves in the country have disappeared. In Maharashtra, the cause of their disappearance is attributed to the decline in faith, and breakdown of community structure following greater individualisation and urban penetration. In Pondicherry, the sacred groves are now akin to 'unregulated supply forests' for firewood.

Government efforts to conserve biological resources have resulted in a multitude of programmes comprising networks of national parks and sanctuaries, reserved and protected forests, biosphere reserves and other such in-situ conservation units. Important as these have been in stemming ecological destruction, they have remained inadequate and in some cases, have proved to be counter productive and self-defeating. Most of these programmes strictly prohibit or regulate the productive activities of the local dependent population within the protected area boundaries. Several national parks and sanctuaries in India, home to tribal and non-tribal peasant population whose only stable resources are the forests, are now witnessing deliberate habitat destruction or incitement to destruction by wood poachers and by local communities who have been denied these resources. forests fires and other ecological damage have been set off by villagers in Binsar Sanctuary (U.P), Nagarhole National Park (Karnataka), Bharatpur National Park (Rajasthan), and other protected areas, all a product of hostility harboured by local communities whose customary rights have been taken away without any provision of acceptable alternatives, and whose traditional knowledge and practices have been ignored or devalued (Kothari et.al., 1995).

5. Reviving Local Community Systems

In the face of the above erosion, a number of efforts are being made to revive LCS, either in the traditional form, or in new innovative forms. Examples can be cited from all over India.

Plagued by the problems of deforestation and poor resource availability, many communities have taken to regenerating and protecting natural forests of their own initiatives. In eastern India more than 10,000 communities oversee the forests by operationalizing community based management. Made effective by local leaders, indigenous knowledge systems and 'consensual desition-making', they have stabilized and regenerated their forests (Proffenberger and McGean, 1996). In the Alwar district of Rajasthan, villagers with NGO help have regenerated forests and converted water-deficient area into a water-surplus one, using predominantly traditional knowledge of hydrology and water-harvesting structures; at least one forest (or 1200 ha.) has been declared a "public sanctuary" for wildlife (Singh 1997).

The Beej Bachao Andolan (BBA), or Save the Seed Movement, initiated by the workers of the Chipko movement in the Tehri Garhwal region of the Himalaya, has succeeded in restoring the indigenous crop diversity by reviving the practice of baranajah, which had been abandoned at the advent of Green Revolution. At the time the BBA began, the Hemavalghati region of Tehri Garhwal had only a handful of indigenous rice varieties left in cultivation and most of the baranajah fields had been converted to new soyabean. Today some 126 varieties of rice, 8 of wheat, 40 of finger millet 6 of barnyard millet, 110 of kidney beans, 7 of horsegram, 8 of traditional soyabean, and 10 of French bean are being grown. The aim of BBA is "to revive and maintain the prosperity represented by traditional agriculture in which humans, other animals, and nature can live in harmony" (Jardhari and Kothari 1996).

Navdanya, a people's movement conservation, has initiated efforts to extend conservation beyond the ex-situ gene banks and has conserved genetic resources linked to agricultural crop diversity, in the Garwhal Himalaya, the Deccan, and the Western Ghats. In tune with the ecosystem diversity, Navdanya has initiated, a 'farmer based seed supply system' by promoting in-situ conservation based on the traditional knowledge system existing in the area. These efforts and marginal farmers (Ramprasad 1994). The work of Academy of Development Science in the Konkanregion of Maharashtra, has enabled the tribals to make efficient use of their scarce resources. Effective watershed management and agro-biodiversity revival has made possible grain banks being run in 21 villages. They are jointly involved in preserving the local rice varieties, and reviving their indigenous medicinal system that entail the use of 400 species of medicinal plants (Richaria and Govindswami, 1990).

Herbal medicinal practices have been reinstituted in several tribal areas of Udaipur district. Revivals of sacred groves has taken place in Maharastra, Bihar and Rajasthan. The villagers of Raghunathpur in Ranchi district have saved their 14-ha sacred grove from being axed by landlords. The struggles of the tribals of Keadchalam village in south Bihar prevented the National Thermal Power Corporation from clearing their sarnas. In the North-east, these groves are being revived as 'safety forests' (Mitra and Pal, 1994). In some parts in India efforts are being made at participatory documentation of biodiversity, known to local communities, in the form of Community Biodiversity Register (CBR) (See box).

Community Register For Documenting Local Community Uses Of Biological Diversity

Local communities have for centuries been using and conserving the biological resources found around them. In the process, they have developed knowledge, skills, and techniques (K/S/T) related to these biological resources. At a time when the world is looking for sustainable forms of resource use, these systems have great relevance. Unfortunately, in recent years, they have been rapidly eroded by the impact of modernisation. Also, significant elements of these knowledge systems have, over the years, been appropriated by commercial interests, with little benefits flowing back to local communities. These issues have become a part of global debates on biodiversity and indigenous communities.

Traditional knowledge systems have usually been orally transmitted, and are not recorded. While this may have sufficed in earlier times, there appears to be a need to document these traditions in some form. In this respect, Indian groups and networks involved in environment , health, agriculture, and traditional science and technology, have taken an interesting new initiative. They have prepared a draft format called the Community Biodiversity Register, which is aimed at documenting, at the village level, community K/S/T related to biological resources. The aims are multiple:

a) revitalizing traditional knowledge/skills/techniques; b) protecting traditional/customary rights of local communities by providing proof of resource uses; c) assessing the economic value of community usage and conservation practices; d) priority setting for conserving those resources which are under threat; e) recognizing outstanding K/S/T for rewards; f) sharing the local knowledge with other communities in India for mutual benefit; and g) protecting local K/S/T from exploitation by commercial users (including protection against imposition of intellectual property rights by outsiders), by providing proof of prior use, and giving the possibility of enforcing prior informed consent of the concerned community. Presently, with the help of community-based organisations, this draft format is being field tested in different villages all over the country. Detailed information on the relationship of villagers with their biological surrounds is bring recorded, both in text and visual form. This exploratory exercise will provide inputs for suitably revising the format, so as to make it as widely applicable and comprehensive as possible. The Indian Ministry of Environment and Forests has been asked to assist in spreading it widely, including by publishing the register format in regional languages, and providing the resulting documents a legal status so that it can be used in disputes over intellectual property rights and piracy of knowledge.

Some common elements of a strategy for such revival and perpetuation can be distilled from these examples. These are presented below.

6. Revival and Perpetuation of LCS

6.1 Reviving community rights to resources:

Given that one major reason for the loss of LCS is the alienation from common property resources which they previously managed, it is obvious that revival of community controls over these resources would help to revive LCS. Some steps towards this are being taken in the Joint Forest Management areas by the government; in many other areas, communities themselves have taken back control over forests and waterways. However, serious policy and legal changes are needed to make this devolution of controls possible all over the country. It must also be cautioned, at the same time, that such devolution is by itself not a panacea, since local communities in many places do not any longer have the capacity to manage common property resources; such capacity will have to be rebuilt, and perhaps the more appropriate model for the moment is forms of joint control which provide communities and government agencies equal partnerships in decision-making and management.

6.2 Recreating community control institutions:

Substantial elements of traditional community institutions, such as the Panchayat, can be profitably employed for conservation and sustainable use; the potential of the 73rd Constitutional Amendment on Panchayats, and its extension to tribal areas, needs to be deeply explored. However, since in many cases the local and national situation is very different than what traditional institutions are used to dealing with, there is a need to innovate on these institutions; such innovations can include institutions with joint control mechanisms between community and government (e.g. Joint Forest Management committees), institutions which reflect the boundaries of the natural common property resource being used (e.g. Van Panchayats in the Kumaon Himalayas or similar institutions in parts of Rajasthan), and so on.

6.3 Enhancing/Building on local knowledge

(though by no means all) continues to be relevant from the conservation and sustainable use point of view. Building upon this, rather than replacing it by modern systems, ensures compatibility with other elements of the LCS, suitability to local resources, easier acceptability within the community, and greater social sustainability.

6.4 Ensuring traditional intellectual rights:

In the face of the increasing power of private intellectual rights (IPRs), communities should be empowered with community intellectual rights, which safeguard their knowledge, and ensure that they are fairly benefited by the use of this knowledge by the outside world. Several models of such community IPRs are being suggested all over the world, including in India (Nijar, 1996; Posey, 1996).

6.5 Integrating LCS and larger/modern systems:

LCS knowledge and practical systems an be complemented by introducing ecologically and socially appropriate and sensitive new technologies, at all times being careful not to displace essential elements of the LCS which are important for conservation and sustainable use.

6.6 Research and development at field level:

Most R&D on biological resource use which currently takes place in laboratories or governmental fields far removed from local communities, should shift to where these communities are based; farmers and forest dwellers and fisherfolk themselves should be equal partners in R&D programmes, using their own knowledge and skills, and learning from new

ones introduced by the formal sector. In turn, formal sector students should be constantly exposed to LCS.

6.7 Using market creativity:

The market can become an ally in conservation on biodiversity and sustenance of LCS, provided local communities retain some control over it, local demand and needs are given priority over outside ones, and ecological sustainability is ensured. One innovative method is the establishment of direct links between between aware urban consumers and organic farm producers, eliminating middle links as far as possible.

6.8 Positive social/economic incentives:

Instead of the reverse discrimination faced by LCS today (e.g. organic farming vs. Green Revolution farming, with the latter getting subsidies and support), there should be a system of incentives for practices which are oriented towards sustainable use and conservation. This could include financial and developmental inputs of various kinds, provision of property and intellectual rights, and others.

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