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Forest Ecosystem
Forests, People and Livelihoods
Approach Paper

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Acronyms

ANR	Assisted Natural Regeneration of Forests
ASTRPS	Association of ST and Rural Poor in Regeneration of Degraded Forests
AOFFPS	Area Oriented Fuel Wood and Fodder Project Scheme
AITPN	Asian Indigenous and Tribal Peoples Net Work
BIOP	Bailadila Project
CDB	Convention of Biological Diversity
CFM	Community Forest Management
DONER	Development of North East Region
EDF	Eco-Development Forces Schemes
EEZ	Exclusive Economic Zones
EFAFC	Ecological Footprint analysis and Forest Certification
FAO	Food and Agriculture Organization
FDA	Forest Development Authority
GA	Geographic Area
GIA for GI	Grants-in-aid for Greening India
IAEPS	Integrated Afforestation and Eco-Development Project Scheme
IAY	Indira Awas Yojana
IKS	Indigenous Knowledge system
IPCC	Intergovernmental Panel on Climate Change
ITDA	Integrated Tribal Development Agency
JFM	Joint Forest Management
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MoEF	Ministry of Environment and Forests, Government of India
M & E	Monitoring and Evaluation
NAEB	National Afforestation and Eco-Development Board
NBA	National Biodiversity Act
NFSA	National Food Security Act
NMDC	National Mineral Development Corporation
NTFP	Non-Timber Forest Produce
NWFP	Non-Wood Forest Products
OBC	Other Backward Caste
OWL	Other Wooded Land
PA	Protected Area
PES	Payment for Forest Ecosystem Services
RG	Regional Centers

R & R	Resettlement and Rehabilitation
RTA	Right to Education Act
SAS	Sarva Shiksha Abiyan Scheme
SC	Scheduled Caste
SFR	State Forest Report
SGVSY	Samnavit Gram Vanikaran Samridhi Yojana
SPO	Special Police Officer
ST	Scheduled Tribe
TBGRI	Tropical Botanical Garden and Research Institute
TEEB	The Economics of Ecosystems and Biodiversity
TFRK	Traditional Forest Related Knowledge
UNEP	United Nations Environment Programme
UT	Union Territory
WCMC	World Conservation Monitoring Centre
WRM	World Rainforest Movement
WRI	World Resource Institute

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The Centre for Economic and Social Studies, Hyderabad has recently set up the Research Unit for Livelihoods and Natural Resources (RULNR) with financial support from the Jamsetji Tata Trust, Mumbai. The Unit has three thrust areas of research, forests, drylands and river basins where livelihood is the central theme. The aim of this paper is to provide a basis for discussion on some of the key issues for research under river basins and also provide information on the research themes prioritized as well as the approach adopted by RULNR in carrying out research. The financial support of the Jamsetji Tata Trust and the administrative and logistical support of RULNR in undertaking this work are gratefully acknowledged.

1. Forests: Introduction

A forest, in its basic features, is an area having a very high density of trees that form a habitat for a rich variety of animal and plant kingdoms. According to some estimates, about seventy percent of terrestrial plants and animals live in forests. A terrestrial unit of living organisms (plants, animals and microorganisms), all interacting among themselves on one hand and interacting with the environment in which they live (soil, climate, water and light) on the other, is a forest ecosystem. A forest ecosystem includes high density of trees. The tree is the environmental “common denominator” of the forest ecological community. While forest ecosystem is one kind, there are hundreds of thousands of other defined and undefined ecosystems that can cover from the broadest to the tiniest area. An ecosystem can be as small as a pond or a dead tree, or as large as the earth.

Forests provide a variety of diverse ecosystem services at the regional and global level. These are conservation of soil and water resources, positive influences on local climate, mitigation of global climatic change, conservation of biological diversity, improvement of urban and peri-urban living conditions, protection of natural and cultural heritage, subsistence resources for many rural and indigenous communities, employment generation, and recreational opportunities (Shvidenko *et al.*, 2005: 588).

Forests have an immense effect on the surrounding environments and play a crucial role as major stores of greenhouse gases such as carbon dioxide, and also contribute to reducing global warming. Forests all over the world provide sustainable livelihoods to forest peoples in the form of wild plant foods (fruits, pods, berries, nuts, seeds, leaves, flowers, tubers/ rhizomes/roots, and shoots, parts of stem, mushrooms and lichens); insects and larvae; big and small game; aquatic fauna and avifauna; honey; and an array of herbal medicines. More than 1.6 billion people worldwide depend on forests for some part of their livelihood. Forests, since time immemorial, have been nurturing “exotic” cultures whose traditions reflect the culture-nature interactive web and symbiotic interdependence. Forests are the preserves of nature. The human species (the myriad forms of social groups across the world, no matter what they are known as—aboriginals, tribes, natives, etc.) for whom the forests are habitats, depend on them without depleting the resource base. In other words, there is an inbuilt mechanism of conservation and deterrence of over-exploitation. Ethnographic studies in different parts of the world (Africa, South and South East Asia, Americas and Australia) have yielded a great deal of evidence that

suggests the development of conservation practice often follows the elaboration of environmental knowledge by groups of people, leading to increasingly more sophisticated understanding of the ecosystem in which they dwell.

This process of learning through the means of adaptation, in socio-ecological terms, is seen as adaptive co-management. Adaptive co-management may be defined as a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of learning-by-doing. One of the best examples of institutional management of forests in the Indian context is through sacred groves, taboos, totems, deity-guarded boundaries; and sacral laws such as the prescription of seven meritorious deeds (*saptasantâna*) for the king which include raising a grove (*vana*) and excavating a tank (*tatòðòðâka*). This ideology of raising groves and digging tanks betrays the efforts for creating alternate avenues either in lieu of the cleared forests or to refrain from further degradation of the forested ecotones (Murty, 1993).

In the pre-state egalitarian level of social organization, forests and all kinds of natural resources were pristine ecosystems which were conceived as common properties. There has been neither control over the natural resources nor the social groups. With the emergence of “state” in the trajectory of human history, extensive stretches of pristine ecosystems were increasingly encroached upon, heavily exploited and degraded for timber, forest produce and other commodities of commercial value.

With the beginning of the so called “Urban Revolution” during the ancient times, exploitation of forests for wood and non-timber forest products (e.g., wild plant food sources, fibers, lacquers, gums, latex, and medicinal and aromatic plants) and the consequent degradation of extensive stretches of forests have been going on in different parts of the world. The civilizations of Mesopotamia, Harappa, Egypt, Rome and Greece, to mention a few, can be cited as best examples. Exploitation of forests began near centers of demand, such as cities and mining districts; through the ever extending tentacles of timber trade, the needs of the city for wood grasped and denuded forests many miles away (Hughes, 1983, 1986). For instance, in ancient Greece, the environs of Athens were mostly bare by the fifth century B.C.E. as a result of exploitation of forest cover. Textual evidences such as treaties between Athens and the Macedonian kings shows that in classical times, the city had to depend on the forested north for timber. In ancient India, Pataliputra, the capital of Chandragupta Maurya (fourth century B.C.E.) was perhaps the largest city in the world at that time. According to Megasthenes, the ambassador of Seleucus to Chandragupta, Pataliputra was a city eight miles long and a mile and one-half wide, with 570 towers and sixty-four gates, all surrounded by a moat six hundred feet wide and forty-five feet deep. The city (due to scarcity of stone) was

protected by wooden walls, with slits to be used by archers. Pataliputra was about twice as large as Rome under Emperor Marcus Aurelius. Kautilya's *Arthashastra* (a Sanskrit treatise on politics and statecraft) reveals the importance bestowed on forests for its resources and wildlife in the Mauryan Empire; it unambiguously specifies the responsibilities of the Mauryan officials in the protection of forests, and also gives valuable ethno-biological information on flora and fauna (Kangle 1997; Rangarajan 2010; Shamsastry 1967).

In the light of historical sources, it can be envisaged that although forests were noticeably depleted in ancient times, they were not totally destroyed, and the areas having a forest cover were undoubtedly larger than those existing in late twentieth century. During the present times, forests are being destroyed at unprecedented rates due to unsustainable and illegal logging, agricultural expansion, population pressures, large-scale industrial and infrastructure projects, and national policies that subsidize forest conversion to other uses.

2. Global Forest Cover

There is no single, agreed definition of "forest" due to varying climatic, social, economic and historical conditions, and for many governments, "forest" denotes a legal classification of areas that may or may not have actually tree cover (Shvidenko *et al.* 2005: 590). According to the *Global Biodiversity Outlook* (Secretariat of the Convention on Biological Diversity 2001), forests are defined as "ecosystems in which trees are the predominate life forms" and notes that a more precise definition than this remains surprisingly elusive because trees occur in many different ecosystems, at different densities, and in different forms. Most definitions refer to canopy or crown cover, which is essentially the percentage of ground area shaded by the crowns of the trees when they are in full leaf. The U.N. Framework Convention on Climate Change process has adopted a nationally defined threshold of between 10 percent and 40 percent canopy closure.

The definition of "forest" given by the Food and Agriculture Organization (FAO) is fairly appropriate, and it is the first consistent definition of forests to be applied globally (FAO 1999, 2001). The FAO definition covers ecosystems that are dominated by trees (defined as perennial woody plants taller than five meters at maturity), where the tree crown cover (or equivalent stocking level) exceeds 10 percent and the area is larger than 0.5 hectares. The term includes forests used for production, protection, multiple use, or conservation, as well as forest stands on agricultural land (such as windbreaks and shelterbelts of trees with a width of more than 20 meters) and plantations of different types. It also includes both naturally regenerating and planted forests. The term excludes stands of trees established primarily for agricultural production, such as fruit tree

plantations and trees planted for agro-forestry systems (but rubber and cork oak stands are included). It also includes a category of “temporarily unstocked areas” (clear-cuts, burnt areas and so on) as forest. This means that a country may have logged or burned of its forest, but—unless it converts the area to another officially noted productive land use—it will appear to have retained the same forest area as before. This term, though creates problems in the analysis of forests and may lead to improper assessment of forest cover (WRM 2002), it is still more suitable. Billions of trees outside the forest in cities, along roads and rivers, on farms and so on are not included in the categories of forests mentioned above.

The threshold of 10 percent is crucial in this definition. In many countries, “forest” is typically defined as areas with substantially higher levels of canopy closure (Shvidenko *et al.* 2005: 590). For example, the canopy closure, depending on the age of trees is 30-40 percent in Russia (FFSR 1995) and 60 percent in South Africa (Scholes and Biggs 2004). In the classification of forest introduced by United Nations Environment Programme—World Conservation Monitoring Centre (UNEP-WCMC), all forest classes have a minimum threshold of 30 percent except for the class including sparse trees and woodlands, for which canopy closure is from 10 percent to 30 percent (UNEP-WCMC 2004).

On the basis of the nature of forest cover, some of the forests are called woodlands. Woodlands represent a forest ecosystem with an interrupted tree canopy cover. FRA-2000 defines: (a) those forests with a canopy cover of more than 40 percent as “closed forests”; (b) those with a canopy cover of between 10 percent and 40 percent as “open forests”; and (c) mosaics of forest patches (not quantitatively defined) as “fragmented forests” and “non-forest-lands”; and (d) lands with a tree crown cover (or equivalent stocking level) of 5-10 percent of trees, able to reach a height of 5 meters at maturity (such as dwarf or stunted trees), or shrub and bush cover of more than 10 percent as “Other Wooded Land” (OWL). OWL excludes areas with the tree, shrub, or bush cover specified above, but of less than 0.5 hectares and width of 20 meters, as well as land predominantly used for agricultural practices (FAO 2001). Trees growing in areas that do not meet the forest and OWL definitions are excluded (FAO 2001). The type of forest cover that characterizes OWL broadly comes under the category of woodlands.

A number of countries and regions have undergone periods of extensive forest loss but these countries developed rigid legislative, economic and social background for the transition to sustainable forest management. For example, Europe lost 50-70 percent of the original forest cover, mostly during the early Middle Ages, and North America lost about 30 percent, mostly in the nineteenth century (WRI *et al.* 1996). Forest policies

and economic development in the twentieth century in these regions, however, have encouraged forest restoration and plantation development, restoring a significant part of the forest cover in both Europe and North America. Nonetheless, many forests in these regions continue to decline in quality, are becoming increasingly fragmented, and suffer the impact of industrial pollution. In many parts of the developing world, deforestation continues to accelerate in tandem with poverty and high levels of population growth. For these regions in the developing world, the transition to sustainable forest management is a much greater challenge. And the stakes for the global community are much higher: if tropical developing countries must wait until they reach the level of economic development—and deforestation—of Europe before making this transition, a large percentage of known terrestrial species may become extinct in the process, due to the disproportionate number of species found within the forests (Rodrigues *et al.* 2003).

It is observed, as a general phenomenon, that the area and condition of the world's forest has been reduced by approximately 40 percent, with three quarters of the loss occurring during the last two centuries (Shvidenko *et al.* 2005: 587-621). Forests have completely disappeared in 25 countries, and another 29 countries have lost 90 percent of their forest cover. According to FAO studies: (a) the total forest area in 2005 is less than four billion hectares, corresponding to an average of 0.62 hectares per capita (Table 1); (b) the area of forest is unevenly distributed—for example, 64 countries, with a combined population of two billion, have less than 0.1 hectares of forest per capita; (c) the 10 most forest-rich countries account for two-thirds of the total forest area (Table 2); (d) seven countries or areas have no forest at all; and (e) an additional 57 countries have forest on less than 10 percent of the total land area (FAO 2006). This FAO study also noted that deforestation is continuing at an alarmingly high rate, mainly due to conversion of forests to agricultural land—about 13 million hectares per year; and at the same time, forest planting, landscape restoration and natural expansion of forests have significantly reduced the net loss of forest area. The net change in the forest area in the period 2000 - 2005 is estimated at -7.3 million hectares per year, down from -8.9 million hectares per year in the period 1990 – 2000. This study also highlighted that globally, more than one-third (36 percent) of all forests are primary forests (i.e., forests of native species, in which there are no clearly visible indications of human activity and ecological processes), which are not significantly disturbed; that about six million hectares of these were lost or modified each year since 1990, and there is no indication that the rate of change is slowing down. This rapid decrease stems not only from deforestation, but also from modification of forests due to selective logging and other human interventions through which primary forests move into the category of modified forests. In addition, 104 million hectares of forests, on an average, were reported to be significantly affected each year by forest fires, pests (insects and disease) or climatic events such as drought, wind,

snow, ice and floods. However, the area of forest affected by such disturbances, especially from forest fires in Africa, was severely underreported, and the information is missing from many countries.

Table 1: Forest Area by Biome (Shvidenko *et al.* 2005)

Total Forests (<i>million hectares</i>)							
Biome	Africa	Asia	Europe	North and Central America	Oceania	South America	Total
Polar	0	7	4	9	0	0	21
Boreal	0	653	202	404	0	0	1,258
Temperate	0	168	215	284	17	12	697
Sub-tropical	8	140	29	121	33	24	353
Tropical	618	355	0	103	76	873	2,027
Total	627	1,323	450	921	125	909	4,356

Table 2: Ten countries with Largest Forest Area in 2005 (FAO 2005)

Forest Cover	<i>million ha</i>	<i>percent</i>
Russian Federation	809	20.46
Brazil	478	12.09
Canada	310	7.84
United States	303	7.66
China	197	4.98
Australia	164	4.14
Democratic Republic of the Congo	134	3.38
Indonesia	88	2.22
Peru	69	1.74
India	68	1.72
Others	1333	33.72

Yet another important aspect brought to light in the FAO study is that most of the world's forests (84 percent) remain under public ownership; 11 percent of the world's forests are designated for the conservation of biological diversity; more than 300 million hectares of forests are designated for protection (soil and water conservation, avalanche control, sand-dune stabilization, desertification control and coastal protection); one-third (34 percent) of the world's forests are used primarily for wood production (it is

estimated that nearly half of the removed wood was fuel wood) and Non-Wood Forest Products (NWFPs); and increasing use of forests for recreation and education (FAO 2006). It is difficult to quantify the last feature, as noted in this study. The only region with fairly good data on the use of forests for recreation, tourism, education, and conservation of cultural and spiritual sites is Europe, where provision of such social services was reported as the primary management objective for 2.4 percent of the total forest area. In all, 72 percent of the forest area of Europe (not including the Russian Federation) provides social services—most frequently in combination with other management objectives.

3. Aggregated Forest Ecological Zones

There are different classifications of world's forest by forest types, which are largely incompatible. The classification by UNEP-WCMC consisted of 26 aggregated forest types—15 in tropical forests and 11 in non-tropical biomes (UNEP-WCMC 2004). Based on criteria equivalent to Köppen-Trewartha climatic groups, FRA-2000 considered five biomes—tropical, sub-tropical, temperate, boreal and polar; and these are divided into 20 global ecological zones (FAO 2001). The distribution of aggregated forest types (ecological zones or ecoregions), and their quantification, presented by Shvidenko *et al.*, and the distribution estimated based on remote sensing sources (Shvidenko *et al.* 2005: 595-597) provides an overview (Table 3, also Table 2). About three quarters of the world forests is located in two biomes—tropical (46 percent) and boreal (29 percent). Tropical rain forest is the extensive forest type in the world, constituting 26 percent of the global forest area and nearly 60 percent of the tropical forest area.

Table 3: Forest Area by Region in 2000 (Shvidenko *et al.* 2005)

Forest Area (<i>million hectares</i>)					
Region	Land Area	Natural Forests	Plantation	Total	Forest Coverage (<i>percent</i>)
Africa	2,978	642	8	650	22
Asia	4,362	1,105	120	1,225	28
Europe	983	334	28	362	37
North and Central America	2,137	532	18	549	26
Oceania	849	194	3	198	23
South America	1,755	875	10	886	51
World Total	13,064	3,682	187	3,869	30

3.1. Tropical Forests

Tropical forests occur near the equator, and are characterized by the greatest diversity of species. One of the major characteristics of tropical forests is their distinct seasonality: winter is absent, and only two seasons—rainy and dry—are present. The length of daylight is 12 hours and varies little. The temperature, on an average, is 20-25°C, and varies little throughout the year: the average temperatures of the three warmest and three coldest months do not differ by more than 5 degrees. Precipitation is evenly distributed throughout the year; with annual rainfall exceeding 2000 mm. The soil is nutrient-poor and acidic. Decomposition is rapid and soils are subject to heavy leaching.

Tropical rain forests are closed canopy evergreen broadleaf forests (they require continual temperatures of at least 25°C and an annual rainfall of at least 1500 mm). The canopy is multilayered and continuous, allowing little light penetration. Flora is highly diverse: one square kilometer may contain as many as 100 different tree species. Trees are generally 25-35 m tall, with buttressed trunks and shallow roots, mostly evergreen, with large dark green leaves. These are found in tropical regions with monsoon climate.

Most tropical rain forests are in South America (582 million hectares), Africa (270 million hectares) and Asia (197 million hectares). These are distinguished into moist deciduous forests and dry deciduous forests. The moist deciduous forests cover some 510 million hectares. They develop in areas with a dry season of three to five months, and vary from open forests to open savanna forests, depending on the length of the dry season, human pressures and fire regimes. Only about one-third of these forests are closed primary forests; the rest are open and fragmented forests, including significant areas of secondary forest created by disturbances such as agricultural clearing and fire. In Asia, these forests contain commercially important species such as teak (*Tectona grandis*) and sal (*Shorea robusta*). In tropical dry deciduous forests, the dry season is longer than in the moist deciduous type. More than half of the tropical forests have already been destroyed.

3.2. Boreal Forests

Boreal forests are also known as temperate forests and are referred to as “taiga” (the Russian name for this forest). The taiga (or boreal forest) exists as a nearly continuous belt of coniferous trees across North America and Eurasia. The taiga corresponds with regions of sub-arctic and cold continental climate; long, severe winters (up to six months, with mean temperatures below freezing); short summers (50 to 100 frost-free days); and a mean annual precipitation of 40 cm to 50 cm. The dominant vegetation of the taiga is characterized by coniferous (needle leaf) forests. Although this biome is generally called taiga, the term boreal forest is usually used to refer to the more southerly part of the biome, while the term taiga is more often used to describe only the more northern

barren areas of the Arctic tree circle; this biome extends throughout the high northern latitudes, near 50°N around the arctic circle, between the tundra and temperate forest.

The tundra (the term means “uplands, treeless mountain tract”) is a biome where tree growth is hindered by low temperatures and short growing seasons. There are three types of tundra: Arctic tundra, Alpine tundra, and Antarctic tundra. The vegetation is composed of dwarf shrubs, sedges and grasses, mosses and lichens. Scattered trees grow in some tundra. The ecological boundary (ecotone) between the tundra and the temperate forest is known as the tree line (edge of the habitat at which trees are capable of growing) or timberline.

The taiga occurs from the sub-tropics with the northernmost growing at 72°30' in central Siberia, at an average temperature of 15° to 17°C. Temperate forests occur in Eastern North America, Northeastern Asia, and Western and Central Europe. They are mainly distributed in 55 industrial countries (in Europe, the former Soviet Union, North America, Australia, Japan, and New Zealand).

The taiga is the world's largest terrestrial biome spread over inland regions of Canada, Alaska, Sweden, Finland, Norway, the Scottish Highlands, and Russia (especially Siberia), as well as parts of the extreme northern continental United States, Northern Kazakhstan, Northern Mongolia, and Northern Japan. Countries of this biome contain 47 percent of predominantly coniferous forest (many genera including the evergreen *Pinus* (pine), *Picea* (spruce), *Abies* (fir) and the deciduous *Larix* (larch or tamarack)); 26 percent of predominantly broadleaf forest (many genera including *Populus*, *Betula*, *Quercus*, *Fraxinus*, *Tilia*); and 27 percent of mixed coniferous and broadleaf forests. Other forest types (bamboos, palms, and so on) cover small areas in Japan.

The total area of forests in these countries is estimated to be 1,683 million hectares, supplemented by an additional 795 million hectares of other wooded lands. Thus, the total area of forests and other wooded land is estimated to be 2,478 million hectares, which accounts for 47 percent of the global tree cover. More than one-third (38 percent) of the total forest in these zones is located in the former Soviet Union, 29 percent in North America, 9 percent in Europe, and 25 percent in Australia, Japan, and New Zealand. On average, these countries have 1.3 hectares of forest per capita—about double the global average, although there is great variation between the countries. These statistics do not include China, which has significant areas of temperate and boreal forests—30 percent and 8 percent respectively, of the country's total forest area of 163.5 million hectares.

In India, the entire forest area is under the concurrent list of the State and Central Governments, and is managed by the governments. According to official estimates, 93 percent of the forest area in the country is controlled by the Forest Department and four percent by the Revenue Department. The per capita forest area in India works out to 0.08 hectares, which is one-eighth of the world average of 0.64 hectares (FAO 1995).

4. Forest Cover in India

According to the 10th State of Forest Report (SFR 2005), the forest cover of India is 67.71 million hectares, which is 23.4 percent of the total geographic area. Of this, 5.46 million hectares (1.66 percent) is very dense forest, 33.26 million hectares (10.12 percent) is moderately dense and the remaining 28.99 million hectares (8.82 percent) is open forest, and this includes 0.44 million hectares of mangrove forests. The major areas in which mangroves occur are Sunderbans of West Bengal (47.6 percent), Gujarat (21 percent) and Andaman and Nicobar Islands (14 percent). Madhya Pradesh has the largest area of 7.6 million hectares of forest cover, constituting 11.22 percent of the total forest cover, followed by Arunachal Pradesh (10.01 percent), Chhattisgarh (8.25 percent), Orissa (7.15 percent) and Maharashtra (7.01 percent). The seven North East States together account for 25.11 percent of the total forest cover, whereas all the tribal districts (188) comprise 60.11 percent of the total forest cover of the country.

4.1. Forest Ecological Regions in India

The nature and type of forest are determined primarily by climate, soil type, topography and altitude. India has a diverse range of forests: from the rainforest of Kerala in the south to the alpine pastures of Ladakh in the north; from the deserts of Rajasthan in the west to the evergreen forests in the North East (Table 4). Forests are classified according to their nature and composition, the type of climate in which they thrive, and their relationship with the surrounding environment. Forests in India are divided into six broad types with a number of subtypes: (a) moist tropical (subtypes: wet evergreen, semi-evergreen, moist deciduous, littoral and swamp); (b) dry tropical (dry deciduous, thorn, dry evergreen); (c) montane sub-tropical (broad leaved, pine, dry evergreen); (d) montane temperate (Himalayan moist temperate, Himalayan dry temperate, sub-alpine, moist alpine scrub and alpine).

Table 4: Forest Ecological Regions in India

Groups	Forest Type	% of Total	Occurrence in States/UTs
1.	Moist Tropical Forests Wet evergreen forests	8.75	Arunachal Pradesh, Assam, Karnataka, Kerala, Mizoram, Manipur, Nagaland, Tamil Nadu, Sikkim, Andaman & Nicobar Islands, Goa
2.	Semi-evergreen forests	3.35	Assam, Karnataka, Kerala, Maharashtra, Nagaland, Orissa, Tamil Nadu, Sikkim, Andaman & Nicobar Islands, Goa
3.	Moist deciduous forests	33.92	Andhra Pradesh, Bihar, Gujarat, Assam, Karnataka, Kerala, Maharashtra, Nagaland, Mizoram, Tripura, Meghalaya, Uttar Pradesh, West Bengal, Orissa, Tamil Nadu, Sikkim, Andaman & Nicobar Islands, Goa
4.	Littoral and swamp forests	0.38	Andhra Pradesh, Gujarat, Maharashtra, Orissa, Tamil Nadu, West Bengal Andaman & Nicobar Islands
5.	Dry Tropical Forests Dry deciduous forests	30.16	Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Jammu & Kashmir, Maharashtra, Orissa, Punjab, Rajasthan , Tamil Nadu, Uttar Pradesh
6.	Thorn forests	5.11	Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttar Pradesh
7.	Dry evergreen forests	0.29	Himachal Pradesh, Jammu & Kashmir, Andhra Pradesh, Tamil Nadu

Table 4: Contd...

Groups	Forest Type	% of Total	Occurrence in States/UTs
8.	Montane Sub-Tropical Forests Broad leaved forests	0.38	Assam, Meghalaya
9.	Pine forests	5.99	Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttar Pradesh, Haryana, Punjab
6.	Dry evergreen forests	0.36	Himachal Pradesh, Jammu & Kashmir
7.	Montane Temperate Forests	3.45	Arunachal Pradesh, Karnataka, Manipur, Nagaland, Sikkim, Tamil Nadu
8.	Himalayan moist temperate forest	3.79	Himachal Pradesh, Jammu & Kashmir, Uttarakhand
9.	Himalayan dry temperate forests	0.28	Himachal Pradesh, Jammu & Kashmir
10.	Sub- alpine forests, moist alpine scrub forests and alpine forest	3.79	Jammu & Kashmir, Himachal Pradesh and Uttarakhand

Source: Forest Survey of India 1995

4.1.1. Moist Tropical Forests

Almost all the moist tropical forests (i.e., rain forests) lie near the equator. These are in high rainfall zones where the rainfall ranges between 1750 mm and 2000 mm (often more than 2500 mm). These zones belong to the tropical wet climate. The temperatures here rarely go higher than 34°C or drops below 20°C; the average humidity is between 77 to 88 percent; and there is usually a brief season of less rain. The subtypes of these forests are wet evergreen, semi-evergreen, moist deciduous and littoral and swamp.

Wet Evergreen Forests: These are found in the south along the Western Ghats, the Andaman and Nicobar Islands, and all along the NE region. These are characterized by tall, straight, evergreen trees that have a buttressed trunk or root on three sides like a tripod that helps to keep them upright during a storm. These trees often rise to a great height before they open out like a cauliflower. The more common trees that are found here are the jackfruit, betel nut palm, jamun, mango and hollock. The trees in this forest

form a tier pattern: shrubs cover the layer closer to the ground, followed by the short structured trees and then the tall variety. Beautiful ferns of various colours and different varieties of orchids grow on the trunks of the trees.

Semi-Evergreen Forests: These are found in the Western Ghats, Andaman and Nicobar Islands, and the Eastern Himalayas. Such forests have a mixture of the wet evergreen trees and moist deciduous trees. The forest is dense and is filled with a large variety of trees of both types.

Moist Deciduous Forests: These are found throughout India except in the western and the north-western regions. They occur on the wetter western side of the Deccan plateau, the northeastern part of the Deccan Plateau, and the lower slopes of the Himalayas on the Siwalik Hills from Jammu in the west to West Bengal in the east. These forests are found in areas receiving annual rainfall of 1000 mm to 2000 mm. There is a layer of shorter trees and evergreen shrubs in the undergrowth. These forests are dominated by sal and teak, along with mango, bamboo, and rosewood.

Littoral and Swamp Forests: These are found along the Andaman and Nicobar Islands and the deltas of the Ganga and the Brahmaputra. They consist mainly of whistling pines, mangrove dates, palms, and bullet wood. They have roots that consist of soft tissue so that the plant can breathe in the water.

4.1.2. Dry Tropical Forests

Dry Deciduous Forests: These are found in Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu, and throughout the northern part of the country except in the North East. The canopy of the trees does not normally exceed 25 meters. The principal trees are teak, sal, sandalwood, mahua, khair, bamboo, semal, myrobalan, arjun, banyan and acacia.

Thorn Forests: These are found in areas with black soil in Northern, Western, Central, and Southern India. These forests are usually called dry deciduous woodlands. The trees do not grow beyond 10 meters. Characteristic species in this forest type are spurge, caper and cactus. Ecotones of this type are woodland savanna, shrub savanna and thorny-thicket zones. These landscapes are characteristic of the Deccan, and they serve as sheep/goat and cattle pastoral systems.

Dry Evergreen Forests: These are found along the Andhra Pradesh and Karnataka coasts. They consist mainly of hard-leaved evergreen trees with fragrant flowers, along with a few deciduous trees. These form a part of mangrove forests.

4.1.3. Montane Sub-Tropical Forests

Broad-Leaved Forests: These are found in the Eastern Himalayas and in the Silent Valley of the Western Ghats. There is a marked difference in the vegetation in the two areas. In the Silent Valley, poonspar, cinnamon, rhododendron, and fragrant grass are predominant. In the Eastern Himalayas, these forests consist mainly of evergreen trees and a few deciduous species. There are oak, alder, chestnut, birch, and cherry trees. There are a large variety of orchids, bamboo and creepers.

Pine Forests: These are found in the steep dry slopes of the Siwalik Hills, Western and Central Himalayas and Khasi, Naga and Manipur Hills. The trees predominantly found in these areas are the chir, oak, rhododendron and pine. The trees that are common in the lower regions are *sal*, *sandan*, *amla* and laburnum.

Dry Evergreen Forests: These are found in regions which have prolonged hot and dry seasons and cold winters. These forests generally consist of evergreen trees with shining leaves that have a varnished look. Some of the more common trees in such forests are the pomegranate, olive and oleander. These forests are found in the Siwalik Hills and foothills of the Himalayas, at an altitude of about 1000 meters.

4.1.4. Montane Temperate Forests

Himalayan Moist Forests: These are wet montane temperate forests which occur in the northern and southern parts of India. In the north, they are found in the region to the east of Nepal into Arunachal Pradesh, at a height of 1800 m to 3000 m, receiving a minimum rainfall of 2000 mm. In the south, they occur in parts of the Nilgiri Hills, and the higher reaches of Kerala. Rhododendrons are common in these forests.

In the north, there are three layers of forests: the higher layer has mainly coniferous, the middle layer has deciduous trees such as the oak, and the lowest layer is covered by rhododendron and champa. These forests extend from the Western Himalayas to the Eastern Himalayas. The trees found in the western section are broad-leaved oak, brown oak, walnut, rhododendron, etc. In the Eastern Himalayas, the rainfall is much heavier and therefore, the vegetation is also more lush and dense. There are a large variety of broad-leaved trees, ferns and bamboo. Coniferous trees are also found here, some of the varieties being different from the ones found in the south.

Himalayan Dry Forests: Such forests are found mainly in Lahul, Kinnaur, Sikkim, and other parts of the Himalayas. There are predominantly coniferous trees that are not too tall, along with broad-leaved trees such as the oak, maple and ash. At higher elevations, fir, juniper, deodar and chilgoza are common.

4.1.5. Sub-Alpine Forests

Sub-alpine forests extend from Kashmir to Arunachal Pradesh in altitudes ranging between 2900m to 3500m. In the Western Himalayas, the vegetation consists mainly of juniper, rhododendron, willow and black currant. In the eastern parts, red fir, black juniper, birch and larch are the common trees. Due to heavy rainfall and high humidity, the timberline in this part is higher than that in the west. Rhododendrons of many species cover the hills in these parts.

4.1.6. Moist Alpine and Dry Alpine Forests

Moist alpine forests occur all along the Himalayas and on the higher hills near the Myanmar border. These are characterized by low scrub and dense evergreen trees, consisting mainly of rhododendron and birch. Mosses and ferns cover the ground in patches. This region receives heavy snowfall. Dry alpine forests are found in altitudes ranging from about 3000m to 4900m. Dwarf plants such as black juniper, drooping juniper, honeysuckle and willow are predominant.

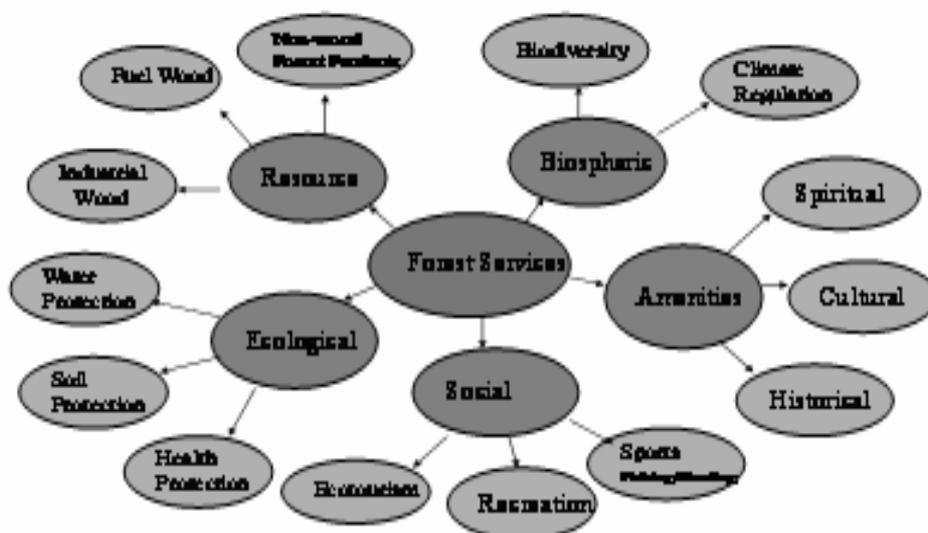
5. Forests, Forest Services and Human Wellbeing

Forests, particularly those in the tropics, provide habitats for half or more of the world's known terrestrial plant and animal species. This biodiversity is essential for the continued health and functioning of forest ecosystems, and it underlies the many ecosystem services that forests provide. More than three quarters of the world's accessible freshwater comes from forest catchments. The water quality declines with decrease in forest condition and cover, and natural hazards such as floods, landslides and soil erosion have large impacts.

This destruction, caused by the commercialization of the environment, has been posing a serious threat to the wildlife and human communities dependent on forests. The history of post-war economic growth, especially, has been one of unsustainable consumption: unsustainable for the planet's ecosystems, for its species diversity and, indeed, for the human race. This aspect, in the concept of the developed and developing worlds, has reversed the sentimental attachment to nature (nature-culture equation), and is only interested in harvesting the nature, driven by the market forces of profitability, with no concern for the devastation of ecosystems and biodiversity. Such a lack of valuation has been the underlying cause for the onslaught on ecosystems and the resultant loss of biodiversity (Shvidenko *et al.* 2005). Analyzing the Indian situation, it has been pointed out by Nadkarni (1996) that forestry economics in India follow a top-down approach; it is important to realize the fact that there are multiple users of forests, each with their own objectives and interest; and that, to reconcile to the conflicts of interest, a participatory style of management rather than a top-down management is needed (Nadkarni 1996).

The multifunctional and multiservice purposes of the world's forests have been underlined in the 1992 Forest Principles. According to this, "forest resources and forest lands shall be managed and used sustainably to fulfill social, economic, ecological, cultural and spiritual needs of present and future generations. The services provided by forests and woodlands are numerous and diverse on all spatial and temporal levels, and include provisioning and regulating cultural and supporting services" (Forest Principles 1992) (Table 5). Some national classifications account for as many as 100 different kinds of forest services such as delivery of industrial and fuel wood, water protection and regulation, ecotourism, and spiritual and historical values (Mather 1999). These various forest services relate to each other in many different ways, ranging from synergistic to tolerant, conflicting and mutually exclusive. The multiservice paradigm of forest management is therefore, quite clear in theory but is often very difficult to implement, as it frequently requires difficult choices and trade-offs. There is no consistent methodology, and proper information is not available, to estimate credible values for many other forest services.

Figure 1: Various Categories of Services Provided by the Forests
(Shvidenko *et al.* 2005)



5.1. Value of Forest Ecosystem Services

According to one recent (and controversial) estimate, the annual value of forest ecosystem services totaled US\$4.7 trillion, roughly 15 percent of the global GNP (Shvidenko *et al.* 2005). In the Indian context, the total annual loss to the Indian society, as a result of forest degradation is estimated at about US\$12 billion (Joshi and Singh 2003). A comparison of the forest cover of the country between the present and preceding

assessment (2003) shows that there is a marginal loss of 728 sq km during the period 2002-2004, which constitutes 0.11 percent. The losses occurred mainly due to destruction caused by tsunami in the Andaman and Nicobar Islands in December 2004; submergence of forests due to construction of dams in Madhya Pradesh and Chhattisgarh; and shifting cultivation as well as bamboo flowering in the North East. The impacts of degradation of forests are felt more acutely by rural communities living in the forests or forest-edge habitats, who suffer a decline in livelihood resources and wellbeing (Byron and Arnold 1999).

6. Forests and Wetlands

One of the primary ecosystems that provide sustainable livelihoods on a large scale the world over is wetland ecosystem (Ministry of Environment and Forests, Government of India 2007; Wetlands International 2009; www.wetlands.org). Wetlands are defined by Ramsar Convention as “marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters” (Barbier *et al.* 1996). Wetlands are integral to a healthy environment. They help to retain water during dry periods, thus keeping the water table relatively stable; they reduce flood levels and trap suspended solids and nutrients; and wetlands are important feeding, breeding and drinking areas for wildlife.

Wetland ecosystems constitute rivers, lakes, marshes, rice fields and coastal areas, and are contiguous with forests and woodland ecosystems. The richest ecosystems among these are estuaries, mangrove forests, mud-flats, small islands (e.g., numerous *lankas* in the Godavari and Krishna valleys of Andhra Pradesh), coastal headlands and cliffs, coastal wetlands, sand dunes, etc. The chief source of livelihood provided by wetland ecosystems are aquatic fauna (marine and freshwater) such as fish, prawns, crabs, turtles, and also several species of resident and migratory birds. This adaptive strategy of harvesting aquatic sources, is fishing; and for the indigenous communities, fishing is synonymous with hunting. An array of such indigenous communities, adapted to marine and riverine environments, have specialized traditional technologies (e.g., gill nets, drag nets, sink nets, traps, floats, rafts (catamarans/*Kattumarams*), canoes, hooks, bows and arrows). For all the communities who depend on forests for livelihoods, wetlands invariably provide the best supporting systems.

6.1. Wetlands and Aquatic Foods

The food resources available in wetlands are fishes and other kinds of aquatic fauna. The global production from fishing and aquaculture together reached, in 2002, about 133 million tons. The global production from capture fisheries is stagnating (it remained

stable at 93 million tons per year between 1999 and 2002), but aquaculture has been expanding. China and Peru are leading in the list of top ten countries with largest catches, and they remained in the top ten for over a decade. About 90 percent of the world's fishery catches are provided by oceans and seas. Catches from inland waters accounted for a little less than 10 percent of the total catch in 2002. The bulk of world production came from developing countries, particularly Africa and Asia. China alone accounted for a quarter of global inland water capture fisheries. Statistics of inland catches are, however, unreliable. Most countries do not report catches made by rural communities, which are often the main users.

Aquaculture is the fastest growing animal based food-producing sector, particularly in developing countries. This sector alone contributes nearly a third of the world's supply of fish products. China and other Asian countries are by far the largest producers. Unlike terrestrial farming, where the bulk of production is based on a limited number of species, aquaculture production derives from more than 220 species. Of these species, carps and related fishes form the largest group in terms of quantity. Other groups include molluscs and aquatic plants. Fast growing emerging activities include farming of the Atlantic cod and fattening of the wild-caught tuna. Tuna is the single most important exploited resource in the high seas, particularly in the Pacific Ocean.

Fishery and aquaculture provide direct employment and revenue to an estimated 38 million people, mainly the fishermen communities, but, increasingly, also to fish farmers. Detailed statistics are often not available, especially for small-scale fishing activities in developing countries. The general trend is that the number of jobs for fishermen is stagnating, while opportunities in aquaculture have been increasing, though less so since 2000.

In many areas, traditionally fished stocks have been depleted and less valuable species are now being targeted by fishers. According to the United Nation's Food and Agricultural Organization (FAO), about half of all monitored stocks are now fully exploited and another quarter is overexploited, depleted, or slowly recovering. The remaining quarter are under or moderately exploited. Available data lead to the conclusion that the global maximum potential for marine capture fisheries has been reached and that more restrictive management measures are needed to sustain many fisheries.

Natural hazards such as cyclones, floods, tidal waves, and of late, tsunamis, have devastating effects on fishing communities. Fishery policies and management have usually focused on single fishery stocks. Growing concerns about ecosystems have prompted a call for increased research into the processes that affect, or are affected by, fisheries. To

implement ecosystem-based fishery management effectively, more needs to be known about interactions of fishes with habitats, aquatic communities, land-based activities, climatic changes, and so on (FAO/UNTRIS 2008). However, the current state of many fishery resources and their associated ecosystems urges prompt action in more effective management. Major market segments for fishery products include salmon, tuna, finfish, shrimp, squid and octopus, in addition to fishmeal used to feed animals.

Fish stocks in inland waters are more difficult to monitor and very few countries can supply reliable data. Inland fishery resources are often undervalued, and are under threat from unsustainable fishing activities as well as from habitat alteration or degradation. Many river basins, especially in developing countries, support intensive fisheries, and in many cases, catches are increasing. Inland fish are considered to be the most threatened group among all the vertebrates used by humans. Nevertheless, efforts are being made in many areas to enhance fish stocks in inland waters.

Fish is mainly consumed fresh, or processed in frozen, canned or cured form. More than three-quarters of the world's fish production is consumed by humans. Most of the remaining portion is fed to animals, particularly in the form of fishmeal.

Fish and seafood consumption vary greatly between different regions of the world, from 1 kg to more than 100 kg per person, per year. The worldwide average use of fish food reached 16.2 kg per person in 2002. The per capita production and consumption are particularly high in China and in other Asian countries.

In many parts of the world, the fisheries sector can help to reduce poverty and achieve food security. Developing countries now supply 70 percent of all the fish for human consumption, making an important contribution to their economies. Fisheries should be effectively integrated into national policies related to poverty reduction and rural development.

World fish trade has increased in terms of both value and quantity. In 2002, China overtook Thailand for the first time to become the world's main exporter of fish and fish products, with exports valued at an estimated US\$4.5 billion. The largest importer in 2002 was Japan, with over one-fifth of the world's imports. Capture fisheries in coastal waters alone contribute US\$34 billion to the gross world product annually.

Fish exports are an increasing source of foreign exchange earnings for many developing countries. These earnings are significantly higher than those coming from other commodities such as rice, coffee and tea. Exports from developing countries are gradually shifting from providing raw material for the processing industry in developed countries

to selling high-value live fish or processed products. Trade in fishery products is increasingly covered by international agreements. Inland fisheries are of particular importance in developing countries like India, and they are the primary source of animal protein to which rural communities have access.

In India, marine fishing is a major source of livelihood in the coastal regions. India's coastline extends to about 8000 km and an Exclusive Economic Zone (EEZ) of 2.02 million sq km adjoining the continental regions and offshore islands (ATREE 2007). There are 53 coastal districts in the maritime states and Union Territories, including the Andaman and Nicobar, and Lakshadweep group of islands. Nearly 25 percent of the country's population lives in these areas; and about 340 communities are primarily occupied in marine and coastal fisheries. These coastal ecosystems consist of estuaries, lagoons, mangroves, backwaters, salt marshes, rocky coasts, sandy stretches and coral reefs. The varieties of fish harvested are shrimps, mackerel, sardines, anchovies, lobsters, pomfret, cuttlefish, marine reptiles (sea turtles, sea crocodiles and sea snakes) and other species.

There are numerous fishing communities (castes) inhabiting the coasts of India (Anthropological Survey of India 1994-2003). These are: (a) Pattinavar, Mukkuvar and Parava in Tamil Nadu; (b) Voda Baliye, Jalari, Pallekaru and Pattapollu in Andhra Pradesh; (c) Nooliya (constitutes Jalari and Voda Baliye), Kaibarat, Khandayat and Rajbhansi in Orissa; (d) Kaibarat in West Bengal; (e) Kharuva, Koli and Macchiyara in Gujarat; (f) Koli in Maharashtra; (g) Mogaveera in Karnataka; and (h) Mukkuvar, Anjotty, Dheevera and Pooislam in Kerala. Social groups belonging to Mukkuvar Caste are also found in Sri Lanka and Lakshadweep Islands in which they are called Melacherries. These fishing communities are organized along caste lines and have traditional governance structures, i.e., caste Panchayats or village councils. These village councils play a vital role in regulating and allocating resource use, ensuring equitable access to resources and providing some form of social insurance, and also in resolving social conflicts (Bavinck 2001).

6. 2. Wetlands and Renewable Fresh Water

There are several types of wetland ecosystems such as riverine (major and minor rivers, hill streams, rivulets, ephemeral streams, feeder channels, lakes, ponds and swamps), and shallow groundwater aquifers, which are the principal sources of renewable fresh water for human use. Ground water, which often gets recharged through wetlands, plays an important role in water supply, with an estimated 1.5 to 3 billion people dependent on it as a source of drinking water. Rivers have been substantially modified around the world to increase water availability for human use. Recent estimates place the volume of water trapped behind dams at 6,000 to 7,000 cubic kilometers.

6. 3. Other Wetland Services with Strong Linkages to Human Wellbeing

(a) *Water Purification and Detoxification of Wastes*: Wetlands, marshes in particular, play a major role in treating and detoxifying a variety of waste products. Some wetlands have been found to reduce the concentration of nitrates by more than 80 percent.

(b) *Climate Regulation*: One of the most important roles of wetlands may be in the regulation of global climatic change through sequestering and releasing a major proportion of fixed carbon in the biosphere. For example, peat lands, although covering only an estimated 3 to 4 percent of the world's land area, are estimated to hold 540 giga tons of carbon, representing about 1.5 percent of the total estimated global carbon storage, and about 25 to 30 percent of that contained in terrestrial vegetation and soils.

(c) *Mitigation of Climate Change*: Sea level rise and increases in storm surges associated with climate change result in the erosion of shores and habitats, increased salinity of estuaries and freshwater aquifers, altered tidal ranges in rivers and bays, changes in sediment and nutrient transport, and increased coastal flooding and, in turn, increase the vulnerability of some coastal populations. Wetlands, such as mangroves and floodplains, play a critical role in the physical buffering of these climate change impacts.

(d) *Cultural Services*: Wetlands provide significant aesthetic, educational, cultural and spiritual benefits. Rivers and water bodies (associated with mountains and hills, forests and trees, animals, etc.) are sacral and constitute large areas of sacral topographies. These areas are revered and protected. The sacral topographies are interwoven into the rubric of cultures as environmental ethics, and these are culturally built-in traditions of environmental protection and conservation. During the recent decades, an environmental movement, called "spiritual ecology", that explicitly encompasses religious and spiritual, as well as intellectual and political components, has been growing exponentially in the United States (Sponsel *et al.* 2007).

(e) *Recreation and Tourism*: Wetlands provide numerous avenues for recreation and tourism. Recreational fishing generates considerable income: About 35 to 45 million people take part in recreational fishing (inland and saltwater) in the United States, spending a total of US\$24-37 billion each year on this pastime. Much of the economic value of coral reefs—with net benefits estimated at nearly US\$30 billion each year—is generated from nature-based tourism, including scuba diving and snorkeling.

7. Forests and Human Species

It would be quite in order to recapitulate, in brief, the evolutionary history of humankind vis-à-vis the forest. The evolution of human species took place in the savanna grasslands/woodlands of East Africa, and the chief source of subsistence was hunting-gathering.

Palaeo-anthropological and palaeontological evidences brought to light from different parts of Africa, Europe, Southwest Asia, Southeast Asia, and South Asia (Campbell 1979; Clark and Piggot 1976; Kuhn and Stiner 2001; Larsen 1998; Sankhyan 2005; Sonakia 1985) have brought to light two human genera, i.e., *Australopithecus* and *Homo*.

The genus *Australopithecus* is extinct. It is represented by: (a) *Australopithecus afarensis* (between 3.6 million years and 3.0 million years before present); (b) *Australopithecus aethiopicus* (2.6 to 2.2 million years); and (c) *Australopithecus robustus*, *Australopithecus boisei* and *Australopithecus africanus* (3.0 to 1.2 million years).

The genus *Homo* is represented by: (a) *Homo habilis*, the earliest member of the genus (2.3 to 1.7 million years); (b) *Homo ergaster* and *Homo erectus* (1.9 - 1.7 million years to 250,000 years); (c) *Homo sapiens heidelbergensis*, archaic *Homo sapiens* (first appearance in Europe and Africa about 0.6 million years); (d) *Homo sapiens neanderthalensis*, *Homo sapiens rhodesiensis* and *Homo sapiens soloensis* (these three are now classified as *Homo neanderthalensis*, popularly known as Neanderthal man, and Neanderthals; they lived during 200,000 years to 40,000 years before present); and (e) *Homo sapiens sapiens* (40,000 years before present to the present). Excepting the last sub-species, the rest are extinct. We (the extant humans) belong to this last sub-species, *Homo sapiens sapiens*, which is now called the Anatomically Modern *Homo Sapiens* (AMHS).

In the biological and social evolutionary history of humankind, humans have adapted to a variety of biomes in the tropical and temperate regimes of the world since about three million years ago (Campbell 1979; Clark and Piggot 1976). Hunting-gathering (big game, small game, avifauna, aquatic fauna and a variety of wild plant foods) has been the main subsistence strategy, and it represents the human way of life for 90 percent of human history (Lee and Devore 1968). The experiments towards animal and plant domestication (of sheep and goat initially and later cattle; and cultivation of wheat and barley) began from about 8000 B.C.E. in the Fertile Crescent (parts of ancient Iran and Iraq); farming systems began to spread to Europe and South Asia from around 6000 B.C.E. (Childe 1964). The regions of Southeast Asia (the zone of Austronesian and Austriasiatic) down to northern part of South Asia (North East India through Ganga Valley, Orissa to Eastern Ghats), witnessed the development of cultural systems based on tuber-crop horticulture, rice cultivation and domesticated pig, fowl and water buffalo. These ecotones of Southeast and South Asia, today, are the major zones of swidden agriculture (shifting cultivation/slash-and-burn cultivation).

8. Forests and Livelihoods

The kinds of forest-based livelihoods and associated forest use have varying degrees of impact on forest resources (Table 6) (Sunderlin *et al.* 2005). In hunting-gathering cultural

systems, the dependence on forests is chiefly for food procurement, with minimal destruction of forests. In the food production systems, forests have been manipulated for shifting cultivation in some regions and irrigation agricultural, in other, without causing large-scale degradation of forest cover.

The irrigation agricultural system in many parts of Asia, Africa and Europe is characterized by agriculture and herdsman husbandry (agro-pastoral economies) and settled village life in favourable ecological zones. In some regions of Africa and Asia, side-by-side with agro-pastoral economies, are communities who practice exclusive nomadic pastoralism or transhumant pastoralism: the herd animals range from cattle, sheep, goats and camels.

In India, these pastoral groups are adapted to varied ecological regions such as the montane and sub-montane zones of the Himalayas, desert-grassland ecosystems of the Thar Desert, and savanna woodlands, shrub savanna and thorny-thicket zones of the Deccan Plateau. These nomadic and transhumant pastoral groups depend on forests and forest-edge habitats for fodder and water for their herds. Most of these communities have practically become symbiotic with village communities; they pen their herds in the agricultural fields after the harvest. The herds graze on the stubble, and the droppings of the livestock manure the fields. The pastoralists and the agriculturists are also engaged in interactive exchange: exchange of items such as grains, woolen blankets, and livestock.

These traditional communities (hunter-gatherers, agro-pastoralists, and shifting cultivators) depend on forests for woods, for making implements and construction of shelters, fire wood, herbal medicines, and other items of non-timber forest produce. It is important to note that these traditional communities live with the forest, conserve the forest and protect the forest, and Anderson calls this “the ecologies of the heart” (Anderson 1996).

8. 1. Forests, and Scheduled Tribes and Castes in India

In India, forest-dependent people (*ādivāsis*/indigenous communities) have been grouped into three categories. To the first category belong the traditional or indigenous communities who have been living in the forest, over the millennia (references to them occur in historical records such as inscriptions, and textual sources, from at least the 4th-5th centuries A.C.E.). These groups are now labeled as Scheduled Tribes (ST) and Scheduled Castes (SC). The second comprises people who have long lived in a given forest area, but are not considered traditional or indigenous. The third category consists of people who have migrated into the forested areas. No matter how they have been classified, the livelihoods of these communities *who live in the forest and whose livelihoods are sustained by the forests* have been in jeopardy without the “forest” or “restricted access to the forest”.

Table 5: Types of Forest-Based Livelihood Modes and Associated Attributes of Forest Use (Suderlin *et al.*2005)

Associated Attributes of Forest Use				
Types of Livelihood	Main Type of Forest Use	Density of Forest	Mode of Forest Use	Forest Product Income as Share of Total Income
A. Hunting and Gathering	Food: capture and collection of forest fauna and flora	High	Use value: high Exchange value: low	High
B. Swidden Cultivation	Source of agricultural land restored by forest fallows. Use and marketing of forest products	Medium	Use value: medium	Medium
C. Sedentary Agriculture at Forest Frontier	Source of new agricultural land. Marketing of forest products	Low	Use value: low Exchange value: high	Low

According to the Population Census 2001 (Government of India), the population of the SCs and STs together comprises 24 percent, with SCs at 16.20 percent and STs at 8.10 percent. The central Indian tribal belt, from Gujarat in the west up to West Bengal in the east, and across the states of Madhya Pradesh, Chhattisgarh and Jharkhand, is among the poorest regions in the country (Malhotra and Bhattacharya 2010). In all, there are 188 tribal districts spread over 26 States/Union Territories (UTs) in the country.

The total forest cover in the tribal districts is 407,032 square kilometers, which is 36.81 percent of the Geographic Area (GA). The state with the highest proportion of Scheduled Tribes is Mizoram (94.5 percent), whereas the State of Goa has no STs. Among the UTs, Lakshadweep has the highest proportion of STs (94.5 percent), whereas Andaman and Nicobar Islands have the lowest proportion (8.3 percent). Coming to the Scheduled Castes, Punjab State has the highest proportion (28.9 percent), and Mizoram has none. Among the UTs, Chandigarh has the highest proportion (17.5 percent) of SCs, while there are none in Andaman and Nicobar Islands.

In Orissa State, there are maximum number (64) of tribal groups; the other states with an appreciable number of tribal groups (the number varies between 19 and 49), in

descending order, are Karnataka, Maharashtra, Madhya Pradesh, West Bengal, Tamil Nadu, Kerala, Andhra Pradesh, Bihar, Gujarat, Manipur and Tripura.

Several areas in the country, predominantly inhabited by the tribals, have constitutionally been accorded special status in the form of Scheduled Areas. These are two categories—Fifth Schedule Area and Sixth Schedule Area, each having distinct rights and privileges for the tribals. These areas also receive special financial allocation. The Fifth Schedule Area covers tribal areas in nine states: Andhra Pradesh, Jharkhand, Gujarat, Himachal Pradesh, Maharashtra, Madhya Pradesh, Chhattisgarh, Orissa and Rajasthan (Table 7). The Fifth Schedule guarantees right over the land, in which they live, to the indigenous people. The Sixth Schedule applies to the northeastern states such as Assam, Meghalaya, Tripura and Mizoram. The Sixth Schedule Areas in the country have been divided into Part I, Part II and Part III (Table 8).

Table 6: Fifth Schedule Areas in the Country

Sl. No.	State	Areas
I.	Andhra Pradesh	Visakhapatnam, East Godavari, West Godavari, Khammam, Adilabad, Srikakulam, Vizianagaram, Mahboobnagar, Prakasam (only some mandals are scheduled mandals)
II.	Jharkhand	Dumka, Godda, Deogarh, Sahabgunj, Pakur, Ranchi, Singhbhum (East & West), Gumla, Simdega, Lohardaga, Palamu, Garwa, (some districts are only partly tribal blocks)
III.	Chhattisgarh	Sarbhuja, Bastar, Raigad, Raipur, Rajnandgaon, Durg, Bilaspur, Sehdol, Chindwada, Kanker
IV.	Himachal Pradesh	Lahaul and Spiti districts, Kinnaur, Pangi Tehsil and Bharmour sub-tehsil in Chamba District
V.	Madhya Pradesh	Jhabua, Mandla, Dhar, Khargone, East Nimar (khandwa), Sailana Tehsil in Ratlam District, Betul, Seoni, Balaghat, Morena
VI.	Gujarat	Surat, Bharuch, Dangs, Valsad, Panchmahl, Sadodara, Sabarkanta (parts of these districts only)
VII.	Maharashtra	Thane, Nasik, Dhule, Ahmednagar, Pune, Nanded, Amravati, Yavatmal, Gadchiroli, Chandrapur (parts of these districts only)
VIII.	Orissa	Mayurbhanj, Sundargarh, Koraput (fully Scheduled Area in these three districts), Raigada, Keonjhar, Sambalpur, Boudhkondmals, Ganjam, Kalahandi, Bolangir, Balasor (parts of these districts only)
IX.	Rajasthan	Banswara, Dungarpur (fully tribal districts), Udaipur, Chittaurgarh, Siroi (partly tribal areas)

Source: www.mmpindia.org/Fifth_Schedule.htm

Table 7: Sixth Schedule Areas in the Country

PART I	PART II	PART III
1. The North Cachar Hills District	1. Khasi Hills District	1. The Chakma District
2. The Karbi Anglong District	2. Jaintia Hills District	2. The Mara District
3. The Bodoland Territorial Areas District	3. The Garo Hills District	3. The Lai District
	PART IIA	
	1. Tripura Tribal Areas District	

Source :<http://indiacode.nic.in>

VIII. 2. Forest-Dependent People in India

(a) *Hunter-Foragers*: There are a large number of hunting-gathering tribal communities (also referred to as hunter-foragers) who inhabit varied thickly forested biomes (which include wetland ecosystems) across the country. These, to mention some, are Malapandaram, Eravallan, Vadda, Kadar, Paliyan, Irula, Katkari, Nari Kuruva, Yanadi, Chenchu, Yerukula and Boya of Tamil Nadu, Kerala and Andhra Pradesh; Gadaba, Paraja, Bondo and Bhatra in the Indravati and Mahanadi river systems in Southern Orissa and Khond and Juang in the Keonjhar District of Northern Orissa; Kuruk in the Bastar District of Chhattisgarh; Birhor of Chotanagpur Plateau; Van Vagri of the desert grasslands of Rajasthan; and Bhil of Rajasthan and Central India. All these communities live predominantly by hunting, but hunting is now forbidden. (The game they once preyed upon were blackbuck, spotted deer, antelope, wild boar, fox, jackal, hare, porcupine, hedgehog, mongoose, monitor lizard and jungle cat; birds like partridge, sand grouse, dove, pigeon, peacock, vulture, common crane; and fish.) Such communities of the Ganga Plains and Central India are less known. Some of them are the Aheriyar (snake catchers, fowlers and hunters), Baheliya (hunters, bird trappers and collectors of jungle produce), Bandi (essentially bird catchers), Bangali (catching birds, hunting and fishing), and Kanjara (hunting, catching birds and turtles) of the Ganga Plains; the Pardhi and Kuchabandhia of Central India. The Onge of Little Andaman Islands subsist by fishing, hunting pigs and turtles, and gathering wild plant foods. In addition to these, there are the marine fishing communities of the west and east coasts to whom a reference has already been made earlier (P. 17).

(b) *Shifting Cultivators*: The second group of forest-dependent people is that of the shifting cultivators who practice swidden agriculture or slash-and-burn agriculture (called *jhum* in the North East and *pôdôu* in the Eastern Ghats). The *jhum* cultivators of the NE

Region (Assam, Nagaland, Tripura, Arunachal Pradesh, Meghalaya, and Manipur) are called *Jhumias*. These are hill communities, and the main sources of livelihood for them are: (a) *jhum* cultivation, (b) dry terrace paddy and wet rice cultivation; (c) horticulture; (d) vegetable cultivation in homestead lands or kitchen gardens; (e) collection of forest produce; (f) piggery; (f) livestock; (g) fisheries; and (h) weaving.

The shifting cultivators in the Eastern Ghats (lower reaches of the Godavari Valley and extending into Orissa and beyond) are the Konda Reddi, Konda Dora, Konda Kapu, Koya, Savara, Samanta, Khond, Bhagata, Valmiki, Nayak Pod, etc. They practice *pôdôu* as well as wet rice agriculture, tuber-crop horticulture, vegetable cultivation in the kitchen gardens, piggery and poultry, fishing, hunting of big and small game, and collection of wild plant foods and forest produce.

It has been argued by some that *jhum* has a deleterious effect on the local environments, depleting the soil of nutrients, reducing the forest cover, causing landslides, etc. Arguments against *jhum* have come especially from state forestry departments, development ministries like Development of North East Region (DONER) and trade promoting entities such as the World Bank, which are interested in exploiting the forest resources for the benefit of national and private capital.

Studies conducted by organizations such as the Indian Institute of Science, Tata Energy Research Institute and UNESCO indicate that *jhum* is indeed a sustainable form of agriculture, best suited to the ecology of the higher mountainous ranges of the North East, and it provides basic level of food sustenance through cooperation. It has been pointed out that *jhum* is intimately integrated with socio-economic fabric of rural societies in North East India. This economic system plays a central role in uniting villages and clans, as well as integrating the people with local modes of commerce. The *jhum* cultivation also prevents them from being subjected to the whims of the larger capital market.

(c) *Pastoral Nomads*: The third group of forest-dependent people is that of the pastoral nomads, who, despite having become symbiotic with village societies move into forests and forests-edge habitats on their transhumance for grazing their herds. These are the camel-herding Rabadis of Rajasthan; cattle breeders of Gujarat (especially Mehasana, Banaskantha and Kaira districts in North Gujarat; Banni, Lakhpat, Nakhtarna, Kharda, Khadir and Abdasa tracks in Kutch; and Gir, Barde and Aleeh in Saurashtra); cattle breeders of Maharashtra (Ahmednagar District, western part of Nasik District, eastern part of Thane District, and southeastern part of Dangs District); cattle and sheep/goat herders of the Maharashtra-Telangana-Karnataka-Rayalaseema plateaus of the Deccan (a typical semi-arid pastoral country with low rainfall of 800 mm to 1000 mm, and

expanses of grasslands, shrub-savannas, and thorny thickets). These pastoral communities of the Deccan are the Dhangar of Maharashtra; the Golla and Kurma of Telangana; the Kuruva and Golla (identified as Yadavas) of Rayalaseema; and the Kurubas of Karnataka.

(d) *Culture Versus Development*: What is crucial in the context of developmental programmes in forest ecosystems is the understanding of the culture histories and culture processes of these communities, to avoid lackadaisical approach—the “we” and the “other”—the former being ridiculously ignorant of the latter’s rich adaptive-cultural systems, but have become the bulwarks in “providing livelihoods and food security” to the latter. The kind of research in which we (RULNR) are engaged will have no meaning and relevance, whatsoever, if these problems are not addressed in right earnest to reverse the exclusive top-down approach and formulate a combination of both bottoms-up and top-down approaches, paying significant attention to the local knowledge traditions.

It is imperative to repeat once again that for the different strands of communities (*âdivâsi*, ST, SC, OBC, etc.) who are the subjects of concern, their existence has been in an ecologically sustainable relationship with the forest(s) they inhabit. But during the present times, they have been struggling for their survival (Haimendorf 1982). The forest, for these societies, is a common property resource. The “state”, from the early historical times till the colonial period, took steps to manage forest resources, with the co-operative participation of the *âdivâsi* communities, safeguarding their interests on forest for livelihoods, commercial products, woods for implements, domestic structures, monumental architecture, aromatic and herbal medicines, animal products, and rituals (both folk and Brahmanical).

The “state” (early historic and medieval Indian) regarded the forest with esteem. It is *aranâya*, the sacral and ritual space for sages and Rishis to perform penance, *yagna* and *yâga* rituals (for the prosperity and welfare of the kings and their citizens), and to attain liberation from this earthly world (*môksa*). The “state” from the early historic times, began to reclaim the forests to establish settlements (*grâma*), with separate wards, called *agrâhâra*, for the priestly class, the Brâhmans. The revenue of the state was dependent upon agricultural production and trade, and this type of cultivable land is the *kseôtra*. The seat of the state’s power is the capitol city, *pura*, and the marketing centers of all commodities are the *pattândas*. The “state” depended on a reciprocal interactive exchange with the forest dwellers for the protection and administration of its frontiers (Murty 1992). These forest dwellers were treated with respect and are referred to as Bhillas, Andh, Kirata, Pulinda, Nishada, Redu, Nayaka, Raja, etc. In the medieval textual sources, they are acclaimed with high esteem. Historical sources reveal several instances of upward social mobility of certain lineages from among these communities, including inter-caste

marriage (hypogamous and hypergamous), and a provision for such a process occurs in *The Sacred Laws of Manu*.

9. Biodiversity

Forests are an important repository for terrestrial biodiversity with three dimensions: structural diversity (such as area of forests, natural and protected forests, species mixture, and age structure); composition diversity (number of total floral/faunal species, for example, endangered species); and functional diversity (the impact of major processes and natural and human-induced disturbances (Noss 1990). Though considerable information on forest-related biodiversity has become available over the past decade (Heywood 1995), consistent global assessment and monitoring are still difficult due to data insufficiency and incompatibility of data.

In the context of forest—biodiversity—and human species, it should be noted that more than 1.7 billion people live in 40 nations having critically low levels of forest cover, in many cases hindering prospects for sustainable development. The number of people living in low-forest cover nations will probably triple by 2025, reaching 4.6 billion, and 13 additional countries will experience forest resource scarcity (Gardner-Outlaw and Engelman 1999). The growth of human population has drastically shrunk the forest-to-people ratio from 1.3 hectares per capita in 1960 to 0.6 hectares per capita at present. By 2025, the ratio is predicted to decline further, to 0.4 hectares per capita (*Ibid.*).

The large-scale damage to biodiversity, globally, has become the major cause of concern for many governments. At the meeting of the environment ministers of the G8 countries and the five major newly industrializing countries that took place in Potsdam in March 2007, the German Government proposed a study on “the economic significance of the global loss of biological diversity” as part of the so-called “Potsdam Initiative” for biodiversity. One of the initiatives that has emerged in this convention is the “The Economics of Ecosystems and Biodiversity” (TEEB) study, being led by UNEP with financial support from the European Commission, German Federal Ministry for the Environment, and the UK Department for Environment, Food and Rural Affairs (www.teebweb.info). The aim of TEEB is a global study to initiate the process of analyzing the global economic benefit of biological diversity, the costs of the loss of biodiversity, and the failure to take protective measures versus the costs of effective conservation. This study has been organized into two phases.

On the basis of the work of Phase I, the Interim Report of TEEB was released in May 2008. It provided strong evidence for significant global and local economic losses and human welfare impacts, attributable to the ongoing losses of biodiversity and degradation

of ecosystems. It focused largely on forests. Phase II of the study sets out to expand on the work begun in Phase I. It will be completed in 2010 and presented in Nagoya, at the 10th Conference of Parties of the Convention for Biological Diversity (CDB COP-10).

The objectives of the Phase II of the TEEB Study are:

- (1) Integrate ecological and economic knowledge to structure the evaluation of ecosystem services under different scenarios.
- (2) Recommend appropriate valuation methodologies for different contexts.
- (3) Examine the economic costs of biodiversity decline and the costs and benefits of actions for reducing these losses.
- (4) Develop “toolkits” for policy makers at international, regional and local levels, in order to foster sustainable development and better conservation of ecosystems and biodiversity.
- (5) Enable easy access to leading information and tools for improved biodiversity practice for the business community—from the perspective of managing risks, addressing opportunities and measuring impacts.
- (6) Raise public awareness of the individual’s impact on biodiversity and ecosystems, and areas where individual action can make a positive difference.

9. 1. Biodiversity in India

India has a rich and varied biodiversity which ranges from tropical rain forests to Alpine vegetation and from temperate forests to coastal wetlands (Rodgers and Panwar 1988). In geographical terms, India constitutes a mere 2.4 percent of the world’s area. India accounts for 7 to 8 percent of the recorded global species. The country has 14 Biosphere Reserves, of which four—the Sunderbans, Gulf of Mannar, Nilgiri and Nanadadevi—are included in the World Network of Biosphere Reserves. About 25 Ramsar wetlands have been designated in the country. India has 599 PAs (including 95 National Parks, 502 Wildlife Sanctuaries, and two Conservation Reserves) covering an area of 15.67 million hectares (4.75 percent of the GA). There are 29 Tiger Reserves within the structural framework of the PA network under the National Tiger Conservation Authority. The endemism of Indian biodiversity is also very high, with about 33 percent of the country’s recorded higher flora being endemic to the country and concentrated mainly in the North East, Western Ghats, North West Himalayas, and the Andaman and Nicobar Islands. On the basis of eco-climate, topography, geomorphology and vegetation biomes, India has been divided into 10 bio-geographic zones (*Ibid.*). These are: (a) Trans-Himalaya (5.5 percent of the total geographical area); (b) Himalaya (6.4 percent); (c) desert (5.6

percent); (d) semi-arid (18.6 percent); (e) Western Ghats (4.0 percent); (f) Deccan Peninsula (42 percent); (g) Gangetic Plains (10 percent); (h) Coasts (2.5 percent); (i) North East (5.2 percent); and (j) islands (0.8 percent).

9.2. Biodiversity and Livelihoods in India

A recent national seminar on “Biodiversity and Indigenous Knowledge System” highlighted various crucial aspects of vital significance to human beings, as it provides food, medicine and industrial raw materials along with an immense potential for accruing many unknown benefits to future generations (Das and Shukla 2007). The areas rich in biodiversity are also the abode of diverse ethnic groups possessing a valuable reservoir of Indigenous Knowledge System (IKS) that has been acquired and developed during the long course of ethnic histories. A rapid pace of development in the regions populated by tribal communities and amalgamation of tribal societies with mainstream societies has led to a threat of gradual erosion of indigenous knowledge base, accompanied with an imminent danger of bio-piracy of valuable resources and knowledge systems. Therefore, an integration of traditional knowledge with modern scientific developments by value addition is an essential requisite for successful application of IKS for economic welfare of the tribal societies in India.

The deliberations in this conference underlined the necessity of evolving a broadly acceptable mechanism for conservation and sustained utilization of biological resources, adequate representation of local tribal communities with regard to conservation or sustainable development, the importance of community-level innovation techniques and policies for improvement and scientific validation of the IKS. Some of the important aspects are as follows:

The current global demand for herbal medicines is approximately US\$54 billion and countries such as Finland and Switzerland, with 1100 and 2700 plant species, are earning US\$22.06 and US\$30.27 million respectively, whereas India with 8000 plant species is earning a significantly lower amount. It has been suggested that to reap the optimum benefits of biological resources, emphasis should be laid on survey and documentation of plant wealth, selection of priority species for different altitudinal zones and identification and characterization of chemical compounds in medicinal plants.

With reference to the National Biodiversity Act (2002), it has been emphasized that there is a need for fair and equitable sharing of the benefits of commercialization of IKS. In a case study of the Kani Tribe in Kerala, their indigenous knowledge about the anti-fatigue properties of a wild plant species, *Trichopus zeylanicus*, has been presented. This valuable knowledge of the tribe has been successfully translated into a scientifically

validated drug “*Jeevani*”, by the efforts of Tropical Botanic Garden and Research Institute (TBGRI), Thiruvanthapuram. An arrangement of equitable sharing of the benefits of commercialization of this drug involves a share of 50 percent of the license fee and royalty for the tribe. Another case study highlighted the potential of the NE Region with regard to essential oils and flavour and fragrance compounds. In 2004, the market potential for essential oils and natural flavor and fragrance compounds was US\$18.4 million. This market is continuously growing at an annual rate of 10 percent for essential oils and 4-5 percent for flavour and fragrance compounds. Cosmetic industry and aromatherapy are other emerging areas for developing entrepreneurship in the NE region. It has been pointed out that the present marketing system for herbal products in the NE region is not catering to the needs of the poor and marginal farmers. It has been suggested, therefore, that a centralized cooperative marketing system for medicinal and aromatic plants and plant-based products is an immediate requirement for promoting medicinal plant farming in the NE region.

Though the NE region has vast potential for aquaculture, there is a deficit of 39 to 80 percent in the production of aquaculture products in this region. This deficit can be overcome by utilizing large areas (93,815 ha) of *beels*/ox-bow lakes. It was stated that about 20,500 ha area of the NE region is currently under unscientific utilization pattern and a significant increase in production can be achieved by training the farmers to adopt modern scientific techniques of aquaculture.

The NE has also a great potential for sericulture, with its great diversity of sericigenous insect ecosystem and habitat level. It has been suggested that several fold increase in yield of silk can be obtained by preparing a distribution map of silk moths and their habitats, evaluation of the qualitative aspect of food plants of silkworms and hybridization of wild species of silkworms with superior ones.

The above cited examples give valuable insights into the biodiversity, indigenous knowledge and the enormous scope in making judicious use of it for livelihood improvement of the local communities in different parts of India.

10. Forests and Climate Change

Forests and woodlands play a significant role in the global carbon cycle and consequently, in accelerating or decelerating global climate change. Forests contain about 50 percent of the world's terrestrial carbon stocks, and forest biomass constitutes about 80 percent of terrestrial biomass. Forests contribute over two-thirds of global terrestrial net primary production. Slowing forest loss and restoring forest cover in deforested areas could help mitigate climate change. Several types of pollution affect forests and contribute to climate change.

Forests in Europe showed a continuous deterioration from 1986 to 1995 due to air pollution, as the proportion of healthy trees fell from 69 percent in 1988 to 39 percent in 1995 (Shvidenko *et al.* 2005: 611-613). Results for 1995-2001 show stabilization at a high level of damage, with almost a quarter of the sample trees rated as damaged due to air pollution. For example, sulfur from the world's biggest source of sulfur emissions, Norilsk in Northern Siberia (about 2 million tons of sulfur dioxide per year), caused tree mortality and degradation of more than 2 million hectares of surrounding forest tundra landscapes during the last four decades (Bruce *et al.* 2004). Air pollution induces changes in tree physiology, phenology, and biochemical cycling. Among air pollutants affecting forest health, the most pervasive are sulfur, nitrogen, heavy metals and ozone. The decline in forests has been due to the combined impact of eutrophication, acidification and climate change (Nelleman and Thomsen 2001). The impacts of pollution on forests are not confined to industrial countries. Although anthropogenic emissions of sulfur dioxide have recently declined in most industrial countries in Europe and North America, emissions have increased in a number of countries in Asia, Africa, and Central and South America. Emissions of nitrogen oxides due to human activities remain constant or have increased over vast regions. Forest fires are other crucial disturbing factors affecting tropical, temperate and boreal forests that severely damage forests and lead to long-term degradation. Fires driven by the El-Ñiño Southern Oscillation during 1997-98 burned more than 20 million hectares in Latin America and Southeast Asia (WGWF 2003). The complete economic, social and ecological consequences of these fires have not been quantified. The cost of carbon loss from these forests due to 1998 fires in Latin America is roughly estimated at US\$10-15 billion, while severe respiratory health problems, together with widespread transport disruption were estimated to cost US\$9.3 billion (WGWF 2003).

Another impact of climate change on forests is increase in temperatures. During the last 30 years, the world has experienced significant temperature increase, particularly in the northern high latitudes (IPCC 2001). The climatic scenario considered by the Third Assessment Report of the IPCC projects the increase in global annual average surface temperature by the year 2100 to be 1.4°C to 5.8°C, higher than the mean over the period 1990 to 2001. In some regions, this projected warming will generate a climate not experienced in recent evolutionary history. Western North America, for example, could be 2°C-5°C above the range of temperatures that have occurred over the past 1000 years. As a whole, precipitation patterns are predicted to increase. This is mostly expected in winter precipitation, and many regions will face either a very small change or a decrease in summer precipitation. In particular, the latter is expected in regions of dry forests and woodlands. Finally, climate variability, such as frequency of extreme events and occurrence of dry and hot periods, are expected to increase substantially

(IPCC 2001). The dramatic changes will be accompanied by the “fertilization effect” of increasing carbon dioxide, concentration and nutrient deposition, which may substantially affect the state, functioning, and dynamics of the world’s forests. Although there is lack of knowledge on the adaptive capacity of tree species, it is likely that an increase in temperature by a few degrees accelerates productivity of forests, though any further increase will affect the forest ecosystems in a clearly negative way. Further, there are also experimental data that do not support carbon dioxide fertilization models. The impacts of changing climate also vary among different measures of ecosystem productivity. Since climate change alters the spatial and temporal patterns of temperature and precipitation (the two most fundamental factors determining the distribution and productivity of vegetation), climate change will cause geographical shifts in the range of individual species and vegetation zones.

Any changes in the natural biomes due to climate change will affect the indigenous people in different parts of the world. Indigenous people constitute about four percent of the global population (somewhere between 300 to 370 million), spread around the world in 70 countries, from the Arctic to the Pacific.

11. Assisted Natural Regeneration of Forests

The need for an effective and low-cost forest and biodiversity restoration and rehabilitation methods has now become imperative in the face of climate change and the global phenomenon of rapid loss of forests and biodiversity. An estimated 850 million hectares of degraded forests exist globally. This need to rehabilitate these degraded forests is prominently enshrined in several global agreements such as the Convention on Biological Diversity and the Kyoto Protocol, among others. The task of forest restoration and rehabilitation is especially daunting for developing countries with inadequate financial resources required for the rehabilitation of critical areas to bring back lost biodiversity and ecosystem services (www.fao.org/forestry/anr/en/).

This strategy (in the perspective of above) is called “Assisted Natural Regeneration” (ANR) of forests. This is a method for enhancing the establishment of secondary forest from degraded grassland and shrub vegetation by protecting and nurturing the mother trees and their wildlings endemic to the area. ANR aims to accelerate, rather than replace, natural successional processes by removing or reducing barriers to natural forest regeneration such as soil degradation, competition with weedy species and recurring disturbances (e.g., fire, grazing and wood harvesting). Seedlings are, in particular, protected from undergrowth and extremely flammable plants such as Imperata grass. In addition to protection efforts, new trees are planted when needed or wanted (enrichment planting). With ANR, forests grow faster than they would naturally. ANR is considered to: (a) be

a cost-efficient way of regenerating forests; (b) provide job opportunities for communities; (c) contribute to strengthening the biodiversity; (d) provide hunting areas; and (e) increase carbon sequestration and carbon sinks which contribute to mitigation of climate change.

12. Sustainable Management of Forests and Poverty Alleviation in India

We come across two terms, which are frequently used, in the management of forests. These are deforestation and degradation. While deforestation is a change of land use from forestry to non-forestry uses, degradation is the conversion of good forest cover into secondary bush, finally leading to desertification (Hazra 2002: 7).

Forest is the second largest land use in India next to agriculture. The forest cover of India is assessed at 67.83 million hectares, which constitutes 20.64 percent of the country's GA, ranging from the Himalayan Temperate to Dry Zone forests. The Indian Subcontinent is rich in mega-biodiversity with high level of endemism. The National Forest Policy stipulates that one-third of area should be under forest or tree cover.

The forests play a vital role in harboring more than 45,000 floral and 81,000 faunal species of which 5150 floral and 1837 faunal species are endemic. The nation has established 597 Protected Areas comprising 95 National Parks, 500 Wildlife Sanctuaries, 2 Conservation Reserves covering 1.5 million hectares, or 4.75 percent GA of the country. The rising demand for forest-based products and the resultant deforestation and encroachment has led to severe loss of natural resources and destruction of habitat.

India is likely to face severe shortage of supply of timber to meet its requirement from both domestic and international front. It is estimated that the demand for timber is likely to grow from 58 million cubic meters in 2005 to 153 million cubic meters in 2020. The supply of wood is projected to increase from 29 million cubic meters in 2000 to 60 million cubic meters in 2020. As a result, the nation has to heavily depend on imports for meeting its growing demand. This could result in loss of high conservation value forests or loss of biodiversity elsewhere.

The Living Planet Report 2006 ranked India as the third highest gross foot print nation, followed by US and China. India is presently the fourth largest economy in terms of purchasing power parity, and it is growing at 8-9 percent per annum. This fast growth, coupled with the needs and aspirations of more than one billion people, is a challenge for conservation of forests, and it cannot be tackled unless environmentally responsible policies are in place. In this regard, the new strategy document of the Forest programme incorporated innovative approaches such as Payment for Ecosystem Services (PES), Ecological Footprint Analysis and Forest Certification (EFAFC).

The Indian Government, to safeguard the forests, launched the Joint Forest Management (JFM) initiative, keeping in tune with the decentralized governance policies, which have significantly influenced the forest management system in the third world (Bardhan 1996; Gopinath Reddy *et al.* 2009; Ratna Reddy *et al.* 2004). In fact, decentralized forest management has become a global discourse for sustainable forest management and poverty reduction. At present, about 60 countries have been implementing decentralized governance in forest management (Ribot 2004). After inception of the Joint Forest Management in the 1990s, decentralized institutions for forest management have expanded phenomenally. In 2006, as many as 85,000 village communities were engaged in forest management, managing about 27 percent of the forestland in India (World Bank 2006).

Prior to independence, the colonial government asserted control over extensive forestlands, resulting in the decline in traditional conservation and management systems around the forests (Gadgil and Guha 1992), and even after independence, the early post-colonial forest policy differed little from the colonial period. The National Forest Policy (1952) did not consider the needs of the local people, its aim being the supply of timber for industrial needs. Commercialization of forests was emphasized, like in the colonial regime, at the cost of the local people. The post-colonial government, in the Forest Policy of 1952, continued to envisage the commercial exploitation of forests, now for “national” interest. Recognition of the importance of forests at the policy level is reflected in enshrining in the Constitution which states: “The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country”. Constitutionally, it has been enjoined upon every citizen of India as a fundamental duty: “to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures” (Article 51 A (G), (1990)). Nadkarni (1996: 20) draws attention to three institutions in the management of forests in India: (a) purely under government ownership and management, but with some amount of participation from the people wherever feasible, as in the case of national parks, wildlife sanctuaries and ecologically rich but reserved forests maintained mainly for environmental considerations; (b) farm forestry in private agricultural lands or in government lands leased to private farmers to produce timber and fuel wood for sale to the larger economy; and (c) JFM and social forestry projects mainly under people’s collective management.

13. Approach by the Research Unit for Livelihoods and Natural Resources (RULNR)

An overview of the forest ecosystems, livelihoods, environmental concerns, and forest management institutions in a global perspective is presented here: (a) to bring into focus the concepts and approaches being pursued at RULNR; and (b) the issues that are

proposed to be addressed in the coming years, to grapple with poverty and squalor among the tribal and rural communities—the STs, SCs, OBCs, etc., of India. These are the “*indigenous and native communities*” who have been living in the forests since millennia, eking out their livelihoods; their adaptive patterns are remarkable cultural systems into which are interwoven the knowledge of nature, plant and animal life, conservation principles, symbols and rituals. The irony unfortunately is, their rights to their forests have been curtailed, and the so-called developmental programmes are abetting their poverty rather than contributing to their wellbeing. In this context, the following are some of the programmes that are proposed for research in the coming years.

(1) Forest Right Act of 2006 and its Impact on the Livelihoods Security of the Forest Dwelling Communities

The Scheduled Tribes (Recognition of Forest Rights) Bill, 2005 is re-christened as “The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006”. The pros and cons of “The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006”, are hotly debated in the academic, government and NGO circles, and there are differences of opinion with regard to the intentions of the Act.

According to one study, though the Act contains many positive elements, there are still enough ambiguities and loopholes, which create hurdles in the implementation process (Gopinath Reddy *et al.* 2009).

Another study points out the pit falls in this Act (AITPN 2006). In the earlier “Scheduled Tribes (Recognition of Forest Rights) Bill, 2005, there is a clear recognition of the symbiotic relationships of the tribals with the forest. The same was stressed in the National Forest Policy of 1988. The Scheduled Tribes (Recognition of Forest Rights) Bill, 2005, is “A bill to recognize and vest the forest rights and occupation in the forest land of forest dwelling Scheduled Tribes who have been residing in such forest for generations but whose rights could not be recorded . . .” On the other hand, the newly passed Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, states that it is “An act to recognize and vest the forest rights and occupation in forest land in forest-dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded. . . .” (AITPN 2006).

This law mixes the interests of the forest-dwelling Scheduled Tribes with that of the “other traditional forest dwellers”. The forest-dwelling Scheduled Tribes no longer remain the focus of the law, contrary to what was originally envisaged. While tribals and forest

are synonymous and one cannot be separated from the other, the same is not the case with the “other traditional forest dwellers”, i.e., the non-tribals. The tribals have emotional, psychological and cultural attachments with the forest, and they have always lived in the forest. On the other hand, for non-tribal forest dwellers, forest and forest-related livelihood activities are the last resort when no other options of livelihood are available. The non-tribals usually do not take livelihood activities in forest by choice. However, by legitimizing their occupation of the forest lands under the guise of “Other Traditional Forest Dwellers”, the act negated the spirit of the various safeguards available to the members of the Scheduled Tribes under the Constitution and other relevant laws of the country. Rather than improving the lot of the tribals, the act will add to the clash of interests between the forest-dwelling Scheduled Tribes and other traditional forest dwellers.

A conspicuous feature of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, is the extension of the cut-off date to qualify for holding of rights from 25 October 1980 to 13 December 2005. At the ground level, the cut-off date is quite immaterial to the majority of the forest-dwelling Scheduled Tribes, as they have been living in the forest for generations, and as such they would have been covered even under the 25 October 1980 cut-off date. This extension of the cut-off date is basically to benefit the “other traditional forest dwellers” that are required to prove that they have been occupying the forest land for three generations under clause (o) of Section 2 of the Act. By extending the date from 25 October 1980 to 13 December 2005, one generation has already been covered!

An anomaly in this act is the ceiling on land occupation. Sub-section (6) of Section 4 states, “Where the forest rights recognized and vested by Sub-section (1) are in respect of land mentioned in Clause (a) of sub-section (1) of Section 3, such land shall be under the occupation of an individual, or family, or community, on the date of commencement of this Act and shall be restricted to the area under actual occupation and shall in no case exceed an area of four hectares”. This provision hardly benefits the Scheduled Tribes. Rather than empowering, this law seeks to dispossess the forest-dwelling Scheduled Tribes of their ancestral lands that they possess in excess of 4 hectares as provided in Sub-section (6) of Section 4. The bill does not even provide for compensation to those who will be forced to share their lands in excess of 4 hectares. A large number of forest-dwelling Scheduled Tribes would have to mandatorily part with large chunks of ancestral lands that they have been actually occupying before the enactment of this act.

According to AITPN “The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006” has been introduced essentially to circumvent the Supreme Court’s order in the case of *Godavarman Thirumalpad vs. Union of India*,

which banned regularization of tribal revenue villages. When the Government of India passed the Forest Conservation Act on the mid-night of 25 October 1980, hundreds of thousands of indigenous/tribal people became illegal residents on the land in which they have been living for generations. Yet, thousands of others also had legal rights under the Forest Conservation Act. For two and half decades, the state governments failed to record and recognize those ancestral rights of tribal communities permitted by the Forest Conservation Act and the subsequent 1990 Guidelines issued by the MoEF. After the Supreme Court stayed the regularization of revenue villages, on 23 November 2001, in the aftermath of *Godavarman Thirumalpad vs. Union of India*, all the tribals living in the forest, irrespective of whether their rights were recognized under the 1980 Forest Conservation Act or not were effectively extinguished (AITPN 2006).

Suffice it would to mention at this juncture that voluminous literature has been churned out on the intricacies and complexities (outcome of hair-splitting debates, heartrending speeches, and brain-storming sessions of intellectuals, planners, activists and NGOs) of “The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, and numerous related acts.

But the down-to-earth reality, pathetically is that the people of the forest, *âdivâsis* (Scheduled Tribes/indigenous communities/OBCs), and an assortment of other under-privileged and disadvantaged social groups dependent on the forest, are living in the same state in which they were 60 years ago, with their rights curtailed and abrogated, their cultures abused, and their survival destabilized and threatened. All the so-called developmental programmes are conceived and abetted to facilitate the spreading of the tentacles of the corporate world, to pilfer the natural and mineral resources in the forested belt inhabited by the *âdivâsis*.

To understand the plight of the *âdivâsis* and get insights into the challenges they are facing for survival—to make the “*research*” we have been pursuing meaningful and relevant—it would be apt to review a few case studies. Here, we restrict ourselves to the most recent incidences reported in national dailies, from the states of Chhattisgarh and Orissa.

Case Study 1: This pertains to Tatemargu, a tribal village in Dantewada District (report by Javed Iqbal, *Sunday Express, i. witness*, April 25, 2010, pp. 1-2). The details to which attention is drawn here are those furnished in this news report. The incident referred to here is one of several such in which the tribals are caught in the cross-fire between the Maoists and the “State”.

This incident refers to the reaction of the State in tackling the Naxalite menace—the gruesome tragedy in which 73 Central Reserve Police Force personnel fell victims and were killed on April 6, 2010. Lakhmu, an *âdivâsi* inhabitant of Tatemarugu was witness when security forces attacked the village, and they had allegedly killed four people, raped three and burnt down 60 buildings with all their produce. One home had lost 40 quintals of rice, another 100 kg of corn, *mahua* and *imli*. Tatemarugu had been an agricultural success story, often described as “the number one village in the Kanta Block, by the *âdivâsis*. The children of Tatemarugu showed no noticeable signs of malnutrition; alcohol prohibition was in place; there were vast numbers of livestock; huge homes built with brick and cement, bought by the *âdivâsis* from Andhra Pradesh with the cash earned through selling rice. How did Tatemarugu become such a success story? The reply given by Lakhmu, is simple: it is all about water. Tatemarugu had access to water through ponds dug by all the villagers, under the instructions of the Maoists.

Case Study 2: This represents the case of two villages, Dhurli and Bhansi of Dantewada District, whose land is sought by Essar Steel, which wants to build a 3.2 million ton steel plant. Essar wants 200 hectares from Dhurli and 400 hectares from Bhansi. The villagers and the company have been meeting over this, the negotiations mediated by the people from the Collector’s office, or the Sub-District Magistrate’s office. The Maoists have threatened to kill any one who accepts Essar’s compensation and package and surrenders their ancestral land. They had kept their word: two people from Bhansi who had accepted the proposal in 2006, and allegedly acted as the company’s agents, were killed. Many villagers say no to the compensation, aware that money eventually runs out. A few have asked for shares in the company, tacitly of course.

Coming to water, Essar’s 3.2 million-ton steel plant will require at least 80,000 cubic meters of water daily. This requirement of water would affect the villages located downstream from the plant.

After all, several complaints have been made and concerns have been raised about the Sankani River that flows through Dantewada Town, the Bailadila Hills, the NMDC mines, and over 30 villages. According to Mangal Kunjam of Goomiyapal Village in Dantewada District, “the entire Sankani is red”. Those who depend on the river for fishing, say there are no fish. Those who depend on the river for cultivating their lands say their fields are suffering. According to Mangal (who is educated and even attending training to work with NMDC), who echoes the feelings of also others, they all prefer agriculture instead of industrial development. The tragedy, however, is that the choice is never left to the *âdivâsis*. Ever since the Salwa Judum came into being, agricultural activities have more or less ceased in a majority of villages. The idea of dragging and herding people from their villages into mismanaged state-run camps has left the fields

empty, and the people without any other alternative, but to choose other professions—either to become Special Police Officers (SPO) or landless labourers in other states.

According to Lingaram Kodopi of Kuakonda Block, they got enough from their lands to feed themselves, and did not suffer as much from the looting and arson by the Salwa Judum, at least until 2009, before the violence intensified in the block. Lingaram laments “NMDC has operated in our area for 52 years but only caused destruction. If having a company nearby could give us development, then we should have had a lot of development. Bailadila is 20 km from here and has been there long before the Naxals. Why don’t we have any education or any hospitals in the area? Not one hospital in 52 years. When our people go to Bailadila for treatment, they humiliate us and don’t admit us to their hospitals”.

Case Study 3: In this news report (*Ibid.*), some more points have been raised, about development in Bastar, as follows. The Bastar Region (which is divided into five districts, i.e., Kanker, Dantewada, Bijapur, Narayanapur and Bastar) is immensely rich in minerals. Dantewada District’s Bailadila hills have 14 iron ore deposits of 1,343.53 million tons. Since 1961, NMDC has been actively engaged in the extraction of many deposits. In Kanker District, there is an estimated 803.53 lakh tons of iron ore. In Bastar District, the main minerals are limestone (1770 lakh tons), dolomite (450 lakh tons), bauxite (53 lakh tons) and diamonds (survey is still being done by an Indo-German venture). The presence of minerals has brought the mining giants, Tata Steel and Essar Steel, to Dantewada, to which reference has been made above. Tata’s 5.5 million ton per annum plant will be located in Lohandiguda Block of Bastar District; it requires 5,000 acres of land; and 11 villages are going to be displaced. Essar’s 3.2 million ton per annum plant requires 1,500 acres of land, and it will displace Bhansi and Durli villages in Dantewada District.

About 50 years after the NMDC was set up in South Bastar, exactly 980 people belonging to Scheduled Tribes were directly employed by the NMDC and the Bailadila projects (BIOP) of the NMDC, as on October 31, 2006 (information given by NMDC under the Right to Information Act). If less than 1000 tribals directly benefit from the mines that have existed in South Bastar for half a century, what are the remaining 95 percent of them supposed to do? Near the Bailadila Hills, where NMDC operates, lie 14 extremely high grade iron ore deposits, worth billions but there also exist tribal villages there which have never even been surveyed by the government.

The mining business is primarily concentrated in regions (in which the Maoist/Naxalite corridor developed) in the mineral rich eastern states of Jharkhand, Orissa, Bihar, Chhattisgarh and parts of West Bengal, Maharashtra and Karnataka (*Deccan Chronicle*,

April 18, 2010, P.10). These areas produce iron ore, non-ferrous metals and steel. In the area not too distant from Dantewada, where 76 CRPF personnel were ambushed by the Maoists, the Tatas, Essar and NMDC are putting up steel plants with significant capacities. It is said that NMDC has been facing opposition for the last six or seven years for putting up its iron plant. Arcelor Mittal, and Posco (South Korean agency), are facing resistance for putting up their plants. The latter is setting-up Rs.52, 000 crore Steel Plant at Balitutha, in the Jagatsinghpur District, in Coastal Orissa. Mining operations by Vedanta are posing similar problems for the tribals in Kalahandi, Southern Orissa, who are said to survive on berries and ants. So, the various sections of the tribal and other population are struggling to prevent the exploitation of mineral wealth in these regions at the cost of their land and livelihoods; and the situation is being exploited by the Maoists. In the process of controlling the Maoist insurgency into the state, it is the beleaguered tribal societies which are caught in the cross-fire.

Case Study 4: The Vedanta Industries is pressing hard to start bauxite mining on the Niyamgiri Hills in South Orissa. The Bianca Jagger Human Rights Foundation has been making attempts to stop this (*Deccan Chronicle*, February 24, 2010). The mine will cause irreversible damage to the lives of thousands of Dongria Kondh Tribals for whom the mountain is the source of food, culture, medicines and the seat of their god. It is predicted that mining will lead to massive deforestation, destruction of local ecosystems; it also threatens water resources. The mountain has a forest cover of more than 60 percent and is the source for two rivers, the Vansadhara and Nagaveli, and 36 springs. It is also the habitat of many endangered species. The Niyamgiri Forest is a proposed wildlife sanctuary. The mining proposal was deemed unsustainable by the Supreme Court of India which found, in May 2009, that "The rehabilitation package for the displaced persons given by the user agency is not in the interest of sustainable livelihoods of the local communities as no land has been given for grazing purposes, raising agricultural crops and carrying out other income generating activities". Bianca Jagger, the founder of the Bianca Jagger Human Rights Foundation, observes that companies whose practices put people and the environment at risk must be held accountable before international law. She argues that we ought to be able to prosecute CEOs under international law, and suggests the extension of the International Criminal Court's jurisdiction to cover crimes against future generations.

One can go on and on about the distressing state of affairs in a pan-Indian context with regard to the (a) destruction of the forests; (b) laying bare thousands of kilometers of tree cover adding to the gloom of climate change; (c) degradation of floral and faunal biodiversity; (d) politicization of the environments with devastating effects of social unrest; (e) abuse of the traditional cultures of the *âdivâsis*; and (f) reducing them to

deplorable levels of poverty in their native environments which are otherwise abundant in natural resources.

In the light of above discussion, the conceptual paradigm that is planned for this project is a grass-root level approach to: (a) understand the successes, and anomalies, in the implementation of the ongoing livelihoods programmes in these areas; and (b) strive to fill the gaps, and endeavour a holistic strategy of sustainable management of environments, habitats, livelihoods and human wellbeing. It is proposed to conduct a field-research covering a few selected operational villages in this region (possibly, in the Niyamgiri Forest of South Orissa, to begin with) with the following objectives, to develop a model for action research:

(i) Study of the efficacy of “The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006”; and the ongoing livelihood and poverty alleviation programmes and the processes of their implementation in this region.

(ii) Base-line survey of villages, and traditional survival strategies: ecology and settlement systems; livelihood resources and subsistence strategies (i.e., hunting-gathering and fishing, shifting cultivation, wetland agriculture, collection of non-timber forest produce); and infrastructure promoted under tribal development and Resettlement and Rehabilitation (R&R) projects (i.e., house construction, sanitation and hygiene, and education and health facilities).

From the results obtained through (i) and (ii) steps outlined above, it is proposed to initiate action plan (for about five years), by joining hands with the governmental agencies and established NGO(s) of this region, to aim at the following goals:

A. Habitat Development: The first part aims at regeneration of biodiversity with endemic flora, in a cluster of villages, for restoration of degraded environments (following the ANR concept, see P. 29 above). The trees that would be grown include food trees on which the tribals depended during earlier times, when the forests were not destroyed—there were not less than 60 species of such wild plant food sources in this belt. The second part of this is watershed management and building of productive village level assets through government schemes such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and Integrated Tribal Development Agency (ITDA), *Indira Awas Yojana*, Eco-Development Scheme (EDS), etc. The third part deals with organization of village layout with traditional domestic architecture, sanitation and recycling of bio-waste, rainwater harvesting, potable drinking water and solar power.

B. Long-term livelihood and food security programmes; empowerment of youth and women, and Self Help Groups; cultivation of vegetable crops (traditional vegetable foods); promotion of local entrepreneurship through agro-forestry and horticulture (aromatic and herbal medicinal plants such as *Centella asiatica*, *Andrographis paniculata*, *Acorus calamus*, *Lawsonia alba*, *Vinca rosea*, *Cymbopogon citratus*, *Withania somnifera*, *Vetiveria zizanioides*, *Decalepis Hamiltonii*, *Hemidesmus indicus*, *Celastrus paniculata*, *Vinca rosea*, *Taxus baccata*, etc.) and orchards of fruit-yielding trees; establishment of small-scale cottage industries for processing the raw materials from these plant products and imparting training to the tribal youth for these operations; facilitating marketing of these items through tie-ups with pharmaceutical industries; cultivation of traditional agricultural crops of this region (rice, millets, grams and oil seeds); and promotion of aquaculture, poultry and livestock; and handicrafts.

(2) *Joint Forest Management for Livelihoods of Forest Dependent Communities (Participatory Co-forest Management and Community Forest Management)*

The Indian Forest Policy of 1968 envisages peoples' involvement in the development and protection of forests, and that, it is essential for forest management to motivate forest communities for the development and protection of forests from which they derive benefits. In pursuance of this objective, the circular (6-21/89 FP) of the Ministry of Environment and Forests (MOEF), Government of India, encourages the involvement of village communities and voluntary agencies for regeneration of the forests. This is called Joint Forest Management (JFM).

Prior to the inception of JFM, there was Community Forest Management (CFM), which was practiced in Orissa as early as the 1950s (Ravindranath *et al.* 2000). Self-initiated forest protection groups and *Vana Panchayats* have been formed in many parts of the country before the inception of JFM, to help regeneration of patches of forests. The *Vana Panchayats* represent one of the largest and collaborative efforts in forest management.

The beneficiaries are essentially village communities, and commercial interests are unimportant. The village communities may be entitled to usufructs such as grass lops of branches, and other minor forest produce, as prescribed by the state. Subject to successful protection, the user group is also entitled to a portion of the proceeds from the sale of mature trees. They may also plant fruit trees to fit into the overall scheme of afforestation and grow indigenous medicinal plants as per requirement.

Access and usufruct rights are limited to people who organize themselves into groups such as cooperatives or village forest communities, and such, access to tree lease (*patta*)

will not be given to individuals. Hence, there is no scope for acquiring ownership or enjoying lease rights over the forestlands. Further no grazing or agriculture is allowed in the demarcated areas. The Forest Department closely supervises the work of the beneficiaries. If the work has been done in an unsatisfactory manner, the usufruct benefits can be withdrawn without paying compensation to anyone for any work that might have been done prior to it.

Joint Forest Management (JFM), which is one of the thrust areas of the forestry programme, received impetus at the national level with the creation of a JFM cell in the MoEF in the year 1998. After the creation of the JFM cell, the area of JFM operations was expanded from 4 million hectares to 17 million hectares. The JFM programmes have been massively funded by the World Bank, EU, ODA and the Japanese DECD or OECF. Models in participatory forest management have been evolving in India since the 1980s. This was followed by acceptance of the principles of community participation in management of natural resources and biodiversity (Ravindranath *et al.* 2000). Accordingly, at present, about 22.02 million hectares of largely degraded forests are being managed and rehabilitated under the Participatory/Joint Forest Management regimes. Communities in about 170,000 forest fringe villages are at present involved in the JFM programme. By February 2006, there were 99,868 Joint Forest Management Committees (JFMCs) covering about 125,000 villages.

The National Afforestation and Eco-Development Board (NAEB), set up in August 1992 (for afforestation, tree planting, ecological restoration and eco-development activities) has been paying special attention for the regeneration of degraded forest areas and lands adjoining forest areas, national parks, sanctuaries and other protected areas as well as the ecologically fragile areas such as the Western Himalayas, Aravallis and Western Ghats. The NAEB, as per the Tenth Five year Plan, set a target of achieving 25 percent forest and tree cover in the country, by the end of 2007 and 33 percent cover by the end of 2012. To achieve these targets, 6.5 million hectares of additional land have to be brought under forest and tree cover by 2007, and a total of 33.6 million hectares of additional land by 2012.

The NAEB has evolved National Afforestation Programme (NAP) to help the respective states for achieving the above goals.

The major components of the NAP are: (i) Grants-in-Aid for Greening India (GIA for GI) (this scheme is the restructured form of the earlier grant-in-aid to voluntary agencies scheme); (ii) Monitoring and Evaluation (M&E); (iii) Communication; (iv) Support to Regional Centres (RG); and (v) Eco-Development Forces Schemes (EDF).

There are four important afforestation projects being operated as centrally sponsored schemes by the MoEF which were launched during the Ninth Plan. These are: Integrated Afforestation and Eco-Development Project Scheme (IAEPS); Area Oriented Fuel Wood and Fodder Project Scheme (AOFFPS); Conservation of Non-Timber Forest Produce including Medicinal Plants (NTFPS); and Association of ST and Rural Poor in Regeneration of Degraded Forests (ASTRPS). According to the recommendation of the mid-term evaluation of these projects for a decentralized approach and speedy fund transfer mechanism, a pilot scheme called *Samnavit Gram Vanikaran Samridhi Yojana* (SGVSY) was launched during 2000-2001, utilizing the delivery mechanism of the Forest Development Agency (FDA) and the JFMC. The overall objective of the NAP, which continues to be the flagship of the NAEB, is to develop the forest resources with people's participation, with focus on improvement in livelihoods of the forest-fringe communities, especially poor. The NAP provides support, both in physical and capacity building terms, to the FDAs which have been established as a federation of JFMCs at the forest division level to undertake holistic development in the forestry sector with people's participation.

The decentralized two-tier institutional structure (FDA and JFMC) allows greater scope to improve forests and livelihoods of the people in-and-around forest areas; and the village is reckoned as a unit of planning and implementation. This two-tier approach, apart from building capacities at the grass-root level, significantly empowers the local people to participate in the decision making under entry-point activities; the community assets are created with a "care and share" concept.

Coming to the FDAs, as on February 6, 2006, there are 680 of them, which have been organized to treat a total area of 9.05 lakh hectares. Bamboo plantations, medicinal plants and Jatropha have been given adequate importance under NAP during the current plan period. The GIA for GI scheme aims at (a) awareness generation about high-quality planting material; and (b) providing grants to voluntary agencies and other bodies for taking up plantation of high-quality planting material. Financial support is provided by the State Forest Department for setting up a central nursery and by various organizations and individuals for setting up satellite nurseries.

The Eco-development Scheme (EDF) was introduced, in the Ninth Five Year Plan (1997-2002) to carry out development schemes in villages adjoining tiger reserves with an outlay of 54 crores. In the Tenth Five Year Plan, it was merged with the "Project Tiger" and the development of national parks and sanctuaries. Eco-development integrates environmental and forestry activities with those of other development agencies. This approach acknowledges that people living near Protected Areas (PA) may have to bear

enormous costs while deriving a few tangible benefits from conservation. Social welfare activities including the provision of drinking water and irrigation facilities, soil and moisture conservation, fencing, laying village roads, health-care camps and employment generation for local communities in the vicinity of the PAs are some of the developmental activities being carried out around the PAs. Sometimes, the existing rural developmental programmes are also linked to conservation projects.

Since 1993, land improvements, implementation of land reforms, land consolidation and soil conservation, minor irrigation, water management and watershed development, animal husbandry, fisheries and Non-Wood Forest Products (NWFP) have come under the jurisdiction of the Panchayats (the village-level administrative unit).

To add to the above schemes for livelihood management, there is the flagship scheme of the government, the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). The main objective of this scheme is to provide livelihoods to the households in the rural area of the country by providing at least one hundred days of guaranteed wage employment, to every household, in every financial year, and to improve village assets.

All the above-cited programmes of the government are well-conceived, ambitious, and inter-related, involving huge investments. This is a system with a top-down approach—like a pyramid, at the apex of which are the arm-chair bureaucrats, and at the bottom of which are the vulnerable and underprivileged forest dwellers (STs) and associated marginalized groups (SCs, OBCs), the so-called beneficiaries. It is proposed to conduct research on this delivery mechanism of development and needless to say, this is time consuming and can only be accomplished as long-term project. The following aspects would be covered under this component:

(i) Documentation of data with all statistical details at the national level, state level, and village level, pertaining to NAEB, JFM/CFM/*Vana Panchayat/VSS*, NAP, IAEPS, AOFFPS, ASTRPS, EDF, FDA SGVSY, MGNREGS, etc., since the inception of these programmes; the expenditures incurred, and the tangible results that can be seen at the grass-root level. This kind of appraisal has not been attempted so far. This compilation will be a compendium with exhaustive bibliographical notes.

(ii) At the micro-level and regional level, it is proposed to study specific eco-regions, for example, the Eastern Ghats, Western Ghats, Orissa, Chotanagpur Plateau, NE, etc. The unit for study will be the jurisdiction of Panchayat Raj Institution. For this, field studies would be conducted in select Panchayat Raj zones to evaluate as to what extent these projects have helped in the past or have been helping during the present in safeguarding

the livelihoods of the dwellers in forests, forest-fringe habitats, rural/peri-urban and urban areas. It purports to examine avenues for an inclusive and integrative approach, coordinating JFM with other ongoing schemes in sustainable management of forests and forest-dependent people.

The various social groups coming under the umbrella of development have been the subjects of several welfare schemes of the government; moreover, every welfare scheme is related in one way or the other to the livelihoods and wellbeing of the stakeholders. These schemes and programmes can have a higher success rate if due attention is paid to the factors of human and social ecology.

(3) Governance of Non-Timber Forest Produce and its Role in Enhancing Livelihood Opportunities of the Forest-Dependent Communities

The annual value of Non-Timber Forest Produce (NTFP) in our country is expected to be about US\$27 billion as against US\$17 billion for wood products. The NTFPs account for about 70 percent of the forest-based export earnings (US\$500 million), and provide up to 55 percent of the total employment in the primary forest sector. Different policies, legislations and programmes of the Government of India have empowered the communities with the ownership rights of the NTFP for collection, trade, value addition, marketing through national level legislation, which is a milestone for poverty alleviation of 250-300 million people living around the forests. India has national-level legislations for ensuring benefits arising out of the Traditional Forest Related Knowledge (TFRK). Unfortunately, no concerted effort to utilize the immense potential of NTFP in different parts of the country has been made, to provide livelihoods, poverty alleviation, employment generation, and sustainable management of biodiversity. To make available pertinent inputs for effective planning, the following is envisaged:

(i) Documentation of *âdivasi* cultures and TFRK in select eco-regions related to forest foods, species of wood and non-wood products for construction, tools and implements, utilitarian items, herbal medicines and aromatic plants, handicrafts and other commodities of commercial use. Attention will be paid to gather the symbiotic association between the *âdivasi* and non-*âdivasi* social groups in the trade and exchange of items in the forested, peri-urban and urban regions. The aim is to identify the forest plant and other products that could be developed as a part of JFM, and extend support to the *âdivasis* with financial and technical know-how for promoting entrepreneurship and income generation. This goes hand-in-hand with the strategy discussed above (9.1 (iv), P. 36).

(4) Development Projects-Induced Displacement (such as Mining and Irrigation) in the Forest Areas and their Impact on Livelihoods of the Forest Dear Oliver,

-Dwelling Communities

It is planned to study select development projects and implementation of Resettlement and Rehabilitation (R&R) programmes of the project-affected people. It is proposed to cover an irrigation project and a mining project. The agenda will encompass the various facets outlined above (11.1 (iii-iv), P. 35; 11.2 (ii), P. 38; and 11.3 (i), P. 39). It is proposed to focus on some of the following:

- (i) Long-term livelihood recovery programmes for people displaced from their native environments and resettled in peri-urban, urban and rural environments.
- (ii) Monitoring the “ethics” of project implementation, humanitarian situation and social audit.
- (iii). Promotion of dry-land forestry, agro-forestry, and sustainable livestock livelihoods. The minor forests and pasture lands are meant essentially for meeting local needs. All considerations of revenue from the forests were to be subordinated to this objective. While some of the forests are largely used for meeting commercial needs and raising revenues for the state, every reasonable facility should be provided to the local people to meet their needs of fuel wood, grass, manure, etc., from these forests (Nadkarni 1996).
- (iv) Watershed management to enhance systems of water productivity for dry farming, agricultural sector (millets and grains), horticultural sector and vegetable crops.
- (v) Special focus on augmenting depleted wetlands (riverine niches, lakes, ponds, marshes, lagoons, estuaries and backwaters) for a stable aquatic food resource base (varieties of fish such as pomfret, sardines, cuttlefish, lobsters, prawns and shrimps) for numerous indigenous communities who survive on wetlands.
- (vi) Building village assets and acting as a facilitator in the implementation of MGNREGS, *Indira Awas Yojana* (IAY), *Sarva Shiksha Abiyan Scheme* (SAS), Right to Education Act (RTA), and the proposed National Food Security Act (NFSA).

References

- AITPN. 2006. *India's Forest Rights Act of 2006: Illusion or Solutions. Indigenous Issues—The Occasional Briefing Papers of AITPN*. New Delhi: Asian Indigenous and Tribal Peoples Net Work.
- Anderson, E.N. 1996. *Ecologies of the Heart: Emotion, Belief and the Environment*. New York: Oxford University Press.
- Anthropological Survey of India. 1994-2003. *People of India: State-Wise Series*.
- ATREE. 2007. *National Capacity Self-Assessment Report on Biodiversity*. Bangalore: Ashoka Trust for Research in Ecology and the Environments (Final Report).
- Barbier, E.B., M.C. Acreman and D. Knowler. 1996. *Economic Evaluation of Wetlands: A Guide for Policy Makers and Planners*. Gland (Switzerland): Ramsar Convention Bureau.
- Bardhan, Pranab. 1996. Decentralized Development. *Indian Economic Review*. XXXI (2): 139-156.
- Bavinck, Maarteen. 2001. Caste Panchayats and Regulation for fisheries along Tamil Nadu's Coromandel Coast. *Economic and Political Weekly*. 36 (13): 1088-1091 and 1093-1094.
- Bruce, F., N. Fresco, A. Shvidenko, K. Dannel and F. Stuart Chapin, III. 2004. Geographic Variations in Anthropogenic Drivers that Influence the Vulnerability and Resilience of Social-Ecological Systems. *Ambio*. 33(6): 376-381.
- Byron, N. and J.E.M. Arnold. 1999. What Futures for the People of the Tropical Forests? *World Development*. 27 (5): 789-805.
- Campelle, B.C. 1979. *Humankind Emerging*. Boston: Little, Brown and Company.
- Childe, Gordon, V. 1964. *What Happened in History*. Baltimore: Penguin Books Ltd.
- Clark, Graham and Stuart Piggott. 1976. *Prehistoric Societies*. Harmondsworth: Penguin books Ltd.
- Das, A.K. and S. P. Shukla. 2007. Biodiversity and Indigenous Knowledge System. *Current Science*. 92 (3): 275-276.
- FAO. 1995. *Non-Wood Forest products 7: Non-Wood Forest Products of Rural Income and Sustainable Forestry*. Rome: Food and Agriculture Organization of the United Nations.
- FAO. 1999. *State of the World's Forests 1999*. Rome: Food and Agriculture Organization of the United Nations.

- FAO. 2001. *Global Forest Resources Assessment 2000—Main Report*. FAO Forestry Paper 140. Rome: Food and Agriculture Organization of the United Nations.
- FAO. 2006. *Global Forest Resources Assessment 2005—Progress towards Sustainable Forest Management*. FAO Forestry Paper 147. Rome: Food and Agriculture Organization.
- FAO/ UNTRS. 2008. *Setting Directions for Sustainable Fisheries and Coastal Livelihoods in Post-Tsunami Context, India: A Report of the Interventions by the FAO under the United Nations Team for Tsunami Recovery Support*. New Delhi: FAO, UNTRS and UNDP.
- Gardner-Outlaw, T. and R. Engelman. 1999. *Forest Futures*. Population Action International.
- Haimendorf, von Fürer Christoph. 1982. *Tribes of India: The Struggle for Survival*. Berkley: University of California Press.
- Hughes, J. Donald. 1983. How the Ancients Viewed Deforestation. *Journal of Field Archaeology*. 10: 437-445.
- FFSR . 1995. *Forest Inventory in Russian Forest Fund*. Part 1. Organization of Forest Inventory, Field Works (In Russian). Moscow: Federal Forest Service of Russia.
- Forest Principles. 1992. *The UN Conference on Environment and Development, Rio-de-Janeiro* (Non-legally Binding Authoritative Statement on Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests).
- Gadgil, M. and Guha, R. 1992. *This Fissured Land - An Ecological History of India*. Oxford University Press, Delhi.
- Gopinath Reddy, M., K. Anil Kumar and Naga Raju Chikkala. 2009. *A Study of Forest Rights Act, 2006 in Andhra Pradesh: An Assessment of its Major Features and Issues in Implementation Process*. Working Paper No. 78. Hyderabad: Centre for Economic and Social Studies.
- Hazra, A.K. 2002. *History of Conflicts over Forests in India: A Market Based Resolution, Working Paper Series, Julian L. Simon Center for Policy Research*. New Delhi: Liberty Institute.
- Heywood, V. (Ed.). 1995. *Global Biodiversity Assessment*. Nairobi (Kenya): United Nations Environment Programme.
- Hughes, J. Donald. 1986. An Ecological Paradigm of the Ancient City. In, Richard J. Borden (Ed.), *Human Ecology: A Gathering of Perspectives*. pp. 214-220. College Park: University of Maryland and The Society for Human Ecology.
- IPCC (Intergovernmental Panel on Climate Change). 2001. *Intergovernmental Panel on Climate Change. Climate Change 2001: The Scientific Basis*. Cambridge: Cambridge University Press.

- Joshi, M. and P.P. Singh. 2003. Applying Natural Resource Economics to Forest Degradation: Lessons from India. *Proceedings of the 12th World Forestry Congress, Volume A*. Quebec, Canada.
- Kangle, R.P. (Translator) 1997. *Kautilya Arthashastra* (Three volumes). New Delhi: Motilal.
- Kuhn, S.L. and M. Stiner. 2001. The Antiquity of Hunter-Gatherers. In C. Panter-Brick, R.H. Layton, and P. Rowley-Conwy (Eds.), *Hunter-Gatherers: An Interdisciplinary Perspective*. pp. 99-142. Cambridge: Cambridge University Press.
- Larsen, C.S. 1998. *Human Origins: The Fossil Record* (Paperback). Illinois: Waveland Press Inc.
- Lee, R. and Devore, I. 1968. Problems in the Study of Hunter-Gatherers. In R. Lee and I. Devore (Eds.), *Man the Hunter*. pp. 7-14. Chicago-Aldine.
- Malhotra, K.C. and Prodyut Bhattacharya. 2010. *Forest and Livelihood Status Paper (Forest Ecosystem)*. Hyderabad: Research Unit for Livelihoods and Natural Resources, Centre for Economic and Social Studies.
- Mather, A. 1999. Society and the Services of Forests. In M. Palo and J. Uusivori (Eds.), *World Forests: Society and Environment*. pp. 86-89. Kluwer Academic Press.
- Ministry of Environment and Forests, Government of India. 2007. *Conservation of Wetlands in India: A Profile (Approach and Guidelines)*. New Delhi: Ministry of Environment and Forests, Government of India.
- Murty, M.L.K. 1992. Hunter-Gatherers, Pastoralists and the State in Southwestern Andhra Pradesh, South India. *Ethnoarchaeologie, Justification, Problems, Limites* (Editions APDCA, Juan-les-Pins, Paris). pp. 325-338.
- Murty, M.L.K. 1993. Environment, Royal Policy and Social Formation in the Eastern Ghats, South India. Presidential Address, *Proceedings of the Indian History Congress, 53rd Session Warangal*. pp. 615-631. Delhi: Indian History Congress.
- Nadkarni, M.V. Forests, Peoples and Economics. 1996. Presidential Address, 55th Annual Conference of the Indian Society of Agricultural Economics. *Indian Journal of Agricultural Economics*. 51 (1 and 2): 1-24.
- Nelleman, C. and M.G. Thomsen. 2001. Long-term Changes in Forest Growth: Potential Effects of Nitrogen Deposits and Acidification. *Water, Air and Soil Pollution*. 128: 197-205.
- Noss, R.F. 1990. Indicators for Monitoring Biodiversity: A Hierarchical Approach. *Conservation Biology*. 4:355-364.

- Rangarajan, M. 2001, *India's Wildlife history: An Introduction*. Paperback.
- Ratna Reddy, V., M. Gopinath Reddy, Velayutham Saravanan, Madhusudan Bandi and Oliver Springate Baginski. 2004. Participatory Forest Management in Andhra Pradesh: A Review. *Working Paper*, Series No.62. Hyderabad: Centre for Economic and Social Studies (CESS).
- Ravindranath, N.H., K.S. Murali and K.C. Malhotra (Eds.). 2000. *Joint Forest Management and Community Forestry in India: An Ecological and Institutional Assessment*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
- Ribot C. Jesse. (2004). Democratic Decentralization of Natural Resources: Institutionalizing Poplar Participation. World Resources Institute.
- Rodgers, W.A. and H.S. Panwar. 1988. *Planning Wildlife Protected Area Network in India*. Volumes I and II. Dehra Dun: FAO and Wildlife Institute of India.
- Rodrigues, A.S.L., S.J. Andelman, M.I. Bakarr, L. Boitani, and T.M. Brooks. 2003. *Global Gap Analysis: Towards a Representative Network of Protected Areas*. Washington D.C.: Center for Applied Biodiversity Science, Conservation International, Washington D.C.
- Sankalia, H.D. 1974. *Prehistory and Protohistory of India and Pakistan*. Poona: Deccan College Postgraduate and Research Institute.
- Sankhyan, A.R. 2005. Human Fossil Evidence from Narmada Valley. *Humankind (The Journal of Indira Gandhi Rashtriya Manav Sangrahalaya, Bhopal)*. 1: 103-115.
- Scholes, R.J. and R. Biggs. 2004. *Ecosystem Services in Southern Africa: A Regional Assessment*. Pretoria: Council for Scientific and Industrial Research, South Africa.
- Shamsastry, R. 1967. *Kautilya's Arthashastra*. Mysore: Mysore Printing and Publishing House.
- Shvidenko, Anatoly, Charles Victor-Barber, Reidar Persson (Coordinating Authors), Gonzalez, Patrick, Rashid Hassan, Petro Lakyda, Ian McCallum, Sten Nillson, Juan Pulhin, Bernardt van Rosenburg, Bob Scholes (Lead Authors), and Marian de los Angeles, Cherla Sastry (Review Editors). 2005. Forest and Woodland Systems (Chapter 21). In, Rashid Hassan, Robert Scholes and Neville Ash (Eds.), *Ecosystems and Human Wellbeing: Current State and Trends*. pp. 587-621. Washington DC: Island Press.
- Sonakia, A. 1985. Skull Cap of an Early Man from the Narmada Valley Alluvium (Pleistocene) of Central India. *American Anthropologist*. 87(3): 612-616.
- Sponsel, Leslie E. (Lead Author), Leslie E. Sponsel (Contributing Author) and David Casagrande (Topic Editor). 2007. Religion, nature and environmentalism. In, Cutler J. Cleveland (Ed.), *Encyclopedia of Earth*. Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment.

- State Forest Report. 2005. *State Forest Report 2005*. Dehradun: Forest Survey of India, Ministry of Environment and Forest.
- Sunderlin, W.D., Arild Angelsen, Brain Belcher, Paul Burgers, Robert Nasi, Levanía Santoso and Sven Wunder. 2005. Livelihoods, Forests and Conservation in Developing Countries: An Overview. *World Development*. 33(9): 1383-1402.
- UNEP-WCMC. 2004. Forest Information Centre. www.unep-wcmc.org/forest/data.
- Wetlands International. 2009. *Planting Trees to Eat fish: Field Experiences in Wetlands and Poverty Reduction*. Wageningen, The Netherlands: Wetlands International.
- WGWF (Working Group on Wildland Fire). 2003. An Overview of Vegetation Fires Globally. A Background Paper Presented to the International Wildland Fire Summit, Sydney, Australia, 8 October 2003. Prepared by the Working Group on Wildland Fire. UN International Strategy for Disaster Reduction and the Global Fire Monitoring Center. *International Forest Fire News No. 29*. pp. 40-55.
- World Bank. 2006. *Unlocking Opportunities, for Forest Development People in India*, Vol. 1. Oxford: Oxford University Press.
- WRI/UNEP/World Bank. 1996. *World Resources 1996-1997*. New York: Oxford University Press.
- WRM (World Rainforest Movement). 2002. The FAO Forest Assessment: Concealing the Truth. *Bulletin No. 61*.

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