CHAPTER THREE

BIODIVERSITY

3.1 Introduction

3.1.1 The term 'biodiversity' encompasses the variety of life on Earth. It is defined as the variability among living organisms and the ecological complexes of which they are part, including diversity within and between species and ecosystems. Biodiversity manifests at species genetic and ecosystem levels. Biodiversity has direct consumptive value in food, agriculture, medicine, industry, etc. It also has aesthetic and recreational value.

3.1.2 India has a rich heritage of species and genetic strains of flora. Overall about six percent of world species are found in India. It is estimated that India is tenth among the plant rich countries of the world and sixth among the centres of diversity and origin of agrodiversity. Out of the total twelve biodiversity hot-spots in the world, India has two, one is the north east region and other is western ghats (Khoshoo, T.N., 1995). The growing urbanization and industrialization causes the decrease of Natural habitats, which further results in the loss to biological diversity. Biodiversity, once lost cannot be recovered.

India's major biographic zones and their area are presented in table 3.1.1 at annexure 3.

3.2 Plant Biodiversity

3.2.1 Plant biodiversity as a national and global resource is extremely valuable but is poorly understood, inadequately documented and often wasted. The preservation of biodiversity is both a matter of investment and insurance to a) sustain and improve agricultural, forestry and fisheries production, b) act as a buffer against harmful environmental changes, c) provide raw materials for scientific and industrial innovations, and d) safe guard transferring biological richness to future generations.

Sl.	Туре	No. of	No. of	Percentage	No. of	No. of
No.		Known	Known	of	Endemic	ThreatenedSpecies
		Species	Species	Occurrence	Species	
		in the	in	in India		
		World	India			
1	2	3	4	5	6	7
Ι	Flowering Plants					
1	Gymnosperm	1021	69	6.75	8	7
2	Angiosperm	281821	17643	6.26	ca. 5725	1700
	Non-flowering					
Π	Plants					
					Not	
1	Virus & Bacteria	11813	903	7.64	Known	Not Known
2	Pteridophytes	12000	1236	10.3	ca.47	ca.414
3	Algae	40000	7182	17.95	ca.1924	Not Known
4	Fungi	98998	14588	14.73	ca.4100	ca.580
5	Lichens	17000	2303	13.55	ca.520	Not Known
6	Bryophytes	16236	2852	17.56	ca.629	ca.80

TABLE 3.2.1 : NUMBER AND STATUS OF PLANT SPECIES IN INDIA

Source : Botanical Survey of India, Kolkata.

* : Approximate

Source: World figures are taken from IUCN Red List version 2010.; data on the number of species in India is taken from 'Plant Discoveries 2009-New Genera, Species and New Records' compiled and edited by M. Sanjappa & P. Singh published by BSI in 2010.

3.2.2 Biodiversity the world over is in peril because the habitats are threatened due to such development programmes as creation of reservoirs, mining, forest clearing, laying of transport and communication networks, etc. It is estimated that in the world wide perspective, slightly over 1000 animal species and sub-species are threatened with an extinction rate of one per year, while 20,000 flowering plants are thought to be at risk.

The table 3.2.2 and chart 3.2.1 depicts the enormous situation of plant species at risk. 73% of the total rare and threatened species are in the endangered category.

TABLE 3.2.2 : RARE AND THREATENED SPECIES (VASCULAR PLANTS)					
Sl. No.CategoryApproximate Number					
1	2	3			
1	Rare	287			
2	Vulnerable	167			
3	Endangered	1366			
4	Possibly Extinct	40			
5	Extinct	28			

Source : Botanical Survey of India, Kolkata.



A comparision of the India Scenario vis –a vis the global situation shows 3.7 % of the World's threatened vascular plants are in India. In India, 7.7 % of vascular plant species are under threat, while at global level, 13.8% vascular plants are in a similar position.

TABLE 3.2.3: THREATENED VASCULAR PLANTS				
STATUS	GLOBAL	INDIA		
Extinct (EX)	380	19		
Extinct/Endangered (EX/E)	371	41		
Endangered (E)	6522	152		
Vulnerable (V)	7951	102		
Rare (R)	14505	251		
Indeterminate (I)	4070	690		
Total under threat	33418	1236		
Total number of species	242013	16000		
Percentage under threat	13.8	7.7		

Source : Botanical Survey of India, Kolkata.

Note : [based on 'Red List of Threatened Vascular Plant Species in India' by C.K. Rao *et al.*, 2003 published by BSI ENVIS Centre (compiled from the 1997 IUCN Red List of Threatened Plants)]



Status Category summary by major taxonomic group of threatened plants in India is available in table 3.2.4 at annexure -3.

TABLE 3.2.5:STATUS CATEGORY SUMMARY AT GLOBAL LEVEL
(IUCN Red List version 2010)

STATUS	NUMBER OF SPECIES
Extinct	86
Extinct in the Wild	28
Critically Endangered	1581
Endangered,	2318
Vulnerable,	4605
Lower Risk/conservation dependent,	237
Near Threatened (includes LR/nt - Lower Risk/near threatened)	1077
Data Deficient,	744
Least Concern (includes LR/lc - Lower Risk, least concern).	1531
TOTAL	12207

Source : Botanical Survey of India, Kolkata. Note : IUCN Red List Categories:

As evident from Chart 3.2.3, at global level, nearly 1% of the plant species are extinct, 13 % critically endangered and 37.72% are in a vulnerable state.



3.3 Conservation Measures of Agro Biodiversity

3.3.1 There is a pressing need is for the conservation of plant species. But it is largely impractical to conserve the very large number of crop species and their wild relatives in their natural habitats. National parks, seed banks etc are initiatives in this direction.

The details of total holdings	collections and s	pecimens of flora i	in India are	shown at
table 3.3.1.		_		

TABLE 3.3.1 : REFERENCE COLLECTIONS OF FLORA					
Sl. No.	I.CategoryTotal NumberTotal Holdingso.Collections and Specimens				
1	2	3	4		
1	Herbarium	65*	5594795		
2	Museums	19	60500		

Source : Botanical Survey of India, Kolkata.

Index Herbariorum online

*

3.3.2 The National Bureau of Plant Genetic Resources (NBGR) established in 1976 as an institution under Indian Council of Agricultural Research (ICAR) emerged as an important organization dealing with various establishments of plant genetic resources. The organization is entrusted with the vital responsibility of germ plasm, exchange with appropriate quarantine measures, survey exploration, their organization, planning and coordination, comprising evaluation, documentation and conservation of diverse plant genetic resources. The National Gene Bank has also been established within the complex. Within the new trade related intellectual property rights (TRIPS) within World Trade Organisation related agreements, documentation of our genetic resources is very important.

TABLE 3.3.2 : STATUS OF EX-SITUCONSERVATION (BASE COLLECTION)				
	OF ORTHO	DOX SEEDS (As on 30 st N	5, AT -18 ⁰ C November, 2010)	
Sl. No.	Crop Group	Species	Accessions*	
1	2	3	4	
1	Cereals	90	150223	
2	Millets & Forages	178	55290	
3	Pseudo Cereals	30	6657	
4	Grain Legumes	69	57246	
5	Oilseeds	58	55803	
6	Fibre Crops	51	11535	
7	Vegetables	151	24377	
8	Fruits	35	530	
9	Medicinal & Aromatic Plants & Narcotics	660	6404	
10	Spices & Condiments	17	2894	
11	Agro-Forestry	244	2442	
12	Duplicate Safety Samples	-	10235	
	Total	1583	383636	

The table 3.3.2 to 3.3.5 present the various conservation measures for plants in India.

Source : National Bureau of Plant Genetic Resources

* : genetic stocks
 No. of crop species conserved -

1583

TABLE 3.3.3 : STATUS OF IN-VITRO CONSERVATION							
	(As on 31^{st} December, 2010)						
Crop group	Genera	Species	Cultures	Accessions			
	(no.)	(no.)	(no.)	(no.)			
1	2	3	4	5			
Tropical Fruits (banana,							
grape)	2	14	7600	414			
	9	41	6140	314			
	5	12	9200	585			
Bulbous and other crops	4	9	3300	171			
(garlic, gladiolus)							
Medicinal and Aromatic							
Plants (species of bacopa,	21	28	4080	170			
mentha, rauvolfia,	21	20	4980	170			
tylophora)							
Spices and Industrial							
crops (ginger, turemeric,	7	27	5880	380			
pepper, cardamom, hops,	/	21	5000	500			
jojoba)							
Total	48	131	37100	2034			

Source : National Bureau of Plant Genetic Resources

TABLE 3.3.4 : STATUS OF CRYOPRESERVATION OF					
	DORMANT BUDS &	POLLEN GRAINS			
(As on 31^{st} December, 2010)					
	Dormant Buds	337			
	Pollen grains	345			
	Wild Relatives*	992			
	Rare & Endangered plants	80			
	Varieties*	654			
	Elite*	4			
	Registered germplasm*	22			
	Number of Species	729			

Source : National Bureau of Plant Genetic Resources

* included in respective Categories stored as orthodox seeds.

TABLE 3.3.5 : STATUS OF GERMPLASM AT NATIONAL CRYOBANK					
	(As on 30 st November 201				
Sl. No.	Category	No. of Accessions			
1	2	3			
Ι	Intermediate & Recalcitrant				
1	Fruits & Nuts	2618			
2	Spices & Condiments	148			
3	Plantation Crops	22			
4	Agroforestry & Forestry species	1640			
5	Industrial crops	1256			
6	Medicinal & Aromatic Plants	5			
II	Orthodox				
1	Cereals	240			
2	Millets and Forages	287			
3	Pseudocereals	76			
4	Grain Legumes	636			
5	Oilseeds	471			
6	Fibres	66			
7	Vegetables	433			
8	Medicinal & Aromatic Plants	849			
9	Narcotics & dyes	34			
10	Miscellaneous	16			
	Total	8797			

OTATUS OF CEDMBLACM . .

Source : National Bureau of Plant Genetic Resources

There are 131 Botanical gardens in India exhibiting and protecting the Plant diversity of India.

3.4 Forest and Trees in India

3.4.1 Though more than one-fifth of India's geographic area is recorded as forest area, it is not known with certainty how much forest area actually bears forest cover. The National Forest Policy (1952 and 1988) aim at having one third of country's land area under forest and tree cover. India has 76.95 million hectares of recorded forest area in March 2007. This accounts for 23.41% of total geographic area. Per capita availability of forests in India is 0.06 ha which is much lower than the world average of 0.8 ha.

	TABLE 3.4.1 : STATE/UT WISE FOREST AREA						
						(Sq.km)	
Sl.	State/UT	Geographic	R	ecorded For	est Area, 200'	7	Percentag
No.		Area	Reserved	Protected	Unclassed	Total	_ e of
			Forest	Forest	Forest	Forest	Forest to
						Area	Geo. Area
1	2	3	4	5	6	7	8
1	Andhra Pradesh	275069	61210	1967	637	63814	23.20
	Arunachal						
2	Pradesh	83743	10546	9528	31466	51540	61.55
3	Assam	78438	17864	-	8968	26832	34.21
4	Bihar	94163	693	5779	1	6473	6.87
5	Chhattisgarh	135191	25782	24036	9954	59772	44.21
6	Delhi	1483	78	7	-	85	5.73
7	Goa	3702	253	845	126	1224	33.06
8	Gujarat	196022	14122	479	4326	18927	9.66
9	Haryana	44212	249	1158	152	1559	3.53
	Himachal						
10	Pradesh	55673	1898	33060	2075	37033	66.52
	Jammu &						
11	Kashmir	222236	17643	2551	36	20230	9.10
12	Jharkhand	79714	4387	19185	33	23605	29.61
13	Karnataka	191791	28690	3931	5663	38284	19.96
14	Kerala	38863	11123	142	-	11265	28.99
15	Madhya Pradesh	308245	61886	31098	1705	94689	30.72
16	Maharashtra	307713	49226	8195	4518	61939	20.13
17	Manipur	22327	1467	4171	11780	17418	78.01
18	Meghalaya	22429	1113	12	8371	9496	42.34
19	Mizoram	21081	7909	3568	5240	16717	79.30
20	Nagaland	16579	86	508	8628	9222	55.62
21	Orissa	155707	26329	15525	16282	58136	37.34
22	Punjab	50362	44	1153	1861	3058	6.07
23	Rajasthan	342239	12454	17416	2769	32639	9.54
24	Sikkim	7096	5452	389	-	5841	82.31
25	Tamil Nadu	130058	19388	2183	1306	22877	17.59
26	Tripura	10486	4175	2	2117	6294	60.02
27	Uttar Pradesh	240928	11660	1420	3503	16583	6.88
28	Uttarakhand	53483	24638	9882	131	34651	64.79
29	West Bengal	88752	7054	3772	1053	11879	13.38
-	Union						
30	Territories	9478	3163	4257	10	7430	78.39
	Total	3287263	430582	206219	132711	769512	23.41

Source : India State of Forest Report 2009

Table 3.4.2 at annexure 3 presents the State/ UT wise details of forest area by ownership. Table 3.4.3 presents the State/ UT wise details of forest area by composition (Coniferous forest, non- coniferous forest, mixed).

TABLE 3.4.4 : FOREST COVER IN INDIA 2007								
Class	Area (Sq. Km)	Percentage of Geographic Area						
1	2	3						
Forest Cover								
Very Dense Forest	83510	2.54						
Moderately Dense Forest	319012	9.70						
Open Forest	288377	8.77						
Total Forest Cover*	690899	21.02						
Non-Forest Cover		_						
Scrub	41525	1.26						
Non-forest**	2554839	77.72						
Total Geographic Area	3287263	100.00						

3.4.2 As per the latest State of Forest Report 2009, the forest cover in the country is 690,889 kmsq. and constitutes 21.02 % of its geographic area.

3.4.3 The following Chart 3.4.1 depicts the forest cover as compared to the total geographic area in different States in India. The corresponding data is **in table 3.4.5 at annexure 3.**



3.4.4 In India, 40.79 % of the total forest area is in the hill districts and this covers 39.82% of the total geographic area of the hill districts. **The table 3.4.6 at annexure 3 depicts the details of State / UT wise Forest Cover in Hill Districts of India.** It is pertinent to mention that, in India, 59.72 % of the total forest area is in tribal districts and covers 37.32% of total geographic area of tribal districts. **The table 3.4.7 at annexure 3 depicts the details of State / UT wise Forest Cover in Tribal Districts of India.**

3.4.5 State /UT wise Forest area covered and its percentage to total geographic area are presented in table 3.4.8a 3.4.8 b at annexure 3.

3.5 Changes in coverage of Forests, Trees and Mangroves

3.5.1 Multi-pronged pressures on forests come from population, cattle grazing, fuel and fodder collection, industry and forest fires, etc. The remaining good forest cover is, therefore, estimated to be just 11% against the desirable 33% of the total land area as per the National Forest Policy. Up to the late seventies, forest land was a prime target for diversion for resettlement, agriculture and industrialization, and this trend was contained only by the Forest (Conservation) Act, 1980.

3.5.2 A significant decrease in the forest cover is reported from Andhra Pradesh, Arunachal Pradesh, Assam, Chhatisgarh, Nagaland and Tripura whereas the states of Jharkhand, Manipur, Meghalaya, Mizoram and Orissa have shown a significant increase in forest cover. The table 3.5.1 at annexure 3 exhibits the details of changes in forest cover in Indian States over time.

3.5.3 It is very important to examine the details of changes in forest cover of the north eastern region which has 24.67% of forest cover to total forest cover of the Country. There has been an increase in forest cover in 2007 over the year 2005 by 598 sq. km. **The table 3.5.2 at annexure 3 exhibits the details of changes in forest cover in the North Eastern States of India.**

3.5.4 In India, only 2.82% of total geographic area is having tree cover. The table 3.5.3 at annexure 3 elaborates the State/ UT wise details of tree cover.

3.5.5 The Country has been divided into 14 physiographic zones. Among them, the zones with highest trea cover to its total geographic area are West Coast (7.78%) followed by Western Ghats (5.31%). The zone wise details are shown in the table 3.5.4.

TABLE 3.5.4 : PHYSIOGRAPHIC ZONE WISE TREE COVER ESTIMATE							
SI. No.	Physiographic Zone	Geographic	Tree	Cover			
		Area (Km²)	Area (Km²)	% of Geog. Area			
1	2	3	5	6			
1	Western Himalayas	329255	8091	2.46			
2	Eastern Himalayas	74618	324	0.43			
3	North East	133990	2243	1.67			
4	Northern Plains	295780	9473	3.20			
5	Eastern Plains	223339	5444	2.44			
6	Western Plains	319098	7497	2.35			
7	Central Highlands	373675	9150	2.45			
8	North Deccan	355988	7559	2.12			
9	East Deccan	336289	11157	3.32			
10	South Deccan	292416	8002	2.74			
11	Western Ghats	72381	3847	5.31			
12	Eastern Ghats	191698	4051	2.11			
13	West Coast	121242	9427	7.78			
14	East Coast	167494	6504	3.88			
	Total	3287263	92769	2.82			
	Source : India State of Forest Report. 2009						

Sl. No.	Physiographic Zone	Area of Phy.Zone	Recorded Forest	Growing Stock (volume in million Cum)				
		(Km ²)	Area (Km ²)	In Forest	In Tree Outside Forest	Total		
1	2	3	4	5	6	7		
1	W. Himalayas	329255	91073	1021.94	191.09	1213.03		
2	E. Himalayas	74618	47965	473.2	69.35	542.55		
3	North East Ranges	133990	79431	341.14	102.85	443.99		
4	Northern Plains	295780	13992	142.6	104.27	246.87		
5	Eastern Plains	223339	31709	240.53	97.43	337.96		
6	Western Plains	319098	13694	7.93	74.36	82.29		
7	Central Highlands	373675	80788	109.37	110.86	220.23		
8	North Deccan	355988	87260	281.07	83.47	364.54		
9	East Deccan	336289	128757	622.18	198.74	820.92		
10	South Deccan	292416	49451	224.42	134.28	358.70		
11	Western Ghats	72381	32399	461.78	118.68	580.46		
12	Eastern Ghats	191698	74418	360.65	75.26	435.91		
13	West Coast	121242	20736	106.21	147.87	254.08		
14	East Coast	167494	17839	105.63	91.06	196.69		
	Total 3287263 769512 4498.65 1599.57 6098.22							

The table 3.5.5 presents the details of growing stock according to physiographic zones.

3.5.6 The Forest Produce has also some role in the degradation of forests. Forest produce is defined under section 2(4) of the Indian Forest Act, 1927. Its legal definition includes timber, charcoal, wood-oil, resin, natural varnish, bark, lac, myrobalans, mahua flowers (whether found inside or brought from a forest or not), trees and leaves, flowers and fruit, plants (including grass, creepers, reeds and moss), wild animals, skins, tusks, horns, bones, cocoons, silk, honey, wax, other parts or produce of animals, and also includes peat, surface soil, rocks and minerals etc. when found inside or brought from a forest, among other things. Forest produce can be divided into several categories. From the point of view of usage, forest produce can be categorized into three types: Timber, Non Timber and Minor Minerals.

The tables 3.5.6 to 3.5.8 at annexure 3 presents the details of State wise Production of forest produce.

3.5.7 Mangrove cover assessment: Mangroves are various kinds of trees up to medium height and shrubs that grow in saline coastal sediment habitats. At the intersection of land and sea, mangrove forests support a wealth of life, from fish to people, and may be more important to the health of the planet than we ever realized.

3.5.8 In India, the major mangrove areas are mainly in 10 State/ UTs of India and
their details are given at table 3.5.9.
TADLE 2.5.0. STATE MICE LIST OF MANCDOME ADEAS

Sl No.	State/UT	mangrove Area
1	2	3
1	West Bengal	Sunderbans.
2	Orissa	Bhaitarkanika, Mahandi, Subernarekha, Devi, Dharma,
		MGRC, Chilka
3	Andhra Pradesh	Coringa, East Godavari, Krishna
4	Tamil Nadu	Pichavaram, Muthupet, Ramnad, Pulicat, Kazhuveli
5	Andman & Nicobar	North Andamans, Nicobar
6	Kerala	Vembanad, Kannur
7	Karnataka	Coondapur, Dakshin Kannada/Honnavar,
		Mangalore Forest Division, Karwar
8	Goa	Goa
9	Maharashra	Achra-Ratnagiri, Devgarh-Vijay Durg, Veldur, Kundalika-Revdanda,
		Mumbra-Diva, Vikroli, Shreevardhan, Vaitarna, Vasasi- Manori,
		Malvan
10	Gujarat	Gulf of Kutch, Gulf of Khambat, Dumas-Ubhrat

Source : Annual Report 2008-2009, Ministry of Environment & Forests

3.5.9 There is an increase of 395 sq.km in mangrove cover assessment from 1991 to 2007 at all India level considering the States as shown in table 3.5.10 at annexure.3.

TABLE 3.5.11: Details of STATE/UT WISE MANGROVE COVER, 2007								
						(Sq. km)		
Sl	State/UT	Very	Moderately	Open	Total	Change w.r.t.		
No.		Dense	Dense	Mangrove		2005assessment		
		Mangrove	Mangrove					
1	2	3	4	5	6	7		
1	Andhra Pradesh	0	126	227	353	-1		
2	Goa	0	14	3	17	1		
3	Gujarat	0	188	858	1046	55		
4	Karnataka	0	3	0	3	0		
5	Kerela	0	3	2	5	0		
6	Maharashtra	0	69	117	186	0		
7	Orissa	82	97	42	221	4		
8	Tamil Nadu	0	16	23	39	3		
9	West Bengal	1038	881	233	2152	16		
10	Andaman & Nicobar	285	262	68	615	-20		
11	Daman & Diu	0	0	1	1	0		
12	Pudicherry	0	0	1	1	0		
	Total	1405	1659	1575	4639	58		

3.5.10 The details of mangrove cover (2007) is given in Table 3.5.11.

Source:India State of Forest Report 2009

In India, very dense mangrove consists of 30%, moderately dense 36% and open mangrove 34% of the total mangroves.

3.6 Diversion of forest land for non-forest use

Forest Conservation Act of India-1980 with amendments in 1988, is to provide for conservation of forests and matters connected with protection of trees from illegal felling and destruction. This act covers all aspects of forests including reserve forests, protected forests or any forest land irrespective of its ownership. Main features of this act are,

- No part of a reserved forest land can be used for non forest purpose by the state government without prior approval from the central government.
- State Government can not lease forest land or its portions to any private person or to any authority, corporation, agency or organization which are not managed or controlled by government.
- A forest land can be cleared of trees (which have grown naturally) only when this land is to be used for reforestation.

However, ground scenario as depicted at table 3.6.1 shows the alarming degree of the forest area diverted since the implementation of Forest conservation act 1980.

Sl. No.	Year	Forest Area Diverted	Cummulative Area Diverted
1	1980	Nil	Nil
2	1981	1331.70	1331.70
3	1982	3674.32	5006.02
4	1983	5100.51	10106.53
5	1984	9348.90	19455.43
6	1985	7676.83	27132.26
7	1986	9310.45	36442.71
8	1987	25925.97	62368.68
9	1988	4868.71	67237.39
10	1989	66768.09	134005.48
11	1990	127361.79	261367.27
12	1991	5065.35	266432.62
13	1992	21756.77	288189.39
14	1993	16182.51	304371.90
15	1994	59962.02	364333.92
16	1995	51428.98	415762.90
17	1996	32862.55	448625.45
18	1997	24738.43	473363.88
19	1998	18425.21	491789.09
20	1999	45784.41	537573.50
21	2000	22386.43	559959.93
22	2001	267897.61	827857.54
23	2002	51172.31	879029.85
24	2003	42729.68	921759.53
25	2004	33079.50	954839.03

TABLE 3.6.1 : DIVERSION OF FOREST LAND FOR NON FOREST USE SINCE THEENFORCEMENT OF FOREST CONSERVATION ACT,1980 (Area in ha.)

Source : Forests & Wildlife Statistics, India, 2004, MOEF



The trend in forest area converted in various years is depicted below at chart 3.6.1.

3.7 Conservation measures to increase forest cover

- 3.7.1 A two pronged strategy to increase forest cover essentially comprises
 - Improving canopy cover in the forest land; and
 - Undertaking afforestation in non-forest and degraded lands, preferably contiguous to forest blocks.

3.7.2 Realising the role of forests in controlling soil erosion, moderation of floods, recharging of ground aquifers, as habitat for wildlife, conservation of bio-diversity and gene pool, etc., programmes were launched as early as the Second Five Year Plan for extensive Watershed Management followed later by establishment of a Protected Areas Network, under the Wildlife (Protection) Act, 1972.

3.7.3 People's participation in the protection of forests: Participation of people in the protection and management of forests has been emphasised in the National Forest Policy, 1988. Pursuant to this policy, Government of India through its resolution dated 1st June '90 formalised the Joint Forest Management (JFM) Programme. The JFM is being practiced through constitution of forest protection committees. About 84,632 committees are managing a total of 17.33 million ha of forest area under JFM.

The table 3.7.1 at annexure 3 shows the progress of joint forest management in India.

3.8 Waste lands

3.8.1 In India, waste lands constitute approximately 20.17 % of the total geographic area covered. **Table 3.8.1 at annexure 3 depicts the State wise distribution of waste lands.** The chart 3.8.1 shows the State /UT wise percentage of wasteland to the total geographic area in India.



3.9 Animal Species in India

3.9.1 There are about 1,250,000 identified species of animal. This includes 1,190,200 invertebrates, among them 950,000 insects, 70,000 mollusks, 40,000 crustaceans, and 130,200 others. There are about 58,800 identified vertebrates, including 29,300 fish, 5,743 amphibians, 8,240 reptiles, 9,800 birds, and 5,416 mammals. As a comparison, almost 300,000 plant species are known. Importantly, the numbers above do not account for species which have not yet been captured or described scientifically. Scientists estimated there might be as many as 10 - 30 million unidentified insect species, many of them living in the rainforest, and up to 1 million mite species. Mites are small arthropods, a group of animals related to but not the same as insects.

3.9.2 The details of endemic animal species in India is presented in table 3.9.1 at annexure 3. The Indian Scenario vis –a –vis the global in respect of the species wise existence of animal kingdom is elaborated in table 3.9.2 annexure 3. The share of various animal species in India is 7.43%.

3.9.3 As reports from the various corners of the globe indicate many animal species have already become extinct/ threatened. The recent addition in the list of threatened / endangered species is shown in table 3.9.3 annexure 3.

The approximate number of rare and threatened vertebrates species in India is presented below.

Sl. No.	Category	Approximate Number					
		Mammalian	Aves	Reptilian	Amphibian	Pisces	
1	2	3	4	5	6	7	
1	EX	1	0	0	0	0	
2	CR	10	13	5	13	5	
3	EN	39	10	9	31	6	
4	VU	47	54	11	21	29	
5	NT	26	59	10	9	25	
Total	433	123	136	35	74	65	

Table 3.9.4: RARE AND THREATENED SPECIES (VERTEBRATES)

- EX : Extinct
- **CR** : Critically Endangered
- EN : Endangered
- VU : Vulnerable
- NT : Near Threatened

The definitions and other details are in Table 3.9.5 at annexure 4.

3.10 Animal Species – Conservation measures

3.10.1 Areas rich in biodiversity and encompassing unique and representative ecosystems are identified and designated as Biosphere Reserves. The goal is to facilitate conservation of representative landscape and India's immense biological diversity as described above. Till date, 15 Biosphere Reserves have been set up. The last one was set up in 29.01.2008 at Kachchh covering parts of Kachchh, Rajkot, Surendranagar and Patan civil districts of Gujarat State. The List of **Biosphere reserves set up in India are shown in Table 3.10.1 at annexure 3.**

3.10.2 The wild life Act provided for setting up National parks and sanctuaries for wild life. The basic idea in trying to encourage wild life is that human welfare is initially linked with it. The Government of India has pledged for all out efforts to conserve which not only seeks to protect and preserve what remains of wild fauna and flora but also seeks to augment this priceless national heritage.

The State/ UT wise list of Natonal Parks and wild life sanctuaries of India is depicted in 3.10.2 at annexure 3. The number of National Parks, Wild life Sancturies, Conservation reserves, Community reserves and Protected areas and respective area covered at all India level are summarized below.

Current Protected Area Status (as on March 2009)							
		Area					
National Parks	100	Covered	39,155 km ²				
		Area	1,18,417				
Wildlife Sanctuaries	514	Covered	km ²				
		Area	1,155.06				
Conservation Reserves	43	Covered	km ²				
		Area					
Community Reserves	4	Covered	17.76 km^2				
		Area	1,58,745				
Protected Areas	668	Covered	km ²				
National Parks % of G.A.	1.19%						
Wildlife Sanctuaries % of G.A	3.60%						
Conservation Reserves % of G.A	0.04%						
Protected Areas % of G.A.							
	4.83%						

Source: Wildlife Institure of India, 2009

3.10.4 Project Tiger: As per the recommendations of a special task-force of the Indian Board of Wildlife, Project Tiger was launched in 1973 with the following objectives:-

- To ensure maintenance of available population of tiger in India for scientific, economic, aesthetic, cultural and ecological value.
- To preserve, for all times, the areas of such biological importance as a national heritage for the benefit, education and enjoyment of the people.

3.10.5 The population of tigers is estimated through tiger census conducted once in 4 to 6 years. The last such census was conducted in 2001-02.

	TABLE 3.10.3 : ALL INDIA TIGER POPULATION IN TIGER RESERVES								
Sl.					Y	ears			
No.	Name of Reserve								2001-02
		1972	1979	1984	1989	1993	1995	1997	*
1	2	3	4	5	6	7	8	9	10
1	Bandipur (Karnataka)	10	39	53	50	66	74	75	82
2	Corbett(Uttaranchal)	44	84	90	91	123	128	138	137
3	Kanha(Madhya Pradesh)	43	71	109	97	100	97	114	127
4	Manas(Assam)	31	69	123	92	81	94	125	65*
5	Melghat (Maharashtra)	27	63	80	77	72	71	73	73
6	Palamu (Jharkhand)	22	37	62	55	44	47	44	32
7	Ranthombore (Rajasthan)	14	25	38	44	36	38	32	35
8	Similipal(Orissa)	17	65	71	93	95	97	98	99
9	Sunderbans (West Bengal)	60	205	264	269	251	242	263	245
10	Periyar (Kerala)	-	34	44	45	30	39	40	36
11	Sariska (Rajasthan)	-	19	26	19	24	25	24	22
12	Buxa (West Bengal)	-	-	15	33	29	31	32	31
13	Indravati (Madhya Pradesh)	-	-	38	28	18	15	15	29
	Nagarkimasagar (Andhra								
14	Pradesh)	-	-	65	94	44	34	39	67
15	Namdhapa (Arunachal Pradesh)	-	-	43	47	47	52	57	61
16	Dudhwa (Uttar Pradesh)	-	-	-	90	94	98	104	76*
17	Kalalad (Tamil Nadu)	-	-	-	22	17	16	28	27
18	Valmiki (Bihar)	-	-	-	81	49	N.R	53	53
19	Pench (Madhya Pradesh)	-	-	-	-	39	27	29	40
20	Tadoba (Maharashtra)	-	-	-	-	34	36	42	38
21	Bandhavgarh (Madhya Pradesh)	-	-	-	-	41	46	46	56
22	Panna (Madhya Pradesh)	-	-	-	-	25	22	22	31
23	Dampha(Mizoram)	-	-	-	-	7	4	5	4
							10		
24	Pench (Maharashtra)	-	-	-	-	-	(1994)	-	14
25	Bhadra (Karnataka)	-	-	-	-	-	_	_	35
	Pakhui- Nameri (Arunachal								26
26	Pradesh)	-	-	-	-	-	-	-	Nameri
27	Bori-Satpura (Madhya Pradesh)	-	-	-	-	30			35
	Total	268	711	1121	1327	1366	1333	1498	1576

Source: Project Tiger, Ministry of Environment & Forests * : under compilation/vetting

The area of tiger reserves in Tiger range States are depicted in table 3.10.4 at annexure 3.

Population of tigers –estimates by refined methodology is presented in the table 3.10.5. As per this data, the tiger population in India is approximately 1411 only.

State	Area K2	Ticon	Number		
State	KM2	Ilger	Numbers	Unner	
		No.	limit	limit	
Shivalik-Gangetic Plain Landscape Complex		1101			
Uttarakhand	1901	178	161	195	
Uttar Pradesh	2766	109	91	127	
Bihar	510	10	7	13	
Shivalik Gangetic	5177	297	259	335	
Central Indian Landscape Complex and Easter	n Ghats La	ndscap	e Complex		
Andhra Pradesh	14126	95	84	107	
Chattisgarh	3609	26	23	28	
Madhya Pradesh	15614	300	236	364	
Maharashtra	4273	103	76	131	
Orissa	9144	45	37	53	
Rajasthan	356	32	30	35	
Jharkhand**	1488		Not assess	sed	
Central Indian	48610	601	486	718	
Western Ghats Landscape Complex					
Karnataka	18715	290	241	339	
Kerala	6168	46	39	53	
Tamil Nadu	9211	76	56	95	
Western Ghats	34094	402	336	487	
North East Hills, and Brahmaputra Flood Plain	S				
Assam*	1164	70	60	80	
Arunachal Pradesh*	1685	14	12	18	
Mizoram*	785	6	4	8	
Northern West Bengal*	596	10	8	12	
North East Hills, and Brahmaputra	4230	100	84	118	
Sunderbans	1586		Not assess	sed	
Total Tiger Population		1411	1165	1657	
Source: Ministry of Environment & Forests, Annual Report 2007-08					

TABLE 3.10.5 : FOREST OCCUPANCY AND POPULATION ESTIMATES OFTIGER AS PER THE REFINED METHODOLOGY

* Population estimates are based on possible density of tiger occupied landscape in the area, not assessed by double sampling.

** Data was not amenable to population estimation of tiger. However, available information about the landscape indicates low densities of tiger in the area ranging from 0.5 to 1.5 per 100 km^2 .

3.10. 6 India is famous for the majestic elephants of the Country. The protective measures adopted to save the elephant population of the country are very important. **The**

designated elephant reserves in India, the area, the number of elephants found are available in table 3.10.6 at annexure 3.

The location of major zoos in India is in table 3.10.7 at annexure 3.

The following table gives the progress achieved in setting up National Parks and Wildlife Sancturies in India.

TABLE 3.10.8 : NATIONAL PARKS AND WILDLIFE SANCTUARIES OF INDIA								
	National Parks Wildlife Sanctuaries Total Area							
Year	Number	Area	Number	Area				
1995	80	34684.53	441	114164.58	148849.11			
1995	80	34684.53	441	114164.58	148849.11			
1999	87	34021.15	485	113163.03	147184.18			
2004	90	36881.53	502	120051.88	156933.41			
2006	100	38024.11	514	117913.77	155980.15			

Source: M/o Environment & Forest

3.11 Livestock Population

3.11.1 The livestock population in the country increased from 369 million in 1977 to the current estimate of 529 million. Grazing by Livestock puts pressure on grasslands and forests. Because of excessive grazing, natural regeneration is either absent or inadequate in a significant portion of the forests in the country.

TABLE 3.11.1 : INDIA'S LIVESTOCK POPULATION								
		(Thousand)						
Sl.	Livestock	Number of Animals						
No.	LIVESLUCK	1977	1982	1987	1992	1997	2003	2007
1	2	3	4	5	6	7	7	8
1	Cattle	180140	192453	199695	204584	198882	185181	199100
2	Buffaloes	62019	69783	75967	84206	89918	97922	105300
3	Sheep	40907	48765	45703	50783	57494	61469	71600
4	Goats	75620	95255	110207	115279	122721	124358	140500
	Horses &							
5	Ponnies	916	900	797	817	826	751	600
6	Pigs	7647	10071	10626	12788	13291	13519	11100
7	Mules	89	131	167	193	220	176	100
8	Donkeys	978	1024	958	967	881	650	400
9	Camels	1068	1078	1001	1031	911	632	500
II	Other Livestock							
1	Yaks	132	128	36	58	59	65	100
2	Mithuns	129	154	129	154	177	278	_
Total		369645	419742	445286	470860	485379	485002	529700

Source : Live Stock Census, Ministry of Agriculture

The trend and extent in growth of livestock population from 1977 to 2007 at all India level are evident from the above table.

3.11.2 An analysis of forests vis-a-vis livestock indicates continued free access to the forest area which has resulted in high rates of growth of livestock population causing land degradation and arresting the development of markets for forage crops. Overgrazing impedes regeneration, retards growth of vegetation, and leads to extinction of good palatable grasses which are replaced by less palatable and inferior grasses. Extensive areas have been invaded by bushes which are not browsed, excessive trampling makes the soil compact and impervious and prevents circulation of air, water, thus exposing the soil to erosion by wind and water.

The State / UT wise livestock population details as per 2007 census are in table 3.11.2 at annexure 3.

3.12 FISHERY

3.12.1 India with a large number of inland water resources and surrounded by sea is a rich source of fishery. **Table 3.12.1depicts the marine fishery resources in India.**

TABLE 3.12.1 : MARINE FISHERY RESOURCES OF INDIA						
Sl. No.	State/Union Territory	Continental Shelf ('000 Sq Kms.)	Number of Landing Centres	Number of Landing Centres	Number of Fishing Villages	
1	Andhra Pradesh	33	508	271	498	
2	Goa	10	88	34	39	
3	Gujarat	184	286	123	263	
4	Karnataka	27	29	88	156	
5	Kerala	40	226	178	222	
6	Maharashtra	112	184	152	406	
7	Orissa	26	63	57	641	
8	Tamil Nadu	41	362	352	581	
9	West Bengal	17	65	44	346	
10	Andaman & Nicobar Islands	35	57	25	100	
11	Daman & Diu	-	7	7	22	
12	Lakshadweep	4	11	19	20	
13	Puducherry	1	28	26	28	
TOTAL		530	1914	1376	3322	

Source: Department of Animal Husbandry and Dairying, Ministry of Agriculture Marine Fisheries Census,2005

3.12.2 The fish production (marine & inland) at all India level over the years, is **presented at Table 3.12.2**. It is pertinent to mention that, though the marine and inland fish production are showing an overall increasing trend, the marine fish production is lower than the inland production in recent years.

TABLE 3.12.2 : FISH PRODUCTION						
				(Lakh tonne)		
Sl No.	Year	Marine	Inland	Total		
1	2	3	4	5		
1	1950-51	5.34	2.18	7.52		
2	1960-61	8.80	2.80	11.60		
3	1970-71	10.86	6.70	17.56		
4	1980-81	15.55	8.87	24.42		
5	1981-82	14.45	9.99	24.44		
6	1982-83	14.27	9.40	23.67		
7	1983-84	15.19	9.87	25.06		
8	1984-85	16.98	11.03	28.01		
9	1985-86	17.16	11.60	28.76		
10	1986-87	17.13	12.29	29.42		
11	1987-88	16.58	13.01	29.59		
12	1988-89	18.17	13.35	31.52		
13	1989-90	22.75	14.02	36.77		
14	1990-91	23.00	15.36	38.36		
15	1991-92	24.47	17.10	41.57		
16	1992-93	25.76	17.89	43.65		
17	1993-94	26.49	19.95	46.44		
18	1994-95	26.92	20.97	47.89		
19	1995-96	27.07	22.42	49.49		
20	1996-97	29.67	23.81	53.48		
21	1997-98	29.50	24.38	53.88		
22	1998-99	26.96	26.02	52.98		
23	1999-00	28.52	28.23	56.75		
24	2000-01	28.11	28.45	56.56		
25	2001-02	28.30	31.26	59.56		
26	2002-03	29.90	32.10	62.00		
27	2003-04	29.41	34.58	63.99		
28	2004-05*	27.79	35.25	63.05		
29	2005-06	28.16	37.56	65.72		
30	2006-07	30.24	38.45	68.69		
31	2008-09	29.78	46.38	76.16		
32	2009-10 (p)	29.89	48.62	78.51		

Source : Department of Animal Husbandry and Dairying, Ministry of Agriculture*: Revised P : Provisional

The State wise fish production data is available in table 3.12.3 at annexure 3.

3.12.3 The inland fishery water resources contributes to the Country's fish production in a significant manner. The table 3.12.4. in annexure 3 presents the details of Inland water resources of water.

3.12.4 Though, the livestock population in the country is increasing over the years, the incidence of livestock and poultry diseases are also increasing which has causes in environmental changes and serious impacts on environmental balance. Table 3.12.5 at annexure 3 gives a summary of the incidence of various livestock and poultry diseases in 2009.
