

# NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN, INDIA

## MIZORAM STATE BIODIVERSITY STRATEGY AND ACTION PLAN



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**CENTRE FOR ENVIRONMENT PROTECTION (CEP)**

## Mizoram State Biodiversity Strategy and Action Plan, 2003



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**NBSAP ADMINISTRATIVE AGENCY** : Biotech Consortium India Ltd.

**MIZORAM BSAP NODAL AGENCY** : Centre for Environment Protection (CEP)

**NODAL AGENCY PERSONNEL** :

1. Shri. A.C. Zonunmawia, Co-ordinator
2. Shri. V.L. Tlana
3. Smt. F. Lalmuanpuii
4. Smt. Rammuanawmi
5. Shri. David M. Thangliana
6. Shri. Rothuama Sailo
7. Shri. Lalduhawma

**STEERING COMMITTEE** :

1. Er. Dunglema, Chairman
2. Smt. Rammuanawmi, Vice Chairman
3. Smt. F. Lalmuanpuii, Member Secretary
4. Shri. A.C. Zonunmawia, Member
5. Shri.M. Lalmanzuala, Member
6. Shri. Rosiama Vanchhong, IFS, Member
7. Shri. K. Hawlla Sailo, Member
8. Dr. Rakesh Mohan, Member
9. Dr. R.K. Lallianthanga, Member
10. Er. Zoliansanga, Member
11. Shri. C. Thangmura, Member
12. Shri. C. Rokhûma, Member
13. Shri. H. Lianmawia, MFS, Member
14. Rev. Thangpuiliana, Member
15. Er. C. Lalduhawma, Member
16. Smt. Lalsangzuali Sailo, Member
17. Smt. R. Lalruatkimi, Member
18. Shri. V.L. Tlana, Member
19. Shri. David M. Thangliana, Member

20. Shri. K.T. Pianga, Member
21. Shri. Rothuama Sailo, Member
22. Smt. R. Lalchhandami, Member

**TPCG MEMBERS ASSOCIATED** : 1. Shri. Ashish Kothari  
2. Dr. P.C. Bhattacharjee

**PEER REVIEWERS** : G.P. Shukla, IFS, R.C. Thanga, IFS, T. Millang, IFS, Yogesh, IFS, Liandawla, IFS, Lalthangliana Murray, IFS, L.R. Thanga, IFS, Kawlnuna, MFS and other officers of Environment & Forests Deptt., Govt. of Mizoram.

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## Mizoram State Biodiversity Strategy & Action Plan

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### CHAPTER 1

#### 1. INTRODUCTION

The National Biodiversity Strategy and Action Plan (NBSAP), a project of Union Ministry of Environment & Forests (MoEF) aims to produce a series of planning documents dealing with the conservation of India's biodiversity, sustainable use of its biological resources, and equity, including in decisions regarding access to such resources and the benefits accruing from them. The project is funded by the Global Environment Facility (GEF) through United Nations Development Programme (UNDP). A unique aspect of the project is that its technical execution is by a Technical and Policy Core Group (TPCG) being coordinated by the NGO Kalpavriksh, and its administrative coordination is by Biotech Consortium India Ltd.

The NBSAP process has included extremely widespread consultation across the country and across all sectors of society, involving tens of thousands of people. It aims to produce not one national action plan, but 18 local (sub-state) plans, 33 state and union territory plans, 10 eco-regional (inter-state) plans, and 13 thematic plans. All these will not only coalesce into a national plan, but will also remain independent for implementation purposes. In addition, over 30 thematic papers have been commissioned on a variety of topics related to biodiversity.

Within this overall process, preparation of the Mizoram State Biodiversity Strategy and Action Plan has been done by the Centre for Environment Protection (CEP) & State Steering Committee, consisting of persons experienced in the field.

The scope of the Mizoram State BSAP includes development of implementable project proposals for possible future support, either from existing funds available or by seeking additional funding. This document aims to produce short (5 years), medium (10 years) and long term (20 years) perspective plans for investment, and technical assistance proposals for sustainable management and development of the State's biological resources within the overall guidelines of NBSAP. It intends in particular to achieve the following objectives :

- (i) to maintain environmental sustainability, and ecological balance, and conserve biodiversity and genetic resources of the State.
- (ii) to increase the vegetative cover in the State by encouraging involvement and participation of the people in protection, and development of biodiversity through various programs.
- (iii) to increase the productivity of biological resources by application of appropriate practices and technologies evolved after adequate research.

(iv) to protect, develop and manage biological resources on a sustainable basis, and to utilize the same to meet local domestic needs and to achieve economic growth, create employment opportunities and promote industrial development.

(v) need-based strengthening and re-organization of the concerned organization, by providing facilities, equipment and personnel, with emphasis on human resource development, to achieve the above objectives.

This exercise also looks at the inter-sectoral linkage (such as the departments of Agriculture, Horticulture, Animal Husbandry, Rural Development, Revenue, Industry, etc.), as experience has shown that the solution of many of the problems of biodiversity management lie outside the biodiversity sector. Such issues will also need to be appropriately addressed by the respective sectors.

### **1.1. PROFILE OF THE AREA:**

Mizoram (“land of highlanders”) was recognized as Lushai Hills and formed part of British India after annexation by the British Government in 1898. The word “*mizo*” applied to all the Mizos living in Mizoram and its adjoining areas of Manipur, Tripura, Chittagong Hill Tracts and the Chin Hills. For discharging administrative functions, a Superintendent was appointed as Head of the Lushai Hill District, assisted by a number of native Chieftains. Soon after independence, Chieftainship was abolished, and on 25<sup>th</sup> April 1952, an Autonomous Mizo District Council was set up. In 1972, Mizoram was accorded the status of Union Territory, and finally on 20<sup>th</sup> February 1987, attained full-fledged statehood.

The geographical area of Mizoram is 21,081 sq. km., stretching 277 km north-south, and 121 km east-west, between 21°58’ – 24°35’ N latitude and 92°15’ – 93°29’ E longitude. It shares inter-state boundaries with Assam (123 km), Tripura (66 km) and Manipur (95 km), and international boundaries with Bangladesh (318 km) and Myanmar (404 km). The administrative setup of the State is divided into 8 Districts with 23 Sub-divisions and 22 Rural Development (RD) Blocks. At the village level, there are Village Councils (Panchayats) in 710 villages (as on 1.4.2000). The development departments of the State Government prepare and implement the plans in their respective spheres of work, coordinated by the Planning Department.

### **1.2. TOPOGRAPHY, CLIMATE, GEOLOGY AND SOIL:**

The entire territory is mostly mountainous, with precipitous slopes forming deep gorges that drain into several streams and rivers. Almost all the hill ranges traverse in the north-south direction. Phawngpui (or Blue Mountain) has the highest peak at 2157 m, whereas the lowest place is Bairabi at 40 m above Mean Sea Level (MSL). The average height of hill ranges in Mizoram is 920 m. The foothills and valleys have tropical forest, while the mid-altitudes have sub-tropical moist climate, and the upper reaches temperate climate. Thunderstorms with heavy downpour during April or May is very common. The average rainfall of Mizoram recorded during 2000-02 and 2001-02 is 8,230.08 mm and 7,334.83 mm respectively. Rainfall is generally less in north Mizoram, increasing gradually towards the south. Winter is dry and moderately cold, whereas summer is warm and wet. Frost occurs in the eastern part of the State in late December or early January. The summer temperature varies from 20°C to 30°C and winter temperature from 8°C to 18°C. The low-lying areas are moist and the higher regions are pleasantly cool. A few rivers flow to north, while most flow southward.



The rocks commonly found are sandstone, shale, siltstone, clay stone and slates. The rock system is weak and unstable, prone to frequent seismic action. Soils vary from sandy loam and clayey loam, to clay, generally mature but leached due to steep gradient and heavy rainfall. Soils are porous with poor water-holding capacity, deficit in potash, phosphorous, nitrogen and even humus; excessive leaching makes them acidic to neutral.

### 1.3. POPULATION:

The original stock in Mizoram was of mongoloid or Tibeto-Burman origin. The Mizos invaded this territory in early 19<sup>th</sup> Century. Sailo is the principal clan amongst the Mizos. The Mizo society has maintained its ethno-cultural values, and is highly organized and disciplined. In those days, a chief headed every village. The chief had absolute control over his village, yet his mode of life and his dress differed in no way from the common people. The only difference was that he did not do manual work. Each family had to contribute a certain amount of rice every year towards the support of the chief, and a portion of every animal taken in by hunters or trappers.

The chief was aided by his council, which met in the chief's house. The opinion of the strongest warriors of the villages exerted considerable influence on the decisions made by the chief and his council, and the village council provided the basis for local demographic organization. In 1991, the population recorded was 6,89,756, a rise of 39.7% since 1981, and by the year 2001 the population reached 8,91,058 (4,59,783 men and 4,31,275 women), showing a rise of 29.2% between 1991 and 2001. Population density is very low, at 42 / km<sup>2</sup>. The urban population makes up 49.5%, and the rural 50.5%. Literacy in Mizoram is very high, at 88.5%. The district-wise population is given at Table 1.1.

**Table 1.1** District-wise human population of Mizoram (2001 census provisional)

District	Population
Aizawl	3,39,812
Lunglei	1,37,155
Champhai	1,01,389
Mamit	62,313
Serchhip	55,539
Lawngtlai	73,050
Saiha	60,823
Kolasib	60,977

Source : Census of India, 2001 (Series-16)

### 1.4. SOCIO-ECONOMIC CONDITIONS:

The Mizos came to India rather recently, when the British annexed the land in 1890. The major ethnic groups in Mizoram include the *hmar*, *paihte*, *pawi/lai*, *mara* and other sub-tribes/clans, and other tribes such as *bru* (*tuikuk*) and *chakma* who came to Mizoram even more recently. Agriculture is the mainstay of the people, and the economy is agrarian. Rice, maize, ginger, mustard and potatoes are the chief crops. Traditional slash-and-burn shifting cultivation (*jhum*) is practised by a large number of people, resulting in the destruction of forest cover and soil erosion. Timber and bamboo are among the important forest products. There are no major industries, only small-scale industries. 48,944 persons are in government and semi-government employment (Table 1.2), and per capita income in the State is Rs.11,667/- (1997-98).

**Table 1.2** Distribution of employees by nature of work (1998 & 1999)

Sl. No.	STATUTORY	YEAR	TECHNICAL	NON-TECHNICAL	TOTAL
1	State Government	1998	9633	29717	39350
		1999	9623	31015	40638
2	Central Government	1998	845	2071	2916
		1999	1255	2785	4040
3	Semi Government	1998	149	711	860
		1999	197	582	779
4	Banking & Insurance	1998	12	742	754
		1999	23	759	782
5	Autonomous District Councils	1998	312	2482	2794
		1999	226	2479	2705
	Total	1998	10951	35723	46674
		1999	11324	37620	48944

Source: Statistical Handbook of Mizoram, 2000.

## 1.5. POLITICAL PROFILE:

The legislature in Mizoram is a unicameral, 40-member Legislative Assembly. In the 1998 Assembly election, Mizo National Front (MNF) bagged 21 seats, its alliance partner, the Mizoram People's Conference (MPC) got 12, Indian National Congress (INC) –6, and independent 1. However, the partnership between MNF and MPC has ended, and the MNF has formed the ministry alone at present, with the help of one independent MLA. Mizoram sends two representatives to parliament, one each to the Lok Sabha and Rajya Sabha.

During the regime of village Chieftains, the biodiversity was well-protected, as removal of forest produce was restricted to meet the barest need for domestic consumption, ensuring sustainable forest management. With the abolition of Chieftainship on 25<sup>th</sup> April 1952, management of land and forests vests with the Government. In District Council areas, management of land and forest vests with the three Autonomous District Councils, the Mara Autonomous District Council (MADC), Lai Autonomous District Council (LADC) and Chakma Autonomous District Council (CADC). A system of grant of land passes by Village Councils existed earlier, and now grant of such passes vests with the Revenue Department, under the control of the Deputy Commissioner.

## 1.6. ECOLOGICAL PROFILE:

**1.6.1. Flora:** No comprehensive, systematic survey and documentation of the flora of Mizoram has yet been carried out, and information about only a limited number of species is available, as discussed in Section 2.3. Some common plant species of Mizoram are listed below:

Tree species		
Sl.No.	Name of species	Local name
1.	Anogeissus acuminata	Zairum
2.	Macaranga denticulate	Zawngtenawhlung
3.	Michelia doltsopa	Zo-ngiau
4.	Gmelina arborea	Thlanvawng
5.	Michelia champaca	Ngiau
6.	Quercus spp.	Fah/Sasua/Then/Thil
7.	Castanopsis spp.	Thingsia
8.	Terminalia myriocarpa	Char

9.	Rhododendron arboreum	Chhawkhle
10.	Prunus cerasoides	Tlaizawng/Paivun
11.	Bombax insigne	Pâng
12.	Acrocarpus fraxinifolius	Nganbawm
13.	Schima wallichii	Khiang
14.	Podocarpus neriifolio	Tufâr
15.	Duabanga grandiflora	Zuang
16.	Ficus tinctoria	Zaman-Hmawng
17.	Ficus benghalensis	Bung
18.	Dysoxylum gobara	Thingthupui
19.	Morus australis	Thingtheihmu
20.	Albizzia thomsoni	Thingri

#### Orchid species

Sl.No.	Name of species	Local name
1.	Vanda coerulea	Lawhlei
2.	Rhyncostylis retusa	Uaihniang
3.	Renanthera imschootiana	Senhri
4.	Phaius tankervilleae	Sasan
5.	Paphiopedilum villosum	Zawngatuikhur
6.	Paphiopedilum hirsutitimum	Zawngatuikhur
7.	Papilionanthe teres	Kela beng
8.	Dendrobium nobile	Bânpui
9.	Dendrobium densiflorum	Bânpui parbit
10.	Dendrobium formosum	Bânpui parvar
11.	Dendrobium chrysotoxum	Bân pareng
12.	Cymbidium irridiodes	Bânsian
13.	Cymbidium mastersii	Bânsiau
14.	Arundina graminifolia	Lelen
15.	Aerides odorata	Ngürtinchhing

**1.6.2. Fauna:** Even for the faunistic composition of the state, no systematic survey has been conducted as yet; the surveys done are described in Section 2.4. However, like the other north-east Indian States, Mizoram is quite rich in wildlife. Seven species of non-human primates viz. hoolock gibbon (*Hylobates hoolock*), Phayre's leaf monkey or *Dawr* (*Presbytis phayrei*), Assamese macaque (*Macaca assamensis*), common langur (*Semnopithecus entellus*), stumptailed macaque (*Macaca arctoides*), rhesus macaque (*Macaca mulatta*) and the slow loris (*Nycticebus cougang*) are found. Among the cats, the tiger (*Panthera tigris*), leopard (*Panthera pardus*), clouded leopard (*Neofelis nebulosa*), golden cat (*Catopuma temmincki*), leopard cat (*Prionailurus bengalensis*), jungle cat (*Felis chaus*) are known to occur in the state. Among the civets, the small Indian binturong (*Arctictis binturong*) is found. Other smaller mammals such as hog badger (*Arctonyx collaris*), Burmese ferret badger (*Melogale personata*), crab-eating mongoose (*Herpestes urva*), Indian flying fox (*Pteropus giganteus*), common giant flying squirrel (*Petaurista petaurista*), Malayan giant squirrel (*Ratufa bicolor*), etc. are also found. Among ungulates, barking deer (*Muntiacus muntjak*), sambar (*Cervus unicolor*), serow (*Nemorhaedus sumatraensis*) and goral (*Nemorhaedus goral*) are common. Unique among the avian fauna worth mention are the Hume's bartailed pheasant, Blyth's Tragopan and grey Peacock pheasant and several species of hornbills. There are no overall estimates of floral and faunal diversity so far.

### 1.6.3. Ecosystems:

#### a) Aquatic ecosystem:

The aquatic ecosystem has not been properly studied yet in Mizoram; even the concerned department (i.e. Fisheries Department) is not in a position to undertake surveys or research to scientifically classify and identify the aquatic species due to lack of basic infrastructure. There are 14 major rivers in the State (Table 1.3), most of which are rain-fed, running in spate during the monsoon and almost dry during the summer months. Some important fish species of Mizoram are listed below, as compiled by Centre for Environment Protection (CEP).

#### Some fish species of Mizoram

<i>Sl.No.</i>	<i>Species name</i>	<i>Local name</i>
1.	Barbus tor tor (Hamilton)	Nghahrah
2.	Barbus tor mosal	Nghaphusen
3.	Maraena thyroidea	Ngharul
4.	Chanda manarays	Nghathinghar
5.	Bagarius yurrellie	Thaichhawwinu
6.	Labeo rohita	Nghatun (Tunhang)
7.	Labeo calbasu	Nghatun (Tunzen)
8.	Xenentodon cancila	Nghafunglawr
9.	Channa orientalis	Nghakhing
10.	Channa marulius	Nghakhing
11.	Amblypharyngodon mola	Nghadawl
12.	Puntius filamentosus	Nghameidum
13.	Puntius sarana	Nghameidum
14.	Botia geto	Nghasanghal
15.	Noemacheilus spp.	Sarba
16.	Channa striatus	Nghavawk
17.	Notopterus chitala	Nghakhuai
18.	Homaloptera montana	Nghazawnggek
19.	Mastacembelus armatus	Nghaler

**Table 1.3** Major rivers of Mizoram

<i>Sl.No.</i>	<i>Name of River</i>	<i>Length in Km.</i>
1	Tlawng	185
2	Tiau	159
3	Chhingtuipei (Kolodyne)	138
4	Khawthlangtuipei (Karnaphuli)	128
5	Tuichang	120
6	Tuirial	117
7	Tuichawng	107
8	Mat	90
9	Tuipei	86
10	Tuivawl	72
11	Teirei	70
12	Tuirini	59
13	Serlui	56
14	Langkaih	68

Besides these rivers, there are wetlands, small lakes and ponds, such as Tamdil, Palak and Rengdil.

## b) Terrestrial ecosystem:

### i) Natural forests :

Most of the forests of Mizoram are of seed origin. Much of Mizoram was covered by moist deciduous, semi-evergreen and evergreen forests. However, with the passage of time, these have become degraded with low stocking of economical species. They are confined to small pockets scattered throughout the State. Such forests are home to many diverse species of plants and animals.

### ii) Miscellaneous forests mixed with bamboos:

These are mostly open forests, constituting the major forest cover in the State. They are secondary forests, on fallow land that was previously jhumed.

### iii) Bamboo forests:

They are confined mainly to the low-lying areas, with the non-clump forming bamboo (*Melocanna* sp.) dominating. Jhuming is rampant in these areas. Mizoram has the highest proportion of bamboo in the country, with 49.1% of the forest cover constituting bamboo.

### iv) Man-made forests:

These are forest plantations, some owned by the Government, others privately-owned. They are mostly teak, and are still below exploitable age. However, mature teak has been harvested from some plantations in small quantities, to supplement the timber requirement of the State.

**1.6.4. Agricultural systems:** The major agricultural production of the state comes from jhuming, which is the mainstay of the people of Mizoram. Paddy is the main crop; others include maize, vegetables and spices.

**1.6.5. Land and water use:** Management of land and forests is the responsibility of the Government. In District Council areas, the District Councils look after the management of land and forests. A system of grant of land passes by village councils existed earlier, and now grant of such passes vests with the Revenue Department under the control of the Deputy Commissioner. However, the Village Council grants permits to villagers for jhuming on community land. Regular cadastral survey and record of rights are yet to be carried out in a systematic manner. In the absence of a survey settlement, there are many unauthorized settlements, both in reserved forests and unclassed forests, which need to be regularized. A proper land tenure system, based on appropriate land use, is absolutely essential to promote land-based production activities in the private, Government and community sectors, and this task is being carried out by the Revenue Department. The Revenue Department has been undertaking cadastral land survey throughout Mizoram since 1999, and it is expected to be completed in 2003. The present land use system is given at Table 1.4. Regarding water use, the Public Health Engineering Department responsible for drinking water supply. A water harvesting program has also been carried out, in which 11,944 G.C.I. tanks were distributed to 138 villages during 2001-2002, the department is planning to distribute 446 G.C.I. tanks of 7500 litres capacity each, to 5 villages. Management of rivers is under the control of the State Department of Environment & Forests.

**Table 1.4** Land use system in Mizoram

	<i>Land use</i>	<i>1998-1999</i>	<i>1999-2000</i>
	Area under forest cover[including jhum and fallow land] (km <sup>2</sup> )	18,775	18,775
	Area jhumed in one year (km <sup>2</sup> )	466.34	437.07
	Area under agricultural [not including jhum](km <sup>2</sup> )	1010.46	896.01

Area under afforestation (km <sup>2</sup> )	32.5	42.7
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Source : Statistical Handbook of Mizoram, 2000.

## CHAPTER 2

### 2. CURRENT STATUS OF BIODIVERSITY :

Mizoram has a very rich biodiversity, in accordance with the enormous diversity of ecosystems that make up the State. This diversity at the species, sub-species and variety level, is a result of evolutionary processes. However, in the last few decades, this diversity has faced increasing erosion. Habitat loss, hunting and over-exploitation of resources, introduction of exotic species in river ecosystems, poisoning and other factors including progressive disempowerment of local communities, population growth and destabilization of Mizo traditional management systems, have caused this loss. The dimensions of the loss are as yet unclear, as baseline data, research and monitoring are poorly developed in the State. Some elements of the loss, which have remained undetected or severely under-studied, include decline of the sub-species and varieties. This silent erosion is not necessarily due to anthropogenic factors, but often due to complex and less understood environmental factors. Thus, for conservation measures to be implemented effectively, it is imperative to have a basic understanding of the flora and fauna of the State, beginning with status surveys.

**2.1. Status of forests:** According to Champion and Seth (1968), the forests in Mizoram are classified under three types viz.

- (1) Tropical wet-evergreen forests
- (2) Tropical semi-evergreen forests
- (3) Montane sub-tropical pine forests

The National Remote Sensing Agency, Secunderabad (1979) classified the forest of Mizoram into six categories viz.

- (1) Sub-tropical evergreen forest
- (2) Tropical evergreen forest
- (3) Tropical moist deciduous forest
- (4) Bamboo forest
- (5) Quercus forest
- (6) Jhum land — current, old and abandoned

According to the Botanical Survey of India, Eastern Zone, Kolkata (1992) the forest of Mizoram is classified as follows :-

- (1) Eastern Himalaya wet temperate forest
- (2) Cachar tropical semi-evergreen forest
- (3) Assam sub-tropical pine forest
- (4) Secondary moist bamboo forest [jhum fallows]
- (5) Tropical wet evergreen forest
- (6) Montane sub-tropical forest

A collaborative up-to-date survey needs to be carried out to consolidate the actual status of forests in Mizoram.

Of the forest types, the most important is tropical wet-evergreen forest, which is rich in valuable timber species, and found mainly in south and west Mizoram. Timber species in

the top canopy of these forests include *Dipterocarpus turbinatus*, *Artocarpus chaplasha*, *Terminalia myriocarpa*, *Amoora wallichii*, *Michelia champaca* and *Mesua ferrea*. Bamboos and canes also occur abundantly in the middle and lower storeys. Important bamboos are *Dendrocalamus strictus*, *Bambusa tulda*, *Dendrocalamus giganteus* and *Dendrocalamus hamiltonii*.

The common species in the tropical semi-evergreen forests are *Michelia champaca*, *Schima wallichii*, *Gmelina arborea*, *Cedrela toona*, etc. Bamboos and canes are also abundant. Semi-evergreen forests occur in the central, north, northwest and western parts of the State. This type covers the major portion of Mizoram, while the eastern fringes of the State bordering the Chin Hills of Myanmar, are higher in elevation and have montane sub-tropical pine forests. Here, the climate is cooler and annual precipitation is lower than in forests in other parts of the State.

The common species of sub-tropical pine forests include *Pinus keseya*, *Quercus* spp., *Castanopsis* spp., *Schima wallichii*, *Rhododendron arboreum*, *Rhus semialata*, etc.

Mizoram has vast natural forest resources, but due to the age-old practice of shifting cultivation, vast area comprising valuable timber trees and other forest resources have been converted into degraded land. In a study under taken by the Forest Survey of India (FSI), it is estimated that during 1987-97, an area of about 0.38 million ha. (3800 km<sup>2</sup>) has been affected by shifting cultivation this also doesn't tally with the figures in table 1.3. Most of the dense forests are now located in small pockets, in relatively inaccessible areas.

The forest cover, based on satellite data of Dec. 1998 is estimated at 18,338 km<sup>2</sup>, representing 86.99% of State's total geographic area. The dense forest is 3,786 km<sup>2</sup> and open forest is 14,552 km<sup>2</sup>. A decrease of 437 km<sup>2</sup> in forest has been observed between 1997 and 1999. Dense forest registered a decrease of 526 km<sup>2</sup>. While the open forest increased by 125 km. State of Forest Report 1999 of FSI is given below.

1. Actual forest cover of Mizoram	- 18,338 km <sup>2</sup> (including forest fallows)
2. Dense forests (crown density >40%)	- 3,786 km <sup>2</sup>
3. Open forests (crown density >10% & <40%)	- 14,552 km <sup>2</sup>
4. Scrub forests	- 212 km <sup>2</sup>
5. Non-forests	- 2,531 km <sup>2</sup>
6. Decrease in forest cover over 1997 to 1999	- 437 km <sup>2</sup>

## 2.2. Notified forests of Mizoram :

A. <i>State-Owned:</i>	<u>Area in km<sup>2</sup></u>
1. Innerline Reserved Forests	570.00
2. Riverine Reserved Forests	1,833.00
3. Roadside Reserved Forests	97.20
4. Other Reserved Forests	1,905.00
	-----
Total:	4,405.20
	-----
5. Wildlife Protected Areas:	
(a) Dampa Tiger Reserve	500.00

(b) Murlen National Park	100.00
(c) Khawnglung Wildlife Sanctuary	35.00
(d) Lengteng Wildlife Sanctuary	60.00
(e) Tawi Wildlife Sanctuary	35.75
(f) Palak Wildlife Sanctuary	15.50
(g) Thorang Wildlife Sanctuary	50.00
(h) Sazatlang Wildlife Sanctuary	15.00

Total:	811.25
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Total (State-owned):	5,216.45
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*B. District Council Forests:*

1. Lai Autonomous District Council (LADC):

(i) Wildlife Protected Areas

(a) Ngengpui Wildlife Sanctuary	110.00
(b) Phawngpui National Park	50.00

Total:	160.00
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(ii) Reserved Forests:

(a) Safety Reserve	78.00
(b) Supply Reserve	45.00
(c) Protected Reserve	70.00
(d) Roadside Reserve	27.00
(e) Station Reserve	44.00
(f) Revenue Reserve	612.00

Total:	876.00
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Total (LADC):	1,036.00
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2. Mara Autonomous District Council (MADC):

(a) Safety Reserve	102.00
(b) Supply Reserve	115.00

Total:	217.00
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3. Chakma Autonomous District Council (CADC):

(a) Safety Reserve	465.00
(b) Supply Reserve	904.00

Total (CADC):	1,369.00
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Total (District Council Forests):	2,622.00
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Total notified forests (State-owned + District Council):	7,838.45
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**2.3. Plant Species:** Although Mizoram has a diverse flora, no extensive and systematic survey and documentation has yet been carried out. Only occasional surveys and some botanical collections have been carried out by A.T. Gage (1899), N.E. Parry (1932), Rev. W.J.L. Wenger (1932), Kajilal (1934), Fisher (1938), Deb and Dutta (1987), and by the Botanical Survey of India (BSI) Shillong. The plant materials collected were deposited scantily in the herbaria of Kew (London), CNH (Howrah) and Shillong. Dr. H. Lalramnghinglova, Botanist, Department of Environment and Forests, Government of Mizoram, has made botanical collections since 1991 and deposited around 400 mounted specimens in a small herbarium of the State Forest Department established for the first time in Mizoram. He published the Handbook of Forest Trees of Mizoram, and Forest Resources of Mizoram 1997, among others. The Botanical Survey of India had undertaken a documentation of the flora of Mizoram since 1989, and the volume is expected to be ready soon.

Being part of the ‘biodiversity hot-spot’ of north-east India a documentation of the forest wealth (e.g., ecological assessment, socio-ecology, anthropology, ethnobotany, biochemistry, fauna, microbiology, biomass production) needs to be taken up. According to Dr. Lalramnghinglova, more than 400 ethnomedicinal plants have been recorded in the State. Of these, 65 species are categorized as rare and threatened species at the local (State) level, and 64 species are new records of ethnomedicinal plants. There are about 20 species of bamboo (Table 2.1) reported from the State. They occupy a large area of the forest, support numerous human needs, including small scale and cottage industries, contributing a good amount of revenue to the State exchequer (Table 2.2). Besides the use of bamboo for construction of houses and agricultural implements (Table 2.3), they are also used for making hats, mats, baskets, cots, spears, weaving implements, etc. In times of food scarcity, its seeds are used as food substitutes. Young shoots of four bamboo species are used as vegetable.

**Table 2.1** List of bamboo species found in the forest of Mizoram

Sl.No.	Botanical names
1	<i>Arundinaria callosa</i> Munro
2	<i>Bambusa arundinacea</i> (Retz.) Roxb.
3	<i>B. khasiana</i> Munro
4	<i>B. longispachus</i> Gamble
5	<i>B. tulda</i> Roxb.
6	<i>B. oliveriana</i> Munro
7	<i>B. vulgaris</i> Schrad ex Wall.
8	<i>Cephalostachyum capitatum</i> Munro
9	<i>C. fuschianum</i> Gamble
10	<i>Chimonobambusa khasianum</i> Munro
11	<i>Dendrocalamus giganteus</i> Munro
12	<i>D. hamiltonii</i> Nees & Arn ex Munro
13	<i>D. hookeri</i> Munro
14	<i>D. longispachus</i> (Kurz) Kurz
15	<i>D. sikkimensis</i> Gamble
16	<i>D. strictus</i> (Roxb) Nees
17	<i>Melocanna baccifera</i> (Roxb) Kurz
18	<i>Melocamus compactiflorus</i> Benth.
19	<i>Neohouzeaua dullooa</i> (Gamble) Camus
20	<i>Pseudostachyum polymorphum</i> Munro

**Table 2.2** Revenue (in rupees) received from bamboo in Mizoram

Year	Total Revenue from all classes of forest	Revenue from bamboo	Percent revenue from bamboo
1991-92	9,276,000	3,246,600	35
1992-93	11,991,000	2,877,840	24

1993-94	11,332,000	4,192,840	37
1994-95	15,887,920	6,667,920	42

**Table 2.3** Consumption of bamboo (Metric Ton) in Mizoram

Use	Total	Rural people	Urban people
House building	27119	22509 (83%)	4610 (17%)
Agricultural implements	1196	933 (78%)	263 (22%)
Total	28315	23442 (83%)	4873 (17%)

Source : Lalrinthangi F.C. (1990), Singh (1996), Progress Report Forestry (1990)

**2.4. Animal species :** In the absence of proper enumeration or census the number, density and population of wildlife in the State can't be ascertained. The State Environment & Forests Department have been undertaking animal census within the wildlife sanctuaries and national parks from time to time. The state avifauna was also not studied properly in the past due to remoteness of the region, difficult terrain, twenty years of insurgency, financial constraint and poor communication. However, according to Shri. Lalramthanga, I.F.S. and Shri. Lalmalsawma (1996), about 226 species of birds from 50 families have been recorded. Once Mizoram was the denizen of a number of wild animals. **But the population dwindled at an alarming rate due mainly to the age old practice of shifting cultivation involving repeated cutting and burning of vegetation and excessive and uncontrolled hunting.** Today only marginal and vanishing forms of fauna are left with us whose future is very deemed and uncertain due to wanton destruction of forests. This is the reason why the available wild animals live only in the interior forests to avoid unfriendly treatment from their superior creature. Zoological Survey of India and Wildlife Institute of India, Dehra Dun at frequent intervals are carrying out faunal survey of the State and a picture of the studied areas are expected to come up with conservation strategies.

**2.5. Agriculture and Livestock :** The State Government gives a policy direction in the matter of land use with socio-economic and environmental **orientation primarily with a view to rehabilitate the tribal jhummia families by weaning them away from shifting cultivation through an integrated approach.** The agricultural food production of Mizoram is **mainly dependent on jhumming;** the production of principal crops in Mizoram is shown at table 2.4. Most of the milk production for adequate sustained supply will depend on the production of quality fodder, feeds and milch cattles. Number of domestic animals in Mizoram as per 1997 census is given at table 3.1.

**Table 2.4** Production of principal crops in Mizoram

Sl. No.	Name of Principal crops	2000-2001 Production (MT)	2001-2002 Production (MT)
1	PADDY	103673	105715
2	MAIZE	16436	16645
3	PULSES	3960	3798
4	OILSEEDS	5682	5498
5	SUGARCANE	6361	9360
6	POTATO	-	9181.5
7	GINGER (green)	-	78285

Source : Statistical Handbook of Mizoram, 2002.

**Table 3.1** Numbers of domestic animals in Mizoram (As per 1997 census)

Sl.No.	Name of Animals	Numbers
1	2	3
1	Cattle	33,312
2	Buffalo	5,365
3	Mithun	2,594
4	Sheep	699
5	Goat	16,036
6	Horse & Ponies	2,002
7	Donkey	5
8	Pig	1,63,181
9	Dog	33,746
10	Cattle	19,737
11	Poultry	12,94,489
12	Duck	12,171
13	Rabbit	1,545
14	Others	342

Source : Statistical Handbook of Mizoram, 2000.

## CHAPTER 3

### 3. STATEMENT OF THE PROBLEMS RELATING TO BIODIVERSITY:

**3.1. Habitat destruction and conversion :-** The main causes of habitat destruction in the State may be grouped into increase in fuelwood and timber consumption, conversion of forest lands to agricultural use due to increase in population and other operations. Jhumming is one of the most ancient systems of farming, believed to have originated in the Neolithic period, around 7000 BC (Borthakur 1992). Shifting cultivation is a widely practised food production system. In Mizoram, in the days when this system of food production emerged, it worked well and soil fertility was maintained as a result of larger fallow cycles of 20 to 30 years. Due to overwhelming pressure on land, the fallow cycle has been reduced to 3 to 5 years. Shifting cultivation has many ill effects but it is still widely practised due to compatibility of the system with the physical environment, steep and undulating topography, socio-economic and cultural factors, physiographic remoteness and isolation, lack of awareness and unfavourable environment, etc. In recent years, due to rapid growth in population and penetration of market forces, increase in support services and basic infrastructure and the indiscriminate use of natural resources, shifting cultivation has proved disastrous due to the following reasons :-

- (i) Shifting cycle has now come down to 3-5 years (Singh and Singh 2000) and production has gone down due to loss of fertility.
- (ii) Deforestation with its related effects such as soil erosion, disturbance in soil and water balance, leading to drinking water shortage and floods in the plains.
- (iii) Loss of biodiversity.

**3.2. Introduction of exotics and monocultures :-** So far the potential detrimental effects from monocultures has not been studied in Mizoram. However, the introduction of exotic fish species into the rivers by the State's Fisheries Department have resulted in the reduction of indigenous species in some areas. Fortunately, this practice has been stopped now. The unsustainable harvest of fish, crabs, prawns, etc. by means of poison, bomb, electric generator, etc. should be banned. Meanwhile, hunting, trapping, snaring, etc. of wild animals including birds is still rampant in the State.

**3.3. Unsustainable models of development :-** Due to lack of deep environmental awareness in policy-making, many models of developmental works are proving to be unsustainable, and the dimensions of such negative impact are as yet unclear, as monitoring, baseline data, impact assessment and threat or risk assessment are poorly developed in the State. For instance, when the Green Mizoram Programme was started, roadside plantations were undertaken along the Aizawl-Lengpui road. But, before long, due to widening and improvement of the road, many young plants were destroyed by debris. This is a clear indication of lack of coordination between developmental departments and lack of proper planning. **Environmental management plans (EMP) have also never been incorporated in developmental plans in the State.**

**3.4. Alienation of citizens :-** During the regime of Village Chieftains, the forests were well-protected, as removal of forest produce was restricted to meet the barest need for domestic consumption, ensuring sustainable biodiversity management. For instance, if trees were to be cut for festivals and the like, prior to cutting them, one of the elders had to make an apology to the Creator of Nature by saying (while holding a trophy of animal skull), ‘We are not going to cut this tree for our own pleasure, as this animal hits and uproots the tree, we are just going to clear the tree out of the jungle...’. In the past, domesticated animals of Mizoram were pig, poultry, dog, cat and mithun. The Mizos were big consumers of meat and most of their demand was met from wild animals. However, during the breeding season of wild animals and birds, a traditional hunting ban was upheld, ensuring their sustainability. However, during the British regime and after the abolition of Chieftainship, commercial exploitation of wild biodiversity started in accessible areas, depleting the rich tropical forests. The traders also made inroads into virgin forests. **Further, the Mizoram (Forest) Act of 1955 framed for the Lushai Hills, allowed petty permits, which also resulted in the selective removal of valuable trees leaving behind only the trees of miscellaneous and inferior quality.**

**When the management of biodiversity became the responsibility of the Government, destabilization of traditional management systems also started resulting in alienation of local communities from natural resources and loss of sense of ownership of natural resources.** The main reason behind all this is lack of administrative coordination among various Government departments and local communities, over-centralization of decision making, inappropriate land tenure system, corruption, lack of enforcement of law and order, lack of political will, lack of public input from planning to implementing a program, lack of empowerment to the people towards joint natural resources management, lack of transparency in information towards biodiversity conservation, inequalities, etc. The present issue of alienation of local communities from natural resources management is based on our experiences under the environmental governance of the Mizoram State Government.

## CHAPTER 4

### 4. MAJOR ACTORS AND THEIR ROLES RELEVANT TO BIODIVERSITY:

**4.1 Governmental Agencies :-** The roles of major actors relevant to biodiversity in the State may be summarized as follows :

**4.1.1 Environment & Forests Department :-** This Department is the nodal agency in Mizoram for biodiversity related activities. **However, their main activity is confined to the forestry sector only to meet the increasing demand of timber, firewood and NTFP by**

**undertaking plantations and regeneration of degraded forest lands in the state.** The department has been implementing various centrally sponsored schemes like Area Oriented Fuelwood and Fodder Project (AOFFP), Integrated Afforestation and Eco-Development Project (IAEP), Non-Timber Forest Produce (NTFP), Association of Scheduled Tribes and Rural Poor (ASTRP) Project and Eco-Development in and around National Parks and Sanctuaries (EDNPS). During 1999-2000, the Department created a 4720 ha (47.20 km<sup>2</sup>) plantation at a cost of Rs. 553.918 lakhs. Plantations of teak, gomari and indigenous species since the inception of the department cover 1,98,153 ha (1981.53 km<sup>2</sup>). The department is also responsible for the management of the ten notified protected areas (PAs) viz. Dampa TR, Phawngpui NP, Murlen NP, Ngengpui WS, Khawnglung WS, Lengteng WS, Tawi WS, Thorang WS, Sazatlang WS and Palak WS, and certain biodiversity hot-spots like Lungkulh virgin forest, etc.

**4.1.2. Soil & Water Conservation Department :-** This Department is also an environment-related agency. The Department implements plantations for soil and water conservation, **coffee plantation, rubber plantation, large cardamom plantation and aleurite plantation.** Soil and water conservation measures undertaken by the Department are as follows :

**(a) Erosion control :-**

Control of erosion caused by running rainwater in cultivation areas, habitation areas, towns and cities.

**(b) Gully control :-**

Construction of check dams, channelisation of speedy stream water at falls and highly erosive points.

**(c) Control of landslide in landslide prone areas :-**

Head water diversion drain, catch water drain, construction of retention dams and retaining walls, silt detention structures, etc.

**(d) River training works :-**

Flow normalization by bed digging and bank erosion control works, flood control by embankment, treatment in the catchment areas, etc.

**4.1.3. Agriculture Department :-** The present approach of the State's Agriculture and Minor Irrigation Department is to achieve food security for the State. The department is also implementing centrally sponsored schemes such as Watershed Development Project in Shifting Cultivation Areas (WDPSCA) and National Watershed Development Project for Rainfed Areas (NWDPR). Since the transfer of minor irrigation from the State's Public Works Department to the Agriculture Department in August 1984, 58 minor irrigation projects, 52 flow irrigation and 6 lift irrigation schemes have been completed to irrigate 2,643 ha (26.43 km<sup>2</sup>) of wet rice cultivation (WRC) areas. During 2001-2002, the total outlay proposed for Minor Irrigation and Command Area Development was Rs. 575 lakhs and 30 lakhs respectively. Priority was given for maintenance of completed Minor Irrigation Projects.

In addition to the on-going projects, new Minor Irrigation projects were started during 2001-2002 with the assistance from NABARD and loan from AIBP for execution of 37 Minor Irrigation Projects covering 2200 ha. of cultivable land for irrigation purpose. Another approach of the Department is to achieve the twin objectives of sustainable production of

biomass and restoration of ecological balance in the vast tracts of rainfed areas in the State. In addition, to solve the problems of the shifting cultivation the department is implementing Zo-hill farming system, which is a three tier system suggested by the Indian Council of Agriculture Research (ICAR), Shillong, i.e. cultivation of trees at the hill tops, cultivation of horticulture crops in the middle portion of the hill slopes and forming terraces at the lower portion of the hill slopes for cultivation of crops, this model has already been approved by the State Land Use Board. The department with little success also introduced other models such as contour trench farming system and terrace farming system. The agriculture link roads completed during 1997-98 and 1998-99 was 43.5 km and 59 km respectively.

**4.1.4. Rural Development Department :-** There are 22 rural development blocks in the State at present. The department is implementing National Program on Improved Chullahs (NPIC), in which 2766 fuel-efficient smokeless chullahs have been distributed all over Mizoram to mitigate extensive use of fuelwood. The department is also implementing other centrally sponsored schemes like Employment Assurance Scheme (EAS), Jawahar Gram Swarozgar Yojana (JGSY), Indira Awas Yojana (IAY), Border Area Development Program (BADP), etc. In addition, there are five District Rural Development Agencies (DRDAs) in Mizoram, which are implementing centrally sponsored schemes like integrated wasteland development project (IWDP) in their respective areas.

**4.1.5. Horticulture Department :-** The main approach of the department is to make the state self-sufficient in horticulture crops, thereby boosting the State's economy in general, and maximizing the income of farmers through plantation of horticulture crops in particular. The Department has now completed a 150 km horticulture link-road. Area and production of horticulture crops in the State is given in Table 3.2 below.

**Table 3.2** Area and production on horticulture crops (for the year 2001-2002)

Sl.No.	Name of crops	Area under plantation (in ha.)	Production (in MT)
1	Vegetables	7416.55	62348
2	Fruits	19028.55	85088.70
3	Spices	9319.5	86610
4	Areca nut plantation	1334	1057
5	Betel vine plantation	282	385
6	Coconut plantation	264	155
8	Aleurite plantation	1827	5334

Source : Statistical Handbook of Mizoram 2002.

**4.1.6. Fisheries Department :-** The main approach of the Department is to make Mizoram self-sufficient in fish products. During 1999-2000, propagation of fish seeds was undertaken, in which 45 lakh fish seeds were propagated in 13 major rivers of Mizoram. 27 lakh fish seeds were distributed to fish farmers at subsidized rates, and 30 lakh carp fingerlings were distributed free of cost to fish farmers. The department is now planning to properly manage rivers of Mizoram including biodiversity conservation. Year wise production of fish in Mizoram is given in Table 3.3.

**Table 3.3** Year wise production of fish in Mizoram

Sl. No.	Year	Fish production (quintals)	Average price per quintal (in Rs.)	Total value (Rs. in lakhs)
1.	2000-01	3045	8000	243.6
2.	2001-02	3154	8000	252.3

TOTAL	6199	16000	495.9
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Source : Statistical Handbook of Mizoram 2002.

**4.1.7. Mizoram State Pollution Control Board** :- The Board does not undertake many activities due to financial constraints and shortage of manpower. The main activities of the Board at present are to issue No Objection Certificate (NOC) and give consent letters for various developmental projects. Meanwhile the Board is supposed to enforce various Central Acts and Rules pertaining to the protection of environment such as the Environment (Protection) Act, 1986, the Water (Prevention and Control of Pollution) Act, the Air (Prevention and Control of Pollution) Act, etc.

**4.1.8. Sericulture Department** :- The main approach of this Department is to make Mizoram green by planting silkworm food plants and boost rural economy by utilizing these for silkworm rearing and cocoon production. At present all the four varieties of silkworms, viz. Mulberry, Eri, Muga and Oak tasar are reared in the State with promising results. The Department now has 39 institutions covering farms and centres, sericulture training institute, silk processing centres, silk weaving centres, seed preservation centres, chowki rearing centres, technical service centres and a multiend semi-automatic silk reeling and twisting factory to make sericulture an effective tool for rural reconstruction.

**4.1.9. Land Revenue & Settlement Department** :- To work out a proper land management system, the Department is now undertaking cadastral land survey throughout the State and the program is expected to be finished during 1999-2003.

**4.1.10. State Council of Educational Research and Training (SCERT)** :- SCERT introduced a text book of Environmental Studies in 25 selected primary schools since 2000 as experiment for Class I & II students, and is planning to introduce the same up to class V in future.

**4.1.11. Armed Forces** :- During the time of insurgency in the State, Armed Forces were also responsible for deforestation. The main factors leading to deforestation are political upheaval during 1966 and continued practice of shifting cultivation. The direct consequence of disturbance in 1966 and indirect effect being depletion of vegetative cover, reduction in the forest area due mainly to grouping of villages, burning of old villages, uncontrolled burning of the so-called "Security line" around the inhabited areas and uncontrolled forest fire. Even when forest fires were detected the people were not free to move to extinguish fires due to restriction on movement from one place to another. It is unfortunate that the restriction of movement and tight security measures resulted in inaction, and a consequent loss of sense of ownership in the minds of the people, who later took part in deforestation. Due to the absence of documentation, the exact loss of biodiversity from the above factors could not be ascertained so far. However, at present the Armed Forces, particularly the Assam Rifles are also engaged in tree planting in the State.

**4.1.12. Mizoram State Cooperative Fruit Forestry & Vegetation Ltd** :- This society is engaged in procurement and selling of agriculture and horticulture crops from its affiliated societies. During 1999-2000 the society made a net profit of Rs. 3,25,691/-. As this agency is a commercial entity, biodiversity conservation is not a central concern to them.

**4.1.13. Mizoram Multi-Commodity Producers Cooperative Union Ltd. (MULCO)** :- MULCO is engaged in the upliftment and betterment of cattle farmers. During 1999-2000,

MULCO sold 20.31 lakh litres of milk. Biodiversity conservation is not their priority at all. However, MULCO is very concerned about treatment of wastes from milk processing.

**4.1.14. Mizoram Food & Allied Industries Corporation Ltd. (MIFCO) :-** MIFCO is undertaking the production of different beverages, and is running a food processing plant at Chhingchhip village. MIFCO is a commercial entity and biodiversity conservation is not a central concern to them.

**4.2. Citizens' groups and NGOs :-** There are a number of local and State level NGOs, of which one or two are actively involved towards the conservation of biodiversity so far, and the majority of them are involved from time to time only due to lack of real understanding of the need to conserve biodiversity.

**4.3. Local communities, rural and urban :-** Since the political upheaval of 1966, the Mizos lost their traditional prudence in the conservation and protection of biodiversity. It is unfortunate to say that the present administrative system of the State, which is not participatory in nature, is also one of the main reasons behind this loss. Despite the introduction of joint natural resources management programs like JFM in the State, perception of the people on biodiversity remained unchanged due to absence of real decentralization of power and participation of the people. The present bureaucratic system does not willingly give even small power to the people, resulting in loss of sense of ownership in the minds of the people.

## **5. ONGOING BIODIVERSITY-RELATED INITIATIVES :**

**5.1. Green Mizoram Program :-** The Government of Mizoram is concerned about the continued depletion of tree cover in the State, resulting from excessive biotic pressures like illicit felling, forest fires, clearing of private and Govt. lands for human habitation and other developmental activities. The Govt. considers it necessary to launch a massive venture for resuscitation and afforestation of all barren lands in Mizoram including private, Govt. and semi-Govt. lands for converting such areas into green cover thereby creating a better environment. With this in view, the Govt. of Mizoram by Notification (vide No.B.11023/13/98-FST dated 6<sup>th</sup> May 1999) constituted a State Level Committee on Green Mizoram under the Chairmanship of the Hon'ble Chief Minister of Mizoram, Shri. Zoramthanga. The Minister of Environment & Forests was a convener. Important heads of Departments, and leaders of various NGOs were also appointed as members.

District Level Committees were also constituted in all the eight Districts of the State under the Chairmanship of the respective Deputy Commissioners, with heads of Government offices, heads of the educational institutions and various leaders of NGOs as members. Broad functions of the State Level Committee and District Level Committee are :-

- (a) To frame a policy where individuals, families/households, communities, NGOs, etc. will be involved in taking up tree planting.
- (b) To identify barren lands under private, Government and semi-Government ownership, for taking up of tree planting.
- (c) To create public awareness towards importance of tree planting, wildlife preservation, fire protection and conservation of nature as a whole.



Green Mizoram Day was first observed on 18<sup>th</sup> June 1999, when 51,631 seedlings were planted within Aizawl town. On 14<sup>th</sup> June 2000, the Green Mizoram Day was observed again, and 1,51,661 seedlings were distributed to Government Departments, educational institutions, NGOs, churches, private land holders, etc. Similar activities were undertaken in other Districts too. The number of seedlings distributed for planting in different Districts is as follows; the species planted were mostly indigenous, due to the absence of assessment the biodiversity implications could not be ascertained :-

(i)	Aizawl District	-	74,982
(ii)	Lunglei District	-	22,839
(iii)	Champhai District	-	7,800
(iv)	Mamit District	-	8,755
(v)	Serchhip District	-	32,285
(vi)	Lawngtlai District	-	5,000

For the third time the Green Mizoram Day was observed on 5<sup>th</sup> June 2001, and about 60,000 seedlings were distributed for planting. However, due to absence of proper follow-up, the outcome of the program is as not fruitful as is expected. Besides, the State Level Committee on Green Mizoram, the Government of Mizoram also constituted State Level Fire Prevention Committee under the Chairmanship of the Chief Minister. District Level Committees were also constituted in all the eight Districts of the State under the Chairmanship of the respective Deputy Commissioners, with heads of Government offices, heads of educational institutions and various leaders of NGOs as members.

**5.2. Joint Forest Management (JFM) :-** The concept of JFM is of relatively recent origin in Mizoram. It was first discussed and debated in a training-cum-seminar jointly organized by Regional Center, NAEB and Department of Environment & Forests in Mizoram on 28<sup>th</sup> February 1994. Government officials and NGOs participated, with a view to evolve an operational strategy with the local people for improving forest management in the State. Accordingly, resolution on JFM was prepared and approved by the Government of Mizoram vide the notification No.B. 11011/36/95-FST Dt.18.9.98.

**5.2.1. Implementation :-** Mizoram started the practice of JFM from 1998-99 onwards and it is now an essential part of all plantation programs. As reported by the State Environment & Forests Department, a total number of 116 Village Forest Development Committees (VFDCs) has raised plantations in an area of 12,740 ha (127.4 km<sup>2</sup>) under JFM upto 2000-2001. The plantations are raised through these VFDCs within notified forest and also on community lands after obtaining the consent of the local Village Council/ Community.

**5.2.2. Impact of JFM :-** The impact of JFM on protection, conservation and regeneration of forests cannot be completely quantified now, as the scheme was initiated only in 1998-99. Likewise, distribution of usufruct and quantum of benefits accrued to VFDC members cannot be highlighted at this stage. Moreover, the concept itself is yet to be clearly understood by the members as well as the Department staff. JFM has brought in appreciable change in outlook among villagers and Forest Department officials, as it provides ample employment opportunities in the form of wages for creation and maintenance of plantations. The theme on planning from bottom to up is reverse in the resolution wherein the preparation and execution of JFM plan is the duty of the Forest Department officials. This indicates that the VFDCs are not intimately involved in the planning. Decentralized administration has advantages that are tempting. Despite the enthusiasm of government and NGOs, the implementation of JFM programs, especially in Mizoram, has left a less than rosy picture on the ground. Progress and

success has been slow, or has resulted in potentially unsustainable outcome. Empowering the people seems somewhat difficult in our administrative system so far.

**5.2.3 Monitoring and Evaluation :-** The Government of Mizoram has appointed the Conservator of Forests, Research & Development Circle, as Nodal Officer on JFM scheme for Mizoram State. In the meantime, monitoring and evaluation at different levels has to be carried out continually by officers of the Environment & Forests Department, MoEF, as well as by reliable NGOs.

**5.2.4 Funds Available and Identified Problems :-** The problems identified by the State Government in preservation, protection and conservation of forests stems mainly from large-scale shifting cultivation and annual forest fires, which have a direct bearing on the rural population, landscape and ecology. The Environment & Forests Department depend almost entirely on the assistance from the Central Government in the form of matching funds and 100% assistance. The allotment of funds under Area Oriented Fuelwood and Fodder Project (AOFFP), Integrated Afforestation and Eco-Development Project (IAEP), Non-Timber Forest Produce (NTFP), Association of Scheduled Tribes and Rural Poor (ASTRP) Project by the Central Government is limited, and is not able to cope with the requirement of the State. However, these schemes should be made people-oriented to be successful.

**5.3. Bamboo Sector Development :-** The Government of Mizoram, by Notification No.B.11012/40/99-FST Dt. 20<sup>th</sup> August 1999, constituted a State Level Bamboo Development Project Monitoring Committee under the Chairmanship of the Chief Secretary, Government of Mizoram. The function of the Committee would be to find ways of implementing the program under the bamboo development project for Mizoram, and to periodically evaluate and monitor its success. Details of the bamboo resources development scheme of the State is shown at Table 3.4. From bamboo nurseries of 2001-2002, plantations were raised in six Forest Divisions, viz. Kolasib, Mamit, Champhai, Lunglei and Thenzawl.

**Table 3.4** Bamboo Schemes

Sl.No.	Project	Year	Work	Area	Fund earmarked
1	NTFP (Project-II)	2000-2001 2001-2002	Creation Creation	300 ha . 200 ha.	18.27 lakhs
2	NTFP Bamboo Plantation	2000-2001 2001-2002	Adv. work Creation	1500 ha. 1500 ha.	53.15 lakhs

Source : Mizoram Forest Diary 2001-2002, E & F Dept.

**5.3.1 Induction of hybrid variety of bamboo :-** Following the decision of the Government of India to take up large scale bamboo plantation in the country, the Environment & Forests Department, Govt. of Mizoram, submitted the Bamboo Resources Development Project for Mizoram to take up 5,000 ha. of Bamboo plantation annually. Based on this, the Government of India has accorded financial sanction of Rs. 250 lakhs for taking up bamboo plantation extending to 2500 ha. (500 ha. annually for 5 years).

In this Bamboo Plantation Project, commercial plantation of high yielding bamboo species like *Bambusa tulda*, *Dendrocalamus giganteus*, *Dendrocalamus hamiltonii*, *Dendrocalamus sikkimensis*, *Dendrocalamus longispatus*, which are locally available, has been taken up. The plantation project was started in 2002 and will be continued on a large scale. It also intends to introduce several high yielding bamboo species like *Dendrocalamus strictus*, *Dendrocalamus kookeri*, *Bambusa arundinacea*, etc. from different parts of the

country and other species from China, Columbia, Indonesia, Thailand, etc. However, impact assessment should be done before large-scale plantation of exotic species is carried out.

**5.3.2 Management Problems :-** The steep terrain of Mizoram makes managing many of the bamboo forests very difficult. However, the main difficulty is **the mahal system of harvesting**. The forest area which comes under bamboo mahal system are riverine and road side. Because of this, the local communities are unable to reap financial benefit from harvesting the resource. The price paid by the mahaldars (contractors) for harvesting rights is very low, and it may be expected that they are making large profit. **Local people have no rights to harvest bamboo in a mahaldar's forest and must pay the mahaldar if they wish to take any clumps. Profits made by the mahaldars are unlikely to reach the local economy because these people are from outside the State** (i.e. non-tribals). In its essence, the system plunders the natural resources of the State whilst giving no benefit whatsoever to the local communities.

**5.4. Conservation of Medicinal Plants :-** Mizoram receives very low priority for scientific investigation of medicinal plants, although it is rich in biodiversity. The first botanical tour was conducted by Gage (1889) and plant collections were made by Parry (1924-28), Wenger (1926-32), Kanjilal (1934), Fischer (1938) and a team of scientists from Botanical Survey of India, Shillong. Recently, Singh *et al.* (1989-95) conducted survey of orchids and collection of other plant specimens for the documentation of the flora of Mizoram. Forest Survey of India, Kolkata, also conducted a survey of forest resources in 1988-89. Nevertheless, no effort was made to survey medicinal plants in the State till 1990. Dr.H. Lalramnghinglova, the local ethnobotanist started work on botanical collection and ethnobotanical research since 1990 and 1995 respectively. According to him, more than 400 ethnomedicinal plants have been recorded in the State, of which it is found that about 230 species have medicinal value. Of these, 65 species are categorized as rare and threatened species at the local (State) level only, and another 64 species are recorded as new ethnomedicinal plants. The depletion of medicinal plants is mainly due to the practice of shifting cultivation, over-exploitation of medicinal plants, uncontrolled forest fire, clearance of land for agriculture, heavy extraction of timber and fuelwood, and collection for food. Keeping this in view, the Government of Mizoram is planning *in situ*, *ex situ* and *in vitro* conservation of medicinal plants, the proposed schemes of which are given below :-

#### **A. PROPOSED PROJECTS/SCHEMES :**

<u>Sl.No.</u>	<u>Project/Scheme</u>	<u>Project Area</u>
1.	Medicinal Plants Conservation Areas (MPCA) in Protected Areas	(i) Murlen National Park (ii) Dampa Tiger Reserve (iii) Ngengpui Wildlife Sanctuary
2.	Medicinal Plants Development Areas (MPDA)	(i) Lengteng Reserve Forests (ii) Dampui Reserve Forests (iii) Lungkulh Reserve Forests
3.	Vanaspati Van	(i) Chalfilh Mountain
4.	Millennium Park cum Botanical Garden	(i) Reiek Mountain

#### **B. APPROVED PROJECTS/SCHEMES :**

1.	Medicinal Plants Plantation under MPDA	(i) Chalfilh area (ii) Tamdil area
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- (iii) Hmuifang forests
- (iv) N.E. Bualpui area
- (v) Sairang forests

**5.5. Community Biodiversity Conservation :-** North Eastern Council (NEC) has sanctioned a Community Biodiversity Conservation (CBC) scheme for Mizoram vide No. NEC/FOR/1-4/98/90-100 Dt. 4.2.1999 at a total cost of Rs. 28.56 lakhs. The scheme will be implemented in four project locations, namely Zote and Ngur under Champhai Forest Division, Hmunpui under Mamit Division, and Rawpui under Wildlife Division. Project locations were approved by NEC vide No. NEC/FOR/BIO-DIV/MZ/59/2000/1 Dt. 3.4.2000, and Rs. 7.14 lakhs is earmarked for each of the project locations.

As per scheme guidelines, 50% of project fund will be used as revolving fund for income generation schemes, while the remaining 50% will be used for forest regeneration. The revolving fund will be given to beneficiaries on a rotation basis as loan at nominal interest, for various trades like piggery, fishery, poultry, vegetable cultivation, carpentry, vegetable/grocery vending, tea stall, blacksmithy, etc.

The loan amount along with interests will be recovered within one year. Village Forest Development Committee (VFDC) members will decide the detailed mode of operation of the revolving fund. The revolving fund is expected to grow with time, and will become a permanent asset for village development.

Planting of seedlings and aided natural regeneration programs will be carried out in specified areas within the project location, covering an approximate area of 100 ha. Reduction of biotic interference from human and livestock activities in the selected conservation area is also proposed. VFDC will devise a reward and punishment mechanism, to help protection and to facilitate regeneration of natural resources within the protected area.

The overall objective of the project is to provide an alternate source of income to the people, thereby reducing their dependence on forest resources and ultimately achieving better conservation and self-regeneration of forest resources through education awareness and responsible behaviour of the people. However, implementation of the scheme is very slow at present, and without a keen interest and dynamic work culture within the implementing agency, the scheme will not be as successful as is expected.

**5.6. Management of Protected Areas :-** So far the State Government has notified ten protected areas (PAs) viz. Dampa TR (500 km<sup>2</sup>), Murlen NP (100 km<sup>2</sup>), Phawngpui NP (50 km<sup>2</sup>), Ngengpui WS (110 km<sup>2</sup>), Lengteng WS (60 km<sup>2</sup>), Khawnglung WS (35 km<sup>2</sup>), Tawi WS (35.75 km<sup>2</sup>), Palak WS (15.50 km<sup>2</sup>), Thorang WS (50 km<sup>2</sup>) and Sazatlang WS (15 km<sup>2</sup>). Local people are largely dependent on most PAs for natural resources (fodder, fuelwood, timber, minor forest produce, etc.) for their livelihood. The traditional lifestyles of these communities have become unsustainable because of the population growth, increase in per capita fuelwood and timber consumption, the depletion of forest resources, and the pressures, direct and indirect market forces. To mitigate all these tensions, the Government of Mizoram is now implementing a centrally sponsored scheme called eco-development program since 1999 in the fringe villages of the PAs. The activities of eco-development programs include creation of terrace farming, piggeries, supply of water storage tanks, raising of cash crops, construction of approach roads, water reservoir, health camps, distribution of cooking gas,

etc. Central assistance received during 1997-98, 1998-99 and 1999-2000 under Protected Areas is given in Table 4.1 below.

**Table 4.1** Funds received under PAs from Govt. of India

Sl. No.	Name of P.A.	Dev. Scheme			Eco-Development			Total Rs.in lakhs
		97-98	98-99	99-00	97-98	98-99	99-00	
1	Dampa TR	12.45	9.65	11.42	4.80	10.50	14.70	63.52
2	Khawnglung WS	3.39	-	1.65	1.15	-	10.55	16.74
3	Phawngpui NP	1.99	2.90	2.15	2.00	1.30	10.20	20.54
4	Ngengpui WS	4.10	1.60	0.55	4.10	2.00	8.00	20.35
5	Murlen NP	4.00	4.45	1.75	4.00	1.32	11.95	27.47
6	Lengteng WS	-	-	-	-	-	10.45	10.54
7	Tawi WS	-	-	-	-	-	-	-

Source : Environment & Forest Dept., Govt. of Mizoram.

During 1999-2000, eco-development programs had been implemented in the fringe villages of Murlen National Park covering N. Khawbung, Ngur, Vapar, Rabung and Tualpui villages. Under Lengteng Wildlife Sanctuary, Kawlbem and Lamzawl villages have been covered. Bungtlang, Rawpui and Pangzawl villages have also been covered under Khawnglung Wildlife Sanctuary. The State Government will again implement eco-development programs in the coming years in the fringe villages of all notified protected areas.

**5.6.1 Eco-development and its efficacy :-** Wildlife conservation measures in the State are not adequate, despite the implementation of eco-development programs in three protected areas. As per guidelines, the implementation of the scheme is supposed to be participatory in nature, involving NGOs, etc. through Village Eco-Development Committee (VEDC). However, implementation of the program is not up to the mark at present due to lack of transparency, awareness, etc. between the local people and the executing agency (i.e. Environment & Forest Department). In addition, this program should be extended to cover four other protected areas.

**5.7. Afforestation :-** As recorded by the Environment & Forests Department, Government of Mizoram, plantation of teak, gomari and indigenous species since the inception of the Department in 1972 covers 1,98,153 ha (1981.53 km<sup>2</sup>). Afforestation undertaken during 2000-2001 and 2001-2002 under centrally sponsored schemes like Non-Timber Forest Produce (NTFP), Association of Scheduled Tribes and Rural Poor (ASTRP), Integrated Afforestation and Eco-Development (IAEP) and Area Oriented Fuelwood and Fodder Project (AOFFP) and Compensatory Afforestation (CA) is given in Table 4.2.

**Table 4.2** Afforestation in Mizoram

Sl.No.	Afforestation	Area in Hectares	
		2000-2001	2001-2002
1	IAEP - (Tlawng, Tiau, Tuivawl & Karnaphuli)	900	900
2	NTFP	250	200
3	ASTRP Model – I & II	170	160
4	AOFFP	3,000	-
5	NTFP Project – II	400	200
6	NTFP (Bamboo)	-	1500
7	CA (Tuirial Hydel Project)	723	1225
<b>TOTAL</b>		<b>5443</b>	<b>4185</b>

Source : Statistical Handbook of Mizoram, 2002

**5.7.1. Impact of Afforestation and its efficacy :-** Various centrally sponsored schemes which have been implemented in Mizoram are not successful in general due to the fact that guidelines are generally neglected by the implementing agency. For instance, centrally sponsored schemes like IAEP, NTFP, ASTRP and AOFFP have been implemented without people's participation, while JFM is supposed to be a central and integral part of all plantation projects. In addition, the State does not have its own forest policy, but the National Forest Policy, 1998 is followed to the extent possible. Due to financial constraints met by the State, developmental works cannot be carried out by the State Environment & Forest Department, apart from those that are 100% centrally sponsored schemes (CSS). At times the State Government is not in a position to contribute matching share if the CSS funding pattern is 50:50 basis. Meanwhile, the State Rural Development Agencies (DRDAs) are also taking up centrally sponsored schemes like Integrated Wasteland Development Program (IWDP). However, as the program has been initiated in Mizoram very recently, it may still be premature to make judgements on their achievement and long term impact; within the literature reviewed, there was insufficient information available to enable an accurate assessment to be made of either the positive or negative impacts of these projects.

**5.7.2 Plantations by other sectors :-** The State's Soil and Water Conservation Department is also implementing soil and water conservation in the form of coffee, rubber, large cardamom and aleurite (Tung) plantations in various parts of the State. During 2001-2002, the department implemented 400 ha. of coffee plantation and 300 ha. of large cardamom plantation, and the First Assam Rifles are also actively involved in plantations in the State since 2000.

**5.8 Power sector :-** The on-going power generation projects under Power & Electricity Department, Government of Mizoram are as follows :-

- (i) Tuipanglui small hydro-electric project (3MW)
- (ii) Kau-Tlabung small hydro-electric project (3MW)
- (iii) Lamsial mini hydro-electric project (500KW)
- (iv) Serlui 'B' hydro-electric project (12 MW)
- (v) Heavy fuel oil-based Bairabi thermal power plant (20 MW)
- (vi) Maicham-II hydro-electric project (3MW)

Apart from the above, detailed project report for Kolodyne Phase-I (120 MW) hydro-electric project is under process with the Central Electricity Authority, New Delhi for Techno Economic Clearance. Techno Economic Clearance for the 80 MW Bairabi Hydro-Electric Project has been obtained vide CEA letter No.F.No.2/MIZ/8/00-PAC/10059-81, dt. 9.11.2000 and Forest & Environmental Clearances of the project were already obtained. Regarding the environmental impact assessment (EIA) of the above-mentioned projects, there are many loopholes like lack of proper assessments of impacts on biodiversity by involving the local communities, etc. For instance, the cost of the project for Bairabi hydro electric project is Rs.42,901 lakhs, number of affected village are six viz. Hortoki, Sairang, Meidum, Phaizau, Dapchhuah and Vaak, and the submergence area will be 10,600 ha (106 km<sup>2</sup>), with about 742 families losing their homes. The State Pollution Control Board (SPCB) has already conducted public hearing for the project as per EIA notification, and one village (i.e. Hortoki) objected the proposed project. The lack of public involvement, and non-availability of the full EIA document to the public, are some critical problems. The EIA notification could be one of the most effective means of conserving biodiversity by checking destructive developmental works, and public involvement needs to be built in centrally, at all stages of the process; without such changes, these essential tools will remain largely paper tigers.

**5.9 Policy and Legislation :-** The State does not have its own biodiversity policy, but the National Forest Policy, 1998 is followed as far as possible. In the past, there was practically no policy implementation and no planned management of the forests.

With the concept of area development program together with efforts to develop the economy of the State, attention has been focused on forests, the only renewable resource of the State. The main thrust of the program is afforestation and enrichment of degraded forests, and protection of existing natural forests to preserve biodiversity.

Mizoram being a hilly State, going by National Forest Policy of 1998, a minimum of 66% of its geographical area should be under forest. Though there was no State Policy on the forest and non-forest land, a New Land Use Policy (NLUP) was formulated in 1984 with a view to restore the ecology and protect the environment from further deterioration. This aim was to be achieved through reduction of jhumming by rehabilitating the jhummys. This NLUP, however, does not quantify the land for different land use including forests. This land use policy is not administrative in nature and not supported by any legislation nor it has any statutory force, and has now been stopped.

No Land Revenue and Land Reforms Act have yet been enacted in the State. However, there is Revenue and Land Settlement Act in the State. The transfer of Property Act, which is a Central Act, has some bearing and relation to the land in the State. The following Central Acts pertaining to biodiversity are applicable in the State.

- (a) The Forest Conservation Act, 1980
- (b) The Wildlife (Protection) Act, 1972
- (c) The Environment (Protection) Act, 1986

Besides above, following State Acts/Rules are applicable for management of biodiversity.

- a) The Assam Forest Regulation of 1891
- b) The Mizoram (Forest) Act, 1955 (as passed by Mizo District Council)
- c) The Pawi Autonomous District Council (Forests) Act, 1979
- d) The Lakher Autonomous District Council (Forests) Act, 1981
- e) The Chakma Autonomous District Council (Forests) Act, 1992
- f) The Mizoram Wildlife (Protection) Rules, 1990

There are so many drawbacks regarding environmental legislation in the State. The Govt. is not strictly enforcing Acts/Rules due to political interference and the like in many processes, and now the public are in the opinion that powerful men are seldom booked while poor people are brought to book for various offences.

**5.10. Communities and People's Movement :-** In Mizoram, social forestry programs are generally managed and looked after by NGOs with remarkable success, while safety reserves and supply reserves are being managed by Village Councils. The State Government is encouraging NGOs activities towards the conservation of biodiversity at present. Activities generally undertaken by NGOs in Mizoram are awareness campaigns and at times plantations and other works pertaining to sustainable development. People's participation in the Government programs towards joint natural resources management is not encouraging in most parts of Mizoram, and this is mainly due to lack of awareness, absence of transparency,

and corruption among the officials resulting in loss of confidence to work with the officials. Thus, there is a **wide gap between the people and the Government.**

**5.11 Past Development Strategy :-** Mizoram, which was earlier part of Assam, attained Statehood on 20<sup>th</sup> February, 1987. There was no planned management of the forests in this hitherto inaccessible remote corner of the country by the then Government, except declaration of the area as “Excluded Area” and the constitution of “Inner Line Reserve Forest”, along the inter-district boundary with the Cachar District of Assam.

Earlier, the population was very scanty, the area was highly inaccessible, and the tract was vast with forests all over, where unrestricted jhumming was practised for production of food crops. It was a picture of neglect, indifference and untrodden tract. None was concerned with the forests except the villagers. Earlier, the village Chief was the supreme and undisputed controller of forest area within his jurisdiction. However, after Chieftainship was abolished, the Government machinery took possession of the land.

Adjacent to the villages, the “Village Safety Reserves” were demarcated by village Chiefs in the interest of health, water supply and protection of village from jhum fires. Utilization of any portion of lands inside these reserves by any person without permit is prohibited. During the period of the District Council, **authorities of the District Council demarcated village safety reserves; presently Village Council demarcated village safety reserves but not from reserve forests or protected areas. However, every village does not have village safety reserves at present.**

The “Village Supply Reserves” have been demarcated for the supply of the needs of the villagers. Any person residing in the village may cut trees, bamboos and collect other forest produce for his household consumption. Among others, reservation of half a mile on both sides of the 16 major rivers in the State and, half a mile on both sides of Aizawl to Silchar road via Sairang was done with a view to conserve soil and water to keep the vital line of communication open. **The Mizo District (Forests) Act, 1955 declared some 55 species of trees as “Reserved Trees” prohibiting felling, tapping or injuring in any manner such trees without permission from Forest Officers.** Thus, development strategy in the past was mainly protection oriented, and development aspect was not given adequate attention. It was only after 1972 when forest department started raising plantations on degraded forest lands to improve their stocking and productivity, that some attention was given to development aspect.

**5.12 Planning Process :-** In the absence of proper survey, demarcation, settlement, and maps of forest lands and disturbed conditions prevailing in the State for long period, **no management plan (working plan) for scientific management of biodiversity could be prepared so far.** Plans are prepared annually on the basis of financial resources allocated by the Planning Commission and Government of India. Biodiversity related development targets are worked out on the basis of sectoral allocation done by the State Government. At the same time, flow of funds from centrally sponsored scheme (CSS) is also not assured for required length of time. The State does not have its own resources to mobilize. Most of the afforestation program that the Forest Department undertakes is from CSS and there is little from the State’s fund. Thus, lack of continuity of adequate funds effects the management and development of biodiversity sector.



## CHAPTER 5

### GAP ANALYSIS

**6.1 Gaps in information :-** As there is little information dissemination towards the conservation of biodiversity among and between the key actors, a systematic plan for the management of biodiversity could not be worked out. Even the concerned department's (Forest Department) Research and Development circle does not have complete information relating to the State's biological resources. Thus, the dimensions of the loss of biodiversity in the State are also as yet unclear, as baseline data, research and monitoring are poorly developed in the State. Some elements of the loss, which have remained undetected or severely under studied, may include decline of subspecies and varieties of a species. Other sectors, which have a direct and strong linkage with the biodiversity sector, like Agriculture Department, Rural Development Department, Revenue Department, Fisheries Department, Animal Husbandry & Veterinary Department, Industries Department, Education Department, Power & Electricity Department, etc., do not have reliable baseline data pertaining to biodiversity, often due to complex and less understood environmental factors. Coordination and linkages are weak and impacts of non-biodiversity sector policies and programs on biodiversity sector are little understood.

**6.1.1 Gaps in vision :-** Our natural environment is a resource — perhaps the most precious of all the earth's resources. It should be treated as such. The measures adopted by the Government until now do not reveal an equal emphasis on the management and development aspects of this vital resource. This is because of a lack of awareness among the masses, Government officials and politicians, and due to a loss of sense of ownership among the masses. These gaps in vision need to be bridged by the State's decision makers/politicians. The following points should be incorporated in their election manifestos :-

#### **Ecology :**

- (a) Ensuring that human activity respects the integrity of ecosystems and does not disturb biodiversity and the ecological resilience of life supporting systems.
- (b) Encouragement of the development of a consciousness that respects the value of all life.

#### **Sustainable Economy :**

- (a) Development of economic policies that will ensure greater efficiency of resource and energy use, as well as development and use of environmentally sustainable technologies.
- (b) Reduction of dependence on non-renewable resources, and ensuring sustainable use of renewable resources.
- (c) Adaptation of more comprehensive social, environmental and technology assessment practices.
- (d) Facilitation of socially and ecologically responsible investment.

**6.1.2 Gaps in policy and legal structure :-** One of the inherent defects in the planning in the State is that our policy makers and concerned departments are making plans for the people not with the people, thereby denying initiative, involvement and participation of the people. The State so far does not have a separate biodiversity policy, but the National Forest Policy, 1998, has been extended to Mizoram. As an adequate statistical data and information

base on biological resources does not exist in the State, judicious planning for the conservation of biodiversity should be worked out.

**6.1.3 Gaps in institutional and human capacity :-** The organizational setup of the State's Environment & Forest Department has been expanded in the last decade, and at present there are five Forest Circles, each headed by a Conservator of Forests (CF): Central Circle, Northern Circle, Southern Circle, Research & Development and Chief Wildlife Warden, eleven Territorial Divisions including one Wildlife Division, six Functional Divisions, one Tiger Reserve and sixty seven Ranges.

The biodiversity sector lacks a proper data generation, compilation, analysis and retrieval system; computerization and use of meteorological information system (MIS), geographical information system (GIS), remote sensing techniques using satellites imageries, etc. is absent. The Research and Development Circle was created in the state in 1987 headed by a CF, with five functional divisions: Working Plan Division, Protection Division, Extension Division, Forest Training School and Resources Survey-cum-Silviculture Research Division, with the attached sections of Botany and Orchidology, in 1990. Of these divisions, only Resources Survey-cum-Silviculture Research Division and the sections of Botany and Orchidology were involved in research activity. The Wildlife Division, under the Chief Wildlife Warden's office, is wholly devoted to wildlife management and biodiversity conservation. Thus, in the State, one of the divisions of the Environment & Forests Department is taking care of biodiversity conservation. In addition, some gaps within the institutional framework include research problems in the areas like managing shifting cultivation, eco-restoration of degraded forests, encroachment of forests, protection of wildlife, protection of endangered species, biodiversity conservation and utilization, biodiversity assessment and monitoring, participatory natural resources management, shifting cultivation (impact studies), etc.

**6.1.3.1 Forestry Research by State Forest Department :-** Forestry Research undertaken by the Resources Survey-cum-Silvicultural Research Divisions is as follows :

**(i) Seed Production Areas (SPAs) :-**

SPAs were set up in collaboration with IRMDFR Jorhat, and 20 ha have been demarcated for the purpose in Kolasib Division at present. This collaborative work on teak (*Tectona grandis*) seed production was started in 1998, and Rs. 2.5 lakhs was spent till date for the project.

**(ii) Research Station at Khamrâng :-**

The research station at Khamrâng (about 60 km north-west of Aizawl) was started in 1988. The common species planted in the area are *Michelia champaca*, *Mesua ferrea*, *Bombax ceiba*, *Bischofia japonica*, *Toona ciliata*, *Chukrasia tabularis*, *Dipterocarpus* sp., etc.

**(iii) Seed & Seedlings Nursery :-**

This was managed on yearly basis in temporary beds. The present seedlings for trial plantation are *Bischofia japonica*, *Mesua ferrea*, *Delonix regia*, *Podocarpus neiriifolia*, *Meliosma pinnata*, etc.

**(iv) Area covered under forestry research work :-**

(a)	Trial plantation	-	445 ha.
(b)	Bambusetum	-	5 ha.

(c)	Preservation plot	-	50 ha.
(d)	MFP/NTFP/NWFP	-	40 ha.
(e)	Cane enrichment	-	15 ha.
(f)	Sample plot	-	5 ha.
(g)	Natural regeneration	-	30 ha.

**(v) Botany Section :-**

The Botany Section was created in 1990 with one Forest Botanist, two Research Assistants and one Forest Guard. The research activities taken up are (i) Inventory survey and collection of plant species, (ii) Establishment of herbarium (around 400 mounted specimens belonging to 98 families and 150 genera are housed in the herbarium), (iii) Medicinal plants research. Financial allotment for the above research work was Rs.4 lakhs only. Facilities are also very poor.

**(vi) Orchidology Section :-**

This section was created along with Botany Section in 1990. Orchidologist is responsible for orchid research, assisted by two Research Assistants and one Forest Guard. The activities taken up are (i) Maintenance of existing orchid houses, (ii) Terrestrial orchid culture, and (iii) Publication. Facilities provided for this section are very poor.

**6.1.3.2 Wildlife Wing :-** For the meaningful conservation and management of wildlife in the State, the post of Chief Wildlife Warden was created. However, it was surprising to learn that no post was so far created for the offices of the Chief Wildlife Warden and for that of the Field Director, Dampa Tiger Reserve, though these two offices have been functioning since 1985 and 1994, respectively. There is also inadequate fund allocation for wildlife sector, budget allocation for this sector is practically neglected in budget allocation of the State.

## CHAPTER 6

### IDENTIFICATION OF ISSUES AND REQUIRED ACTION PLANS

**7.1 Priority 1 : Basic issue :-**

The State must give priority to adequately and fully protect the biological resources in a participatory manner from encroachment, fire damage, illicit felling of trees, degradation and diversion of forests for non-forest purposes. The demand for wood and wood products greatly exceeds sustainable supply from existing forests leading to their depletion, the human and livestock pressure on forest areas is immense sounds like a cliché again given the density of population and intensifying protection of existing biological resources is imperative to ensure their sustainability.

**Sub-issue I :-**

Conservation measures to protect forests from illegal felling, over-exploitation, encroachment, shifting cultivation, fire and other adverse activities are inadequate to ensure their long term sustainability.

**Actions :-**

- Prevention and control of encroachment, diversion, illegal felling through increase patrolling units.

- Prevention and control of encroachment, diversion, illegal felling through people's participation, community empowerment and strict enforcement of laws, survey and demarcation of forests.

**Description of actions :-** With an increase in human population, the demand for forest produce is increasing, thereby increasing the tendency to obtain the same by illicit felling and smuggling of timber, etc. Multipronged measures are therefore to be taken to protect the forests from destruction. Punishment for infringement of laws/rules should be made more stringent, and effective control measures will need to be taken by deploying special forest protection forces equipped with modern arms, communication systems and empowering forest officers to take action on the spot against forest offenders. Involvement of the local communities (people's participation) should be given priority in decision making regarding protection, development and management of forests; the people will need to be involved right from planning to implementation of programs, raising their confidence in the concerned Department. People's participation could be done by the direct involvement of local communities through public consultations, as well as the direct involvement of NGOs. Survey and demarcation of notified forest will need to be completed soon to prevent encroachments on forestlands.

#### **Sub-issue II :-**

Uncontrolled access and use of forests results in utilization beyond their carrying capacity, and further degrades existing biological diversity potential.

#### **Actions :-**

- Demarcation of all notified forests, and limit all forest uses to aggregate carrying capacity.
- Ban on tree felling without a working plan approved by the Union Ministry of Environment & Forests.

**Description of actions :-** Wood balance studies in the State reveals that there is huge deficit of timber and firewood compared to sustainable supplies available. These demands are met mostly from the existing forests, either free of cost or at a highly subsidized rate. The slow but persistent removal of forest produce, without a working plan approved by the Union Ministry of Environment & Forests, degrades the forests. The result is soil erosion and loss of fertility. Thus, a working plan needs to be formulated as soon as possible. Similarly, unassessed and uncontrolled extraction of NTFP further depletes the forest of its valuable resources, should be allowed only on a sustainable basis. The propagation of some NTFPs as inter-crops should be encouraged, and their value addition by processing and marketing support will need to be attended to. Similarly, the consumption of fuelwood can be minimized by encouraging the use of improved chullahs, bio-gas, liquefied petroleum gas (LPG), pressure cooker, etc. and better supply of kerosene oil in rural areas.

Another pertinent point to be given importance is the demarcation of all the notified forests in the State to prevent further encroachment and diversion of forest lands. Cattle damage to forest regeneration and plantations raised will assume serious proportion if the practice of free grazing in forest areas is not stopped in future. For this, fodder cultivation by farmers and stall-feeding of cattle will need to be promoted.

**Sub-issue III :-**

Management, strengthening and keeping continuity of present village safety, supply and bamboo reserves.

**Actions :-**

- Proper management and strengthening of village safety reserves, supply reserves and bamboo reserves should be worked out.
- Expansion and creation of more village safety, supply and bamboo reserves need to be encouraged.

**Description of actions :-** The age-old practice of demarcating village safety, supply and bamboo reserves, and the traditional management systems of these reserves need to be revived constantly, for which awareness campaigns may be incorporated. As many Village Councils have neglected the demarcation of these reserves at present, the significance and biodiversity values of having safety, supply and bamboo reserves need to be created among Village Councils.

**7.2. Priority 2 : Increase productivity (economic yield) of forests :-****Basic issue :-**

Under existing land use pressure like shifting cultivation, fuelwood demand and encroachments, increased productivity in the degraded forests cannot be achieved. Limitation and restrictions on use of forest resources on a priority basis are imperative.

**Action: -**

- Control shifting cultivation by providing alternatives, and take measures to save fuelwood by encouraging the use of energy-efficient cooking devices.

**Description of action :-** To increase productivity, a clear policy to control jhumming needs to be evolved by the State; the present policy has not given desired results. The programs under implementation by the Rural Development, Agriculture and other Departments for control of shifting cultivation, need to be constantly reviewed and modified, based on experience gained, to make them more effective. Simple and appropriate technology, with minimal financial involvement, should be introduced to the farmers. The use of fuelwood saving devices such as bio-gas plant, improved chullahs, LPG, kerosene, solar cooker/lantern, etc. modified according to local designs, need to be encouraged to reduce pressure on existing forests for fuelwood.

**Sub-issue I :-**

Land reforms, land ceiling, survey, demarcation and settlement is a prerequisite to evolve a proper integrated land use system.

**Actions :-**

- Land reforms need to be evolved for the proper management of biodiversity.
- Ceiling of land holdings should be made after survey and demarcation of lands.

**Description of actions :-** Land reforms, land ceiling, survey, demarcation and settlement is a prerequisite to evolve proper integrated land use system. This task is yet to be completed in the State. Hence, the Revenue Department needs to give top priority to the above work, to

complete it as soon as possible, as it has a strong linkage with management of biological resources on a sustainable basis in the State.

**Sub-issue II** :- Low-growing stock in degraded forest lands is resulting in continuing low productivity.

**Action** :-

- Improve stocking of degraded forests through afforestation or enrichment planting in degraded forests or **abandoned jhum areas** (community land).

**Description of action** :- The low financial input in the forestry sector for afforestation needs to be enhanced. However, proper planning regarding intended use, site specific species, production of adequate quality nursery stock, protection, raising inter-crops, and most important of all, the involvement of people is a must to make the program successful and fruitful. In addition, it is important that indigenous species are planted; otherwise large-scale plantation of exotics could cause other problems.

**Sub-issue III** :-

Lack of understanding among officials and local communities regarding the real costs of unsustainable development, coupled with unrealistic expectation regarding returns.

**Action** :-

- Education, extension and motivation/incentives for farm, social forestry programs, benefit sharing, economic incentives for farm forestry/social forestry, NTFP (including fruit trees and medicinal plants).

**Description of action** :- If the pressure on the notified forests can be reduced, it will help in improving their productivity. For this, **forestry should be extended outside forest area** by motivating the people, through education/extension and giving them incentives to promote farm/social forestry for meeting their own fuelwood requirement by undertaking biomass plantation, fodder cultivation as inter-crop in forest plantations. For this, the Village Councils and NGOs can play an important role to mobilize the people's effort. They can initiate joint forest management (JFM), with scope for benefit sharing. Subsequently, development of NTFP and its proper harvesting and marketing will have to be developed. Private plantation should be promoted. However, afforestation should be made as participatory as possible in degraded forests or abandoned jhum areas **only**.

**7.3. Priority 3: Strengthen policy, legislation and institutional framework** :-

**Basic issue** :-

To enhance the performance of the biodiversity sector, the State will require a strengthened institutional framework, which includes biodiversity policy, legislation, organizational and financial support and community empowerment.

**Sub-issue I** :-

An adequate statistical data and information base on biological resources does not exist to permit judicious biodiversity conservation planning.

**Actions** :-

- Improve database and information system; strengthen administration and institutional framework, organizational set up, strategic planning and analytical capacity.

- Constitution of State Biodiversity Board.

**Description of actions :-** The biodiversity sector lacks a database for proper planning. Hence, proper data generation, compilation, analysis and retrieval system should be established. Computerization and use of meteorological information system (MIS) and geographical information system (GIS), remote sensing techniques using satellite imageries, should be initiated to help in monitoring, evaluation and processing of data in the various Circles and Divisions. The State should also establish a Biodiversity Research Institute (BRI), which shall consist of units/sections such as silviculture, agroforestry, botany and biodiversity, ornithology, orchidology, biochemistry and biotechnology, wildlife, and herbarium-cum-research laboratory.

Studies should be conducted to assess production, local consumption and market needs, of both wood and non-wood forest products in the State.

Existing organizational structure will need restructuring/strengthening, to improve work culture and to take up the above functions and cope with new emerging challenges. Proper policies about personnel recruitment, promotion, transfer and training to develop skills and abilities will need to be addressed with a view to improve efficiency and services to the people.

Constitution of State Biodiversity Board (SBB) to look after biopiracy, traditional knowledge, intellectual property rights (IPRs) and biodiversity registers is imperative. In other words, SBB will ensure that the indigenous people are entitled to the recognition of the full ownership, control and protection of their cultural and intellectual property; the right to have special measures to control, develop and protect their sciences, technologies and cultural manifestations, including human and other genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literature, designs, and visual and performing arts.

**Sub-issue II :-** Legislations are outdated.

**Actions :-**

- Review and revise the existing Forest Acts and Rules from the biodiversity point of view, to regulate management and use of biodiversity and its products.
- Empowering forest officers to evict encroachers and confiscate vehicles carrying illegal forest produce and providing protection to the forest officers.

**Description of actions :-** There is a need for creation of a legal cell in the PCCF Office and appointment of Retainer Lawyer to effectively deal with the rising number of wildlife/forest offence cases, and speedier disposal of pending cases by the courts. Concerted efforts should be made to review/revise the existing Acts and Rules pertaining to biodiversity conservation in the State, to take care of the present and future needs. The revised Acts and Rules should incorporate provisions such as powers to confiscate vehicles engaged in forest/wildlife offences, and to evict encroachers.

Further, to reduce the man-animal conflict because of the provision in the Wildlife (Protection) Act, 1972, suitable rules to compensate the damage done to life and property by wild animals will need to be framed. Besides, there should be specific and clear-cut rules made for carrying out the provisions of the Forest (Conservation) Act, 1980. A proper

legislation to give legal support to Joint Forest Management (JFM) activities should also be evolved, specifying the forest area to be brought under JFM, and the investment needs therein.

**Sub-issue III :-**

Inter-sectoral co-ordination and linkage are weak, and impacts of non-biodiversity sector policies and programs on the biodiversity sector, are little understood.

**Action :-**

- Better co-ordination among the different developmental departments .

**Description of action :-** An integrated land use approach involving the participation of and co-ordination among various Government Departments, such as Land Revenue, Agriculture, Animal Husbandry & Veterinary, Rural Development, PWD, Tourism, Horticulture, Power, Fishery, and Soil & Water Conservation, will need to be adopted, for which a Co-ordination Committee or a task- or sub-committee of the proposed State Biodiversity Board should be constituted. Further, such departments should earmark some percentage of their budget for biodiversity conservation, to mitigate damage done by them to biological resources. The first task would be to harmonise the various policies and laws within which the departments work.

**Sub-issue IV :-**

Lack of monitoring and evaluation limits improvement, and perpetuates inefficiency.

**Action :-**

- Critically evaluate and monitor projects, to assess success or failure of projects; scope for improvement.

**Description of action :-** Clear objectives will have to be defined to improve project implementation, and to periodically measure progress towards the objectives. Monitoring will have to be done by an independent agency to keep track of both physical and financial activity through regular quantified reports. Evaluation should also be undertaken to assess the results of the implementation of projects. In addition, community-based monitoring should also be done, in which communities will be able to use their own knowledge and indicators for monitoring and evaluation, supplemented with outside training and capacity building.

**Sub-issue V :-**

Financial support for the biodiversity sector is inadequate.

**Actions :-**

- Identify/justify prerequisite financial and investment support.
- Establish clear sector priorities and requirements.
- Document biodiversity revenues (values) as related to biodiversity investment.

**Description of actions :-** Financial support for the biodiversity sector is very meagre, though direct and intangible benefits from biodiversity are immense. So, whatever may be the issue, strategy and planning, it cannot be achieved until and unless the financial allotment on this sector is increased substantially, and for that, a decision is to be taken at the highest level. Moreover, investment in the biodiversity sector is highly labour-intensive, and that too flows to the weakest section of the society, so employment generation in such investment is perhaps



the highest. As the State does not have its own resource (financial), most of the financial support will have to be provided by the Central Government.

#### **7.4. Priority 4 : Expand forest area :-**

##### **Basic issue :-**

Notified forest areas in the State are far less than 66% of the total geographical area as envisaged in the National Forest Policy, 1988. Further, the different categories of forests in the State are subjected to heavy biotic pressures like jhumming, illegal felling, forest fire, encroachments, etc., resulting in continuous degradation of the biological resources. The situation will be worse unless the existing notified forest areas are expanded, protected and scientifically managed on a sustained basis with community participation through village forests development committees.

##### **Sub-issue I :-**

The unclassed forests, extending over an area of about 6000 km<sup>2</sup> are degrading at a very fast pace owing to the practice of shifting cultivation. Though the implementation of some programs like New Land Use Policy (NLUP) has made some impact to reduce jhum cultivation, yet previously jhummed lands that would have been available for regeneration, are not protected or managed, but left open to the local communities for meeting their requirement of timber and other forest produce, resulting in no less degradation than when subjected to jhumming at 3-5 year intervals.

##### **Actions :-**

- The jhum lands to be made available for regeneration and management will be identified.
- Priority will be given to those areas where existing forest area is found inadequate to meet the local demands of timber and other forest produce.
- Identified jhum lands will be constituted into community reserve, or village safety/supply reserves as per the existing provision of the Wildlife Protection Act for protection, development and management for the production of timber, fuelwood and other forest produces on a sustained basis.

**Description of actions :-** It is proposed that about 1550 km<sup>2</sup> jhum lands will be identified and constituted into community reserve to be developed and managed by the community, for sustainable supply of forest produce to the people. Thus, it is expected to increase the area of reserved forest from the existing 7843 km<sup>2</sup> to about 9393 km<sup>2</sup>.

##### **Sub-issue II :-**

Inadequate village safety supply and supply reserve to meet the actual needs of the villages. There are about 699 inhabited villages in the State, many of which either do not have Village Safety Reserve or Supply Reserve near or around the village, or such reserves are depleted/inadequate due to unsustainable felling of trees by the community. Such degraded reserves need immediate rehabilitation and treatment, for providing tree cover around the village as well as for meeting the local demand of timber, small wood, fuel-wood, etc.

##### **Actions :-**

- All the villages in the State, which do not have or have inadequate Village Safety & Supply Reserves, will be identified.

- In consultation with the concerned Village Council, VFDC, NGOs and Revenue Department, the degraded community lands near or around the village will be demarcated for constitution into Village Safety Reserves and Village Supply Reserves or Community Reserve.

**Description of actions** :- After constituting such areas into Village Safety & Supply Reserves or Community Reserves, they will initially be protected, developed and managed by the community. Full control should continue to vest with the village community, with the Forest Department only playing a facilitating role. This means that the head of the committee should be selected by the community as a whole (with all adults including women being part members of the committee).

It is estimated that a minimum of 100 ha. of community lands will be made available by the Revenue Department around each of the villages, for constitution into Village Safety & Supply Reserves. Thus, a total area of about 700 km<sup>2</sup> is earmarked to be notified as Village Safety & Supply Reserves for management under JFM. This is expected to increase the area of Village Safety & Supply Reserve from the existing 2648 km<sup>2</sup> to about 3348 km<sup>2</sup>. In addition, biodiversity should be integrated into the management priorities of Village Safety Reserves.

#### **7.5. Priority 5 : Non-Timber Forest Products (NTFPs) :-**

##### **Basic issue :-**

NTFPs are drawing great attention today, as many of these are not only used as food and medicine by local tribals, but can also supplement their livelihood and income generation. The major NTFPs include bamboo, cane, broomsticks, medicinal plants, agar, wild fruits, vegetable, leaves, and honey. However, there is no complete record available regarding their removal. In absence of adequate data, projection for future needs could not be made. Hence, their survey, conservation, cultivation, harvesting and marketing in organized manner will be necessary. Simultaneously, studies on their consumption pattern and utilization would be necessary to plan for their judicious exploitation.

##### **Sub-issue I :-**

NTFPs form importance source of food, medicine and livelihood, especially for the rural people, and need planning for development and conservation accordingly.

##### **Actions: -**

- Plantation of various species whose fruit, leaves or other parts are used as food, medicine or other purposes, on degraded/abandoned jhum lands and community lands.
- Enrichment plantation of cane and tending of natural cane areas.
- Protection and distribution of seedlings free of cost for planting by farmers on their lands.

**Description of actions** :- All the actions should be taken with people's participation. Women's empowerment would also be integrated.

**Sub-issue II :-**

Commonly used and effective herbal plants have become rare and endangered species, and some plants will soon be on the verge of extinction unless crash conservation measures are taken up for their revival.

**Actions :-**

- **In-situ conservation** :- The existing national parks and wildlife sanctuaries are not enough to conserve medicinal plants diversity; smaller matrix conservation sites need to be promoted. Areas representative of various habitats, as well as fragile ecosystems would be identified and conserved through the involvement of the local people, since no *in-situ* conservation can succeed without the fullest cooperation and involvement of the local people. Villages, whose surroundings are rich in ethnoflora, are encouraged to preserve tribal medicinal forests or ethno-forests in natural habitats. It is necessary that the local people are allowed to feel ownership of their native resources and usufructory rights to protect the bio-resources from over-exploitation. For instance, *Smilax glabra* (local name *luangngil*), *Homalomena aromatica* (local name *anchiri*), *Cinnamomum zeylanica* (local name *thakthing*), *Aquilaria malaccensis* (local name *thingrai*), etc. have been collected by people from outside Mizoram State since the 1970s, as if it were their own property; and as a result *Smilax glabra* and *Aquilaria malaccensis* have become critically endangered species.
- **Ex-situ conservation** :- Germplasm collection of the common, rare and endangered species for *ex-situ* conservation through the establishment of herbal farms, drug gardens or living pharmacy in suitable agro-climate conditions is imperative. Introduction or re-introduction and incorporation of important medicinal plants in traditional eco-agrosystems, homestead and semi-permanent gardens are also practicable. Development of agro-forestry models incorporating medicinal plants should be encouraged.

**Sub-issue III :-**

The age-old bamboo mahal system of the State should be made more effective or replaced by community management and dynamic in order to ensure exploitation of bamboo on a sustained basis. Further, involvement of local people in exploitation of this resource is not taking place under the present system.

**Actions :-**

- Local villagers in whose village area exploitation of bamboo is going on should be actively involved in the process to ensure equitable distribution of economic returns from the resource.
- Sufficient provision of funds for regeneration of bamboo stock in the harvested area should be made, for improvement and development of this resource, and these activities should be implemented in a participatory manner.

**Sub-issue IV :-**

The gregarious flowering of bamboo is predicted to occur during 2005-2007 in the North-East Indian States. Scientists have predicted that gregarious flowering of bamboo will occur in an estimated area of 18,000 km<sup>2</sup> in the States of Mizoram, Tripura, Manipur and parts of Assam and Meghalaya. The epicenter of bamboo flowering will be in Mizoram. In order to

mitigate the catastrophic famine subsequent to gregarious flowering of bamboo, the following actions have been recommended.

**Actions :-**

- Detailed survey and mapping of bamboo resources in collaboration with the Forest Department and Forest Survey of India (FSI) should be prepared.
- A bamboo flowering database should be prepared involving International Bamboo and Rattan Research Institute (INBAR), Beijing, Rain Forest Research Institute (RFRI), Jorhat, FSI and Forest Department.
- Improve State and National Highways to facilitate timely extraction of bamboos that are set to flower in 2005-2007.
- Feasibility of transporting bamboos by waterways through Bangladesh needs be explored for making resource available for users in coastal Orissa and Andhra Pradesh.
- Setting up of mini-mechanical pulping mills at strategic locations, and the pulp to be compressed into high-density pulp sheets and blocks in the small scale industry sector, for long-term space effective storage and economic transportation.
- Import of suitable technology to convert bamboo into high value products like laminated boards, composite boards, railway sleeper boards, etc.
- The possibility of using seed of bamboo for animal feed through collection just before maturity, should be explored.
- The steep and inaccessible areas should be left to regenerate naturally, while in accessible areas 50% will be taken up for regulated natural regeneration, 30% for mixed bamboo plantation and the other 20% for tree plantation.

**7.6. Priority 6 : Soil & water conservation :-**

**Basic issue :-**

Mizoram has steep and rugged terrain with deep gorges. Thus, site-specific technologies should be adopted depending on the terrain and feasibility. Various soil and water conservation measures proposed which will form part of the afforestation activity are given below :-

**Actions :-**

- Check dams and plugs in drainage line using locally available wood and stones.
- Inter-cropping with legumes.
- Growing legume cover crops, etc.
- Stacking wooden poles and cut brushwood across the slope along the contours.

**7.7. Priority 7 : Expansion of Protected Areas (PAs) :-**

**Basic issue :-**

At present, protected areas in the State include two National Parks, seven wildlife sanctuaries and one Tiger Reserve, covering a total area of 971.25 km<sup>2</sup>, which is 4.61% of the total geographical area of the State (i.e. 21081 km<sup>2</sup>).

**Sub-issue I :-** Inadequate Protected Area Network in view of the low population density (2.9 persons/km<sup>2</sup>) but rich flora and fauna.

**Action :-**

- The State shall identify ecologically sensitive areas to be declared as protected areas (PAs) in consultation with leading institutions like the Indian Council of Forestry Research & Education, Wildlife Institute of India, leading NGOs, local people, etc.

**Sub-issue II :-**

Lack of quantified data and reliable information on wildlife, as well as limited awareness and appreciation of the importance of wildlife for man.

**Actions :-**

- It is proposed to undertake research/studies on wildlife, through consultancies or research fellowships in collaboration with Universities/Institutions and NGOs.
- To highlight the importance of wildlife protection and conservation among public and school children, wildlife awareness campaigns through publicity media and extension should be taken up, in collaboration with NGOs and various religious organizations.
- National Wildlife Action Plan (NWAP) should be implemented in toto by the State.

**Sub-issue III :-**

Presently, the wildlife organizational setup at to manage PAs is inadequate. People's participation in management of PAs is imperative.

**Actions :-**

- The organization of the Wildlife Wing is inadequate in respect of trained manpower, equipment and facilities. Hence, to manage the protected areas properly in the line of scientific management, the set-up will need to be strengthened adequately.
- Local community should be involved in the management of PAs.
- The State should have adequate wildlife-trained personnel.

**Description of actions :-** Wildlife field staff are posted in remote PAs that are lacking in facilities. Further, the nature of duties of staff posted in such areas is tougher as compared to other Territorial Forest staff. Hence, to improve the welfare of wildlife field staff, incentives such as special pay, uniform supply (twice a year), medical aid, accommodation facilities, etc. as recommended in Subramaniam Committee Report (1994) should be given. Special pay per month Rs. 600, Rs. 500, Rs. 400, Rs. 300 to D.F.O., A.C.F., R.O. and Foresters/Forest Guards respectively, is proposed. The State should have adequate wildlife-trained personnel to man all positions right from the Park Director down to forest guards. Wildlife-trained personnel must not be transferred to non-wildlife postings. In addition, local community, NGOs, etc. should be involved in the management of PAs, and benefit sharing would be ensured in the process.

**Sub-issue IV :-**

The existing network of National Parks/Sanctuaries should be expanded and strengthened to include all representative taxa of the State.

**Action :-**

- Increase of protected area network, promotion of eco-tourism, allocation of adequate funds to the Wildlife Wing, encouragement of people's participation, and increase in eco-development programs for such protected areas (PAs).

**Description of action :-** The State is rich in biodiversity, and population density is low. The existing PA network is inadequate to cover all bio-zones. More areas will need to be brought under the PA network, covering all the major ecosystems. **Promotion of eco-tourism in PAs is the need of the hour.** Considering the importance of wildlife in the State, enhancement of fund allocation to the Wildlife Wing from the State's plan budget/forestry plan budget is recommended for development of PAs. **People's participation in the conservation of wildlife should be encouraged, without which the wildlife sector will face serious setbacks; eco-development programs should also be increased to cover all PAs.**

**In the fringe villages of all PAs, an eco-development committee (EDC) should be constituted under the chairmanship of the respective President of the Village Council and a representative of the Forest Department as Member Secretary. The EDC members shall be representatives of Village Council, school/college teachers, NGOs, farmers, etc. including women.** The Government will bear the expenditure to be incurred for implementing action plans proposed by the EDC, through the Forest Department. The operations of EDC fund shall be in a joint account in the name of the Chairman and Member Secretary.

Local people should be centrally involved in planning, implementing, and monitoring PA management as well as receiving benefits from them, in consonance with the conservation values and objectives. An independent monitoring agency should also be appointed, which may consist of researchers of Universities/Institutions or reliable NGOs.

#### **7.8. Priority 8: Adoption of the new Panchayat Act :-**

There are some provisions to provide for people's empowerment in the management of natural resources. One formal manifestation of this was a Central Government circular in 1990 to all States, on Joint Forest Management (JFM). This quasi-policy statement directed the involvement of village communities in the regeneration of degraded forest lands. However, there are conflicting reports on the success of JFM, with serious flaws such as inadequate devolution of power to local communities. Nevertheless, JFM is seen as a progressive step, away from the centralized, exclusive State-managed regime of the last 100 years.

**The most powerful, however, is the Constitution (Seventy-third-Amendment) Act, 1992, regarding village panchayats. This law sought to bring the power to manage local resources closer to the people. The Panchayat (Extension to Scheduled Areas) Act, 1996 is even more powerful in this respect, bestowing unprecedented elements of self-government to scheduled adivasi/indigenous areas. Thus, the State should adopt or extend the new Panchayat Act to fully exploit the possibility of successful program implementation in joint natural resources management, etc.**

#### **7.9. Priority 9: Education, awareness and training for biodiversity conservation :-**

##### **Basic Issue :-**

Education, awareness and training for biodiversity conservation are essential both for the younger generation and the older generation. It also needs to cover both urban and rural populations, and actions should reach out to sectors like decision makers and government agencies, formal education/training systems, non-formal education/training systems, local communities and industry. The following objectives should be adopted to create such awareness :-

- 1) To develop sensitivity to the environment and its problems.
- 2) To create an awareness regarding the loss of biodiversity.
- 3) To develop the basic understanding of structure, processes, problems and interdependence of biodiversity components.
- 4) To help in developing skills for identifying and solving biodiversity-related problems.
- 5) To develop concern for biodiversity, and encourage active participation in its conservation.
- 6) To develop an ability to evaluate biodiversity components and educational programs in terms of ecological, economic, social, cultural, aesthetic and educational factors.

### **Actions :-**

- **Decision makers & Government agencies** :- Policy level decisions are most crucial in any development or conservation program; therefore, policy makers need to be fully aware of biodiversity conservation issues. Thus, presentation kits and awareness training need to be given to decision makers and government agencies from time to time.
- **Formal education system** :- The formal education system provides great scope for creating awareness about biodiversity and its conservation among children and youth. The following methodologies should be adopted by the State in this regard.

<i>Stage</i>	<i>Objectives</i>	<i>Content</i>	<i>Teaching Strategy</i>
Primary	Awareness	Surroundings from home to outdoor situations.	Audio-visual and field visits.
Lower Secondary	Real life experiences, awareness and problem identification.	As above and general sciences.	Classroom teaching, practicals and field visits.
Higher Secondary	Conservation, assimilation of knowledge, problem identification and action skills.	Science-based and action-oriented work.	Classroom teaching, practicals, and fieldwork.

- **Non-formal education systems** :- Non-formal education systems among general population through various media are very effective in creating awareness about biodiversity and its conservation. Traditional knowledge/practices, biopiracy, intellectual property rights (IPRs) should be highlighted. Traditional practices that support biodiversity conservation need to be documented in a popular way, both in story format, as well as factual documentation. This information, from all over the State, needs to be shared in the form of songs, stories and lessons. Journals/Newsletters also need to be published in the local language, to inform the people about latest development in biodiversity related initiatives, etc. In addition, local folk media and traditional modes of learning should be used to impart biodiversity education and awareness.

- Local communities :- There is a need for capacity building on biodiversity at village level, through village level training institutions and environmental NGOs. The State Government should make a separate budgetary allocation for this.
- Industry :- As industries are major consumers of biodiversity, awareness on biodiversity needs to be created among entrepreneurs. Environmental impact assessment (EIA) should also be made mandatory for any developmental projects.
- Media :- Print and electronic media should be utilized for disseminating biodiversity related information to various sections of society.

### **7.10 Priority 10 : Hydroelectric power projects :-**

#### **Basic Issue :-**

Large numbers of power projects are being proposed to be initiated in ecologically sensitive areas. These will not only cause a lot of damage to the local environment, but in most cases will also cause a lot of hardship to and displacement of the local population. In addition, many power projects do have the potential for serious damage to the area's unique and critically important biodiversity and also to cause major social disruption. Thus, based on inputs received at the public hearing on biodiversity conservation (with reference to hydel project) the following actions have been recommended.

#### **Actions :-**

- The State has vast hydropower potential. However, due to the potentially detrimental impact on environment by hydel projects, development of power potential in the State should be local need-based only.
- Alternatives like wind energy, solar energy, micro hydel and run-of-the-river projects need to be explored more seriously.
- Big dams should not be encouraged and hydel projects should not be built in ecologically sensitive areas (ESAs).
- Environment impact assessments should be done in consultation with the local people.
- The implementing agency should strictly adhere to the conditions set out in the environmental clearance letter. In addition, it should be evaluated whether the conditional clearance for power projects that has been given to the project authorities in the past, has been followed. If the conditions have not been met, no further projects should be allowed.
- Expenditure incurred for compensatory afforestation (CA) should be evaluated and monitored strictly and there should be transparency to ensure that expenditure being incurred is for CA and not anything else.

### **7.11 Priority 11 : Public participation in the Environmental Impact Assessment process:-**

#### **Basic Issue :-**

Environmental impact assessment (EIA) is meant to ensure that economic development does not undermine the ecological basis on which all life depends. EIAs are progressive tools in the direction of sustainable development planning. EIAs are supposed to give a full understanding of the impact of a proposed project on nature and people, and help assess whether the project should or should not be taken up. Public involvement needs to be built in centrally, at all stages of the process. EIAs also form the base of mitigatory plans if the



project is approved. The following actions have been recommended to ensure public participation in the EIA process for any major undertakings, i.e. projects, plans, programs or policies, etc.

### **Actions :-**

- (1) Identification of issues and impacts (scoping) :- This establishes the scope of the project. Public participation activities at this stage are primarily devoted to informing the public about the project and determining what citizens feel about the need being addressed and the potential project. The effort by the proponent agency should be to establish a rapport and a spirit of cooperation with the local people.
- (2) Conduction of baseline studies of the environment :- The baseline study should record the environmental status quo in the study area. At this stage, the information given to the public could take the form of what is being surveyed and why. Feedback to this information is often helpful in identifying existing databases. Thus, the public's response can reduce the time and cost of the baseline survey. Often, citizens can also identify areas of particular local interest, which should be highlighted in the environmental impact report.
- (3) Prediction and evaluation of impacts :- Impact evaluation involves the prediction and interpretation of changes that would result from implementation of the activity/project under consideration. The public can assist in this process in several ways. For example, by reviewing the alternatives being considered, they can ensure that no viable alternative is inadvertently omitted. Where legal standards are not in force, comments from the public can be useful in establishing project-specific criteria or maximum tolerable levels of change. Finally, the information-feedback cycle must be maintained to hold the public's interest and prevent alienation.
- (4) Mitigation planning :- Mitigation measures are planned to reduce undesirable project effects. One of the major inputs at this stage is ensuring that the mitigation measure is itself acceptable. Consider, for example, a new housing project that draws heavily on a diminishing water supply. One mitigation measure is to collect and treat waste water from the urban area and recycle it. In many areas this measure, though technically feasible, is culturally unacceptable. As before, public review will ensure that all reasonable measures are considered.
- (5) Comparison of alternatives :- The comparison of alternatives is done to identify the one or several preferred actions. Local values could be used to weigh the importance of environmental factors at this stage. It is very important that the public have an input into what is recommended to decision makers. It is at the comparison-of-alternatives stage that the preferred project alternative is identified. Therefore, at this stage any potential conflicts will come clearly into focus. If the public involvement program has been effective to this point, it should be possible to resolve conflicts in a spirit of cooperation.
- (6) Decision making relative to the proposed action :- The 6<sup>th</sup> stage in an environmental impact study is the actual decision on which alternative will be implemented. At this stage, public involvement activities have three objectives. First, the public should be informed what the decision is and why. Ideally, the decision should be based on the recommendations arising out of the comparison of alternatives. However, this is not always the case. The second objective is the final resolution of conflicts. In this regard, it may be necessary to compensate certain individuals in order to even out the

distribution of benefits. Finally, if the decision makers are responsible to the public, the third objective will be the solicitation of feedback concerning the final decision.

(7) Study documentation through the preparation of an environmental assessment (EA) or an EIS (environmental impact statement) :- The 7<sup>th</sup> stage is the preparation of a study document in the form of an EA or EIS. Public involvement would consist of reviews and comments on draft documents. Stages 6 and 7 in the EIA process could actually be combined. If public participation is to be effective in the various stages of the EIA process, the public participation program must be carefully planned. A good public participation program does not occur by accident. Planning for public participation should address the following elements :

- Delineation of objectives of public participation during the pertinent EIA stages.
- Identification of individuals of the public anticipated to be involved in the pertinent EIA stages.
- Selection of public participation techniques which are most appropriate for meeting the objectives and communicating with the public. It may be necessary to delineate techniques for conflict management and resolution.
- Development of a practical plan for implementing the public participation program.

However, background information on three site-specific topics should be considered : (1) previous levels of citizen participation, (2) inherent problems in implementing public participation programs, and (3) usage of observations and/or general principles related to planning public participation programs.

Levels of citizen participation can range from situations in which the citizens do not participate at all, to situations involving token citizens' participation, to situations where citizens share equally in planning, to situations where citizens actually control the planning process. The following table shows various stages along this continuum.

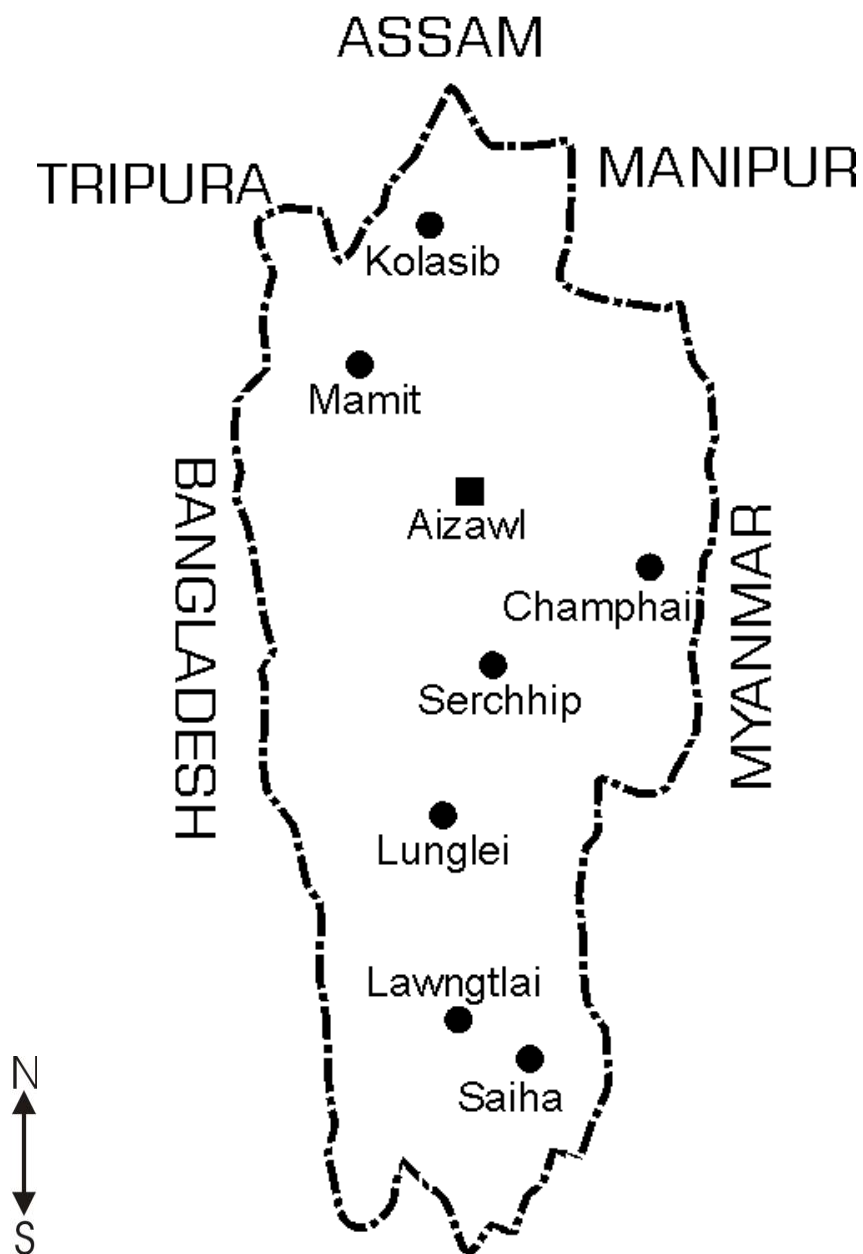
Non-participation		Degrees of tokenism			Degrees of citizen power		
Manipulation	Therapy	Informing	Consultation	Placation	Partnership	Delegated power	Citizen control

Non-participation (manipulation + therapy) :- This describes levels of non-participation that have been contrived by insincere public participation planners to substitute for genuine participation. Their real objective is not to enable people to participate, but to enable *power holders* to educate or persuade the participants.

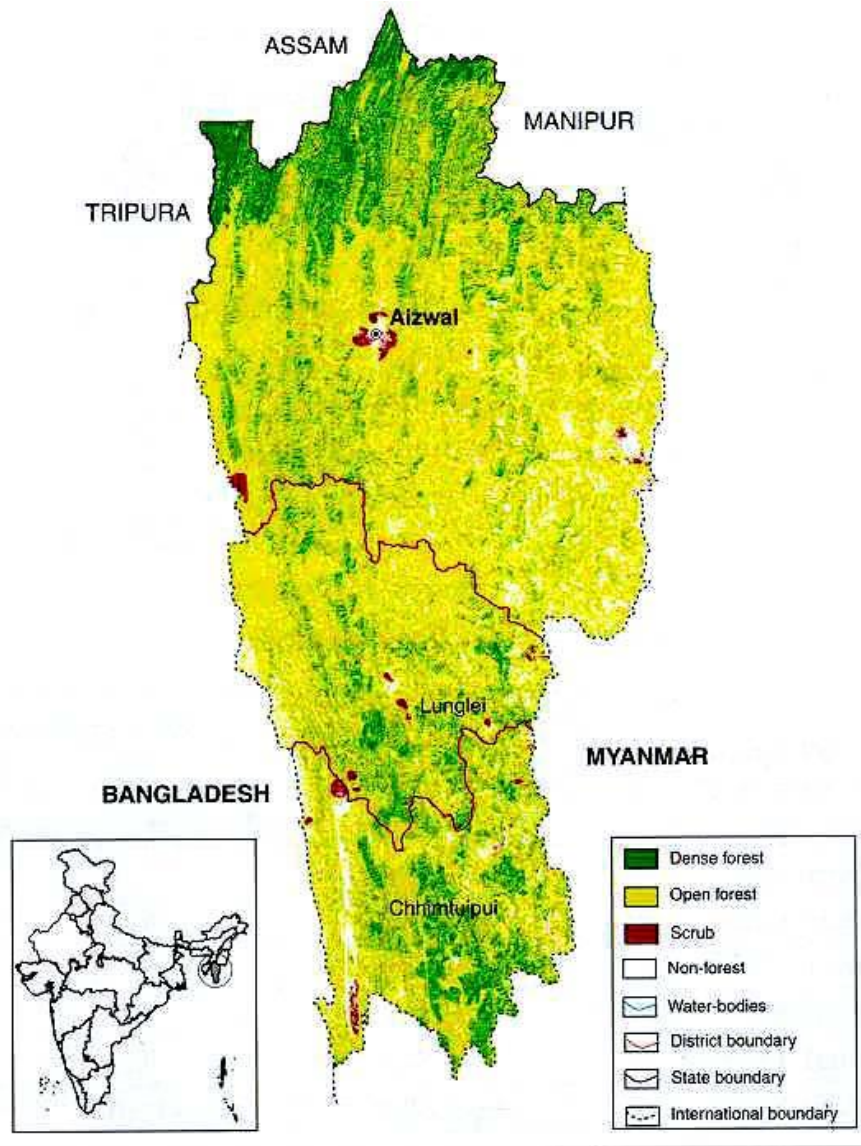
Degrees of tokenism (informing + consultation + placation) :- Here, the public is allowed to hear and to have a voice. When these activities are preferred by power holders as the total extent of participation, citizens may indeed hear and be heard. But under these conditions they lack the power to insure that their views will be heeded.

Degrees of citizen power (partnership + delegated power + citizen control) :- These are levels of citizen power with increasing degrees of decision making involvement. Citizens can enter into a *partnership* that enables them to negotiate and engage in trade-offs with traditional power holders. Have-not citizens obtain the majority of decision making seats, or full decision making power. Most public participation programs, however, stop at the various degrees of tokenism of the above table.

**MAP OF MIZORAM SHOWING WHERE PUBLIC HEARINGS WERE CONDUCTED FOR NBSAP**



### FOREST COVER OF MIZORAM



## INDEX – Implementing agencies

- 1) 7.1. *Priority 1* : **Sub-Issue I & II** : Environment & Forests Department, Govt. of Mizoram through direct involvement of NGOs. **Sub-Issue III** : Environment & Forests Department, Local Administration Department, and reliable NGOs (for awareness creation).
- 2) 7.2. *Priority 2* : **Basic Issue** : Environment & Forests, Rural Development, Horticulture, and Agriculture Departments. **Sub-Issue I** : Land Revenue and Settlement Department. **Sub-Issue II** : Environment & Forests, State Remote Sensing Centre (Planning Department), and Soil & Water Conservation Departments. **Sub-Issue III** : Environment & Forests Department, Environmental NGOs, and village-based NGOs.
- 3) 7.3. *Priority 3* : **Sub-Issue I** : Environment & Forests Department, State Remote Sensing Centre, and Planning Department. **Sub-Issue II** : Environment & Forests, and Law & Judicial Departments. **Sub-Issue III** : Initiative may be taken up by Govt. of Mizoram in which the Co-ordination Committee should be constituted under the chairmanship of the Chief Secretary, PCCF/Secretary, E & F Deptt. as member secretary, and heads of all other Departments and leaders of NGOs as members, or this could also be a Sub-Committee of the proposed State Biodiversity Board (SBB). **Sub-Issue IV** : Environment & Forests Department, Mizoram University and local environmental NGOs (e.g. Centre for Environment Protection). **Sub-Issue V** : Environment & Forests, and Planning Departments.
- 4) 7.4. *Priority 4* : **Sub-Issue I** : Environment & Forests Department, State Forest Development Agencies through Village Forest Development Committees (VFDCs), and local NGOs. **Sub-Issue II** : Environment & Forests, Local Administration, Land Revenue & Settlement Departments, and local NGOs.
- 5) 7.5. *Priority 5* : **Sub-Issue I & II** : Environment & Forests Department with the direct involvement of people. **Sub-Issue III** : Environment & Forests Department, through people's participation, involving local NGOs. **Sub-Issue IV** : Environment & Forests Department in consultation with Forest Survey of India (FSI), International Bamboo and Rattan Research Institute, and Rain Forest Research Institute.
- 6) 7.6. *Priority 6* : Environment & Forests, and Soil & Water Conservation Departments.
- 7) 7.7. *Priority 7* : **Sub-Issue I** : Environment & Forests Department. **Sub-Issue II** : Environment & Forests Department, in consultation with Universities/Institutions and local environmental NGOs. **Sub-Issue III** : Environment & Forests Department. **Sub-Issue IV** : Environment & Forests Department, through the direct involvement of local people and environmental NGOs.
- 8) 7.8. *Priority 8* : State Government.
- 9) 7.9. *Priority 9* : School Education Department (for formal education), and Centre for Environment Protection (CEP) with Central Young Mizo Association (CYMA) for non-formal education.
- 10) 7.10. *Priority 10* : Environment & Forests, and Power & Electricity Departments, in consultation with Research Institutes and local environmental NGOs.
- 11) 7.11. *Priority 11* : Environment & Forests, and Power & Electricity Departments, in consultation with Research Institutes and local environmental NGOs.

## REFERENCES

1. Bhattacharjee, P.C. Wild (Plant and Animal) Biodiversity pp.86. MoEF and Kalpavriksh. 2000. *NBSAP : Guidelines & Concept Papers*. MoEF, GOI & Kalpavriksh. New Delhi.
2. Borthakur, D.N. (1992). *Agriculture of the North Eastern Region with special reference to hill agriculture*, Beecee Prakashan, Guwahati, pp-137-51.
3. *Census of India 2001, Series – 16, Mizoram*. Provisional Population Totals (Distribution of Workers and Non-workers) Paper – 3 of 2001. pp-74 – 97.
4. *Draft Annual Plan 2001-2001*. Deptt. of Agriculture & Minor Irrigation, Govt. of Mizoram (2001), Aizawl.
5. Fischer C.E.C. (1938). *The Flora of the Lushai Hills*. Firma KLM Private Limited, Calcutta.
6. *Forest Diary 2001-2002*. Department of Environment & Forests, Government of Mizoram, Aizawl. Linkman Production, Titagarh, West Bengal, India.
7. Gage A.T. (1899). *A Botanical Tour in the South Lushai Hills*. Periodical Expert Book Agency, Delhi – 32.
8. Kanchi Kohli & Ashish Kothari. The EIA Farce. *Earthscapes, The Hindu* (Folio 3/6) May 20, 2001.
9. Kanjilal U.N., Kanjilal P.C. Das A, Dey R.N. *Flora of Assam 5 Vols*. Government Press, Shillong, India (1934-40).
10. Lalrinthangi F.C. (1990), Singh (1996). *Progress Report Forestry (1990)*.
11. Lalramnghinglova, H & L.K. Jha. Ethno-medicinal Plants Development in Mizoram. *Agroforestry and Forest Products* (proceeding international workshop). Vol.I 28<sup>th</sup> - 30<sup>th</sup> November, 2000 pp. 395-404. Deptt. of Forestry, NEHU. Mizoram Campus, Aizawl (India).
12. Lalramthanga, I.F.S. & Lalmalsawma (1996). *Sava Zirna Kawhmuhtu Mizote Tan*. Deptt. of Environment & Forests, Govt. of Mizoram (1996), Aizawl.
13. Larry W. Canter, *Environmental Impact Assessment (1996)*, McGraw-Hill, Inc., Singapore, pp-589 to 591.
14. *National Wildlife Action Plan (2002-2016)*, Ministry of Environment & Forests, Govt. of India, by Sanctuary Magazine, Mumbai. pp-25.
15. Parry N.E. (1932). *The Lakhers*. Appendix VII. Firma KLM Private Limited, Calcutta.
16. Singh M.K. & Singh N.P. (2000). *Agroforestry — A sustainable land use system for shifting cultivation in North Eastern India*, Agroforestry & Forest Products Vol. 1. Deptt. of Forestry, NEHU, Mizoram Campus, Aizawl (2000). pp-31.
17. *State Forestry Action Programme*. Deptt. of Environment & Forests, Govt. of Mizoram (1996). Aizawl.
18. *Statistical Handbook, Mizoram 2000*. Directorate of Economics & Statistics, Government of Mizoram. Milan Press, Aizawl (2000).

19. Statistical Handbook, Mizoram 2002. Directorate of Economics & Statistics, Government of Mizoram. Everly Press, Aizawl (2002).
20. Shruti Devi, V & Kanchi Kohli. Legal Spaces for Conservation. *Earthscapes, The Hindu* (Folio 4/4) May 20, 2001.
21. *Zoram Thlirna*. Vol.I, No.I November-December 2000.pp.11-46. Publicity Cell, Information & Public Relations, Govt. of Mizoram, Aizawl.