

CHAPTER 1

INTRODUCTION

1.1. Brief background:

Biodiversity may be defined as the richness of species of plants, animals, and microorganisms in any given habitat such as land, water (fresh or saline including seas) or as parasites or symbionts. It is a product of evolution over millions of years. It may be subdivided into three categories – *genes*, *species*, and *ecosystem*. *Genetic diversity* refers to the variations in the genes within a species. This covers distinct populations of the same species (for example we have thousands of traditional varieties of rice in India.). The term *Species diversity* refers to the populations of different plants, animals, and microorganisms in a given habitat, existing as an interacting system. They are also referred to as communities. An aggregate of communities occurring as an interacting system in a given ecological niche makes an *Ecosystem*

Biodiversity is the source of all living materials used as food, shelter, clothing, biomass energy, medicaments, and host of other raw materials used in bio-industrial development. Thus, the ecology & economy of the country depends upon the status of its Biodiversity.

India is predominantly a biomass-based country with largely bio-industrial pattern of development. Our stakes in biodiversity are high. There is an increasing pressure on natural resources due to growing human population and enhanced pace of socio-economic development. This has led to degradation of habitats and has resulted in loss of biodiversity and agricultural productivity. Biodiversity is an irreplaceable resource: its extinction is forever. Such loss of species affects not only the plants, animals and microorganisms in nature together with those under cultivation / domestication and used in industry, but also species whose values are yet to be ascertained. In normal evolutionary process, some species get extinct and new species come up, but the influence of human race has resulted in staggering losses of species at accelerated pace. Scientists estimate that humans are causing the extinction of perhaps one species every hour! The conservation and sustainable utilization of Biodiversity should therefore be central to all developmental planning in a developing country like ours, because our economy is based on agriculture, animal husbandry, forestry, and fisheries.

To prevent continuing genetic erosion and to promote concerted efforts to conserve biodiversity by all nations, acting both individually and collectively, a Global Convention on Biodiversity (CBD) was adopted at the U. N. Conference on Environment & Development in 1992. It came into force in December 1993. So far, over 174 countries, including India, have ratified the CBD. The CBD is a unique international agreement. It provides a

framework for integrated action in biodiversity conservation, sustainable use, and equitable sharing of benefits. To implement the provisions of the CBD the Government of India initiated the process of preparation of National Biodiversity Strategy and Action Plan (NBSAP) in the year 2000. It is being carried out at 5 different levels, local (sub state), state / union territory, eco-region (inter state), thematic and national.

1.2. Scope of the SAP:

Among the 18-biodiversity 'hotspots' identified in the world, 2 are in India. These are:

- (i) Eastern Himalayas and
- (ii) Western Ghats.

Besides these two mega 'hotspots', 26 endemic centers have been identified in India (Nayar, 1989). Aravalli range is one of these identified endemic centres. Aravallis form an important Eco-region of the country. They act as a natural physical barrier between the 'Thar' desert and the rest of the country. The Aravalli hills, spread over southern parts of Haryana, Rajasthan, and parts of Gujrat, have cradled Indian civilization and culture. There are evidences to show that the 'Vedic' culture developed here. The long history of human settlements in Aravallis coupled with the current population explosion has exerted tremendous pressure on the biodiversity of this area. Number of species in the region are now either threatened or on the verge of extinction. The biodiversity of the region is threatened not only in the physical terms but also in terms of knowledge and concern about it.

This document attempts to cover the status of Biodiversity of Aravalli eco-region and suggests Strategy and Action Plan for its conservation and sustainable use. It covers the whole of Aravalli ranges i.e. the Aravalli hills in the states of Gujrat, Rajasthan, and Haryana.

Attempt has been made to cover the entire range of biodiversity available in the area in the diverse habitats such as natural eco-systems, agricultural ecosystems, and wetlands. The animal biodiversity (wild as well as domesticated) has also been included. It also covers people's perception about biodiversity and its conservation. Presently the status of the biodiversity, in all its forms i.e. wild as well as domesticated, is on decline. Although people of the region suffer hardships because of the scarcity of resources, yet the attitude of villagers towards conservation of nature and the existing biodiversity is lukewarm. People in general do not appear to be conscious about loss of biodiversity in the region. This is perhaps due to decrease in the direct contribution of the biodiversity in improving the quality of life.

1.3. Objectives:

Aravalli ranges form the lifeline of this region. A number of rivers originating form Aravallis sustain life in the adjoining areas. These hills provide necessary resources for sustaining human and livestock populations of the area. About half a century ago, the productivity of these hills was excellent but developments during last fifty years have adversely affected their biodiversity and capacity to sustain the mounting pressure.

The objectives of the BSAP are:

- To document the present status of biodiversity of the Aravalli eco-region.
- To develop a strategy to put a halt on further degradation of the Aravallis and to attempt restoration of their past ecological status and glory.
- To stress on the need to revive the indigenous knowledge that helped in conservation of the biodiversity and the physical environment. Over centuries, the local communities had developed a knowledge system and culture that conserved biodiversity. However, this system is getting eroded under the influence of modernization.
- To involve the local people in day-to-day management of the biological resource by creating their stakes in its management and its judicious utilization.
- Sustainable utilization of natural resource for meeting the needs of fuel, fodder, material for housing of the local communities, and raw material for a wide range of cottage / village industries, medicine and genetic resources for agriculture.
- To suggest mechanism for the preservation of the land races, such as, providing some economic incentives to the farmers for their cultivation.
- To suggest the legal measures necessary for promoting awareness and conservation of biodiversity.
- To prepare an Action Plan for sustainable use of Biodiversity, based on the needs and aspirations of the people including the women and the downtrodden sections of the society.

1.4. Contents:

This document describes the present status of the biodiversity of the Aravalli Eco-region spread over the states of Haryana, Rajasthan, and Gujrat, and the reasons for its deterioration. It covers:

1. Present status of the forests, reasons for their degradation, and approaches for rehabilitation, conservation, and revival of the traditional relationship between the people and the forests with the introduction of Joint Forest Management.
2. Present status of wildlife, causes of its decline and suggestions for conservation.
3. Agricultural biodiversity, the changes that have taken place, the result of these changes and suggestions for preservation of land races and fertility of the soils.
4. Present status of the biodiversity of domesticated animals, poultry, and fisheries; causes of degradation and suggestions for improvements.

The SAP is based on the issues raised by the local people in village meetings and the information collected from over 159 villages spread over the three states. The issues raised are:

- Reduction in the area under forest.
- Loss of canopy density of forests.
- Quantitative and qualitative loss of species / number.
- Adverse effect of introduced exotics in forest areas.
- Mechanization and modernization of agriculture.
- Government support in the introduction of high yielding varieties.
- Effect of indiscriminate use of chemical fertilizers and pesticides in agriculture with Govt. support.
- Extensive and haphazard mining.
- Excessive use of underground water for irrigated agriculture.
- Increased dependency on allopathic medicine system, ignoring the indigenous knowledge of medicinal plants.
- Commercial exploitation of certain medicinal and other plants without taking care of their regeneration.
- Introduction of exotic species of fishes in water bodies.
- Pollution and degradation of water resources by extraction of copper, zinc, and other minerals.

1.5. Methodology:

The Coordinator of the eco-region constituted an Eco Working Group (EWG) consisting of members from various sections of the society. List of members is at Annexure. 1

A number of meetings of the EWG were organized. In these meetings, besides the members of EWG, knowledgeable local individuals, scientists working on the biodiversity related subjects, interested NGOs, villagers, members of the Village Forest Protection Committees, Sarpanch of the village Panchayats, and forest officers of the area were invited to participate (Annexure 2,17 and 18). Details of the meetings are in Annexure 5.

In the first meeting of the EWG, the members discussed about the NBSAP Guidelines and concept papers, scope of its coverage, and methodology to be adopted for the process. It was decided that the information needed for the NBSAP, like the present status of biodiversity of the region (natural ecosystems, wild species of plants and animals, agricultural ecosystems, and domesticated species and varieties), and people's perception for its sustainable use etc., be collected by the identified research workers who have been involved in biodiversity related research work and projects. These individuals were to visit the representative villages in the region, talk to the villagers, and collect the information. Initially Dr. O .P. Kulhari, Rakesh Shrivastava, Dr. R.D. Sharma, and Dr. M. K. Sharma who were working on Biodiversity related research were assigned the task of collecting information for Sikar, Jhunjhunu, and Jaipur districts. They collected information from 12 villages.

They observed that this method had following shortcomings:

- The villagers were initially quite indifferent towards the investigators; collection of information was therefore difficult.
- The villagers were shy towards strangers and therefore avoided contacts with the investigators.
- Some villagers wanted to know if there was any monetary benefit to them for providing information.
- Aravallis cover a vast area and local dialect varies from village to village. The investigators felt difficulty in communicating with the people. It caused hindrance in collection of information.
- Investigators needed at least 8 to 10 days of stay in the village for establishing a workable rapport with the villagers and to obtain authentic information.

This methodology was therefore considered expensive and time consuming.

In view of the above, it was decided that in a vast and extensive Ecoregion like the Aravallis, the people who live in the area and are well versed with the local dialect should be involved in collection of information. Local NGOs like Sewa Mandir and Magra Mewar Vikas Sansthan could be very helpful in this task. The information could also be collected through the local functionaries of the Forest Department, and schoolteachers, who live in villages and know the local community very well.

It was therefore, decided that the information about NBSAP process should be collected through NGOs, knowledgeable local individuals and forest employees, living in those areas. Involvement of Village Forest Protection and Management Committees in compilation of information ensured involvement of women, backward sections of the

society and tribals. A set of questionnaire (8 forms in Hindi) was developed to collect relevant information from different villages (Annexure 3).

1.5.1. Documentation of published and research work:

Universities of Bikaner, Jaipur, Ajmer, and Udaipur are involved in carrying out research work in various aspects of biodiversity in the Aravalli Eco-region. Compilation of published and unpublished research material has been done. Dr. Yogesh Shrivastava of Rajasthan University, Dr. S.S. Katewa, Senior Reader, Udaipur University, and Dr. M. Parvateesum of Government College Ajmer have documented the research work (Annexure 4).

1.5.2. Public Participation:

A number of meetings with the villagers and public hearing cum workshops were organized for involving different sections of the village community in the NBSAP programme. Help of Village Forest Protection Committees, Gram Panchayats, NGOs, and Forest Department and other departments, was taken to ensure participation and involvement of all sections of the society.

Information about the meetings organized is given in Table 1.

Table-1

S. No	Date	Place of meeting	Participants	Subject discussed
1	6.11.2000	Jaipur	Members of EWG, Scientists working on Biodiversity, NGOs & Forest Officers.	Discussions about the NBSAP Project, scope of coverage, and methodology to be adopted for the process.
2.	8.12.2000	Udaipur	Members of EWG, Scientists of Udaipur University working on Biodiversity, NGOs, and Village level organizations and Forest Officers.	Discussions about the formats for the collection of field data and identification of suitable individuals for collection of data in Southern Aravallis.

3.	30.12.200	Ajmer	Members of EWG, Forest Officers, NGOs, and knowledgeable individuals having good contacts with villagers.	Discussions about the NBSAP Program and identification of individuals who could get the information from the villagers for different villages in Central Aravallis.
4.	5.1.2001	Sariska (Alwar)	Members of EWG, Forest Officers, NGOs.	Discussions about the NBSAP Project and identification of individuals for collection of information in the prepared questionnaires from the selected villages.
5.	11.1.2001	Raoli wildlife sanctuary (Rajsamand)	Members of EWG, Forest Officers, NGOs, and knowledgeable individuals.	Discussions about the NBSAP process, and identification of individuals for collection of information from the villagers of Raoli Wildlife sanctuary.
6.	5.2.2001	Udaipur	Working Group members, Forest Officers, NGOs, Scientists, village organizations.	Co-coordinator reviewed the information collected by various individuals. Some additional villages were also selected for collection of biodiversity information.
7.	6.2.2001	Paliyakhera	Villagers, members of VFPMCs, local leaders, various stakeholders, members of EWG, subject matter specialists, NGOs, and Forest Officers.	Exchange of views on the status of biodiversity of the area, people's perception, and methods for sustainable utilization of indigenous biodiversity. Information about ethnic medicines and folk

				knowledge etc. etc.
8.	7.2.2001	Kewda (Udaipur)	Villagers, elected members of Panchayat, members of VFPMC, school teachers, members of Eco Working Group, Forest Officers, NGOs etc.	Obtained people's perception of sustainable utilization of biodiversity, collected information about ethno-botany, ethno-zoology, and ethno-forestry, information collected by Shri Damodar Tulsia was cross checked in the meeting and was found to be correct.
9.	8.2.2001	Mt. Abu (Sirohi)	Working Group members, Forest Officers, Local NGOs, Press people and knowledgeable local people.	Coordinator talked about the NBSAP Project, its objectives and the process for preparing the strategy and action plan, identified the villages from where the information was to be collected in the questionnaires and identified the persons who will do the job.
10.	11.2.2001	Sadri (Pali)	Forest Officers, members of Eco Working Group and knowledgeable local people.	Discussed the NBSAP Project – objectives and methodology for collection of information in the questionnaires, identified people and villages for collection of information and mass contact.
11.	16.4.2001	Gandhi Nagar (Gujrat)	Working Group members and Forest Officers of Gujrat State.	Exchange of views about the NBSAP Project, people's participation and collection of data from Aravalli areas of Gujrat

				State.
12.	20.4.2001	Jaipur.	Eco Working Group members, University scientists, NGOs, and knowledgeable individuals.	Discussed the methodology adopted for mass contact and compilation of information relating to NBSAP Project. The draft Action Plan is likely to take at least three more months in finalization.
13	10.5.2001	Bujarail, Raoli (Rajsamand)	Members of EWG, Villagers, Elected members of Panchayat, & Forest Officers	Collected information about the status of forests, agriculture and people's aspirations about restoring the biodiversity of the area.
14	23.5.2001	Raghunath pura (Alwar)	Members of EWG Aravalli, Aravari Sansad, villagers,	Collected information about the status of the existing Biodiversity in natural forests and in agricultural fields, problems of mining etc.
15	25.5.2001	Bagheri & Chandela villages. (Mt. Abu)	Members of EWG, Filming team NBSAP, Sarpanch, villagers, & Forest officers	Information about the biodiversity, people's suggestions for restoring the biodiversity and its uses.
16	26.5.2001	Hetemji village. (Mt. Abu)	Members of EWG, Filming unit of NBSAP Villagers, forest officers	Information about the loss of indigenous flora & fauna, people's aspirations for rehabilitation.
17	26.5.2001	Arna village (Mt. Abu)	Same as above	Same as above
18	26.6.2001	Gurgaon Haryana	Members of Haryana Nodal agency, Villagers of Haryana, members of <i>Mahila</i>	Discussed the present status of biodiversity of Aravallis in Haryana, the agricultural diversity, the

			<i>Mandals</i> of Haryana, Officials of Agriculture, Animal husbandry, Forest Department, Sarpanchs of Panchayats, Coordinator of Aravalli EWG.	status of wild and domesticated animals, legal help in preservation of the forests that have been regenerated in Haryana Aravallis.
19	28.8.2001	Bharev & Sihad villages (Dhariawad Udaipur)	Members of EWG, Villagers, Members of Village Forest Protection and Management Committees	Information about the status of biodiversity of the forests, and agriculture. Working of the Village Forest Protection Committees.
20	13.10.2001	Bhanpur Kalan (Jaipur)	Members of EWG, Villagers, Members of VFPMC, Forest officers	Talked to the villagers and collected information about the Biodiversity related subjects. Forest plantations raised by VFPMC have started giving revenue.

Minutes of these meetings are available at Annexure 5.

For NBSAP process, the Aravalli ecoregion was divided in three distinct geographic divisions based on the general characteristics of the range and on the similarity of form elements such as dimension, relief, slope, and drainage pattern:

1. Northern Aravallis
2. Central Aravallis
3. Southern Aravallis

(Southern Aravallis was sub-divided into two parts – Borhat plateau and Abu massif).

. A set of questionnaire in Hindi (Annexure 3), was developed to record information about the present status of biodiversity, its uses, perceptions, and aspirations of people. The Local NGOs, schoolteachers, college lecturers, knowledgeable local individuals, employees of the forest dept., and VFPMCs etc., were involved in collection of information in the questionnaire. Information from 159 villages was collected.

There are a large number of hamlets, villages, towns, and cities all over the Aravallis and it was not possible to touch and survey each village and city within the available resources and time. However to know various trends and to verify them as many as 159 villages and towns were selected at random. Detailed information was collected. A

glimpse of findings of these surveys is available in Annexure 2,6,7,8,9,10,11,12,13, 14, 15, 16, and 17.

A number of meetings with villagers, local officers, NGOs, schoolteachers, college lecturers, and members of VFPMCs were organized to obtain views of the different sections of the society about the status and preservation of the biodiversity.

These questionnaires have provided detailed information about the village profile, status of natural ecosystem, the agricultural biodiversity, and related matters.

Besides, a team of experts was deputed to collect the other supportive data and related information to fill up the gaps, in the information collected by the prescribed questionnaire.

Services of subject experts were also taken to have the technical details about different sectors of biodiversity. Experts on forestry, agriculture, animal husbandry, wild animals, medicinal plants, ethnic groups, geography etc. were consulted and their views were taken in the form of articles.

CHAPTER 2

PROFILE OF ARAVALLI ECOREGION

2.1 Geographical profile:

Starting from (latitude 28^o.24N' and longitude 77^o.12' E) Delhi, the Aravallis run across the States of Haryana and Rajasthan and reach the plains of Gujrat Near Palanpur (latitude 23^o. 20'N longitude 73^o .45'E). Aravallis are the oldest mountain system of the Indian subcontinent. They have been the scene of repeated pene-planation and rejuvenation in the past and there is considerable topographic evidence to that effect. The tops of the ridges in Haryana and also in parts of Rajasthan are flat. The Width of these tops in some cases exceeds 5 km representing the rejuvenated surface of the former penepplain. The present day rocks and stumps of once a gigantic mountain system the Aravallis remain interesting, both geologically and geo-morphologically. Physically the Aravallis are spread over a length of about 700 km with their width varying from less than 10 km to over 100 km. Map –1 shows the spread of Aravallis.

In Delhi, the Aravallis start as low scattered ridges, hardly 30 to 50 meters above the ground, but gradually gain height and take shape of continuous ranges as one moves in southwest direction. In Haryana, these hills are locally called as 'mewat hills'. The height attained by these hills near Nuh town is about 412 meters. In adjoining areas of Rajasthan, the offshoots of the Aravalli hills are spread in Sikar, Srimadhapur, Neem-ka-Thana and Khetri, with wide valleys. Here they also gain in height culminating in the peaks of Ragunathgarh (1055m) and Harshnath (820m). The scattered and flattened hilltops form small plateaus. In Alwar and Jaipur, the Aravallis splay out into the Torawati Hills and hills of northeast Jaipur. The average height varies from 400m to 670m with some peaks attaining heights above 700m. These are Babai (792m), Bairath (740m), and Kho (920m). Near Jaipur, the elevation is reduced to around 500m and a saddle is formed with a number of spurs, some of these are buried or half buried under the wind blown sand. Around Sambhar-lake, the topography is comparatively open with isolated hillocks. Further, south the ranges open out to form several ridges and gain in height. At Taragarh Ajmer, it attains the height of 873m. Southwest of Ajmer the hills are squeezed into a strip of about 50 kms width and have several gaps. This is the midland country of Rajasthan from where the Aravallis fan out towards the plateau of Sirohi and the highlands of Mewar, the rugged hills of Rajsamand, Udaipur, and Dungarpur region. In Sirohi district, the Aravalli hills have a distinct feature in the form of an isolated hill mass of the Abu Massif with an area of about 5180 sq km. Abu Massif is separated from the main range by a narrow pass. Mt. Abu

plateau (19km x 6 km) is nearly 1200m above sea level. It is an irregular plateau surrounded by several projected peaks and slopes particularly on the western and northern sides being extremely precipitous. The most striking features are the gigantic blocks of syenitic rock which present most fanciful and weird shapes, at places molded into rounded caverns and holes resembling the section of a largely magnified sponge. The most phenomenal of the caverns on surface is the Nakki Lake. Attached to Mt. Abu is Oria plateau, about 60 m higher than Abu and lies below the main peak of Gurushikher with an elevation of 1722 m. It is the highest peak between the Himalayas and the Nilgiris. The other adjoining prominent peaks are near the village Ser (1597 m), Achalgarh (1380 m), and other peaks west of Delwara.

The part of Aravallis, located between Gogunda (1090m) and Kumbhalgarh is locally called the Bhorat Plateau. It is the highest plateau in Aravallis. This section has the high peaks of Jargah (1431m), and Kumbhalgarh (1206m). The height of the Aravallis reduces in the southwest. In Gujrat, near Khed- Brahma and Palanpur, they get reduced to a few scattered hillocks hardly 100m.

2.1.1. Salient features:

The Aravallis form a division between the sands of the Thar and the largely non-aeolian terrains of the Central Highlands to the east. The range is also one of the main Indian watersheds, separating the drainage of the Bay of Bengal, through the rivers like the Chambal, and other tributaries of the Yamuna, from that of the Arabian Sea through the Mahi, Sabarmati, Luni, and other rivers. Its importance goes far beyond this, for it marks, the present-day frontier between the western Asiatic desert region, and the true peninsula of the sub- continent. The Aravallis serve as the main source of a number of the rivers viz. Luni, Banas, Berach, Gambhir, Ghambhiri, Mahi, Banganga, Bandi, Morel, Sabi, Sota, Mansi, and Vakal (Sabarmati) in the region.

The Aravallis although act as a barrier and check the movement of Indian desert into the Indo-Gangetic plains of Uttar Pradesh.. In the northern Aravallis presence of a number of **gaps** between Ajmer to Delhi, restrict this character of the hills to some extent. The main gaps are located at (1) Pushkar, (2) Pilwa, (3) Ajwa, (4) Mored, (5) Kuchaman – Sambhar, (6) Gagor, (7) Bhuni, (8) Ghat ki Dhani, (9) Ghatwa – Rupgarh, (10) Bajor – Rewasa Ranoli (11) Gudha – Kantli, (12) Singhana – Irroth. These gaps have been shown in the Map-2. Dry conditions in the area and high wind velocity over the region results in extensive wind erosion and formation of sand dunes. The water and wind erosion complement each other to form sandy ravines in the eastern side of Aravallis.

West of Aravallis, one is in a land of low and uncertain rainfall, and of extremes of climate both seasonal and diurnal; a land of precarious agriculture where pastoralism is the main way of life and until very recently the camel was the main means of transport. South-east of

Aravallis, one is in a region of higher and more reliable monsoon rainfall, and somewhat less variable temperature, much of it enormously productive agriculturally, a land of settled village life.

Hence, this range of hills forms the frontier between what is fundamentally western Asiatic and tropical patterns of climate; and consequently also a frontier for many aspects of the natural fauna and flora, and of the technology and life style of the people. Many other aspects of these are of course common to both sides of the hills.

MORPHO TECTONIC FRAME WORK

The Aravallis are a part of the Peninsular India. It is one of the three fundamental segments of the Indian Subcontinent – the other two being the Himalayas and their extension to the East and the west, and the Indo Gangetic Plains. The Indian Peninsula is entirely unlike the other two segments both geologically and physio-graphically. It is a stable mass of the Precambrian rocks some of which have been there since the formation of the Earth. Again of the five folded regions constituting the basement of the Indian Platform recognized in the Indian Peninsula in a chronological order from oldest to youngest, the Aravalli folding comes at the second position, next to the Dharwar folding and the Delhi folding at the fifth position with Eastern Ghats and Satpura folding at the third and fourth position.

Geo-morphologically the Aravallis are a part of the Central Highlands that is one of the six main regions into which the Indian Sub continent is divided. The central Highlands are also one of the five main divisions of the Indian Peninsula. They are a large expanse of the Hilly country roughly triangular in shape encompassed by the Great Plains on the North, the Aravalli range on the west and Satpura range on the south. The Northern part of the central Highlands includes the Bundelkhand uplands, the Aravalli range and the undulating country between the two.

(Mathur, S. M. 1991 Physical Geology of India, NBT, Delhi)

Aravalli hills are spread in a number of districts of Rajasthan, Haryana, and Gujrat. Extent of Aravallis in different districts is given in Table 2.

Table - 2.

S. No.	State	Districts covered	
		More than Half to the Entire area of the district in Aravallis	Part of the districts only

1	Haryana	--	Gurgaon, Faridabad, Rewari, Mahendragarh, Bhiwani
2	Rajasthan	Alwar, Udaipur, Rajsamand, Sirohi -	Jhunjhunu, Sikar, Jaipur, Nagaur, Dausa, Ajmer, Pali, Dungarpur, Tonk, Bhilwara, Chittorgarh, Bundi, Banswara, and Jalore.
3	Gujrat	--	Banaskantha, Sabarkantha

2.1.2 Main Rivers of Aravallis:

The rivers of Aravalli zone are ephemeral and flow only during the rainy season. Major rivers of Aravallis are depicted in Table 3.

Table - 3

S. No.	Name of State	Name of major rivers
1	Haryana	Sabi, Indori
2	Rajasthan	Luni, Jawai, Kantli, Banganga, Banas, Berach, Kothari, Banas (west), Mansi, Vakal, Jakham, Mahi
3	Gujrat	Banas, Sabarmati, Arjuni river

2.1.3. Water bodies and wetlands:

Many water bodies / wetlands are present in the Aravalli zone which not only recharge the underground water tables but also sustain a large number of aquatic fauna and flora. Some of the important water bodies / wetlands are listed in Table 4.

Table - 4

Sate	Name of water body	Area (ha.)	Nature and man made or natural
Gujrat	Dantiwada (Banaskantha),	4200	Fresh water, man-made
	Dharoi (Sabarkantha),	26400	Fresh water, man-made
	Hathmati Reservoir (Sabarkantha)	3340	Fresh water, man-made
	Maheshwar (Sabarkantha)	1784	Fresh water, man-made
Rajasthan	Sambhar, (Jaipur and Nagaur) (Ramsar site)	7200	Brackish water, natural

	Ajgara talao (Ajmer)	1000	Fresh water, man-made
	Ansagar (Ajmer)	384	Fresh water, man-made
	Foyssagar (Ajmer)	128	Fresh water, man-made
	Gund Talao (Ajmer)	200	Fresh water, man-made
	Pushkar Raj Sarovar (Ajmer)	200	Fresh water, man-made
	Tabiji Tank (Ajmer)	128	Fresh water, man-made
	Buchara (Jaipur)	233	Fresh water, man-made
	Mansagar (Jaipur)	711	Fresh water, man-made
	Ramgarh lake (Jaipur)	1114	Fresh water, man-made
	Pichhola-Fetehsagar complex (Udaipur)	1480	Fresh water, man-made
	Baghela Tank (Udaipur)	100	Fresh water, man-made
	Bhatewar Tank (Udaipur)	387	Fresh water, man-made
	Jaisamand or Dhebar lake (Udaipur)	7224	Fresh water, man-made
Haryana	Kotla Dhar Jheel (Nuh & Sohna)	1000	Fresh water, natural
	Sultanpur lake (Gurgaon)	346	Fresh water, natural

(Wetlands of India – A Directory, MoEF, 1990)

2.1.4 Minerals:

Aravallis are the richest ranges in India as far as minerals are concerned. Over 70 different minerals are found in these hills out of which about 65 are being exploited on commercial scale. These are classified as (a) Major minerals and (b) Minor minerals.

Leading minerals found in Aravallis are Zinc, Lead, Silver, Cadmium, Marble, Precious and semi-precious stones, Tungsten, Gypsum, Soapstone, Rock-phosphate, Asbestos, Clay, Calcite and building stone.

A glimpse of minerals exploited in different states is given in Table 5.

Table - 5

S. No.	State	Mineral
1	Delhi	Building stone, Sand
2	Haryana	Glass sand, Graphite, Mica, Quartz, poor quality Slate along with building stones
3	Rajasthan	Zinc, Lead, Granite, Marble, Mica, Rock-Phosphate, Asbestos, Soap-stone, Lime-stone, Tungsten, Beryllium, Uranium, Diamond, Emerald, Copper, Building stone.
4	Gujrat	Building Stone, Copper, Lead, Zinc, Lime stone, Marble, Mica, Calcite

Map-1.
Spread of Aravallis

Map – 2
Major gaps in Aravallis.

2.1.5. Soils:

Soils in Aravalli ecosystem fall under 4 broad categories:

1. Aridisols,
2. Alfisols,
3. Vertisols
4. Inceptisols.

Aridisols occur generally west of Aravallis in parts of Alwar, Jaipur, Bhiwani, Mahendragarh, and Rewari.

Alfisols are comparatively mature soils and are found in the districts of Faridabad, Gurgaon, Alwar, Tonk, Bhilwara, Udaipur, parts of Chittorgarh, Banswara and Dungarpur. Their texture varies from coarse to fine loamy.

Vertisols are with comparatively rich clay contents and have fine texture. Their permeability is slow. These soils crack when dry. They are found in parts of Banswara, Chittorgarh, Dungarpur, Udaipur, Sabarkantha, and Banaskantha districts.

Inceptisols occupy areas along the foothills of Aravalli in the districts of Sirohi, Jalore Pali, Rajsamand, Udaipur, Bhilwara, and some parts of Alwar.

2.1.6. Climate:

The Aravalli region has three distinct seasons i.e. summer, Monsoon, and winters. Annual average rainfall in the region varies between 500 to 700mm. The area therefore falls in a semi-arid region of the country. However, in Mt. Abu where the average annual rainfall is much higher, sub-humid conditions prevail. The monsoon season in the region starts from the beginning of July and lasts till end of the September. Occasionally the region receives pre-monsoon showers in the month of June and post-monsoon showers in the month of October. In winter season occasionally winter showers, associated with the passing western disturbances over the region are also received. The highest rainfall is received during the months of July – August.

Summer season starts from the beginning of March, when the temperature starts rising progressively through April – May – June. Maximum day temperature during hot season generally varies from 40°C to 45°C whereas the minimum night temperature during this period varies between 20°C to 27° C. However, in southern Rajasthan, particularly in areas having altitude above 1000m, the maximum day temperature ranges between 31°C to 35°C and the night temperature during the same period varies from 21°C to 24°C.

Winter season starts from November and lasts till February. January is the coldest month of the year when the average maximum temperature varies between 4°C to 10°C. In Mt. Abu, the minimum night temperature occasionally drops below 0°C. During winter, months passing western disturbances over the region bring ice-cold winds from higher altitudes, at time accompanied by showers. The entire region comes under the spell of a cold wave for a short period of 3 to 7 days.

Aravallis, because of their location on the fringe of “Thar Desert” are prone to frequent droughts. Although the flora and fauna of the region has evolved with the arid / semi arid conditions, yet frequent failure of monsoon brings in immense stress to the human and cattle population of the region. With increase in the population density in the region the ill effects of drought have become more pronounced,

2.2. Socio – economic profile:

The old time honored, social classification based largely on traditional occupation and in some cases on consideration of caste is still followed in the entire Aravalli eco-region.

The main social groups living in the region are mentioned in Table 6.

Table - 6

S. No	Zone of Aravalli	Major casts/communities/clans/ethnic groups living
1	Northern	<i>Jat, Rajput, Brahmin, Gurjar, Ahir, Meo, Jain, Muslim, Meena, Sikh, Yadav, Mali, Kumhar, Julaha, Nai, Khati, Lohar, Teli, Rangrej, Baniya.</i>
2	Central	<i>Brahmin, Jat, Rebari, Rajput, Rawat, Gurjar, Kumhar, Julaha, Teli, Rangrej, Mali, Baniya, Muslim.</i>
3	Southern	<i>Bhil, Garasia, Rajput, Brahmin, Patel, Jain, Lok Rajputs (12 sub-casts at Mt. Abu), Bhil-Meena, Meena, Damor, Kathodia, Rebari, Lohar, Kalal, Kumhar, Julaha, Baniya, Muslim, Bohra, Dholi.</i>

[Information collected during survey (Annexure 2and6)& from district Gazetteers of the region]

Jats are first-rate agriculturist and posses fine physique. They have monopolized agriculture. They mostly live in Northern and parts of Central Aravallis.

Gurjars are mostly cattle breeders and agriculturist. They mostly live in north and central Aravallis. this community has suffered most because of degradation of grass birs and forests and release of forestland for various purposes.

Ahirs are also good cultivators and are also engaged in dairying and animal husbandry.

Raikas are agro-pastoralists. They are renowned camel and sheep breeders, but some of them also cultivate land. They migrate with their animals to different parts of country. Numerically they form the largest migrant group in India.. They mostly live in western Rajasthan but some of them also reside in the central and parts of southern Aravallis. Their land holdings are small. The main purpose of keeping the land is to have village ties rather than agriculture. Raikas along with other nomads of western Rajasthan have evolved a life style having a combination of agriculture and pastoralism based on the utilization of large tracts of uncultivable and marginal lands along with the seasonal use of rain fed tract as pasture. This pattern of resource utilization involves the practice of mobility depending upon the rains, state of pastures and other factors. The partition of the country also had a major influence in changing pattern of their movement. Exclusion of Sindh from their

grazing areas has aggravated pressure on grazing land and overturned an established pattern of regional complementarities

Rawats are inhabitants of central Aravallis, particularly - Ajmer and Merwara area. Because of adverse agriculture conditions of the area, they prefer to join military and paramilitary forces.

Meos, predominate in the northern Aravalli belt in Haryana and adjoining area of Rajasthan. Though Muslims by religion, they claim their origin from Rajputs. They are agriculturists but not as good as Jats. (District Gazetteer Gurgaon by K. S. Bhuria, IAS & B. Raj Bajaj 1983)

The **Bhils** are recognized as the oldest living inhabitants of the southern Rajasthan and adjoining parts of neighboring Gujrat, M.P., and Maharastra. In Aravalli, the Bhils are concentrated in Dungarpur, Banswara, Udaipur, and Chittorgarh districts of Rajasthan.

A Bhil female works harder than the male. She collects wood from the jungle; graze the cattle and also helps in the crop fields. They clean the cattle shed and remove the cow dung. Hence, Bhil daughter is considered as an economic asset and therefore at the time of marriage her parents demand "dapa" (Bride price) to compensate the loss.

Today the Bhils have by and large, taken to commercial crops. There are segments among them who harvest three crops a year. However, those living in the interior areas even now continue to suffer from dire poverty. The Bhils, who have larger size of holdings, benefit from the irrigation dams.

The educated Bhils have taken service as a source of their livelihood. Unlike 'Caste Hindus', the Bhils do not follow any traditional occupation.

Among the five numerically major tribal groups of Rajasthan, the Minas constitute the largest group forming 49.47% of the total tribal population of Rajasthan. They are concentrated mainly in the district of Jaipur, Dausa, Udaipur, Alwar, Tonk, Banswara, Dungarpur, and parts of Chittorgarh.

The Minas are essentially agriculturists. Recently they have accepted improved tools such as tillers, tractors, pumping sets, power thrasher and also improved seeds, manures and other agricultural inputs. There is a prevalence of 'batt' system (share cropping) among the Minas (specially in Rajasthan). This system has three varieties:

(1) 'Chhota Batt': In this form, the owner gives his land to the sharecropper, who in return pays him one-fourth portion of the total produce.

- (2) 'Hadi Batt': In this category, the landowner pays revenue and also provides agricultural inputs. The sharecropper manages for the bullocks and input to cultivate land. The sharecropper pays half of the produce to the landowner.
- (3) 'Hansil Batt: In this category, the landowner only pays the land tax. The sharecropper contributes agricultural input and labour. He pays only one third of the yield to the owner.

Of late, there has been a diversification in the Mina economy. The Minas have taken to education. This has helped them to maximize their absorption in government services. They are now employed in state and all India services as well as teachers, clerks, foreman, technician, and electrician and in a variety of jobs in government. .

Garasia constitute the third largest tribal group of the region. Garasia are allied to the Bhils but they rank just above them in social scale. They claim to be the descendants of Rajputs by Bhil women. The highest concentration of Garasia is in southern Aravallis, particularly in Pali, Sirohi, Udaipur, and adjoining areas in Gujrat.

The Garasia girls have as much freedom as the boys in choosing their own partner and no one can be forced to marry against her or his wishes. Veil (covering face) is common among married women who are highly respected and no man can dare cut jokes with a married Garasia lady. The cases of ill treatment of wives by their husbands are rare because of the fear that a wife may retaliate and go to her father or brother's house. A widow is allowed to remarry. Before her remarriage, she has to be freed from the spirit of her deceased husband by the 'devala', so that he may not trouble her. Widow remarriage is generally performed in the evening, as she should avoid her entrance into her new house in daylight. The Garasia women play an important role in the making of major decisions regarding marriage and adoption. They generally put on very colorful dresses.

Damors were basically animistic, but with the passage of time, they have accepted Hindu gods and goddesses. Some of their deities are purely of local importance. Besides the local deities, the Damors also worship Hindu Gods.

The Damor economy depends largely on agriculture. The land holding size with the people is low. If the rains are normal, the Damors take two crops in a year. Otherwise, they have to be satisfied with one crop. Though agriculture is the principal occupation of Damor, they have taken to a number of other supplementary occupations for earning a livelihood.

Small groups of **Kathodis** also live in southern Aravallis. They have specialized in manufacturing of Kutch (Katha) from *Acacia catechu* (Khair) trees. They also collect MFP and act as casual Labourer.

Rebaris are mostly confined in central and southern Aravallis. Their main profession is rearing of sheep, camel, and cattle. Many of them are constantly on move with their flocks of sheep and camel, pasturing them in Govt. Forests and cultivated lands.

Some of them have started cultivation. They are hardy people with sharp features. They eat meat, drink wine, and allow widow remarriages. Economically they are rich because of their animals. Generally, the financial matters in Rebaris are managed by their women folk.

Besides agriculture and animal husbandry, some people work as traditional artisans. Pottery, carpentry, black smithy, gold smithy, cattle driven oil expellers etc., are prevalent in the region.

2.3 Political Profile:

From Gujrat to Delhi the Aravalli eco-region covers

- 1) Two districts in Gujrat
- 2) Eighteen districts in Rajasthan
- 3) Five districts in Haryana

The Collector and District Magistrate (Deputy Commissioner) is the executive head of the district administration. He is responsible for collection of land revenue, law and order and coordinating between different departments besides supervising various development programmes. Tehsildars, Revenue inspectors, and Patwaries in the field support him. Jurisdictions and nature of duties of these officers are well defined. For maintenance of land records, each district has a number of Tehsils.

According to the provisions of Panchayat Raj Act, with a view to make each village a pivot of economic development and having the right of local governance, **Panchayat Samities** have been constituted, under the Panchayati Raj System in all the three states of the region. There is a "Gram Panchayat" for every village or group of villages, with the population ranging from 2000 to 5000. Gram Panchayat is an elected body having a number of "Panchas", and one of them is a Sarpanch. It is mandatory to have the required representation of people of Schedule Caste, Scheduled tribes and women members in Panchayat.

A cluster of Gram Panchayats forms a "Panchayat Samiti" which is headed by an elected "Pradhan". Pradhan looks after the development works of the Panchayat Samiti. The Block Development Officer, a government official, is the executive head of the Samiti. All Panchayat Samities of a district are represented by the 'Pradhans' in "Zila Parishad" / "Zila Panchayat". Zila Parishad / Zila Panchayat comprises of elected members, who in turn elect a "Zila Pramukh". A senior government officer is generally the chief executive of Zila Parishad / Panchayat. These Zila Parishads / Zila Panchayats discuss and approve the plans proposed by the Panchayat Samities. The plans are executed by the Panchayat Samities.

2.3.1. Detailed Information about district-wise Tehsils and Panchayat Samities is shown in Table 7.

Table -7.

Sr. No	State	Name of District	Name of Tehsils	Name of Panchayat Samities (P.S.)
1	Gujrat	Banaskantha	<ol style="list-style-type: none"> 1. Palanpur 2. Deesa 3. Dantiwara 4. Danta 5. Vadgam 6. Amirgarh 7. Deodar 8. Dhanera 9. Tharad 10. Kankarej 11. Bhabhar 	<ol style="list-style-type: none"> 1. Palanpur. 2. Deesa 3. Dantiwara . 4. Danta 5. Vadgam. 6. Amirgarh. 7. Deodar 8. Dhanera. 9. Tharad 10. Kankarej. 11. Bhabhar
		Sabarkantha	<ol style="list-style-type: none"> 1. Himatnagar 2. Idar 3. Vadali 4. Khedbrahma 5. Vijaynagar 6. Bhiloda 7. Modasa 8. Megraj 9. Bayad 10. Dhansura 11. Talod 12. Prantij 	<ol style="list-style-type: none"> 1. Himmatnagar 2. Idar . 3. Vadli . 4. Khedbrahma . 5. Vijaynagar 6. Bhiloda . 7. Modasa , 8. Megraj . 9. Bayad . 10. Dhansura . 11. Talod . 12. Pratij .
2	Rajasthan	Alwar	<ol style="list-style-type: none"> 1. Behror 2. Mandawar 3. Kishangarh Bas 4. Tijara 5. Bansur 6. Alwar 7. Ramgarh 8. Thana Gazi 9. Rajgarh 10. Lachmangarh 	<ol style="list-style-type: none"> 1. Nimrana 2. Bharor 3. Mandawa 4. Kotkasim 5. Tijara 6. Bansur 7. Kishangarh Bas 8. Ramgarh 9. Thana Gazi 10. Umrain 11. Rajgarh 12. Reni 13. Govindgarh 14. Kathumar.
		Ajmer	<ol style="list-style-type: none"> 1. Kishangarh 2. Ajmer 3. Nasirabad 4. Beawar 5. Sarwar 6. Kekri 	<ol style="list-style-type: none"> 1. Silora 2. Pisangan 3. srinagar 4. Arain 5. Jawaja 6. Masuda 7. Bhinai 8. Kekri
		Banswara	<ol style="list-style-type: none"> 1. Ghatole 2. Garhi 3. Banswara 4. Baghidora 5. Kushalgarh 	<ol style="list-style-type: none"> 1. Ghatole 2. Pipalkhunt 3. Garhi 4. Talwara 5. Bagidora 6. Anandpuri 7. Sajjangarh 8. Kushalgarh

		Bhilwara	<ol style="list-style-type: none"> 1. Asind 2. Hurrda 3. Shahpura 4. Jahazpur 5. Mandal 6. Banera 7. Raipur 8. Sahara 9. Bhilwara 10. Kotri 11. Mandalgarh 	<ol style="list-style-type: none"> 1. Asind 2. Hurrda 3. Shahpura 4. Mandal 5. Banera 6. Jahazpur 7. Raipur 8. Sahara 9. Suwana 10. Kotri 11. Mandalgarh
		Bundi	<ol style="list-style-type: none"> 1. Naenwa 2. Hindoli 3. Keshorai Patan 4. Talera. 	<ol style="list-style-type: none"> 1. Naenwa 2. Hindoli 3. Keshorai Patan 4. Talera
		Chittorgarh	<ol style="list-style-type: none"> 1. Rashmi 2. Gangrar 3. Begun 4. Kapasan 5. Chittorgarh 6. Bhadesar 7. Dungla 8. Nimbahera 9. Bari Sadri 10. Chhoti Sadri 11. Pratapgarh 12. Arnaud 	<ol style="list-style-type: none"> 1. Rashmi 2. Bhupalsagar 3. Kapasan 4. Chittorgarh 5. Bhadesar 6. Dungla 7. Nimbhaherra 8. Bari Sadri 9. Chhoti Sadri 10. Pratapgarh 11. Arnaud 12. Begun 13. Bhainsrorgarh.
		Dausa	<ol style="list-style-type: none"> 1. Baswa 2. Sikrai 3. Dausa 4. Lalsot 	<ol style="list-style-type: none"> 1. Bandikui 2. Dausa 3. Sikrai 4. Lalsot
		Dungarpur	<ol style="list-style-type: none"> 1. Dungarpur 2. Aspur 3. Simalwara 4. Sagwara 	<ol style="list-style-type: none"> 1. Bichhiwara 2. Dungarpur 3. Aspur 4. Simalwara 5. Sagwara
		Jaipur	<ol style="list-style-type: none"> 1. Kotputli 2. Bairath 3. Shahpura 4. Chomu 5. Jamwa Ramgarh 6. Amber 7. Phulera 8. Jaipur 9. Sanganer 10. Dudu 11. Phagi 12. Bassi 13. Chaksu 	<ol style="list-style-type: none"> 1. Kotputli 2. Viratnagar 3. Shahpura 4. Govindgarh 5. Amber 6. Jamwaramgarh 7. Sambar 8. Dudu 9. Sanganer 10. Jhotwara 11. Bassi 12. Phagi 13. Chaksu.
		Jalore	<ol style="list-style-type: none"> 1. Ahore 2. Jalore 3. Bhinmal 4. Sanchore 5. Raniwara 	<ol style="list-style-type: none"> 1. Ahore 2. Saila 3. Jalore 4. Bhinmal 5. Jaswantpura 6. Sanchore 7. Raniwara

		Jhunjhunu	<ol style="list-style-type: none"> 1. Jhunjhunu 2. Chirawa 3. Khetri 4. Nawalgarh 5. Udaipurwati 	<ol style="list-style-type: none"> 1. Alsisar 2. Chirawa 3. Surajgarh 4. Jhunjhunu 5. Buhana 6. Nawalgarh 7. Udaipurwati 8. Khetri
		Nagaur	<ol style="list-style-type: none"> 1. Nagaur 2. Merta 3. Jayal 4. Ladnu 5. Didwana 6. Nawa 7. Parvatsar 8. Degana. 	<ol style="list-style-type: none"> 1. Ladnu 2. Nagau 3. Jayal 4. Didwana 5. Mundawa 6. Degana 7. Makrana 8. Kuchaman 9. Merta 9. Reni 10. Parvatsar
		Pali	<ol style="list-style-type: none"> 1. Jaitaran 2. Raipur 3. Sojat 4. Pali 5. Marwar Junction 6. Bali 7. Desuri 	<ol style="list-style-type: none"> 1. Jaitaran 2. Raipur 3. Rohit 4. Sojat city 5. Pali 6. Kharchi 7. Rani 8. Sumerpur.
		Rajsamand	<ol style="list-style-type: none"> 1. Bhim 2. Deogarh 3. Kumbhalgarh 4. Amet 5. Rajsamand 6. Nathdwara 7. Railmagra 	<ol style="list-style-type: none"> 1. Bhim 2. Deogarh 3. Amet 4. Kumbhalgarh 5. Rajsamand 8. Khamnor 9. Railmagra
		Sikar	<ol style="list-style-type: none"> 1. Fatehpur 2. Lachhamangarh 3. Sikar 4. Danta Ramgarh 5. Sri Madhopur 6. Neem-ka-Thana 	<ol style="list-style-type: none"> 1. Fatehpur 2. Lachhamangarh 3. Dhond 4. Piprali 5. Danta Ramgarh 6. Khendela 7. Sri Madhopur 8. Neem-ka-Thana
		Sirohi	<ol style="list-style-type: none"> 1. Shivganj 2. Sirohi 3. Pindawara 4. Revdar 5. Abu Road. 	<ol style="list-style-type: none"> 1. Shivganj 2. Sirohi 3. Pindwara 4. Revdar 5. Abu Road.
		Tonk	<ol style="list-style-type: none"> 1. Malpura 2. Niwai 3. Toda Rai singh 4. Tonk 5. Uniara 6. Devli 	<ol style="list-style-type: none"> 1. Malpura 2. Niwai 3. Tonk 4. Tod Rai Singh 5. Uniara 6. Devli
		Udaipur	<ol style="list-style-type: none"> 1. Gogunda 2. Girwa 3. Vallabhnagar 4. Kotra 5. Jhadol 6. Malvi 7. Khairwara 8. Sarada 9. Salumber 10. Dhariawad. 	<ol style="list-style-type: none"> 1. Gogunda 2. Bargaon 3. Mavli 4. Kotra 5. Girwa 6. Bhindar 7. Jhadol 8. Sarada 9. Salumber 10. Dhariawad

				11. Khairwara.
3	Haryana	Bhiwani	1. Bhiwani 2. Bawani Khera 3. Tosham 4. Dadri 5. Loharu 6. Siwani	1. Badhra 2. Bawani Khera 3. Bhiwani 4. Dadri-I 5. Dadri-II 6. Loharu 7. Tosham 8. Kairu 9. Siwani
		Faridabad	1. Ballabhgarh 2. Faridabad 3. Palwal 4. Hathin 5. Hodel	1. Ballabhgarh 2. Faridabad 3. Hathin 4. Hodel 5. Palwal 6. Hassanpur.
		Gurgaon	1. Gurgaon 2. Pataudi 3. Nuh 4. Ferozepur Jhirka 5. Punhana 6. Sohna 7. Taoru	1. Farukhnagar 2. Ferozepur jhirka 3. Gurgaon 4. Nagina 5. Nuh 6. Pataudi 7. Punhana 8. Sohna 9. Taoru
		Mahendragarh	1. Mahendragarh 2. Narnaul	1. Ateli Nangal 2. Kanina 3. Mahendragarh 4. Nangal Chaudhary 5. Narnaul
		Rewari	1. Rewari 2. Bawal 3. Kosli	1. Rewari 2. Khol at Rewari 3. Jatusana 4. Bawal 5. Nahar.

(Communication from Conservator forests Gandhinagar, Resource Atlas Rajasthan, and Statistical Abstract of Haryana 1999-2000)

Each State has a legislative assembly. The population of the state determines the number of constituencies for an assembly. A certain percentage of seats are reserved for persons belonging to Scheduled Castes and Scheduled tribes. Similarly the number of representatives elected by each state for Lok Sabha, is in proportion to the population of the states.

2.4. Ecological Profile:

2.4.1 Ecological Profile:

Aravalli hills have a variety of eco-systems that include natural forests ecosystems that support a variety of natural plants, trees, and wild animal life and agricultural ecosystems (Annexure – 7). These ecosystems have been affected considerably by the biotic factors. The natural forests are now in different stages of degradation. A number of species of the indigenous plants and trees are declining in number, whereas some new plants have come up. Similarly, some species of wild animals are getting reduced and others are increasing. In Agricultural fields, changes have taken place in the cropping pattern and water uses.

Information about the present status of these ecosystems of the entire Aravalli Eco-region (from Haryana to Gujrat) has been collected through questionnaires. It gives ecological profile of randomly selected 159 villages. Information about the present status of forest ecosystem, along with the species of trees and wild animals decreasing / increasing in numbers, agricultural crops cultivated in the area and water use etc., has been collected and is available at Annexure 6.

2.4.2. Natural Forests:

Forests are distributed all over the Aravalli hills. The species composition and density varies from place to place. Generally speaking, the forests in northern Aravallis have more xerophytic characteristics in comparison to the forests in the southern Aravallis. About 73% of the forests are in various stages of degradation. Only 27 % area supports forests with a crown cover of over 40 % as shown in the table 8.

The density classes of forests as per classification of Forests survey of India are as under:

- (i) Dense Forests: Crown cover over 40 %.
- (ii) Open Forests: Crown cover between 10 to 40 %.
- (iii) Scrub and barren forests: Crown cover less than 10 %.

2.4.3. District-wise distribution of dense and open forests:

Information, about district-wise distribution and status of forests as in 1997 and 1999 is given in Table 8.

Table 8

S. No.	Name of State	Name of District	Geog Area (sq km.)	Forest (sq km.)							
				Dense		Open		Total		Scrub	
				1997	1999	1997	1999	1997	1999	1997	1999
1	Haryana	Bhiwani	5099	8	26	14	15	22	31	20	5
		Faridabad	2150	7	23	10	33	17	56	2	34
		Gurgaon	2716	13	43	17	199	30	242	21	71
		Mahendragarh	3009	13	24	26	47	39	71	11	0
2	Rajasthan	Ajmer	8481	50	43	104	125	154	168	191	212
		Alwar	8380	310	328	822	806	1132	1134	487	476
		Banswara	5037	45	45	303	303	348	348	181	181
		Bhilwara	10455	10	26	129	144	139	170	180	213
		Bundi	5550	78	163	292	255	370	418	229	212

		Chittorgarh	10856	417	560	1145	1037	1562	1597	431	454
		Dungarpur	3770	79	79	139	142	218	221	133	130
		Jaipur	14068	40	81	388	392	428	437	471	443
		Jalore	10640	21	26	111	115	132	141	152	202
		Jhunjhunu	5928	-		55	89	55	89	157	157
		Nagaur	17718	1	1	30	61	31	62	59	105
		Pali	12387	199	212	414	406	613	618	234	261
		Sikar	7732		8	94	95	94	103	214	184
		Sirohi	5136	341	361	432	439	773	800	356	374
		Tonk	7194	16	27	56	91	72	118	64	131
		Udaipur	17279	1414	1536	1834	1718	3248	3254	894	853
3	Gujrat	BanasKantha	12703	433	443	313	314	746	747	247	256
		Sabarkantha	7370	370	370	305	304	675	674	284	291

(State of Forest Report, 1997 & 1999)

2.4.4. Zonation in Aravallis:

The vegetation in Aravalli hills shows distinct elevational zones. The species intermingle at different zones yet a definite pattern of these elevational zones is perceptible.

In the **lower zone**, the common species are *Adhatoda vasica*, *Cassia auriculata*, *Jatropha curcas*, *Diospyros melanoxylon*, *Acacia nilotica*, *Butea monosperma*, and *Terminalia bellirica*, etc.

In the **middle zone**, common species are *Acacia catechu*, *A. senegal*, *Lansea coromandelica*, *Anogeissus pendula*, *Woodfordia fruticosa*, and *Euphorbia nivulia* etc.

In **upper zone**, the common species are *Boswellia serrata*, *Anogeissus pendula*, *A. latifolia*, *Sterculia urens*, *Euphorbia neriifolia*, and *Erythrina suberosa*, etc.

Status of natural regeneration of important species in Aravallis is poor. This is mainly because the area is subjected to heavy pressure of grazing by domestic livestock. In some areas like Mt. Abu, the exotics like *Lantana* have formed thick cover. It does not permit local species to regenerate themselves.

2.4.5. Wildlife:

A number of wild animals such as Tiger, Leopard, Sloth bear, Sambhar, Chital, Chow-singha, Nilgai, Porcupine, Ratel, Wild boar, Jackal, Wolf, Hyena, Civets, Flying squirrel, Mongoose, Crocodile etc. are found in Aravallis. A list of important plants, mammals, birds, reptiles, amphibians, and some non-chordates found in Aravallis are at Annexure 7 to 12. Unfortunately, invertebrates are least studied taxa in the Aravalli eco-region.

A number of wildlife rich areas of Aravallis have been notified as Protected Areas under Wildlife (Protection) Act, 1972 as listed below in Table 9.

Table – 9.

S. No.	State	Nature of Protected area	Name of protected area	Key Animal Spp.	Key Plant spp.
1	Delhi	Sanctuary	Indira Priyadarshini Sanctuary	Nilgai	Dhok, Kumtha
2	Haryana	-do-	Sultanpur National Park	Water fowls	Khejri, Munja
3	Rajasthan	Sanctuary	Phulwari sanctuary	Sloth bear	Dhawra, Mahua, Bamboo
		--do--	Jaisamand Sanctuary	Chinkara	Dhok
		--do--	Sitamata sanctuary	Flying squirrel	Teak Bamboo
		--do--	Bassi Sanctuary	Leopard	Dhawra and Tendu
		--do--	Jamwa Ramgarh Sanctuary	Leopard, Tiger	Dhok, Salar
		--do--	Kumbhalgarh Sanctuary	Leopard, Wolf, Four-horned antelope	Dhok, Salar, Ber,
		--do--	Mt. Abu Sanctuary	Sloth bear, Leopard	Dhawra, Am, Jamun and Bamboo
		-- do--	Nahargarh Sanctuary	Leopard	Dhok
		--do--	Sajjargarh Sanctuary	Leopard	Dhok
		--do--	Sariska Sanctuary*	Tiger	Dhok, Ber, Palas, Salar, Bamboo
		--do--	Todgarh Raoli Sanctuary	Leopard, Sloth bear	Dhok, Ber, Palas, Salar.
			Ramsar Site	Sambhar	Flamingoes
4	Gujrat	Sanctuary	Balaram Ambaji Sloth bear Sanctuary	Sloth bear	Dhawra, Dhok

(* Preliminary notification to declare Sariska as a National Park has been issued)

2.4.6. Agriculture systems:

The entire Aravalli eco-region falls under different agro-climatic zones. Each has its own special characteristics. The rainfall in the entire region is erratic with uneven distribution. The irrigation facilities are limited. In most of the area, generally one crop (Kharif) during the monsoon season is raised under rain-fed conditions. In areas where irrigation facilities are available because of irrigation dams or wells, Rabi cultivation is also done. Bajra, sesame, jowar, maize, and variety of pulses are grown in Kharif seasons in most of the areas. In southern Aravallis paddy is also grown during Kharif season. Coarse cereals and small millets are traditionally cultivated on a very small scale in southern Aravallis. The main crops raised during Rabi season are wheat, barley, gram, mustard, and oil seeds. Because of smallholdings, low capital investment capacity and lack of adequate infrastructure facilities like canals and power, the farming system is mostly subsistence agriculture. In areas that have irrigation facilities, most of the farmers have switched over from traditional method of subsistence farming to commercial farming. Vegetables, with a ready market in nearby towns and cities are cultivated extensively. There is a general increase in the use of fertilizers, adoption of high yielding varieties of crops seeds, use of insecticides and fungicides. Mechanization is being done in the farming techniques. Use of tractors and tractor drawn implements is increasing. The use of fertilizers, high yielding seeds and mechanization started with the "grow more food" campaign in early sixties.

2.4.7. Other land / water uses:

Sambhar lake in Rajasthan occupies a depression in the Aravallis schists and appears like a valley in the Aravalli ranges. It is a shallow lake with an average depth not exceeding 60 cm. having a length of about 22.5 km and width varying from 3.2 to 11.2 km. The lakebed is almost flat with a gradient of less than 10 cm/ km.

Sambhar is known for salt production. Technically the process of extraction of salt is very simple. The saline water of the lake after evaporation by solar heat, leaves behind a crust of salt on the lakebed, which is collected. The saline water of the lake contains sodium chloride along with other sodium salts such as sulphates and carbonates but the difference in the solubility of various sodium salts at different temperature allows for the crystallization of sodium chloride at high summer temperature while the sulphate and carbonates are still in solution. In areas, surrounding the lake, salt is also made from the sub-surface brine. The saline water is available at shallow depth of 3 to 5 m. Villagers do this type of salt production privately. However, the Sambhar Salts limited, a joint venture of Hindustan Sambhar Salts Ltd., with the State Govt. of Rajasthan, manages the salt production from the lake

2.4.8. Phyco-culture:

Spirulina, a green alga found in Jamwa Ramgarh Lake near Jaipur is rated very high for its nutritional and medicinal properties. Commercial production of *Spirulina* on a small scale has been started in Bassi Tehsil of Jaipur district.

Spirulina, a blue green alga also known as 'magic alga' is the richest known source of protein in the world. Besides protein the presence of carbohydrates, fats, carotenoids, vitamins and minerals make it a "complete food for tomorrow" (WHO). This alga has therapeutic and chemo-preventive applications. Its popular use has been in treatment of anemia, malnutrition, arthritis, and even in obesity. Its recent endeavor has been in arresting AIDS and cancer. With these enormous benefits of *Spirulina*, many production units have come up all over the world. It is being produced in south India also. Because of its sensitivity to temperature, intensity of light, photoperiods, and pH, it is being produced mostly under strictly controlled conditions of poly-houses.

In Rajasthan, Dr. Pushpa Shrivastava, Associate Professor, Rajasthan University Jaipur, separated a local strain of *Spirulina* from Jamua Ramgarh Lake that is resistant to the climatic extremes. She also developed a technique of cultivating it in open. Since Jaipur falls in semi-arid region of the country and therefore has extremes of climatic conditions, Dr. Shrivastava has developed indigenous methods of controlling the temperature and other conditions. She has also applied for a patent for the technique developed by her.

Dr. Shrivastava has also organized a group of local women called "Manjul *Spirulina* Samwardhan Sansthan" in Burthal Village of Bassi Tehsil in Jaipur district. The purpose of this organization is to train women for cultivating *Spirulina* with local technique. So far, about 280 women have been trained for cultivation of *Spirulina* alga.

- Average production of dry *Spirulina* is between 8 gms to 10 gms / per day / Sq. mt.
- Maximum production is 14 gms / per day / sq mt (summer)
- Minimum production is 5gms / per day / per sq mt (winter)
- The cost of production of dry *Spirulina* by this technique comes to Rs. 130/- per kg.
- The market price of *Spirulina* is about Rs. 700/- per kg.
- On an average, a woman can generate an additional income of Rs. 1000/- per month by cultivation of *Spirulina* in her home.

2.5. Brief history on the management of Aravallis in different states

History of management of Aravallis hills differs from state to state.

2.5.1. Haryana:

In Haryana, the ownership of land in Aravallis mostly vests with the village community under the control of the Village Panchayats. In past, Aravalli hills in Haryana were very well wooded. During British rule the Village Panchayats, managed these areas in a reasonably sustainable manner. The Panchayats with the help of elderly persons and Lambardars exercised an effective control over the behavior of the individuals. Historically important events of the region are as under; -

- During World War II (1939-45), commercial felling of trees was undertaken for manufacturing of charcoal yet the condition of the vegetation in general was good.
- In 1952, with the introduction of new Panchayat Raj system the role and influence of village elders decreased. The Panchayats took political shape. Elected representatives could not exercise control over the felling of trees by the villagers.
- In 1956 famine conditions in the region induced un-restricted felling of trees by the villagers in the region.
- In the year 1962-63, consolidation of holdings was done in the agricultural land. The cultivators removed all trees from their holdings. This shifted the entire pressure of collection of firewood to the community lands.
- In sixties and early seventies, mechanization of agriculture led to further felling of trees in the agricultural fields. All trees causing obstructions in the movement of machines were removed.
- Simultaneously there was a steep rise in the demand of construction material. This led to vast expansion of stone quarries in the Aravallis leading to further destruction of forest cover.
- In the year 1966, Haryana State was created. By this time, the entire Aravalli region became devoid of tree growth making it a wooded waste.
- In 1968-69, with the launching of Green Revolution most of the fallow lands, whether owned by the individuals or by the community that partially served the purpose of grazing were brought under plough. The grazing pressure on these areas was diverted towards the Aravallis.
- In 1985, a scheme of providing subsidy for purchase of goats was launched in the region. Un-restricted grazing by these goats further denuded the area completely.
- In May 1992, the Government of India notified Aravallis in Gurgaon and Alwar districts under Sections 3(1) and 3(2) (v) of the Environment (Protection) Act 1986 restricting certain activities in the area that were causing Environmental degradation in the region. The activities restricted included location of new industries, new mining, cutting of trees, construction of clusters of new dwelling units and laying of new electric lines in specified areas.

- During 1991 to 1997, Aravalli afforestation project was successfully implemented in Haryana. 35,000 ha of common lands were afforested under this project with the involvement of Panchayats and local people.

2.5.2. Rajasthan:

In Rajasthan, the forests of Aravallis were owned by the state. Important landmarks in the management history of these forests are mentioned below: -

- Pre-independence period:

Before independence of the country, most of the forests in Rajasthan were under the control of the princely states. The rulers of these states rigidly preserved and protected the forests for their personal uses including hunting of wild animals.

Permission for extraction of wood etc. was given to the individuals only in cases of bona-fide needs. Anyone found cutting trees without permission, even for genuine urgent need, was punished. The local people resented this but could not do much.

- Post-independence period:

The conditions changed after independence when the popular government took control of the state. Working plans were drawn up for management of all the state forests. Although most of the Working Plans had provided for a Concessionist Working Circle but this was not considered enough by the Politicians. In their effort to do justice to the tribal and other people living in and near the forests, the state government granted liberal concessions to the people. The state government through its notification no. 4241/ F. 34 (44) Rev./ 53 dated 24-11-1955, granted concessions for obtaining forest produce to all the tribals and the agriculturists residing in the forest divisions of Udaipur, Chittorgarh, Banswara (including district of Dungarpur), Kota (including district of Baran), Bundi, Jhalawar and Tonk.

The scale of the concessions granted is mentioned in Table 10.

Table – 10.

S. No.	Material	Frequency	Limit
1	Timber for house building	One in three years	168 cft/ family
2	Timber for agricultural purpose	Every year	15 cft/ family

3	Fencing material for agricultural field & houses	--	Any quantity needed
4	Fuel wood	Every year	Free head loads for any purpose

Royalty Charges: No royalty was charged up to the above-prescribed quantity. In case of excess requirements of timber, only one eighth of the applicable royalty was to be charged. While granting these concessions, the state government did not consider the capacity of the existing forests to sustain the heavy pressure put on them.

No provision was made for regulation of fellings for availing these concessions. The villagers generally resorted to scattered felling of trees in the forest areas. Only the selected pieces of wood were collected to meet their requirements. No provisions were made for regeneration of the area so felled. These concessions were much in excess of the carrying capacity of the forests and therefore resulted in rapid degradation of the forests. A number of dense forest areas of the state turned into degraded or barren forest areas. Although the state government has not withdrawn these concessions, yet in absence of the forest growth in the area, these concessions cannot be availed by the people any more.

Harvesting of forest produce was done through the agency of contractors. This was discontinued in 1968. The departmental working of forests was started thereafter. This departmental working was also implemented with the aim of earning revenue for the state. Felling in natural forests was stopped by the Forest Department in mid eighties. Afforestation activities in degraded and barren Aravalli hills were taken up from mid seventies under various Plan schemes, World Bank assisted Social Forestry Project, and OECF (Japan) assisted Aravalli Afforestation Project.

In 1991, the **Joint Forest Management** was introduced. It helped in changing the attitude of the people, local communities and the officials of the Forest Department.

Beginning of **participatory management** was made with the introduction of **Social forestry programmes** in the state. However, it took a concrete shape in 1991 after the enunciation of the **National Forests Policy in 1988**. The state government issued detailed guidelines for implementation of the Joint Forest Management in the development and afforestation of the degraded forests. The Concept of **JFM** was implemented in a big way with the launching of **Aravalli Afforestation Programme** in the state from 1992 onwards under which plantations were raised over 1,51,053 ha .

2.5.3. Gujrat State:

Brief history of management of the forests on Aravallis in Gujrat state is as under: -

- Pre-independence:

Prior to independence the Aravalli ranges in Gujrat State were the private property of rulers of the erstwhile princely states and jagirdars. These states were very small in size. Their total number in the two Aravalli districts of Gujrat was around 30. During that period, the local people were endowed with liberal rights, privileges, and concessions of all kind. The jagirdars did not attempt to manage the forest in any way except charging royalty on the trade of the forest produce at the time of crossing limits of their state. However, rigid protection was provided for areas reserved for hunting. In some of these princely states even the exploitation of charcoal and firewood was also allowed to the contractors on payment of royalty. The rate of royalty was very low. This is evident from the following examples. A full grown Mahua (*Madhuca indica*) tree could be cut and removed by just paying a royalty of Rs. 4.00. Similarly, Semal and Salar were extracted for supply to match factory at Porbandar and Cambay on payment of a nominal royalty. Only Idar, a small state in the region, had attempted forest conservation on a very limited scale, as is evident from the administrative report of Bombay Presidency for the year 1886-87. It observed, "The Idar state alone attempts any forest conservancy. It has one or two teak reserves. The introduction of effective conservancy on a large scale would be most difficult in consequence of the immemorial rights of the Bhils to forest produce. The Bhils would certainly resent and resist any interference."

- **Post- Independence Period (1948):**

Immediately after independence of country the rulers of some of the states entered into long-term contracts for removal of (i) timber, charcoal and firewood (ii) manufacturing of Katha (iii) extraction of matchwood species in one core agreement was that the contractor will pay at the rate of Re. 1/- per tree of Semal of 36" growth. The contractor was bound to pay a minimum of rupees 5000/- irrespective of the fact that whether he actually exploited 5000 trees or not. The condition of small *Jagiri* forest was still worst. The repeated felling at short intervals resulted in degradation in tree cover.

- From 1959 onward, the forests were brought under systematic working by implementing a working scheme for the management of the forests.

- **Involving people in management of forests.**

In 1982, the Govt. of Gujrat issued a government resolution for restoration of degraded forestland with prior permission of the state Govt. The government resolution made it clear that the land was to be leased for 20 years period to the respected academic institutions, tree growers co-operative societies, public trusts

and industrial institutions as well as private institutions. The scheme did not get a proper response.

- **Joint Forest Management.**

In 1991, the Gujrat Govt. issued a government resolution on Joint Forest Management. Under this the protection and regeneration of the areas was to be undertaken with the involvement of local people. This scheme has been well taken and is being implemented with some success.

2.6. Notification of Scheduled Areas:

Provisions of the Panchayat (extension to scheduled areas) Act 1996 were made applicable to Scheduled Areas of Aravallis in Rajasthan and Gujrat. There are no Scheduled areas in Haryana and Delhi.

2.6.1. In Rajasthan, the following areas have been declared as scheduled areas

1. Dungarpur district
2. Banswara district
3. Tehsils of Phalsia, Kherwara, Kotra, Sarada, Salumber, Lasadia. And 81 villages of Girwa Tehsil in Udaipur district.
4. Pratargarh Tehsil in Chittorgarh district
5. Abu Road Block of Abu Road Tehsil in Sirohi district.

The provisions of the Panchayat (extension to scheduled areas) Act 1996 were made applicable in Rajasthan by an ordinance issued on 25.6.1999. This was later on approved by the state legislature and became an Act viz. Rajasthan Panchayati Raj (Modification of provision in the application to the scheduled areas) Act 1999.

Under this Act the Gram sabha has been empowered to

1. Approve the plan programmes and projects for social and economic development before such plans, programmes, and projects are taken up for implementation by the Panchayats.
2. Selection of persons as beneficiaries under the poverty alleviation programme.
3. Be consulted before making the acquisition of land in the scheduled areas for development project and report re-setting or rehabilitating persons affected by such projects in the scheduled areas.
4. Recommend prospecting licenses for mining leases for minor minerals in scheduled areas to any person or body of persons.
5. Recommend concession for the exploitation of minor mineral by auction in the scheduled areas.
6. The ownership control and management of MFP., subject to such rules as may be prescribed by the state government as to

7. Prevent alienation of the land in the scheduled areas and to take appropriate action in accordance with the laws in force in the state, to restore any unlawfully alienated land of a scheduled tribe.
8. Exercise Control over money lending to the members of scheduled tribes.
9. Exercise control over institutions and functionaries in all social sectors to the extent and in the manner to be specified by the state government.
10. Every Gramsabha shall be competent to safeguard and preserve the traditions and customs of the people, their cultural identity, community resources and the customary mode of dispute resolution.

In the scheduled areas, provisions have further been made for planning and management of minor water bodies, as may be specified by the state government, by the Panchayat Raj Institutions at such level as prescribed.

Similarly the Panchayat Raj Institutions, at appropriate level, or gram sabha (as may be prescribed), shall have the power to enforce prohibition or to regulate or restrict the sale and consumption of any intoxicant subject to such rules, as may be made by the state government in this behalf.

2.6.2. In Gujrat state in Aravalli region, parts of Banaskantha and Sabarkantha districts are also included in scheduled area. Apart from other provisions, the Act provides for giving the control and management of Minor Forest Produce (subject to such rules as may be prescribed by the state government) to “Zila Panchayats”. Now these Zila Panchayats dispose off the MFP by auctioning them to private contractors and earn revenue. This revenue, so far has not been passed on to the “Gram Sabhas” because of logistic reasons.

CHAPTER 3

CURRENT (KNOWN) RANGE AND STATUS OF BIODIVERSITY

3.1. State of natural ecosystems and status of biodiversity:

Aravalli ranges have a variety of eco-system and ecological niches. They can broadly be classified as:

- (1) Forest ecosystem (Wild plants and animals)
- (2) Grassland ecosystem
- (3) Agriculture ecosystem (Cultivated crops & Domesticated animals)
- (4) Aquatic ecosystem.

3.1.1. Forest Ecosystem:

The forest growth varies considerably in different parts of Aravallis. Although large tracts of Aravallis now support forests in various stages of degradation, yet in number of areas, particularly in Sanctuaries and National Parks, there are still some dense stands of natural forests.

According to classification of Forest types by Champion and Seth (1968), the Forests of **Northern and Central Aravallis**, fall in the following categories

- 5E1. *Anogeissus pendula* forest (*Anogeissus pendula* scrub).

- 5/E1/ (5/E1/DS1). *Anogeissus pendula* scrub
- 6B/C1. Desert thorn forest
- 6/1S1. Desert dune scrub.
- 5E2. *Boswellia serrata* forest.
- 5/E5. Butea forest
- 5/E9. Dry Bamboo brakes
- 5/DS3. Euphorbia scrub.

3.1.2. 5E1. *Anogeissus pendula* forests.

This is the most predominant type of forest of the Aravalli hills. *Anogeissus pendula*, locally called “Dhok” or “Dhokra” forms pure or markedly gregarious stands with its associates. The species composition of the associates differs from locality to locality. A general composition of species in different canopies is:

- I. TOP CANOPY - *Anogeissus pendula*, *Boswellia serrata*, *Acacia catechu*, *Acacia leucophloea*, *Diospyros cordifolia*, *Sapindus emarginatus*, *Butea monosprema*, *Azadirachta indica*, *Ficus glomerata*, *Lannea coromandelica*, *Sterculia urens*, *Albizia odoratissima*, *Schrebera swietenoides*, *Tamarindus indica*.
- II UNDER STOREY - *Dichrostachys cinerea*, *Wrightia tinctoria*, *Zizyphus mauratiana*, *Grewia tenax*, *Securinega leucopyrus*,
- III SHRUBS – *Adhatoda vasica*, *Capparis sepiaria*, *Lepidagathis cristata*,
- IV GROUND COVER – *Cassia tora*, *Indigofera cordifolia*, *Borreria hispida*, *Argemone mexicana*, *Aerva javanica*, *Acanthus spp.*,

3.1.3. *Anogeissus pendula* Scrub:

In some areas, because of heavy browsing pressure, the *Anogeissus pendula* gets reduced to spreading and creeping forms, which sometimes form prostrate cushions looking like topiary work. This is the last stage of degradation before it is totally eliminated.

3.1.4. 6B/C1. Desert thorn Forest:

This sub-group occurs on low hillocks or hills in the Aravallis in Haryana and adjoining areas of Rajasthan. It consists mostly of very open crop of scattered trees of *Prosopis cineraria* and *Acacia senegal*.

Zizyphus scrub is common throughout the degraded belt in Haryana and adjoining parts of Rajasthan. Common species being *Zizyphus nummularia* with sporadic small trees of *Acacia leucophloea*, *Dichrostachys cinerea*, *Acacia senegal*, *Prosopis cineraria*, and *Capparis decidua*,

3.1.5. 6 /1S1. Desert Dune Scrub:

Some areas have a very open and irregular formation of stunted trees and bushes covering a very small portion of soil. The vegetation is markedly xerophytic consisting of *Prosopis spicigera* and *Salvadora oleoides* etc.

3.1.6. 5/E2. *Boswellia serrata* Forest:

In these areas *Boswellia serrata* along with *Lannea coromandelica* tend to occupy the higher reaches whereas middle and lower slopes are covered with almost pure crops of *A. pendula* with its associates like *Acacia catechu*, *Diospyros melanoxylon* etc.

3.1.7. 5/E5 *Butea* Forest:

In these areas, *Butea monosperma* forms almost pure stands with some *Acacia leucophloea*, *Prosopis spicigera*, *Ziziphus mauritiana*, and *Z. nummularia*. Pure stands of *Butea* are often seen in small patches in valleys with deep clayey soils.

3.1.8. 5/E9. Dry Bamboo Brakes:

Almost pure *Dendrocalamus strictus* with a sprinkling of the tree and shrub species of the local form like *Anogeissus pendula* and *Lannea coromandelica*.

In Bamboo brakes, the absence of trees may often be due to biotic factors. At places natural examples also occur. Probably because of associated soil condition.

3.1.9. DS3. *Euphorbia* scrub:

The *Euphorbia* scrub owes its presence to the edaphic factors along with excessive grazing and felling of tree growth. *Euphorbia nivulia*, *E. neriifolia* are conspicuous along with *Rhus mysurensis* and *Ziziphus nummularia*. (Ajmer-Beawar-Deogarh section of Aravallis).

3.1.10. Forests of Southern Aravallis fall in the following categories:

1. (5E1) *Anogeissus pendula* forests
2. (5E1/DS1) *Anogeissus pendula* scrub
3. (5B/C2) Northern Dry Mixed Deciduous forests
4. (5A/C1b) Dry Teak forest
5. (5A/ C1a) Very Dry Teak forest
6. (5/E2.) *Boswellia* forest
7. (5E6) *Aegle* forest
8. (5E9) Dry Bamboo brakes
9. (8A/C3) central Indian sub-tropical hill forest

(Forest types 1 and 2 have been described earlier)

3.1.11. Northern Dry Mixed Deciduous Forests (5B/C2):

The floristic composition of this forest type is:

I & II Storey: *Anogeissus latifolia*, *Boswellia serrata*, *Lannea coromandelica*, *Sterculia urens*, *Soymida febrifuga*, *Albizia odoratissima*, *Acacia leucophloea*, *Embllica officinalis*, *Wrightia tinctoria*, and *Mitragyna parvifolia*.

III Storey ; *Holarrhena antidysenterica*, *Vitex negundo*, *Woodfordia fruticosa*, *Jatropha sp.*

IV a Herbs: *Tridax procumbens*, *Cassia tora*, *Pavonia spp.*, and *Borreria hispida*

IV b Grasses: *Chrysopogon spp.* *Apluda mutica*, *Heteropogon contortus*, and *Aristida spp.*

3.1.12. Dry Teak Forest (5A/C16):

These are mixed dry deciduous forests with teak usually forming the major proportion of the crop. The characteristic associates are *Anogeissus latifolia*, *Terminalia tomentosa*, and *Diospyros melanoxylon*. General floristic composition is as under:

I Storey: *Tectona grandis*, *Boswellia serrate*, *Lannea coromandelica*, *Anogeissus latifolia*, *Diospyros tomentosa*, *Terminalia tomentosa*, *Butea monosprema*, *Hymenodictyon excelsum*, *Cochlospermum religiosum*, *Cassia fistula*, *Bauhinia racemosa*, *Bridelia retusa*, *Ougeinia oogeinsis*, *Dalbergia latifolia*, and *Schrebera swietenoides*.

II Storey: *Wrightia tinctoria*, *Flacourtia indica*, *Zizyphus xylopyrus*, and *Dendrocalamus strictus*.

Shrubs: *Holarrhena antidysenterica*, *Nyctanthes arbor-tristis*, and *Zizyphus nummularia*.

Herb: *Cassia tora*, *Ocimum americanum*, and *Achyranthes aspera. etc.*

Grasses: *Themeda quadrivalvis*, *Heteropogon contortus*, *Dicanthium annulatum*, *Andropogon pumilus*, and *Aristida hystrix*.

3.1.13. (5A/ C1a)Very Dry Teak Forest:

These are very open forest areas of very poor quality on stony and shallow soils derived from crystalline rocks or trap. The general floristic composition of the forest is as under:

I Top Storey:: *Tectona grandis*, *Terminalia tomentosa*, *Anogeissus latifolia*, *Emblica officinalis*, *Cochlospermum religiosum*, *Soymida febrifuga*, *Diospyros melanoxylon*, *Mitragyna parviflora*, *Boswellia serrata*, *Sterculia urens*, *Butea monosperma*, *Holoptelea integrifolia*, *Madhuca indica*, *Aegle marmelos*, and *Dalbergia paniculata*,

II Storey: *Acacia catechu*, *Gardenia turgida*, *Zizyphus xylopyrus*, *Flacourtia indica*, *Acacia leucophloea*, and *Dendrocalamus strictus*.

Shrubs: *Carissa carandus*, *Securinega leucopyrus*, *Helicteres isora*, *Zizyphus nummularia*, *Woodfordia fruticosa*, and *Holarrhena antidysenterica*.

Herbs: *Cassia tora*, and *Atylosia sp.*

Grasses: *Apluda mutica*, *Themeda quadrivalvis*, *Dicanthium annulatum*.

3.1.14. 5/E2: Boswellia Forest:

An open forest in which *Boswellia* forms an overwood to stunted trees and shrubs of dry deciduous forests. Sometimes, almost pure consociations of well grown mature

trees or pole crops occur. Teak, whenever it occurs in association, is generally stunted. There is low grass and scanty undergrowth.

3.1.15. 5/E9. Dry Bamboo Brakes:

Dendrocalamus strictus occurs and forms dense brakes. A scattered overwood of hardier species of dry deciduous forest like *Anogeissus latifolia*, and *Lannea coromandelica* is also present.

3.1.16. 5/B 5 Butea Forest:

On flat ground this type presents a savannah appearance with scattered, stunted and very malformed trees or thickets of *Butea* standing over short grass or bare ground. Sometimes in association with *Acacia leucophloea*.

3.1.17. 5/E6 Aegle Forest:

Floristic composition of this forest is *Aegle marmelos*, *Acacia catechu* along with *Mimosa rubicaulis*, *Nyctanthes arbor-tristis*, *Heteropogon contortus*, *Aristida spp.*, and *Apluda mutica*.

3.1.18. Central Indian Sub-tropical hill Forest (8A/ C3):

These forests occur on the upper reaches of Mt. Abu area in Sirohi district of Rajasthan. The Mt. Abu Plateau is about 19 km. Long and 6 kms wide with an average height of 1300 m. Its highest point is at Gurushikhar, which is 1722 m (5650 feet) above MSL.

Owing to the far-reaching effects of clearing, grazing and burning, very little of original climax vegetation is left.

The floristic composition is as under:

Top and under storey:

Bauhinia racemosa, *Syzygium cumini*, *Ficus glomerata*, *F. infectoria*, *F. pumila*, *Anogeissus latifolia*, *Emblica officinalis*, *Adina cordifolia*, *Mallotus philippensis*, *Ougeinia oogeinsis*, *Ficus glomerata*, *Erythrina suberosa*, *Anogeissus sericea*, *Dendrocalamus strictus*, *Salix babylonica*, *Michalia champaca*, *Phoenix sylvestris*, *Sterculia villosa*, and *Moringa concanensis*.

Shrubs:

Carissa spinarum, *Rosa moschata*, *R. involucrata* (Red data species), *Strobilanthes callosus*, *Jasminum humile*, *J. sambac*, *Dicliptera abuensis*, *Adhatoda beddomei*, and *Caesalpinia decapetala*.

Lantana camara has infested most of the area and has formed impregnable thickets.

3.1.19. Pteridophytic flora:

A number of ferns grow on these hills but because of heavy infestation of *Lantana*, they are highly threatened. Ferns that are present in moist humid pockets include: *Blechnum orientale*, *Davallia pulchra*, *Pteris quadriaurita*, *Asplenium trapeziforme*, *Phymatodes lepidotum*, *Adiantum caudatum*, *Adiantum hispidulum*, *Actinopteris dichotoma*, *Cheilanthes farinosa*, *Cheilanthes tenuifolia*, *C. aravallensis*, *Cyathea spinulosa*, *Athyrium fimbriatum*, *Asplenium varians*, *Nephrodium molle*, and *Polypodium quercifolium* (Dhondiyal, 1967, Dist. Gazetteers of Sirohi)

3.1.20. Grass:

Cymbopogon martini, *Sehima nervosum*, *Apluda mutica*, and *Heteropogon contortus*.

3.1.21. Herb:

Oxalis corniculata, *Artemisia nilagirica*, and *Tithonia rotundifolia*

3.1.22. Orchids:

Aerides crispum, *A. multiflorum*, *Vanda tessellata*, *V. testacea*, *Eulophia ochreatea*, *Habeneria digitata*, and *H.marginata*..

3.1.23. Climbers:

Celastrus paniculata, *C. stylosa*, *Hiptage benghalensis*, *Ceropegia attenuata*, *C. bulbosa*, *Ficus pumila*, and *Mucuna pruriens*.

3.1.24. Lichens:

Crustose forms of lichens are also present on rocks and tree – trunks. No scientific work on lichen flora has been undertaken in the area.

3.1.25. Exotics:

A number of exotic plant species have been introduced mainly with the object of ornamental purpose. Some of them have naturalized in the hills of Mt. Abu. Important introduced species include *Grevillea robusta*, *Eucalyptus sp.*, *Solanum seafortianum*, *Agathis robusta*, *Pinus roxburghii*, *Cedrus deodara* etc.

3.2. Status and diversity of wild animals

3.2.1. Status and diversity of wild animals:

As per classification of the Bio-geographic zones of India (Rodger and Panwar, 1988) Aravallis fall under the Semi-arid zone. They support a large variety of wild animals ranging from non-chordates to mammals. The rapid growth of human and live stock population in

the region in recent years has taken a heavy toll on the forests and wild animals of Aravallis (Annexure 13 and 14). Till about a hundred years ago these ranges provided shelter to three big cats viz. tiger, lion, and leopard. The lion is now locally extinct in Aravallis. The last authentic sighting/ hunting record of lion in Aravallis is of 1872, when a British officer obtained a skin of a lioness shot near Mt. Abu (Wild wonders of Rajasthan, 1997). Lion is now confined to the Gir Forests of Gujrat. The tiger, leopard, and their prey animals like Cheetal, Sambhar, Nilgai, Chausingha, etc are still found in the protected areas of Aravallis. Other wild animals found include Sloth bear, Wolf, Fox, Jackal, Hyena, Small Indian civet, Common Palm civet, Small Indian mongoose, Grey mongoose, Ruddy mongoose, Monitor lizard, Indian rock python etc. Pea-fowl and Grey partridge are quite common. Great Indian Bustard and Lesser florican are also found in central Aravallis. Five species of small cats viz. Caracal, Jungle cat, Fishing cat, Desert cat, and Rusty spotted cat are found in the region. The Caracal and Fishing cats are now highly endangered in the region.

Smooth Indian Otter, Ratel, and Pangolin are also found in the region but their number is getting reduced. Their survival in the region is threatened.

Out of three species of crocodiles found in India only one species, i.e. *Crocodylus palustris* (Mugger) is found in some of the water bodies of Aravallis. The region provides suitable habitat for one species of land tortoise i.e. *Geochelone elegans* (star tortoise). Both are included in the list of threatened species.

The state governments have notified a number of areas as sanctuaries and national parks to protect the wild animals. A list of Protected Areas is given in Table 9.

3.2.2. Threats to the wild animals:

Deforestation of Aravallis is causing degradation and shrinkage of the habitats. This is the main threat to their survival in the region. Poaching of animals for hide, meat, and bones etc further aggravates the situation. Inhabitants of villages adjoining the wildlife sanctuaries and national parks depend on these areas for their needs of firewood, grazing, and other forest produce. The pressure of grazing on these areas is at times heavy and even results in confrontation between the people and the wildlife staff.

3.3. Grassland Ecosystem

3.3.1. Grassland Ecosystem:

Some areas in the Aravalli eco-region especially in the central and southern Aravallis have semi savannah growth. Locally they are called "Birs" in Rajasthan. Aravallis in Haryana and Gujrat do not have such areas. The tree/ scrub growth in these areas is scattered in the grassland. The tree species found in these areas include *Anogeissus pendula*, *Prosopis cineraria*, *Acacia leucophloea*, *Prosopis juliflora*, *Acacia senegal*, along with *Balanites*

aegyptiaca, and *Ziziphus nummularia*. The scrub growth consists of *Mimosa hamata*, *Calotropis procera*, *Cassia auriculata* etc. the climbers found are *Asparagus racemosus*, *Cuscuta reflexa*, *Abrus precatorius*, and *Ventilago calyculata* etc. The grasses found are *Cenchrus ciliaris*, *Sorghum halepense*, *Apluda mutica*, *Desmostachya bipinnata*, *Dactyloctenium scindicum*, *Saccharum spontaneum*, *Aristida spp.* *Cymbopogon martini*, *Themeda quadrivalvis*, *Sehima nervosum*, and *Dicanthium caricosum*.

Some of these grasslands have an impervious 'kankar' pan underneath which does not permit growth of trees on the ground. The natural tree growth in these areas is stunted and sparse.

3.3.2. Present status of Grasslands:

Almost all the "Birs" in the Aravallis are under the control of the State Forest Department. These grasslands, because of neglect and mismanagement, are now in a badly degraded stage. The areas are overgrazed and heavily infested with *Prosopis juliflora*. Because of uncontrolled grazing during monsoon the rootstock of perennial grasses like *Cenchrus ciliaris* and *Dicanthium annulatum* is not allowed to flower and seed the area..

Unfortunately, the Forest Department did not realize the importance of these birs in the village economy . Large areas were either released for cultivation in the sixties, or were planted. Most of these plantations failed because of the hard underground pan. The only species of tree that survived was *Prosopis juliflora*. The thickets of this plant have adversely affected the growth of grasses in the area. The degradation of these area adversely affected the local villagers, pastoral communities, and wildlife particularly the grassland birds like Lesser florican, Hubara and Great Indian Bustard.

Even the Working Plan prescriptions are not followed. The areas are mostly allotted to the village Panchayats for harvesting of the grasses after the monsoon and subsequent grazing. In practice these days the Forest Department is not in a position to restrict grazing even during the monsoon. The areas are subject to uncontrolled grazing. Unpalatable weeds are therefore replacing the palatable grasses. The grasslands are loosing their productivity. The productive potential of these areas is very good and their proper management can further improve by taking local people in confidence.

3.4. Agriculture Ecosystems:

3.4.1. Agriculture Ecosystem:

One of the important components of the biodiversity is the diversity in the crop species and varieties. In Aravalli Eco-region due to evolutionary forces, gene pools were created and perpetuated with modification by natural selection by local cultivators. The "Jhakharana" variety of "Bajra" in north – eastern Aravallis in Alwar, Mahendragarh and Rewari districts, "Kamod" and "Sal Sutar" varieties of paddy and "Malan" and "Sathi" varieties of maize in

the southwestern Aravallis are a few varieties to be quoted. The farmers in Aravalli Range maintained seeds of wild and domesticated plants by their own methods and skills. Information about the traditional varieties and new varieties introduced is given below.

3.4.2. Information regarding biodiversity of crops (varieties):

Information regarding biodiversity of crops of Aravalli eco-region is given in Table 11.

Table - 11

S.No.	Crop	Traditional variety
1	Wheat	Arjun, Farmy, Tedia, Vajia, Kathia, Kanak, Gajji, Gunj, Kharchi, Katha, Kendesori, Larma Roja, Shabarmati sonara, Sonarab
2	Paddy	Kamod, Ropadi, Basmati(Local) Kolam, Kali, Kamod/Raj-Bakol, Bhog, Sutar, Sunar, Tukeri, Patheria, Teliaso, Samli, Dagar, Kajal, Mahudi, Rati sal, Batki, Sal sutar, Zeera, Hegra, Nawabi kolam, Dholi sal, pataria, Palaria, Barusal, Mahulia, Popatio, Vaddi, Panna, Kotaparmal
3	Maize	Malan, Sathi, Dholi, Sathi pilli, Dudh nogra, Farm sameri, Nani Gangdi, Nani pilli, Mo, Pilli
4	Chickpea	Dohad yellow, Kabuli, Maru (Pila Chana) Annigeri, Ujain-21, Ujjain-24
5	Urd	Khutadia, Validia, Dungia, Taliya, Bhuriya
6	Cotton	Khandwa-1, Digvijay, Devirraj, Deshi Cotton, Maly-3, Nerma
7	Pigeon pea	Kushalgarh local
8	Bajra	Jakharana, Sikary,
9	Jawar	Safed Lal, Malvi, Merta selection.
10	Jav	Modia
11	Sarso	Laturia, Lotani

During village meetings the cultivators generally expressed that although the old varieties of wheat cultivated by them earlier needed less amount of irrigation and was good in taste, the chapattis remain soft and believe it to be more nutritive and there was no requirement of artificial chemical fertilizers; only some farmyard manure was good enough. Yet, it had some inherent drawbacks. These were:

1. The yields were less.

2. The plants were very tall, and in the month of March with strong winds in the area they were susceptible to lodging.
3. These varieties are still cultivated in area where adequate irrigation facilities are not available.
4. Some cultivators mentioned that they grow it for their family consumption.

Similarly, the local variety of Bajra is considered to be good because of its taste and is very suitable for making “Khechri” (a common preparation; new variety is not considered good for this preparation). It gives good fodder and its water requirement is less in comparison to the new variety. The yield of the new variety is more than that of the local variety.

Cultivation of gram in many parts of Northern Aravallis particularly in Gurgaon and Rewari has been very adversely affected because of increased salinity in the ground water of the area. The cultivators say that the vegetative growth of the plant is good but it does not bear any fruits.

Although new varieties of barley have been developed but they also need more water. Because of shortage of water for irrigation, cultivators prefer to cultivate the local / indigenous varieties of barley.

Improved varieties of mustard are generally cultivated. New variety, with the available amount of irrigation gives good harvest. Other advantage with the improved variety is that the seed doesn't fall. Early and late, both varieties give good harvest. This crop is more remunerative and less expensive.

The improved variety of Gawar (Clusterbean) 365 and local variety, both are cultivated. This crop is easy to grow and does not need much investment. However, it is highly susceptible to damage by Nilgai or Blue-bull (*Boselaphus tragocamelus*).

The villagers also said that by use of tractors instead of bullocks, the soil results in superficial working of soil. The substratum of soil remains hard and is probably responsible for some of the soil borne diseases. The use of pesticides is increasing. In Aravalli areas of Haryana the size of holding of about 70% population is 1 ha or less. The rotation of crop and leaving field fallow are the practices that are being given up. This is resulting in the degradation of fertility of the fields.

3.4.3. Improved crop varieties Introduced in Aravallis:

New improved and high yielding variety of seeds developed for agricultural crops have been introduced in Aravalli ecoregion also. Important varieties introduced are given in Table 12.

Table - 12

Crop	Improved variety
------	------------------

Wheat	Raj-3765, Raj-3077, Raj-1482, Raj-1555, Kalyansona, Lok-1, WH-147
Barley	RD-2035, RD-2052, RD-2503, RD-2508, RD-2552, RD-31, RD-103, BL-2
Mustard	Varun, Pusa Bold, RH-30, PR-15, Bio-902
Chickpea	RSG-44, GNG-146, GNG-663, C-235, G-130, H-208, RSG-2
Pearl millet	RHB-30, RHB-90, Raj-171, HHB-60, HHB-67
Maize	Mahi Kanchan, Mahi Dhawal, Ageti-76, Ganga-2
Pigeonpea	Prabhat, Gwalior-3, T-21
Groundnut	RG-141, MA-10, M-13, RSB-87
Sorghum	CSH-6, CSH-9, CSV-10, CSV-15
Clusterbean	RGC-936, RGC-197, RGC-1003, RGC-986
Sesame	RT-46, RT-54, RT-125
Cotton	RS-875, Raj HH-16, RST-9, RG-8, Bikaneri Narma
Mungbean	RMG-62, RMG-268
Cowpea	RC-19, FS-68, C-152
Mothbean	FMM-96, RMO-40, IPCMO-912, RMO-435
Urdbean	Krisna, T-9
Paddy	Chambal BK-190, BK-79, P, Bes-1, Ratna, Jaya, 1R-64, Pusaz-21, Mahi Sugan, IET 13549, Dhan vagad, Dhan GR-17, Kalinga III

Introduction of these varieties have substantially increased the productivity of the crops. To maintain the productivity of the soil the farmers have to put in chemical fertilizers as well as farmyard manure in good quantity. A comparison of the mean crop productivity over sets of five years is shown in Table 13.

Table – 13

Crop	Crop Productivity (ka ha ⁻¹)		% Increase
	Mean of 1982-83 to 1986-87	Mean of 1995-96 to 1999-2000	
Maize	934	1029	10.2
Groundnut	694	982	41.2
Cotton	251	676	169.3
Pearl millet	298	380	27.5
Kharif Pulses	147	201	36.7
Sesame	102	115	12.7
Wheat	1820	2567	41.0
Barley	1506	1996	32.5

Mustard	784	957	22.0
Chickpea	681	702	3.1

(Source RAU-ARS, Durgapura Jaipur)

Dr. D. K. Saxena and Dr. S. M. Bhatnagar of Rajasthan Agriculture University Agriculture Research Station Jaipur, reported that in spite of introduction of these new high yielding varieties and new technologies there is a vast gap in the realizable production and the actual production in various crops. The Table 14 below highlights this difference.

Table - 14

Crop	Productivity (q ha ⁻¹)	
	Realized	Realizable
Wheat	27-28	50-60
Barley	20-21	60-70
Mustard	10-11	20-25
Chickpea	7-8	30-35
Isabgol	5-6	14-15
Coriander	6-7	11-12
Cumin	3-4	7-8
Fennel	8-9	15-16
Fenugreek	5-6	15-16
Pigeon pea	7-8	16-18
Pearl Millet	4-5	30-35
Sorghum	4-5	40-45
Maize	11-12	30-35
Clusterbean	2-3	16-18
Groundnut	9-10	20-25
Cotton	10-11	22-24
Mothbean	2-3	8-9
Cowpea	3-4	9-10
Mungbean	4-5	12-14
Sesame	1-2	6-8

(Source RAU- ARS Durgapura Jaipur)

3.4.4. Agricultural Biodiversity:

The information collected from villages indicates that 67 types of agriculture produces are cultivated in the eco-region. The Table 15 given below indicates the distribution of the produces in various parts of Aravallis.

Table - 15

S. No.	Local name of crops	Latin name	Growing status*		
			Southern Aravalli	Central Aravalli	Northern Aravalli
1	Rayda	<i>Eruca sativa</i>	++	+++	++
2	Jeera	<i>Cuminum *cyminum</i>	+	++	
3	Isabgol	<i>Plantago ovata</i>	+	+	

* +++ = Abundant, ++ = Common, + = Less common.

4	Sama	<i>Echinochloa colonum</i>	Collected from wild +		
5	Kodra	<i>Paspalum scrobiculatum</i>	+		
6	Banti		+		
7	Kuri, Kura	<i>Urochloa panicoides</i>	+	+	
8	Arbi	<i>Colocasia esculenta</i>	+		
9	Toor	<i>Cajanus cajan</i>	+++		
10	Kharbu	<i>Oryza rufipogon</i>	Grains collected from wild +		
11	Rai	<i>Brassica juncea oleracea</i>	+	+	
12	Urd	<i>Phaseolus mungo</i>	++	+	
13	Kapas	<i>Gossypium herbaceum</i>	+	+	++
14	Til	<i>Seasamum indicum</i>	++	+++	
15	Kulathi	<i>Dolichos uniflorus</i>	+	+	
16	Mung	<i>Phaseolus aureus</i>	++	++	+
17	Chawla	<i>Vigna unguiculata</i>	+	+	+
18	Ratanjyot	<i>Jatropha curcas</i>	Collected from wild +++	Collected from wild++	
19	Ramtil	<i>Guizotia abyssinica</i>	+++		
20	Ganna	<i>Saccharum officinarum</i>	+		+
21	Adrakh	<i>Zingiber officinale</i>	+		
22	Ratalu	<i>Dioscorea bulbifera</i>	+		
23	Haldi	<i>Curcuma longa</i>	+		
24	Arandi	<i>Ricinus communis</i>	++	+	
25	Piyaj	<i>Allium cepa</i>	+		+++
26	Soyabeen	<i>Glycine max</i>	+		
27	Surajmukhi	<i>Helianthus annuus</i>	+	+	
28	Kangani,	<i>Amaranathus hybrida</i>	++	+	

29	Gahun (wheat)	<i>Triticum aestivum</i>	++	++	+++
30	Makki (maize)	<i>Zea mays</i>	+++	+	+
31	Bajra	<i>Pennisetum typhoides</i>	+	++	+++
32	Jou (Barley)	<i>Hordeum vulgare</i>	+	++	+
33	Chana (Gram)	<i>Cicer areitinum</i>	+	++	+
34	Dhaniya	<i>Coriandrum sativum</i>		+	
35	Mirch	<i>Capsicum annuun</i>	+	+	+
36	Moth	<i>Phaseolus aconitifolius</i>		+	+
37	Tamator	<i>Lycopersicon esculetum</i>		+	+
38	Methi	<i>Trigonella foenumgraecum</i>		+	
39	Mehndi	<i>Lawsonia inermis</i>		++	
40	Sonf	<i>Foeniculum vulgare</i>		+	
41	Ajwain	<i>Trachyspermum ammi</i>		+	
42	Bengan	<i>Solanum melongena</i>		+	
43	Palak	<i>Spinacia oleracea</i>		+	+
44	Shakargand	<i>Ipomoea batatas</i>		+	+
45	Rijka	<i>Medicago sativa</i>	++	+	
46	Mooli	<i>Raphanus sativus</i>	+	+	+
47	Fool Gobhi	<i>Brassica oleracea botrytis</i>	+	+	+
48	Lahsun	<i>Allium Sativum</i>		+	+
49	Tambakoo	<i>Nicotiana tabacum</i>		+	+
50	Gheeya	<i>Lagenaria Siceraria</i>	+	+	+
51	Tinda	<i>Citrullus vulgains var fistulos</i>	+	+	+
52	Bhindi	<i>Abelmoschus esculentus</i>	+	+	+
53	Aloo	<i>Solanum tuberosum</i>	+	+	+

54	Sarson (Mustard)	<i>Brassica campestris</i>	+		+++
55	Mungphali	<i>Arachis hypogea</i>	++	++	+
56	Singhada	<i>Trapa natans</i>	+	+	+
57	Kamalgatta	<i>Nelumbo nucifera</i>	+	+	+
58	Jowar	<i>Sorghum miliaceum</i>	+	+	+
59	Gawar	<i>Cyamopsis tetragonoloba</i>	+	++	+++
60	San	<i>Crotalaria juncea</i>			++
61	Tarbooj	<i>Citrullus vulgaris</i>	+	+	+
62	Kharbooja	<i>Cucumis melo</i>	+	+	+
63	Phut, Kachra	<i>C. melo</i> var. <i>momordica</i>	+	+	+
64	Kakri	<i>C. melo</i> var. <i>utilissimum</i>	+	+	+
65	Khira	<i>C. sativus</i>	+	+	+
66	Torai	<i>Luffa acutangula</i>	+	+	+
67	Gajar	<i>Daucas carota</i>	+	+	++

(Data collected in the present study also see Annexure 15 and 16)

3.4.5. Principal crops of Aravalli eco-region:

Principal crops of Aravalli eco-region grown in various districts are shown in Table 16.

Table – 16

1	Pearl Millet	Jaipur, Jhunjhunu, Sikar, Alwar, Bhiwani, Rewari, Faridabad, Mahendragarh, Gurgaon, Sabarkantha, Banaskantha
2	Jowar	Ajmer, Tonk, Nagaur, Alwar, Bhilwara, Udaipur, Pali, Chittorgarh, and Bhilwara.
3	Maize	Rajsamand, Bhilwara, Chittorgarh, Udaipur, Dungarpur, Banswara, Sabarkantha, Banaskantha
4	Pigeon pea	Alwar
5	Kharif Pulses	Jaipur, Ajmer, Jhunjhunu, Sikar, Udaipur, Dungarpur, Sabarkantha, Banaskantha
6	Cotton	Ajmer, Pali, Bhilwara, Banswara, Rewari, Gurgaon
7	Groundnut	Jaipur, Chittorgarh, Bhilwara,
8	Sesame	Pali
9	Clusterbean	Sikar, Jhunjhunu, Rewari, Mahendragarh,

10	Wheat	Jaipur, Dausa, Alwar, Chittorgarh, Ajmer, Bhilwara, Bhiwani, Rewari, Faridabad, Mahendragarh, Gurgaon, Sabarkantha, Banaskantha
11	Barley	Jaipur, Dausa, Ajmer, Bhilwara, Rewari, Mahendragarh
12	Mustard	Alwar, Jhunjhunu, Pali, Jaipur, Sikar, Rewari, Mahendragarh, Gurgaon, Faridabad
13	Chickpea	Jhunjhunu, Sikar, Alwar, Bhilwara,
14	Castor	Sabarkantha, Banaskantha
15	Tuberous crop	Banswara, Chittorgarh, Dungarpur, Udaipur, Sabarkantha, Banaskantha

(Information collected in the present study, also see Annexure 15 and 16)

3.4.6. Coarse Cereals and small millets:

Coarse cereals and small millets are cultivated in Aravalli region from time immemorial. They have good genetic variability. With the overall change in agriculture scenario, emphasis on growing of small millets has decreased considerably. The coarse cereals, particularly Maize and Bajara, still continue as staple food in large tracks of the eco-region. Similarly small millets namely finger millet (*Eleusine coracana*), Fox-tail millet (*Setaria italica*), Kodo millet (*Paspalum scrobiculatum*), Proso millet (*Panicum miliaceum*), Banyard millet (*Echinochloa frumentacea*) and Little millet (*Panicum miliare*) are grown in southern Aravallis for food by tribals in Chittorgarh, Udaipur, Banswara, Dungarpur, Sirohi, Sabarkantha and Banaskantha districts. These are considered as famine food of the region. Out of these six small millets, the finger millet 'Ragi' occupies a pride position and it is among indispensable component of dry land farming. The fodder of this crop is also useful. The flour of finger millet provides good proteins, minerals and essential vitamins. Fox-tailed millet locally called, as *Kangani* is cultivated in southern Aravallis. Besides the seeds, the crop also provides fodder for animals. It is an early maturing, drought resistant crop. It can be stored for a long time without fear of any insect pest attack on seed. The flour is used for making chapattis. The raw seeds are boiled and eaten like rice or also in form of porridge. Agriculture University Udaipur has developed an improved variety SR-11 of Finger millet. Some varieties contain high percentage of iron in their seeds. When eaten as staple food, these can provide sufficient amount of thiamine, riboflavin, and niacin. Kodo millet is highly drought resistant crop and grows in very poor and light soils. It is grown as a pure crop as well as mixed with other crops. The grain is very coarse with a horny seed coat, which is removed before cooking. The de-husked grain is cooked like rice or made into flour for porridge or chapattis.

Common millet is quick maturing, highly drought resistant grain crop, often grown during famine and scarcities. This is grown on poor soils as an un-irrigated crop, which matures in 90-100 days. The husk forms about 35% of the grain yield and the husked grain is cooked and eaten or used for making chapattis. The straw is somewhat coarse but is used as fodder for cattle in emergency.

Banyard millet closely resembles to a weed commonly found in dry lands and in rice fields. It is capable of withstanding both drought as well as water logging. The crop is quick growing, robust, tufted annual grass grown in Kharif season. When the crop is ripe it is cut and stacked in the field for a week before threshing. The threshability of the grain is quite good. The fodder of the crop is poor in nutritional quality.

Cultivation of these crops is rapidly going down. This reduction in area is because of number of factors like:

1. There is a marked change in food habits of the tribal people. Use of small millets has decreased considerably. Maize and wheat are now preferred cereals.
2. Less remunerative market, because it is consumed by local tribal population only.
3. Cultivation of cereals, other than small millets, gives the tribal farmers better barter opportunities and bargaining power. The fodder produced is also more in case of maize and other cereals in comparison to the small millets.
4. Construction of water reservoirs in the Aravallis has made more water available for irrigation. This is influencing the cropping pattern. Cultivation of wheat, paddy and cash crops like ginger, *Arbi*, *Ratalu*, turmeric, etc is increasing in tribal areas of southern Aravallis.
5. Non-availability of good quality/ improved seeds of the small millets has adversely affected their cultivation. Agricultural Universities and Agriculture Department have not paid any attention for improvement of the seeds of these millets. No work has been done to improve the agricultural practices of these millets. The entire attention is on wheat, paddy, maize, and pulses.

The area under these crops is now shifted for cultivating pulses, soya bean, paddy, maize, and other more remunerative crops, which have higher water requirements.

The entire Aravalli eco-region is more prone to famines. These crops are drought tolerant and can survive droughts. These crops are therefore indispensable for dry lands and hill agriculture. To protect them from extinction and maintain their biodiversity efforts should be made to preserve maximum germplasm of local types. Because of their use in preparation of fortified foods, its use for the development of a food industry should also be explored / promoted.

The Govt. could provide incentives to production of small millets by procuring them on good support prices. The state and central governments do not provide any support price for small millets. More production of small millets does not mean more money to the cultivators. This year (2001 KHARIF) there was bumper harvest of Bajra. However, in absence of good market and storage capacity of the cultivators the prices fell sharply. The cultivators had to sell their produce at almost half the normal price. The Food Corporation of India did some nominal purchase but it was too late and too little. The state government did not purchase even a grain of Bajra.

3.4.7. Fruits (wild and cultivated):

Besides cultivated fruits, a number of wild fruits having good food and economic value grow in the forests of the region. Some of the important fruits of the region are:

- **Mango:** Occurs naturally in the southwestern hills of the Aravallis particularly in Mt. Abu area. It is widely cultivated throughout the eco-region.
- **Jamun:** Two species of *Syzygium* namely *S. heyneanum* and *S. jambos* occur naturally in riverine parts in the southern Aravallis. The variety *S. cumini* is cultivated throughout the eco-region. Its fruit is much valued for its taste and medicinal values.
- **Khajur (*Phoenix sylvestris*):** It occurs almost throughout the Aravallis but it is concentrated mostly in southern Aravallis where its fruit is collected during summer season. The tribals also sell the fruit in local market. The *Phoenix* fruit (Khajur) is dried and stored. The cultivators use it as nutritive sweet fruit while doing agricultural works in their maize crop during monsoon. In Mt. Abu, Khajur trees are tapped for extract of “*Neera*”, a sweet liquid that oozes out from fresh cuts made in the tree and is collected in earthen pots. Excessive tapping of trees for “*Neera*” results in death of the trees.
- **Karonda:** Two species of *Carissa* are found in the region. *C. spinarum* is the wild variety that grows in southern Aravalli whereas the variety *C. congesta* is cultivated throughout the eco-region for its fruit. The fruits of wild variety are collected in very large quantity in southern Aravallis and are consumed locally and sold in market also.
- **Sitaphal (Custard apple)-*Annona squamosa*:** Sitaphal occurs naturally in the southern region of Aravallis. In some degraded areas near habitations it occurs as a gregarious species. The pulp is sweet and nutritive. The fruits collected from the wild are sold in local market and are also consumed.

- **Ber (*Ziziphus mauritiana*):** Ber occurs naturally throughout Aravalli region. It is also cultivated as a fruit crop. A number of varieties have been developed for commercial purposes. These include gola, sev, choumu, mudia, umrain, etc. The fresh as well as dried fruits are sold locally and sent to far off places like Bengal and Assam. Ber is a useful food for wild ungulates and birds of the Aravallis eco-region.
- **Aonwla (*Emblica officinalis*):** Aonwla is an important fruit plant of Aravalli especially of central and southern parts. Although the size of wild variety is small, yet the quantity of fruit produced is very large. The fruit is used in Ayurvedic medicines especially in manufacture of 'triphala' and 'chawanprash'. Cultivated varieties have been developed with large size and massive pulp. They are mostly used for 'murabba' purpose. Commercial orchards for aonwla cultivation are coming up throughout the region.
- **Kair (*Capparis decidua*):** This is very widely distributed throughout Aravallis. The shrub *Capparis decidua* is named after its fruit kair. The fruit is a small berry and is used for preparing pickles. The dry fruits are preserved and used as a vegetable to be cooked later. The nutritional and medicinal values associated with this fruit are high. The studies have shown that this fruit is rich in crude protein, crude fiber, iron, Zinc, Manganese, and Copper. These properties remain unaffected during processing of the fruit. No scientific study for the improvement of fruit, its propagation, harvesting, and processing are undertaken. These need some attention.

The Kair shrub is an important roosting site for local and migratory small birds. Wild ungulates and birds eat the fruit. In highly degraded areas it provides shelter to small mammals from the scorching summer sun.

Other important fruits occurring naturally / cultivated in the region along with their present availability trends are given in Table 17.

Table – 17.

Name of fruit	Trend
Amrood – <i>Psidium guajava</i> ,	C, +
Gonda – <i>Cordia dichotoma</i>	=
Gondi – <i>Cordia gharaf</i>	=
Timru – <i>Diospyros melanoxylon</i>	-
Tamarind – <i>Tamarindus indica</i>	=
Mahuwa – <i>Madhuca indica</i>	=
Piloo – <i>Salvadora persica</i>	=

Gangeran – <i>Grewia tenax</i>	-
Kaith – <i>Feronia limonia</i>	=
Bel – <i>Aegle marmelos</i>	=
Sangri – <i>Prosopis cineraria</i>	-
Dansan – <i>Rhus mysurensis</i>	-
Banana – <i>Musa paradisiaca</i>	C, +
Wild Banana – <i>Ensete superbum</i>	=
Kakar – <i>Flacourtia indica</i>	=
Papaya – <i>Carica papaya</i>	C, +
Falsa – <i>Grewia asiatica</i>	C, =
Bad – <i>Ficus benghalensis</i>	=
Anjir – <i>Ficus carica</i>	=
Goolar – <i>Ficus glomerata</i>	-
Nimbu – <i>Citrus lemon</i>	C, +
Maha nimbu – <i>C. grandis</i>	C, +

* C cultivated, = stable, - decreasing, + increasing

The Forest Departments in the region, during last fifteen years, have also planted species like Mahua, Aonwla, Sitaphal, Mango, Jamun Bel, Keith, Ber, Bad, Gouda etc. on a large scale along with their normal forest species in the forest plantations.

The fruits have local markets only. Recently some rich farmers have started planting Nimbu and Aonwla on commercial scale. The fruits as such are sold in the nearby markets without any processing.

3.4.8. Condiments and spices:

In Aravallis, Fenugreek (*Trigonella foenumgraecum*), Red chilies (*Capsicum annum*), Turmeric (*Curcuma longa*), and Ginger (*Zingiber officinale*) are cultivated on commercial scale in central and southern regions

3.5. Agro-climatic Zones:

On the basis of climatic conditions prevailing in the area and the agriculture produce, the Aravallis can be divided into the following five agro-climatic Zones:

- **Transition plain of inland drainage, (Nagaur, Sikar, Jhunjhunu, parts of Mahendragarh and Bhiwani).**

The areas are covered with sand dunes and inter-dunal sandy plains. Drainage is not well developed and streams that flow in rainy season disappear in sandy fields after covering some distance. bajra, sesame, and Kharif pulses are the main crops

of rainy season. wheat, barley, mustard, and gram are grown as irrigated crops or on conserved soil moisture during Rabi.

- **Flood prone eastern plain, (part of Alwar, Gurgaon, Rewari, Faridabad):**

The region has a rich alluvial soil that is replenished annually by floodwater. In periods of heavy rainfall, the rivers overflow their banks and inundate submerging the area. The annual rainfall is about 750 mm. The region produces bajara, sorghum (Jowar), maize, sugarcane, sesame, and a variety of pulses in Kharif season while wheat, barley, gram, and mustard are cultivated during Rabi season.

- **Semi-arid eastern Plain (Jaipur, Dausa, Tonk, Ajmer):**

Annual rainfall of the region varies from 50-60 cm. bajara and pulses are sown in Kharif season and barley, wheat, gram and mustard in Rabi season. The productivity is reasonably good.

- **Transitional plain of Luni Basin (Nagaur, Pali, Jalore & parts of Sirohi):**

Annual rainfall is about 50cm. The area produces bajara, maize, gawar, sesame, and pulse in the Kharif season. In the Rabi season wheat, barley and mustard are cultivated in irrigated areas.

- **Sub-humid southern plains and the Aravallis hills (Bhilwara, Rajsamand, Udaipur, parts of Sirohi, Banaskantha, Sabarkantha):**

Annual rainfall varies from 50-95cms. There are a number of surface water streams like Ghambhiri, Sabarmati, Banas and their tributaries but they are all ephemeral. The area produces maize as the chief food crop of Kharif season. However, paddy is also grown in some areas. In Rabi, sesame, wheat, gram, and oil seeds are main crops.

- **Humid southern plains (Banswara, Dungarpur):**

The area has an average rainfall 70-75 cm / year. maize, sorghum and Paddy are main food crop of Kharif season. groundnut, wheat, mustard, sesamum, and rapeseed are also grown.

3.6. Status and diversity of domesticated animals:

Domestic animals make a major contribution of the economy of the people of Aravallis. They not only provide the drought power but also provide valuable manure for the agricultural fields and food for the people in form of milk, milk products, & meat. Even the dead animals are useful because they provide skins & hides. "Gurjar" and "Rebari" communities living in the Aravallis keep large number of animals like cows, buffaloes, sheep, goats, and camels. They generally sell the animal products like milk and *ghee*. Goats and sheep are sold to the traders.

Although there are some good indigenous breeds of cattle in the region but by and large, **people generally maintain large number of unproductive cattle of nondescript breed that does not need much care.**

Some of the indigenous breeds of animals found in the Aravalli region are much prized for their sturdiness, heat tolerance, diseases resistance and for thriving in adverse habitat conditions.

The important breeds of the region are:

3.6.1. Cow:

Important **breeds of cows** found in the Aravallis are: -

- (i) Haryana,
- (ii) Mewati,
- (iii) Gir,
- (iv) Kankrej,
- (v) Malvi,
- (vi) Nagori,

Haryana breed is mainly found in Northern Aravallis and parts of central Aravallis. This is a double purpose animal. The cows possess good milk strain and the males make good drought cattle. The raised head makes it look stubborn and majestic. The face is long and pointed and the forehead is flat. A perceptibly raised bone, in the middle of forehead is the characteristic sign of the breed. Nostrils are broad and black. Eyes are big and shining. Ears are comparatively small and have a slight drop. Horns are 10 to 20 cm long and shapely. They are almost straight when small but slope inwards when grown in size.

Mewati breed is found in northern Aravallis. They are valued as dual-purpose cattle and for heavy plough and carting. They are mostly white in colour with a dark head. The cows give fairly good quantity of milk. The Mewat cattle show 'Gir' characteristics but also bear some resemblance to Haryana breed, indicating a mixture. They have long pointed face and raised forehead. The horns growing from the outer corners of the head with their points turned back is the principal identification mark of the breed.

Gir breed is from central Aravallis. It is a dual-purpose animal but is mostly preferred for dairying. Its milk strain is considerably higher than other breeds of Aravalli like Haryana and Malvi. Average milk yield being 5.5 kg. to 9 kg. per diem. Locally it is also called "Ajmera" or "Renda". It is hardy and a good tolerant of heat. The most characteristic feature of the Gir cattle is its good forehead which often goes deep into the head and covers the eyes so as to make them look like closed. The animal thus gives the impression

of being in a perpetual slumber. The horns have a peculiar shape. Originating from the fringe of the forehead, they slope down or backwards first, go forward after a slight rise and then form a concave curve. They are pointed at end.

Kankrej This breed is found in parts of central / southern Aravallis. It is a dual-purpose breed, cows giving plentiful milk and bulls good for drought purposes. The average yield of milk from a cow of this breed is 4.5 kg to 9 kg per diem, while the bullocks are renowned for pulling heavy weights and prove very useful for cultivating heavy types of soil. The average weight of a Kankrej animal is between 360 to 410 kg .The animals are mostly black, gray, and light gray colored.

Malvi cattle are found in southern Aravallis. It is hardy and strong animal, a draught breed, very useful for pulling heavy weight and for cultivation in strong soils. Malvi breeds have two types of animals the large ones and the small ones called Bari-Malvi and Choti- Malvi. Choti-Malvi breed is more common in southern Aravallis.

Nagori breed is found in central Aravallis. It is a purely drought breed. The bullocks are regarded, as the best is the whole of India for all kinds of agricultural operations. They have great stamina and surefootedness in work on medium heavy soils or in pulling heavy weight. Being leggy, they are very good fast trotters. They are famous for their speed in carts and raths.

3.6.2. Buffalos:

Breeds of buffalos found in the Aravallis are: -

- (i) Murrah,
- (ii) Surti, and Mehsana

Murrah: The people almost throughout the Aravallis eco-region keep Murrah buffalos. This breed is considered to be the best milk yielding variety of India. The animals of this breed have characteristically curled horns and have massive and stocky built with deep frame and short massive limbs. The average milk yield is about 11 kg per diem, which some time goes up to 14 kg. The fat content is high (about 7 %). The male animal is placid, docile, and slow worker but is powerful for heavy cartloads.

Surti and Mehsana buffaloes are of medium size. Although the milk yield of these animals is not high but they are reared in southern Aravallis in Udaipur, Dungarpur, Banaskantha, and Sabarkantha districts. These have adapted well to the agro-geo climatic conditions of the region.

3.6.3 Goats:

Goats are reared for milk, meat, and hides. Some of the goat breeds give high yield of milk. These animals, because of their ability to survive on meager quantities of fodder, are reared all over the Aravallis range. The animals graze in forest areas and cause substantial damage to the natural vegetation of the area especially to the natural regeneration of the forests. The important breeds of goats found in Aravalli eco-region are:

- (i) Jakharana
- (ii) Marwari
- (iii) Sirohi.

Jakharana:

This breed is found in northern Aravallis near the village Jakharana in Alwar district. The breed is named after the village where it is found. The milk yield of this goat is very high and goes up to 8 kg milk per day. The goat is black in colour with white spots around its eyes, face and ears. The milk yield of this breed decreases as one moves away from this village.

Marwari:

Marwari goat is found in central Aravallis. This is a breed for mutton. Marwari goats have long coats all over the body with poorly developed udders and are much heavier than the other breeds.

Sirohi:

This breed of goat gets its name from Sirohi district of Rajasthan. It is mainly a goat for milk. It is medium sized goat with thin, smooth, clean, pliable skin, small ears and stunted horns with bay or the chestnut as the predominant colour. The average milk yield varies between 2-3 kg per day. Teats are long and hanging.

With increase in the fodder availability because of large scale plantation programme in Aravallis particularly in Rajasthan quite a number of villagers have sold of their goats and in turn have purchased Cows/Bufalos.

3.6.4. Sheep:

Sheep rearing is an important occupation of the cultivators in single crop areas of Aravallis, since they are engaged in agricultural occupation for only about four months in a year. Sheep and wool thus contributes substantially to the economy.

A number of varieties of sheep are reared in the region. The important breeds found in the region are: -

- (i)Chokla,

- (ii) Marwari,
- (iii) Nali,
- (iv) Sonadi
- (v) Malpura.

Chokla:

This sheep is light or medium in weight. Dark brown or black patches that are considered as distinctive breed characteristics mark brown face. The tails and ears are of medium length. It produces good quality carpet wool. The ewes weigh between 20-32 kg and ram weigh between 30-40 kg. It is distributed in northern Aravallis.

Marwari:

This sheep has a black face and stocky built with medium or short tail and ears. The breed is hardly thrifty and disease resistant. The body weight of ewes & rams is the same as that of chokla. The quality of wool is coarse. This breed is mainly confined to northern and central Aravallis.

Nali:

Nali sheep is a brown-faced animal with medium to long leafy ears. It has a big sized body with good depth. Short legs and yellow hooves. The tail is long, tapering. The body weight of ewes varies from 30 to 35 kg and that of ram between 32 to 40 kg. The wool is very greasy and the quality is medium to coarse. It is generally stained yellow. It is a breed of northern part of Aravallis.

Sonadi:

Sonadi sheep have long well built body with white or light brown faces. The colour often extends to neck and limbs. Long bare legs, long tail and long ears that trail on the ground while grazing are the characteristic features of this breed. The wool is of coarse quality. This breed is distributed in southern Aravallis

Malpura:

The sheep of this breed have long well built body with white or light brown faces, colour often extending to the neck and the limbs. They have long bare legs, medium to long trails and small ears. The wool produced is very coarse and is suitable for manufacture of *namdass* and small carpets. This breed is distributed in northern and central Aravallis.

3.6.5. Camel:

Camel is used for transport of man and material in remote areas of Aravallis. It is also used for pulling of specially designed camel-carts in rural areas. In central and southern Aravalli region, "Rebaris" breed camels in good number. This provides them with good income "Grazing" by the herds of camels in forest areas of Aravallis causes extensive damage to the forests.

3.6.6. Poultry:

Local non-descript breed of birds, desi-murghi are reared in small numbers for domestic consumption all over the Aravallis eco-region. However, large numbers of poultry-estates have now come up around big cities. The white leghorn is the popular exotic breed for layers.

3.6.7. Fisheries:

Central and southern Aravallis have a number of streams and tanks that support a good number of species of fishes. Some common species are mentioned in Table – 18.

Table - 18

S. No.	Local Name	Latin Name
1	Patola	<i>Notopterus notopterus</i>
2	Silver Chal	<i>Oxygaster bacaila</i>
3	Chal	<i>O. bacaila</i>
4	Galaar	<i>Barilius bola</i>
5	Galva	<i>Barilivs bendelisis</i>
6	Chadla	<i>Danio devario</i>
7	Zebra	<i>Rasbora daniconius</i>
8	Malwa	<i>Amblypharyngodon mola</i>
9	Catla	<i>Catla catla</i>
10	Narein	<i>Cirrhinus mrigala</i>
11	Reba	'C' Reba
12	Pathar Chatta	<i>Garra gotyla</i>
13	Rohu	<i>Labeo rohita</i>
14	Sarsi	<i>L. gonius</i>
15	Dudhia	<i>L. boggut</i>
16	Kallaunt	<i>L. calbasu</i>
17	Mamol	<i>L. fimbriatus</i>
18	Bata	<i>L. bata</i>
19	Puthi	<i>Puntius sophore</i>
20	Puthi	<i>P. ticto</i>
21	Kharata	<i>P. sarana</i>
22	Mahaseer	<i>Tor tor</i>
23	Baam	<i>Mastacembelus armatus</i>
24	Katav / katar	<i>Mystus cavasius</i>

25	Pitar	<i>M. aor</i>
26	Singara	<i>M. seenghala</i>
27	Lanchi	<i>Wallago attu</i>
28	Suya	<i>Xenentodon cancila</i>
29	Sanwal	<i>Channa marulius</i>
30	Ghirhi	<i>C. punctatus</i>
31	Kabra	<i>C. striatus</i>
32	Baam	<i>Mastacembelus armatus</i>
33	Sisa	<i>Ambassis nama</i>

Under the fisheries development scheme of Govt. a number of exotic fishes have been introduced in these water bodies without proper consideration of the requirement of indigenous fishes. In Jaisamand Lake in southern Aravallis, one species of exotic fish *Tilapia mossambica* was introduced. This introduction has adversely affected the local species. It now forms about 80 % of the fish population of the lake (estimate by local fishermen). Survival of indigenous fishes that are considered tastier and fetch higher prices in the market is threatened. The situation cannot be controlled now.

3.7. Aquatic ecosystem:

Wetlands have been defined as " areas of submerged or water saturated lands, both natural or artificial, permanent or temporary, with water i.e. static or flowing, fresh or brackish, or salty including area of marine water, the depth of which at low tide does not exceed six meters" (IUCN 1971). A good diversity of aquatic habitats are present in the Aravallis. It has both lentic and lotic aquatic habitats.

The range of lotic habitat spans from large semi-perennial and ephemeral rivers to the small streams and nullahs. The period of flow of many rivers is decreasing day by day.

The lentic habitats range from large deep reservoirs to small village ponds.

Aquatic eco-system can be divided into two categories i.e. Natural and Manmade.

3.7.1. Natural aquatic habitats

3.7.1. 1. Rivers and streams

A number of rivers originate from Aravalli hills. A list of important rivers originating from Aravallis is given in Table 3

Deforestation and degradation of forest cover over Aravalli hills is causing soil erosion and is adversely affecting the flow of water in the river. The period of water flow, in most of the rivers is getting reduced. In many cases, the flow of water in the rivers ceases with the end of monsoon. This in turn is affecting the flora and fauna of the ecosystem.

3.7.1.2. Natural lakes:

Sambhar lake (Rajasthan), is one of the important natural lakes of India. This lake spreads over about 90 sq.km. This lake is caused by inland drainage of two small rivers viz. Rupangarh and Mendha that drain into it. The water of the lake is highly saline and is used for production of salt on commercial scale. It is a **Ramsar** site and supports a large population of flamingoes and other migratory water fowls.

3.7.1.3. Man-made aquatic habitats:

3.7.1.4. Fresh water-bodies:

A good number of fresh water bodies and wetlands are scattered all over the Aravallis. They are very rich in biodiversity and support a number of species of plants and fishes of economic importance. They also support a large number of migratory and local water birds every year. A list of important water bodies has been given in Table 4.

3.7.1.5. Paddy fields:

Many low-lying pockets in southern Aravallis are used for paddy cultivation. The districts of Udaipur, Rajsamand, Banswara, Dungarpur (all in Rajasthan) , Sabarkantha, and Banaskantha (both in Gujrat) have paddy growing areas. Paddy fields provide good breeding sites to a number of amphibians in the region. These paddy fields are mostly rain fed where irrigation is hardly done.

3.7.1.6. Fish-ponds:

A large number of fishponds created by the Fisheries Departments are spread over the Aravalli ecoregion. Important among them are near Jaisamand (Alwar), Jamua Ramgarh (Jaipur), Sainthal sagar (Dausa), Rajsamand, Jaisamand (Udaipur) etc. These provide suitable habitats for aquatic plants and animals.

3.7.1.7. Village ponds / step-wells:

Almost every village in the Aravallis has a large or small pond located generally at the outskirts of the village. They are sources for drinking water for cattle and also human population. In some localities, step-wells have been constructed for this purpose. The walls of step-wells support a variety of lithophytic plants such as *Ficus carica*, *Lindenbergia indica*, *Woodfordia fruticosa*, *Indoneesiella echioides*, etc. They also provide shelter to a number of species of animals like Rock pigeon, Dusky crag martin, Swallows, Bank myna, fresh water snakes, and frogs etc.

3.7.2. Threats to aquatic habitats:

Aquatic habitats are under pressure everywhere and Aravallis are no exception. Disposal of treated and untreated domestic sewage and industrial effluents, runoff from agricultural fields and degraded lands, atmospheric fallout, and man's recreational activities contribute

large amount of inorganic nutrients, organic matter, silt and a variety of organic and inorganic toxic substances to the water bodies.

Main threats to the existence of the aquatic ecosystems may be categorized as;

- Siltation
- Drainage of pesticides from agricultural fields.
- Infestation by noxious exotic weeds like Water hyacinth.
- Pollution from industries and towns
- Decreased inflow of water into the wetlands.
- Encroachment on the bed and banks.
- Mining in the catchment areas.

3.7.3. Aquatic plants diversity of Aravallis:

During rainy season, numerous streams, and rivers flow in Aravallis. Water also accumulates in some depressions forming puddles, pools, and lakes. Large and small artificial lakes and tanks have been built to meet the requirements of drinking water for people living in the region. All these water bodies harbour a variety of aquatic vegetation. People living in the vicinity of these water bodies use the aquatic vegetation for various purposes. Some of the uses are mentioned in Table 19.

Table – 19

Part use	Purpose of use	Species commonly used
Seed	Food	<i>Echinochloa colonum</i> , <i>E. crus-galli</i> , <i>Hygroryza aristata</i> , <i>Euryale ferox</i>
Tuber	Food	<i>Cyperus bulbosus</i> , <i>Scirpus grossus</i>
Whole plant	Food	<i>Nymphaea nauchali</i> , <i>Rorippa indica</i>
Fruits	Food	<i>Trapa natans</i> , <i>Ottelia alismoides</i>
Leaves	Food	<i>Veronica anagallis aquatica</i>
Whole plant	Fodder	<i>Aeschynomene indica</i> , <i>Coix lacryma-jobi</i> , <i>Echinochloa colona</i> , <i>E. crus-galli</i> , <i>Hygroryza aristata</i>
Culms, leaves stem etc.	Rope	<i>Desmostachya bipinnata</i> , <i>Pandanus odoratissimus</i> , <i>Rotula aquatica</i> , <i>Sesbania bispinosa</i> , <i>Typha elephantina</i> , <i>T. angustata</i>
Stem, branches, leaves etc.	Basket & mat	<i>Arundo donax</i> , <i>Phragmites karka</i> , <i>Salix tetrasperma</i> , <i>Typha elephantina</i> , <i>T. angustata</i> , <i>Vitex negundo</i>
Leaves	Thatching	<i>Desmostachya bipinnata</i> , <i>Typha angustata</i> , <i>T. elephantina</i>
Culms	Furniture, Musical instruments	<i>Phragmites karka</i> , <i>Arundo donax</i> , <i>Phragmites karka</i>
Leaves	Medicine	<i>Bacopa monnieri</i> , <i>Centella asiatica</i> , <i>Eclipta alba</i>

Plant species vary with the water conditions. Plants commonly associated with flowing, stagnant, and saline water in Aravalli region are listed in Table 20.

Table – 20

S. No.	Nature	Important plants
1	Free floating (Planktons)	<i>Lemma sp. Wolffia sp. Azolla sp.</i>
2	Submerged but not anchored	<i>Ceratophyllum demersus, Potamogeton crispus</i>
3	Submerged but anchored through roots	<i>Vallisneria, Hydrilla verticillata</i>
4	With floating leaves but anchored	<i>Nymphaea nauchali, Trapa natans.</i>
5	Anchored and emergent	<i>Sagittaria sp. Oryza rufipogon, Monochoria vaginalis, M. hastata</i>
6	Reeds swamps	<i>Phragmites karka, Typha angustata, T. elephantina, Arundo donax</i>
7	The dry phase plants	<i>Echinochloa colonum, E. crus-galli, Phoenix sylvestris</i>

(Pareek, A., 1988)

Apart from these, a number of plants occurring in saline water are also found in Aravallis region e.g. *Salsola foetida, Suaeda fruticosa, Haloxylon recurvum*, etc.

3.7.4. Aquatic fauna of Aravalli wetlands:

Wide range of aquatic/wet habitat loving fauna, starting from lower group (Annexure 19 and 20) to mammalia is found in the water bodies/wetlands of the region. These include freshwater sponges, leeches, water mites, crustaceans, molluscs, fishes, amphibians, reptiles, birds, and mammals. Important taxa are mentioned in Table 21.

Table - 21

Group	Species
Poriphera	<i>Eunapius carteri, Correspongilla sp., Dosilia sp., Ephyditia sp. etc.</i>
Annelida	<i>Metaphire posthuma, Hirudinaria granulose, Aporrectodea calginosa, Eutyphoeus waltoni etc.</i>
Arthropoda	<i>Eretes sticticus, Guigrotus flammulatus, G. penjabensis, G. pusillus, Herophydrus musicus, Hydaticus fabricii, Hyphoporus kempii, Laccophilus flexuosus, L. parvulus, L. sharpi etc.</i>
Mollusca	<i>Unio sp., Lymnaea (Pseudosuccinia) acuminata f. typica, Gyraulux</i>

	<i>convexiusculus</i> , <i>Macrochlamys indica</i> , <i>Indoplanorbis indica</i> , <i>Gabbia orcula</i> var. <i>producta</i> , <i>Thiara (Melanoides) tuberculata</i> , <i>Bellamya benghalensis</i> , <i>Pila globosa</i> etc.
Fishes	Please see Table 18.
Amphibia	<i>Occidozyga cyanophlyctis</i> , <i>O. hexadactyla</i> , <i>Limnonectes limnocharis</i> , <i>Tomopterna breviceps</i> , <i>Hoplobatrachus tigerina</i> , <i>Bufo melanostictus</i> , <i>B. andersoni</i> , <i>Microhyla ornata</i> , <i>Uperodon systema</i> etc.
Reptilia	<i>Crocodylus palustris</i> , <i>Kachuga tecta</i> , <i>Lissemys punctata</i> , <i>Trionyx gangeticus</i> , <i>Xenochrophis piscator</i> etc.
Birds	<i>Podiceps ruficollis</i> , <i>Pelecanus onocrotalus</i> , <i>P. philippensis</i> , <i>P. crispus</i> , <i>Phalacrocorax carbo</i> , <i>P. fuscicollis</i> , <i>P. niger</i> , <i>Anhinga rufa</i> , <i>Egretta garzetta</i> , <i>E. alba</i> , <i>E. intermedia</i> , <i>Ardea purpurea</i> , <i>A. cinerea</i> , <i>Bubulcus ibis</i> , <i>Ardeola grayii</i> , <i>Nycticorax nycticorax</i> , <i>Dupetor flavicollis</i> , <i>Botaurus stellaris</i> , <i>Mycteria leucocephalus</i> , <i>Ciconia episcopus</i> , <i>Anastomus oscitanus</i> , <i>Ephippiorhynchus asiaticus</i> , <i>Threskiornis melanocephala</i> , <i>Pseudibis papillosa</i> , <i>Plegadis falcinellus</i> , <i>Platalea leucorodia</i> , <i>Phoenicopterus roseus</i> , <i>Anser anser</i> , <i>A. albifrons</i> , <i>A. indicus</i> , <i>Dendrocygna javanica</i> , <i>D. bicolor</i> , <i>Marmaronetta angustirostris</i> , <i>Tadorna ferruginea</i> , <i>T. tadorna</i> , <i>Anas acuta</i> , <i>A. crecca</i> , <i>A. formosa</i> , <i>A. poecilorhyncha</i> , <i>A. platyrhynchos</i> , <i>A. strepera</i> , <i>A. penelope</i> , <i>A. querquedula</i> , <i>A. clypeata</i> , <i>Aythya ferina</i> , <i>A. nyroca</i> , <i>A. fuligula</i> , <i>Nettapus coromandelianus</i> , <i>Netta rufina</i> , <i>Sarkidiornis melanotus</i> , <i>Grus grus</i> , <i>G. antigone</i> , <i>Rallus aquaticus</i> , <i>Porzana pusilla</i> , <i>P. porzana</i> , <i>P. fuscus</i> , <i>Amaurornis akool</i> , <i>A. phoenicurus</i> , <i>Gallicrex cinerea</i> , <i>Gallinula chloropus</i> , <i>Porphyrio porphyrio</i> , <i>Fulica atra</i> , <i>Hydrophasianus chirurgus</i> , <i>Metopidius indicus</i> , <i>Vanellus indicus</i> , <i>V. malabaricus</i> , <i>Pluvialis squatarola</i> , <i>Charadrius dubius</i> , <i>C. alexandrinus</i> , <i>Limosa limosa</i> , <i>Numenius arquata</i> , <i>Tringa erythropus</i> , <i>T. tetanus</i> , <i>T. stagnapillie</i> , <i>T. nebularia</i> , <i>T. ochropus</i> , <i>T. glareola</i> , <i>Actitis hypoleucos</i> , <i>Gallinago stenura</i> , <i>G. gallinago</i> , <i>Calidris minuta</i> , <i>Philomachus pugnax</i> , <i>Rostratula benghalensis</i> , <i>Himantopus himantopus</i> , <i>Recurvirostra avosetta</i> , <i>Sterna aurantia</i> , <i>Chlidonias hybridus</i> , <i>Rynchops albicollis</i> etc. (Annexure 21)
Mammals	<i>Lutra perspicillata</i> , <i>Felis viverrina</i> (Probably present in Silised-Alwar and Jaisamand-Udaipur.)

(Reviving Wetlands, 1998, Himanshu publications, Udaipur, New Delhi).

CHAPTER 4

STATEMENT OF PROBLEMS RELATED TO BIODIVERSITY

4.1. Wild Biodiversity:

4.1.1. Forests:

Main reasons for degradation of the biodiversity in the forest areas are as under:

- (i) Increase in human population has enhanced the demand of land for expansion of cities and agriculture.
- (ii) Regularization of encroachments on forestlands induces further encroachments.
- (iii) Increase in population of useless cattle in the region, because of free grazing of cattle in state forests. The grazing pressure is much more than the carrying capacity of the forests.
- (iv) All forest areas in the region are overgrazed, affecting the natural regeneration of the forests. Regeneration even in the felled coupes was adversely affected because of overgrazing.
- (v) Exotics like *Lantana*, *Xanthium strumarium*, *Parthenium*, that have crept into wild are hindering natural regeneration of native species.
- (vi) Excessive tapping of Khajur (*Phoenix sylvestris*) trees for extraction of "Neera" in and around Mt. Abu is resulting in death of these trees. A large number of honeybees also get killed daily in the process. Death of honeybees in large numbers is also effecting the production of honey in Mt. Abu. It may also in future effect the regeneration of trees that depend upon the bees for pollination.
- (vii) Degeneration of traditional social values for protection of "Orans" and totem trees.

- (viii) Politicization of Panchayats that control the community-lands has eroded moral and social authority of village elders..
- (ix) Mining of minerals, sandstone, and marble. This adversely affected the vegetation and water sources of the area.
- (x) Excessive selective felling of tree species of commercial value. like *Acacia catechu*, *Dalbergia latifolia*, etc., and over exploitation of medicinal plants like *Chlorophytum borivillianum*, *Eulophia ochreata*, etc.
- (xi) Selective felling of trees by the Concessionist affected the composition and the density of the forests.
- (xii) The Forest Departments planted *Prosopis juliflora* in grass birs and degraded forests.
- (xiii) Construction of large irrigation dams resulted in submergence of forestlands.
- (xiv) Large chunks of forests were released for rehabilitation of the oustees of the areas that came under submergence.
- (xv) Increase in demand of timber and fuel-wood of the ever growing cities resulted in more felling of trees.
- (xvi) Development / construction of roads, railways, and power lines.

4.1.2. Wild Animals:

Main reasons for decline in number of wild animals in the region are:

- Shrinkage of habitat is affecting species like Tiger, Sambhar, Chital, Four-horned antelope, Sloth bear etc.
- Degradation of habitat caused because of uncontrolled grazing by cattle of adjoining villages.
- Scarcity of water and sharing of waterholes by domestic animals resulting in transmission of contagious diseases.
- Excessive hunting of animals, like tiger by former rulers of the erstwhile states It is recorded that one former ruler of a state shot over a hundred tigers in his life time. Similarly immediately after independence of the country some urban elites took up excessive hunting of wild animals.
- Hunting of animals by professional communities like Bawarias, Kalbalias, Jogis, Kanjars, Sansis etc.
- Introduction of exotics causing alteration and destruction of natural habitats of wild animals.
- Knocking down of wild animals by the motor vehicles on the roads.
- Trade in animal bones, nails, and skins of Tiger and Leopard;

- Trade in skins of lesser cats, Jackals, Foxes for their fur. According to a report of the Forest Department Rajasthan, one trader, of animal skins, in Abu Road town, had over 60,000 skins of cats, foxes, jackals etc in his possession.
- Excessive use of pesticides and rat poison is causing casualties in animals living in and around agricultural fields and human settlements.

4.2. Domesticated:

4.2.1. Loss of Traditional crop:

Traditional crops cultivated in the region were Bajara, Maize, Wheat, Barley, Gram, , Jowar, Paddy, minor millets and Pulses. The production of the traditional varieties of crops has suffered adversely because of:

- Increasing demand of food production, and the inability of these crops to cope with the growing demands. This resulted in introduction of high yielding varieties.
- The government policies of promoting the high yielding varieties by providing seeds, fertilizers, and pesticides at subsidized rates.
- The public distribution system helped in changing the food habits of the people by providing wheat at cheap rates even in non- wheat-eating areas.
- Even in Food -for- Work programme executed by the government, wheat is distributed as part wages, in Maize and Bajra eating areas.
- Consumption of coarser grains such as Bajra, Jowar, Maize and minor millets got reduced by easy availability of wheat at cheaper rates.
- Development of irrigation facilities by construction of medium and small irrigation projects, lift irrigation, and tapping of underground water for agricultural purposes resulted in increase in areas under irrigated crops. The area under traditional crops got reduced.
- There is no market for disposal of surplus production of minor millets.
- Crops like cluster beans and pulses are more susceptible to damage by Nilgai (blue bull). The cultivators avoid growing of these crops in areas where large populations of this animal exist.

4.2.2. Domesticated Animals:

Important reasons for loss of domesticated biodiversity are:

- Mechanization of agriculture resulting in reduced dependence on bullocks for ploughing of fields and transportation of the produce.

- Development of infrastructure, particularly construction of roads and rural electrification, is reducing the role of animals in transportation of people and produce. Electrification of wells has helped in replacement of the animal-power by electricity.
- Introduction of exotic breeds of cow like Jersey etc., has reduced the importance of good local breeds, at least in the cities and towns for production of milk.

4.3. Fisheries:

Introduction of exotic fishes like *Tilapia mossambica* in water bodies of the region has adversely affected the production of indigenous fishes. The population of this species in some water bodies like Jaisamand (Udaipur) is now estimated to be about 80 % of the total fish population. It is a profusely breeding fish. It breeds 7-8 times in a year. This observation is based on interviews of the local fishermen in presence of officers of Fisheries Department

CHAPTER 5
ONGOING BIODIVERSITY INITIATIVES
MAJOR ACTORS AND THEIR CURRENT ROLES RELEVANT TO BIODIVERSITY

5.1. Governmental:

5.1.1. Forest Department:

Forests are the most important and valuable bio-resources of the Aravallis. Distribution of forests over the entire eco-region is not uniform. In northern Aravallis, the area under forest is much smaller than that in the central and southern Aravallis. In Haryana-Aravallis, about 88% of the area is barren (HARSAC 1996). The forest department manages most of the forests on the Aravallis. The department is responsible for conservation, protection, regeneration, and extraction of various forest produce from the forest areas. The demand of forest produce is increasing with the increase in human population. To meet this ever growing demand the department has put more emphasis on increasing the productivity of the forestlands.

National Forest Policies enunciated by the Government of India from time to time and Forests Act have played an important role in the management and conservation of the forests all over the country and Aravallis are no exception.

5.1.2. National Forest Policy:

The British enunciated the first forest policy for India in 1894. The aim of this policy was to serve the immediate interests of the foreign rulers. Its salient features were:

- The forest were considered as 'reservoirs of valuable timber' and land for cultivation. The main object of their management was to earn revenue for the state.
- In case of an effective demand for cultivable land, the forestland was to be released for the purpose without any hesitation.

Indiscriminate release of forestland for cultivation and destruction of forests not only deprived the local people of the fuel, fodder, timber and other forest produce but it also stripped the land of its natural defense against erosion and vagaries of nature.

After independence, the Government of India in 1952 adopted a new National Forest Policy. This policy laid emphasis on the following points:

- The need for evolving a system of balanced and complimentary land use under which each type of land is allotted to that form of use under which it would produce most and deteriorate the least.
- The need for checking:
 - (i) The denudation in mountainous region for sustaining the perennial water supply of the river systems.
 - (ii) The erosion of soil along the treeless banks of great rivers leading to ravine formation and threats of degradation of agricultural field.
 - (iii) Invasion of sea-sands on coastal areas and shifting of sand dunes in the Rajputana desert:
- The need for establishing tree-lands, wherever possible, for the amelioration of physical and climatic conditions, promoting, the general well being of the people.
- The need for ensuring, progressively increasing, supplies of grazing, small wood for agriculture implements and in particular of firewood, to release the cattle-dung for manure, to step up food production.
- The need for sustained supply of timber and other forest produce required for defense, communications, and industry.
- The need for the realization of the maximum annual revenue is perpetuity, consistent with the fulfillment of the needs as enumerated above.

Although the concerns for deterioration of environment and need for increasing the availability of fodder, fuel and small timber etc. was mentioned in the policy, yet no substantial follow-up action to implement it was undertaken. Meeting the timber requirements of the industry, defense, and communications along with the earning of revenue for the state continued to dominate the management objectives.

The forests continued to suffer the neglect. Indiscriminate diversion of forestland for non-forestry purposes continued uninterrupted. It stopped only when the central government brought in the 'Forest (conservation) Act 1980'.

Prior to this enactment, forestland in Aravallis was considered as an unlimited reservoir of land, which could be used for allotting land to people on any pretext. Land allotment campaigns were launched for allotting land for expansion of agriculture. Thousands of

hectares of fertile valley lands were released in the districts of Udaipur, Chittorgarh, Banswara, and Dungarpur, for relocation of people displaced by construction of large dams. Good forestlands close to Sariska Sanctuary, and the entire Bardod Wildlife closed area were released for expansion of agriculture. Large forest areas were released for setting up of industrial areas and housing colonies in the region. Such examples can be sighted all over the ecoregion. Enactment of this Act put a halt to such arbitrary releases of forestlands.

Mining activities, continued in the forest areas in violation of the Forest conservation Act 1980. This was stopped only after intervention of the Supreme Court of India on 6.12.96.

5.1.3. New National Forest Policy(1988):

In 1988 the Government of India adopted its new policy and for the first time gave due priority to

- 1) Environmental stability and Ecological balance
- 2) Meeting the needs of the local population.

The paragraph 2.2.2 of the new policy states:

“The principal aim of forest policy must be to ensure the environmental stability and maintenance of ecological balance, including atmospheric equilibrium, which are vital for sustenance of all life-forms, human, animal and plants. The derivation of direct economic benefits must be subordinate to principal aim”.

Also- paragraph 4.3 of the new policy states:

“ The life of tribal and the poor people within and near the forest revolves around forests, the rights and concessions enjoyed by them should be fully protected. Their domestic requirements of fuel-wood, fodder, minor forest produce and construction timber should be the first charge on forest produce. These and substitute materials should be made available through conveniently located depots at reasonable prices”.

This was a marked shift in the National Policy in the management objectives of the forests. The shift was from meeting the commercial demands of the forest products and maximizing the state revenue to meet the subsistence needs of the local people.

This resulted in;

- Stopping the commercial exploitation of the forests by forest contractors or by departmental agency.
- The local people were involved in protection and management of the forests by constituting Village Forest Protection and Management Committees..

These steps are producing encouraging results. The process of shrinkage of forest areas has been checked effectively. The degraded forest areas are now getting rehabilitated as has been reported by remote sensing data.

5.1.4. Joint Forest Management:

The Government of India, in pursuance of its newly adopted National Forest Policy, issued detailed guidelines to all state governments on June 1, 1990. These guidelines provided for a massive people's movement, in protection, development, and management of degraded forests by involving the village communities with active participation of women and voluntary agencies. It marked a total shift in the management policy of the state forests. The state controlled forest management was to give way to a new decentralized, participatory and local need based management of the forests. As a follow up of the guideline, the state governments of Gujrat and Rajasthan issued orders in 1991, regarding implementation of Joint Forest Management (JFM) and formation of Village Forest Protection Committees. In Haryana because of the earlier existing Act, the Punjab Common Lands Act 1961, the village forest protection committees were constituted under that Act.

In both these states (Rajasthan and Haryana) the externally funded schemes for afforestation were implemented in the field by involving the Village Forest Protection and Management Committees formed under JFM programme.

Salukhera village with a mixed population of different communities is about 55 kms from Udaipur on Jhadole road. The officials of Forest Department constituted a Village Forest Protection and Management Committee on February 1, 1993. A ten-member working committee was constituted. One of the villagers, Shri Lal Singh Jhala, was elected as the chairman. The Deputy Conservator of Forests (Central Division), Udaipur, officially registered the VFPMC on 25-11-1993. From 1993 to 1996, the VFPMC successfully raised plantations over an area of 200 hectares of barren hills. The committee also was instrumental in removing illegal encroachments from this forestland. The committee did exemplary work in protection of the forests and in equitable distribution of grasses and other non-timber produces. Statistics of the extraction of fodder by the villagers indicate that the collection of fodder per family increased from 8.6 quintals per family in the first year to 23.4 quintals per family in the fourth year of the formation of the VFPMC. The Salukhera VFPMC also successfully protected about 1086 hectares of natural forests of Jhadole Forest Range. It now plays an important role in the overall development of the village and its

economy. Salukhera village provides a good example of healthy and active co-operation between the Forest Department and the members of VFPMC. In one case, some villagers had encroached upon a piece of degraded forestland. Although the Forest Department had registered an offence case against them but these people did not leave the possession of the encroachment. The VFPMC members morally persuaded these members to vacate their illegal possessions.

The Forest Department, from its resources had provided the villagers with a diesel flourmill. The members of VFPMC are now operating this flourmill. The VFPMC has taken a number of steps in the improvement of the village economy. An approach road for the village has been constructed. Fish farming was successfully introduced in the anicut constructed in the forest area. Bamboo seedlings planted in the degraded forests by the committee have done well in the area. The regular harvest of the bamboo crop from the plantations will provide a regular source of income to the society members.

In recognition of the exemplary work of protection of the forests done by the VFPMC, this village committee was awarded “**Indira Priyadarshini Vrikshamitra Award**” by the Government of India in 1996.

5.1.5. Programmes and Schemes:

The main thrust of the department is on increasing the productivity of the existing degraded forestlands. Steps being taken in this direction include:

- Reforestation of degraded forests by raising of plantations of local plant species and encouraging natural regeneration in the area.
- Taking steps for intensive soil and moisture conservation measures.
- Involving the local village communities through Joint Forest Management
- Increasing the production and availability of Non-timber Forest Produce (NTFP).
- *In-situ* conservation of important medicinal plants by planting them in suitable habitats.
- Establishment of herbal gardens in different parts of the ecoregion.
- *Ex-situ* conservation by setting up of arboretums at suitable places.
- Raising of environmental plantations in the cities,
- Encouraging farm and agro-forestry by making available suitable plants for the purpose.

The department is, however, not giving due importance to the tree improvement research for genetic improvement of selected species, using modern biotechnology. Similarly not much is being done to improve the productivity of the *grass birs* (as mentioned in paragraph 3.2.2. earlier). Concerted efforts have also not been made to effectively tackle the problem caused by windblown sand that crosses the Aravallis through the gaps as mentioned in Para 2.1. This needs special treatment.

The respective state governments have implemented a number of schemes for afforestation of Aravallis. Some of the important schemes implemented are:

- “Rehabilitation of common lands in the Aravallis Hills” launched by Haryana Forest Department in 1990 with the financial support by the European Union. Under this project, afforestation cum rehabilitation of 38050 ha of common lands was carried out by Haryana Forest Department. The project followed the JFM mode in undertaking the plantation programme. The project has led to recovery of natural vegetation including fodder in large areas. For its notable work the project was awarded “Indira Priyadarshini Vrikshamitra” award by the Ministry of Environment and Forests government of India.
- Aravallis Afforestation Project launched by forest department, Rajasthan in the year 1992-93 with the financial assistance from OECF Japan. Under this programme, afforestation works have been done over an area of 1,51.093. ha. (F.D. communication).

In implementation of this project, intensive soil and moisture conservation measures were adopted. Apart from planting of indigenous trees, emphasis was also laid on planting of species giving Non Timber Forestry Products (NTFP) and on promoting natural regeneration in the areas. As a result of protection provided in the areas, the natural regeneration of even *Dalbergia latifolia* and *Santalum album*, which had almost disappeared, is coming up again.

During Implementation of these projects, the forest departments of both the states attempted the “people first approach” in the spirit of the National Forest Policy. This has produced good results because of the involvement of the local community in the afforestation project in all its stages right from micro planning to the completion of plantations and its subsequent management.

The Village Committees have evolved their own systems for harvesting / sharing of grass and other NTFP. Now most of the VFPMCs have substantial amount in Post Office / Bank, which they are using for small village development works. They even finance needy small farmers for purchase of seed, fertilizers etc on minimal interest.

5.1.6. Effect on Biodiversity:

The local communities were involved in the process of planning and execution. The species selected for plantations were indigenous and reflected choice of the local people. These afforestation projects have substantially increased supply of forest produce from the area and have led to an economic emancipation of under privileged groups.

5.1.7. Effect on Women:

All over the Aravalli Eco-region, women have especially benefited from the increased supply of fodder and other non-timber produce from the JFM areas. This has been clearly brought out during our current survey. Paliyakhera Village in Udaipur district of Rajasthan is one of such examples.

Paliyakhera is a small village, about 45km away on Udaipur Jhadole road, in Makdadeo Panchayat. In 1996 the villagers, with the help and assistance of the local forest official constituted a Village Forest Protection and Management Committee. Out of a total of 153 members, the VFPMC has 63 women members. A Women's Advisory Sub-committee, consisting of seven women members has also been constituted. Smt. Jogadi Bai, a local woman is presently the chairperson of this Sub-committee. The VFPMC and the Women's Advisory Sub-committee meet very regularly. The village women actively participate in such meetings. This has resulted in considerable increase in the active role of the village women in the protection and management of the village forests. The active participation of the village women in the VFPMC has resulted in the following achievements: -

- Forest and plantation area spread over 230 ha has been brought under strict protection by performing the ritual of "Kesar Chhanta". This is being successfully managed by active involvement and cooperation of women. As is the case everywhere, collection of firewood for domestic consumption is the job of women of the village. Here they are discharging their responsibilities in a responsible way by collecting only the dry and fallen wood from the area and maintaining the traditional sanctity of "Kesar Chhanta"
- Women keep a keen watch over the protected forest area. They even go out for collective patrolling of the area and report about the woodcutters coming from nearby villages.
- Women are actively involved in collection of fodder grasses from the protected areas. During last three years, they extracted approximately 130 M tons of dry grass from the area. The VFPMC levied a nominal amount of money per month per sickle used for grass collection and earned a sum of Rs. 15,825/-

- On recommendation of the Women's Advisory Committee, the VFPMC purchased utensils worth Rs. 6215/-, needed for social and community functions in the village,
- On recommendation of the women members of the VFPMC Paliyakhera, six months training in tailoring was given to some women of the village and the forest department, under World Food Programme made sewing machines available to them. These women are now having an additional income of rupees 200/- to 300/- per month from stitching clothes.
- On the demand of the women members of the VFPMC, two bathrooms for women were constructed in the village.
- The women members of VFPMC Paliyakhera constituted a Women Self help Group in the month of November 2001. The Group had decided to save a sum of Rs. 50/- per month; all members of the Group are depositing this amount regularly. Presently there are 16 members in the Group and it had a deposit of Rs, 1600/- in February 2002.

Availability of fuel wood, fodder, and water in the JFM areas before and after implementation of JFM is indicated in Table-22.

Table - 22

S. No.	Activities under taken	Prior to implementation of JFM	Present position
1	Time consumed in fodder collection	4 - 5 hours in collecting one head load.	1-2 hours for one head load
2	Quantity collected daily	2 head loads	4-5 head loads
3	Total availability of fodder	Almost one fourth of the present quantity	4-5 times more. Villagers of adjoining villages also permitted to collect.
4	Time consumed in collection of firewood.	4-6 hrs for one head load of firewood.	1-2hrs for one head load of firewood.
5	Quantity of firewood that could be collected daily	1-2 head load per day	3-4 head load per day
6	Rise in water table in village wells	--	About 25 % higher.

(Above information is based on interviews taken by Dr. N.C.Jain member EWG.)

5.1.8. Social and community initiatives for forest protection.

5.1.8.1. Orans and Sacred Grooves.

Numerous communities in the Aravallis protect patches of forests by dedicating them to local deities and ancestral spirits. In Southern Aravallis especially in Udaipur and Dungarpur districts, the tribal people perform a ritual of sprinkling of “Kesar” (Saffron) water over the trees over a patch of forests to protect its trees from felling, pollarding etc. The process is called “KESAR CHHANTA”. Kesar for this purpose is brought from the temple of Kesariyaji. The ritual is performed by the village ‘Bhopa’ (pious man) in the presence of villagers with beating of drums and blowing of ‘Conch’ to propitiate “KESARIYAJI”. The villagers take a vow of not cutting or damaging the tree growth of the area in any way for a period of 5 years to begin with. The villagers believe that their deity will administer punishment to any one indulging in cutting or damaging the trees in the area. It is believed that the punishment is mostly in the form of death of the offender.

5.1.8.2. Totem trees;

In past, there was a system of associating certain species of trees with people belonging to different castes and gotras (Clans). People of that particular caste/ clan did not damage trees of these species. e.g., felling / cutting / burning of Neem is prohibited for Rajputs belonging to Rathore clan. It is believed that their clan goddess “Nag ne chia” appeared from a Neem tree in Nagaana village in Barmer district and blessed maharaja Chooharji of Jodhpur.

Shri Kalubhai Makedadeo a ‘Bhil’ tribal of Paliyakhera village Udaipur informed that the Bhil tribals worship a number of species of forest trees. They associate these trees with their clan (gotra). According to him some of the totem trees for different gotras of Bhil tribals are as under:

Gotra of Bhils	Totem trees
‘Pargi’ and ‘Badera’	<i>Azadirachta indica</i>
‘Bhagora’	<i>Butea monosperma</i>
‘Babaria’	<i>Dalbergia latifolia</i>
‘Beebal’	<i>Aegle marmelos</i>
‘Dangji’	<i>Dendrocalamus strictus</i>
‘Dindore	<i>Helicteres isora</i>
‘Dodiyar’	<i>Zey mays</i>
‘Gamer’	<i>Gmelina arborea</i>
‘Jamania’	<i>Syzygium cumini</i>
‘Maheeda’	<i>Terminalia bellirica</i>

'Neenama'	<i>Ficus religiosa</i>
'Semalia'	<i>Bombax ceiba</i>
'Mina'	<i>Paspalum scrobiculatum</i>
'Aamelear'	<i>Papaver schimperanus</i>

Village elders, however, feel that their younger generation is not fully aware of such traditions. This awareness can be revived without much difficulty.

5.1.9. NGOs;

Presently, only a few NGOs are active in the field of biodiversity related activities. Some of them are working for conservation, whereas, there are others who are in a way working against the interest of conservation. Sewa Mandir is one NGO that is working for community involvement and JFM. The other extreme example is of an Udaipur based NGO that is instigating people for de-notification of Phulwari Ki Nal wildlife sanctuary.

5.1.9.1. Seva Mandir:

Seva Mandir is an Udaipur based NGO working in the field of education, health, women, & child development, and natural resources etc.

Seva Mandir has been involved in a number of Biodiversity studies undertaken earlier in the Aravalli region such as:.

- (i) The Biodiversity Conservation Prioritization Project (BCPP) at Bichiwara village of Jhadole, Tehsil in Southern Aravallis- August-1997.
- (ii) Documentation of people's knowledge and perception about Biodiversity conservation across depleted ecosystems and agro-ecological zones in Rajasthan, - October-1997.
- (iii) Strategy for conserving Biodiversity in Mahad cluster in Phulwari-Ki-Nal wildlife sanctuary in Kotra Block of Udaipur district, May and June-1997.

In view of the importance of Joint Forest Management in an overall approach to natural resource management, it joined the programme of JFM in 1991. Seva Mandir formally constituted seven VFPMCs. Only five of these VFPMCs are operational. The position of these VFPMCs is as under:

- **Shyampura** VFPMC was the First Village Forest Protection and Management Committee formed by Seva Mandir. Shyampura is a tribal village 80-km to the south of Udaipur. Seva Mandir had been associated with this village since 1981. Out of a patch of 50 ha of degraded forest land allotted to it the Shyampura VFPMC has raised plantations over 37 ha only. The villagers had encroached upon 13 ha of

land. The VFPMC now protects this plantation along with another 150 ha of other forestland planted by the Forest Department in 1984.

- **Kojo Ka Guda** is a village 45 km west of Udaipur. Seva Mandir formed a VFPMC here. A micro-plan for an area of 50 ha of degraded forests was prepared. The work at this site did not start because of a conflict between the villagers over the rights on the land. Seva Mandir workers feel that they did not get adequate support from the Forest Department for resolving the conflict.
- **Bichiwara** village is on Jhadole- Som road; here Seva Mandir formed a VFPMC in 1993. This VFPMC is managing an area of 712 ha. The VFPMC Bichiwara is also facing problems of internal conflicts of the user groups. Some part of the allotted land is under encroachment by the people of adjoining village and by members of VFPMC itself. Seva Mandir workers blame the Forest Department for not helping in getting the land vacated by the encroachers.
- **Saru- Mohandongri** is located in Girwa Tehsil of Udaipur. Saru is revenue village and Mohandongri is the name of the hamlet where the VFPMC was formed. The VFPMC was registered on 13-04-1993. Proposals for developing 50 ha of degraded forests were sent to the Forest Department in 1993. The forest department at first did not issue the necessary sanction for starting the work. After much persuasion, after a lapse of 3 years, the Forest department issued permission to start work. Surprisingly, it was not for the area demanded by the VFPMC. Permission was given for an area that was highly degraded and refractory. The work on this site was taken up in 1998. The site is difficult to protect. As usual, the support of villagers is lacking. A watchman has been engaged to protect the plantation.
- **Talai** is located in Jhadole Tehsil of Udaipur district. Proposals for formation of VFPMC were sent to the Forest department in February '95 but the registration was done after one year in 1996. To start afforestation work on the site, Seva Mandir submitted a micro-plan to the Forest department in November '96. However, the sanction to start work was given in January '99. The Forest department caused this abnormal delay.

Operational Difficulties: Seva Mandir, an NGO with a good record of accomplishment is facing difficulties in implementation of the JFM Programme. The most common difficulties faced by Seva Mandir in the working of JFM Programme are as under:

- Inordinate delay in registration of VFPMS constituted by the NGOs.
- Delayed allotment or at times total refusal of allotment of degraded forest lands by the Forest department, without assigning any specific reason, for undertaking forest

development works. In one case, Seva Mandir was arbitrarily asked by the forest department to shift to another area.

- Discrimination in allotment of forestland for undertaking forest development works to VFPMCs formed by the NGOs.
- Practically the forest officials provide no technical guidance to the VFPMCs working with the NGOs.
- The normal support of the department to the VFPMCs in resolving conflicts regarding encroachments is not provided.

5.1.9.2. Foundation for Ecological Security:

This is an organization, earlier known as Tree Grower Co operative Federation, promoted by National Dairy Development Board, has started taking up greening of degraded forest areas with JFM approach in Mansi Wankal Watershed of Udaipur district. Initially an area of 300 ha of government forests have been allotted for the purpose.

5.1.9.3. VIKSAT: Under the patronage of Nehru Foundation for Development, the VIKSAT is involved mainly in undertaking activities of development of forest and water resources in Banaskantha and Sabarkantha districts of Gujrat Aravallis.

It is assisting the Village Forest Committees in strengthening of the Joint Forest Management programme by undertaking various training programmes for capacity building, communication, documentation, research and policy intervention.

5.1.9.4. DEVELOPMENT SUPPORT CENTRE is an Ahmedabad based organization. It is involved in Tribal development activities in Banaskantha and Sabarkantha districts. The other activities undertaken by the DSC include providing management support in watershed development programme, tribal development activities, creating positive environment for natural resource management and developing village level institutes.

5.1.9.5. Manav Kalyan Trust: It is located in Kheroj village of Khedbrahma Tehsil of Sabarkantha district. The main activities of this NGO are:

- Implementing Watershed Development Programme
- Undertaking Tribal Development activities
- Developing village people's organization.

5.2. Communities and people's movement:

In a number of villages in Aravallis, the local people have constituted forest protection committees to regenerate the forests in their villages. In many cases, these are self initiated, and in many others, local forest officers and NGOs have played an important role in encouraging the villagers in the constitution and functioning of the societies. Some examples are:

- **SAADNI:** Saadni is a small village near Pratapgarh in Chittorgarh district. The villagers organized themselves in 1990 and formed an informal committee to protect around 230 ha of degraded natural teak and Bamboo forests near their village. This forest was a part of Janagarh Forest Block of the Forest Department. After introduction of JFM in Rajasthan in 1991, the local forest officers formally constituted this VFPMC in 1992. This VFPMC with support of forest department successfully raised plantation over 170 ha, of local species like Bamboo, Khair, Aonwla, Mahua, Bahera, and Bel etc. This was done in addition to the area protected by them earlier. The VFPMC is presently protecting about 400 ha of valuable teak and bamboo forests.

The VFPMC has a membership of 184 of which 90 are women members. A women sub-committee has been constituted. This sub committee and the VFPMC meetings are regularly held.

The protection provided by the villagers through VFPMC has actually transformed the once degraded forest into a well-stocked natural forest. The average height of bamboo in this forest is now over 18' and the number of culms per clump is up to 50. The villagers, in collaboration with the forest department enumerated and marked the total growing stock in the area. The bamboo crop is now ready for harvest. The VFPMC members initially wanted to harvest bamboos from the entire area in one year but after detailed discussions with the forest officials they have now decided to work the area on a four-year working cycle. This will provide income to the villagers on a regular basis. The local D.F.O., after detailed deliberations with the VFPMC has prepared a management plan for working of the forests by the VFPMC. This is a successful example of joint effort of the community and the forest department in revival of the forest wealth.

- **Nakor:** is a tribal village near Deogarh town in Chittorgarh district. The village was earlier known for illicit fellings in the well-stocked state forests of Deogarh Forest Range. After introduction of the JFM in Rajasthan, the local forest officials constantly interacted with the villagers and persuaded them to protect the forests and form a VFPMC. In 1995 the VFPMC was formally constituted. The committee, from 1995 to 1999, has successfully raised over 250 ha of plantations. Only local

species like Bamboo, Aonwla, Khair, Bel, Mahua, Bahera etc were planted in the area. Medicinal plants like Chitrak and Ratanjot were also grown in substantial quantities on contour trenches and also on fence trench.

The VFPMC has strength of 104 members including 52 women members. There is a women sub-committee that meets regularly to watch interest of women members. The plantation area has responded well to the protection given to it by the villagers. Besides the trees planted the growth of indigenous grass is luxuriant in the area. The villagers have devised their own system for distribution of grass amongst the members of VFPMC and the villagers of adjoining villages. They charge at the rate of Rs. 50/- per *darati* for the grass harvesting season (November onwards). In June 2001 this VFPMC had a cash balance of Rs. 93,000/-, earned from harvest of grasses only from the plantations. The villagers have used Rs. 62,000/- for providing crop loans to the needy village farmers for purchase of seed and other agricultural inputs. The rate of interest charged is very nominal and is decided by the general body of the VFPMC. The amount was loaned in June 2001 and was recovered back in November / December 2001. Despite three draught years in the region these villagers did not feel any shortage of fodder for their cattle.

The plantations presently have a good stock of Bamboo, Aonwla, and other species. These are almost ready for harvesting. A management plan for the planted area is under preparation in consultation with the villagers. The likely income accruing to the VFPMC from harvest of Bamboos, Aonwla fruits and grasses will be around Rs.3 to Rs. 4 lacks per year. The Villagers are hopeful to take up various local development works in the village without looking for out side help.

In a way this committee is setting an example as to how by managing their natural resources properly the village community can be self sufficient and fulfill Gandhi ji's dream of "Gram Swarajya" to some extent

- **Nayakhera** is a small village located at a distance of about 15 kms from Udaipur city. The local forest ranger took initiative and persuaded the villagers to constitute a VFPMC. The village elders also favored the idea of protecting their own forest to meet their basic needs of fodder and fuel and supported the idea. The VFPMC was registered on 13-06-1995. It has successfully raised plantations over 315 ha of degraded forestland adjoining the village. The survival and rate of growth of the planted seedlings and other vegetation in the area has been excellent. The villagers now take pride in showing the dense growth of Bamboos and others plants in the

afforested areas. In addition to these plantations, the VFPMC is also protecting another 120 ha of natural forests in their area. The grass produced in the area has a ready market. An anicut, built with the assistance of Forest department, has not only helped in raising of water table in the village wells but has also been useful in directly irrigating some agricultural fields. The Forests Department has contributed funds for installation of two hand pumps for drinking water in the village and construction of a link road in the village. Recently, the state prize for the forest protection was awarded to Nayakhera VFPMC.

- **Bhaonta- Kolyala** (A success story of community initiative in revival and management of Forests)

Bhaonta and Kolyala are twin villages located in the Aravalli hills in Alwar district of Rajasthan. People belonging to Gurjar, Balai, and Rajput communities inhabit these villages. The agriculture is mostly rain fed with some area dependent on irrigation. Since the agricultural holdings are small varying from 0.2 to 2.5 ha., animal husbandry plays an important role in the village economy. Almost all the families own some form of livestock. Pastoral production is mostly for household consumption but the livestock is a valued asset in case of emergencies when it can be converted into cash. This is especially true in case of goats. The animals, particularly the goats are daily taken to forests for grazing. There is a forest area of About 600 ha in the immediate vicinity of Bhaonta village. This forest area, because of excessive grazing and over exploitation of firewood and small timber had become degraded.

Initiative to rehabilitate this area came from Tarun Bharat Sang, an NGO active in the region. The Tarun Bharat Sangh had organized a foot march in the area for creating consciousness for protection of forests and construction of Johads. The villagers in Bhaonta wanted a Johad to be constructed in the village. Repeated interactions with the workers of Tarun Bharat Sangh motivated the villagers to set up an organization to take collective decisions for construction of Johad and for protecting the forests in their village. It was named as a "gram sabha". This "gram sabha" is not recognized by the state and has no legal authority. It has an open membership with a Quorum of 22 adult members who by and large represent each hamlet in two villages . Women are usually present in small numbers. The gram sabha meets once every month on the day of "Amavasya". Minutes of every meeting of the gram sabha are recorded. Apart from "Adhyaksha" it has no office bearer. The office of "Adhyaksha" is informal and he has no power except for organizing the monthly meetings. In the meeting, any issue relevant to the village community could be discussed.

The “gram sabha” evolved a pattern of regulation and penalties. The rules were formed keeping in mind the needs of the village community and carrying capacity of the forests. Over grazing and tree felling were perceived to be the prime reasons for degradation of the forests. Grazing is an important need of the villagers and its total prohibition was impossible. A conscious decision was taken to allow grazing of goats in the forests. Shepherds were asked not to cut any trees for grazing of goats. The village community also tried to reduce the number of goats in the village. Only wood that was dry or on the forest floor was allowed to be collected for fuel. Decision to protect forests went hand in hand with water harvesting works. After 10 years of successful forest protection, on suggestion of Tarun Bharat Sangh, the “gram sabha” declared the forest as “Bhairon Dev Van Abhayaranya” in October 1998 as an example of successful effort at conservation by local community.

The people of Bhaonta Kolyala now feel confident of asserting their rights to, and de-facto control over, natural resources, even though there is no governmental recognition to it. **Highlighting the visible linkages between the forest, water, and agriculture, were the major means of motivating the villagers towards conservation**

- **Hamirpur** is a very small village in remote area of Thanaghazi Tehsil of Alwar district. Like most of the other villages of the area, it suffered scarcity of water. Daily, the village women had to walk over a distance of two kilometers just to fetch a pot of drinking water. The village cattle used to be shifted to other areas for drinking water. Tarun Bharat Sangh (TBS), a registered NGO started working in the area in mid eighties. Their main thrust was on reviving traditional water bodies of the villages (Johads) and to protect the trees, forests, and wildlife of the region. TBS workers involved themselves in a constant dialogue with the villagers. A series of discussions were organized between the villagers and TBS workers. Awareness marches with the slogan “build Johads and save jungle” were also organized. The villagers of Hamirpur took a collective decision to contribute their labor for construction of Dam. The villagers who could not provide labor made monetary contributions at the rate of Rs. 900/- per family. Almost 25 % cost of construction of a 50 feet wide and 11 feet high Jabar Sagar Dam was contributed by the villagers. Construction of the dam has transformed this parched landmass into an area with plenty of water and prosperity.

There are a number of such examples all over the Aravallis eco-region.

5.3. Wildlife:

The Forest Department is presently providing protection to the wildlife and their habitat. To reduce biotic pressure in the tiger habitat in Sariska Sanctuary, the Forest Department attempted translocation of some villages. The attempt did not succeed.

Since Aravallis fall in semiarid zone, availability of drinking water for the wild animals is a perpetual problem. Creation of new waterholes and improvement of the existing ones is being given priority.

However, very little work is being done in and around the Protected Areas to reduce the pressure of grazing and demands of other forest produce of the adjoining villages.

Ex-situ conservation is being done for some species in various zoos. Periodic monitoring of the wild animals is being done in different Protected Areas. This needs improvement in quality based on recent technology available in this regard. Although a number of species of the wild animals are on the verge of extinction in the area, practically no research work is being undertaken for evaluating their present ecological status.

Increase in population of some species of wild animals, particularly Nilgai, is causing problems in many areas. The people of the region have started reacting by organizing agitations against the policy of the government of not initiating any effective measure to check their population particularly in agricultural fields.

5.4. Agriculture:

The main aim of the government policy is to augment the agricultural production.

To ensure production and availability of quality and improved seeds **of high yielding varieties** to the cultivators the agriculture department is putting emphasis on strengthening seed villages and seed production programme. It is also encouraging research on location-specific, crop-specific technology, and adoption of dry farming technologies to augment agricultural production in the rain-fed areas. The agriculture department has now started suggesting the balanced use of chemical fertilizers and integrated pest management approach. It is also now suggesting use of sprinklers/ drip-irrigation practices for judicious use of ground. In order to harness maximum return per unit of water, emphasis is also given on growing low-water-duty crops i.e. pulses and oil-seed as compared to cereals. The agriculture department, however, does not in any way provide incentives to the cultivators for growing indigenous varieties of crops and other land races. On the other hand, emphasis is given on cultivation of high-yielding varieties of crops with necessary inputs of irrigation, fertilizers, and pesticides.

Agriculture in Aravallis is primarily rain-fed. Monsoon period in the region is short. The rainfall is aberrant and uncertain. Monsoon is generally late in its arrival and early in departure compared to other parts of the country. Irrigation by tube wells is causing lowering of water table in the area. The main crops cultivated in the region are wheat, bajara, maize, and jowar along with mustard and linseed. Other oil seeds namely groundnut and soya-bean are also getting popular. Cotton and sugarcane are confined to small areas.

In northern Aravallis, particularly in Jaipur and Dausa districts of Rajasthan farmers practice farm forestry by protecting the natural regeneration of Babool trees that come up in their fields and planting saplings of *Ailanthus excelsa*. When felleable these trees are harvested and transported to nearby markets. Some veneering plants using *Ailanthus* for plywood have come up in the area. This provides additional income to the cultivator and at the same time meets the fuel and small timber needs of these towns. This in a way has become a part of their cropping pattern. This practice of farm forestry needs to be introduced in a big way in other parts of the ecoregion,

5.5. Animal Husbandry:

In the Aravalli region animal husbandry is an important activity and plays a vital role in the rural economy by providing employment and stabilizing the household income.

Live stock management is labor-intensive. Women manage most of the activities in livestock management. This activity directly benefits the women of the family.

Live stock population in the Aravallis is very large. The low productivity of degraded forests and other grazing grounds in the area has aggravated the shortage of quality fodder for the animals. The milk yield of the cattle is therefore very low.

At present, the emphasis of Animal Husbandry Department is on the improvement of the breed of the cattle. In past, the policy of the Animal Husbandry Department was to improve the productivity of local cattle by cross breeding it with high milk yielding exotic varieties.

This policy has failed in most of the areas because of non-availability of nutritive fodder and veterinary care. Some limited success has, however, been achieved in urban areas, where the cross –breed is reared for dairying. **The Animal Husbandry Department is now emphasizing on selective breeding of indigenous breeds by artificial insemination.**

The implementation part of this scheme is very weak.

5.6. Fisheries:

The main emphasis of the fisheries department is on setting up of hatcheries for increasing the production of fish. The emphasis is also on increasing the fish-seed and its production. There is practically no check on the fish-seed brought by the contractors from other parts

of the country for local water bodies. There is no programme of increasing the indigenous varieties of fish in the region, however. Exotic fishes are being introduced without considering the requirements of the highly valued indigenous fishes.

5.7. Irrigation:

5.7.1. Irrigation:

In post independence period the irrigation facilities in the region have increased considerably. This increase is due to construction of a number of small, medium, and large dams all over the Aravallis. Increased availability of electric power and diesel in the region has been responsible for sinking of a large number of bore wells. **Unrestricted pumping of water for cultivation of high water consuming / cash crops, from these bore wells and inadequate re-charging of ground water has resulted in lowering of the water table in the region.**

Construction of medium and small dams on the rivers draining into the lakes has reduced the volume of water reaching in these wetlands. Even a wetland like Sambar Lake is now threatened.

Increased availability of water has influenced the cropping pattern of the region. The area under crops needing more water has increased. In southern Aravallis the area under sugarcane, paddy, new varieties of wheat, etc. has increased. In central and northern Aravallis, area under new and improved varieties of wheat, mustard, onion, cotton, and vegetables has increased. Along with agriculture, people have also taken up apiculture in a big way. This is more common in the northern parts of the region; Bee-boxes are kept near mustard fields.

Floriculture has also been introduced in some areas of northern Aravallis particularly in Alwar, Faridabad, and Gurgaon districts.

5.7.2. Tarun Bharat Sangh's Model for reviving the water regime of the land:

Denudation of forests over large areas in Alwar district of Rajasthan resulted in excessive soil erosion. The small tanks and water bodies got either damaged or silted up. The water table of the area went down making most of the open wells dry. The traditional system of irrigation by pulling out water by bullock driven *Charas* collapsed. The villagers started migrating to towns and cities in search of new jobs. At this stage, Tarun Bharat Sangh approached the villagers and with their involvement started construction of small earthen dams called *Johads*. Simultaneous attention was given to the protection and conservation of natural forest growth of the area. Emphasis was laid on three things:

- Johads should be constructed to catch water
- Forest should be protected to check erosion of soil.

- There should be consensus within the community on all decisions.

During monsoon, the Johads got filled up with water and provided much needed relief to the villagers. It started a sort of chain reaction in the area. Along with the construction of Johads the villagers also laid emphasis on the revival of the natural forests in their catchments by providing protection to the degraded forests. The villagers resolved not to carry axe into the forests while going for grazing of cattle or even for collection of dry fallen fuel wood. The village community formed a “Gramsabha”. Its members protected the forests and also penalized the people cutting trees and shrubs. The forest cover started reviving and even the wild animals staged a come back. The villagers declared the forest area near Bhaonta - Kolyala as a *sonchirri* and named it as “**Bhairaon Deo Lok Vanya Jeev Abharyaranya**”. According to the villagers, leopards have also been sighted in this sanctuary.

Beginning with the Jogiwala Johad on a small nullah, many small and big Johads were built by the people. Wooded hill slope and these Johads collectively recharged the ground water on the area. The water table in the wells started to rise, the dry and abandoned wells came back to life. Regeneration of degraded forests on the hills and building of the Johads checked the soil erosion in the area and made water available to the villagers. The percolation of water into the soil not only raised the water table of the area but it also created an ecological miracle by making the ephemeral Arvari river into a perennial one.

Revival of a river in Aravallis

According to R. N. Athavale Emeritus scientist of National Geophysical Research Institute Hyderabad, prior to rehabilitation of the degraded hill forests and construction of Johads about 35 % of the rainwater was lost immediately as seasonal run-off. Another 50 % was lost due to evaporation and transpiration. Only about 15 % of the total rainfall recharged the groundwater. Of this 5 % became soil moisture, as the soil was too dry. Another 5 % constituted the base flow, implying the amount of groundwater returned to the surface stream or river. Of the remaining 5 %, some parts were tapped by wells and used, but the rest percolated to depth below the well and streambed. According to him after intervention by TBS there was an additional recharge of groundwater to the tune of 20%. The river was made perennial by availability of additional 17 % of rainfall as effluent seepage

during non-monsoon months. The seasonal runoff in the stream was reduced from 35 % of rainwater to only 10 %. About 22 % of the runoff (excluding the 10 % seasonal runoff during the monsoon) is regulated and spread out over the year, This is responsible for revival of the Arvari river,

(Down To Earth, March 15, 1999.)

CHAPTER 6 GAP ANALYSIS

6.1. Gaps in information:

In a country with land-based economy, the decision makers at various levels have not fully appreciated the importance of conservation of biodiversity in poverty alleviation and providing sustainable development. Development of the area is generally associated with providing electricity, roads, irrigation etc. Development of natural resources like conservation of rain water, forests and pastures etc. get a backseat

This is mainly because of lack of informed vision at all levels.

6.2.1. Wild Biodiversity:

- Although Aravallis are one of the 26 endemic centres of Biodiversity in India (Nayar, 1989), no detailed survey to identify prime Biodiversity areas has been undertaken to this date.
- The Aravallis harbour a number of threatened and endangered species of wild animals. Such as Pangolin, Star-turtle, Leopards, and Tree-frogs etc. In the absence of information about their present status and distribution and ecological requirements, no meaningful conservation programme can be taken up.
- In Mt. Abu, thousands of honeybees get killed daily in the earthen pots hung for collection of "Neera". In the long run this is likely to adversely effect the regeneration of a number of local plants species whose pollination is done by

these bees. The present practice of collecting “Neera” should be stopped immediately.

- The impact of various human activities, including development projects, forestry practices, and village / livestock uses, is not adequately known, or monitored.
- Large quantities of fertilizers, and pesticides are being used in modern farming. The run-off from these fields reaches a number of important wetlands of this region. The harmful effects of these chemicals are well known. However, systematic studies of the effect of these chemicals on the fauna and flora of the wetlands of this region are grossly insufficient.
- Effect of pesticides and rodenticides on the fauna of area is also not fully known. It has been observed in developed countries that the rats and mice have become resistant to these rodenticides. These pose a potential threat to their natural predators like wild small cats, foxes, and birds of prey etc.
- Lack of awareness in the organizations that have influence over the wetlands about the socio-economic values of the wetlands is causing erosion in the utility of these areas to the community. At times the intake of water to these areas is reduced by its diversion for other purposes.
- Local people are probably over-exploiting certain medicinal plant species like *Salem-mishri*, and *Safed-musli*. Availability of ready market and lack of alternative sources of income in the area is the main cause for this. Information about their productivity vis-a-vis exploitation is totally lacking.
- Information on lower groups of plants and animals occurring in diverse habitats of this region is meager. Information on soil micro-flora and fauna of the various types is totally lacking.
- Information about the weed flora of different crops and their relationship with the crop-productivity is not known.
- Information on wildlife dependent on Agriculture and the impacts of change in agricultural patterns on such wildlife is lacking.
- The Biodiversity impact of exotics is not known with any degree of precision.

6.2.2 Domesticated Biodiversity:

- Information about the land races of different crops still being grown in this region by small/tribal farmers needs to be systematically assessed. Some of these are said to be very nutritive. Nutritional value of the individual races needs to be documented.
- The kind and rate of erosion of indigenous crop varieties is not known.

- The scientific information regarding cultivation of gram is lacking with the farmers. In a meeting with the farmers in Gurgaon, we were informed that they have abandoned the cultivation of Gram because Gram crop though looking healthy does not flower and produce fruits; the cultivators do not know the cause of this phenomenon.

6.3. Gaps in Vision:

- Drought is a common phenomenon in the region. The state governments, in order to provide relief to the drought-affected population, undertake employment generating relief works. Populist relief works, mostly involving “kuchha” earthworks, such as construction of roads, Helipads, and airstrips (proposed), are undertaken. These works get washed off during the good rain years and are of no utility to the people. They do not in any way contribute in combating the future droughts. Very low priority is given to afforestation works and works for water harvesting .
- The importance of grasslands in the rural economy, primarily based on agricultural and animal husbandry, cannot be over emphasized. It has not been properly visualized by the state Government. These areas considered as tree less blanks were either released for agriculture under the garb of grow-more-food or were planted with of *Prosopis juliflora* by the forest department. Consequently, the prime pasturelands of this region were destroyed.
- The nomadic lifestyle of Raikas along with other nomads of western Rajasthan at times comes in conflict with the local populations, particularly when the crops are damaged by the migrating sheep or the number of village cattle is too large to share the common pastures with the migrating sheep. The state government took some steps to reduce the extent of migration by
 - a) Trying to ‘improve’ the sheep breeds by hybridization with Russian and Australian breeds,
 - b) Forming cooperative societies of the shepherds and developing 100 ha pasture plots for them in different areas, and
 - c) Forming a marketing federation for disposal of the wool. All these interventions failed because the government did not attempt to graft on to existing pattern; - instead it tried to rip down the existing forms and replace them with alternating arrangements,

This failed because the prevailing arrangements were not without resilience and relevance to the conditions that produced them. The nomads continued to stick to the old system. The failure on the part of the government to successfully intervene had the consequences of marginalizing the nomads from the focus of concerns

- Introduction of exotics like *Lantana*, water hyacinth, broom-bush and mesquite etc. has deeply eroded the local biodiversity over vast areas. The damage being done by these exotics needs to be systematically assessed. In this regard, the local people in Mt. Abu mention that a number of useful plant species have totally disappeared from the forest as a result of widespread colonization by *Lantana*.
- The continuous increase in pressure on the forests to meet the demands of timber, fuel and fodder of increasing population has not been followed up with a proportionate increase in productivity with proper management of the produce.
- Since bulk of Agriculture, over 70% in the region is rain-fed, adequate measures for harvesting, storage, and utilization of rainwater are needed but not much research work is being done on this aspect. A little work that has been done, is not being used on a wide scale with the exception of some parts of Alwar and Ajmer districts of Rajasthan.
- The stakeholders in biodiversity are not fully aware of the role and importance of Biodiversity in sustaining livelihood, for example, the shortage of available bio-resources for fuel and fodder is felt by the villagers, but of their own they seldom take any initiative to remedy the situation. There is a need to orient and motivate them to take up Biodiversity related initiatives.
- Development departments like Irrigation and Public Works Departments do not visualize the impact of construction activities on the overall ecology of the area. Constructions of such structures at times reduce or destroy the rare habitats of a number of species. Construction of small dam on a river draining into Sambhar lake has substantially reduced the inflow of water into this RAMSAR site.
- Economic benefits of raising trees along with the agricultural crops, especially in the rain-fed areas have not been fully visualized by most of the farmers. These should be quantified and be made available to the cultivators.

6.4. Gaps in policy and legal structure:

- Interstate coordination

Presently there is no interstate coordination body to discuss and resolve interstate environmental and Biodiversity issues. The states have such bodies to resolve interstate Law and order and Water issues.

- Environmental Notification

In view of the environmental degradation that was taking place in the northern Aravallis, the Ministry of Environment and Forests GOI issued a notification in May 92 restricting certain activities in certain specified area. As per provisions of this notification, the environmental clearance for these activities was to be given by the MoEF. The GOI, on 4.11.99 delegated the power to allow the activities to the State Governments of Haryana and Rajasthan. A direction was given to the State Governments to prepare a Master Plan for integrating the environmental concerns keeping in view the future land use of the area within two years. In addition, two committees were formed

- 1) State level Expert committee for giving the environmental clearance of the proposals, and

- 2) Monitoring Committee with the District Collector as its chairman This committee is to see that the conditions stipulated at the time of clearance are followed.

Both the state governments have formed these committees and they are functioning. None of the state governments have so far prepared the desired Master plan. The main purpose of the notification has been partly diluted because the state governments are more susceptible to local pressures of mining, construction, and industrial lobbies.

- Women, besides managing their domestic chores like cooking, cleaning, spinning, and grinding, have to work as gatherers of fuel wood for cooking and fodder to feed the livestock. In some cases of extreme poverty, these head loads are the main source of their income. Women are therefore important stakeholders in forests. Welfare of women therefore directly depends upon the quality and availability of forest resources. They, generally have more knowledge and awareness about different trees, fodder plants, and agricultural biodiversity. Yet, they are marginalized at the time of decision-making and benefit sharing. At times women are not permitted to even sit with men in the meetings. As was observed in two village meetings organized by the EWG
- In some states, a provision for constitution of separate women subcommittee has been made for the VFPMCs. The forester of the area is supposed to organize its meetings and interact with its members. He is supposed to report their views in the general body and executive body of the VFPMC. Proper interaction with the

village women is difficult because the forest department does not have women employees at the frontline level that can meaningfully interact with the village women.

- In the region, only the extremely poor men and women earn their daily income by selling of head loads of fuel wood and fodder. At present, no poverty alleviation programme focused for their development is being implemented in the area.
- A number of VFPMCs have been constituted all over the region. They are managing large forest / plantation areas. Presently they are using their social and moral influence in handling the offenders. They do not have any legal authority under the Forest Act to deal with all such offences.
- In the scheduled areas of Aravallis (Rajasthan) the tribals have to sell the NTFP including medicinal plants to the RAJAS SANGH, a cooperative body constituted for providing services in the tribal region. This body in turn does the marketing of all the NTFP. The VFPMCs, have no role in collection and marketing of NTFP.
- There is no provision in the Wild life (Protection) Act 1972 to notify community-controlled areas as sanctuaries without communities losing their traditional rights over the resources.
- The Wild life Protection Act does not provide for management of wild animal populations. In the absence of any natural predator and availability of ideal habitat conditions in the form of agricultural fields the number of blue bull has already reached menacing proportions. The cultivators are almost desperate about this mega-pest and are organizing 'Dharnas' against the policy of the Govt.

6.5. Gaps in Institutional and Human capacity:

- Presently there is no institutional structure for bringing the stakeholders together on a regular basis.
- As a result of lack of information and knowledge, seeds of noxious weeds like *Parthenium* and *Croton bonplandianum* have inadvertently got introduced into the country along with consignments of PL-480 wheat. They have suppressed local flora including the fodder grasses and have become alternate hosts to various microbial pests of local crops.
- Introduction of genetically modified agricultural crops can adversely affect the indigenous crops, vegetation, and livelihood of people.
- As a result of lack of knowledge and adequate human capacity to identify and weed-out undesirable fish from the lots of fish released as seed in Jaisamand

Lake (Udaipur) followed by increase in number of undesirable fish have adversely affected the fish fauna of this largest lake of the Aravallis.

CHAPTER 7

MAJOR STRATEGIES TO FILL THESE GAPS, AND ENHANCE / STRENGTHEN ONGOING MEASURES

7.1. Strategies :

Natural bio-resources, particularly the forest resources are generally taken for granted by the villagers. There is general lack of awareness about the importance of biodiversity and the role played by it in the rural economy. Many leaders, particularly at Gram Panchayat level, even though aware of the importance of the forests in the village society, lacked the will and capacity to manage them. This became amply obvious when the plantations raised on the Panchayat lands under Social Forestry were transferred to the village Panchayats for management. Some Panchayats are managing them well where as many such plantations were destroyed because some Panchayat leaders showed a total lack of will and capacity to manage them. These are in many ways common to all sectors of biodiversity.

Sector wise strategies suggested to fill up the gaps are as under:

7.2.1. Forestry ;

- Create awareness amongst the decision makers at various levels of in the states right from the village level to state level by taking educational and other programmes for re-emphasizing the role played by conservation of biodiversity in rural economy.
- Fully involve the stakeholders in planning and implementation. Of all biodiversity related conservation programmes,

- Buildup capacity of the local people to manage the community assets on a sustainable basis. Plantations raised on Community lands by the forest departments that were handed over to the village Panchayats have been destroyed in many cases because of lack of capacity and will to enforce discipline.
- Provide for employment of women at the lower levels of the forest staff to facilitate a more meaningful and friendly interaction with the common village women and encourage their involvement in decision-making process of forestry programmes
- The present status of wild bio-resources of the region need to be assessed scientifically and also be digitized as database for general appreciation and use.
- Undertake habitat improvement works in the existing Protected Areas of the region and strengthen the protection machinery.
- Undertake Eco-development works in the buffer areas of the existing PAs to meet the local demands of forest produce.
- Protected areas were notified without taking into account the grazing, fuel, and other needs of the local people that were met by these areas. These needs should be assessed and plans to meet them should be implemented..
- Keeping in view the ever increasing human and livestock population and the deterioration of the site quality of the forestlands, the production from the forestlands may not be enough to meet the future needs of the population with regard to fuel, fodder, and other NTFP. It is necessary to increase the per unit productivity of the forestlands by planting better strains of indigenous trees and plants.
- Forestry research needs to be directed towards increasing the productivity of the indigenous trees by tree improvement programme. This should be done by using modern bio-technology and tree genetics, followed by introduction of the improved tree varieties in the field.
- Improvement of tree species by selection of suitable “plus trees” / creation of seed orchards, for seed collection and raising of seedlings from them.
- Commercial tapping of Khajur trees in Mt. Abu area that results in daily death of thousands of honeybees and Khajur trees should be stopped.
- Modernize the nursery practices by adopting new technologies like uses of root-trainers, green houses, Vermi-compost etc.
- For *in-situ* conservation of the natural flora and fauna, additional areas need to be declared as sanctuaries. Bhondsi in Haryana-Aravallis and other such areas identified by Panchayats and local communities be raised to this status. With an

explicit role for these communities in planning, managing, monitoring and receiving benefits from such protected areas.

- Efforts need to be made to enhance the yield of medicinal plant species of high market potential / value such as glory lily, *Mucuna pruriens*, *Celastrus paniculata*, Salem mishri (*Eulophia ochreata*), Safed musli etc., which occur naturally in the Aravallis. This can be done both *in-situ* by VFPMCs in areas that are being protected by them and *ex-situ* by cultivating them in agricultural fields.
- Increasing the grazing potential of natural grasslands for use as pasturelands for the cattle in the region by eradicating plants like *Prosopis juliflora* and other unwanted bushes. Good fodder grasses could be used for reseeding of the areas.
- Eradication of noxious plants such as *Lantana*, *P. juliflora*, etc. from the potentially productive areas of Aravallis.
- Afforestation programme for tackling the problem of wind blown sand and its subsequent erosion to form sandy ravines should be taken up in areas around the gaps.
- Restoration of forest cover over degraded Aravalli hills. Programmes like Afforestation of Aravalli hills undertaken earlier may be continued. The pace of afforestation / natural regeneration should exceed the rate of deforestation in the area.
- Financial assistance from various foreign funding agencies may be obtained as was done in Haryana and Rajasthan Aravallis.
- Natural regeneration should be given higher priority in areas where rootstock is present.
- Forestry works such as afforestation of new areas, pasture development and water harvesting works should be undertaken on top priority in the Famine relief works.

7.2.2. Agriculture:

- Government support in the form of minimum support price be provided to people for cultivation of land races relating to different crops.
- EIA should be carried out on all agricultural schemes and programmes, especially to assess their potential impact on agricultural and wild biodiversity, and the livelihood of small and marginal farmers including women and children.
- Encouraging and educating farmers for production of Vermi-compost and other forms of compost for the purpose of organic farming.
- Support be provided to organic farming practices and for marketing of their produce.

- Encourage planting of suitable tree species on agricultural lands by informing them about the economics of farm forestry and making available good quality planting stock.
- Support to set up Cottage-Agro-based industries using surplus produce of local fruits and vegetable crops such as tomato be encouraged after ensuring that local need for subsistence and local market are met first.
- Control of blue bull population in the region through appropriate measures.

7.2.3. Animal husbandry

- Improvement of productivity of local cattle by their breed improvement, using pure indigenous breed.
- Attempt should be made to find out socio-ecological solutions, acceptable to nomads, for the problems faced by them.

7.2.4. Fisheries:

- Encouraging mass production of indigenous commercial fish fry by local people for use as seed in water bodies of the region.

7.2.5. Mining:

- Mining should be prohibited in all ecologically and culturally sensitive areas.
- Assessment of the impact of mining activity on biodiversity to be undertaken on scientific basis.
- An independent board or authority may be constituted to monitor the impact of mining and take necessary action to check its ill effects.
- Mining policy should take care of all direct and indirect threats to the biodiversity and environment of the area. This should ensure safe disposal of the overburden from the mining areas.

7.2.6. Development Departments:

- All construction activities of Irrigation and Public Works Departments should be subjected to Environmental Impact Assessment before their execution in the fields.

7.3. Laws & Policies:

- Review and amendment in the state laws and policies relating to biodiversity be undertaken from the point of view of Biodiversity and local livelihood based on biodiversity.
- Biodiversity be made a part of curriculum at the school and college levels.
- The poverty alleviation programmes should focus on development of the skills of the extremely poor men and women who earn their daily income by selling of

head loads of fuel wood and fodder. Activities based on the sustainable use of bio-resources available in the area should be undertaken for generating income.

- Eco-tourism to be promoted in the forest areas and wildlife sanctuaries of the region.

CHAPTER 8

REQUIRED ACTIONS TO FILL GAPS, AND ENHANCE / STRENGTHEN ONGOING MEASURES

Based on the gaps defined and the strategies outlined the actions that need to be taken up are as follows:

- 8.1.** Actions for conservation and sustainable use of the natural ecosystems, wild plants, and animal diversity: This should include creating awareness about conservation of biodiversity in the decision makers at various levels.

8.1.1. Action 1: Valuation of the contribution of the Aravallis and their biodiversity, to the plains below, and to resident and migrant populations

Category: High priority to be completed in 3 to 5 years.

Details:

- Study the effect of forest cover on the Aravallis on the ground water table of the adjoining areas
- Study the effect of forest cover on the post monsoon flow of water in the rivers originating from Aravallis.
- Study the effect of increased availability of forest produce including NTFP and medicinal plants on the economy of the villagers in the adjoining region.

Responsibility: . Biodiversity Boards (proposed), Forest Department / Ground water Department / Irrigation Department / NGOs.

Time frame: Study proposals to be formulated within one year of the finalization of the NBSAP. Studies to be completed within three years.

Resources required: Rs. 1.0 Crore for undertaking studies in all states of Aravallis, for period of three years.

8.1.2/ Action 2: Increasing forest cover in the natural forests / community lands by plantation / protection.

Category: High priority – ongoing.

Details:

- Regeneration / Afforestation of Aravallis on a large scale.
- Afforestation to check the problem of wind blown sand and ravine formation in northern Aravallis.
- Afforestation and pasture development on community lands and encouraging tree planting on suitable marginal agricultural lands.
- Use of economic, indigenous species for planting with emphasis on those yielding NTFPs.
- Linkage of poverty alleviation with the afforestation.
- Involvement of people, particularly women and weaker sections of society, in Joint Forest Management by ensuring their mandatory participation in the decision making process.
- Encouraging self initiated conservation measures by village communities.
- Intensive water conservation measures.

Responsibility: State Forest Departments / VFPMCs / Gram Sabha / Local NGOs.

Time frame: Ongoing activity. Its pace is to be accelerated, and the programme to be continued for next 15-20 years.

Resources required: To be assessed by the respective State Forest Departments. Funds may be provided by the GOI or foreign funding agencies with a share in cash or kind from local communities to ensure greater stake.

8.1.3. Action 3: Increasing productivity of tree species for production of fuel, fodder, small timber, and NTFPs.

Category: High priority, long term- 15 to 20 years.

Details:

- Selection of “Plus trees” for seed production.
- Tree breeding for volume and quality improvement, using bio-technological methods.
- Application of advanced tree breeding methodology, selection process for evolving superior genetic strains, clonal propagation of elites, tissue culture.
- Initial nutritional requirements to be met by organic fertilizers if necessary after studies.
- Development of proper silvicultural practices and management plan, in consultation with the local communities, for field application.

Responsibility: - Forest Research Institute / AFRI, Jodhpur, Forest Departments and Universities of the states.

Time frame: Initial steps to begin immediately and detailed project to be drafted within a period of one year of finalization of the NBSAP.

Resources needed: Rs.2.0 Crore for first 10 years to be provided by the Ministry of Environment and Forests, GOI.

8.1.4. Action 4: Study of ecological status of medicinal and other economically important plants.

Category: High priority to be completed within 3 years.

Details:

- Division-wise inventory of the medicinal and other economically important plant species.
- Assess the productivity potential of the area vis-a-vis exploitation.
- Possible value additions.

Responsibility: Forest Departments in collaboration with Ayurved colleges (including local vaids) and Universities of the states.

Time frame: The project proposal should be prepared within 6 months of the finalization of the NBSAP. (The Forest Department and Ayurved colleges can frame the proposals.)

Resources required: Rs. 25 Lakh, for a period of 3 years. Funds be provided by State/ Central Govt. / ICMR. DTSM. (Ministry of Health GOI)

8.1.5. Action 5: Inventorization of wild flowering and flowerless plants of the level of, algae, lichens, mosses, liverworts, and pteridophytes.

Category: Medium priority to be completed within 10 years.

Details:

- Division-wise inventory of plants of different groups.
- Identification of keystone species.

Responsibility: Botanical Survey of India, Western Circle, Universities of the states, NGOs, and communities.

Time frame: Project proposals be formulated within one year of the finalization of the NBSAP.

Resources required: Rs. 40.0 Lakh over a period of 10 years. The required funds be provided by State Department of Science and Technology: Ministry of Environment and Forests.

8.1.6. Action 6: Inventorization of wild micro-flora e.g. fungi and bacteria down to the level of mycoplasma..

Category: Medium priority to be completed in a period of 10-15 years.

Details:

- Survey of fungal, bacterial, and mycoplasma infections of wild plants
- Survey of soil fungi and bacteria forming mycorrhizal associations with higher plants and other fungi of the rhizosphere in thickly forested areas.
- Survey of bacterial flora of the rhizosphere in the aforesaid areas.
- Survey of the bacterial and mycoplasmic flora of phyllo and antho plants

Responsibility: Botanical survey of India, State Universities in collaboration with ICAR.

Time frame: Project be prepared within 2 years of finalization of NBSAP.

Resources required: Initially 2.5 crore for a period of 5 years. To be provided by ICAR and GOI.

8.1.7. Action 7: Improvement of habitat and management of the Protected areas.

Category: High priority. Long term

Details:

- Providing adequate number of perennial water holes in the PAs.
- Providing a proper mix of tree canopy and open grasslands for the wildlife of the PAs.
- Provide for an adequate core zone in PAs.
- Provide protection against uncontrolled fires and grazing by cattle.
- Provide rigid protection against poaching of animals.
- Provide for proper veterinary facilities for treatment of wild animals in case of epidemics etc.

Responsibility: Forest Department / Panchayats in case of community controlled areas.

Time frame: Management Plans for the PAs to be finalized within two years of the finalization of NBSAP.

Resources required: As per the management plan of each PA. To be provided by MOEF and state governments,

8.1.8. Action 8: Assess the needs of villagers around the Protected Areas in respect of grazing, fuel and all other forest produce that were met by the PA

Category: High priority to be completed within three years of finalization of NBSAP

Details:

- Assess the total requirements of the villages surrounding the PAs.
- Prepare an integrated micro-plan of all the villages for development of alternative resources to meet their demands.

Responsibility: Forest Department / NGOs / DRDAs.

Time frame: To be started within a year of finalization of the NBSAP

Resources required: Rs. 50.0 Lacs for formulation of projects of eco-development around the PAs. To be provided by the forest department / GOI.

8.1.9. Action 9: Undertaking Eco development works in the fringe areas of PAs.

Category: High Priority.

Details:

- Constitution of Eco –Development Committees (EDCs in the villages, ensuring involvement of people particularly women and weaker sections of the society in the decision making process.
- Execution of works through these EDCs.
- Encouraging self initiated conservation measures by village communities.

Responsibility: Forest Departments / EDCs. /NGOs.

Time frame: The Eco development plans should be formed with in two years of finalization of NBSAP.

Resources required: As per Plans made under Action 7 above. Funds to be provided by GOI with a share in cash or kind from local communities to ensure greater stakes..

8.1.10. Action 10: Eradication of *Lantana* from Mt. Abu sanctuary and adjoining areas.

Category: High priority within 10 years.

Details:

- Eradication of *Lantana* from prime forest areas of the Aravallis like Mt Abu and other areas.
- Planting of reclaimed areas with native shrub and tree species selected judiciously.
- Community in general and women in particular be involved in the task at planning and implementation level
- Well thought out methodology be adopted for the eradication.
- Eradication and checking it's subsequent spread to be made as an ongoing practice.

Responsibility: State Forest Departments and Village Panchayats. EDCs.

Time frame: An action plan be made within 6 months of finalization of NBSAP.

Resources needed: Rs. 5.0 Crore.

8.1.11. Action: 11: Inventorization for assessing the status of threatened cat species (Leopard, Caracal, Fishing cat and Rusty spotted cat)

Category: - High Priority

Details:

- Inventorization of wild animals; this will include
- Collection of data on present distribution, population and status..
- Habitat status and home range delineation.
- Identification of limiting factors and bottlenecks in population building.

Responsibility: Forest Departments of the States in collaboration with WII / Local Universities / NGOs.

Time Frame: The project proposal should be prepared within 6 months of the finalization of the NBSAP.

Resources required: Rs. 15.00 Lakh, for a period of 3 years. The central government should sponsor this programme.

8.1.12. Action 12: Study the status of Chausingha in Aravallis.

Category: High priority: To be completed within 5 years

Details:

- Collection of data on present distribution, population and status..
- Habitat status and home range delineation.
- Identification of limiting factors and bottlenecks in population building.

Responsibility: Forest Departments of the States in collaboration with WII / Local Universities / NGOs.

Time Frame: The project proposal should be prepared within 6 months of the finalization of the NBSAP.

Resources required: Rs. 15.00 Lakh, for a period of 3 years. The central government should sponsor this programme.

8.1.13. Action 13: Inventorization for assessing the status of Star turtle.

Category: High priority: To be completed within 5 years

Details:

- Collection of data on present distribution, population and status..
- Habitat status and home range delineation.
- Identification of limiting factors and bottlenecks in population building.

Responsibility: Forest Departments of the States in collaboration with WII / Local Universities / NGOs.

Time frame: Project proposals to be made within one year of the finalization of the BSAP.

Resources required: Rs 15.00 Lakh for a period of five years. The programme should be sponsored by GOI Ministry of E & F.

8.1.14. Action 14: Inventorization for assessing the status of Pangolin.

Category: High priority: To be completed within 5 years

Details:

- Collection of data on present distribution, population and status..
- Habitat status and home range delineation if possible.
- Identification of limiting factors and bottlenecks in population building.

Responsibility: Forest Departments of the States in collaboration with WII / Local Universities / NGOs.

Time frame: Project proposals to be made within one year of the finalization of the BSAP.

Resources required: Rs 20.00 Lakh for a period of five years. The programme should be sponsored by GOI Ministry of E & F.

8.1.15. Action 15: Inventorization of non-chordate fauna of the Aravallis.

Category: Medium priority 5-10 years.

Details:

- Collection, identification and preservation.
- Brief notes on their biology.
- Ecological status and their role in eco-system.

Responsibility: MoEF, ICAR (Agriculture fields) , ICFRE, and State Universities. and interested NGOs.

Time frame: Project proposal be prepared within a period of one year of finalization of the NBSAP.

Resources needed: Rs. 30 Lakh initially for a period of ten years to be provided by the State Department of Science & Technology.

8.1.16. Action 16: Identification of critical habitats that need protection such as Sambhar Wetland (Ramsar site) and taking up steps to protect them.

Category: High priority within 3 years.

Details:

- Identification of ecologically sensitive areas.
- Demarcation of the wetland and its surround
- Notification under the Environment protection Act .for restricting harmful activities.

Responsibility: Environment Department / Forest Department / Revenue Department / Sambhar Salts / Mining Department

Time frame: Notification of Sambhar lake as an environmentally sensitive area should be issued within 2 years of finalization of NBSAP process.

Resources required: Rs. 5.0 Lac, to be provided by the MoEF Government of India.

8.1.17. Action 17: Initiate measures for conservation of wetlands (Sainthal Sagar, Sambhar, Mangalsar, Nakki lake, and Fateh Sagar complex)

Category: High priority: To be carried out within a period of 5 years.

Details:

- Study of Anthropogenic activities affecting the individual wetland
- Qualitative and quantitative assessment of major threats (Pollution, Siltation, Eutrophication etc)
- Implementation Remedial measures needed to check the above threats
- . Identification of stakeholders and their dependence on wetlands.
- Evaluation of the direct and indirect benefits to the community.

Responsibility: NGOs. Village Panchayats, Forest Department, Local Bodies, Irrigation Department, and Pollution Control Board etc.

8.1.18. Action 18: Study of the socio-economic values of major wetlands of the region.

Category: Medium priority: To be carried out within a period of 10 years.

Details:

- Selection of major fresh water and saline wetlands for such studies.
- Identification of stakeholders and their dependence on wetlands.
- Study of the life forms.
- Evaluation of the direct and indirect benefits to the community.
- Anthropogenic activities affecting the wetlands.

Responsibility: Universities of concerned states and NGOs.

Time Frame: Project proposals be made within 2 years of finalization of NBSAP.

Resources required: Rs. 1.00 Crore over a period of 10 years.

8.1.19. Action 19: *In-situ* conservation of wildlife in new areas like Bhondsi (Haryana) and Bhaonta Kolyala (Alwar- Raj)

Category: High priority: to be completed in next 3 years.

Details:

- Ecological study of the area reclaimed with community participation
- Declaration of the area as a sanctuary (After amendment in WL (P) Act 1972.)
- Habitat improvement and protection with community participation.
- Further development of eco-tourism and educational tourism.

Responsibility: GOI. State Forest Department in collaboration with local Panchayat.

Time frame: Proposal to be prepared within 6 months of finalization of NBSAP.

Resource required: State Forest Departments, local bodies, MLAs and MPs funds allotted to them.

8.1.20. Action 20: Ecological restoration of old grasslands (birs).

Category: High priority: To be completed within 5 years.

Details:

- Eradication of exotic plants (*Prosopis juliflora* etc.) from these areas.
- Enrichment sowing / planting of indigenous grasses of high nutritive value.
- Determination of minimum number of trees that may be allowed to grow in the grasslands.
- Determination of carrying capacity of the birs and restricting the number of cattle within that number.
- Introduction of **Joint Grassland management** practices similar to JFM by involving local people.

Responsibility: State Forest Departments, VFPMCs, Eco Development Committees (EDCs) and Panchayats.

Time frame: To be completed within 10 years.

Resources required: Rs. 10.0 crore over a period of 5 years.

Time Frame: Project proposals be made within 2 years of finalization of NBSAP.

Resources required: Rs. 50.00 Crore over a period of 5 years.

8.2. Actions to conserve and sustainably use of agro-diversity, other domesticated plant, and animal diversity.

8.2.1. Action 21: Promoting cultivation of land races like Kangani (*Setaria italica*),

Category: High priority.

Details:

- Providing subsidies for cultivation of Kangni (Fox-tailed Millet) of millets.
- Providing subsidies for cultivation of local varieties of wheat, barley, and rice.
- Providing subsidies for cultivation of local varieties of pulses and gram.
- Procuring these crops for public distribution system.
- Providing higher support prices to encourage their cultivation.
- Facilitate link to consumers and consumer groups including those in cities.

Responsibility: Central and State governments, NGOs, Consumer groups.

Time Frame: Could start immediately and be made an on going activity for next 20 years.

Resources needed: Adequate funding from Central / State governments. National Bureau of Plant Genetic Resources(NBPGR).

8.2.2. Action 22: Promotion of organic farming - production of Vermi-compost.

Category: High priority

Details:

- Awareness campaign about organic compost.
- Training programmes for producing Vermi-compost and other forms of organic compost.
- Financial support in the form of soft loans for developing infrastructures.
- Women to be especially involved in this activity.

Responsibility: Agriculture depts. NGOs, Gram Panchayats.

Time frame: Program to start immediately and to continue for next 20 years.

Resources needed: 50 crore for next 10 years.

8.2.3. Action 23: Promotion of farm forestry

Category: High priority to continue for next 10 years.

Details:

- Working out the economics of the programme based on actual data from the areas where it is being practiced.
- Organizing extension and training programme for cultivators.

- Raising of needed plants of good quality.

Responsibilities: Agriculture Department / Forest department / NGOs./ Krishi Vigyan Kendras / VAs.

Time frame:

Programme to start within one year of finalization of NBSAP

Resources needed: Rs 5.0 crore per year for next ten years.

8.2.4. Action 24: Value addition by processing of surplus vegetables cultivated in the area like Peas and tomatoes etc. Setting up of Agro-based cottage industry.

Category: High priority to be completed in 5 years.

Details:

- Organizing training programmes for village women for processing of vegetables.
- Financial support for infrastructure development in the form of loans.
- Formation of women cooperatives for marketing of the produce.

Responsibility: Agriculture Depts. Krishi Vigyan Kendras and department of Co-operative Societies

Time frame: Programme to start within 6 months of finalization of NBSAP and may continue for next 10 years,

Resources needed: Rs. 4.00 Crore for next 10 years.

8.2.5. Action 25: Setting up of an Authority for certifying products of organic farming. Fruits, Vegetables, and Cereals of organic origin will fetch more money if they were of a certified quality.

Category: High priority within one year.

Details:

- Competent authority for issuing certificate to products of organic farming to be formed.
- Establishment of analytical laboratory for detection of residues of pesticides and synthetic manures at micro level.
- Pattern of "Agmark laboratory " could be followed.

Responsibility: Central Govt.

Time frame: Authority may be set up within a year from finalization of NBSAP.

Resources needed: Central Govt. to work out and make provision in their budget.

8.2.6. Action 26: Environmental Impact Assessment to be made mandatory before introduction of any new variety of seeds of agricultural crops.

Category: High Priority, Immediate.

Details: Assess the impact of the new variety of seeds that are proposed to be introduced, on soil, water, other crops, and the natural biodiversity of the area.

Responsibility: ICAR, Agricultural Universities, and Research Institutes,

Time frame: Immediately after the finalization of the NBSAP.

Resources needed: To be provided by ICAR / GOI as per requirements.

8.3. Actions to develop fisheries:

8.3.1. Action 27: Mass production of fish fry by local farmers.

Category: Medium to be completed in 10 years.

Details:

- Training of farmers in artificial / induced breeding of important local fish species.
- Provision of soft loans for establishing infrastructure for fish farms.

Responsibility: Department of fisheries and NGOs.

Time frame: Proposal to be submitted within 6 months after finalization of the NBSAP.

Resources needed: Rs.5.0 crore spread over 5 years.

8.4. Action to develop animal husbandry:

8.4.1. Action 28: Improvement of indigenous breeds of cattle.

Category: Medium priority 10-20 years.

Details:

- Procurement and distribution of pedigree bulls of identified local species for natural servicing.
- Establishment of semen banks for collection of semen for artificial insemination where natural servicing is not available.
- Exploring the use of embryo transfer technology for building of pure bred species.

Responsibility: Animal husbandry departments and Veterinary Collages of the states. NGOs like BAIF, Go Sewa Sangh, etc.

Time frame: A comprehensive proposal be made within 2 years of finalization of the NBSAP.

Resources required: Rs.40 crore over a period of 20 years.

8.4.2. Action 29: Study on the socio-economic-ecological factors involved in the nomadic pastoralism should be undertaken with a view to reach at a long-term viable solution to the present situation of conflict and hardship faced by the nomads.

Category: High priority with-in 3-5 years.

Details: Conduct intensive study to understand the socio-economic-ecological requirements of the nomadic people and access their requirements.

Responsibility: Animal husbandry Department / NGOs

Timeframe: The Study proposals may be framed within a year of finalization of the NBSAP. The field study and reports should be prepared within 3 years.

Resources required: Rs 15.0 Laks for a period of three years.

8.4.3. Action 30: Study of the possibilities of utilizing the natural “sewan”(Lasiurus *sindicus*) grasslands in the Indira Gandhi Nahar Pariyojna area, spread over thousands of hectares on either side of the canal for pasturing these sheep should be examined with involvement of the nomads.

Category: High to be completed within 3-5 years.

Details: Conduct study about the grazing potential of the area and specific needs of the nomads.

Responsibility: Revenue (Colonization) Department / Command Area Development Department / Forest Department / NGOs.

Time frame: The study proposals to be made within a year of finalization of the NBSAP. Study report to be prepared within 2 years.

Resources Required: Rs 5.00 Laks for a period of two years.

8.4.4. Action 31: Exploring the possibilities of creating sheep-pastures in the uncommand areas and on the left bank of the Indira Gandhi Nahar be explored.

Category: High priority to be completed within 3 –5 years.

Details: Identification and demarcation of uncommand land within the gross command area.

Survey of its present and future grazing potential of the area.

Responsibility: Revenue (Colonization) Department / Command Area Development Department / Forest Department / NGOs

Resources Required: Rs. 20.00 Laks for a period of three years.

8.5. Actions relating to policy and legal changes:

8.5.1. Action 32: Employing suitable women as frontline forest staff for facilitating meaningful involvement of women in decision making in VFPMCs

Category: High priority to be completed within 3 years.

Details:

- Recruitment of women at the level of foresters and Forest Guards.
- To be trained as professional foresters for having understanding of species of grasses, shrubs, and trees used by the community.
- To be trained to act as extension worker to encourage village women to participate in the decision taking meetings at village level.

Responsibility: Forest departments of the states.

Time Frame: Necessary amendments in the service rules may be done within 6 months of finalization of NBSAP.

Resources required: Nil. (There is a mandatory provision in the JFM guidelines that there will be at least 30% women representation in the executive committee. At least one of the three key posts, i.e. President, Vice President and Treasurer, is to be held by a women member. There is also a provision for women sub-committee and the local forester has to organize regular meeting of this sub-committee and put up their recommendations in the Executive Committee meetings. The

idea of having lady foresters and forest guards is that the village women will be in more comfortable in their presence while discussing their problems and issues.)

8.5.2. Action 33: Development of skills for alternate income generation to reduce the dependence on the forest produces.

Category: High priority (to be completed in next 5 years)

Details:

- Training to be given to women to develop skills of sewing and knitting. Presently the village women have to buy their garments from near by towns and larger villages. If they learn sewing and stitching they can meet the local demands and earn a handsome amount regularly.
- Training to be imparted to the village women for developing the skills for processing and marketing of the NTFPs and medicinal plants found in the area.
- Training to be given for processing of fruits, vegetables and other agricultural produce grown in the area for enhancing the market value of local products.
- Training to produce *Spirulina* on commercial scale in suitable areas.
- Constitution of co-operatives for marketing of the produce.

Responsibility:

Women and Child welfare department / Agriculture Department / Forest Department, and NGOs.

8.5.3. Action 34: Changes in laws and policies from bio-diversity point of view.

Category: High priority within 3 years.

Details:

- Review of Wildlife (Protection) Act 1972. towards the following:
- Involving local communities in protection and management of Sanctuaries and National Parks.
- Management of populations of Nilgai that has become a pest of agriculture.
- Provision for declaring community lands as sanctuary if local community so desires without infringing their traditional rights over the area.
- Ban on commercial extraction of “Neera” in areas like Mt. Abu, which results in death of thousands of honeybees’ daily.
- Amendments in Forest Act to delegate powers of forest officers to VFPMCs for dealing with forest offence cases. (There is already a provision in the JFM guidelines that the President of VFPMC has to be an elected member from the village. However, presently the Secretary has to be the local Forester or Forest Guard. Nevertheless, after two years of working of VFPMC any suitable local person can replace him. This needs more efforts in capacity building of the villagers to take up the post.)

Responsibility: State and Central Governments.

Time frame: Within two years.

Resources required: Nil

8.5.4. Action 35: Amendments in the Mines & Minerals Act.

Category: High priority, medium –term (with in 3 years).

Details:

The Mines & Minerals Act needs to be modified with provisions added to achieve the following three major objectives.

- Assessment of the impact of all mining activities on biodiversity, prior to and during the implementation of these activities, and their appropriate modification to ensure that the objectives of conservation and sustainable use are being met;

- Empowerment of the gram sabha / village tribal council, to be able to participate in decision regarding mining within their jurisdiction. (such a provision already exists under “ Extension of Panchayat Raj Act to Scheduled Areas”)
- Mandatory provision for ecological rehabilitation of the abandoned mining sites.

Responsibility: State Mining Departments, Panchayat Raj Department and in consultation with the State Biodiversity Board when set up.

Time Frame: Recommendations for specific changes within one year of the finalization of the NBSAP.

Resource required; No extra financial resources required,

8.5.5. Action 36: In Famine relief Works top priority to be given to the works that help in protection / regeneration / augmentation of the natural resources of the region.

Category: High priority

Details:

- Works of water harvesting, minor irrigation , watershed management, and works that help in recharging of ground water should be taken up on top priority.
- Afforestation and other forestry works that help in production of fodder fuel and other biomass needed by the community to be given high priority while sanctioning relief works.
- Works for augmenting water supply for wild animals be taken up on priority basis in forest and wildlife areas.
- Other relief works to be taken up only if works mentioned above can not be taken up.

Responsibility:

State governments / Famine relief departments / District administration.

Time frame: Immediate change in the state policy is needed.

Resources required: No resources needed. All it needs is change in policy.

8.5.6. Action 37: Environmental Impact Assessment of all Irrigation Projects in Aravalli region to be made mandatory.

Category: High priority, Immediate

Details:

Irrigation projects have direct relationship with the biodiversity of the area. The availability of water in the area is increased in one area and decreased in other area. The biodiversity is affected in both the cases. The decision to construct a dam should be taken after total overall impact assessment of its effect on biodiversity.

Responsibility: Irrigation Department, Environment Department. Biodiversity Boards and NGOs.

Time Frame: It could be implemented immediately after the finalization of the NBSAP. It should be made a part of all irrigation projects.

Resources required: To be provided by irrigation department as per the requirements.

8.5.7. Action 38: Setting up of State Biodiversity Boards in each of the Aravalli range states.

Category: High priority, immediate (within one year).

Details:

- A State Biodiversity Board should be set up with equal representation from relevant government departments, conservationist, NGOs and experts, social action groups, community representatives chosen by the communities themselves, and political leaders of local government.
- The responsibility to implement this NBSAP; ensure that all development planning and projects in the state adhere to the principles of biodiversity, and sustainably utilizing biological resources.
- The required notified powers to ensure the fulfillment of the above responsibilities.
- Chairpersonship by an eminent environmentalist or biodiversity expert, preferably from outside the government.
- Periodic meetings (at least once in every six months) of the entire Board and more frequent meetings of subgroups or committees for specific purposes.

Responsibility: State governments (with action being initiated by the planning department).

Time frame: The Board to be set up within 6 months of the finalization of the BSAP.

Resources required: Rs, 20 lakh for first 3 years of its running. To be provided by the state Planning Departments or sought from Central Government.

8.5.8. Action 39: Setting up of Aravalli Development Authority:

Category: High priority

Details:

- The Authority to be headed by a senior officer of the rank of chief secretary with supporting officers of various disciplines dealing with the natural resources of the concerned states on deputation for proper coordination.
- Ensure judicious utilization of the natural resources of Aravallis by the states of the region.
- Responsible for coordination and implementation of BSAP with the State biodiversity boards of three states.
- Ensure that all development planning and projects in the state adhere to the principles of biodiversity, and sustainably utilizing biological resources.

Responsibility: Government of India.

Time frame: To be created immediately after the completion of the NBSAP process.

Resources required: To be worked out on finalization of the BSAP of the ecoregion.

Funds to be provided by the Government of India under hill area development programme for Aravalli hills.

8.5.9. Action 40: Monitoring of conservation actions including JFM and their impacts.

Category: Medium priority, long term (ongoing, over 10 to 20 years).

Details:

- A regular and systematic framework and mechanism should be developed to monitor the impact of all actions taken for conservation of biodiversity. In particular, the monitoring should focus on the ecological impacts, and on the social – economic impacts on local communities.
- A participatory methodology, involving the local communities, relevant stakeholders and integrating traditional / community knowledge with modern / formal knowledge, should be evolved.
- For improvement in the implementation of JFM a continuous exchange of ideas between the local communities / NGOs and the Forest Department is essential. Efficacy of the present system should be tested regularly.

Responsibility: State Universities of the area, in association with the Wildlife Institute of India, authorized by the state governments. Forest department / NGOs/ VFPMCs.

Time frame: Ongoing, starting immediately and carrying on for 10 to 20 years; with periodic reviews to assess progress and results.

Resources needed: Rs. 2.0 Crore, over the next 10 years; further resources to be determined during the course of these 10 years.

8.6. Action 41: Training programmes for decision makers.

Category: High priority

Details:

Training programmes and workshops to be organized to provide relevant information about biodiversity and create awareness amongst the people's representatives starting from Village Sarpanch to Members of Parliament. Similar programmes to be organized for government officials of various levels.

Responsibility: Department of Personal and training GOI / States, Panchayat Raj training institutes, Officers training institutes, NGOs.

Time frame: Ongoing, starting immediately and carrying on for next ten years; with periodic reviews to assess progress and results.

Resources required: Ten crore for next ten years,

CHAPTER 9

OPERATIONAL IMPLEMENTATION OF THE ACTION PLANS AND FOLLOW UP.

9.1. Setting up of State Bio-Diversity Boards

The Action Plans defined in chapter 9 are to be implemented by various agencies. For successful implementation and coordination of these Action Plans at state level there should be an influential and powerful enough organization/body to see that adequate funds are allocated for approved activities. This body should also be in a position to coordinate and monitor the progress of various sectors. For this purpose, a State Biodiversity Board is proposed to be created. Till this board is created it is suggested that the state planning department be designated as Nodal Agency for SBSAP programmes.

Necessary strengthening of Planning Dept. will have to be done by providing an independent cell for the purpose. It would be the responsibility of this cell to monitor the progress and facilitate the implementation of the programmes.

On creation of State Biodiversity Board this cell, as such, will be merged with it.

After finalization of the Action Plans by the State Govt. monitoring of the progress of implementation of the programmes should also be done at national level by the Ministry of Environment and Forests or any other suitable agency.

9.2. Setting up of Aravalli Development Authority:

Aravalli hills have special significance in the overall economy and well being of the people of the states of Haryana, Rajasthan, and Gujrat. They, not only act as a natural physical barrier between the "Thar Desert" and the fertile Indo-Gangetic plains, but also influence the ecology and hydrology of the region, A number of big and small rivers, that provide

valuable water to the parched plains, originate from these hills. The forest and mineral resources of these hills have been continuously exploited by the ever-increasing consumer needs and greed of the urbanites and people living in the nearby plains. Reckless felling of trees unrestricted grazing; haphazard mining coupled with a total neglect of this ecosystem is responsible for wholesale degradation of most of the Aravallis. Degradation of forest cover over the hills has resulted in accelerated rate of soil erosion. Large tracts of these hills have been converted into rocky wastes. The riverbeds have been choked with coarse sand; recharging of ground water in the region has reduced considerably

Traditionally the people living in Aravallis are dependent upon the forest produce for their survival. These people earn their lively hood from the forests. Some of them are amongst the poorest of the poor people in India. The forest based life support system used to provide them with food, fruits, fodder, fuel, small timber, and a variety of non-timber products. These people are facing the problems due to degradation of the Aravallis due to reckless felling of trees and the resultant degradation of the water channels.

Forested hills, in past, regulated the flow of rivers and streams and recharging of underground water table. Degradation of these hills has adversely affected lives of these people.

After independence of the country, no serious attention was paid for development or preservation of the natural resources of Aravallis by any of these states. The need for eco restoration of the Aravallis is urgent. Its natural resource base needs intensive scientific study and development. Development of the Aravallis, as a forested hill system, in the regional context will

- Provide life-sustaining ecosystem to the people living there.
- Increase the post monsoon flow of water in the rivers originating from these hills (As happened in case of Arvari and Sursa rivers of Alwar district and Soop river of Jhunjhunu Distt).
- Improve the water regime of the adjoining region.
- Check the process of desertification in the fertile areas of these states.
- Preserve the biodiversity of the region.

Aravalli eco-region, for development and preservation of its environment, needs intensive scientific study, regulated utilization of its natural resource and periodical monitoring of its environmental status.

The effects of treatments given to one area of these hills have far reaching consequences on areas in the adjoining state. (Deforestation and soil erosion in the southern Aravallis in Udaipur district of Rajasthan directly affect the waters of Sabarmati and Mahi rivers in

Gujrat. Similar activities in Northern Aravallis in Jaipur district have direct bearings on the flow of water in Sahibi in Haryana). Therefore, the development of forests and natural resources of the Aravallis will have to be undertaken on an eco-regional basis. This would also need substantial increase in allocation of funds for development of the region..

The state governments of the region are not in a position to provide enough funds for development of the region. It has become necessary to look for some other sources for funding the development of Aravallis. Keeping in view the ecological importance of the Aravallis, the role it plays in maintaining the hydrology of the area, and its present critical stage of degradation, it would be proper to include this important hill system in the Hill area Development Programme of the Government of India. (Presently only two hill systems of the country viz. the Himalayas and the Western Ghats are included in the Programme).

A separate authority should be created under the proposed Biodiversity Act **for coordinating conservation, development, and judicious utilization of the natural resources of Aravallis, with the states of the ecoregion**. Since the authority will have to deal with a number of states and the Central government it should be headed by an officer of the rank of Chief Secretary of the state supported by officers of various disciplines dealing with the natural resources and officers of the concerned states on deputation for proper coordination.

Various tasks that may be assigned to this authority will include:

1. Coordinate with the Biodiversity boards of the states of Aravalli ecoregion about the Biodiversity conservation / development programmes in Aravallis.
2. Preparation of a comprehensive development plan for the entire ecoregion
3. Set priorities for sustainable development of different areas.
4. Provide funds to the state governments / organizations for undertaking approved development schemes in the region.
5. Monitor the progress of implementation of approved schemes.
6. Issue guidelines for judicious utilization of natural resources in various states.
7. Take / Initiate suitable necessary action against violations of the guidelines.

CHAPTER 10

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