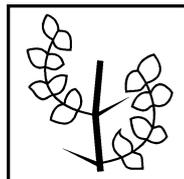




KACHCHH SUB-STATE BIODIVERSITY STRATEGY AND ACTION PLAN

PREPARED UNDER THE
NATIONAL BIODIVERSITY STRATEGY
AND ACTION PLAN- INDIA



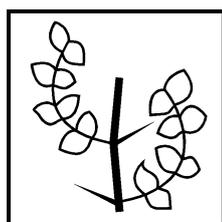
**Gujarat Institute of Desert Ecology
Bhuj, Kachchh**

2002

Dedicated to
The Undying Spirit
of
People of Kachchh

KACHCHH SUB-STATE BIODIVERSITY STRATEGY AND ACTION PLAN

PREPARED UNDER THE
NATIONAL BIODIVERSITY STRATEGY
AND ACTION PLAN- INDIA



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Preface

Biodiversity conservation is considered to be one of the key elements for Sustainable Development. Efforts were made, therefore, to include it as necessary developmental agenda at country to local levels. To achieve the goals many efforts were made to draw strategic action plans at various levels. Out of all such plans majority failed in achieving their goals and objectives. Unequivocally, the failure of such plans owe to their 'top-bottom' approach of planning. The messages were loud and clear that centralised, round-the-table planning will not withstand the ground realities and thus decentralised, participatory, 'bottom-up' approach are the need of hour. It is really great to find that that the NBSAP-India has followed the later approach. It is also of a great satisfaction that GUIDE is also one of the partners in the national exercise of this kind and magnitude. It is even personally very satisfying that the biodiversity values of Kachchh are now getting special focus at national level.

This document is prepared under extraordinary situation, when almost entire district was passing through a traumatic experience of earthquake. Nevertheless, it was the Kachchhi spirit and their deep sense of belongingness to their land that overcome all the odds and gave serious inputs to this document. The document, on its part, provides a synergy between the issues of biodiversity conservation and livelihood of local communities, especially in the rural context. This paradigm shift from wildlife (flora-fauna) centric to livelihood centric approach gave biodiversity conservation a much needed humane face. I am sure with the kind of strategies and actions suggested in this document, it will bring more friends than enemies to entire conservation efforts. I knew that we needs to go many more miles before we operationalize most of the recommendations of this report, yet with concerted efforts from all like minded individuals and agencies, operating within or outside Kachchh, this journey could be faster and easier.

10 September 2002

Y.D. Singh

Director, GUIDE

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A.M. Dixit

Project Coordinator

Table of Content

Preface.....	v
Acknowledgements	vii
Table of Content.....	ix
Abbreviations Used	xi
1 Introduction	1
1.1 Brief Background to the NBSAP	1
1.2 Scope of the BSAP.....	1
1.3 Objectives of the BSAP	2
1.4 Contents of the BSAP	3
1.5 Methodology	3
2 Profile of Area	7
2.1 Geographical Profile	7
2.2 Social Conditions.....	8
2.3 Economic Conditions	9
2.4 Political Profile.....	10
2.5 Ecological Profile	11
2.6 Brief Conservation History	14
2.7 Disasters	15
3 Current Range and Status of Biodiversity	17
3.1 Current Magnitude of Biodiversity	17
3.2 The Distribution of Biodiversity (Hot-Spots).....	24
4 Causes of Biodiversity Degradation	31
4.1 Major Causes of Biodiversity Degradation	31
4.2 Supplementary Causes of Biodiversity Degradation	36
5 Major Actors and Their Current Roles	43
5.1 Communities	43
5.2 Government Departments	44
5.3 NGOs and Citizen Groups	45
5.4 Academic/ Research Institutions.....	46
6 Important Initiatives	49
6.1 Research and Studies.....	49
6.2 ‘Abhiyan’ –A Network of NGOs.....	49
6.3 Efforts in rural women empowerment	49
6.4 Medicinal plant cultivation farm.....	49
6.5 Revival of ‘Tharparker’ breed of cattle	50
6.6 Community based ‘Anaj Bank’	50
6.7 Mangrove regeneration program.....	50
6.8 Grassland regeneration programs.....	50
6.9 Rann area development	51
6.10 Regeneration of UNPs by NGOs	51
6.11 Demands for sustainable industrialization	51
6.12 Promotion of organic farming practices	51
6.13 Individual efforts of plant specimen collection.....	51
6.14 Waterfowl census.....	51
6.15 Sea turtle hatchery	52
6.16 Mass-movements for tree plantation	52
6.17 Watershed Development Programs	52
6.18 Setting up of Kachchh Ecology Fund.....	52
6.19 Drought Proofing Program (DPP).....	52
6.20 Creation of Setu	53
6.21 Setting up of Kachchh Resource Information Centre (KRIC)	53
6.22 Livelihood support programmes	53

7	Gap Analysis	55
7.1	Gaps in Information	55
7.2	Gaps in Vision	58
7.3	Gaps in Policy and Legal structure	59
7.4	Gaps in Institutional and Human Capacity.....	61
7.5	Gaps in Actions	62
8	Strategies	65
9	Proposed Actions.....	67
9.1	Expanding and improving knowledgebase on Biodiversity	67
9.2	Initiation of conservation programs centred on flagship species of regional importance	68
9.3	Promotion of landscape level planning for biodiversity conservation	68
9.4	Enhancing the role of women in biodiversity conservation initiatives	69
9.5	Prosopis juliflora Control for ecosystem and community benefits.....	69
9.6	Enhancing and improving the scope of partnership of different stakeholders in biodiversity conservation	70
9.7	Strengthening of PA Network	75
9.8	Enhancement and restoration of Agro-biodiversity.....	77
9.9	Formulating policy and legislative frameworks to support the cause of biodiversity conservation.....	78
9.10	Human Resource Development for Biodiversity Conservation	79
9.11	Mobilizing education and awareness programmes towards biodiversity values and their conservation	80
9.12	Overall Institutional Mechanism for coordination and implementation of different strategies and actions	81
10	Literature Cited and Consulted	85
	Annexures.....	91

Abbreviations Used

BADP	Border Area Development Programme	JFM	Joint Forest Management
BD	Biodiversity	KDWLS	Kachchh Desert Wildlife Sanctuary
BNHS	Bombay Natural History Society	KEF	Kachchh Ecological Fund
BSAP	Biodiversity Strategy and Action Plan	KERC	Kachchh Ecological Research Centre
CAZRI	Central Arid Zone Research Institute	KMVS	Kachchh Mahila Vikas Sangathan
CBO	Community Based Organization	KRIC	Kachchh Resource Information Centre
CEE	Centre for Environment and Education	KSKM	Kachchh Sajeew Khedi Manch
CF	Conservator of Forest	KVK	Krishi Vigyan Kendra
CPLR	Common Property Land Resources	LAC	Local Advisory Committee
CREB	Conservation of Rare and Endangered Biodiversity	LBS	Lala Bustard Sanctuary
DDP	Desert Development Programme	LF	Lesser Florican
DPP	Drought Proofing Project	LRK	Little Rann of Kachchh
DRDA	District Rural Development Agency	MFP	Minor Forest Produce
EIA	Environmental Impact Assessment	MoEF	Ministry of Environment and Forests
FCA	Forest Conservation Act	MoU	Memorandum of Understanding
FD	Forest Department	MPP	Minor Plant Produce
FES	Foundation for Ecological Security	MT	Million Tonnes
FPIK	Forum for Planned Industrialization for Kachchh	NBSAP	National Biodiversity Strategy and Action Plan
FSI	Forest Survey of India	NGO	Non-government Organisation
GAU	Gujarat Agriculture University	NRI/K	Non-resident Indians/Kachchhis
GEC	Gujarat Ecology Commission	NSS	Narayan Sarovar Sanctuary
GEDA	Gujarat Energy Development Agency	NTFP	Non-timber Forest Produce
GEER	Gujarat Ecological Education and Research Foundation	PA	Protected Area
GEF	Global Environment Facility	Q	Quintals
GIB	Great Indian Bustard	R&E	Rare and Endangered
GIS	Geographical Information Centre	SAC	Space Application Centre
GMDC	Gujarat Mineral Development Corporation	SACON	Salim Ali Centre for Ornithology and Natural History
GoK	Gulf of Kachchh	SEAP	State Environmental Action Programme
GRK	Great Rann of Kachchh	SHG	Self Help Group
GSFDC	Gujarat State Forest Development Corporation	SSP	Sardar Sarovar Project
GSRDC	Gujarat State Rural Development Corporation	TGA	Total Geographical Area
GUIDE	Gujarat Institute of Desert Ecology	TPCG	Technical and Policy Core Group
HYV	High Yielding Varieties	TRA	Total Reporting Area
ICEF	Indo-Canada Environment Facility	UNDP	United Nations Development Programme
ICMAM	Integrated Coastal Marine Area Management	UNP	Underutilized Native Plants
IWDP	Integrated Watershed Development Project	VRTI	Vivekanand Research and Training Institute
		WCMC	World Conservation Monitoring Centre
		WII	Wildlife Institute of India
		WPA	Wildlife Protection Act

1 Introduction

1.1 Brief Background to the NBSAP

The Convention on Biodiversity held in Rio di Janeiro in 1991, was the strongest step to address the issues related with the conservation of biodiversity. India was one of the signatories of Rio Declaration. One of the major outcomes of the convention was that all the countries must prepare their National Biodiversity Strategy and Action Plan (NBSAP) and thus India is committed to prepare its own NBSAP.

The NBSAP, a project of Union Ministry of Environment and Forests (MoEF) aims to produce a series of planning documents dealing with the conservation of India' biodiversity, sustainable use of its biological resources, and equity including in decision regarding access to such resources and the benefits accruing from them. The NBSAP exercise thus aims to: (a) identify the full complexity of issues, (b) exploring different perspectives to deal the complexity of issues, (c) open a dialogue among holders of different perspectives, and (d) develop an implementable action programme with short, medium and long term perspective. The project is funded by the Global Environment Facility (GEF) through United Nations Development Programme (UNDP). A unique concept of the project is that its technical execution is by a Technical and Policy Core Group (TPCG) being coordinated by an NGO Kalpavriksh, and its administrative coordination is by Biotech Consortium India Ltd.

One of the major challenges in the whole exercise was to prepare the NBSAP a more of country level plan and at the same time not to loose the flavours from the local level issues. To overcome this problem, the NBSAP process has included extremely widespread consultations across the country and across all sectors of society, involving tens of thousands of people. It aims to produce not one national action plan but 18 local (substate) plans, 33 state and union territory plans, 10 ecoregional (interstate) plans and 13 thematic plans (Table 1.1). In addition, over 30 sub-thematic papers have been commissioned on a variety of topics related to biodiversity. This decentralized and participatory mode of resource planning is a paradigm shift from earlier routine centralised planning where very little scope was for taking into account the views of different levels of stakeholders and that too from different part of the country.

#	Planning Levels	No. of Working Groups
1	Local/ regional (sub-state)	18
2	State	33
3	Eco-region (inter-state)	10
4	Thematic areas	13
5	Sub-thematic areas	30
6	Cross-cutting thematic areas	4

Within this overall process, one of the sub-state action plans is on 'Kachchh District' in Gujarat, which has been drafted by nodal agency- the Gujarat Institute of Desert Ecology (GUIDE).

1.2 Scope of the BSAP

The separate Biodiversity Strategy and Action Plan (BSAP) for Kachchh, while provide opportunity to prepare a District level plan of action for conservation of biodiversity, it is also expected to provide important inputs to both Gujarat State BSAP and finally to the NBSAP. However, before finalising the scope of BSAP, it is important to outline major biodiversity related concerns of Kachchh. These concerns are (a) conservation values of Kachchh (b) livelihood issues of local communities and, (c) prospects for industrial based economic development.

1.2.1 High Conservation Values

Ecologically, Kachchh is an important unit as it falls under a separate biotic province '3A' (Kachchh desert of bio-geographic zone- the Indian Desert) of the country (Rodgers and Panwar, 1988) and thus representing a distinct gene pool of Indian Arid Regions. The region is supporting a rich diversity of habitats including (a) thorn forests, (b) grasslands and savannah, (c) coastal & marine areas, (d) mangrove forests, (e) saline deserts, (f) freshwater wetlands etc. The region bears one of the few remnant patches of natural thorn forests in the country. Although, few patches of these forest types are also present in some parts of Rajasthan, yet forest patches in Kachchh are biologically in better condition. Similarly, Kachchh supports largest mangrove forests in the entire Western Coast. Such a matrix of different ecological system within a region is the key factor for assemblage of many globally rare and endangered species (both plants and animals), including a few endemic ones. Some of the rare and endangered species include Wild Ass, Caracal, Wolf, Spiny Tailed Lizard, Great Indian Bustard, Lesser Florican, Houbara Bustard etc. The region is considered as one of the entry point for the large number of migratory waterfowls during the winter.

1.2.2 Livelihood Issues

The district is generally poor in basic amenities such as drinking water, health, education, etc., and causing low level of development at the grass-root level. Accordingly, poverty is prevailing phenomenon in the region. This leads to over dependence on biomass-based natural resources for the subsistence. Four rural based groups can be identified whose livelihood is directly dependent on the surrounding resources. They include the farmers, the livestock keepers, the fishermen and landless labors.

1.2.3 Industrial Development

The industrial development in the district is mainly pushed forward because of two key elements- (a) presence of long coastline along the Gulf of Kachchh and (b) presence of vast storage of mineral resources like lignite, limestone, bentonite, bauxite etc. There are already many industrial and developmental projects centred on these two areas like developments of ports and jetties, thermal power stations, salt based industries, cement industries etc. These industries, just by their operational methods, are known to damage the ecological integrity of area. More seriously, most of these industrial developmental sites are overlapping with the biodiversity hot-spots of the region.

The natural fallout of these three major issues is the different conflicts of interests at various stakeholder levels. Therefore, by and large, the scope of Kachchh-BSAP can be seen to address the followings:

- (a) to conserve the integrity of different ecological systems
- (b) to integrate (a) with the livelihood related issues
- (c) to integrate (a) and (b) with sustainable development related issues

1.3 Objectives of the BSAP

As per the guidelines given by TPCG, the main goal of preparation of Kachchh-BSAP is to develop strategies and prioritized actions that need to be taken in the short, medium and long term. Specifically, the objectives of the Kachchh-BSAP are to:

- i. Document and analyze the existing baseline information related to various components of biodiversity
- ii. Identify and analyze the problems related to biodiversity conservation
- iii. Identify major stakeholders and analyze their roles in biodiversity conservation
- iv. Evaluate the ongoing efforts and initiatives

- v. Identify major gaps in biodiversity conservation
- vi. Develop gender, equity and empowerment sensitive strategies and actions to fill the gaps

1.4 Contents of the BSAP

This document presents a detailed action plan for biodiversity conservation in Kachchh. Following this chapter, chapter 2 describe the salient features of the district. Chapter 3 present a biodiversity profile of the district. This chapter is based on the compilation of information from different sources. In Chapter 4, the major and subsidiary causes of biodiversity degradation are explored and presented. While, Chapter 5 present a brief account of key players in the district who can help in implementing this action plan, the Chapter 6 reports the key initiatives already taken by different players to help conserve the biodiversity. Based on these chapters, a detailed Gap Analysis is presented in Chapter 7 and in order to fulfil the identified Gaps broad strategies were identified and listed in Chapter 8. Chapter 9 presents the key action points emerged under different strategies.

1.5 Methodology

1.5.1 Constitution of Advisory Committee

The process of preparation of Kachchh-BSAP was started after Director of Gujarat Institute of Desert Ecology (GUIDE) has signed a MoU with the National Project Director, MoEF in January, 2001. At the onset, as per the guidelines given by TPCG, a 20 member Local Advisory Committee (LAC) was constituted for the overall supervision of the entire exercise. The members of the LAC represent broadly the sectors from Forest Department, NGOs, Farmers, Nature lovers, Senior citizens and academicians from Kachchh district. Later, in order to strengthen the LAC, seven more persons, representing the women and industries were included in the LAC (Table 1.2). The complete list of members of LAC and their break-up are presented in Annexure 1.1 and 1.2.

Membership by Sector	Number of Members		
	Men	Women	Total
Forest / Wildlife Dept.	3	-	3
District/ Civil Administration	1	-	1
Scientists/ Academics	4	-	4
Other Professionals (Doctors & Lawyers)	2	1	3
NGO	4	2	6
Senior Citizens/ Individuals	5	-	5
Local Community Members	1	-	1
Corporate Sectors	2	-	2
Students	1	-	1
Others (Small enterprise)	1	-	1
Total	24	3	27

1.5.2 Setback due to Earthquake

Immediately after the constitution of LAC, its first meeting was held on 22nd January 2001, where some decisions regarding the future course of action were made and responsibilities were given to different persons. However, due to the devastating earthquake of 26th January 2001, the priorities of all the individuals and institutions were shifted to relief and rehabilitation work and there was no focus on preparation of Kachchh-BSAP till middle of June 2001. Only after getting some feedback from the Mid-term Workshop at New Delhi (13-15 June, 2001), the preparation of Kachchh- BSAP was reinitiated in July, 2001.

1.5.3 Call for Participation

Since the foremost principle for preparation of BSAP is to make it a decentralised, participatory and stakeholder driven planning exercise, it is important to bring as many people as possible from different sections of the society into this whole exercise. For this, mass appeals were made through local Gujarati newspapers and local News Channel operated through Cable-TV network. Other than these mass appeals, brief notes on BSAP was prepared in Gujarati and circulated to different schools, colleges, NGOs and some government departments, calling for their participation. In response to these call for participation, only 3 persons has shown some interest and contacted us (Annexure 1.3).

Call for Participation

Local News Papers
Local Cable TV News
Circulating of pamphlets,
notes to school/ colleges/
Govt. dept.

1.5.4 Identification of Key Issues

It was realised that if the views of different stakeholders are to be necessarily incorporated in the preparation of BSAP, there need to push forward some clear agenda, which entuse the community and other stakeholders to participate in this process. Broadly, two major issues were identified for discussions with communities and other stakeholder groups. These include (a) the linkages of biodiversity with the livelihood systems of different communities and (b) wildlife conservation in and outside the Protected Areas. Keeping in view the social-economical-ecological scenario of Kachchh, the livelihood related issues were further classified into four major groups based on the differences in pattern of interaction with resources. These four groups include:

Key Conservation Issues

Dryland Farming
Nomadic Pastoralism
Coastal Area Fisheries
Minor Plant Produce
Wildlife Conservation

Dryland Farming. Issues like soil-water conservation, hybrid varieties and use of chemical fertilisers and pesticides, loss of local cultivars and varieties of crops etc. were identified for discussion, which are directly or indirectly associated with the livelihoods of large number of *farmers*.

Nomadic Pastoralism. Issues like degradation of common grazing lands, expansion of *Prosopis juliflora*, migration, loss of local livestock breeds, etc. were identified as livelihood related concerns of a very large number of *maldharis*.

Coastal area fisheries. Issues like mangrove conservation, industrial development along the coast, over-fishing by mechanised trawlers, loss of fish diversity and catch etc. were discussed as livelihood related concerns of *fishermen* communities of Kachchh.

Minor Plant Produce (MPP). Issues like under-utilised plants, medicinal plants, MPP collection, etc. were discussed as livelihood related concerns of rural communities in general, but very specifically of *landless or socio-economically backward* communities.

Wildlife conservation issues like human-wildlife conflicts (e.g. crop damage by wild herbivores and livestock killing by wild predators); alienation of rural communities towards protected area based conservation; habitat damage of many wild species due to various anthropogenic and developmental activities etc. were emerged as key issues to be discussed with different natural resource stakeholders. While discussing all these issues, major focus was given to understand the different causes of the problems and to identify some strategies and actions to tackle the problems.

1.5.5 Interactions with Stakeholders

The above identified issues were discussed with the stakeholders and other concerned section of the society at two different levels - individual and group. Meetings with individuals were done extensively and covered the following major representatives of society:

- Natural resource dependent rural communities
- Government departments
- Researchers and naturalists
- Politicians
- Donor Agencies
- Industries
- Rural Banks
- Senior citizens
- Non Resident Kachchhis

At group level, 15 village meetings were organised in different parts of Kachchh (Annexure 1.4). Out of these 15 meetings, five were exclusively organised with women groups. These meetings were organised with the help of Kachchh Mahila Vikas Sangathan (KMVS)- a leading women based NGO. In these meetings women representatives from about 100 villages have participated. In order to understand the issues related with the protected areas, three meetings were conducted in and around the protected areas of Kachchh. In these meetings, representatives of about 20 villages were present (See **Plate 1**). Similarly, in order to understand the issues related with coastal region, two village meetings were conducted near the coastal area, where representatives of about 15 villages were present. Thus, in total, between 500-600 persons have participated in these meetings and contributed significantly in problem identification and solutions. This figure, considering the unprecedented situation after the earthquake, seems to be quite satisfactory. Brief descriptions about all these meetings are presented in Annexure 1.5.

Process of Interaction

Consultations with individuals
Group consultations through 15 village meetings (5 exclusively with women groups)
Interacted with 500-600 persons

1.5.6 Interactions at different forums

Other than meetings and discussions with Kachchh based stakeholders, there was adequate interaction with different persons at individual and group levels. The group level interaction was possible at following workshops/ meetings:

- Mid term workshop of NBSAP at New Delhi between 13-15 June 2001.
- Workshop on Medicinal Plants under Gujarat State –BSAP at Gandhinagar on 18th August 2001.
- Workshop on Gujarat State- BSAP at Gandhinagar on 31st August 2001.
- Regional Workshop of NBSAP – Western Region at CEE, Ahmedabad between 7-9 Novemeber, 2001.
- Workshop on 16th January 2002 at Vadodara organised by Gujarat Ecology Commission to attempt a synergy between two parallel processes viz. NBSAP and State Environmental Action Plan (SEAP).
- Meeting with Mr. H.S. Panwar, former Director, Wildlife Institute of India, Dehra Dun, on 1st May 2002. The meeting mainly focused on scope of conservation planning at landscape level.
- Meeting with UNDP representatives at New Delhi between 6-7 August 2002 for prospect of funding to support some of the actions emerged during the BSAP.

In addition, e-mail based interaction was also established with experts working on different areas of biodiversity, TPCG members and coordinators of different thematic and sub-thematic working

groups. The interactions at this level provided very valuable inputs in giving the direction to this report.

1.5.7 Analysis of existing reports and documents

In order to achieve the objectives of the Kachchh-BSAP, especially the identification of gaps in current knowledge and ongoing initiatives taken for biodiversity conservation, information was collected from various sources including published and unpublished study reports; EIA reports; scientific papers; records from Govt. department; records from NGOs; State and district Gazetteers; popular articles published in periodicals or newspapers; etc. Relevant information was also collected from various other parallel initiatives like World Bank aided Gujarat State Environmental Action Programme (SEAP) on biodiversity conservation.

1.5.8 Report Preparation

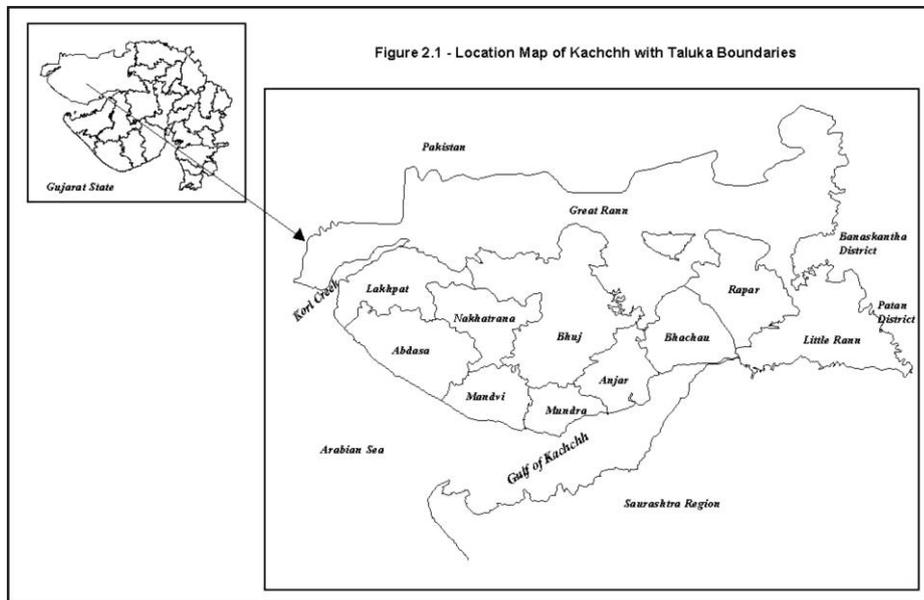
Based on various level of interactions with stakeholders for problem analysis and evaluation of ongoing initiatives, institutional mechanisms and policy frameworks, the first draft of Kachchh-BSAP was prepared in March 2002 and circulated to selected people, including few LAC members. Based on the comments received, a second draft report was prepared, incorporating necessary changes. This second draft report was then circulated to large number of people including the LAC members and also to TPCG in April-May 2002. The key sections of the report were also presented in different forums within and outside Kachchh. After receiving the comments on the second draft, necessary changes were incorporated and this final report was prepared.

2 Profile of Area

2.1 Geographical Profile

2.1.1 Location

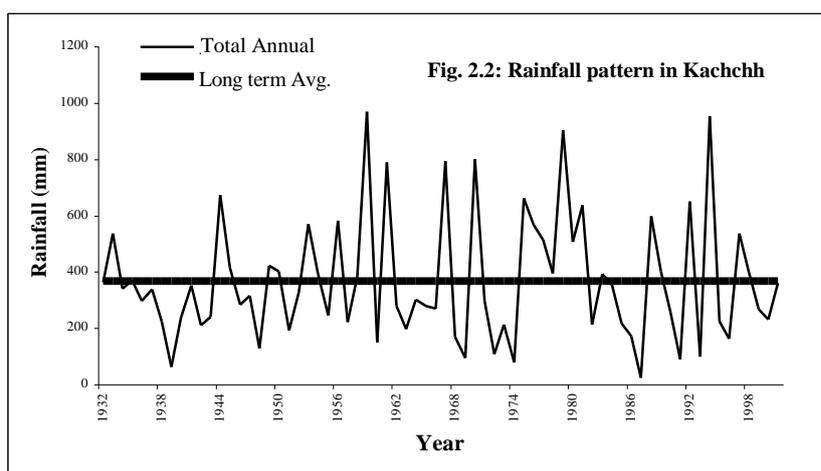
Kachchh is the second largest district of the country and encompasses an area of 45,652 km², and forms the northwestern region of Gujarat state. The district stretches between 22°41'11" to 24°41'47" north latitude and 68°09'46" to 71°54'47" east longitude and covers about 24% of Total Geographical Area (TGA) of the State. Out of the total landmass, a huge area is under saline deserts of Great Rann of Kachchh (17,500 km²) and Little Rann of Kachchh (5,180 km²), occupied the northern and southeastern parts of the district, respectively (see **Figure 2.1**). The district shares its border with Pakistan from two sides- (a) on the northern side of Great Rann of Kachchh and (b) western side of Kori Creek. Coastal waters of Gulf of Kachchh and Arabian Sea surround the southern and southwestern parts of Kachchh, respectively. The northeastern part of the district is sharing its boundary with the State of Rajasthan and especially the fringe areas of Thar Desert. The Kachchh district is linked with the mainland of Gujarat and Peninsula of Saurashtra by sharing its border with four districts viz. Banaskantha, Mehsana, Surendranagar and Rajkot.



2.1.2 Climate

Kachchh falls in the arid tracts of the country and has an arid-coastal climate. It experiences extremes of weather condition and has three seasons, winter, summer and monsoon. The winter season lasts usually from the middle of November to the end of February with January being the coldest month having an average minimum temperature of 4.6°C. However, mercury seldom drops below the freezing point. Summer starts from March and continues till June end, with the maximum temperature ranging between 39 to 45°C. The monsoon commences with the onset of south-west monsoon and continues between July and September. The average annual precipitation is 366 mm, which on an average falls within 13 rainy days. The variation in the timing and quantity of rainfall is very high having about 60% coefficient of variation (see **Fig. 2.2**). The rainfall clearly recorded an upward gradient from west to east. Winds are generally moderate to high with an annual average speed of 11.3 km/h. Due to high temperature and wind speed; the evapo-transpiration rates are very high- about 2.25 meter of water evaporates in a year. According

to Thornwhaite index of Aridity, the district falls under arid-to semi-arid condition characterized by high index of aridity (*above 40%*) indicating significant deficiency of soil moisture.



2.1.3 Land Use Pattern

The huge land mass i.e. about 55% of the total geographical area of the district is excluded from the landuse statistics, which mainly include the Ranns, and parts of Banni and coastal regions. This is an important caveat in reading the landuse data for the district. The effect of extreme environmental conditions is reflected in the landuse pattern. Accordingly, about 40% of TRA of the Kachchh is either under barren or culturable waste categories (Table 2.1). Only about 38% area is under private cultivation and about 15% area is under the forest category, which is, despite an arid region, close matches with the State average of about 16%.

Landuse Class	Area (ha)	% of TGA	% of TRA
Total Geographical Area (TGA)	4565200		
Total Reported Area (TRA)	1957629		
Forest	288579	6.3	14.7
Barren	430337	9.4	22.0
Culturable Waste	348179	7.6	17.8
Non-agriculture	72973	1.6	3.7
Permanent Pasture	70058	1.5	3.6
Current Fallow	115757	2.5	5.9
Net Sown Area	631746	13.8	32.3

Source: State Revenue Dept.

2.2 Social Conditions

2.2.1 Demography

As discussed earlier, about 50% area of Kachchh is saline marshy desert known as 'Ranns', which is devoid of human settlements. According to 1991 census, there are 884 inhabited villages and 10 towns in the district. Out of the total 884 inhabited villages, 392 are small in size i.e. having a population below 500 persons, 373 villages fall in population group size of 500-1999, 103 villages are in population range of 2000-4999 and 16 are in the large group size, having population over 5000.

In 1872, the first Indian census estimated the population of Kachchh to be 4,87,305. The official census in 1961 estimated the total population of Kachchh as 6,96,440. The population has almost doubled itself in next three decades as according to 1991 census, total human population of Kachchh district is 12.6 lakh with a sex ratio of 1000 males per 964 females (District Census Handbook, 1991). The density of human population was reported to be 65 persons per km² (excluding the Ranns). Of the total human population of Kachchh, 69% are rural and 31% are

urban. Interestingly, while total human population in Kachchh is increased from 6.96 Lakh in 1961 to 12.6 lakh in 1991, the decadal growth rate recorded a downward trend between 1961 and 1991 (Table 2.2). The literacy rate of the district is about 53%, which is lower than the State average of 61%. Among the talukas Rapar and Lakhpat recorded the lowest rate of literacy (33 and 39%, respectively).

2.2.2 Ethnic Groups

More than 70% of the population of district belong to Hindu community, followed by Muslims and Jains. Among the Hindus, Rajput, Brahmin, Bania, Lohana, Ahir, Kanbi, Bhatiya, Lohar, Suthar, Darji, Kumhar and Charan are the chief castes. Around 19% of the total population belonged to socio-economically weaker section of the society, which include scheduled castes (11.9%) and scheduled tribes (7%). The predominant scheduled caste in the district is Meghwal, while the dominant scheduled tribe is Koli.

2.3 Economic Conditions

In Kachchh, primary economic sectors are Agriculture, pastoralism, fishing, mining and to a certain extent the forestry.

In Kachchh, like in other regions of the state, major occupation type is agriculture. According to 1991 census, of the total human population 32.6% were main workers and rests were marginal and non-workers. Of the total main workers, more than 57% were engaged in agriculture sector as cultivators, labourers and in allied activities of livestock rearing, forestry, fishing & hunting & orchards cultivation etc (District Census Handbook, 1991). In the rural context, therefore, settled agriculture, nomadic pastoralism, agriculture labours, and coastal-water fishing are the major occupational groups (Table 2.3).

Parameters	Value
No. of Villages	884
No. of Towns	10
Total Human Population (1991)	1262507
Male	642,823
Female	619,684
Density (No./km ²)	65
Rural Population	874650
Urban Population	387857
SC Population	11.9%
ST Population	6.95%
Decadal Population Growth	
1961-1971	2.77 %
1971-1981	2.59 %
1981-1991	2.51 %
Literacy	53%
Male	64%
Female	41%
Source: District Census handbook, 1991.	

Main Workers											Marginal Worker	Non-Worker
Cultivators	Agri. Lab.	Livestock & allied	Mining	Household Industry	Other Indus.	Construction	Trade	Transport	Other Serv.			
8.8	8.3	1.7	0.3	0.7	2.5	1.1	2.9	2.5	3.7		3.7	63.7
Source: Source: District Census handbook, 1991.												

While, Rajputs, Kanbis Patel (or Kadva Patel), Malis and Kolis are the main agriculturist community, the Haliputra and Rasiputra Muslims are the main livestock keepers and commonly known as Maldharis. These people are also excellent traditional craftsmen and are contributing to the district's economy through folk embroidery and other local crafts. The Ahirs, Charans and Rabaris, who travel far places with their livestock in search of green pasture, also practise semi-nomadism.

Livestock rearing is one of the major sources of livelihood for the people of Kachchh. In fact, in the district, the population of livestock is always higher than the human population. The livestock population of district increased from 0.94 million in 1962 (animal density of 48 per km²) to 1.4 million in 1992 (animal density of 73 per km²), showing about 50% increase in the number of animals. The change is also recorded in the species composition (see Table 2.4).

Type	1962	1992	% Change
Cattle	460289	345555	-24.9
Buffalo	80489	115382	+43.4
Sheep	180707	475252	+163.0
Goat	200047	443996	+122.0
Camels	6658	17639	+164.9
Others	11907	14767	+24.0
Entire District	940097	1412591	+50.3

Source: District Animal Husbandry Dept.

2.4 Political Profile

2.4.1 Administration

Prior to the independence, the Kutch was one of about 370 constituent princely states of the Northern Division of Bombay Province. After the independence, Kutch was kept as a centrally administered territory under a Chief Commissioner appointed by the Govt. of India. While other princely states of Gujarat mainland were integrated with Bombay State, the Kutch was called as 'Part C' State. However, on 1st November 1956, in accordance with the State reorganisation Act, 1956, the Kutch was merged with Bombay State. On 1st May 1960, the present State of Gujarat was created partitioning the Bombay State in Accordance with Bombay Reorganisation Act, 1960 and Kutch was merged with Gujarat.

Administratively, the district is divided into ten talukas viz. Bhuj, Mandvi, Mundra, Abdasa, Lakhpat, Nakhatrana, Rapar, Bhachau, Anjar and recently created Gandhidham. Bhuj City is the district headquarters.

2.4.2 Elected People Representatives

A single Member of Parliament and three Members of State Legislative Assembly represent the Kachchh district. Apart from that, there are different levels of Panchayati Raj Institutions currently working in the entire district (Table 2.5).

People's Representatives	Number
Member of Parliament (MP)	1
MLA	3
District Panchayat	1 (Total Members 28)
Taluka Panchayat	9 (Total Members.164)
Gram Panchayat	200

Source: District Panchayat

2.4.3 Forest Administration

During the princely time many resource rich areas were given legal protection by decalring them as 'Rakhals'. At the time of formation of Gujarat State in 1960, the total State owned forest was about 474.6 km², constituting about one percent of TGA of the district. However, subsequently the State owned forest area has increased and reached to the present value of 3129.4 km² i.e. about 6% of TGA of the district (see Table 2.6). Of the total forest area 1806.26 km² is under reserved forest category. All the Rakhals were put under reserved forests. At present there are 29 Rakhals with an area of about

1960-61	1979-80	1989-90	1992-93	1995-96	2000-01
474.6	3265.0	2870.4	2867.7	2885.8	3129.4

Source: Gujarat Forest Statistics

27900 ha. Off late, the main focus of management of these Rakhals shifted to grass production. On the basis of quality of grass, therefore, these Rakhals were grouped as Superior Rakhals (10840.88 ha) and Inferior Rakhals (17059.29 ha). The superior Rakhals are closed for livestock grazing and grass from these areas are normally cut and stored for distribution during the pinch period. The inferior Rakhals are normally sold out for grazing or kept open for grazing in most part of the year.

The entire control of the forest is rested with two Forest Divisions – Kachchh west and Kachchh east. Other than these territorial divisions, a social forestry division is also operational in the district. These forest divisions were further divided into 16 ranges and administered by Range Officers. The entire forest administration is vested with one Conservator of Forests (CF), four divisional level forest officers (DFOs). The collection of forest produce, including the MFP (or NTFPs) is however under the control of Gujarat State Forest Development Corporation (GSFDC).

2.4.4 Defence Forces

Since the district shares a very substantial length of its border with Pakistan, there is always a substantial presence of defence forces in Kachchh district. Almost entire Greater Rann of Kachchh is under the effective control of defence forces, mainly by BSF. Similarly, on the coastal side also the Water Wing of BSF control the territory beyond the Kori Creek area. In addition, in the western part of the district there is a full-fledged air base near Naliya. In most of the cases, the areas under the control of defence forces are also ecologically important and sensitive areas.

2.5 Ecological Profile

2.5.1 Geomorphology

The geomorphology of Kachchh has been shaped by intricate interplay of climate, neo-tectonics and litho-units. Broadly, the landforms in the district can be grouped under the following categories: (a) Hills and undulating plains, (b) Coastal plains, (c) Littoral plains, (d) Deltaic plains, (e) Raised mud flats and (f) Ranns.

Much of the Kachchh mainland and about 30% of the district's total area is under the hills and undulating plains. In fact, there is a long hill range traversing east-west direction commonly called as 'Central Bhuj Ridge'. Kala Dungar (458 m a.s.l.) and Dhinodar (388 m a.s.l.) are the two highest peaks of the district. The coastal plains occur mainly in the south of the Kachchh mainland, which are extensively used for agriculture practices. The littoral plains occur in the Kachchh mainland all along the Arabian Sea and Gulf of Kachchh. Sediments brought by the tributaries of Indus and Saraswati river systems built the deltaic plain to the west of Kachchh mainland. The raised mud flats occur especially along the northern margin of the Kachchh mainland and include the famous saline flatland of 'Banni'. Such raised mudflats are also extended within the Ranns. The Great Rann and the Little Rann are the remnants of two extended arms of the Arabian Sea. It is believed that in the geological time scale, these areas were under the Arabian Sea and the entire Kachchh mainland was an island.

2.5.2 Geology

Geologically, Kachchh is considered to be a very young but very diverse region, where rocks of different periods are found exposed. An immense accumulation of volcanic rocks principally formed by basaltic lavas known as Deccan Traps is occurring extensively over Kachchh and thus most important geological signature. The oldest rocks exposed in Kachchh are the sedimentary rocks of the middle Jurassic age. These different geological features pose serious limitations to the ground water potential of the region. The best groundwater zone of the region is restricted to a long, narrow belt of Cretaceous Sandstone (commonly known as Bhuj Sandstone) spread from Anjar to Lakhpat. Kachchh also provide many representative rocks type as a reference series at the national level. Most of these series are named after the nearest villages, for example, Nari series, Kirthar series and Lakki series (all Tertiary period); and Umia series, Chari series and Pachchham series (all Mesozoic period). The geology of the region also supports fossils of different plant and animals of different ages. While there are many places, where marine fossils are found in plenty (e.g. Major parts of Lakhpat and Abdasa talukas), the fossil evidences of

Dinosaurs were also recoded at many places of Kachchh (e.g. Dahisara village in Mandvi Taluka and Kunverbet) (see Box 2.1).

2.5.3 Rivers

There are no perennial rivers flowing in Kachchh. However, there are many ephemeral rivers/streams, retaining water only for a few days after rainfall, mostly during the monsoon. The rivers are originated from the central upland and flows either northward or southward. The major north flowing rivers are Khari, Nara, Bhukhi, Nirona, Kaila, Chang and Karsawali, which pour their water in the plains of Banni and Rann. The major south flowing rivers are Bhukhi, Rukmawati, Phot, Nagwanti and Khari, which drain their water in the Gulf of Kachchh.

2.5.4 Natural Ecosystems

Within the country-level bio-geographic classification, Kachchh is separately grouped as one of the biotic province (i.e. 3A - Kachchh Desert) within the larger bio-geographic zone -the Indian Desert (Rodgers and Panwar, 1988). It consists of a mosaic of three major ecological regions viz. (a) saline flats of Ranns and Banni (b) coastal regions and (c) mainland of Kachchh. These regions support many different habitats (Table 2.7).

Habitat	Approx. Area (km ²)	Reference
Great Rann of Kachchh	17500	GEC, 1994
Little Rann of Kachchh	5180	GEC, 1994
Banni Grassland	3800	GEC, 1994
Mangroves	727	GEER, 1999
Other Coastal Areas including Creeks	456	GEC, 1994
Thorn & Scrub Forest	2800	
Rocky & Stony area with or without scrub	5575	Singh & Kar, 1996
Cultivated Fields	7827	Singh & Kar, 1996

2.5.5 Wildlife

Different habitats and vegetation types support a large number of floral and faunal species, which are adapted - physiologically, as well as ecologically- to the local arid condition. Many of the species are under globally threatened categories. However, the home of last population of Wild Ass in Little Rann of Kachchh and breeding grounds of Flamingoes, Great Indian Bustard and Lesser Frlicans are the key wildlife attractions for Kachchh. The area is also known for its very diverse and rich avifauna including migratory waterfowls and other terrestrial birds, including many rare and endangered species.

2.5.6 Agriculture and Cropping System

Agriculture is the mainstay of majority population as more than 55% of population is involved in agriculture cultivating about one third area of the total district. There are however, regional differences in cropping area at taluka level due to changing soil-water condition. While, Lakhpat recorded the least area under crops (21%), Mundra registered maximum (59%). The cropping intensity for the district is around 105% i.e. only 5% area is subjected to cropping more than once, reflecting (a) the poor availability of water for irrigation and (b) majority of agriculture is rainfed. The major cereal crops are Jowar, Bajra and Wheat, while Groundnut, Cotton and Castor are major cash crops. Other than these crops, two major horticultural crops are also quite common in the area that includes Date Palm and Sapota (Cheeku).

2.5.7 Minerals and Mining

Kachchh is gifted with rich mineral resources of high economic values (Table 2.8). Mining of these economically valuable minerals like lignite, bauxite, bentonite and limestone is, therefore, one of the major primary economic sectors of the Kachchh. Major concentration of these minerals is seen in the Western part of the district, mainly covering the parts of Lakhapat, Abdasa and Nakhatrana talukas. While, Bauxite and lignite are exclusively mined by Gujarat Mineral Development Corporation (GMDC), rest of the minerals are opened for private sector mining, which are about 3000 in numbers.

Mineral	Total reserve (MT)	% of Kachchh to Gujarat	Exploitable Reserve (MT)
Limestone	7765	74	NA
Lignite	312	45	217
Bauxite	42.4	44	31
Bentonite	180	NA	NA

Source: Directorate of Geology and Mining

Box 2.1

Kachchh – A Jurassic Park

The rock of Kachchh, none of them older than Jurassic, crop out in three anticlinal hill ranges and an isolated mass to the east known as Wagad. The northernmost range, nearly 100 miles long, composed chiefly of lower Jurassic sediments is broken into four islands, which from west to east are Pachchham, Khadir, Bela and Chorar. The median range which is by far the most important and occupies the northern margin of the main island of Kachchh proper, forms a gentle arc extending from the town of Lakhpat south east and eastwards 120 miles. The southern most range centres in the Charwar and Karol hills, south of Bhuj and extends for about 40 miles roughly parallel to the central portion of the median range. These three ranges are broken up by transverse undulations into a number of domes, the erosion of which has exposed successive beds in a concentric series of small scraps, which afford an ideal opportunity to a fossil collector.

The total thickness of Mesozoic rocks of Kachchh has been estimated to be 6300 feet. This bed of Mesozoic rock has been subdivided into the following four groups. The lower three are entirely marine in origin, while the upper most includes a fresh-water plant-bearing stage intercalated between beds with marine fossils.

(i) **The Lower Pachchham:** Majority of the hills are formed of a thick massive bed of yellowish sandstone and limestone often crowded with specimens of *Corbula lyrata*, *Trigonia pullus*, *Astarte*, *Cucullaea*, *Megateuthis*. Below the massive bed come shales and sandstones containing *Lima*, *Gorvillia*, *Rhychonella*, *Exogyra* etc.

The Upper Pachchham: This comprises light grey or yellowish limestone and marls and at the top, very compact, white limestone with shale intercalations. It is exposed at Jarra, Kira, Jura and Halman hills. The lower parts of Upper Pachchham are especially rich in corals: 127 species have been found out of which 61 are newly identified. These include *Lophosmia*, *Stylina*, *Astroenia*, *Favia*, *Placosmia*, *Trochosmia*, *Montilivaltia*, *Isastraea*, *Thamnastraea*, *Centrastraea*, *Comosens*, *Metethmos*, *Kobya* etc. Various Brachiopods and Lamellibranchs have also been found. Cephalopods were also recorded in tow zones and include *Sivajiceras*, *Epinorphoceras*, *Macrocephalites* sp. etc.

(ii) **The Chhari Series:** The next series in ascending order derives its name from a village bordering Banni. Cephalopods are abundantly found in the calcareous sandstones around Kira hill. Various species of Echinoids, brachiopods, lamellibranchs, cephalopods and corals are recorded from here. Also, single crocodilian amphicoelus vertebra has been collected from this series.

(iii) **The Katrol Series:** The Katrol series, which rests upon the uppermost subdivision of the Chhari beds, is of considerable thickness.

(iv) **The Umia Series:** The Umia series, named after a village, is more than 3000 ft thick. It consists of sandstones of various kinds and sand shales. Cephalopods fauna of this series comprises of Belemnoids, Nautiloids, Phylloceratids, Perisphinctids etc. whereas, Lamellibranchs include *Astarte*, *Gryphaea*, etc. Various species of *Trigonia* were also reported. A portion of the jaw of Sauropterygian, *Thaumatosaurus indicus* (a Dinosaurs), is obtained from these beds. Coral species like *Stylina* and many plant fossils were also recorded from this series.

Source: Singh (2001)

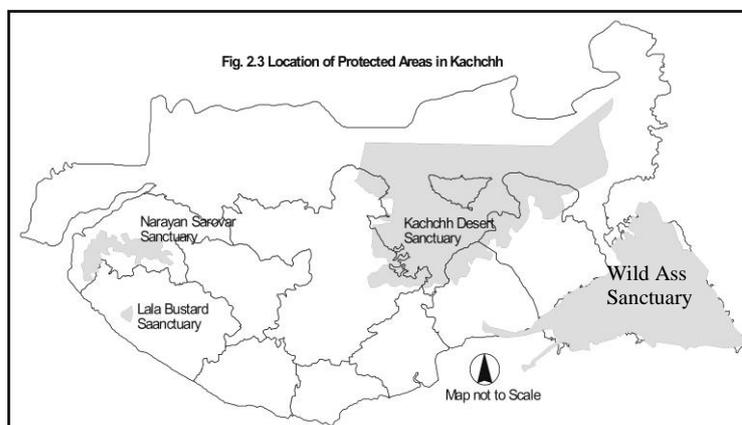
2.6 Brief Conservation History

Although, the practice of conservation of natural resources in the Kachchh goes way back to the princely times, it seems that “from a remote period until about late 19th Century, the tree growth on the lands of Kutch was subjected to excessive destruction by man and beast” (Clutterbuck, 1935). Princely states has given protection to certain resource rich areas and called these areas as ‘Rakhals’. The concept of Rakhals was largely initiated around 1880, although a few such areas were identified even before that. In the first instances, the major objectives of having these Rakhals were to ensure the supply of big games and grass for State purposes, but in most cases, there was a ban on all kind of tree cutting. The number of Rakhals was added in subsequent years. At the time of Clutterbuck’s visit, there were about 50 Rakhals, which were managed by State. Five different kinds of management practices were in operation at that time, mainly to control grazing and tree cutting. The creation of Rakhals was a strategy towards creating large blocks of regular forests in Kachchh.

The past records show that there were plentiful of wild animals like lions, leopards, chinkaras, black-bucks and other game animals in Kachchh district in the beginning of the 19th century (Cutch Gazetteer, 1880), which subsequently declined significantly. Even, certain species like lion and blackbuck are now locally extinct. During the colonial regime, these forests were of less importance to the British rulers due to their relatively low commercial production value and thus very limited has been done to improve the condition of the forests in the area.

However, in the post independence era the Forest Department took over the charge of the Rakhals

and their management. However, only 29 Rakhals with an area of 279 km² were under their control in entire district. Based on quality of grass, these Rakhals were grouped as Superior Rakhals (10840.88 ha) and Inferior Rakhals (17059.29 ha) (Anon. 1972). The superior Rakhals were closed for livestock grazing and grass from these Rakhals was cut, collected and stored annually to meet the fodder need of the livestock during pinch period. The inferior Rakhals were sold out for grazing or kept open for grazing for most part of the year. However, management objectives of these Rakhals had predominance of utilitarian approach instead of their sustainable use.



During last three decades, in order to protect and conserve the floral and faunal elements of the arid region and to preserve the ecological integrity of some of the representative habitats of Kachchh, four wildlife sanctuaries were created (Table 2.9; Fig. 2.3). Interestingly, part of one of the sanctuary (viz. Naryan Sarovar Sanctuary) was de-notified by the State Assembly in 1995. This was the first instance wherein a PA has been de-notified by State Government based on consideration, other than wildlife conservation.

PA	Area (km ²)	Year of Notification	Major Habitats
Narayan Sarovar Sanctuary	444.23	1995	Thorn-Scrub Forest, Savanna
Lala Great Indian Bustard Sanctuary	2.03	1992	Grasslands
Wild Ass Sanctuary	4953.70	1973 & 1978	Saline marshlands, <i>Bets</i>
Kachchh Desert Sanctuary	7506.22	1986	Saline marshlands, Thorn forests, Savanna, <i>Bets</i>

Source: Singh, 1998

2.7 Disasters

The district is a disaster prone area due to droughts, cyclones and earthquakes. While, the droughts and cyclones are directly damaging the natural resources, the earthquakes, like the one, which shake the Kachchh, recently, adversely affect the very economy of the region.

Between 1932 and 1996, district experienced more than 15 droughts like conditions of different intensities (see **Figure 2.2**). Specifically, in the last 10 years (i.e. between 1990 and 2001), district faced 4 droughts and 3 cyclones, causing heavy losses to agriculture, livestock and natural vegetation.

3 Current Range and Status of Biodiversity

The objective of this chapter is to examine what is known of the magnitude of biodiversity and its distribution in ecological, organismal and genetic levels. An assessment of the current magnitude of biodiversity is fundamental to all discussion about its conservation or sustainable use. The chapter also discusses the distribution of biodiversity, the identification of centers of diversity and prioritization of sites for conservation purposes.

3.1 Current Magnitude of Biodiversity

3.1.1 Landscape Diversity

Singh and Kar (1996) identified six major landforms from Kachchh (Table 3.1). (1) Much of the Kachchh mainland is under the *hills and undulating plains*. The major islands (*bets*) of Bela,

Land Form	Area (km ²)	Major Locations
Hills and undulating plains	13442	Nakhatrana, Pachchham, Dhinodar, Khadir, Bela
Coastal plains	2995	Mandvi, Mundra, Jhakhau
Littoral plains	3705	Nirona, Kandla, Surajbari, Jhakahu, Mandvi
Deltaic Plains	1285	Kori Creek,
Raised mud flats	4744	Banni, Allah bund, <i>Bets</i> in GRK
Rann	16991	GRK, LRK

Source: Singh and Kar (1996)

Khadir and Pachchham have also maximum area under hills and undulating plains. (2) The *coastal plains* occur mainly in the south of the Kachchh mainland, but some areas in the north of Kachchh mainland are also within this category. (3) The *littoral plains* occur in the Kachchh mainland all along the Arabian sea and Gulf of Kachchh. The deltaic plain to the west of Kachchh mainland is

essentially a land of relict fluvial processes. (4) The *deltaic plain* was built by sediments brought by Indus-Saraswati river systems. (5) The *raised mud flats* occur especially along the northern margin of mainland, but also within the Great Rann of Kachchh, the Little Rann and along the north-western fringe of the Great Rann. The Banni area falls within this category. (6) The saline marshy Rann found in two distinct land masses – the Great Rann and Little Rann – and are the remnants of two extended arms of the Arabian sea.

Other than the above discussed geomorphologically distinct landscapes in Kachchh, local communities have also identified different landscape based on the physical, economical and cultural basis. Some of these traditionally identified landscapes include the regions like Rann, Khadir, Bela, Vagad, Pranthal, Pachchham, Banni, Powerpatti, Garda, etc.

3.1.2 Ecosystems and Habitat Diversity

Due to geographical situation and prevailing physio-climatic conditions, following major natural eco-systems and habitats can be delineated from Kachchh:

- Saline marsh lands – mainly located in Great and Little Rann of Kachchh.
- Savanna- mainly located in Banni and part of Abdasa, Lakhpat talukas
- Thorn-scrub forests – mainly located in Nakhatrana, and Lakhapat taluka near NSS.
- Seasonal wetlands – mainly located in parts of Banni and Ranns.
- Mangroves- mainly located in Kori Creek and near Jhakahu
- Coastal marine system- mainly include Gulf of Kachchh

Important terrestrial and aquatic habitat types are presented in **Plate 2** and **Plate 3**.

3.1.2.1 Saline Marsh Lands

In all probability Rann is largest saline and marshy tracts in the entire world. The Great Rann of Kachchh (GRK) and the Little Rann of Kachchh (LRK) with an area of about 16780 km² and 5180 km², respectively, constitute the entire Rann of Kachchh. The Ranns in general characterized by a flat topography, annual water inundation pattern, high salinity, barrenness and many 'bets'. The bets are slightly raised isolated patches of land with less salinity and support some xerophytic vegetation. While GRK is predominately a barren area with some greenery on bets, it supports one of the largest congregations of the Flamingoes for breeding (commonly known as Flamingo City), where about 100-200 thousand birds lay the eggs. Unlike, GRK, the LRK is quite rich in biodiversity and is famous for the last remaining population of Wild Ass.

3.1.2.2 Savannah (Grasslands)

Savannah is one of the major ecosystems of the Kachchh and is recorded along with the thorn and scrub forests of *Acacia* and *Euphorbia* species. The grasslands of Kachchh are grouped under *Dicanthium-Cenchrus-Lasiurus* type (Dabadghao and Shankarnarayanan, 1973; Yadava and Singh, 1977). These grasslands belong to the degraded stage of vegetation community that is prevented from progressing towards climax community due to the continued grazing and recorded very low productivity (Pandya and Sidha, 1982). Although these grasslands are distributed in almost all parts of the district, they are predominant in the parts of Lakhpat, Abdasa and Nakhatrana talukas, Khadir bet and Banni area.

Besides supporting the regional economy through livestock sector, these grasslands also play an important role in performing various ecological functions including the maintenance of bio-diversity of the region. More than 450 km² area of grassland are falling within the PA system of Kachchh (Table 3.2) and supporting many wild animal species including many rare and endangered ones like Great Indian Bustard, Houbara Bustard, Lesser Florican, Chinkara, Wolf, Fox, Desert Cat, Caracal, and spiny tailed lizard.

Table 3.2: Extent of grasslands in PAs

PA	Grassland Area (km ²)	Source
NSS	273	GUIDE & GEER (2001)
LBS	2	GUIDE (2001)
WAS	61	GEER (1999)
KDWLS (Khadir)	126	GEER (1999)
Total	462	

3.1.2.3 Thorn Scrub Forests

This is the natural forest system of the Kachchh. In general, due to poor canopy formation the forests are very open and mainly constituted by *Acacia nilotica* and/or *A. Senegal*. While in the hilly areas *A. senegal* dominates, *A. nilotica* is generally found in better soil conditions. The co-dominant species varies according to the soil and moisture condition and mainly include *Euphorbia nivullia*, *Prosopis cineraria*, *Salvadaora oleoides*, *Capparis deciduas* etc. The invasion of *Prosopis juliflora* is very common in these natural thorn forests, changing its structure. Although, these forests are found scattered throughout the district, they are predominantly recorded from western part of Kachchh i.e. Nakhatarana, and Lakhapat taluka. While, large area under such forests are outside the PA system, about 13000 ha area of these forest are recorded in NSS (GUIDE & GEER, 2001).

3.1.2.4 Seasonal Wetlands

There are many natural seasonal wetlands in Kachchh. In total about 258 wetlands were delineated through satellite imageries. These wetlands cover approximately 21772 km² area,

which is more than 80% of the entire state (SAC, 1998). Majority of these wetlands, are however, found in the saline flatlands of Ranns and Banni. These wetlands support large number of migratory waterfowls in winter.

3.1.2.5 Mangroves

Along the 410 km long coastline of Kachchh, mangroves are distributed in the form of narrow discontinuous patches and covered about 727 km² area (GEER, 1999). This is more than 75% of the total mangrove area of Gujarat. In Kachchh, dense and sparse mangroves covered about 344 km² and 383 km² areas, respectively. While, the best mangrove patches are found in Kori creek and area around Jhakhau coast, there are few remnant patches in the coastal areas of Mundra, Anjar and Bhachau talukas (GEER, 1999). This is because the Kori creek and Jhakhau areas are very close to the international border and thus have relative difficult accessibility and get higher degree of protection against biotic pressures. In these areas the trees gain a height of more than 5 meters.

Paradoxically, while Kachchh has the maximum mangrove cover in the State, it displays very low diversity in mangrove species. The area has only one dominating mangrove species—*Avicennia marina*. Other species like *Rhizophora mucronata*, *Ceriops tagal*, *Avicennia officinalis* and *A. alba* are found in very small proportion.

3.1.2.6 Coastal Marine System

Gulf of Kachchh is the major marine system along the southern boundary of Kachchh. Aligned approximately E-W, the gulf is about 170 km long and 75 km wide at the mouth. While the southern coast of GoK is fringed by extensive mud flats, the northern coast mainly formed the tidal flats. This entire area is diverse in floral and faunal elements and very productive in terms of fishery resources (see Gulf of Kachchh below).

3.1.3 Vegetation Types in Kachchh

Vegetation of Kachchh varies with these different ecological regions. According to the classification given by Champion and Seth (1968), 14 vegetation types were recorded from the Kachchh (See Table). Further, the vegetation mapping of the Kachchh region was attempted by French Institute of Pondichery during late sixties (Gaussen et al, 1968). It described the vegetation through the notion of “Series” of vegetation, which were further classified for their physiognomic characteristics. Among the dry vegetation types, the vegetation of Kachchh is grouped under *Salvadora oleoides-Prosopis spicigera* series, which is represented in physiognomic forms of discontinuous thorny thickets and scattered shrubs. Under wet vegetation type, mangroves were also identified separately.

#	Type	Description
1	4B/TS1	Mangrove scrub
2	4B/TS2	Mangrove forest
3	5A/C3	Southern dry mixed deciduous forest
4	5B/E3	Babul forest
5	5B/E8b	Babul Savannah
6	5A/E8c	Salvadora-Tamarix scrub
7	6B/C1	Desert Thorn Forest
8	6B/DS1	<i>Zizyphus</i> scrub
9	6B/DS2	Tropical <i>Euphorbia</i> scrub
10	6B/E1	<i>Euphorbia</i> scrub
11	6B/E2	<i>Acacia senegal</i> forest
12	6B/E3	Rann Saline Thorn Scrub
13	6B/E4	<i>Salvadora</i> Scrub
14	6B/E4/DS1	<i>Cassia auriculata</i> scrub

Source: GUIDE & GEER (2001)

3.1.4 Wild Species Diversity in Kachchh

The current state of knowledge on wild plant and animal species diversity is given below:

3.1.4.1 Plant Species Diversity

The current state of knowledge about the plant species diversity is mainly the result of many studies conducted in the past by different authors in different parts of the Kachchh (Table 3.4). Accordingly, there are about 700 species of flowering plants recorded from the

Kachchh by Rao and Sabnis (1977). However, in a fresh attempt to prepare a checklist of plant species, team of GUIDE, through some ongoing field studies, has already collected 640 species (GUIDE, 2002) and large area of Kachchh is yet to be explored. Out of these 640 species, 527 species are recorded in wild conditions and remaining under cultivated conditions. These recorded

Habit	No. of species
Herbs	321
Tree	94
Shrub	76
Grass	57
Under shrub	44
Climber	28
Twining	20
Total	640

Source: GUIDE (2002)

species belongs to 109 families, and dominated by herbs. There are 57 species of grass recorded from the district (Table 3.5). Further, ongoing survey of medicinal plants in Kachchh, conducted by GUIDE, recorded the use of about 130 species for different medicinal purposes by local rural communities. Also, out of a total 92 species, most commonly used in pharmacies, 42 species are recorded from Kachchh during the above survey (GUIDE, 2002). Some of the most commonly recorded wild plant species include, among the trees, *Acacia nilotica*, *Acacia Senegal*, *Salvadora oleoides*, *Salvadora persica*, *Azadirachta indica*, *Prosopis cineraria*, *Prosopis juliflora* etc; among the shrubs: *Euphorbia nivulia*, *Grewia tenax*, *Balanites aegyptica*, *Capparis aphylla*, *Cassia auriculata*, *Zizyphus mauritiana*; among the ground flora: *Aristida adscensionis*, *Desmostachya bipinnata*, *Indigofera cordifolia*, *Eragrostis*, *Lapidagathis trinervis*, *Dicanthium annulatum*, *Tephrosia villosa* etc.; and among the climbers: *Tinospora cordifolia*, *Combratum decandrum* etc. In the coastal intertidal zones, the most dominating mangrove species is *Avicinnia marina* with occasional record of *Rhizophora mucronata*. The detail list of all the plant species is given in **Annexure-3.1**.

The flora of Kachchh is, therefore, a very common one and thus typically similar with other arid and semi-arid areas including Rajasthan state. Only one species viz., *Helichrysum cutchicum*, recorded so far, is endemic to Kachchh. However, there are many state and country level rare species. According to the Red Data Book of Indian Plants (Nayar and Sastry, 1987), two species, viz. *H. cutchicum* and *Campylanthus ramosissimus* are falling under the rare category. However, in a State level list of rare plants given by WCMC, 14 species are recorded from Kachchh (Table 3.6). Unlike the flowering plants, there is very limited focus on systematic studies on the non-flowering plants of Kachchh. Only four species of Gymnosperm and two species

Year	Author(s)	No. of species	Area of Work
1880	Palin, C.T.*	200	Entire Kachchh
1926	Thacker, J.I.	526	Entire Kachchh
1977	Rao & Sabnis	720	Entire Kachchh
1981	Rao, K.S.S.	574	South Eastern Kachchh
1993	Bhatt, J. B.	518	Western Kachchh
2002	GUIDE**	640	Reserved Forests of Kachchh

* Mentioned in Bombay Gazetteer (Kachchh). ** Ongoing studies.

#	Species
1	<i>Campylanthus ramosissimus</i>
2	<i>Citrullus colocynthis</i>
3	<i>Commiphora wightii</i>
4	<i>Convolvulus auricomus var. volubilis</i>
5	<i>Convolvulus stocksii</i>
6	<i>Dipcadi erythraeum</i>
7	<i>Helichrysum cutchicum</i>
8	<i>Heliotropium rariflorum</i>
9	<i>Indigofera caerulea</i>
10	<i>Ipomoea kotschyana</i>
11	<i>Pavonia ceratocarpa</i>
12	<i>Sida tiagii</i>
13	<i>Tephrosia collina var. lanuginocarpa</i>
14	<i>Tribulus rajasthanensis</i>

Source: GUIDE (1998)

of Pteridophytes were recorded from Kachchh, out of which *Ephedra foliata* is considered to be a very rare plant, mainly located in Navinal Dhuva, Bharapar, Bela and Roha Hill (GEC, 2002).

3.1.4.2 Faunal Species Diversity

According to the information compiled from different sources, the existing faunal species record is deficient and not complete because it is well explored for some taxa or group of organism and ignored for others. Also, there is lack of systematic efforts in making an inventory of species belonging to different taxa and groups in totality, rather in most of the cases, the inventory was made only from those areas where some research project was carried out. As a result, the total picture is patchy and incomplete. However, compilation of information revealed that there are about 770 species from Kachchh (Table 3.7). The record of only 246 species of invertebrate looks highly underestimates mainly due to non-record of insect fauna (Table 3.8). The detail of all these species with relevant information is given in Annexure-3.2.

Taxa	No. of Species
Invertebrates	246
Fish/Prawns	115
Amphibians	7
Reptiles	44
Birds	306
Mammals	51
Total	769
Source: see Annexure 3.1	

Taxa	No. of Species	Taxa	No. of Species
Butterfly	38	Flies/Mosquito	12
Spiders	42	Snails and Bivalves	53
Crabs	32	Worms/Leeches	9
Scorpions	5	Sponge/Animones	11
Ants/Termites	5	Protozoa	16
Cockroach/Cricket	7	Others	5
Grasshopper/Locusts	5	Total	246
Bees/Wasp	6	Source: see Annexure 3.1	

Some of the flagship species of different ecosystems include Great Indian Bustard (grasslands), Wild Ass (Saline Ranns), Chinkara (Open thorn-scrub forest) and Flamingoes (wetlands) (See **Plate 4**). Among the vertebrates, there are many rare and threatened species recorded from the Kachchh. Some of these species include:

Reptiles: Black Cobra, Desert monitor lizard, Indian Crocodile, Spiny tailed lizard, Olive Ridley turtle, Green turtle, Star tortoise etc.

Birds: Great Indian Bustard, Lesser Florican, Houbara bustard, Pied tit, Sociable lapwing, White browed bush chat, Grey hypocolius, Long eared owl, White backed vulture, Sarus crane, Greater Flamingo, Lesser Flamingo, Indian Skimmer, Dalmatian Pelican, Eurasian spoonbill, Greylag Goose, Bar headed Goose, etc.

Mammals: Caracal, Chinkara, Grey wolf, Desert Fox, Longeared hedgehog, Ratel, Desert Cat, Indian pangolin, Dugong (Sea Cow), Common Dolphin etc.

Endemic species: Wild Ass (*Equus hemionus khur*), *Metapenaeus kutchensis* (prawn), *Cryptopodion kachhensis* (lizard).

Other than the above qualitative assessments of status of different groups of animals, in certain cases there is some specific information generated through short term surveys. These surveys throw some light on the conservation status of targeted species or taxa.

Sites	Maximum Recorded	
	Species	Number
Bhimsar Tank (Anjar)	13	109
Bhimsar Tank (N'rana)	21	119
Chhari-Dhandh	35	50900
Don Reservoir	27	528
Kukma village tank	23	318
Khirjog & vakrio	22	30286
Lair reservoir	24	558
Rudarmata dam	16	141
Shinay reservoir	21	291
Vijayasagar	21	514
Bhukhi Reservoir	10	188
Rukmavathi	25	725
Sandhan	22	701
Devisar	23	1643
Source: Lopez and Mundkur (1997)		

only a few Green Turtle were found dead on the beach. According to the survey report, coastal stretch between Mandvi and Bhambhdai is the most potential area for sea turtle conservation in Kachchh. This is also supported by the egg collection data by the Forest Department from this stretch (see Table). In the year 1999-2000 FD has collected 4395 eggs from 37 nests with a average clutch size of 118.78 eggs per nest. The increase in number of eggs

Year	No. of eggs
1990-91	1271
1991-92	2038
1992-93	3391
1999-00	4395
Source: GUIDE (2001)	

population of 94 muggers (Vijay Kumar 1997; Vijay Kumar *et al* 1999). With this number of muggers, Kachchh was reported as holding the second largest population in the State. The Pragsar lake, Rudramata reservoir and Nirona dam are supporting more than 80% population of these crocodiles and thus important for their conservation (Table 3.12). Similarly, Rukmavati and Khari are the two river systems where the crocodiles were recorded.

Raptors. Kachchh support very rich diversity of Raptors- the birds of prey. More than 40 species has been reported from the region so far (see Annexure 3.2c). Although the raptorial avifauna is found throughout the district, a few areas can be considered as hot spots for raptors. Some of these areas include the open grasslands dominated landscape in Abdasa taluka, hilly landscapes of Khavda and Pachchham islands, and mosaic of open grassland-scrub lands of Banni area and all along the coastal region. The fringe areas of Great Rann of Kachchh and Little Rann of Kachchh also

Migratory Waterfowls. It is well known that Kachchh is a gateway for many winter migratory waterfowls. Between 1994 and 1996, man-made reservoirs and natural wetlands were surveyed for waterfowls and identified 15 important waterbodies for waterfowl conservation (Lopez & Mundkur, 1997) (Table 3.9). 1959 onwards, Bombay Natural History Society (BNHS) has also conducted many avifaunal surveys in the area, with a focus on migratory waterfowls.

Sea Turtle. Kachchh recorded very sporadic nesting of two endangered species of turtle viz. Olive Ridley and Green Turtle. Of these, Olive Ridley are visiting Kachchh in relatively larger number. Recent survey conducted by GUIDE (2001) recorded 61 nests of Olive Ridley (Table 3.10), while

Coastal Stretch	Number	Coastal Stretch	Number
Pingleshwar	1	Nanalayja	21
Suthri	2	Mandvi	22
Chhhachhi	3	Tragadi	4
Banbhdai	1	Total	61
Bada	7	Source: GUIDE (2001)	

collection almost from the same stretch, indicate increase on breeding population of Olive Ridley Turtle.

Indian Crocodile. Inland wetlands in Kachchh also provide habitat for the endangered marsh crocodile (*Crocodylus palustris*). Last crocodile survey in Kachchh recorded the presence of crocodile from 8 water bodies and two rivers courses with a total

Water Body	Total
Devisar tank	1
Edumund lake	3
Pakithalav	1
Pragsar lake	48
Rudramata dam	17
Sarsuya tank	3
Khengarsagar	1
Nirona dam	12
Khari river	2
Rukmavati R.	6
Total	94
Source: Vijay Kumar (1997)	

support very rich diversity of raptors. Some of the rare raptors species of Kachchh include White backed vulture (*Gyps bengalensis*), Steppe eagle (*Aquila nipalensis*), Osprey (*Pandion haliaetus*), Peregrine falcon (*Falco peregrinus*), Long eared owl (*Asio otus*), Laggar falcon, Palla's fishing eagle etc.

Sarus Crane. Sarus crane (*Grus antigone antigone*) is one of the three cranes (others are Common and Demoiselle cranes) visited in Kachchh. There are only four population estimates available for Sarus (Table 3.13), which recorded that the population of this bird species is declined sharply during the last 15 years (Singh, H.S. 1999).

Year	Agency	No. of Birds	Location
1984	State Forest Dept.	541	N.A.
Jan., 1998	GEER Foundation	10	Adesar, Nanda dam, Nanda Bet, Fatehgadh
July, 1998	WII, Dehra Dun	4	Chhari Dandh
Feb. 1999	WII, Dehra Dun	10	Adesar, Nanda dam, Rudramata Dam
Source : Singh (1999)			

3.1.5 Domesticated Diversity

3.1.5.1 Crop Varieties

There is not much documented information available regarding the crop varieties grown in Kachchh. However, discussion with large number of farmers clearly revealed that Kachchh has several crop varieties suited to the edapho-climatic condition of the region. Discussion with farmers also reveals that there were local varieties of many crops including Bajra, Jowar, Math (kidney beans), Mag (green gram), Chana (chick pea), Guar (cluster bean), Kulthi (horse gram) etc. In Pachchham area two varieties of Bajra are grown –the Kuwasio and Bhurti. While Kuwasio is suitable under good rainfall condition, the Bhurti is suitable under poor rains (Vyas, 1999). Only one serious attempt to document the crop varieties in Kachchh was made by Shah (1999) and mainly focus on Abdasa taluka. In all, the survey recorded 18 crop varieties that were grown till few decades back. Seven varieties of Jowar were grown of which Pucchar and Rattar are grown even today. Interestingly, there were six varieties of wheat growing in the area while none are grown any more. The minor millet has many varieties like Nangli (finger millet), Cheno (common millet), Anu (Panic seeds), Batti (Kodo millet). However, these are almost vanished from the area. The discussion with old age farmers revealed that Khadir island, Pachchham island, and part of Rapar, Abdasa, Lakhpatt and Nakhatrana taluka the local varieties are still growing and have high potential for their conservation.

3.1.5.2 Livestock Breeds

The last livestock census conducted in 1997 recorded 1.65 million heads of livestock from Kachchh district. Among the cattle, the most common breed is Kankrej. The most dominating non-descriptive breeds in Kachchh are Vaghiari, Vaghdia and Gardi. The last two breeds are specific to the region of Vagad (part of Rapar taluka) and Garda (Part of Abdasa taluka). The maldharis has strong opinion that the bullocks of both Garda and Vagad regions are relatively very sturdy and good for ploughing purpose due to their strong legs. Vaghiari is the most common cattle breed in Kachchh and closely related with Kankarej breed. The famous tharparker breed of cattle, were present in good number in few decades back are almost vanished from the area. Few individual efforts are however, now

Animal Type	Total Animals
Cattle (Indigenous)	371884
Cattle (Cross breed)	2947
Buffalo	164928
Sheep (Indigenous)	614831
Total Goat	467985
Camels	17381
Source: Animal Husbandry Dept.	

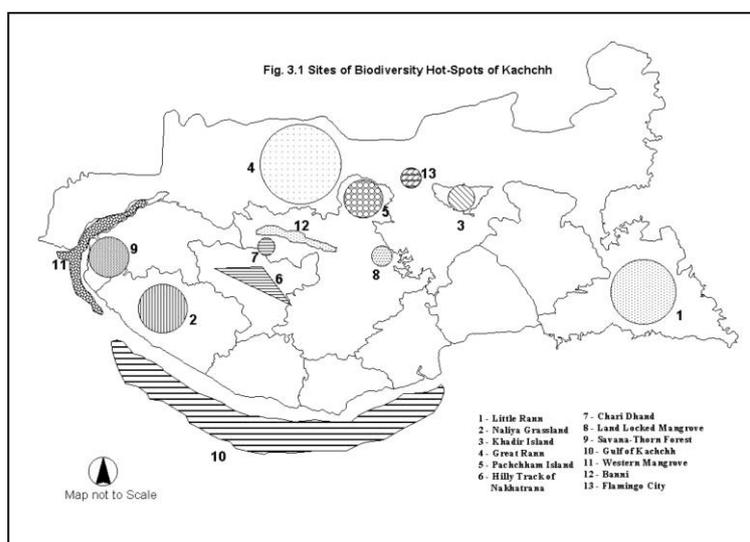
going on to revive this breed in Kachchh. The Gazetteer of Bomaby Presidency (Kachchh) published in 1880 also highlighted three major breeds of cattle –the Vagadia, Banniai and Kachchhi. The last livestock census recorded a total of about 3.72 lakh cattle of indigenous breeds and only about 3000 animals were of cross-breeds (Table 3.14). However, these figures are not available on breed basis. Among the buffaloes, however, there is only one breed reported from Kachchh viz. Sindhi (or Kundi).

There were two breed of goat in Kachchh –the Hamia and Deshi; the former being shorter and of a finer breed than the latter one. Similarly, two breeds of sheep are recorded from the Kachchh the Patanwadi and Kachchhi Marwari. The livestock census highlight that there are no crossbreed sheep and goats in Kachchh. Kachchh has long been very famous for its camels and there is a local breed, which is slightly shorter in made but faster in walk and therefore better suited for riding than for burden. Jakhau area was the major camel-breeding centre. Similarly, the Kachchh was once famous for its horses because of their sturdiness. Abdasa taluka was the chief breeding area. Also, there were two reported breeds of donkeys, the Sindhi and the Kachchhi. Among the dogs, a special breed of Kachchhi hounds known as ‘Taaji’ are bred and reared by the pastoralists of Banni to guard their sheep and goats (Tiwari and Rehmani, unpublished).

3.2 The Distribution of Biodiversity (Hot-Spots)

The above-discussed range of diversity, both at species and ecosystem levels, are distributed in different parts of Kachchh and forms some unique assemblages of floral and faunal elements and thus can be considered as the biodiversity hot-spots. It is understood that delineation of such centres of diversity require adequate exploration and sampling, however, based on the current understanding and available information in Kachchh, a few such areas can be identified as hot-spots for biodiversity conservation (Fig 3.1)

These areas were identified as hot-spots mainly on the basis of (a) record of rich assemblage of floral and faunal species (b) presence of rare and endangered species and, (c) exhibition of some unique ecological phenomenon. Following is the brief description of these hot spots.



3.2.1 Naliya Grasslands

The Abdasa Taluka of Kachchh support large areas of grassland, especially around the Naliya which is rich in species diversity (Table 3.15). The total coverage of these grasslands ranged between 170-200 km². These grasslands provide ideal habitats for some rare floral and faunal elements. *These grasslands are unique in the entire world that they provide ideal habitat for three globally threatened bustard species viz. Great Indian Bustard (GIB), Houbara bustard and Lesser Florican.* For GIB and Lesser florican, these grassland provide one of the very few breeding sites (Singh 2001). A maximum of 18 GIBs were counted in a single day (GUIDE

Taxa	No. of Species
Reptiles	5
Birds	40+
Mammals	8
Plants	90+

Source: GUIDE (2001)

2001). Forest Department has also recorded three nesting sites of the Lesser Floricans from this area. Recently, in 1999, 66 Floricans (mainly males) had been recorded from this area. Similarly, in year 2000, one forest officer has reported sightings of about 52 Houbara bustards from this area, of which one group counts of 17 birds (Singh 2001). Recent survey (year 2002) also recorded a very rare bird species (the White Browed Bush Chat) from these grassland areas after a gap of many years (Justus Joshua, Pers. Comm.). Other than these flagship bird species, the area also support large number of other animal species, including the Chinkara, Grey Wolf, Common Fox, Spiny Tailed Lizard, Fan throated lizard etc (Table 3.16). In order to provide some protection to this important habitat in general and GIB in particular a small area (about 2 km²) is declared as Wildlife Sanctuary.

Species	Number
Great Indian Bustard	20-25
Lesser Florican	120-125
Houbara bustard	40-50
Chinkara	400-425
Nilgai	220-230
Jackal	70-90
Fox	80-90
Wolf	10-20
Hyena	5-10
Mongoose	200-225

Source: Gujarat State Forest Dept.

3.2.2 Thorn Forest- Savanna Mosaic in Narayan Sarovar Sanctuary

The thorn forest and Savanna are the two most dominating natural vegetation types in Kachchh. These two vegetation types are however forming a mosaic in part of Lakhpatt taluka and adequately represented within 444.23 km² area of Naryan Sarovar Sanctuary (NSS). Around 120 km² and 275 km² area of the sanctuary are covered by the thorn forest and savanna, respectively. The entire NSS area support very rich floral and faunal values (Table 3.17). In fact, very large area of this sanctuary exhibit edaphic climax of tropical thorn forests which is remaining in only a few parts of the country. The NSS is rich in floral diversity both in terms of species and their assemblages. Presence of more than 250 species of plants and 18 vegetation associations, clearly highlight the floral richness of the area (GUIDE & GEER, 2001).

Taxa	# of Species
Plant	255
Reptiles	24
Amphibians	8
Avifauna	183
Mammals	27
Butterfly	34
Spiders	29
Raptors	19

Source: GUIDE and GEER (2001)

NSS also supports diverse faunal elements represented by many rare and endangered species including, Caracal, Wolf, Chinkara, Spiny Tailed Lizard, Desert Cat, Porcupine etc. According to above study, there are about 1285 Chinkara within NSS. Also Forest Department has conducted a Wildlife census in September 1999

Species	Estimated Population	Species	Estimated Population
Chinkara	1550-1600	Fox	100-125
Nilgai	350-400	Desert Fox	10-15
Wolf	40-50	Wild Boar	350-400
Jackal	300-350	Desert Cat	20-25
Hyena	40-50	Porcupine	150-200
Caracal	10-20		

Source: Gujarat State Forest Dept.

and estimated good number of wild animals from the NSS area (Table 3.18).

3.2.3 Great Rann of Kachchh

Salt-impregnated GRK is one of the most remarkable and unique features of Kachchh and probably one of its own kinds in the entire world due to its wilderness value. It covers between 16000-17000 km² area with an average altitude is about 15 meter above mean sea level, and thus appears like a table-top surface, interspersed with small uplands (islands) locally called 'bets'. The GRK owes its origin to a marine transgression in geological time scale and is tectonically an unstable area. Other than geological uniqueness, GRK is also very interesting from biological and ecological points of view. Ecologically, it represents one of the largest seasonal saline wetland

areas having the water depth ranging from 0.5 to 1.5 meter. However, after October-November, water start drying up and the area turns into a saline desert, where the thick deposit of crystal of salts is common scene.

Other than supporting large number of Falmingoes (see below), the wetland of GRK also support large number of other water birds including Pelicans, Great Crested Grebe, Black stork, Brahminy Duck, Common Pochard, Tuffed Pochard, White Eyed Pochard, Gulls, Terns, Stints, Plovers etc. The mudflat areas near Lodrani is considered as one of rich wetlands in Kachchh fro migratory waterfowls. The mixture od saline flat land and raised bets provide ideal habitat for many other wild animal species including Wild Ass, desert fox, desert cat, Indian porcupine, saw scaled viper, krait, cobra and several species of lizards including the spiny tailed lizard. Due to the presence of geologically diverse rocks, many bets also support rich fossilized fauna, including the skull of dinosaur and wood fossils (Singh, 2001). Al large part of the GRK is covered under Kachchh Desert Wildlife Sanctuary.

3.2.4 Flamingo City

Right in the midst of the GRK, there is a slightly raised ground where water starts receding first, thus enabling large number of flamingoes to build their mud nests or repairing of old ones. This area which is around 10 km from the Nir out-post on Kala Dungar, is popularly known as ‘Flamingo City’. The local name given to this area is ‘Hunj Bet’ (Hunj is the Kachchhi name for flamingo). The area is famous for the largest congregation of Greater Flamingoes in the entire subcontinent for the breeding purpose. Small mounds of muds make the nests on the ground and on each mounds the birds lay their eggs. In 1945, Dr. Salim Ali estimated a population of half million birds from the site. About 1 lakh birds are still visiting the area if rains are good. The area may not be considered as very rich in diversity, but it supports one of the magnificent ecological phenomenon, which need to be preserved. Ironically, there is very limited ecological data available about the area and the magnificent phenomenon of breeding. The area is currently a part of Kachchh Desert Wildlife Sanctuary.

3.2.5 Little Rann of Kachchh

The LRK is similar to the GRK as far as physiography, climate, vegetation and overall edaphic condition are concerned. However, they are significantly different in silt deposition characteristics. While silt of GRK has been deposited by the Indus river, the LRK shows strong affinity with the silts brought from the rivers of Gujarat. Also, due to different inundation pattern (due to rain water pouring from the rivers like Rupen and Banas), the level of salt deposition on the soil surface is also comparatively less in LRK.

Although it appears that ecologically LRK is a homogenous entity, but in reality it form a mosaic of habitats, formed due to various interactions between Rann, bets and mainland areas (Singh 2001). In biodiversity point of view the LRK is in real sense a hot-spot (Table 3.19) and have very high scientific research, ecological educational and wilderness values.

Table 3.19: Species diversity in LRK

Taxa	Number	Taxa	Number
Phytoplankton	113	Reptiles	25
Plants	157	Amphibians	4
Invertebrates	66	Birds	178
Spider	28	Mammals	33
Prawns	11	Source: Singh (2001)	
Fish	22		

LRK is world famous for the last remaining population of endemic Wild Ass and to protect this species almost entire LRK is covered under Wild Ass Sanctuary (WAS). According to last census (Jan. 1999), the total population of Wild Ass is about 2839 (GEER, 1999). Other than the wild ass, the LRK also provide ideal habitat for large number of bird species. Many seasonal wetlands in the area attract large number of resident and migratory waterfowls. A total of 178 species of birds, including 81 terrestrial and 97 aquatic, were recorded from the area. About 80000 birds were counted from different water bodies of LRK (see Table 3.20). Greater and Lesser Flamingoes, White Pelican, Dalmatian Pelican, Common crane, Great crested grebe, Caspian tern and Houbara bustard are some of the indicator bird species for LRK (GEER 1999).

Water Bodies	Maximum Count
Bajana	6846
Nava Talav	14067
Nanda (North)	13104
Nanda (South)	24783
Shedwa	19528
Surajbari	1827
Total	80155
Source: GEER (1999)	

Among the many important biodiversity values, LRK also has great potential to support brackish water fisheries, especially the prawn fisheries (Pravez, 1991). The mixing of tidal waters from the Gulf of Kachchh with the freshwater flow during the monsoon makes the area an important nursery ground for prawns. The major centres of this fishery is therefore found on the western side of the LRK, where from the Surajbari Creek the tidal water goes in. The recent study conducted by GEER Foundation revealed that a substantial number of fishermen (more than 8000) are actively engaged in the fisheries in the LRK, mainly during the period between late July to early October. The total annual landing of the fishery from LRK varies between 2500 to 3000 MT and thus a very lucrative economic activity (GEER, 1999). Eleven species of prawns have been recorded with the major contribution from *Metapenaeus kutchensis* (an endemic species to Kachchh) and *M. affinis*.

3.2.6 Khadir Island

Khadir island is one of the largest bets in Great Rann of Kachchh and separated from the main land by a minimum of 8 km. It occupies about 313 km² area and support different vegetation types including the mixed scrub thorn and savanna. The habitat of the Khadir is so unique that once the area was considered suitable for reintroduction of the hunting leopard (Dr. M.K. Ranjit Singh, Pers. Comm.).

The area supports very diverse floral and faunal elements. According to a recent survey conducted by GUIDE, about 150 plant species were recorded only from Chhaparia Rakhhal of this bet. Common plant species recorded from the area include: *Salvadora persica*, *Salvadora oleoides*, *Acacia nilotica*, *Acacia Senegal*, *Moringa oleifera*, *Opuntia elatior*, *Capparis deciduas*, *Prosopis cineraria*, *Zizyphus nummularia* etc. in the top canopy, while *Maytenus emerginata*, *Melhania futteyporensis*, *Commiphora wightii*, *Grewia tenax*, *Cordia gharaf* etc. constituted the under storey. About 80 species (including grass species) were recorded from the ground flora. The study conducted by GEER Foundation recorded 4 different types of species associations in herbaceous layer. The same study recorded the presence of 21 mammalian species including Indian Wild Ass, Chinkara, Indian Wolf, Ratel, Caracal, Desert Fox, Stripped Hyena, Desert Cat etc. (GEER 1999). Also, there was a record of 6 species of reptiles including Spiny tailed lizard, Indian monitor lizard, Saw-scaled viper, Russel's Viper etc. A total of 46 terrestrial and 38 aquatic birds species were recorded from the area. This highlights the significance of the island amidst the vast expanse of mud flats. Some of the important bird species include: Greater Flamingo, White Pelican, Houbara Bustard, Common crane, Demoiselle crane, Crested lark, short toed lark, Black Stork, Pale Harrier, Marsh Harrier etc. (GEER Foundation 1999). About 40 years ago there was a good population of Chinkara in Khadir area, most of them are now poached (Himmatsinhji Pers. Comm.).

Other than wild diversity, Khadir is also known for its dryland farming practices and still cultivating large areas with the local crop varieties. Although there is no documentation and inventories of these local crop varieties, but the discussion with the local farmers highlights that there is a high scope of conservation of these local varieties in the Khadir. Khadir is also very diverse in its cultural and archeological heritage. Presence of a site of Harappan or Indus Valley Civilization at Dholavira is also highlighting the value of this entire landscape. At present the Khadir Island is a part of Kachchh Desert Wildlife Sanctuary.

3.2.7 Pachchham Island

Pachchham is the northern most highland of the Kachchh mainland located on the border of GRK. Total geographical area of the island is about 469 km². The area is surrounded by the saline marsh of GRK from north, east and west and by flatland of Banni from the south, giving it an island like appearance. In general, the island is hilly in nature where the highest peak of Kachchh –the Kala Dungar (458 mASL)- is located.

The island is supporting different natural habitats that include savannah, scrub thorn forests and wetlands. Some rapid floristic surveys recorded more than 250 plant species from the area. *Acacia senegal*, *A. nilotica*, *Salvadora oleoides*, *S. persica*, *Euphorbia nivulia* and *Capparis decidua* are the common plant species, which form different floral communities in combination with other species. Although the island support the common plant species of Kachchh, but on the upper reaches of Kala Dungar, the elements of dry deciduous vegetation also appears, with the species like *Sterculia urens*, *Lannea coromandalica*, *Bombax ceiba*, *Butea monosperma*, *Albizia* sp. etc. The area also support many faunal species, including a few rare and endangered ones. Neelgai, chinkara, wild boar, and jackal are the common species, while, the endangered species like wolf, desert fox and desert cat, are also reported from the area. On the eastern most fringe areas of the island a few herds of wild ass were also reported. The island is one of the last few areas where the traditional cattle breeding and trading are still practiced, and the area still support good number of cattle of indigenous breeds. Since, the agriculture is predominantly a rainfed one, the crop cultivation still revolves around the local varieties. The scope of conservation of these local (desi) crop varieties and livestock breeds is very high in this area. The island is also well known for its fossil wealth. Culturally, also the area is well known for its handicraft work. The island is currently a part of Kachchh Desert Wildlife Sanctuary.

3.2.8 Hilly tracts of Nakhatrana and Dhinodar Dungar

The hills and undulating areas occupy about 30% area of Kachchh and thus a very dominating land forms. However, due to variation in edaphic and geological materials, these hills vary in their vegetation quality, and thus overall diversity. For vegetation point of view, one of the most potential hilly area lies around Nakhatrana, including the second highest hill of Kachchh – the Dhinodar. This entire hilly tract support very rich *Acacia* thorn forest and *Euphorbia* scrub. Recent ecological surveys conducted by GUIDE recorded more than 150 plant species from this area. The area supports the best population of *Commiphora wightii* (Gugal- a medicinal plant) in Kachchh. The area also support very diverse faunal element. In fact one of the last remaining population of leopard in Kachchh is using the habitats in these hilly areas especially the foothills of Dhinodar.

3.2.9 Western Mangrove Area

Mangroves are mainly concentrated in the western part of the district especially in the Kori Creek and area around Jhakahau (Table 3.21). Majority of these mangroves are Reserved Forest and thus under the control of Forest Department (West Mangrove reserved forest). At total extent of about 670 km² of mangrove has been reported from this area (Singh, 1999). Recent ecological studies conducted by GUIDE, reported the domination of a single mangrove species viz. *Avicennia*

marina. Besides *A. marina* two other species seldom recorded are *Suaeda nudiflora* and *Salicornia brachiata*. On the contrary, study reported a very rich faunal diversity (Table 3.22) associated with these mangroves (GUIDE 2000).

Location	Dense	Sparse	Total
Kori Creek	306.2	337.1	643.3
Lakhpat Taluka	2.3	2.1	4.4
Abdasa Taluka (near Jakhau)	16.5	5.0	21.5
Total	325.0	344.2	669.2

Source: Singh (2000)

Taxa	No. of Species
Molluscs	37
Crustacean	21
Polychaets	3
Birds	42

Source: GUIDE (2000a)

3.2.10 Gulf of Kachchh

The Gulf of Kachchh (GoK) is the largest Gulf in the entire West Coast, covering an area of about 7350 km². The depth of this gulf varies between 20-60 meter, with a mean of 30 meter (Sen Gupta and Deshmukhe, 2000). A negative water balance characterizes the GoK, where the evaporation exceeds the sum of precipitation and river runoff (Table 3.23). However, large quantity of sediments from River Indus (in Pakistan) get moved along the Kachchh peninsula and slowly accumulate. This compensates the nutrient deficiency in gulf water due to poor runoff condition. The salinity of GoK increases from mouth to upstream from 35 to 40 ppt. The interaction of physical and chemical characteristics of the GoK, however, creates suitable habitat conditions for diverse life forms in the gulf, especially in the southern side. There is, however, no detailed study has been conducted on the northern side of the Gulf, bordering Kachchh district and the floral and faunal composition are quite different between the two sides of the GoK. Nevertheless, based on recent surveys conducted for ICMAM project, 40 species of phytoplankton were recorded. Many rare and endangered faunal species were also reported from this part of the Gulf. Recently, live corals with associated flora and fauna have been reported for the first time near Mundra port area (Sen Gupta and Deshmukhe, 2000). Endangered species like Olive Ridley turtle, Green turtle, Common Dolphin, Sperm whale etc are recorded from this part of GoK. Highly endangered species like Dugong has also been reported occasionally from this coastal water.

Parameters	Values
Area (km ²)	7350
Depth Range (m)	20-60
Depth Mean (m)	30
River Runoff (Mm ³ yr ⁻¹)	140
Rainfall (Mm ³ yr ⁻¹)	3087
Evaporation (Mm ³ yr ⁻¹)	7350
Water Balance (Mm ³ yr ⁻¹)	-4123
Turnover Time (days)	8-51
Tides (m)	3-8
Tidal expanse (km)	0.5-2

Source: Sen Gupta & Deshmukhe (2000)

3.2.11 Banni

Banni covers an area of 3847 km², which is about 8.4% of total geographical area of the district. The area is absolutely flat with an altitude ranging between 3-5 meter above sea level. More than two third area of Banni is high in salinity. During the fifties, Banni was predominantly a good grassland, with very low density of trees and shrubs (10-15/ha) of *Salvadora oleoides*, *S. persica*, *Acacia nilotica* and *Capparis decidua*. The area was, therefore, considered as one of the largest and finest grassland of Asia. At that time more than 40 species of grasses were present commonly, which are reduced now to only about 10-15 species. Other than the grass species, the Banni predominantly support the species of *Sueda*, which is very helpful in reducing the salinity in the Banni. The Banni was also supporting very rich and diverse faunal elements. While the seasonal wetlands support very large number of migratory waterfowls, the grasslands are the home of many other wild animal species including chinkara, wolf, houbara bustard, common cranes etc. About 273 bird species were reported from Banni, which include 107 migratory species (Tiwari and Rahmani, 1997). During last few decades, *Prosopis juliflora* has started invading the area and

now covered almost all the good grassland areas. Other than ecological values of Banni, the area also support large population of maldharis, the livestock owners. The area is also famous for the handicraft work.

3.2.12 Chhari Dhand and nearby seasonal wetlands in Banni

In Banni, which is predominantly a flat area, have many depressions, where rainwater gets collected during monsoon. These shallow water lakes are locally known as 'Dhand', 'Jhil' or 'Talav'. Based on Survey of India toposheet a total of 34 such wetlands exist in the Banni area. Among these *Dhands*, Chhari, Servo, Vakario, Khirjog, Abdha, and Luna are the major ones. All these wetlands are supporting large numbers of waterfowls. Chhari-Dhand is the largest among these seasonal wetlands, with a water spread area of about 10 km². More than 50000 waterfowls have been recorded from this lake (Lopez and Mundkur, 1997). The adjoining Khirjog and Vakrio reported more than 30000 birds during winter. The endangered bird species like Dalmatian Pelican (*Pelicanus crispus*), Oriental Darter (*Anhingia rufa*), Blacknecked Stork (*Ephippiorhynchus asiaticus*) and Indian Skimmer (*Rynchops albicollis*) visit these wetlands almost every year. Other than waterfowls, About 32 species of raptors were also recorded along these wetlands. These wetlands also attracts large number of common cranes. Tiwari and Rahmani (1996) reported, a total of about 40,000 common cranes in the year 1994. The latest waterfowls count of the Chhari Dhand, organized by Forest Department, recorded about 55 species and 50000 birds. Due to high concentration of water birds, the Chhari Dhand and some of its adjoining water bodies are under serious consideration to include in the Ramsar Site.

3.2.13 Land locked mangroves

About 50 km away from Bhuj, there is a land-locked patch of mangrove forest of about 2 ha size. Clearly, this is a remnant mangrove patch which is surviving without having any direct contact from sea water. The present sea-coast is about 50 km away from this site. This mangrove patch is located in the fringe areas of Great Rann with plenty of saline groundwater. The place is locally known as 'Shravan Khavadia' (named after the famous Hindu mythological characters Shrawan Kumar). The area is treated as a sacred grove. Earlier, it was a grove of more than 100 trees of *Avicinnia marina*, but 60-70 trees have been uprooted and damaged by the severe cyclonic storm in 1998. These trees were 15-20 m in height, with 2-4 m girth and more than 160 years old. Logically it could be concluded that in past there may be a sea-coast on this tract which was receded away due to geological transformations. However, these patches are thriving mainly due to micro-environmental conditions provided by the saline Rann and the protection due to mythological significance. This is an unique phenomena of ecological adaptability and thus need to be conserved. There are few more such land-locked mangrove patches in the same stretch towards Lakhpat.

3.2.14 Rainfed Farms in parts of Lakhpat, Abdasa and Rapar Talukas

The majority of these taluka are practicing the rainfed farming. Discussion with local farmers suggests that in large chunk of these areas, there are farmers who are still growing indigenous varieties of crops and thus still preserving the genetic diversity of crops (see section on domesticated diversity). Ironically, no systematic efforts have been made to document the real scenario of agro-biodiversity in these areas.

4 Causes of Biodiversity Degradation

Based on the magnitude and extent, the causes of biodiversity degradation are discussed under two categories- major causes of biodiversity degradation and supplementary causes of biodiversity degradation. However, many policy and other issues related to biodiversity conservation in Kachchh has been discussed in the chapter on Gap Analysis.

4.1 Major Causes of Biodiversity Degradation

4.1.1 Invasion of *Prosopis juliflora*

Prosopis juliflora is an exotic species introduced in the region mainly by forest department under different plantation schemes to arrest the expansion of Ranns. The first major plantation program of this species was conducted during the early 1960s. After the initial plantation efforts along the

fringe areas of Ranns, Banni and Coastal tracts, the species is spreading very fast on its own and encroaching large tracts of productive lands (See Plate 5). According to the latest report, about 3478-km² area (i.e. 7.6 percent of total geographical area) of the district is covered by *P. juliflora* (SAC, 2001). Other than private farmlands, the species has encroached almost all other

land use categories. The worst affected areas include the river courses, grasslands, coastal region and saline fringe areas of Ranns and bets. The most obvious effect of invasion of this species is evident in Banni region. Satellite data based analysis clearly highlighted that between 1980 and 1988, the grassland were declined at an unprecedented rate of about 3000 ha/year (Table 4.1) and

Prosopis juliflora has invaded the area at a rate of about 2600 ha/year (Jadhav et al, 1992). Similarly, in the three ecologically important areas viz. Narayan Sarovar Sanctuary, Khadir island and Wild Ass Sanctuary in Little Rann of Kachchh, the *Prosopis juliflora* has encroached upon many important habitats in last many years (Table 4.2).

Land Use	Area (in ha.)		Rate (ha/year)
	1980	1988	
Grassland	101099	76786	-3039
Prosopis	37893	59282	+2673
Prosopis + Grass	56550	56781	+29
Total Veg. Cover	195542	192849	-336

Source: Jadhav et. al. (1992)

Area	Area (Year)	Area (Year)
Narayan Sarovar Sanctuary	630 ha (1988)	1870 ha (1999)
Khadir Island	NA	8944 ha (1995)
WAS (excluding Bets)	4005 ha (1984)	5349 ha (1995)
Bets in WAS	4336 ha (1984)	6030 ha (1995)

Source: GUIDE & GEER (2001), GEER (1999)

In the context of *Prosopis juliflora* invasion, it is understood that this species generate huge biomass in the region, but if the cost of generating these biomass are weighed against the many ill-effects, it could be proved to be a disastrous in bringing lot of negative changes in the entire ecological system of the region. Any floral species with the capacity for rapid growth and early maturity would require copious amount of nutrients and water that too very fast. In the region like Kachchh, its role in disturbing the groundwater balance is an important issue which is completely overlooked.

4.1.2 Over fishing from the coastal water

The 406 km long coastline along the Gulf of Kachchh provides ample scope of marine fisheries in Kachchh. The Gulf is known for its mangrove forests and also Coral Reeves, which are known breeding and nourishing grounds for many varieties of fishes and prawns (see Chapter 3). The district currently has 18 coastal water fish landing centres, where, about 2500 families with about 15000 fishermen populations are operating. Jhakhau, Modhava, Salaya, Tragdi, Bhadreswar, Luni and Mundra are the major centres of fishing in Kachchh, and thus mainly contributing in more than 70 thousand tonnes of annual fish production of the district (Table 4.3). While, simple looking of these data does not indicate the level of exploitation of fishery resources, there are some other indications of increased exploitation. The rapid increase in number of mechanised boats in lieu of non-mechanised boats (Table 4.4)

Year	Production (in MT)
1993-94	63,234
1994-95	76,826
1995-96	72,677
1996-97	76,662
1997-98	71,787
1998-99	69685
1999-00	75029
2000-01	64696

Source: State Fisheries Dept.

Year	Mechanised Boats	Non-mechanised Boats
1997-98	675	523
1998-99	975	224
1999-00	1031	229
2000-01	1121	233

Source: State Fisheries Dept.

indicate that there would be more catches of juvenile fishes, jeopardising the sustainability of the system. This is even more damaging due to no regulation and control over mesh size. The problem further aggravates with the increasing number of fishermen coming from far off places of west coast and east coast during April to August, which largely coincides with the peak breeding season of majority of marine fishes. While, the local fishermen avoid fishing during this period, these outsiders catch the brood

fishes and leads to serious fall in fish stocks. In addition, there is a report that at State level, the proportion of economically valuable fishes are significantly gone down in last 20 years (NEERI, 2002), causing direct threat to fish biodiversity. Similar, trend is also expected in marine fisheries of Kachchh.

4.1.3 Overgrazing by domestic livestock

According to the last conducted livestock census of 1997 Kachchh support about 16.5 lakh heads of livestock. Other than these resident livestock population, following a good rainfall year, there is an in-migration of large number of livestock from neighboring districts and even neighboring state like Rajasthan. This large number of livestock population is mainly dependent upon the common grazing areas under a free grazing regime

Taluka	1972	1976	1982	1987	1992
Abdasa	78982	53977	79264	57085	73173
Anjar	59106	38577	67873	57049	58580
Bhachau	62210	49965	83249	69683	95488
Bhuj	109917	90431	202964	127521	135879
Lakhpatt	37466	26362	51209	30433	44194
Mandvi	72504	52371	64405	67029	69932
Mundra	43976	27828	36702	38774	32767
Nakhatrana	79576	63727	70887	60913	73951
Rapar	80698	81066	115660	93555	105309
Total	624434	484304	772213	602041	689274

Source: District Animal Husbandry Dept.

Year	ACU/Ha. CPLR
1972	0.56
1977	0.52
1982	0.87
1987	0.70
1992	0.81

and thus putting lot of pressure on the grazing resources. While, the livestock:CPLR ratio in district has not changed significantly in last 20 years (Table 4.6), the effective grazing area has been reduced due to invasion of *Prosopis juliflora* in large part of CPLRs. At present about 1840 km² area of Kachchh is covered only by *Prosopis juliflora*, while another 1639 km² area is having significant proportion of *Prosopis juliflora* (SAC, 2001). This effectively removed nearly 3500-

km² area from the CPLR as grazing land and, therefore, the pressure on remaining grazing area has significantly increased, leading to overgrazing.

4.1.4 Habitat loss and discontinuity due to mining activities

Mining of many economically valuable minerals like lignite, bauxite, bentonite and limestone is one of the major primary economic sectors of the Kachchh (See Chapter 2). Major concentration of these minerals is seen in the Western part of the district, where large scale of mining is either in operation or in the pipeline for clearance (Table 4.7).

Mineral	Agency	No. of projects	Total Prod. (MT/year)
Lignite	GMDC	8	11.0
Limestone	Private	8	13.3
Bauxite	GMDC	6	16.23
Source:			

The mining activities exert many direct or indirect impacts on the various biodiversity values of this region, through habitat modification and habitat fragmentation. One of the most serious jolts to the efforts of biodiversity conservation in Kachchh was affected when about 321-km² area of Narayan Sarovar Sanctuary (NSS) was de-notified (out of a total 765.69 km² area) for opening the doors for mining industry in the area. This de-notification of sanctuary has opened many serious conservation issues in an around the PA.

Example

- There are evidences showing movement of animal species from south-western part of NSS towards Naliya. Many potential ‘satellitic’ habitat patches between these two major gene pools support the continuity of gene flow. These habitat linkages are threatened by the future limestone and lignite mining activities.
- Existing narrow ‘chicken neck’ area between western and eastern parts of NSS is very important for wildlife movement and gene flow. This corridor area would be highly threatened due to proposed mining activities all around- from the north, the lignite mining and from the south, the limestone mining.
- The proposed lignite mining area in Umrasar village by GMDC has found to be affected potential habitats of Indian Wolf (GUIDE, 2000b). Being adjacent to NSS, such mining activity will hamper the gene flow between the two areas. Similarly, the area between NSS and Mata-no-madh is also very rich in terms of wild life and severely fragmented due to mining activities.

4.1.5 Encroachments and unregulated grazing in grasslands of high biodiversity values

The grassland areas between Lala Bustard Sanctuary and adjoining areas of Naliya Air Force Station are the critical habitats for the GIB and Lesser Floricans. These grasslands are one of the last remaining breeding grounds of these species in the country and thus have very high conservation significance. Most of these grasslands are outside the PA system and belong to Revenue Department. However, in recent years many parts of these grasslands are encroached for cultivation. It is noted that this trend has direct correlation with the recently settled farmer families, mainly from outside Gujarat, who are doing extensive cultivation around these grassland areas and slowly encroaching these grasslands. Similar trends are also reported in other parts of the district, especially from those areas where the irrigation potential is relatively better. Some preliminary analysis by integrating both the village level revenue land records and recent satellite pictures, highlighted the extent of such encroachments (GUIDE, unpublished). These encroachments, while reduces the area of grassland also resulted serious habitat fragmentation.

Moreover, from these grasslands, a large livestock population (more than 13000 livestock heads) fulfils their fodder demand under open grazing system. Since these birds are laying their eggs on

the bare ground, the free grazing cause trampling of grasslands and in many cases the eggs are damaged. These bird species are slow breeders and thus lay only 1-2 eggs at a time, and damage of eggs like that is simply a loss of one breeding year. This conflict in resource use pattern is one of the major threats to the conservation of these species.

4.1.6 Killing of Wolf by maldhari community

There are many reports that the Rabaris and other Maldhari communities who mainly rear the small ruminants like goats and sheep, kills the wolf in many parts of Kachchh, especially in the Abdasa and Lakhpat talukas and Banni. These are the regions where density of wolf is relatively higher. It is important to note here that the wolf is the most dominating predator in Kachchh and thus have important role in the ecological food chain. The wolves more than often kill the sheep and goats. Since the compensation mechanism for this loss of animals is not very effective, as an immediate retaliatory action, these Maldhari communities, whenever found any den with the pups of wolf, killed them by smoking the dens or by poisoning. The killing of wolf is also very common in Banni. After a good rainfall, the graziers from eastern Kachchh (i.e. from Vagad, Anjar and Bhachau) migrate into the Banni with their sheep. These nomadic tribes, called as Dhaberias, in retaliation of sheep lifting, generally killed the wolves by trapping them into deep pits. Also, often the local graziers of Banni used to kill the wolves through iron jaw traps or other traps (Tiwari and Rahmani, unpublished). They also reported that during their study period, within a month three wolves were killed on two different occasions.

4.1.7 Predation on sea turtle eggs

Sandy beaches of Kachchh coast provide suitable nesting grounds for two endangered sea turtles- Olive Ridley and Green Turtles (see Chapter 3). Past records, show nesting from both the species. However, during recent surveys, nests of only Olive Ridley were found in the entire coastal belt of Kachchh (GUIDE, 2001). Paradoxically, study also reported that almost all the nests were under heavy predation mainly by animals.

Table 4.8: Turtle egg predation		
Total Nest Recorded	Human Predation	Animal predation
24	9	15
Source: GUIDE (2001)		

The *Koli* community (a scheduled tribe) are also predated on the eggs to certain extent (Table 4.8). Because of such heavy predation, the breeding success of turtle from the Kachchh coast is very less. Further, considering that in the entire western coast of India, the Olive Ridley Turtle lays the eggs only in Kachchh coast, this loss of eggs could be a major setback to entire turtle conservation efforts.

4.1.8 Wild Ass habitat fragmentation due to Narmada canal

Under Sardar Sarovar Project (SSP), the Kachchh branch canal will cross the narrow neck of the northern tip of Little Rann of Kachchh, which joins it with great GRK near Adesar. According to last many census of Wild Ass, while the domination of wild ass is in the LRK area, there is also a significant population of wild ass in the GRK side (Table 4.9) and there is a large dispersion and continuous movement between these two major populations (GEER Foundation, 1999). The Kachchh branch canal will certainly restrict the movement of Wild Ass population between the two Ranns, causing isolation of population. The detailed ecological impact of this canal on wild ass population has still not been conducted.

Table 4.9: Number of Wild Ass in two Rann areas		
Year	GRK	LRK
1976	169	326
1983	488	957
1990	604	973
1999	594	1522
Source: GEER (1999)		

4.1.9 Uncontrolled expansion of salt pans around WAS and coastal tracts

The salt industry is one of the leading industries of Kachchh, as it produces about 1.5 million MT salts annually. The industry has a very rapid growth in last few years and thus expanding very fast. However, such expansion has many negative consequences on the biodiversity of Kachchh.

Example

- Increasing number of salt pans in the LRK areas release large quantities of highly saline waters in the surrounding water. This increases the salinity to a very high level and negatively affects the growth of fishery, especially the prawn fishery adjoining Surajbari creek near LRK (GEER, 1999).
- Newly developed salt pans around the Suarajbari area, erected bunds to divert the water from the creek to their pans, causing serious damage to prawn fishery in the area. Other major consequence of these bunds is felt on the breeding area of Flamingoes. Due to such diversion of water, there is serious shortage of food items (like algae) in the potential breeding areas and thus flamingos are abandoning the site (Justus Joshua, Pers. Comm.).
- The salt industry within WAS has been established in a very haphazard manner. The remote sensing analysis revealed that within WAS the salt work area has increased from 6948 ha in 1984 to 13357 ha in 1995. Many of these salt works are also constructed near the bets and there are increased level of disturbances due to vehicular movements. These has significantly reduced the effective habitats of wild ass population and forced them to move outside the sanctuary limits GEER, 1999).
- In many areas, it has been reported that salt industries has diverted the seawater towards their salt pans through modification in water channels. This change in watercourses negatively affects the mangrove vegetation, especially its regeneration (G.A. Thivakaran, Pers. Comm.).

4.1.10 Industrial development along the coastal belt

The trends shows that in last many years, there is some rapid increase in setting up of industrial units in Kachchh. This could mainly be attributed to couple of broad reasons viz. (a) the realization of mineral resource potential and (b) the focus on capitalizing the maritime potential of the state, with Kachchh being in a strategic location as the nearest coast for the whole north-western India. In this context, some notable steps taken by the government are (a) release of rich mineral reserves in Western Kachchh (through denotification of Narayan Sarovar Sanctuary) and (b) encouraging private sector participation in Ports.

Also, it is realised that due to perpetual water shortage in almost entire Kachchh, for the industrial point of view, the most potential sites would be its long coastal belt, where industries can manage their huge water demands through technological solution like de-salination etc. For that, there is a clear State Policy to promote industrial centres along the coastal belt of Kachchh. There are already a few big industrial projects launched in the coastal tract like of ports and jetties. Due to such industrial development, the ecology of entire coastal belt gets threatened. Two major ecological systems threatened most by these activities are the mangroves and the creeks. The cutting of large area of mangrove during the construction of a port near Mundra and dredging of a creek to make a way for captive jetty for cement industry are the two recent consequences of industrial development in coastal area. Also, due to two large all-season ports in Kandla and Mundra, the ship traffic is also going to increase tremendously, and there is always a threat of spillage of hazardous chemicals and oils, which can be a serious threat to the marine life of Gulf of Kachchh. In last few years there is already, few such accidents reported from the area. These all activities affect the breeding of fish species that, in turn, have impact on livelihood of the fishermen communities.

Recently, in post earthquake scenario, govt has announced tax holidays for industrial settings for next five years in Kachchh and it is believed that this will further invite large investment of industries in the area. In the wake of very weak regulatory framework, especially based on carrying capacity of the region, these industrial set-ups bound to exert pressure on natural resources.

4.1.11 Unplanned upstream development

Being an arid region, in Kachchh, there is a policy of maximisation of rainwater harvesting, through construction of check dams, and other irrigation reservoirs. However, there are some cases of negative ecological consequences of these upstream developments on the downstream systems. One clear case of such unplanned development is evident in the Banni area. It is believed by many environmentalists that with the construction of many medium irrigation schemes on the north flowing rivers, the freshwater flow into Banni is reduced significantly (Table 4.10). As a result of such reduced freshwater flow, the phenomena of washing of salinity from the soil and deposition of fertile silt have also reduced and salinity start increasing in the soil of Banni, which in turn, reduced the grassland areas of Banni (Ferroukhi, 1994). In addition, discussion with both experts on mangrove and local community also suggest that due to blockade of freshwater flow in the upstream areas, the regeneration potential of mangroves in some patches may also get affected in long term.

Dam	Year of Completion	Gross Storage Capacity (MCM)	Part of Banni area affected
Rudramata	1970	64.74	Central & East
Nirona	1970	30.19	Central
Nara	1981	41.03	West
Kaila	1955	13.98	Central
Kasawati	1976	8.88	Eastern
Gajansar	1960	9.52	Western
Total		168.34	

Source: GUIDE (1998a)

Similarly, under watershed development schemes, there are some cases where series of water harvesting structures were constructed in grasslands of high conservation values like the grasslands near Naliya. Such activities will certainly affect the population of endangered grassland dependent birds like GIB and Lesser Floricans.

4.2 Supplementary Causes of Biodiversity Degradation

4.2.1 Hunting

Hunting of wild animal species is not a very common practice in the region, although few sporadic incidences of wild animal killing were reported from the region. Interaction with local communities suggested that defence personnel posted along the coastal region and on different bets of Ranns are very frequently kills many wild animals, including Chinkara and wild boar. The biggest menace to game is shooting Chinkara on water at night by blinding them with powerful light; snaring the hare and; partridge in the nets (Himmatsinhji, Pers. Comm.). Other than these, many local communities are poaching the spiny tailed lizard- an endangered species. In many areas, even local communities suggested that people from other states like Rajasthan, are also visiting their area and catch large number of this lizard. Certain sections of the communities are used these lizard in making some pickle.

4.2.2 Killing of Crocodiles

In many of the water bodies of Kachchh, a small population of crocodile is thriving (see Chapter 3). The migration of these crocodiles from one water body to another is a common phenomenon. During the migration these animals have to pass though some agricultural fields or occasionally

near the human habitation. The villagers, just because of their fear from the crocodile, very often kill these animals once they noticed their presence. There are many such cases reported (Vijay Kumar, Pers. Comm.).

4.2.3 Over extraction of medicinal plants

Kachchh is supporting many plant species of very high medicinal values (see Chapter 3), of which many species are exploited heavily. As a result of which the population of these species were declined sharply in the past. One very good example of such exploitation is Gugal (*Commiphora wightii*) plants. Kachchh is one of the very few regions where this species is still found in good number. The species has high use-value to pharmaceutical and perfume industries and is subjected to heavy exploitation. In addition, Atal *et al.* (1975) reported that during mid sixties, annually 300 to 400 tonnes of Gugal were sold from Bhuj market, highlighting the potential of the area, and level of exploitation. Further, crude method of gum collection leads to high mortality of the plants significantly declining the population (Table 4.11). Recent survey of GUIDE also identified 13 plant species which are used at commercial level, although the scale of such operation is not known (GUIDE, 2002).

Year	Quantity (in Tonnes)
1963-64	30.00
1964-65	10.20
1965-66	4.00
1966-67	1.10
1967-68	0.43
1968-69	0.33
1969-70	0.75
1994-95	4.60
1995-96	1.70
1996-97	1.30
1997-98	2.28
1998-99	2.42

Source: Dixit and Rao (2001)

4.2.4 Exploitation of native trees for charcoal making and fuel wood

Acacia nilotica, commonly known as ‘Desi Bavad’ is one of the native tree species of the region. Interaction with communities and many senior citizens revealed that the number of trees of this species has declined sharply in last couple of decades. One of the major factors for the decline in the population of this species is the cutting of trees for charcoal making. Although no empirical data is available to prove this, however, certain areas are more affected. For example, many residents of Banni has informed that about 20-25 years back Banni has sufficient number of trees of this species, but at present there are hardly any trees of this species, as most of the trees are exploited for charcoal making. Similarly, in parts of Abdasa taluka and the area adjoining the NSS has many good forest patches of *A. nilotica*, where the tree cutting has started on a large scale from 1959 onward, laying exposed large tracts of land and thus reducing the number of this native trees sharply (Himmatsinhji, Pers. Comm.).

In addition, the majority of rural community depends upon the firewood to meet their daily requirement of energy. It is important to mention here, that govt. officials generally claims that after the introduction of *Prosopis juliflora* the Kachchh is considered as fuelwood surplus district and cutting pressure is reduced from the native trees. However, it was observed that this claim holds true only where the density of native trees are very less. In the areas with good density of native trees, the rural communities are still collecting the fuelwood from these species despite good number of *Prosopis juliflora* in their vicinity. A study on fuelwood use patterns from Narayan Sarovar Sanctuary (GUIDE and GEER, 2001) area identified that villagers use about 15 species of plants for fuelwood purpose. *Acacia nilotica* and *Acacia senegal* are the most frequently used species while the *Prosopis juliflora* was lowly preferred. There are four major resource user groups’ viz. local village communities, local small hoteliers (Dhabas), the Narayan Sarovar temple and defence personnel (see Box 4.1). The maximum firewood is collected for domestic purpose i.e. about 400 tonnes per month. This huge collection of fuelwood from NSS naturally affects the structure and function of the last remaining patches of natural thorn forests.

Box - 4.1

Firewood Extraction from Narayan Sarovar Sanctuary Area

- About 30% families collected firewood every day; 45% twice a week; 19% once in week and about 6% families buy 1-2 camel cart of firewood once in month.
- For domestic consumption, average per person per day wood collection was about 26.5 kg, which finally removed about 400-450 tonnes of firewood in a month from the sanctuary area.
- Defence personnel living around the sanctuary extract about 0.3 tonnes/month.
- Similarly, 7-8 tonnes of firewood is removed monthly for non-domestic purpose e.g. Local dhabas (6.75 tonnes/month); Narayan Sarovar Temple (0.56 tonnes/month).
- Contrary to general impression, *Prosopis juliflora* is not a preferred species by local villagers, due to its thorny nature. Preferred species are, however, *Acacia nilotica*, *Acacia senegal*, *Salvadora oleoides* and *Tamarix indica*.

4.2.5 Lopping/ cutting and grazing in mangroves

Almost all the species of mangroves, including the most dominating one – the *Avicennia marina*, are widely used by coastal people for various purposes especially for fodder and fuel. Between 3-4 lakh livestock heads are present in the coastal region of Kachchh, which are substantially dependent on mangroves for fodder (GES, 1997). In the Navinal creek areas, people are coming from long distances (i.e. about 15 km) to collect leaves of mangroves to meet their fodder requirements, and that about 650 kg of leaves were collected by a team of four persons in a month and about 10-15 such groups are regularly collect the leaves. This heavy biomass removal is also evident on the patches of mangroves as on an average every tree of *A. marina* has 48% of lopped branches (GUIDE, 1996). Recent study also suggests that there are heavy tree cutting and lopping in mangrove near Mundra, whereas near the Jhakhau they are relatively less (GUIDE 2000a). Similarly, in the Surajbari area, about 25 fishermen families cut around 225 tonnes of mangrove wood per year, out of which about 36 tonnes were used just for boiling the prawn catch (Naik *et. al.* 1991). In addition, the large camel population along the coastal tract (about 10000 in total; in Tund Wand alone there are about 4000 camels) directly feed on mangroves and especially hampering the regeneration (G.A. Thivakaran, Pers. Comm.).

Location	Cutting	Lopping
Mundra	22.6	34.2
Jhakhau	4.2	1.3

Source: GUIDE (2000a)

4.2.6 Human wildlife conflict due to crop damage by wild animals

Other than the normal risks of rainfall failure to the dryland farming practices, the farmers are facing the menace of crop raiding by wild animals especially the wild boar, neelgai, in certain area the Chinkara and Wild Ass around WAS. Farmers are relating the increase in crop raiding in last few years to (a) the reduction of food availability for wild animals due to overall degradation of natural habitats, (b) protection given by Forest Department to these wildlife species and thus their numbers are increased, (c) the uncontrolled expansion of *Prosopis juliflora* around their fields and (d) financial inability of farmers' to take other protective measures like barbed wire fencing etc. In certain cases, feral pigs are also causing serious damage to the crops (see Box 4.2).

The farmers generally remove all the *Prosopis juliflora* from their fields, but no one is taking care of common village lands or government land (especially the revenue lands). On these lands, during last many years (mainly after 1970s), the *Prosopis juliflora* grows very luxuriantly without any control and form dense bushy thickets. During the daytime, these bushy thickets are good hiding place for these wild animals, which came out in the night and raid the crops causing serious economic loss to the farmers. Farmers have to spend a lot of labour (or if hired a watchman, then the money) to drive these animals out.

Box – 4.2
Crop damage by Feral Pigs

In many of the village meetings around WAS, it was strongly emerged that the feral pigs are also damaging the crops heavily. According to the villagers, persons from a specific community from nearby towns and cities clandestinely leave few young pigs in the villages. In due course of time, the number of pigs increased sharply and most of them feed mainly on the agricultural crops. Later, members of this community visit these villages and used to catch a few pigs and sold in the cities. Since this activity does not involve any maintenance cost, it is a very profitable business for many, and thus spreading in many areas, resulting into serious socio-economical consequences. Also, few environmentalists has strong opinion that as a long-term consequence of this, there may be mixing of genes (from feral pigs) in the wild boar population leading to loss of genetic diversity!!

4.2.7 Loss of grass species diversity in grazing lands

In Kachchh during the past many years, there are efforts from different section of the society including Govt., NGOs, communities and other institutions to restore the grasslands for productive uses. In earlier days, the seeds were collected from different parts of Kachchh and they were sown in such regeneration efforts. However, in recent years, when such efforts are increased, the seeds are brought from different parts of Gujarat (like Valsad) and even from other States (like Rajasthan, Madhya Pradesh and Uttar Pradesh). With this kind of efforts, two key issues are emerging after discussion with maldharis, which need further probing:

- a. Only a few high yielding species are getting promoted, and thus there is an unsaid monoculture of grazing land is encouraged.
- b. In many cases, the species selected are native to Kachchh, but since the seed are brought from different agro-climatic zones, the grasses are not as good as the original Kachchhi grasses (see Box 4.3).

Box- 4.3
Habai or Kans grasses!!

The Kachchh, like any other region, has sub-regional variability's in their edapho-climatic conditions. These sub-regional variations were, however, had strong linkages with the traditional livestock system. In earlier times, one such linkage was in preference of grass from a particular area, which according to maldhari was more suitable for their cattle. One such example was told by maldhari. According to him, there are two small hilly areas near the present Kansvati reservoir. These are known as Habai and Kans dungar. In earlier days, when the livestock keepers from Bhuj and nearby villages go to market to purchase the grasses, they used to ask the seller 'which grass you have – Habai or Kans?' If he gets the 'Habai' grass he feel very satisfied because the grass from Habai hill was supposed to be better one than the Kans dungar. Grass from Habai was cut and stored by the former Kachchh State for the State horses and elephants as also for livestock.

4.2.8 Disintegration of traditional diverse agriculture system

As happened in almost all parts of the country, under the policy of green revolution, in Kachchh also there is intensification of agriculture practices. As a result of this, the HYV are promoted by Govt. agencies. In the year 2000 there was a total of about 6800 Quintals of hybrid seeds sown in Kachchh,

Table: 4.13: Growth of hybrid seeds and chemicals in Kachchh				
Year	Hybrid Seeds (Q)	Chemical Fertiliser (MT)	Liquid Pesticide	Powder Pesticide
1995 - 96	5940	22050	269600	236625
1996 - 97	6220	22750	274310	240800
1997 - 98	6180	27930	285800	253300
1998 - 99	6500	29440	296844	293056
1999 -2K	6800	29570	332900	310000

Source: District Agriculture Dept.

which is showing an increasing trend in last five years (Table 4.13). In addition, there are huge amount of chemical fertilisers and pesticides used to support the HYV.

4.2.9 Improperly defined property right regimes in Banni

Based on discussion with communities it was emerged clearly, that more than often, due to improperly defined property right regimes, community has indifferent roles in natural resource management and thus there is a gross degradation of these resources. One such case is evident in Banni. The Banni has a disputed property right regime, where the dispute is between the Revenue and Forest Department. However, in any case, whether it is a revenue land or a forestland, there is no private ownership in this, more than 3000 km² landmass. However, the local community has traditional rights of grazing in these lands. Under these contexts, this land is considered as one of the largest landmass under open-access regime (not even a common property regime), where villagers do not have any incentives to manage the resource. On the contrary, in pre independence period, the land was effectively operated under common property regime and thus the same maldharis were having some community grazing rules etc. as measures of natural resource management. All these factors cumulatively affect the overall change in pastoral system in Banni (Box 4.4).

Box- 4.4 Pastoralism in Banni

In the former state of Kachchh, no goats or sheep were allowed to enter Banni. Only the livestock of locals grazed there. This practice was continued till the time of the 'Part C' State (see Introduction Chapter). Now even camels invade parts of the Banni (particularly in the vicinity of Chhari Dhandh). The camel is a browser and where the soil is saline without tree cover, these animals feed upon salt tolerant plant species – the *Sueda* (Himmatsinhji, Pers. Comm.).

After the invasion of *Prosopis juliflora* and degradation of grasslands, the sheep and goat population start increasing. The most recent change in the Banni grazing system is the increasing number of buffaloes and significant decline in the population of cattle. About 70% households are now keeping buffaloes (GUIDE, unpublished report).

4.2.10 Weak regulatory mechanisms for resource extraction and restoration

There are very weak regulatory mechanisms to control excessive resource exploitation especially in the context of improvement in resource extraction technologies. A change in agricultural and land management technologies has often accompanied by a change in property regime and often affects the biodiversity.

Example

- With increasing capacity to exploit Ground Water, the agriculture is expanded in many parts of the district (e.g. villages near Lala Bustard sanctuary), however, there are no regulatory mechanism to control the conversion of large tracts of grasslands into agriculture fields. These grasslands, as discussed earlier, are very important for biodiversity conservation.
- Due to improvement in mining technology, the rate of exploitation of minerals has increased in last few decades, resulting into the fast expansion of land based mining activities. However, due to weak regulatory mechanism, the ecological restoration of mining areas and overburden are still not a priority of mining agencies.
- The State Government has a policy of promoting marine fisheries by planning to develop about 70 fishing centres in Kachchh under a perspective plan for year 2025. However, there is no regulation and even perspective plan to maintain sustainable level of fish harvesting.

4.2.11 Impact of scarcity relief on traditional resource management system

Highly subsidized government sponsored scarcity relief measures with very short-term objectives, while on one side encourage gross misuse and leakages of government fund, on the other hand, triggered many negative effects on traditional resource management practices.

Example

- The start of cattle camps artificially increases the number of unproductive cattle in the region, putting enormous pressure on already constrained fodder resources.
- Assured fodder during dry periods acted as disincentives to manage the CPLRs for fodder regeneration and thus disintegration of community based institutions.
- Easy money from the employment generation activities through earth works, forced farmers to ignore the preparation of their field for agriculture, especially in the rainfed areas, resulting into serious loss of productivity.

5 Major Actors and Their Current Roles

The biodiversity conservation is a national agenda, where each and every individual has some stakes and, therefore, has roles to play. However, each region has some specific natural resource related issues and many region specific actors are evolved to deal with those issues. Kachchh is no exception and many such players are emerged during the course of time. The list is too long but at the community and institutional (both government and non-government) level following are the key players who can play significant role in conserving the biodiversity of the region.

5.1 Communities

Farmers, fishermen and pastoralists are the three major community groups who have substantial dependence on the natural resources, very specifically on biodiversity. Due to their dominant resource use pattern, they also play major roles in conservation of biodiversity.

5.1.1 *Farmers*

Out of the total net sown area in Kachchh, more than 80% (i.e. about 5 lakh ha) of the land is under rainfed condition and thus faces severity of recurrent droughts and low dependability of rains. Out of the total landownership, about 10% of total agricultural land holding is with economically weaker section of the society. According to the 1991 census, there are about 2.25 lakh people¹; earning their livelihood directly from the agriculture sector (as cultivators and agriculture labour) and majority of them are linked to dryland farming sector. Due to increasing economic risks in the rainfed farming sector, large number of cultivator families started migrating from the region resulting into the creeping phenomenon of ‘absent landlordism’.

5.1.2 *Pastoralists and cattle breeders*

Livestock based livelihoods are a characteristic feature of the region. In Kachchh there are more than 1.65 million heads of livestock which are dependent heavily upon about 3 lakh ha of pasturelands. More than 20 thousand population are exclusively worked and engaged in livestock rearing activities (popularly known as ‘*maldhari*’). However, the total population who are dependent upon livestock sector may be quite high as large number (if not all) of farmers also either keeping some livestock or dependent upon them. Both, the settled and nomadic pastoralists exist in the region. Seasonal migration is, therefore, a common phenomenon. Based on the herd composition of livestock, there are clearly two distinct types of maldhari communities (a) those who mainly keep cattle and buffaloes and (b) those who mainly keeps sheep and goats, mainly belong to ‘*Rabari*’ and ‘*Bharwad*’ community. Although, milk selling is the main economic activity, but the sale of animal and wool also contribute substantially to the annual income of these maldhari communities. In certain pockets of the district, especially the Banni and Pachchham regions, traditional methods of livestock breeding still persist, especially of cattle and buffalo. However, due to recurrent drought like situation, there is high mortality of livestock, and thus these communities suffer heavy economic loss

5.1.3 *Coastal Fishermen*

In Kachchh, coastal fishery is one major economic activity with an average annual catch of more than 70000 tonnes. There are about 2500 families with more than 15000 fishermen population operating in the coastal tract. Of these fishermen families, there is a substantial population of those fishermen who catch fish in the shallow, inter-tidal zone and most of them don’t even have

¹ This is the estimate of workers population and need not to be confused with the total population.

boats for deep water fishing. These fishermen are known as 'Pagadiyas'. They sell their fish catch in the local markets. However, there are substantial numbers of fishermen who own the boats, both mechanized and non-mechanized. Pagadiyas and boat fishermen, through their association, are in most of the cases using traditional fishing gears and follow some self-regulations in fish catching like seasonal breaks in fishing activities etc. Importantly, these fishermen community also closely associated with the mangroves and can also play major role in mangrove management.

5.1.4 Other Forest Resource Users

Other than the above major occupational groups, there are many others from rural population who collect wide varieties of minor plant produce for their ethnic-uses like medicine, food, fibre, dyes, religious etc. While, almost entire rural community depends upon the plants of their surroundings, the traditional local *vaidyas* (herbal healers) and *Dais* (untrained mid wives) are collecting varieties of plants for specific medicinal purpose. Also, members of tribal communities like *Kolis*, *Paradis* and *Bhils* are using different wild animal species as food items.

5.2 Government Departments

5.2.1 Forest Department

For details see Chapter 2

5.2.2 District Rural Development Agency (DRDA)

DRDA, due to their direct involvement in various socio-economic development programs in rural areas, can play some effective roles, in biodiversity conservation. However, at present there is a serious lack of awareness and sensitivity among the DRDA officials on various biodiversity related issues of the region. Watershed development program is one major area where they can take some immediate lead to address some of the biodiversity conservation issues.

5.2.3 Gujarat Mineral Development Corporation (GMDC)

Despite, the main focus on two minerals viz, lignite and bauxite, GMDC is the top player in mining activities and expanded their activities in large areas of Kachchh. Since the major region of their activity also coincides with rich and diverse flora and fauna, there is bound to have some conflicts. While, GMDC is currently involved in many social welfare activities in rural areas, there is no program, which can support floral-faunal conservation or any other biodiversity linked livelihood support activities. It is also generally observed that majority of the officers has little sense of appreciation of the not so rich but rare biodiversity of the area.

5.2.4 Gujarat State Forest Development Corporation (GSFDC)

This is an sister organization of forest department, who is mainly dealing with collection of MFP from the forest areas and thus control very large resource on which the rural community (especially landless labours) also had traditional stakes.

5.2.5 Gujarat Energy Development Agency (GEDA)

In Kachchh, GEDA has initiated some energy plantation program especially in the Abdasa taluka. Also, they had installed a biomass based gasifier in Abdasa taluka, where the major biomass was coming from *Prosopis juliflora*. Although, due to some technical problems the gasifier did not

function for long, but with this kind of interventions, they can always play a major role in *Prosopis juliflora* control and management in certain tracts of Kachchh.

5.2.6 Defense Forces

For the details see Chapter 2.

5.3 NGOs and Citizen Groups

5.3.1 Sahjeevan

Sahjeevan has been working in Kachchh since 1991. It earlier operated under the name of Janvikas Ecology Cell. The main objectives of Sahjeevan is to (a) promote conservation based economic development (b) to prepare a cadre of eco-sensitive workers at grass root level through training programmes. The activities are mainly concentrated in three agro-ecological units – Pachchham island, Nakhatrana hilly tract and coastal tracts of Mundra. Sahjeevan's major initiatives are with Kachchh Mahila Vikas Sangathan (KMVS) and operating in about 36 villages. The major activities of Sahjeevan include minimization of risks of dryland farming, improvement in drinking and irrigation water condition and, grassland and fodder management. Promotion of organic farming practices is one major activity of Sahjeevan. Sahjeevan is strongly advocating sustainable development in Kachchh through planned industrialization and for this they had initiated a Forum for Planned Industrialization for Kachchh (FPIK) to promote the concept among the citizens.

5.3.2 Kachchh Mahila Vikas Sangathan (KMVS)

KMVS came into being in 1989 with the objectives of working among poor rural women towards their total empowerment. Right from inception KMVS decided to access national resources and work in partnership with the Government. The most striking feature of the KMVS is that the organization is directed and owned by local rural women and adequately represented in Board of Governors. KMVS is working in 4 talukas and about 150 villages of Kachchh, with a total women membership is about 6200. KMVS is also closely working with 56 women Sarpanchs. KMVS is mainly working on six major areas – Savings and credits, Handicraft, Legal and Panchayat, Health, Education and Environment. With its very broad based support among the village women, the KMVS can play important role in biodiversity conservation of Kachchh.

5.3.3 Vivekanand Research and Training Institute (VRTI)

VRTI is a premier NGO established in 1975 near Mandvi and mainly focused on the water centered rural development programs. The VRTI is the premier organization in demonstrating the feasibility of ground water recharge through recharge-wells in different geological formations. The organization is also conducting many training programmes for the rural communities towards overall natural resource management of the region. VRTI is also supporting many activities related to dryland farming.

5.3.4 Agrocell

Agrocell, a sister organization of VRTI, is one very successful agriculture support organization working in Kachchh, especially the marketing of agricultural products.

5.3.5 Kachchh Ecological Research Centre (KERC)

KERC, a sister organization of Corbett Foundation (of Corbett Tiger Reserve), was established around 5 years back in Tera village of Abdasa taluka. Their major focus was to develop the grasslands of Abdasa taluka. In 1999, KERC had worked on the status of traditional crop varieties in Abdasa taluka and highlighted the loss of many small millet varieties from the region. Being a sister concern of reputed Corbett Foundation, whose expertise lies in development of Eco-tourism in wildlife rich areas, KERC can be a pivotal organization in promoting the eco-tourism in Abdasa taluka.

5.3.6 NRI- Association

As discussed earlier, in Kachchh large numbers of persons from local communities are settled outside the Kachchh, both within and outside the country, locally known as Non-Resident Kachchhis (NRKs). Most of these NRKs are very successful business personalities in their respective places. Although, these NRK are living far away places from the Kachchh, but they have very strong socio-cultural bonding with the region. Due to this emotional bonding, these NRKs are providing lot of financial support to different community development programs. In order to channelise the money in priority areas they have recently formed an 'NRI-Association'. At present, they are not focusing any action for the environmental management or biodiversity conservation, mostly due to lack of awareness of the issues.

5.4 Academic/ Research Institutions

5.4.1 Gujarat Institute of Desert Ecology (GUIDE)

Ever since its inception in 1995, GUIDE has been involved in conducting many ecological studies in Kachchh. During last 7 years GUIDE has completed more than 20 short and medium term projects covering almost all the major land units of Kachchh. Some of the important areas and sector where GUIDE is involved, include: the PA management; combating desertification; biodiversity conservation of rare and endangered species; mangroves and their associated fauna; documentation of ethnobotanical uses; environmental-economic analysis of grasslands; community based restoration of grasslands (in Banni), *bets* (in Rann) and mangroves, etc. Working on these short to medium-term projects, GUIDE has gained lot of experience and insight on various ecological systems, especially the grasslands, mangroves and thorn forests. Also, with successful implementation of community-oriented projects like restoration of Banni grasslands, it has attempted to bridge the gap between the scientific institutions and rural resource dependent community. Based on the scientific expertise and ecological understanding GUIDE possess, their role in biodiversity conservation of the region is very significant.

5.4.2 Gujarat Ecological, Education and Research (GEER) Foundation

Although located in Gandhinagar, the GEER-Foundation has a long presence in the Kachchh, through various research projects. As one of their major goals, GEER Foundation is focusing mainly on generating ecological baseline information of different Protected Areas of the State. In Kachchh also, GEER Foundation has recently conducted many ecological surveys to understand and develop such benchmark data. Some important surveys include: the Wild Ass Sanctuary in the Little Rann of Kachchh; the mangroves; the Sarus Cranes etc.

5.4.3 Gujarat Ecology Commission (GEC)

Located at Vadodara, GEC is one of the apex bodies of Government of Gujarat focusing on various ecological issues of entire Gujarat. However, GEC has taken some initiatives in restoration of Banni grasslands through community participation. GEC under its mandate created GUIDE in 1995 to promote ecological research in Kachchh. Many programs of GEC are implemented through GUIDE in Kachchh. Recently, GEC launched a community based mangrove regeneration program in Kachchh funded by Indo-Canadian Environment Facility (ICEF).

5.4.4 Central Arid Zone Research Institute (CAZRI)

CAZRI has established one of its regional centres at Kukuma village in 1987, with the objectives of conducting research on grasses, forestry, dryland farming and arid horticulture appropriate to the region. For the experimentation purpose they have about 60 ha land. During the past many years, this centre has tested different silvi-pastoral models with different species (varieties) combinations. The special focus was to evaluate the potential of different grass species especially the varieties of different *Cenchrus* species. With the vast experience of working in arid regions, CAZRI can play very important role in land regeneration activities of Kachchh, especially in restoration of grazing lands.

5.4.5 Gujarat Agriculture University (GAU)

GAU has established one of its zonal agriculture research stations at Bhachau in 1954 to carry out research on varied agricultural related problems of North-West Agro-climatic zone. The primary consideration was to deal with soil salinity, aridity, soil erosion and rehabilitation of wastelands. The focus is also on to support dryland farming practices.

5.4.6 Krishi Vigyan Kendra (KVK)

KVK is located near Mundra and involved in many interventions with dryland farming sector. The agriculture extension is one of their main activities. They are also seriously promoting the horticulture in the region, especially the Date Palm, locally known as Kharik. To support their crop related research programmes, it has a well equipped tissue culture lab.

6 Important Initiatives

In this section, some of the important initiatives and actions that have undertaken in the region and, those have either direct or indirect relevance to biodiversity conservation, are discussed.

6.1 Research and Studies

In order to fill some gaps in basic knowledge regarding the biodiversity of the area, there are many efforts going on. While, GUIDE has generated lot of information on different aspects of biodiversity in past few years, GEER Foundation has also produced vary valuable ecological information, especially in Protected Areas (see Chapter 5). Besides these, Wildlife Institute of India (Dehra Dun), an institution of national repute is conducting a long-term research on Indian Wolf and other associated fauna. Salim Ali Centre for Ornithology and Natural History (SACON) is conducting a long term monitoring of bustard population in Kachchh. One important study ‘Conservation of Rare and Endangered Biodiversity (CREB)’ has just been completed. This 4-year study, while focus the entire State, has special emphasis on the R&E species (both flora and fauna) of Kachchh. For the first time, ecological information of about 33 rare and threatened species (17 plants, 5 herpetofauna and avifauna each and 6 mammals) were systematically collected and used in their conservation plan (GEC, 2002). The study was supported by GEC. The findings of these studies would certainly help conservation of biodiversity in Kachchh.

6.2 ‘Abhiyan’ –A Network of NGOs

Kachchh is very rich in terms of NGOs (latest figures suggests that there are about 100 NGOs operating in Kachchh) and importantly majority of these NGOs are operating in region specific. Before the devastating cyclone of May 1998 (popularly known as Kandla Cyclone), these NGOs were mostly operating in isolation. However, in response to cyclone, a network of grassroot organizations was founded and given the name as Kachchh Nav Nirman Abhiyan, popularly known as ‘Abhiyan’. At present about 30 NGOs are parts of this network. The NGOs that formed the network, belonged to varied backgrounds and formed a strong collective of multi specialty groups working in tandem towards a common goal. After the devastating earthquake of 2001, this network has done commendable work in immediate relief and rehabilitation work. Even as it continues working on relief and rehabilitation, Abhiyan also expanded its key areas of development support based on common needs. Collectively, Abhiyan member organizations cover about 350 villages in the district. One major focus of the Abhiyan includes the progress towards the sustainable natural resource management in the district. Abhiyan has recently launched a training module for the rural workers in the area of natural resource management, with a focus on social, economical, cultural and ecological peculiarities of the Kachchh.

6.3 Efforts in rural women empowerment

For detail see KMVS in Chapter 5.

6.4 Medicinal plant cultivation farm

Few years back government has initiated a medicinal plant cultivation farm near Kukuma village in about 40 ha area. The purpose of this farm is to cultivate a few medicinal plants, which are suitable to grow in arid conditions and supply them to government, supported Ayurvedic colleges and factories. Accordingly, about 8 medicinally important plant species are currently cultivated in this farm. While a few plant species started giving production, few are still in the experimental stage of cultivation.

6.5 Revival of 'Tharparker' breed of cattle

Recently, there are a few small scale individual efforts (supported by some Jain Trusts) in Abdasa Taluka to bring the famous 'Tharparker' breed of cattle. For this, they purchased a few pure breed bulls and cows from Rajasthan, and now trying to breed them locally. Initial results are quite encouraging.

6.6 Community based 'Anaj Bank'

Sahjeevan and KMVS had started working for a model of women centered grain bank in Laiyari village. Women show a very keen interest on the concept and the outcomes of initial first year were also very encouraging. However, the programme got a serious setback due to the earthquake in the region.

6.7 Mangrove regeneration program

Indo-Canadian Environment Facility (ICEF) has recently (2002) launched a large-scale mangrove regeneration program around the Gulf of Kachchh and Gulf of Khambhat areas. While, GEC is coordinating the overall program in the two areas, GUIDE is implementing the programme in Kachchh coastal areas. As per the target sets for Kachchh coast, around 1000 ha area will be regenerated in the period of five years. Two sites have already been identified for this purpose. The programme aims to create models for community based management and sustainable utilization of mangrove resources. The entire program thrusts upon the involvement of community in the whole exercise. Other than this, during last five years, the Forest Department has also taken some initiatives in regenerating the mangroves in the forest lands in the coastal belt. Initial results of these efforts are very encouraging.

6.8 Grassland regeneration programs

As discussed earlier, GEC has initiated some grass regeneration program in Banni with community involvement. With some encouraging results, these projects are now adopted in around 10 villages covering approximately 1100 ha area. The project is financially supported under Border Area Development Program (BADP). Also, in order to implement different projects in a co-ordinated manner, a district level committee for Banni development has been constituted under the chairmanship of District Collector. Other than these models specifically developed in Banni, a few attempt has also been made to develop community owned fodder-banks in other part of the district (Box 6.1).

Box - 6.1 Fodder Bank in Laiyari Village

Realizing the problem of perpetual shortage of fodder in village areas, 'Sahjeevan' has initiated an experiment of developing a fodder bank in Laiyari village, with the help of villagers. In this experiment, villagers produced large quantity of fodder in village pasturelands and stored in a fodder bank. Later, at the time of scarcity, they negotiated with the district administration and sold all the fodder to the district administration at Rs. 3/- per Kg. The same fodder was then distributed to the villagers as a scarcity relief measures at government subsidized rate of Rs. 0.50 to 1.00 per Kg. In this way, the villagers while met their own fodder requirements, also earn good revenue out of this.

6.9 Rann area development

GUIDE has recently (2002) initiated regeneration and restoration program for fringe areas of Great Rann. The major focus is on the *Bets*, where restoration of grassland and construction of water harvesting structures will be attempted. This will help the wild faunal population of the area.

6.10 Regeneration of UNPs by NGOs

There are many NGOs, promoting cultivation of useful underutilized native plants of Kachchh. Some of these plants include Gugal (*Comiphora wightii*), Ketki (*Agave americana*), Kuarpathu (*Aloe vera*). etc and already have good market for their products. VRTI and Gramaya Shilpi are the two forerunning NGOs working in this direction. Similarly, there are many progressive farmers, who are also adopting cultivation of such plants.

6.11 Demands for sustainable industrialization

Concerned with the alarming rate at which industries started operating in Kachchh, followed by local protests by villagers, Panchayat and groups, a Forum for Planned Industrialization in Kachchh (FPIK) was set up as an informal network of organizations and individuals of Kachchh. The main objectives of FPIK are- conducting impact assessment of industrial projects for the village groups; lobby and prepare blue prints for planned industrialization and; build up awareness among the citizens on the issues of environment and industry.

6.12 Promotion of organic farming practices

In order to promote sustainable agriculture practices in Kachchh through organic farming practices, Kachchh Sajeev Kheti Manch (KSKM), a forum of like minded farmers, environmentalists and citizens, has been initiated few years back. The SKM sets the objectives of: creating awareness among different sections of the society including farmers on the values of organic farming; provide training to farmers regarding key elements of organic farming including the production of organic manure; identify the marketing channels for the organic products. The KSKM through regular meeting of farmers, both irrigated and dryland has created a network of farmers who are ready to practice organic farming in certain parts of their field. In order to derive better price to these organic products, KSKM is organizing regularly the producer-buyers meetings in different part of the district.

6.13 Individual efforts of plant specimen collection.

There are many cases in Kachchh where individuals have taken some initiatives in collecting plant specimens of their regions. One such worth mentioning effort is that by Late Ismail Master of Tugga village in Pachchham. He had collected plant specimen of Pachchham and adjoining areas. In addition, he had also collected seeds of all the wild plants, including the herbaceous plants. Discussion with environmentalists of Kachchh highlighted many such efforts from different sub- regions of Kachchh.

6.14 Waterfowl census

There are large numbers of birdwatchers in almost all parts of the Kachchh who regularly collect information on bird fauna. These birdwatchers regularly conduct the waterfowl census in different water bodies. Realizing the potential of these vast human resources, district Forest Department has also organized a two-day waterfowl census in Chhari Dhand and other adjoining wetlands in

Banni region, by pooling all the birdwatchers of the district. Forest Department is planning to do such exercise on a regular basis.

6.15 Sea turtle hatchery

The Forest Department has set-up a hatchery for sea-turtles, where the eggs are collected from the coastal areas by hiring the services of local fishermen. These eggs are incubated under controlled environment. During last few years, the forest department has released many thousands of turtle hatchlings to open sea from this hatchery.

6.16 Mass-movements for tree plantation

The tree plantation is one of the major agenda of many religious groups. However, the one movement, which has significant contribution in this area, is the 'Koti-Vriksha Abhiyan'. In Kachchh, many villages are covered under this mass-movement, where tens of thousands of trees were planted in last few years. However, in such mass-scale plantation program, there is a gross ignorance of native species (like Khejdi, *Prosopis cineraria*), which are hardy and drought resistant and at the same time meet the fuel and fodder requirement of local community.

6.17 Watershed Development Programs

In Kachchh, two major watershed development schemes are in operation- IWDP and DDP. Although, these programs are meant for the improvement in socio-economic condition of region, the focus is on the community based land and water management. These watershed development schemes are operating in all the talukas of the district. DRDA is the nodal agency for implementing these programmes.

After the earthquake, there was a huge attention from various national and international agencies towards the Kachchh. As a result of this, there start many new initiatives which have strong linkages with and bearings on natural resource management. A few important initiatives are discussed below.

6.18 Setting up of Kachchh Ecology Fund

A Kachchh Ecological Fund (KEF) has been setup after the earthquake. The fund has been supported by UNDP with the major financial assistance from the Government of Netherlands. The basic objective of creating this fund is to support and facilitate planning and implementation initiatives towards long-term recovery of the region. The project was considered as Kachchh Ecological Planning. One of the major objectives of Phase-I planning is to prepare some proposals for 10 critical sectors of Kachchh. These sectors include, water, agriculture, animal husbandry, grasslands, land management, industries, mangroves, fisheries, mining and institutional reforms. Biodiversity conservation, which cut across all the above sectors, was not separately included in this exercise. The Phase-II process has just initiated where project proposals, identified during Phase-I, are going to be implemented by different agencies.

6.19 Drought Proofing Program (DPP)

Drought is a regular phenomenon in Kachchh, and in every instance government used to spent huge amount of money to counter the effect of drought. However, in these measures there used to be serious leakages of funds. In order to find out a long-term solution, Prime Minister Office (PMO), under their earthquake relief measure, has launched a massive Drought Proofing Project in Kachchh, with a total financial support of about 800 million rupees. The DPP will largely focus on the issues of drinking water, fodder and livelihood in about 300 villages of the district. The

entire program is under operation through a separate DPP Secretariat and the entire fund will be routed through the NGOs.

6.20 Creation of Setu

Setu is a post-earthquake initiative emerged from Abhiyan. With the coming of many national and international donor agencies for rehabilitation works, it was realized that for effective implementation of different projects, there should be some system of information facilitation to community, NGOs, donor agencies and most importantly the government. In a sense the major tasks of Setu have been to gather information, assess the needs, co-ordinate and to involve the local people in planning and implementing projects. At present there are about 25 Setus in the entire district. Each Setu covers about 15-20 villages and thus a total of about 400 villages are covered under the network of Setus. One of the major job taken up by each Setus, after the load of earthquake related rehabilitation work is reduced, to create a detailed inventory of human, economical and ecological resources at village level. In the process, Setu after long consultations with community members, identifying different developmental priorities of each village separately. Government has also recognized these centres as the official channel to route all and information and assistance. The entire project was funded by UNDP.

6.21 Setting up of Kachchh Resource Information Centre (KRIC)

In order to promote ready and easy accessibility of information on natural and socio-economic resources in disaggregated form to the various user communities, under the network of Abhiyan, a computerized KRIC was setup. The KRIC get the information feedback from all the member NGOs, various government departments, research institutions and Setu etc.

6.22 Livelihood support programmes

After the earthquake, many international NGOs and donor agencies has initiated different livelihood support programs in worst affected areas. Some of these agencies include CARE, OXFAM, UNDP, NDDDB etc. The focuses of these livelihood support programs are on the pastoralists, dryland farming communities and artisans.

7 Gap Analysis

The examples given under each section is not exhaustive, but they provide an impression of the kind of gaps existing under each category.

7.1 Gaps in Information

- i. The complete inventory of plant and animal species, which is the first requisite for any biodiversity conservation plan, is lacking for the area. Only a few scattered studies, many of which are very old, have been attempted to document the flora and fauna of Kachchh district (see Chapter 3). The species level inventory is quite satisfactory for some higher taxa like birds, mammals and flowering plants, but not enough for many others lower taxa.

Examples:

- Being an arid tract, the ecological importance of invertebrate fauna especially the insects and lower plants like lichens etc. is more in Kachchh, however there is serious gap in their inventories.
 - The information about many ecologically important faunal taxa such as rodents and plant species like Khijado (*Prosopis cineraria*) and Desi Bawad (*Acacia nilotica*) are not adequate. *Acacia nilotica*, for example, is one of the dominating species in the region but there are evidences of its natural death in many parts of the region. There is no study to understand the cause of the death of this important species in the region.
- ii. The structural and functional values and roles of various habitat types (ecosystems) are least studied, which is pre-requisite for any resource management planning including biodiversity conservation.

Examples:

- The dominant ecosystems such as grasslands (or savannah), scrub-thorn forests and saline deserts (like Ranns and Banni) are least studied in terms of their dynamics.
 - Hills and hill ranges, which are relatively rich in biodiversity, are completely ignored in the ecological studies.
 - The invasion of *Prosopis juliflora* in the district is one of the most debatable issues, but there are no efforts to evaluate the ecological-social-economical impacts of such biological invasion.
 - Due to arid and semi-arid climate, Kachchh is highly prone to desertification like conditions leading to biodiversity loss. However, no systematic study has been conducted to understand the effect of land degradation on biodiversity values.
- iii. The area supports some of the globally rare and endangered (R&E) species. However, except a recent initiative through CREB project (see Chapter 6), very little effort has been made to generate key ecological data, which are crucial to develop conservation plans for such species.

Example:

- The basic information on conservation status of R&E species, such as population, distribution range, habitat requirement and the major threats are not available.

- The current knowledge about the “Flamingo City” is limited to one of the largest breeding grounds for Flamingoes, where the ecological information on aspects like the availability and diversity of food items, breeding success, threat factors *etc.*, are completely lacking.
 - Off late, substantial population of wild ass has dispersed outside the WAS and causing serious crop damage. However, there is no scientific information available on the ecology of wild ass population outside its natural habitat (i.e. LRK).
 - The small population of crocodile in Kachchh is totally ignored. The migration pattern and alternative water sources of these animals is not known which is very important for their conservation, especially in the region with high inter-annual rainfall variability.
- iv. There is a lack of multi-disciplinary system research on the issues like pastoralism, dryland farming, intertidal fisheries, CPLRs etc., which have direct implications on biodiversity conservation and socio-economic development of the region.
 - v. There is no spatio-temporal mapping of natural resources of Kachchh. A few attempts have been made earlier but due to larger scale and coarser resolution, it’s utility in resource planning is very limited.
 - vi. It is understood that there are still many local varieties of crops and livestock breeds exist in certain pockets of Kachchh (see Chapter 3), yet no efforts have been made to prepare an inventory of these varieties and breeds and their major centers.
 - vii. Both, the policy makers and agriculture promoters (e.g. agriculture department, agriculture universities and extension service providers) focus only to produce “more grains”, and in the process they overlook the value of low grain producing but traditional diverse rainfed farming. There is also non-recognition of evolution of the traditional system as an economic risk-minimization system and efficient *in situ* conservation of limited seeds (see Box 7.1). Similarly, government’s extension programmes has largely ignored the farmers’ indigenous seed conservation measures like traditional seed storage system (See Box 7.2).

Box - 7.1

Rain Determined Crop selection –“Rammol”

In Kachchh, the farmers normally prepare their lands before the monsoon, but seed sowing is done at different times. This is a strategy to save their seeds from being wasted due to subsequent failure of monsoon. Mostly, well-drained soils are cultivated first to use available soil moisture. In addition, these soils take less time for land preparation, thus more area can be covered in short time span. In the rainfed farming system, the percentage of land under cultivation varies according to the size of holdings, type of soil and the amount of rains. If the first rains are good, the lighter soils are planted with bajra, mung, tal and math. Some fields are left fallow waiting for the next rains. In the event of second rain, medium soils are sown with vaal, guar and jowar and heavier soils with jowar. In years of good or medium first rains, single crop predominates, but when first rains are poor then mixed cropping is resorted to. This system of mixed cropping is locally known as “Rammol” (i.e. leaving to the God).

Interestingly, even in the irrigated farming system, the first rain governs the cropping pattern. In the event of good rainfall more cash crops like cotton, vaal and castor are sown, with some groundnut and bajra. If the first rains are poor then proportion of bajra and groundnut is increased. When faced with a long dry-interspell, the farmers give protective irrigation to the shallow rooted crops like bajra and groundnut with the hope that the deeper rooted cotton and castor will survive till the rains come.

Source: Rodrieug et. al. (1997).

Box - 7.2
Traditional Seed Storage System

In Kachchh, the majority of farmers are involved in risky rainfed cultivation. It is generally believed that there is a good rainfall after a cycle of every 5-6 years and the in-between are normally poor rainfall years. Therefore, rainfed cultivators resort to traditional methods to save their valuable seeds for better years. In one such case, farmers store seeds in earthen pots called as “*Kothi*” (ranges between 3 & 6 feet height). The seeds are generally stored in these *kothis* mixed with filtered sand, ash of cow-dung and dry leaves of neem tree. The storage of seeds with these three things has some clear advantages as:

- (a) Sand- helps in maintaining a constant low temperature. Due to earthen pot and sand inside, even very high atmospheric temperature (common to Kachchh in extreme summer) would not affect the seed.
- (b) The ash of cowdung- helps in absorbing the moisture inside the *kothi* and thus maintains a dry storage condition, suitable for bacterial and fungal free condition.
- (c) Dry neem leaves- maintain an insect free condition inside the *kothi*.

Thus these three ingredients ensure an ideal seed storage condition even in a very hostile climatic condition. In addition to these, before the seeds are stored in the *kothi*, farmers leave the seeds in the open air for one of the coldest nights. This process keeps the vitality of seeds intact. In fact, this is a scientifically accepted technique of “Cold Treatment” for increasing the seed dormancy period, which farmers are practicing through their traditional wisdom.

- viii. Formal crop breeding sectors usually ignore the farmers’ definitions of a useful variety.

Example

- Desi Bajra –less preferred by wild animals due to the small size.
- Desi Castor- less preferred by wild animals due to spines on the fruits.
- Desi Mug and Math- Due to large size compared to hybrid varieties it is easy to harvest and thus labour saving.
- In farmers’ view, the crops having longer association with soils (i.e. the longer growing period of crop) will have higher nutritive values (*like a baby who feeds on mother’s milk for longer period is healthier*). Therefore, they strongly feel that desi varieties of crops, although record lower yields, have high nutritive values and good taste and the crop residues also have better fodder value.

- ix. Despite more direct association with the natural resources, the role of women is poorly acknowledged in various biodiversity conservation efforts, especially in using plants for traditional health care; preservation of local seeds; diversification of farming system (Box 7.3) etc.

- x. There is very poor availability of biodiversity related reference materials for students (research and undergraduates) as well as common public for the future uses.

Box – 7.3
Women & Crop Selection

In many of the rural communities of Kachchh, the role of women is quite substantial in decision making about crop selection. In the Ahir community, for example, women only decide that which crop (or crop combination) should be sown in which parcel of land under different rainfall condition. She even decides the quantity of seeds of different crops (combination), which need to be sown under different soil and rainfall conditions. Most importantly, these decisions are generally taken considering the future demand of fodder for their cattle under uncertain rainfall condition.

Example

- There is no systematically arranged herbarium for the area, although a few scattered collections of plant samples are available with a few individuals, institutions or NGO. For preservation of animal samples also there is no facility like insectaria, museum etc.

- Limited reading material on environment and biodiversity is available in Gujarati language for reference such as identification keys for both plants and animals, restricting the use by local communities. Also, there is lack of a good library with books & periodicals on biodiversity related subjects, especially in the context of drylands.
- xi. Routine data gathering systems by government machinery involving huge overhead cost is not effective to monitor the changes in various natural resource related problems.

Example

- The 'land use' data generated at an annual basis by Revenue Department mainly records changes in land ownership categories rather than the actual changes in 'land use' types. As a result, area defined as 'forest' or 'permanent pastures' often does not have a tree or grass cover, and thus give a completely wrong picture of resource availability to the planners.
- The forest cover classes used by FSI are too broad and insufficient to understand the true extent of changes in arid regions like Kachchh. The vegetation in arid environment tends to be very sparse and, therefore, neither major improvements nor decline can be noticed when broad cover classes are used for classification.
- In an area like Kachchh, where the drought is a recurrent phenomenon, current five yearly census of livestock population does not reflect the dynamics of population structure and composition in real sense. These data has limited utility in trend analysis and in management planning. It is understood that despite various coping strategies adopted by maldharis, droughts have serious impacts on the overall livestock population of the area, which cannot be captured and understood by taking a five yearly data. In addition, the cattle census does not record the population of different breeds of livestock, which respond differently to the droughts.

7.2 Gaps in Vision

- i. A general impression that emerges in vision is that environmental conservation and socio-economic development cannot go alongwith. Therefore, the larger section of the society considers biodiversity and environmental conservation as anti-developmental ploys. The progressive looking concepts like 'sustainable development' and 'adaptive managements' are yet not understood properly.
- ii. Majority officers in most of the government departments have little understanding about the concept of conservation. The top-level planners projected the Kachchh as an industrial district. Therefore, most of the Government departments, including those who are dealing with natural resources and the other major players of economic developments like industries, do not have any appreciation to the fragile ecosystems and limited but otherwise important natural resources of Kachchh.

Example

- The natural vegetation types like scrub, thorn and savannas are not considered as "Forest types". In many Govt. and institutional reports 'there is no forest in Kachchh' is the most common phrase used. In fact, they do not recognize the fact that these are the natural vegetation types and evolved according to physio-climatic conditions of Kachchh. Similarly, grasslands, in most cases, are the neglected lot and generally considered as 'wastelands'.
- iii. Majority of NGOs are implementing mostly the community based rural development programs and having limited focus on environment and biodiversity. Similarly, the scientists working on ecology and biodiversity related issues often ignore the socio-economical constraints in rural areas and come out with impractical solutions. Therefore,

from both sides these are viewed as two independent sectors, resulting into the ignorance of synergy between rural development and environmental management issues.

- iv. There are serious differences of opinion regarding the cost and benefits (both ecological and economic) of *Prosopis juliflora* in Kachchh, which of late resulted into two *Prosopis juliflora* lobbies- the pro- & against. There is hardly any effort in managing the problem taking middle ground on this.
- v. Under FCA and WPA, many activities linked to the economic development are not allowed for the villages habited inside PAs. People living in such villages consider this as a clear disincentive in conserving the wildlife and thus feel detached with the entire PA based conservation program.
- vi. PA system mainly focuses on the conservation of wild biodiversity. However, biodiversity around the village communities living within the PAs is largely ignored. Due to such perception, the conservation of agro-biodiversity has never been an agenda of PA conservation, although there are large tract of agricultural lands within PAs where the prospect of *in situ* conservation of indigenous crop varieties are very high. Similarly, the conservation of indigenous livestock breeds also does not get conservation priority within PAs.
- vii. While the farmers' vision has always encompassed integrated, long-term security of their farmlands and the health of the humans and the cattle, the vision of the agricultural policy makers and associated institutions has been to reap short-term benefits. These two mismatched visions have created a wide gap in the understanding and managing the local agricultural systems, especially the rainfed system.
- viii. The government understands productivity as a single crop yield whereas farmers have always treated productivity as a system yield, based on biodiversity. The inability of the government agencies to understand this complex vision of farmers has resulted in each of the state policies becoming anti-diversity. Similarly, the food security assured by the traditional farming systems has never been really appreciated by the government.
- ix. Of late, many NGOs and government department see action research as an alternative to the basic research (instead by pursuing both, they should have complimentary benefits). As a result there are serious paucity of information on different ecological and socio-economical issues.

7.3 Gaps in Policy and Legal structure

- i. Although, of late, participatory conservation approach has been advocated a lot, there is no legal framework, which could provide long-term 'tenure right' to the community on the regenerated/ conserved resources. Lack of such legal framework can in fact rob the entire regenerated resource by outside players like industries, government or corporate sectors, defeating the entire purpose of regeneration/ conservation. Those communities who are living near the coastal region where most of the new developments are rapidly coming-up raised such concerns.
- ii. *Non-settlement of PA boundaries.* Although PAs were notified long back, yet legal formalities for settlement of boundaries and community rights are not completed causing lots of skepticism and confusion to local communities. This has serious implications in those areas where community has taken some initiatives for natural resource management through restoration and regeneration programs.

Example

- Ziladen Bet in WAS is a disputed area where recently some NGOs have started regeneration and restoration efforts. However, there are lot of skepticism and confusion in their approach due to unsettlements of the boundaries.

- iii. *Lack of regional perspectives.* Govt. has a policy to clear each developmental project separately and for that reason EIAs are conducted for each project in isolation. There is, however, no consideration for carrying capacity based regional planning.

Example

- In Kachchh, despite large number of industries in pipeline for clearance, regional environmental planning has yet not been adopted. In fact, under a Public Interest Litigation, the Supreme Court has given instructions to State Govt. on this regard to develop a regional environmental planning in the ecologically sensitive western part of Kachchh where large number of mining based industries, thermal power stations and port based activities are planned for near future (see Chapter 3).
- iv. There is no regulatory framework for coastal area development in the region.
- v. There is a lack of effective regulatory framework for restoration of mining areas. According to MoEF guidelines, the restoration of mined areas is mandatory and is the responsibility of mining companies and agencies, but more than often such guidelines are ignored, mainly due to weak monitoring and law enforcement mechanisms.
- vi. There is no regulatory mechanism for fish catch in coastal areas of Gujarat. There are no fishing guidelines either, for use of fishing equipments like mesh size, size of trawler etc. A draft fishery related bill is long pending with the government.
- vii. Under compensatory plantations of Sardar Sarovar project, trees were planted in many high potential grazing lands. Such compensatory plantations in Kachchh have no scientific value and more than often pose threats to local biodiversity.
- viii. Despite the presence of large contiguous patches of pasturelands having high biodiversity and fodder values, there is no effective institutional mechanism to control the illegal encroachments.
- ix. Due to different legal Acts, all the trees were given legal protection against their cutting within forest area (FCA) and in the non-forest lands (Saurashtra Tree Felling Act). Although, there is no restriction in removing or cutting the *Prosopis juliflora* outside forest areas, due to the charcoal making activity there are restrictions on its free removal (see Box 7.4).

Box –7.4
Legal Status of *Prosopis juliflora* removal

1. According to FCA, within a forest area, trees can be felled only under some management scheme (like working plan/working scheme or management plan). Thus, the removal of *Prosopis juliflora* from any forest area also needs to be prescribed in working (or management) plan. For example, in Banni that is a protected forest area and heavily infested by *Prosopis juliflora*, its removal is restricted because there is no working plan for the Banni.
2. From the forest department side, there is no restriction in cutting or removal of *Prosopis juliflora* if it is outside the limit of forest area i.e. village panchayat or other revenue department land. However, permission from Forest Department is needed to convert the wood of *Prosopis juliflora* into charcoal. This clause is, however, applied even on the revenue lands, village common lands or even on the private farms.
3. Off-late Forest Department has delegated the power to revenue officer (village *talati*) of issuing license (or pass) of charcoal making from all those lands, which are lying 1.6 km away from the forest boundary. Only in the forestlands or any other lands within an aerial distance of 1.6 km from the forestlands, Forest Department has the authority to grant permission for such conversion.
4. Due to report of large-scale illegal operation of charcoal making from govt. lands, Forest Department has recently withdrawn the licensing authority from village *talati*.

- x. Considering the large number of livestock population in Kachchh and also large number of in-migrating livestock from other parts of the state or even from neighboring states, the pressure on grazing lands of the district are tremendous. However, there is no policy on grazing or grazing land management to reduce the pressure on fodder resources.
- xi. Due to security concerns of border area, several biodiversity rich areas of the district are effectively under the control of defense forces and thus out of reach of research institutions, NGOs or environmental enthusiasts. While some of these areas have very high potential for development of eco-tourism, there are restrictions in opening these areas to tourists, specially the foreign tourists. Some of such areas include the Flamingo-City, Naliya grasslands (near air force station), mangrove areas near Jakhau etc.

7.4 Gaps in Institutional and Human Capacity

- i. The District Planning Board is grossly unaware about the various biodiversity related issues of the region. At present, there is no institutional mechanism, which could advise the District Planning Board regarding the need of biodiversity linked programs and funding, especially the livelihood related ones, in the annual and Five year plans.
- ii. Village based communities in general have strong traditional understanding about the values of biodiversity but very poor in organizing themselves as a group to protect and conserve those values.
- iii. The forest department is grossly under-staffed, especially at the level of field staffs. Moreover, the field staffs are not well oriented (and to certain extent not motivated) for participatory mode of management and conservation. There are some serious gaps in communication between the communities and personnel of forest department.
- iv. In order to bring more wildlife enthusiasts in the entire conservation exercise, forest department has a position of Honorary Wildlife Warden. However, just a single honorary wildlife warden is not enough in larger district like Kachchh.
- v. The western part of Kachchh (including area around NSS) is relatively a backward, region, having high potential for wildlife conservation but facing serious resource conflicts in the form of mining and other developmental projects. However, the NGO movement in this part of the district is very limited, resulting into restricted community based activities and thus their mobilization.
- vi. No space for inter-state or inter-district coordination on the various natural resource related issues like livestock migration and grazing; coastal water fishing etc.
- vii. Due to socio-cultural background, majority of students pursue career in trade and business and thus no interest in environment and biodiversity. In addition, at educational level, there are no post-graduate departments for life-science subjects; therefore, there is always a dearth of good students available for environmental research and other activities.
- viii. Unlike, other occupation types, pastoralists (maldharis) do not have any forum at district level to discuss, and settle various issues related to livestock and grazing land management.
- ix. In traditional pastoral system, there used to be a substantial off-take of livestock from the Kachchh through livestock sale. This used to have a functional role of providing some respite to the grazing lands from intensive use, a characteristic feature of arid pastoral system. With the disintegration of traditional livestock markets (especially of cattle), the number of sales is highly reduced. To support this, however, there is no formal/organized livestock sale system exists.
- x. In the industrial sector, most of the community-industry interface revolves around the labour. The industry is not trained to work jointly with community in other resource

related sectors. There is complete lack of awareness among the industries on progressive partnership approaches like JFM.

- xii. Compensatory afforestation program by industries is only compensating the number of trees, they diverted. However, this won't compensate the community's pre-project level of access to resource.

Example

- After the construction of Gujarat Adani Port near Mundra, the fishing communities are not having any access to the creeks where they used to fish before the project. Similarly, maldharis who used to collect mangrove leaves as fodder from the project areas, now have no access to the mangroves areas.

- xiii. No organized marketing and extension support for minor crops and other non-agricultural products (like UNPs), therefore, farmers suffered heavy losses mainly due to fluctuating prices or unforeseen diseases and pest attack.

Example

- Sudden fall in the price of Mindhiavad (*Cassia eitalica*), a medicinal plant (i.e. Rs. 40 per kg three years back to current rate of Rs. 5 per kg) does not even return the labor expenses of the farmer. Therefore, in many areas this crop is left unharvested.
- Majority of farmers are not aware about different requirements (like pest control, soil suitability etc.) of these plants and thus the chances of crop failure are quite high, which incurred loss to the farmers.

- xiv. No adequate institutional support system for farmers who are practicing rainfed farming in general to address the issues like loss of indigenous crop varieties, non-availability of seeds, micro- credit and price support etc.

- xv. Most of the dryland farming practices are by default organic in nature and thus their food products are free of chemicals. Such products have great demand among city dwellers, and need to be properly marketed in larger cities, where substantial population from Kachchh resides. Although, there are few forward looking farmers, who on their own initiatives, grow certain fruit and other food items following organic farming methods, no institutional support system is existing to promote such initiatives.

7.5 Gaps in Actions

- i. There is hardly any community based conservation models exist in the region.
- ii. De-notification of NSS clearly highlights the government's bias towards industrial development at the price of conservation.
- iii. Despite a well-known fact that the area supports very large number of winter migratory waterfowls, no wetlands are covered in PA network. Similarly, despite rich biodiversity values in the coastal areas, no coastal-marine area is under PA network.
- iv. For the conservation of endangered bird species- the Great Indian Bustard, sanctuary of 2-km² areas is not sufficient, while large contiguous grassland areas, mostly under revenue department, are lying unprotected.
- v. *Prosopis juliflora* is considered as a serious problem to the overall ecological integrity of the district by larger section of the society and want to eradicate the species. However, no organized efforts have been made in this direction at Government, NGO and Community level.

- vi. Unlike Green Revolution, in the dryland-farming sector, there are no alternative sets of farming prescriptions developed, suitable within sub-regional peculiarities. In fact, the models of well-known practices like agroforestry and silvipasture were not promoted seriously by government and adopted by the farmers.
- vii. While implementing other natural resource development programmes in different parts of the region, project authorities ignore the importance of critical habitats of many rare and endangered species.

Example

- Water harvesting intervention has been made in the vast stretch of grasslands near Vengaber village in Abdasa taluka. These grasslands are habitat of globally threatened bird species like Great Indian Bustard and Lesser Florican. With the construction of such water-harvesting structures, the breeding area of these species is going to be seriously restricted.
- viii. With the notification of four PAs, Kachchh is probably having maximum number of PAs at the district level in the entire country. However, there are not serious efforts from the government in conserving the values in protected areas of the region, as reflected through increasing level of degradation in these PAs especially the Narayan Sarovar Sanctuary and Wild Ass Sanctuary. While, at state level, the Forest Department is managing many high profile PAs (like Gir, Velavadar and Hingolgarh) very effectively, PAs in Kachchh are largely ignored for major management inputs. At state level, these PAs of arid regions are not getting high priority for management inputs.
- ix. There is gross neglect of local people's perception in preparation of long-term management plan of protected areas where the dependency of rural community is substantial. Very specifically, in such planning exercises there is complete neglect of conservation concerns of women.
- x. Although a need is strongly felt to diversify the rainfed agricultural field through a mixture of seasonal and perennial crops, very little has been done on this direction. Despite many success stories in growing and marketing of under-utilized native plants like *Aloe vera* (kuarpathu), *Agave americana* (ketki), *Cassia etalica* (mindhiavad), *Commiphora wightii* (Gugal) etc, there are no sincere efforts in promoting these species in farmers' fields to diversify the crops in fields and thus raise the income.
- xi. Kachchh has a strong tradition of livestock breeding and some regions of the district like Banni and Pachchham are still following this breeding program traditionally. However, there is no support program for this, rather Animal Husbandry Department grossly overlooked the opportunities and imposing tailor-made high-yielding livestock-breeding programs.
- xii. While, the children of scheduled castes and tribes, who have settled life, get all support from the government in accessing education (hostels) and other basic needs like health care etc. (e.g. education of tribal girls etc.), there is no such provisions for children of nomadic communities like Maldhari, Rabaris and Bharwads. Due to their unsettled life these children have no access to the basic education facilities and other needs.
- xiii. In majority of government's rural development programs, the beneficiaries are mostly an individual family, while there are very limited programs where group or collective efforts get supported and encouraged.
- xiv. The ecological research is the backbone of any conservation plan. However, there is hardly any effort to prioritize the research areas in Kachchh and also there is no attempt to develop perspective research plan by the leading institutions like GUIDE.

- xv. Despite large number of tourists, especially the foreigners and non-resident Kachchhis, visiting Kachchh every year, no serious efforts have been made in developing packages of eco-tourism.

8 Strategies

The main goal of biodiversity conservation action plan is to combine short-term conservation measures to ensure human survival with long-term conservation measures to safeguard the resource base and improve the quality of life’.

Following, broad biodiversity conservation strategies are emerged for Kachchh district:

1. Improving knowledge base of the characteristics, uses, threats to, and values of biological diversity. Although, the focus will be on scientific research and studies, the major thrust will be on understanding the vast traditional knowledge system.
2. Initiation of holistic conservation projects around some flagship species of regional importance.
3. Promotion of conservation planning at larger landscape level.
4. Special focus to enhancing the role of women in various biodiversity conservation initiatives.
5. Control and management of *Prosopis juliflora* for ecosystem and community benefits.
6. Enhancing and improving the scope of partnership of different stakeholders in biodiversity conservation.
7. Enhancing and improving the scope of conservation through strengthening of PA network.
8. Enhancement and conservation of agro-biodiversity.
9. Formulating policy and legislative frameworks to support the cause of biodiversity conservation.
10. Human resource development for effective biodiversity conservation.
11. Preparing the stakeholders for ‘informed’ decision making on biodiversity conservation through an integrated information, education and communication system.
12. Promoting an institutional mechanism for effective coordination, execution and monitoring of different biodiversity conservation programs.

9 Proposed Actions

“The success of a biodiversity action program will depend on being able to pull the components and disciplines together into an integrated approach. But, no matter how biologically or technically sound, action plans often fails where they ignore the vital role and influence of public awareness levels; fail to incorporate local and traditional knowledge; fail to address the issues of poverty and economic development and; fail to consider contemporary policy issues” (Global Biodiversity Assessment, 1995).

9.1 Expanding and improving knowledgebase on Biodiversity

1. Develop and implement short, medium, and long-term *perspective research/study plan* covering important aspects of biodiversity of Kachchh. The research programs should cover three broad overlapping areas: the inventories of ecosystems/habitats and species; ecosystem functions and species population dynamics and; management of living resource use. However, the prioritisation of these research and studies needs to be done through larger consultation and discussion with experts and major stakeholders.

Priority: Medium **Time Frame:** Immediate

2. Systematic *documentation of traditional knowledge system* especially related to methods of farming, crop-breeding, grazing, livestock breeding, ethnobotany and other natural resource management. For this, there is a need to promote approach like *Community Biodiversity Register* in the range of locations such as fishing settlements, nomadic and non-nomadic pastoral settlements, irrigated and rainfed farming villages, different natural landscapes etc.

Priority: High **Time Frame:** Immediate

3. Develop a GIS based Kachchh Land Resource Information System (*KLARIS*) and for that initiate high resolution, large scale mapping of natural resources of Kachchh to account spatio-temporal variations. GUIDE has already initiated some work on this, which needs to be supported and strengthened.

Priority: Medium **Time Frame:** Medium

4. Create a systematic, finer-scale *network of weather monitoring stations*, especially to collect rainfall and evapo-transpiration data. About 30 such stations can be created in different parts of the district. Responsibility of collecting the information can be given to voluntary organizations (NGOs) working in different regions. These data can be used in various natural resource planning and management. The network can be supported under Setu.

Priority: Medium **Time Frame:** Immediate

5. Initiate village level *livestock census at annual basis*, instead of current five yearly operations. Many states are already conducting such annual livestock census successfully. The entire census exercise can be linked with the network of Setu. On the experimental basis, such exercise can be initiated in the Banni region.

Priority: Medium **Time Frame:** Immediate

6. In arid and semiarid areas (including most part of Gujarat and Rajasthan), where the vegetation are very sparse, the national level forest mapping (done by FSI) must include some more cover categories at the lower end i.e. <40% cover class, using new generation, high resolution satellite imageries. These lower end categories can then be used in monitoring the vegetation cover changes not only in Kachchh but also in all the other arid and semi-arid regions of the country.

Priority: Medium *Time Frame:* Medium

9.2 Initiation of conservation programs centred on flagship species of regional importance

1. At the national level, ‘Project Tiger’ and ‘Project Elephant’ were successfully implemented in many parts of the country. The whole idea of such projects was the conservation of a gambit of different ecosystems, habitats and associated species by keeping these larger species in the core of conservation program (Flagship Species approach). On the similar lines, in order to develop comprehensive biodiversity conservation plan and in view of some flagships species, Projects ‘GIB’ (for grassland system), Wild Ass (for Saline Ranns), Chinkara (for thorn-scrub forest) and Flamingoes (for wetlands) can be initiated in Kachchh. With these projects, while cross linkages between, animal, human, habitats and other ecological parameters can be understood properly, in the process large area and many associated species will get conserved.

Priority: Medium *Time Frame:* Medium

9.3 Promotion of landscape level planning for biodiversity conservation

1. It is understood that vastness of the region contributes high degree of heterogeneity at landscape and ecosystem levels. The biodiversity values are, therefore, widely dispersed and not confined to smaller land units, highlighting the difficulties in conserving these values primarily through either the existing network of protected areas (PAs) or its extension. Therefore, a detailed conservation planning is required at larger landscape level representing mosaics of different sub-systems. Following three major landscape units can be identified for such detailed planning:
 - The entire Naliya-Lakhpat-Narayan Sarovar-Mata-no-Madh and hilly tract of Nakhatrana area (broadly the western part of Kachchh) should be considered as one landscape unit. This landscape unit can be a suitable candidate for developing conservation strategies for savannas, mangroves and thorn forests as natural ecosystems and, for dryland farming and livestock diversity as domesticated systems.
 - The landscape of Ranns (LRK and GRK) and Banni should be planned to focus the wildlife conservation especially the large number of migratory waterfowls, flamingos and wild ass. In Banni, the focus will also be on to support pastoralism.
 - A large landscape unit can be identified in Pachchham, Khadir and Vagad (part of Rapar taluka). This landscape unit would be suitable to conserve the crop and domesticated diversity.

Priority: High *Time Frame:* Medium

9.4 Enhancing the role of women in biodiversity conservation initiatives

1. In all the natural resource related decision-making bodies (both of government and community based) women's representation should be at least 33%. This should be implemented through a Government Resolution (GR).

Priority: High *Time Frame:* Immediate

2. The agro-biodiversity conservation program can be taken up with the help of women. Considering the substantial knowledge base and role of women on the seed selection and seed preservation, a network of *seed banks of local varieties centred on women* can be established. To start with, the effort can be initiated in some villages of Pachchham, Abdasa, Lakhpat and Khadir areas. Such seed banks will help in dissemination of local varieties of seeds to other areas including those which are adopting organic farming. Also, Women centred grain distribution system need to be promoted to ensure long term food security at household level. For this, women centred '*grain (Anaj) bank*' of indigenous crop varieties, especially the millets, need to be promoted in different parts of the region. KMVS can take lead role in this effort.

Priority: High *Time Frame:* Immediate

3. Despite a vast potential for medicinal plants, there is very poor use of these plants by village communities in curing many common and chronic diseases. Women, in most of the cases, are the most vulnerable group and need to take care some of their health issues, themselves. Therefore, a *medicinal plant conservation program centred on women*, with the major focus on *revitalization of traditional preventive health care practices and nutritional support* need to be initiated. To begin with, this program can be initiated in 10-15 villages covered within 3-4 clusters, in Pachchham, Khadir, Abdasa and Lakhpat regions, due to their remoteness. The main component of this program would be the capacity building of women (especially the midwives) in identification of right medicinal plants from the surrounding areas; cultivation techniques of useful plants; the methods of extraction of useful parts; preparation and use of medicine etc. through a training module. Also, for the purpose, small '*Aushadhiya Van*' (medicinal plant garden) in each village need to be created where important medicinal plants are grown and used by community for different purpose.

Priority: High *Time Frame:* Immediate

9.5 *Prosopis juliflora* Control for ecosystem and community benefits

There is a need to develop different models for community based *Prosopis juliflora* control. A couple of model ideas, emerged from the village meetings are given below:

1. It is important to realize that *Prosopis juliflora* did more harm than good to Kachchh mainly due to gross failure of both the government and community to manage it. *Prosopis juliflora* plant has high coppicing capacity and thus regular cutting by local communities. Therefore, they rarely attain tree forms; instead, they mostly form dense bushy thickets and severely suppress the ground vegetation. It is believed that reducing the density of plants and directed the growth of plants for a tree form, will open the space for ground vegetation (mainly the grass). Growing of more number of trees (rather than bushy shrubs) will also enhance the economic value of the plant. Initially, such efforts can be tried in different areas representing different edaphic-climatic condition (including Banni), through experimentation at pilot scale.

Priority: High **Time Frame:** Immediate

2. Need to promote *Prosopis juliflora* management through collective community efforts by giving them some short and medium-term economic incentives. One such major incentive would be manage *Prosopis juliflora* as ‘buffer’ biomass for collective drought proofing. However, there need to develop some replicable models where the access and benefit sharing mechanism is addressed through village committee. In the committee women representation should be at least 33%. The incentives of managing the *Prosopis juliflora* may include:
 - The derived economic benefits (i.e. charcoal or timber) can be used in developing other natural resources or to resolve some specific natural resource conflicts within the village, with less need of outside support. For example, in Jhinjhuwada village (adjoining WAS) the villagers planed to generate revenue from *P. juliflora* for putting barbed wire fencing around agriculture fields to resolve crop damage by wild animals. Similarly, in the Khadak village near NSS, villagers wanted to use this resource in soil-moisture conservation works.

Priority: High **Time Frame:** Immediate

3. There need to be complete removal of *Prosopis juliflora* from ecologically sensitive and bio-diversity rich areas including Protected Areas. Some of the important areas which need its removal include: the *bets* in the WAS, NSS, Grasslands of Abdasa taluka near Naliya, sides of Dhinodhar and Nanamo hill etc.

Priority: High **Time Frame:** Immediate

9.6 Enhancing and improving the scope of partnership of different stakeholders in biodiversity conservation

1. Need to develop newer models of natural resource regeneration and rehabilitation, including biodiversity conservation through promoting innovative ideas from both the individuals and group of individuals from the communities. The major focus should be on developing integrated models for different resource sectors with three sub-models- (i) community organisation and management, (ii) technology search, development and adoption and (iii) higher economic returns. Models should be developed within different sub-regional peculiarities. Within the models Models should also develop alternative frameworks for Participatory Monitoring and Evaluation of different projects. These proposals can be given financial support and experimented through short and medium term projects. The process of development of different models should be documented in as much detail as possible. At the field level interventions, the fund should be utilized mainly to share, with the community beneficiaries, the economic costs of innovative testings and experimentations. At State level, similar efforts have been attempted through NGO-Environment Action Fund (NEAF) under GEC.

Priority: High **Time Frame:** Immediate

2. There is a need for ecological regeneration and restoration of degraded areas (including saline tracts). The possibility of bringing degraded areas into conservation areas are quite high as at present such lands provide limited benefits to the community. However, in such restoration efforts, the protection of xerophytic species (like *Sueda* in saline tracts) needs to be ensured. With some well-defined mechanism of usufruct sharing, one can generate local community participation in developing such lands.

Priority: Medium **Time Frame:** Medium

3. Since, event of nesting of sea-turtle in Kachchh (especially the Olive Ridley) is sporadic in nature, it is a big question that whether there need to have a conservation program for Sea Turtle in Kachchh or not? However, the increasing numbers of egg collection in last few years by FD (see Chapter 3) give some optimism for their conservation. For this, there need to support a *sea-turtle conservation program with the involvement of fishing communities*, especially those living near the potential stretch between Mandvi and Bhambhdai. Following are the key elements of such support program:
- Initiate an awareness programme for the sea-turtle conservation, especially targeted to the fishing communities.
 - FD should offer community some partnership in managing the Turtle Hatchery. For this, there is a need to develop package of capacity building for fishermen communities in safe egg handling, managing the eggs in hatcheries and releasing the hatchlings in sea etc, through a training module.
 - Provision of monetary incentives to the community for each turtle hatchling, released in the sea. With the increasing monetary benefits in subsequent years, community will try to maximise the egg collection and for that they may go one step ahead and start conserving the potential beach areas for egg laying, against possible future threats like sand mining, increasing tourism or even pollution.
 - At later stage, larger incentives can be given in direct monetary terms or through some village development schemes.

Priority: Medium **Time Frame:** Medium

4. Need to develop different models of community managed fisheries resources in coastal tracts, especially with the participation of *Pagadiyas*, operating mainly in the intertidal regions. Following may be the key elements of these models:
- Community driven regeneration and restoration of mangrove forests aptly backed-up by appropriate legal support against the diversion of regenerated lands (with the community efforts) for any developmental or industrial needs. The regenerated mangroves need to be used as a fodder resource in a regulated manner, specifically during the years having droughts.
 - Enhancement of stock and diversity of marine fishery resources (including fish, crabs, prawns, lobsters etc.) through combination of traditional and modern methods. For this a package of capacity building of communities needs to be developed.
 - In order to give some degree of resource security to the fishing community, long-term right of some stretch of near-shore coastal water can be given to the fishing community, especially to the *pagadiyas*.
 - Improve access to low-cost fishing gears to pagadiyas through micro-credits operated through SHGs.

Priority: High **Time Frame:** Immediate

5. Similar to above, there need to develop some model of conservation of prawn fisheries near Surajbari creek area in the LRK region with the involvement of fishing communities. One important element of developing these models should be to evolve strategies to reduce the conflicts and impacts of different developmental activities like growth of salt pans and constructions of highways and bridges all along the catchment of the entire tidal creek. In a sense such issues should be treated as a problem of sub-ecoregional scale and where the health of entire system needs to be looked after.

Priority: High **Time Frame:** Immediate

6. Need to develop participatory monitoring mechanism to control over-fishing by mechanised trawlers especially in creek areas. This needs to be backed up by appropriate legal and administrative support.

Priority: Medium **Time Frame:** Medium

7. Need to develop community driven eco-tourism program especially to *involve maldhari and fishing communities*. There is very high potential of developing such plan in western part of Kachchh (especially around the Naliya area and Jhakhau coast). Followings are the key elements of this program:

- Need to develop a package of awareness and capacity building for community especially to focus eco-tourism.
- FD should develop a quick (time bound) compensation giving mechanism to the maldharis possibly through some reliable NGO.
- Development of a package of *community driven eco-tourism* around Wolf/GIB/Lesser Florican and mangroves near Jhakhau and nearby creeks. The package should be developed through a consultative process where all the major stakeholders including village communities, forest department, tourism department, GUIDE, KERK, Sahjeevan and KMVS should participate.
- Although, major revenue can be generated through foreign tourists, there is also possibility of attracting the local tourists, especially the large number of Jain pilgrims and the visiting non-resident Kachchhis.
- This project can be developed in the form of community owned micro-enterprises/cooperatives.

With such kind of approach, issues like human-wildlife conflicts can also be reduced, as community will start getting some ‘direct benefits’ from the same wild animal, which were otherwise causing economic loss to them. In the present context, it may be the issue of sheep-goat lifting by wolves.

Priority: Medium **Time Frame:** Medium

8. Need to initiate a program of *joint ‘Rakhal’ management* with the involvement of maldhari communities and forest Department. Such management approach need to be centred on the grass production and can be developed in the line of JFM. To develop such models, a few ‘Inferior Rakhals’ can be adopted for this purpose.

Priority: High **Time Frame:** Immediate

9. Need to promote *community enforced grazing rules* in the region, backed up by sound scientific information base. There would be three major elements of this program:

- Identification and delineation of different grazing zones in Kachchh, based on the potential of land, water and fodder, using field based and satellite based information.

Priority: High **Time Frame:** Immediate

- In order to build some pressure on district administration and politicians, community can adopt resolutions (‘Thahrav’) at village or ‘juth panchayat’ level and enforce the grazing rules and regulations, especially against the livestock coming from neighbouring districts or states.
- In addition, there need to promote a district level “*Maldhari Sangathan*” with a hierarchical representation of maldharis from village, juth panchayat, taluka, sub-regions and finally to district. This *Sangathan* then enforce some grazing rules for different parts of district based on the availability of fodder resources in a

particular year. There should be adequate scope for women representative in this *Sangathan*.

Priority: Medium **Time Frame:** Medium

10. Traditional cattle-breeding activities in the areas like Banni and Pachchham need to be given support. In these regions, only Kankrej would thrive. In other regions, Tharparkar breed can be promoted. Such breeding programme is possible by few interested individuals or some institutions/organisations/trusts. That maintenance of purity of the breed is very important and essential; the maldhari alone would not be able to manage this kind of breeding programme.

Priority: High **Time Frame:** Medium

11. Need to develop model for regeneration and restoration of hills of higher biodiversity values, like Kala Dungar, Dhinodar, Roha, Nanamo etc., with the participation of village communities. The program can be undertaken with JFM like approach.

Priority: High **Time Frame:** Medium

12. In order to provide some space for traditional function of livestock off-take from the region, a larger market for livestock sale need to be organised through a 'Pashu Mela' (Livestock Fare) especially after the monsoon. Such fares, while open livestock trading practice, can also provide a good interaction ground for exchange of livestock breeds, sharing of various traditional systems of livestock health care and other livestock related issues. On experimentation basis these can be tried for at least for 2-3 years and based on the response of the maldharis, further decision should be taken.

Priority: Medium **Time Frame:** Medium

13. Being a border district, the presence of security forces is quite substantial and large coastal and inland areas are effectively under their control. Due to the presence of a large number of disciplined human resources and their accessibility to very remote areas, the security forces can contribute substantially to the cause of biodiversity conservation in Kachchh. At present, however, there is negligible role of these security forces in biodiversity conservation. It is important, therefore, to enhance the participation of different segments of defence forces in different biodiversity conservation related issues of Kachchh. However, in order to mobilise this vast human resource, they need to aware on biodiversity conservation issues of the region. Following are the key areas where participation can be generated:

- Organize one-week capsule course on biodiversity and related issues for defence personnel as an orientation and training program. In a year, two such courses can be undertaken. GUIDE should take initiatives on this.

Priority: Medium **Time Frame:** Medium

- Help in collecting basic spatio-temporal information on flora and fauna from restricted but biodiversity rich areas to help monitoring the health of ecological systems, e.g. distant mangrove areas in Kori and Sir creeks, flamingo city and other bays in Ranns.
- Help propagate mangroves in interior areas of creeks and tidal marshes.
- Eradication of *Prosopis juliflora* from ecologically sensitive areas (like river beds, hills, grasslands, *bets* etc.) and facilitate community management in the *Prosopis juliflora* removed areas. Such program can be taken up in a few pilot areas.

Priority: Medium **Time Frame:** Medium

- Help conservation of coastal fisheries by controlling the mechanised trawler fishing in the creek areas through joint patrolling with the local community representatives.

Priority: Medium **Time Frame:** Medium

14. It is understood that industry are good in production management but poor in social-environmental management. Although, few industrial groups in Kachchh have developed basic amenities like mobile health care units, bus-stands, community halls, school buildings etc. in the rural areas, there is gross ignorance from the industries in developing natural resource bases of the region. Based on the interactions with the representatives of communities and industries, following roles of industries in natural resource management has emerged:

- In Kachchh, efforts have already been initiated to create a Trust like body with representatives from Industries, NGOs and Government. All the industries in Kachchh can be member of this Trust. However, the membership can be accorded only to those industrial groups who contribute a minimum of 1% of their annual turnover to the trust. The contributed amount will, however, be used for biodiversity conservation and other natural resource management activities in the villages around the industry. Implementation of all the activities will be done through NGOs, selected by the Trust authorities. The NGO will, therefore, work on behalf of industry in the village. (in fact a few industrial groups has already agreed to this proposal).
- Under the instructions of MoEF, compensatory afforestation is a mandatory action for industries. A strong industry-community partnership can be developed by involving the community in the entire compensatory afforestation program through a JFM type of approach. The large part of the usufruct from such regeneration efforts can be given to the community. In such mechanism, both the parties will get benefits, community- by directly accessing the regenerated resources, and the industries - by reducing their overhead costs on labour intensive regeneration. However, the industry has some scepticism with such approach as they felt that with this kind of partnership, there can be substantial delay in achieving the set targets of compensatory afforestation, and for that MoEF can penalised them. Some *change in definition of the targets by MoEF* can, however, resolve this problem. Such efforts can also be taken up in the mining area restoration programs.

Priority: Medium **Time Frame:** Medium

- Private participation in biomass based regeneration programs can be invited through competitive bids. Provision of benefits to the local community should be one of the major criteria for evaluation of bids and community should evaluate the proposed benefits and choose the best one for them. The vast tracts of saline land, which need large monetary investments for their regeneration, would be one potential area for trying out such efforts.

Priority: Low **Time Frame:** Medium

- Organize orientation program on biodiversity and other natural resource related issues for personnel from industries. In a year, 2 such programs can be undertaken. GUIDE should take some initiatives on this.

Priority: Medium *Time Frame:* Medium

9.7 Strengthening of PA Network

1. *Settlement of PA Boundary.* Boundaries of all the four PAs of Kachchh need to be settled immediately.

Priority: High *Time Frame:* Immediate

2. *Zoning of PAs.* The zoning is an important management tool to separate incompatible resource uses within PAs. However, none of the protected areas of Kachchh resort to zoning for effective management. Following are important suggested zoning schemes, which can be adopted:

- In order to reduce the effect of expanding salt works, salt manufacturing zones need to delineate in WAS (GEER, 1999). Further, since the sustainability of these zones largely depends upon the availability of saline ground water for salt making, its supply must be ensured.
- In order to provide longevity and sustainability to the Lala GIB Sanctuary, other potential habitats found in the contiguous grassland areas also need to be protected from grazing during the breeding season. Also, in order to ensure the protection against the illegal encroachment of these grasslands, these lands should be transferred to forest department. Forest department should manage these lands under 'Inferior Rakhil' scheme, so that the larger benefit of fodder should go to the community. Forest Department should promote a community enforced restrained grazing in the area for certain period after the monsoon.
- Wildlife rich areas in Narayan Sarovar Sanctuary (mini-core areas in GUIDE & GEER, 2001) need higher degree of protection and priority for management.

Priority: High *Time Frame:* Immediate

3. *Preservation of habitat contiguity.* One of the key elements of the conservation of wild animal diversity is to ensure the dispersion of population by providing habitat contiguity. Following important habitat contiguity issues need proper attention:

- Enforcing regulated mining activities around NSS area. This is important for habitat contiguity between NSS and Naliya; NSS and Mata-no-madh; and western and eastern parts of NSS.

Priority: High *Time Frame:* Immediate

- Strict enforcement of laws regarding the restoration of mining areas needs to be ensured. The restored areas should be managed by communities for larger livelihood generation and biodiversity conservation (community conserved areas).

Priority: High *Time Frame:* Immediate

- Engineering intervention like construction of bridges at few points in Sardar Sarovar canal passing through WAS. This is important for movement of wild ass population between the two Ranns. However, the behavioural response of Wild Asses needs to be monitored for initial few years.

Priority: High *Time Frame:* Immediate

4. *Inclusion of important wetlands under PA network.* At present, in Kachchh none of the wetlands are included under PA network, while the biodiversity values of some of the wetlands are very high. Two wetland areas, one inland and one coastal-marine, need to be considered for the sanctuary status. These include:
- Chhari Dandh and Servo Dandh, which are part of Banni landscape.
 - Kori creek, which is the part of Arabian Sea and located on the mouth of Gulf of Kachchh.
 - Other than these, there is a need to identify and manage some small patches of coastal tract (say around 5 km stretch) as *sanctum sanctorum* and used for coastal and marine flora and fauna conservation, including mangrove and fisheries.

Priority: High **Time Frame:** Medium

5. *Removal of Prosopis juliflora.* One of the major habitat improvement requirements in all the PAs of Kachchh is the removal of *Prosopis juliflora* from the important habitats like riverbeds, grasslands and, thorn and scrub forests. Special focus is needed for bets in WAS. Forest Department should organize local populace for collecting the ripe pods of *Prosopis juliflora* and fix reasonable rate for these collected pods. These pods should be crushed and used as cattle feed. This would help minimise further dispersal of seeds.

Priority: High **Time Frame:** Medium

6. *Community support actions.* In order to bring the community in mainstream of conservation within PAs, and to reduce their alienation from biodiversity conservation, there is a need of many support actions to improve the economic bases of community living inside PAs, without changing the basic resource use pattern and characteristics. Followings are some indicative actions emerged through discussion with community:

- In NSS, the PA management should facilitate either a milk collection centre or promoting a mini-dairy at some vantage point. In this way, the profit taken by intermediaries will go directly to the community. This can increase the family income from milk by at least 50-60%. However, PA authorities need to monitor the increase in number of livestock.

Priority: Medium **Time Frame:** Medium

- Introduction of mobile veterinary hospital to support livestock based sector. This will also help in checking the spread of diseases from domestic to wild animals.

Priority: Medium **Time Frame:** Medium

- In NSS, many of the dryland farmers have shown interest in growing local crop varieties, but the overall availability of the seed is very poor in the area. The conservation of these local seeds within the PAs can be supported through setting up of (a) some seed banks (see above) and (b) micro- credit facility, preferably through promotion of Self Help Groups within the PAs.

Priority: High **Time Frame:** Immediate

- In PAs like NSS, where more than 30 villages are within the sanctuary area, Forest Department should bring local community in management of PAs. This is even more relevant due to low number of field staff and thus unable to control free grazing and/or tree cutting from PAs limit. In NSS, communities are keen to protect and manage different Rakhals (reserved forests) for their fodder requirement, through forest protection committees. Forest Department should

encourage such efforts and develop some partnership with community. One of the natural outcomes of such efforts would be the increase fodder availability for the wild herbivores. This should be first tried out on a pilot basis.

Priority: High **Time Frame:** Medium

9.8 Enhancement and restoration of Agro-biodiversity

1. Need to support some target-oriented projects for restoration of agro-biodiversity in the region. For this, ongoing initiatives like ‘Kachchh Sajeev Kheti Manch (KSKM)’ can be supported. Since, the organic farming; traditional farming practices; crop diversification; conservation of indigenous varieties and; exploring the fair price market links, are interrelated issues, KSKM should enlarge their scope of work and develop an institutional framework rather a discussion forum, for enhancement and restoration of Agro-biodiversity.

Priority: High **Time Frame:** Immediate

2. Inventory of local and wild relatives of different crops and livestock breeds from the entire district and setting up of an exhaustive spatial and non-spatial database for these varieties/ breeds.

Priority: High **Time Frame:** Immediate

3. Some of the locally lost varieties need to be located from state or national level seed banks and promote their cultivation in farmer’s field

Priority: High **Time Frame:** Immediate

4. Need extensive education and awareness campaign to enhance the understanding of long-term consequences of loss of local seed varieties; role of dryland farming in ecological sustainability of the region and concepts and benefits of organic farming. Sajeev Khet Manch, has already working on this line, need to support their activities.

Priority: High **Time Frame:** Immediate

5. Documentation of success stories of farmers who are practicing traditional systems of cropping, organic farming, breeding of indigenous livestock breeds. Create awards and rewards systems for the farmers for more diverse farms, cultivation of indigenous varieties of crops, adoption of organic farming, innovative crop protection techniques, livestock breeding etc.

Priority: High **Time Frame:** Immediate

6. In order to promote cultivation of local crop varieties, the seeds should be available to the farmers in time, and for that introduction of some mobile seed outlets, with provision of micro-credits may be supported. This can be linked with already discussed women run ‘seed banks’.

Priority: Medium **Time Frame:** Medium

7. Need to diversify the rainfed field with seasonal and perennial ‘useful under-utilised plants (UNP)’. This can fetch the farmers some income during the non-cropping period of the year. Some of such perennial plants may be Gugal (*Commiphora wightii*), Ketki (*Agave americana*), Kuvarpatha (*Aloe vera*), Mindhiavad (*Cassia etalica*) etc.

Information regarding the crop protection, harvesting etc. need to be made available for farmers through extension program. However, in order to make it as a profit making practice, some market linkages need to be developed for such non-agricultural products. Success of some NGOs on this can be taken as model for replication (see Chapter 6). The program can be initiated in villages of Abdasa, Lakhpat, Rapar talukas and Khadir and Pachchham areas.

Priority: High *Time Frame:* Immediate

8. Need *support for value added products* from agriculture and UNP. So low cost technology need to be developed and promoted for small-scale plant processing units through group credits (like through Self Help Groups).

Priority: High *Time Frame:* Immediate

9.9 Formulating policy and legislative frameworks to support the cause of biodiversity conservation

1. The large tracts of grasslands around Lala Bustard Sanctuary are under the administrative control of either Gujarat State Rural Development Corporation (GSRDC) or with Revenue Department. Considering their importance for the conservation of all the three bustard species (viz. GIB, Lesser Florican and Houbara bustard) administrative control of these lands should be transferred to Forest Department. Forest Department should classify these lands under 'inferior rakhali' and managed for both bustard conservation and fodder supply.

Priority: High *Time Frame:* Immediate

2. Almost all the PAs are inhabited by large number of villages, where the agriculture and cattle rearing are the prime occupations. However, at present there is no focus on agro- and domesticated biodiversity conservation within PAs. There is a need to be some policy changes in PA conservation regarding this and give adequate attention and support to agro- and domesticated biodiversity conservation within a PA.

Priority: Medium *Time Frame:* Medium

3. All the community driven resource regeneration or restoration programs need to be backed up by some legal framework (like signing of MoU between the community and relevant authorities) to stop the diversion of such regenerated land (or even the coastal tracts) for any developmental and industrial activities, for a certain period. Such legal frameworks will enhance the confidence of community and thus promote community driven programs.

Priority: High *Time Frame:* Immediate

4. In compensatory afforestation, the existing definition of targets like 'total area covered' or 'total trees planted' need to be reviewed in order to promote the 'community-industry' partnership based compensatory afforestation. Targets can be redefined to indicate the actual success of such joint efforts e.g. number of MoU signed, or the number of beneficiary groups involved in the program (similar to JFM).

Priority: Medium *Time Frame:* Medium

5. In order to address the issues of *Prosopis juliflora* invasion, there needs a policy and legal support from State Government for community driven *Prosopis juliflora* eradication/management, by granting ‘full use rights’ of *Prosopis juliflora* trees grown in revenue lands to the Village Panchayat. The current practice of issuing the licence (or pass) needs to be redesigned or removed. In addition, government should include this species under a separate category of ‘invasive species’ and thus there should be no restriction on any form of use of this plant (including charcoal making).

Priority: High **Time Frame:** Immediate

6. In order to garner more support to the bottom-up approach of conservation all the forest and PA management plan should be developed through a larger consultative process. Even already developed management plan need to be discussed with the communities and if necessary need to be modified. Similarly, all the government departments associated with natural resource management should follow similar bottom-up approach of planning exercise. In addition, there should be mandatory public hearings of all the developmental projects where the diverted land or water has legal or customary rights of use with the community. The community need to be well informed about the project. Public hearings should be conducted in one of the location within the impact zone of the project, so that large number of local stakeholders should participate.

Priority: High **Time Frame:** Immediate

7. All major developmental projects should follow the recommendations of a Regional Environmental Planning For this there is an immediate need to finalise Regional Environmental Planning especially for ecologically sensitive coastal zones and mineral belts (parts of Lakhpat, Abdasa and Nakhatrana talukas). The Regional Environmental Planning should also follow a ‘bottom-up’ approach and views of all the stakeholders should be incorporated in the plan. The plan needs to be seriously debated in the format of public hearings. Also, there should be some regulation to control the expansion of salt industries in the WAS area and the areas adjoining Surajbari creek which causes serious threats to prawn fisheries.

Priority: High **Time Frame:** Immediate

8. In order to give equal opportunities to children of nomadic pastoral communities, there is a need to initiate some program support, similar to that of tribal welfare program. Under this program, maldhari children should be provided free education, health care, and vocational training etc. through State sponsored and NGO run schools.

Priority: High **Time Frame:** medium

9.10 Human Resource Development for Biodiversity Conservation

1. Need to create a cadre of ‘Rural Experts’ in different natural resource related sectors. These experts will essentially emerge with the development of different community based conservation models.

Priority: High **Time Frame:** medium

2. Need to promote some NGOs or extend the activities of a few NGOs to the biodiversity sensitive areas where no NGOs are currently operating, e.g. the larger part of Lakhpat taluka, area in and around NSS etc. Abhiyan should take some initiative on this.

Priority: High *Time Frame:* Medium

3. In order to build a cadre of qualified students from Kachchh for field-based studies, post-graduate departments in the life-science subjects with specialization on field based research need to be open.

Priority: Medium *Time Frame:* Medium

4. Before making any development related plans, Forest Department should hire the services of communication experts, preferably women working in the field of natural resources. The communication expert, after large consultation process with the community and other stakeholders, submit the report to department. While, this will bridge the communication gap between forest department and community, it would specially address the critical issues like gender and equity in the planning exercise, which are otherwise often ignored. In addition, the field staff of forest department should be oriented and motivated for participatory work, through regular trainings and exposure trips; rewards/awards etc. Also, need to build technical capacity of forest guards for collecting basic ecological data for monitoring purpose. For this, some simple but important habitat and wildlife related data can be identified and collected through forest guards. 'Sahjeevan' with the help of GUIDE can impart training to the forest guards through some short term capsule courses.

Priority: High *Time Frame:* Medium

5. Need to create few more positions of honorary wildlife wardens in different talukas/regions/PAs. The wildlife warden should have knowledge and understanding of the subjects. Also, provide some reasonable honorarium to meet some of their expenses on stationary, communication, travel etc.

Priority: Low *Time Frame:* Medium

9.11 Mobilizing education and awareness programmes towards biodiversity values and their conservation

1. In order to improve the educational and awareness level of stakeholders in general, following programmes can be taken up:
 - Organise biodiversity festivals at different centres. Similarly, some mobile-biodiversity mela can also be organised covering large part of the district.
 - There is a need for technical and financial support to those efforts where communities are maintaining some good herbarium. This can be linked with proposed 'biodiversity register' program.
 - As an awareness and education tool, there is a need for creating botanical gardens and live-museums with insectaries, aquarium, aviary and snake parks.
 - Preparation of identification keys for plants and animals in vernacular language. (take cue from the published book 'Birds of Kachchh' in Gujarati by Kavi Tej of Naliya
 - In order to give an overall picture of biodiversity in Kachchh, there is a need to include a detailed chapter on Biodiversity in Kachchh District Gazetteer. GUIDE should voluntarily contribute the chapter.

Priority: Medium *Time Frame:* Medium

2. For the reference work, there is a need of setting-up of a scientifically organised state-of-art herbarium and documentation centre. For effective dissemination of information, an

ENVIS centre can also be created. Information outreach should be made through printed/online newsletters.

Priority: Medium *Time Frame:* Medium

3. Ensure the availability of natural resource related data in public domain. Abhiyan should take responsibility of all socio-economical data, while GUIDE should take responsibility about bio-physical data. Link these data with KRIC (see above).

Priority: High *Time Frame:* Immediate

4. Need to document and collate scattered old historical accounts related to biodiversity. These are lying with many individuals including the members of the royal family, and few environmentally aware individuals and many institutions and organisations. This can be taken up through a small time bound project.

Priority: High *Time Frame:* Immediate

9.12 Overall Institutional Mechanism for coordination and implementation of different strategies and actions

1. In Kachchh, majority of BSAP programs can be coordinated and implemented through a multi-layered, decentralised institutional arrangement. Such an implementation framework is needed at two broad levels (i) to prioritise the programmes and coordinate with different government sectors and also to garner financial support and (ii) to implement the program at ground level. Specifically, following are the key elements of the overall suggested institutional arrangement for implementation of Kachchh- BSAP:
 - At the state level, there is a need to create State Biodiversity Board – an apex body to coordinate biodiversity related actions, emerged from NBSAP and other processes. Create a Gujarat Biodiversity Conservation Fund (GSBCF).
 - At district level there is a need to create ‘Kachchh District Biodiversity Board (KDBB)’- the apex institutional body to prioritised and coordinate the district level actions through a Technical and Policy Core Group (TPCG). The TPCG should mainly be a stakeholders’ body with the representative form different communities, NGOs, institutions, industries and government departments, chaired by the District Development Officer (DDO). The PCG should have a minimum of 33% women representatives.
 - KDBB will have two major functional units: (i) Community Conservation Initiatives (CCI) and (ii) Biodiversity Support Network (BSN). While the CCI will largely promote the biodiversity linked livelihood support programmes, the BSN will initiate those programs which have long term impact and give a direction to the biodiversity conservation programmes in Kachchh, like education, awareness, research, and monitoring etc.
 - The KDBB will be linked to the District Planning Board. Three members from PCG will be nominated in the District Planning Board who will carry forward the various proposals on biodiversity conservation and include them in the district level annual and 5-year plans.
 - KDBB will also create a ‘Kachchh Biodiversity Conservation Fund (KBCF)’, with a share from GSBCF and other collateral funding from outside sources such as UNDP, GEF etc. and contribution from corporate sectors and NRIs etc. The fund will be utilised to support CCI and BSN programmes. Tentatively, 65% share of KBCF will be earmarked for CCI and 35% will go to BSN.

- The programmes with financial sanctions will be finally implemented through various development support networks. Certain initiatives have already been taken in promoting such networks. For example, while the network of ‘Abhiyan’ helps in providing NGO support for program implementation and developing human resources in the area of natural resource management (NRM); the network of ‘Setu’ helps in prioritisation of issues at local level and information transfer. Similarly, the ‘KRIC’ disseminates relevant data to both project planners and implementing agencies (see Chapter 6 for details of these networks). The KMVS with its many branches in the region helps in women empowerment and their participation in various NRM programs. GUIDE with its strong research base helps in making important inventories and scientific studies of different systems.

However, there is an important caveat associated to all these suggested strategies and actions. All these conservation strategies and actions should followed up by stakeholder driven micro-planning exercise where the role of community should be direct and more.

The Table 9.1 presents the summary of all the suggested actions.

Table 9.1: Summary of suggested strategies and actions

Action Suggested	Relevant Section	Priority	Time Frame	Follow-up responsibility	Relevant Line Department
9.1 Expanding and improving knowledgebase on various aspects of Biodiversity					
Perspective research/ study plans	9.1.1	Medium	Immediate	GUIDE	-
Documentation of traditional knowledge	9.1.2	High	Immediate	GUIDE	-
KLARIS	9.1.3	Medium	Medium	GUIDE	-
Network of weather monitoring stations	9.1.4	Medium	Immediate	Setu	Agriculture
Annual Livestock Census	9.1.5	Medium	Immediate	Setu	Animal Husbandry
Change in forest cover classes in arid and semi-arid regions	9.1.6	Medium	Medium	GUIDE	Forest
9.2 Initiation of conservation programs centred on flagship species of regional importance					
Conservation of flagship species of the regional importance	9.2.1	Medium	Medium	GUIDE	Forest
9.3 Promotion of landscape level planning for biodiversity conservation					
Landscape level planning	9.3.1	High	Medium	GUIDE	Forest
9.4 Enhancing the role of women in biodiversity conservation initiatives					
Minimum 33% representation of women in NRM decision making bodies	9.4.1	High	Immediate	KMVS	Concerned Govt. Dept.
Seed Banks and Grain Bank of local varieties centered on women	9.4.2	High	Immediate	KMVS	Agriculture
Revitalization of traditional health care practices for women and children through native plants	9.4.3	High	Immediate	KMVS	Health
9.5 <i>Prosopis juliflora</i> control for ecosystem and community benefits					
Reduction of <i>Prosopis juliflora</i> through density control and conversion from bushy form to trees	9.5.1	High	Immediate	GUIDE	Forest
Use of <i>Prosopis juliflora</i> to meet economic needs for other NRM related activities	9.5.2	High	Immediate	VRTI	Revenue / Forest
Removal of <i>Prosopis juliflora</i> from ecologically sensitive areas	9.5.3	High	Immediate	GUIDE	Revenue/ Forest
9.6 Enhancing and improving the scope of partnership of different stakeholders in biodiversity conservation					
Promote innovative actions for NRM activities by communities	9.6.1	High	Immediate	Abhiyan	-

Action Suggested	Relevant Section	Priority	Time Frame	Follow-up responsibility	Relevant Line Department
Eco-restoration of degraded lands for conservation and benefit sharing	9.6.2	Medium	Medium	Abhiyan	Revenue
Community based Sea turtle conservation	9.6.3	Medium	Medium	GUIDE	Forest
Community based coastal fisheries management	9.6.4	High	Immediate	GUIDE	Fisheries
Support to prawn fisheries near Surajbari in LRK	9.6.5	High	Immediate	GUIDE	Fisheries
Guidance and monitoring of trawler fishing	9.6.6	Medium	Medium	KERC	Fisheries / Maritime Board
Promotion of community driven eco-tourism	9.6.7	Medium	Medium	KERC	Forest, Fisheries Tourism
Joint Rakhhal management	9.6.8	High	Immediate	GUIDE	Forest
Delineation of grazing zones	9.6.9	High	Immediate	GUIDE	Animal Husbandry
Promotion of a district level maldhari sangathan	9.6.9	Medium	Medium	GUIDE	Animal Husbandry
Support traditional cattle breeding activities	9.6.10	High	Medium	Sahjeevan	Animal Husbandry
Restoration of hills of high biodiversity values	9.6.11	High	Medium	GUIDE	Forest / Revenue
Organization of Pashu Mela	9.6.12	Medium	Medium	Sahjeevan	Animal Husbandry
Orientation and training to defense personnel	9.6.13	Medium	Medium	Sahjeevan	BSF
<i>Prosopis juliflora</i> eradication jointly with community	9.6.13	Medium	Medium	GUIDE	BSF
Joint patrolling with the community in creeks to control trawler fishing	9.6.13	Medium	Medium	GUIDE	BSF / Maritime Board
Joint industry-community compensatory plantation activities	9.6.14	Medium	Medium	GUIDE	Forest
Land regeneration through private initiatives	9.6.14	Low	Medium	GUIDE	Revenue
Orientation and training to personnel from different industries	9.6.14	Medium	Medium	Sahjeevan	Industry
9.7 Strengthening of PA Network					
Settlement of PA boundaries	9.7.1	High	Immediate	GUIDE	Forest/ Revenue
Zoning of PAs	9.7.2	High	Immediate	GUIDE	Forest
Enforcing regulated mining activities around PAs	9.7.3	High	Immediate	Sahjeevan	Forest/ Mining
Restoration of mining areas and their management by community	9.7.3	High	Immediate	GUIDE	Forest/ Rvenue/ Mining
Provision of passages in Sardar Sarovar Canal in WAS	9.7.3	High	Immediate	GUIDE	Forest / Irrigation
Inclusion of important wetlands under PA network	9.7.4	High	Medium	Sahjeevan	Forest/ Revenue
Removal of <i>Prosopis juliflora</i> from PAs	9.7.5	High	Medium	GUIDE	Forest
Milk collection Centre	9.7.6	Medium	Medium	KMVS	Forest
Mobile veterinary hospital	9.7.6	Medium	Medium	Sahjeevan	Animal Husbandry/ Forest
Support to conservation of indigenous crop varieties	9.7.6	High	Immediate	Sahjeevan	Forest/ Agriculture
Joint Rakhhal management in NSS	9.7.6	High	Medium	GUIDE	Forest
9.8 Enhancement and restoration of Agro-biodiversity					
Support to Kachchh Sajeev Kheti Manch	9.8.1	High	Immediate	KSKM	-
Inventory of local and wild relatives of different crops	9.8.2	High	Immediate	GUIDE	Agriculture

Action Suggested	Relevant Section	Priority	Time Frame	Follow-up responsibility	Relevant Line Department
Revival of some locally lost varieties of crop varieties	9.8.3	High	Immediate	VRTI	Agriculture
Awareness and education campaign for seed conservation vis-à-vis dryland farming	9.8.4	High	Immediate	Abhiyan	Agriculture
Documentation of success stories on NRM	9.8.5	High	Immediate	VRTI	-
Creation of mobile seed outlets for indigenous crop varieties	9.8.6	Medium	Medium	KMVS	Agriculture
Promotion of underutilized perennial native plants of high economic values	9.8.7	High	Immediate	Abhiyan	Agriculture/ Forest
Technology search and improvement for low cost value added products	9.8.8	High	Immediate	Abhiyan	Agriculture
9.9 Formulating policies and legislative frameworks to support the cause of biodiversity conservation					
Transfer of grasslands to forest department	9.9.1	High	Immediate	GUIDE	Forest/ Revenue
Support to agrobiodiversity conservation within PAs	9.9.2	Medium	Medium	GUIDE	Forest/ Agriculture
Legal framework against diversion of community regenerated land	9.9.3	High	Immediate	Abhiyan	Revenue/ Forest
Redefine the target of compensatory afforestation	9.9.4	Medium	Medium	GUIDE	Forest
Legal support for <i>Prosopis juliflora</i> removal by community initiatives	9.9.5	High	Immediate	GUIDE	Revenue/ Forest
Bottom-Up approach of resource planning and mandatory public hearing	9.9.6	High	Immediate	Abhiyan	Forest/ Revenue/ Irrigation/ Agriculture
Regional Environmental Planning	9.9.7	High	Immediate	FPIK	-
Support welfare programmes for children of nomadic pastoralists	9.9.8	High	Medium	KMVS	Animal Husbandry/ Education
9.10 Human resource development for biodiversity conservation					
Create a cadre of Rural Experts	9.10.1	High	Medium	Abhiyan	-
Promote some NGOs in remote areas	9.10.2	High	Medium	Abhiyan	-
Opening of post-graduate department in life-science subjects	9.10.3	Medium	Medium	GUIDE	Education
Training and orientation to forest staff	9.10.4	High	Medium	Sahjeevan	Forest
More positions of Honorary Wildlife Warden	9.10.5	Low	Medium	GUIDE	Forest
9.11 Mobilizing education and awareness programmes towards biodiversity values and their conservation					
Develop different tools to increase awareness	9.11.1	Medium	Medium	Sahjeevan	-
Setting up of ENVIS Centre	9.11.2	Medium	Medium	GUIDE	Forest
Availability of natural resource related data in public domain	9.11.3	High	Immediate	Abhiyan	-
Documentation and collation of historical accounts related to biodiversity of the region	9.11.4	High	Immediate	GUIDE	-
9.12 Overall Institutional Mechanism for coordination and implementation of different strategies and actions					
Setting-up of an institutional mechanism for implementation	L-1	High	Immediate	GUIDE	-

Time Frame: Immediate= Within one year; Medium = within 3 years

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Annexure 1.1

Detail List of LAC Members (Kachchh Sub-state)

#	Name	Address	Phone/Fax/Mobile/Email
1	Prof. Y. D. Singh	Director, Gujarat Institute of Desert Ecology, Post Box # 83, Opposite Chogleshwar Temple, Mundra Road, Bhuj - Kachchh	Ph. 02832-32160-32163 (O)
2	The Conservator of Forest	Kachchh District, Behind District Industrial Centre, Bhuj, Kachchh	Ph. 02832 – 50236 (O)
3	The Deputy Conservator of Forest	Kachchh- West Division, Arihant Nagar, Bhuj, Kachchh	Ph. 02832 – 30766 (O)
4	The Deputy Conservator of Forest	Kachchh- East Division, Near Forest Circle Office, Behind District Industrial Centre Bhuj, Kachchh –	Ph. 02832-
5	Mr. Himmatsinghji	The Palace, Near Jubilee Circle, Bhuj, Kachchh	Ph. 02832 – 50078 (R)
	Mr. K.C. Shroff	“Shrujan”, Bhujodi, Kachchh.	Ph. 02832- 41903 (O)
7	Mr. Sandeep Virmani	Sahjeevan, 104, Lotus Colony, Bhuj, Kachchh	Ph. 02832- 51814 (O) Mobile – 98252- 28590
8	Mr. Dinesh Bhai Sanghvi	Gram Swaraj Sangh, At & Post Nilpar, Taluka Rapar, Kachchh – 370 165	Ph. 02830 - 20113
9	Mr. Raisingh Rathod	Hon. Wildlife Warden, “Pankaj”, 7/A, Shaktinagar-2, Bhuj, Kachchh	Ph. 02832- 22187
10	Mr. Dalpatbhai Danidharia	Sr. Executive, Agrocell Industries Ltd., Kodai Crossing, Mandvi Taluka, Kachchh- 370 460	Ph. 02834- 75423, 20253 (O) Fax- 02834- 20838
11	Mr. Ravibhai Soni	Nehru Lok Seva Sangathan, Rapar, Kachchh	
12	Mr. Navin Bapat	Audit Department, Bahumali Bhavan, Bhuj, Kachchh	
13	Dr. Nipun Buch	Shushrooha Clinic, Near Modern Talkies, Nagar Vandi Road, Bhuj, Kachchh	Ph. 02832- 51475 (R) , 25375 (C)
14	Prof. R.S. Dodiya	Head, Botany Department, Lalan College, Bhuj	Ph.
15	Mr. Sailesh Vyas	Sahjeevan, 104, Lotus Colony, Bhuj, Kachchh	Ph. 02832- 51814 (O). 22806 (R)
16	Mr. Fakir Mohammad Turk	Village Dhrab, Mundra Taluka, Kachchh	Ph. 02838- 22588 (R)
17	Mr. H.L. Lalka	Kachchh Food, Fodder and Fuel Development Centre, P.O. Kothara, Taluka Abdasa, Kachchh	Ph. 02831- 80120, 82224
18	Ms. Sushma Iyenger	Member Secretary, Kachchh, Nav Nirman Abhiyan, Bhuj, Kachchh	Ph. 02832-23426, 23448 (O) Mobile: 98240-60473 Email: abhiyan@india.com
19	Mr. Anup Kumar Gupta,	Sr. Vice President, Gujarat Adani Port Ltd., Post Bag No. 1, Mundra, Kachchh- 370 421	Ph. 02838- 88201 to 208 (O) Fax: 02838 – 88230, Email –apport@ad1.vsnl.net.in
20	Mr. A.E. Rao	Vice President (Tech), Sanghi Industries Ltd., Sanghipuram, P.O. Motiber, Kachchh – 370 655	Ph. 02831-74131/32/ 35/36 Email- silspmcd@ad1.vsnl.net.in
21	Ms. Bharti Nanjar	Kachchh Mahila Vikas Sangathan (KMVS), Pusharad ni Brahmपुरi, Oswad Seri, Mundra, Kachchh	Ph. 02838-23104
22	Ms. Shehnaz Saiyed	Kachchh Mahila Vikas Sangathan (KMVS), Naliya, Abdasa Taluka, Kachchh	Ph. 02831- 22165 (O), 02832- 25053 (R).
23	Mr. Devjibhai Dhamecha	DP Arts, Dev Krupa Jin Plot, Dhrangadra, Surendranagar- 363 310	Ph. 02754- 50560
24	Dr. Arun Mani Dixit	Scientist, Gujarat Institute of Desert Ecology, Post Box # 83, Opposite Chogleshwar Temple, Mundra Road, Bhuj – Kachchh	Ph. 02832-32160-32163 (O) Email: arunmdixit@rediffmail.com
25	Dr. Justus Joshua	Scientist, Gujarat Institute of Desert Ecology, Post Box # 83, Opposite Chogleshwar Temple, Mundra Road, Bhuj – Kachchh	Ph. 02832-32160-32163 (O) Email: just_monk@hotmail.com
26	Dr. G.A. Thivakaran	Scientist, Gujarat Institute of Desert Ecology, Post Box # 83, Opposite Chogleshwar Temple, Mundra Road, Bhuj - Kachchh	Ph. 02832-32160-32163 (O) Email: ga_thiva@rediff.com
27	Mr. I.L. Patel	At & Post Village Mota Dhavda, Nakhatrana Taluka, Kachchh.	Ph. : 02835 – 83033

Annexure –1.2

Sector wise break-up of LAC Members

Membership by Sector	Number of Members			Name of Members
	Male	Female	Total	
Forest/ Wildlife Dept.	3	-	3	CF, Kachchh District DCF, Kachchh West Div. DCF, Kachchh East Div
District/ Civil Administration				
Development Department	-	-	-	-
Social Welfare Department	-	-	-	-
Planning Department	-	-	-	-
Scientists/ Academics	4	-	4	Pof. Y.D. Singh Dr. A.M. Dixit Dr. Justus Joshua Dr. G.A. Thivakaran
Other Professionals (Doctors, lawyers, engineer, teachers etc.)	2	1	3	Dr. Nipun Buch Prof. R.S. Dodiya Ms. Shehnaz Saiyed
NGO	4	2	6	Mr. Sandeep Virmani Mr. Sailesh Vyas Mr. Dinesh Bhai Sanghvi Mr. Ravi Bhai Soni Ms. Sushma Iyenger Ms. Bharti Nanjar
Independent Individuals	6	-	6	Mr. Himmatsinhji Mr. K.C. Shroff Mr. H.L. Lalka Mr. Raisingh Rathod. Mr. Naveen Bapat Mr. Devjibhai Dhamecha
Local Community Members	1	-	1	Mr. Fakir Mohammad Turk
Local Governance Institutions	-	-	-	-
Armed Forces	-	-	-	-
Corporate Sectors	2	-	2	Mr. Anup Kumar Gupta Mr. A.E. Rao
Students	1	-	1	Mr. I.L. Patel
Religious Heads	-	-	-	-
Artists	-	-	-	-
Others (Small enterprise)	1	-	1	Mr. Dalpatbhai Danidharia
Total	24	3	27	

Annexure- 1.3

List of persons who showed interest in NBSAP process and contacted GUIDE

Name and contact details of the respondent	Area of expertise	Source of information	Follow-up by executing agency and subsequent involvement of respondent
Dr. Nipun Buch, Bhuj	Ayurvedic doctor	Through some magazine	Included in LAC
Mr. Digvijay Singh Madhav Singh Jadeja, At & Post Beraja, Taluka Mundra – PIN 73451	Working in the office of Deputy Executive Engineer in Bhuj and doing voluntary rural development works in and around his village	Through news item on NBSAP and Kachchh BSAP in Local daily News Paper.	We provide reading material on NBSAP and Kachchh sub-state in Gujarati language. Also invited in village meeting at Jarpara, but he did not turned up on that day.
Mr. Shivji Bhai Shah, At & Post Rampar Gadhwal, Abdasa Taluka, Kachchh	Working towards the development of land regeneration model where interaction between land-tree-livestock is given importance. Trying to revive the 'Tharparker' breed of cattle.	Through the Call for participation brochure	We visited his village and discussed many thing about the land regeneration models. We also visited the site where he is trying to regenerate a piece of land near the coast, which was earlier completely covered by <i>Prosopis juliflora</i> .

Annexure – 1.4

Village Meetings Organized during Kachchh-BSAP

S.N	Date of Meeting	Village	No. of Villagers Present in the Meeting	Coordinator	Contact Phone Number
1	16 July 2001	Mundra	35 (all women)	Ms. Bharti Nanjar, KMVS	02838-23104
2	16 July 2001	Jarpara	20 (all male)	Mr. Fakir Mohammad	02838-22588
3	18 July 2001	Vigodi	30 (all male)	Mr. Narayan Bhai Joshi	02835-75651
4	20 July 2001	Khavda	25 (all women)	Bhavna Ben, KMVS	922-88218
5	21 July 2001	Nakhatrana	25 (all women)	Ms. Meena Ben/ Ms. Dimple Ben, KMVS	915-21124
6	22 July 2001	Gugariyana Village	10 (all male)	Rai Singh Rathod	02832 - 22187
7	25 July 2001	Naliya	40 (all women)	Ms. Sahnaz Ben, Karuna ben, KMVS	911-22165
8	27 July 2001	Jarpara	50 (7 women)	Fakir Mohammad Dhanraj Gadhvi	918-22588 (R) 918- 23449 (O) 918-40137 (R)
9	28 July 2001	Naliya	50 (all male)	Jayesh Lalka, KFFFDI, Kothara	952831-82224, 80120
10	9 August 2001	Khadak Village	25 (all male)	-	-
11	11 August 2001	Manadi Wandh	20 (all male)	Dinesh Bhai Sanghvi, Gram Swaraj Sangh, Nilpar (Rapar)	02830-20113
12	27 Sept. 2001	Naredi Village, Near Dhrangadra	20 (all male)	Gautam Bhai, Kediya, Dhrangadra	02754-23147
13	27 Sept. 2001	Jesada Village, Near Dhrangadra	20 (all male)	Gautam Bhai, Kediya, Dhrangadra	02754-23147
14	28 Sept. 2001	Jhnjuwada, Village	40 (all male)	Narottam Kaka. Jhinjuwada	02757-20475
15	29 Sept. 2001	Dhrangadra	35 (8 women)	Gautam Bhai, Kediya, Dhrangadra	02754-23147
			445 (140 women and 305 male)		

Annexure –1.5
Chronology of the meetings

Date	Person	Discussion Points
3 July 2001	Mr. Srivastava, CF Kachchh	Discussed about the project progress and possibility of organizing a meeting near NSS.
	Mr. Raisingh Rathod	Discussed about the status of the project. Briefed him about the major issues emerged during the Delhi workshop. He offered his services for this exercise.
4 July 2001	Dr. Nipun Bhuch	Discussed about the future course of action. He suggested name of some persons who may be useful in the entire NBSAP exercise.
	Mr. Vadi, DCF, West	Discussed about the possibilities for Participatory PA-management especially in LBS and NSS.
	Dr. Hitesh Jani, Ayurvedic Doctor	Discussed about the potential of medicinal plants in Kachchh.
	Ms. Bharti Nanjar, KMVS, Mundra	Briefed her about the project. Fixed a meeting on 16 th July 2001.
	Mr. Fakir Mohd. , Dhrab	Discussed about problems and potential of conservation of medicinal plants. Fixed a meeting with KMVS women on 16 th July 2001
5 July 2001	Mr. Chaturvedi, DCF, East	Briefed him about the NBSAP project. Asked his opinion and key issues to be covered under the project
	Mr. Dinesh Bhai Sanghvi, Gram Swaraj, Lilpar, Rapar	Discussed about dryland farming etc. and possibilities of organizing a public meeting at Rapar in August.
	Mr. Yogesh Bhai, Gram Swaraj, Rapar	Discussed about different aspects of Dryland farming in Kachchh.
6 July 2001	Mr. Shambhu Dan Gadhvi, Dholavira	Discussed on various ecological issues of Khadir island and requested about organizing a meeting at Dholavira.
	Mr. Shailesh Vyas, Sahjeevan, Bhuj	Discussed him about the status of the project and also get feedback on major issues related to biodiversity of Kachchh
7 July 2001	Mr. Vinod Gala, Kachchh News, Bhuj	Briefed him about the project. Requested him for a space in his daily TV news. He agreed to takeup an initial interview where we can introduce the project, major issues and call for participation.
	Mr. Raisingh Rathod, Bhuj	Discussed on many aspects of the project and planning visits of different villages and meeting of people.
	Mr. Himatsinhji, Bhuj	Discussed about five major issues. He gave many useful feedbacks on the five issues.
	Mr. Sandeep Virmani, Sahjeevan	Briefed him about the five major issues. Gave him a short note on the BSAP for the comments and feedback.
	Ms. Shehnaz Ben, KMVS, Naliya	Fixed a meeting with KMVS women on 25 th July 2001.
8 July 2001	Mr. Naryan Bhai Joshi, Vigodi Village	Fixed a meeting with villagers on 18 th July 2001
	Ms. Kaushalya Bahen Rathod, Dayapar Village	Fixed meeting with women from Anghanwadi on 18 th July 2001
	Mr. Y.K. Gahlot, GM (Project), Mr. R. P. Pandya, Manager (P&A) & Mr. A.K. Srivastava, Sr. Manager (Mines), GMDC, Panandhro	Discussed about possible roles of GMDC in biodiversity conservation of local area including PAs. Also discussed about the possibilities of creating interface between GMDC and local community through joint mining area rehabilitation. Concepts like JFM were discussed in detail.
9 July 2001	Mr. Anup Kumar Gupta, Sr. Vice President and Mr. Ketan Doshi, Gen. Manager, Adani Ports, Mundra	Briefed them about the project. Discussed to identify grey areas where community/ industry interface can be developed. Clearly, some possibility of developing the partnership in the area of land regeneration including the mangrove.
10 July 2001	Mr. Mukesh Bhai Zaveri, MLA and Chairman, GMDC	Briefed him about the project and five key areas. He assured the cooperation where it is possible, especially as the capacity of Chairman GMDC.
	Mr. Kantibhai Shroff, Srujan, Bhujodi	Briefed him about the project took his opinion on five major issues of biodiversity conservation. He, through his excellent far-sightedness vision, gave many finer tips for this program. He also assured support for this program.

Date	Person	Discussion Points
	Mr. Deepak Bhai Mankad, Reporter, Kachchh Mitra	Briefed him about the project and five issues for printing in his paper. He agreed to take this.
16 July 2001	Meeting with Women at KMVS, Mundra	Discussed on different issues related with biodiversity especially the dryland farming related issues in very length. About 35 women had participated in the discussion. Women showed keen interest in grassland management and improvement of dryland farm diversity. Also agreed to work on medicinal plant conservation and health related issues, as an extension of their ongoing efforts
	Meeting with farmers and maldharis at Jarpara	Discussed different issues related with biodiversity especially the dryland farming and grazingland related issues in very length. About 20 farmers had participated in the discussion
17 July 2001	Meeting with Mr. Tarachand Cheda, ex MLA and President Sarv Seva Sangh	Briefed him about the NBSAP and our effort. Get very good response from him. He was insisting on linking the entire action (plan) with the livelihood of different community. He was skeptical about the possibilities of dryland farming. Insisting on some kind of Jan-Andolan.
	Meeting with Mr. Praveen Pardeshi, UNDP office Bhuj	Briefed him about the project especially related to dryland farming and the conservation of indigenous crop varieties. He also took lot of interest in wildlife conservation especially the GIB and Lesser Floricans.
18 July 2001	Meeting with Kulin Kant Shah, Gramyashilpi, (Bhuj)	Discussed with him on the possibilities of growing underutilized yet very useful native plants for fruit, medicinal and other economic activities.
	Meeting with Mr. Babulal Shivji Panchadi, A farmer in village Palanpur Badi near Nirona	Discussed about many aspects of dryland farming. He highlighted the problem of water and shift from irrigated farming to dryland farming. He asked for another meeting with all villagers sometime in the last week of July.
	Meeting at Vigodi Village Narayan Bhai Joshi	Discussed in detail the issues of farming, especially the dryland farming and the farmer's fears to diversify the crops suitable for the region. Major issue emerged as the farmers want to diversify the crop with some other economic values, but they had fear of not getting proper economic return due to unorganized market. About 30 villagers were present.
19 July 2001	Mr. Madhubhai Makad Krishi Vigyan Kendra, Mundra	Briefed him about the NBSAP. He highlighted very high rate of migration of farmers from the coastal region of Mundra-Mandvi to other places. Their lands are however cultivated by poorer section of the society. In contrast, he said the Pranthal region of Rapar taluka, despite the dryland farming (with high risks) migration is very less.
	Mr. Prakash Tulpule, Yousuf Mehrauli Foundation, Kachchh Sanjeevani Farm, Bidada (Mandvi)	Briefed him our effort in pushing the issues of dryland farming into BSAP. Discussed about the possibilities of Organic Farming in Kachchh and its potential for replicability. He suggested the revival of Kachchh Sajeew Kheti Manch for networking purpose. He offered his services for on-farm training to different cadres from farmers, NGOs, women etc. Lodging facilities for these trainees (3-4 at a time) can be provided by Yousuf Mehrauli foundation.
20 July 2001	Meeting with women at KMVS, Khavda	Discussed with about 25 women from different villages of Pachchham region. Insist on Bullock and cow dung manure for agriculture. Also said about the need of seeds, main emphasis on desi (native) seeds. Lot of scope for native seed conservation as many families are still using native seeds.
21 July 2001	Meeting with women at KMVS, Nakhatrana	Discussed with about 25 women from different villages of Nakhatrana taluka. Like in Khavda, they also felt the need of bullock for farm level work, but at the same time concern about their fodder. They said that poor farmers won't get their share of irrigation water from the reservoirs. On the issue of dry farming they wanted some price support from govt. Also, they want to continue with desi seeds but circumstances do not allow them. There was a serious concern about mixing of desi and other seeds. Even the definition is very confusing. Few felt that the seeds of their own farm (may be of selected ones) as desi. Wanted 'Mahiti' about different possibilities. Women felts that cow as the animal of poor's and buffalo of richmens. Linking of scarcity relief and removal of Prosopis; need of hassle free permit of charcoal making and cutting down the role of forest corporation in MFP collection are also suggested.

Date	Person	Discussion Points
22 July 2001	Meeting with village community at Gugariyana near NSS	Discussed with about 10 poor villagers. Most of them were involved in agriculture, livestock, and fisheries activities. Ready to involve in any program provided they get enough economic return in lieu of their usual earning from labor. Lack of mahiti (information) on different possibilities were emerged as major bottleneck. Easy loan procedure from banks and make some rules. See mangrove forest as good source of fodder and seriously concerned about grazing of cattle from outside in their region.
23 July 2001	Meeting with officials from Indian Institute of Rural Development, Rajasthan	Discussed about the possibilities of vermiculture in Kachchh as a quick economic return for farmers as well as maldharis. With a very crude economic analysis, it seems to be having a very high economic return to the farmers. IIRD has some project from Dept. of Biotechnology to support this program in 400 farmer's field. Need some experimentation in the drier regions of Pachchham, Abdasa, Lakhpat and Khadir.
	Meeting with Mr. K.C. Shroff, 'Srujan', Bhujodi Ph.	Briefed him about the progress. Discussed mainly on Agrobiodiversity related issues and specially about the vermicompost. He informed about his recent experiments with vermicompost.
25 July 2001	Meeting with Women at KMVS, Naliya. Coordinator: Ms. Shehnaz ben	About 40 women from different villages participated in the meeting. Mainly discussed about the issues related with the fishing and fishermen community. Issues like degradation of mangrove and international border of Pakistan had strongly emerged. We also discussed about the agro-biodiversity. Women gave a unanimous acceptance for desi seed based farming against the hybrid ones. One of the women, is conserving and sowing desi seeds as her 105 yrs old mother-in-law traditionally preserve the seeds. One woman in fact gave us the desi variety of Til for taste. Need of nursery of different useful underutilized native plants (UUNP) were realized.
26 July 2001	Gujarat State Seed Corporation (GSSC), Bhuj.	Discussed on possibilities for market for desi varieties through Seed Corporation. It was strong feeling that to create a market for desi-seed is very difficult. GSSC is exclusively marketing the hybrid and selected seeds. It was felt that because of high cost of seeds and lots of inputs (chemicals and labour) this market was much more oriented for relatively richer farmers. We also discussed about the possibility of seed certification from Agriculture university, but they only certify 'notified' seeds. May be we needed to redefine the definition of 'notification'. Need to discuss with extension dept. of GAU.
	Mr. Velji Bhai, Bhartiya Kisan Sangh, Bhuj, Kachchh.	Briefed them about the project and seek appointment some time in August.
27 July 2001	Mr. Ravji Sondarva, Ahmedabad	Busy with Ravji in filming EQ affected areas of Bhuj. Also filmed the contrasting natural beauties of Kachchh while driving on the way to Jarpara.
	Meeting with villagers at Jarpara Coordinated by Fakir Mohammad Bhai of Dhrab and Dhanraj Bhai Gadhvi of Bhujpur	About 50 persons had attended the meeting including about 7 women (including Sarpanch of the villages Jarpara). In the meeting the concerns of villagers on expansion and resource use methods of Adani has strongly emerged. Although a few persons were for the Adani, majority were against Adani. Still, ready to see some joint programme with industry. Need subsidy and other technical support systems for water saving irrigation devices like drips and sprinklers. Marketing yard and cold storage type of arrangements were felt needed for Kharik and Chikoo fruits, which are rapidly perishable. Asked for mahiti (information) on different possibilities. Identified Prosopis as the shelter ground for Neelgai and Wild boar and suggested permits for coal making. More stress on marketing through cooperatives.
28 July 2001	Meeting with Mr. Himmatsinghji	Briefed him about the progress of the project. Discussed various possibilities for agro-biodiversity conservation. He suggested to take views of Tera based Khatau Foundation especially on traditional seed conservation. Overall he was quite happy with the progress of the project. Suggest a meeting of LAC some time in mid-or end of August for future course of actions.

Date	Person	Discussion Points
	Meeting with villagers at Naliya Coordinated by Mr. Jayesh Lalka of Kachchh Food, Fruit and Forest Development Trust	About 50 persons has attended the meeting. All the five issues were discussed. Farmer's main concerns were: Less manual labors, low price of crops, even hybrid and crop raidin by neelgai and wild boar. In fact one farmer has estimated benefit of 1acre of wheat cultivation. It was found that a farmer spent about 5000 Rs, while the selling of price gave him just about 5500Rs. So it is not that profitable. Efforts of Agrocell can be supported. Possibility of marketing through co-operatives or small village groups are quite high. However, some changes in State Cooperative laws/act is needed to remove the bottlenecks. Similarly crop insurance policy and their utility in dryland areas need to be emphasized. The problem of some weeds on fallow lands were highlighted. Desi seeds need market support under a cooperative mode. Value added products may fetch more income to farmers. For the conservation of medicinal plants, education/awareness is must. On the grassland related issues, the diversion of village lands to Land Bank (under forest deptt.) found to be a critical issues, JFM can be tried on these lands. Prosopis based gasifier can be run with Village Panchayat support.
8 Aug. 2001	Mr. Dilip M. Maru, Astt. General Manager, NABARD, Bhuj	Briefed him about the NBSAP and our five areas of concern. Main discussion was focused on dryland farming and support for indigenous crop varieties. He suggested to accord some special status for those farmers who cultivate indigenous varieties and then make a project proposal for the total support system including training, marketing etc. Other than that under different schemes, NABARD can provide financial assistance to them. He suggested that the entire program should have strong institutional support. Also, NABARD can help in promoting Organic farming practices, vermicompost schemes etc. He also suggested creating some self-help groups in the villagers, to whom NABARD can support directly.
9 Aug. 2001	Mr. A.E. Rao, Vice President, Sanghi Cement Industries, Sanghipuram, Kachchh.	Briefed him about the NBSAP and five issues. Discussed the possible role for industries in the BSAP. He cautioned that no industry could commit the things at this stage of NBSAP. Rather, he suggested that in the BSAP Industries could play their role on case-to-case basis. Any action, which asks large financial implications, industry would like to avoid. However, industry should see as an active support system with their human resources and can help in technical assistance by organizing training programs, take up some demonstration models e.g. organic farming etc. He however, felt strongly that industries, especially in Kachchh like regions, should not encroach upon the community's scarce resources like ground water etc.
	Meeting at Khadak Village.	About 25 villagers had attended the meeting. The majority of the community belonged to Daneta Jath (muslims). Briefed them about NBSAP, Kachchh-BSAP and 5 issues. Regarding the dryland farming construction of Farm Ponds was their first priority, as it will give water to each farm equitably, interestingly few villagers had a view that one or two check dams would not provide water to all farmers. The villagers wanted financial support from govt. for farm ponds as they cannot divert their labour for this work. There are many farmers who are also keeping good number of livestock, during the drought they have to migrate out from their village, then who will take care of their perennial crops like mindhiavad (which we had suggested). The crop raiding by wild boar is problem and because desi-bajra matures in longer time (than hybrid) they are more prone to crop raiding or otherwise farmers need to watch its crop for more period (again losing its labour !!). Possibility of control of Prosopis through village committee seems to be more realistic for them, but need some outside support to eradicate it for once. Prosopis was also seen as the cause of decline of GW. Need some rights from FD to protect nearby rakhals or other forest area (Possibility of JFM!!). Wanted some control from Panchayat on migratory livestock from different parts of Kachchh. Or alternatively, they suggested a district level 'Maldhari Sangathan' with a hierarchical representation of maldharis to a village, juth panchayat, taluka and region. These different levels of maldhari sangathan can enforce some grazing rules (as was practiced in earlier

Date	Person	Discussion Points
		time).
10 Aug. 2001	Meeting with Mr. Himmatsinhji	Briefed him about the meeting with Sanghi and villagers from Khadak. Discuss the issue of controlling the grazing of migratory livestock especially of sheep and goats. He suggested meeting Mr. Tarachand Cheda for this regard. Discuss about the possibilities of making a documentary film on biodiversity of Kachchh. He suggested getting some idea of budgetary requirement for that and then he can try to mobilize the required fund.
	Meeting with Mr. Ramjibhai Savani, President, NRI Association of Kachchh, Kera	Briefed him about the NBSAP and our five area of concern. Discussed mainly on dryland agrobiodiversity and livestock related issues. He fully endorsed our viewpoints and assured for help, mainly in the form of financial support, if necessary, through his association.
11 Aug. 2001	Meeting with Mr. Dinesh Bhai Sanghvi, Gram Swaraj Sangh, Nilpar, Rapar Taluka	Briefed him about the progress of the work. He was satisfied with the work we had done so far.
	Meeting with the villagers in Manadi Wandh (Rapar taluka) Coordinator- Mr. Dinesh Bhai Sanghvi	About 20 farmers have attended the meeting, which was not prefixed. The majority of villagers were doing rainfed farming ('Ram Mol' in Kachchhi) predominantly with indigenous varieties. As expected, they wanted to shift to hybrid varieties in search of better economic return, provided the get water for irrigation. However, they recognize many other values of desi varieties compare to hybrid types. Saw their earthen seed storage systems. For water conservation they wanted to do farm bunding. According to Dinesh Bhai manually one acre of farm need about 80-90 man days of labour to complete the bunding. When asked about the possibility of a community tractor, farmers appreciated that. Farmers suggested that maintenance and their loan repayment etc. will be their responsibility and managed by a village committee. There is no selling of cowdung manure, rather they put them into their respective fields. Ready to diversify their crop provided the market is available for UUNPs. Failing of Mindhiavad to provide good price to the farmers has setup a bad example. Prosopis eradication must be a top priority, but need some financial support for that.
	Meeting with Mr. Bhura Bhai, a farmer in Anandpur village (Rapar Taluka) Coordinator- Mr. Dinesh Bhai Sanghvi	Discussed briefly about the problems of farmers. Need of water harvesting was suggested but no plan for its judicious use through drip or sprinkler systems (no end-use planning!!). Suggested a stable marketing mechanism for product like mindhiavad, gugal etc. Informed us that about 5 years back mindhiavad had a price of about 1300 Rs. per 40 kg, while current price is about 200 Rs per 40 kg.
12 Aug. 2001	Meeting with Mr. K.C. Shroff, Shrujan, Bhujodi	Briefed him about the progress of work. Visited his vermicompost site. It looked very well and lots of newborn earthworms were visible. Suggested meeting with Mr. Kapil Shah at Vadodara for discussion on organic farming. Also suggested photographic documentation of Plant species of Kachchh in next two months. Regarding the marketing mechanism for UUNPs and medicinal plants he was very optimistic due to earlier experiences of Agrocell. According to him organizing these are not very difficult. Gave example of efforts for Kharik (date palm) promotion in Kachchh through an integrated approach. Similarly, he suggested we should create a niche in market for desi varieties. Possibility of giving support to desi-varieties through a trust or board (like Spice Board) can also be explored. Since most of the rainfed farming is already a type of organic farming (no chemical inputs), we need to market these with a label of 'organic product'. However, he emphasized to dovetail the vermicompost making to this rainfed farming, so that at one side farmers can increase their agricultural production and at the same time they can earn some extra revenue by selling the vermicomposts. Regarding the problem of migratory livestock, especially the sheep and goats, he appreciated the idea of a Maldhari Sangathan.
13 Aug. 2001	Mr. H.L. Lalka, Retd. Forest Officer	Discussed about the NBSAP and its major areas of concerns. He suggested the name of few villages who are still cultivating with local varieties, especially in Nakhatrana and Lakhpat talukas. He highlighted the migration of Jain community (Dasa Oswal) from 39

Date	Person	Discussion Points
		villages of Abdasa taluka to Mumbai, due to un-economic conditions of cultivation. He suggested that there are large fallow lands due to such migration, which can be used in fodder cultivation. He also given the list of villages where good breeds of cattle still exists. He also suggested Joint Rakhal Management in some parts of the district. Most importantly, he, being a retired forest officer, suggested that the targets given to FD should be based on Physio-climatic condition of the region, otherwise there would be no results, despite large money inputs.
	Mr. Kartik Chauhan, Wildlife Researcher.	Discussion was mainly focused on conservation of wildlife species like wolf, caracal etc., on which he is currently working on. He highlighted that Caracal is getting stiff resource competition from domestic cats. However, domestic dogs (mainly pubs) and cats are major prey base of hyena. He opined that compensation mechanism to Rabaris for the sheep/goat lifting by wolf, is very difficult to work out. He suggested that NBSAP should target potential areas lying outside PA network, because they are more vulnerable for habitat changes, encroachments and degradation.
	Mr. Sandeep Virmani, Shajeevan and LAC Member	He based on his work in rural areas of Kachchh highlighted many important aspects of agriculture and pastoralism. He suggested a grazing policy need to be developed for rotational grazing on the basis of grazingland capacity. So a grassland zoning exercise is must. He highlighted the case of industries in Coastal areas and thus loss of mangroves. He suggested a watershed based development in Kachchh.
30 Aug. 2001	Mr. Vivekanandan, Coordinantor, Sub-thematic group Pastoralism and Biodiversity.	Discussed about the various aspects of Pastoralism in different regions. He suggested to organize a regional workshop on problems of pastoralism in Gujarat.
27 Sept. 2001	Mr. Devjibhai Dhamecha, Naturalist, LAC member, Dhrangadra	Briefed him about the NBSAP and get his views on WAS area and its conservation issues. He informed that there is a school level eco-club program from the FD in the state. He argued that the problem of WAS need to be seen in a holistic manner. He highlighted the problem of expansion of salt industries in WAS and the congregation of Wildass outside or in the fringe areas of sanctuary, mainly due to habitat degradation in <i>Bets</i> . He also stressed on identification of illegal salt pans and their immediate closures.
	Meetings with Villagers in Naredi	About 20-25 villagers were present during the discussion. Farmers highlighted the over pumping of groundwater in the region. No one is cultivating with desi varieties. Although, they realized that the current agricultural practices are not sustainable. The crop damage by wildboar, wild ass and neelgai was emerged as big problem, felt need of fencing of their field.
	Meeting with villagers in Jesada	About 20-25 villagers were present during the discussion. Highlighted the problem of crop damage by feral pigs and wild ass. Informed that increase in number of feral pigs is mainly due to promotion by Sikh Sardars of neighbouring cities. Highlighted the loss of pastoral lands and thus the milk production. <i>Prosopis juliflora</i> invasion was found as the main reason of productivity loss.
28 Sept. 2001	Meeting with villagers in Jhinjuwada. Coordinatot: Shri Narottam Kaka	About 40 villagers were attended the meeting. The major issues raised were the problem of crop raiding by wild ass, neelgai and wild/feral pigs. The major damage to the pulses and cotton. Villagers suggested that there is no problem to Wildass due to salt industry, rather the degradation of <i>bets</i> due to infestation of <i>Prosopis juliflora</i> is the main problem to wild ass, and thus they are moving out of the sanctuary area. There are still some scope of conservation of desi varieties, especially the tal, mag and jowar. More use of chemical fertilizer mainly due to low availability of cow dung manure, which in turn a result of declining number of cattle population. While tractorization decline the need of bullocks, the general preference to buffalo milk decline the number of cattle in villages. Suggested permission to use <i>Prosopis juliflora</i> for coal making and income generated through this can be used for barbed wire fencing. Salt industry in WAS is dying its natural death as it cannot compete with the low cost salt production from coastal areas.

Date	Person	Discussion Points
29 Sept. 2001	Stakeholder Meeting at Dhrangadra. Coordinator: Gautam Bhai Kedia.	Meeeting was attended by all the major stakeholders including the forest department, industries, agarias, farmers and nature lovers. Between 35-40 persons have attended the meeting. It was highlighted that the salt cess (tax) is collected by revenue department from the industries for socio-economic development of the region but this revenue are normally transferred to other developmental works, even outside the region. There was a big dispute over the claim of erection of barbed wire fencing under 50% subsidy scheme by FD. Industry representative suggested the relocation of excess wildass population to other countries, and in the process can earn revenue also.
15 Jan., 2002	Brainstorming session at Vadodara with GEC and GES and TPCG members	The session was conducted to synergise the two state level documents on Biodiversity –the NBSAP prepared by Gujarat State forest Department and the State Environmental Action Programme (SEAP) prepared by GEC. Several inputs were given from the Kachchh sub-state action points especially related to <i>Prosopis juliflora</i> control, grassland regeneration, and agrodiversity.
1 May, 2002	Meeting with Mr. H.S. Panwar	The meeting was attended by about 15 persons representing NGOs, Forest Department, community representative, wildlife experts and scientists of GUIDE. Mr. Panwar had suggested the inclusion of landscape level planning for biodiversity conservation for Kachchh, where he had suggested one major landscape to focus domesticated diversity mainly the agrodiversity and the second to focus wild natural diversity. The importance of institutional mechanism in implementing the suggested actions was raised and multi-level decentralised institutional mechanism was advocated by many. Overall, the members found list of recommended actions are quite exhaustive and thus need to be merged within larger programmes.

Annexure 3.1

List of Wild Plants from Kachchh

S. NO.	Scientific Name	Local Name	Family
1.	<i>Abelmoschus manihot</i>	Ran bhindi, Jangli bhindi	Malvaceae
2.	<i>Abrus precatorius</i>	Chanothi	Fabaceae
3.	<i>Abutilon fruticosum</i>	Zini Khapat, Zinki khapat,	Malvaceae
4.	<i>Abutilon indicum</i>	Khapat, Dabliar	Malvaceae
5.	<i>Abutilon spp.</i>		Malvaceae
6.	<i>Abutilon theophrasti</i>	Nani khapat, Bhonykhanski	Malvaceae
7.	<i>Acacia binosa</i>		Mimosaceae
8.	<i>Acacia leucophloea</i>	Hermobaval, Hiver, Samadi	Mimosaceae
9.	<i>Acacia nilotica subsp. Indica</i>	Baval, Bavar, Bibarjo zad	Mimosaceae
10.	<i>Acacia Senegal</i>	Goradio baval, Desi baval	Mimosaceae
11.	<i>Acalypha ciliate</i>	Dadri, Runchalo dadro,	Euphorbiaceae
12.	<i>Acalypha indica</i>	Dadari, Dadarjo, Dadaro,	Euphorbiaceae
13.	<i>Acanthospermum hispidum</i>		Asteraceae
14.	<i>Achyranthes aspera var porphyristachya</i>	Sonar	Amaranthaceae
15.	<i>Achyranthes aspera var. aspera</i>	Anghedi, Anghedo, Aghado	Amaranthaceae
16.	<i>Adhatoda zeylanica</i>	Ardusi	Acanthaceae
17.	<i>Aegle marmelos</i>	Bili	Rutaceae
18.	<i>Aeluropus lagopoides</i>		Poaceae
19.	<i>Aerva lanata</i>	Kapuri	Amaranthaceae
20.	<i>Aerva persica</i>	Bur, Gorakhganjo	Amaranthaceae
21.	<i>Agave Americana</i>	Ramban, Ketaki	Liliaceae
22.	<i>Ailanthus excelsa</i>	Rukhdo, Moto arduso	Simaroubaceae
23.	<i>Alangium salvifolium</i>	Ankol, Ankoli	Alangiaceae
24.	<i>Albizia amara</i>	Shirish	Mimosaceae
25.	<i>Albizia odoratissima</i>	Dholosaras, Dholo Shirish, Sasalozad	Mimosaceae
26.	<i>Alhagi spp.</i>		Fabaceae
27.	<i>Aloe barbadensis</i>	Kunvarpato	Liliaceae
28.	<i>Alternanthera sessilis</i>		Amaranthaceae
29.	<i>Alysicarpus longifolius</i>	Ghodasamaervo	Fabaceae
30.	<i>Alysicarpus monilifer</i>		Fabaceae
31.	<i>Alysicarpus procumbens</i>		Fabaceae
32.	<i>Alysicarpus tetragonolobus</i>	Samervo	Fabaceae
33.	<i>Alysicarpus vaginalis</i>		Fabaceae
34.	<i>Amaranthus lividus</i>	Tandaljo	Amaranthaceae
35.	<i>Amaranthus spinosus</i>	Kandharo tandarbhe	Amaranthaceae
36.	<i>Amaranthus tricolor</i>		Amaranthaceae
37.	<i>Amaranthus viridis</i>	Rajgaro Adbau Rajgaro	Amaranthaceae
38.	<i>Ammannia baccifera</i>	Jal agio, Lal agio	Lythraceae
39.	<i>Anagallis arvensis</i>		Primulaceae
40.	<i>Anaphalis cutchica</i>		Asteraceae
41.	<i>Andrographis echinoides</i>	Kariyatu	Acanthaceae
42.	<i>Andropogon pumilus</i>		Poaceae
43.	<i>Anethum graveolens</i>	Suwa	Apiaceae
44.	<i>Anisomeles indica</i>	Chodharo	Lamiaceae
45.	<i>Antigonon leptopus</i>	Ice-cream vel	Polygonaceae
46.	<i>Argemone mexicana</i>	Darudi	Papaveraceae
47.	<i>Argyrea nervosa</i>	Samudrasok, Vardharo	Convolvulaceae
48.	<i>Aristida funiculata</i>	Lanp	Poaceae
49.	<i>Aristida mutabilis</i>		Poaceae
50.	<i>Aristolochia bracteolata</i>	Kidamari	Aristolochiaceae
51.	<i>Aristolochia spp.</i>		Aristolochiaceae
52.	<i>Asparagus dumosus</i>		Liliaceae
53.	<i>Asparagus racemosus</i>	Satvari	Liliaceae
54.	<i>Asphodelus tenuifolius</i>	Dungro	Liliaceae
55.	<i>Astragalus prolixus</i>		Fabaceae
56.	<i>Asystasia gangetica</i>		Acanthaceae

S. NO.	Scientific Name	Local Name	Family
57.	<i>Avena spp.</i>		Poaceae
58.	<i>Avicennia marina</i>	Cher	Avicenniaceae
59.	<i>Azadirachta indica</i>	Limdo	Meliaceae
60.	<i>Balanites aegyptiaca</i>	Ingorio, Hingoriyo, Angario	Balanitaceae
61.	<i>Barleria acanthoides</i>		Acanthaceae
62.	<i>Barleria cristata</i>		Acanthaceae
63.	<i>Barleria prionitis</i>	Kadha aserio, Pilo Kanta aserio	Acanthaceae
64.	<i>Basella rubra</i>	Poi	Basellaceae
65.	<i>Bauhinia racemosa</i>	Kasotri, Asotri, Apto, Asondaro, Rakta kachnar	Caesalpiniaceae
66.	<i>Bergia ammannioides</i>		Elatinaceae
67.	<i>Bergia suffruticosa</i>	Ropatri, Lavariyu	Elatinaceae
68.	<i>Bidens biternata</i>	Karakokdi, Samara kokdi	Asteraceae
69.	<i>Blainvillea acmella</i>	Dholu Foldu	Asteraceae
70.	<i>Blepharis linariaefolia</i>	Gokhru kandho	Acanthaceae
71.	<i>Blepharis maderaspatensis</i>		Acanthaceae
72.	<i>Blepharis repens</i>	Zinku Utingan	Acanthaceae
73.	<i>Blumea mollis</i>	Bhutaco, Chanchadmari	Asteraceae
74.	<i>Boerhavia chinensis</i>	Rafedi, Rafdial, Sanidhokriar	Nyctaginaceae
75.	<i>Boerhavia diffusa</i>	Satodi	Nyctaginaceae
76.	<i>Boerhavia elegans</i>		Nyctaginaceae
77.	<i>Boerhavia verticillata</i>	Zeri Satodo	Nyctaginaceae
78.	<i>Bombax ceiba</i>	Savar, Shimlo	Bombacaceae
79.	<i>Borreria articularis</i>	Ganthiyu, Kharsat Shankhalo	Rubiaceae
80.	<i>Borreria stricta</i>		Rubiaceae
81.	<i>Bothriochloa intermedia</i>	Dharfo, Sarvu	Poaceae
82.	<i>Bothriochloa pertusa</i>		Poaceae
83.	<i>Bouchea marrubifolia</i>		Verbenaceae
84.	<i>Bougainvillea glabra</i>	Boganvel	Nyctaginaceae
85.	<i>Butea monosperma</i>	Khakharo, Palash, Kesudo	Fabaceae
86.	<i>Bytneria herbacea</i>	Adbaupal, Hanjo	Sterculiaceae
87.	<i>Cadaba indica</i>	Batkani, Katikal	Capparaceae
88.	<i>Calotropis gigantea</i>	Akado	Asclepiadaceae
89.	<i>Calotropis procera</i>	Nano Akado	Asclepiadaceae
90.	<i>Campylanthus ramosissimus</i>		Scrophulariaceae
91.	<i>Capparis decidua</i>	Kerdo, Kera	Capparaceae
92.	<i>Capparis grandis</i>	Thikari, Dumro, Dumrejozodo	Capparaceae
93.	<i>Capparis sepiaria</i>	Kanthar, Kantharo	Capparaceae
94.	<i>Capparis spinosa</i>	Kavari	Capparaceae
95.	<i>Cardiospermum halicacabum</i>	Trigharivel, Valfofi	Sapindaceae
96.	<i>Carica papaya</i>	Papaiyu, Papita	Caricaceae
97.	<i>Carissa congesta</i>	Karamada	Apocynaceae
98.	<i>Caryota urens</i>	Shivjata	Arecaceae
99.	<i>Cassia absus</i>	Chimed, Chon	Caesalpiniaceae
100.	<i>Cassia angustifolia</i>	Son-Makkai	Caesalpiniaceae
101.	<i>Cassia auriculata</i>	Aval, Avari, Avar	Caesalpiniaceae
102.	<i>Cassia fistula</i>	Garmalo	Caesalpiniaceae
103.	<i>Cassia italica subsp. micrantha</i>	Mindhi, Aval, Pataval	Caesalpiniaceae
104.	<i>Cassia obtusifolia</i>	Kuvandio, Pochandio	Caesalpiniaceae
105.	<i>Cassia occidentalis</i>	Sundro, Vadisundri	Caesalpiniaceae
106.	<i>Cassia pumila</i>	Nidhecholjozad, Chimediyu	Caesalpiniaceae
107.	<i>Cassia spp.</i>		Caesalpiniaceae
108.	<i>Casuarina equisetifolia</i>	Saru	Casuarinaceae
109.	<i>Catharanthus pusillus</i>	Ubhi Shingani, Sheda Shingni	Apocynaceae
110.	<i>Catharanthus roseus</i>	Barmasi	Apocynaceae
111.	<i>Cayratia carnosa</i>	Khat-Khatumbo	Vitaceae
112.	<i>Celastrus paniculatus</i>	Malkagani, Malkankni	Celastraceae
113.	<i>Celosia argentea</i>	Lambdi, Lampdi	Amaranthaceae
114.	<i>Cenchrus biflorus</i>	Motu-Dharmanu	Poaceae
115.	<i>Cenchrus ciliaris</i>	Dhaman	Poaceae
116.	<i>Cenchrus setigerus</i>	Dharamnu, Dhamanu	Poaceae
117.	<i>Ceropegia bulbosa</i>	Kundher, Kund, Kundjimath	Asclepiadaceae
118.	<i>Chenopodium album</i>	Chil, Chilni, Bhaji	Chenopodiaceae

S. NO.	Scientific Name	Local Name	Family
119.	<i>Chloris barbata</i>	Mindadiu	Poaceae
120.	<i>Chloris montana</i>		Poaceae
121.	<i>Chlorophytum tuberosum</i>	Karli, Karliji bhaji	Liliaceae
122.	<i>Chrozophora rotleri</i>	Kalo okharad	Euphorbiaceae
123.	<i>Chrysopogon fulvus</i>	Draf, Khad-Sundhiu	Poaceae
124.	<i>Cissampelos pareira</i>	Venivel, Karandhiu, Phadvel	Menispermaceae
125.	<i>Cissus quadrangulare</i>	Hadsankal	Vitaceae
126.	<i>Cissus repanda</i>	Gandavelo	Vitaceae
127.	<i>Cistanche tubulosa</i>	Jogido	Orobanchaceae
128.	<i>Citrullus colocynthis</i>	Indravarna, Kokadavarna	Cucurbitaceae
129.	<i>Citrus medica</i>	Bijoru	Rutaceae
130.	<i>Cleome brachycarpa</i>		Capparaceae
131.	<i>Cleome burmanni</i>		Capparaceae
132.	<i>Cleome gracilis</i>		Capparaceae
133.	<i>Cleome gynandra</i>	Ghandhatu	Capparaceae
134.	<i>Cleome spp. 1</i>		Capparaceae
135.	<i>Cleome spp. 2</i>		Capparaceae
136.	<i>Cleome viscosa</i>	Pilitilvan	Capparaceae
137.	<i>Clerodendrum inerme</i>	Tapvel, Tappan	Verbenaceae
138.	<i>Clerodendrum phlomidis</i>	Arni	Verbenaceae
139.	<i>Clitoria ternatea</i>	Garni, Gokaran, Koyal, Bibli	Fabaceae
140.	<i>Coccinia grandis</i>	Ghiloda, Tindora, Tondli	Cucurbitaceae
141.	<i>Cocculus hirsutus</i>	Vevedi, Vevti, Vagval, Vadhi	Menispermaceae
142.	<i>Cocculus pendulus</i>	Orad, Valur, Parwatti	Menispermaceae
143.	<i>Coldenia procumbens</i>	Okhrad, Basario	Boraginaceae
144.	<i>Commelina albescens</i>	Shishmuliu	Commelinaceae
145.	<i>Commelina benghalensis</i>	Sishmuliu	Commelinaceae
146.	<i>Commelina diffusa</i>	Sishmuliu	Commelinaceae
147.	<i>Commelina forskalaei</i>	Shishmuliu	Commelinaceae
148.	<i>Commelina spp.</i>		Commelinaceae
149.	<i>Commiphora wightii</i>	Gugal	Burseraceae
150.	<i>Convolvulus arvensis</i>	Khetrau Phudardi, Veldi	Convolvulaceae
151.	<i>Convolvulus auricomus var. auricomus</i>	Ruchhad neri	Convolvulaceae
152.	<i>Convolvulus auricomus var. volubilis</i>		Convolvulaceae
153.	<i>Convolvulus microphyllus</i>	Shankhvali, Man	Convolvulaceae
154.	<i>Convolvulus rhyniospermus</i>		Convolvulaceae
155.	<i>Convolvulus stocksii</i>		Convolvulaceae
156.	<i>Corallocarpus conocarpus</i>		Cucurbitaceae
157.	<i>Corallocarpus epigeus</i>		Cucurbitaceae
158.	<i>Corbichonia decumbens</i>		Aizoaceae
159.	<i>Corchorus aestuans</i>	Chunch, Chhadhari	Tiliaceae
160.	<i>Corchorus depressus</i>	Bahu phali	Tiliaceae
161.	<i>Corchorus fascicularis</i>		Tiliaceae
162.	<i>Corchorus olitorius</i>	Kagagisodo, Gunpatdjo zad	Tiliaceae
163.	<i>Corchorus tridens</i>		Tiliaceae
164.	<i>Corchorus trilocularis</i>	Ubhi munderi	Tiliaceae
165.	<i>Cordia dichotoma</i>	Moto Gundo	Ehretiaceae
166.	<i>Cordia gharaf</i>	Liar Gundi, Nani Gundi	Ehretiaceae
167.	<i>Cordia sebestena</i>	Vilayati Gunda	Ehretiaceae
168.	<i>Crateva nurvala</i>	Vayvarno, Varno	Capparaceae
169.	<i>Cressa cretica</i>	Rudanti, Palio, Khariyu	Convolvulaceae
170.	<i>Crinum asiaticum</i>	Nagdaman	Amaryllidaceae
171.	<i>Crotalaria burhia</i>	Kharshan, Vagdaushan	Fabaceae
172.	<i>Crotalaria juncea</i>	Shun, Shan, Shaniyu	Fabaceae
173.	<i>Crotalaria leptostachya</i>		Fabaceae
174.	<i>Crotalaria orixensis</i>	Tripani Fatakoyo	Fabaceae
175.	<i>Croton bonplandianum</i>		Euphorbiaceae
176.	<i>Cryptostegia grandiflora</i>	Rabarvel	Asclepiadaceae
177.	<i>Ctenolepis cerasiformis</i>	Ankh Futmani	Cucurbitaceae
178.	<i>Cucumis callosus</i>	Kothimdu Gaivasukadan	Cucurbitaceae
179.	<i>Cucumis prophetarum</i>	Kantalo Indran	Cucurbitaceae
180.	<i>Cucumis setosus</i>		Cucurbitaceae
181.	<i>Cuscuta chinensis</i>	Amarvel	Cuscutaceae

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182.	<i>Cuscuta hyalina</i>		Cuscutaceae
183.	<i>Cuscuta reflexa</i>	Amarvel Anatvel	Cuscutaceae
184.	<i>Cyamopsis tetragonoloba</i>	Gawar, Guwar	Fabaceae
185.	<i>Cymbopogon martinii</i>	Rosha Ghas	Poaceae
186.	<i>Cymbopogon schoenanthus</i>		Poaceae
187.	<i>Cynodon dactylon</i>	Darabh	Poaceae
188.	<i>Cyperus bulbosus</i>		Cyperaceae
189.	<i>Cyperus haspan</i>	Needanmoth, Meecho	Cyperaceae
190.	<i>Cyperus spp. 1</i>		Cyperaceae
191.	<i>Cyperus spp. 2</i>		Cyperaceae
192.	<i>Cyperus spp. 3</i>		Cyperaceae
193.	<i>Cyperus squarrosus</i>		Cyperaceae
194.	<i>Cyperus triceps</i>		Cyperaceae
195.	<i>Dactyloctenium aegyptium</i>		Poaceae
196.	<i>Dactyloctenium indicum</i>		Poaceae
197.	<i>Dalechampia scandens</i>	Yarval, Aajval	Euphorbiaceae
198.	<i>Datura innoxia</i>	Kantalo Dhanturo	Solanaceae
199.	<i>Datura metel</i>	Ganthovalo, Dhanturo	Solanaceae
200.	<i>Derris indica</i>	Karanj	Fabaceae
201.	<i>Desmodium gangeticum var. gangeticum</i>		Fabaceae
202.	<i>Desmodium velutinum</i>		Fabaceae
203.	<i>Desmostachya bipinnata</i>	Dabh	Poaceae
204.	<i>Dichanthium spp.</i>		Poaceae
205.	<i>Dicoma tomentosa</i>	Pardeshi Kandheri	Asteraceae
206.	<i>Digera muricata</i>	Kanjro Lolar	Amaranthaceae
207.	<i>Digitaria adscendens</i>		Poaceae
208.	<i>Dipcadi erythraeum</i>	Jungli dongli	Liliaceae
209.	<i>Diplocylos palmatus</i>	Shivlingi	Cucurbitaceae
210.	<i>Dipteracanthus patulus</i>	Tutadi, Teetuli, Sisodi	Acanthaceae
211.	<i>Dipteracanthus spp.</i>		Acanthaceae
212.	<i>Dolichos biflorus</i>		Fabaceae
213.	<i>Echinochloa colonum</i>	Samo, Motujiriu	Poaceae
214.	<i>Echinops echinatus</i>	Shulio, Utkanto	Asteraceae
215.	<i>Eclipta prostrata</i>	Bhangaro	Asteraceae
216.	<i>Ehretia laevis</i>	Dantrango, Vadhwardi	Ehretiaceae
217.	<i>Eleusine indica</i>	Adhan nagli, Ukdo	Poaceae
218.	<i>Enicostemma axillare</i>	Zinku Kariyatu, Kadvinai	Gentianaceae
219.	<i>Ephedra foliata</i>		Ephedraceae
220.	<i>Eragrostis ciliaris</i>		Poaceae
221.	<i>Eragrostis spp.</i>		Poaceae
222.	<i>Eragrostis tenella</i>		Poaceae
223.	<i>Eucalyptus globulus</i>	Nilgiri	Myrtaceae
224.	<i>Euphorbia caducifolia</i>		Euphorbiaceae
225.	<i>Euphorbia elegans</i>		Euphorbiaceae
226.	<i>Euphorbia granulata</i>		Euphorbiaceae
227.	<i>Euphorbia hirta</i>	Vadi dudhi, Vadi rati dudhi	Euphorbiaceae
228.	<i>Euphorbia nivulia</i>	Thor	Euphorbiaceae
229.	<i>Euphorbia orbiculata</i>		Euphorbiaceae
230.	<i>Euphorbia thymifolia</i>	Chhapri dudhi, Chhirvel,	Euphorbiaceae
231.	<i>Euphorbia tirucalli</i>	Kharsani	Euphorbiaceae
232.	<i>Evolvulus alsinoides</i>	Kali Shankhawali	Convolvulaceae
233.	<i>Fagonia indica</i>	Dhamasha, Dharmau	Zygophyllaceae
234.	<i>Fagonia schweinfurthii</i>	Dhamaso	Zygophyllaceae
235.	<i>Farsetia jacquemontii</i>	Abdau aselio	Brassicaceae
236.	<i>Ficus benghalensis</i>	Vad	Moraceae
237.	<i>Ficus racemosa</i>	Umaro, Umbar, Gular	Moraceae
238.	<i>Ficus religiosa</i>	Piplo	Moraceae
239.	<i>Ficus spp.</i>	Pipli	Moraceae
240.	<i>Fimbristylis sieberiana</i>		Cyperaceae
241.	<i>Fimbristylis spp.1</i>		Cyperaceae
242.	<i>Fimbristylis spp.2</i>		Cyperaceae
243.	<i>Fumaria indica</i>	Pitapapdo	Fumariaceae
244.	<i>Gisekia pharmaceoides</i>		Molluginaceae

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245.	<i>Glinus lotoides</i>	Mitho Okharad	Molluginaceae
246.	<i>Glossocardia bosvallea</i>	Adbau Suva	Asteraceae
247.	<i>Gmelina arborea</i>	Sivan	Verbenaceae
248.	<i>Gomphrena globosa</i>	Gentleman's Button	Amaranthaceae
249.	<i>Goniogyna hirta</i>		Fabaceae
250.	<i>Gossypium herbaceum var. acerifolium</i>	Kapas, Desi Kapas	Malvaceae
251.	<i>Grewia abutilifolia</i>		Tiliaceae
252.	<i>Grewia flavescens</i>	Choghari gangi	Tiliaceae
253.	<i>Grewia tenax</i>	Nagbala, Gangeti	Tiliaceae
254.	<i>Grewia tiliaefolia</i>	Dhaman	Tiliaceae
255.	<i>Helichrysum cutchicum</i>		Asteraceae
256.	<i>Helicteres isora</i>	Maradsing, Ati, Aiti, Atai	Sterculiaceae
257.	<i>Heliotropium bacciferum</i>		Boraginaceae
258.	<i>Heliotropium marifolium</i>	Zinku Okhard	Boraginaceae
259.	<i>Heliotropium paniculatum</i>	Zumkhadu	Boraginaceae
260.	<i>Heliotropium rariflorum</i>		Boraginaceae
261.	<i>Heliotropium spp.</i>		Boraginaceae
262.	<i>Heliotropium subulatum</i>	Pilo Hathisundho	Boraginaceae
263.	<i>Heliotropium supinum</i>	Ghedio Okharad	Boraginaceae
264.	<i>Hemidesmus indicus</i>	Durivel, Uplasari	Asclepiadaceae
265.	<i>Heteropogon contortus</i>	Dabhsuliu, Kagadiu, Sukhli	Poaceae
266.	<i>Hibiscus hirtus</i>	Baporis	Malvaceae
267.	<i>Hibiscus lobatus</i>	Tali	Malvaceae
268.	<i>Hibiscus lunarifolius</i>		Malvaceae
269.	<i>Hibiscus ovalifolius</i>	Chanak bhindo	Malvaceae
270.	<i>Hibiscus palmatus</i>		Malvaceae
271.	<i>Hibiscus panduraeformis</i>		Malvaceae
272.	<i>Hibiscus spp.</i>		Malvaceae
273.	<i>Holoptelea integrifolia</i>	Kanjo, Papda, Audo-aodo	Ulmaceae
274.	<i>Hygrophila auriculata</i>	Kantashelio, Akaro, Akharo	Acanthaceae
275.	<i>Indigofera caerulea var. monosperma</i>	Gado, Gudo, Jangli gali	Fabaceae
276.	<i>Indigofera cordifolia</i>	Gadargari, Ridhgari	Fabaceae
277.	<i>Indigofera glabra</i>		Fabaceae
278.	<i>Indigofera hochstetteri</i>	Bethi gali	Fabaceae
279.	<i>Indigofera linifolia var. linifolia</i>	Jinkigali, Nahnigali	Fabaceae
280.	<i>Indigofera linnaei</i>	Fatakiya, Bhongyal	Fabaceae
281.	<i>Indigofera oblongifolia</i>	Zil, Ziladi, Zildo	Fabaceae
282.	<i>Indigofera sessiliflora</i>		Fabaceae
283.	<i>Indigofera tinctoria</i>	Gali, Nil, Gudi	Fabaceae
284.	<i>Ipomoea aquatica</i>	Narivel	Convolvulaceae
285.	<i>Ipomoea cairica</i>		Convolvulaceae
286.	<i>Ipomoea dasysperma</i>	Dipad vel	Convolvulaceae
287.	<i>Ipomoea dichroa</i>	Safed panwali fudaradi	Convolvulaceae
288.	<i>Ipomoea eriocarpa</i>	Bodi Fudardi	Convolvulaceae
289.	<i>Ipomoea fistulosa</i>	Nafatvel, Besharmi	Convolvulaceae
290.	<i>Ipomoea kotschyana</i>		Convolvulaceae
291.	<i>Ipomoea muricata</i>	Bhamardi, Gulabi gario	Convolvulaceae
292.	<i>Ipomoea nil</i>	Kalandana	Convolvulaceae
293.	<i>Ipomoea obscura</i>	Vad fudardi	Convolvulaceae
294.	<i>Ipomoea pes-caprae</i>	Maryad vel, Dariyani vel	Convolvulaceae
295.	<i>Ipomoea pes-tigridis</i>	Photial Wagpadi	Convolvulaceae
296.	<i>Ipomoea quamoclit</i>	Ganesh vel	Convolvulaceae
297.	<i>Ipomoea triloba</i>	Nani fudardi	Convolvulaceae
298.	<i>Jatropha gossypifolia</i>		Euphorbiaceae
299.	<i>Justicia heterocarpa</i>		Acanthaceae
300.	<i>Justicia procumbens</i>	Pittpapdo, Rati manjrado	Acanthaceae
301.	<i>Justicia simplex</i>		Acanthaceae
302.	<i>Justicia spp.1</i>		Acanthaceae
303.	<i>Justicia spp.2</i>		Acanthaceae
304.	<i>Justicia spp.3</i>		Acanthaceae
305.	<i>Kalanchoe pinnatum</i>	Panfuti, Life plant	Bryophyllaceae
306.	<i>Kickxia ramossissima</i>	Bhini ghilodi, Bhini chat	Scrophulariaceae
307.	<i>Kirganelia reticulata</i>		Euphorbiaceae

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308.	<i>Kohautia aspera</i>		Rubiaceae
309.	<i>Lactuca runcinata</i>		Asteraceae
310.	<i>Lagenaria leucantha</i>	Duthie, Kadri tunedi	Cucurbitaceae
311.	<i>Lamnea coromandelica</i>	Madhol, Modhad, Miniyo	Anacardiaceae
312.	<i>Lantana camara</i>	Indradhanu	Verbenaceae
313.	<i>Lantana salvifolia</i>		Verbenaceae
314.	<i>Launaea procumbens</i>	Moti bhonpatri	Asteraceae
315.	<i>Launaea sarmentosa</i>	Bhonpatri, Nani bhonpatri	Asteraceae
316.	<i>Lawsonia inermis</i>	Mehndi	Lythraceae
317.	<i>Lepidagathis cristata</i>		Acanthaceae
318.	<i>Lepidagathis trinervis</i>	Harancharo, Paniru	Acanthaceae
319.	<i>Leptadenia pyrotechnica</i>	khip, Ranser	Asclepiadaceae
320.	<i>Leptadenia reticulata</i>	Dodi, Khirdodi, Nani Dodi	Asclepiadaceae
321.	<i>Leucaena latisiliqua</i>	Pardesi baval, Losobaval, Vilayati baval	Mimosaceae
322.	<i>Leucas aspera</i>	Kubi	Lamiaceae
323.	<i>Leucas cephalotes</i>	Khetrau kubo, Dosinokubo	Lamiaceae
324.	<i>Leucas longifolia</i>		Lamiaceae
325.	<i>Leucas urticaefolia</i>	Kubo	Lamiaceae
326.	<i>Limonia acidissima</i>	Kotha	Rutaceae
327.	<i>Lindenbergia muraria</i>	Pirsadedi, Zamarval	Scrophulariaceae
328.	<i>Lotus garcini</i>	Kamal	Fabaceae
329.	<i>Luffa acutangula</i>	Jangli Turiya	Cucurbitaceae
330.	<i>Luffa cylindrica</i>	Galku	Cucurbitaceae
331.	<i>Lupinus albus</i>		Fabaceae
332.	<i>Lycium barbarum</i>	Taleti	Solanaceae
333.	<i>Lycopersicon lycopersicum</i>	Tameta, Tamata	Solanaceae
334.	<i>Maerua oblongifolia</i>	Hemkand	Capparaceae
335.	<i>Mangifera indica</i>	Aambo, Keri, Aam	Anacardiaceae
336.	<i>Marsilea spp.</i>		Marsileaceae
337.	<i>Maytenus emarginata</i>	Vico, Vickdo	Celastraceae
338.	<i>Medicago sativa</i>	Lachko, Rajko	Fabaceae
339.	<i>Melanocentris jacquemontii</i>		Poaceae
340.	<i>Melhania magnifolia</i>	Adbau Khapa	Sterculiaceae
341.	<i>Melia azaderach</i>	Bakanlimdo, Bakan Nimb	Meliaceae
342.	<i>Merremia aegyptia</i>	Panch pan ni fudardi	Convolvulaceae
343.	<i>Merremia gangetica</i>	Undardi, Undarkani, Undari	Convolvulaceae
344.	<i>Merremia tridentata</i>	Bhinigario	Convolvulaceae
345.	<i>Mimosa hamata</i>	Kasi, Kaibaval	Mimosaceae
346.	<i>Mirabilis jalapa</i>	Gulbas, 4' clock plant	Nyctaginaceae
347.	<i>Mollugo nudicaulis</i>		Molluginaceae
348.	<i>Mollugo pentaphylla</i>		Molluginaceae
349.	<i>Momordica denudata</i>	Kantol, Kantol jeeval	Cucurbitaceae
350.	<i>Monsonia senegalensis</i>	Rati fuldi	Geraniaceae
351.	<i>Monstera deliciosa</i>	Shurpankha	Araceae
352.	<i>Moringa concanensis</i>	Jangli Sargu, Saragavo	Moringaceae
353.	<i>Moringa oleifera</i>	Saragvo, Mittho saragvo	Moringaceae
354.	<i>Mukia maderaspatana</i>	Chanak-Chibhdi	Cucurbitaceae
355.	<i>Musa paradisiaca</i>	Kela	Musaceae
356.	<i>Najas minor</i>		Najadaceae
357.	<i>Nelumbo nucifera</i>	Vado Kamalful, Kamal	Nymphaeaceae
358.	<i>Nerium indicum</i>	Lal karen	Apocynaceae
359.	<i>Nicandra physaloides</i>		Solanaceae
360.	<i>Nothosaerva brachiata</i>		Amaranthaceae
361.	<i>Nymphaea pubescens</i>	Kamal, Kamudani	Nymphaeaceae
362.	<i>Ocimum americanum</i>	Tukmariya, Jungli tulsi	Lamiaceae
363.	<i>Ocimum basilicum</i>	Damro, Maruo, Sbjjo	Lamiaceae
364.	<i>Ocimum gratissimum</i>	Ram Tulsi, Mala Tulsi	Lamiaceae
365.	<i>Ocimum sanctum subsp.-?</i>	Shyam Tulsi	Lamiaceae
366.	<i>Oldenlandia affinis</i>		Rubiaceae
367.	<i>Oldenlandia corymbosa</i>	Parpat, Parpapti	Rubiaceae
368.	<i>Oligochaeta ramosa</i>		Asteraceae
369.	<i>Opuntia elatior</i>	Fafda thor	Cactaceae

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370.	<i>Oxalis corniculata</i>	Changeri, Navari	Oxalidaceae
371.	<i>Pandanus odoratissimus</i>	Kevdo	Pandanaceae
372.	<i>Panicum antidotale</i>	Dhun, Dhunsado	Poaceae
373.	<i>Panicum maximum</i>	Gini-Ghas	Poaceae
374.	<i>Panicum spp.</i>	Sanu takriyo	Poaceae
375.	<i>Parkinsonia aculeata</i>	Rambaval	Caesalpinaceae
376.	<i>Parthenium hysterophorus</i>		Asteraceae
377.	<i>Passiflora caerulea</i>	Krishnakamal	Passifloraceae
378.	<i>Pavetta crassicaulis</i>	Papat	Rubiaceae
379.	<i>Pavonia arabica var. arabica</i>	Ratobalbuvaro	Malvaceae
380.	<i>Pavonia ceratocarpa</i>	Karandia, Khatumbdejo,	Malvaceae
381.	<i>Pavonia procumbens</i>	Adavia, Adalio	Malvaceae
382.	<i>Pavonia zeylanica</i>		Malvaceae
383.	<i>Pedaliium murex</i>	Ubhu gokharu	Pedaliaceae
384.	<i>Pentatropis spiralis</i>	Shingroti	Asclepiadaceae
385.	<i>Pergularia daemia</i>	Chamar dudheli	Asclepiadaceae
386.	<i>Periploca aphylla</i>	Singdio, Rati-khip, Hom	Periplocaceae
387.	<i>Peristrophe paniculata</i>	Adhedi, Lisi adhedi	Acanthaceae
388.	<i>Phyllanthus fraternus</i>	Bhonyamli	Euphorbiaceae
389.	<i>Phyllanthus virgatus</i>	Moti bhonyamli	Euphorbiaceae
390.	<i>Physalis minima</i>	Popti, Parpopti	Solanaceae
391.	<i>Pithecellobium dulce</i>	Goras amla	Mimosaceae
392.	<i>Pluchea arguta</i>		Asteraceae
393.	<i>Plumbago zeylanica</i>	Chitrak, Chitro	Plumbaginaceae
394.	<i>Plumeria rubra</i>	Khadchampo	Apocynaceae
395.	<i>Polycarpaea corymbosa</i>	Jangli soa, Rupa puli	Caryophyllaceae
396.	<i>Polycarpaea spicata</i>	Chhogaro, Vajradanti	Caryophyllaceae
397.	<i>Polygala chinensis</i>		Polygalaceae
398.	<i>Polygala erioptera</i>	Patsan, Bhonyasan	Polygalaceae
399.	<i>Polygala irregularis</i>		Polygalaceae
400.	<i>Polygonum glabrum</i>		Polygonaceae
401.	<i>Polygonum plebeium</i>		Polygonaceae
402.	<i>Portulaca oleracea</i>	Ghol	Portulacaceae
403.	<i>Portulaca quadrifida</i>	Zini luni, Patluni, Sunluni,	Portulacaceae
404.	<i>Portulaca tuberosa</i>	Idar	Portulacaceae
405.	<i>Potamogeton pectinatus</i>		Potamogetonaceae
406.	<i>Pouzolzia zeylanica</i>		Urticaceae
407.	<i>Premna resinosa</i>	Kundher	Verbenaceae
408.	<i>Premna spp.</i>		Verbenaceae
409.	<i>Prosopis chilensis</i>	Gando Baval	Mimosaceae
410.	<i>Prosopis cineraria</i>	Khijado, Shami	Mimosaceae
411.	<i>Psidium guajava</i>	Jamphal	Myrtaceae
412.	<i>Psoralea corylifolia</i>	Gawar, Bavachi	Fabaceae
413.	<i>Psoralea plicata</i>	Kapurio	Fabaceae
414.	<i>Pulicaria wightiana</i>	Sonfulki, Sisoria, Sonasalia	Asteraceae
415.	<i>Pupalia lappacea</i>	Bhurat, Gadar bhurat	Amaranthaceae
416.	<i>Rhus mysurensis</i>	Dasan, Davan, Dasarni	Anacardiaceae
417.	<i>Rhynchosia minima var. laxiflora</i>	Dariavel	Fabaceae
418.	<i>Rhynchosia minima var. minima</i>	Nahnkamalvel	Fabaceae
419.	<i>Ricinus communis</i>	Diveli, Divelio	Euphorbiaceae
420.	<i>Rivea hypocrateriformis</i>	Fang	Convolvulaceae
421.	<i>Rosa spp.</i>	Gulab	Rosaceae
422.	<i>Ruellia tuberosa</i>	Bandhukadi	Acanthaceae
423.	<i>Rungia repens</i>		Acanthaceae
424.	<i>Salicornia brachiata</i>		Chenopodiaceae
425.	<i>Salsola baryosma</i>		Chenopodiaceae
426.	<i>Salvadora oleoides</i>	Piludi	Salvadoraceae
427.	<i>Salvadora persica</i>	Pilvo, Piludi	Salvadoraceae
428.	<i>Salvia santolinaefolia</i>		Lamiaceae
429.	<i>Sapindus emerginatus</i>	Aritha	Sapindaceae
430.	<i>Sarcostemma acidum</i>	Som	Asclepiadaceae
431.	<i>Schweinfurthia papilionacea</i>	Sanipat	Scrophulariaceae
432.	<i>Scirpus spp.1</i>		Cyperaceae

S. NO.	Scientific Name	Local Name	Family
433.	<i>Securinega leucopyrus</i>	Chhini, Thumari, Shenvi	Euphorbiaceae
434.	<i>Seddera latifolia</i>		Convolvulaceae
435.	<i>Senra incana</i>		Malvaceae
436.	<i>Sericostoma pauciflorum</i>	Karvas	Ehretiaceae
437.	<i>Sesamum indicum</i>	Tal	Pedaliaceae
438.	<i>Sesbania bispinosa</i>	Ikad	Fabaceae
439.	<i>Sesbania cannabina</i>	Lisikad	Fabaceae
440.	<i>Sesuvium portulacastrum</i>		Aizoaceae
441.	<i>Sesuvium sesuvioides</i>		Aizoaceae
442.	<i>Setaria glauca</i>		Poaceae
443.	<i>Setaria tomentosa</i>	Chiktu, Kutri	Poaceae
444.	<i>Setaria verticillata</i>	Chipatiu-Motu	Poaceae
445.	<i>Sida acuta</i>	Bala	Malvaceae
446.	<i>Sida alba</i>	Kantalobala	Malvaceae
447.	<i>Sida cordata</i>	Bhoyabala, Nidhidhatuval	Malvaceae
448.	<i>Sida cordifolia</i>	Bala, Baldana, Kharenti	Malvaceae
449.	<i>Sida ovata</i>		Malvaceae
450.	<i>Sida tiagii</i>		Malvaceae
451.	<i>Siegesbeckia orientalis</i>	Pilibadkadi	Asteraceae
452.	<i>Solanum albicule</i>		Solanaceae
453.	<i>Solanum incanum</i>	Ubhi Ringni	Solanaceae
454.	<i>Solanum indicum</i>	Ubhi Ringni, Vadringni, Dorili	Solanaceae
455.	<i>Solanum nigrum</i>	Piludi	Solanaceae
456.	<i>Solanum surattense</i>	Bhoringni, Bhoyringni	Solanaceae
457.	<i>Sonchus oleraceus</i>	Dudhli Sonki	Asteraceae
458.	<i>Sorghum halepense</i>	Baru, Barua	Poaceae
459.	<i>Spergula arvensis</i>		Caryophyllaceae
460.	<i>Sphaeranthus senegalensis</i>	Gorakh mundi, Bhurandi	Asteraceae
461.	<i>Spirodela polyrrhiza</i>		Lemnaceae
462.	<i>Sporobolus spp.</i>		Poaceae
463.	<i>Sterculia urens</i>	Kadai,	Sterculiaceae
464.	<i>Sterculia villosa</i>	Sardol	Sterculiaceae
465.	<i>Striga angustifolia</i>	Dholo agiyo	Scrophulariaceae
466.	<i>Striga asiatica</i>	Agiyo	Scrophulariaceae
467.	<i>Striga densiflora</i>	Agiyo	Scrophulariaceae
468.	<i>Striga gesneroides</i>	Rato agiyo	Scrophulariaceae
469.	<i>Suaeda fruticosa</i>	Khari luni ni bhaji	Chenopodiaceae
470.	<i>Suaeda maritima</i>	Luno, Lano	Chenopodiaceae
471.	<i>Suaeda nudiflora</i>	Moras	Chenopodiaceae
472.	<i>Syzygium cumini</i>	Jambu	Myrtaceae
473.	<i>Syzygium spp.</i>		Myrtaceae
474.	<i>Tamarindus indica</i>	Amlı	Caesalpiniaceae
475.	<i>Tamarix aphylla</i>	Lai	Tamaricaceae
476.	<i>Tamarix ericoides</i>		Tamaricaceae
477.	<i>Tamarix spp.</i>		Tamaricaceae
478.	<i>Tamarix troupii</i>		Tamaricaceae
479.	<i>Taverniera cuneifolia</i>	Jethimadh, Jethimal	Fabaceae
480.	<i>Tecomella undulata</i>	Ragat rohido, Roydo, Rohido	Bignoniaceae
481.	<i>Tephrosia collina var. lanuginocarpa</i>		Fabaceae
482.	<i>Tephrosia hamiltonii</i>		Fabaceae
483.	<i>Tephrosia pauciflora</i>	Vitho Sarpankho	Fabaceae
484.	<i>Tephrosia purpurea</i>	Sarpankho	Fabaceae
485.	<i>Tephrosia senticosa</i>		Fabaceae
486.	<i>Tephrosia spp.</i>		Fabaceae
487.	<i>Tephrosia strigosa</i>		Fabaceae
488.	<i>Tephrosia tinctoria</i>		Fabaceae
489.	<i>Tephrosia uniflora subsp. Petrosa</i>		Fabaceae
490.	<i>Teramnus labialis</i>		Fabaceae
491.	<i>Terminalia spp.</i>		Combretaceae
492.	<i>Thespesia populnea</i>	Paras piplo, Pardeshi bhindi	Malvaceae
493.	<i>Thevetia peruviana</i>	Pili Karen	Apocynaceae
494.	<i>Tinospora cordifolia</i>	Gulvel, Gadu, Gudaj	Menispermaceae
495.	<i>Tragus biflorus</i>	Vandariu ghas	Poaceae

S. NO.	Scientific Name	Local Name	Family
496.	<i>Trianthema portulacastrum</i>	Satodo	Aizoaceae
497.	<i>Trianthema triquetra</i>	Satodi	Aizoaceae
498.	<i>Tribulus pentandrus</i>		Zygophyllaceae
499.	<i>Tribulus rajasthanensis</i>		Zygophyllaceae
500.	<i>Tribulus terrestris</i>	Bethu, Gokhru, Mithu gokhru, Akanti	Zygophyllaceae
501.	<i>Trichodesma amplexicaule</i>	Undha fuli, Agiya kharsan	Boraginaceae
502.	<i>Trichodesma indicum</i>	Undha fuli, Agiya kharsan	Boraginaceae
503.	<i>Tricholepis amplexicaulis</i>	Ubho Mulo	Asteraceae
504.	<i>Trichosanthes cucumerina</i>	Jangli parval	Cucurbitaceae
505.	<i>Tridax procumbens</i>	Pardesi bhangaro	Asteraceae
506.	<i>Trigonella foenum-graecum</i>	Bhaji, Methi	Fabaceae
507.	<i>Triumfetta pentandra</i>		Tiliaceae
508.	<i>Triumfetta rhomboidea</i>	Bhurati, Japati	Tiliaceae
509.	<i>Triumfetta rotundifolia</i>	Zipti, Gol zipti	Tiliaceae
510.	<i>Triumfetta spp.</i>		Tiliaceae
511.	<i>Typha angustata</i>	Gha bajriyo, Bant, Band, Kalpan	Typhaceae
512.	<i>Typha spp.</i>		Typhaceae
513.	<i>Urginea indica</i>	Jangli dungli, Jangli pyaz	Liliaceae
514.	<i>Urochondra setulosa</i>		Poaceae
515.	<i>Vallisneria spiralis</i>		Hydrocharitaceae
516.	<i>Verbascum chinense</i>	Kalhar, Kolhala, Kutki	Scrophulariaceae
517.	<i>Vernonia anthelmintica</i>	Kalijiri	Asteraceae
518.	<i>Vernonia cinerascens</i>	Vadi sadebi	Asteraceae
519.	<i>Vernonia cinerea</i>	Sahadevi, Sadedi	Asteraceae
520.	<i>Vicoa indica</i>	Sonasali	Asteraceae
521.	<i>Vigna radiata var. sublobata</i>	Jangli mug, Adbau mug	Fabaceae
522.	<i>Vigna trilobata</i>		Fabaceae
523.	<i>Viola cinerea var stocksii</i>	Banafsa	Violaceae
524.	<i>Wattakaka volubilis</i>	Dodi, Motidodi, Malti	Asclepiadaceae
525.	<i>Wrightia spp.</i>		Apocynaceae
526.	<i>Zizyphus mauritiana</i>	Bor, Boadi, Bordi, Borjo zad	Rhamnaceae
527.	<i>Zizyphus nummularia</i>	Chani bor, Chania bor, Palia	Rhamnaceae
528.	<i>Zornia gibbosa</i>	Samarapani	Fabaceae
529.	<i>Zygophyllum simplex</i>	Patlani, Atheli, Alethi	Zygophyllaceae

The list is compiled from different sources and based on recent surveys of GUIDE.

Annexure 3.2a

Invertebrate Faunal Diversity of Kachchh

Sr. No.	Species#	Status*	Area Recorded #
	PROTOZOA		
1.	<i>Acanthocystis spinibera</i>	C	WAS
2.	<i>Amoeba proteus</i>	C	WAS
3.	<i>Arcella vulgaris</i>	R	WAS
4.	<i>Chlamydomonas hirtus</i> var. <i>minor</i>	R	WAS
5.	<i>Chrysamoeba</i> sp.	R	WAS
6.	<i>Colleps hirtus</i>	C	WAS
7.	<i>Euglena acus</i>	R	WAS
8.	<i>Euglena caudate</i>	C	WAS
9.	<i>Euglena. Mutabilis</i>	C	WAS
10.	<i>Euglena. Spirogyra</i>	C	WAS
11.	<i>Glaucoma pyrajormis</i>	C	WAS
12.	<i>Loxodes strictus</i>	C	WAS
13.	<i>Ophryoglena flava</i>	R	WAS
14.	<i>Paramoecium bursaria</i>	R	WAS
15.	<i>Paramoecium caudatum</i>	R	WAS
16.	<i>Stentor coeruleus</i>	R	WAS
	PHYLUM-PORIFERA		
17.	<i>Adocia</i> sp.	C	GK
18.	<i>Tetilla dactyloidea</i>	C	GK
	COELENTERATA		
19.	<i>Anemonia</i> sp.	C	GK
20.	<i>Anthopleura</i> sp.	C	GK
21.	<i>Bunodactis</i> sp.	C	GK
22.	<i>Metapeachia</i> sp.	C	GK
23.	<i>Paracondylactis</i> sp.	C	GK
24.	<i>Stoichactis gigantum</i>	C	GK
25.	<i>Plumularia badia</i>	C	GK
26.	<i>Sertularia rugosissima</i>	C	GK
27.	<i>Cerianthus</i> sp.	C	GK
	ROTIFERA		
28.	<i>Brachionus rubens</i>	R	WAS
	NEMATOHELMINTHES		
29.	<i>Dugesia</i> sp.	R	WAS
30.	<i>Rhabditis cranganorensis</i>	R	WAS
	ANNELIDA		
31.	<i>Glycera</i> sp.	C	GK, KC
32.	<i>Heteromastus</i> sp.	C	GK
33.	<i>Perinereis</i> sp.	C	GK
34.	<i>Glyphidrilus tuberosus</i>	NC	LRK
35.	<i>Perionyx excavatus</i>	NC	LRK
36.	<i>Glossiphonia</i> sp.	C	LRK
	ARTHROPODA		
37.	<i>Daphnia</i> sp.	R	WAS
38.	<i>Balanus amphitrite</i>	C	GK, KC
39.	<i>Balanus tintinabulum</i>	C	GK
40.	<i>Balanus balanoidus</i>	C	GK, KC
41.	<i>Acetes indicus</i>	C	KN
42.	<i>Cyclops</i> sp.	C	WAS
43.	<i>Cypris</i> sp.	C	WAS
44.	<i>Emerita</i> sp.	C	GK, KC
45.	<i>Exhippolysmata ensirostris</i>	C	KN
46.	<i>Exopalaemon styliferus</i>	C	KN
47.	<i>Lucifer</i> sp.	C	KN
48.	<i>Macrobrachium</i> sp.	C	GK
49.	<i>Matuta planipus</i>	C	GK

Sr. No.	Species#	Status*	Area Recorded #
50.	<i>Metapenaeus affinis</i>	C	KN
51.	<i>Metapenaeus dobsoni</i>	C	KN
52.	<i>Metapenaeus kutchensis</i>	C	KN
53.	<i>Nematopalaemon sp.</i>	C	KN
54.	<i>Neopisesarma mederi</i>	C	GK, KC
55.	<i>Ocypoda ceratophthalma</i>	C	GK
56.	<i>Pagurid diogenes</i>	C	KN
57.	<i>Palaemon sp.</i>	C	WAS
58.	<i>Panaeus merguiensis</i>	C	KN
59.	<i>Parapenaeopsis sculptilis</i>	C	KN
60.	<i>Parapenaeopsis stylifera</i>	C	KN
61.	<i>Penaeus indicus</i>	C	GK
62.	<i>Squilla sp.</i>	C	GK
63.	<i>Macrophthalmus depressus</i>	C	GK, KC
64.	<i>Metapograpsus messor</i>	C	p, q, r, s
65.	<i>Metapograpsus maculates</i>	C	GK, KC
66.	<i>Nanosesarma minutum</i>	C	GK
67.	<i>Uca lacteal annulipes</i>	C	GK, KC
68.	<i>Portunus palagicus</i>	C	GK, KC
69.	<i>Scylla serrata</i>	R	WAS
70.	<i>Clibanarius longitarsus</i>	C	GK, KC
71.	<i>Diogenes sp.</i>	C	KN
72.	<i>Periopthalmus sp.</i>	C	KN
73.	<i>Polydesmus sp.</i>	NC	LRK
74.	<i>Arctosa khudiensis</i>	UC	WAS, NSS
75.	<i>Arctosa mulani</i>	C	WAS
76.	<i>Cheiracanthium sp.</i>	C	NSS
77.	<i>Clubiona sp.</i>	UC	NSS, WAS
78.	<i>Decobius putus</i>	C	WAS
79.	<i>Evippa praelongensis</i>	C	WAS
80.	<i>Evippa shivajiai</i>	C	WAS
81.	<i>Gnaphosa sp.</i>	UC	NSS
82.	<i>Hippasa madhuae</i>	UC	NSS
83.	<i>Hippasa pisanrina</i>	C	WAS
84.	<i>Hippasa pisauritra</i>	C	NSS
85.	<i>Larinia chloris</i>	C	NSS
86.	<i>Marpissa sp.</i>	C	NSS
87.	<i>Neoscona bengalensis</i>	UC	NSS
88.	<i>Neoscona rumphi</i>	C	NSS
89.	<i>Neoscona tuberculatus</i>	C	WAS
90.	<i>Nephila maculata</i>	NC	LRK
91.	<i>Olios sp.</i>	R	NSS
92.	<i>Oxyopes wroughtoni</i>	NC	LRK
93.	<i>Pardosa birmanica</i>	C	WAS
94.	<i>Pardosa annanchela</i>	C	WAS
95.	<i>Pardosa annandalai</i>	C	WAS, NSS
96.	<i>Pardosa birmanica</i>	C	WAS, NSS
97.	<i>Pardosa sumatrana</i>	C	WAS
98.	<i>Pardosa sutjherlandi</i>	UC	WAS, NSS
99.	<i>Pardosa. Fletcheri</i>	C	WAS
100.	<i>Pardosa. Sumatrana</i>	C	WAS, NSS
101.	<i>Phidippus sp.</i>	C	NSS
102.	<i>Plexyppus payakullii</i>	C	NSS
103.	<i>Sahastata ashapuriae</i>	R	NSS
104.	<i>Storena sp.</i>	UC	NSS
105.	<i>Tetragnatha fletcheri</i>	C	WAS
106.	<i>Tibellus pashanensis</i>	UC	NSS
107.	<i>Tibellus poonaensis</i>	UC	NSS
108.	<i>Trochosa sp.</i>	C	WAS, NSS
109.	<i>Uloborous olivacea</i>	C	WAS
110.	<i>Xysticus sp.</i>	C	WAS
111.	<i>Lycosa madani</i>	C	WAS

Sr. No.	Species#	Status*	Area Recorded #
112.	<i>Lycosa moulmeinensis</i>	C	WAS
113.	<i>Lycosa wronghtoni</i>	C	WAS
114.	<i>Lycosa. Madhuae</i>	C	WAS
115.	<i>Lycosa. Nigrotibialis</i>	UC	WAS, NSS
116.	<i>Heterasmetrus phipsoni</i>	NC	LRK
117.	<i>Heterasmetrus swammerdami</i>	NC	LRK
118.	<i>Mesobuthus temulus temulus</i>	NC	LRK
119.	<i>Ranatra elongata</i>	C	WAS
120.	<i>Laccotrephes maculatus</i>	C	WAS
121.	<i>Trombidium gigas</i>	NC	LRK
122.	<i>Anaphaeis aurota</i>	C	NSS
123.	<i>Apharitis acamas</i>	C	NSS
124.	<i>Ariadne ariadne</i>	C	NSS
125.	<i>Atrophanaura aristolochiae</i>	VC	NSS
126.	<i>Azanus ubaldus</i>	C	NSS
127.	<i>Byblia ilithyia</i>	C	NSS
128.	<i>Catochrysops strabo</i>	C	NSS
129.	<i>Catopsilia pomona</i>	VC	NSS
130.	<i>Catopsilia crocale</i>	VC	NSS
131.	<i>Colotis amata</i>	VC	NSS
132.	<i>Colotis danae</i>	VC	NSS
133.	<i>Colotis etrida</i>	VC	NSS
134.	<i>Colotis eucharis</i>	VC	NSS
135.	<i>Colotis vestalis</i>	VC	NSS
136.	<i>Danus chrysippus</i>	VC	NSS
137.	<i>Euchrysops cnejus</i>	C	NSS
138.	<i>Euchrysops parrhasius</i>	C	NSS
139.	<i>Eurema hecabe</i>	VC	NSS
140.	<i>Eurema laeta</i>	VC	NSS
141.	<i>Ixias marinne</i>	C	NSS
142.	<i>Ixias pyrene</i>	C	NSS
143.	<i>Papilio demoleus</i>	C	LRK, NSS
144.	<i>Papilio lomedon</i>	C	LRK
145.	<i>Pieris brassicae</i>	C	WAS
146.	<i>Precis almana</i>	C	NSS
147.	<i>Precis hierta</i>	VC	NSS
148.	<i>Precis orithya</i>	VC	NSS
149.	<i>Rapala airbus</i>	C	NSS
150.	<i>Spialla galba</i>	C	NSS
151.	<i>Spindasis vulcanus</i>	C	NSS
152.	<i>Syntarucus jesous</i>	C	NSS
153.	<i>Syntarucus plinius</i>	C	NSS
154.	<i>Tarucus nara</i>	C	NSS
155.	<i>Zizeeria sp.</i>	C	NSS
156.	<i>Zizula galka</i>	C	NSS
157.	<i>Amasacta moorrei</i>	C	WAS
158.	<i>Pseudoshinx discistriga</i>	C	LRK
159.	<i>Blatta germanica</i>	C	LRK, WAS
160.	<i>Periplaneta americana</i>	C	LRK WAS
161.	<i>Procerus ramamurthy</i>	C	WAS
162.	<i>Gryllodes sp.</i>	C	WAS
163.	<i>Modycogryllus sp.</i>	C	WAS
164.	<i>Gryllus domesticus</i>	C	LRK, WAS
165.	<i>Gryllus bimaculatus</i>	C	LRK, WAS
166.	<i>Acrida sp.</i>	C	WAS
167.	<i>Chrotoganus trachypterus</i>	C	WAS
168.	<i>Anacridium rubrispinum</i>	C	WAS
169.	<i>Locusta migratoria</i>	C	WAS
170.	<i>Humbertiella indica</i>	C	WAS
171.	<i>Apis florae</i>	NC	Kachchh
172.	<i>Apis indica</i>	NC	Kachchh
173.	<i>Apis dorsata</i>	NC	Kachchh
174.	<i>Apis millifera</i>	C	WAS

Sr. No.	Species#	Status*	Area Recorded #
175.	<i>Larrea sp.</i>	C	WAS
176.	<i>Xylocopa aestuans</i>	C	LRK
177.	<i>Camponotus compressus</i>	VC	LRK, WAS
178.	<i>Oecophylla smaragdina</i>	VC	LRK, WAS
179.	<i>Microtermes obesi</i>	C	LRK
180.	<i>Odontotermes obesus</i>	C	LRK
181.	<i>Odontotermes parvidens</i>	C	WAS
182.	<i>Anopheles elegans</i>	VC	LRK, WAS
183.	<i>Anopheles stephensi</i>	VC	LRK, WAS
184.	<i>Culex fatigans</i>	VC	LRK, WAS
185.	<i>Musca domestica</i>	C	LRK, WAS
186.	<i>Hydaticus faricil</i>	C	WAS
187.	<i>Hydrophilus olivaceus</i>	C	WAS
188.	<i>Dysdercus cigulatus</i>	C	WAS
189.	<i>Diplacodes trivialis</i>	C	WAS
190.	<i>Gerris sp.</i>	C	WAS
191.	<i>Labidura riparia</i>	C	WAS
192.	<i>Myrmelon contractus</i>	C	WAS
193.	<i>Ceutorotus cornutus</i>	C	WAS
	MOLLUSCA		
194.	<i>Anadara antiquata</i>	C	WAS
195.	<i>Ariophanta bajadera</i>	C	WAS
196.	<i>Ariophanta solata</i>	C	LRK, WAS, GK
197.	<i>Assiminea sp.</i>	C	GK, KC
198.	<i>Bellamyia dissimilis</i>	C	WAS
199.	<i>Bythinia stenothyroides</i>	C	WAS
200.	<i>Cassidula sp.</i>	C	GK, KC
201.	<i>Cerithedia (Cerithideopsis) cingulata</i>	C	WAS
202.	<i>Cerithium obtusa</i>	C	GK
203.	<i>Cerithium scabridum</i>	C	GK
204.	<i>Chiton sp.</i>	C	GK
205.	<i>Indoplanorbis exustus</i>	C	WAS
206.	<i>Lamellidens sp.</i>	C	LRK, WAS, GK
207.	<i>Littorina scabra</i>	C	GK, KC
208.	<i>Lymnaea (Pseudosuccinea) luteola</i>	C	WAS
209.	<i>Melampus sp.</i>	C	GK, KC
210.	<i>Mellania striatella luberculata</i>	C	WAS
211.	<i>Meretrix sp.</i>	C	WAS
212.	<i>Nassa dorsata</i>	C	GK, KC
213.	<i>Nassa stolata</i>	C	GK
214.	<i>Natica tigrina</i>	C	WAS
215.	<i>Onchidium verruculatum</i>	C	GK, KC
216.	<i>Opeas gracile</i>	C	LRK, WAS, GK
217.	<i>Planaxis sulcatus</i>	C	GK, KC
218.	<i>Planorbis exustus</i>	C	LRK, WAS, GK
219.	<i>Polinices sp.</i>	C	GK, KC
220.	<i>Pyrene sp.</i>	C	GK, KC
221.	<i>Telescopium telescopium</i>	C	GK, KC
222.	<i>Thais lacera</i>	C	WAS
223.	<i>Thais rugosa</i>	C	GK
224.	<i>Thiara (Melanoides) tuberculata</i>	C	WAS
225.	<i>Vivipara dissimilis</i>	C	WAS
226.	<i>Zootecus insularis</i>	C	WAS
227.	<i>Andora rhombea</i>	C	GK, KC
228.	<i>Angulus sigualta</i>	C	KC
229.	<i>Bankia rochii</i>	C	GK, KC
230.	<i>Crassostrea sp.</i>	C	GK, KC
231.	<i>Dicyathifer sp.</i>	C	GK, KC
232.	<i>Donax sp.</i>	C	GK, KC
233.	<i>Gafrarium sp.</i>	C	GK, KC
234.	<i>Katylisia sp.</i>	C	GK, KC
235.	<i>Lyrodus sp.</i>	C	GK, KC
236.	<i>Macra mera</i>	C	GK, KC

Sr. No.	Species#	Status*	Area Recorded #
237.	<i>Marticia sp.</i>	C	GK, KC
238.	<i>Paphia sp.</i>	C	KC
239.	<i>Pholas orientalis</i>	C	GK, KC
240.	<i>Saccostrea sp.</i>	C	GK, KC
241.	<i>Scapharca inequivalvis</i>	C	GK, KC
242.	<i>Shaeroma terebrans</i>	C	GK, KC
243.	<i>Solen truncatus</i>	C	GK, KC
244.	<i>Sunnetta cripta</i>	C	GK, KC
245.	<i>Tellina sp.</i>	C	GK, KC
246.	<i>Teredo sp.</i>	C	GK

The list is compiled from the following sources: GEC (1996), Desa *et al* (1995), Desai (1994), GUIDE (2000), GUIDE and GEER (2001), Pandya and Pathak (1997), Singh (1999). The following works were done in following areas: GK = Gulf of Kachchh; KN = Kandla; LRK = Little Runn of Kachchh; NSS = Narayan Sarovar Sanctuary; WAS = Wild Ass Sanctuary; KC= Kori Creek.

* Status given is not for the entire district but subjective ratings for the respective study sites. Following status categories given : C = Common; NC = Not Common; VC = Very Common; UC = Uncommon, R = Rare

Annexure- 3.2b
Fish Fauna of Kachchh

Sr. No.	Species	Common Name
1.	<i>Parastromateus niger</i>	Black Pomphret
2.	<i>Eulamia melanoptera</i>	Black Shark
3.	<i>Harpodon neherus</i>	Bombay Duck
4.	<i>Tachysurus caelatus</i>	Cat Fish
5.	<i>Pomphret chinensis</i>	Chinese Pomphret
6.	<i>Anchoviella sp.</i>	Clupeoides
7.	<i>Sardinella fimbriata</i>	Clupeoides
8.	<i>Sardinella longiceps</i>	Clupeoides
9.	<i>Thrissocles sp.</i>	Clupeoides
10.	<i>Coilia reynaldi</i>	Coilia (Rainbow)
11.	<i>Coilia dussumieri</i>	Coilia (Rainbow)
12.	<i>Otolithus argeteus</i>	Danded Jew Fish
13.	<i>Scoliodon sorrakowah</i>	Dog Shark
14.	<i>Dolphinus delphis</i>	Dolphin
15.	<i>Jonioeps sina</i>	Drab Jew Fish
16.	<i>Jonioeps vogleri</i>	Drab Jew Fish
17.	<i>Muraenesox talabonoides</i>	Eel
18.	<i>Caranx sezfasciatus</i>	Electric Ray
19.	<i>Caranx kalla</i>	Electric Ray
20.	<i>Cymolutes sindersis</i>	Electric Ray
21.	<i>Engraulis hamiltoni</i>	Electric Ray
22.	<i>Gobus albopuntatus</i>	Electric Ray
23.	<i>Narcine timlii</i>	Electric Ray
24.	<i>Ophichthys orientalis</i>	Electric Ray
25.	<i>Pelliona sladeni</i>	Electric Ray
26.	<i>Pelliona elangata</i>	Electric Ray
27.	<i>Sciana osseus</i>	Electric Ray
28.	<i>Stromateus sinensis</i>	Electric Ray
29.	<i>Glossogobius ciuris</i>	Grey Fish
30.	<i>Eulamia ellioti</i>	Grey Shark
31.	<i>Myrnillo manazo</i>	Gummy Shark
32.	<i>Sphyrna blochii</i>	Hammer headed Shark
33.	<i>Hilsa ilisha</i>	Hilsa (River Shad)
34.	<i>Eleutheronema tetradactylum</i>	Indian Salmon
35.	<i>Penius penicillatus</i>	Jumboo Prawn
36.	<i>Peneaus indicus</i>	Jumboo Prawn
37.	<i>Nibea diaeanths</i>	Jew Fish
38.	<i>Chorinemus sancti patri</i>	Leather Jacket
39.	<i>Chorinemus lisan</i>	Leather Jacket
40.	<i>Penulirus orantus</i>	Lobster
41.	<i>Thnus orientalis</i>	Lobster
42.	<i>Aterlomycterus marmoratus</i>	Marbled Cat Shark
43.	<i>Peryophthalmus sp.</i>	Mudskipper
44.	<i>Liza dussumieri</i>	Mullet
45.	<i>Liza macrolepis</i>	Mullet
46.	<i>Liza tade</i>	Mullet
47.	<i>Liza vigiensis</i>	Mullet
48.	<i>Trichiurus savala</i>	Ribbon Fish
49.	<i>Otolithoides biourites</i>	Rock Pearch
50.	<i>Otolithus rubber</i>	Rosy Jew Fish
51.	<i>Gingymostoms ferrugineum</i>	Rusty Shark
52.	<i>Hippocampus cuda</i>	Sea Horse
53.	<i>Psammoperca waigiensis</i>	Sea Pearch
54.	<i>Cybiium commersoni</i>	Seer Fish
55.	<i>Indocybium guttatum</i>	Seer Fish
56.	<i>Chiloscylium indicum</i>	Shark (Catshark)
57.	<i>Chirocentrus dorab</i>	Silver Bar
58.	<i>Amblypharynogdon mola</i>	Silver Fish
59.	<i>Catla catla</i>	Silver Fish
60.	<i>Cirrhinus mrigal</i>	Silver Fish

Sr. No.	Species	Common Name
61.	<i>Labeo bata</i>	Silver Fish
62.	<i>Labeo boga</i>	Silver Fish
63.	<i>Labeo rohita</i>	Silver Fish
64.	<i>Rohtee cotio</i>	Silver Fish
65.	<i>Johnius glaucus</i>	Silver Jew Fish
66.	<i>Scanoides biauritus</i>	Small Scianids
67.	<i>Sphyrna tudes</i>	Squat headed Shark
68.	<i>Tetradon inermis</i>	Squid Fish
69.	<i>Polynemum indicus</i>	Thread Fin
70.	<i>Alopias vupinus</i>	Thresher
71.	<i>Galeocerdo cuvieri</i>	Tiger Shark
72.	<i>Rhincodon typus</i>	Whale Shark
73.	<i>Pampus argenteus</i>	White Pomphret
74.	<i>Kowala coval</i>	White Sardine
75.	<i>Stegostoma varium</i>	Zebra Shark
76.	<i>Arius arius</i>	NA
77.	<i>Arothron sp.</i>	NA
78.	<i>Bempros sp.</i>	NA
79.	<i>Chiloscylium arabicum</i>	NA
80.	<i>Congresox talabonoides</i>	NA
81.	<i>Cynoglossus arel</i>	NA
82.	<i>Euryglossa orientalis</i>	NA
83.	<i>Gobies sp.</i>	NA
84.	<i>Hyporhamphus sp.</i>	NA
85.	<i>Ilisha metastoma</i>	NA
86.	<i>Johnius bolengerii</i>	NA
87.	<i>Johnius macropterus</i>	NA
88.	<i>Lepturacanthus savala</i>	NA
89.	<i>Lutjanus johni</i>	NA
90.	<i>Otolithus cuvieri</i>	NA
91.	<i>Protonibea dicanthus</i>	NA
92.	<i>Scoliodon laticaudatus</i>	NA
93.	<i>Thryssa mystax</i>	NA
94.	<i>Thryssa vitrirostris</i>	NA
95.	<i>Trypauchen vagina</i>	NA
96.	<i>Armbassis ranga</i>	NA
97.	<i>Boleophthalmus glaucus</i>	NA
98.	<i>Bragmaceros sp.</i>	NA
99.	<i>Clupeid sp.</i>	NA
100.	<i>Cynoglossus mystax</i>	NA
101.	<i>Dormitator maculates</i>	NA
102.	<i>Engraulis mystax</i>	NA
103.	<i>Gobius planiotrons</i>	NA
104.	<i>Paraplagusia blochii</i>	NA
105.	<i>Stolephorus indicus</i>	NA
106.	<i>Synaptura commersoniana</i>	NA
107.	<i>Syngnathus spicifer</i>	NA
108.	<i>Tetrodon luniaris</i>	NA
109.	<i>Thryssa dussumieri</i>	NA
110.	<i>Thryssa purva</i>	NA
111.	<i>Thryssa setirostris</i>	NA

Source: GUIDE (1997); GUIDE (2000); Desa et al. (1998), GEER (1999).

Annexure- 3.2c

Avifauna of Kachchh

S. N.	Species	Common Name	AS
1.	<i>Coturnix coromandelica</i>	Rain Quail	C
2.	<i>Coturnix coturnix</i>	Common Quail	C
3.	<i>Francolinus francolinus</i>	Black Francolin	C
4.	<i>Francolinus pictus</i>	Painted Francolin	C
5.	<i>Francolinus pondicerianus</i>	Grey Francolin	C
6.	<i>Pavo cristatus</i>	Indian Peafowl	VUN
7.	<i>Perdica argoondah</i>	Rock Bush Quail	C
8.	<i>Perdica asiatica</i>	Jungle Bush Quail	C
9.	<i>Anas acuta</i>	Northern Pintail	UC
10.	<i>Anas clypeata</i>	Northern Shoveller	C
11.	<i>Anas crecca</i>	Common Teal	C
12.	<i>Anas penelope</i>	Eurasian Wigeon	R
13.	<i>Anas platyrhynchos</i>	Mallard	R
14.	<i>Anas poecilorhyncha</i>	Spot billed Duck	C
15.	<i>Anas strepera</i>	Gadwall	R
16.	<i>Aythya ferina</i>	Common Pochard	C
17.	<i>Aythya fuligula</i>	Tufted Pochard	R
18.	<i>Aythya nyroca</i>	Ferruginous Pochard	R
19.	<i>Dendrocygna javanica</i>	Whistling Teal	UC
20.	<i>Nettapus coromandelianus</i>	Cotton Pygmy Goose	R
21.	<i>Rhodonessa rufina</i>	Redcrested Pochard	R
22.	<i>Sarkidiornis melantosa</i>	Comb Duck	UC
23.	<i>Tadorna ferruginea</i>	Brahminy Duck	R
24.	<i>Turnix suscitator</i>	Barred Buttonquail	R
25.	<i>Turnix tanki</i>	Yellow legged Buttonquail	R
26.	<i>Dendrocopos mahrattensis</i>	Yellow crowned Woodpecker	UC
27.	<i>Dinopium Javanese</i>	Golden backed Woodpecker	UC
28.	<i>Jynx torquilla</i>	Eurasian Wryneck	R
29.	<i>Megalaima haemacephala</i>	Coppersmith Barbet	R
30.	<i>Upupa epops</i>	Common Hoopoe	C
31.	<i>Coracias benghalensis</i>	Indian Roller	C
32.	<i>Coracias garrulous</i>	European Roller	C
33.	<i>Alcedo hercules</i>	Common Kingfisher	C
34.	<i>Halcyon amayroptera</i>	White throated Kingfisher	C
35.	<i>Halcyon pileata</i>	Black-caped Kingfisher	VR
36.	<i>Ceryle rudis</i>	Pied Kingfisher	C
37.	<i>Merops orientalis</i>	Green Bee eater	C
38.	<i>Merops persicus</i>	Blue cheeked Bee-eater	R
39.	<i>Clamator jacobinus</i>	Pied Crested Cuckoo	UC
40.	<i>Cuculus canorus</i>	Common Hawk Cuckoo	UC
41.	<i>Eudynamis scolopacea</i>	Indian Koel	C
42.	<i>Phaenicophaeus leschenaultii</i>	Sirkeer Malkoha	C
43.	<i>Centropus sinensis</i>	Greater Coucal	C
44.	<i>Psittacula krameri</i>	Rose ringed Parakeet	C
45.	<i>Apus affinis</i>	House Swift	C
46.	<i>Cypsiurus balasiensis</i>	Palm Swift	R
47.	<i>Tachymarptis melba</i>	Alpine Swift	C
48.	<i>Tyto alba</i>	Barn Owl	R
49.	<i>Asio flammeus</i>	Short eared Owl	UC
50.	<i>Asio otus</i>	Long eared Owl	VR
51.	<i>Athene brama</i>	Spotted Owlet	C
52.	<i>Bubo bubo</i>	Great Horned Owl	C
53.	<i>Bubo nipalensis</i>	Spot bellied Eagle Owl	R
54.	<i>Glaucidium radiatum</i>	Jungle Owlet	VR
55.	<i>Caprimulgus affinis</i>	Franklin's Nightjar	R
56.	<i>Caprimulgus asiaticus</i>	Indian Nightjar	C

S. N.	Species	Common Name	AS
57.	<i>Caprimulgus europaeus</i>	Eurasian Nightjar	C
58.	<i>Caprimulgus mahrattensis</i>	Sykes's Nightjar	C
59.	<i>Columba livia</i>	Blue Rock Pigeon	C
60.	<i>Streptopelia chinensis</i>	Spotted Dove	C
61.	<i>Streptopelia decaocto</i>	Eurasian Collared Dove	C
62.	<i>Streptopelia senegalensis</i>	Laughing Dove	C
63.	<i>Streptopelia tranquebarica</i>	Red Collared Dove	C
64.	<i>Ardeotis nigriceps</i>	Great Indian Bustard	R
65.	<i>Chlamydotis macqueeni</i>	Houabara Bustard	R
66.	<i>Sypheotides indica</i>	Lesser Florican	R
67.	<i>Amaurionis phoenicurus</i>	White breasted Water Hen	C
68.	<i>Fulica atra</i>	Common Coot	C
69.	<i>Gallinula chloropus</i>	Common Moorhen	C
70.	<i>Porphyrio porphyrio</i>	Purple Moorhen	C
71.	<i>Anthropoides virgo</i>	Demoiselle Crane	C
72.	<i>Grus antigone</i>	Indian Sarus Crane	VR
73.	<i>Grus leucogeranus</i>	Common Crane	R
74.	<i>Pterocles alchata</i>	Chestnut bellied Sandgrouse	C
75.	<i>Pterocles indicus</i>	Painted Sandgrouse	C
76.	<i>Pterocles orientalis</i>	Black bellied Sandgrouse	C
77.	<i>Pterocles senegallus</i>	Spotted Sandgrouse	C
78.	<i>Actitis hypoleucos</i>	Common Sandpiper	C
79.	<i>Arenaria interpres</i>	Ruddy Turnstone	UC
80.	<i>Calidris alpina</i>	Dunlin	C
81.	<i>Calidris minuta</i>	Little Stint	C
82.	<i>Calidris temminckii</i>	Temminck's Stint	UC
83.	<i>Calidris tenuirostris</i>	Sanderling	C
84.	<i>Limicola falcinensis</i>	Broad billed Sandpiper	UC
85.	<i>Limosa lapponica</i>	Bar tailed Godwit	C
86.	<i>Limosa limosa</i>	Black tailed Godwit	C
87.	<i>Numenius arquata</i>	Eurasian Curlew	C
88.	<i>Numenius phaeopus</i>	Whimbrel	C
89.	<i>Phalaropus lobatus</i>	Red necked Phalarope	R
90.	<i>Philomachus pugnax</i>	Ruff	R
91.	<i>Tringa erythropus</i>	Spotted Redshank	UC
92.	<i>Tringa glareola</i>	Wood Sandpiper	C
93.	<i>Tringa nebularia</i>	Common Greenshank	C
94.	<i>Tringa ochropus</i>	Green Sandpiper	C
95.	<i>Tringa stagnatilis</i>	Marsh Sandpiper	C
96.	<i>Tringa tetanus</i>	Common Redshank	C
97.	<i>Xenus cinereus</i>	Terek Sandpiper	C
98.	<i>Burhinus oediconemus</i>	Stone Plover	C
99.	<i>Esacus magnirostris</i>	Great Stone Plover	UC
100.	<i>Charadrius alexandrinus</i>	Kentish Plover	C
101.	<i>Charadrius dubius</i>	Little Ringed Plover	C
102.	<i>Charadrius hiaticula</i>	Common Ringed Plover	C
103.	<i>Charadrius leschenaultii</i>	Greater Sand Plover	C
104.	<i>Himantopus himantopus</i>	Blackwinged Stilt	C
105.	<i>Himantopus ostralegus</i>	Eurasian Oystercatcher	C
106.	<i>Pluvialis apricaria</i>	Eurasian Golden Plover	R
107.	<i>Pluvialis squatarola</i>	Grey Plover	R
108.	<i>Recurvirostra avosetta</i>	Pied Avocet	UC
109.	<i>Vanellus gregarius</i>	Sociable Lapwing	VR
110.	<i>Vanellus leucurus</i>	White tailed Lapwing	VR
111.	<i>Vanellus malarbaricus</i>	Yellow wattled Lapwing	C
112.	<i>Vanellus vanellus</i>	Red wattled Lapwing	C
113.	<i>Cursorious corromandalicus</i>	Indian Courser	C
114.	<i>Cursorious cursor</i>	Cream coloured Courser	R
115.	<i>Dromas ardeola</i>	Crab Plover	R
116.	<i>Glareola lacteal</i>	Small Pratincole	R
117.	<i>Chlidonias hybridus</i>	Whiskered Tern	R

S. N.	Species	Common Name	AS
118.	<i>Gelochelidon nilotica</i>	Gull billed Tern	C
119.	<i>Larus argentatus</i>	Herring Gull	VR
120.	<i>Larus brumicephalus</i>	Brown headed Gull	C
121.	<i>Larus genei</i>	Slender billed Gull	R
122.	<i>Larus fuscus</i>	Lesser Black backed Gull	R
123.	<i>Larus ridibundas</i>	Common Black headed Gull	C
124.	<i>Rynchops albicollis</i>	Indian Skimmer	R
125.	<i>Sterna acuticauda</i>	Black bellied Tern	C
126.	<i>Sterna albifrons</i>	Little Tern	R
127.	<i>Sterna aurantia</i>	River tern	C
128.	<i>Sterna bergii</i>	Great Crested Tern	R
129.	<i>Sterna caspia</i>	Caspian tern	R
130.	<i>Sterna sandvicensis</i>	Sandwich Tern	R
131.	<i>Accipiter badius</i>	Shikra	UC
132.	<i>Accipiter gentiles</i>	Goshawk	UC
133.	<i>Accipiter nisus</i>	Eurasian Sparrow hawk	UC
134.	<i>Accipiter virgatus</i>	Besra Sparrow Hawk	C
135.	<i>Aquila clanga</i>	Greater Spotted Eagle	UC
136.	<i>Aquila heliaca</i>	Imperial Eagle	C
137.	<i>Aquila pomarina</i>	Lesser Spotted Eagle	UC
138.	<i>Aquila rapax</i>	Tawny Eagle	C
139.	<i>Butastur teesa</i>	White eyed Buzzard	C
140.	<i>Circaetus gallicus</i>	Short toed Snake Eagle	UC
141.	<i>Circus aeruginosus</i>	Eurasian Marsh Harrier	UC
142.	<i>Circus macrourus</i>	Pallid Harrier	UC
143.	<i>Circus melanoleucos</i>	Pied Harrier	C
144.	<i>Elanus caeruleus</i>	Black Shouldered Kite	UC
145.	<i>Gyps bengalensis</i>	Indian White backed Vulture	R
146.	<i>Gyps fulvus</i>	Eurasian Griffon Vulture	UC
147.	<i>Gyps indicus</i>	Indian Long billed Vulture	UC
148.	<i>Haliaeetus leucogaster</i>	White bellied sea eagle	VR
149.	<i>Haliaeetus leucoryphus</i>	Palla's Fishing Eagle	VR
150.	<i>Haliaeetus Indus</i>	Brahminy Kite	UC
151.	<i>Hieraaetus fasciatus</i>	Bonelli's Hawk Eagle	UC
152.	<i>Hieraaetus pennatus</i>	Booted Eagle	UC
153.	<i>Milvus migranus</i>	Pariah Kite	UC
154.	<i>Neophron percnopterus</i>	Scavenger Vulture	UC
155.	<i>Pandion haliaetus</i>	Osprey	R
156.	<i>Pernis ptilorhynchus</i>	Oriental Honey Buzzard	UC
157.	<i>Sarcogyps calvus</i>	Red headed Vulture	UC
158.	<i>Falco chicquera</i>	Red headed Merlin	UC
159.	<i>Falco jugger</i>	Laggar Falcon	R
160.	<i>Falco peregrinus</i>	Peregrine Falcon	C
161.	<i>Falco subbuteo</i>	Eurasian Hobby	UC
162.	<i>Falco tinnunculus</i>	Common Kestrel	UC
163.	<i>Podiceps cristatus</i>	Great crested Grebe	C
164.	<i>Podiceps nigricollis</i>	Black necked Grebe	UC
165.	<i>Tachybaptus ruficollis</i>	Little Grebe	C
166.	<i>Anhinga melanogaster</i>	Indian Darter	UC
167.	<i>Phalacrocorax carbo</i>	Large Cormorant	UC
168.	<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	UC
169.	<i>Phalacrocorax niger</i>	Little Cormorant	C
170.	<i>Ardea cinerea</i>	Grey Heron	C
171.	<i>Ardea purpurea</i>	Purple Heron	C
172.	<i>Ardeola grayii</i>	Indian Pond Heron	C
173.	<i>Bubulcus ibis</i>	Cattle Egret	C
174.	<i>Casmerodius albus</i>	Great Egret	C
175.	<i>Egretta garzetta</i>	Little Egret	C
176.	<i>Egretta gularis</i>	Western Reef Heron	C
177.	<i>Ixobrychus sinensis</i>	Yellow Bittern	R
178.	<i>Mesophoyx intermedia</i>	Intermediate Egret	C

S. N.	Species	Common Name	AS
179.	<i>Phoenicopus minor</i>	Lesser Flamingo	C
180.	<i>Phoenicopus ruber</i>	Greater Flamingo	C
181.	<i>Pegaldis falcinellus</i>	Glossy Ibis	R
182.	<i>Platalea leucorodia</i>	Eurasian spoonbill	R
183.	<i>Pseudibis papillosa</i>	Black Ibis	C
184.	<i>Threskiornis melanocephalus</i>	Asian White Ibis	UC
185.	<i>Pelecanus crispus</i>	Dalmatian Pelican	C
186.	<i>Pelecanus onocrotalus</i>	Great White Pelican	C
187.	<i>Pelecanus philippenis</i>	Spot billed Pelican	UC
188.	<i>Anastomus oscitans</i>	Openbill Stork	C
189.	<i>Ciconia ciconia</i>	White Stork	VR
190.	<i>Ephippiorhynchus asiaticus</i>	Black necked Stork	C
191.	<i>Leptoptilos dubius</i>	Greater Adjutant Stork	VR
192.	<i>Leptoptilos javanicus</i>	Lesser Adjutant Stork	VR
193.	<i>Mycteria leucocephala</i>	Painted Stork	UC
194.	<i>Gavia stellata</i>	Red throated Diver	C
195.	<i>Lanius collurio</i>	Red backed Shrike	R
196.	<i>Lanius cristatus</i>	Brown Shrike	R
197.	<i>Lanius excubitor</i>	Great Grey Shrike	UC
198.	<i>Lanius minor</i>	Lesser Grey Shrike	C
199.	<i>Lanius schach</i>	Long tailed Shrike	UC
200.	<i>Lanius vittatus</i>	Bay backed Shrike	C
201.	<i>Aegithina nigrolutea</i>	Marshall's Iora	C
202.	<i>Aegithina tiphia</i>	Comon Iora	C
203.	<i>Corvus corax</i>	Raven	C
204.	<i>Corvus macrorhynchos</i>	Jungle Crow	C
205.	<i>Corvus splendens</i>	House Crow	C
206.	<i>Dendrocitta vagabunda</i>	Indian Treepie	UC
207.	<i>Dicrurus macrocercus</i>	Black Drongo	C
208.	<i>Oriolus oriolus</i>	Eurasian Golden Oriole	UC
209.	<i>Pericrocotus cinnamomeus</i>	Small Minivet	C
210.	<i>Pericrocotus erythropygius</i>	White bellied Minivet	VR
211.	<i>Pericrocotus ethologus</i>	Long tailed Minivet	R
212.	<i>Tephrodornis pondicerianus</i>	Lesser Woodshrike	C
213.	<i>Hypocolius ampelinus</i>	Grey Hypocolius	R
214.	<i>Cercomela fusca</i>	Indian Chat	C
215.	<i>Copsychus saularis</i>	Magpie Robin	UC
216.	<i>Ficedula parva</i>	Red breasted Flycatcher	C
217.	<i>Leucocirca aureola</i>	White Browed Fantail Flycatcher	C
218.	<i>Luscinia svecica</i>	Bluethroat	UC
219.	<i>Monticola cinclorhynchus</i>	Blue capped Rock Thrush	R
220.	<i>Oenanthe deserti</i>	Desert Wheatear	C
221.	<i>Oenanthe isabellina</i>	Isabelline Wheatear	C
222.	<i>Oenanthe opistholeuca</i>	Strickland's Chat	VR
223.	<i>Oenanthe picata</i>	Variable Wheatear	C
224.	<i>Oenanthe xanthopyrma</i>	Rufous tailed Chat	UC
225.	<i>Phoenicurus ochruros</i>	Black Redstart	C
226.	<i>Rhinomyias brunneata</i>	Brown chested Flycatcher	R
227.	<i>Saxicola caprata</i>	Pied Bush Chat	C
228.	<i>Saxicola macrorhyncha</i>	Stolickza's Bush Chat	VR
229.	<i>Saxicola torquata</i>	Common Stone Chat	C
230.	<i>Saxicoloides fulvicata</i>	Indian Robin	C
231.	<i>Terpsiphone paradisi</i>	Paradise Flycatcher	UC
232.	<i>Acridotheres ginginianus</i>	Bank Myna	C
233.	<i>Acridotheres tristis</i>	Common Myna	C
234.	<i>Strunus pagodarum</i>	Brahminy Starling	C
235.	<i>Strunus roseus</i>	Rosy Starling	C
236.	<i>Hirundo concolor</i>	Dusky Crag Martin	C
237.	<i>Hirundo daurica</i>	Red rumped Swallow	C
238.	<i>Hirundo fluvicola</i>	Streak throated Swallow	C
239.	<i>Hirundo rustica</i>	Barn Swallow	R

S. N.	Species	Common Name	AS
240.	<i>Hirundo smithii</i>	Wire tailed Swallow	UC
241.	<i>Hirundo tahitica</i>	House Swallow	UC
242.	<i>Pycnonotus cafer</i>	Red vented Bulbul	C
243.	<i>Pycnonotus leucogenys</i>	White eared Bulbul	C
244.	<i>Cisticola juncidis</i>	Zitting Cisticola	C
245.	<i>Prinia buchanani</i>	Rufous fronted Prinia	C
246.	<i>Prinia flaviventris</i>	Yellow-bellied Prinia	UC
247.	<i>Prinia gracilis</i>	Graceful Prinia	C
248.	<i>Prinia hodgsoni</i>	Grey breasted Prinia	C
249.	<i>Prinia inornata</i>	Plain Prinia	C
250.	<i>Prinia socialis</i>	Ashy Prinia	C
251.	<i>Prinia sylvatica</i>	Jungle Prinia	C
252.	<i>Zosterops palpebrosus</i>	Oriental White Eye	C
253.	<i>Acrocephalus aedon</i>	Thick billed Warbler	C
254.	<i>Acrocephalus arundinaceus</i>	Great Reed Warbler	C
255.	<i>Acrocephalus dumetorum</i>	Blyth's Reed Warbler	C
256.	<i>Chrysomma sinensis</i>	Yellow eyed Babbler	UC
257.	<i>Hippolais caligata</i>	Booted Warbler	UC
258.	<i>Locustella naevia</i>	Grasshopper Warbler	C
259.	<i>Orthotomus sutorius</i>	Common Tailorbird	C
260.	<i>Phylloscopus collybita</i>	Common Chiffchaff	C
261.	<i>Phylloscopus trochilus</i>	Willow Warbler	C
262.	<i>Sylvia althaea</i>	Greater Whitethroat	C
263.	<i>Sylvia curruca</i>	Lesser Whitethroat	C
264.	<i>Sylvia hortensis</i>	Orphean Warbler	UC
265.	<i>Sylvia nana</i>	Desert Warbler	R
266.	<i>Turdoides caudatus</i>	Common Babbler	C
267.	<i>Turdoides malcomi</i>	Large Grey Babbler	C
268.	<i>Turdoides striatus</i>	Jungle Babbler	C
269.	<i>Alauda arvensis</i>	Eurasian Skylark	UC
270.	<i>Alauda gulgula</i>	Eastern Skylark	UC
271.	<i>Ammomanes deserti</i>	Desert Lark	R
272.	<i>Ammomanes phoenicurus</i>	Rufous tailed Lark	C
273.	<i>Calandrella brachydactyla</i>	Greater Short toed Lark	C
274.	<i>Calandrella cheleensis</i>	Asian Short toed Lark	C
275.	<i>Calandrella raytal</i>	Sand Short toed Lark	C
276.	<i>Eremopterix grisea</i>	Ashycrowned Sparrow Lark	C
277.	<i>Galerida cristata</i>	Crested Lark	C
278.	<i>Galerida deva</i>	Sykes's Crested Lark	C
279.	<i>Mirafra cantillans</i>	Singing Bush Lark	C
280.	<i>Mirafra erythroptera</i>	Indian Bush Lark	C
281.	<i>Nectarinia asiatica</i>	Purple Sunbird	C
282.	<i>Anthus campestris</i>	Tawny Pipit	C
283.	<i>Anthus rufulus</i>	Paddy Field Pipit	C
284.	<i>Anthus similis</i>	Brown Rock Pipit	C
285.	<i>Anthus trivialis</i>	Tree Pipit	C
286.	<i>Motacilla alba</i>	White Wagtail	C
287.	<i>Motacilla cinerea</i>	Grey Wagtail	C
288.	<i>Motacilla citreola</i>	Yellow headed Wagtail	C
289.	<i>Motacilla flava</i>	Yellow Wagtail	C
290.	<i>Motacilla maderaspatensis</i>	Pied Wagtail	C
291.	<i>Lonchura malabarica</i>	Indian Silverbill	C
292.	<i>Lonchura malacca</i>	Black headed Munia	C
293.	<i>Lonchura striata</i>	White rumped Munia	C
294.	<i>Passer domesticus</i>	House Sparrow	C
295.	<i>Passer montanus</i>	Yellow throated Sparrow	C
296.	<i>Ploceus philippinus</i>	Baya Weaver	C
297.	<i>Parus nuchalis</i>	Pied Tit	R
298.	<i>Carpodacus erythrinus</i>	Common Rose Finch	R
299.	<i>Emberiza bruniceps</i>	Red headed Bunting	R
300.	<i>Emberiza buchanani</i>	Grey necked Bunting	C

S. N.	Species	Common Name	AS
301.	<i>Emberiza cia</i>	Rock Bunting	C
302.	<i>Emberiza hortulana</i>	Ortolan Bunting	R
303.	<i>Emberiza melanocephala</i>	Black Headed Bunting	UC
304.	<i>Emberiza striolata</i>	Striolated Bunting	C
305.	<i>Melophus lathami</i>	Crested Bunting	R
306.	<i>Rhodopechys githaginea</i>	Trumpeter Finch	VR

This list is compiled from the following sources: Ali (1945), GEC (1996), GUIDE (1997), GUIDE and GEER (2001), Pandya and Pathak (1997), Singh (1997), Singh (1999).

Status is based on subjective ratings from the sources given above. C = Common; R = Rare; UC = Uncommon; VR = Very Rare; VUN = Vulnerable

Annexure 3.2d

Mammals of Kachchh

#	Species	Common Name	Global Status*	Status in Kachchh**
1.	<i>Cynopterus sphinx</i>	Short-nosed Fruit Bat	-	C
2.	<i>Pteropus giganteus</i>	Indian Flying Fox	-	R
3.	<i>Pteropus medius</i>	Common Bat	-	C
4.	<i>Herpestes javanicus</i>	Small Indian Mongoose	-	C
5.	<i>Herpestes edwardsi</i>	Common Mongoose	-	C
6.	<i>Funambulus pennanti</i>	Five-striped palm Squirrel	-	C
7.	<i>Bandicota indica</i>	Bandicoot	-	C
8.	<i>Golunda ellioti gujerati</i>	Indian Bush Rat	-	R
9.	<i>Meriones hurricanae</i>	Sand-colored Rat	--	C
10.	<i>Millardia meltada</i>	Field Rat	-	C
11.	<i>Mus booduga</i>	Field Mouse	-	C
12.	<i>Mus decumanus</i>	Brown Rat	-	C
13.	<i>Mus musculus</i>	Indian Desert Gerbill	-	C
14.	<i>Rattus cutchicus cutchicus</i>	Kutch Rat	-	C
15.	<i>Rattus leadowi</i>	Kachchh Rock Rat	-	C
16.	<i>Rattus mettada</i>	Soft-furred Field Rat	-	C
17.	<i>Rattus rattus</i>	Common House Rat	--	C
18.	<i>Suncus murinus</i>	Grey Musk Shrew	--	C
19.	<i>Tatera indica</i>	Indian Gerbill	-	C
20.	<i>Sus scrofa</i>	Indian Wild Boar	-	C
21.	<i>Sus scrofa domestica</i>	Pig	-	C
22.	<i>Antelope cervicapra</i>	Blackbuck	LRnt	R
23.	<i>Boselaphus tragocamelus</i>	Nilgai OR Bluebull	-	C
24.	<i>Gazella gazella</i>	Chinkara	LRnt	R
25.	<i>Canis aureus</i>	Golden Jackel	-	C
26.	<i>Canis lupus</i>	Indian Grey Wolf	LRnt	R
27.	<i>Vulpes bengalensis</i>	Indian Fox	DD	R
28.	<i>Vulpes vulpes pusilla</i>	Desert Fox	LRnt	R
29.	<i>Felis caracal</i>	Caracal	EN	VR
30.	<i>Felis chaus</i>	Jungle Cat	LRnt	C
31.	<i>Felis rubiginosus</i>	Rusty - spotted Cat	LRnt	VR
32.	<i>Felis silvestris ornata</i>	Desert Cat	LRnt	R
33.	<i>Panthera pardus</i>	Leopard	VU	VR
34.	<i>Equus hemionus khur</i>	Wild Ass	EN	R
35.	<i>Hyaena hyaena</i>	Striped Hyaena	LRnt	C
36.	<i>Hystrix indica</i>	Indian Porcupine	-	C
37.	<i>Lepus nigricollis dyanus</i>	Desert Hare	-	C
38.	<i>Lepus nigricollis ruficaudatus</i>	Black-naped Hare	-	C
39.	<i>Hemiechinuds auritus</i>	Long-eared Hedgehog	-	R
40.	<i>Paraechinus micropus</i>	Pale Hedgehog	-	C
41.	<i>Mellivora capensis</i>	Ratel or Honey Badger	LRnt	R
42.	<i>Lutra perspicillata</i>	Smooth Indian Otter	LRnt	VR
43.	<i>Paradoxurus hermiphrodatus</i>	Common Palm Civet	LRnt	R
44.	<i>Viverricula indica</i>	Small Indian Civet Cat	LRnt	R
45.	<i>Manis cressicaudata</i>	Indian Pangolin	LRnt	R
46.	<i>Pipistrellus coromandra</i>	Indian Pipistrelle Bat	-	R
47.	<i>Delphinus delphis</i>	Common Dolphin	LRnt	R
48.	<i>Presbytis entellus</i>	Common Langur	-	VR
49.	<i>Neophocaena phocaenoides</i>	Finless Porpoise	IK	R
50.	<i>Dugong dugong</i>	Dugong	CR	VR
51.	<i>Balaenoptera sp.</i>	Whale	CR	VR

Source: GEC (1994, 1996, 2002); GUIDE and GEER (2001); GUIDE (1997); Pandya and Pathak (1997); GEER (1999)

* Global status was given according to BCPP-CAMP Workshop. LRnt= Lower risk near threatened; CR= Critically endangered; EN= Endangered; VU=Vulnerable; IK= Insufficient Knowledge Status given in Italics are from ZSI (1994) ** Status in Kachchh was given subjectively based on the above-referred studies.