REVITALISING COMMUNITIES THROUGH REGENERATING MANGROVES

Experiences of
VIKAS-Centre for Development
&
SAVE-Saline Area Vitalisation Enterprise Ltd.
Ahmedabad

Prepared by
Ms. Alka Palrecha
2013

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Alka Palrecha
People in Centre *Consulting*

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Alka Palrecha
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Contents

1. Introduction

1.1 Context

Private sector investments for developmental programmes are increasingly being recognised. The private sector is normally contributing towards social sector programmes like health, education or environmental programmes like regeneration of water bodies, plantation and others. There are no attempts made to strategically combine environmental rejuvenation with human resource development. The mangrove development carried out by VIKAS and Saline Area Vitalisation Enterprise (SAVE) may be mentioned as a comprehensive model encompassing physical, vegetative and economic aspects, carried out in such a manner that ensures financial and institutional sustainability with engagements of private sector.

Mangrove regeneration works of SAVE/VIKAS have resulted in not only biological outcomes like increase in area under mangrove, but has also brought improvements in lives and livelihoods of marginalized local communities with sustained efforts for engaging them meaningfully. The unique operations initially of VIKAS and later of SAVE has thus developed natural resources and human resources together. In addition, there are indirect benefits of environmental and economical mangrove plantations. This work thus merits a comprehensive understanding for increasing its outreach. This document apt titled **'Revitalising Communities through Regenerating Mangroves'** is an effort to bring this work for the attention it deserves.

1.2 SAVE, VIKAS and Jan Shakti Parishad (JSP)

Along the coast of Gujarat, poverty linked with degeneration of natural resources is evident. Large parts of 8.0 million people living along the coast of Gujarat are engaged in low-investment, low-return agriculture, animal husbandry and fisheries. In order to achieve twin objectives of regeneration of natural resources and poverty alleviation, SAVE, a private limited company works with poor, consolidating this human resource in such a way that it becomes meaningful to the company as well as poor individuals.

VIKAS, a registered society Non Government Organisation (NGO) and trust have been working in rural coastal areas of South Gujarat since 1978. It began its work in these areas, as the natural conditions were unfavourable and hence, people were poor. The poverty was of such an extent that large number of marginalised communities worked as bonded labourers to repay the debts, locally known as '*chakar*' for male member and '*paniyari*' for female members. Men are engaged in agriculture, animal husbandry and fisheries work and women as maid for domestic work at extremely low or no wages. This practice mainly with Rathods and Vasavas has been in existence for generations as the interest on debt cumulates. They themselves had land with low productivity yielding no returns with their low investments on it.

In last two decades, the arguments of protection of vulnerable just because they are vulnerable are slowly diminishing. The efforts of the NGOs in liberalised economy with shrinking grants is to convert 'beneficiary' into 'customers' for 'social business'. This was not fruitful for mainstreaming the marginalised as there was a missing link. It requires that the ownerships of these customers to the company be also built. They also have to take risks for venturing into business like a shareholder. Thus, SAVE was incorporated to take the VIKAS learning ahead in 1995 to have a business model with primary producers as shareholders.

Jan Shakti Parishad, a membership based organization originated from VIKAS and is registered as a society. Its members are marginalized poor of Bharuch district. The objective of its formation and operations are as its parent organization VIKAS. However, it is formed by the recipients of the VIKAS and consists of them and works towards mainstreaming themselves.

1.3 Genesis of Mangrove Development Programme

Restoration of Mangroves (REMAG) project implemented by the Gujarat Ecology Commission (GEC) during 2002-2007 with financial support from India Canada Environment Facility (ICEF) was an opportunity to get these communities out of cycle of poverty so that they have a dignified means of earning their livelihoods. In addition, it also regenerated natural resources benefitting the local communities significantly. VIKAS was granted the mangrove development programme along with four other NGOs from REMAG.

Though the original REMAG project came to a close by 2007 due to proposed Kalpasar project[1], it was important to carry forward the mangrove restoration initiatives in the state in view of their socio-economic benefits to the dependent communities and environmental and ecological functions and services provided by the mangroves. Hence, the GEC continues the mangrove restoration activities in the state with a major thrust on public-private partnership (PPP) based management/governance regime. Under the extended REMAG programme, investments by private sector companies/ industries have also been encouraged with community participation in the mangrove development/restoration efforts. By this time, SAVE was the only technically qualified company to take up plantation and sapling generation programmes on behalf of communities. It was also a mean to bring private investments into elimination of poverty and regeneration of natural resources, hence SAVE took this opportunity and till date continues the regeneration of mangroves in coastal Gujarat. JSP executes the mangrove plantation programme through its members. SAVE is their client that has developed the programme of mangrove restoration.

[1] Kalpsar Project: The Kalpasar Project envisages building a dam across the Gulf of Khambat for establishing a huge reservoir for fresh water for irrigation, drinking and industrial purposes. Due to this, the mangrove plantation in these coastal areas was curtailed as the sea water that is necessary for mangroves was stopped with the dam towards the coast.

1.3 Objectives

As SAVE and VIKAS have been involved in mangrove development for more than a decade and already brought an area of around 1000 hectares under plantation, a comprehensive account capturing following details is the main objective of this document.

1. Environmental benefits of mangrove restoration.
2. Economic outputs with actual employment generation due to activities of plantation.
3. Social and institutional outcomes.
4. Influencing policy makers tor mangrove regeneration.

1.4 Methodology

There are several studies about valuation of direct and indirect benefits accrued from mangrove plantations. However, they have large variations in the values realized. Hence, for the objectives of this review, an empirical study based on experience and observation is done. Methodology of feasibility study is based on participatory principles and involved local communities as well as mapping for getting real time data in spatial changes.

Participatory Methods: The documentation is undertaken with a view to capture the tangible and non-tangible benefits of multi functions of mangroves viz. socio-economic, ecological as well as institutional. Key consideration is to bring out the differences by inclusion of community. For this, an attempt at understanding how the local communities consider the importance and benefit from the mangrove restoration activities being carried out is made. Transect walks are taken in above mentioned villages for understanding status of key parameters like distances to mangrove plantation to benefit from it for daily needs like fuel and fodder. Resource maps are drawn for select villages for comprehensive understanding of spatial distribution of mangroves and other land uses in the village. Demographic and village resource information is compiled from village functionaries and structured participatory rural appraisals. Interviews and discussions were done with different social groups to understand their daily and seasonal practices with respect to mangroves. Additionally, following methods are used for socio-economic feasibility assessment

1. Secondary source information and data including status of demographic data, mangrove status at various levels are collected as a background for this documentation.
2. Design of unstructured interviews, key informant interviews, focused group discussions and formal talks with individuals/groups are done for assessing actual benefits at community level. Group discussion with marginalized groups and women would be done separately to note their views.
3. Interviews at household levels are conducted to quickly capture user level benefits accrued. These are not representative as they are not random survey but selected interviewee. Interpretation of these surveys is translated as assessments of impact of mangrove restoration.

It is important to understand the changes in lives and livelihoods of people due to mangrove restoration. It is tricky information and its quantification is usually difficult to account rightly. Following methods were used to find it.

1. Direct question during the interview.
2. Prevailing selling price in the village for produce like fish, mudskipper, and crab.
3. Expenses made on procuring/buying fodder and fuel for domestic use.
4. Incomes of the households (This is rarely answered correctly; however some conjectures are attempted in a few cases)

Mapping: An exercise of mapping the impact of restoration of the area under consideration by comparing digital data of 2000 (before restoration) and digital data of 2012 (after restoration) is done. Thus remote sensing data is used as a monitoring tool to assess the effectiveness of restoration and conservation programmes of the mangroves, where direct impact is difficult to know due to marshy soils and creeks.

Relevant satellite images of the coastal areas where plantation is done were obtained from Landsat. Subsequently, land use classification was done on these using ARCGIS software. The satellite images of winter were taken for classification, as these are clear sky days. Also, care was taken to have the imagery of a day when the tides are low. The mangroves on low tide days are out and the increased land due to sedimentation is visible. The same tide days are chosen for post plantation period to detect following changes.

1. Land reclamation due to mangrove plantation.
2. Development of mangroves.
3. Changes in the areas of salt pans (as it has impacts on mangrove development).

1.5 Scope

The scope of the documentation is limited to mangrove restoration work of SAVE and VIKAS in following seven villages.

Table 1: Villages of Mangrove Restoration by SAVE and VIKAS

Sr. No.	Name of the Village	Taluka	District
1.	Nada	Jambusar	Bharuch
2.	Asarsa	Jambusar	Bharuch
3.	Neja	Jambusar	Bharuch
4.	Malpur	Jambusar	Bharuch
5.	Kanthiajal	Hansot	Bharuch
6.	Dandi	Olpad	Surat
7.	Mithapur	Okha	Jamnagar

The plantation area of mangroves is not exactly marked as the technology like global positioning system (GPS) were not known commonly at the times of plantations. In the first six villages, no other agency has carried out mangrove plantation work, so it is assumed that the change in mangrove coverage in the above villages can be attributed to the efforts of SAVE/VIKAS.
Regeneration of mangroves naturally occurs once there is some plantation. So the current spread of mangroves is stimulated with the mangrove plantation taken up by SAVE/VIKAS. Apportioning of the benefits accrued of mangroves to natural growth vis a vis plantation is not done as part of this document. The accounts of

benefits herein are the benefits accrued to the above villages due to mangroves. Similarly, change detection in maps is for the coast adjoining above villages. Again the village boundaries are not there in the marshy land, hence, a polygon is marked on the seaward side of these villages for change detection in terms of mangrove cover and increased availability of land.

2. Mangroves in India and Gujarat

2.1 Context

The English Oxford Dictionary defines Mangrove as a tree or shrub, which grows in tidal, chiefly tropical, coastal swamps, having numerous tangled roots that grow above ground and form dense thickets. Mangroves are salt-tolerant plants that chiefly grow in tropical and subtropical intertidal regions of the world. The area in which these plants grow is called 'mangrove ecosystem'. Mangroves are considered to be very productive but at the same time these plants are extremely sensitive and fragile. The mangrove ecosystem also nurtures other plant and animal species.

It is an established fact now that the mangrove ecosystems on coastline are a major factor in saving lives and property during natural calamities like cyclones and erosion. The mangrove ecosystems also accrue economic benefits as these areas are grounds of breeding, feeding and nursery for many estuarine and marine organisms. Consequently, these areas are used for captive and culture fisheries. They are also important source of honey, tannins, wax, besides fish. Furthermore, it is believed that the ecosystem has a very large unexplored potential for natural products useful for medicinal purposes and also for salt production, apiculture, fuel and fodder, etc.

The scientific community traces the origin of mangroves in the Indo-Malayan region. This is on account of the fact that this area has more mangrove species as compared to any other place in the world. Today, mangroves are observed in about 30 countries in tropical subtropical regions covering an area of about 99,300 sq. km. (Singh 2000).[2]

Human pressures and natural calamities are considered detrimental for mangrove ecosystems. Increasing industrialization along the coastlines and discharge of domestic and industrial sewage has resulted in pollution of these areas. Various studies have pointed to these issues. Over the past few decades, mangroves have been facing many threats, which can be grouped into two, natural and anthropogenic. The natural threats comprise climatic changes, cyclones and physical processes. The anthropogenic threats include diseases, deterioration, pollution, grazing, agriculture, aquaculture and human encroachment (including reclamation), etc. It is believed that over the past five decades, over 50 percent of the mangrove cover has been lost due to the above factors.

[2] Finlayson and Moser (1991) estimated the total mangrove area of the world at about 140,000 Sq. Km. while UNDP (1995) has estimated it as 240,000 Sq. Km.

2.2 Mangroves in India

A glance at the distribution of mangrove ecosystems on Indian coastlines indicates that the Sundarban mangroves occupy very large area. This is followed by Andaman-Nicobar Islands and Gulf of Kutch in Gujarat.

Figure 1: Mangroves in India

Source: http://www.fao.org/docrep/x8080e/x8080e07.htm

According to the India State of Forest Report 2011 by Forest Survey of India (FSI), mangroves in India account for about 3 percent of the world's mangrove vegetation and are spread over an area of 4,662.56 sq. km along the coastal areas of the country. Sundarbans in West Bengal accounts for almost half of the total area under mangroves in India.

Table 2: Status of Mangrove Plantation in India (Sq. Km)

	Assessment Year											
State & UT	1987	1989	1991	1993	1995	1997	1999	2001	2003	2005	2009	2011
Andhra Pradesh	495	404	399	378	383	383	397	333	329	354	353	352
Goa	0	3	3	3	3	5	5	5	16	16	17	22

Gujarat	427	412	397	419	689	901	1031	911	916	991	1046	1058
Karnataka	0	0	0	0	2	3	3	2	3	3	3	3
Maharashtra	140	114	113	155	155	124	108	118	158	186	186	186
Orissa	199	192	195	195	195	211	215	219	203	217	221	222
Tamil Nadu	23	47	47	21	21	21	21	23	35	36	39	39
West Bengal	2076	2109	2119	2119	2119	2123	2125	2081	2120	2136	2152	2155
A&N Islands	686	973	971	966	966	966	966	789	658	635	615	617
Puducherry	0	0	0	0	0	0	0	1	1	1	1	1
Kerala	0	0	0	0	0	0	0	0	8	5	5	6
Daman & Diu	0	0	0	0	0	0	0	0	1	1	1	1.56
Total	4046	4255	4244	4256	4533	4737	4871	4482	4448	4581	4639	4662.56

* This assessment pertains only to the mangrove cover and does not include the tidal creeks and water bodies within the mangrove forests.
Source: FSI Report, 2011

It is critical to ensure appropriate management of the mangrove ecosystems. The management can aid in opening avenues for self-employment like ecotourism, fishing, beekeeping and cottage industries based on mangrove forest products, thus enhancing the socio-economic conditions of the local communities.

India has been practicing mangrove forest management since long. Sundarbans mangroves are considered to be the first mangroves anywhere in the world, where scientific management was put to use. The area's first management plan was implemented in 1892 (Chaudhuri and Choudhury, 1994).

The Government of India extending due attention to the mangroves, set up the National Mangrove Committee in the Ministry of Environment and Forests in 1976 to advise the government on mangrove conservation and development. The first meeting of the panel stressed on the need to conduct a survey to ascertain the extent of existing mangrove areas in the country. The National Mangrove Committee in 1979 recommended areas for research and development and for management of the mangroves. Based on the of the Committee's recommendation, 15 mangrove areas were identified for conservation. The National Forest Policy, 1988 has included the effective conservation and management of natural forest ecosystems (including the mangrove ecosystem) as a priority area for forestry research.

The legislative framework for mangroves dates back to The Indian Forest Act, 1927 and later the Wildlife (Protection) Act, 1972. While these Acts do not specifically mention mangroves, these can also apply to the conservation of mangrove ecosystems. Since 1927, the Indian Forest Act has been applied to the mangrove forests of Sundarbans, which have been declared as a reserved area (Naskar and Mandal, 1999). Subsequently, the Environment (Protection) Act, 1986 played an important role in the conservation and management of mangrove ecosystems.

2.3 Status of Mangroves in Gujarat:

Gujarat has the longest sea coastline of 1,650 km in the country. The state has mangroves spread over an area of 1,058 sq. km. Kutch with mangroves spread over 778 sq. km has 74 percent of the state's mangrove spread. Beside Kutch, mangroves are majorly found in Jamnagar and Bharuch.

Table 3: District-wise Mangrove Coverage in Gujarat (Area in sq. km)

Sr. No.	District	Very Dense Mangrove	Moderately Dense Mangrove	Open Mangrove	Total
1	Ahmedabad	0	1	29	30
2	Amreli	0	0	1	1
3	Anand	0	0	0	0
4	Bharuch	0	21	22	43
5	Bhavnagar	0	6	13	19
6	Jamnagar	0	28	131	159
7	Junagarh	0	0	1	1
8	Kutch	0	118	660	778
9	Navsari	0	0	1	1
10	Porbandar	0	0	0	0
11	Rajkot	0	1	1	2
12	Surat	0	7	13	20
13	Vadodara	0	0	2	2
14	Valsad	0	0	2	2
	Total	0	182	876	1,058

Source: FSI Report, 2011

The extensive mangrove ecosystem in Gujarat in past had faced degradation and depletion owing to developmental activities along with natural disasters and anthropogenic interactions. In fact, until about 1960s, mangroves were considered as 'economically unproductive areas' and hence, they had faced destruction caused by expansion of economic as well industrial development activities (Hirway and Goswami, 2007). The efforts of the state government in promoting mangroves started right since 1960s, when it undertook plantation of mangroves. In recent years, the condition has improved with the combined efforts of state government and international development agencies working on restoration and regeneration of mangroves in the state.

This is supported by the FSI report. The State saw an increase in mangrove cover from 1991 till 1999, when it increased to 1,031 sq. km. Although it fell to 911 sq. km in 2001 but since then an area of 147 sq. km has been added. The 2011 FSI Report has commended Gujarat's contribution in planting and regenerating the mangroves. It says that compared with 2009 assessment, there has been a net increase of 23.34

sq. km in the mangrove cover of the country. This can be attributed to increased plantations particularly, in Gujarat and regeneration of natural mangrove areas.

A recent example of increasing mangrove cover is the Gujarat Forestry Development Project in the State, which focuses on a major mangrove plantation drive along the coastal regions of Kutch and Jamnagar. The project is being implemented by the State Forest Department at the cost of Rs. 830 crore over a period between 2007-08 to 2014-15.

A recent Gujarat Institute of Development Research Study, 'Socio-Economic and Ecological Benefits of Mangrove Plantation, A Study of Community Based Mangrove Restoration Activities in Gujarat', which was sponsored by Gujarat Ecology Commission states that some time back over 13 different rare species of mangroves with a height of around 30 feet were found in south Gujarat, which were not covered in the FSI report. These species are found along the coast in the Valsad and Navsari. The report states that this was revealed during a study taken up by the Gujarat Ecological Education Research Foundation.

While the earlier efforts focused on restoring and increasing the mangrove cover in the state, one noticed the absence of participatory approach involving local communities in the regeneration of mangroves. Acknowledging the dependence of coastal communities on mangroves and the need for their participation in regeneration of mangrove ecosystems, the GEC initiated the project REMAG with financial support from the ICEF, New Delhi. The project focuses on enhanced capacity of the communities to regenerate and sustainably manage mangrove resources for increased livelihood opportunities; increased support from industries and active involvement of the government in community based regeneration and conservation of mangroves. With the original project getting over by 2007, GEC has evolved a new arrangement supported by public private partnership to continue the project.

The GEC acts as Nodal Agency with key responsibilities of preparing project management plan, financial management, providing trainings on both technical and social aspects to the Project Implementation Partners (PIPs) and community based organizations (CBOs) for smooth implementation of the project, liaising with Government departments, industries, academic institutions and other agencies in the State, etc. It has selected various voluntary organizations as its PIP.

The latest district-wise status of development of mangroves in Gujarat presented in the table below shows that there has been significant increase in mangrove cover in the State even during the last few years, as the total mangrove cover has increased by 30 percent from 6,391 ha during 2009 to 8,326 ha during 2010.

Table 4: District-wise Status of Development of Mangroves in Gujarat, 2010 under REMAG Project

Sr. No.	District	Mangrove Area (ha)		Percentage Share
		2009	2010	
1	Ahmedabad	500	500	6.0
2	Anand	550	650	7.8

3	Bharuch	180	685	8.2
4	Bhavnagar	80	600	7.2
5	Kachchh	1261	1356	16.3
6	Navsari	30	305	3.7
7	Valsad	0	90	1.1
8	Rajkot	850	850	10.2
9	Surat	2940	3290	39.5
	TOTAL	**6391**	**8326**	**100.0**

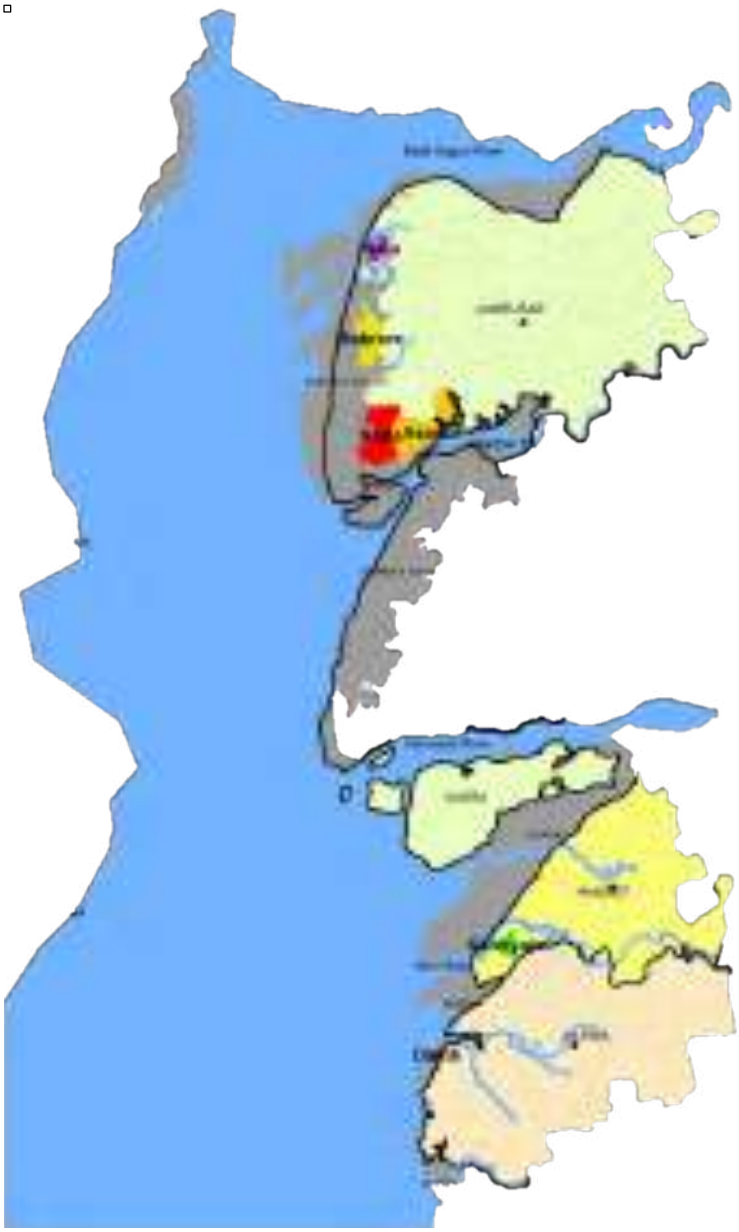
Source: Gujarat Ecology Commission, March 2010.

Thus, it can be inferred that an important contribution towards the development and increase in area under mangrove is due to community based approach adopted by the State by involving local community based organizations with financial support from both the State as well as private agencies.

3. Area and Village Profile

The coastal villages where SAVE and VIKAS are engaged in mangrove restoration are part of Jambusar Taluka of Bharuch district and Olpad Taluka of Surat district The village of Kanthiajal lies in Hansot Taluka of Bharuch district.

Figure ---: Location Map of South Gujarat Programme Villages

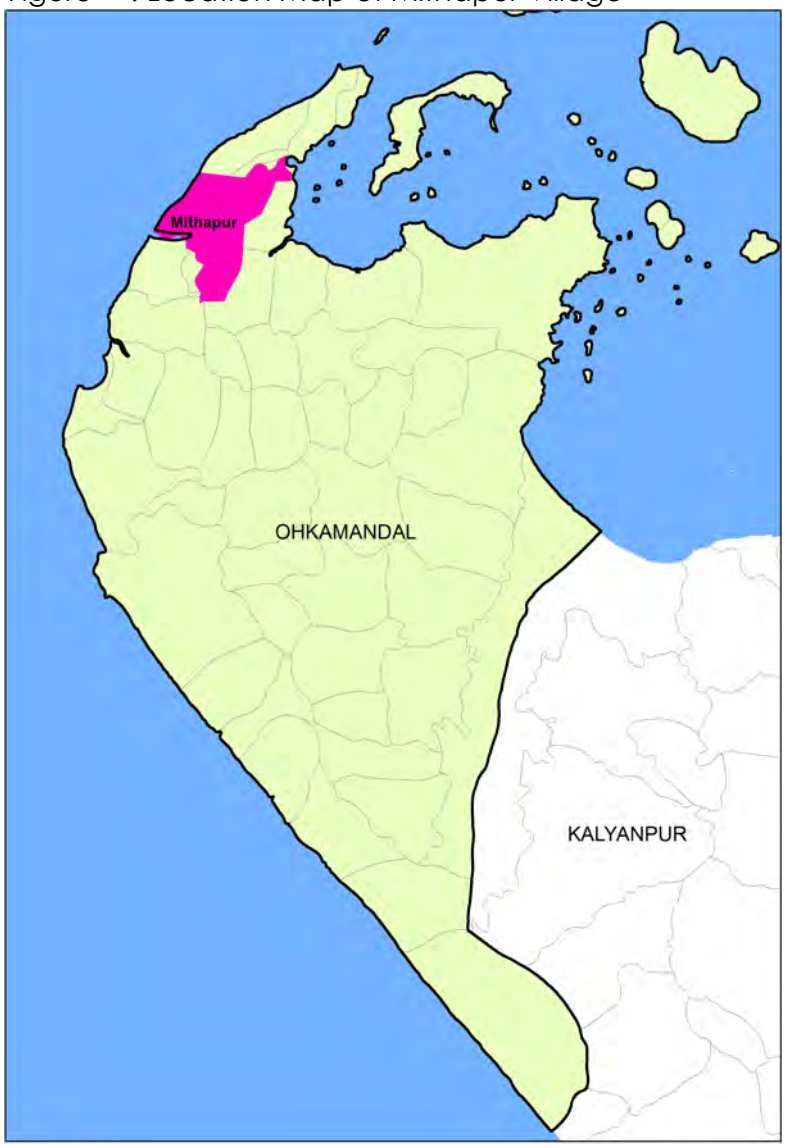


Jambusar Taluka and Hansot Taluka, Bharuch DIstrict

Olpad Taluka, Surat District

These villages are in coastal South Gujarat. Apart from these villages, mangrove plantation is carried out in Mithapur of Okha Taluka of Jamnagar district. Other than Mithapur, all villages taken up for mangrove restoration of South Gujarat have similar characteristics and physiography, climate and socio-economic conditions.

Figure ---: Location Map of Mithapur Village



Okhamandal Taluka, Jamnagar District

3.1 Physiography

Jambusar and Hansot talukas are located in the North West and South West part of Bharuch district respectively. The Taluka of Olpad, in North West of Surat district is next to Hansot Taluka. The coastline of Jambusar, Hansot and Olpad is 32 km, 26.6 km and 40.9 km respectively. These Talukas have a shoreline of Arabian Sea and are surrounded by Gulf of Cambay as shown in the map below. Major rivers in Jambusar Taluka are Mahisagar and Dhadhar, while Narmada River flows through Hansot Taluka. River Kim forms the northern boundary of the Hansot Taluka as also of the Surat district.

The area has sedimentary deposits derived from basalt brought down by the Dhadar River and its tributary. This along with recent alluvium of Mahi River and marine alluvium from four landforms namely, alluvial plain of mid-land, flood plain of Mahi and Dhadar River and coastal low land.

These Talukas like most Talukas of South Gujarat bordering on the sea, can be divided into two well-marked zones, each having distinctive characteristics of soil, climate, and the kinds of primary production leading to socio-economic conditions. (1) The Coastal track comprises villages that are more or less barren, fringed for the most part by drifted sand and salt marsh. This belt of villages, having light soil and bordering on the coast, which used to grow only bajri and wheat and later started growing cotton may be characterized as the outer or western zone. In addition, they have disadvantage of being spatially remote from market and services with poor communication, transport and infrastructure. (2) The inland tract comprises a highly cultivated rich plain, and poorer land gradually merges into hills and forests towards the east. This belt of villages having much more productive black soil and grows many crops, may be called the inner or eastern zone of these coastal Talukas.

As the mangrove restoration project is in the coastal marshes, all these villages are lie in first zone having a long belt of wasteland, saline wasteland and brown soils. These villages have limited water resources and entrenched with salinity.

One case in point is the Taluka of Jambusar, Jambusar has majority of villages with mangrove plantation spread over an area of 1,09,827 hectare out of which 9,519 hectare is fallow. This is about 85 percent of its total area.

The soil of the saline area is heavy textured, i.e. it has more clay and less permeability. The permeability of the soil is 0.3 to 0.4, that is, 0.3 to 0.4 centimeter per hour can penetrate in the soil. The salt concentration of the soil is also high. It is 0.2 to 1.0 (i.e. 0.2 to 1.0 gram of salt per 100 grams of soil). It is estimated that large part of the saline land has more than 0.5 salt concentrations, i.e. no crop can grow on it. In the non-saline area, the soil is black, alluvial or gorad. This soil is good for cultivation.[3]

3.2 Climate and Rainfall

The climate of the Taluka is warm. The summer is hot from March to May and winter is brisk from November to February. South-west monsoon brings rain to these Talukas.

Average rainfall particularly in Jambusat is low. The table below shows that it is also fluctuating and in year 2009, it was as low as 230 mm in the whole year. Many years are declared as scarcity years in these Talukas.

The maximum temperature in May is around 40^0-45^0 centigrade, and the minimum temperature in winter remains around 15^0 centigrade.

Table 5: Rainfall Data of last Decade in Talukas of Olapad, Hansot and Jambusar

Taluka	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Avg.**
Jambuser	387	492	610	546	717	717	801	489	230	724	571.30
Hansot	638	885	810	810	1255	958	1196	901	633	1154	924.00
Olpad	681	870	1123	1256	1421	1266	1477	1334	1029	1491	1194.80

[3] Block Level Plan for Full Employment, Jambusar Taluka:Bharuch District, 1978, Vikas Centre for Development, Ahmedabad

Okhamandal	341	136	508	322	413	642	903	557	816	1246	588.40

Source: Meteorological Department, Gandhinagar

3.3 Land Utilization

One important feature of the land utilization pattern in the coastal Talukas of Bharuch is that almost one-third of the area is under non-agricultural use. This is not because of the development of non-agricultural sector as it appears, but is due to the fact that large saline and wastelands are unsuitable for agriculture.

Additionally, it has fallow land, as a result, the net sown area is limited. Land use classification of these Talukas is given in Table 6 below.

Table 6 : Rainfall Data of last Decade in Talukas of Olapad, Hansot and Jambusar
Source: Meteorological Department, Gandhinagar

Name of the Taluka	Total Geographical Area	Forest	Barren and Unculturable Land	Land put to Non Agricultural Use	Permanent pastures and other grazing lands	Land under miscellaneous uses	Culturable waste	Current Fallows	Other fallows	Net area sown	Area sown more than once	Gross cropped are
Jambusar	109827	0	6110	31756	2759	0	883	9519	0	58800	4043	62843
Hansot	39879	983	694	7860	1821	0	4779	7415	26	16301	351	16652
Olpad	68705	0	1300	3940	1504	1070	15707	144	12	45028	7943	52971

Source: Season and Crop Report, 20011, Department of Agriculture, Government of Gujarat

There is no forest land in Jambusar and Olpad Talukas, however, some forest land is present in Hansot Taluka.

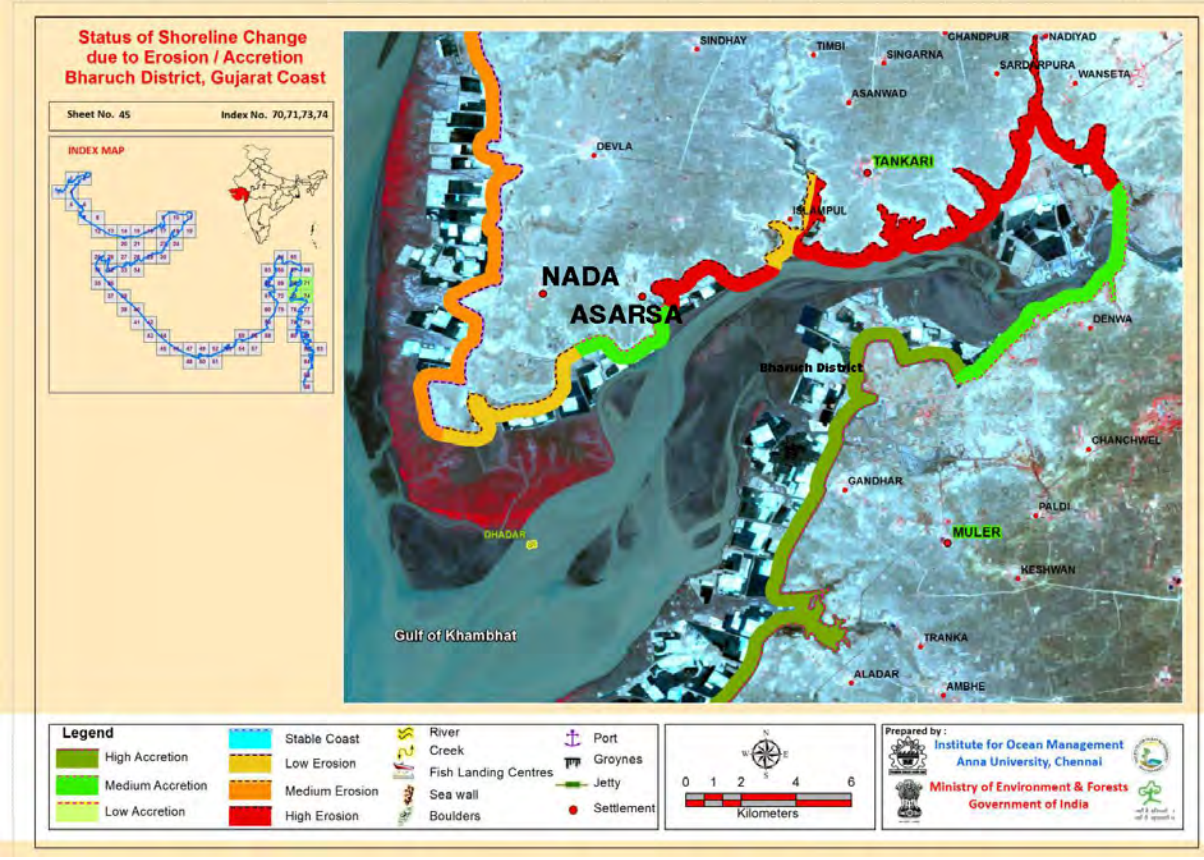
The shorelines are changing due to erosion and accretion and 11 villages of Jambusat Taluka fall in high erosion category. The villages of Asarsa and Nada are included in this list.[4] However, when total geographical areas of Jambusar were compared between year 1977 and 1997, it was found that there is a net increase of 87 hetcatres in the taluka. In the year 1977, total geographical area of the Taluka as per SCR was 1,09,740 hectares and in 1997, it was 1,09,827 hectares. Further investigation at the village level in this matter with the use of satellite imagery is made later in the report.

[4] http://www.gczma.org/uploads/Docs/DetailsofShorelinechanges-Gujarat%20State.pdf

Following images depict status of shoreline in the areas being studied. The images indicate that in Jambusar Taluka, there are stretches of erosion as well as accretion. The village of Nada has medium erosion where Asarsa village has severe erosion. Part of Nada village and Asarsa both exhibit accretion is smaller stretches. In the next image, Malpur and Neja villages have stable coasts. However, part of Asarsa village shows medium erosion. The village of Kanthiajal is in the accretion zone and the village of Dandi has medium erosion. In Jamnagar district, mangrove plantation is done in Mithapur, the image indicates that it lies in medium erosion zone.

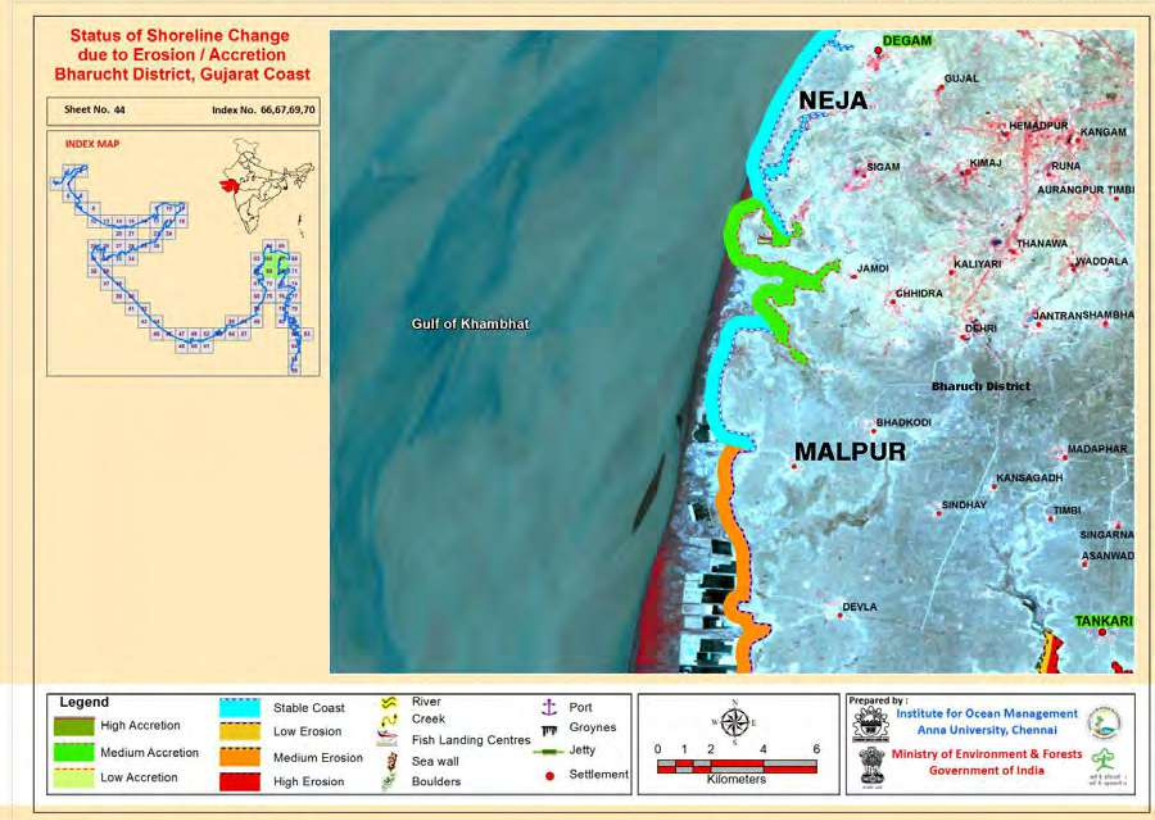
Thus, an overall scenario suggests that there is a trend of erosion of shore line and the land is increasingly not suitable for agriculture. This leads to severe degradation of environment as well as deteriorating livelihoods. There seem to be an urgency to find occupation to improve lives and livelihoods as poor quality of land and hostile nature is impacting adversely especially to poor people.

Figure 3: Shoreline Changes, Nada and Asarsa Villages, Jambusar Taluka



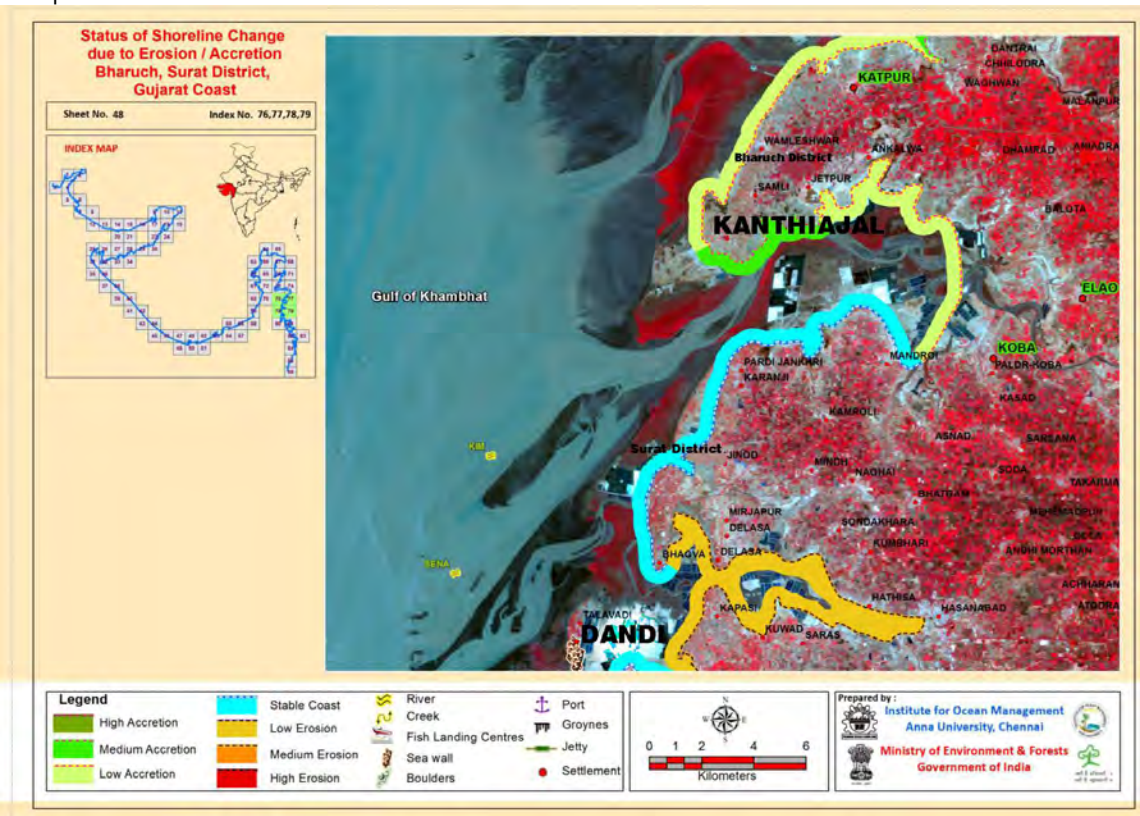
Source: Institute of Ocean Management, Anna Malai University, Chennai

Figure 4: Shoreline Changes, Malpur and Neja Villages, Jambusar Taluka



Source: Institute of Ocean Management, Anna Malai University, Chennai

Figure 5: Shoreline Changes, Kanthiajal Village, Hansot Taluka and Dandi Village, Olapad Taluka



Source: Institute of Ocean Management, Anna Malai University, Chennai

Figure 6: Shoreline Changes, Mithapur, Okhamandal Taluka

Source: Institute of Ocean Management, Anna Malai University, Chennai

3.4 Villages Profiles

The villages where mangrove restoration is carried out are in South Gujarat. Some plantation is done in partnership with Tata Chemicals at Mithaput Taluka, Okha Jamnagar district. However, Mitahpur does not have long-term presence of SAVE or VIKAS.

3.4.1 Demography

The population, literacy, sex ratio of the villages under study as per census 2011 is given below. As compared to overall literacy of Gujarat, the studied villages have much lower ratio of literate persons. Gujarat's average for literate people in 2011 is 85.75 percent. The study villages have 65 to 83 percent literacy. Gujarat's sex ratio as per Census 2011 is 0.91. Gujarat's sex ratio is lower than national average of 0.94. The sex ratios of the study villages are given in following table. The sex ratio is lower than Gujarat average in the villages of Asarsa and Nada,

Table 7:

Village	Total No_HH	Total Population	BPL Population	% BPL Population	Total Male Population	Total Female Poulation	Male Female Ratio	Population Age < 6 Years	Population SC	Population ST	Population Literate	% Literacy	Total Working Population	% Working Population
Nada	612	2697	515	19.10	1475	1222	0.83	310	30	361	1751	65	1278	47
Asarsa	149	841	319	37.93	464	377	0.81	86	0	162	602	72	416	49
Neja	141	560	342	61.07	283	277	0.98	74	8	277	371	66	190	34
Malpore	325	1777	537	30.22	617	560	0.91	NA	4	258	1200	68	643	36
Kanthiyajal*	300	1600	361	15.78	1138	1149	1.01	NA	40	295	1500	66	1023	45
Dandi*	687	3310	759	22.93	1748	1562	0.89	303	134	13	2745	83	1187	36
Mithapur	2293	10508	2847	27.09	5497	5011	0.91	847	2298	54	8360	80	3518	33

Source: Based on provisional census 2011

* Census 2011 does not have details of village of Kanthiajal and Dandi, hence derived from discussions with key people

The villages of Dandi and Mithapur are distinct as Dandi is predominantly fisher village and is not dependent on agriculture, whereas Mithapur has a well known Tata Chemicals that has impacted lives, labour and livelihoods of residents significantly.

Neja as well as Asarsa are smallest villages amongst all the villages under mangrove restoration programme.

The village of Neja and Asarsa of Jambusar Taluka seemed to be lacking in opportunities and assets. The village of Neja has maximum proportion of scheduled tribal population amongst all the villages. Both these villages have maximum proportion of below poverty line (BPL) population amongst study villages.

Castes and Occupations: The majority of castes in the study villages are from the other backward class and includes Rathods, Gohils, Darjis, Suthars, and Prajapatis. The backward castes include Parmars and Makwanas. Other castes are Machhis, Kharwas and Vagharis. There are tribal communities in small number viz. Vasavas and very few houses of Dubla and Kunbis. The general castes are Patels, Brahmins and Jains. The major population in coastal villages of Bharuch district is of Rathods who are landless or have small landholdings impacted by crippling poverty that has held them bonded to the landlords for labour work.

All the villages of Jambusar Taluka i.e. Nada, Asarsa, Neja and Malpore have Rathod population in majority. Kanthiajal village has majority population of Patels having agricultural land. Around 60 percent of their agriculture land is inundated in sea and hence, landholdings have reduced considerably. The village of Dandi has maximum number of Machhis, Karwas and Koli Patel population.

The main occupation in the villages of Jambusar Taluka is agriculture, fishing and animal husbandry to some extent. Kanthiajal has diversified to some extent by way of getting educated with salaried jobs by migrating out. This was a necessity as more than half agricultural land is inundated in sea and marginal landholdings are remaining. They have also taken up work for diamond cutting and polishing as Surat offers such opportunities and is close to Kanthiajal. People of Dandi village are comparatively prosperous as they are involved in fishing and they manage to get significant catch. They own boats and fishing is their primary occupation.

Labour under Bondage: As natural conditions of these coastal areas are hostile and have low water available for agriculture with erratic rainfall, the returns from agriculture are very low. With more than 50 percent of workforce engaged in agriculture and related labour work, the availability of work is also low. The landowners usually engage them at very low wages and labour is freely available, these wages used to be much lower than minimum wages prescribed by the state. This had forced them to borrow, and the inability to pay back the debts forced them to work on annual contract as a bondage known as 'Chakar', wherein the meagre wage is paid annually. Chakar is paid about Rs. 1000 to Rs. 1500 per month on a yearly basis. Also, in such circumstances, their wives are forced to become Panihari – maidservant with the family of the employer, who is supposed to work for the family from six in the morning till late night. Most of the Panihari women are not paid at all or are paid a meagre amount of Rs. 50 to Rs. 100 per month. Chakar and Panihari are not granted any days to take off, paid on the basis of 'no work no pay'. Thus the net amount received by them is reduced from the above-mentioned wages. This debt and thus bondages passes on to next generation.

A survey done by VIKAS in 1978 mentions that the region had 15,000 such families working as bonded labourers. A recent survey points that their number stands at 1,485 families. The situation in study villages is as follows.

Village	Total No_HH	Total Population	BPL Population	% BPL Population	Total Male Population	Total Female Poulation	Male Female Ratio	Population Age < 6 Years	Population SC	Population ST	Population Literate	% Literacy	Total Working Population	% Working Population
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Source: Based on provisional census 2011

* Census 2011 does not have details of village of Kanthiajal and Dandi, hence derived from discussions with key people

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Table 8

Village	Total No_HH	Total Population	Chakar	Paniyari
Nada	612	2697	3	3
Asarsa	149	841	12	0
Neja	141	560	37	4
Malpore	325	1777	12	1

Source: Survey done by SAVE and VIKAS, 2012

The villages of Asarsa and Neja apparently poorest villages have maximum proportion of bonded labour.

3.4.1 Agriculture

Though agriculture is the main occupation of most of the study villages, farmers are continuously struggling to make the ends meet. There are several reasons for it. Firstly, cultivated land per person is very low (0.22 hectare) due to large tracts of wasteland. Secondly, the cultivated land is not productive especially in saline coastal tracts. This limits the choice of crops available to farmers as they have to grow salt resistant varieties and cannot go for the high yielding varieties. Thirdly, the area has very low irrigation potential in surface and ground water resources. This accompanied by erratic rainfall creates a lot of uncertainty in agriculture.

The study villages of Jambusar Taluka have rainfed agriculture. Major crops cultivated in the area are cotton, pigeonpea, sorghum, pearlmillet and wheat. The

present source of irrigation water is tube-well and dug wells. At present, the groundwater depth is 10 to 12 m and water quality is saline. The salt laden winds from the seaside impact the crops adversely and reduces the yields. There are no shelterbelts to protect agriculture from harmful seaside winds and storms that are frequent throughout the year.

The table below is about the productivity of crops grown in study villages. It is much lower as compared to productivity of same crops in Gujarat. For example a study[5] states the yield of rice at 18.63 Q/ha, wheat 11.55 Q/ha and cotton at 15.21 Q/ha.

Table 9: Current Agriculture and Crop Productivity

Sr. No.	Crop	Productivity (Quintal/Hectare)
1	Cotton	7-8
2	Pigeon pea	7.5 -8
3	Sorghum (Rabi)	12-15
4	Pearl Millet	10 -12
5	Rice	8 -10
6	Wheat	12 -15
7	Sesame	5 – 7
8	Castor	8 - 10

Source: Discussions with key people

The village of Kanthiajal in Hansot Taluka was completely dependent on agriculture some years ago. Patels and Parajapatis were the landowners and Rathods and Harijans were engaged as agriculture labour or for fishing. With the sea level rise, sea water has got into the village. Earlier seashore was 5 km away from the village but today the village is right at the seashore. This has reduced landholdings significantly. Now the communities have started migrating out for work, as sustenance on agriculture alone is not viable. Remaining agriculture is rainfed, as the groundwater has turned saline.
The village of Dandi is entirely engaged in fishing and has no dependency on agriculture.

3.4.3 Fisheries

The coastal villages under study except the village of Dandi engage in estuarine, freshwater and inland fishery. The entire coastal region fronting Gulf of Cambay offers very limited marine fisheries. The estuarine fisheries are spread over tidal zones of Dhadhar, Mahisagar and Kim-Narmada River where the admixture of fresh and saline water create favourable conditions.

Around 10 to 25 percent of population in the study villages of Jambusar Taluka and in the village of Kanthiajal of Hansot Taluka is engaged in fishing in estuarine waters. They are mainly Machhis, Vagharis, Kharwas and Rathods. Machhis is a caste that is traditional fishers. For most others fishing is additional occupation and not a full time occupation. Fishers of Jambusar Taluka have very limited boats and generally carry

[5] http://ageconsearch.umn.edu/bitstream/137372/2/2-N-Mehta.pdf

out artisanal fishery with nets or even ropes. The major fishes caught are prawn, mudskipper (lepta), crab, bombay duck (bumala) and mullet (boi).

In Dandi, the sea has receded by around one kilometer. The availability of fishes has reduced significantly and thus, outside jobs are sought. Largely persons from Koli Patel population of the village have migrated to New Zealand, Middle East and other countries and the aspiration of the youth in the village is to find a job there for a regular income.[6]

Inland fishery is not developed in a systematic manner in the Taluka due to resistance from dominant vegetarian communities.

The fishery in the study villages is characterized by distinct seasonality. In the monsoon season, there is maximum catch, reducing in winter and almost null in summer. Due to seasonal nature of fishery, major portion of the annual income of a fisherman household is earned within a period of 3 to 5 months. The situation not only affects the living condition of fisher folk, but also fishery development schemes. Since there is not much fishing during monsoon and in the absence of any alternate employment opportunity, the artisanal fishers have to depend on money lenders or fish traders which ultimately keeps them under perpetual indebtedness and consequently under poverty.

The other reason for the underdevelopment of fisheries is lack of proper marketing facility in absence of which fishers have to depend upon traders for marketing of fish. These traders, some of them are local and others from Bharuch and Surat have transport facility and access to market as far as Mumbai and Calcutta. They buy fish when it is caught at the seashore itself at a very low price and sell it at a very huge price in the metropolitan cities like Mumbai.

3.4.4 Industries

Till recently, industries in the Jambusar and Hansot Taluka of Bharuch district were not developed due to lack of forest, minerals and other natural resources necessary to generate industrial activities. This has confined the industries to agro processing units like cotton ginning and pressing units only.

With the establishment of Special Economic Zone and Special Investment Region namely Petroleum, Chemicals and Petrochemicals Investment Region (PCPIR) at Dahej, some ancillary industries like chemicals and plastic have come up in the region. In addition due to proximity of industrial hub Surat, associated industries of garment and diamond cutting have started functioning.

In the study villages as well as other coastal villages, there is a large potential of salt manufacturing units. However, it was not fully explored till recently but now there is increasing interest in them.

[6] http://www.outlookindia.com/article.aspx?210634

4. Social and Institutional Outcomes

4.1 Background

As a part of its development strategy over the years, VIKAS initiated a group of institutions with specific mandate and mission sharing a common vision.

First and foremost amongst them to translate its vision, VIKAS set up associate organizations, which include Saline Area Vitalisation Enterprise (SAVE), and people's membership based organizations named JSP in Jambusar block of Bharuch district that are jointly engaged in mangrove restoration initiative.

Then, for the watershed development work, watershed development committees were formed in some of the villages. Additionally, at the village levels self help groups (SHGs) and apex level membership organisations were formed. The outcome of VIKAS penetration and reach reflects its initiatives and impacts.

1. 170 village level organisations have been formed.
2. 3 Taluka level membership based 'Parishads' have been formed.
3. A total of 6,800 members are with organisations formed by VIKAS.
4. A total of 835 hectares of wastelands were given to 9 cooperative societies for revitalisation and joint cultivations to the following villages.

Table 10

Neja	80 ha
Dehgam	200 ha
Slgam	200 ha
Malpur	40 ha
Kalak	200 ha
Asanvad	70 ha
Timbi	20 ha
Thakor Talawdi	25 ha

An Integrated Wasteland Development Programme was formally introduced in the above villages to include cooperative societies in the project villages. It was during this time in 1995 that SAVE was formed as a public limited company and appointed to provide technical and managerial services for the objective of wasteland development. It is designed to facilitate mainstreaming of the marginalized in the changing macro-economic environment. The company provides services to poor and other stakeholders engaged in livelihood and other enterprise development including natural resource regeneration.

4.2 Evolution of Institutions for Mangrove Development

With a strong base at the grass root level and armed with newly placed liberalisation economy in India, there was a need for newer institutions to deal with poverty. As per its mandate, SAVE has supported the start up and flourishing of many nano enterprises run by poor households and the development service delivery run by community organizations and entrepreneurs in sectors as diverse as salt making, agri-processing, waste management, provisions for households, alternate energy production and financial services.

These privately funded and managed institutions (company) were envisaged by SAVE as being formed by people, for the people and of the people with a clear objective of livelihood enhancement. Some of the members of the institutions formed by VIKAS mentioned earlier are founders of these newer institutions meant for mangrove regeneration and fisheries. SAVE promoted such institutions so that poor be part of mainstream development process by consolidating their numbers into a collective workforce and proactively engaging them with market economy. Thus, poor were a resource to be reckon by themselves and others. To improve their lives and livelihoods, entrepreneurship is promoted and strengthened. Following table provides details of such institutions engaged in mangrove development and associated activities.

Table 11: Institutional Memberships for Mangrove Development

			Approximate Number of HHs			Institutional Memberships, No. of Members				
Village	Total No_HH	Perosons/HH	Agriculturist	Fishers	Labourers*	Agriculturist	Fishers	Labourers	Type of the Institution	Name of Institution
Nada	612	4	400	70	200	250	0	0	WD+MD	Jalstrav Vikas Samiti
Asarsa	149	5	60	90	90		0	22	SG+MD	Tamvar Vikas Samiti
Neja	141	4	80	22	60	12*** + 120	0	60	WD+AC	Jalstrav Vikas Samiti, Bhathiji Co-op Society, Tamvar Vikas Samiti
Malpore	325	5	200	70	80	80	80	50	WD+MD	Jalstrav Vikas Samiti

Kanthiyajal*	300	5	270	50	50	100	150	200	MD	Morkantha Tamvar Vikas Samiti
Dandi*	687	5	0	687	20**	NA	687		MD	Dandi Tamvar Vikas Samiti
Mithapur	2293	5	NA							

Source: Key Resource Persons of the Villages, 2013-11-06.
* Includes fisher working as part time labourers too, implying there are a few people counted in both fishers and labourers.
** Dandi village labourer, work as labour for fisheries only.
*** Members of 'Sahyog Krishi Input Centre' for agricultural interventions
WD – Watershed Development, MD – Mangrove Development, AC – Agricultural Cooperative, SG - Saving Group.

It is evident from the above table that the institution development for mangroves often had genesis in the watershed development work carried out in the villages. The watershed works are essentially for development of land and water and once it is done, the institutions thus formed are redundant. The next step for the human resource development is to engage them in meaningful activities to generate employment and thus enhance their livelihoods. The objective of such institutions is also to make them sustainable by way of having some resources with them. The belief for supporting them is that if sensitive, thinking and committed members of such institutions are endowed with some resources, they would make judicious use of it, for benefiting the communities they are engaged with.

4.3 Evolution of Institutions for Enhancing Livelihoods of Fishers

VIKAS and SAVE has long standing commitments for improving the conditions of fishers as much as agricultural labourers. This is evident in VIKAS's initial engagements with them through saving activities. As the Tamvar Samitis are formed out of watershed committees, similarly genesis of fishers groups are from the saving groups. Following is an overview of saving groups formed by VIKAS primarily having fishers as their members and VIKAS's financial contribution in these groups.

Table12: Institutional Memberships of Fishers

Sr. No.	Name of Group	Village, Taluka	No of Members	Savings in Rs.
1.	Sagar Vikas Mandal	Suva, Vagara	28	165
2.	Bhathiji Mandal	Paniyadra, Vagara	63	17470
3.	Khodiyar Adivasi Mandal	Paniyadra, Vagara	77	31826
4.	Sant Kabir Chaitnya mandal	Paniyadra, Vagara	70	36080
5.	Yogeshwar Adivasi Vikas Mandal	Goladra, Vagara	35	31661
6.	Jay Mahashakti Mandal	Goladra, Vagara	26	2795
7.	Yuva Narmada Mandal	Kaladra, Vagara	35	00
8.	Yuva Namda Arthik Pravurti Mandal	Kaladra, Vagara	35	18000

Source: Records of VIKAS

As per SAVE's mandate of private sector clients, wherein members of community are included in a variety of industries to develop strategies to minimize their environmental impact, cut costs, and grow revenues, fishers, who were also members of these groups were also advised to form a company. It was felt that by way of financial independence they would liberate from vicious circle of loan, debt and exploitation of middlemen in buying and selling of their produce. SAVE's intent is to organise the fishers by way of engaging them directly with market as a collective ergo transforming them into a financially stable, vibrant entrepreneur unit. The motto of this engagement is to move away from popular build-operate-transfer model to build-own-transform model. For this, it has invested Rs. 50,000 as equity to form a company in 2012. Initially, 16 members were given loan of Rs. 1000 each for the activities of fisheries. Now there are 22 members and they collectively sell the fish catch. Thus, they have already made a profit of Rs. 8,765. Another such company is formed in the village of Nada with 12 persons as members. Till date they have profit of Rs.34,091. It is hoped that these smaller profits would lead to a favourable investment climate for attracting investments for expansions.

4.4 Sustainability

SAVE strives to make businesses more sustainable. For the objective of institutional sustainability, it needs to be translated in terms of financial independence with market linkages as well as some assets and deposits as surplus, which may be reinvested for the benefit of the institution thus reaching its members. Towards this belief, the financial growth detailed in the table below is realized for various institutions wherein SAVE is involved. The key characteristic of a sustainable business institution is that it should best reflect the interests of the business and the interests of its stakeholders. The institutions formed by SAVE acknowledges and values what matters to them explicitly and makes untiring efforts to materialize it for their own well being.

Table 13

	Name of the Institution	Business Till Date	Clear Profit	Reinvestments

Building community and village institutions that are organized, transparent, and that can manage their own development priorities are thus initiated with a belief that this approach would lead to more sustainable outcomes and help them reach sufficient scale to reach more of the poor.

Several projects created over more than two decades engagements have given rise to a cadre of professionals within the community members with skills and motivation to form self-managed and self-reliant organisation for enhancing their livelihoods. This has expedited the process of because the members involved speak the same language and share similar life experience of those they are trying to mobilize. It also helps the organisation meet its objectives at a lower cost thus achieving efficiency, effectiveness and sustainability.

4.4 Enhancement of Awareness, Skill, Leadership, Self-Confidence, and Status

The institution development leads to human resource development as well as natural resource development. Improvement in natural resources leads to human resource development too and a definite correlation exists between the two. This was evident in the process of institution development and is described in enhancement of personal development traits like increased awareness, improved skills, evolving leaderships, growing self-confidence and rising status by members of the community.

Increased Awareness: The members of community especially amongst Rathods have come a long way from undignified bondages to serve as a labourer to meaningfully getting employed. They recognize the opportunities in working as a collective and are gradually learning to take the opportunities market may offer if understood and executed in a manner that the benefits are gained by all the stakeholders. Gradually, they are valuing education for their children.

Improved Skills: The skills of dealing with external world, may it be from Government, landowners or higher communities or people who are better endowed in anyway, have taken a giant leap. These bonded labours have now discovered the strength to voice their rights. They are no longer afraid of landowners and negotiate fair wages for their labour. Other skills like participation in meetings to present their issues, collectives for savings and credits from it, maintaining or understanding the accounts of the saved or credited funds, negotiating for better price for their goods and services, analyzing the loopholes for getting better prices and having a solution oriented approach are some of them.

Evolving Leaderships: Developing leaderships in the rural sector for social business means proactively looking for individuals spread across in the region, establishing contact, entering into dialogue and then identifying areas where they would want to work on and supporting the same. Over the years, SAVE has identified, dialogued with, and supported committed individuals and facilitated their leadership skills, enabling such leaders to execute their ideas on rural businesses through pilot projects. It has also build leadership among staff in associated organizations like JSP that has already created a second rung of leaders who are taking the vision of SAVE forward in their own way by facilitating forming newer ways of business benefitting the locals. The fishers company formed at Asarsa and Nada are some of such examples.

Growing Self-Confidence: As the communities have started organizing and beginning to manage their own institutions, their self-esteem and confidence grew. Over time, some of the groups have taken over most of the functions performed earlier by project staff and/or other functionaries of VIKAS. Examples of these kinds of groups are ---------- It is expected that these organizations would enable the poor to develop linkages with the financial sector and markets, and eventually, will become credit and investment worthy.

Rising Status: With improvement in economic situation, the decision making abilities and freedom to choose ones work has given rise to better status for the members of the communities like Machchi, Rathods, Vasavas, and Vagharis. This is an obvious outcome as they have started negotiating returns of the services provided as labourer by way of finding alternate markets for their goods and services. Earlier during the period of stress, they would succumb to landowners and moneylenders easily without demanding a fair price for their produce and services. Now with the strength of better stability of other community members and the companies they are part of exhibit resilience in both the periods of crisis as well as growth.

5. Environmental and Economical Benefits

It is widely acknowledged, computed and well documented that mangroves offer immense environmental and economic benefits. However, the benefits accrued from young mangroves is a miniscule part of its potential value. A very important dimension of mangrove benefits is about the wide gap between its present and potential value. The value of mangroves increases at an exponential rate with the improvement in its quality.

SAVE, VIKAS and associated organisations are engaged in mangrove development since 2002 and growing till date. Total mangrove plantation done till date is as per table below. In addition, proposed mangrove plantation of 250 ha is to be done in Nada and Devla villages during the year 2013-15.

Table : Mangrove Plantation Done by SAVE/VIKAS

No.	Name of Village and Taluka	Oranisations Involved	Programme/ Partners	Year	Area Brought Under Mangrove (ha)
1.	Nada, Jambusar	VIKAS	REMAG-GEC	1999- 00	200
2.	Asarsa, Jambusar	JSP, SAVE (Technical Expert)	Essar	2011-12	100
		SAVE, JSP (Implementation)	Essar	2012- 13	100
		SAVE	Essar (Ongoing)	2013- 15	100
3.	Neja, Jambusar	VIKAS	REMAG-GEC	1999- 00	150
4.	Malpore, Jambusar	JSP, SAVE (Implementation)	Adani	2012- 13	100
		SAVE, JSP (Implementation)	Adani (Ongoing)	2013- 15	100
5.	Kathiajal, Hansot	VIKAS	REMAG-GEC	1999- 00	200
6.	Dandi, Olapad	VIKAS	REMAG-GEC	2005- 06	100
		SAVE	Essar Shipping	2011- 12	100* (Monitoring)
7.	Mithapur, Okhamandal	SAVE	TCSRD	2002- 03	75
8.	Mundra, Mundra		Adani	2010- 11	90000* Plants
	Total Area Brought Under Mangrove				1225

Source: Records of SAVE/VIKAS

* Not considered for total area

However, the mangrove cover changes over a decade are detected from satellite images. The GPS location of exact planting done by SAVE and VIKAS is unavailable, hence increase in mangrove cover is found in the respective villages by way of extending approximate boundaries of the village through the shore in mudflats. The change in mangrove coverage is as per the table below. Almost 1721 ha (60% of area under mangrove in year 2000) increase in area under mangrove is evident in the table.

Table :

No.	Village	Area under Mangrove in 2000 Ha	Area under Mangrove in 2012 Ha	Area under Sparse Man grove in 2000 Ha	Area under Sparse Man-grove in 2012 Ha
1.	Nada	1844	2002	896	00
2.	Asarsa				
3.	Neja	16	320	173	00
4.	Malpur				
5.	Kanthiajal	297	592	117	56
6.	Dandi	382	1291	206	00
7.	Mithapur	00	55	00	00
	Total	**2539**	**4260**	**1392**	**56**

Source: Satellite image analysis of images of year 2000 and 2012

The major benefits observed in the villages where plantation is done are described herein.

5.1 Prevention of Erosion in land – Phenomena of Accretion and Retention of Soils

The mapping of erosion and accretion exhibited characteristics of the study villages as described in earlier chapters. When the same shorelines were analysed for changes in last decade, the detection is presented below. The erosion in Dandi as per the image analysis is subject to change as it is a very dynamic coast and within days there would be changes in landforms, hence it is not considered. The net gain is significant and it reflects that mangroves are supporting shore stabilization and retention on soils reaching the coast.

Table :

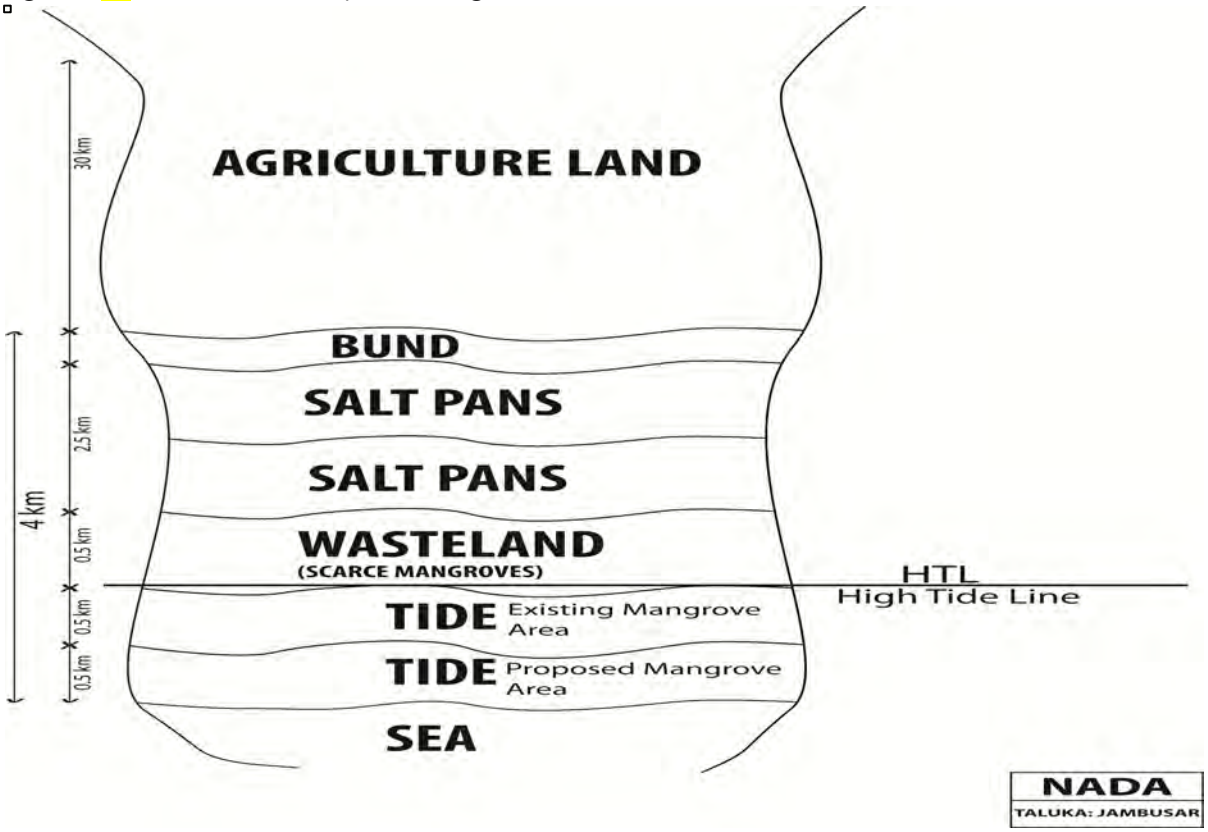
No.	Village	Description in Institute of Ocean Management Maps	Increased Area in 2012 Hectare
1.	Nada	Accretion	
2.	Asarsa	Sever erosion, medium erosion and in parts accretion	4103
3.	Neja	Stable	
4.	Malpur	Stable	2245
5.	Kanthiajal	Accretion	-173
6.	Dandi	Medium erosion	NA

7.	Mithapur	Medium erosion	-34
	Total		6141

Source:

Mangroves support retention of soils once it reaches the shores as it gets trapped in its roots. However, there are numerous other factors like construction of jetties, other sea structures and ports that influences phenomena of erosion and accretion. At the same time, it merits mention that the scenario without the mangroves would not result in retention of soil and thus accretion as mentioned in the table above.

Figure: --- Schmatic Map of Village Nada



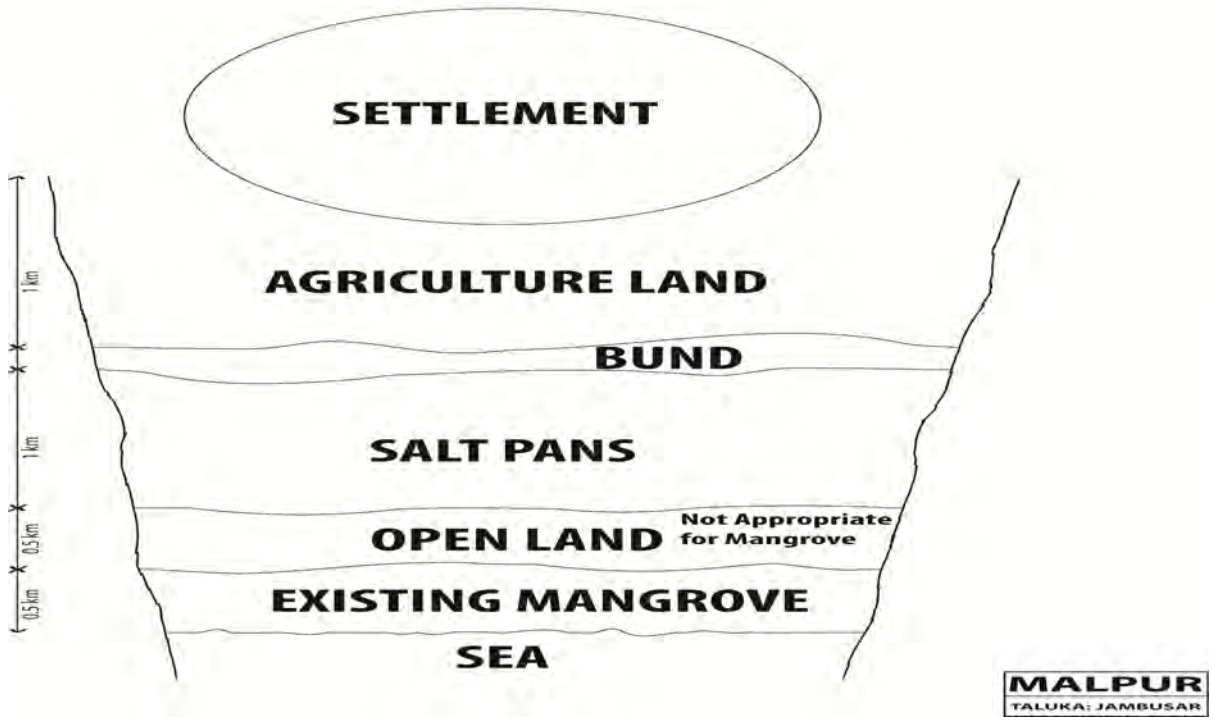
Source: Information from Community in a PRA

It was mentioned in the village of Nada that due to accretion the land in Nada has increased substantially. They have mudflats where fishes like mudskipper are found as well as with the increase in land, it is leased out for salt works. According to them around 600 ha (6 sq km) has increased in last five years. This has resulted in 400 ha (4 sq km) of lease for saltpans and 200 ha of saltpans are being considered for approval. The labour employment generated for 400 ha (1000 acre) of saltpans is for around 200-250 persons for 8 months in a year. In addition, skilled workers like drivers, electricians, and mechanics are other jobs that are absorbed in salt works. In addition, the marshes have also increased and thus potential of mangrove plantation has increased as shown in above figure.

However increasing saltpans have detrimental effect on mangroves as these saltpans construct bund that does not allow the rainwater to reach the Areas of

these Mangrove forests as in villages of Malpur and Nada. This leads to increasing sedimentation of the mud flats that is not conducive to the growth of Mangroves. Secondly, the brine is salt pans is more concentrated and when released on mudflats, it destroys mangroves. Thirdly and most importantly is that mangroves are being cut so that saltpans may be put up.

Figure : Schematic Map of Malpur Village



Source: Information from Community in a PRA

5.2 Employment for Rural Poor

Locals are engaged at all the stages of mangrove development like site selection, nursery development, transfer of saplings, guarding the plantation and collection of seeds. All these activities generate work for communities and help sustain them in the economical crisis. Generation of employment and hence wages in a typical mangrove plantation programme may be considered for extrapolation of total work done by SAVE/VIKAS.

Collection of Seeds: ass
Raising Nursery: ui

Sowing/Planting Sapling: df
Direct Dibbling: df

Guarding Plantation: sdd;kkb

5.3 Availability of Fishes

The benefits to fishers are two folds, firstly due to increase in availability as also due to increased prices of catch with elimination of fish traders. Two apparent indicators of the profitability of fishing are number of people taking to fishing and the increase in period of availability.

All the population of Dandi village is occupied in fishing, while the rise in numbers of fishers is evident in other villages as given in table below.

Table : Change in Fishers Numbers Over the Years Post Mangrove Plantation

	Name of Village	Earlier No. of Fishers	Current No. of Fishers	Fishers of Other Villages
1.	Nada	15 Years Back 30 Traders Nil	200 + 4 Traders	--
2.	Asarsa	4 Years Back 40	70 + A group of 15 fishers for collective market	Nada, Kapuria, Devla, Islampur, Tankari – Through the year Malpur, Bhadkodra – Only in winter for mudskipper
3.	Neja	10 Years Back Nil	17*	Sigam 12 Khimodna 15 Dahegam 08
4.	Malpur	2 Years Back 120	135*	--
5.	Kanthiajal	15 Years Back 20	100*	--

* Including fishers as secondary occupation

Source: Discussions with Key People, 2013

The other significant narration from all the above villages is that the availability of mudskipper is year round now that was only during winter earlier. Mudskipper and crabs propagate in mudflats only. Increase in land areas specifically mudflats have increased with accretion over time as mentioned earlier in this report. It also enables fishers to lay nets for mudskipper with the increased availability of land, otherwise they used to catch mudskipper with In Asarsa, it is reported that Boi fish has started propagating recently that was not there at all.

Elimination of the trader in between and initiating collective marketing of fishes has made a difference of Rs. 10 per kilogram in its price for all the species of fishes. A fisher is able to catch 3 to 8 kgs of fishes per day. The selling price of Prawn is Rs. 80 per kg, mudskipper being Rs. 60 per kg and crabs are sold at Rs. 80 per kg. The availability of mudskipper is maximum in winter but are now available throughout the year. Prawns are caught in monsoon only.

Table :

	Name of Village	Earlier Catch of Fishes	Current Catch of Fishes
1.	Nada	Mudskipper 1 Quintal (Q) Prawn 2 - 3 Q	Mudskipper 2 Q Prawn 3 - 4 Q
2.	Asarsa	Mudskipper 1.5 Q Boi 1 Q	Mudskipper 5 Q
3.	Neja	No Fishing	Mudskipper, Prawan, Crab,

				Bumala, Boi	1Q
4.	Malpur	Mudskipper, Prawn, Boi, Crab	10 Q	Mudskipper, Prawn, Boi, Crab, Bumla	12 Q
5.	Kanthiajal	Mudskipper, Prawn, Boi, Crab	5 Q	Mudskipper, Prawn, Boi, Crab, Bumla	20 Q

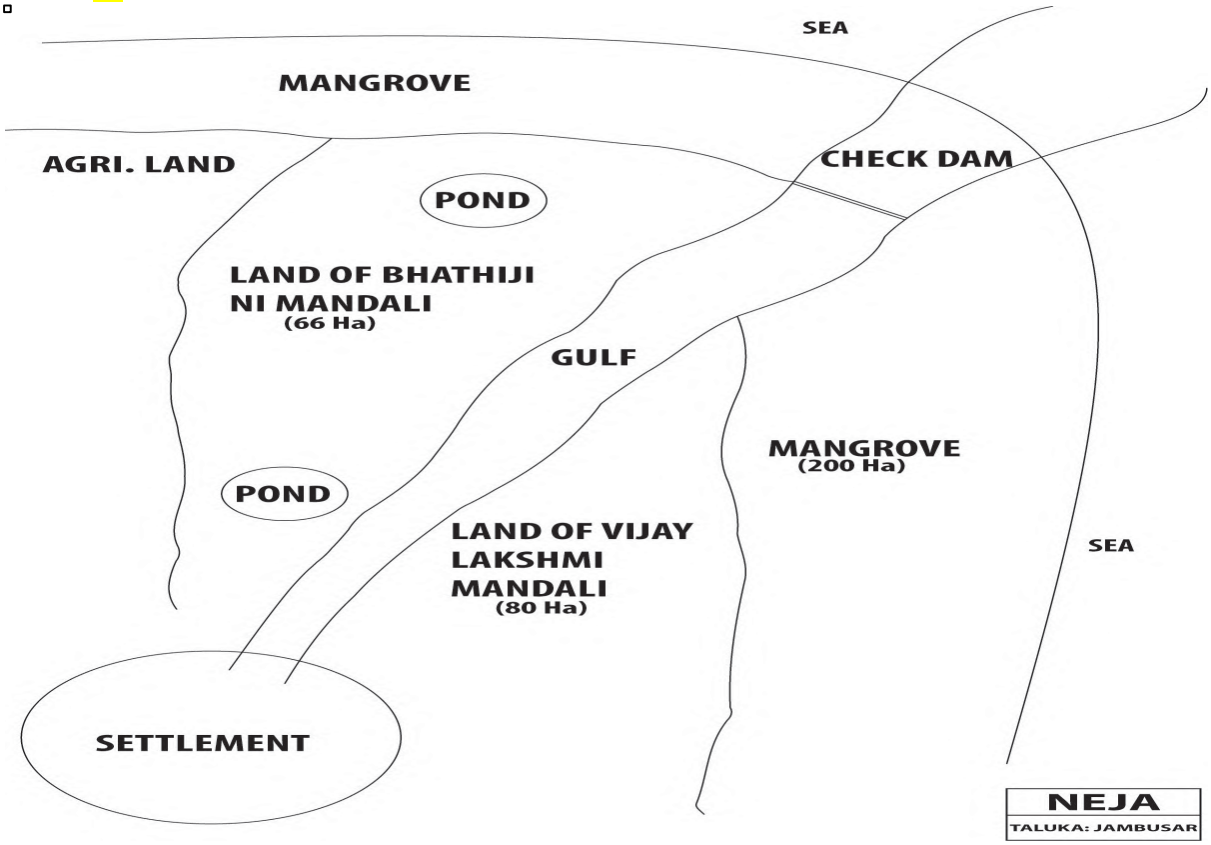
Source: Discussions with Key People, 2013

Mangroves provide nursery grounds for fish, prawns and crabs, and support fisheries production in coastal waters. Young fish, shrimp, crabs and other animals in the sea need a safe place to grow, away from many predators. Only those young animals that find refuge survive to grow to full size. Smaller fish or shrimp (prawn) swimming in open waters may soon be eaten by larger fish. Mangroves are good nurseries because they provide hiding places for young animals. Finger-like roots of the mangroves are this protection, along with the abundant food supply that comes from mangrove leaves, makes mangrove areas very good nurseries for many important sea animals.

5.4 Protection to Agriculture from Impacts of Saline Winds and Wind Speed

Mangroves act as bio shield and protect landward areas from winds. The winds coming from seaward side are laden with salts and hence are damaging to agriculture. The village of Neja as depicted in the figure below has mangroves a shield between agricultural lands and sea. Saline winds and dust used to blow to such an extent that visibility was for a few meters only. This caused loss of productivity especially of cotton and to other crops grown next to shore. Cotton is predominant crop in this village and it is cultivated in around 500 acre in this village alone. Out of these 100 acres lies adjutant to the sea. The yield of cotton used to be about 0.75 quintal per acre only due to the dust and winds. Mangrove plantation is done in 1999-2000 here and they matured in about 8 years. So since last five years the dust storms have reduced and become almost non-existent. Cotton yield per acre has more than doubled and is about 2 quintal per acre now thus contributing substantially to farmers.

Figure ---: Schmatic Map of Village Neja



Source: Information from Community in a PRA

5.5 Fodder and Fuel

Nada, Neja and Kanthiajal villages have older mangroves that are matured as the plantation is done around the year 2000. There are significant agriculturist families in the villages of Nada, Neja, Malpore and Kanthiajal. These families usually own cattle also. All the agricultural families avail fodder in summer (an average of 60 days) at least one head load per day and fuel head load about 20 times in a year from mangroves. Based on the numbers of agriculturists in the villages having mature plantation following conjectures are made as an estimate of value of fuel and fodder from mangroves.

Table ----:

Village	Total HH	Persons Per HH	Agriculturist	Agriculturist HH*	Fuel-Fodder Gathering HHs#
Nada	612	4	400	200	100
Neja	141	4	80	40	20
Kanthajal	300	5	270	135	67

Source: Discussions with people in these villages
* Assuming that half the persons in a HH are agriculturists
# Assuming that half of the families gather from mangroves

Considering that per head load on an average 10 kg is carried, total contribution of the mangroves towards fodder and fuel would be as follows.

Table ___:

Village	HHs Benefitting	Number of Fodder Head load	Number of Fuel Head Load	Total Fodder Gathered Kilograms	Total Fuel Gathered Kilograms
Nada	100	6000	2000	60000	20000
Neja	20	1200	400	12000	4000
Kanthiajal	67	4020	1340	40200	13400
Total	187	11220	3740	112200	37400

Source: Discussions with people in these villages

If average cost of fuel and fodder be Rs. 3 per kg, then a value of Rs. 3,36,600 and Rs. 1,12,200 is realized towards fodder and fuel respectively per year. This amounts to a total of Rs. 4,48,800 per annum since last 5 to 8 years in these villages. Similar returns are expected in other villages and younger plantations once they mature.

The contribution of mangrove towards fodder and fuel to community is beneficial, but at the same time felling of these plants for fuel is detrimental to its development. Unchecked use for fodder also results in stunted plants eventually withering. Hence for development of mangroves it is imperative to have alternate arrangement of fodder and fuel with social forestry or other means.

Another aspect which needs due consideration is open grazing. In the village of Nada depletion of Mangroves started from 1971 onwards, when a group of merchants from Kutch along with about 2000 camels wit support from some local strong people allowed camel grazing in these mangrove forests. The local villagers resisted this but the resistance was not strong enough to force the Maldharis of Kutch to take away their camels. The result was a rapid decline in the density and height of these erstwhile dense mangrove forests. Within five years of the encroachment by the Maldharis the height of these Mangroves reduced from an average of 10 feet to less than five feet. By 1988 the height reduced to a further 3 feet. After 1990 these mangrove forests reduced to a stripped area with small-depleted mangroves. The resistance of the villagers that initially started at a small scale grew up slowly and the pressure created by these villagers finally paid off after twenty-five years when the district administration ordered the removal of these Maldharis from the village and the mangrove forest area.

This resistance of the villagers was good for the mangrove patches and today there have been some improvements in the health of these mangroves.

5.6 Other Contributions of Mangrove Plantations

There are many other ecosystem services provided by mangroves. As the valuation and quantification of all of them is not done in here, some pointers towards the contribution are as follows.

5.6.1 Coastal Tourism

There was an attempt to pilot youth tours to increase their awareness of coastal ecology with an element of adventure in mudflats and mangroves. It attracted good number of urban youth and some employment was generated for locals.

Mangroves once mature will also provide shelter for migratory birds and serve as roosting and foraging grounds. Thus these have the potential of serving as recreational ground for bird watching and observation of other wildlife.

5.6.2 Protection from Storm Surge, Tsunami and Cyclones

It is established after the tsunami in South India that the areas having mangrove were least damaged. They would have inherent value of protecting the assets and lives of coastal communities in the event of natural hazards.

5.6.3 Protection and Propagation of Biodiversity

Mangrove produces leaf litters, which are valuable source of food for animals in estuaries and coastal waters. They decompose and are broken by bacteria, fungi and other microorganisms that nourish animals. In addition they also provide nursery grounds and shelter to terrestrial, aquatic, amphibians as well as avian thus protecting and increasing biodiversity.

5.6.4 Carbon Sequestration

Mangrove management handbook[7] mentions that mangrove contribute 1,800-4,200 grams of carbon per square meter per year. This will lead to reduction in carbon emission and reduction in carbon in air in near shore areas. Mangroves absorb and trap carbon.

[7] Mangrove Management Handbook by D.M. Melana, J. Atchue III, C.E. Yao, R. Edwards, E.E. Melana, H.I. Gonzales, Department of Environment and Natural Resources supported by USAID, 2000

6. Influencing Policies

Engagements in improvement of ecology and economy for decades have resulted in recognition of the efforts and currently Mr. Rajesh Shah is a member of coastal zone management authority for the Government of Gujarat. This is an opportunity to draw attention of policymakers for the objectives of the organization as well as for the well being of coastal population.

In an attempt to save mangroves of Nada village, advocacy was done for stopping the lease for spread of saltpans. This is reflected in media and found support. A report to this effect is annexed.

This authority is empowered to give clearance to projects within CRZs. However, the limitation is that the time given to review the project is very limited so a detailed study required for the clearance is not viable. Attempts are made to point out violations in the meetings of authority. Possible areas for advocacy may be,

- To put a curb on rampant increase in saltpans. These are detrimental to ecology. In the study villages itself the increase in saltpans is given in following table. There is an increase in 2274 ha amounting to about 60% increase in area under saltpans.

No.	Villages	Change in Saltpan Areas in ha		Change in Saltpans Area in ha
		Year 2000	Year 2013	
1.	Nada & Asarsa	2812	4678	1866
2.	Neja & Malpore	546	817	271
3.	kanthiajal	87	224	137
4.	Dandi	1127	1670	543
5.	Mithapur	239	205	-34
	Total	3445	5719	2274

Source: Satellite image analysis of 2000 and 2013 images

- Policies for promotion of bio shields that are recommended for fodder needs and better prevention of natural hazards.

- Promotion of tourism activities that provide livelihoods to local population as well as do not cause any damage to mangrove ecology.

7. Social, Economical & Technical Potential of Up-scaling

7.1 Relevance

About 132,440 ha. Area in Jamnagar, Rajkot and Kutch districts of coastal mudflats has been notified as reserved forests. However, most of these are barren.[8]

It has been estimated by experts that the total coastal wetlands in Gujarat is of 2508300 ha or 25083 sq. km.[9] Space Application Centre (SAC) has estimated this area at 2850000 ha or 28500 sq km. As against this, the area under mangroves is 1058 ha as per FSI report of 2011. The total potential area for mangroves including the area having mangroves in Gujarat is estimated at 1675.40 sq km. It means that 63.15% plantation is done.

It is clear that although mangrove plantation is done in some parts of the coast, still there is ample scope for further plantation as majority of coastal mudflats in the area are still devoid of vegetation.

7.2 Availability of Mud Flats in Study Villages

The potential of mangrove plantation has increased in the villages under study as well as along the coast in accretion zones. There were large mudflats that are not planted and conducive to growing mangroves. Following table provides details of mudflats in the study villages. As the village of Dandi is very dynamic and the changes in mudflats are frequent, they are not included in total areas

Table---: Changes in area under saltpans in 2000 and 2012

No.	Villages	Change in Saltpan Areas in ha		Change in Saltpans Area in ha
		Year 2000	Year 2012	
1.	Nada & Asarsa	5910	8147	2237
2.	Neja & Malpore	908	2882	1974
3.	kanthiajal	1366	1155	-211
4.	Dandi	6236	2069	-4167
5.	Mithapur	0	0	0
	Total	8184	12184	4000

[8] Valuation of Coastal Resources – The Case of Mangroves in Gujarat, Hirway Indira and Goswami Subhrangsu, 2007, Academic Foundation and Centre for Development Alternatives

[9] Mangroves in Gujarat, Gandhinagar, Singh H.S., 1999, Gujarat Ecological Education and Research (GEER) Foundation

Source: Satellite image analysis of images on year 2000 and 2012

7.3 Model of Social Enterprise

As a model of social enterprise SAVE has demonstrated that a full-service consulting firm is able to develop effective strategies for promoting conservation. Its partners include a wide range of businesses, non-profits, philanthropists, public institutions and the government.

SAVE enables its clients create new programs, evaluate existing initiatives, comply with regulations, make business practices more sustainable, communicate with stakeholders, and recruit exceptional talent from local communities grooming them eventually forming self sustaining institutions at the local levels.

On behalf of philanthropic institutions, private donors, and other private and public capital providers, SAVE has develops new investment models that combine both mission- and profit-driven goals. The thought of engaging and making primary producers an integral part of business has grown and is being adopted by many stakeholders trying to debut into developmental works and thus has many takers.

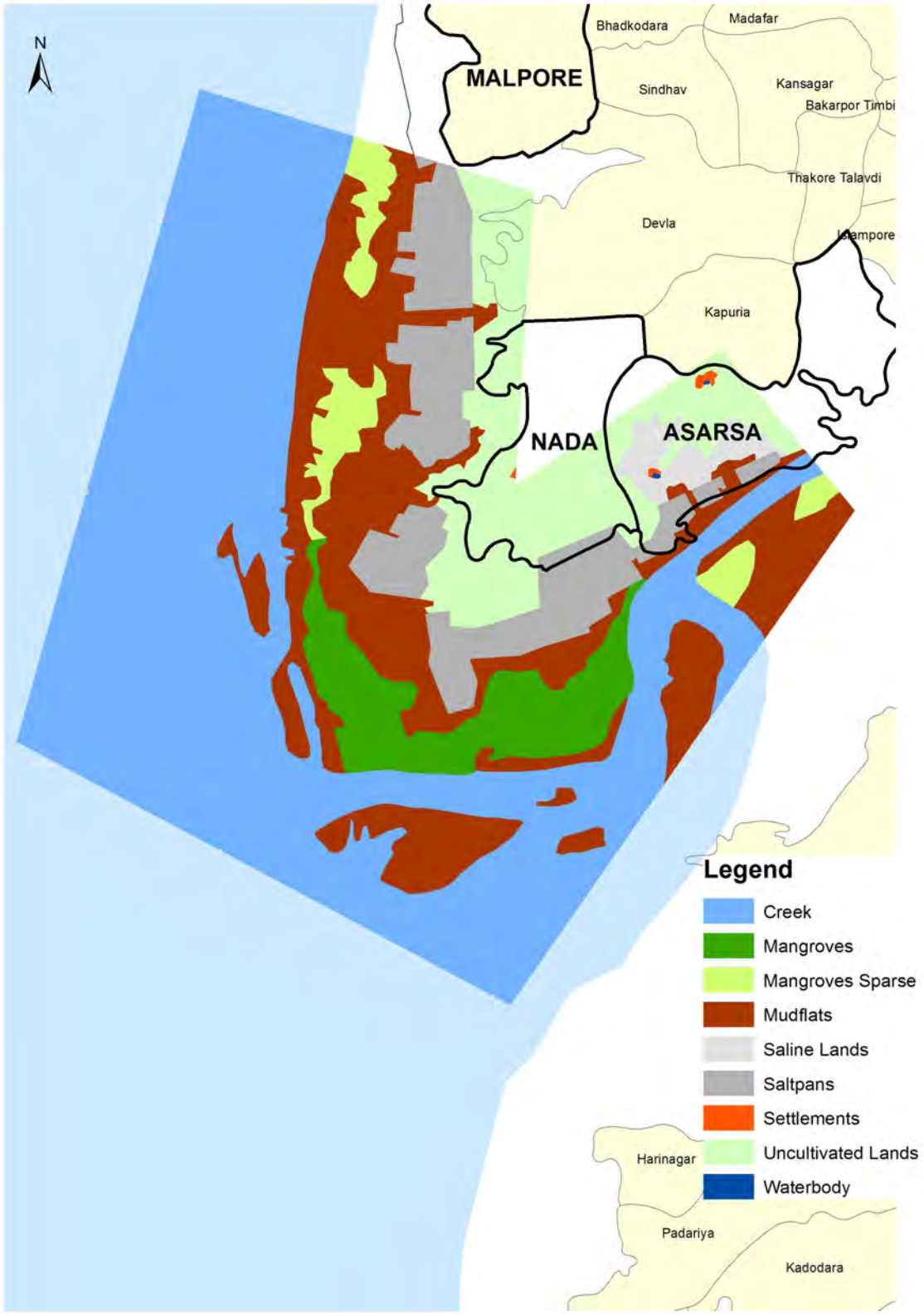
7.4 Market-Based Philanthropy

On behalf of private companies, SAVE looks for investment opportunities and strategies that catalyze positive changes and complement social investment activities. SAVE has examined progressive investment strategies on coastal areas for food and agriculture, and energy systems.

Air, water, land, oceans—SAVE tackle a broad spectrum of environmental issues and sees opportunity where such problems intersect.

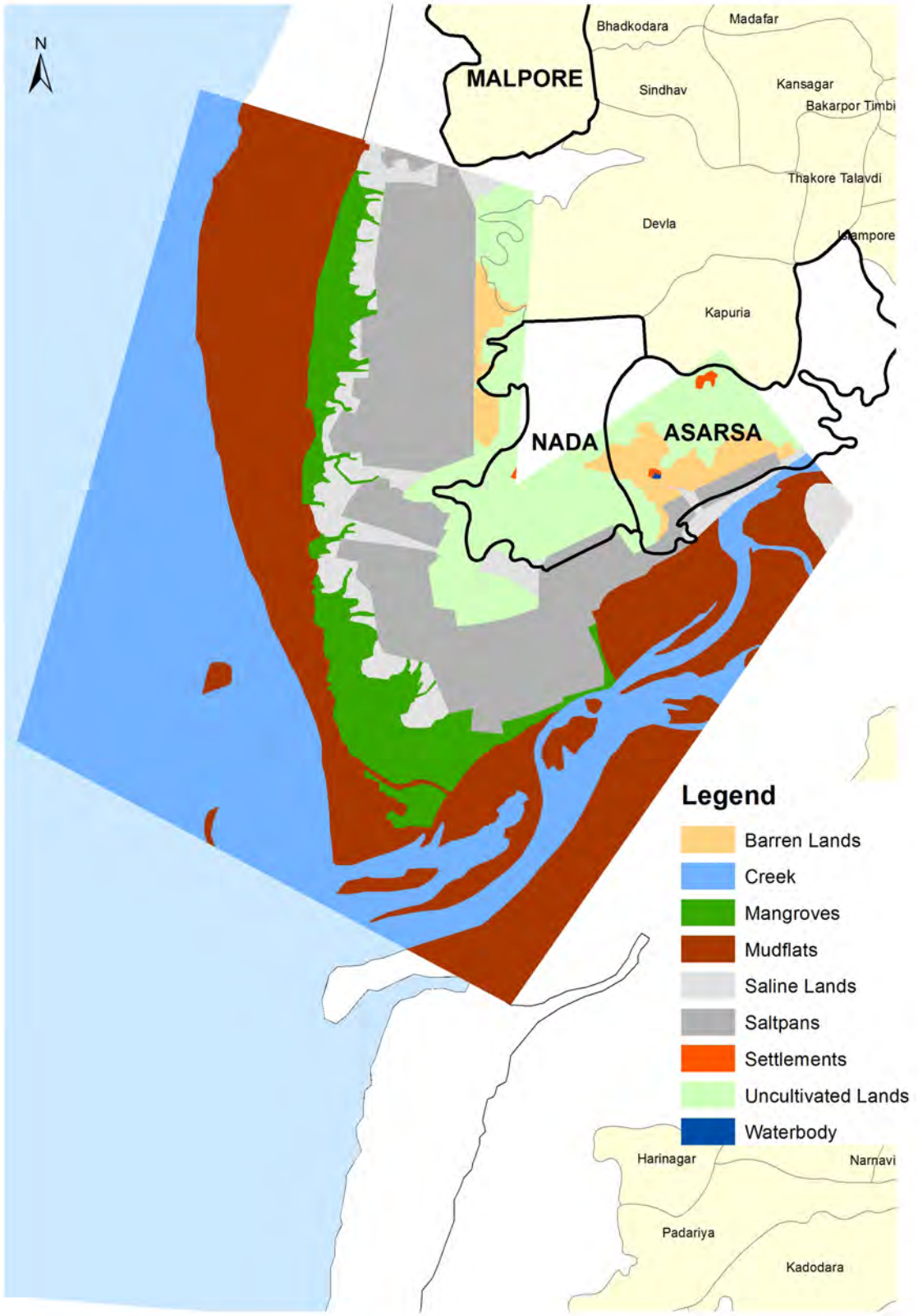
SAVE's sustainable finance practice blends significant financial industry experience with an uncommon understanding of the operational "nuts and bolts" of sustainability. This combination can take many forms. At its most advanced, SAVE's sustainable finance practice has designed and launched a private growth equity fund with a sustainability mandate. Similarly, SAVE has worked with both foundations and non-profits to craft strategies that investments for improving environmental outcomes. This conceptual work is complemented by practical, on-the-ground experience in conservation and development. We have run several business planning efforts for conservation areas, mangroves being one of them.

ANNEXURE 1: Nada and Asarsa – Land Use Year 2000



Land Use Map year 2000	
Village Nada and Asarsa, Taluka Jambusar, District Bharuch	**People in Centre *Consulting***

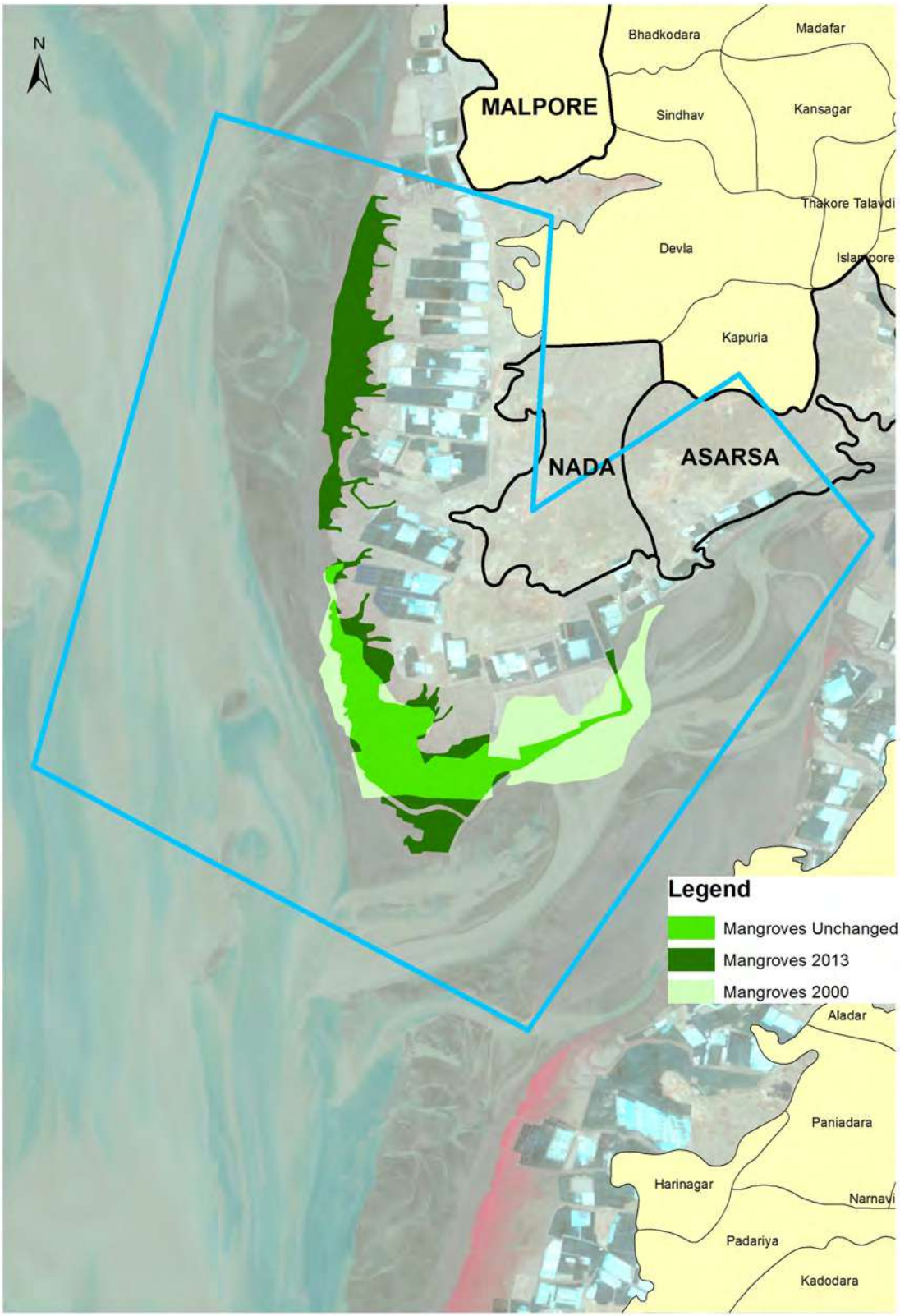
Nada and Asarsa – Land Use Year 2012



Land Use Map year 2012

Village Nada and Asarsa, Taluka Jambusar, District Bharuch	**People in Centre *Consulting***

Nada and Asarsa – Change in Mangrove Cover



Change in Mangrove Cover	
Village Nada and Asarsa, Taluka Jambusar, District Bharuch	**People in Centre *Consulting***

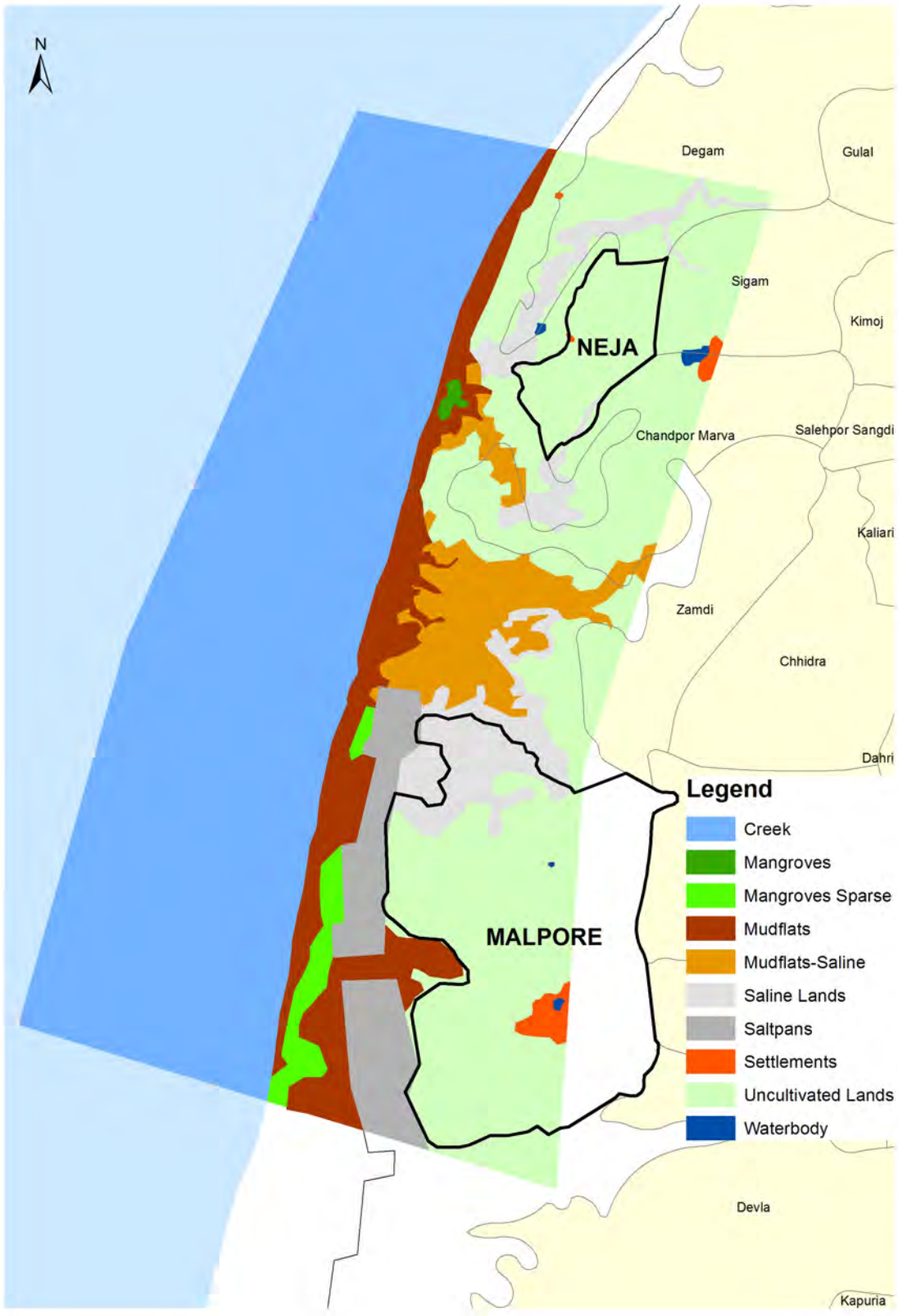
Nada and Asarsa – Land Use Changes

The area of these two villages and its surrounding are covered by creeks, agricultural land, mudflats and saltpans along with the presence of mangroves.

Mangroves that were sparsely seen in 2000 have been fully grown in the study of recent images. The major change that has been observed is the development of the new area on the southern side. There is a growth in the mangroves on one side of the bank of the River Dhadhar. The area just besides it seems to have been submerged in the water during the recent year, this may be attributed to the growth in the activities of the saltpans in these areas.

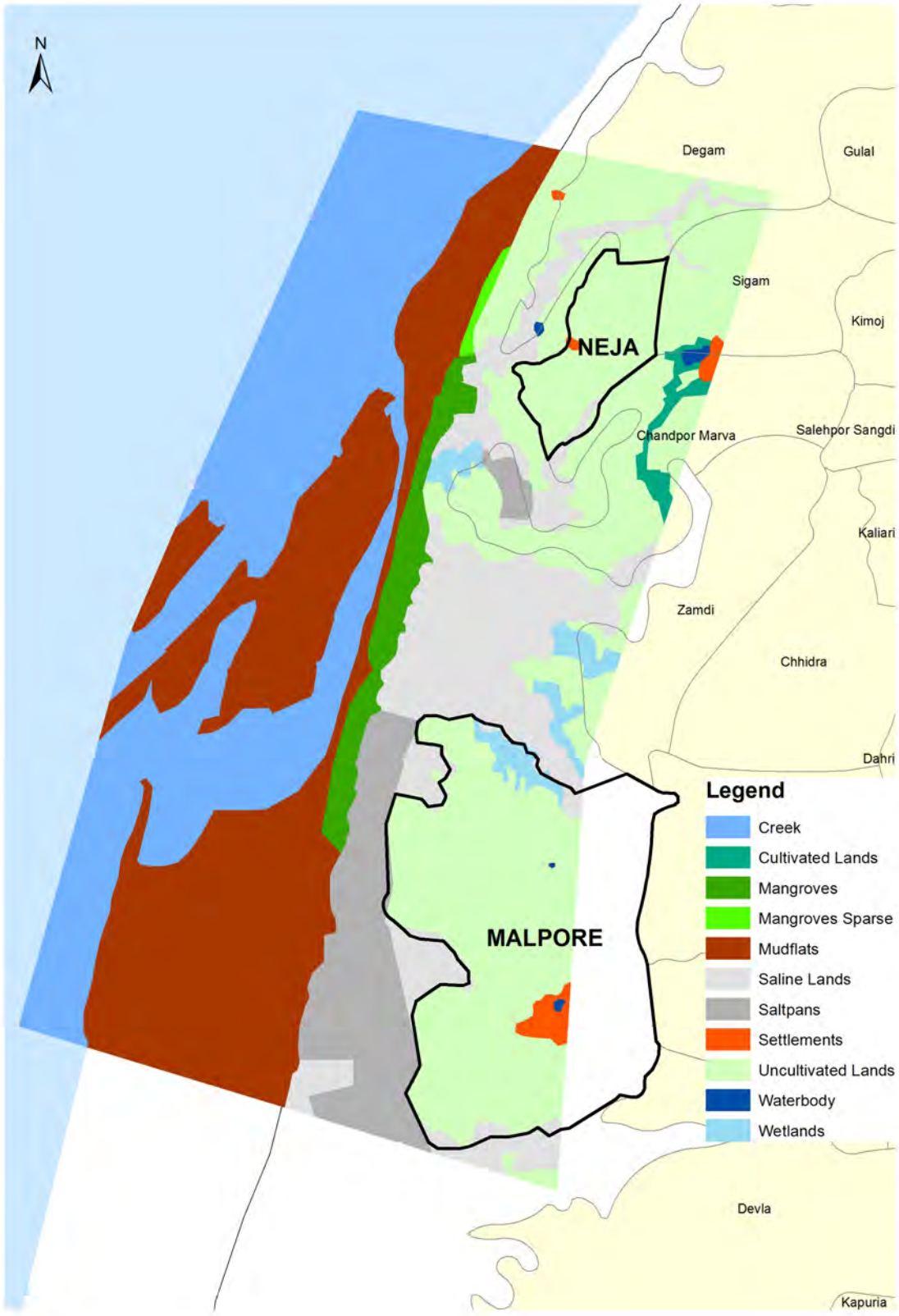
Legends	Area in year 2000 (ha)	Area in year 2012 (ha)	Change in Area (ha)
Creek	14145	700	
Mangroves	1844	9424	
Mangroves Sparse	896	2002	
Mudflats	5911	8147	
Saline Lands	447	1422	
Saltpans	2813	4678	
Settlements	23	23	
Uncultivated Lands	3338	3023	
Waterbody	4	2	
Grand Total	29423	29423	

ANNEXURE 2: Neja and Malpore – Land Use Year 2000



Land Use Map year 2000	
Village Neja and Malpore, Taluka Jambusar, District Bharuch	**People in Centre *Consulting***

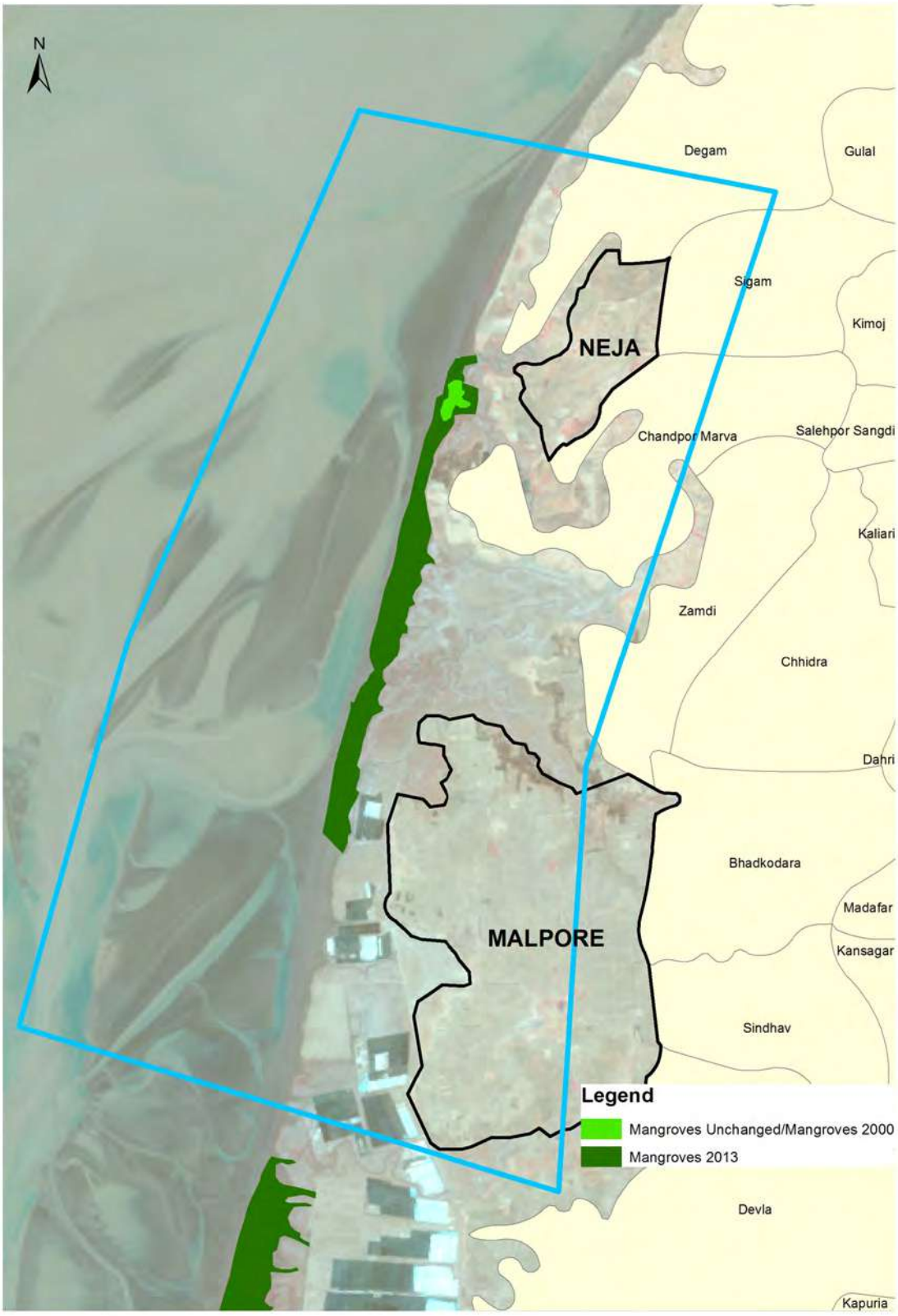
Neja and Malpore – Land Use Year 2012



Land Use Map year 2012

Village Neja and Malpore, Taluka Jambusar, District Bharuch	**People in Centre *Consulting***

Neja and Malpore – Change in Mangrove Cover



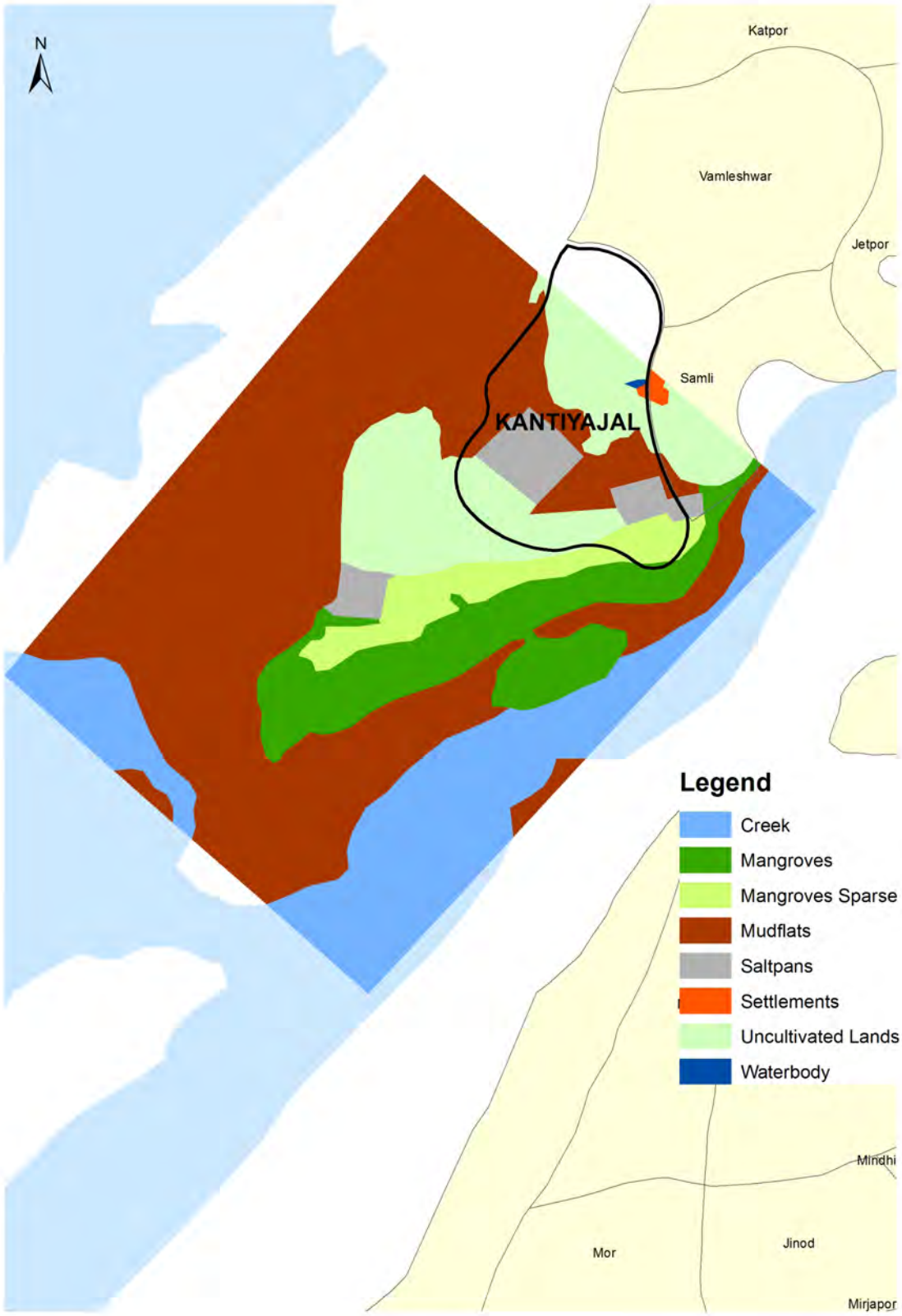
Change in Mangrove Cover	
Village Neja and Malpore, Taluka Jambusar, District Bharuch	**People in Centre *Consulting***

Neja and Malpore – Land Use Changes

During the year 2000 surrounding areas of the Neja village was agricultural land, mudflats and saltpans. While there were three different location of settlements seen in 2000 the same has increased by a small area in the recent years. There is also presence of water bodies which has remained more or less unchanged. Mudflats are also seen in the study area which is probably saline looking at the white coloured signature in the image and the presence of salt pans nearby. The mudflats covers nearly 12.26 percentage of the study area in 2000 which is seen a little dried in the recent image of 2013 which can be attributed to temporary seasonal change. The main change that has been observed is the changes in mangroves areas. The area covered by mangroves in 2000 was only 1640 ha amounting to around 0.13% of the total study area which has increased to 3200 ha which would be about 2.57% of the total study area. The increase seen in the growth of mangroves is of more than 5 folds during this periods.

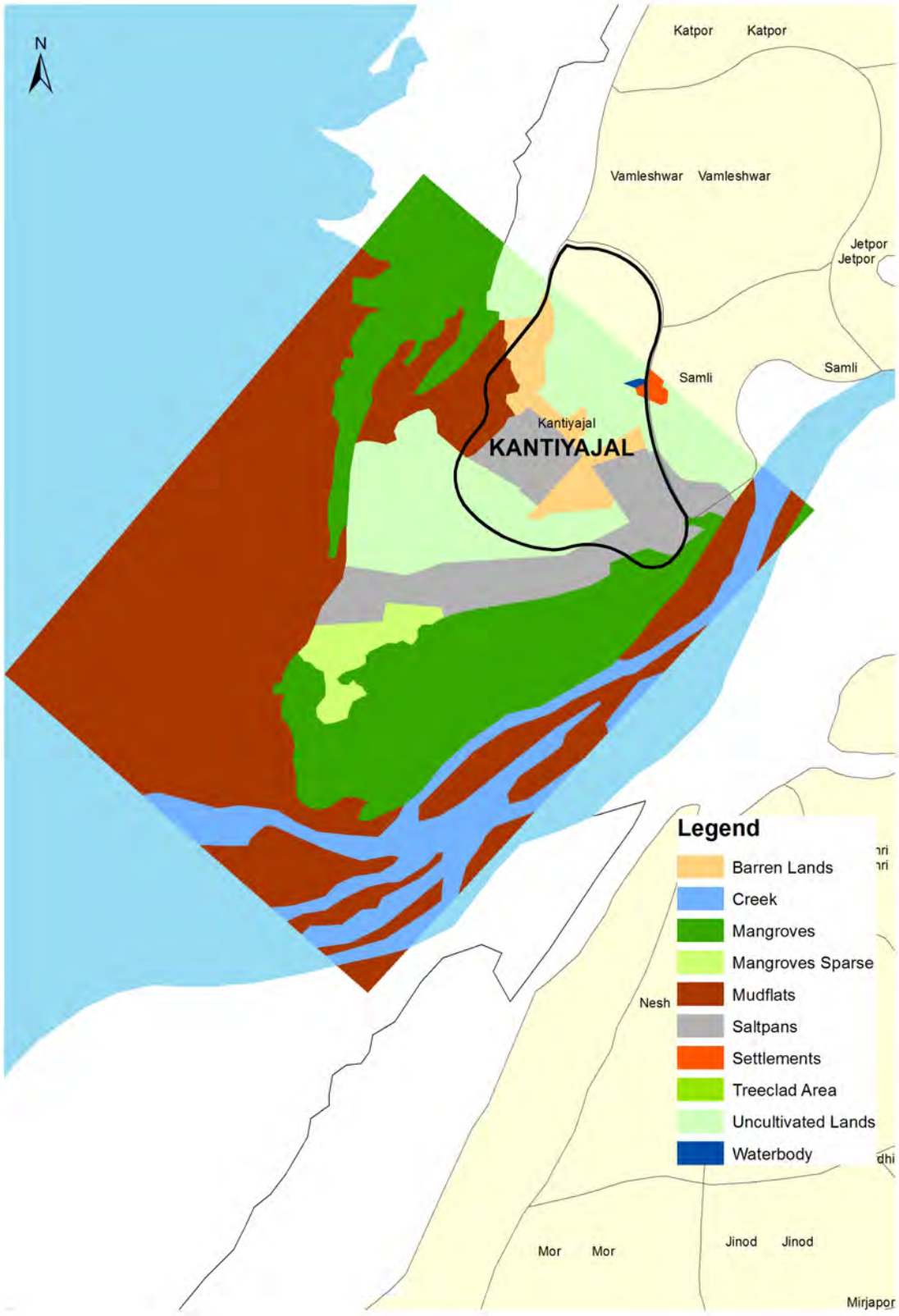
Legends	Area in year 2000 (ha)	Area in year 2012 (ha)	Change in Area (ha)
Creek	5509	2957	-2552
Mangroves	16	76	60
Mangroves Sparse	173	321	147
Mudflats	909	28	-881
Mudflats (Saline)	621	2882	2262
Saline Lands	778	1566	788
Saltpans	547	817	271
Settlements	66	70	5
Uncultivated Lands	3840	3545	-295
Water Body	16	16	0
Wetlands	0	193	193
Grand Total	12475	12474	--

ANNEXURE 3: Kanthiajal – Land Use Year 2000



Land Use Map year 2000	
Village Kanthiajal, Taluka Hansot, District Bharuch	**People in Centre *Consulting***

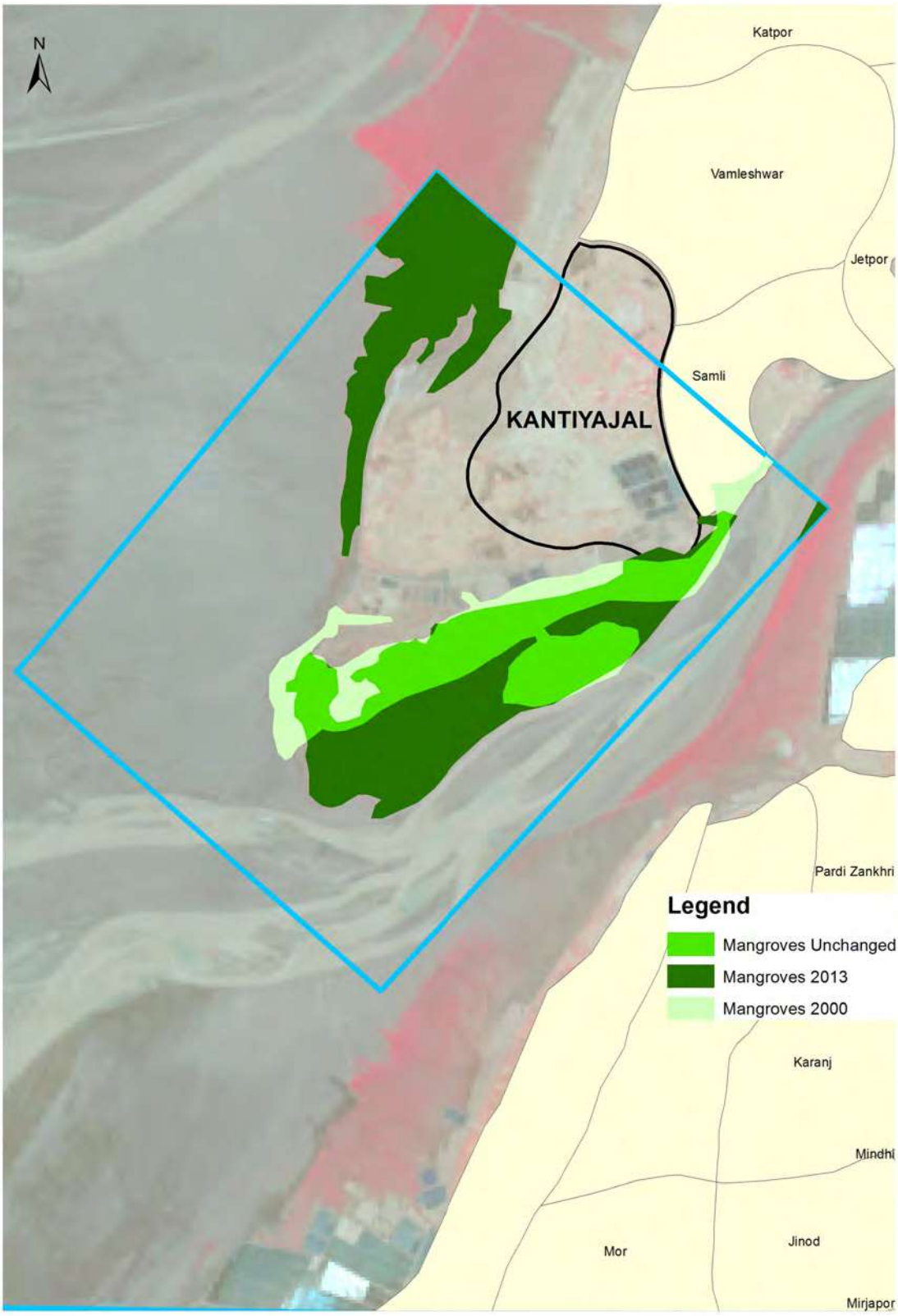
Kanthiajal – Land Use Year 2012



Land Use Map year 2012

Village Kanthiajal, Taluka Hansot, District Bharuch	**People in Centre *Consulting***

Kanthiajal – Change in Mangrove Cover



Change in Mangrove Cover	
Village Kanthiajal, Taluka Hansot, District Bharuch	**People in Centre *Consulting***

Kanthiajal – Land Use Changes

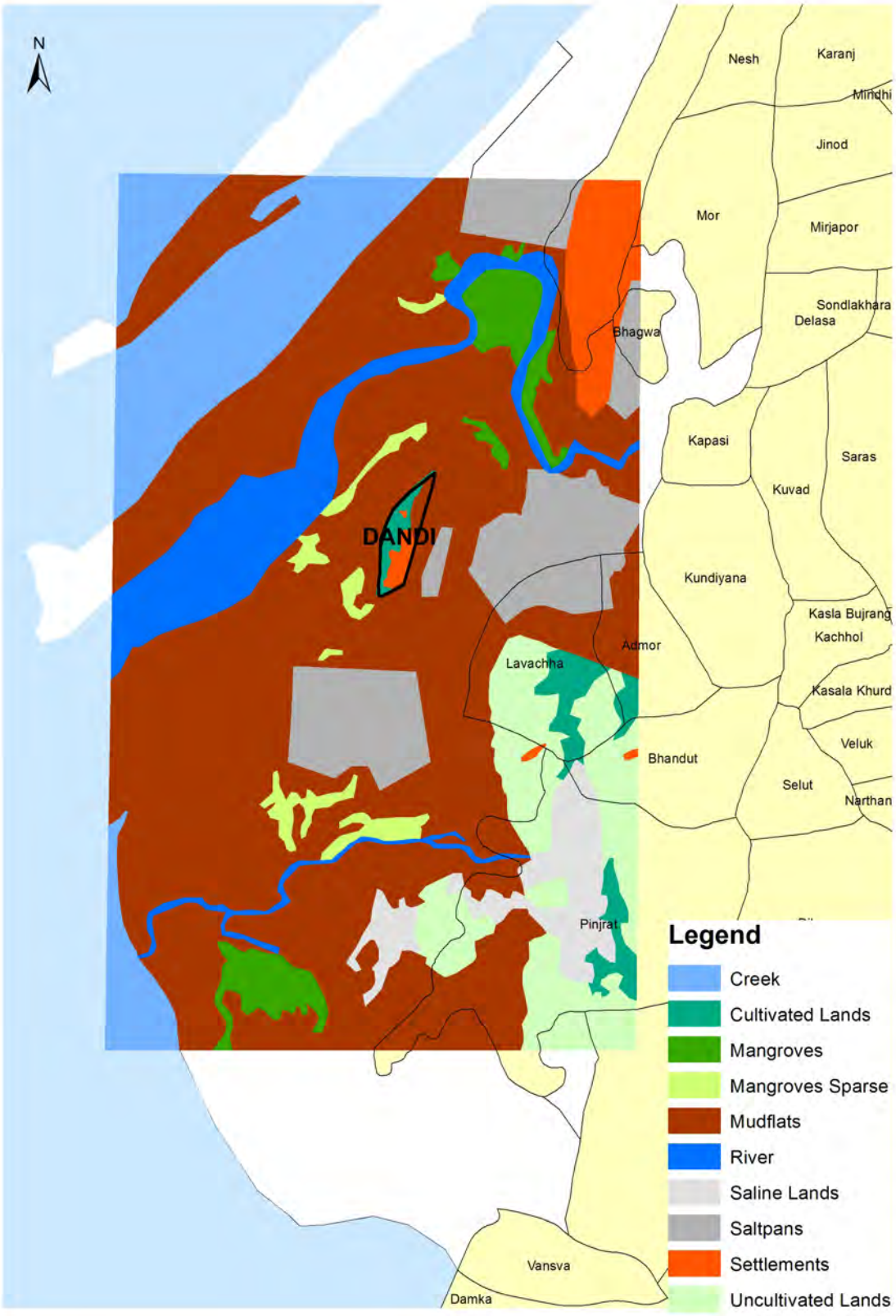
Largely, Kanthiyajal village and its surrounding are covered by creeks, agricultural land, mudflats and saltpans along with the presence of mangroves.

Mangroves, which were only seen at the mouth of the creek in the year 2000, are visible developed on the western coast in the recent images. The major observed change is the development of the new area on the western side and southern side there with a significant growth in the mangroves.

The total area covered by the mangroves in the year 2000 was 297 ha which has increased to 592 ha in the recent years. The saltpan activities area has also increased by 136 ha compared to the year 2000 converting mudflats into saltpans. There is only a slight change in the settlement and the agriculture areas while the later seems to have been decreased by a little and converted to saltpans.

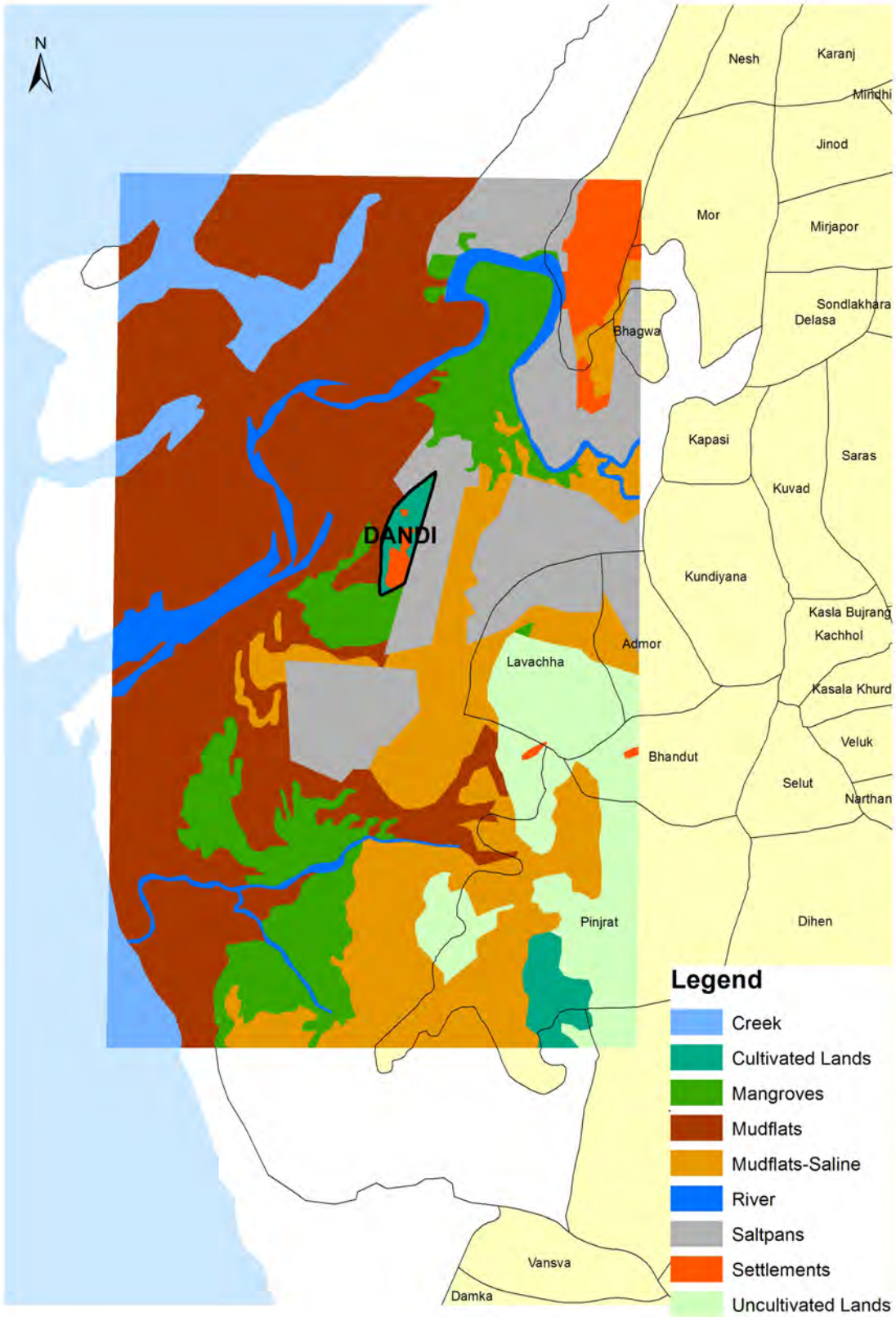
Legends	Area in year 2000 (ha)	Area in year 2012 (ha)	Change in Area (ha)
Creek	497	259	-238
Mangroves	297	592	295
Mangroves Sparse	117	54	-64
Mudflats	1366	1155	-211
Saltpans	89	224	136
Settlements	5	5	0
Uncultivated Lands	359	371	11
Waterbody	1	1	0
Waterbody	1	1	0
Barren Lands	0	71	71
Total	2732	2732	--

ANNEXURE 4: Dandi – Land Use Year 2000



Land Use Map year 2000	
Village Dandi, Taluka Olapad, District Surat	**People in Centre *Consulting***

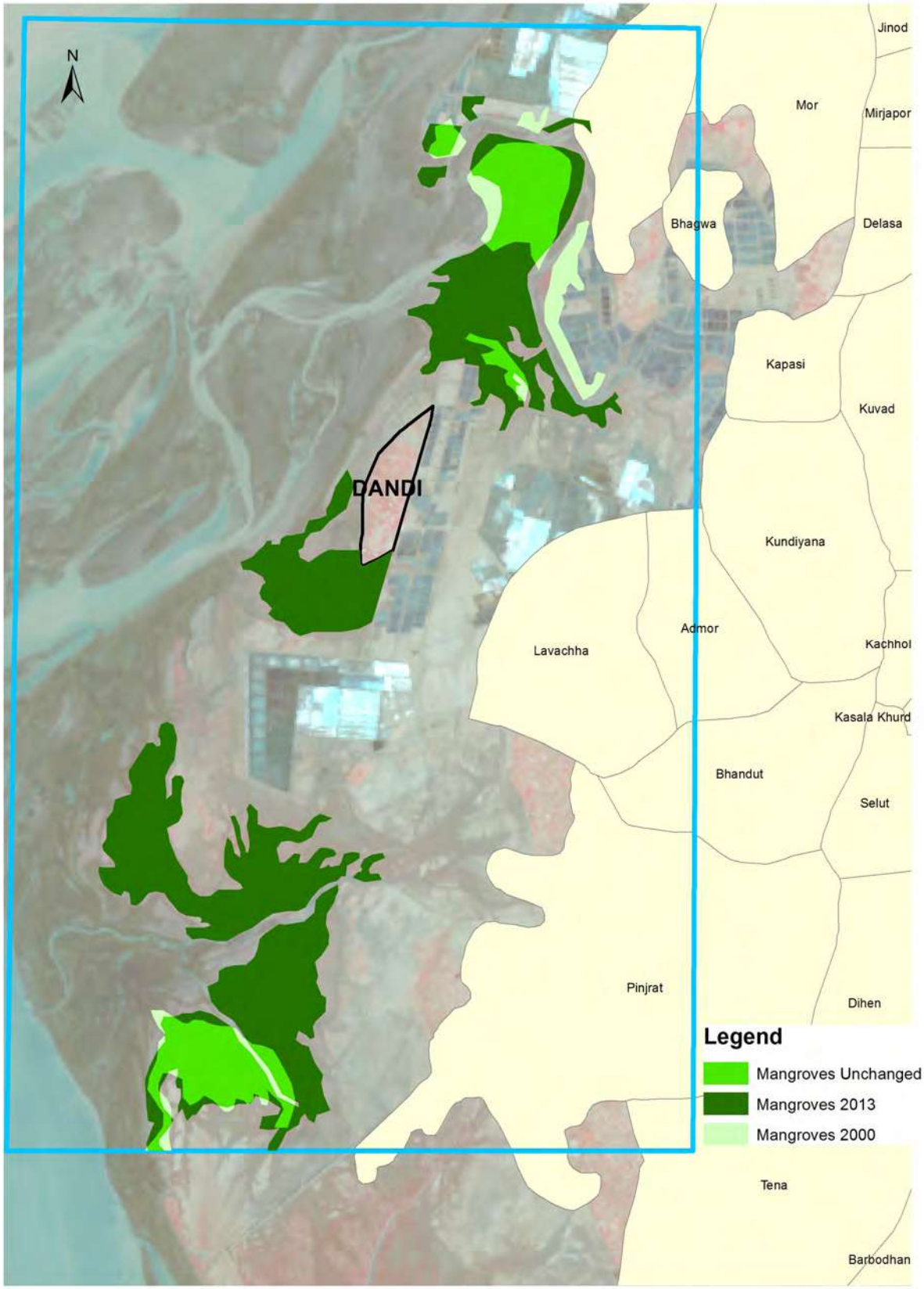
Dandi – Land Use Year 2012



Land Use Map year 2012

Village Dandi, Taluka Olapad, District Surat	**People in Centre *Consulting***

Dandi – Change in Mangrove Cover



Change in Mangrove Cover	
Village Dandi, Taluka Olapad, District Surat	**People in Centre *Consulting***

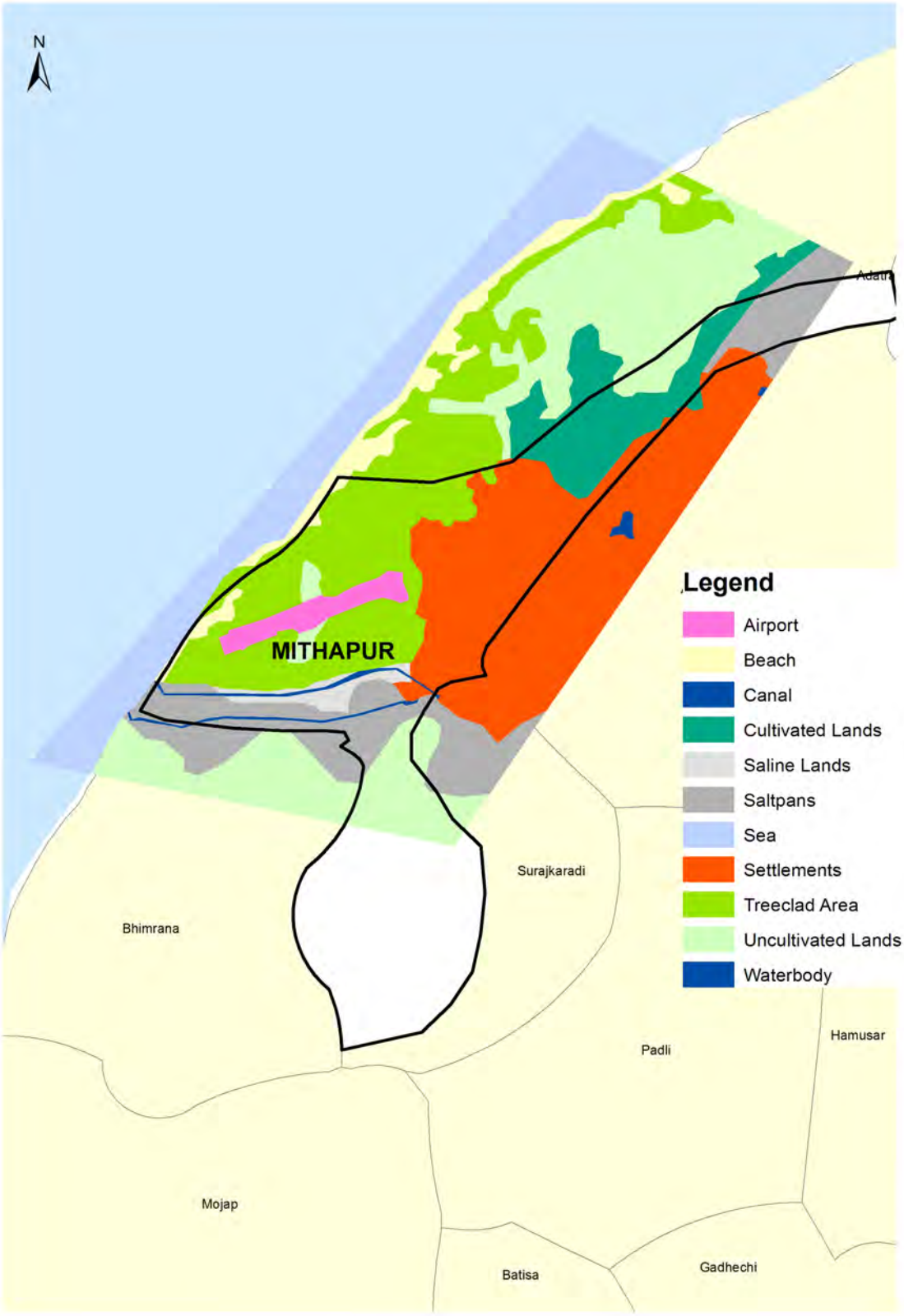
Dandi – Land Use Changes

In the village Dandi, mangroves, which were only seen on the northern side of the village in 2000, have well grown in the recent year. There hasn't been any significant growth in the surrounding area but the major change that has been observed is the development of mangroves on the southern side of the village and on the extreme south of the study area. Another change that has been observed is the growth of activities of saltpans near the Dandi village. The saltpan industries seem to have been almost doubled during this decade.

The total area covered by the mangroves in the year 2000 was 382 ha that have increased to 1291 ha in 2013. The saltpan industry has also increased by 505 ha compared to the year 2000 converting the area covered under mudflats. The settlement and the agriculture areas are generally unchanged compared to the changes in the other categories.

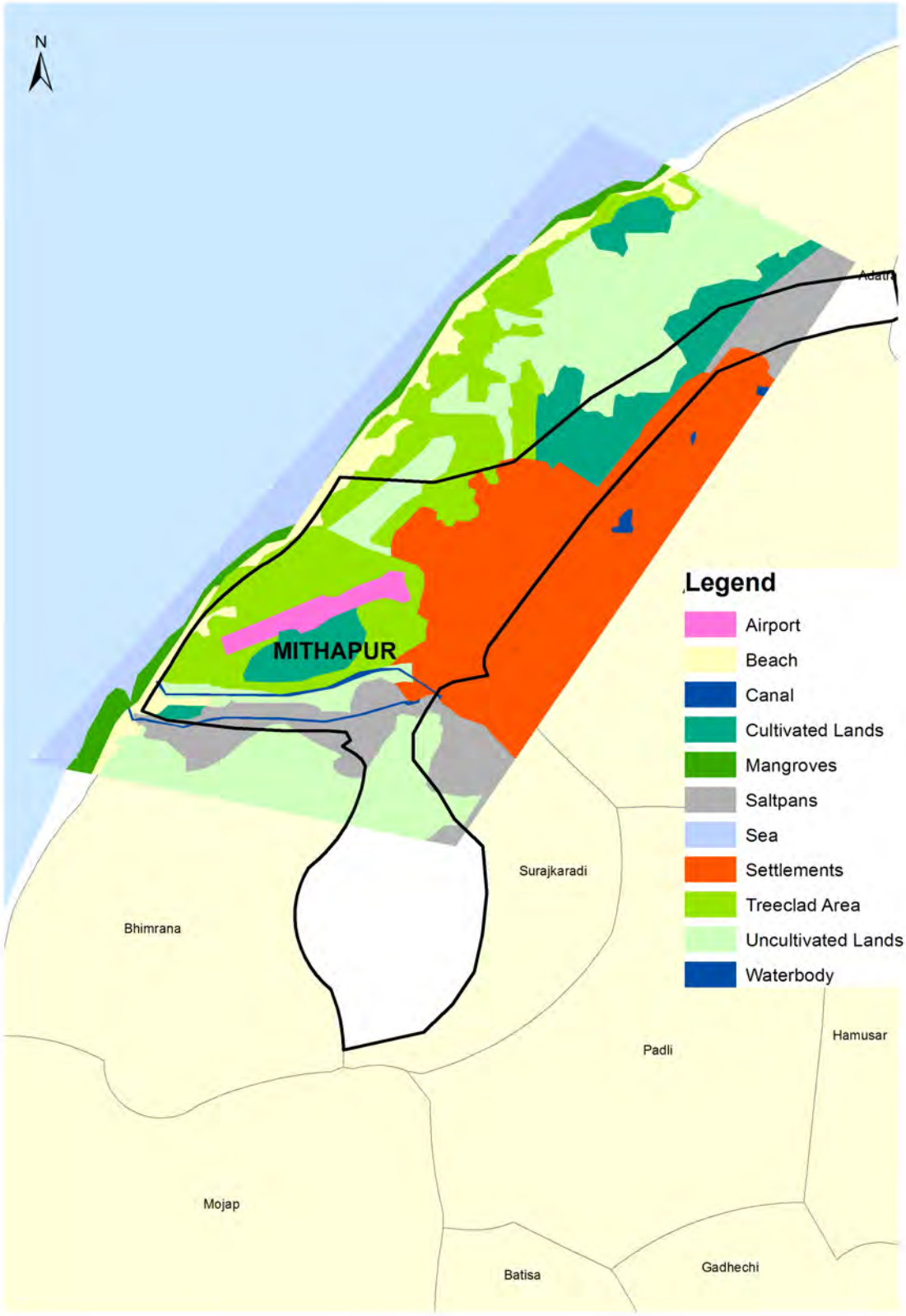
Legends	Area in year 2000 (ha)	Area in year 2012 (ha)	Change in Area (ha)
Creek	1401	718	-683
Cultivated Lands	244	201	-43
Mangroves	382	1291	909
Mangroves Sparse	206	0	-206
Mudflats	6237	4328	-1909
River	858	507	-350
Saline Lands	418	2069	1651
Saltpans	1127	1670	543
Settlements	377	298	-79
Uncultivated Lands	932	1100	167
Total	12181	12181	0

ANNEXURE 5: Mithapur – Land Use Year 2000



Land Use Map year 2000	
Village Mithapur, Taluka Okhamandal, District Jamnagar	**People in Centre *Consulting***

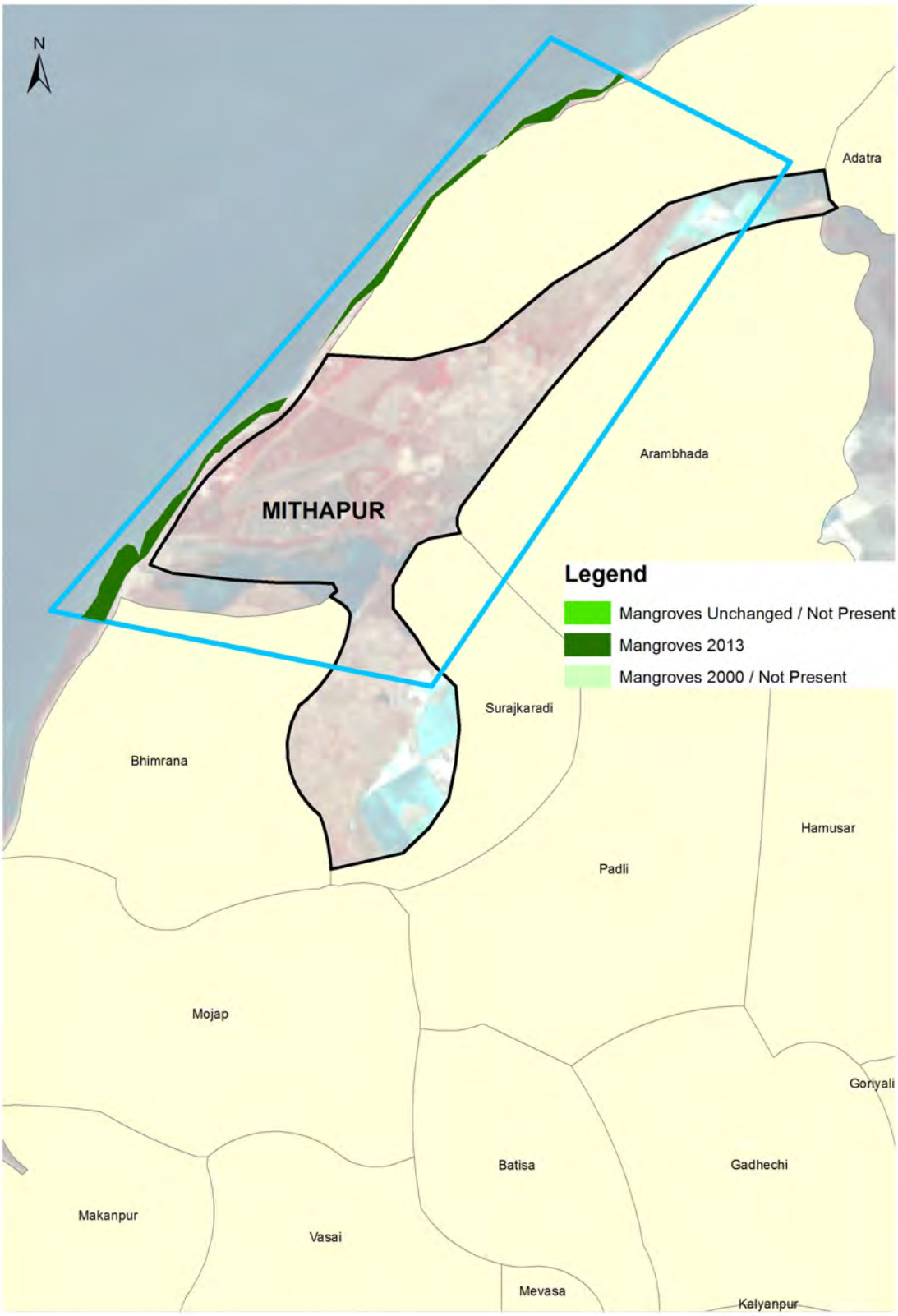
Mithapur – Land Use Year 2012



Land Use Map year 2012

Village Mithapur, Taluka Okhamandal, District Jamnagar	**People in Centre *Consulting***

Mithapur – Change in Mangrove Cover



Change in Mangrove Cover	
Village Mithapur, Taluka Okhamandal, District Jamnagar	**People in Centre *Consulting***

Mithapur – Land Use Changes

Mithapur in Gujarat, in the western part of India, has historically been the 'salt capital of the world'. The very hot and mostly dry coast of this region is ideal for the production of salt through the natural evaporation process in saltpans (as the fields fed with brine from the sea are called).

There have been few changes in the cultivated and uncultivated agricultural fields there is also a slight increase in the build-up areas. The more significant change seen from the satellite images of the year 2000 and 2013 is the development of the mangroves within the study area. There was no prominent signature of the mangroves seen during the year 2000 in the northern and western side of the study area which was clearly visible in the more recent images. About 55 ha of total study area.

Legends	Area in year 2000 (ha)	Area in year 2012 (ha)	Change in Area (ha)
Airport	36	35	0
Beach	84	86	2
Canal	13	13	0
Cultivated Lands	147	192	45
Saline Lands	23	0	-23
Mangroves	0	55	55
Saltpans	240	205	-34
Sea	270	207	-63
Settlements	474	509	35
Treeclad Area	416	351	-65
Uncultivated Lands	483	531	48
Waterbody	4	4	0
Grand Total	2189	2189	0

ANNEXURE 5: Media Report on Destruction of Mangroves in Nada Village

Times of India-Ahmedabad 22/8/2012

Gulf of Khambhat's mangroves in danger

Rajiv Shah | TNN

Gandhinagar: In a systematic blow to high accolades Gujarat received from the Centre over the "net increase in the mangrove cover", reports from Jambusar in Bharuch in south Gujarat suggest that things may now be moving in the opposite direction. The reports point to the coastal areas in Gulf of Khambhat where the Gujarat Ecology Commission (GEC) and NGOs jointly developed dense mangroves plantations.

The government has received a complaint from a civil society activist, who happens to be a member of the state-sponsored Gujarat Coastal Zone Management Authority, that heavy mangroves plantation is in the danger of being wiped out. The plantation was carried out under a programme funded by the Indo-Canadian Environment Facility (ICEF) in 1999-2001 in about 25 sq km area. The complaint comes at a time when recently released annual report of the Union ministry of forests and environment said the mangroves cover in Gujarat has increased from 1,046 sq km in 2009 to 1,058 sq km in 2011.

Principal secretary, environment and forests, H K Dash, who received the complaint from Rajesh Shah, told TOI that he is "looking into the matter" and has called for all details, "including if a particular salt producing company was allowed to build a protective wall next to the sea coast and remove mangroves".

COASTAL DEFENDERS

He has asked GEC and the district collector of Bharuch to find out the truth and take necessary action under the environment protection act. GEC member-secretary A K Verma added, "We are trying to find out. But you cannot give lease to a company to produce salt in the area without coastal zone regulation clearance, which is a Government of India prerogative."

When contacted, Shah said that in his letter to Dash, he had detailed how the NGO Vikas Centre for Development in association with the GEC had "carried out mangrove plantation and regeneration on the coast of village Nada in Jambusar block". The project was funded by the Canadian facility, and a decade later it has developed "into dense vegetation. However, "during past week a salt producing company has started its salt pan development activity, under which they are building a large earthen bund cutting across the plantation. In the process, they are uprooting the mangroves."

Shah added, "Out of the 25 sq km area where mangroves forestation was carried out a decade ago, we estimate around five sq km area running along an 18-km coastal stretch has already been adversely affected." Insiders in the government added, the uprooting of plantation "may have taken place as lately Gujarat government has become lukewarm towards mangroves plantation along the Gulf of Khambhat because of the Kalpasar project.

The Canadian facility project for mangroves plantation was suddenly stopped midway in 2006 after the state government decided to go ahead with the proposed sweet water lake, Kalpasar, in the Gulf. File notings say, mangroves plantation along the coastal Gulf may have the "potential of proving to be a hurdle for obtaining environmental clearance for the Kalpasar project". This led to stopping of the mangroves plantation activity in Mahadevpura and Bhangadh areas in Ahmedabad district, Tada talao area in Anand district, and Nada and Meha-Moradpur areas in Bharuch district.

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