CMPA Technical Report Series

11

Support to the development of a people's biodiversity register and its use for identifying biodiversity heritage sites in the Chodan-Madel village

by
Dr. Fraddry D'Souza, Ms. Asha Giriyan,
Ms. Christina de Souza, Ms. Shalita Dourado, Mr. Santosh Gad

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Indo-German Biodiversity Programme
Conservation and Sustainable Management of Coastal and Marine Protected Areas

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LIST OF ACRONYMS

BCC	Biodiversity Conservation Corps
BHS	Biodiversity Heritage Site
BMC	Biodiversity Management Committee
CMPA	Coastal and Marine Protected Areas
FAO	Food and Agriculture Organization
FRLHT	Foundation for Revitalisation of Local Health Traditions
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GSBB	Goa State Biodiversity Board
IDB 2017	International Day for Biological Diversity, 2017
IUCN	International Union for Conservation of Nature
MoEFCC	Ministry of Environment, Forests, and Climate Change, Government of India
MPCA	Medicinal Plant Conservation Area
NBA	National Biodiversity Authority
PBR	People's Biodiversity Register
PRA	Participatory Rural Appraisal
PWD	Public Works Department
SC	Scheduled castes
SHG	Self-help group
ST	Scheduled Tribes
TERI	The Energy and Resources Institute
TSG	Technical Support Group
VP	Village Panchayat

Executive Summary

The changing relationships between people and their ecological resource base are very significant to folk ecological knowledge and wisdom. The People's Biodiversity Register of Chodan-Madel village, in Tiswadi taluka of Goa, is an attempt at understanding how local people of the village understand their flora and fauna within their ecological framework, their perceptions of ongoing ecological changes, and their preferences in the management of the same.

The development of the People's Biodiversity Register is a continuous process, the preparation of which is the responsibility of the village Biodiversity Management Committee. As per the 2013 People's Biodiversity Register guidelines issued by the National Biodiversity Authority, the responsibilities of the Biodiversity Management Committee are:

1. Most significantly, the preparation of the People's Biodiversity Register through consultation with the local people, for comprehensive documentation of the availability and knowledge of local biological resources and uses associated with them.
2. Providing advice on referrals made to it by the State Biodiversity Board for granting approvals within its jurisdiction, and to maintain data on local practitioners utilising the said biological resources.
3. Maintenance and validation of the People's Biodiversity Register by the village Biodiversity Management Committee.

The mandate of the State Biodiversity Board towards the village Biodiversity Management Committee is the provision of guidance and technical support to the Biodiversity Management Committee for preparation of the People's Biodiversity Register.

TERI, a Technical Support Group of the Goa State Biodiversity Board was given the responsibility of facilitating the development of the village People's Biodiversity Register of Chodan-Madel. The facilitation of documentation of the biodiversity of

Chodan-Madel is therefore a critical element in the way forward to the development of the People's Biodiversity Register. Under the umbrella of the MoEFCC-GIZ-CMPA Project, support was rendered to facilitate the development of the village People's Biodiversity Register, which was further employed for identifying potential biodiversity heritage sites in Chodan-Madel.

The activities to facilitate the development of the village People's Biodiversity Register commenced with a project inception meeting and ward-wise participatory rural appraisal exercises. Here resource maps were prepared of each of the 9 wards of the village through discussion with and collaborative effort of members of the respective wards. Both natural and infrastructure resources of importance to the local people were indicated in the maps and the presence of these resources was then authenticated via transect walks with the BMC and ward members. The various means by which use of the local land is made was also recorded via GIS mapping, and the degree of land use under each category was also acquired.

Awareness was created among the members of the village at the various levels. Efforts to generate awareness on the People's Biodiversity Register commenced with the first meeting in the village at the outset of the project, followed by an awareness workshop at the village level. Participation in the International Day for Biological Diversity 2017 that was celebrated at Kala Academy, Goa, also served to spread awareness. Walks were conducted to generate awareness on mangroves and associated biodiversity among the students of the two schools of Chodan-Madel. Volunteer groups known as Biodiversity Conservation Corps were formed for each ward of the village that were then trained in the documentation of the local biodiversity, using photography as the tool for documentation. The community was engaged on the ward level as well as on the village level. This was achieved during the ward-wise resource mapping activities and by conducting a festival on biodiversity that becomes more apparent in the monsoon, which acted as a platform for bringing about awareness and for spreading knowledge on those cultural aspects of the village that are rooted in biodiversity.

The knowledge gathered on Chodan-Madel, its biodiversity, and resources was then utilized to study the feasibility of sites within the village as Biodiversity Heritage Sites. The criteria for selection of Biodiversity Heritage Sites, based on the country's Biodiversity Act 2002 and as prescribed by the National Biodiversity Authority, were explored and based upon suitability, were studied further to demonstrate the feasibility of sites within Chodan-Madel as Biodiversity Heritage Sites.

Chapter 1

Background and Objectives

Folk knowledge flows from practices. The handling of such knowledge does not occur through a formal procedure – the maintenance, transmission, and augmentation of folk knowledge occurs almost entirely through its application in practice. Therefore the changing relationships between people and their ecological resource base are very significant to folk ecological knowledge and wisdom. In the present-day scenario, the ease of access to newer resources like modern medicines decreases the dependence on local medicinal plants and animals, and due to takeovers by government and private interests, local people lose their control over their resource base. Folk knowledge and wisdom, whose content is time-specific and detailed in the local context, is of value, and must, therefore, be supported by maintaining it through the creation of more formal institutions. The People's Biodiversity Register (PBR) is an attempt at doing so, by documenting, along the prescribed guidelines of the National Biodiversity Authority (NBA), how local people understand flora and fauna within their ecological settings, their perceptions about ongoing ecological changes, and their preferences in the management of the same. Legal importance is given to the PBR as a base document as it provides evidence of prior knowledge and therefore documentation in a careful manner is necessary.

The development of the PBR is a continuous process, the preparation of which is the responsibility of the village Biodiversity Management Committee (BMC). As per the 2013 PBR guidelines issued by the National Biodiversity Authority (NBA), the responsibilities of the BMC are:

1. Most significantly, the preparation of the People's Biodiversity Register through consultation with the local people, for comprehensive documentation of the availability and knowledge of local biological resources and uses associated with them.

2. Providing advice on referrals made to it by the State Biodiversity Board for granting approvals within its jurisdiction, and to maintain data on

local practitioners utilising the said biological resources.

3. Maintenance and validation of the PBR by the village BMC.

The mandate of the State Biodiversity Board towards the village BMC is the provision of guidance and technical support to the BMC for preparation of the PBR.

TERI, a Technical Support Group of the Goa State Biodiversity Board (GSBB), was given the responsibility of facilitating the development of the village PBR of Chodan-Madel. The facilitation of documentation of the biodiversity of Chodan-Madel is therefore a critical element in the way forward to the development of the PBR. Under the umbrella of the MoEFCC-GIZ-CMPA Project, support was rendered to facilitate the development of the village PBR, which was further employed for identifying potential biodiversity heritage sites in Chodan-Madel.

India has recognized the importance of sustainability and conservation programmes in the country, and through the cooperation of the Ministry of Environment, Forests, and Climate Change, Government of India (MoEF&CC) with the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH has been commissioned to implement the Project 'Conservation and Sustainable Management of Coastal and Marine Protected Areas (CMPA)' jointly with the MoEF&CC in India.

The overall objective of the project is '*to contribute to the improvement of the conservation and sustainable use of biodiversity in the pilot protected areas, while taking into consideration the economic circumstances of the local population*'. The CMPA Project goal is to improve the protection of biodiversity by promoting participatory approaches for the conservation and management of existing coastal and marine protected areas, taking into account the economic well-being of the local population. It also supports the creation of new protected areas in the future.

Dr. Salim Ali Bird Sanctuary at Chodan-Madel Island, Goa, has been selected as a pilot site for the implementation of the CMPA Project. In order to reach the intended goal with respect to the conservation and sustainable use of biodiversity at and around the pilot area, it was suggested that the local Biodiversity Management Committee be facilitated in the development of the village PBR. This was carried out through undertaking the following tasks:

- Awareness and community mobilization for understanding biodiversity, the need for conservation, and the steps to be undertaken to achieve this goal
- Preparation of resource mapping documents of the village using PRA process
- Training and capacity building and initiation of biodiversity documentation
- Examining the potential of areas of Chodan-Madel village as biodiversity heritage sites

Chapter 2

Introduction

The People's Biodiversity Register, or PBR, is an attempt at recording the knowledge and perceptions of the population of any given region on the local biodiversity and its status, uses, history, current changes and the forces spurring these changes. Through the PBR an attempt is also made at documenting local perspectives on who would gain or lose as a result of the utilisation of biodiversity resources and changes in ecological settings. An information system of this type has potential to support the management of natural resources in a decentralised manner, as also permitting the equitable sharing of the benefits obtained from the commercial utilisation of such resources and the knowledge associated with them. It is expected that the process of development of the PBR will augment and reinforce the knowledge of the public on the significance of biodiversity conservation, its sustainable use and equitable sharing of benefits derived from it, as well as mobilising grassroots action (Gadgil, 2000).

The socio-economic benefits of PBR are as follows (NBA, 2013):

1. Conservation and management of local biodiversity
2. Sustainable utilization of biological resources
3. Equitable sharing of benefits obtained from biological resources
4. Protection of traditional and other knowledge recorded in the PBR
5. Legal protection and regulation of bio-resources access to outside agencies and individuals

Thus, the PBR is a component of the knowledge base that serves for the conservation, sustainable utilization, and the sharing of the benefits of biodiversity in a fair manner. It focuses on species and varieties, and also is concerned with maintenance and judicious management of various ecosystems such as coasts, forests, and khazan lands or reclaimed wetlands, saltmarshes, and mangrove areas, which are used for agriculture, aquaculture, and salt-panning purposes. The PBR also aim to engage people in its undertaking, as human beings are an integral component of ecosystems. It takes into account all streams of

knowledge and promotes the decentralizing of ecosystem management to the lowest possible level of governance. PBRs are also concerned with the many aspects and interconnections of human interaction with the ecosystems, such as harvest of biomass, processing, technologies, among others, with groups of people providing various perspectives on the management of pertinent resources. Hence, PBR as a tool will help in revitalizing local traditions and generating awareness among the younger generation regarding the social relevance of local knowledge and improved planning of local natural resources, thereby promoting the participatory approach to planning the management of bio-resources at the micro-level.

The project aims to facilitate the BMC of Chodan-Madel village in the development of the PBR through various activities that have been conducted at the village and ward levels, commencing with the relatively simpler activities.

2.1 Chodan-Madel village

Chodan-Madel is located in Goa, a state on the western coast of India. The island falls in the Tiswadi taluka of the North Goa district (Table 1). It is the largest of the estuarine islands of Goa, lying between the coordinates 15°25' - 15°30'N and 73°45' - 73°59'E, respectively. Situated approximately 8 km upstream from the mouth of the Mandovi estuary, the westernmost tip of the island is at the confluence of the Mapusa and Mandovi rivers. Access to the island from the mainland is via ferry from Ribandar or Pomburpa.

Chodan-Madel is divided by creeks and backwaters that have tidal variations, a network formed from the Mandovi and Mapusa rivers and the Cumbarjua canal. Access to these channels by motor boat is restricted to high tide, but the channels are accessible by canoe even during low tide. It is a natural island, essentially a projection of basalt wherein the land surface has become extended peripherally as a result of heavy siltation through the sedimentation of the Mapusa River, Norora creek, and Mandovi estuary up to the current edge of estuarine water. Upon establishment of mangrove swamps, their root system trapped fine sediments, and in this manner, land was built up along low coasts. The mangroves have gradually overgrown areas that were earlier utilised for paddy cultivation and fish farming, making the land unsuitable for agriculture in recent times. Established mangrove vegetation occupies about 2.5 sq. km. of the island.

The ecosystem of Chodan-Madel is fragile. The regional map of Chodan-Madel Island obtained from the State Town and Country Planning Department indicates that naturally occurring forest cover is also to be found at Chodan-Madel, as are areas for agriculture and aquaculture in the form of paddy fields, khazans, orchards, and fish farms (Figure 1). Natural mudflats are found along the banks of the river Mandovi. The two major ecosystems of Chodan-Madel are the mangroves and the khazans. Rich mangrove forests exist on the island of Chodan-Madel, especially within the Dr. Salim Ali Bird Sanctuary – the state's only protected area of estuarine status (Figure 2). The mangroves support a diversity of life forms, both those which are migratory and those that are endemic to Goa's coast. Khazans are used in Chodan-Madel for agriculture and aquaculture purposes.

Table 1
Location details of Chodan-Madel village

Village:	Chodan – Madel	**Taluka:**	Tiswadi
Gram Panchayat:	Chodan – Madel	**Nearest market place:**	Panaji
Nearest town:	Panaji	**District:**	North Goa
Nearest railway station:	Carambolim	**State:**	Goa

Source: Chodan-Madel Gram Panchayat

Figure 1 Map of Chodan-Madel village.

Figure 2. Google image of Chodan-Madel village.

Table 2
Demographics of Chodan-Madel village

Sr. No.	Feature	Details
1	Total village inhabitants	5563
2	Total number of households	1273
3	Female population	50.6%
4	Male population	49.4%
5	Child population	8.6%
6	Scheduled castes (SC) category	1.56%
7	Scheduled tribes (ST) category	7.9%
8	Average literacy rate	80.7%
9	Average working population	38%
10	Major occupations	Fishing, agriculture, horticulture, service (government & private), small commercial activities, provision of road transport
11	Self-help groups	9
12	Communidade Associations	3

Source: Census of India (2011), and Da Silva et al (2014)

Table 3
Wards of V.P. Chodan-Madel

Ward No.	Ward name
1	Madel
2	Kerem
3	Karabhat
4	Saude
5	Pandavada
6	Malevada
7	Sodetim
8	Devgim
9	Orando

Source: Chodan-Madel Village Panchayat

Table 4
Members of the BMC under VP Chodan-Madel

Sr. No.	Name	Designation
1	Smt. Divya Usapkar	Chairperson
2	Smt. Arti Bandodkar	Woman member
3	Smt. Vaishali Mandrekar	Woman member
4	Shri. Tukaram Kholkar	SC/ST member
5	Shri. Vishal Acharya	Member
6	Shri. Premanand Mahambare	Member
7	Smt. Ranjana Raul	Secretary

Source: Chodan-Madel Biodiversity Management Committee

2.2 Demographic and socio-economic details of chodan-madel

The inhabitants of Chodan-Madel number at 5563 people residing in 1273 households. 50.6% of the island's population is female and 49.4% is male. The child population stands at 8.6%. A total of 1.56% of the population falls under the Scheduled castes (SC) category and 7.9% under the Scheduled Tribes (ST) category. Of the total population, 80.7% are literate, with the distribution of males and females being almost equal (Table 2). The working population comprises 38% of the island's total population, a large majority of which are categorized as main workers having work for more than 6 months in the year (Census of India, 2011, Da Silva et al, 2014).

The major occupations within Chodan-Madel are conducting of guided tours in the Dr Salim Ali Bird Sanctuary; fishing activities through various modes such as crabbing and the use of stake nets, bag nets, gill nets, and vouli; agriculture and horticulture; small commercial activities; and provision of road transport via buses, motorcycle pilots, and rickshaws (Da Silva et al, 2014).

2.3 Local governance

The most significant governance authority of the island is the village panchayat (V.P.). In immediate successive level of authority to the V.P. are the district administration, the Member of the Legislative Assembly, and the Department of Town and Country Planning. The inshore activities in the estuarine surroundings of Chodan-Madel comprises of fishing and the navigation of boats. These inshore activities are under the regulation of the Departments of River Navigation, Captain of Ports, and Fisheries (Da Silva et al, 2014).

The island is governed by the village panchayat of Chodan-Madel. The village panchayat is divided into 9 wards (Table 3). Under the Biodiversity Act 2004, a village level Biodiversity Management Committee (BMC) was formed under V.P. Chodan-Madel and the members of the BMC are indicated in Table 4.

Chapter 3

Resource mapping of Chodan-Madel

Resource mapping was conducted ward-wise in Chodan-Madel in the months of March 2017 – June 2017. In order to facilitate the ward-wise resource mapping, a detailed land use map of the entire village and individual ward-wise land use maps were prepared with the help of Google maps and regional village maps. These maps helped to trace and validate the resource mapping and transect walk undertaken during the PRA exercises. An overview of the data gathered from the land use maps is presented in Table 5.

3.1 Ward mapping through Participatory Rural Appraisal (PRA)

The resource mapping activity was carried out utilising the participatory rural appraisal (PRA) approach through discussion with and collaborative effort of members of the respective wards, and the participation of government officials such as members of the village BMC, the Sarpanch and Gramsevak. The ward resources and their locations as indicated by the ward members during the resource mapping activity were then validated through a transect walk held in the ward, with the ward members and BMC and respective panch members. The ward map of Chodan-Madel is presented in Figure 3.

3.1.1 Ward I - MADEL

Fishing and agriculture are the main activities of Ward I. The ward has traditional fishermen using both canoes (20 numbers) and boats with outboard motors (20 numbers) and fishing activity is also carried out at the sluice gates, of which 2 are present in the ward.

The Dr. Salim Ali Bird Sanctuary is present in Ward I. Several species of migratory birds and mangroves are observed here. In the vicinity, one may also obtain prawns, fish, crabs, oysters, and large-sized black shellfish or *khube*.

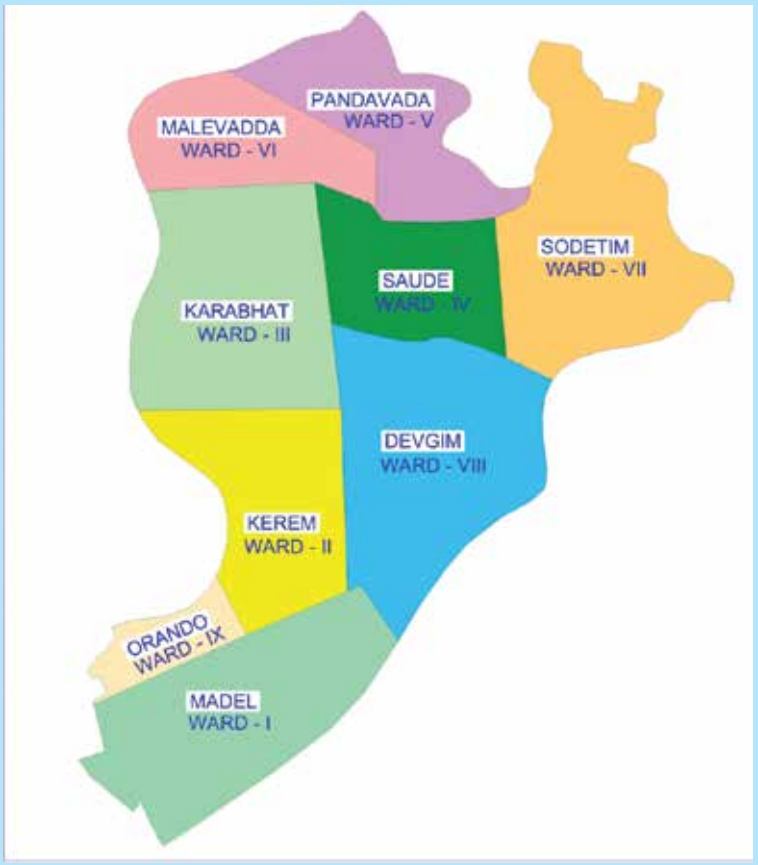
The major species of fish that are available in the ward are white prawns, *shevto*/mullet, *karchane*, *kalundar*/catfish, crabs, and shellfish.

Khazans are cultivated for paddy varieties like Corgut, Jyoti, and Karjat. In the dry season, horticultural crops are cultivated in the varan

Table 5
Overview of land use in Chodan-Madel village

Zone	Ward-wise area as percentage								
	Ward I Madel	Ward II Kerem	Ward III Karabhat	Ward IV Saude	Ward V Pandavada	Ward VI Malevada	Ward VII Sodetim	Ward VIII Devgim	Ward IX Orando
Total ward area km²	2044.96	1120.77	2048.67	774.11	1500.74	1177.13	2286.50	2121.99	378.78
Settlements %	34.58	23.3	28.42	72.94	32.11	24.28	12.02	29.32	21.17
Paddy field %	38.4	2.88	28.13	10.45	43.04	15.3	63.07	42.27	25.1
Khazans %	3.98	36.84	17.21	–	8.75	38.38	4.74	0.76	1
Water body %	15.7	11.05	11.68	0.5	12.89	18.3	19.72	15.57	29.17
Mangroves %	3.82	6.8	2.83	–	1.19	1.58	–	4.41	9.62
Road %	1.76	1.56	6.65	7.25	1.81	1.78	0.43	1.97	1.59
Slope %	1.74	17.54	5.05	8.83	0.17	0.35	–	5.66	12.32

Figure 3. Ward-wise map of Chodan-Madel Village



khazan, such as *alsande*/red kidney beans, chillies, and vegetables like *tambdi bhaji*/red amaranthus, ladyfingers/okra, *chitaki mitaki*/cluster beans, *norkhol*/kohlrabi, brinjals/eggplant, *val*/green field beans, and onions.

Cashew plantations are widely observed as are coconut orchards and plantations of varieties of mango like Mancorada, Correl, and Totapuri.

Madel ward has 200 households in total and a resident population of approximately 1500 people. The ward also has eight self-help groups.

Figure 4. Resource map of Madel ward carried out along with ward members.

Figure 5. Land-use map of Madel Ward

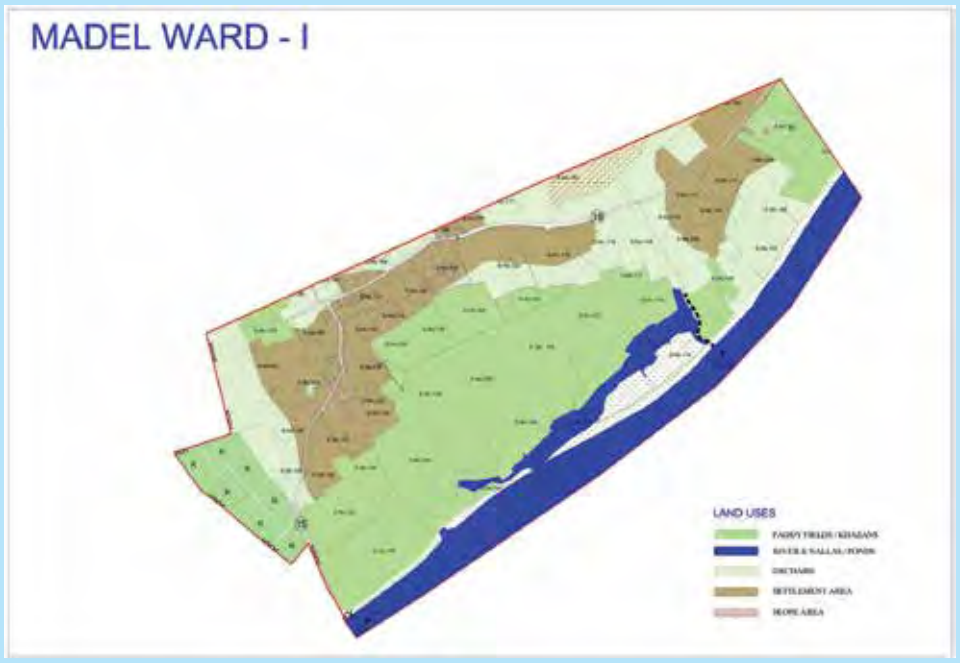


Figure 6. Google image map of Madel Ward showing major ecosystems.

Zone	Area (sq.km.)
Ward area	2044.963
Paddy field	785.219
Settlement area	707.139
Water body	321.139
Khazans	81.525
Mangrove	78.194
Road	36.142
Slope	35.605

Figure 7. Natural resources of Ward I – Madel

Bund

Dr. Salim Ali Bird Sanctuary

Grazing land

Haari method of fishing

Mango plantation

Public well

Land lying fallow due to salt water intrusion

Figure 8. Infrastructure resources of Ward I – Madel

Anganwadi

Canara Bank – Madel Branch

Church of Our Lady of Grace

Devki krishna, Bhumika, Mallinath, Hanuman Temple

Ferry to Old Goa

Local museum

Bio gas plant

Vermicomposting unit

Traditional coconut measuring and rating method

3.1.2 Ward II - KEREM

This ward is located along one side of the central hillock of Chorao. A total of 69 houses are found in this ward, with a total population of 421 individuals. Ward 2 is made up of Kerem, Carabhat (part), Sirsat Wado, and Devgim (part). The bank of the river Mandovi adjoining the ward is fringed by mangroves. Located within the mangroves fringing the river, 4 sluice gates and 5 fish ponds/poiem are present in this ward. The fish that are harvested include shevtale/mullets, crabs, prawns, vagyo, burate, and karchane.

A large area within the boundary of the ward is covered by forest and cashew plantations. Houses under the 20 point programme are also located in this area. Also located within the forested area are a 150 m3 capacity water tank constructed by the Public Works Department (PWD) and the Hindu crematorium.

At the base of the hillock are vegetable and paddy fields, interspersed with public wells. Residential houses are found distributed between the fields and the banks of the river Mandovi. 60 families in the agricultural occupation reside in the ward. A wide variety of fauna is observed in the ward, such as peafowl, parrots, monkeys, gar or the Bengal water monitor lizard, wild pigs, jungle fowl, wild cats, mongoose, and rabbits.

Of the two temples in the ward, the Gopal Krishna temple is located on the banks of the Mandovi, while the Bal Gopal Goverdhan temple is located in the hilly forested area of the ward. Two crosses are also found along the banks of the river. Two anganwadi are found in the ward.

Figure 9. Resource map of Kerem ward carried out along with ward members.

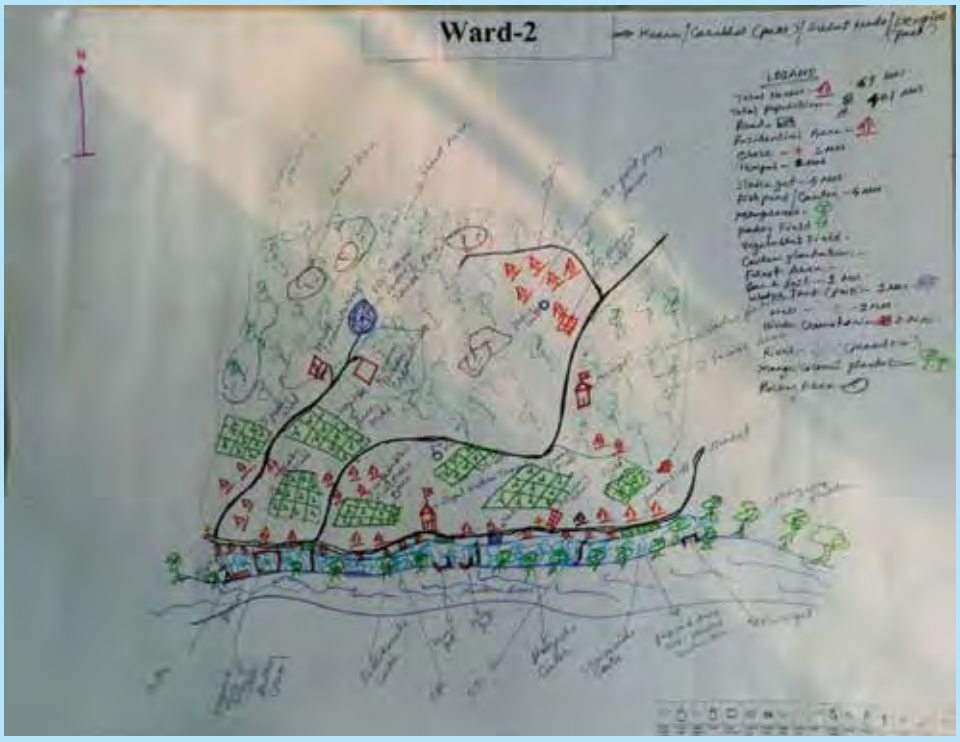


Figure 10. Land-use map of Kerem Ward

Figure 11. Google image map of Kerem Ward showing major ecosystems.

Zone	Area (sq.km.)
Ward area	1120.777
Khazans	412.988
Settlement area	261.251
Slope	196.68
Water body	123.852
Mangrove	76.246
Paddy field	32.266
Road	17.494

Figure 12 Natural resources of Ward II - Kerem

Fishing area

Sluice Gate

Sluice Gate

Bund, Sluice gate

Talli or pond

Vegetable fields

Figure 13. Infrastructure resources of Ward II – Kerem

Anganwadi

Primary School

Gopal Krishna Temple

Bal Gowardhan Shrine

Cross

Cashew liquor processing unit

Hindu crematorium

3.1.3 Ward III - KARABHAT

Ward 3 comprises Belabhat, Carabhat, and Conoldem.It is residential in large part, and has smaller stretches of fields and forest/plantation cover. The ward is bounded on 2 sides by the Mandovi, which is fringed with mangrove species, along which 3 sluice gates are found. The jetty for the Pomburpa ferry is located in this ward. The fish caught at the sluice gates include *vagyo*, *sungtam*/prawns, *shetkeo*, *tipreo*, *kalundar*/catfish, and *shevtale*/mullet. The catch is sold in the Mapusa market to fetch a good price. Karchane, a fish species similar to shevto/ mullet but of a differing colour, is available during the monsoons and prepared as a curry.

In the residential section are located the St. Bartholomew church, the Livramento chapel, the Katayani temple, cross, anganwadi, a few shops, and a bar, apart from the households present in this area.

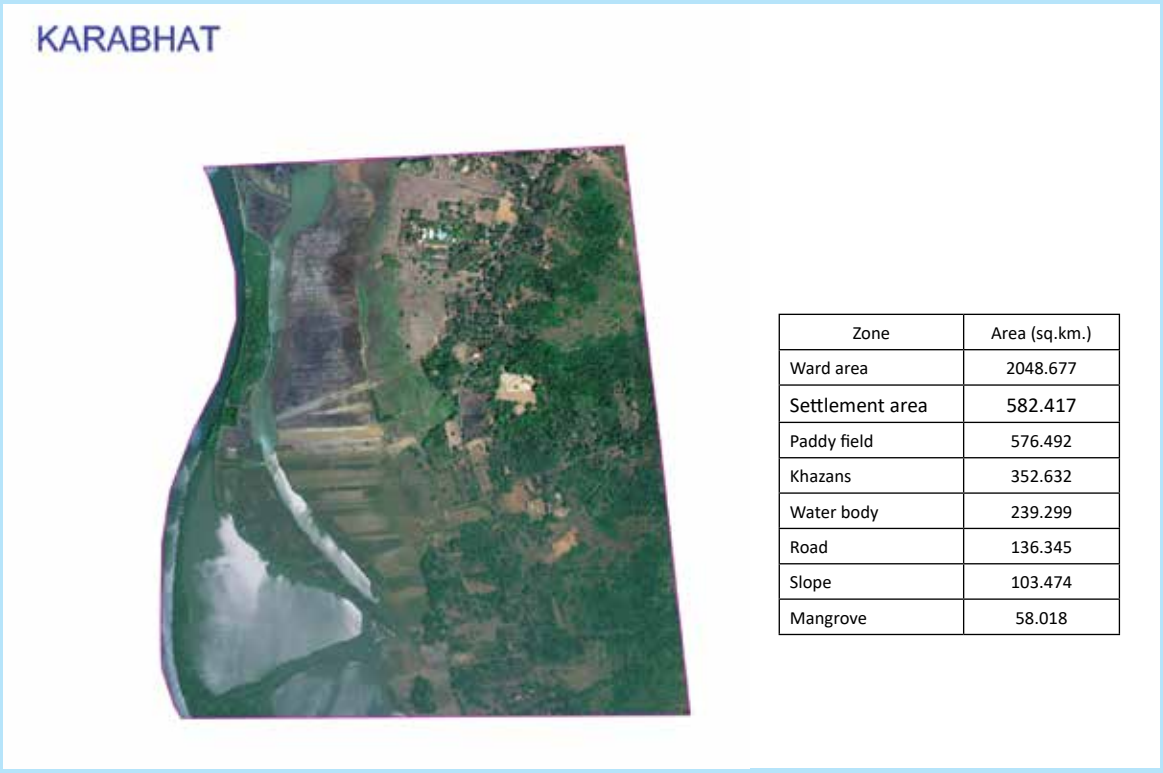
Towards the north of the ward, the green cover is formed by forest species, cashew plantation, coconut and mango plantation, and medicinal plants. Notable among these is the kamin vodd. The field areas are in large part located towards the south of the ward. The major crops cultivated in the fields of this ward are Corguto and Jyoti rice varieties, vegetables, alsande/red kidney beans, chawali/black-eyed peas, onions, mirsango/ chillies, bhende/ladyfingers, tambdi bhaji/red amaranthus, tidki midki/cluster beans, mule/ white radish, val/field beans, and nab/kohlrabi. 4 farm ponds are located in the fields. The ward presently has a cow nuisance – the cows are bought on government schemes on which taxes are not imposed, and have subsequently been neglected. Therefore, the fields are now not regularly cultivated with vegetable crops.

A self-help group and a tenant association are also present in the ward.

Figure 14. Resource map of Karabhat ward carried out along with ward members.

Figure 15. Land-use map of Karabhat Ward.

Figure 16. Google image map of Karabhat Ward showing major ecosystems.



Zone	Area (sq.km.)
Ward area	2048.677
Settlement area	582.417
Paddy field	576.492
Khazans	352.632
Water body	239.299
Road	136.345
Slope	103.474
Mangrove	58.018

Figure 17: Natural resources of Ward III - Karabhat

Sluice gate

Excavation and levelling

Seasonal stream

Figure 18. Infrastructure resources of Ward III – Karabhat

Anganwadi

Katayani Temple

St. Bartolomew's Church

Sai Baba shrine

Livramente Chapel

Ferry to Pomburpa

Chorão Isand Resort

3.1.4 Ward IV - SAÚDE

Ward 4, composed of Bautana, Saúde, and Gavona, is the smallest ward of the Chodan-Madel village panchayat, but is rich in biodiversity. The common species of birds observed here are the koel, flame-back woodpecker, and fantail, while that of butterflies are the Jezebel and Lemon Pansy. *Chunnam*, *kusdam*, and *kandam* are among the wild berries found in the locality. The Rebelo mango variety is locally available, but the Bhism mango variety, that was previously available, now no longer is. The *goting* tree is of note among the vegetation of the ward. The fruiting *Ficus* species, also found in the ward, is a possible source of food for birds.

Black pepper was previously cultivated in the ward and sold in the markets. Some pepper vines are still visible on mango trees. Fields have been lying fallow since the last 50 years, in which trees are now growing. The majority of the mango trees are of the Mancorada variety. Other cultivated vegetables are the long brinjals, *alsande*/red kidney beans, *moong*/mung bean, and the *jalgi mirsang* and *vatkuli* varieties of chilli peppers.

The other commonly observed species are teak, coconut, *satvan/Alstonia scholaris*, jackfruit, cashew, *rumod*, and *vovlam*.

The village panchayat building of Chodan-Madel is located in this ward, in the vicinity of which are Dayanand High School and Raghuvir and Premavati Salkar Higher Secondary School. The Saúde chapel is located in this ward and a cemetery is located its proximity. Residential houses are located interspersed between large tracts of paddy fields. A small area has green cover of cashew and forest species, within which is found a PWD water tanks.

The Vishnu temple in the ward has an associated tank for water storage. The water of a public well

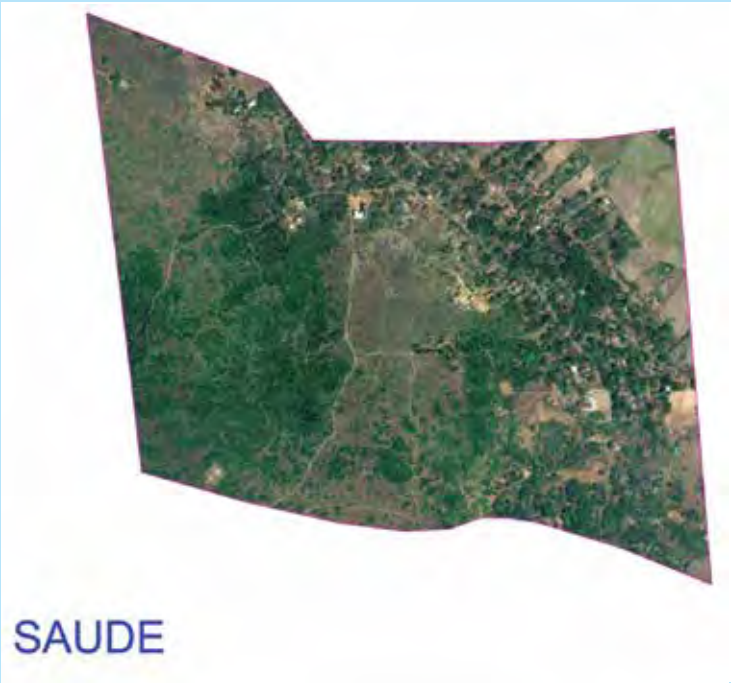
Figure 19. Resource map of Saúde ward carried out along with ward members.

Figure 20. Land-use map of Saúde Ward

found in the ward is said to possess medicinal properties. The other temple of the ward, located close to the Vishnu temple, is the Chapeshowar temple. The jetty has a built-up stone structure, or dovornem, situated near it, that was in earlier times utilized by fisherwomen and other people for keeping *vojem* - as a platform to lay baskets of fish, vegetables, and other goods in order for the baskets to be lifted unaided to rest on the head for manual transport into the village after alighting from the ferry. Two culverts are found along the road leading to Bicholim.

Dhalo is a cultural art practised in the temple of the ward. It is a popular folk dance performed by women, and has religious and social connotations.

Figure 21 Google image map of Saúde Ward showing major ecosystems.



Zone	Area (sq.km.)
Ward area	774.119
Settlement area	564.683
Paddy field	80.966
Slope	68.404
Road	56.155
Water body	3.911

Figure 22. Natural resources of Ward IV - Saúde

Public well

Old public well

Open ground

Figure 23. Infrastructure resources of Ward IV – Saúde

Nossa Senhora de Saúde Chapel

Vishnu Temple

Chapheshwar Shrine

Shrine

Cemetery

Panchayat

Dayanand High School and Raghuvir and Premavati Salkar Higher Secondary School

Public Health Centre

State Bank of India branch

Dovornem

PWD water tank

3.1.5 Ward V - PANDAVADA

Ward 5 is composed of Muddi, Boctawado (part), Pandawado, Khursawado, Camarbhat (part), and Malewado (part). It has a total of 102 houses and 559 residents.

This ward is bounded on one side by the PWD storm water drain. The drain channelizes the rain water coming down from the hillock into the poiem of the khazan fields. The ward is largely residential, and within this area is present branches of the post office and Central Bank of India, St. Bartholomew's High School, Holy Cross chapel, and old age home, the village electricity department, and 10 public wells.

The hilly area in this ward has cover of a cashew plantation and forest species. Atop the hillock is the Christ the King monument, close to which is the PWD reservoir. The route to the Pomburpa ferry is lined with large tracts of fields.

Figure 24. Resource map of Pandavada ward carried out along with ward members.

Figure 25. Land-use map of Pandavada Ward

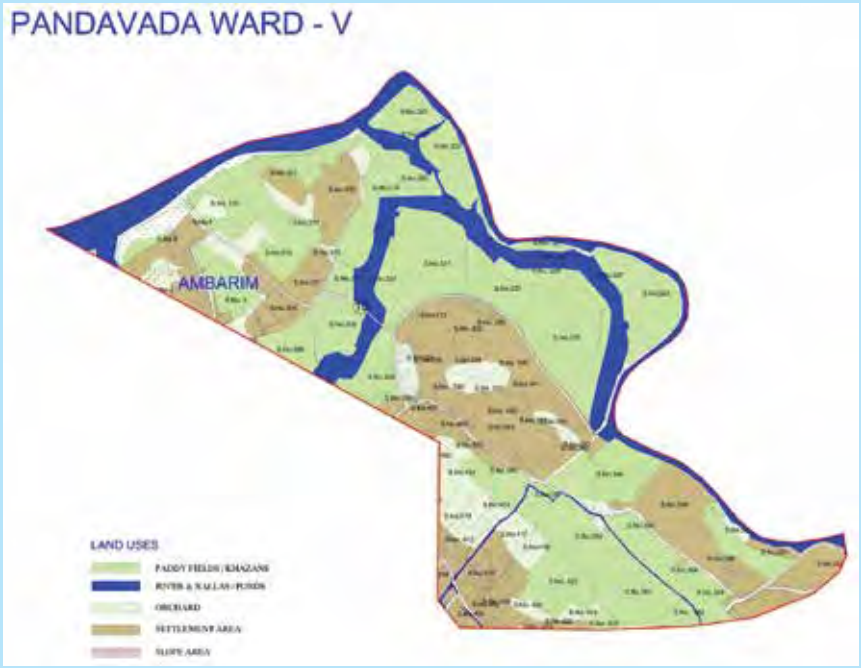
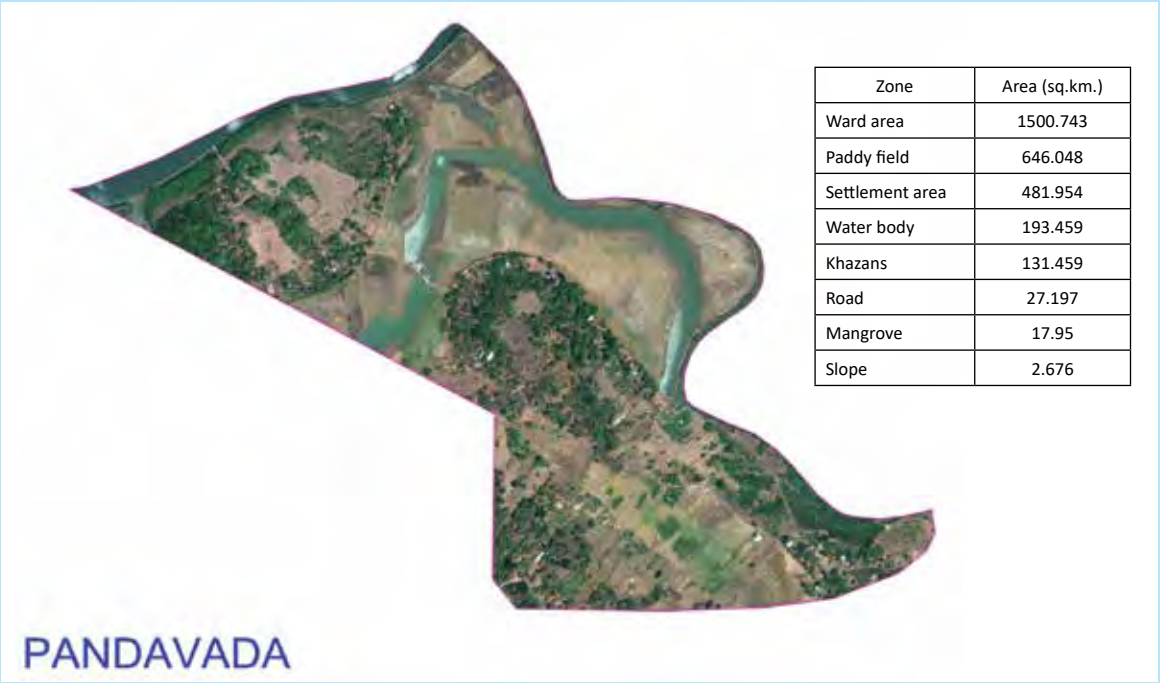


Figure 26. Google image map of Pandavada Ward showing major ecosystems.



Zone	Area (sq.km.)
Ward area	1500.743
Paddy field	646.048
Settlement area	481.954
Water body	193.459
Khazans	131.459
Road	27.197
Mangrove	17.95
Slope	2.676

Figure 27 Natural resources of Ward - Pandavada

Trench for rain water/*val*

Ficus benghalensis/ Banyan tree/*vad*

Figure 28. Infrastructure resources of Ward V – Pandavada

Monument to Christ the King

Holy Rosary chapel

Chapel

Hindu crematorium

Cashew liquor processing

Tank for rain water harvesting- jal kund

Storm water drain

PWD water tank

3.1.6 Ward VI - MALEVADA

Interactions were conducted on site with farmers and other local people during the transect walk of the ward. Two tenant associations in the ward were noted, both belonging to the Chorao Communidade: Ambelim Tenant Association, and Candlim Tenant Association. The khazan land that is cultivated for paddy and horticulture is owned by the Communidade, whereas residences are individually owned.

The transect walk commenced in Ambelim at the St Peter's chapel. The resources encountered en route were the Ambelim manos/sluice gate, a jetty that was previously a stopping point by the Gasolina ferry that used to ply the Mapusa River between Aldona and Panjim, a bandh constructed in recent years that has been overgrown with mangroves over the last 20 years, Candlim khazan land with the sluice gate in operational condition, poiem in the fields from which khube/shellfish are regularly harvested by the local people, Candlim bandh/embankment near the Calvim bridge, and fields where mixed vegetable farming is practised. The hilly area in the vicinity of the vegetable fields contains a variety of wild plants with medicinal uses. Several farm ponds were observed in the farming belt, but these are currently not in use due to siltation. The community hall is located close to the Devaki Krishna temple. The temple well is an abundant source of water, providing potable water to 14 families around the temple. It is the main source of drinking water in that locality. A progressive farmer living near Kumate Tollem was also interviewed, who propagates mixed horticulture on his farm of areca nut, coconut, fruit-bearing trees, and spices like black pepper

Figure 29. Resource map of Malevada ward carried out along with ward members.

Figure 30. Land-use map of Malevada Ward

and chillies. Turtles are found in the Kumate Tollem, and protection to the tollem is proposed. In the fields surrounding the farm, alsande/red kidney beans, chillies, and other vegetables are grown. In the monsoon season, the Jyothi and Corguto varieties of paddy are cultivated. Local fishermen with canoes operate the sluice gates with kutavni. The fish varieties caught at the sluice gates/manos are white prawns, shevtale/ mullet, pearlspot, and khube/shellfish. The notable wild fauna of this ward are the turtles found at Kumate Tollem, frogs, and peafowl, whereas the major domesticated livestock consists of buffaloes, cattle, and poultry.

Figure 31. Google image map of Malevada Ward showing major ecosystems.

Zone	Area (sq.km.)
Ward area	1120.777
Khazans	412.988
Settlement area	261.251
Water body	196.68
Paddy field	123.852
Road	76.246
Mangrove	32.266
Slope	17.494

Figure 32. Natural resources of Ward VI - Malevada

Ambarim *manos*/ sluice gate

Candlim sluice gate

Candlim *manos*

Public well

Spiritual medicinal value, main source of drinking water

Figure 33. Infrastructure resources of Ward VI – Malevada

Devaki Krishna Piso Ravalnath temple

Religious site from 50 years ago

Chapel

St Peter's chapel

Community Hall

Ambarim Jetty

3.1.7 Ward VII - SODETIM

Ward 7, comprising of Sodetim, Caraim, and Boctawado, has a total population of 850 individuals residing in 250 households. The major occupations in this ward are agriculture, horticulture, and fishing.

A large portion of this ward is comprised of the khazan – paddy and vegetable fields, and *poiem* – which is bounded on one side by the Mandovi river, lined with mangroves. A sand extraction area exists on the outer boundary of the ward within the river. A *nalah* runs through the khazan, connecting with the *poiem* near the river. 4 sluice gates and mango and cashew plantations, and 24 farm ponds are present within the khazan area. Mango varieties of Mancorada, Maldes, Xavier, and Mussarat are cultivated.

Two temples of Gopal Krishna and Vadeshwar are located in this ward.

The outer portions of the ward, away from the river, comprise the residential section of the ward. Also present in this section are branches of the Central Bank of, HDFC Bank India, post office, and Farmers' Club.

Figure 34. Resource map of Sodetim ward carried out along with ward members.

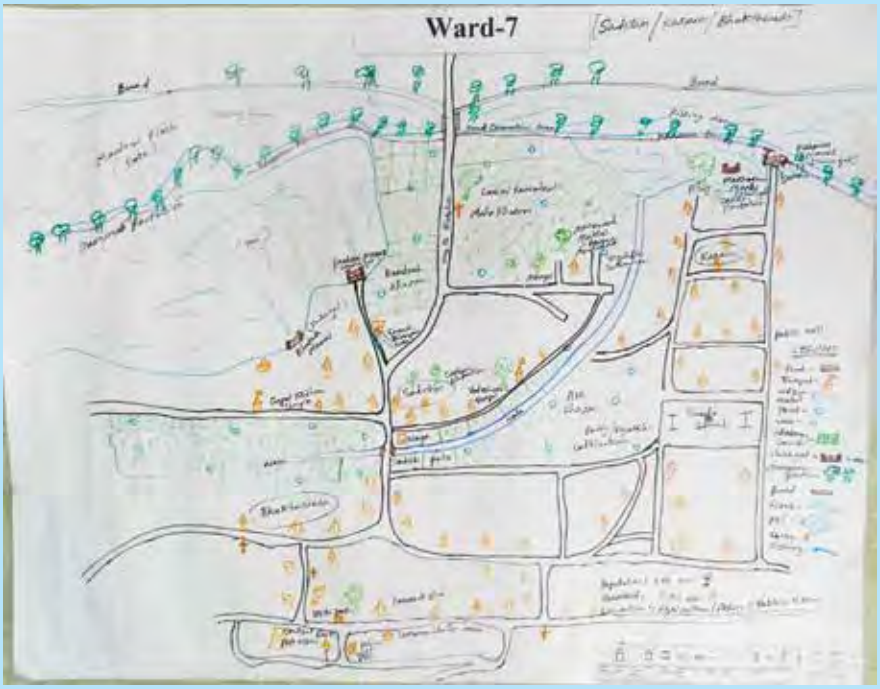


Figure 35. Land-use map of Sodetim Ward

Figure 36. Google image map of Sodetim Ward showing major ecosystems.

Zone	Area (sq.km.)
Ward area	2286.505
Paddy field	1442.154
Water body	451.003
Settlement area	274.836
Khazans	108.569
Road	9.943

Figure 37. Natural resources of Ward VII – Sodetim

Manos/sluice gate and *bundh*/ embankment

Fields

Public well

Ficus benghalensis/Banyan tree/*Vad*

Figure 38. Infrastructure resources of Ward VII – Sodetim

Vadeshwar temple

Communidade office

HDFC Bank branch

Canal for tidal water

3.1.8 Ward VIII - DEVGIM

The ward is partially agricultural, with cultivation of paddy, horticultural crops like chilli and chawli/ black-eyed peas, prawn farming, and catch of local fish species. Cashew is found in abundance, and the fruit is processed to prepare urrak and feni. Many old mango trees are found in the ward, which are 250-300 years old. Among the mango varieties found on the island are Mancorada, Xavier, Santan, Maldes, Pairi, Corel, Fernand, and god ambo – a variety that is sweet when it is raw. Bism is a variety that was present on the island but is now no longer available. Varieties of chilli and jackfruit are found in the ward.

A private plant nursery has been set up in the ward, on lease to a non-resident of the ward, and has exotic plants for sale.

Wild fruit such as *kandam*, *chunnam*, and *zambul*/ Indian black plum and cashew varieties are the wild fruit found in the ward.

Flowers and plants are used for religious purposes in the ward.

Buffaloes are reared for milk in the ward, and it was recorded that jersey cows are also reared, but their presence in the ward was not observed. Cow dung cakes, observed to be drying in the sun, are utilized for burning during cremations. They are also used as fuel to heat bathing water in motki/large traditional earthenware pots, set over traditional outdoor fireplaces.

Figure 39. Resource map of Devgim ward carried out along with ward members.

Figure 40. Land-use map of Devgim Ward

Figure 41. Google image map of Devgim Ward showing major ecosystems.

Zone	Area (sq.km.)
Ward area	2121.996
Paddy field	897.097
Settlement area	622.338
Water body	330.556
Slope	120.287
Mangrove	93.718
Road	41.834
Khazans	16.166

Figure 42. Natural resources of Ward VIII - Devgim

Horticultural fields

Old well for field irrigation

Old well- abandoned

Old drain

Ficus religiosa/peepal tree & religious site for Holi rituals

Figure 43. Infrastructure resources of Ward VIII – Devgim

Cross

Shrine to St. Joseph Vaz

Cross to St. Joseph Vaz

PWD water tank

3.1.9 Ward IX - ORANDO

Ward 9 of Chodan-Madel is largely residential, having a total population of 2400 in 500 households. The houses in this area come under the 20 point programme. The ward is bounded on one side by the Mandovi river, and partially on the other side by the Mapusa river. The banks of both the rivers are lined with mangrove species such as *thipli/Avicennia* sp., *chip/Sonneratia* sp., *shengo/ Rhizophora* sp., and *uro/Excoecaria* sp. The ward has a fishing area in the Mapusa river adjoining which is an old jetty that is currently in disuse. During the Chaturthi festival celebrations, the jetty is the point at which the *Ganapati visarjan* takes place. Stretches of forest area and mango and cashew plantations are present in the ward. *Shivlo* is a sour mango variety present in the ward that becomes sweeter during the monsoons. The Mandovi river provides further fishing areas to the ward. Separating the river from the land is a *bandh*/embankment, along which are present a sluice gate (varana), and two old jetties marked by crosses. In bygone days, *Gasolina* boats used to berth at the old jetties in the ward. Two khazan areas adjoin the Mandovi in this ward namely the Varan khazan and the Kalkon khazan. In the Varan khazan, the crops cultivated are paddy and vegetables such as *chawali*/black-eyed peas and *alsande*/red kidney beans. A traditional system is used for irrigating the fields, wherein large tins or *laat* attached to a pole are used to draw water from farm ponds using a swinging mechanism. 20 farm ponds are present in this khazan area, as is a tank where lotus flowers grow abundantly. Fish are also found in this tank, such as karchane, catfish/*kalundar*, and *pitol*. In the vicinity of this khazan is the attambaim well, the water of which was in earlier times used by the whole village but is now is disuse due to the dumping of garbage near it. The Kalkon khazan is utilized for paddy cultivation and has the presence of 3 farm ponds. A third area of khazan, called Tivo khazan, used to be present earlier. It was utilized for agriculture, but was gradually neglected and subsequently taken over by mangroves. This land is presently lies within the Dr. Salim Ali Bird Sanctuary.

A *nalah* is also found to run through the ward. 5 public wells, two of which provide government water supply are observed, as is a crocodile tank or mangeachi tanki, where crocodiles are still observed. Near this tank is the burkeachi baim, a well with a narrow opening that widens below. Three temples are present in the ward, one of

Figure 44 Resource map of Orando ward carried out along with ward members.

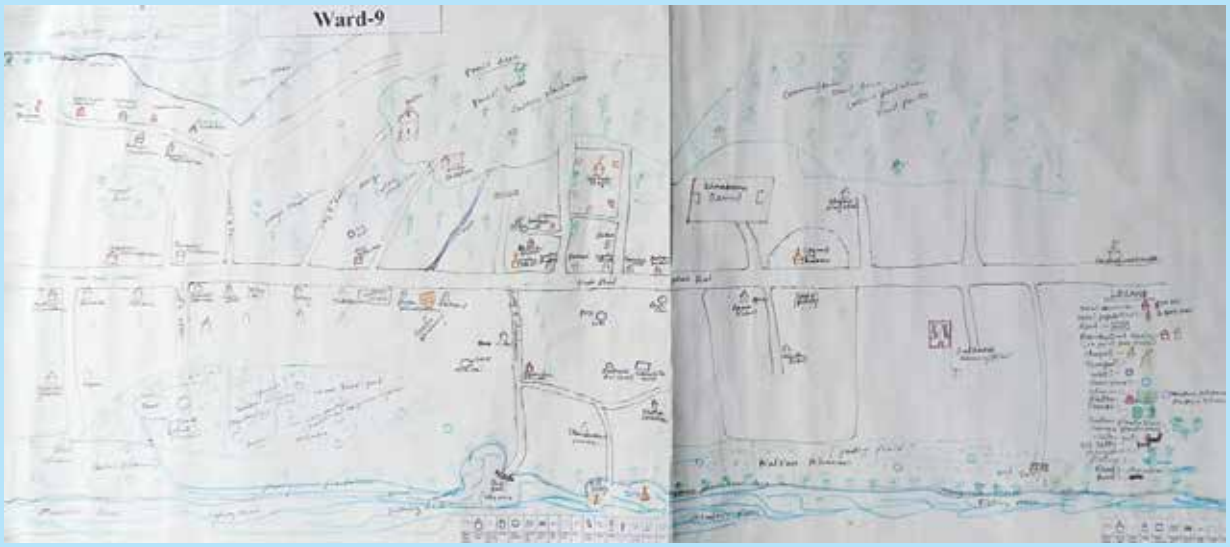
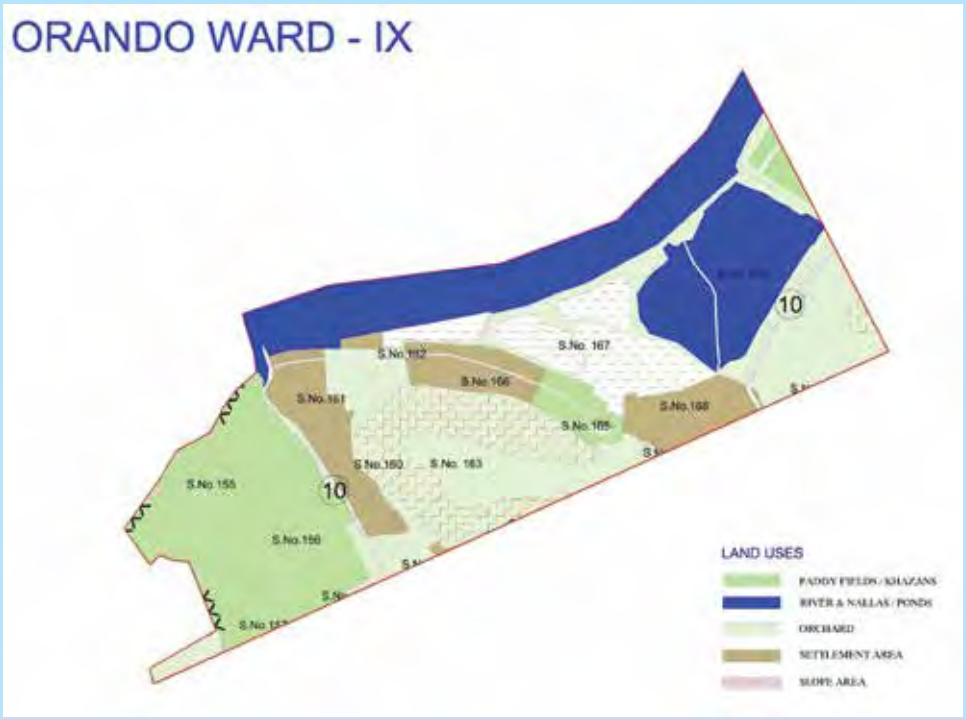


Figure 45. Land-use map of Orando Ward



which has the presence of phirangi vaunsh (Ficus variety) and kel/strangler fig near it. In another temple dedicated to Gauleshwar/Satteri, the rakhandar is kept outside. Three chapels are also observed, as is the Mother Teresa convent, which was the Mahadev temple before conversion. The ruins of the first church and cemetery of Chodan-Madel are to be observed in the ward. The ward also shows the presence of the Hindu Samshan, Copro or old police station dating from colonial times, and Chamberem ground, and a rice mill and bakery.

Figure 46. Google image map of Orando Ward showing major ecosystems.

Zone	Area (sq.km.)
Ward area	378.78
Water body	110.494
Paddy field	95.077
Settlement area	80.191
Slope	46.701
Mangrove	36.471
Road	6.039
Khazans	3.807

Figure 47. Natural resources of Ward IX – Orando

Play ground

Stake net/*haari* method of fishing

Figure 48. Infrastructure resources of Ward IX – Orando

Sai Baba temple

Firgavas shrine

Cross

Old jetty

Bakery

Figure 49. Ward-wise resource mapping activity

Ward I - Madel

Ward II - Kerem

Ward III - Karabhat

Ward IV - Saúde

Ward V - Pandavada

Ward VI - Malevada

Ward VII - Sodetim

Ward VIII - Devgim

Ward IX - Orando

Chapter 4

Facilitation of development of Chodan-Madel village PBR

Several activities were conducted in Chodan-madel village to facilitate the development of the village PBR by the BMC and other village members, as follows:

4.1 Creating awareness on PBR among village BMC and panchayat & government officials

The inception/kick-off meeting conducted for facilitating the development of the Chodan-Madel Peoples Biodiversity Register (PBR) commenced at 3:45 p.m. on 15th March 2017, at the Chodan-Madel village panchayat. The meeting was attended by officials of GIZ-India, Goa State Biodiversity Board (GSBB), Goa Forest Department, members of the Chodan-Madel Biodiversity Management Committee (BMC), elected village panchayat members, and officials of TERI-Goa.

The meeting focused on creating awareness among the BMC members and panch members about PBR and its process of implementation in Chodan-Madel village. This project, falling under the umbrella of the CMPA-MoEFCC project of the Indo-German Biodiversity Programme, is being jointly implemented in Chodan-Madel by GIZ-India and the Goa Forest Department, in association with GSBB. The importance of PBR, especially in the context of Chodan-Madel, was elaborated on, highlighting the necessity of the involvement of the local people in the development of the PBR and enhancing their knowledge of this subject. Information on the scope and timeline of the work was also delivered, including the study to be implemented for determining the feasibility of sites in Chodan-Madel for designation as Biodiversity Heritage Sites. Further to this, a discussion was held to clarify queries raised that were related to the project, as also points on biodiversity-related issues that fall under the jurisdiction of the village BMC.

Two members of the village BMC were selected as the points of contact for the duration of the project, who would serve as coordinators, along with the appointed coordinator of TERI,

Figure 50. Initiation meeting with officials of GIZ-India, GSBB, Goa Forest Department, members of Chodan-Madel BMC and elected panchayat members, and officials of TERI

to facilitate the arrangement of meetings with groups or knowledgeable individuals from the village wards, and with the ward panchayat officials and BMC. Resource maps of each of the 9 wards of Chodan-Madel were subsequently prepared in conjunction with knowledgeable individuals of the wards.

4.2 Spreading of awareness on PBR at the village level

Talks were held during various meetings to spread awareness on the importance of PBR, and the necessity for the involvement of the local people in the development of the same. This was carried out in the initial stages of the project at the village and school levels, and also as a prelude to the preparation of the ward-wise resource maps of the village with ward members.

4.3 Participation & awareness creation on International Day for Biological Diversity 2017

May 22 is celebrated annually on a global scale as the International Day for Biological Diversity (IDB). The national celebrations of IDB 2017 were held in Goa at Kala Academy, Panaji - Goa, under the theme for 2017 of 'Biodiversity and Sustainable Tourism'. An exhibition was organized at the venue by the Goa State Biodiversity Board, garnering the participation of several companies, NGOs, and government departments.

TERI featured the biodiversity-related projects undertaken by the organization, especially in the context of the People's Biodiversity Register (PBR). The currently ongoing project of preparation of the PBR of the village of Chodan-Madel, Goa, was showcased, depicting, through participatory rural appraisal activities, the process of resource mapping via community interaction and transect walks, and the peoplescape of the village.

The exhibition was held over a period of 2 days, from 22nd – 23rd May 2017.

4.4 Developing awareness among school students on mangroves & associated biodiversity

Awareness walks on mangroves and associated biodiversity were conducted by TERI officials for two schools of Chorao on 12th and 13th June 2017, for students of Dayanand High School and St. Bartholomew's High School, respectively.

The walks commenced with gathering the students in a group and explaining to them what the mangrove ecosystem is, the adaptations exhibited by the mangroves for survival in the harsh environmental conditions were elaborated upon, as well as those that allow species such as *Rhizophora* to maintain tenuous hold on the soft soil of the mud flats. The functions of the mangrove ecosystem were brought to the attention of the students in terms of associated

Figure 51. Spreading awareness on the people's biodiversity register and its importance

Village members being made aware of the PBR and its importance during the ward-wise participatory rural appraisal (PRA) exercise.

Figure 52. Participation in International Day for Biological Diversity 2017 and spread of awareness on the People's Biodiversity Register

Spreading of awareness on PBR at IDB 2017 at Kala Academy, Panaji, and visit to the TERI stall by officials of GIZ-India, Goa State Biodiversity Board, Botanical Society of India, social activists, and members of Chodan-Madel BMC

Figure 53. Awareness walks on mangroves and associated biodiversity conducted for students of Dayanand High School & St. Bartholomew's High School

fauna, and in building up the coastline and providing protection against storm surges to the coastline and adjacent ecosystems. The resources that human beings obtain directly from the mangrove ecosystem were expanded upon for the students.

The students then walked along the embankment within the sanctuary, where the various species of mangroves present within and the common benthic species were pointed out to them. Other fauna commonly found in the mangroves were discussed with the students, such as the mugger, or Indian marsh crocodile, otters, fish and shellfish species of commercial importance, and the black mud crab.

The students then visited the Interpretation Centre, where the interactive displays caught their attention and interest, and where observations made during the walk up to the Centre were recapitulated and some students recounted the observations they had made for the first time.

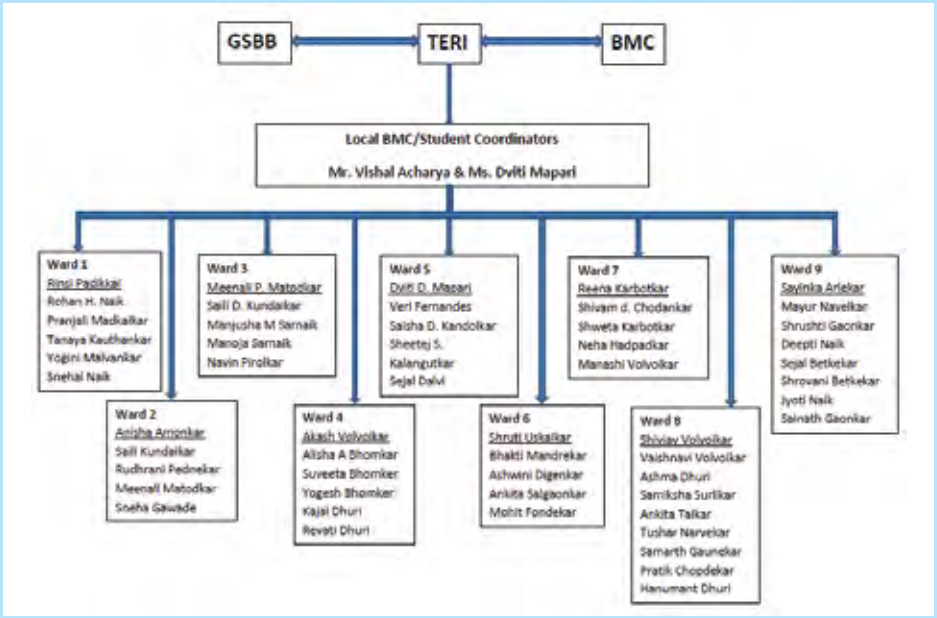
The students expressed their feedback as the awareness walk being a memorable trip. Though being from the island and having visited the sanctuary previously, this experience opened their eyes further in getting to know about the mangrove ecosystem, the associated biodiversity, and the importance of mangroves to human wellbeing.

The walks, each conducted over the duration of 1.5 hours, concluded with a snack break, and a group photo being taken of all the attending students.

4.5 Training of residents of Chodan-Madel in biodiversity documentation

Training workshops on biodiversity documentation were conducted at the Chodan-Madel village panchayat on 15th & 16th June 2017 to facilitate the development of the People's Biodiversity Register (PBR) of Chodan-Madel. The workshops were attended by members of the wards of the village, of varying age groups, as well as members of the village Biodiversity Management Committee (BMC). The

Figure 54. Members of the Chodan-Madel Biodiversity Conservation Corps



workshops were conducted for the formation of the Biodiversity Conservation Corps (BCC) and capacity building of the BCC and BMC members to take forward the task of inventorying the local biodiversity in the development of the PBR. Two workshops were conducted to permit attendance in smaller groups and to ensure a more thorough understanding of the subject by the participants.

Each workshop commenced with an introduction to the People's Biodiversity Register, its importance, and the necessity of the involvement of the local people in the development of the PBR, as well as the role of TERI as a facilitator in the development of the same. The recording of photographic and other data for reporting in the formats prescribed by the National Biodiversity Authority was also elucidated.

The second segment of the workshop highlighted points to be taken into consideration for ideally capturing images of local flora and fauna, in terms of obtaining clarity of photographs as well as images taken from various angles to serve as an aid in identification of the subject. As students formed the majority of the participants in the workshops, the focus was given to the capture of images utilizing smartphone cameras. A short interactive practical session was also held where hands-on demonstrations were given individually to participants on capturing photographic data relevant to inventorying the local biodiversity for the village PBR.

To maintain continuity with the participants upon completion of the workshops and to receive data for developing the PBR, BCC groups were formed for each of the village wards, where each group would collect data in only its respective ward. A volunteer from each group was designated coordinator of that group, and an overall coordinator was appointed to be responsible for collection of data of all the wards. A Whatsapp Messenger group was also formed for the purpose keeping continuity with data collection and for maintenance of contact between the groups, BMC members and other individuals of the village, and officials of GIZ and TERI. TERI would maintain regular contact with the coordinators for further communication.

Figure 55. Workshops conducted for training of village residents in documentation of biodiversity

4.6 Developing biodiversity awareness at the village level

A biodiversity festival was organized in the village of Chodan-Madel on 25th June 2017 to showcase the wild and domestic biodiversity of the village that is typically apparent in the monsoon season. The programme, consisting of talks on the importance of biodiversity and its conservation interspersed with traditional cultural items, was conducted at the Shri. Vishnu Devastan in Chodan-Madel. It commenced with the village song that described the beauty and natural wealth of the village. The winner of the logo drawing competition to institute a logo for the village Biodiversity Management Committee was then awarded a prize, and appreciation tokens were given for the other entries submitted. Chodan-Madel, rich in its heritage of medicinal plants, has available abundant knowledge of traditional medicine. Four traditional medicine practitioners of the village were felicitated during the programme for keeping alive this traditional knowledge, and the associated cultural legacy of the village.

Speeches were delivered to the audience on the progress in the preparation of the People's Biodiversity Register (PBR) and the awareness and capacity building activities for the PBR by an official of TERI Goa. The Member Secretary of Goa State Biodiversity Board, Shri. Pradip Sarmokadam, spoke on biodiversity that becomes apparent in the monsoon, its importance, and the importance of developing the PBR; and Dr. Aaron Lobo, Technical Advisor for the CMPA project, a pilot site of which is the Dr. Salim Ali Bird Sanctuary in Chodan-Madel, spoke on the CMPA project in Goa.

Interspersing the speeches were traditional cultural items, performed by members of the village, of *dhalo* and *fugdi*. The *dhalo* song that was performed during the programme is part of a folk dance form that is traditionally performed by women belonging to tribal communities of Gawdas, Naiks, Dessais, and others. The Earth is the chief deity who is praised and whose glory is sung through various nomenclatures, for her appeasement and hailing, to give rise to her blossoming and fruition through this ritual. The *fugdi* is another type of traditional folk song

Figure 56. Biodiversity display and visitors at the Chodan-Madel Biodiversity Festival

that has been passed down orally through the generations. It reflects love for nature, showing a harmonious relationship between man and the natural environment. The programme drew to its conclusion with the *ghumat arati*. The *ghumat* is a traditional percussion instrument of Goa, originally consisting of the skin of the gar or Bengal monitor lizard (*Varanus bengalensis*) stretched over an earthenware pot-like frame, which is now played utilizing the legally-permitted sheepskin. The *ghumat arati* was performed by men of the village, singing traditional religious compositions.

The display of both wild and domesticated fruits, vegetables, flowers, edible and medicinal plants, rice and other seed varieties was kept open to those who visited the venue and attended the programme. Appreciation of the display and of the enthusiasm of the village Biodiversity Management Committee members, students, and other village members in organizing it and the cultural items of the programme was expressed by the officials present. Medicinal plants were also distributed to members of the audience.

Figure 57. Programme of Chodan-Madel Biodiversity Festival

Figure 58. Entries received for the Biodiversity Management Committee logo competition

Winning entry

Chapter 5

Feasibility study on possible Biodiversity Heritage Sites

A study was carried out to determine the feasibility of sites within Chodan-Madel to be designated as Biodiversity Heritage Sites (BHS). This assessment has been conducted following the ward-wise PRA exercise and resource mapping

5.1 Rationale for BHS

Over the course of several decades, indigenous people and small communities have been receiving recognition popularly, as well as in academic circles, for being commendable in their role as conservationists. This has been credited to their understanding of the natural world, both spiritual and practical. The evidence in justification are the conservation ethics expressed in the local culture, religious beliefs that envisage other beings as social and conscious beings, and the comparatively greater biodiversity found within the natural areas that have been traditionally managed by such people.

The beliefs and behaviour of human communities drive the sustainable management of natural resources, and their close connections with the natural environment are intensified by the local cultures. Traditional cultures do not distinguish between objective and sacred knowledge, and religious beliefs and rituals are associated in a fundamental way to the daily tasks of life. It is now firmly believed that there is need to obtain a more clear understanding of spiritual and cultural beliefs and the related local systems with which traditional resource management is associated. In this manner, valuable insights would be gained into the changing values of local communities with regard to the protection of natural resources.

The declaration of Biodiversity Heritage Sites (BHS) is given provision in the National Biodiversity Act (2002), thereby allowing for recognition of community initiatives in natural resource conservation. According to Section 2 of the Biodiversity Act, 2002, Biodiversity Heritage Sites have been defined as 'Well-defined areas that are unique, ecologically fragile ecosystems - terrestrial, coastal and inland waters and marine - having rich biodiversity comprising any one or more of the following components: richness of

wild as well as domesticated species or intra-specific categories, high endemism, presence of rare and threatened species, keystone species, species of evolutionary significance, wild ancestors of domesticated/cultivated species, past pre-eminence of biological components represented by fossil beds and having significant cultural, ethical or aesthetic values and are important for the maintenance of cultural diversity, with or without a long history of human association with them'.

Biodiversity Heritage Sites provide several advantages to the local communities living in their vicinity:

- Conservation, promotion, and sustainable use of biological diversity
- Agro-biodiversity conservation and management
- Curbing of rapid biodiversity loss in intensely managed areas
- Provision of access to and sharing of genetic resources and technologies for sustainable use
- Traditional rights and privileges are not affected
- Provision of the mechanism of prior informed consent
- Provision of benefit-sharing mechanisms
- Serves to enhance the quality of life of local communities

5.2 Methodology utilised in the feasibility study

5.2.1 Criteria for selection of feasible areas of Chodan-Madel as BHS:

As per the provisions of Section 37 of the Biological Diversity Act, 2002, areas possessing one or more of the characteristics listed below may meet the criteria for identification and notification as BHS:

1. Areas containing a mosaic of natural, semi-natural, and man-made habitats, which together contain a significant diversity of life forms
2. Areas containing significant components of domesticated biodiversity and/or representative agro-ecosystems with ongoing agricultural practices that sustain this diversity
3. Areas, including very small ones, that offer refuge or corridors to threatened or endemic fauna or flora, such as community conserved areas or urban greens or wetlands.
4. All kinds of legal land uses, whether government, community, or private, and could be considered under the above categories
5. As far as possible those sites that are not covered under the Protected Area network under the Wildlife Protection Act 1972 as amended may be considered.
6. Areas that provide habitats, aquatic or terrestrial, to seasonal migrant species for feeding and breeding
7. Areas that are maintained as preservation plots by the research wing of the Forest Department
8. Medicinal Plant Conservation Areas (MPCA) that are established in collaboration with Foundation for Revitalisation of Local Health Traditions (FRLHT), Bengaluru

5.2.2 Biodiversity assessment

The ward-wise PRA exercises of resource mapping and resource validation through transect walks were utilized in determining the feasibility of areas of Chodan-Madel to be declared as a BHS. Further, a meeting was held with the BMC and elected village panchayat members, including the village sarpanch, to enhance their understanding of BHS and its implications, and feedback and information were gathered at the same time as to possible locations that may qualify for declaration as BHS.

5.2.3 Ecological services provided by the village ecosystems

Secondary data was reviewed for the ecological services provided to the island and village community by the major ecosystems present.

5.3 BHS criteria significant in terms of Chodan-Madel and associated observations

5.3.1 Biodiversity assessment based on criteria applicable to Chodan-Madel

Characteristics 1-6 for identification and notification of areas as BHS are found to be applicable to Chodan-Madel village, through

meetings with the local people and data gathered during the ward-wise PRA exercises.

Through the feasibility study, several species of flora and fauna have been enumerated from the island of Chodan-Madel: Agrobiodiversity and traditional species grown in the khazans were represented by 17 species, traditional aquaculture/*poiem*/sluice gates with 44 species, mangroves and associated flora and fauna at 83 species, benthic fauna at 16 species, prawns/ shrimp at 5 species, fish at 13 species, snakes at 13 species, other large reptiles at 4 species, mammals at 14 species, migratory birds at 58 species, resident birds at 49 species, timber by 2 species, floristic diversity by 115 species, threatened fauna by 12 species, economically important plants by 4 species, cereals and legumes by 6 species, fibre-producing plants by 1 species, fodder plants by 2 species, vegetables and tuber crops by 15 species, spices by 6 species, domesticated fruits by 14 species, minor fruits/ wild berries by 7 species, plantation crops by 9 species, bamboo by 1 species, medicinal plants by 59 species, ornamentals by 28 species, wild relatives of crops by 4 species, endemic fauna by 1 species, and keystone organisms by 2 species.

The observations made through the conducted feasibility study on the biodiversity of the village have been listed below as per the criteria for declaration of BHSs provided under Section 37 of the Biological Diversity Act, 2002:

1. *Areas containing a mosaic of natural, semi-natural, and man-made habitats, which together contain a significant diversity of life forms*: Present on Chodan-Madel is an intricate system of mangrove vegetation, khazans, poiem, and plantations of varieties of mango, cashew, coconut and teak. These adjacent ecosystems provide nesting, feeding and breeding grounds to a wide variety of fauna, both resident and migratory. Chodan-Madel is known to contain some of the best mangrove forest in Goa. Due to the presence of the Dr. Salim Ali Bird Sanctuary on the island, birds may be observed in their natural settings, and this phenomenon is also observed in the mangrove areas of the island outside of the sanctuary. The khazans of Goa are marvels of engineering, and those of Chodan-Madel are cultivated with salt-tolerant paddy varieties and winter vegetables, whereas aquaculture in the poiem produces various fish and shellfish for consumption. Salt tolerance is not a commonly observed feature of paddy. Crops cultivated on khazans, being indigenous varieties that have been cultivated over centuries, have significant evolutionary experience of resistance to pests and viral attacks which forms the basis of their survival for centuries. The khazans blend in a highly harmonious manner with the local people, animals, plants, land, and water.

Annexure 1 and Annexure 2 provide the wide variety of species observed on Chodan-Madel of mangroves and associated species, timber species, floristic diversity, economically important flora, fibre and fodder species, bamboo species, medicinal plants, ornamental species, wild relatives of crops, and the diversity of bird life and other fauna. Two keystone species have been observed in Chodan-Madel, namely, *Ficus exasperata* and *Apis dorsata*. Keystone species are extremely significant in maintaining ecological diversity and community structure, and in supporting the viability of other species in the community that could otherwise be conserved only through expensive methods. The loss of these keystone species of Chodan-Madel would cause a drastic change in the diversity of herbivore animals dependent on them and the insects involved in seed dispersal.

2. *Areas containing significant components of domesticated biodiversity and/or representative agro-ecosystems with on-going agricultural practices that sustain this diversity*: The island possesses large tracts of khazan lands which are representative of saline floodplain agro-ecosystems typical of and unique to the estuarine regions of Goa. Traditional aquaculture practised in the poiem, a component of the khazans, also contributes to the agro biodiversity of the island. The agro-biodiversity of Chodan–Madel comprises of in major part:

- Varieties of salt-tolerant rice
- Varieties of mango, namely *Mancurada*, *Rebelo*,

Table 6
Threatened/vulnerable species

Sr.No.	Species	Common name	IUCN Status
1	*Anhinga melanogaster*	Darter	Near threatened
2	*Ciconia episcopus*	Woolly-necked stork	Vulnerable
3	*Clanga clanga*	Greater spotted eagle	Vulnerable
4	*Crocodylus palustris*	*Mugger*, marsh crocodile	Vulnerable
5	*Leptoptilos javanicus*	Lesser adjutant stork	Vulnerable
6	*Lutrogale perspicillata*	*Uda*, smooth Indian Otter	Vulnerable
7	*Macaca radiata*	*Makad*, Monkey	Endemic to south India
8	*Machlolophus aplonotus*	Indian Black-lored tit	Endangered
9	*Manis crassicaudata*	*Kahawle mazar*, Indian Pangolin	Endangered
10	*Melanochelys trijuga*	*Hagaro kasav*, Indian black turtle	Near threatened
11	*Numenius arquata*	Eurasian curlew	Near threatened
12	*Python molorus*	*Azgar*, Indian Rock Python	Near threatened
13	*Rusa unicolor*	*Meru*, *Shengado*, Indian Sambar Deer	Vulnerable
14	*Sterna aurantia*	River tern	Near threatened
15	*Threskiornis melanocephalus*	Oriental white ibis	Near threatened

Xavier, *Santan*, *Maldes*, *Pairi*, *Correl*, *Godd ambo*, *Fernand*, *Shivro*, *Mussurat*, and *Totapuri*
- Old local varieties of cashew, and newer grafts such as *Vengurla* and *Balli*
- Varieties of chilli peppers such as *Jalgi mirsang*, *Tarvoti mirsang*, and *Vatkuli mirsang*
- Local varieties of brinjals/eggplant
- *Poiem* & sluice gates that sustain fish diversity

Annexure 1 and Annexure 2 provide the agrobiodiversity and traditional species cultivated in the khazans, species associated with traditional aquaculture, cereals and legume species, vegetables and tuber crops, spice crops, fruit-bearing species, and plantation crops.

3. *Areas, including very small ones, which offer refuge or corridors to threatened or endemic fauna or flora, such as community conserved areas or urban greens or wetlands*: Chodan-Madel has the presence of several migratory bird species, and some vulnerable, near-threatened, and endangered fauna, as indicated in Table 6. *Macaca radiata* is a species endemic to south India that is found on Chodan-Madel. The island thus provides shelter and safety to these species.

The above 3 criteria highlight the wide and diverse flora and fauna that is present on Chodan-Madel. The presence of this varied and harmoniously co-existing mosaic of natural, semi-natural, and man-made habitats, as depicted by the khazans and mangroves of Chodan-Madel; the diverse agricultural and other domesticated diversity, as well as the large numbers of varieties observed among in several crop/plantation species on the island; and the provision of refuge to migratory and resident species, especially those that are threatened or endemic, are factors that strongly indicate that sites on Chodan-Madel have the potential to be declared as BHS.

5.3.2 Ecological services provided by khazans and mangroves

A. Ecological services provided by khazans:

Khazan lands are known to provide substantial ecological services, in which area, they are on par with wetlands. Khazans have particular heritage

and historical value as their origins can be traced back to ancient communities. Khazan are a special niche ecosystem, as they are man-made for coastal agricultural purposes. Khazans deliver several ecological services, such as (Sonak, 2014):

1. Playing an important role in various ecological processes and life support systems in terms of their regulation and maintenance.
2. Serving as barriers to wind, tide, and wave action
3. Playing a vital role in regulation of hydrological flows
4. The khazan biota, both the vegetation and soil biota, aid in water supply functions such as the filtering, retention, and storage of water
5. Khazans play a role in retention of soil, sedimentation, and controlling erosion, by trapping sediments present in water and stabilizing bottom sediments to prevent erosion
6. Khazans are stabilisers and accumulate sediment at the intertidal and sub-tidal areas of the coast. They act as sinks for nutrients, providing a buffer or filter against the nutrient and chemical inputs to the coast.
7. Khazan soil biota aids in the mineralization of organic matter present in soils and sediments
8. Khazans accumulate animal and plant organic matter and release minerals, thereby contributing to soil formation. This play a vital role in maintaining crop productivity
9. Khazan flora are involved in the biogeochemical cycling of nutrients
10. Khazans treat a large volume of organic waste thus aiding in water purification
11. The reflectance properties of khazan vegetation aids in climate regulation, important for human health
12. Khazans support wild pollinator species, such as birds and insects, thus contributing towards pollination
13. Khazans are in situ genetic reserves, conserving endemic biodiversity, as they are ecosystems having particular ecological conditions
14. Through the process of evolution spanning millennia, khazans have developed biotic interactions with the biotic and abiotic components of the ecosystem thus acting as biological control against pests and diseases
15. A variety of goods and renewable resources are available from khazans that may be exploited for human use and consumption
16. Salt-tolerant varieties of rice are cultivated in khazans, thus providing food security to the coastal poor
17. Bacteria isolated from khazan environments produce several compounds of pharmaceutical value
18. The existence value of the green fields and water bodies of khazans is significant as the 'feel good' atmosphere created has a positive effect on mental health
19. Khazans are live museums exhibiting a wide variety of tropical and endemic biodiversity, and rare salt-tolerant varieties of rice, which add value to global biodiversity
20. Khazans have religious and spiritual value and their operation follows rituals
21. Khazans have historical value as their origin dates back to the phase in history when the transition occurred from food gathering to cultivation
22. Khazans are still operational in their original form of architecture that originated with primitive communities, and therefore they are of extremely high heritage value that commonly existing ecosystems cannot match.
23. Khazans potentially contribute to the safety of human life and structures by possessing the ability to mitigate extreme events
24. The resources and choices provided by khazans provide insurance to human communities against the effects of natural calamities

B. Ecological services provided by mangroves:

Several ecological services are derived from mangroves, adding to the vast array of benefits derived from these ecosystems (Dhargalkar et al, 2014):

1. Mangroves are highly important in shoreline stabilization, wherein the above-ground root structures behave as a sieve, reducing

current velocities and shear, and enhancing the process of sedimentation and retention of sediments. Thus they stabilize soils and reduce erosion, especially under high energy conditions

2. Mangroves provide coastal protection by forming natural barriers against normal sea conditions and storms. Acting as a buffer between the ocean and the shore that protects infrastructure development and safeguards life, mangroves are able to dissipate approximately 70-90% of the energy of wind-generated waves.
3. Mangroves are the habitat and provide a source of food for varied communities of fauna, both that inhabit the interior of the mangrove forest and those in the adjacent coastal waters. Some animals depend on the mangrove ecosystem through all their life stages, whereas others utilize the ecosystem only at certain stages, generally the reproductive and juvenile stages.
4. Mangroves provide a natural system of filtration, absorbing pollutants as well as nutrients and suspended material, thereby exerting control over pollution and improving coastal water quality.
5. Mangroves have traditionally been utilized by coastal communities in a sustainable manner for the production of food, medicines, fuel wood, fodder, and construction materials. Sustainable livelihood fisheries increases the income obtained by coastal communities, especially in those areas adjacent to mangroves as a positive correlation between the presence of mangroves and the catch obtained.
6. Mangrove swamps are extremely efficient as sinks of carbon where sequestered atmospheric carbon is stored in their above-ground and below-ground biomass
7. Many mangrove areas are potentially suitable for ecotourism

5.4 Initial meeting to advance the consultative process for the declaration of Biodiversity Heritage Sites

An initial meeting was held with the members of the BMC, the Sarpanch, and elected panchayat members at Chodan-Madel village panchayat on 6th July 2017. The significance of Biodiversity Heritage Sites (BHS) was elaborated upon, and was discussed particularly in the context of Chodan-Madel. Further to this, a discussion was held among those present as to the sites on the island that present potential for designation as BHS.

Ward 5 has the potential sites: the *tollem*, or pond, and Christ the King hillock

- The *tollem* is inhabited by the Indian black turtle (*Melanochelys trijuga*), whose IUCN status is Near Threatened.
- The Christ the King hillock is the habitat of various species of fauna, including the endangered Indian pangolin (*Manis crassicaudata*), Indian porcupine (*Hystrix indica*), and wild boar (*Sus scrofa cristatus*). Additionally, it is the rainwater catchment area and a source of water to the springs of the island and is of importance as the island is surrounded by brackish/saline estuarine water. It is also the site of a vast cashew plantation.

Ward 6 has the potential site of *Bara Shimecho Rakhandar*

- The site of *Bara Shimecho Rakhandar* has cultural significance linked to biodiversity. The area is believed to be under the protection of a spiritual being and is therefore intact and kept untouched by human activity. It is a forested area on the banks of the river.

Ward 7 has the potential site: Pisay

- Pisay is a spiritual location that is not infringed upon by human presence, and contains original forest species. Marsh crocodiles or muggers (*Crocodylus palustris*), of vulnerable status, are found at the sluice gate in the vicinity of Pisay.

Figure 59. Initial meeting held in Chodan-Madel to advance the consultative process for the declaration of Biodiversity Heritage Sites

Figure 60. Workshop meeting for dissemination of project outcomes and discussion of way forward

5.5 Workshop meeting for dissemination of project outcomes

A meeting was held on 24th July 2017 at 3:30 p.m. at the premises of Goa State Biodiversity Board, Saligao, to present the outcomes of the project on "Facilitation of preparation of People's Biodiversity Register (PBR) documentation for Chodan-Madel Village". The meeting was attended by officials from GIZ, Goa Forest Department, Goa State Biodiversity Board, members of the Biodiversity Management Committee (BMC) and Sarpanch of Chodan-Madel village, and officials of TERI. Also present were students from the village Biodiversity Conservation Corps who volunteered to collect data for the development of the People's Biodiversity Register of the village.

The meeting commenced with a presentation made on the capacity-building of the Chodan-Madel BMC members and other members of the village, especially the student volunteers, and further outcomes of the project. The developments of the feasibility study conducted of the potential of areas of the village to be considered for designation as biodiversity heritage sites were highlighted.

A discussion on the project outcomes and feasibility study followed the presentation. The pros and cons of biodiversity heritage sites were reviewed for the benefit of all those present. Queries were raised for clarification and the way forward was examined.

Chapter 6

Way Forward in Developing the Village People's Biodiversity Register

The activities described in the earlier chapters of this report have encouraged and spurred the development of the village PBR. The student volunteers of the BCC groups are collecting data for biodiversity documentation with enthusiasm and with a heightened awareness of the natural world around them and the unique characteristics of Chodan-Madel.

The Whatsapp group created for ease of coordination between the members of the BCC groups and the appointed student coordinator and TERI officials has provided a platform through which all members can be apprised of the status of the data collections and any requirements that may arise.

The NBA provides 32 formats, grouped into 4 main categories, into which the collected data on the biodiversity of any given village panchayat or urban municipality will be recorded. The data thus collected for Chodan-Madel is being recorded in parallel into the formats prescribed by the NBA. The list of formats is detailed in Table 7 below. Format 1 (Agrobiodiversity – Crop plants) is provided in Table 8 as an example of the manner in which the data collected will be recorded into the village PBR.

Table 7
List of formats prescribed by the National Biodiversity Authority for recording biodiversity-related data towards development of the People's Biodiversity Register

Category	Format	Brief Description
Agro-biodiversity	Format 1	Crop Plants
	Format 2	Fruit plants
	Format 3	Fodder crops/ species
	Format 4	Weeds
	Format 5	Pests of crops
	Format 6	Markets for domesticated animals
	Format 7	Peoplescape
	Format 8	Landscape
	Format 9	Waterscape
	Format 10	Soil type
Domesticated Biodiversity	Format 11	Fruit trees
	Format 12	Medicinal plants (herbs, shrubs, trees, etc.)
	Format 13	Ornamental plants/ trees/ climbers etc.
	Format 14	Timber plants/ trees
	Format 15	Domesticated animals
	Format 16	Culture fisheries
	Format 17	Markets/ fairs for domesticated animals, medicinal plants, and other products
Wild Biodiversity	Format 18	Trees, shrubs, herbs, tubers, grasses, climbers, etc.
	Format 19	Wild plant species of importance
	Format 20	Aquatic biodiversity
	Format 21	Wild aquatic plant species of importance
	Format 22	Wild plants of medicinal importance
	Format 23	Wild relatives of crops
	Format 24	Ornamental plants
	Format 25	Fumigate/ chewing plants
	Format 26	Timber plants
	Format 27A	Coastal and marine flora
	Format 27B	Coastal and marine fauna
	Format 28	Wild animals (Mammals, birds, reptiles, amphibia, insects, others)
Urban Biodiversity	Format 29	Flora
	Format 30	Fauna
	Format 31	Any other information of local importance

The data will further be recorded into NBA-prescribed formats 2 – 31 by the BCC groups. The development of the PBR is a continuous process and the collected photographic data and data on traditional knowledge of biodiversity will form the basis of the Chodan-Madel People's Biodiversity Register.

Table 8

Table 8: Format 1 prescribed by the National Biodiversity Authority for recording of data on local biodiversity (in progress)

Sr. No.	1	2	3	4	5	6	7		8	9	10	11	12	13	14
	Crop	Scientific name	Local name	Variety	Landscape/ habitat	Approx. area shown	Local status		Special features	Cropping season	Uses	Associated TK	Other details	Source of seeds/ plants	Community Knowledge Holder
							Past	Present							
1	Rice	Oryza sativa	Baath/ Tandul	Jyothi (brown & white)	Khazan & Morrod	sq. mt.	N.A.	Present	N.A.	June - Oct. & Oct. - March (Vaigan)	Consumption	N.A.	N.A.	Saved Seeds	N.A.
2	Amaranth	*Amaranthus viridis*	*Dhovi bhaji*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
3	Amaranth	*Amaranthus caudatus*	N.A.	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October March	N.A.	N.A.	N.A.	N.A.	N.A.
4	Amaranth	*Amaranthus sp.*	*Tambbdi bhaji*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October March	N.A.	N.A.	N.A.	N.A.	N.A.
5	Beans	*Vigna unguiculata*	*Alsande*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
6	Beans	Unidentified sp.	*Merule*	N.A.	Khazan	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
7	Black Pepper	*Piper nigrum*	N.A	N.A.	Kitchen Garden	N.A.	N.A.	Present	N.A.	April - May	Consumption	N.A.	N.A.	N.A.	N.A.
8	Black-eyed bean/ black- eyed pea/ goat pea	*Vigna unguiculata var. unguiculata*	*Chowli*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October - March	Consumption	N.A.	N.A.	N.A.	N.A.
9	Bottle gourd	*Lagenaria siceraria*	*Konkan dudhi*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
10	Brinjal	*Solanum melongena*	*Vainguim*	long	Khazan	N.A.	Past	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
11	Chillies	*Capsicum frutescens*	*Firngi* Mirsang	N.A.	Khazan	N.A.	N.A.	Present	N.A.	2-3 months after sowing	Consumption	N.A.	N.A.	N.A.	N.A.
12	Chillies	*Capsicum annum*	Mirsaang	Jalgi	Khazan	N.A.	N.A.	Present	N.A.	September -October	Consumption	N.A.	N.A.	N.A.	N.A.
13	Chillies	*Capsicum annum*	Mirsang	Vaatkuli	Khazan	N.A.	N.A.	Present	N.A.	September October	Consumption	N.A.	N.A.	N.A.	N.A.
14	Cluster bean/ Guar	*Cyamopsis tetragonoloba*	*Tidki Midki*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	2-3 months after sowing	Consumption	N.A.	N.A.	N.A.	N.A.
15	Corn	*Zea mays*	*Moke*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.

Sr. No.	1	2	3	4	5	6	7		8	9	10	11	12	13	14
	Crop	Scientific name	Local name	Variety	Landscape/ habitat	Approx. area shown	Local status		Special features	Cropping season	Uses	Associated TK	Other details	Source of seeds/ plants	Community Knowledge Holder
							Past	Present							
16	Daikon radish	*Raphanus sativus*	*Moolo*		Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
17	Ivy gourd	*Coccinea grandis*	*Tendlim*	N.A.	Kitchen Garden	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
18	Kohlrabi/ Turnip	*Brassica caulorapa*	*Knaab*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
19	Mung Bean	*Vigna radiata*	*Moong*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
20	Okra	*Abelmoschus esculentus*	*Bhende*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
21	Onion	*Allium Cepa*	*Kaande*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	October March	Consumption	N.A.	N.A.	N.A.	N.A.
22	Pumpkin	*Cucurbita pepo var. styriaca*	*Doodhi*	Kitchen Garden	Khazan	N.A.	N.A.	Present	N.A.	October - March	Consumption	N.A.	N.A.	N.A.	N.A.
23	Rice	*Oryza sativa*	*Baath/ Tandul*	Korgut	Khazan	N.A.	N.A.	Present	Salt tolerant	June -March	Consumption	N.A.	N.A.	Saved Seeds	N.A.
24	Rice	*Oryza sativa*	*Baath/ Tandul*	Kothari	Khazan	N.A.	10-20 years ago	N.A.	salt tolerant	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
25	Rice	*Oryza sativa*	*Baath/ Tandul*	Patni	Khazan	N.A.	10-20 years ago	N.A.	salt tolerant	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
26	Ridge gourd	*Luffa acutangula*	*Shir Gosali*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	2-3 months after sowing	Consumption	N.A.	N.A.	N.A.	N.A.
27	Sugarcane	*Saccharum officinarum*	*Ush*	N.A.	Vegetable Garden	N.A.	N.A.	Present	N.A.	October -March	Consumption	N.A.	N.A.	N.A.	N.A.
28	Taro	*Colocasia esculenta*	*Maaddi*	N.A.	Kitchen Garden	N.A.	N.A.	Present	N.A.	June -October	Consumption	N.A.	N.A.	N.A.	N.A.
29	Turmeric	*Curcuma longa*	*Halad*	N.A.	Kitchen Garden	N.A.	N.A.	Present	N.A.	June -October	Consumption	N.A.	N.A.	N.A.	N.A.
30	Yard-long Bean	*Vigna unguiculata var. Sesquipedalis*	*Vaal*	N.A.	Khazan	N.A.	N.A.	Present	N.A.	June - October	Consumption	N.A.	N.A.	N.A.	N.A.

Figure 61: Categorisation of biodiversity photographs for Format 1 prescribed by the National Biodiversity Authority (in progress)

Okra/Bhende (*Abelmoschus esculentus*)

Onion/Kaande (*Allium Cepa*)

Amaranth / Dhovi Bhaji (*Amaranthus viridis*)

Amaranth (*Amaranthus caudatus*)

Amaranth / Tambdi Bhaji(*Amaranthus sp.*)

Taro / Maaddi (*Colocasia esculenta*)

Chillies / Jaalgi Mirsaang (*Capsicum annum*)

Vaatkuli Mirsaang (*Capsicum annum*)

Chillies / Firngi Mirsang (*Capsicum frutescens*)

Ridge gourd / Shir Gosali (*Luffa acutangula*)

Black pepper / Kaallim mirim (*Piper nigrum*)

Brinjal / Vainguim (*Solanum melongena*)

Annexures

Annexure 1: Overview of diversity of flora of Chodan-Madel

Sr. No.	Species	Variety/ Local name	Agro- biodiversity	Mangrove sp.	Mangrove associate	Floristic diversity	Economically important	Cereals/ Pulses	Fibre/fodder species	Vegetable/ Tuber crop	Minor vegetable	Spices	Fruit varieties		Minor fruitPlantation	Crop	Medicinal	Ornamental	Canes
													Present	Lost					
1	*Abelmoschus esculentus*	*Bhende, ladyfinger/ okra*	✓														✓		
2	*Acalypha hispida*	Cat's tail				✓												✓	
3	*Acampe praemorsa*	Brittle orchid				✓													
4	*Acanthus illicifolius*	*Morando*, sea holly		✓		✓													
5	*Achyranthes aspera*	Prickly chaff flower				✓													
6	*Acrostichum aureum*	*Ankur*, Golden leather fern		✓							✓								
7	*Aegiceras corniculatum*	River mangrove		✓															
8	*Allamanda blanchetti*	Purple allamanda				✓												✓	
9	*Allamanda cathartica*	Yellow allamanda, golden trumpet, buttercup				✓												✓	
10	*Allium cepa*	*Kaando*, onion	✓							✓							✓		
11	*Alocasia macrorrhizos*	*Maadi*, giant taro								✓									
12	*Aloe vera*	Indian aloe																	
13	*Alstonia scholaris*	Scholar tree				✓													
14	*Amaranthus viridis*	*Tambdi bhaji*, red amaranthus	✓			✓													
15	*Amorphophallus campanulatus*	*Suran*															✓		
16	*Amorphophallus paeonifolius*	*Suran*, elephant foot yam								✓									
17	*Ampelocissus latifolia*	Wild grape				✓													
18	*Anacardium occidentale*	*Cazu*, cashew				✓	✓						Old local, grafts- Vengurla, Balli	–		✓	✓		
19	*Ananas comosus*	Pineapple				✓							N.A.	–		✓	✓		
20	*Andrographis paniculata*	*Kirayte*, creat															✓		
21	*Annona muricata*	Soursop				✓							N.A.	–					
22	*Annona reticulata*	Custard apple				✓							N.A.	–					
23	*Annona squamosa*	*Sitaphal*, sugar apple																	
24	*Areca catechu*	*Supari*, areca nut				✓	✓									✓			

Sr. No.	Species	Variety/ Local name	Agro- biodiversity	Mangrove sp.	Mangrove associate	Floristic diversity	Economically important	Cereals/ Pulses	Fibre/fodder species	Vegetable/ Tuber crop	Minor vegetable	Spices	Fruit varieties		Minor fruitPlantation	Crop	Medicinal	Ornamental	Canes
													Present	Lost					
25	*Artocarpus altilis*	Breadfruit				✓							N.A.	–			✓		
26	*Artocarpus heterophyllus*	Jackfruit				✓							N.A.	–			✓		
27	*Averrhoa bilimbi*	*Bimal*, bilimbi				✓							N.A.	–					
28	*Avicennia alba*	*Hipli*		✓															
29	*Avicennia officinalis*	*Tivar*		✓		✓			✓										
30	*Avicennia marina*	N.A.																	
31	*Azadirachta indica*	Neem															✓		
32	*Bambusa bambos*	*Kondo*, Indian Thorny Bamboo																	✓
33	*Barleria cristata*	Philippine violet				✓												✓	
34	*Boerhavia diffusa*	*Punarnava*, red spiderling				✓													
35	*Bougainvillea glabra*	Bougainvillea				✓												✓	
36	*Brassica caulorapa*	*Knaab*	✓																
37	*Bridelia retusa*	*Phatar phod*, spinous kino tree				✓											✓		
38	*Bruguiera cylindrica*	*Upati*, white Burma mangrove		✓															
39	*Butea monosperma*	*Palas*, flame of the forest				✓											✓		
40	*Caesalpinia crista*	Crested fever nut			✓	✓													
41	*Caesalpinia pulcherrima*	Peacock flower																✓	
42	*Calycopteris floribunda*	N.A.				✓													
43	*Calotropis gigantea*	Crown flower				✓													
44	*Capsicum annum*	*Mirsang*, chilli pepper	✓			✓						✓					✓		
45	*Capsicum fuitescens*	*Vatkuli, Jalgi mirsang*, cayenne pepper	✓									✓							
46	*Careya arborea*	Wild guava				✓													
47	*Carica papaya*	Papaya				✓							N.A.	–		✓	✓		
48	*Carissa carandas*	*Candam*				✓							N.A.	–	✓			✓	
49	*Carissa congesta*	N.A.				✓													
50	*Caryota urens*	Fishtail palm				✓													
51	*Cassia fistula*	*Bhavo*, amaltas				✓											✓		

Sr. No.	Species	Variety/ Local name	Agro- biodiversity	Mangrove sp.	Mangrove associate	Floristic diversity	Economically important	Cereals/ Pulses	Fibre/fodder species	Vegetable/ Tuber crop	Minor vegetable	Spices	Fruit varieties		Minor fruitPlantation	Crop	Medicinal	Ornamental	Canes
													Present	Lost					
52	*Cassia tora*	*Taikilo*, Foetid cassia				✓					✓						✓		
53	*Catharanthus roseus*	Periwinkle				✓												✓	
54	*Cayratia trifolia*	Bush grape				✓													
55	*Ceiba pentandra*	Kapok tree				✓													
56	*Celosia argentea*	*Kudduki bhaji*, silver ockscomb									✓						✓		
57	*Chromolaena odorata*	Siam weed				✓													
58	*Chrysanthemum spp.*	*Shewti*, chrysanthemum																	
59	*Cinnamomum tamala*	Indian bay leaf																	
60	*Cinnamomum zeylanicum*	*Tikki*, cinnamon				✓						✓							
61	*Citrus maxima*	Pomelo											N.A.	–					
62	*Coccinia grandis*	*Tendlim*, ivy gourd								✓									
63	*Colocasia esculenta*	*Alu*, *tere*, taro								✓									
64	*Cocos nucifera*	*Naal*, coconut				✓	✓		✓				Banauli	–					
65	*Cosmos sulphureus*	Cosmos orange				✓												✓	
66	*Crossandra infundibuliformis*	*Abolim*, crossandra				✓											✓	✓	
67	*Curcuma longa*	*Haldi*, turmeric								✓		✓					✓		
68	*Cyamopsis tetragonoloba*	*Tidki midki*, cluster beans	✓																
69	*Cymbopogon citratus*	*Ganjan*, lemon grass				✓											✓		
70	*Cynodon dactylon*	*Durvo*, Bermuda grass				✓											✓		
71	*Cyperus spp.*	Sedge			✓														
72	*Datura innoxia*	*Dhaturo*, datura															✓		
73	*Delonix regia*	*Gulmohar*, flame tree				✓													
74	*Dendrophthoe falcata*	Honeysuckle mistletoe				✓													
75	*Derris heterophylla*	N.A.			✓				✓										
76	*Derris trifoliata*	N.A.				✓													
77	*Dioscorea esculenta*	*Kaatekongi*, lesser yam								✓							✓		
78	*Drynaria quercifolia*	Oakleaf fern				✓													

Sr. No.	Species	Variety/ Local name	Agro- biodiversity	Mangrove sp.	Mangrove associate	Floristic diversity	Economically important	Cereals/ Pulses	Fibre/fodder species	Vegetable/ Tuber crop	Minor vegetable	Spices	Fruit varieties		Minor fruitPlantation	Crop	Medicinal	Ornamental	Canes
													Present	Lost					
79	*Eleusine indica*	Indian crowfoot grass				✓													
80	*Eucalyptus spp.*	*Nilgiri*, eucalyptus															✓		
81	*Excoecaria agallocha*	*Uro*		✓		✓													
82	*Ficus benghalensis*	*Vad*, banyan tree				✓											✓		
83	*Ficus exasperata*	Sandpaper tree				✓													
84	*Ficus glomerata*	*Rumad*, cluster fig tree															✓		
85	*Ficus racemosa*	Cluster fig tree				✓													
86	*Ficus religiosa*	*Pipal*, sacred fig															✓		
87	*Garcina indica*	*Birand*, kokum				✓													
88	*Gingiber officinale*	*Alem*, ginger								✓									
89	*Glinus lotoides*	Lotus sweetjuice				✓													
90	*Gliricidia sepium*	Mexican lilac				✓										✓			
91	*Gomphrena globosa*	*Butao*, globe amaranth, bachelor's buttons				✓												✓	
92	*Gossypium herbaceum*	*Kapus*, Levant cotton															✓		
93	*Grewia asiatica*	Phalsa				✓													
94	*Grewia nervosa*	*Asalo*				✓							N.A.	–	✓				
95	*Grewia tilifolia*	N.A.				✓													
96	*Helianthes annus*	Common sunflower				✓													
97	*Helicanthes elastica*	N.A.				✓													
98	*Hibiscus rosa-sinensis*	*Doshin*, shoeflower				✓												✓	
99	*Holoptelea integrifolia*	*Vamlo*, Indian elm				✓											✓		
100	*Impatiens balsamina*	Garden balsam				✓												✓	
101	*Ipomoea batatas*	*Kongi*, sweet potato								✓									
102	*Ixora coccinea*	*Pitkoli*, jungle geranium											N.A.	–	✓				
103	*Jasminum spp.*	*Mogrim*, jasmine															✓		
104	*Jasminum malabaricum*	Wild jasmine				✓													
105	*Jasminum multiflorum*	Star jasmine				✓												✓	
106	*Jatropha curcas*	*Erand*, jatropha														✓	✓		

Sr. No.	Species	Variety/ Local name	Agro- biodiversity	Mangrove sp.	Mangrove associate	Floristic diversity	Economically important	Cereals/ Pulses	Fibre/fodder species	Vegetable/ Tuber crop	Minor vegetable	Spices	Fruit varieties		Minor fruitPlantation	Crop	Medicinal	Ornamental	Canes
													Present	Lost					
107	*Kandelia candel*	*Kangala*		✓		✓													
108	*Lagenaria ciceraria*	*Konkan dudhi*, bottle gourd															✓		
109	*Lannea coromandelica*	*Moi*, Indian ash tree				✓											✓		
110	*Lantana camara*	Lantana				✓													
111	*Lawsonia alba*	Henna				✓													
112	*Lawsonia inermis*	*Methi*, fenugreek																	
113	*Leucas aspera*	Common leucas				✓													
114	*Luffa acutangula*	*Shir ghosali*, ridge gourd	✓			✓				✓									
115	*Mangifera indica*	*Ambo*, mango				✓	✓						Mancorada, Rebelo, Xavier, Santan, Maldes, Pairi, Corel, God ambo, Fernand, Shivro, Mussurat, Totapuri	Bhism		✓	✓		
116	*Microcos nervosa*	*Asalo*																	
117	*Mimosa pudica*	*Lajje vokol*, touch-me-not																	
118	*Mimusops elengi*	Spanish cherry				✓													
119	*Mirabilis jalapa*	Four o'clock plant				✓												✓	
120	*Moringa oleifera*	*Moshing*, drumstick								✓							✓		
121	*Murraya koenigi*	*Karipatta*, curry tree										✓					✓		
122	*Musa paradisiaca*	*Kele*, banana											Saldati, Raspali, Maindoli, Elchi, Savarboni	–		✓	✓		
123	*Mussaenda philippica*	Mussaenda				✓												✓	
124	*Ochna obtusata*	N.A.				✓													
125	*Ocimum tenuiflorum*	*Tulsi*, basil				✓											✓		
126	*Oryza sativa*	*Tandul*, rice (Korgut, Jyoti, Jaya varieties)	✓			✓		✓									✓		
127	*Pachystachys spicata*	Cardinal's guard				✓												✓	
128	*Pedilanthus tithymaloides*	Devil's Backbone				✓												✓	

Sr. No.	Species	Variety/ Local name	Agro- biodiversity	Mangrove sp.	Mangrove associate	Floristic diversity	Economically important	Cereals/ Pulses	Fibre/fodder species	Vegetable/ Tuber crop	Minor vegetable	Spices	Fruit varieties		Minor fruitPlantation	Crop	Medicinal	Ornamental	Canes
													Present	Lost					
129	*Petalidium barleroides*	N.A.				✓												✓	
130	*Phyllanthus emblica*	*Avalo*, amla, Indian gooseberry				✓											✓		
131	*Piper nigrum*	*Miria*, black pepper				✓						✓				✓	✓		
132	*Plectranthus amboinicus*	*Ortelao*, Indian borage, Indian mint															✓		
133	*Plumeria alba*	*Chamfo*, white frangipani				✓												✓	
134	*Plumeria rubra*	*Chamfo*, red frangipani				✓												✓	
135	*Pogostemon purpurascens/ benghalensis*	Bengal pogostemon				✓													
136	*Porteresia coarctata*	N.A.			✓														
137	*Portulaca oleracea*	Common purslane				✓													
138	*Portulaca pilosa*	Kiss-me-quick				✓												✓	
139	*Psidium guajava*	Guava				✓							N.A.	–					
140	*Raphanus sativus*	*Mulo*, radish	✓																
141	*Rauvolfia serpentina*	*Atki*, Indian snakeroot				✓											✓		
142	*Rhizophora apiculata*	N.A.		✓															
143	*Rhizophora mucronata*	N.A.		✓		✓													
144	*Rosa spp.*	Rose				✓												✓	
145	*Sapindus spp.*	*Rito*, soapnut															✓		
146	*Solanum melongena*	*Vaingi*, brinjal, eggplant, aubergine	✓			✓													
147	*Sonneratia alba*	*Chipa*		✓		✓													
148	*Sonneratia caseolaris*	*Chipa*		✓		✓													
149	*Smilax zeylanica*	N.A.				✓													
150	*Spathiphyllum wallisii*	Peace lily				✓												✓	
151	*Sphaeranthus indicus*	East Indian globe thistle				✓													
152	*Sterculia urens*	Indian tragacanth, gum karaya				✓													
153	*Strychnos nux-vormica*	Karo															✓		
154	*Syzygium caryophyllatum*	South Indian plum				✓													

Sr. No.	Species	Variety/ Local name	Agro- biodiversity	Mangrove sp.	Mangrove associate	Floristic diversity	Economically important	Cereals/ Pulses	Fibre/fodder species	Vegetable/ Tuber crop	Minor vegetable	Spices	Fruit varieties		Minor fruitPlantation	Crop	Medicinal	Ornamental	Canes
													Present	Lost					
155	*Syzygium cumini*	*Jambool*, Java plum				✓							N.A.	–					
156	*Tabernaemontana corymbosa*	N.A.				✓												✓	
157	*Tabernaemontana divaricata*	Crepe jasmine				✓												✓	
158	*Tamarindus indica*	Tamarind				✓													
159	*Tectona grandis*	*Sailo*, teak				✓											✓		
160	*Terminalia arjuna*	*Arjun*															✓		
161	*Terminalia bellirica*	*Goting*				✓											✓		
162	*Thevetia cascabela*	Yellow oleander				✓												✓	
163	*Tithonia rotundifolia*	Mexican sunflower				✓												✓	
164	*Triphasia trifolia*	N.A.				✓							N.A.	–	✓				
165	*Vigna radiata*	Moong, mung bean	✓					✓											
166	*Vigna unguiculata*	*Chowli*, *alsande*, cowpea	✓			✓		✓									✓		
167	*Vigna unguiculata subsp. sesquipedalis*	*Vaal*, yardlong bean, long-podded cowpea	✓					✓											
168	*Vigna unguiculata var. unguiculata*	*Chowli*, black-eyed peas	✓					✓											
169	*Xylocarpus moluccensis*	N.A.		✓															
170	*Zea mays*	*Moke*, maize	✓					✓		✓									
171	*Zizyphus mauritania*	*Bor*, Indian jujube				✓							N.A.	–	✓		✓		
172	*Zizyphus oenopolia*	*Kaneram*				✓							N.A.	–	✓				
173	*Zizyphus rugosa*	*Chunnam*				✓							N.A.	–	✓				
174	*Unidentified*	*Kusdam*											N.A.	–	✓				
175	*Unidentified*	*Merule*	✓																
176	*Unidentified*	*Sating*															✓		

Annexure 2: Overview of diversity of fauna of Chodan-Madel

Sr. No.	Species	Local name	Type	Benthic	Pelagic	Edible	Not edible	Resident	Migratory	Associated with mangroves
1	*Acetes sp.*	Galmo	Prawns		✓	✓				✓
2	*Acridotheres fuscus*	Jungle myna	Bird					✓		
3	*Acrocephalus agricola*	Paddyfield warbler	Bird						✓	✓
4	*Acrocephalus dumetorum*	Blyth's reed –warbler	Bird						✓	
5	*Acrocephalus stentoreus*	Indian great reed-warbler	Bird						✓	
6	*Actitis hypoleucos*	Common sandpiper	Bird						✓	
7	*Aegithina tiphia*	Common lora	Bird					✓		
8	*Alauda gulgula*	Oriental skylark	Bird					✓		
9	*Alcedo atthis*	Common kingfisher	Bird					✓		✓
10	*Ambassis urotaenia*	Bhurato	Minor fish species		✓	✓				✓
11	*Amaurornis phoenicurus*	White-breasted water hen	Bird					✓		✓
12	*Anas acuta*	Northern pintail	Bird						✓	✓
13	*Anas crecca*	Common teal	Bird						✓	
14	*Anas poecilorhyncha*	Spot-billed duck	Bird					✓		
15	*Anastomus oscitans*	Asian openbill stork	Bird					✓		
16	*Anguille spp.*	Baam (small prawns, to dry)	Prawns			✓				✓
17	*Anhinga melanogaster*	Darter	Bird					✓		✓
18	*Anodontostoma chacunda*	Gibra	Minor fish species		✓	✓				✓
19	*Anthus rufulus*	Paddyfield pipit	Bird					✓		
20	*Ardea alba*	Great egret	Bird					✓		✓
21	*Ardea cinerea*	Grey heron	Bird					✓		✓
22	*Ardea intermedia*	Median egret						✓		✓
23	*Ardea purpurea*	Purple heron	Bird					✓		✓
24	*Ardeola greyii*	Indian pond heron	Bird					✓		✓
25	*Bubulcus ibis*	Cattle egret	Bird					✓		
26	*Butorides striata*	Little green heron	Bird					✓		✓
27	*Calidris alba*	Sanderling	Bird						✓	✓
28	*Calidris minuta*	Little stint	Bird						✓	✓
29	*Calidris temminckii*	Temminck's stint	Bird						✓	
30	*Centropus sinensis*	Greater coucal	Bird					✓		
31	*Ceryle rudis*	Pied kingfisher	Bird					✓		✓
32	*Chanos Chanos*	Gholshyo, Milk Fish	Minor fish species		✓	✓				✓

Sr. No.	Species	Local name	Type	Benthic	Pelagic	Edible	Not edible	Resident	Migratory	Associated with mangroves
33	*Charadrius alexandrinus*	Kentish plover	Bird						✓	✓
34	*Charadrius dubius*	Little ringed plover	Bird						✓	
35	*Chlidonias hybrida*	Whiskered tern	Bird						✓	
36	*Chroicocephalus brunnicephalus*	Brown-headed gull	Bird						✓	✓
37	*Chroicocephalus ridibundus*	Black-headed gull	Bird						✓	
38	*Ciconia episcopus*	Woolly-necked stork	Bird						✓	✓
39	*Cinnyris asiaticus*	Purple sunbird	Bird					✓		
40	*Circus aeruginosus*	Eurasian marsh harrier	Bird						✓	
41	*Clanga clanga*	Greater spotted eagle	Bird						✓	✓
42	*Columba livia*	Blue rock pigeon	Bird					✓		
43	*Copsychus saularis*	Oriental Magpie Robin	Bird					✓		
44	*Coracias benghalensis*	Indian roller	Bird					✓		
45	*Corvus splendens*	House crow	Bird						✓	
46	*Crassostrea cucullata*	kalvam, oysters	Shellfish	✓		✓				✓
47	*Crocodylus palustris*	Mangem, mugger/marsh crocodile	Reptile							✓
48	*Dendrocygna javanica*	Lesser whistling duck	Bird						✓	
49	*Dicaeum concolor*	Nilgiri flowerpecker	Bird					✓		
50	*Dicrurus macrocercus*	Black drongo	Bird					✓		
51	*Egretta garzetta*	Little egret	Bird					✓		✓
52	*Egretta gularis*	Western reef egret	Bird					✓		✓
53	*Elanus caeruleus*	Black-shouldered kite	Bird					✓		
54	*Etroplus suratensis*	Tipro/Kalundar	Major fish species		✓	✓				✓
55	*Eudynamys scolopacea*	Asian koel	Bird					✓		
56	*Fabricius spp.*		Benthic species	✓						✓
57	*Fenneropenaeus indicus*	Motti sungtam (white), Indian Prawn	Prawns		✓	✓				✓
58	*Gallinago gallinago*	Common snipe	Bird						✓	✓
59	*Gelochelidon nilotica*	Gull-billed tern	Bird						✓	✓
60	*Gerres filamentosus, G. limbatus, G. oyena*	Shetki (3 varieties)	Minor fish species		✓	✓				✓
61	*Glossogobius giuris, Gobius spp.,*	Kharchaani	Major fish species		✓	✓				✓
62	*Halcyon pileata*	Black-capped kingfisher	Bird					✓		✓
63	*Halcyon smyrnensis*	White-breasted kingfisher	Bird					✓		✓
64	*Haliaeetus leucogaster*	White-bellied sea eagle	Bird					✓		✓

Sr. No.	Species	Local name	Type	Benthic	Pelagic	Edible	Not edible	Resident	Migratory	Associated with mangroves
65	*Haliastur indicus*	Brahminy kite	Bird					✓		✓
66	*Hemiramphus xanthopterus*	Toki, Half beak	Minor fish species		✓	✓				✓
67	*Hieraaetus pennatus*	Booted eagle	Bird						✓	
68	*Hilsa toil, Tenualosa toli*	Pevo	Minor fish species		✓	✓				✓
69	*Himantopus himantopus*	Black-winged stilt	Bird						✓	✓
70	*Hirundo rustica*	Barn swallow	Bird						✓	
71	*Hirundo smithii*	Wire-tailed swallow	Bird					✓		
72	*Ichthyaetus ichthyaetus*	Pallas's gull	Bird						✓	✓
73	*Ictinatus malayensis*	Black eagle	Bird					✓		
74	*Katelysia opima*		Benthic species	✓		✓				✓
75	*Lates calcifer*	Chonkul/ Chonok/sea bass	Minor fish species		✓	✓				✓
76	*Lanius isabellinus*	Isabelline shrike	Bird						✓	
77	*Leptocoma zeylonica*	Purple-rumped sunbird	Bird					✓		
78	*Leptoptilos javanicus*	Lesser adjutant stork	Bird					✓		✓
79	*Lutjanus argentimaculatus, L. ehrenbergii, L. indicus, L. quinquelineatus, L. rivulatus, Lethrinus nebulosus*	Tamso (6 varieties)	Minor fish species		✓	✓				✓
80	*Lutrogale perspicillata*	Smooth Indian Otter, Uda	Mammal							
81	*Lymnocryptes minimus*	Jack snipe	Bird						✓	✓
82	*Macaca radiata*	Monkey, Makad	Mammal							
83	*Machlolophus aplonotus*	Indian Black-lored tit	Bird					✓		
84	*Manis crassicaudata*	Indian Pangolin, Kahawle mazar	Mammal							
85	*Martesia striata*		Crab	✓						✓
86	*Megalaima haemacephala*	Coppersmith barbet	Bird					✓		
87	*Melanochelys trijuga*	Indian black turtle, Hagaro kasav	Reptile							
88	*Meretrix casta*		Benthic species	✓		✓				✓
89	*Merops leschenaulti*	Chestnut-headed bee-eater	Bird					✓		
90	*Merops philippinus*	Blue-tailed bee-eater	Bird						✓	
91	*Mesophoyx intermedia*	Median egret	Bird						✓	
92	*Metapenaeus brevicornis*		Prawns		✓					✓
93	*Metapenaeus monoceros*		Benthic species	✓						✓
94	*Microcarbo niger*	Little cormorant	Bird					✓		✓
95	*Milvas migrans*	Black kite	Bird					✓		
96	*Modiolus sp*		Benthic species	✓						✓

Sr. No.	Species	Local name	Type	Benthic	Pelagic	Edible	Not edible	Resident	Migratory	Associated with mangroves
97	*Motacilla alba*	White wagtail	Bird						✓	
98	*Motacilla flava*	Yellow wagtail	Bird						✓	
99	*Mugil cephalus, Valamugil cunesius*	Shevto/ Shevtale/ Mullet	Major fish species		✓	✓				✓
100	*Mytilus viridis*		Benthic species	✓						✓
101	*Numenius arquata*	Eurasian curlew	Bird						✓	
102	*Numenius phaeopus*	Whimbrel	Bird						✓	✓
103	*Nycticorax nycticorax*	Black-crowned night heron	Bird					✓		✓
104	*Oriolus oriolus*	Eurasian golden oriole	Bird						✓	
105	*Orthotomus sutorius*	Common tailorbird	Bird					✓		
106	*Osteogeneiosus militaris, Arius caelatus, A. maculatus, A. arius, A. venosus, A. thalassinus, Plicofollis tenuispinis, A. platystomus*	Sangat (8 varieties)	Minor fish species		✓	✓				✓
107	*Pandion haliaetus*	Osprey	Bird						✓	✓
108	*Panulirus polyphagus*	Shivod (lobster)/ Mud Spiny Lobster	Prawns			✓				✓
109	*Paphia malabarica*		Crab	✓		✓				✓
110	*Parapenaeopsis stylifera (Kiddi shrimp), Paleomon spp., Macrobrachium rosenbergii (freshwater scampi)*	Poting (lobster small)	Prawns			✓				✓
111	*Parvo cristatus*	Indian peafowl	Bird					✓		
112	*Passer domesticus*	House sparrow	Bird					✓		
113	*Pelargopsis capensis*	Stork-billed kingfisher	Bird					✓		✓
114	*Penaeus indicus*		Prawns		✓					✓
115	*Penaeus merguiensis*		Prawns							✓
116	*Penaeus monodon*	Waagi (Giant Tiger Prawns, Asian Tiger shrimp)	Prawns		✓	✓				✓
117	*Periophthalmus sp.*	Mudskippers	Minor fish species							✓
118	*Pernis ptilorhyncus*	Oriental honey buzzard	Bird					✓		
119	*Phalacrocorax carbo*	Great cormorant	Bird						✓	✓
120	*Photopectoralis bindus*	Khampi, Pony Fish	Minor fish species		✓	✓				✓
121	*Plegadis falcinellus*	Glossy ibis	Bird						✓	✓
122	*Pluvialis fulva*	Pacific golden plover	Bird						✓	
123	*Pluvialis squatarola*	Grey plover	Bird						✓	✓
124	*Polymesoda erosa*	Motte kube-kalle, mud clam	Shellfish	✓		✓				
125	*Pomadasys maculatus, Terapon jarbua, Terapon puta, Pelates quadrilineatus*	Korkoro (4 varieties)	Minor fish species		✓	✓				✓

Sr. No.	Species	Local name	Type	Benthic	Pelagic	Edible	Not edible	Resident	Migratory	Associated with mangroves
126	*Portunus sanguinolentus*	Dhavi, green big crab, softer than mud crab	Crab	✓		✓				✓
127	*Prinia socialis*	Ashy prinia	Bird					✓		
128	*Protonibea diacanthus, Nibea maculate, Johnius belangerii, Dendrophysa russelli, Nibea albiflora, Johnieops borneensis, Otolithes argenteus, Johnius macrorhynus*	Dhadyaro (8 varieties)	Minor fish species		✓	✓				✓
129	*Psettodes erumei,Cynoglossus macrostomus, C. arel, C. puncticeps, Synaptura commersonnii, Brachirus orientalis, Paraplagusia bilineata, Pseudorhombus arsius*	Lepo (8 varieties)	Minor fish species		✓	✓				✓
130	*Psilopogon viridis*	White-cheeked barbet	Bird					✓		
131	*Psittacula krameri*	Rose-ringed parakeet	Bird					✓		
132	*Python molorus*	Indian Rock Python, Azgar	Reptile							
133	*Rusa unicolor*	Indian Sambar Deer, Meru, Shengado	Mammal							
134	*Sardinella gibbosa, S. longiceps*	Tarlo (2 varieties)	Minor fish species		✓	✓				✓
135	*Saxicola torquatus*	Common stonechat	Bird						✓	
136	*Scatophagus argus*	Mutri, Spotted Scat	Minor fish species		✓	✓				✓
137	*Scylla serrata*	ramka, black hard	Crab	✓		✓				✓
138	*Sesarma spp.*		Benthic species	✓						✓
139	*Sillago sihama*	Mudhoshi	Major fish species		✓	✓				✓
140	*Spatula querquedula*	Garganey	Bird						✓	✓
141	*Spilopelia chinensis*	Spotted dove	Bird					✓		
142	*Sterna aurantia*	River tern	Bird					✓		
143	*Stolephorus indicus*	Motyali, Indian anchovy	Minor fish species		✓	✓				✓
144	*Stoliphorus commersonii, Escualosa thorracata*	Velli (2 varieties)	Minor fish species		✓	✓				✓
145	*Sturnus pagodarum*	Brahminy starling	Bird					✓		✓
146	*Tadorna ferruginea*	Brahminy shelduck	Bird						✓	✓
147	*Telescopium telescopium*		Crab	✓						✓
148	*Thalamitta crenata*		Benthic species	✓						✓
149	*Threskiornis melanocephalus*	Oriental white ibis	Bird					✓		✓
150	*Treron pompadora*	Pompadour green pigeon	Bird					✓		
151	*Tringa erythropus*	Spotted redshank	Bird						✓	

Sr. No.	Species	Local name	Type	Benthic	Pelagic	Edible	Not edible	Resident	Migratory	Associated with mangroves
152	*Tringa glareola*	Wood sandpiper	Bird						✓	
153	*Tringa nebularia*	Common greenshank	Bird						✓	✓
154	*Tringa ochropus*	Green sandpiper	Bird						✓	
155	*Tringa stagnatilis*	Marsh sandpiper	Bird						✓	
156	*Tringa totanus*	Common redshank	Bird						✓	✓
157	*Trypauchen vagina*	Baale, Eel Goby	Minor fish species		✓	✓				✓
158	*Tyto alba*	Barn owl	Bird					✓		
159	*Vanellus indicus*	Red-wattled lapwing	Bird					✓		
160	*Villorita cyprinoides*	small black kube	Shellfish	✓		✓				
161	*Xenus cinereus*	Terek sandpiper	Bird						✓	
162	*Uca spp.*	Fiddler crab	Benthic species	✓						✓
163	*Unidentified*	Naini, female type	Crab	✓		✓				✓
164	*Unidentified*	Baano, reddish, male	Crab	✓		✓				✓
165	*Unidentified*	bhingulyo, fiddler crab	Crab	✓			✓			✓
166	*Unidentified*	motko, fiddler crab	Crab	✓			✓			✓
167	*Unidentified, Snake-like appearance*	eichan, small	Unidentified benthic fauna	✓						✓
168	*Unidentified, Snake-like appearance*	khodos, big	Unidentified benthic fauna	✓						✓
169	*Unidentified*	Kaddi (medium with hard shell)	Prawns			✓				✓
170	*Unidentified*	Maajad (medium size)	Prawns			✓				✓
171	*Unidentified*	Aakri	Minor fish species		✓	✓				✓
172	*Unidentified*	Pittol	Minor fish species		✓	✓				✓
173	*Unidentified*	Gibber	Minor fish species		✓	✓				✓
174	*Unidentified*	Oriental darter, panbode, budyo	Bird						✓	

CMPA Technical Report Series

11

Support to the development of a people's biodiversity register and its use for identifying biodiversity heritage sites in the Chodan-Madel village

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Conservation and Sustainable Management of Coastal and Marine Protected Areas