

BEFORE THE NATIONAL GREEN TRIBUNAL  
WESTERN ZONAL BENCH, PUNE  
ORIGINAL APPLICATION NO. 184 OF 2024

In the *suo-motu* matter application numbered Original Application No. 1121/2024 by the National Green Tribunal Principal Bench, New Delhi.

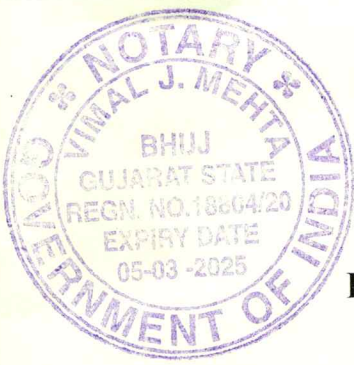
Versus

The Principal Chief Conservator of Forest, Gujarat and others.

...Respondents

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1.		Affidavit in Reply on behalf of Respondent No. 1.	



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**AFFIDAVIT-IN-REPLYON BEHALF OF RESPONDENT NO.1**

**PRINCIPAL CHIEF CONSERVATOR OF FOREST, GUJARAT**

I, BharatbhaiMotibhai Patel, Age: 44 years, serving as Deputy Conservator of Forests, Banni Grassland Division, having address at Arihantnagar Road, Bhuj, do hereby state on solemn oath and make this affidavit on behalf of Principal Chief Conservator of Forest, Gujarat, Respondent No.1 herein, having address at Aranya Bhawan, Block No. A/3, Near 'Ch' Circle, Opposite St. Xaviers High School, Sector 10/A, Gandhi Nagar, Gujarat as under:-

1. I have read and understood the Order dated 02.09.2024 issued by the National Green Tribunal Principal Bench, New Delhi, in reference to the News Item titled "How Banni grasslands of Kachchh Gujarat can be restored." Published on 20.08.2024 in The Hindu. I am competent to file this affidavit as I am well acquainted with the issues highlighted by the Hon'ble Tribunal regarding the degradation and restoration efforts for Banni grasslands.-
2. I state and submit that the Grasslands of Banni have been officially recognized as protected forest under Section:29 of the Indian

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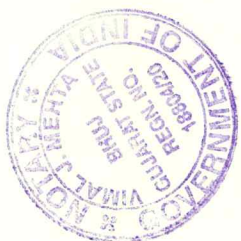
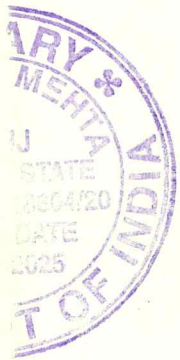
Forest Act of 1927, following the notification No: RR/155/55 issued by the Office of the Chief Commissioner of Kachchh on 11.05.1955. The same order of the Office of the Chief Commissioner of Kachchh has been annexed here under **ANNEXURE-A.**

3. I state and submit that the total area of Banni Protected Forest is 2,46,507.14 ha falling between 23° 22' 15" N and 23° 48' 07" N latitude and 69° 09' 14" E and 70° 10' 23" E longitude with a perimeter of 367 km. I further state that the Banni protected Forest as per the Notification dated 11.05.1955 is bounded as follows:

- The north by the Great Ran of Kutch and the Mahal of Khawada
- The south by boundaries of the Talukas of Bhachau, Anjar, Bhuj, Nakhatrana and Lakhpat.
- The east by the waste land bw taluka of Bhachau and Mahal of Khadir
- The west by the Rann and desolate portion of the west of Kori Creak

4. I state and submit that the Banni Grassland serves a critical function as an ecosystem, making substantial contributions to ecological services and enhancing biodiversity. In recognition of its significance for sustainable development and conservation in the Banni area, the Forest and Environment Department, Government of Gujarat took the commendable initiative to establish the Banni Grassland Division in 2011. This division is dedicated to fostering effective management and protection of this invaluable landscape. The department is structured efficiently, comprising total 66 staff members, which includes one Deputy Conservator of Forests, one Assistant Conservator of Forests, and five Range Forest Officers. The said resolution of the Forest and Environment Department has been annexed herein under **ANNEXURE-B.**

5. I state and submit that a comprehensive working plan has been prepared by the Gujarat Forest Department to ensure this unique



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ecosystem's scientific conservation and development. The Government of India by Ministry of Environment, Forest and Climate Change have approved this draft working plan for Banni Grassland Division on 13.09.2023 for the period from 2020-21 to 2029-30. This draft working plan was examined in accordance with the provisions of the Forest (Conservation) Act 1980, National Working Plan Code – 2014 and the guidelines issued by Ministry of Environment, Forest, and Climate Change from time to time. The said approval has been annexed herein under **ANNEXURE-C**. The Working Plan has been annexed herein under **ANNEXURE-D**.

6. I state and submit that the as per the GPS based survey of Banni carried out by the District Inspector Land Record, Kachchh, the area of Banni Protected Forest is approximately 2,46,507.14 ha vide DSO/Banni measurement/Green Tribunal Order/2019-20, dated 01/11/2019 [Annexure VII of the Working Plan]. This area also constitutes the area of Kachchh Desert Wildlife Sanctuary and Charidhundh Conservation Reserve through subsequent notification of Govt. of Gujarat [Annexure II and Annexure III of the Working Plan (**ANNEXURE-D**)]. Therefore, subtracting both of these areas of subsequent notifications, the actual working plan area encompasses about 1,71,753.23 ha. Further, as the human settlement area in Banni and other area falls under various developmental works has not been surveyed and demarcated, the actual area for working may also vary. Therefore, for the working plan, an approximate area of 1,71,753.23 ha is considered.

7. With respect to the affected area for grassland restoration, I state and submit that the north of the Banni Forest area lies the extensive saline desert of Kutch. This land adjacent to this area is characterized by its salinity, highlighting its distinctive ecological features. These regions are interconnected with the Gulf of the Arabian Sea, further underscoring their strategic significance. As

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per approved Working Plan, analysis of the Land use and Landcover status of the Banni protected forest is based on the LISS-4 Imageries. The recent Land Use and Land Cover (LULC) analysis of year 2019 (post monsoon data) found saline/barren land (45.78%) is the major Land Use and Land Cover (LULC) types, followed by grassland with scrub (30.89%) and Prosopis juliflora infested areas (16.37%) [page 13 of Working Plan of Banni Forrest (ANNEXURE-D)]. The Research paper itself describes 579.94 sq.km (22.19%) as a barren land and 148.45 sq.km.(5.68%) as a salt affected area which are not suitable for grassland restoration. The same has been annexed herein under **ANNEXURE-E**.

8. I state and submit that the sample size employed for the KrantiguruShyamji Krishna Verma (KSKV)Kachchh University research is disproportionately small considering the extensive geographical expanse of the Banni Grasslands, which covers an area of approximately 2465.07 sq km. That the study also fails to account for critical ecological aspects, specifically the seasonal transformation of low-lying areas into wetlands during the monsoon season. These seasonal wetlands serve as vital wintering grounds for a significant population of migratory birds, an aspect that has been overlooked in the said research. I further state that the aforementioned factors raise concerns regarding the comprehensiveness and accuracy of the conclusions drawn from the research study.

9. I state and submit that the study conducted by the KrantiguruShyamji Krishna Verma (KSKV)Kachchh University and the results published in the Article in The Hindu shows that the essential elements such as Nitrogen (N), Phosphorus (P), Potassium (K), Iron (Fe), Manganese (Mn), Copper (Cu), and Zinc (Zn) are found in low concentrations in the study areas. With an area of about more than 2000 km<sup>2</sup>, 80% of these locations are



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deficient in vital nutrients, making them unsuitable for grassland restoration.

10.I state and submit that the Soil of Banni lands consist of moderately fine texture with higher proportion of silt and clay. As per the Working Plan, in spite of the Banni lands being alluvial and sandy, the soils are inherently saline. Since this land area has been under seawater some thousands of years, its current groundwater is saline. Through capillary movement, this water surface evaporates and leaves sand deposits on the top soil. The soil pH (alkaline) makes a major part of the grassland unsuitable for the growth and productivity of palatable grass species.

11.I state and submit that since the soil of Banni is inherently saline and consists of recent alluvium mixed at places with Aeolian sandy deposits and the entire area has deep to very deep clayey and coarse-textured soils in discontinuous patches, the salinity of the soil is highly variable from 1.0 to 15 Mmhos/cm and the pH ranges from 6.5 to 8.5. The presence of high silt and clay content restricts the vertical and lateral movement of surface and subsurface water and creates waterlogging and flooding in low lying areas after the monsoon.

12.As published in the Article in The Hindu on Banni soil having high Electrical Conductivity [EC] indicating a sign of good soil fertility, I state and submit that the Article also reveals that the Cation Exchange Capacity [ECE] is low. This contradiction suggests that elevated EC does not necessarily indicate high fertility, instead it seems to reflect increased soil salinity.

13.I deny all the contents of research study pertaining to 'Precipitation' of the region. I state and submit that as per the research study, the yearly rainfall in the area is unpredictable and low (mean 288 mm), with a coefficient of variation ranging from 60 to 80%. The average annual rainfall is approximately 317 mm.



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which is totally contradicts with the findings of study. I further state and submit that the rainfall in Banni region is from the Southwest monsoon which is scant with an average of 5 rainy days and the spread is also irregular. The region receives (June-September) very low rainfall with an average annual rainfall of 317 mm with a coefficient of variation of 65%. Therefore, droughts are a recurring phenomenon in Banni. During the period between 1901 and 2019, a total of 63 droughts were recorded. In the last 10 year, the region received an average annual rainfall of 415 mm which is greater than the average rainfall of the Kachchh [page 8 and 9 of the Working Plan (ANNEXURE-D)].

14. I deny all the contents of research study pertaining to 'Infiltration Rate'. Soil water infiltration is the process by which irrigation or rainfall penetrates the soil either horizontally or vertically through pores, tying surface water, soil water, and groundwater together. I state and submit that due to proximity to the Sea as well as Great Rann of Kachchh, the groundwater in Banni is chiefly saline and is thus unsuitable for human and livestock consumption. I further state that as per the approved working plan, the soil permeability of Banni area ranges between 0.0 cm/hr and 0.5 cm/hr. About 40% and 30% of the Banni area falls under very slow and slow permeability (0.00 to 0.13 cm/hr) respectively, whereas only 30% of Banni is under the moderate permeability range. This situation subsequently leads to waterlogging during good rainfall years and low-lying areas act as a seasonal wetland, which attracts a good number of migratory birds. This area is heaven for migratory birds which cannot be converted as a grassland.

15. I deny all the contents of research study pertaining to the Land Use Land Cover Status of the region. I state and submit that as per approved working plan, analysis of the Landuse and Landcover status of the Banni protected forest is based on the LISS-4 Imageries. The recent Land Use and Land Cover (LULC) analysis



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of year 2019 (post monsoon data) found saline/barren land (45.78%) is the major Land Use and Land Cover (LULC) types, followed by grassland with scrub (30.89%) and Prosopis juliflora infested areas (16.37%) [page 13 of Working Plan of Banni Forrest]. The Research paper itself describes 579.94 sq.km (22.19%) as a barren land and 148.45 sq.km.(5.68%) as a salt affected area which are not suitable for grassland restoration. The same has been annexed herein under **ANNEXURE-E**.

16.I deny all the contents of research study pertaining to 'Cation Exchange Capacity'. The Cation Exchange Capacity is a critical parameter for assessing the fertility and nutrient holding capacity of soil. I say and submit that the CEC is an inherent soil characteristic and its difficult to alter significantly. The research study indicates that the CEC value is very low around 180000 ha, such a low value shows that soil has low fertility. Therefore, 75% of the land cannot support healthy crops due to inherent soil properties.

17.With regards to contents of high SAR Values in the research study, I state and submit that the High SAR value suggests high soil sodacity, which can adversely impact soil structure, reduced water infiltration and impaired plant development. Therefore, I submit that such elevated levels of sodacity and the resulting poor soil structure in certain areas of the Banni region are not conducive to supporting grassland restoration efforts.

18.I state and submit that the Working Plan covers 171753.23 hectares. As per the Working Plan, Banni division has three different working circles for protection, conservation and management of Banni forest area, which includes; Grassland Working Circle (GWC), Prosopis Working Circle (PWC) and Biodiversity Conservation (Overlapping) Working Circle. The total area for the Grassland circle is 76000 ha. Activities under this



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working circle will cover the removal of *Prosopis*, seed sowing of locally collected palatable grasses, protection of the area from open grazing, grass harvesting and development of grasslands.

19.I state and submit that as per Working Plan study and field visit observations, the Banni area is dry, with deficient rainfall and salinity. A study has taken 91 soil samples up to 1 m depth. It has a high inherent salinity of up to 11 mhos/cm. None of the nearby areas has a water source for large-scale artificial irrigation, and if irrigation is provided, the salinity in the soil is likely to make the land more infertile. So, artificial irrigation is not helpful for this area.

20.I state and submit that the research study shows water holding capacity of 150000 ha, which is excessively high. Such high saline water retention leads to significant waterlogging in the soil with inherent salinity, rendering it unsuitable for plantation purposes. I further submit that an analysis considering factors such as pH levels, electrical conductivity (EC), cation exchange capacity (CEC), salinity, and waterlogging conditions, along with the geographical characteristics of the Greater Rann of Kutch and Vekaria Rann, reveals the following: (i) that 70% of the area is unproductive for vegetation or plantation, and (ii) that the remaining 30% of fertile land, suitable for grass production, is primarily concentrated around the villages inhabited by displaced or unsettled Maldharis. I state that based on the feasibility of restoration of areas, efforts are being made for eco-restoration.

21.I state and submit that as part of the ongoing pilot project initiated by the Forest Department of Gujarat since 2020-21 period, I am pleased to report that the approximately 9750 hectares have undergone grass improvement efforts in last five year. The year wise restoration record has been annexed herein under ANNEXURE-F.



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YEAR	AREA RESTORED (IN HA)
2020-21	850
2021-22	3900
2022-23	2400
2023-24	1300
2024-25	1300
<b>TOTAL</b>	<b>9750</b>

22. I state and submit that a total of 85 Forest Ponds have also been constructed, contributing positively to the ecosystem since the implementation of pilot project. Consequently, the Forest Department has collected 40.75 lac kg of Grass. Furthermore, with the Department's permission, the Maldharis [the inhabitants of Banni who are livestock herders] residing in the area have harvested around 37 lac kg grass, supporting their livelihoods while ensuring sustainable practices. The year wise collection record has been annexed herein under **ANNEXURE-G**.

YEAR	Grass Collected by Forest Department (in lac kg)
2020-21	7.00
2021-22	6.25
2022-23	8.00
2023-24	12.00
2024-25	7.50
<b>TOTAL</b>	<b>40.75</b>

23. It is submitted that eco-restoration of Banni area has already been initiated by the State Government for which financial provisions are also made in State Budget. The Scheme is a continuous item in the State plan and the eco-restoration works will be further continued to cover the feasible area under grass development and



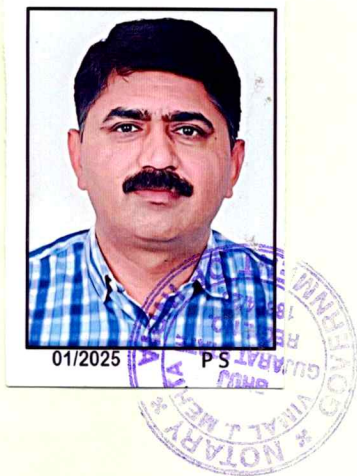
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other suitable measures. The inherent high salinity and drought proneness of the area are the limiting factors which are also taken into consideration for this purpose.

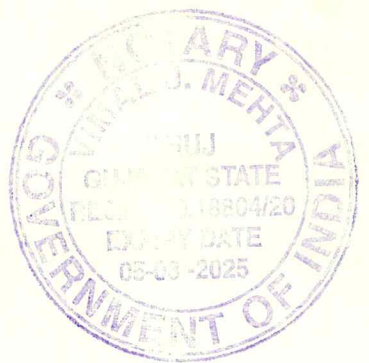
24. In view of the facts and submissions made hereinabove, it is most respectfully prayed that this Hon'ble Tribunal may be pleased to acknowledge that the answering respondent has been actively working towards the conservation, restoration, and sustainable management of the Banni Grasslands through initiative of the Pilot Project of approved Working Plan for the period 2020-21 to 2029-30 and pass appropriate orders.

Solemnly affirmed at \_\_\_\_\_ on this \_\_\_\_ day of February 2025.



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Deponent



SOLEMNLY AFFIRMED  
BEFORE ME

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VIMAL J. MEHTA  
NOTARY  
GOVT. OF INDIA

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**भारत सरकार**  
**GOVERNMENT OF INDIA**




भरतभाई मोतीभाई पटेल  
Bharatbhai Motibhai Patel  
जन्मनु वर्ष / Year of Birth : 1980  
पुरुष / Male

**5614 8302 9778**

**आधार - सामान्य माहसनी अधिकार**



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**भारतीय विशिष्ट ओम्पाई प्राधिकरण**  
**UNIQUE IDENTIFICATION AUTHORITY OF INDIA**

सरनामं:  
S/O मोतीभाई रुपभाई पटेल,  
पटेलवास, प्राथमिक स्कूल पास,  
वज्रपुर नवा, वज्रपुर जूना,  
बनास कान्ठा, गुजरात, 385320

Address:  
S/O Motibhai Rupabhai  
Patel, Patelvas, Near  
Primary School, Vajapur  
Nava, Vajapur Juna, Banas  
Kantha, Gujarat, 385320

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Copy : APPENDIX 'B'

Government of Kutch.

No. NR/155/55  
RR

The Secretariat  
Bhuj, 11th May 1955.

In exercise of the powers vested in him under Section 29 of the Indian Forest Act 1927 read with the Government of India, Ministry of States Notification No. 104-J dated 14th August 1950, the Chief Commissioner is pleased to declare the area specified in the schedule herebelow to be protected forest with effect from 1st June 1955 and that the provisions of Chapter IV of the said Act shall be applicable to it from the said date.

- SCHEDULE -

The area as "Banni" and bounded as follows :-

To the north by the Great Rann of Kutch and the Mahal of Khawada, to the south by boundaries of the Talukas of Bhachau, Anjar, Bhuj, Nakhatrana and Lakhpur to the east by the waste land between the Taluka of Bhachau and Mahal of Khadir, and to the west by the Rann and the a desolate portion to the west of kori creek.

By order.

K.V. Bhatt

Secretary to the Chief  
Commissioner for Kutch.

Grass Development Scheme (Banni Project)  
Section 1 (New item)  
Establishment of New Posts and Administrative  
Approval reg.

The Government of Gujarat  
Forest and Environment Departments  
Resolution Number: FST- 112010-928 -M  
Sachivalay, Gandhinagar  
Date: 3/9/2011

Ref:

1. Principal Chief Conservator of Forests, Gujarat State, Gandhinagar, Letter No: A.,: ૫૮૫ / 27/ ૫ / 616-17/10 -11, Dated: 16/3/011.
2. Forest and Environment Department Resolution No: FST / 1109/1222/M-Dt. 17/4/2010

### **Resolution**

In the financial year 2010-11, a new division will be created under the Grass Development Scheme (Banni Project) as per the resolution outlined in Section (2). The allocated budget for this division is Rs. 1.00 lakh as token. In relation to this, for the financial year 2011-12, the Principal Chief Conservator of Forests proposed the Grass Development Scheme (Banni Project) Section 1 as a new item, based on the Ref: letter (1).

The proposal includes a total budget of Rs. 100.00 lakh (Rupees One Crore only) for the establishment and filling of 66 new temporary posts, as well as the transfer of 12 posts from the World Food Programme, all of which are currently under the consideration of the Government.

2. Administrative approval is granted with subject to the conditions outlined below, under this scheme shall be paid at the conclusion of the consideration period for Establishing, filling, and incurring an expenditure of ₹100 lakhs for the financial year 2011-12.

No	Administrative Position	Pay scale	No.of Post
1	Deputy Conservator of Forests	15600-39100	01
2	Range forest Officer	9300-34800	06
3	Range forest Officer (Survey)	9300-34800	01
4	Forester	5200-20200	15
5	Forest Guard	5200-20200	24
6	clerk	5200-20200	01
7	Surveyor	9300-34800	02
8	Driver	Via. Outsourcing	03
9	Peon	Via. Outsourcing	01
The following positions are to be filled by transfers from the World Food Programme.			
10	Assistant Conservator of Forests	9300-34800	01
11	Forests Guard	5200-20200	01
12	Head clerk	9300-34800	01
13	Accountant	9300-34800	04
14	Clerk	5200-20200	01
15	Peon	4440-7440	01
16	Peon cum Driver	4440-7440	02
17	Driver	5200-20200	01
		<b>Total</b>	<b>66</b>

3. 12 positions to be filled by transfers from the World Food Program and it will be effective from 1/09/2011.
4. Posts of drivers and Peon will be filled according to the resolution of General Administration Department dated: 01/04/2010 will have to be obtained from outsourcing.
5. Steps will be taken to fill the posts of Class-1 and Class-2 as per the provision of the ratio prescribed in the recruitment rules.
6. Class-3 posts as per the provisions of the Recruitment Rules, if it is due to promotion and if it is due to direct recruitment. 16/02/2006, date of General Administration Department. must be filled in accordance with the provisions of resolution 4/6/2009.
7. The work of these posts within the limits of the sanctioned posts of Class 04 of the department is being done by the General Administration Department. Outsourcing has to be done within the limits of the budgetary provision approved as per the provisions of resolution 30/11/2006.
8. Whether the pay scales of the posts are as per ROP-1998? It will be the responsibility of the Principal Chief Conservator of Forests to check it.
9. The candidate who is appointed through direct recruitment will get a regular appointment after the date of the Finance Department. Pursuant to the provisions of Resolution No. 18/03/2005: ॠॡॠ / 2003 / GOE / 10 (PAFFA), the State Govt. be covered under the new enhanced pension scheme introduced from 1/4/2005. And the orders issued from time to time in this regard and to be issued in future will be applicable to the candidates appointed through direct recruitment.
10. While filling up these posts, it should be ensured that the standard of reservation is maintained as per the rules. If there is a backlog space while filling these posts, it should be given priority.
11. The recruitment to these posts shall be made in accordance with the provisions of the existing recruitment rules, rules and regulations of the Government and the prescribed procedure.
12. These schemes shall be used only for the purpose for which they have been sanctioned.
13. The expenditure in respect of these places shall be met from the grants sanctioned for this purpose by the Department for the year 2011-12. And these costs must be paid for.
14. Purchase of 2 jeeps and 4 utility vehicles. As per the provisions of the resolution dated 24/9/2008, the vehicle and vehicle receivable should be within the limit of Rs 5 lakh per vehicle.

15. Procurement of other equipment shall be made in accordance with the existing procurement policy of the Government and in an efficient manner.
16. The expenditure in this regard shall be met from the grant sanctioned for the year 2011-12 by debiting subject to the limit of grant under the said section.

Demand Number	:	26 (Plan)
Sector	:	(G) Capital Accounts of Economic Services
Sub Sector	:	(A) Capital Accounts of Agriculture and Allied Activities
Major Head	:	4406- Capital Outlay on Forestry and Wild Life
Sub Major head	:	01- Grass Development Scheme
Minor Head	:	101- Forest Conservation and Development
Sub head	:	24 Grass Development Project

17. These orders have been made pursuant to the consent received from the note dated 26/08/2011 signed by the Additional Chief Secretary (Finance).

By order and in the name of Hon. Governor of Gujarat State.

(M. L. Charel)  
Deputy Secretary  
Forests and Environment

To,

- Principal Chief Conservator of Forests, Dr, Jivraj Mehta Bhavan, Gandhinagar
- Additional Principal Chief Conservator of Forests, (D&M) Gujarat State, Gandhinagar
- Additional Principal Chief Conservator of Forests, (Financial Management) Gujarat State, Gandhinagar
- Chief Conservator of Forests, Kutch forest Circle, Bhuj
- Accountant Genral, Gujarat State, Ahmedabad/Rajkot

— એનેક્ષર-૧૫

૨૦૧૧-૧૨

આદિવાસી/ખાન

ઘાસચારા વિકાસ યોજના (બત્રી પ્રોજેક્ટ)

વિભાગ-૧ (નવી બાબત)

નવી જગ્યાઓ ઉભી કરવા તથા વહીવટી મંજૂરી  
બાબત.

ગુજરાત સરકાર

વન અને પર્યાવરણ વિભાગ

ઠરાવ ક્રમાંક: એકએસટી-૧૧૨૦૧૦-૯૨૮-મ

સચિવાલય, ગાંધીનગર,

તારીખ -૩/૯/૨૦૧૧

વ્યાજો લીધા :-

- (૧) અગ્ર મુખ્ય વન સંરક્ષકશ્રી, ગુ. રા., ગાંધીનગરના પત્ર ક્રમાંક: પવચ/૨૭/અ/૯૧૬-૧૭/૧૦-૧૧  
તા.૧૬/૩/૨૦૧૧
- (૨) વન અને પર્યાવરણ વિભાગનો ઠરાવ ક્રમાંક: એકએસટી/૧૧૦૯/૧૨૨૨/મ તા.૧૭/૪/૨૦૧૦

ઠરાવ

સને ૨૦૧૦-૧૧ ના નાણાકીય વર્ષમાં ઘાસચારા વિકાસ યોજના (બત્રી પ્રોજેક્ટ) અંતર્ગત નવુ  
ડીવીઝન ઉભુ કરવા બાબતે આમુખ (૨) ના ઠરાવથી રૂ. ૧.૦૦ લાખની પ્રતીક જોગવાઈ કરવામાં આવેલ  
હતી. જેને સૈધ્ધાંતિક મંજૂરી આપવામાં આવેલ આ સંદર્ભે વર્ષ ૨૦૧૧-૧૨ ના નાણાકીય વર્ષ માટે ઉપર  
આમુખ (૧) માં દર્શાવેલ પત્રથી અગ્ર મુખ્ય વન સંરક્ષકશ્રી દ્વારા ઘાસચારા વિકાસ યોજના (બત્રી  
પ્રોજેક્ટ) વિભાગ ૧ નવી બાબત તરીકે દરખાસ્ત કરવામાં આવેલ હતી. આ દરખાસ્ત અંતર્ગત કુલ રૂ.  
૧૦૦.૦૦ લાખ (અંકે રૂપિયા એક કરોડ પુરા) નો ખર્ચ કરવા માટેની યોજનાકીય વહીવટી મંજૂરી આપવાની  
તથા ૬૬ નવી હંગામી જગ્યાઓને ઉભી કરવા અને ભરવા તથા તે પૈકીની ૧૨ જગ્યાઓ વિશ્વ અન્ન  
કાર્યક્રમમાંથી તબદિલીથી ભરવા માટેની બાબત સરકારશ્રીની વિચારણા હેઠળ હતી.

૨૦.૨૨

૨૦/૯/૨૦૧૧

૧૧/૧૧

૨૦/૯/૨૦૧૧

૨. આ અંગે પુખ્ત વિચારણાને અંતે આ યોજના હેઠળની નીચે મુજબના મહેકમને નીચે કસાવેલ શરતોને આધિન ઉભી કરવા તથા ભરવા તથા સને ૨૦૧૧-૧૨ ના વર્ષમાં રૂ ૧૦૦.૦૦ લાખનો ખર્ચ કરવાની આથી વહીવટી મંજૂરી આપવામાં આવે છે.

ક્રમાંક	મહેકમની જગ્યાનો સંવર્ગ	પગાર ધોરણ(રૂ.)	જગ્યાની સંખ્યા
૧	નાયબ વન સંરક્ષક	૧૫૬૦૦-૩૬૧૦૦	૦૧
૨	રેન્જ ફોરેસ્ટ ઓફીસર	૬૩૦૦-૩૪૮૦૦	૦૬
૩	રેન્જ ફોરેસ્ટ ઓફીસર (સર્વે)	૬૩૦૦-૩૪૮૦૦	૦૧
૪	ફોરેસ્ટર	૫૨૦૦-૨૦૨૦૦	૧૫
૫	ફોરેસ્ટ ગાર્ડ	૫૨૦૦-૨૦૨૦૦	૨૪
૬	ક્લાર્ક	૫૨૦૦-૨૦૨૦૦	૦૧
૭	સર્વેયર	૬૩૦૦-૩૪૮૦૦	૦૨
૮	ડ્રાઈવર	આઉટ સોર્સિંગથી	૩
૯	પટાવાળા	આઉટ સોર્સિંગથી	૧
નીચેની જગ્યાઓ વિશ્વ અન્ન કાર્યક્રમમાંથી તબક્કાવીધી ભરવાની રહેશે.			
૧૦	મદદનીશ વન સંરક્ષક	૬૩૦૦-૩૪૮૦૦	૦૧
૧૧	ફોરેસ્ટ ગાર્ડ	૫૨૦૦-૨૦૨૦૦	૦૧
૧૨	મુખ્ય કારકુન	૬૩૦૦-૩૪૮૦૦	૦૧
૧૩	એકાઉન્ટન્ટ	૬૩૦૦-૩૪૮૦૦	૦૪
૧૪	ક્લાર્ક	૫૨૦૦-૨૦૨૦૦	૦૧
૧૫	પટાવાળા	૪૪૪૦-૭૪૪૦	૦૧
૧૬	પ્યુન કમ ડ્રાઈવર	૪૪૪૦-૭૪૪૦	૦૨
૧૭	ડ્રાઈવર	૫૨૦૦-૨૦૨૦૦	૦૧
		કુલ	૬૬

- ૩ વિદ્ય અન્ન કાર્યક્રમમાંથી તળહિલીથી ભરવાની ઘટી ૧૨ જગ્યાઓ તા. ૧/૬/૨૦૧૧ ની અસરથી અમલમાં રહેશે.
- ૪ ગાઈવર અને પટાવાળાની જગ્યાઓ સામાન્ય વહીવટ વિભાગના તા. ૧/૪/૨૦૧૦ ના ઠરાવ અનુસાર આઉટ સોર્સિંગથી મેળવવાની રહેશે.
- ૫ વર્ગ-૧ અને વર્ગ-૨ ની જગ્યાઓ ભરતી નિયમોમાં ઠરાવેલ રેશીયોની જોગવાઈ મુજબ ભરવા કાર્યવાહી કરવાની રહેશે.
- ૬ વર્ગ-૩ ની જગ્યાઓ ભરતી નિયમોની જોગવાઈ મુજબ જો બઢતીના કાળે આવતી હોય તો તે પ્રમાણે અને જો સીધી ભરતીના કાળે આવતી હોય તો નાણા વિભાગના તા. ૧૬/૨/૨૦૦૬, સામાન્ય વહીવટ વિભાગના તા. ૪/૬/૨૦૦૯ ના ઠરાવની જોગવાઈઓ પ્રમાણે ભરવાની રહેશે.
- ૭ વિભાગે વર્ગ-૪ ની મંજૂર કરેલ જગ્યાઓની મર્યાદામાં આ જગ્યાઓની કામગીરી સામાન્ય વહીવટ વિભાગના તા. ૩૦/૧૧/૨૦૦૬ ના ઠરાવની જોગવાઈઓ મુજબ મંજૂર થયેલ બજેટ જોગવાઈની મર્યાદામાં આઉટ સોર્સિંગથી કરાવવાની રહેશે.
- ૮ જે તે જગ્યાઓના પગાર ધોરણો આર.ઓ.પી-૧૯૯૮ પ્રમાણે છે કે કેમ તે ચકાસી લેવાની અગ્ર મુખ્ય વન સંરક્ષકશ્રી ની જવાબદારી રહેશે.
- ૯ સીધી ભરતીથી નિમણૂંક પામનાર ઉમેદવારને નિયમિત નિમણૂંક મળ્યા બાદ નાણા વિભાગના તા. ૧૮/૩/૨૦૦૫ ના ઠરાવ ક્રમાંક: નપન/૨૦૦૩/જીઓઆઈ/૧૦(પાક)ની જોગવાઈ પ્રમાણે રાજ્ય સરકાર દ્વારા તા. ૧/૪/૨૦૦૫ થી દાખલ કરવામાં આવેલ નવી વર્ધિત પેન્શન યોજના હેઠળ આવરી લેવાના રહેશે તથા આ અંગેના વખતોવખત બહાર પાડેલ અને ભવિષ્યમાં બહાર પડનાર હુકમો સીધી ભરતીથી નિમણૂંક પામેલ ઉમેદવારોને લાગુ પડશે.
- ૧૦ આ જગ્યાઓ ભરતી વખતે અનામતનું ધોરણ નિયમોનુસાર જળવાય તે જોવાનું રહેશે. આ જગ્યાઓ ભરતી વખતે બેકલોગની જગ્યા હોય તો તેને અગ્રિમતા આપવાની રહેશે.
- ૧૧ આ જગ્યાઓ ઉપરની ભરતી સરકારશ્રીના જે તે જગ્યાના પ્રવર્તમાન ભરતી નિયમો, નિતિ નિયમો, નિતી નિયમોની જોગવાઈ અને નિયત પદ્ધતિને અનુસરીને કરવાની રહેશે.
- ૧૨ આ યોજનાઓ જે હેતુ માટે મંજૂર કરવામાં આવેલ છે, તે હેતુ માટે જ ઉપયોગમાં લેવાની રહેશે.
- ૧૩ આ જગ્યાઓ અંગેનું ખર્ચ સને ૨૦૧૧-૧૨ ના વર્ષની વિભાગની આ હેતુ માટે મંજૂર થયેલ ગ્રાન્ટ માંથી જ કરવાનું રહેશે તથા નિયત થયેલ સદરે આ ખર્ચ ઉધારવાનું રહેશે.
- ૧૪ ૨ જીપ અને ૪ યુટીલીટી વાહનની ખરીદી બંદર અને વાહન વ્યવહાર વિભાગના તા. ૨૪/૯/૨૦૦૮ ના ઠરાવોની જોગવાઈ અનુસાર મળવાપાત્ર વાહન અને વાહનદીઠ રૂ ૫ લાખની મર્યાદામાં કરવાની રહેશે.

વિભાગીય સાધન સામગ્રીની ખરીદી સરકારશ્રીની પ્રવર્તમાન ખરીદનીતિની અનુસાર અને કરકસરયુક્ત રીતે કરવાની રહેશે.

વુદ્ધ આયોગનો ખર્ચ નીચે જણાવેલ સદર હેઠળ ગ્રાન્ટની મર્યાદાને આધિન ઉધારીને અને ૨૦૧૧-૧૨ માં વર્ષની મંજૂર થયેલ ગ્રાન્ટમાંથી મેળવવાનો રહેશે.

માંગણી ક્રમાંક	:	૨૬ (આયોજન)
સેક્ટર	:	(ગ) આર્થિક સેવાઓના મૂડી હિસાબ
સબ સેક્ટર	:	(ક) કૃષિ અને સંલગ્ન પ્રવૃત્તિઓના મૂડી હિસાબ
મુખ્ય સદર	:	૪૪૦૬-વન નિર્માણ અને વન્યપ્રાણી જીવન અંગે મૂડી ખર્ચ જોગવાઈ
પેટા મુખ્ય સદર	:	૦૧-ઘાસચારા વિકાસ યોજના
ગૌણ સદર	:	૧૦૧-વન સંરક્ષણ અને વિકાસ
પેટા સદર	:	૨૪- ઘાસચારા વિકાસ યોજના

૧૭. આ વિભાગની સરખા ક્રમાંકની કાર્યલ પત્રની અધિક મુખ્ય સચિવશ્રી(નાણાં) ની તા ૨૬/૮/૨૦૧૧ ની નોંધથી મળેલ સંમતિ અન્વયે આ હુકમો કરવામાં આવે છે.

ગુજરાતનાં રાજ્યપાલશ્રીના હુકમથી અને તેમના નામે,

પ્રમીલા  
(એમ એલ ચારેલ)

નાયબ સચિવ  
વન અને પર્યાવરણ વિભાગ.

પ્રતિ,

- અગ્ર મુખ્ય વન સંરક્ષકશ્રી, ગુજરાત રાજ્ય, ડૉ. જીવરાજ મહેતા ભવન, ગાંધીનગર.
- અધિક અગ્ર મુખ્ય વન સંરક્ષકશ્રી, (ડી. એન્ડ એમ) ગુજરાત રાજ્ય, ગાંધીનગર.
- અધિક મુખ્ય વન સંરક્ષકશ્રી, (નાણાકીય વ્યવસ્થાપન), ગાંધીનગર.
- વન સંરક્ષકશ્રી, કચ્છ વન વર્તુળ, કચ્છ ભૂજ
- એકાઉન્ટન્ટ જનરલશ્રી, ગુજરાત રાજ્ય અમદાવાદ/રાજકોટ.

I/52925/2023



भारत सरकार  
GOVERNMENT OF INDIA  
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय  
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE  
CHANGE

क्षेत्रीय कार्यालय, गांधीनगर / Regional Office, Gandhinagar  
(Sub Regional Office, Jaipur)



ए 407, 409 "अरण्य भवन", सीएच-3 सर्कल के पास, सेक्टर-10 ए, गांधीनगर-382010/ A-407 & A-409,  
"ARANYA BHAWAN" Near CH-3 Circle, Sector-10A, Gandhinagar-382010  
Tel No: +9179-23255067 Email: iro.jaipur-mefcc@gov.in

दिनांक: 13<sup>th</sup> September, 2023

To  
Principal Chief Conservator of Forests (HoFF)  
Government of Gujarat  
Aranya Bhavan, Near CH-3 Circle,  
Sector-10 A, Gandhinagar - 382010 Gujarat.  
Sub: Approval of Working Plan for Banni Grassland Division -reg.  
Ref:- A/W. Plan/T.3/40/2023-24 dated 05.09.2023.  
Sir,

Kindly refer to the subject and reference cited above. I am directed to inform that the draft working plan for Banni Grassland Division for the **period from 2020-21 to 2029-30** and submitted by the Gujarat Forest Department was examined in accordance with the provisions of the Forest (Conservation) Act 1980, National Working Plan Code-2014 and the guidelines issued by Ministry of Environment, Forest, and Climate Change New Delhi from time to time. After careful consideration, I convey the central Government's approval to the draft working plan of Banni Grassland Division for the Period 2020-21 to 2029-30 subject to the following conditions:

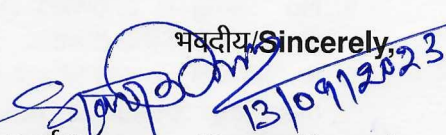
1. The approval is accorded for a period of 10 years from 2020-21 to 2029-30.
2. No felling shall be undertaken without prior approval of this office as per the Ministry order No.9-7/2012-ROHQ dated 23rd February, 2018.
3. Boundaries of the division shall be demarcated and maintained properly as per working plan.
4. No felling is allowed during the working plan period as the same is not proposed in the draft.
5. In Natural Forest Management Working Circle, no felling is prescribed, and area is proposed for naturally regeneration with proper closures/ fencing and soil /water conservation measures. This should be strictly followed.
6. In Soil and Moisture Conservation (Overlapping) Management Working Circle, no felling is prescribed, and area is proposed for artificially as well as naturally regeneration with proper closures/ fencing and soil /water conservation measures. This should be strictly followed.
7. In Wildlife Management (Overlapping) Working Circle, management shall be strictly in accordance with the provisions of Wild Life Protection Act 1972 in consultation with Chief Wild Life Warden.
8. In Joint Forest Management (overlapping) Working Circle is prescribed whole area of entire forest of the division. The JFM should be promoted in entire Division in the forest area having the status of RF/PF as well as Wildlife. Support activities should be taken up in the area through JFM.

*[Handwritten Signature]*  
13/09/2023

I/52925/2023

9. In Forest Protection (overlapping) Management Working Plan circle area prescribed is entire forest area of division. The area should be properly demarcated and boundary pillars should be constructed on priority basis.
  10. No Forest area shall be leased out to any Organisation/Government Department/Contractors for carrying out any activity without approval of Central Government and collection of boulders, bajri, sandstone etc shall not be allowed without prior approval of Central Government under Forest (Conservation) Act 1980.
  11. Intensive fire protection measures shall be ensured and adequate funds for this purpose shall be made available by the State Government.
  12. Budget provisions for the work prescribed in the working plan should be provided on annual basis and the State Government should ensure that no deviation takes place on account of shortage of fund.
  13. Construction of new roads in forest area shall not be taken up for the purpose of extraction of timber etc.
  14. No deviation shall be made from the prescription of working plan read with the conditions stipulated herein above without prior approval of the appropriate authority.
  15. This approval does not ipso-facto imply approval of any proposed non-forestry activities requiring clearance under Forest (Conservation) Act-1980. Such activities shall not be undertaken until separate forest clearance is obtained under the Act.
2. The Central Government reserves the right to review, modify or withdraw the approval given as above at any point of the time depending upon the management needs and any other orders of the Central Government or of the Hon'ble Supreme Court of India in the matter in future.
  3. In this context, it is requested to kindly submit a final copy of the working plan after incorporating all the suggested corrections as mentioned in State Forest Department's letter dated 05.09.2023.

भवदीय/Sincerely,

  
 (श्रवण कुमार वर्मा/Shrawan Kumar Verma)  
 क्षेत्रीय अधिकारी/Regional Officer (RO)  
 क्षेत्रीय कार्यालय, गांधीनगर/  
 Regional Office (RO), Gandhinagar.

**प्रतिलिपि/Copy to:**

- I. The Additional Director General of Forests (FC) Ministry of Environment, Forest and Climate Change, New Delhi.
- II. The PCCF (Working Plan), B-Wing, 5<sup>th</sup> Floor, Aranya Bhawan, Gandhinagar, Gujarat.
- III. The Chief Conservator of Forests, Banni Grassland Division of Gujarat.
- IV. The Deputy Conservator of Forests, Banni Grassland Division of Gujarat.
- V. Guard file.



**Working Plan  
of  
Banni Protected Forest**



*COMPILED AND WRITTEN BY*

**ANITA KARN, IFS**

**CHIEF CONSERVATOR OF FORESTS**

**KACHCHH CIRCLE, BHUJ**

By mail

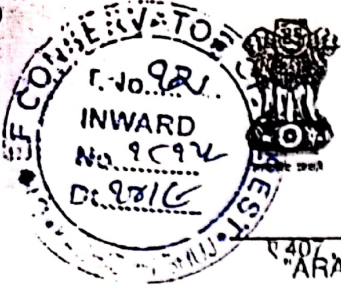
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FC-67/GIM-37/2022-GNR

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भारत सरकार  
GOVERNMENT OF INDIA  
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय  
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE  
CHANGE  
क्षेत्रीय कार्यालय, गांधीनगर / Regional Office, Gandhinagar  
(Sub Regional Office, Jalpur)



प 407, 409 "अरण्य भवन", सीएच-3 सर्कल के पास, सेक्टर-10 ए, गांधीनगर-382010/ A-407 & A-409,  
"ARANYA BHAWAN" Near CH-3 Circle, Sector-10A, Gandhinagar-382010  
Tel No: +9179-23255067 Email: iro.jalpur-mefcc@gov.in

दिनांक: 13<sup>th</sup> September, 2023

To  
Principal Chief Conservator of Forests (HoFF)  
Government of Gujarat  
Aranya Bhavan, Near CH-3 Circle,  
Sector-10 A, Gandhinagar - 382010 Gujarat.  
Sub: Approval of Working Plan for Banni Grassland Division -reg.  
Ref:- A/W. Plan/T.3/40/2023-24 dated 05.09.2023.  
Sir,

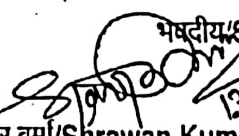
Kindly refer to the subject and reference cited above. I am directed to inform that the draft working plan for Banni Grassland Division for the period from 2020-21 to 2029-30 and submitted by the Gujarat Forest Department was examined in accordance with the provisions of the Forest (Conservation) Act 1980, National Working Plan Code-2014 and the guidelines issued by Ministry of Environment, Forest, and Climate Change New Delhi from time to time. After careful consideration, I convey the central Government's approval to the draft working plan of Banni Grassland Division for the Period 2020-21 to 2029-30 subject to the following conditions:

1. The approval is accorded for a period of 10 years from 2020-21 to 2029-30.
2. No felling shall be undertaken without prior approval of this office as per the Ministry order No.9-7/2012-ROHQ dated 23rd February, 2018.
3. Boundaries of the division shall be demarcated and maintained properly as per working plan.
4. No felling is allowed during the working plan period as the same is not proposed in the draft.
5. In Natural Forest Management Working Circle, no felling is prescribed, and area is proposed for naturally regeneration with proper closures/ fencing and soil /water conservation measures. This should be strictly followed.
6. In Soil and Moisture Conservation (Overlapping) Management Working Circle, no felling is prescribed, and area is proposed for artificially as well as naturally regeneration with proper closures/ fencing and soil /water conservation measures. This should be strictly followed.
7. In Wildlife Management (Overlapping) Working Circle, management shall be strictly in accordance with the provisions of Wild Life Protection Act 1972 in consultation with Chief Wild Life Warden.
8. In Joint Forest Management (overlapping) Working Circle is prescribed whole area of entire forest of the division. The JFM should be promoted in entire Division in the forest area having the status of RF/PF as well as Wildlife. Support activities should be taken up in the area through JFM.

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9. In Forest Protection (overlapping) Management Working Plan circle area prescribed is entire forest area of division. The area should be properly demarcated and boundary pillars should be constructed on priority basis.
  10. No Forest area shall be leased out to any Organisation/Government Department/Contractors for carrying out any activity without approval of Central Government and collection of boulders, bajri, sandstone etc shall not be allowed without prior approval of Central Government under Forest (Conservation) Act 1980.
  11. Intensive fire protection measures shall be ensured and adequate funds for this purpose shall be made available by the State Government.
  12. Budget provisions for the work prescribed in the working plan should be provided on annual basis and the State Government should ensure that no deviation takes place on account of shortage of fund.
  13. Construction of new roads in forest area shall not be taken up for the purpose of extraction of timber etc.
  14. No deviation shall be made from the prescription of working plan read with the conditions stipulated herein above without prior approval of the appropriate authority.
  15. This approval does not ipso-facto imply approval of any proposed non-forestry activities requiring clearance under Forest (Conservation) Act-1980. Such activities shall not be undertaken until separate forest clearance is obtained under the Act.
2. The Central Government reserves the right to review, modify or withdraw the approval given as above at any point of the time depending upon the management needs and any other orders of the Central Government or of the Hon'ble Supreme Court of India in the matter in future.
3. In this context, it is requested to kindly submit a final copy of the working plan after incorporating all the suggested corrections as mentioned in State Forest Department's letter dated 05.09.2023.

भवदीय/Sincerely  
13/09/2023  
  
(श्रवण कुमार वर्मा/Shrawan Kumar Verma)  
क्षेत्रीय अधिकारी/Regional Officer (RO)  
क्षेत्रीय कार्यालय, गांधीनगर/  
Regional Office (RO), Gandhinagar.

प्रतिलिपि/Copy to:

- I. The Additional Director General of Forests (FC) Ministry of Environment, Forest and Climate Change, New Delhi.
- II. The PCCF (Working Plan), B-Wing, 5<sup>th</sup> Floor, Aranya Bhawan, Gandhinagar, Gujarat.
- III. The Chief Conservator of Forests, Banni Grassland Division of Gujarat.
- IV. The Deputy Conservator of Forests, Banni Grassland Division of Gujarat.
- V. Guard file.

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## **PART - I**

### **Summary of facts on which proposals are made**



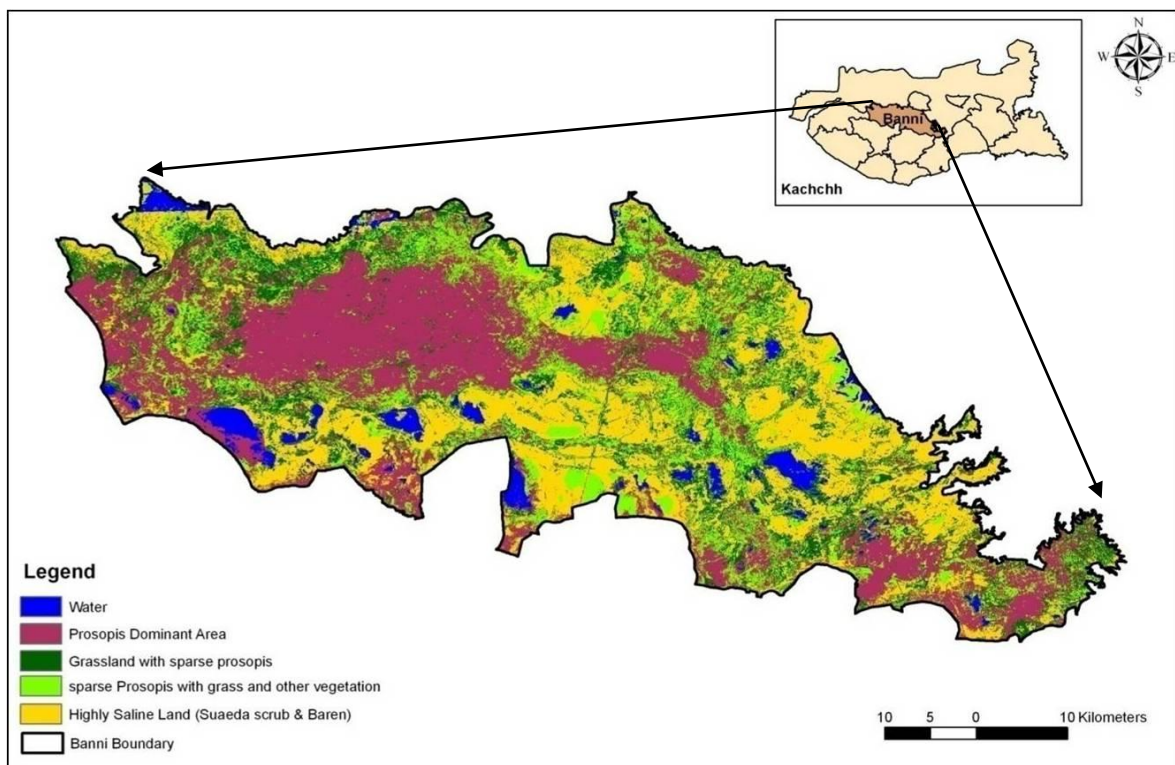
## Chapter 1

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## 1.1. NAME AND SITUATION

**1.1.1.** Banni Grasslands covers an area of over 2,464.62 km<sup>2</sup>, of the Kachchh district, in the State of Gujarat, India. It is regarded as the only remaining single natural vast stretch of grassland in the Indian sub-continent, and was once referred as Asia's finest grassland (GUIDE, 1998). The area is located in the central part of the Kachchh district and falls under the Desert Biogeographical Zone of the country. A total of 55 villages under 19 Gram Panchayats of Bhuj taluka are located inside Banni. Banni has the legal status of a Protected Forest since 1955 and is under the administrative control of the revenue department in the Kachchh district (**Annexure I**).

**1.1.2.** The total area of Banni Protected Forest (PF) is 2,464.62 km<sup>2</sup> falling between 23° 22' 15" N and 23° 48' 07" N latitude and 69° 09' 14" E and 70° 10' 23" E longitude with a perimeter of 367 km (Figure 1.1).



**Figure 1.1 : Map showing location and boundary of Banni Protected Forest in Kachchh district.**

1.1.3 The Banni Protected Forest as per the notification dated 11-05-1955 is bounded as follows:

North: Great Rann of Kachchh and boundaries of Khavda Mahal.

South: Taluka boundaries of Bhachau, Anjar, Bhuj, Nakhatrana and Lakhpat.

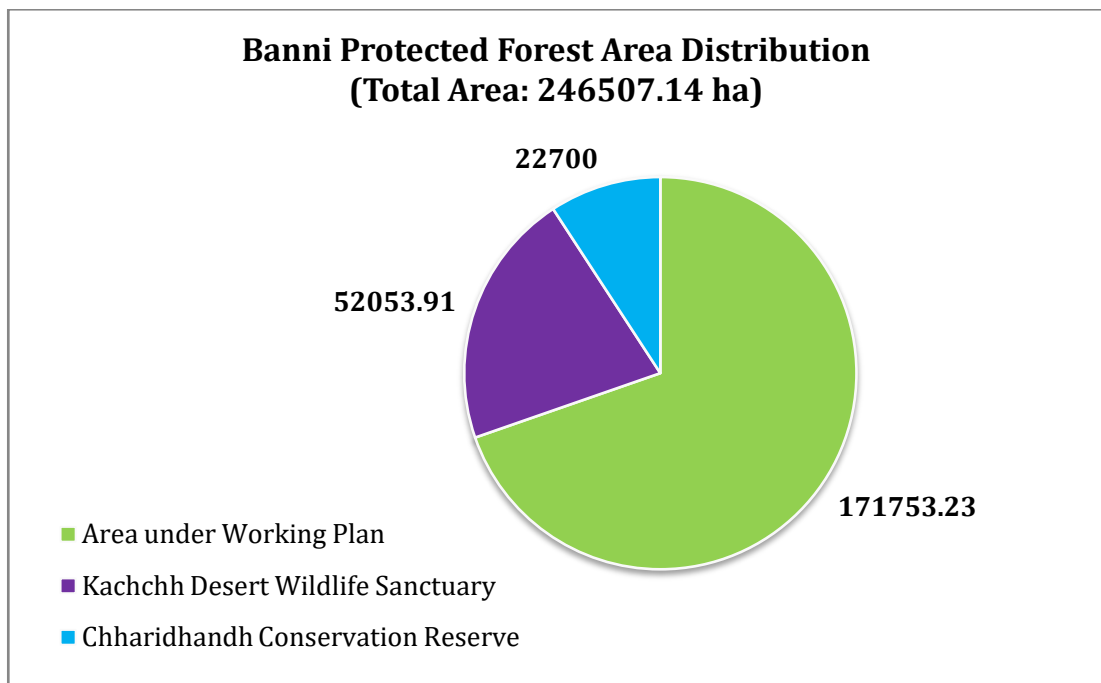
East: Wasteland between the Taluka of Bhachau and Khadir island.

West: Rann and the desolate portion to the west of the Kori creek.

1.1.4 The plan will be known as the “Working Plan of Banni Protected Forest”. It prescribes management of the Banni Protected Forest of Kachchh district, for the next 10 years.

1.1.5 The actual working plan area (proposed) would be 1,71,753.23 hectares which excludes the 52053.91 hectares area of Kachchh Desert Wildlife Sanctuary (KDWS) and 22700 hectares area of the Chharidhandh Conservation Reserve (CCR), which are managed through separate management plans (Figure 1.2).

1.1.6 The Banni Grassland division at present consists of five ranges and is headquartered at Bhuj, Kachchh District.



**Figure : 1.2 : Banni Protected Forest area showing details of Protected Area**

## 1.2 CONFIGURATION OF THE GROUND

1.2.1. The plains of Banni represent an embayment between the Kachchh mainland uplift in the south, the Pachchham uplift in the north and the Wagad and Bela uplift in the east. Banni plains form a low alluvial table, rising 3 to 10 m above the level of the Great Rann, and the entire area is more or less flat. In the southern part of Banni there is an intervening stretch of high saline wasteland that separates the Banni from the Kachchh mainland, known as Little Rann of Banni.

1.2.2. It is commonly believed that Banni was formed by detritus and sediments brought down and deposited by the many rivers flowing northward from Bhuj ridge like *Nara, Bhurud, Bhukhi, Nirona, Kaila, Khari, Kaswati, Panjora*, etc. However, the sediments show a strong affinity to the materials brought down by the rivers such as Indus, Luni, Banas and Saraswati, which in the recent geological past flowed through this area from the north and east (Kadikar, 1994). There are also evidences to suggest that Banni is a part of the Great Rann of Kachchh (GIAP, 1989) and together with the Little Rann, used to form “the old arms” of the Arabian Sea that silted up, and subsequently, gave rise to the Banni plains (Figure 1.3).



**Figure 1.3: Old map of Kachchh showing location of Banni on the old arm of Great Rann of Kachchh. (Source: Gazetteer of Bombay Presidency Vol-V, 1880)**

### 1.3 GEOLOGY, ROCK AND SOIL

#### 1.3.1 Geology and Rock:

The Banni Zone of Kachchh belongs to Jurassic period with recent alluvium deposits. The soils of Banni are inherently saline and consist of recent alluvium mixed at places with Aeolian sandy deposit and the entire area has deep to very deep clayey and coarse-textured soils in discontinuous patches. This is in spite of the Banni lands being alluvial and sandy, and more importantly, Banni soil is inherently saline since this land area had been under the seawater some thousands of years, therefore, its current groundwater is saline. Through capillary movement, the surface water evaporates and leads to salt deposits on the topsoil.

The southern edge of Banni is an extensive slightly low-lying area, created by a historical extension of the Arabian Sea (Burnes, 1835), at the western edge of the Greater Rann of Kachchh (from the Kori creek and eastward). This area has been gradually silted, and given its origin, its soil is highly saline (Little Rann of Banni). The other source is the central part of the Greater Rann of Kachchh from which wind-borne salty dust particles are deposited in the northern parts of Banni.

#### 1.3.2 Soil Environment

The soil of Banni is inherently saline and consists of recent alluvium mixed at places with Aeolian sandy deposits and the entire area has deep to very deep clayey and coarse-textured soils in discontinuous patches. The salinity of the soil is highly variable from 1.0 to 15 Mmhos/cm and the pH ranges from 6.5 to 8.5. The presence of high silt and clay content restricts the vertical and lateral movement of surface and subsurface water and creates waterlogging and flooding in low lying areas after the monsoon. The Banni soil is moderately fine-textured covering 59% of the area followed by medium-textured soil covering 25% of the area.

### 1.3.2.1. Soil Zonation

Banni area can be broadly classified into four soil zones i.e. i) Soils of West Coast, Kachchh Peninsula, Hilly Terrain (spread over 0.67% of Banni area), ii) Soils of Pediments (spread over 1.12% of Banni area), iii) Soils of Arid Plains (spread over 0.37% of Banni area), and iv) Soils of Muddy swamp (spread over 1.46% of Banni area). The Soil of Arid Plains is subdivided into Subtype-I and Subtype-II, which cover 0.17% and 0.20% of the Banni area, respectively. Likewise, Soil of Muddy swamp is divided into Subtype-I, Subtype-II, Subtype-III and Subtype-IV, which cover 0.30%, 0.39%, 0.21% and 0.56% of the Banni area.

### 1.3.2.2 Soil Permeability

Soil permeability of Banni area ranges between 0.0 cm/hr and 0.5 cm/hr. About 40% and 30% of the Banni area falls under very slow and slow permeability (0.00 to 0.13 cm/hr) respectively, whereas only 30% of Banni is under the moderate permeability range. This situation subsequently leads to waterlogging during good rainfall years and low lying areas act as a seasonal wetland, which attracts a good number of migratory birds.

### 1.3.2.3 Soil Salinity

The overall soil quality of Banni Protected Forest area was assessed during 2020 at 23 sampling locations. In total 23 pits (each of 1 m depth) were dug for soil characterization. Soil samples were collected across the layers (0-15 cm, 15-30 cm, 30-60 cm and 60-100 cm) from each pedon. In total, 91 soil samples were collected from 4 pedons (in one pit sampling was done till 60 cm, as it reached water Table). The sampling involved packing of soil samples in pre-cleaned airtight plastic bags, labeling with appropriate code numbers and transfer to the laboratory for further processing and analysis. The collected soil samples were air-dried, homogenized, and sieved through 2 mm mesh (Tandon, 2005). The particles with < 2 mm were retained in pre-cleaned plastic bottles for further laboratory analysis. The result of soil samples analyzed is given in **Annexure VI**.

Soil salinity is the major problem and natural constraint of the Banni area. The area under soil salinity ranges upto 2.5 M mhos/cm (very low to low

salinity) and decreases along the depth. A similar trend is noticed in very high saline (15 M mhos/cm) situation only upto 120 cm depth. In contrast to this, the area under moderate (3-5 M mhos/cm) to high salinity (5-15 M mhos/cm) shows a positive trend with the soil depth upto 120cm (Figure 1.4).

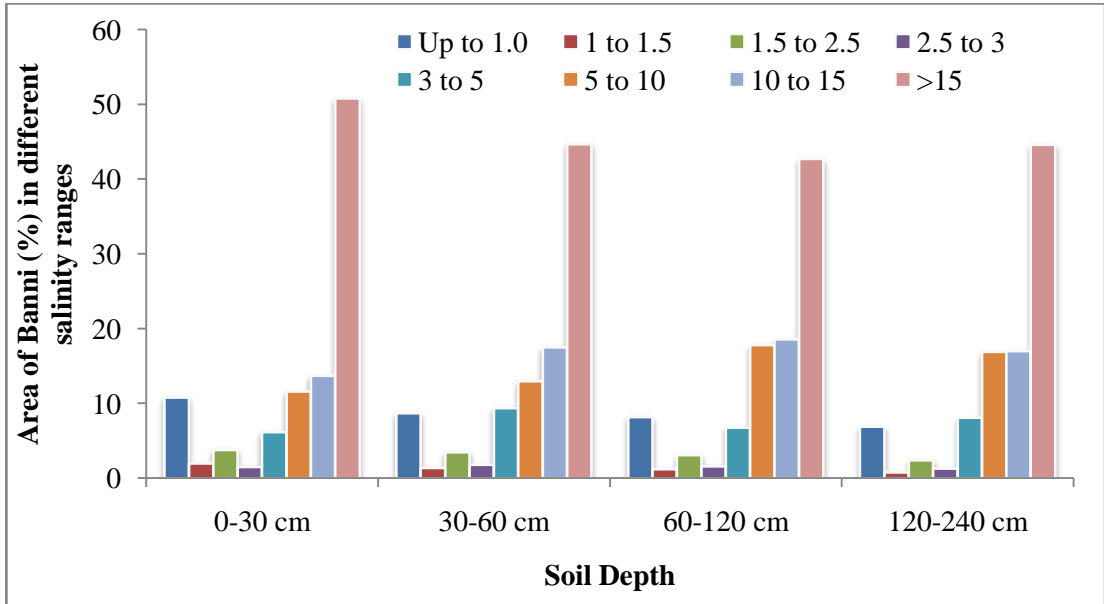


Figure 1.4 : Soil Salinity status of Banni Protected Forest

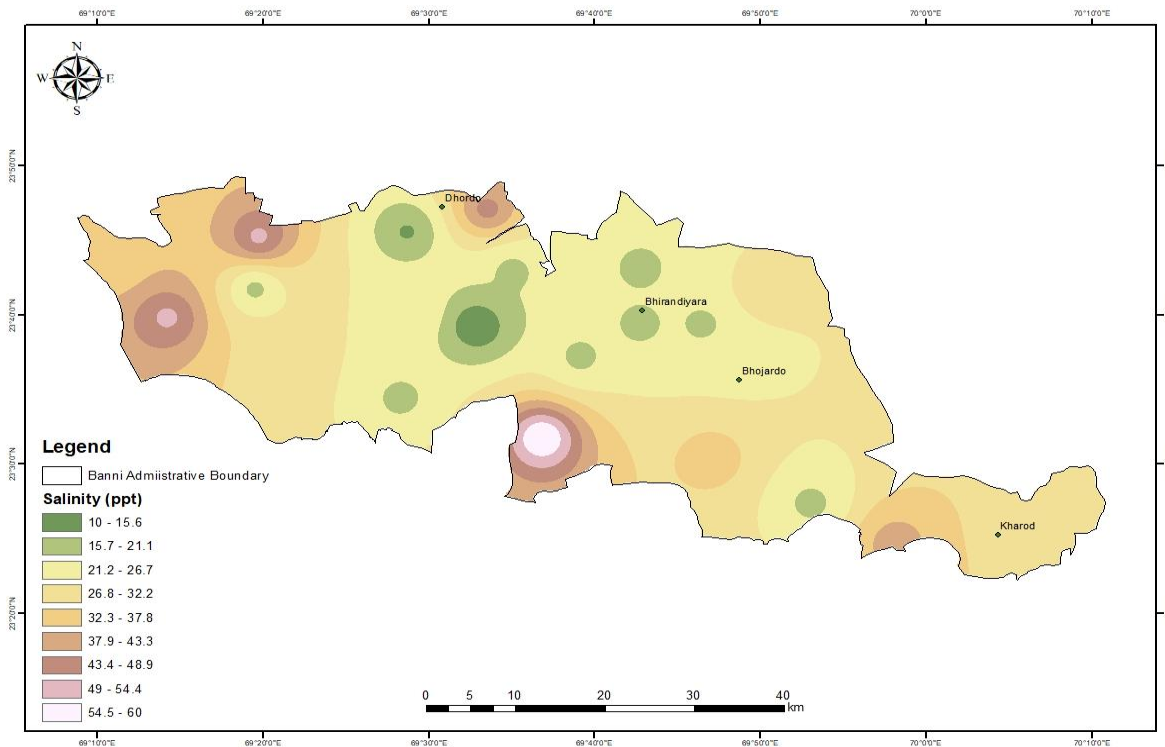
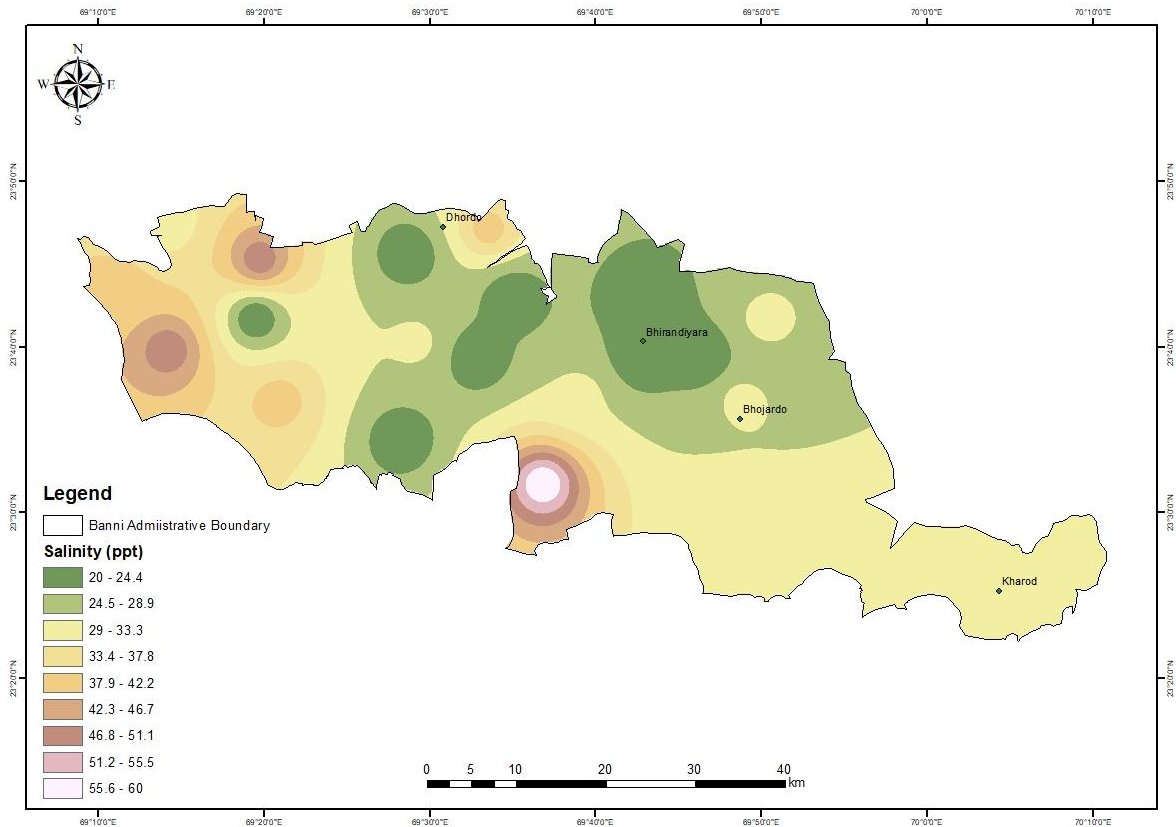


Figure 1.5: Soil salinity map of Banni Protected Forest (0-30 cm depth) during the year 2020



**Figure 1.6 : Soil salinity map of Banni Protected Forest (0-100 cm depth) during the year 2020**

## 1.4. Climatic Parameters

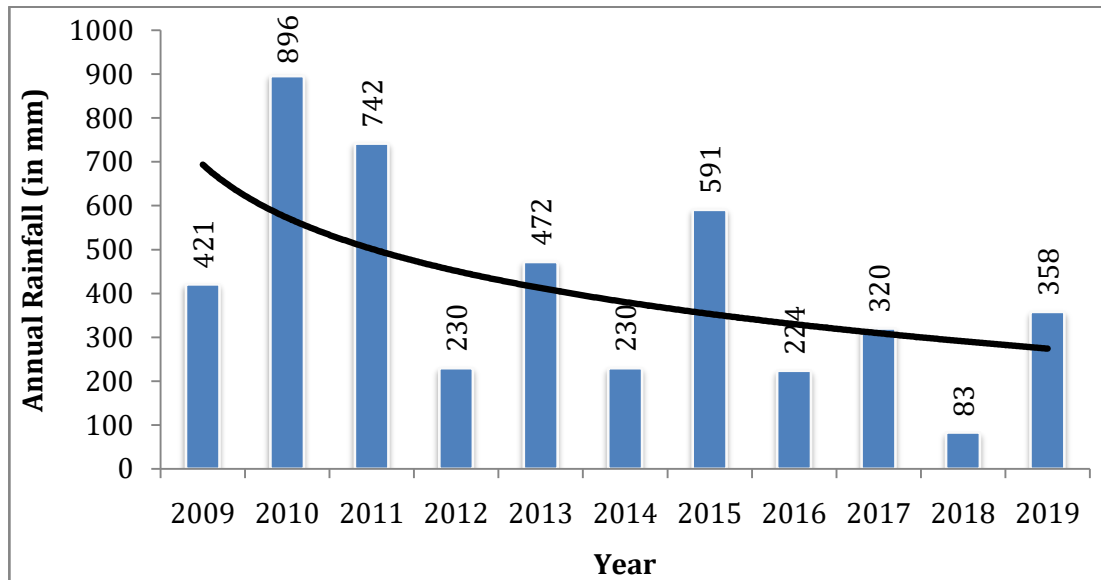
### 1.4.1. Climate

The climate of Banni is characterized by frequent drought and extreme temperatures. Based on the climatic zone of the country Banni falls under arid zone. The temperatures in the Banni ranges between 49°C in summer (May–June) and 10°C during winter (January– February). During summer, dust-laden winds are very frequent and the average wind speed recorded during winter, summer and monsoon are 16 km/h, 24 km/h and 9 km/h, respectively. The humidity ranges between 0.8% and 98%. The annual evapotranspiration is 1887 mm and relative humidity varies between 50% and 60%.

### 1.4.2. Rainfall

The rainfall in Banni region is from the Southwest monsoon which is scant with an average of 5 rainy days and the spread is also irregular. The region receives (June- September) very low rainfall with an average annual rainfall of

317 mm with a coefficient of variation of 65%. Therefore, droughts are a recurring phenomenon in Banni. During the period between 1901 and 2019, a total of 63 droughts were recorded. In the last 10 year, the region received an average annual rainfall of 415 mm which is greater than the average rainfall of the Kachchh (Figure 1.7).



**Figure 1.7: Graph showing Rainfall pattern in the last 10 years at Banni Protected Forest (Source: IMD)**

### 1.4.3. Water Supply

Banni is in the water scarce or deficit zone of the country due to its inherent arid climate. Though the subsurface water in Banni exists at a shallow depth of about 3 m, it is highly saline and thus not suitable for drinking or irrigation purposes. The presence of high silt and clay content lessens the vertical and lateral movement of surface and subsurface water and creates waterlogging and flooding in low lying areas after the monsoon. During monsoon, water flow from hilly areas of central Kachchh received by Banni while tidal water from Great Rann of Kachchh also enters towards the northern fringes of Banni grassland.

## Chapter 2

## Maintenance/ increase in the extent of forest and tree cover

## 2.1 Area of forests under different legal classes :

The entire Banni grassland is a notified Protected Forests under the Indian Forest Act, 1927. Some of its area in the eastern part falls under the Protected Area, Kachchh Desert Wildlife Sanctuary and some of its western part is protected under Charidhundh Conservation Reserve (Table 2.1).

**Table 2.1: Distribution of Area under the Banni Protected Forest**

Total Banni Protected Forest area (in Ha.)	Kutch Desert Wildlife Sanctuary area falls in Banni Protected Forest (in Ha.)			Chharidhandh Conservation Reserve (in Ha.)	Banni Working Plan Area (in Ha.)
1	2	3	4	5	6 ((1-(4+5))
246507.14	1	Moti Dadhar	5810.52	22700	171753.23
	2	Udai (Neri)	11617.43		
	3	Berdo	13206		
	4	Lakhara Velara	21419.96		
	Total KDWLS falls in Banni		52053.91		

## 2.1.1.State of Boundaries

Survey of the outer boundary of the Banni Protected Forests was done by Superintendent Land Records, Kachchh District in 2019 and the area was demarcated with Boundary pillars (Figure 2.1).

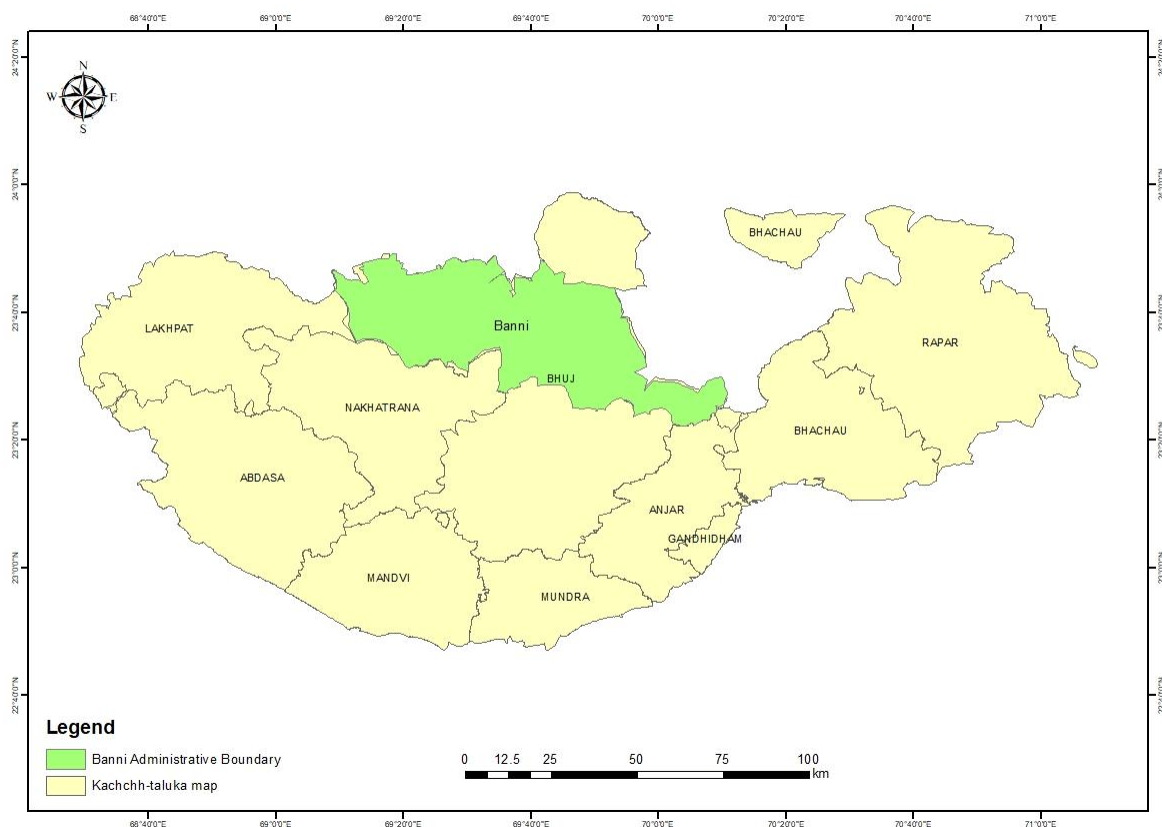
## 2.1.2 Legal Position

As per the Govt. of Kachchh notification no. RR-155/55, dated 11<sup>th</sup> May 1955; the Chief Commissioner of Kachchh had declared the Banni grassland area as 'Protected Forest' under Section 29 of the Indian Forest Act, 1927 (**Annexure I**). The protected forest is under the administrative control of the revenue department. Part of the Banni Protected Forest is

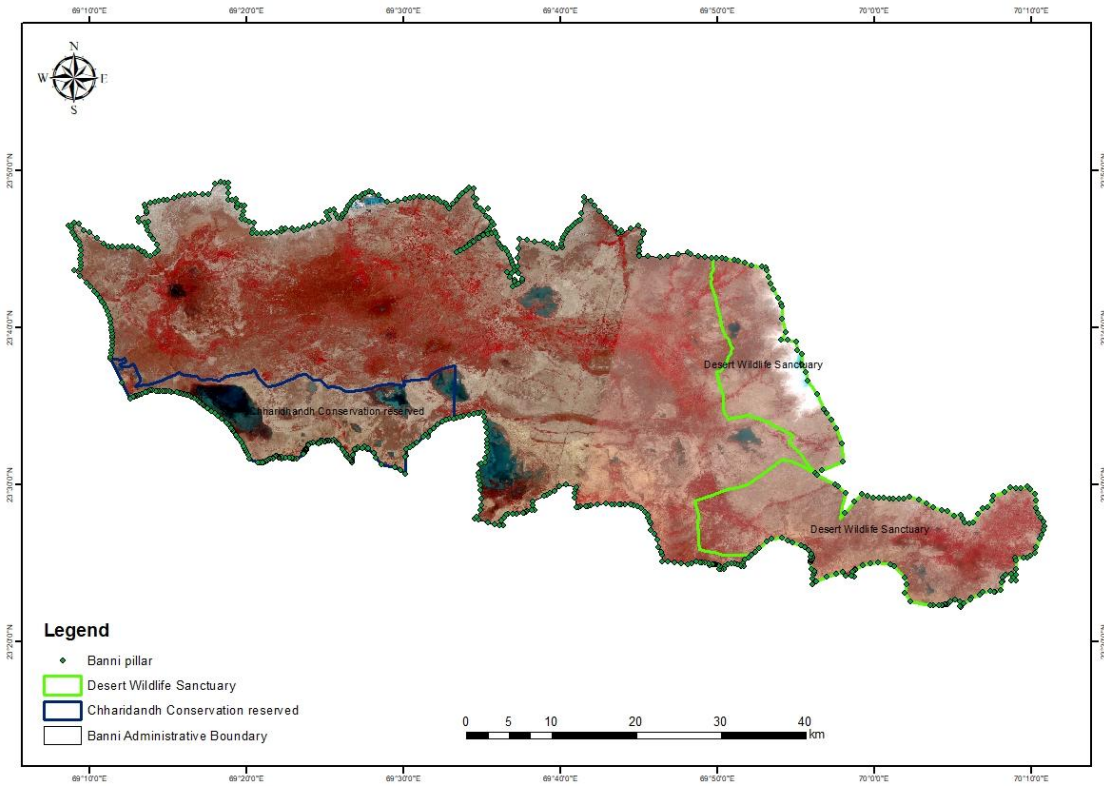
declared under the Wildlife (Protection) Act, 1972 as the Kachchh Wildlife Desert Sanctuary (KDWS) in the eastern fringe of Banni, vide notification no. GSABN-41-85-WLP-1386-207-V-2, dated 28<sup>th</sup> February 1986 (**Annexure II**) and Charidhundh wetland in the south-western part as Charidhundh Conservation Reserve (CCR) vide notification no. GVN-2008(33) WLP-102003-341-W (641), dated 9<sup>th</sup> July 2008 and GVN-2008 (38) WLP-102003-341-W (641), dated 1<sup>st</sup> August 2008 (**Annexure III**) (Figure 2.2).

### 2.1.3. Rights and Concessions

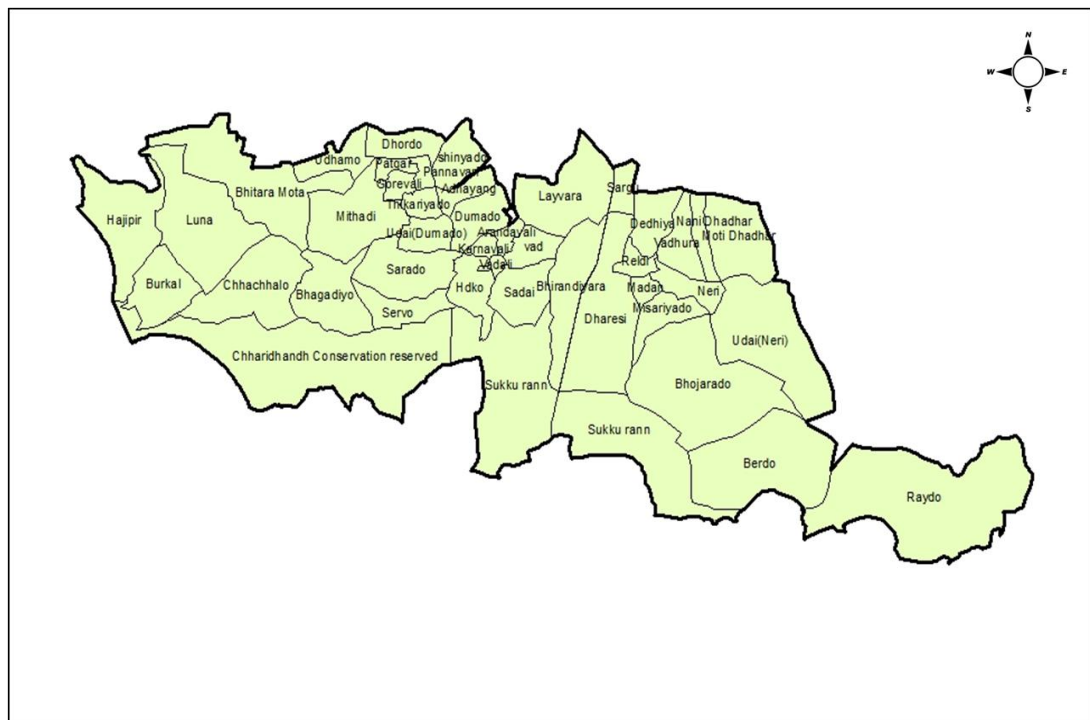
Though the area was declared as 'Protected Forest' in the year 1955 and is inhabited by 55 villages under 19 Gram Panchayats of Bhuj Taluka of Kachchh (**Annexure IV**), the rights and concessions for the inhabited villages are in the process of being finalised by the revenue authorities who are the custodian of the Banni Protected Forest (Figure 2.3).



**Figure : 2.1 Map showing the outer boundary of Banni Protected Forest lying with talukas of Kachchh district**



**Figure 2.2 : Map showing Banni Grasslands with Chharidhundh Conservation Reserve and Kachchh Desert Wildlife Sanctuary.**



**Figure : 2.3 : Map showing villages inside Banni Protected Forest**

## 2.2. Forest area under different Working Circle/Management plan (Past):

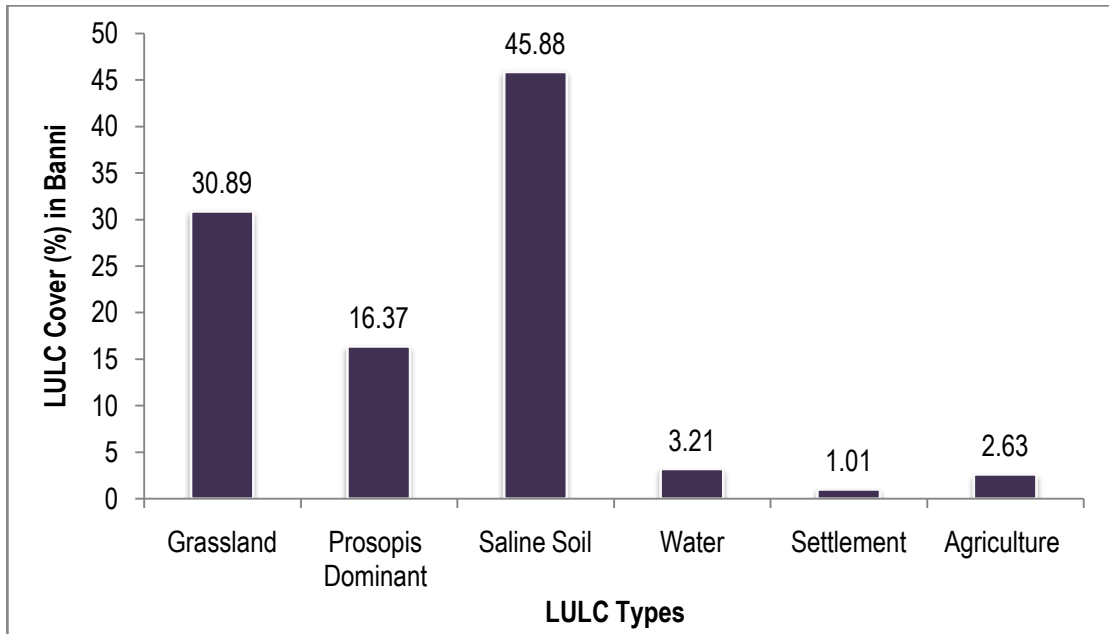
Forest area of the Banni Grassland Division is divided into 5 Forest Ranges (Tuga, Sarado, Shagru, Bhirandiyara and Berodo) that are further divided into 15 Rounds and 25 Beats. Out of the total 2,49,674.45 ha area of Banni Protected Forest, a total of 1,88,909.74 ha (76.64%) is covered under the Working Plan under 5 working circles i.e. (1) Grassland Working Circle, (2) Protection cum Improvement Working Circle, (3) *Prosopis juliflora* Working Circle, (4) Joint Forest Management (Overlapping) Working Circle and (5) Wildlife (overlapping) Working Circle with various objectives of management (**Annexure V**). The part of Banni which falls under the KDWS and CCR are managed as per their respective approved management plans.

**2.3. Percentage of forest with secured boundaries:** The entire geographical area under Banni Grassland Division is categorised as Protected Forests and the forest cover is mainly Savannah grassland. The outer boundary of the Banni Protected Forest was demarcated in the current financial year 2019-20 and boundary demarcation of inhabited villages within the Banni is ongoing.

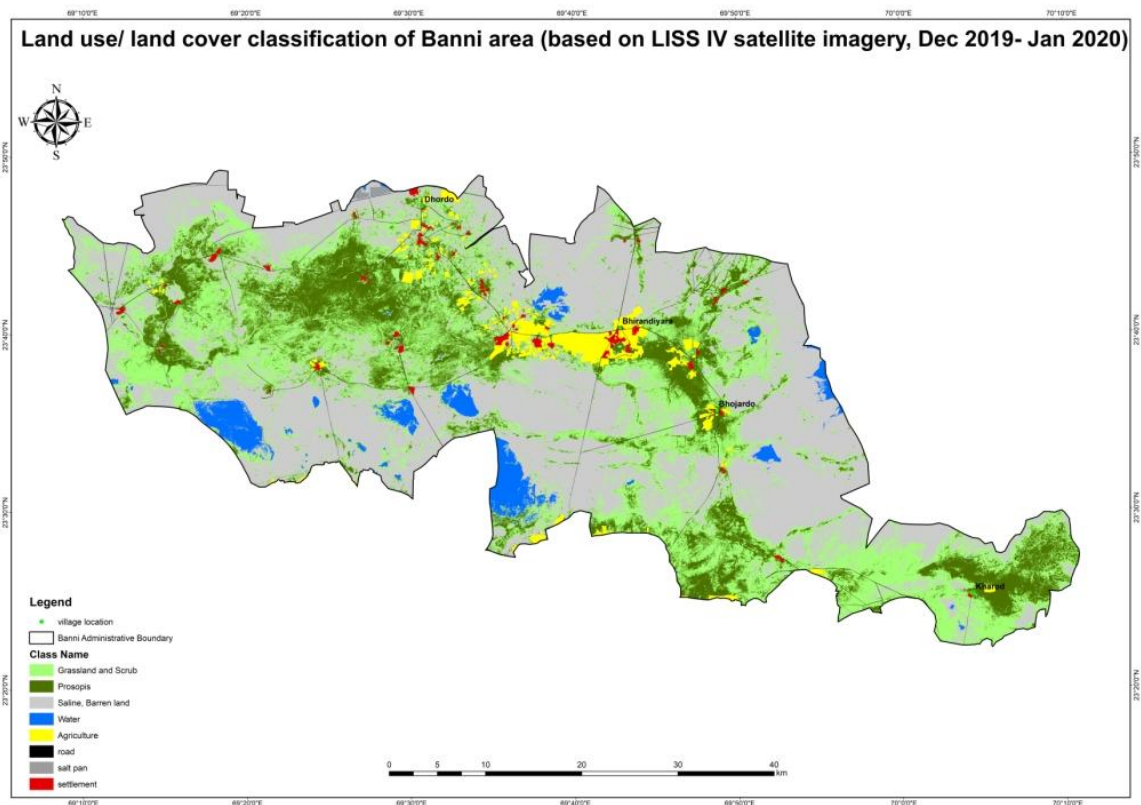
**2.4. Land use land cover (LULC) status :** Analysis of the Landuse and Landcover status of the Banni protected forest is based on the LISS-4 Imageries. The recent LULC analysis of year 2019 (post monsoon data) found saline/barren land (45.78%) is the major LULC types, followed by grassland with scrub (30.89%) and *Prosopis juliflora* infested areas (16.37%) (Table 2.2).

**Table 2.2: Landuse and Landcover status of Banni Protected Forest**

Sl. No.	LULC category	2019	
		Area (ha)	Area (%)
1	Grassland	76130	30.89
2	Prosopis Dominant	40357	16.37
3	Saline Soil	113084	45.88
4	Water	7904	3.21
5	Settlement	2494	1.01
6	Agriculture	6492	2.63
	<b>Total Area</b>	<b>246462</b>	<b>100</b>



**Figure 2.4: LULC cover of Banni Protected Forest in 2019 (post monsoon period)**



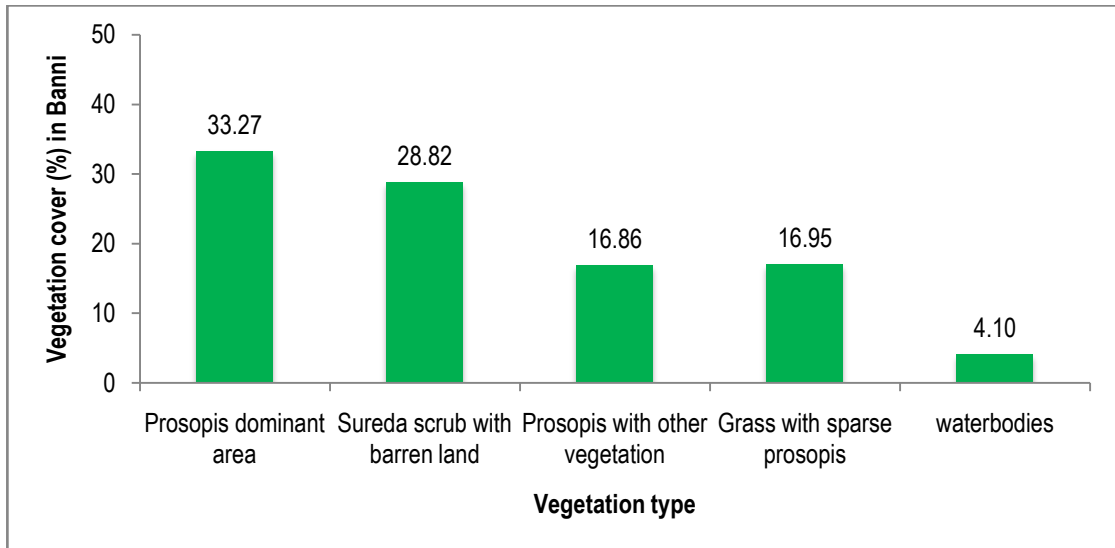
**Figure 2.5 : Land use and land cover status of Banni Protected Forest in post monsoon 2019.**

## 2.5. Threats to the forest

Banni Protected Forest was once a productive grassland used by the Maldharies as a free grazing land by their livestock over centuries. Now, the grassland is facing several natural as well as of anthropogenic threats which are as follows:

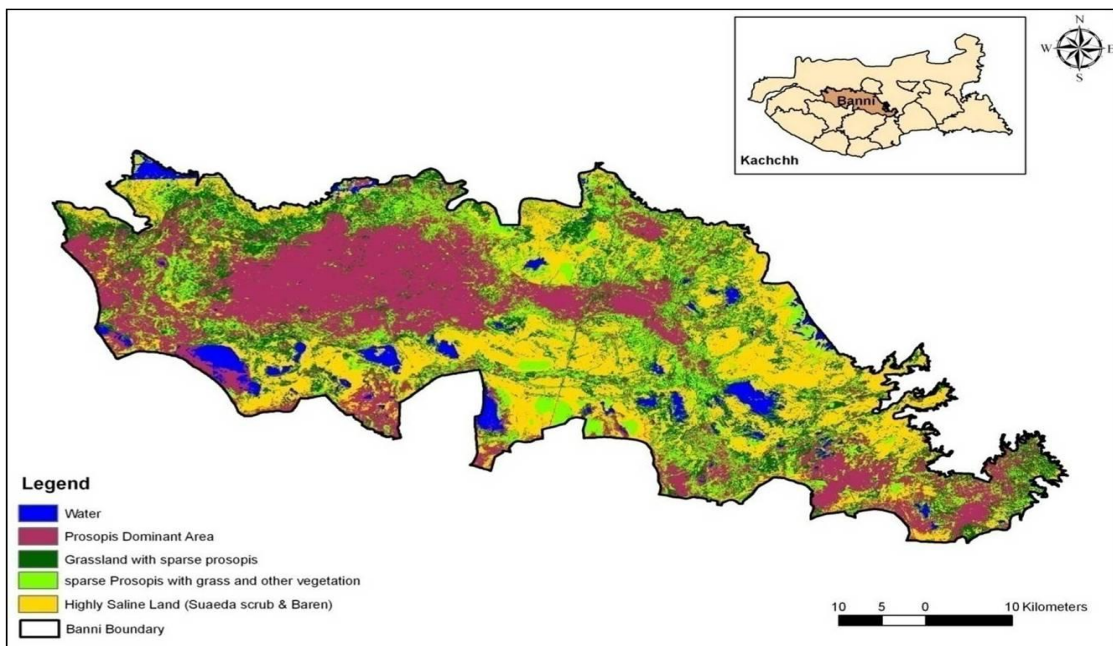
1. As the area falls under the arid zone of the country, **desertification** is the major constraint for the ecology of this area. Further, due to effects of **climatic change** and **anthropogenic activities**, the ecosystem has been adversely affected.
2. With the introduction of *Prosopis juliflora* in the fringe areas of northern Banni to check the spread of Great Rann of Kachchh towards Banni, the grassland is now invaded by this alien species which affects the biological diversity of Banni.
3. Banni is inherently **saline** and the vegetation pattern of the grassland is mainly dependent on salinity level. The damming of various rivers of the Central Kachchh region flowing towards Banni has been changing the hydrodynamics and inherent salinity pattern of the grassland. This has led to increase in the salinity level of the Banni in recent times. This has also affected the vegetation dynamics of the grassland.
4. The fringe areas and those surrounding inhabited villages of the grassland are facing **heavy grazing pressure and seasonal encroachment** which has a negative impact on the grassland ecosystem and its dependent biodiversity.
5. **Illegal cutting of *Prosopis juliflora*** for charcoal making results in unsystematic and haphazard clearing of the area in patches which affects the overall ecosystem of Banni.

**2.6. Distribution of different forest types:** Banni protected forest mainly falls under the subcategory Savannah grassland of Tropical Thorn Forests. With the introduction of *Prosopis juliflora* in the year 1960, at present, a major part of the area has been converted into woodland. Thus, the forest cover of Banni is analysed and sub-divided based on vegetation types such as Prosopis dominant area, Prosopis mixed with other vegetation, grass with sparse prosopis, Sueda scrub and other halophytic vegetation with barren land and water bodies with aquatic vegetation (Figure 2.6).



**Figure 2.6: Coverage of Vegetation types in Banni Protected Forest (GUIDE, 2010)**

**2.7. Tree cover outside forest area:** The areas outside Banni also being inherently saline, do not support tree species except for a few thorny species like *Acacia sp.*, *Prosopis cineraria*, *Salvadora sp.*, *Tamarix sp.*, etc. Some fringe areas outside Banni located in the southern and western side are suitable for growth and development of tree species (Figure 2.7). The fringe areas located on the northern and eastern fringe are not suitable for tree species except few thorny species.



**Figure 2.7: Map showing vegetation cover of Banni Protected Forest**

## Chapter 3

### Maintenance, Conservation and Enhancement of Biodiversity

#### 3.1. Forest Composition and Distribution

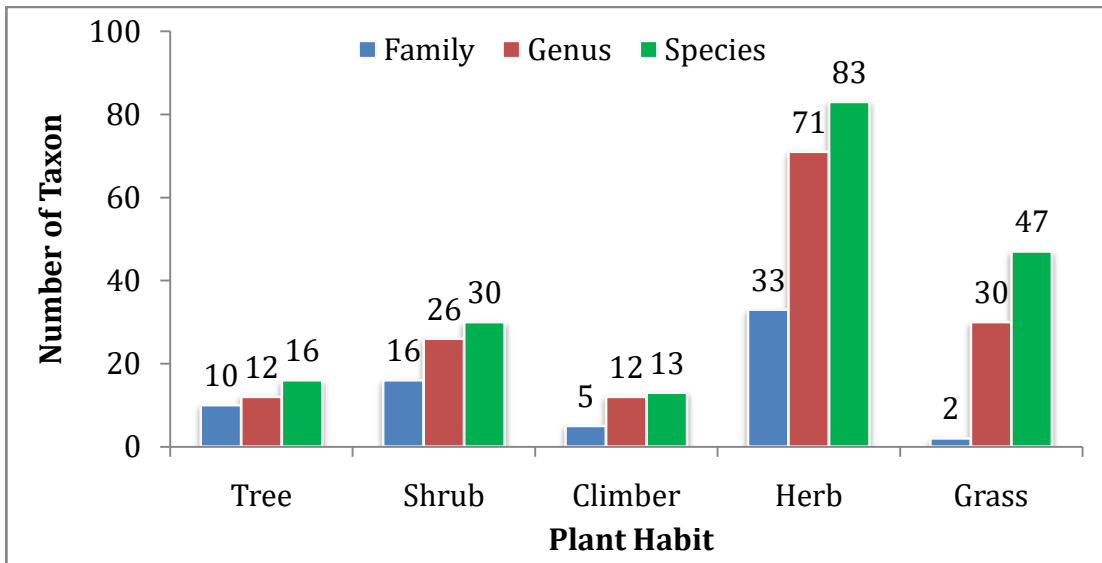
According to Champion and Seth's classification, the Banni Protected Forest areas fall under "VI-B Northern Tropical Thorn Forests", sub-type "Desert Thorn Forests (C-1)" (Kachchh, Saurashtra, Gujarat) and is inherently a 'grass with savanna shrub' ecosystem in which grasses, shrubs, herbs and trees coexist in a mosaic of grassland with sparsely distributed woodland patches.

##### 3.1.1. Floristic Composition and condition of the Tree Crop

Based on the rapid survey of flora of Banni Protected Forest conducted by the local staff with the help of scientists of GUIDE, a total of 189 species of plants belonging to 151 genera and 66 families were found in Banni Protected Forest which include 83 species of herbs, 47 species of grasses, 30 species of shrubs, 13 species of climbers and 16 species of trees (Figure 3.1). Banni is basically a savannah grassland and therefore, tree species richness is low and distributed sparsely in areas having low salinity. The major species of tree crops in the grassland are Gando baval (*Prosopis juliflora*), Desi-baval (*Acacia nilotica*), Khari Jar (*Salvadora persica*), Mithi Jar (*Salvadora oleoides*) and Kerdo (*Capparis decidua*). Among the grass species recorded, *Sporobolus helvolus* is dominant in protected grassland (protected grass plots) whereas in a heavily grazed areas (unprotected area), *Desmostachya bipinnata* is dominant.

The waterlogged and marshy saline areas of the grassland get colonized by sedges like *Fimbristylis sp.*, *Scirpus sp.*, *Cyperus sp.* and *Eleocharis sp.*, whereas low to moderately saline areas are covered with annual halophytic species such as *Zygophyllum sp.*, *Cressa sp.* and *Portulaca sp.* etc. *Suaeda fruticosa* is a predominant species in low-lying saline areas and in some location its density are in a range of 4,000 - 8,000 individuals/ha. High saline areas are colonized by perennial grasses of low productivity and unpalatable species like *Aeluropes sp.*, *Urochondra setulosa*, etc. The perennial, palatable grasses with high productivity species like *Sporobolus pallidus*, *S. helvolus*, *Dichanthium annulatum*, *Cenchrus ciliaris*, *C.*

*setigerus*, *Desmostachya bipinnata* etc., which are grows in low to moderate saline areas of the grassland (Singh and Kar, 1996).



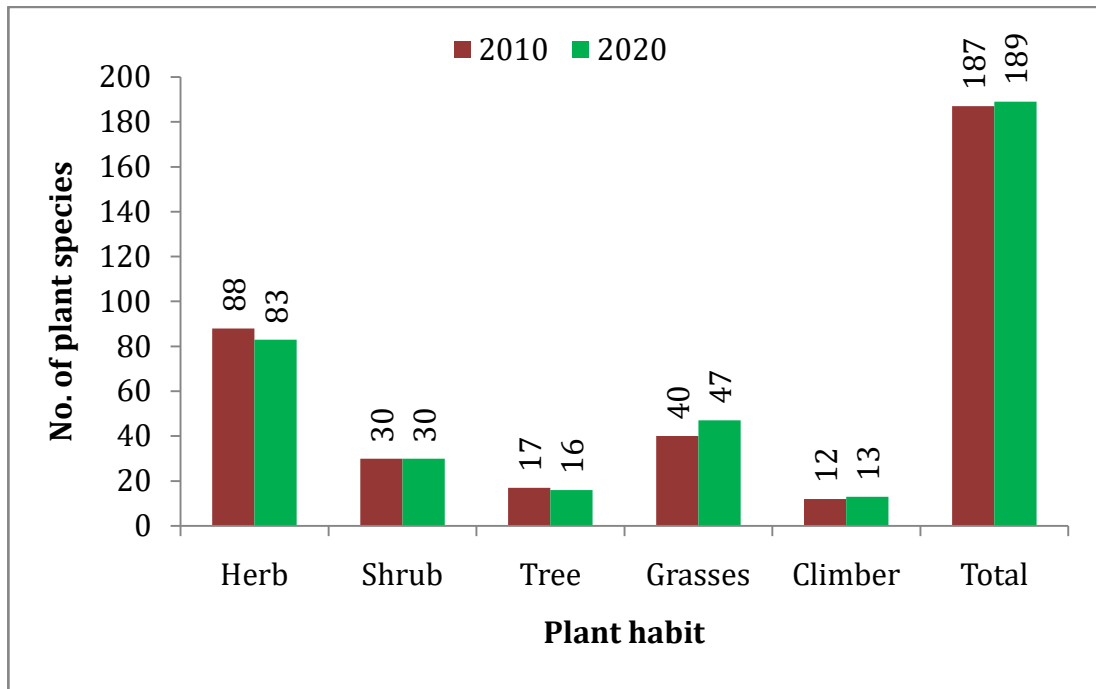
**Figure 3.1: Taxonomic diversity of flora in Banni Protected Forest**

The shrub and tree strata mainly composed of *Prosopis juliflora*, *Prosopis cineraria*, *Acacia nilotica*, *Acacia leucophloea*, *Acacia senegal*, *Salvadora persica*, *Salvadora oleoides*, *Capparis deciduas* and *Tamarix* sp. Among the tree species, *Acacia nilotica*, was once distributed all over the Banni, but it has been reduced and replaced by *Prosopis juliflora*, an invasive alien species, in due course of time. *Azadirachta indica*, *Ziziphus numularia* and *Calotropis procera* are also found in the grassland and are mainly distributed in villages and human settlements within the Banni grassland.

Now, *Prosopis juliflora* is a prominent tree species of the grassland and has invaded most of the areas and is also spreading rapidly. Except in few patches, first or second coppice growth of *Prosopis juliflora* is predominantly seen in the area. Near village tanks, some good patches of *Acacia nilotica* are also seen with short height. *Salvadora* sp. is also present in few patches of the grassland.

**3.1.2. Plant species diversity:** Banni is a dynamic ecosystem mainly dominated by grass species. However in recent times it is dominated by *Prosopis juliflora*. The recent rapid survey (Monsoon, 2020) in the Banni grassland recorded a total of 189 species of the plant consisting of 16 species of tree, 30 species of shrub, 13 species of climbers, 83 species of herbs and 47 species of grasses (Table 3.1). A

comparative account of species diversity of the grassland between the year 2010 and 2020 is shown in Figure 3.2.



**Figure 3.2: Comparative Plant species richness in 2010 and 2020 in Banni Protected Forest**

**Table 3.1: List of plants recorded by the rapid survey (monsoon 2020) from Banni Protected Forest**

Sr. No.	Family	Scientific Name	Local Name
		<b>Tree</b>	
1	Balanitaceae	<i>Balanites aegyptiaca</i> (L.) Del	Hingor
2	Ceasalpiniaceae	<i>Tamarindus indica</i> L.	Ambli
3	Mimosaceae	<i>Acacia leucophloa</i> (Roxb.) Wild.	Hirmo
4	Mimosaceae	<i>Acacia nilotica</i> (L.) Del. subsp. <i>indica</i> (Bth.) Brenan	Deshi Baval
5	Mimosaceae	<i>Prosopis cineraria</i> (L.) Druce	Khijdo
6	Meliaceae	<i>Azadirachta indica</i> A. Juss.	Limdo
7	Meliaceae	<i>Melia azadirach</i> L.	Pinjoro
8	Moraceae	<i>Ficus benghalensis</i> L.	Vad jo Zad
9	Moraceae	<i>Ficus racemosa</i> L.	Umerjo Zad
10	Myrtaceae	<i>Eucalyptus globules</i> Labil.	Nilgiri
11	Ehraceacea	<i>Cordia dohotoma</i> Forsk.	Gunda
12	Ehraceacea	<i>Cordia gharaf</i> (Forsk.) E. & A.	Liyar
13	Anacardiaceae	<i>Mangifera indica</i> L.	Ambo

Sr. No.	Family	Scientific Name	Local Name
14	Salvadoraceae	<i>Salvadora oleoides</i> Decne.	Khara Pilu
15	Salvadoraceae	<i>Salvadora persica</i> L.	Khari Zar, Pailu
16	Tamaricaceae	<i>Tamarix aphylla</i> (L.) Karst.	Lai
		<b>Shrub</b>	
17	Amaranthaceae	<i>Puppalia lappacea</i> (L.) Juss.	Gadar Bhurat
18	Asclepiadaceae	<i>Calotropis gigantea</i> (L.) R. Br.	Dholo Akad
19	Asclepiadaceae	<i>Calotropis procera</i> (Ait.) R. Br.	Akado
20	Convolvulaceae	<i>Ipomea fistulosa</i> Mart. Ex. Choisy	Besharmi
21	Capparaceae	<i>Cadaba fruticosa</i> (L.) Flem.	KaroPijaro,
22	Capparaceae	<i>Capparis decidua</i> (Forsk.) Edgew.	Kerado
23	Capparaceae	<i>Maerua oblongifolia</i> (Forsk) A. Rich	Pinjolo
24	Caesalpiniaceae	<i>Cassia angustifolia</i> Vahl	Sonmakai
25	Chenopodiaceae	<i>Atriplex stocksii</i> (Wt.) Boiss.	Khati Palakh,
26	Chenopodiaceae	<i>Suaeda fruticosa</i> (L.) Forsk. ex Gmel.	Khario Luno
27	Chenopodiaceae	<i>Suaeda nudiflora</i> (Willd.) Moq.	Morus
28	Euphorbiaceae	<i>Euphorbia caducifolia</i> Hains	Thor
29	Euphorbiaceae	<i>Ricinus communis</i> L.	Arenda
30	Fabaceae	<i>Alhagi maurorum</i> Medikus	Javaso, Javas
31	Fabaceae	<i>Indigofera oblongifolia</i> Forsk.	Zeel, Zeel Jo Zad
32	Fabaceae	<i>Indigofera tinctoria</i> L.	Nili Gari
33	Fabaceae	<i>Sesbania sesban</i> (L.) Meer.subsp. <i>sesban</i> var. <i>sesban</i>	Ekad
34	Liliaceae	<i>Aloe barbadensis</i> Mill.	Kunvar pathu
35	Liliaceae	<i>Asparagus racemosus</i> Willd. var. <i>javanicus</i> (Kunth) Baker	Akal Kandha Ni Val
36	Lythraceae	<i>Lawsonia inermis</i> L.	Mandhi
37	Malvaceae	<i>Abutilon indicum</i> (L.) subsp. <i>indicum</i>	Khapato
38	Malvaceae	<i>Abutilon ramosum</i>	Khapat
39	Malvaceae	<i>Hibiscus ovalifolius</i> (Forsk.) Vahl	San Bhindo, Kurad Val
40	Mimosaceae	<i>Prosopis Juliflora</i> (Sw) DC.	Gando Baval
41	Rhamnaceae	<i>Zizyphus nummularia</i> (Burm. F.) W. & A.	Bordi, Boedi,
42	Rutaceae	<i>Citrus limon</i> (L.) Burm.f.	Limbu
43	Solanaceae	<i>Solanum incanum</i> L.	Ubhi Ringni
44	Solanaceae	<i>Lycium barbarum</i> L.	Garothi, Gerati
45	Solanaceae	<i>Withania somnifera</i> (L.) Kurz.	Asun

Sr. No.	Family	Scientific Name	Local Name
46	Tamaricaceae	<i>Tamarix ericoides</i> Rottl.	Lai Jo Zad
		<b>Climber</b>	
47	Asclepiadaceae	<i>Leptadenia pyrotechnica</i> (Forsk.) Decne.	Khip
48	Asclepiadaceae	<i>Pentatropis spiralis</i> (Forsk.) Decne	Dhodheji
49	Asclepiadaceae	<i>Pergularia daemia</i> (Forsk.) Chiov.	Dudhariyal
50	Convolvulaceae	<i>Ipomoea pes-tigridis</i> L.	Fotiyal
51	Cucurbitaceae	<i>Coccinia grandis</i> (L.) Voigt	Tindora
52	Cucurbitaceae	<i>Corallocarpus epigeous</i> (Rottl. & Wild) Cl	Navi val
53	Cucurbitaceae	<i>Ctenolepis cerasiformis</i> (Stocks) Hk. f.	Dod Val,
54	Cucurbitaceae	<i>Cucumis callosus</i> (Rottl.) Cogn.	Kotimbda vel,
55	Cucurbitaceae	<i>Cucumis prophetarum</i> L.	Indriyal
56	Cucurbitaceae	<i>Momordica balsamina</i> L.	Adbau Karela
57	Cucurbitaceae	<i>Mukia maderespatensis</i> (L.) M. Roem.	Ankhfutmani
58	Euphorbiaceae	<i>Dalechampia scandens</i> L. var. <i>cordofana</i>	Char Val
59	Fabaceae	<i>Rhynchosia minima</i> (L.) DC. var. <i>minima</i>	Mogariyal
		<b>Herb</b>	
60	Euphorbiaceae	<i>Acalypha indica</i> L.	Dadar jo zad
61	Acanthaceae	<i>Blepharis maderaspatensis</i> (L.) Roth	Uti Gan
62	Acanthaceae	<i>Peristrophe bicalyculata</i> (Retz.) Nees	Lasi Adhedi
63	Aizoaceae	<i>Zaleya decandra</i> Burm.	Bethi Satodi
64	Amaranthaceae	<i>Achyranthes aspera</i> L. var. <i>porphyristachya</i> Hk. f.	Vado Andhado
65	Amaranthaceae	<i>Aerva persica</i> (Burm.f.) Merril	Bou
66	Amaranthaceae	<i>Aerve lanata</i> (L.) Juss	Gorkhadi
67	Amaranthaceae	<i>Alternanthera sessilis</i> (L.) DC	Kantaro Jar Bhangaro
68	Amaranthaceae	<i>Amaranthus viridis</i> L.	Adbau Rajgaro
69	Amaranthaceae	<i>Celosia argentea</i> L.	Lampadi
70	Amaranthaceae	<i>Digera muricata</i> (L.) Mart.	Lolar
71	Apocynaceae	<i>Catharanthus roseus</i> L.	Asi sada
72	Aristolochiaceae	<i>Aristolochia bracteolata</i> Lamk.	Kida Mari

Sr. No.	Family	Scientific Name	Local Name
73	Asteraceae	<i>Blainvillea acmella</i> (L.) Philip.	Aso Bhangaro
74	Asteraceae	<i>Blumea eriantha</i> DC	-
75	Asteraceae	<i>Echinops echinatus</i> Roxb.	Utkanto, Utkandheri,
76	Asteraceae	<i>Eclipta prostrata</i> (L.) L. Mant.	Bhangaro
77	Asteraceae	<i>Grangea maderaspatana</i> (L.) Poir.	Nandheri Gorakh Val
78	Asteraceae	<i>Launaea procumbens</i> Roxb.	Moti Bhonpatri
79	Asteraceae	<i>Launaea resedifolia</i> (L.) Druce	Dhariyai Gurval
80	Asteraceae	<i>Oligochaeta ramosa</i> (Roxb.) Wagenitz	Kandhari, Nandhi Uth
81	Asteraceae	<i>Pulicaria wightiana</i> (DC.) Cl.	Son Fuladi
82	Asteraceae	<i>Vernonia cinerea</i> (L.) Less.	Sadodi
83	Boraginaceae	<i>Coldemia procumbens</i> L.	Ukharad
84	Boraginaceae	<i>Heliotropium marifolium</i> Koen.ex Retz. var. <i>marifolium</i>	Dungario Agio
85	Caesalpiniaceae	<i>Cassia italica subsp. micrantha</i> Brenan	Mindhiavar,
86	Caesalpiniaceae	<i>Cassia pimila</i> Lam.	Rato Chon
87	Capparaceae	<i>Cleome gynandra</i> L. Var. <i>gynandra</i>	Bidhro
88	Capparaceae	<i>Cleome viscosa</i> L.	Badhod
89	Caryophyllaceae	<i>Polycarpaea corymbosa</i> (L.) Lam.	Jangali soa
90	Chenopodiaceae	<i>Chenopodium album</i> L	Chir
91	Commelinaceae	<i>Commelina diffusa</i> Burm.f.	-
92	Convolvulaceae	<i>Convolvulus arvensis</i> L.	Neri val
93	Convolvulaceae	<i>Convolvulus microphyllus</i> (Roth) Sieb. ex Spr.	Mankhani
94	Convolvulaceae	<i>Cressa cretica</i> L.	Oin
95	Convolvulaceae	<i>Evolvulus alsinoides</i> (L.) L. var. <i>linifolius</i> (L.) Baker	Kari Sankhval
96	Elatinaceae	<i>Bergia capensis</i> L.	Rapatri
97	Euphorbiaceae	<i>Croton bonplandianum</i> Baill.	-
98	Euphorbiaceae	<i>Crozophora rottleri</i> (Geis.) Juss	Karo Okharad
99	Euphorbiaceae	<i>Euphorbia hirta</i> L.	Vadi Dudheli
100	Euphorbiaceae	<i>Euphorbia thymifolia</i> L.	Pat Dudhi
101	Euphorbiaceae	<i>Phyllanthus fraternus</i> Webst.	Pat Amari
102	Fabaceae	<i>Alysicarpus longifolius</i> (Rottl. ex Spr.) W. & A.	Vado Sanervo
103	Fabaceae	<i>Alysicarpus monilifer</i> (L.) DC. var. <i>monilifer</i>	Shanervo

Sr. No.	Family	Scientific Name	Local Name
104	Fabaceae	<i>Goniogyna hirta</i> (Willd.) Ali	Undarkani
105	Fabaceae	<i>Indigofera cordifolia</i> Heyne ex Willd.	Gadar Gari
106	Fabaceae	<i>Indigofera linnaei</i> Ali.	Fatakiya
107	Fabaceae	<i>Tephrosia uniflora</i> Pers. subsp. <i>Petrosa</i>	Sarpankhi
108	Gentianaceae	<i>Enicostema axillare</i> (Lamk.) Roynal	MameCho
109	Lamiaceae	<i>Leucas aspera</i> (Willd.) Spr.	Gumu
110	Lamiaceae	<i>Ocimum canum</i> Sims in bot.Mag.	Tak Marvo
111	Lythraceae	<i>Ammannia baccifera</i> L.	Rato Jal Agio
112	Lythraceae	<i>Ammannia desertorum</i> Blatt. & Hallb	Rato Jal Agio
113	Malvaceae	<i>Pavonia arabica</i> Steud. var. <i>Arabica</i>	Rato Balbuwaro
114	Malvaceae	<i>Sida acuta</i> Burm. f.	Adbau Balbuwaro
115	Malvaceae	<i>Sida cordifolia</i> L.	Barabovaro,
116	Mimosaceae	<i>Mimosa hamata</i> Willd.	Kai bavari
117	Molluginaceae	<i>Glinus lotoides</i> L.	Aso Okharad
118	Molluginaceae	<i>Mollugo cerviana</i> Ser.	Jaras
119	Molluginaceae	<i>Mollugo pentaphylla</i> L.	-
120	Nyctaginaceae	<i>Boerhavia diffusa</i> L.	Rafadi
121	Nyctaginaceae	<i>Commicarpus verticillatus</i> (Peir) Standl	Dhokariyar
122	Papavaraceae	<i>Argemon Mexicana</i> L.	Darudi
123	Polygalaceae	<i>Polygala erioptera</i> DC. var. <i>erioptera</i>	Patsan
124	Polygonaceae	<i>Polygonum plebeium</i> R. Br. var. <i>indica</i> (Heyne ex Roth) Hook.	Ratanjyot
125	Portulacaceae	<i>Portulaca meridiana</i> L.	Zinaki Luni
126	Portulacaceae	<i>Portulaca oleracea</i> L.	Lakha Luni
127	Portulacaceae	<i>Sesuvium Protulacastrum</i>	-
128	Rubiaceae	<i>Borreria articularis</i> (L.f.) F.N. Will.	Bikan, Baakan Jo Zad
129	Sapindaceae	<i>Cardiospermum halicacabum</i> L.	Bkan Fofti,
130	Scrophulariaceae	<i>Bacopa monnieri</i> (L.) Pennell	Kadvi Naveri
131	Scrophulariaceae	<i>Leucas cephalotes</i>	Piri Sadedi
132	Solanaceae	<i>Physalis longifolia</i> Nutt.	Fofati, Fotaji Val
133	Solanaceae	<i>Physalis minima</i> L.	Fofati, Fad
134	Solanaceae	<i>Solanum surattense</i> Burm. f.	Jangali Ringani
135	Tiliaceae	<i>Corchorus aestuans</i> L.	Kag Gisodi, Kag

Sr. No.	Family	Scientific Name	Local Name
			Kela
136	Tiliaceae	<i>Corchorus capsularis</i> L.	Dodali
137	Tiliaceae	<i>Corchorus depressus</i> (L.) Stocks	Mundheri
138	Tiliaceae	<i>Corchorus olitorius</i> L.	Chunchh
139	Zygophyllaceae	<i>Fagonia bruguieri</i> DC. var. <i>bruguieri</i>	Dhramau, Dhamaso,
140	Zygophyllaceae	<i>Fagonia schweienfurthii</i> (Hadidi) Hadidi	Dhramau
141	Zygophyllaceae	<i>Tribulus terrestris</i> L.	Akanthi
142	Zygophyllaceae	<i>Zygophyllum simplex</i> L.	Pat Lani
		<b>Grass</b>	
143	Cyperaceae	<i>Cyperus difformis</i> L.	Chiyo
144	Cyperaceae	<i>Cyperus haspan</i> L.	Chiyo, Nidan moth
145	Cyperaceae	<i>Cyperus rotundus</i> L. Subsp. <i>Rotundus</i>	Moth
146	Cyperaceae	<i>Frimbristylis millicea</i> (L.)	Chiyo, Nidan moth
147	Poaceae	<i>Aeluropus lagopoides</i> (L.) Trin. ex Thw.	Khario Ga
148	Poaceae	<i>Apluda mutica</i> L.	Bhungario Ga
149	Poaceae	<i>Aristida adscensionis</i> L. subsp. <i>adscensionis</i>	Jandhar Lambha Ga
150	Poaceae	<i>Aristida funiculata</i> Trin. & Rupr.	Laso Lambh
151	Poaceae	<i>Bothriochloa pertusa</i> (L.) A. Camus	Jinjavu Ga
152	Poaceae	<i>Brachiaria ramosa</i>	Para ghas
153	Poaceae	<i>Cenchrus biflorus</i> auct.	Dhaman Gha,
154	Poaceae	<i>Cenchrus ciliaris</i> L.	Dhaman Gha
155	Poaceae	<i>Cenchrus setigerus</i> Vahl	Anajaniyo
156	Poaceae	<i>Chloris barbata</i> Sw.	Rusad Gha
157	Poaceae	<i>Chloris virgata</i> Sw.	Rusad Gha,
158	Poaceae	<i>Cynodon dactylon</i> (L.) Pers.	Chhabbar Gha
159	Poaceae	<i>Dactyloctenium aegypticum</i> (L.) P. Beauv.	Kagatango Gha,
160	Poaceae	<i>Dactyloctenium scindicum</i> Boiss	Chund gha
161	Poaceae	<i>Desmostachya bipinnata</i> (L.) Stapf	Darab, Gha, Dab
162	Poaceae	<i>Dichanthium annulatum</i> (Forak.) Stapf	Dunuhi gha
163	Poaceae	<i>Digitaria adscendens</i> (H.B.&K.) Henr.	-
164	Poaceae	<i>Digitaria pennata</i> (Hochst.)	-

Sr. No.	Family	Scientific Name	Local Name
		Cooke	
165	Poaceae	<i>Dinebra retroflexa</i> (Vahl) Panz	Viper
166	Poaceae	<i>Echinochloa colonum</i> (L.) Link	Sanvadha Sau
167	Poaceae	<i>Eleusine compressa</i> (Forsk.) Aschers. & Schweinf.	Gandhiro Gha,
168	Poaceae	<i>Eleusine indica</i> (L.) Gaertn.	Adbau Madanu
169	Poaceae	<i>Elyonurus royleanus</i> Nees ex A. Rich.	-
170	Poaceae	<i>Eragrostis ciliaris</i> (L.) R. Br. <i>var. ciliaris</i>	Fuliyu Gah
171	Poaceae	<i>Eragrostis minor</i> Host. Icon.Deser.Gram.	-
172	Poaceae	<i>Eragrostis tenella</i> (L.) P. Beauv. ex R. & S.	Limor
173	Poaceae	<i>Eragrostis tremula</i> Hochst.	Marmar
174	Poaceae	<i>Eragrostis unioides</i> (Retz.) Nees ex Steud	-
175	Poaceae	<i>Melanocenchrus jacquemontii</i> J. & S.	Vekar
176	Poaceae	<i>Panicum miliaceum</i> L.	Moraiyo
177	Poaceae	<i>Panicum antidotale</i> Retz.	Gum Gha
178	Poaceae	<i>Pennisetum glaucum</i> R. Br.	Bajra
179	Poaceae	<i>Saccharum spontaneum</i> L.	Kan Gha,
180	Poaceae	<i>Setaria glauca</i> (L.) P. Beauv.	Sani Bhichdi
181	Poaceae	<i>Sorghum bicolor</i> (L.) Moench	Juwar
182	Poaceae	<i>Sporobolus coromandelianus</i> (Retz.) Kunth	Khariyu Ga
183	Poaceae	<i>Sporobolus fertilis</i> (Steud.) Clayton	Ganthiar, Khari Ga,
184	Poaceae	<i>Sporobolus helvolus</i> (Trin.) Th. Dur. et Sch	Khevai
185	Poaceae	<i>Sporobolus marginatus</i> Hochst. ex A. Rich.	Khevai Ga
186	Poaceae	<i>Tetrapogon tenellus</i> (Roxb.)Chiove	Kagio,Chinki
187	Poaceae	<i>Themeda triandra</i> Forsk.	Rato Gha
188	Poaceae	<i>Tragus biflorus</i> (Roxb.) Schult.	Gah
189	Poaceae	<i>Urochondra setulosus</i> (Trin.) Hubb	Kkariyu Gah

### 3.1.2.1. Plant Species Diversity

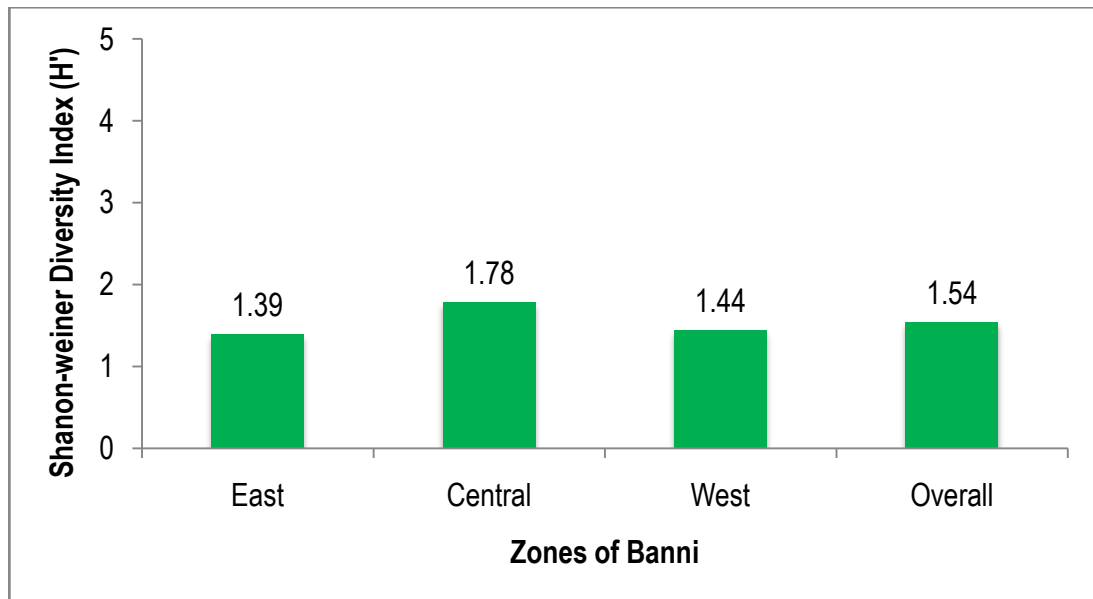
A rapid survey using sample quadrates during monsoon assessed plant diversity characteristics of the grassland by dividing the entire grassland into East Banni, Central Banni, and West Banni region. As per the analysis, the maximum number of species were recorded from Central Banni with the highest Shannon-Weiner Diversity Index ( $H'$ ) and Simpson diversity Index, followed by West Banni and lowest in the East Banni (Table 3.2 and Figure 3.3). The Margalef species richness was also highest in Central Banni, followed by East Banni and West Banni (Table 3.2 and Figure 3.4). The Species Dominance ( $D$ ) was found highest in East Banni, followed by West Banni and lowest in Central Banni while species evenness was recorded highest in West Banni, followed by East Banni and Central Banni region. Overall in Banni, a total of 49 species were recorded with Shannon-Weiner species diversity Index ( $H'$ ) of 1.54 and Margalef species richness of 1.51 (Table 3.2).

**Table 3.2: Diversity of plant species in Banni Protected Forest**

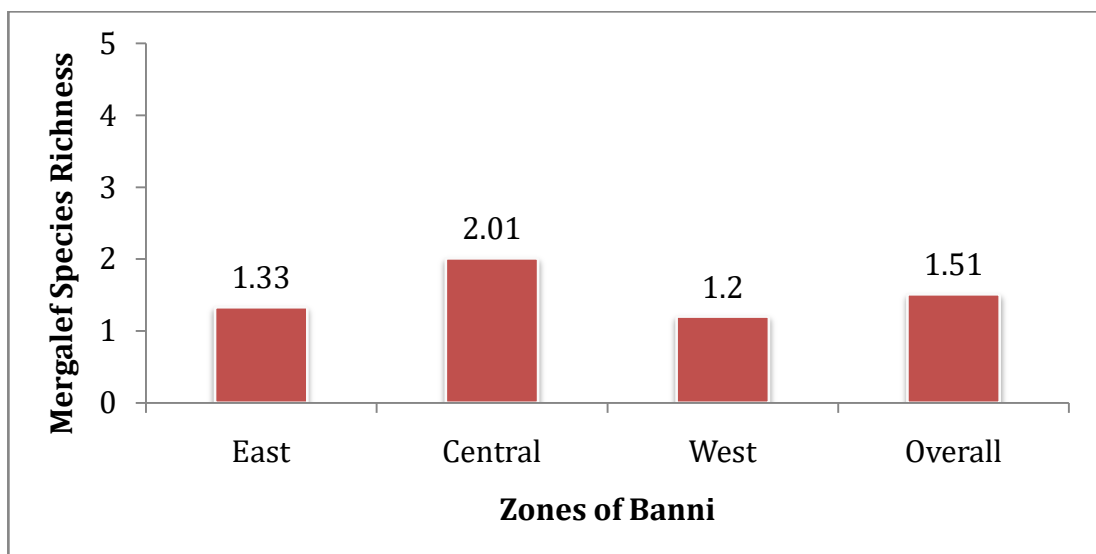
Diversity characteristics	East	Central	West	Overall
Species	21	36	28	49
Individuals	1336	2159	906	4401
Dominance ( $D$ )	0.35	0.28	0.31	0.31
Simpson Diversity ( $1-D$ )	0.65	0.72	0.69	0.69
Shannon-Weiner diversity ( $H'$ )	1.39	1.78	1.44	1.54
Evenness ( $e^{H/S}$ )	0.63	0.58	0.73	0.65
Margalef species richness	1.33	2.01	1.20	1.51
Equitability ( $J$ )	0.71	0.72	0.81	0.75

Vegetation analysis were made to understand the distribution of different habits viz. herb, shrub and tree of the grassland based on species diversity. species diversity (Shannon-weiner Diversity Index) of different plant habit in different parts of the grassland is shown in figure 2.9 and figure 2.11.

The analysis of species diversity of different plant habits of the grassland highlighted the fact that species diversity of herbs, shrub and tree also varied between different parts of the grassland. The Shannon-Weiner Species Diversity Index of grasses were varied between less than 0.5 to maximum of 2.5 (Figure 3.5) while Shannon-Weiner species diversity index of shrub and tree varied between 0 to 2 (Figure 3.6) and 0 to 1 (Figure 3.7) respectively in different parts of the grassland.



**Figure 3.3: Plant Species Diversity in different zones of Banni Protected Forest**



**Figure 3.4: Plant Species Richness in different zones of Banni Protected Forest**

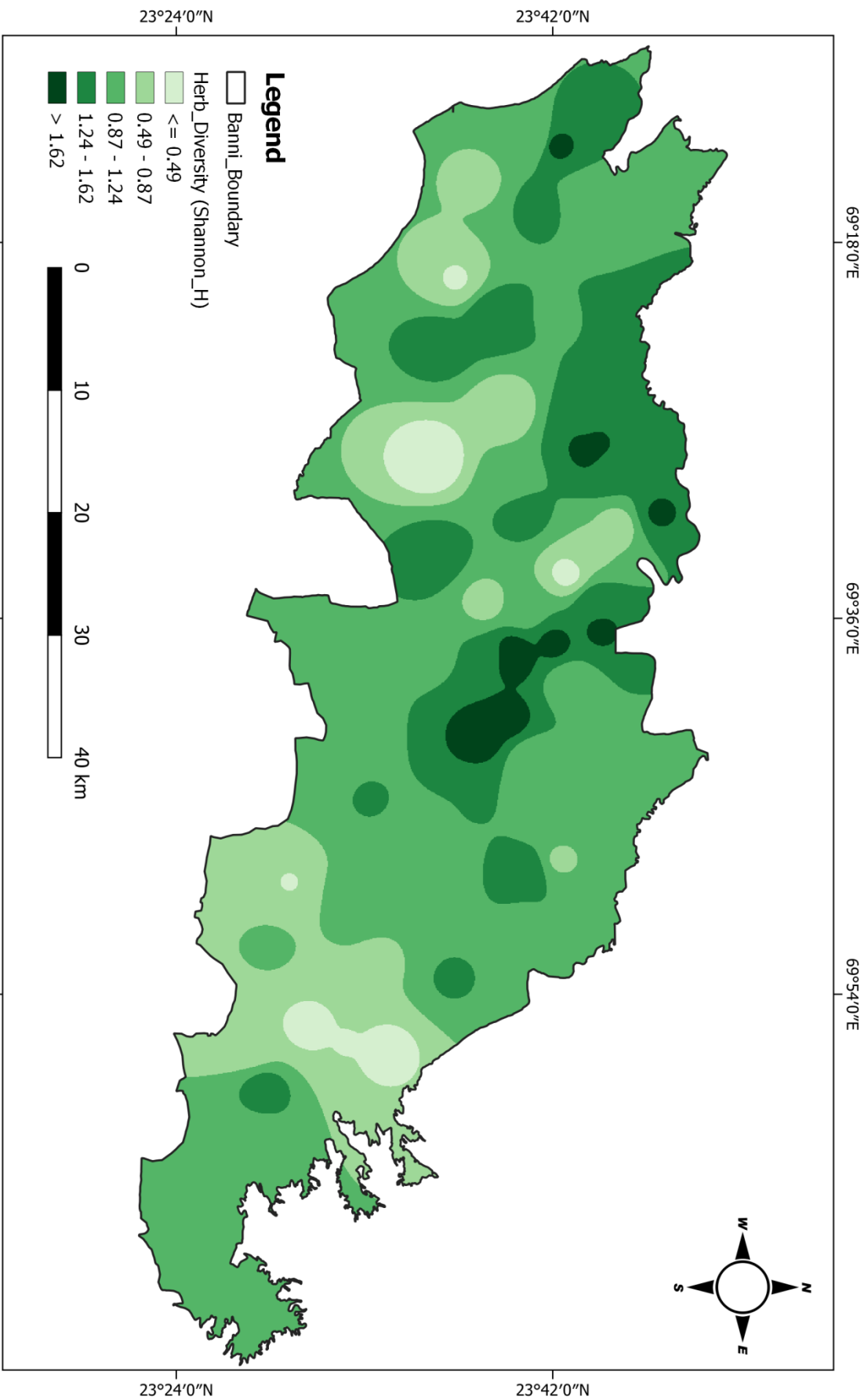


Figure 3.5: showing the species diversity of herbaceous vegetation in the Banni Protected Forest

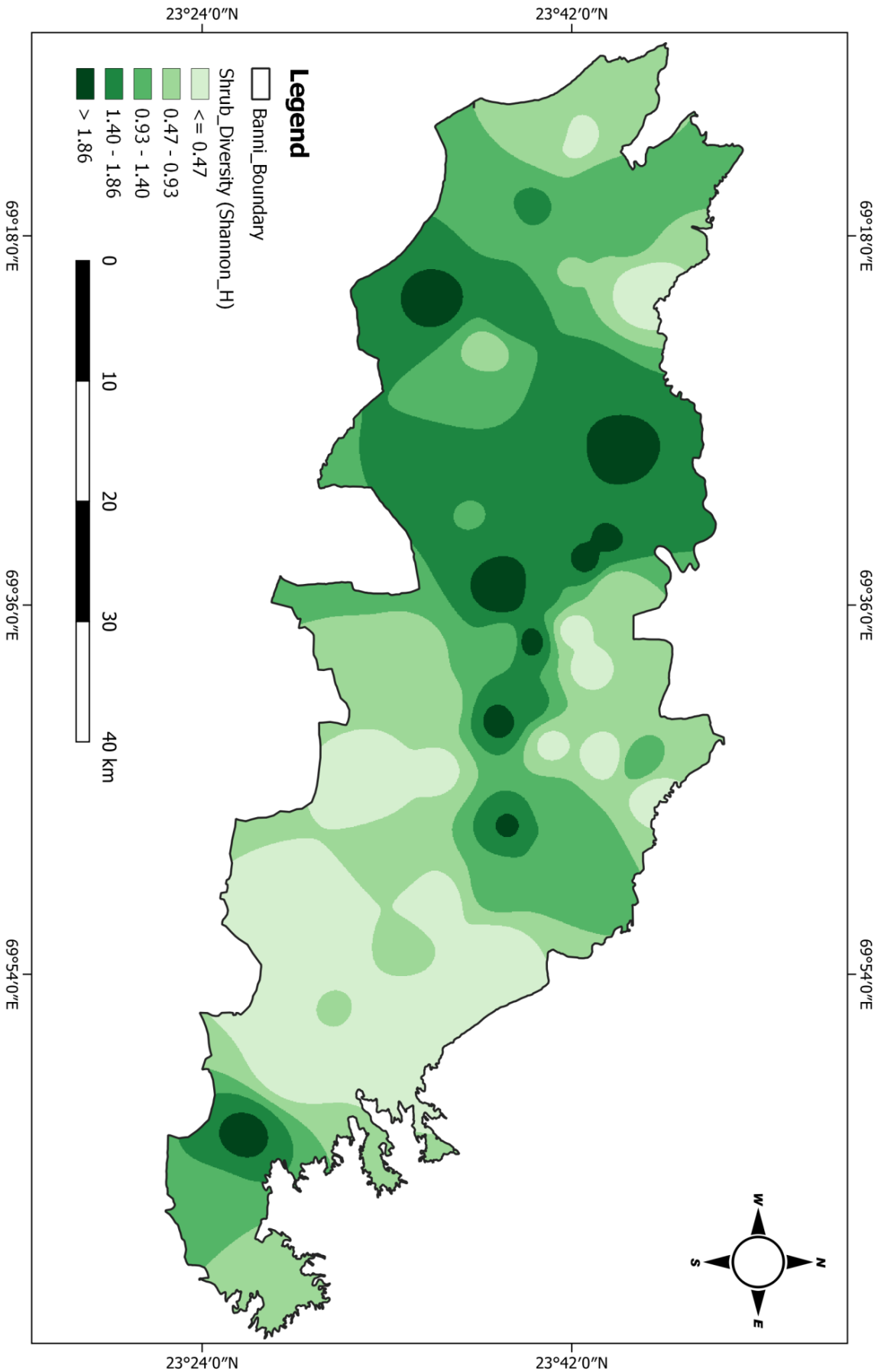


Figure 3.6: showing the species diversity of shrub vegetation in the Banni Protected Forest

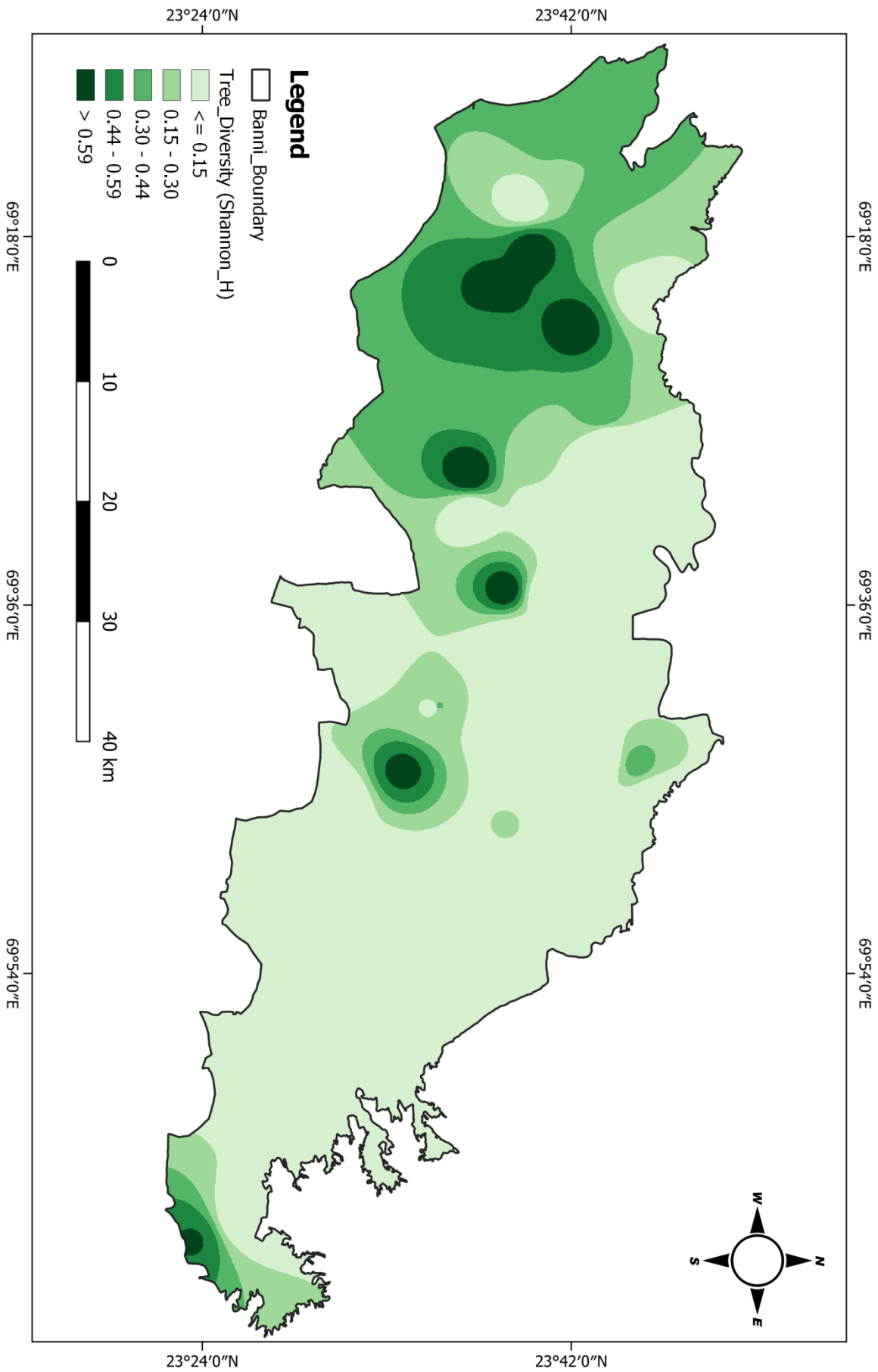


Figure 3.7 : showing the species diversity of tree vegetation in the Banni Protected Forest

### 3.1.2.2. Density, Frequency and Abundance of vegetation

The rapid survey also observed the phyto-sociological status of vegetation based on quadrat sampling. The density of different plant habits viz. herb, shrub and tree in different parts of the grassland is shown in figure 2.6 and figure 2.8. Similarly, The analysis highlighted the fact that density of herb, shrub and tree in different parts of the grassland are not uniform and patchily distributed. The density of herbs were varied from less than 5 individuals/quadrat (size: 25cm X 25cm) to a maximum of 20 individuals/quadrat (Figure 3.8) while density of shrub and trees varied between 0 to 5.5 individuals/quadrat (size: 5m X 5m) (Figure 3.9) and 0 to 1.7 individuals/quadrat (size: 10m X 10m) (Figure 3.10) respectively.

The survey recorded the highest frequency of *Cressa cretica* (100%), *Cyprus rotundus* (100%), and *Prosopis juliflora* (100%) among the recorded plant species in east Banni, and in central Banni highest frequency was recorded of *Prosopis juliflora* (87%), followed by *Brachiaria ramosa* (75%), while in west Banni highest frequency recorded was of *Cressa cretica*, *Cyprus rotundus*, *Suaeda nudiflora* and *Prosopis juliflora* (100%) (Table 3.3). In overall Banni, highest frequency recorded of *P. juliflora*, followed by *Cyprus rotundus* and *Cressa cretica*.

As per the rapid vegetation survey, *Cyprus rotundus* was the most abundant plant species, followed by *Cressa cretica* and *Aeluropus lagopoides* in east Banni. Similarly, *Cyprus rotundus* was the most abundant species in central Banni, followed by *Cressa cretica* and *Chloris barbata*. In west Banni, the most abundant species was *Chloris barbata*, followed by *Cyprus rotundus* and *Aeluropus lagopoides*. In overall Banni, *Cyprus rotundus* was the most abundant plant species, followed by *Cressa cretica* and *Chloris barbata* (Table 3.3).

*Cyprus rotundus* was highest in density among the recorded plant species of Banni, followed by *Cressa cretica*, *Chloris barbata* and *Aeluropus lagopoides* (Table 3.4). While among the tree and shrub species, *P. juliflora* was highest in density in Banni due to its invasive nature.

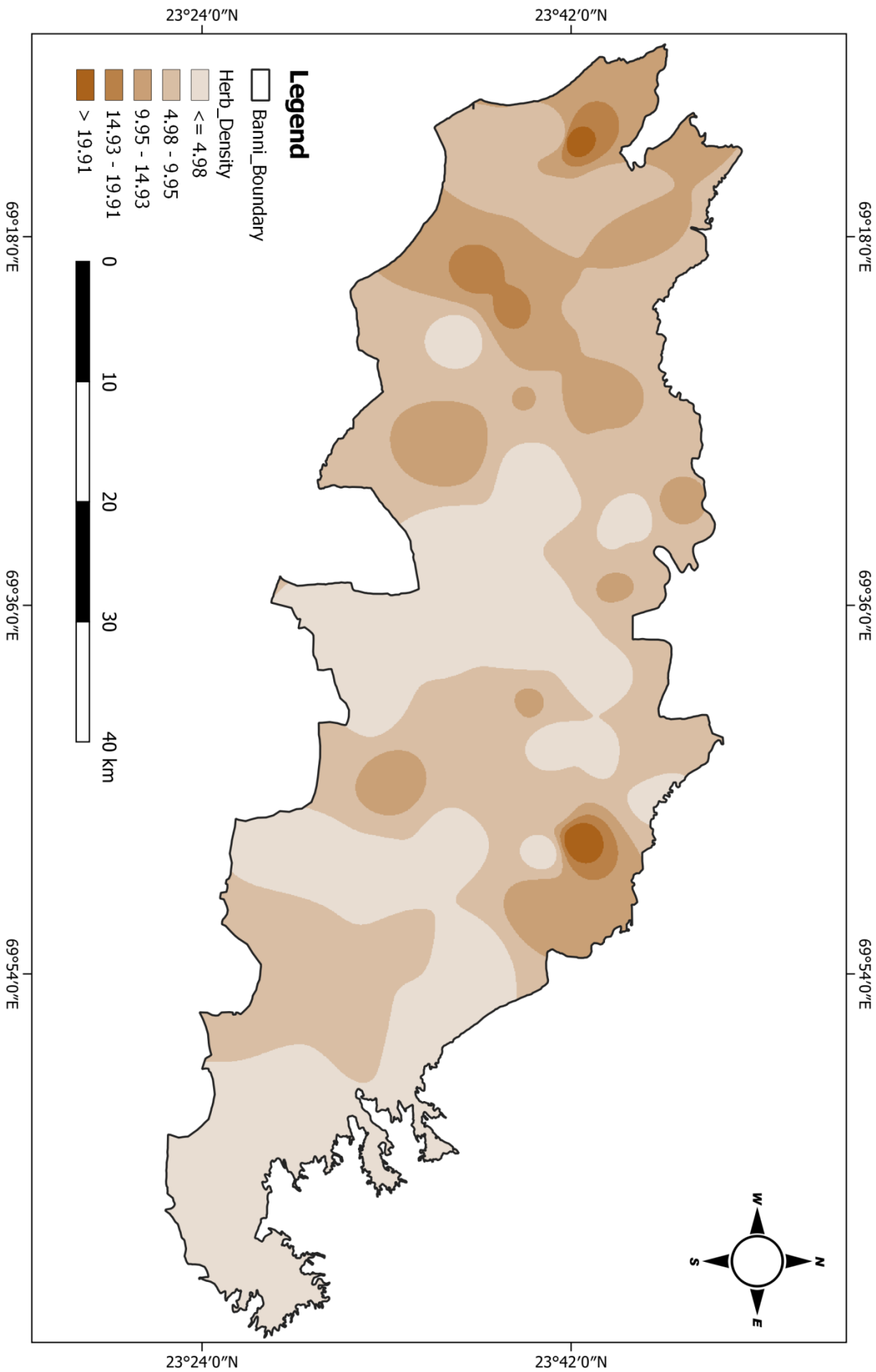


Figure 3.8: showing the density of herbaceous vegetation in the Banni Protected Forest

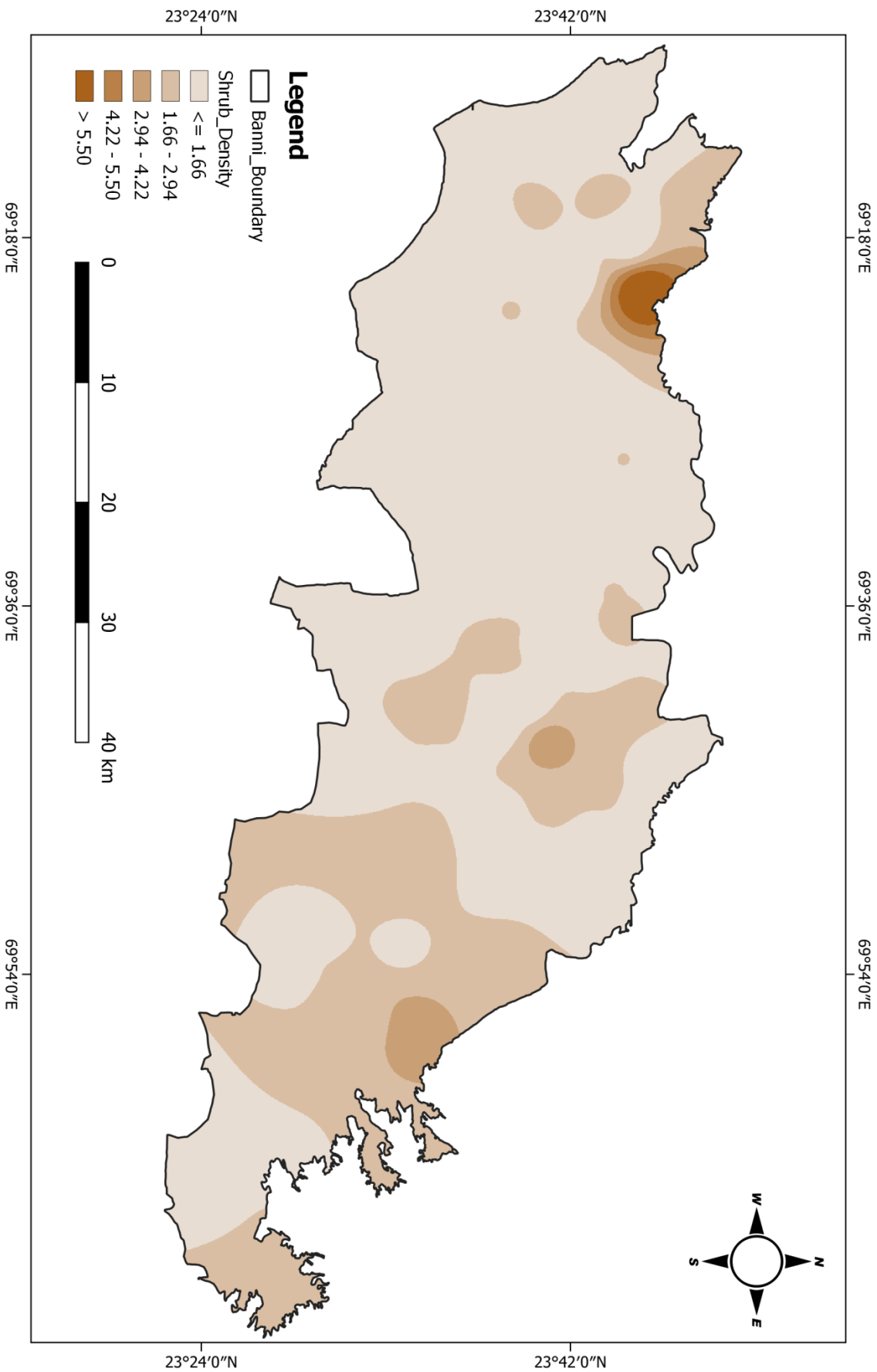


Figure 3.9: showing the density of shrub vegetation in the Banni Protected Forest

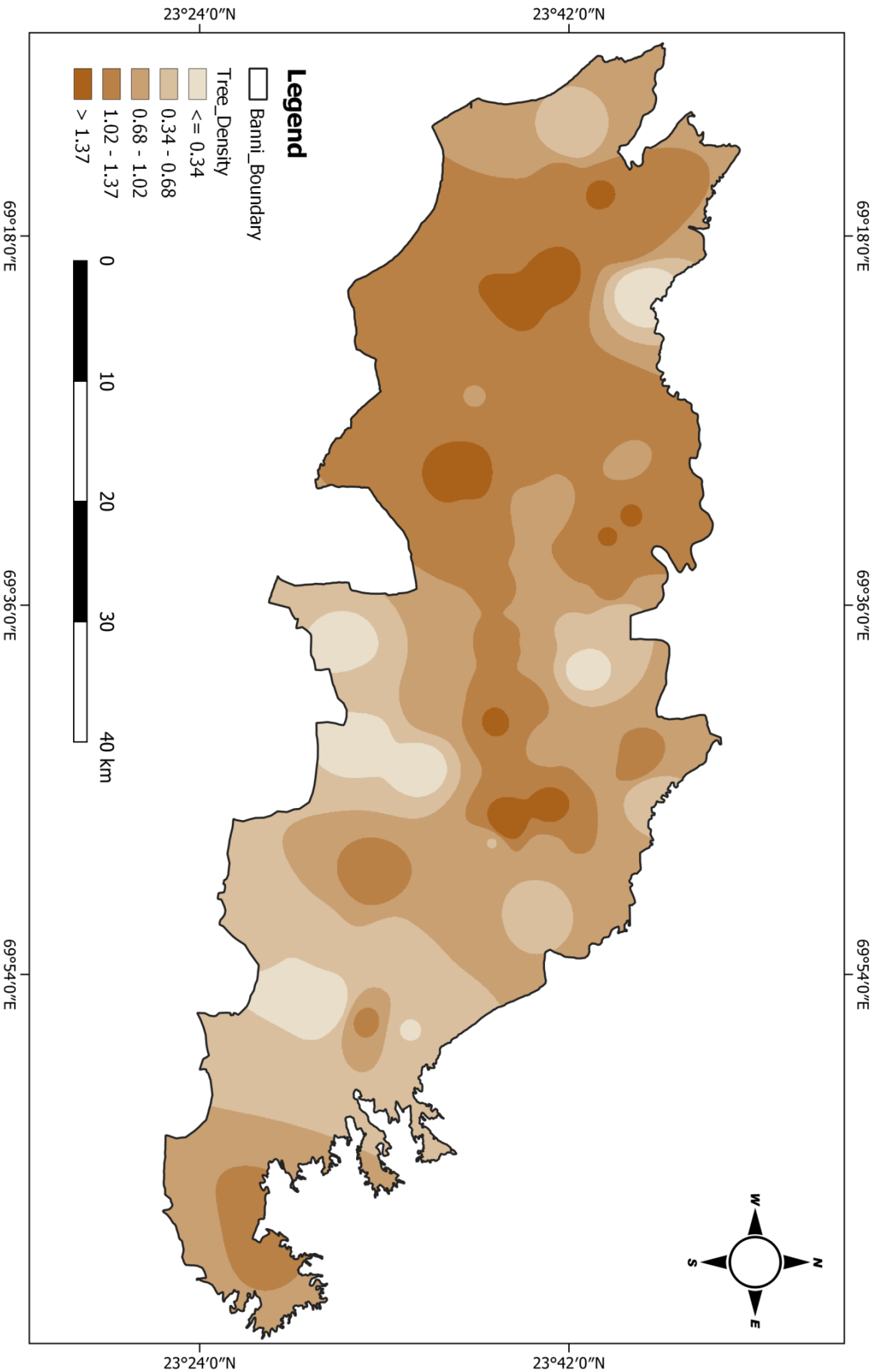


Figure 3.10: showing the density of tree vegetation in the Banni Protected Forest

Table 3.3: Phytosociology of plant species in Banni Protected Forest

Sl. No.	Plant species	Frequency			Abundance			Density		
		East	Central	West	East	Central	West	East	Central	West
1	<i>Acacia nilotica (L.) Del.</i>	-	12.50	-	-	1.00	-	-	0.13	-
2	<i>Achyranthes aspera L.</i>	-	12.50	-	-	2.00	-	-	0.25	-
3	<i>Aeluropus lagopoides (L.) Trin. ex Thw.</i>	60	37.50	42.86	17.67	26.33	29.00	10.60	9.88	12.43
4	<i>Ammannia baccifera L.</i>	-	12.50	28.57	-	24.00	15.50	-	3.00	4.43
5	<i>Aristida histricula Edgew.</i>	-	12.50	-	-	27.00	-	-	3.38	-
6	<i>Bacopa monnieri (L.) Pennell</i>	-	-	14.29	-	-	10.00	-	-	1.43
7	<i>Blumea eriantha DC</i>	20	-	-	11.00	-	-	2.20	-	-
8	<i>Launaea procumbens Roxb</i>	20	-	-	7.00	-	-	1.40	-	-
9	<i>Brachiaria ramosa (L.) Stapf</i>	60	62.50	-	7.00	14.40	-	4.20	9.00	-
10	<i>Calotropis procera (Ait.) R. Br.</i>	-	50.00	-	-	1.00	-	-	0.50	-
11	<i>Capparis decidua (Forsk.) Edgew.</i>	-	37.50	14.29	-	1.00	2.00	-	0.38	0.29
12	<i>Chloris barbata Sw.</i>	60	75.00	28.57	14.33	36.00	48.50	8.60	27.00	13.86
13	<i>Convolvulus microphyllus (Roth) Sieb. ex Spr</i>	20	-	-	7.00	-	-	1.40	-	-
14	<i>Corchorus depressus (L.) Stocks</i>	-	37.50	14.29	-	9.67	6.00	-	3.63	0.86
15	<i>Corchorus olitorius L.</i>	20	25.00	14.29	2.00	8.50	3.00	0.40	2.13	0.43
16	<i>Cressa cretica L.</i>	100	62.50	71.43	77.40	68.20	24.60	77.40	42.63	17.57

Sl. No.	Plant species	Frequency			Abundance			Density		
		East	Central	West	East	Central	West	East	Central	West
17	<i>Cyperus glomeratus</i>	-	12.50	-	-	5.00	-	-	0.63	-
18	<i>Cyperus rotundus L.</i>	100	62.50	71.43	140.80	132.80	46.60	140.80	83.00	33.29
19	<i>Dactyloctenium aegyptium (L.) P. B.</i>	20	37.50	14.29	13.00	24.33	24.00	2.60	9.13	3.43
20	<i>Dactyloctenium indicum Boiss.</i>	-	25.00	-	-	7.50	-	-	1.88	-
21	<i>Dichanthium annulatum (Forak.) Stapf</i>	-	25.00	-	-	6.00	-	-	1.50	-
22	<i>Digera muricata (L.) Mart.</i>	-	-	28.57	-	-	2.00	-	-	0.57
23	<i>Echinochloa colonum (L.) Link</i>	20	37.50	-	3.00	20.67	-	0.60	7.75	-
24	<i>Eclipta prostrata (L.) L. Mant.</i>	-	12.50	-	-	25.00	-	-	3.13	-
25	<i>Eleusine indica (L.) Gaertn.</i>	-	12.50	-	-	11.00	-	-	1.38	-
26	<i>Eragrostis ciliaris (L.)</i>	40	50.00	-	6.50	16.00	-	2.60	8.00	-
27	<i>Eragrostis japonica</i>	-	50.00	-	-	25.50	-	-	12.75	-
28	<i>Eragrostis tremula Hochst.</i>	-	-	14.29	-	-	23.00	-	-	3.29
29	<i>Euphorbia hirta L.</i>	-	12.50	-	-	12.00	-	-	1.50	-
30	<i>Euphorbia thymifolia L.</i>	-	12.50	14.29	-	6.00	3.00	-	0.75	0.43
31	<i>Evolvulus alsinoides (L.)</i>	-	12.50	-	-	17.00	-	-	2.13	-
32	<i>Frimbristylis millicea (L.)</i>	-	12.50	42.86	-	16.00	15.67	-	2.00	6.71
33	<i>Goniogyna hirta (Willd.) Ali</i>	-	37.50	14.29	-	11.33	11.00	-	4.25	1.57

Sl. No.	Plant species	Frequency			Abundance			Density		
		East	Central	West	East	Central	West	East	Central	West
34	<i>Heliotropium marifolium Koen. ex Retz.</i>	20	25.00	-	6.00	4.50	-	1.20	1.13	-
35	<i>Indigofera linifolia Retz.</i>	-	12.50	-	-	24.00	-	-	3.00	-
36	<i>Indigofera limnaei Ali.</i>	-	25.00	-	-	6.50	-	-	1.63	-
37	<i>Cyperus haspan L.</i>	-	12.50	-	-	8.00	-	-	1.00	-
38	<i>Leucas aspera (Willd.) Spr.</i>	-	12.50	-	-	10.00	-	-	1.25	-
39	<i>Mollugo cerviana Ser.</i>	-	12.50	-	-	3.00	-	-	0.38	-
40	<i>Mukia maderaspatensis (L.) M. Roem.</i>	-	12.50	-	-	1.00	-	-	0.13	-
41	<i>Pavonia arabica Steud</i>	20	12.50	-	1.00	7.00	-	0.20	0.88	-
42	<i>Physalis minima L.</i>	-	25.00	14.29	-	3.50	8.00	-	0.88	1.14
43	<i>Portulaca meridiana L.</i>	20	12.50	14.29	8.00	3.00	3.00	1.60	0.38	0.43
44	<i>Prosopis juliflora (Sw) DC.</i>	100	87.50	71.43	3.60	4.14	5.60	3.60	3.63	4.00
45	<i>Salvadora persica L.</i>	20	-	14.29	1.00	-	1.00	0.20	-	0.14
46	<i>Sporobolus helvolus (Trin.) Th. Dur. et Sch</i>	20	-	28.57	8.00	-	8.00	1.60	-	2.29
47	<i>Suaeda fruticosa (L.) Forsk. ex Gmel.</i>	-	12.50	14.29	-	21.00	6.00	-	2.63	0.86
48	<i>Suaeda nudiflora (Willd.) Moq.</i>	40	62.50	71.43	15.00	18.20	24.00	6.00	11.38	17.14
49	<i>Vernonia cinerea (L.) Less.</i>	-	-	28.57	-	-	10.00	-	-	2.86

A total of 16 species of palatable grasses have been recorded recently through rapid survey and their composition and phytosociology have been estimated (Table 3.4).

Table 3.4.: List of palatable species of livestock in Banni Protected Forest

Sl No	Grass species	Frequency (%)	Abundance	Density
1	<i>Aristida adscensionis</i>	10.00	77.83	77833
2	<i>Cenchrus biflorus</i>	5.00	3.67	1833
3	<i>Chloris barbata</i>	43.33	16.58	71833
4	<i>Cynodon dactylon</i>	13.33	5.25	7000
5	<i>Dactyloctenium aegypticum</i>	10.00	21.33	21333
6	<i>Dactyloctenium indicum</i>	8.33	9.60	8000
7	<i>Desmostachyabipinnata</i>	35.00	12.52	43833
8	<i>Echinochloa colonum</i>	46.67	15.75	73500
9	<i>Eleusine compressa</i>	5.00	17.33	8667
10	<i>Eleusine indica</i>	46.67	28.46	132833
11	<i>Eragrostis ciliaris</i>	11.67	16.86	19667
12	<i>Setaria glauca</i>	10.00	26.67	26667
13	<i>Sporobolus coromandelianus</i>	11.67	16.14	18833
14	<i>Sporobolus fertilis</i>	55.00	8.27	45500
15	<i>Sporobolus helvolus</i>	31.67	5.63	17833
16	<i>Tetrapogon tenellus</i>	8.33	9.40	7833

**3.2. Status of biodiversity conservation in forests:** Banni a protected forest, therefore, as per the provision of the Indian Forest Act and Forest Conservation Act, 1980 the biodiversity of this unique grassland is conserved. The major focus in the grassland is to protect the grassland ecosystem by conserving and enhancing grass species and its productivity. Eco-restoration activities of Banni grassland was initiated by the Gujarat Ecology Commission in the year 1998. Later on, Grassland Action Plan was prepared in the year 2009 by the forest department.

The Banni Grassland Division has implemented various *in-situ* conservation activities to protect sensitive/RET/ IUCN Red List species and their habitats within the grassland. The eastern part of the grassland is protected under Kachchh Desert Wildlife Sanctuary and some of the western parts are protected under Chharidandh Conservation Reserve as per the provision of Indian Wildlife (Protection) Act, 1972.

- 3.3. Status of species prone to overexploitation:** Being a grassland, palatable grass species are grazed by large number of livestock owned by Maldharies. Free grazing is practised since historical time in the Banni grassland. No other species of this grassland are exploited by the locals. After the invasion of *P. juliflora*, it is being used for charcoal making by some local people. However, harvesting of *P. juliflora* has been banned by the Government of Gujarat in Banni grassland in the year 2008. To protect, conserve, and manage biodiversity in villages and their jurisdiction, the constitution of Biodiversity Management Committee's (BMC) in all Gram Panchayats falling within Banni are in process. The respective committees of Gram Panchayats of Banni will document biodiversity and associated traditional knowledge on biodiversity in the People's Biodiversity Register (PBR) as per the Biological Diversity Act, 2002. The BMCs of respective Gram Panchayats will be responsible for and implement Access and Benefit-Sharing (ABS) of biological resources as per the provision of Biological Diversity Act, 2002.
- 3.4. Conservation of Genetic Resources:** The genetic diversity and resources of this grassland especially the native grass species are being restored, conserved and managed through various grassland development projects under various schemes of Government. Banni buffalo is recognized as 11<sup>th</sup> National breed of buffalo "Kundi". Various NTFPs are being collected from the Banni such as honey, gum, and charcoal by the Gujarat State Forest Development Corporation Ltd. (GSFDCL) by involving the local people. The local people also traditionally collect NTFPs including MAPs for their domestic usage and livelihood.
- 3.5 Fauna and their habitats:** Banni is a Savannah grassland/scrubland ecosystem that provides a suitable habitat for many grassland fauna. A total of 5 species of amphibian, 16 species of reptile, 262 species of birds, and 14 species of

mammals are reported from the grassland (Table 3.5). Banni is also a wintering ground for a large number of migratory avifauna and also a stopover for migratory birds of Central Asian Flyway. During monsoon and post-monsoon many of the areas of Banni are converted into a wetland which is suitable habitat for migratory birds and other faunal species. The flagship wild species of this grassland include; chinkara, desert cat, desert fox, Hubara bustard, Raptors, Cranes, Grey Hypocolius, Stoliczka's Bush Chat and Spiny-tailed lizard.

**Table 3.5: Taxon diversity of major groups of fauna recorded from Banni Protected Forest**

	Amphibians	Reptiles	Birds	Mammals
Order	1	2	14	5
Family	3	10	51	10
Genus	4	15	153	13
Species	5	16	262	14

**3.6. Wildlife in General:** Banni is naturally a dynamic grassland ecosystem that provides and supports numerous wildlife adapted to the inherent climatic conditions of this grassland. The major mammalian wildlife of Banni includes Blue bull, Chinkara, Indian hare, Wild boar, Jackal, Indian wolf, Caracal, Hyena, Foxes, Jungle cat and desert cat. It also provides a habitat for a rich diversity of avifauna, herpetofauna, invertebrates, and micro-organisms. The remarkable avifauna of the Banni includes Flamingos, MacQueen's Bustard, White-winged Black Tit, Stoliczka's Bush Chat, Grey Hypocolius and cranes. The Grassland of Banni is a wintering ground and stopover site for migratory raptors and migratory cranes. In the present survey, a total of 5 species of amphibian, 16 species of reptile, 262 species of birds, and 14 species of mammals were recorded so far from the Banni (Table 3.5). The checklist of amphibians, reptiles, birds and Mammals are given in table 3.6 to 3.10, respectively.

### 3.6.1. Herpetofauna

A total of five amphibian species under three families reported from Banni grassland. The species are mainly distributed in seasonal waterbodies of the

grassland and also reported from small pools and wet soils. Among them two species, *Hoplobatrachus tigerinus* and *Bufo melanostictus* are categorised as Vulnerable species (Table 3.6). Similarly, a total of 16 species of reptiles are recorded from the grassland which are belonging to 13 families. Among the recorded reptilian species, 6 species snake, 3 species of skink and 4 species of lizard (Table 3.7). Among the lizard, Spiny-tailed lizard is unique and native species of this grassland. Among the reptilian species of the grassland, five species fall under vulnerable (VU) category in the redlist of threatened species (IUCN, 2019) and two species fall under data deficient (DD) and remaining species falls under least concern category.

**Table 3.6: Checklist of Amphibian species of Banni Protected Forest**

S. No	Scientific Name	Common name	Family	IWPA, 1972	IUCN, 2019
1	<i>Hoplobatrachus tigerinus</i>	Indian Bull Frog	Ranidae	Schedule IV	VU
2	<i>Euphlyctis cyanophlictis</i>	Skipper Frog	Ranidae	Schedule IV	NT
3	<i>Bufo stomaticus</i>	Marbled toad	Bufoidea	--	NT
4	<i>Bufo melanostictus</i>	Common Indian Toad	Bufoidea	--	VU
5	<i>Microhyla ornata</i>	Ornate narrow-mouthed frog	Microhylidae	--	LC

**Table 3.7: Checklist of Reptile species of Banni Protected Forest**

S. No	Scientific Name	Common name	Family	IWPA 1972	IUCN, 2019
1	<i>Calotes versicolor</i>	Garden Lizard	Agamidae	--	NT
2	<i>Sitana ponticeriana</i>	Fan throated Lizard	Agamidae	--	LC
3	<i>Trapelus agilis</i>	Brilliant Ground Agama*	Agamidae	--	DD
4	<i>Saara hardwickii</i>	Spiny-tailed lizard	Agamidae	Schedule II	VU
5	<i>Chamaeleon zeylanicus</i>	Chamaeleon	Chamaeleonidae	Schedule II	VU
6	<i>Varanus bengalensis</i>	Bengal Monitor	Varanidae	Schedule II	VU

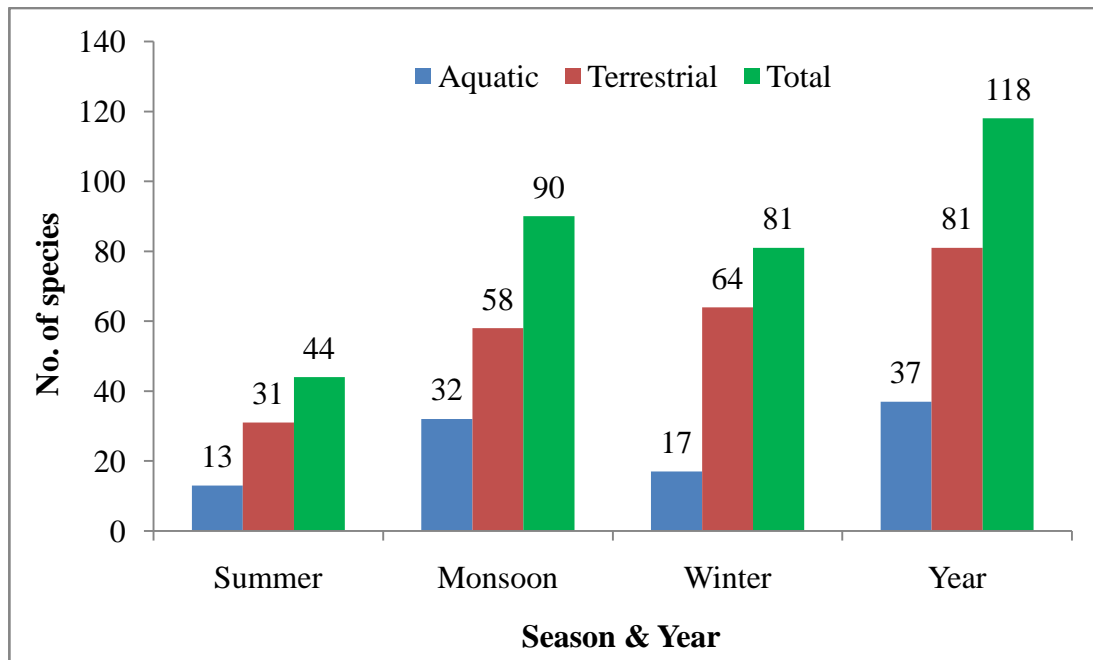
S. No	Scientific Name	Common name	Family	IWPA 1972	IUCN, 2019
7	<i>Hemidactylus flaviviridis</i>	House Gecko	Gekkonidae	--	LC
8	<i>Eutropis carinata</i>	Common Keeled Grass Skink	Scincidae	-	LC
9	<i>Eutropis macularius</i>	Eastern Bronze Skink	Scincidae	-	LC
10	<i>Ophisops jerdoni</i>	Jerdon's Snake Eye Skink	Lecertidae	--	DD
11	<i>Coelognathus helena</i>	Common Trinket	Colubridae	Schedule IV	NT
12	<i>Ptyas mucosa</i>	Rat Snake	Colubridae	Schedule IV	NT
13	<i>Xenochrophis piscator</i>	Checkered Keelback Snake	Colubridae	Schedule IV	NT
14	<i>Eryx johnii</i>	Earth Boa	Boidae	Schedule IV	LC
15	<i>Naja oxiana</i>	Black Cobra	Elaphidae	Schedule II	DD
16	<i>Echis carinatus</i>	Saw-scaled viper	Viperidae	Schedule IV	NT

### 3.6.2. Birds

The important avifauna of this area includes Flamingos, Houbara Bustard, White-winged Black Napped Tit, Stoliczka's Bush Chat and Grey Hypocolius. Banni grassland is known for its rich diversity of avifauna. The water bodies of Banni support over 150 species of migratory and resident birds and are important staging ground for several thousands of migratory cranes (GEC, 1998). Various workers reported rich diversity of birds from Banni grassland; 78 birds species by CEDO (2012), 66 species by Sorensen (2007) and 250 species from Chhaari-Dhand by Sen (2012). Further, Banni grassland acts as breeding and nesting ground for more than 250 bird species, including resident, winter migratory birds (Banni Breeder's Association, 2012). Among the reported birds from Banni grassland, 47 species are threatened (IBC, 2012).

A total of 262 species of birds were recorded in Banni by GUIDE team during 2016 (Table 3.9). Among the recorded birds, 118 were resident to Banni, 76 species were resident/short migratory in nature and rest of 68 species were migratory birds. Sesaon wise number of terrestrial and aquatic bird species

reported from the grassland is shown in Figure 3.11. On analysing the feeding habitats of recorded birds, it was found that, 87 species were insectivore, 69 species of omnivore, 68 species of carnivore, 20 species of granivore, 15 species of piscivore, 2 species of frutivore and one nectarivore species. According to the Wildlife (Protection) Act, 1972, total 3 species fall under Schedule-I, and rest of the 259 species falls under Schedule-IV. Among the total recorded bird species, 4 species were Critically Endangered (CR), 1 species in Endangered category (EN), 8 species under Vulnerable (VU), 11 under Near Threatened (NT) and rest of 238 species under Least concern (LC) category in Redlist of Threatened animal (IUCN, 2019).



**Figure 3.11: Seasonal distribution of birds in Banni Protected Forest**

Rapid survey on the avifauna of Banni conducted during the post-monsoon, 2020, recorded 115 species of birds with 3322 individuals from the sampling locations. The survey revealed that the Shannon-Weiner diversity index ( $H'$ ) of 3.25 and Simpson diversity index of 0.94 showed the medium to high diversity avifauna in the grassland. Similarly, the species richness of the avifauna in Banni was also high. Among the three regions of Banni, the avifaunal distribution and diversity are more or less uniform in the East, Central, and West Banni region (Table 3.8). The avifaunal species dominance and species evenness in all three regions of Banni was also uniform during the survey.

**Table 3.8: Avifaunal diversity of the Banni Protected Forest during post-monsoon, 2020**

Diversity characteristics	East Banni	Central Banni	West Banni	Overall
Taxa_S	105	107	108	115
Individuals	907	1333	1082	3322
Dominance_D	0.06	0.06	0.05	0.06
Simpson_1-D	0.94	0.94	0.95	0.94
Shannon_H	3.21	3.28	3.27	3.25
Evenness_e^H/S	0.72	0.70	0.76	0.73
Margalef	7.41	7.93	7.49	7.61
Equitability_J	0.90	0.90	0.92	0.91

**Table 3.9: Checklist of Birds of Banni Protected Forest (GUIDE, 2016)**

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
1	<i>Elanus caeruleus</i>	Black-winged Kite	R	LC	Sch-IV
2	<i>Pernis ptilorhynchus</i>	Oriental Honey-buzzard	RM	LC	Sch-IV
3	<i>Milvus migrans</i>	Black Kite	R	LC	Sch-IV
4	<i>Haliastur Indus</i>	Brahminy Kite	R	LC	Sch-IV
5	<i>Accipiter badius</i>	Shikra	R	LC	Sch-IV
6	<i>Accipiter nisus</i>	Eurasian Sparrow-hawk	RM	LC	Sch-IV
7	<i>Buteo rufinus</i>	Long-legged Buzzard	RM	LC	Sch-IV
8	<i>Butastur teesa</i>	White-eyed Buzzard	R	LC	Sch-IV
9	<i>Hieraaetus fasciatus</i>	Bonelli's Eagle	R	LC	Sch-IV
10	<i>Hieraaetus pennatus</i>	Booted Eagle	RM	LC	Sch-IV
11	<i>Aquila heliaca</i>	Eastern Imperial Eagle	RM	VU	Sch-IV
12	<i>Aquila rapax</i>	Tawny Eagle	R	LC	Sch-IV
13	<i>Aquila nipalensis</i>	Steppe Eagle	M	LC	Sch-IV
14	<i>Aquila clanga</i>	Greater Spotted Eagle	RM	VU	Sch-IV
15	<i>Aquila pomarina</i>	Lesser Spotted Eagle	R	LC	Sch-IV
16	<i>Sarcogyps calvus</i>	Red-headed Vulture	R	CR	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
17	<i>Aegypius monachus</i>	Cinereous Vulture	RM	NT	Sch-IV
18	<i>Gyps fulvus</i>	Griffon Vulture	RM	LC	Sch-IV
19	<i>Gyps indicus</i>	Indian Vulture	R	CR	Sch-IV
20	<i>Gyps bengalensis</i>	White-rumped Vulture	R	CR	Sch-IV
21	<i>Neophron percnopterus</i>	Egyptian Vulture	RM	EN	Sch-IV
22	<i>Circus cyaneus</i>	Northern Harrier	M	LC	Sch-IV
23	<i>Circus macrourus</i>	Pallid Harrier	M	NT	Sch-IV
24	<i>Circus pygargus</i>	Montagu's Harrier	M	LC	Sch-IV
25	<i>Circus aeruginosus</i>	Western Marsh-Harrier	M	LC	Sch-IV
26	<i>Circaetus gallicus</i>	Short-toed Snake-eagle	R	LC	Sch-IV
27	<i>Pandion haliaetus</i>	Osprey	RM	LC	Sch-I
28	<i>Falco peregrinus</i>	Peregrine Falcon	M	LC	Sch-IV
29	<i>Falco subbuteo</i>	Eurasian Hobby	RM	LC	Sch-IV
30	<i>Falco chicquera</i>	Red-headed Falcon	R	LC	Sch-IV
31	<i>Falco jugger</i>	Laggar Falcon	RM	NT	Sch-IV
32	<i>Falco tinnunculus</i>	Common Kestrel	RM	LC	Sch-IV
33	<i>Cursorius cursor</i>	Cream-coloured Courser	M	LC	Sch-IV
34	<i>Cursorius coromandelicus</i>	Indian Courser	R	LC	Sch-IV
35	<i>Glareola lacteal</i>	Small Pratincole	R	LC	Sch-IV
36	<i>Vanellus leucurus</i>	White-tailed Lapwing	M	LC	Sch-IV
37	<i>Vanellus indicus</i>	Red-wattled Lapwing	R	LC	Sch-IV
38	<i>Vanellus malabaricus</i>	Yellow-wattled Lapwing	R	LC	Sch-IV
39	<i>Vanellus gregarius</i>	Sociable Lapwing	M	CR	Sch-IV
40	<i>Pterocles exustus</i>	Chestnut-bellied Sandgrouse	R	LC	Sch-IV
41	<i>Pterocles senegallus</i>	Spotted Sandgrouse	M	LC	Sch-IV
42	<i>Pterocles indicus</i>	Painted Sandgrouse	R	LC	Sch-IV
43	<i>Francolinus francolinus</i>	Black Francolin	R	LC	Sch-IV
44	<i>Francolinus pondicerianus</i>	Grey Francolin	R	LC	Sch-IV
45	<i>Coturnix coturnix</i>	Common Quail	RM	LC	Sch-IV
46	<i>Coturnix coromandelica</i>	Rain Quail	R	LC	Sch-IV
47	<i>Perdicula argoondah</i>	Rock Bush-Quail	R	LC	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
48	<i>Pavo cristatus</i>	Indian Peafowl	R	LC	Sch-I
49	<i>Turnix suscitator</i>	Common Buttonquail	R	LC	Sch-IV
50	<i>Grus grus</i>	Common Crane	M	LC	Sch-IV
51	<i>Grus antigone</i>	Sarus Crane	R	VU	Sch-IV
52	<i>Grus virgo</i>	Demoiselle Crane	M	LC	Sch-IV
53	<i>Chlamydotis undulata</i>	Houbara Bustard	RM	VU	Sch-I
54	<i>Columba livia</i>	Blue Rock Pigeon	R	LC	Sch-IV
55	<i>Streptopelia decaocto</i>	Eurasian Collared-dove	R	LC	Sch-IV
56	<i>Streptopelia tranquebarica</i>	Red Collared-Dove	R	LC	Sch-IV
57	<i>Streptopelia senegalensis</i>	Little Brown Dove	R	LC	Sch-IV
58	<i>Spilopelia chinensis</i>	Spotted Dove	R	LC	Sch-IV
59	<i>Psittacula krameri</i>	Rose-ringed Parakeet	R	LC	Sch-IV
60	<i>Clamator jacobinus</i>	Pied Cuckoo	RM	LC	Sch-IV
61	<i>Hierococcyx varius</i>	Common Hawk-Cuckoo	RM	LC	Sch-IV
62	<i>Cuculus canorus</i>	Common Cuckoo	RM	LC	Sch-IV
63	<i>Eudynamis scolopacea</i>	Asian Koel	R	LC	Sch-IV
64	<i>Phaenicophaeus leschenaultii</i>	Sirkeer Malkoha	R	LC	Sch-IV
65	<i>Centropus sinensis</i>	Greater Coucal	R	LC	Sch-IV
66	<i>Tyto alba</i>	Barn Owl	R	LC	Sch-IV
67	<i>Bubo bubo</i>	Eurasian Eagle-Owl	R	LC	Sch-IV
68	<i>Athene brama</i>	Spotted Owlet	R	LC	Sch-IV
69	<i>Asio flammeus</i>	Short-eared Owl	M	LC	Sch-IV
70	<i>Caprimulgus europaeus</i>	Eurasian Nightjar	M	LC	Sch-IV
71	<i>Caprimulgus asiaticus</i>	Indian Nightjar	R	LC	Sch-IV
72	<i>Caprimulgus affinis</i>	Savanna Nightjar	R	LC	Sch-IV
73	<i>Tachymarptis melba</i>	Alpine Swift	RM	LC	Sch-IV
74	<i>Apus affinis</i>	Little Swift	RM	LC	Sch-IV
75	<i>Merops persicus</i>	Madagascar Bee-eater	RM	LC	Sch-IV
76	<i>Merops orientalis</i>	Little Green Bee-eater	R	LC	Sch-IV
77	<i>Coracias garrulous</i>	European Roller	RM	NT	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
78	<i>Coracias benghalensis</i>	Indian Roller	R	LC	Sch-IV
79	<i>Upupa epops</i>	Common Hoopoe	RM	LC	Sch-IV
80	<i>Jynx torquilla</i>	Eurasian Wryneck	M	LC	Sch-IV
81	<i>Dendrocopos mahrattensis</i>	Yellow-fronted Pied Woodpecker	R	LC	Sch-IV
82	<i>Mirafra erythroptera</i>	Indian Lark	R	LC	Sch-IV
83	<i>Eremopterix grisea</i>	Ashy-crowned Sparrow-Lark	R	LC	Sch-IV
84	<i>Eremopterix nigriceps</i>	Black-crowned Sparrow-Lark	R	LC	Sch-IV
85	<i>Ammomanes phoenicurus</i>	Rufous-tailed Finch-Lark	R	LC	Sch-IV
86	<i>Alaemon alaudipes</i>	Greater Hoopoe-Lark	R	LC	Sch-IV
87	<i>Calandrella raytal</i>	Indian Short-toed Lark	R	LC	Sch-IV
88	<i>Galerida cristata</i>	Crested Lark	R	LC	Sch-IV
89	<i>Galerida deva</i>	Tawny Lark	R	LC	Sch-IV
90	<i>Mirafra cantillans</i>	Singing Bushlark	R	LC	Sch-IV
91	<i>Hirundo concolor</i>	Dusky Crag Martin	R	LC	Sch-IV
92	<i>Hirundo rustica</i>	Barn Swallow	RM	LC	Sch-IV
93	<i>Hirundo smithii</i>	Wire-tailed Swallow	R	LC	Sch-IV
94	<i>Hirundo fluvicola</i>	Streak-Throated Swallow	R	LC	Sch-IV
95	<i>Hirundo daurica</i>	Red-rumped Swallow	RM	LC	Sch-IV
96	<i>Lanius vittatus</i>	Bay-backed Shrike	R	LC	Sch-IV
97	<i>Lanius collurio</i>	Red-backed Shrike	RM	LC	Sch-IV
98	<i>Lanius isabellinus</i>	Rufous-tailed Shrike	M	LC	Sch-IV
99	<i>Lanius schach</i>	Long-tailed Shrike	R	LC	Sch-IV
100	<i>Lanius cristatus</i>	Brown Shrike	M	LC	Sch-IV
101	<i>Lanius meridionalis</i>	Southern Grey Shrike	M	LC	Sch-IV
102	<i>Dicrurus macrocercus</i>	Black Drongo	R	LC	Sch-IV
103	<i>Corvus splendens</i>	House Crow	R	LC	Sch-IV
104	<i>Corvus macrorhynchos</i>	Large-billed Crow	R	LC	Sch-IV
105	<i>Corvus corax</i>	Common Raven	R	LC	Sch-IV
106	<i>Pericrocotus cinnamomeus</i>	Small MinSch-IVet	R	LC	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
107	<i>Pericrocotus erythropygus</i>	White-bellied Minivet	R	LC	Sch-IV
108	<i>Aegithina nigrolutea</i>	White-tailed Iora	R	LC	Sch-IV
109	<i>Sturnus pagodarum</i>	Brahminy Starling	R	LC	Sch-IV
110	<i>Sturnus roseus</i>	Rosy Starling	M	LC	Sch-IV
111	<i>Acridotheres tristis</i>	Common Myna	R	LC	Sch-IV
112	<i>Acridotheres ginginianus</i>	Bank Myna	R	LC	Sch-IV
113	<i>Hypocolius ampelinus</i>	Grey Hypocolius	M	LC	Sch-IV
114	<i>Pycnonotus leucotis</i>	White-eared Bulbul	R	LC	Sch-IV
115	<i>Pycnonotus cafer</i>	Red-vented Bulbul	R	LC	Sch-IV
116	<i>Cisticola juncidis</i>	Zitting Cisticola	R	LC	Sch-IV
117	<i>Prinia hodgsonii</i>	Grey-breasted Prinia	R	LC	Sch-IV
118	<i>Prinia buchanani</i>	Rufous-fronted Prinia	R	LC	Sch-IV
119	<i>Prinia inornata</i>	Plain Prinia	R	LC	Sch-IV
120	<i>Prinia sylvatica</i>	Jungle Prinia	R	LC	Sch-IV
121	<i>Prinia socialis</i>	Ashy Prinia	R	LC	Sch-IV
122	<i>Prinia gracilis</i>	Graceful Prinia	R	LC	Sch-IV
123	<i>Orthotomus sutorius</i>	Common Tailorbird	R	LC	Sch-IV
124	<i>Acrocephalus stentoreus</i>	Clamorous Reed-warbler	M	LC	Sch-IV
125	<i>Acrocephalus dumetorum</i>	Blyth's Reed-Warbler	M	LC	Sch-IV
126	<i>Acrocephalus agricola</i>	Paddyfield Warbler	RM	LC	Sch-IV
127	<i>Hippolais caligata</i>	Booted Warbler	RM	LC	Sch-IV
128	<i>Chrysomma sinense</i>	Yellow-eyed Babbler	R	LC	Sch-IV
129	<i>Turdoides caudatus</i>	Common Babbler	R	LC	Sch-IV
130	<i>Turdoides malcolmi</i>	Large Grey Babbler	R	LC	Sch-IV
131	<i>Turdoides striatus</i>	Jungle Babbler	R	LC	Sch-IV
132	<i>Sylvia hortensis</i>	Orphean Warbler	M	LC	Sch-IV
133	<i>Sylvia curruca</i>	Lesser Whitethroat	M	LC	Sch-IV
134	<i>Sylvia communis</i>	Common Whitethroat	M	LC	Sch-IV
135	<i>Sylvia nana</i>	Desert Warbler	M	LC	Sch-IV
136	<i>Phylloscopus collybita</i>	Common Chiffchaff	M	LC	Sch-IV
137	<i>Muscicapa striata</i>	Spotted Flycatcher	RM	LC	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
138	<i>Ficedula parva</i>	Red-breasted Flycatcher	M	LC	Sch-IV
139	<i>Copsychus saularis</i>	Oriental Magpie-Robin	R	LC	Sch-IV
140	<i>Luscinia svecica</i>	Bluethroat	RM	LC	Sch-IV
141	<i>Phoenicurus ochruros</i>	Black Redstart	RM	LC	Sch-IV
142	<i>Saxicola caprata</i>	Pied Bushchat	RM	LC	Sch-IV
143	<i>Saxicola torquatus</i>	Common Stone Chat	RM	LC	Sch-IV
144	<i>Saxicola macrorhynchus</i>	Stoliczka's Bush Chat	R	VU	Sch-IV
145	<i>Oenanthe isabellina</i>	Isabelline Wheatear	M	LC	Sch-IV
146	<i>Oenanthe xanthopyrna</i>	Kurdish Wheatear	M	LC	Sch-IV
147	<i>Oenanthe deserti</i>	Desert Wheatear	RM	LC	Sch-IV
148	<i>Oenanthe picata</i>	Variable Wheatear	RM	LC	Sch-IV
149	<i>Saxicoloides fulicata</i>	Indian Robin	R	LC	Sch-IV
150	<i>Parus nuchalis</i>	White-naped Tit	R	VU	Sch-IV
151	<i>Nectarinia asiatica</i>	Purple Sunbird	R	LC	Sch-IV
152	<i>Passer domesticus</i>	House Sparrow	R	LC	Sch-IV
153	<i>Petronia xanthocollis</i>	Chestnut-shouldered Petronia	R	LC	Sch-IV
154	<i>Anthus campestris</i>	Tawny Pipit	RM	LC	Sch-IV
155	<i>Anthus rufulus</i>	Paddyfield Pipit	RM	LC	Sch-IV
156	<i>Anthus similis</i>	Long-billed Pipit	RM	LC	Sch-IV
157	<i>Motacilla flava</i>	Yellow Wagtail	RM	LC	Sch-IV
158	<i>Motacilla citreola</i>	Citrine Wagtail	RM	LC	Sch-IV
159	<i>Motacilla cinerea</i>	Grey Wagtail	M	LC	Sch-IV
160	<i>Motacilla alba</i>	White Wagtail	RM	LC	Sch-IV
161	<i>Ploceus philippinus</i>	Baya Weaver	R	LC	Sch-IV
162	<i>Ploceus manyar</i>	Streaked Weaver	R	LC	Sch-IV
163	<i>Lonchura malabarica</i>	White-throated Munia	R	LC	Sch-IV
164	<i>Emberiza melanocephala</i>	Black-headed Bunting	M	LC	Sch-IV
165	<i>Emberiza buchanani</i>	Grey-necked Bunting	M	LC	Sch-IV
166	<i>Emberiza striolata</i>	House Bunting	R	LC	Sch-IV
167	<i>Anser anser</i>	Greylag Goose	M	LC	Sch-IV
168	<i>Dendrocygna javanica</i>	Lesser Whistling-Duck	R	LC	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
169	<i>Tadorna ferruginea</i>	Ruddy Shelduck	RM	LC	Sch-IV
170	<i>Marmaronetta angustirostris</i>	Marbled Teal	RM	VU	Sch-IV
171	<i>Anas acuta</i>	Northern Pintail	M	LC	Sch-IV
172	<i>Anas crecca</i>	Common Teal	M	LC	Sch-IV
173	<i>Anas poecilorhyncha</i>	Western Spot-billed Duck	RM	LC	Sch-IV
174	<i>Anas strepera</i>	Gadwall	M	LC	Sch-IV
175	<i>Anas penelope</i>	Eurasian Wigeon	M	LC	Sch-IV
176	<i>Anas querquedula</i>	Garganey	M	LC	Sch-IV
177	<i>Anas clypeata</i>	Northern Shoveler	M	LC	Sch-IV
178	<i>Rhodonessa rufina</i>	Red-crested Pochard	M	LC	Sch-IV
179	<i>Aythya ferina</i>	Common Pochard	M	LC	Sch-IV
180	<i>Aythya fuligula</i>	Tufted Duck	M	LC	Sch-IV
181	<i>Nettapus corormendelianus</i>	Cotton Teal	R	LC	Sch-IV
182	<i>Sarkidiornis melanotos</i>	Comb Duck	R	LC	Sch-IV
183	<i>Ceryle rudis</i>	Pied Kingfisher	R	LC	Sch-IV
184	<i>Alcedo atthis</i>	Common Kingfisher	RM	LC	Sch-IV
185	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	R	LC	Sch-IV
186	<i>Amaurornis phoenicurus</i>	White-breasted Water-hen	R	LC	Sch-IV
187	<i>Gallicrex cinerea</i>	Water-cock	R	LC	Sch-IV
188	<i>Porphyrio porphyrio</i>	Purple Swamp-hen	R	LC	Sch-IV
189	<i>Gallinula chloropus</i>	Common Moorhen	RM	LC	Sch-IV
190	<i>Fulica atra</i>	Common Coot	RM	LC	Sch-IV
191	<i>Podiceps cristatus</i>	Great Crested Grebe	M	LC	Sch-IV
192	<i>Podiceps nigricollis</i>	Black-necked Grebe	M	LC	Sch-IV
193	<i>Tachybaptus ruficollis</i>	Little Grebe	R	LC	Sch-IV
194	<i>Pelecanus onocrotalus</i>	Great White Pelican	RM	LC	Sch-IV
195	<i>Pelecanus crispus</i>	Dalmatian Pelican	RM	VU	Sch-IV
196	<i>Pelecanus philippensis</i>	Spot-billed Pelican	RM	NT	Sch-IV
197	<i>Phalacrocorax carbo</i>	Great Cormorant	RM	LC	Sch-IV
198	<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	RM	LC	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
199	<i>Phalacrocorax niger</i>	Little Cormorant	RM	LC	Sch-IV
200	<i>Anhinga melanogaster</i>	Darter	RM	NT	Sch-IV
201	<i>Ardea cinerea</i>	Grey Heron	RM	LC	Sch-IV
202	<i>Ardea purpurea</i>	Purple Heron	RM	LC	Sch-IV
203	<i>Butorides striatus</i>	Little Heron	R	LC	Sch-IV
204	<i>Ardeola grayii</i>	Indian Pond-Heron	R	LC	Sch-IV
205	<i>Bubulcus ibis</i>	Cattle Egret	RM	LC	Sch-IV
206	<i>Casmerodius albus</i>	Large Egret	RM	LC	Sch-IV
207	<i>Mesophoyx intermedia</i>	Intermediate Egret	RM	LC	Sch-IV
208	<i>Egretta garzetta</i>	Little Egret	R	LC	Sch-IV
209	<i>Egretta gularis</i>	Western Reef-Egret	RM	LC	Sch-IV
210	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	R	LC	Sch-IV
211	<i>Mycteria leucocephala</i>	Painted Stork	RM	NT	Sch-IV
212	<i>Ciconia episcopus</i>	Woolly-necked Stork	R	LC	Sch-IV
213	<i>Ciconia ciconia</i>	European White Stork	M	LC	Sch-IV
214	<i>Ciconia nigra</i>	Black Stork	M	LC	Sch-IV
215	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	R	NT	Sch-IV
216	<i>Anastomus oscitans</i>	Asian Openbill-Stork	R	LC	Sch-IV
217	<i>Threskiornis melanocephalus</i>	White Ibis	R	NT	Sch-IV
218	<i>Pseudibis papillosa</i>	Black Ibis	R	LC	Sch-IV
219	<i>Plegadis falcinellus</i>	Glossy Ibis	RM	LC	Sch-IV
220	<i>Platalea leucorodia</i>	Eurasian Spoonbill	RM	LC	Sch-IV
221	<i>Phoenicopterus ruber</i>	Greater Flamingo	RM	LC	Sch-IV
222	<i>Phoenicopterus minor</i>	Lesser Flamingo	RM	LC	Sch-IV
223	<i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana	R	LC	Sch-IV
224	<i>Metopidius indicus</i>	Bronze-winged Jacana	R	LC	Sch-IV
225	<i>Rostratula benghalensis</i>	Greater Painted-Snipe	R	LC	Sch-IV
226	<i>Himantopus himantopus</i>	Black-winged Stilt	R	LC	Sch-IV
227	<i>Recurvirostra avosetta</i>	Pied Avocet	RM	LC	Sch-IV
228	<i>Numenius phaeopus</i>	Whimbrel	M	LC	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
229	<i>Numenius arquata</i>	Eurasian Curlew	M	NT	Sch-IV
230	<i>Limosa limosa</i>	Black-tailed Godwit	M	NT	Sch-IV
231	<i>Limosa lapponica</i>	Bar-tailed Godwit	M	LC	Sch-IV
232	<i>Tringa erythropus</i>	Spotted Redshank	M	LC	Sch-IV
233	<i>Tringa totanus</i>	Common Redshank	RM	LC	Sch-IV
234	<i>Tringa stagnatilis</i>	Marsh Sandpiper	M	LC	Sch-IV
235	<i>Tringa nebularia</i>	Common Greenshank	M	LC	Sch-IV
236	<i>Tringa ochropus</i>	Green Sandpiper	M	LC	Sch-IV
237	<i>Tringa glareola</i>	Wood Sandpiper	M	LC	Sch-IV
238	<i>Xenus cinereus</i>	Terek Sandpiper	M	LC	Sch-IV
239	<i>Actitis hypoleucos</i>	Common Sandpiper	RM	LC	Sch-IV
240	<i>Gallinago gallinago</i>	Common Snipe	RM	LC	Sch-IV
241	<i>Lymnocyptes minimus</i>	Jack Snipe	M	LC	Sch-IV
242	<i>Calidris minuta</i>	Little Stint	M	LC	Sch-IV
243	<i>Calidris temminckii</i>	Temminck's Stint	M	LC	Sch-IV
244	<i>Calidris alpine</i>	Dunlin	M	LC	Sch-IV
245	<i>Calidris ferruginea</i>	Curlew Sandpiper	M	LC	Sch-IV
246	<i>Philomachus pugnax</i>	Ruff or Reeve	M	LC	Sch-IV
247	<i>Burhinus oedicnemus</i>	Eurasian Thick-knee	R	LC	Sch-IV
248	<i>Esacus recurvirostris</i>	Great Thick-knee	R	LC	Sch-IV
249	<i>Pluvialis squatarola</i>	Grey Plover	M	LC	Sch-IV
250	<i>Charadrius hiaticula</i>	Common Ringed Plover	M	LC	Sch-IV
251	<i>Charadrius dubius</i>	Little Ringed Plover	RM	LC	Sch-IV
252	<i>Charadrius alexandrinus</i>	Kentish Plover	RM	LC	Sch-IV
253	<i>Charadrius mongolus</i>	Lesser Sand Plover	RM	LC	Sch-IV
254	<i>Larus ridibundus</i>	Black-headed Gull	M	LC	Sch-IV
255	<i>Larus ichthyaetus</i>	Pallas's Gull	M	LC	Sch-IV
256	<i>Larus brunnicephalus</i>	Brown-headed Gull	RM	LC	Sch-IV
257	<i>Larus geneii</i>	Slender-billed Gull	M	LC	Sch-IV
258	<i>Chlidonias hybridus</i>	Whiskered Tern	RM	LC	Sch-IV
259	<i>Gelochelidon nilotica</i>	Gull-billed Tern	RM	LC	Sch-IV
260	<i>Sterna caspia</i>	Caspian Tern	RM	LC	Sch-IV

Sr. No	Scientific Name	English Name	MS	IUCN (2019)	IWPA, 1972
261	<i>Sterna aurantia</i>	RSch-IVern Tern	R	LC	Sch-IV
262	<i>Sterna albifrons</i>	Little Tern	R	LC	Sch-IV

### 3.6.3. Mammal

The grassland ecosystem is naturally suitable for herbivorous mammals and short to medium-sized carnivores. Due to the presence of large numbers of cattle movement in the open grassland of Banni, herbivorous mammals like Blue bull and Chinkara have been restricted to *P. juliflora* thickets and remote areas having less movement of livestock, while predators mammals like Grey wolf, Jackals and Hyena are well dispersed in whole of the Banni Protected Forest area due to the presence of livestock and distribution of herbivorous in the remaining areas of Banni. As per a recent estimation, about 40-50 survive in the whole Kachchh district. Caracal, Jackal, Indian Hare, Wild boar, Foxes, Desert cat, Jungle cats and mongoose are other mammals found in the area. The rapid survey during post-monsoon 2020 recorded (directly and indirect evidence) 14 species of mammal from the Banni. Among the recorded species of mammal, a six species were carnivore, followed by three species each of ruminant/herbivore and rodents and one species each of Lagomorpha and Insectivores.

**Table 3.10: Checklist of Mammal species of Banni Protected Forest**

S. No	Scientific Name	Common name	Family	IWPA, 1972	IUCN, 2019
1	<i>Boselaphus tragocamelus</i>	Nilgai	Bovidae	Sch- III	LC
2	<i>Gazella gazella</i>	Chinkara	Bovidae	Sch- I	LC
3	<i>Sus scrofa</i>	Wild Boar	Suidae	Sch- III	LC
4	<i>Herpestes edwardsi</i>	Common Mongoose	Herpestidae	Sch- IV	LC
5	<i>Hyena hyena</i>	Stripped Hyena	Hyaenidae	Sch- III	NT
6	<i>Canis aureus</i>	Jackal	Canidae	Sch- II	LC
7	<i>Vulpes bengalensis</i>	Indian Fox	Canidae	Sch- II	NT
8	<i>Felis chaus</i>	Jungle Cat	Felidae	Sch- II	NT

S. No	Scientific Name	Common name	Family	IWPA, 1972	IUCN, 2019
9	<i>Felis libyca</i>	Desert Cat	Felidae	Sch- II	NT
10	<i>Lepus nigricollis</i>	Indian Hare	Leporidae	Sch- IV	LC
11	<i>Funambulus penneti</i>	Five-striped Palm squirrel	Sciuridae	Sch- IV	LC
12	<i>Tatera indica</i>	Desert Gerbil	Sciuridae	--	LC
13	<i>Hystrix indica</i>	Indian Porcupine	Hystricidae		
14	<i>Hemiechinus auritus</i>	Longeared Hedge Hog	Insectivora	Sch- IV	LC

### 3.7. Threats and challenges to Wildlife

Banni is naturally a savannah grassland ecosystem which is dynamic and once a productive grassland that supported many wildlife species survive and flourish. The wildlife of this grassland faces several challenges from natural phenomena and anthropogenic activities. The intensity of threats and challenges for the wildlife in this grassland is on rise. The major threats and challenges are as follows:

1. Desertification and land degradation due to ongoing climatic changes resulted in a loss of suitable habitat from a large area of Banni.
2. Saline water intrusion into fringe areas of Banni mostly in northern parts lead to the loss of large areas of the grassland.
3. Increasing salinity in the majority of the grassland resulted in the loss or eradication of native flora of the grassland. Effecting in loss or reduction of feeding species for wildlife.
4. Drought and erratic rainfall are common to this grassland and impact the wildlife survival in the grassland.
5. Invasion of *P. juliflora* in flourishing grassland areas leads to loss of feeding and breeding habitat for native wildlife in the area.
6. The increasing number of livestock resulted in heavy grazing in the grassland which in turn leads to loss of grazing land for wild herbivores.

7. Seasonal encroachment of some areas of the grassland for agriculture, infrastructure development, tourism development, etc. leads to loss/degradation of habitats and migratory/movement of wildlife species.
8. Illegal cutting of *P. juliflora* for charcoal preparation in some areas is a threat for the wildlife that uses *P. juliflora* for breeding and resting purpose.
9. Increasing frequency or movement of a large number of vehicles in recent times due to increasing tourism potential of the area increases the instances of animal road kill.

### 3.8. Protection and Management of Fauna

In the western part of the Banni, a large track of wetland exists which is known as Charidhundh. This wetland is spread in approximately 80 km<sup>2</sup> which supports feeding and breeding ground for a large number of water birds. The wetland is also a wintering ground for a large number of migratory birds and corridors for wildlife species. Forest and Environment Department, Govt. of Gujarat vide Notification No. GVN-2008 (38) WLP-102003-341-W (641), Dated 1<sup>st</sup> August 2008, declared the area as “**Conservation Reserve**”. Locally, a pond or a water body is called Dhundh. This Dhundh is well known as a foraging ground for migratory as well as resident birds. During the good monsoon years, a large number of aquatic birds like Flamingos, Pelicans, Cranes, Spoonbills, Ducks, Pochards, Coots, Cormorants, Darters, etc. dwell in the dhundh water. In the year 2000, the first-ever census was carried out by the Forest Department. The number of birds was estimated around 74955 consisting of 82 species. This area is being managed as per a separate management plan.

A total of 7506.22 km<sup>2</sup> area of the Great Rann of Kachchh and its surrounding area were declared as Desert Wildlife Sanctuary in the year 1987 by the Government of Gujarat. This sanctuary covers around 38000 Ha of eastern parts of Banni and is managed as per a separate management plan. These two protected areas are conserved and managed as per the provision of the Wildlife (Protection) Act, 1972.

**Photo Plate I: Flora in Banni Protected Forest***Chloris barbata**Zygophyllum simplex**Corchorus depressus**Mimosa hamata**Rhynchosia minima**Coccinia grandis*

## Photo Plate II: Flora Banni Protected Forest



*Dinebra retroflexa*



*Digera muricata*



*Cressa cretica*



*Ipomea aquatica*



*Physalis minima*



*Urochondra setulosa*

**Photo Plate III: Mammalian Fauna in Banni Protected Forest**

Golden Jackal



Jungle Cat



Grey Mongoose



Wild Boar



Chinkara



Blue bull

**Photo Plate IV: Avifauna in Banni Protected Forest**

Chestnut-billed Sangrouse



Hubara Bustard



Black Kite



Eurasian Eagle Owl



Dalmatian Pelican



Common Crane



Painted Stork



Grey Heron



Indian Curser



Eurasian Marsh Herrier



Eurasian Spoonbill



Asian Openbill Stork

**Photo Plate VI: Herpetofauna in Banni Protected Forest***Euphlyctis* sp.

Spiny-tailed Lizrad



Saw-scaled viper



Red Sand Boa

## Chapter 4

**Maintenance and Enhancement of Forest Health and Vitality**

**4.1. Status of regeneration:** In Banni Protected Forest, the diversity of tree and shrub is minimal due to its climate, inherent salinity and poor soil quality. The majority of areas of Banni are infested with *Prosopis juliflora* and profuse natural regeneration can be seen in dense *Prosopis* thickets. Natural regeneration of grass species is profuse in low-lying areas as well as in *Prosopis* dominated areas during the monsoon. In open grassland areas, due to overgrazing, natural regeneration of grass is limited and very sparse.

A rapid survey on regeneration was conducted during the post-monsoon based on the sampling of 25 quadrates (3 m x 3 m) in different parts of Banni Protected Forest. The regeneration survey was conducted as per the National Working Plan Code, 2014. The survey recorded the regeneration status of 10 species of shrubs and trees commonly occurring in Banni (Table 4.1).

During the survey presence of *P. juliflora* was recorded from 84% of the quadrates. Among the quadrates, 25% of quadrates have good regeneration of *P. juliflora*, about 25% have fair regeneration while more than 40% of quadrates have no regeneration. *Prosopis cineraria* is a native tree species of Banni, observed in only 4 quadrates out of 25 quadrates surveyed. Among which three quadrates have new regeneration while one quadrate has no regeneration. Similarly, *Acacia nilotica*, *Salvadora persica* and *Salvadora oleoides* are native tree species of Banni and their regeneration status was recorded in three, five and four quadrates out of the total surveyed quadrates. The regeneration status of these species fall under 'no regeneration' and 'new regeneration' category. New regeneration has been recorded for *A. nilotica* and *S. persica* in some quadrates while for *S. oleoides* only 'no regeneration' was recorded during the survey. The regeneration survey highlighted that the other species like *Calotropis procera*, *Capparis decidua*, *Suaeda fruticosa*, *Suaeda nudiflora* and *Tamarix aphylla* are sparsely distributed in the Banni and their regeneration status mostly falls under 'no regeneration' category except in a few location

'good regeneration' and 'fair regeneration' recorded for *C. procera* and *C. decidua*.

**Table 4.1: Regeneration status of shrub and tree species of Banni Protected Forest**

Sampling Plot No.	<i>Acacia nilotica</i>	<i>Calotropis procera</i>	<i>Capparis decidua</i>	<i>Prosopis juliflora</i>	<i>Salvadora persica</i>	<i>Suaeda fruticosa</i>	<i>Suaeda nudiflora</i>	<i>Prosopis cineraria</i>	<i>Salvadora oleoides</i>	<i>Tamarix aphylla</i>
1	-	-	-	e	-	-	-	-	-	d
2	-	-	-	-	-	-	-	-	d	-
3	-	-	-	a	d	-	-	e	-	-
4	-	d	-	d	-	-	-	-	d	-
5	-	b	-	b	-	-	-	-	-	-
6	-	a	d	b	-	-	-	-	-	-
7	-	d	d	a	-	-	-	-	-	-
8	-	-	-	a	e	-	-	-	-	-
9	-	-	-	-	-	-	d	-	d	-
10	d	-	-	d	-	-	-	d	-	-
11	-	-	-	b	-	-	-	-	-	-
12	-	d	-	d	-	-	-	-	-	-
13	-	-	-	c	e	-	-	-	-	-
14	-	-	-	a	-	-	-	-	-	-
15	-	-	b	-	-	-	-	-	d	-
16	-	-	-	a	-	-	-	-	-	-
17	-	-	-	b	-	-	-	-	-	-
18	-	d	-	d	-	-	-	e	-	-
19	-	-	-	b	-	d	-	-	-	-
20	e	-	d	b	e	-	-	-	-	-
21	-	-	-	d	-	d	-	-	-	-
22	-	-	-	-	-	-	d	-	-	-
23	-	-	-	d	-	-	d	-	-	-
24	e	-	-	d	d	-	-	e	-	-
25	-	-	c	d	-	-	-	-	-	-

a: Good Regeneration; b: Fair Regeneration; c: Poor Regeneration; d: No Regeneration; e: New Regeneration

- 4.2 **Area affected by forest fire:** Forest fire incidences are infrequent in Banni. The grasslands during the monsoon and post monsoon serve mostly as a grazing ground for the local livestock population. At the onset of summer, most of the Banni area remains dry. Thus, the chances of forest fire are negligible in Banni.
- 4.3. **Area damaged by natural calamities:** Banni area is prone, as in the whole of Kachchh district to natural calamities/disasters like frequent droughts, desertification and land degradation, salinity intrusion from Great Rann of Kachchh, high winds and flash floods. These natural calamities lead to the degradation of grassland every year in Banni. With the infrastructure development in many areas of Banni, the natural flow path of water during monsoon is blocked. Therefore, in above-normal rainfall year, many of the areas of Banni are subjected to flooding.
- 4.4. **Area protected from grazing:** Banni was historically an open grazing land for the huge livestock population of the locals of Banni as well as of Maldharis migrating from other parts of the State. Therefore, grazing pressure is high in forest areas of Banni. As per a recent survey, a total of more than 88018 heads of livestock (including 20659 heads of cattle, 55374 heads of buffalo, 5869 heads of sheep, 5849 heads of goat and 267 heads of horse and ponies ) are present in local villages of Banni.
- 4.5. **Lopping practices:** Banni is an open grassland, therefore, fodder collection by local people is nil. However, grass plot developed by the forest department are protected and collection of grasses from the grass-plot by the Banni division. Cutting and lopping of *P. juliflora* is a major lopping practice for charcoal preparation in some pockets of Banni. A study conducted by Manjunatha et al. (2018), highlighted that charcoal preparation is the primary occupation of 20% of households and secondary occupation for 60% of households of Banni. Earlier lopping of *P. juliflora* and other common trees and shrubs were practiced in nearby villages areas of Banni, but, with the availability and distribution of LPGs to villagers, the lopping of trees and shrub for fuelwood has seen to be considerably reduced in the Banni area.

**4.6 Area infested by invasive weed species in forests:** *Prosopis juliflora*, the major invasive species of this grassland, was introduced during 1960 in the northern fringe of Banni, bordering with Great Rann of Kachchh (GRK) to check desertification of Banni grassland through GRK.

After the introduction, *Prosopis* infested areas was 378 km in 1980 which was increased to 684 km in the year 1992 (Kadikar 1994). Jadhav *et al.* (1992) reported that *Prosopis* is spreading faster rate in Banni and he assessed that the spread rate was 2,670 ha per year in between 1980 to 1988, and later in next 10 years *prosopis* spread was between 4,800 ha per year (Jadhav *et al.* 1998). The *P. juliflora* dominant area has shown an alarming increase rate of 5,412 ha /year within a span of 13 years between 1997 and 2009 (SoEK, 2011)

Estimation by SAC (2002) highlighted that 56% of Banni will be covered by *P. juliflora* by 2020. This could destroy the entire biodiversity and grassland ecosystem, if proper controlling measures are not immediately taken.

As per the recent satellite data (2020), the *Prosopis* dominant area is 40356 ha. Apart from *P. juliflora*, few other weeds such as *Parthenium hysterophorum* and *Ipomea* sp. are found in Banni.

**4.7 Incidences of pest and diseases:** Incidences of pests and diseases for wild plants or wild animals has not been reported from the Banni. However, some diseases on livestock have been reported from time to time by the Maldharis and other inhabitants.

**4.8 Forest degradation and its drivers:** Banni Protected Forest was once Asia's finest grassland. With the impact of natural as well as anthropogenic factors considerable areas of the grassland have been degraded in the last 50 to 60 years. The major degradation happened after the introduction of *Prosopis juliflora*, which has now covered most of the good grassland areas of Banni. Further, the recent climatic change and associated desertification and land degradation has negatively affected major parts of the grassland ecosystem. Though, Banni is an inherently saline land its salinity was controlled due to the freshwater flow of rivers arise from the central Kachchh. Now with damming and other infrastructure development, the natural water flow to Banni has been blocked which leads to increased salinity level in most of the areas of southern

and central Banni. Banni is located in the arid zone of the country which receives low and erratic rainfall and therefore Banni experiences consecutive drought once every four years. The low rainfall, consecutive drought and added grazing pressure leads to the fast degradation of grassland.

Seasonal agriculture and grazing practices in fringe areas of villages within Banni and its outside boundary, mostly in southern fringes, has contributed sizebally to the degradation of grassland areas. With the establishment of Dairy related activities and improvement of transport facilities in Banni, the number of livestock has also been increased which leads to increased grazing pressure.

- 4.9 Pollution control and protection of environment:** Banni is remotely located and its human population is comparatively less. Therefore, pollution related to soil, water and air is negligible.

**Chapter 5****Conservation and Maintenance of Soil and Water Resources****5.1. Area treated under soil and water conservation measures**

The Banni Grass land is a vast salt affected region that represents an embayment between the Kachchh Mainland in the south, the Linear Trench Zone and Island chain in the north. This geomorphic unit covers about 3000 km<sup>2</sup>. The Banni plain forms a low alluvial tableland rising about 03 - 10 m above the sea level. The soils of Banni are sandy to silty loam with thin layers of clay. On account of high silt and clay content, the overall permeability of the soils is low and as a result, the vertical as well as lateral movement of surface and sub surface water is considerably inhibited causing inundation during rainy season.

The subsurface water is highly saline and hence no wells are dug in the area. The rain water is collected in large open tanks and used for human and animal consumption. During summer months shallow wells are dug in dry tank bed to get percolated water with moderate salinity. High salinity and impeded surface and subsurface drainage characterize 96% of the entire Banni area.

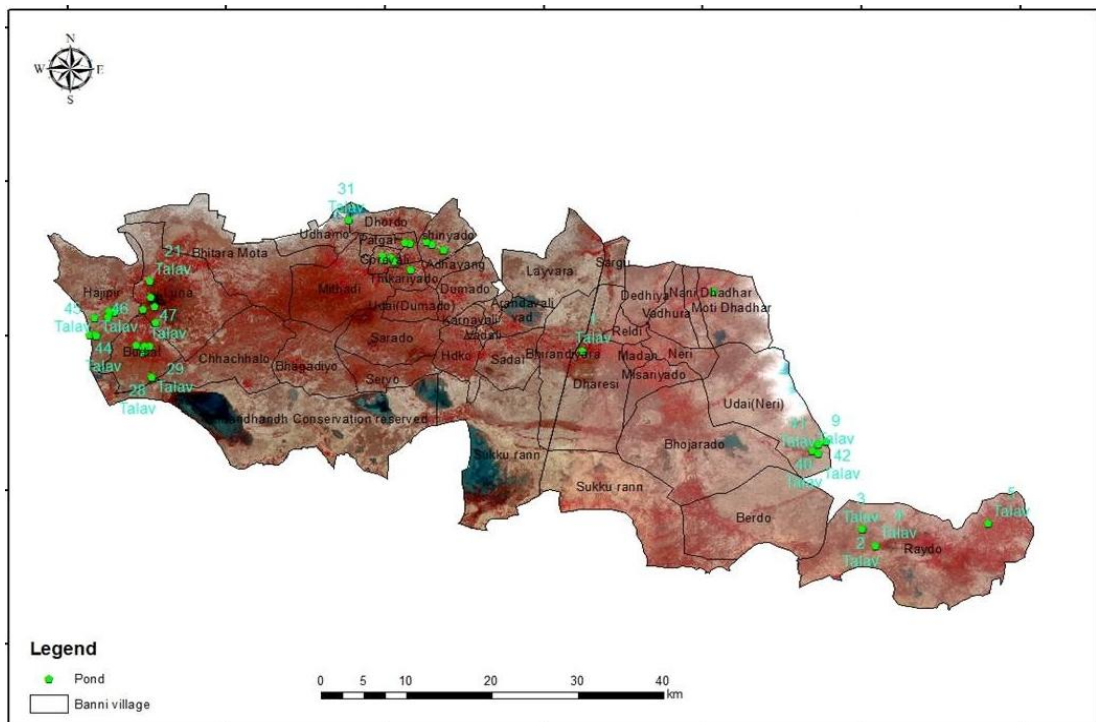
Soil and water conservation in rangelands, help in speeding up the regeneration of grasses and shrubs. Contour and peripheral bunding, mulching, wind breaks and shelter belts, water storage streams and pitting have been found suitable as soil and water conservation practices in Banni. The livestock poses major threat to the grasslands by way of over grazing which has affected the species composition, reduction in palatable species and productivity. The loss of grass and herb cover exposes the top soil that gets eroded during rains and also by wind.

Lack of soil moisture is a pertinent issue in Banni. Salinity is also a major problem in Banni grasslands. In Banni, sea water from the Kori creek which travels Eastward during high tides and strong winds accentuates the salinity problem in north-western part of Banni. Nearly 50% of Banni experiences high salinity, 40% experiences moderate to high salinity and 10% has low salinity. Low salinity soil in the region is suitable for the growth of palatable species whereas moderate to high salinity soils allow growth of halophytes. Further,

low vegetation in high saline areas supports the wind to transport salt particles resulting in increased salinity.

The pH values of soil samples (1 m depth) ranged between 6.74 and 8.08. The EC values are useful in measuring the soluble salts concentration in the soil. Lower EC values are associated with lower salinity values. The EC in the present analysis varied between 129  $\mu\text{S}/\text{cm}$  and 5891  $\mu\text{S}/\text{cm}$ . Organic Carbon improves soil nutrient status, helps in arresting soil/ water runoff, and is associated with moisture content. Value of TOC (%) ranged from 0.01% to 1.01% in the soil samples. The salinity values in the analyzed soil samples varied from 10 ppt – 70 ppt. The Sodium Adsorption Ratio (SAR) is useful during the management of sodium affected areas. The SAR of samples varied from 0.04 - 3.50. Soils with  $\text{SAR} \geq 13$  may have an increased dispersion of organic matter content and clay particles, general degradation of soil structure, etc. In the present study the values for SAR fall under favourable range. Values of other analyzed parameters are given in **Annexure IV**.

During the last decade, 66 forest ponds/van talav have been constructed in different parts of the Banni (Figure 5.1) under soil and moisture conservation work within the grassland by Banni Grassland Division (Table 5.1).



**Figure : 5.1 Map showing Van talav constructed in Banni Protected Forest**

**Table 5.1: Water Conservation Work Details**

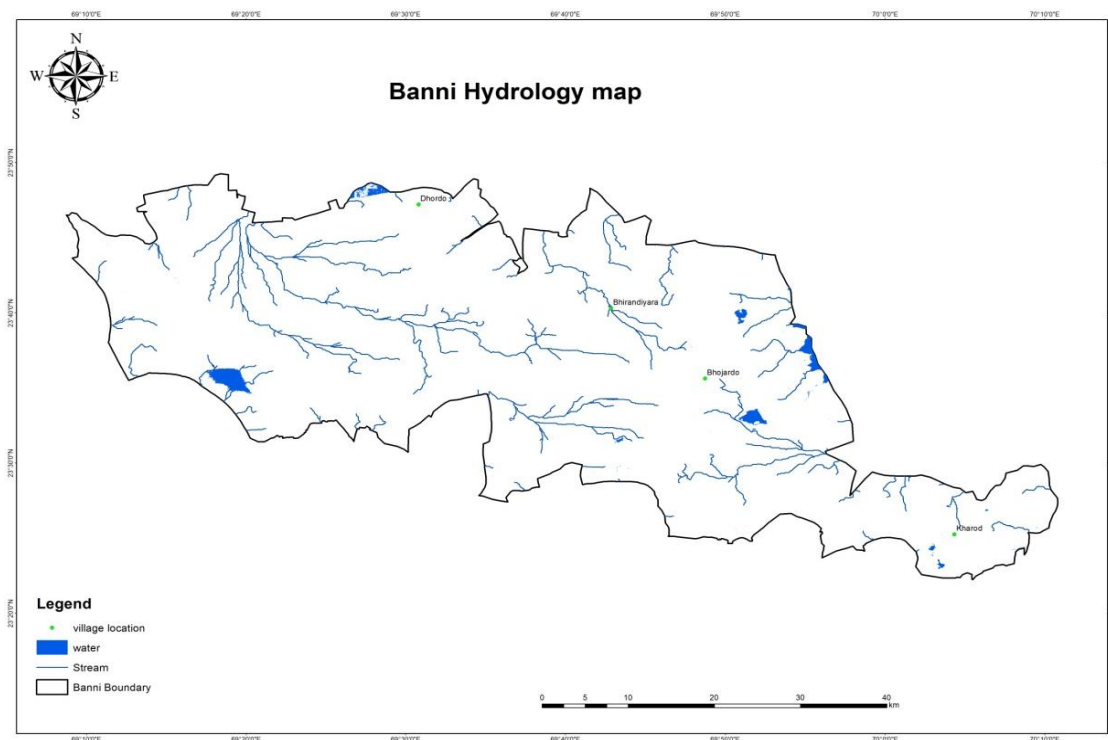
Year	Scheme/ Head	Project/ Model	Range	Number	Expenditure (in lakh)
2012-13	Forest Conservation and Development	Grass Development Project	Berdo	4	13.88
			Sarado	2	5.95
			Bhirandiyara	1	2.86
			Sargu	1	3.03
			<b>Total</b>	<b>8</b>	<b>25.72</b>
2015-16	Forest Conservation and Development	Grass Development Project	Berdo	4	18.45
			<b>Total</b>	<b>4</b>	<b>18.45</b>
2016-17	Forest Conservation and Development	Grass Development Project	Bhirandiyara	4	19.89
			Sargu	2	5
			<b>Total</b>	<b>6</b>	<b>24.89</b>
2017-18	Forest Conservation and Development	Grass Development Project	Bhirandiyara	5	25
			Tuga	1	5
			Sarado	2	10
			Berdo	1	5
			<b>Total</b>	<b>9</b>	<b>45</b>
2018-19	Forest Conservation and Development	Grass Development Project	Tuga	1	4
			Berdo	1	4
	Climate Change Mitigation and Adaptation	Grassland Restoration-NAFCC Project	Tugaluna	6	30
			Sarado	3	12.50
			Saragu	2	10
	Forest Conservation and Development	CAMPA	Tuga Luna	5	15
			Sarado	1	3
<b>Total</b>	<b>19</b>	<b>76.50</b>			
2019-20	Climate Change Mitigation and Adaptation	Grassland Restoration-NAFCC Project	Tuga Luna	7	35
			Sarado	5	25
	Forest Conservation and Development	Grass Development Project	Berdo	4	14.81
			Tugaluna	4	19.91
	<b>Total</b>	<b>20</b>	<b>34.72</b>		
			<b>Grand Total</b>	<b>66</b>	<b>225.28</b>

## 5.2. Duration of water flow in the selected seasonal streams

The word 'Banni' is derived from 'Bannai', which means newly made, signifying the land that has been formed by detritus and sediments brought down by the rivers such as Indus, Luni, Banas and Saraswati, which in recent geological past, flowed through this area from the north and the east.

Though the Banni region is inherently saline, the presence of Rivers Khari, Bhurud, Nara, Kalia, Kaswati and Panjora earlier, helped in reducing the salinity of the area during good rainfall years. Construction of dams viz., Rudramata, Nirona, Nara, Kaila, Kaswati and Gajansar during 1960 stopped fresh water flow into the Banni, thus adversely affecting nutrient supply and making the area more saline. The water bodies and general water flow in Banni area is shown in figure 5.2.

Due to semi-arid nature of Kachchh, the rainfall in Banni region is erratic and poor. Rain by Southwest monsoon is scant and confined to only 4-5 days and occurs as an instant downpour. The average annual rainfall is 317 mm with 2 drought years in a cycle of 5 year. During 1901 - 2019, around 63 drought years were recorded.



**Figure : 5.2 Map showing Hydrology of Banni Protected Forest**

### 5.3. Wetlands in forest areas

During 2009 the water bodies in Banni covered a total of 5,055 ha, in 2019, it covered 7,905 ha. Banni being a dual ecosystem, the low lying areas form seasonal shallow wetlands and these waterlogged and marshy saline areas get colonized by sedges. The low to moderately saline areas are covered with halophytes.

In Banni, there are numerous depressions/ shallow lakes in Banni, locally known as Dhandh and around 34 smaller and bigger size Dhandhs exist in the landscape. The largest wetland in Banni is the Chhari - Dhandh, a saucer shaped wetland, which is managed as a Conservation Reserve. Several other wetlands exists in the area e.g. Abdha-Jheel, Kheerjog-Dhand, Kunjevarti-thanth, Luna-Jheel, Mokaro-Jheel, Shervo-Dhand, Vekaria-Dhand and Hanjtal. All the water bodies in Banni are seasonal.

#### 5.4. Water level in the wells in the vicinity (up to 5km) of forest area

The pastoral community has dug up traditional water harvesting structures called 'Virdas' which are shallow wells of 9-12 ft that collect rain water.

#### 5.5. Status of aquifers

Due to proximity to sea as well as Great Rann of Kachchh (GRK), the groundwater in Banni is chiefly saline and is thus unsuitable for human and livestock consumption. The monsoon flow and depressions are identified by the local community, further dug and widened to form a **Jheel**. The runoff is accumulated in Jheel and over the time gets infiltrated to the shallow aquifers. During lean periods the Jheels are desilted and several small dug wells are made to tap the shallow aquifers i.e. **Virdas**. The monsoon water is infiltrated and stored above the saline water in shallow aquifers *via* Jheels-Virdas. These are the traditional water harvesting structures in Banni.

So far groundwater occurrence in surrounding area of Banni is largely dependent upon the constituents of alluviums. There is almost negligible potential of groundwater where clay is dominant contributors of alluvium. There are some patches in adjoining alluvial areas of Kachchh mainland where the phreatic water table conditions takes place at shallow depth of 5 m - 10 m. depending upon rainfall, the water level shows high range of fluctuations sometimes during drought year the aquifers are completely dried. In addition to this, some clayey pockets also show very shallow groundwater at a depth of about 2 to 2.5 m.

So far as consistence monitoring of these aquifers is concerned, no agency has monitored these aquifer regularly however, some fragmentary attempts by local NGOs and researchers have been made. Monitoring the water level and quality of these aquifers is a crucial task as the history reveals that shallow

aquifer potential was tapped by local communities before the damming of rivers. Still in some areas, post monsoon irrigation and critical irrigation are being practiced by local farmers during good rainfall year.

Photo Plate VII: Wetlands in Banni Protected Forest



Vekariya lake, Banni



White Rann during monsoon and winter



Seasonal Wetland near Bhirandiyara

## Chapter 6

**Maintenance and Enhancement of Forest Resource Productivity****6.1. Growing stock of wood**

Due to the inherent grassland ecosystem of Banni, tree species and its population are very thin and sparsely distributed in few locations. A large tract of Banni protected forest is savannah grassland which naturally supports few tree species such as *Salvadora sp.*, *Acacia sp.*, *Prosopis cineraria* etc. which are mostly not used as timber species due to their morphological features. The species are mostly used as a minor timber such as in handicrafts which is a secondary occupation for the local communities residing in Banni grassland.

*Prosopis cineraria* provide fodder, timber, fuel and edible pods useful as fresh and preserved vegetables. The leaf biomass ranges from 25-45 kg/ tree/ year (Ghosh *et al.*, 2015) *Ziziphus nummularia* bush yield varies from 23-323 kg/ha. *Ailanthus excelsa*, a deciduous tree, yields 5-7 quintals of green leaves twice a year (Diwedi, 1993; Jat *et al.*, 2011). Apart from this other species such as *Moringa olifera*, *Hardwickia binata*, *Colospermum mopane*, *Acacia tortilis*, *Acacia senegal*, *Acacia nilotica*, *Calligonum polygonoides*, etc. are also recorded in Banni.

**6.1.1.** With the invasion of *P. juliflora*, a considerable land of Banni Protected Forest has been converted to *P. juliflora* woodland. Majority of the *P. juliflora* are shrubby and their growth is limited due to the soil condition of Banni while some of the areas of Banni have good growth of *P. juliflora*, mostly located in the western parts.

As the Banni is a large track of unsurveyed area, and till date under the control of Revenue Dept., no systematic growth data is available to assess the growing stock. A ground survey was carried out to assess the crown density of *Prosopis*. The enumeration was made by putting square quadrates in each quadrate. The average crown density of *Prosopis* was found out to be 0.1 to 0.2 in whole of Banni area. Biomass productivity of *P. juliflora* ranges from 5930.2 Ton/year to 35581.2 Ton/year (Vaibhava *et al.*, 2012).

## 6.2. Increment in volume of Identified Timber Species

Banni is dominated by graminoids and forbs with scattered trees. The trees largely comprise of *P. juliflora*, *Acacia sp.* and *Salvadora sp.* These species are suitable for saline patches and grow slowly under stress or adverse climatic conditions. The volume of these trees is not available from the base year 2009.

## 6.3. Efforts towards enhancement of forest productivity through quality plantation activities

Palatable grasses, herbs, shrubs and trees comprise of 10 species, 8 species, one species and 3 species, respectively. Around 85 species are unpalatable in Banni comprising of 58 herbs, 25 grasses and 2 shrubs. Thus, 79.4% species being unpalatable lead to pressures on the resources.

The grassland productivity is around 620 kg/ha in 1999 (Bharwada & Mahajan, 2012). The area under grassland has reduced from 142,000 ha in 1989 to 63,000 ha in 2009 while the area invaded by *P. juliflora* has increased to 82,000 ha (Koladiya *et al.*, 2016).

Banni region largely comprises of grassland. Silvipastoral activities have been performed with combination of tree species such as *Azadirachta indica*, *Acacia sp.* and *Leucaena sp.* and grasses like *Cenchrus ciliaris* and *Cenchrus setigerus*. The neem in combination with grasses is most adopted silvipastoral system. Fodder production was more through *C. ciliaris* than *C. setigerus*.

The plantation activities under the Banni grassland is mainly grass plot development and grass restoration through plantation of native grass species which are palatable species and their productivity is comparatively higher than other native grass species of this grassland. The grass plantation activities made in the last 5 years is given in table 6.1.

**Table 6.1: List of Plantation work done in previous years**

(Scheme/Head: Forest Conservation and Development, Project/ Model: Grass Development Project)

Year	Forest Range	No. of Location	Area of Plantation (in ha)	Expenditure
2014-15	Berdo	5	400	65.82
	Tuga (Luna)	1	100	16.80
		Total	500	82.62

Year	Forest Range	No. of Location	Area of Plantation (in ha)	Expenditure
2015-16	Berdo	11	1179	179.96
	Tuga (Luna)	2	271	45.25
	Bhirandiyara	1	100	11.19
		Total	1550	236.40
2016-17	Berdo	5	410	8.49
	Hajipir	3	240	4.96
	Saragu	3	300	5.72
	Bhirandiyara	3	500	9.92
	Sarado	1	10	4.91
		Total	1460	34.00
2017-18	Sargu	11	290	78.91
	Bhirandiyara	13	1010	224.19
		Total	1300	303.10
2018-19	Sarado	2	200	53.51
	Berdo	3	250	60.36
	Tuga	5	250	63.26
		Total	700	117.13
2019-20	Tuga	4	400	91.86
	Bhirandiyara	1	100	23.38
	Berdo	4	300	73.28
		Total	800	188.52
<b>Grand Total</b>			<b>6310</b>	<b>961.77</b>

#### 6.4. Carbon Stock

Organic carbon improves soil nutrient status, helps in arresting soil/ water runoff, and is associated with moisture content. Value of TOC (%) ranged from 0.01% to 1.01% in the soil samples. Based on TOC (%), the soil samples analyzed may be graded as low to medium with two exceptions which would fall under high category. The distribution of soil carbon content in different parts of Banni Protected Forest is shown in figure 6.1 and figure 6.2. The concentration of TOC in soil is directly related to the continuous growth and decay of leaf litter. Given the geological settings, studies carried out by other researchers suggest that TOC content in soils of Kachchh is low to medium. Carbon levels are directly related to the continuous growth and decay of leaf litter. Since, Banni is largely grassland; tree leaf litter is almost negligible.

The predominant tree species in Banni are *Salvadora* sp. and the invasive *P. juliflora*. The *Prosopis* has invaded 50% of the total area with grassland having around 30%. Average density of *P. juliflora* in Banni is recorded as 2053/ha.

The CO<sub>2</sub> sequestration potential of *P. juliflora* tree is reported around 1847 kg/tree. Direct measurements of soil C have indicated sequestration of 45 - 80 g C/m<sup>2</sup>/year.

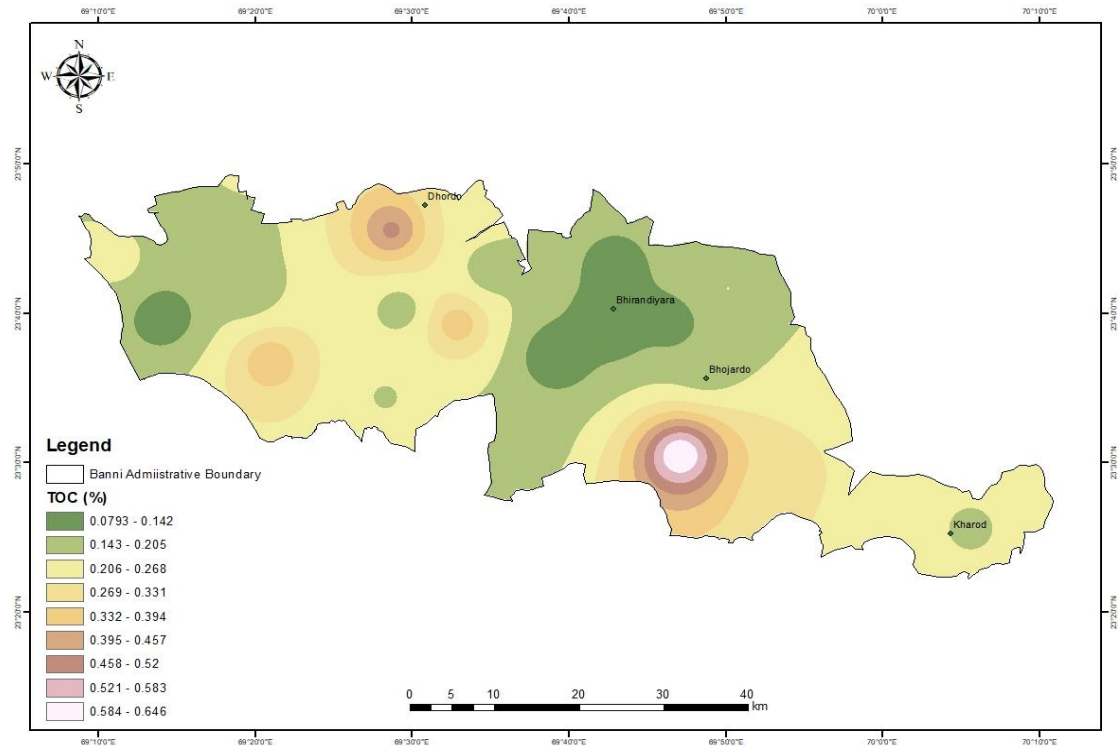


Figure 6.1: Soil Organic Content map of Banni Protected Forest (0-30 cm depth) during the year 2020

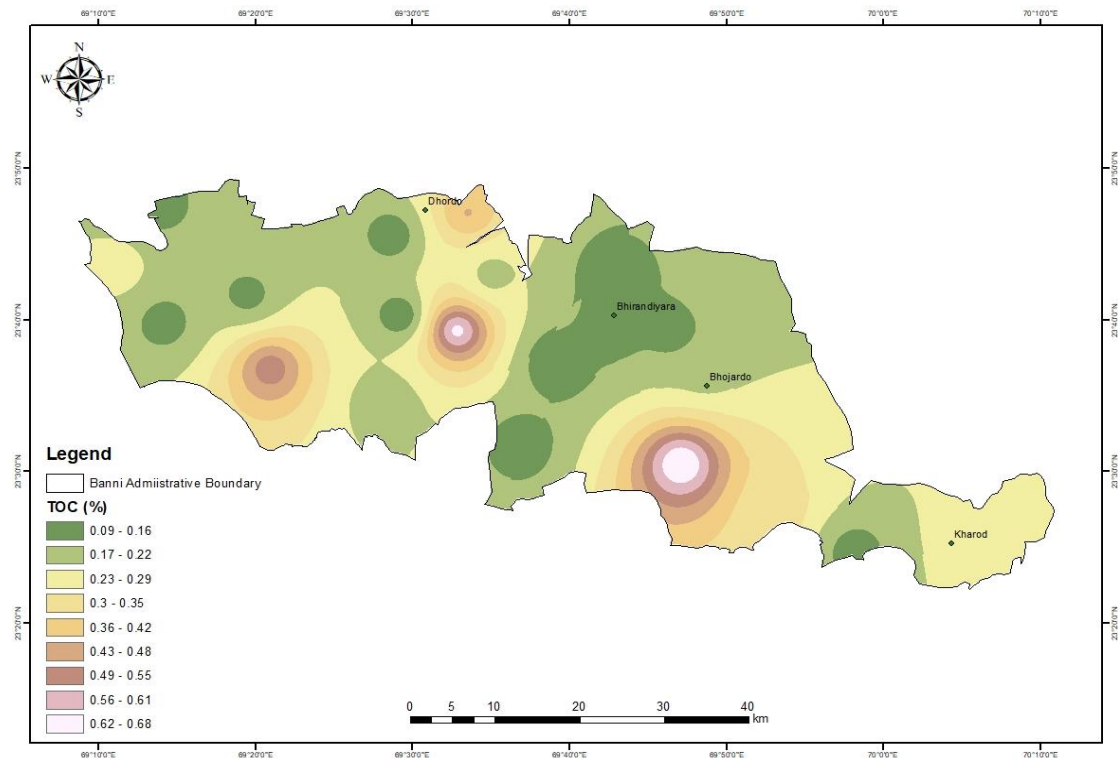


Figure 6.2: Soil Organic Content map of Banni Protected Forest (0-100 cm depth) during the year 2020

## Chapter 7

**Optimization of forest resource utilization**

- 7.1 Recorded removal of timber:** Banni protected forest is a grassland and hence timber producing trees are mostly absent. Tree species being small-sized and of short height, such as *Acacia sp.*, *Salvadora sp.* and *P. juliflora*, are not suitable to be used as timber. The tree species of Banni are mainly used locally for small wood, firewood and fodder.
- 7.2 Recorded removal of fuelwood:** The socio-economic survey conducted by staff in coordination with scientists of GUIDE, highlighted that in Banni, a family uses an average of 2 kg of firewood per day or 6132.8 kg/day from Banni. The annual harvest of firewood is equivalent to 2238.47 metric tons/year which is equal to Rs. 6.37 lakh. Although LPG gas usage has increased, firewood is still necessary to enhance the taste of traditional cuisine as it is believed. *Prosopis juliflora* (Ganda baval) plants utilised as fuel by most of the community in Banni.
- 7.3 Recorded removal of locally important Non Timber Forests Produce (NTFPs) including Medicinal and Aromatic Plants (MAPs):** NTFPs like honey, gum and charcoal are collected by the Gujarat State Forest Development Corporation (GSFDC) from Banni Protected Forests since last 15 years with the involvement of the local community. The Forest Department and GSFDC harvested 972.36 quintals of NTFP in the state with a selling value of Rs. 291.19 lakh, according to Gujarat Forest Statistics 2018-2019. Traditionally, local people collect NTFPs from Banni for herbal medicine by the local people for their own uses and curing some diseases of their livestock.

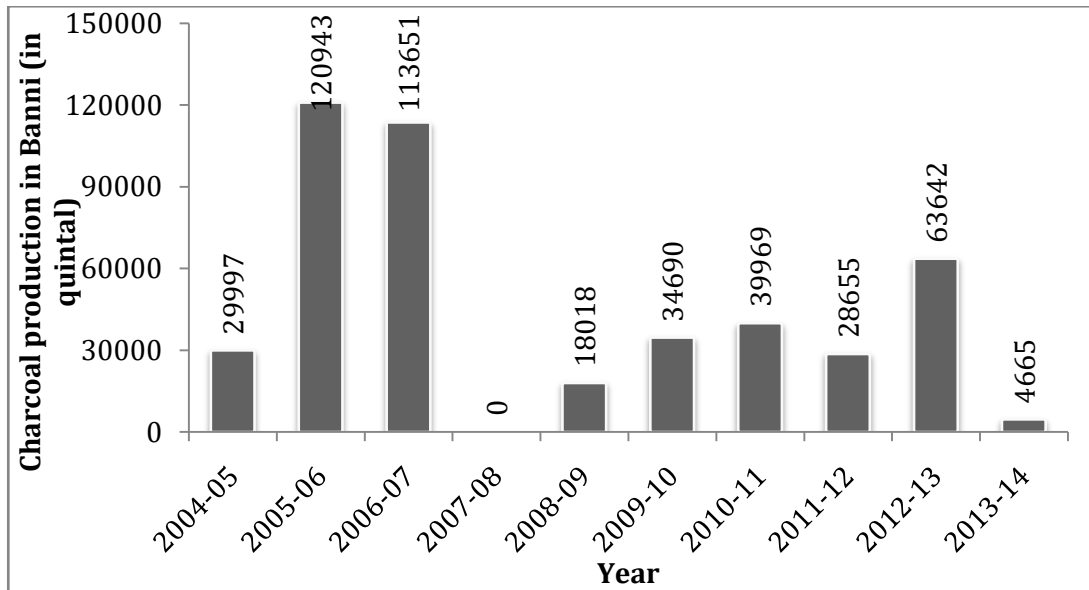
The major NTFPs collected from Banni includes; honey, wax, gum and major MAPs is Guggal gum. As per the estimation of NTFPs and MAPs in the last 10 year, a total of 3624 quintals of honey, 33 quintals of wax, 1426 quintals of gum and 23.8 quintals of Guggal gum from Banni protected forests (table 7.1). The mean honey, wax, gum and Guggal gum collection from Banni were 402.67, 3.66, 14.42, 196.58, 3.61, 1.16, 1.01 quintals respectively.

**Table 7.1: NTFP Collection in last 10 years from Banni Protected Forest**

Year	NTFP collection (in quintal)						
	Honey	Wax	Gum-1	Gum-2	Guggal-1	Guggal-2	Guggal-3
2011-12	738.96	8.86	-	1.68	16.66	1.15	1.01
2012-13	878.66	12.25	-	7.61	0.43	-	-
2013-14	181.82	1.11	17.19	332.55	-	-	-
2014-15	274.38	2.8	25.77	993.65	-	-	-
2015-16	182.02	2.56	0.25	11.44	0.53	-	-
2016-17	662.67	2.33	6.48	23.87	3.22	-	-
2017-18	392.35	1.99	-	5.23	0.74	-	-
2018-19	128.13	0.38	-	-	-	-	-
2019-20	185.00	0.64	-	-	0.09	-	-
Total	3623.99	32.94	49.69	1376.04	21.67	1.15	1.01
Mean/yr	402.67	3.66	12.42	196.58	3.61	1.16	1.01

**7.3.1. Charcoal:** Charcoal is the major NTFP of Banni after two decades of its introduction to Banni. Charcoal is mainly prepared from the wood biomass of *P. juliflora* by the local people and the prepared charcoal was transported to other parts of the state as well as the country. In present market price, per metric tons (1000 kg) of charcoal sold in an average of Rs. 12000. Therefore, sufficient labour wages as well as local contractors are involved in this business. After the order of the Deputy Collector, Bhuj vide no. Land/Vash/2684/2005, for cutting of *P. juliflora* and preparing the charcoal from an area of 16,400 ha to BPL families for GSFDC, Gujarat State, there was no control over the area. In this process, because of the haphazard cutting of *P. juliflora*, the production of honey had gone down and the area was converted into shrub growth of this tree. Department of Forests and Environment, vide G.R.No. TRV-102004-2033-K, dated: 06/05/2008, has regulated the cutting of the *P. juliflora* in the community and Govt. waste lands. This has completely restricted the cutting in Banni protected forests. For livelihood purpose, the local people have resorted to cutting of Ganda baval and conversion into charcoal.

Though, charcoal production from the Bhuj taluka including Banni in last 10 years (2004-05 to 2013-14) was 454230 quintals with average production rate 50470 quintals/year (Figure 7.1).



**Figure 7.1: Trend of Charcoal production in last 10 years (2004-05 to 2013-14).**

**7.3.2. Honey:** Honey is the other NTFP produced which is collected on a large scale from the Banni area. Production of honey largely depends on *Prosopis* stock and therefore scientific management is a prerequisite for sustainable production. Honey collected in last 10 years from Banni is shown in table 7.1.

**7.4. Demand and supply of timber and important non-timber forest produce:** Timber and wood mostly are imported from other parts of Gujarat or nearby states for modernization and improvement in housing requirements. In the Banni area, accessibility to LPG is growing due to various government initiatives. Nevertheless, as traditional cuisine favours firewood-based cooking methods, the use of firewood demand is still persistent. The household survey revealed that the dried branches of *P. Juliflora* are mostly used as firewood.

#### **7.5 Removal of fodder**

In the Banni area, local grazers own cows, buffaloes, goats, sheep and camels for about 500 years. Over 88018 heads of livestock live off the Banni grasslands, as per the Livestock Census of 2019. The region shows that the area is shared by

Sindhi speaking maldharis (cattle breeders), the Muslim communities including Halaypotra, Hingora, Hingorja, Jat, and Mutwa along with Meghwal Hindus tribes. The field study found that most of the Maldharis are not storing the grass and directly access it from the grasslands and have a free-grazing system in Banni for a longtime. During summer, the pastoralists procure fodder from private vendors and the government's subsidized outlets.

Grasses are in demand during droughts and are imported from other districts of Gujarat and also from outside the state. As the animal population is quite substantial, there is a huge demand for fodder, which is aggravated by the repeated droughts. The domestic animal population as per the 1992 census was 25351 which increased to 57073 as per Livestock Census, 2012 and the recent survey in the year 2019 the total livestock was 88018.

Local Maldharis are nomadic by habit and go for free grazing. No routine agriculture systems have been adopted because of erratic rainfall and soil condition. Sometimes, they raise fodder crops for their domestic cattle.

The grass is in great demand during scarcity/drought years. Therefore, Banni division collect grasses from the grass plots and stores in grass godowns to be distributed to Maldharis during scarcity. Grass collected by the division in last 10 years is given in Table 7.2.

**Table 7.2: Grass collection in last 10 years from Banni Protected Forests**

Sl.No	Year	Area (Hec.)	Collected grass (Kg)
1	2010-11	-	-
2	2011-12	-	-
3	2012-13	-	-
4	2013-14	-	-
5	2014-15	500	-
6	2015-16	1550	-
7	2016-17	1460	-
8	2017-18	1300	81758
9	2018-19	700	-
10	2019-20	800	200100
11	2020-21	800	700000
	<b>Total</b>	<b>7110</b>	<b>981858</b>

## 7.6. Valuation of the products:

**7.6.1. Valuation of Milk and Dairy business:** The mainstay of Banni is animal husbandry. The valuation of Banni in terms of socio-economics is mainly dependent on grass productivity. Traditionally the Banni pastoralists were breeders of livestock and were involved in the trade of the Banni Buffalo and Kankrej cattle and bullocks, and Banni was not traditionally a dairy-farming economy. After the introduction of dairy in 2009-2010 for milk collection, the pastoralists of Banni started selling milk in large quantities. The introduction of dairy has led to a revival of buffalo breeding in Banni. Also, registration of Banni buffalo as the country's 11<sup>th</sup> buffalo breed in India in 2011 motivated the Maldharis, especially the younger generation, to continue and strengthen their pastoral occupation (Bharwada & Mahajan, 2012).

**7.6.2. Valuation of Charcoal:** Charcoal making is the second biggest source of income for Maldharis after livestock. *Prosopis* wood is harvested for making charcoal, without uprooting the tree. Due to an official ban throughout the period 1995 to 2004, the values of charcoal produced from Banni dropped (at the ~20,000 ton/year). But then, in 2004-05, the ban has been lifted, what was expressed in peak values of charcoal production, from 54,000 to 230,000, 224,000, and 219,000 tonnage in 2007. It led to a reduction in area under *Prosopis* as Maldharis resorted to removing *Prosopis* trees from the roots for making charcoal. Maldharis recollect that the grasslands had come back as a result of its removal, as uprooting the tree frees up the land allowing grasses to grow in that area. It is hard to estimate the exact amount by which the production went up but estimates of the increase in the number of charcoal-laden vehicles leaving Banni suggest that it could have been as high as ten times (Bharwada & Mahajan, 2012). In 2008, this ban was again imposed.

Milk income contributes more than 95% of the total pastoral income of Banni and more than 85% of the total income of Banni. Charcoal income contributes around 14% of the total income of Banni (Mathur and Sharma, 2019).

**Chapter 8****Maintenance and Enhancement of Social, Economic, Cultural and Spiritual benefits**

- 8.1 Number of JFM committees and area (s) protected by them:** As per the Census of 2011, Banni has a population 29555 and 10077 HH under 55 villages of 19 Gram Panchayats. Joint Forest Management Committees (JFMC) have not been formed within the Banni division till date.
- 8.2 Labour welfare:** For carrying out various activities of Banni division, mainly for grassland development local people are being regularly involved to provide them income and employment. They are also involved in the protection of grass plots, grass cutting and storage works.
- 8.3 Use of indigenous knowledge:** Maldharis have traditional medicinal plant knowledge which guards them against diseases. In the villages, there are traditional experts called '*bhagiya*' who are trusted by locals and are considered authorities with the expertise they had gained over years in animal health and animal exchange facilities.
- 8.4 Extent of cultural/ sacred groves:** Within its jurisdiction, the Banni division has no sacred groves. A well known sacred grove, Shraavan Kavadiya is located in the south-eastern fringe of Banni. This is unique inland mangrove, which survived for 1000 years and is located more than 100 km far from the seas coast. Recently, almost all the mangrove trees of species *Avicennia marina* are lost due to changes in climatic and geophysical conditions of the area.

The Banni Muslim Communities have the habit of preventing any plant in the region from exploitative use. If any person feels that the particular plant is over exploited, this will be raised at their Jamat (Friday prayer meeting) and the same will be discussed and necessary decisions will be made for its conservation.

**8.5 Ecotourism areas and activities:** The popular tourist destinations located in and around the Banni protected forest are Rann of Kutch, Kaladungar, India Bridge, Banni Grass Land etc. Rann Utsav attracts both national and foreign tourists to come and explore the uniqueness of Kachchh district.

**8.6 Social customs:** There are a total 55 villages and 19 panchayats within the Banni grassland boundary. The culture and language indicates that majority of Banni residents have their origin from Sind. *Raysipotras* (literally-children of *Raysi*) took their clan name from their ancestor *Raysi* (a saint), belonged to Dhal caste of Sind. The nomadic pastoralist communities of Banni, the *Maldharis*, comprise of 22 ethnic communities. The largest pastoral group traditionally are grassland dependent communities comprising of several Muslim communities like *Jat*, *Raysipotra*, *Saiyads*, *Mutava*, *Node*, *Sumra*, *Juneja*, *Bhatti*, *Halepotra*, *Khattris*, etc.. These communities are settled in small groups or in a cluster of small family/clan houses locally known as 'Wandh', positioned nearer to a water source. Thus, gradually the livestock owners of the Banni have become settled in 55 villages of Banni. 'Bunga' is the traditional house of the natives of this grassland. The roof is thatched by *Cyprus* - a grass species predominantly available in many parts of Banni. The materials generally used in construction are clay bricks and mud, while the walls and floor are plastered with a thin layer of cow dung.

All these pastoral groups follow Islam and have always had a strong influence on Sufi traditions. Their traditional music, Sindhi *kafis*, also draws a lot from Sufism. The other community in Banni is Meghwal who migrated from Marwar region of Rajasthan in the early 19<sup>th</sup> century, thus are locally known as Marwada. They follow Hindu religion and are also strong worshippers of Ramdev Pir. Vadhas is another community involved in carpentry work making fine lacquered furniture.

Cattle were always the most prized possession for Banni pastoralists. Many of their fairs, festivals, and socialization revolve around their livestock. It is quite common among them to visit each other for sharing the pain and the joy of their herds. When a pastoral family loses many animals in a disease breakout; or

when they leave for migration; or bring in new animals from elsewhere; there is a tradition in which friends and relatives visit such family.

*Maldharis* are landless and dependent on *gauchar* (village commons) for their livestock rearing. Livestock rearing is the traditional occupation and was the predominant source of income for pastoralists. Pastoralists who own large buffalo population sold few milch buffaloes every year. Pastoralists owning small buffalo population sold buffaloes whenever they needed cash for meeting expenses for social ceremonies such as marriage, construction of new house, and emergencies.

- 8.7 Status of compliance of Forest Right Act (FRA):** In compliance with the Forest Right Act (FRA), Forest Rights Act Committees have been constituted in 40 villages out of 55 villages/vandhs of the Banni area. The FRA Committee is constituted in Dhordo, Patgar, Wudo, Saniyara, Bhirandiyara, Reldi, Madan and Bhojardo. The committee constitution in the remaining villages in progress.
- 8.8. Dependency of local people on NTFPs:** The majority of the community is involved in pastoralism and very few are working in the private sector. Hence, most of the residents rely on the grass growing in the Banni area for cattle fodder. Gum collection is also a major livelihood option other than agriculture. As mentioned earlier, *Maldharis* go for open grazing rather than stall feeding.
- 8.9. Other aspects:** As per historical records of “people of Banni” in the 18<sup>th</sup> century, most of whom of the Dhal caste from the Sind desert region (currently in Pakistan), who practiced pastoral livelihood based on livestock grazing, temporarily settled in Banni. But during the period of India’s princely rule, in the late 19<sup>th</sup> century and the early 20<sup>th</sup> century, when Banni has become an administrative unit within the Kachchh principality, the ruler declared Banni as “Reserved Grassland”, and nomadism between Banni and the Sind desert prevailed.

Given the low soil moisture content and the high soil salinity of the Banni, cultivation is infrequently practiced and livestock has been the mainstay of the Banni people. Cattle have been the main livestock component, seconded in by

buffalo. Jointly, the two comprised 49% of livestock animals, while sheep and goats have been as common in number but not that economically significant. All these livestock species have been free ranging the whole of Banni tract has been used as grazing land. The livestock animals depended solely on the provisioning services of the Banni ecosystem for their water and forage requirement with no added fodder and water transported from elsewhere.

The Banni people, locally called Maldhari, i.e. cattle breeders, keep and breed two superior breeds, one of cattle and the other of buffalo. The Kankrej breed, which is the heaviest cattle breed of India is highly adapted to extreme and prolonged drought conditions. Buffalo and of the local indigenous breed, Khunni is also highly adapted to Banni environment, is among the heaviest and highest milk productive breed in India.

'Kharai' camels, a unique breed of camels only found in Kachchh, adopted to forage mangrove vegetation and sustain in saline land. Majority of camels of Banni belong to the Kharai breed.

Banni people specially women are highly skilled in handicraft making. This provide livelihood as a primary and also secondary occupation to the considerable population of Banni. With increasing tourism in Banni area, mainly in the White desert, Hajipir and Kalodungar, the people of Banni are getting a sizeable income from handicraft making apart from milk selling.

**Chapter 9****Adequacy of Policy, Legal and Institutional Framework****9.1 Existing policy and legal framework and their compliance:**

As per the Govt. of Kachchh's notification no. RR-155/55, dated 11<sup>th</sup> May 1955; the Chief Commissioner of Kachchh had declared the Banni grassland area as 'Protected Forest' under Section 29 of the Indian Forest Act, 1927. Till date, this area is under the administrative control of the revenue department. Part of the Banni Protected Forest is declared under the Wildlife (Protection) Act, 1972 as under the Kachchh Wildlife Desert Sanctuary in the eastern fringe of Banni and the Charidhundh wetland located in the south-western part of Banni is protected as under "Charidhandh Conservation Reserve".

Banni grassland was declared as 'Protected Forest' in the year 1955 and is inhabited by 55 villages under 19 Gram Panchayats of Bhuj taluka of Kachchh (**Annexure VI**) The outer boundary of the protected forest is demarcated and village boundary demarcation within Banni is under process.

The policies of Govt. of Gujarat for other Protected Forests and Grass Vidi's of Gujarat state are also followed for Banni grassland. Further, protection flora, fauna and wildlife, grassland development and restoration of degraded areas of Banni is the major focus of the Division.

**9.2 Status of Approved Working Plan and Compliance:** After the formation of the Banni Grassland Division by bifurcating Kachchh East and Kachchh West Divisions, first Working Plan for the Banni Grassland Division was approved in the year 2009-2010. As per the Working Plan, Banni Protected Forest was divided into 5 working circles viz. Grassland Working Circle, Prosopis Working Circle, Improvement cum Regeneration Working Circle, Wildlife Working Circle (overlapping) and Joint Forest Management Circle (overlapping) for management purpose.

**9.2.1. Grassland Working Circle:** It was observed that 30.90% of the total area was comprised of dense and sparse grassland as per the satellite imageries of 2003.

As per the recent LISS-4 imageries, the grassland/scrub cover of the grassland is 30.89%. Therefore, the major patches of dense and sparse grass were kept under Grassland Working Circle. The grass growth has also been observed at many places in the areas under sparse *Prosopis* cover has also been considered for the Grassland Working Circle. Thus, the total area for the Grassland circle was 67,321.04 ha. This working circle covered the removal of *Prosopis*, protection of the area from open grazing, and development of grasslands.

**9.2.2. Protection cum Improvement Working Circle:** Major patches of barren, high saline soil with or without vegetation and salt-affected areas with/without vegetation were put into Protection cum Improvement Working Circle. This encompasses the area from the desert border towards the inner side of Banni, an area of about 2 Km<sup>2</sup> falls under this working circle. The area largely encompasses barren and saline lands and devoid of much vegetation with some sporadic patches of vegetation at few places. In addition to the above classes, the area under water bodies has also been kept under the same working circle. The areas falling under Kachchh Desert Wildlife Sanctuary and Charidhundh Conservation Reserve were subtracted from the working plan circle area. Therefore, the area under this working circle was 80,218.80 ha.

**9.2.3. *Prosopis juliflora* Working Circle:** *Prosopis* has been planted in Banni during late 1950s and it has invaded vigorously in most of the Banni grasslands. According to the study done by Kadikar (1994), the area under *Prosopis* was 37,890 ha in 1980 subsequently dense *Prosopis* area increased to 86,569 ha in 2009. Considering the spread of dense *Prosopis* in 2009 and the scope of profuse coppicing and regeneration in the future, it would be appropriate to put the major patches of dense *Prosopis* cover under the *Prosopis* Working Circle based on the thematic map of 2009 for the management of the growth of *Prosopis*. The *Prosopis* tree cover will be worked at regular intervals and will be maintained as a tree cover. The good grass patches of the reasonable area will be treated as grassland. The local Panchayats will work out the area with the active participation of local communities. The benefit-sharing to Panchayats will be 80% and 20% of government revenue. Further, to make a compact patch from the management angle inter spread of small patches of sparse *Prosopis*

area were also added, and were proposed under *Prosopis* Working Circle totaling an area of 41,369.9 ha.

**9.2.4. Joint Forest Management Working Circle (Overlapping):** The whole working plan areas were overlapped by this working circle. The joint forest management were to be promoted through GUIDE, NGOs, and other stakeholders as well as industries in all the working circles. This overlapping working circle was constituted to provide active participation of local peoples in the management and conservation of the Banni area and its wildlife.

**9.2.5. Wildlife Working Circle (Overlapping):** The whole working plan areas were be overlapped by this working circle. The major emphasis was focuss to conserve the fauna, especially avifaunal diversity in the region. The area attracts a mass population of migratory birds like Flamingos and Cranes. The seasonal water bodies/wetlands which attract a large population of migratory birds were to be conserved and developed.

### 9.3 Number of forest offences:

Illegal charcoal preparation is the major forest offences in Banni Protected Forest due to its remote location and presence of a dense cover of *P. juliflora* in Banni compared to other parts of the district. Cutting of *P. juliflora* and preparation of charcoal is a prohibited activity in Banni vides Govt. of Gujarat GR dated 06/05/2008 (**Annexure X**) (List is given in Table 9.1). The forest offences are mainly associated with wildlife crime and violation of Forest Conservation Act., encroachment, etc.

**Table 9.1 : Forest Offences year wise in Banni Grassland Division**

Sl. No.	Year	Offence Register No.	Charcoal Seized (No. of Bori, 40 kg/bori)	Solved / Pending
1	2014-15	1/2014-15	350	Pending
2	2015-16	1/2015-16	260	Solved on 12/07/2016
3	2016-17	1/2016-17	25	Solved on 07/09/2016

Sl. No.	Year	Offence Register No.	Charcoal Seized (No. of Bori, 40 kg/bori)	Solved / Pending
4	2017-18	2/2017-18	250	Solved on 22/05/2019
5	2018-19	1/2018-19	270	Solved on 28/12/2018
6		3/2018-19	200	Solved on 29/07/2019
7		4/2018-19	140	Solved on 10/10/2018
8		5/2018-19	720	Solved on 28/10/2020
9		7/2018-19	300	Solved on 16/03/2019
10		2019-20	1/2019-20	181
11	2/2019-20		25	Solved on 24/07/2019
12	3/2019-20		250	Solved on 29/10/2020
13	4/2019-20		170	Solved on 16/10/2020
14	5/2019-20		102	Solved on 19/12/2020
15	6/2019-20		22	Solved on 28/07/2020

**9.4. Status of research and development:** There has been several research and studies on the various aspect of Banni grassland. Notable among them are the biodiversity survey of the grassland conducted by GUIDE in the year 2010-11 and Forest Resource Survey of Kachchh including Banni was conducted by GUIDE (2014). Various other agencies and NGOs have carried out some studies on Banni grassland.

Literature review on research works on various aspects of banni grassland by various authors highlighted the banni ecology, biodiversity, environment, socio-

economocs, etc. Notable among them include; Soil Survey Division (1986), Jadhav *et al.* (1992), Saxena (1992), Kadikar (1994), Dixit (1997), GUIDE (1998), Sastri *et al.* (2003), Bharwada and Mahajan (2006), Deepa and Lakhmapurkar (2009), Vijay Kumar *et al.* (2011), Vaibhava *et al.* (2012), Bharwada and Mahajan (2012), , Koladiya *et al.* (2012), Sanghvi *et al.* (2013), Koladiya *et al.* (2014), Patel (2015), Vijay Kumar *et al.* (2016), etc.

The first baseline status of soil of Banni area was investigated by the soil survey division, Govt. of India. While the overall ecological aspects and their restoration through ecological principles was investigated by the GUIDE in year 1998. Various biodiversity components of the Banni grassland was surveyed and highlighted by various researchers which includes Vijay Kumar *et al.* (2011), Koladiya *et al.* (2012), Sanghvi *et al.* (2013), Koladiya *et al.* (2014), Patel *et al.* (2015), Vijay Kumar *et al.* (2016), Joshi *et al.* (2017), etc. The landuse and land cover analysis of Banni are made earlier by the Jadhav *et al.* (1992). Further, LULC analysis was made by Kadikar (1994), Sastri *et al.* (2003), Vaibhava *et al.* (2012), etc. Deepa and Lakhampurkar (2009) relates the soil salinity and *Prosopis juliflora* growth. Dixit (1997) studied on the ecological degradation of Common Property Land Resources: Problems and Prospects in Banni. GUIDE (1998) highlighted the status of Banni grassland and exigency of restoration efforts while, GUIDE (1998) also made comprehensive document on '*Ecorestoration of Banni Grassland*'. Saxena (1992) highlighted the halophytic vegetation of Banni grassland. The status of grassland of Kachchh specifically highlighted the Banni grasslandby Vijay Kumar *et al.* (2011). Bharwada and Mahajan (2006) highlighted the socioecology of Banni by a document on Lost and forgotten: grasslands and pastoralists of Gujarat, and prepared a monograph titled 'Let it be Banni Understanding and Sustaining Pastoral Livelihoods of Banni' in 2012.

Some experimental plots for grass developed were made by the Gujarat Ecology Commission. As a climate change mitigation activity under NAFCC Project of MoEF & CC, New Delhi, grass plot development in 600 ha area (including 100 ha seed bank) of Banni has been carried out by the Banni division under the guidance of GEER Foundation, Gandhinagar.

**9.5. Human resource capacity building efforts:** The capacity building programme through various training related to protection, conservation and management of forest and wildlife has been given to the field/ground staff and frontline staffs of the Banni Division from time to time by the training and research wing of Department of Forest, Govt. of Gujarat. Further, various programmes related to wildlife, forest, social forestry, biodiversity conservation, etc. have been conducted by Kachchh East, Kachchh West, Banni Division and Social Forestry Division.

No specific training has been organized for the locals of Banni.

**9.6 Forest Resource Accounting:** The forest resources of Banni are mainly the fodder productivity from grasses and other palatable species. Apart from the grass productivity, NTFPs collection such as honey and gum is the major forest resources of Banni which aids to the livelihood of the residents. Some people are also involved in charcoal preparation by cutting of *P. juliflora*. (Manjunath *et al.*, 2019). The details of NTFPs collected in last 10 years is given in table 7.1. and the grass collected in last 10 years is given in table 9.2.

Table 9.2: Grass collection in last 10 years from Banni Protected Forest

Sl. No.	Year	Collected Grass (Kg)
1	2010-11	-
2	2011-12	-
3	2012-13	-
4	2013-14	-
5	2014-15	-
6	2015-16	-
7	2016-17	-
8	2017-18	81758
9	2018-19	-
10	2019-20	200100
11	2020-21	700000
	<b>Total</b>	<b>981858</b>

- 9.7 Budgetary allocations to the forestry sector:** In the previous plan period, various activities were planned for conservation, protection, restoration and management of grasslands and other habitats of Banni. A total of 6310 ha of Banni land has been covered for grass plantation and restoration activities allocation of Rs. 961.77 lacs from various heads and schemes of Forest Department and other projects (Table 6.1). Further, a total of 66 water conservation structures have been created by the division with an allocation of Rs. 225.28 lakh under various schemes and projects of the Department of Forests (Table 5.1).
- 9.8 Existence of monitoring, assessment and reporting mechanism:** Monitoring and evaluation parameters are defined in the first working plan of Banni. Various control forms are filled up by the competent authority of the division which is recorded and communicated to higher authority from time to time.
- 9.9 Public awareness and education:** Research articles and reports on various aspects of the Banni protected forests are published. Notably, a field book on 'Birds of Banni Grassland' authored by GUIDE Scientists was published by the Ravi Shankaran Foundation, Mumbai. The efforts to increase public awareness of the importance and the benefits provided by forests and sustainable management of forest have been made. As part of awareness campaign; brochures, pamphlets, leaflets, posters, etc. have been distributed. Meetings with the general public were also conducted to inform them of the benefits provided by forests and grasslands to society.
- 9.10 Adequate manpower in forest division:** The details of sanctioned, permanent, temporary and seasonal posts are given in Table 9.3. At present in the Banni division, 26 posts are filled out of 48 sanctioned posts while 22 posts remain vacant. As per the requirement of daily wage/contractual manpower for various activities of the division mainly for grass plot development and other conservation and management activities, labourer are hired. The wages for the labourers are as per the minimum daily wages fixed by the Govt. of Gujarat. The vacancy at several levels has seen to be a constraint to effective implementation.

**Table 9.3. Manpower details of the Banni Division**

Sl. No	Class	Approved post	Filled post	Vacant post	Remarks
1	D.C. F	1	0	1	-
2	A.C. F	1	1	0	-
3	R.F. O	5	5	0	-
4	R.F.O (S)	1	0	1	1 post transfered to Rajkot forest circle
5	Forester	7	5	2	-
6	Beat Guard	25	17	8	-
7	HeadClerk	1	0	1	1 post transfered to Ahmedabad Forest Division
8	Accountant	2	2	0	
9	Clerk	2	1	1	-
10	Surveyor	1	0	1	-
11	Peon	1	0	1	-
	<b>Total</b>	<b>47</b>	<b>31</b>	<b>16</b>	-

## Chapter 10

## Activities under taken in last plan

## 10.1. Activities Undertaken During Five Year Plans

Banni is a highly vulnerable and fragile ecosystem, which experiences extreme climatic hazards from severe drought to flooding conditions on regular basis. This impacts the grassland negatively in terms of productivity and loss of biodiversity. For conservation, management and restoration purpose, various activities have been initiated by the Banni Division as per the treatment method prescribed under the existing working plan, 2009 of Banni Protected Forests. The activities like grass plot development, experimental grass plot development, grass restoration, protection, fencing and soilmoisture conservation activities have been undertaken in Banni.

**Table 10.1: Deails of Grass development works done in the last working plan period**

Year	Forest Range	No. of Location	Area of Plantation (in ha)	Expenditure
2014-15	Berdo	5	400	65.82
	Tuga (Luna)	1	100	16.80
		Total	500	82.62
2015-16	Berdo	11	1179	179.96
	Tuga (Luna)	2	271	45.25
	Bhirandiyara	1	100	11.19
		Total	1550	236.40
2016-17	Berdo	5	410	8.49
	Hajipir	3	240	4.96
	Saragu	3	300	5.72
	Bhirandiyara	3	500	9.92
	Sarado	1	10	4.91
		Total	1460	34.00

Year	Forest Range	No. of Location	Area of Plantation (in ha)	Expenditure
2017-18	Sargu	11	290	78.91
	Bhirandiyara	13	1010	224.19
		Total	1300	303.10
2018-19	Sarado	2	200	53.51
	Berdo	3	250	60.36
	Tuga	5	250	63.26
		Total	700	117.13
2019-20	Tuga	4	400	91.86
	Bhirandiyara	1	100	23.38
	Berdo	4	300	73.28
		Total	800	188.52
<b>Grand Total</b>			<b>6310</b>	<b>961.77</b>

**Table 10.2. Details of Water Conservation and Management Work**

Year	Scheme/ Head	Project/ Model	Range	Number	Expenditure (in lakh)
2012-13	Forest Conservation and Development	Grass Development Project	Berdo	4	13.88
			Sarado	2	5.95
			Bhirandiyara	1	2.86
			Sargu	1	3.03
			<b>Total</b>	<b>8</b>	<b>25.72</b>
2015-16	Forest Conservation and Development	Grass Development Project	Berdo	4	18.45
			<b>Total</b>	<b>4</b>	<b>18.45</b>
2016-17	Forest Conservation and Development	Grass Development Project	Bhirandiyara	4	19.89
			Sargu	2	5
			<b>Total</b>	<b>6</b>	<b>24.89</b>
17	Forest	Grass	Bhirandiyara	5	25

Year	Scheme/ Head	Project/ Model	Range	Number	Expenditure (in lakh)
	Conservation and Development	Development Project	Tuga	1	5
			Sarado	2	10
			Berdo	1	5
			<b>Total</b>	<b>9</b>	<b>45</b>
2018-19	Forest Conservation and Development	Grass Development Project	Tuga	1	4
			Berdo	1	4
	Climate Change Mitigation and Adaptation	Grassland Restoration-NAFCC Project	Tugaluna	6	30
			Sarado	3	12.50
			Saragu	2	10
	Forest Conservation and Development	CAMPA	Tuga Luna	5	15
			Sarado	1	3
				<b>Total</b>	<b>19</b>
2019-20	Climate Change Mitigation and Adaptation	Grassland Restoration-NAFCC Project	Tuga Luna	7	35
			Sarado	5	25
	Forest Conservation and Development	Grass Development Project	Berdo	4	14.81
			Tugaluna	4	19.91
			<b>Total</b>	<b>20</b>	<b>34.72</b>
			<b>Grand Total</b>	<b>66</b>	<b>225.28</b>

Table 10.3: Cattle Pond (Aveda) Development

Sl. No.	Year	Scheme/ Head	Division	Number	Expenditure (in lakh)
1	2015-16	Forest Conservation & Development	Banni Grassland Division	5	1.50
2	2016-17	Forest Conservation & Development	Banni Grassland Division	10	3.00
3	2017-18	Forest Conservation & Development	Banni Grassland Division	10	3.00
			<b>Total</b>	<b>25</b>	<b>7.50</b>

## Chapter 11

## Past Systems of Management

**11.1 General history of the forests:**

Banni was once the Asia's finest and only remaining single natural vast stretch of grassland in the Indian sub-continent. The name Banni is derived from a Kachchhi word '*Bannai hui*' which means 'newly made up', signifies that the land has been as per evidence, formed by detritus and sediments brought down and deposited, predominantly by many rivers such as Indus, Luni, Banas and Saraswati which in the recent geological past flowed through this area from the north and east.

No documented history of this forest area is available. But, it is said that the whole area of Banni was being used as grazing ground by the domestic cattle, in addition to the grass, the whole area was interspersed with *Acacia nilotica* trees.

During the times of the Princely State of Kachchh, Banni was considered a separate administrative unit, i.e. *mahal* meaning "Reserved Grassland" (Census of India, 1961). During June 1948 Banni was included in Bhujtaluka at the time of the reorganisation of the Revenue administration of the State of Kachchh. In 1956, Kachchh was merged in the reorganised Bombay State, and became one of the districts of the State, and later of Gujarat State.

After 1947, grazing in Banni was regulated by imposing a fee for different categories of livestock. Due to heavy rains/flood during 1959, the government provided assistance to the villagers and grazing regulations were removed and the emergence of open access regime started. A large number of livestock from every part of the state and even neighbouring states gained free access into Banni for 3-4 months, especially during monsoon.

Banni grassland was declared as 'Protected Forest' under section 29 of Indian Forest Act 1927 vide the Notification Dated: 11/05/1955 and the area is under the jurisdiction of the Revenue Department. The management of the ecosystem

of the Banni is done by State Forest Department as per the prescriptions of the Working Plan.

Palatable as well as perennial grasses were abundant in this area. The 1960-1961 was a benchmark year in the ecological and socio-economic history of Banni. As a major management intervention to stop the advancement of the Rann along the northern fringes of Banni, *Prosopis juliflora* was planted, which over time invaded a major portion of the grassland.

## **11.2 Past system of management and their results:**

### **11.2.1. During Princely Rule**

During Princely Rule, Maharao (King) of Kachchh declared Banni as “Reserved Grassland”. During the period, only milking cattle and buffalos were allowed to graze. Sheep and goats were strictly prohibited for grazing (SoEK, 2011). After 1947, grazing was regulated by imposing a fee for different categories of livestock; ranging from INR 0.12 per/year for each sheep and goat to INR 2.25 for buffalo. All livestock including sheep and goats were permitted for grazing. This was enforced until 1957 (SoEK, 2011).

In the wake of scarcity in 1957-58, an unusual calamity occurred in 1959 when heavy rains flooded the area, jeopardizing the lives and property of *maldharis*. Government provided assistance in various forms to the villagers to tide over the difficulty.

### **11.2.2. After 1957**

The grazing regulations disappeared and emergence of open access regime commenced after 1957. Large number of livestock from every part of the state and even neighbouring states gained free entry into Banni for 3-4 months especially during monsoon season (Bharara, 1987; Ferroukhi, 1994 and SoEK, 2011). During the period, The green forage production was 4147.2 lbs./acre (app. 4646 kg/ha) (Census of India, 1961, Village survey monographs-Bhirandiyara).

1960-61 was benchmark in the ecological and socio-economic history of Banni. GSFD, as a major management intervention to stop the advancement of the

Rann along the northern fringes of Banni, planted *Prosopis* in an area of 31,550 ha.

Gajansar dam was constructed across Panjora river during 1960 (stopped flow to western Banni), Rudramata dam was constructed across Khari/Pur river during 1970 (stopped flow to Central and Eastern Banni), Niruna dam was constructed across Bhurud river during 1970 (stopped flow to Central Banni), Kaswati dam across Kaswati river during 1976 (stopped flow to Eastern Banni) and Nara dam across Nara river during 1981 (stopped flow to Western Banni) played a significant role in reduction of fresh water flow into Banni except during very heavy rainfall years. Thus, contributed increasing the salinity. Punjabi-road resulted inundation of sea water in an area of 827km<sup>2</sup> in 1980 to 1033km<sup>2</sup> in 1992 (GUIDE 1998).

Ground Water Institute, Pune (1974); recommended protecting *Virda* and increasing the surface water tank size to 5 to 10 acres with a depth to 15 feet.

ICAR, 1977 recommended fencing of existing permanent pastures, operational research project in Banni, silvi-pastoral management, etc.

The other activities undertaken based on the aforesaid recommendations are: improvement of the sweet water availability in Banni by the District Panchayat in 1979-80, in which 72 ponds were constructed and to develop the vegetative cover, an area of 290 ha was afforested at Dhordo village.

#### **11.2.2.1. Grassland Policy and Banni Development Agency (BDA)**

Ministry of Agriculture, GoI 1966 recommended two stage activities. State-1 for detailed soil survey and pilot projects to determine the salinity leaching requirements, drainage methods, reclamation procedures, soil and water management etc.

Stage-2 for delineate areas which have promise for reclamation and for agricultural purposes and a comprehensive master plan for development. Areas unfit for agriculture can be considered for development of pasture and forest purposes.

### 11.2.2.2. Banni Development Agency (BDA)

In 1967-68, the Animal Husbandry Department of the Government of Gujarat initiated a Banni Development Agency (BDA), perhaps as a follow up action based on the Ministry of Agriculture team's (1966) recommendations, mainly to solve the socio-economic and ecological problems of Banni region.

The main goal of BDA was to ensure fodder security, in addition to developing small village ponds to negate the drinking water demand of the local livestock in the Banni region. However, due to administrative and other issues like shortage of funds, its smooth functioning was affected and it was closed down during early 2000. The problems visualized for the failure of proper functioning of BDA were:

- a) The shortage or inadequate funds has deterred the targeted activities of the BDA.
- b) Lack of appropriate plans for long-term functioning of BDA.
- c) There are no permanent staff in the BDA and are deputed from Animal Husbandry and other departments.
- d) The qualification of the higher authorities (Banni Development Officer) of BDA is not defined and the post is occupied either by a veterinarian or a microbiologist, which hinder the main targeted activity of grassland development.

As there was no past system of management except grass plots are raised and development works by the Banni development authority after 1966, productive grassland, Banni is deteriorating because of the following reasons:

- i. Heavy and uncontrolled grazing by livestock
- ii. The widespread invasion of *Prosopis juliflora*
- iii. Dams constructed on rivers naturally flowing towards Banni from central highland parts of Kachchh
- iv. Periodic occurrence of drought
- v. Continuous increase in soil salinity

Presently, haphazard cutting of *Prosopis juliflora* for charcoal

### 11.2.2.3. Working Plan of Kachchh District

The Working plan of Kachchh Forest Division (1972) states that Banni was declared as Protected Forest under section 29 of Indian Forest Act, 1927, under the former Kachchh Government Notification No. HR/155/55 dated 11-5-1955 with an intension to manage the area under the jurisdiction of the state of the State Revenue Department.

### 11.2.3. After 1980

Water supply for many Banni villages through pipelines was initiated. The dependency of traditional water harvesting structures *Virda* declined. *Virda* played an important role in regulating livestock grazing of an area. Grazing of livestock from one village to the boundary of other village was controlled by forbidding the use of water to the straying animals. Thus, grazing was confined within the vicinity of their village. Illegal puncturing of pipelines provides access to water for free grazing animals and water is not a constraint, therefore, they graze over longer distances (SoEK 2011).

A reconnaissance soil survey of Banni was carried out by the Soil Survey Department, Vadodara during the year 1985. In 1989- High Level Committee recommended road-cum-reclamation bund from Khavda to Lakhpat to prevent salinity ingression along the northern fringe of Banni and reconnaissance soil survey using 250ha grids.

In CEPT, 1985 recommended dismantling of Punjabi road or increase the height of Khavda-Hajipir road, pilot projects on pasture development, etc.

WRD, 1988 recommended construction of Gaudli-Santalpur road cum reclamation bund and surface water harvesting by gully plug and veil tanks.

GEC, 1993- *Prosopis* management, range development and management, grazing regulations, etc.

#### 11.2.3.1. Charcoal Policy

Govt. order No. Land/Vash/2684/2005 permitted cutting of *Prosopis* and Charcoal Preparation in private lands (this has resulted in increase of charcoal mafias, Cutting of other wood for charcoal preparation and resultant increased

land degradation. Therefore, Government of Gujarat made another order for banning charcoal production and its regulation.

GDFE letter No. G.R. No. TRV-102004-2033-K, dated 06 May, 2008 regulated cutting of *Prosopis* for Charcoal Preparation in community and Govt. waste lands and other areas in Banni protected forests.

To manage this area, under the fourth five-year plan, Banni development authority was created and since 1967, Banni is managed by the Animal Husbandry Dept. of Govt. of Gujarat. Now, the district level Banni grass development committee constituted vide G.R. no. MIS-102008/239394/M dated: 07/08/2008 by Forest and Environment Department, Govt. of Gujarat. The chairperson is Collector and the member secretary is director, GUIDE, Kachchh.

#### **11.2.3.2. Integrated Grassland Development**

The GUIDE and Forest Department developed a pilot project on “Integrated Grassland Development in Banni”, and the same project was presented before the Hon’ble Chief Minister on 11<sup>th</sup> December 2006 by ShriHasmukh Shah, Chairman, GUIDE. The project of an estimate of Rs. 664 lakh was sanctioned by Forests and Environment Department, vide letter no: PRC-102006-SAF-2-G, dated 07/05/2007. However, the project could not be implemented.

#### **11.2.4. After 2009**

The first Working plan of Banni Protected Forests, was approved on year 2010 and a separate division – Banni Grassland Division was formed under the Kachchh Circle of the Gujarat State Forest Department for implementation of the Working Plan.

GPS survey by the Settlement Commissioner & Land Record Director, Gujarat State, the area comes out to be 2,49,674.45 ha i.e. 2497 km<sup>2</sup> between 23° 22’15” N and 23° 48’07” N latitude and 69° 09’14” E to 70° 10’23” E longitude with a perimeter of 367 km.

Under the fourth five-year plan, “Banni Development Authority” was constituted. Under this project, grass development works, water reservoirs,

desilting works of existing tanks, grass seed collection, made of grass plots, afforestation works, checking of desert expansion, etc. were carried out. Till the year 1993-1994, about Rs. 170 lakh were spent under this scheme. In addition to this, different public welfare activities were carried out in Banni by other govt. Dept. such as Dept. of Water supply, District Panchayat, Rural Development Agency. Various developmental and welfare activities carried out in the Banni area after the forest conservation act 1980 need proper documentation, survey and regularization under the Forest Conservation Act.

### 11.3. Present Management

The forest department is adopting the technical way of reviving the grassland through ploughing, adding farmyard manure, leaching out the salinity through small trenches and seed sowing of local grasses. Also, the areas are fenced through double fencings with barbed and trench. The areas are coming up with grasses but it will take at least 3-4 years for revival and after that these areas are to be protected from open grazing continuously. Due to the expiry of Working Plan in 2019, working scheme has been proposed to be taken up the work.

The availability of rainwater being less in Banni, ingress of *Prosopis* in Banni is high. Therefore, highly saline areas have to be managed as *Prosopis* cover only. The local Panchayats have represented for cutting of Gandabaval and conversion into charcoal. The marketing may be done through Gujarat State Forests Development Corporation (GSFDC) so that local people will get maximum income and employment through this activity.

**11.4. Past yield, Revenue and Expenditure:** The average during past working plans and details for each year during the plan under revision is generally given along with critical analysis. The grass, gum, wax and honey production in last 10 years is given in table 7.1.

In Banni the total grass productivity was 3096.16 kg/ha of which only 33.06 per cent (1023.66 kg/ha) was of palatable, while rest was unpalatable. Of this, the productivity of palatable grass species was 483 kg/ha while that of herbs was 539.45 kg/ha (GUIDE, 2004). Banni Development Authority developed 3739 Ha

as fodder plot and from these plots, 53.8 lakh kg of grass was collected. The GSFDC has also collected gum from the *Prosopis juliflora* the gum collection since last 10 years is given in table 7.1

After the permission granted by the revenue department in year February 2005 for preparation of Charcoal in Banni, about 20,000 kg per month is being produced by GSFDC from Banni. In addition to this, charcoal is being prepared from other areas of the Banni region.

About revenue incurred, no details are available so far. The grant allocated and expenditure in last 10 years is shown in table 11.1 and in table 11.2.

**Table 11.1: Grant allocation and Expenditure in last 10 years at Banni Protected Forest (Grass Development Scheme, 4406-Plan)**

Financial year	Grant Allocated (in lakhs)	Expenditure (in lakhs)
2012-13	272.12	262.66
2013-14	331.8	330.92
2014-15	353.91	353.24
2015-16	559.26	556.78
2016-17	488.51	488.39
2017-18	736.8	729.23
2018-19	716.24	146.3
2019-20	729.03	534.47

**Table 11.2: Revenue generated and Expenditure in last 10 years at Banni Protected Forest**

Type of work	Grant and Expenditure	Grass Collection	Reparing of Grass Godown	Construction of Grass Godown
2012-13	Grant.Allo	-	-	-
	Expen.	-	-	-
2013-14	Grant.Allo	-	-	-

Type of work	Grant and Expenditure	Grass Collection	Reparing of Grass Godown	Construction of Grass Godown
	Expen.	-	-	-
2014-15	Grant.Allo	-	-	-
	Expen.	-	-	-
2015-16	Grant.Allo	-	-	-
	Expen.	-	-	-
2016-17	Grant.Allo	-	-	40.63
	Expen.	-	-	27.98
2017-18	Grant.Allo	11.3	1.5	-
	Expen.	9.24	1.5	-
2018-19	Grant.Allo	-	-	-
	Expen.	-	-	-
2019-20	Grant.Allo	18.77	-	-
	Expen.	15.94	-	-

### 11.5. Statistics of growth and yield

Banni protected forest never had any working plan/management plan in the past so a systematic working of the area never occurred. However, some efforts are done in past to develop grassland in Banni.

Gujarat Institute of Desert Ecology (GUIDE) and Vivekanand Research and Training Institute (VRTI), also established grass plots at Bhirandiyara and Dhordo villages of Banni. The activities carried out in these two plots werere seeding of palatable grass species, enriching the nitrogen content by planting leguminous species, soil amendments to retain soil moisture, reduce salinity by shallow ploughing and enrichment of farmyard manure, and leaching the salts by ridge formations.

**11.6. Statistics of forest carbon stock:** Default values used concerning estimating forest carbon stock must be brought clearly so that specific values can be developed through experimentation and research.

**WORKING PLAN  
OF  
BANNI PROTECTED FORESTS**

**PART – II**



**FUTURE MANAGEMENT  
DISCUSSED AND PRESCRIBED**

## Chapter 1

## BASIS OF PROPOSALS

## 1.1. GENERAL OBJECTIVES OF MANAGEMENT

Grassland is an ecosystem dominated by grasses, where average annual precipitation is sufficient enough to support predominantly grasses, sparsely distributed shrubs along with few trees, and is mainly distributed in areas of low and erratic rainfall.

Banni is a dual ecosystem; predominantly grassland whereas some parts of Banni form seasonal wetlands during good rainfall years. Being primarily a grassland, the area needs to be maintained for grassland dependent livelihood opportunities; i.e. livestock system. Since desertification and land degradation process is high in Banni, an innovative approach is a prerequisite to maintain the grassland resources sustainably. To achieve this, it is imperative that the planning and policy need to be integrated using the scientific and local knowledge for developing and sustainably utilizing the resources. However, appropriate awareness and cooperative approaches need to be initiated to make this successful (Figure 1.1).

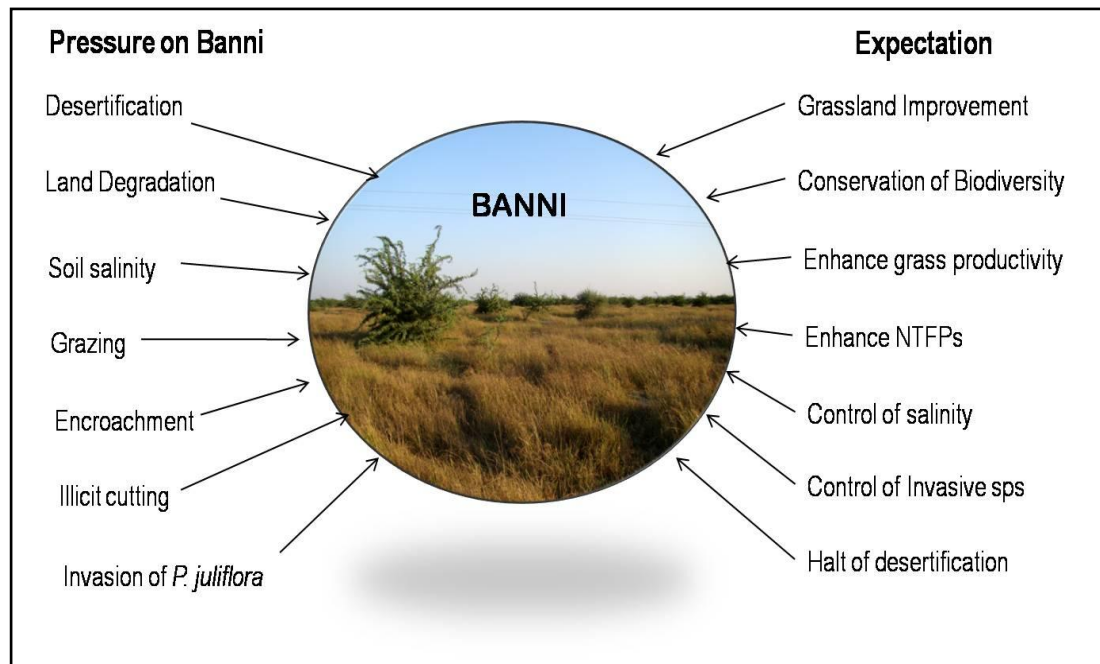


Figure 1.1: Fundamentals of the working plan proposal for Banni Protected Forest

Therefore, the major objectives of the management revolve around the following factors;

#### **1.1.1. Dynamics of Forests and Stands**

Banni was scientifically explored only during recent decades. The desertification, climate change and over-exploitation of resources have cumulatively impacted the ecological degradation of Banni which in turn has adversely affected the productivity of the natural resources; i.e. fodder resources. To enhance the vitality of the natural resources of Banni, it is essential to undertake appropriate restoration/reclamation activities which includes soil moisture conservation, enhancing the soil fertility, and amendments to reduce the soil salinity and thereby enhancing the productive potentials.

#### **1.1.2. Forests and Soil**

Banni area falls under the Desert Biogeographic Zone of India. The area receives a very scanty and erratic rainfall, high wind velocity and is prone to soil erosion. This subsequently leads to a high level of land degradation, which results in poor or low soil productivity.

#### **1.1.3. Forest and Water**

Banni being located in drylands, scanty and erratic rainfall limits soil moisture and surface water availability. There are no sources of fresh water in Banni in the form of lakes or rivers, and the groundwater, which is available at a depth of about 3 to 5m is highly saline and unsuitable for drinking purposes for humans and livestock. It is essential to increase the surface water availability through the development of shallow ponds and also crucial to promote traditional rainwater harvesting practices, locally known as '*virda*' (well within a shallow tank).

#### **1.1.4. Forest and Biodiversity**

Banni region has a very fascinating history, geography, and biodiversity. Banni supported 189 species of flora and 297 faunal species. The flora especially the grasses and herbs have adapted to the dryland climate as well as soil conditions of Banni and this is the scenario for many faunal species especially grassland

dependant species. The flora of Banni is sturdy enough to survive under harsh climatic conditions and is highly nutritive for livestock and wildlife. The grassland degradation has made an impact on its flora and fauna which needs to be improved through site-specific habitat development programs. Innovative habitat improvement programs, conservation of important wildlife areas and threatened flora would preserve the genetic pool of Banni.

#### **1.1.5. Climate and Forests**

Climate change is a global phenomenon affecting ecosystem dynamics and Banni is no exception. Measures are essential to control the Green House Gas (GHG) emissions, especially Methane and Nitrous Oxide which are mainly released from animal husbandry. Further, it is crucial to enhance the carbon sequestration potentials of the grassland and its vegetation. Grasslands are known for their high potential of carbon sequestration which is nearer to tropical forests. Therefore, efforts should be focused on the improvement of the carbon sequestration potentials of grassland and periodical assessment on the sequestration potential and thereby undertake timely corrective measures. Along with this climate change mitigation as well as adaptation measures needs to be taken on a priority basis.

It is important that the Banni inhabitants are exposed to climate change awareness in order to obtain better results in enhancing the carbon sequestration potential of Banni.

#### **1.1.6. Socioeconomic considerations and generation of Forest Based Employment Opportunities and Livelihood Options**

The inhabitants of Banni are known as *Maldharis*, livestock herders whose livelihood mainly dependent on livestock. They migrate during drought years along with their livestock. Therefore, it is essential that alternative livelihood supports through fodder security (grassland development), collection and market linkages for milk and milk-based products, minor forest products like *Prosopis* based honey, gum as well as handicrafts, etc., charcoal making and ecotourism options needs to be explored in a focused manner. These activities need to be organized and managed through joint committees with representation from Panchayats, local communities, and the forest department.

### 1.1.7. Objective of Management

Considering the inhabitants of Banni and their dependency on the grassland and overall improvement of grassland and maintaining ecological balance, the following general objectives are proposed:

- a) Maintenance of environmental stability through conservation and wherever necessary, restoration of the ecological balance. To conserve and utilize forest resources on scientific and rational principles.
- b) Conserving and preserving the natural grassland ecosystem of the protected forests with a variety of flora and fauna which is representative of the biodiversity and natural resources of the area.
- c) Conserving water, checking soil erosion and denudation in catchment areas of the river, *Dhundh* and *Thatth* in the interest of soil and water conservation for mitigating floods and droughts
- d) Optimization of the productivity of grass to meet the local demand for fodder, in a predominantly livestock-based economy of the region.
- e) To reduce the salinity of the land, and to control the advancement of the desert by taking up large-scale soil and moisture conservation measures followed by plantation of saline resistant ethnic species.
- f) Meeting the requirement of firewood, fodder, MFP, and NTFPs for the rural population.
- g) To improve vegetation cover of the barren land with the active participation of local people.
- h) To manage and utilize the *Prosopis* on a sustainable basis.
- i) Involve the local community and their active participation in the process of management of forests.
- j) To achieve Sustainable Development of Banni in the process.

### 1.2. Tool for Integrated Development

The development of Banni in an integrated manner gradually leads to its sustainability. This necessitates linking the scientific and traditional knowledge for effective development and management. Nevertheless, a constant scientific monitoring mechanism also needs to be established for maintaining the sustainability of Banni on a long-term basis.

### 1.3. Method of Treatment to be Adopted

Banni grasslands continue to face degradation. Main drivers of change include increasing soil salinity, invasion by *Prosopis juliflora*, grazing pressures, water scarcity, climate change and desertification. The soil of Banni is alluvial and sandy with inherent salinity. The spread of saline area in Banni is rapid during recent years, about 50 percent of the area contains very high (>15 M mohs/cm), 40 percent moderate to high (3-15 M mohs/cm), and 10 percent area facing low salinity (1-3 M mohs/cm) problems. Added, 70 percent area of Banni falls under a very slow to slow permeability range, causes flooding and waterlogging in many parts during the rainy season. Climate abnormalities further aggravates the soil salinity issues. Thus, soil and climate, the two of the most critical environmental parameters of life on earth are intimately interrelated and brought together. These factors have contributed to the deterioration of a major part of the grasslands of Banni.

Such soil conditions with a high level of salinity, low nutrients, low permeability, and waterlogging along with high climatic abnormalities allow only grassland-based animal husbandry which remains the only viable economic option in this area. Following are the methods of treatment for reviving the grassland ecosystem:

- i. The areas having good natural regeneration of grasses to be preserved and weeds, especially *Prosopis*, which is seen to be hindering the growth of grasses should be removed.
- ii. The areas having less degraded soil and having good natural regeneration of grasses should be supported by the sowing of indigenous superior grass species for the facilitation of the natural regeneration to establish itself.
- iii. By creating shallow ponds in the area, for more rainwater harvesting will enhance the soil moisture and thereby increase the productivity of the land.
- iv. By planting suitable, indigenous tree/shrub species along the desert border for preventing or checking the advancement of the desert.
- v. Intensive soil and moisture conservation works will be taken up.

- vi. Activities to be undertaken for wildlife conservation and management.
- vii. Loss in biodiversity due to heavy biotic influences led some species to eventual extinction. Efforts to be taken up for protecting the rich biodiversity of the grassland through various in-situ conservation measures and specific efforts will be made for the protection and development of these areas.
- viii. Joint Forest Management has been one of the most encouraging efforts in rehabilitation of the degraded areas and involving people in the management of forest resources. The efforts will be further strengthened and steps will be initiated for making the JFM sustainable by making the flow of benefits available to local communities on a short term regular basis.
- ix. Completion of survey settlement and demarcation of the areas with a permanent boundary cairns needs a special thrust and the entire area will be demarcated.
- x. The basic principle for the management of the forest should be sustainable development and utilization of forest resources with the active participation of local communities.

#### **1.4. Constitution of Working Circles**

As per the GPS based survey of Banni carried out by the DILR, Kachchh, the area of Banni Protected Forest is approximately 2,46,507.14 ha vide DSO/Banni measurement/Green Tribunal Order/2019-20, dated 01/11/2019 (Annexure VII). This area also constitutes the area of Kachchh Desert Wildlife Sanctuary and Charidhundh Conservation Reserve through subsequent notification of Govt. of Gujarat (Annexure II and Annexure III)). Therefore, subtracting both of these areas of subsequent notifications, the actual working plan area encompasses about 1,71,753.23 ha. Further, as the human settlement area in Banni and other area falls under various developmental works has not been surveyed and demarcated, the actual area for working may also vary. Therefore, for the working plan, an approximate area of 1,71,753.23 ha is considered.

### 1.5. Justification For Working Circles

The name Banni signifies that the land has been formed by detritus through the river-borne sediments of Indus, Luni, and Banas. At present, the core issue of Banni is salinity which is governed by the rainfall of the area. Higher rainfall leads to lowering the soil salinity while lower rainfall increases the soil salinity and these changes are a yearly phenomenon.

Considering the above, a total of three working circles will be constituted, which includes; Grassland Working Circle (GWC), *Prosopis* Working Circle (PWC) and Biodiversity Conservation (Overlapping) Working Circle (Table 1.1).

The area of Banni is a continuous geographical area and have not been systematically worked on working plan prescriptions. Further, Banni is an un-surveyed area; hence, it is difficult to divide it into blocks and compartments based on stock position and other natural features. Nevertheless, for the management purpose under the Working Plan, the whole forest area under this working plan is divided into 4 blocks (Forest Range) and 45 compartments (27 compartment for GWC and 18 Compartment for PWC) corresponding to Forest Range and villages therein (Annexure VIII). One block comprises the area of one Forest Range. Similarly, one compartment represents the area of one village. However, as the survey and demarcation of gram Panchayats and the village is not yet done it becomes mandatory to complete the survey of the demarcation along with the implementation of the Working Plan.

**Table 1.1: Proposed Working Circles**

Sr.No.	Name of the Working Circle	Approx. Area (in ha.)
1	Grassland Working Circle	76000
2	<i>Prosopis</i> Working Circle	24500
3	Biodiversity Conservation (Overlapping) Working Circle	171753.23
<b>Total Area</b>		<b>171753.23</b>

### 1.5.1. Grassland Working Circle

As per the recent LISS-4 imageries, the grassland/scrub cover of the grassland is 30.90%. Therefore, the major patches of dense and sparse grass have been put under Grassland Working Circle. The grass growth has also been observed at many places in the areas under sparse *Prosopis* cover has also been considered for the Grassland Working Circle. Thus, the total area for the Grassland circle is 76000 ha. Activities under this working circle will cover the removal of *Prosopis*, protection of the area from open grazing and development of grasslands.

### 1.5.2. *Prosopis* Working Circle

*Prosopis* was planted in Banni during late 1950s and it has invaded vigorously in most of the Banni grasslands. Considering the status of dense *Prosopis* in 2019 and the scope of profuse coppicing and regeneration in the future, it would be appropriate to put the major patches of dense *Prosopis* cover under the *Prosopis* Working Circle based on the thematic map of 2019 for the management of the growth of *Prosopis*. The *Prosopis* tree cover will be worked at regular intervals and will be maintained as a tree cover. The Gujarat State Forest Development Corporation will work in the coordination with JFMC, gram panchayat, any other suitable agency for charcoal production. Further, to make a compact patch from the management angle, inter spread of small patches of sparse *Prosopis* area is also added which makes *Prosopis* working circle to an area of 24500 ha. other uses of *Prosopis* can also be explored and included.

### 1.5.3. Biodiversity Conservation (Overlapping) Working Circle

The whole working plan area will be overlapped by this working circle. The major emphasis will be focussed to conserve the floral and faunal diversity of the Banni grassland. The area also attracts large and dense population of migratory birds like Flamingos and Cranes. The seasonal water bodies/wetlands which attract a large population of migratory birds will be conserved and developed. Within the grassland, major patches of barren, high saline soil with or without vegetation and salt-affected areas are seen. These areas will be developed and restored using ecological principles for enhancing biodiversity. Further, biodiversity and sensitive wildlife species will be

conserved and improved with the participation of local people through the active participation of Joint Forest Management (JFM) committees and Biodiversity Management Committee (BMCs).

#### 1.6. Period of the Working Plan and Necessity for Intermediate Revision

The period of this working plan will be for 10 years. The results and outcomes of each working circles may be reviewed after 5 year for mid course correction by the Consultative Committee under the chairmanship of Principal Chief Conservator of Forests (HoFF) with representation from RAPCCF (MoEF& CC).

The members of the Committee will be as under:-

1	Principal Chief Conservator of Forests and Head of the Forests Force (PCCF & HoFF)	Chairman
2	Principal Chief Conservator of Forests (Wildlife)	Member
3	Additional Principal Chief Conservator of Forests (D & M)	Member
4	Additional Principal Chief Conservator of Forests, MoEFCC, Regional Office, Bhopal	Member
5	Expert, Office of the Forest Survey of India, Dehradun	Member
6	Director/Representative of AFRI, Jodhpur, Rajasthan	Member
7	Joint Secretray (Budget), Forest and Environment Department, GoG, Gandhinagar	Member
8	Chief Conservator of Forests, Working Plan, Gujarat state, Gandhinagar	Member Secretary
9	Conservator of Forests, Working Plan, Junagadh	Member
10	Chief Conservator of Forests, Kachchh Circle	Member
11	Deputy Coservator of Forests, Banni Grassland Division	Member

**Chapter 2****GRASSLAND WORKING CIRCLE****2.1. Special Objectives of Management**

The District of Kachchh receives very low and erratic rainfall with an average of 12 rainy days per year. An average of four droughts in a decade was reported for Kachchh which in turn leads to very poor growth of vegetation cover in the area. This situation on the scarcity of fodder forces the large herds of livestock to wander over the open, unprotected, poorly stocked pastures, wastelands, or in forest lands. The overgrazing by the livestock further destroys the pastureland and turns it unproductive. Livestock from the surrounding areas of Banni makes this grassland more prone to grazing. Overgrazing as well as continuous grazing by the livestock not only degrades the grassland but also reduces the palatable species by way of grazing it before the seed production. The cumulative effects lead to a decrease in grassland production and an increase in non-palatable weeds. The degree of overgrazing along with increasing soil salinity and frequent droughts are some of the causes for the diminishing productivity of the area. To overcome the man-made as well as natural causes for the deterioration of the area, an integrated effort is a prerequisite.

Presently, the entire Banni is open for grazing. Livestock of Banni as well as from adjoining talukas, districts, and even from the state of Rajasthan, graze freely all over the Banni grassland. At some places, people have established grass plots for their use. The habit of stall-feeding is absent in the area. Stall-feeding is effective only during the period of scarcity when the grass is supplied by the government. The method of treatment in the Grassland Working Circle would involve the development of grassland by planting/seeding superior grass species, uprooting unwanted species and SMC works.

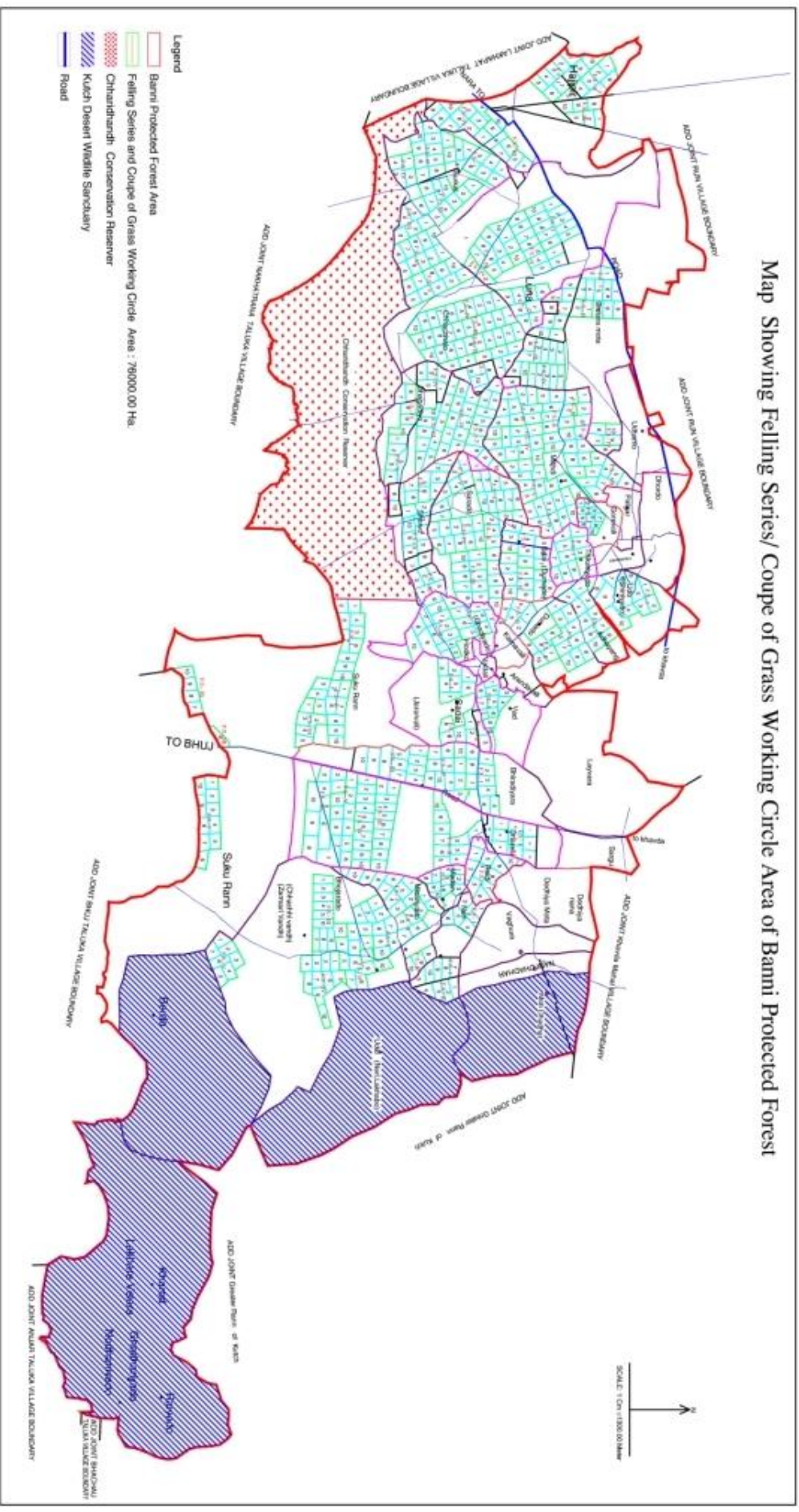
Therefore, the main objective of managing this grassland is to improve the quality as well as the quantity of production of superior palatable grass species. Therefore, the main objectives of the management are;

- i. To improve the production of grass qualitatively and quantitatively by gradually replacing the inferior species of grass with indigenous superior grass species.
- ii. To increase the production of grass by thinning and uprooting unwanted weeds.
- iii. By introducing suitable measures, to conserve the soil and its moisture available in the area.
- iv. To meet the demand of grass of the local inhabitants of Banni, the Kachchh district, and the State of Gujarat.
- v. To provide long term availability of grass through scientific storage of grass for making it available for the use during the scarcity years, which is very frequent.
- vi. In consonance with the above objectives, to meet the local demand for fodder on a sustainable basis.

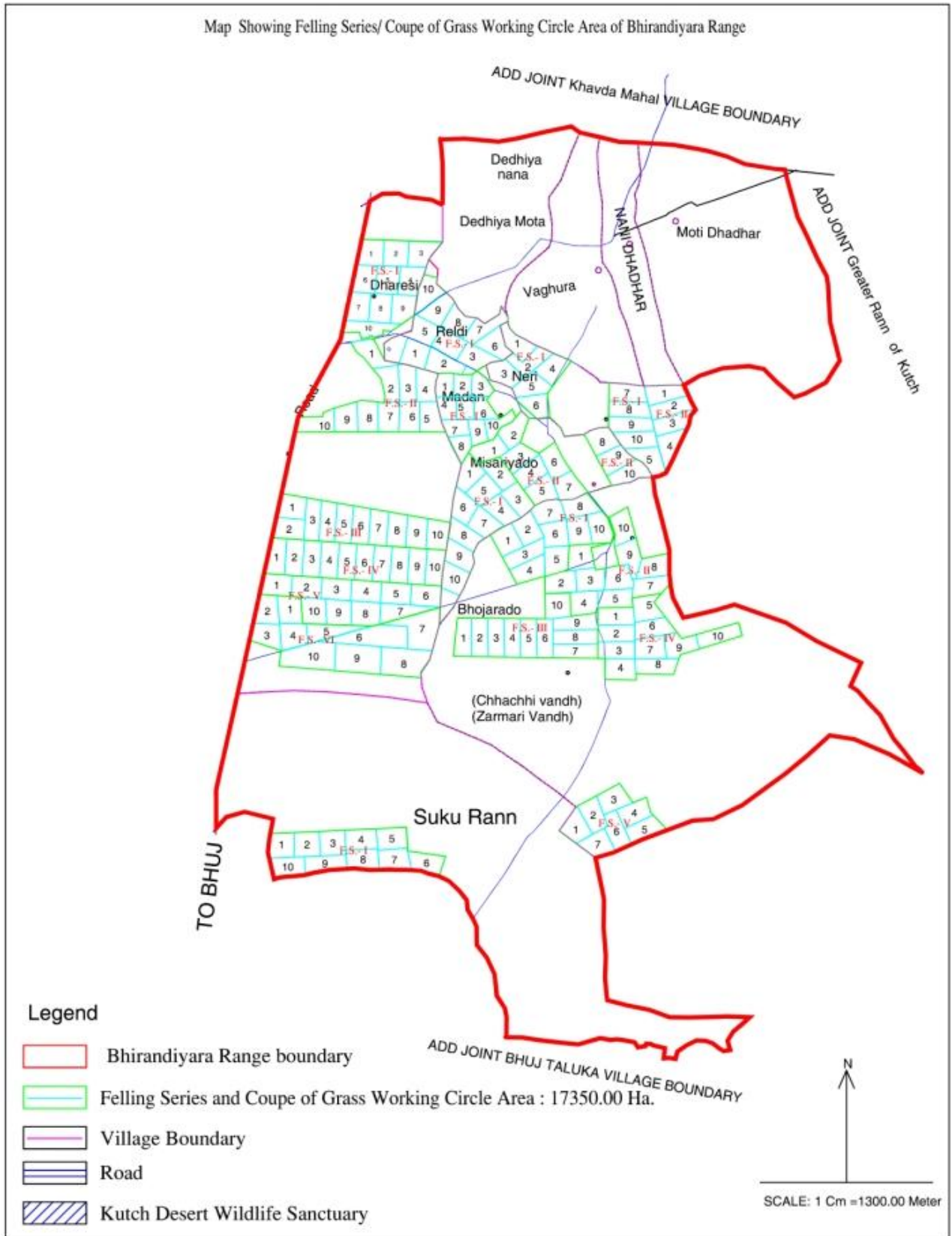
## **2.2. General Constitution of the Working Circle**

This Working Circle comprises all the potential grassland areas of Banni. This circle encompasses an area of about 76000 ha of Banni Protected Forest. According to the fertility of the land, grassland areas can be divided into; good grassland, moderate to good grassland and poor/sparse grassland.

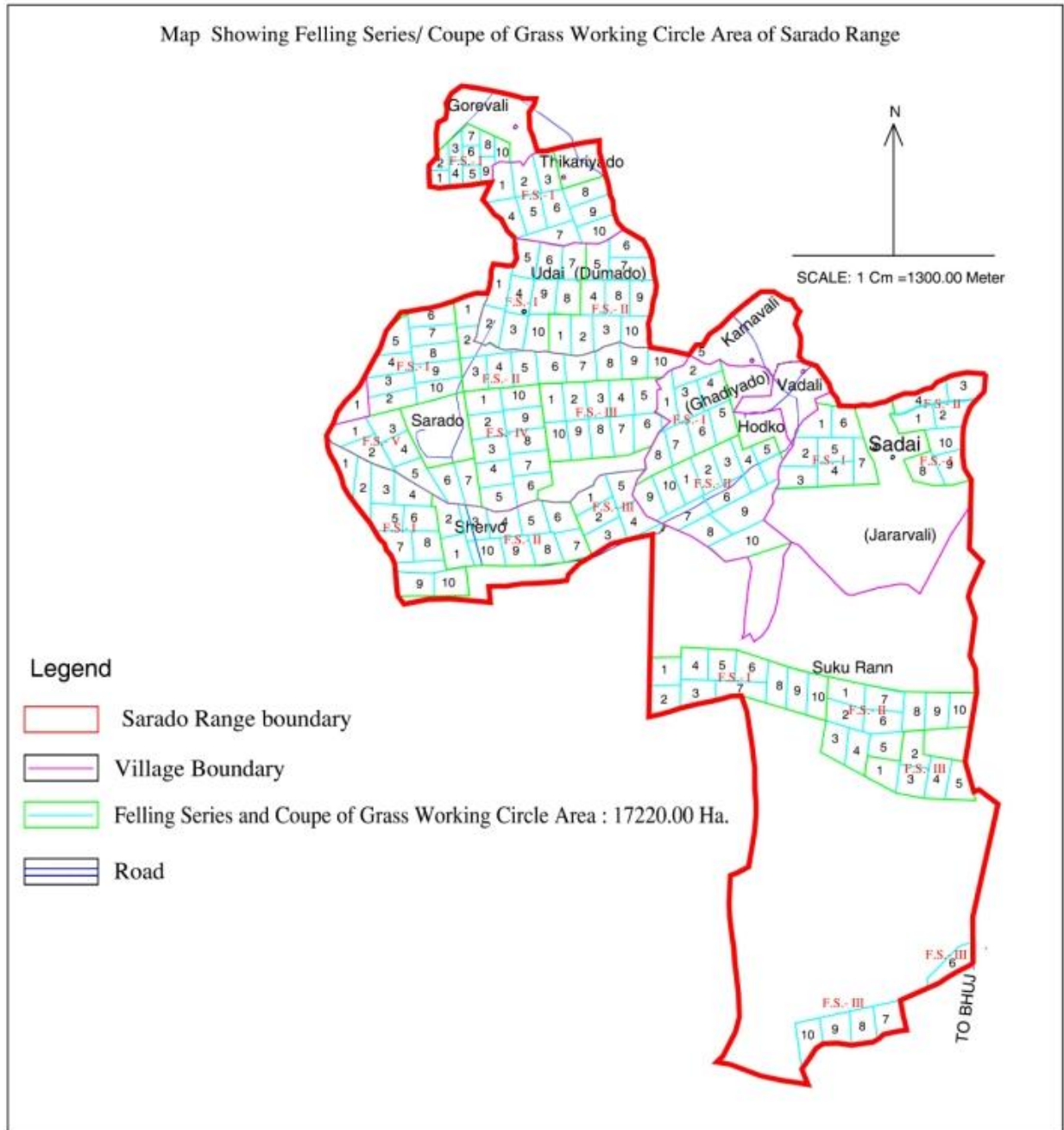
Though a considerable area is proposed under grass cover, the production status of this land category is very poor. The predominant area under this working circle is almost flat; i.e. tableland. The soil is moderate to high saline in nature. Due to the presence of silts clay in the soil, the permeability of water is almost negligible, resulting in the waterlogging of the area. The water table in the substrata is quite high, but the water quality is highly saline and is comparable with seawater. Due to concurrent droughts, scanty and erratic rainfall along with the overexploitation of the resources, the land has become degraded resulting in poor productivity of the area. The Grassland Working Circle (GWC) map is given in figure 2.1 and Forest Range wise maps of GWC is shown in figure 2.2 to figure 2.5. The details of the area allotted to this working circle are given in Annexure-VIII.



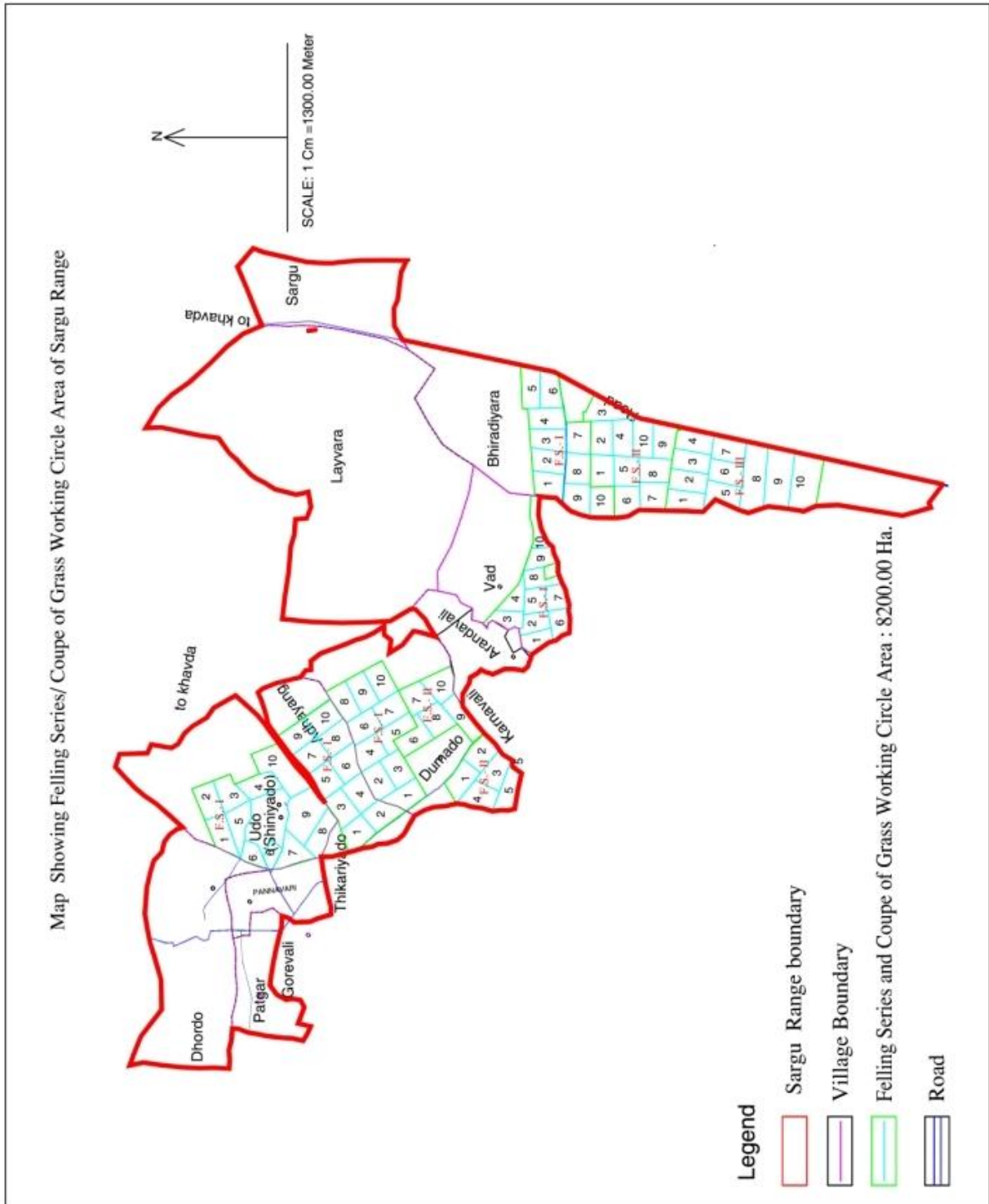
**Figure 2.1: Map showing the Grassland Working Circle**



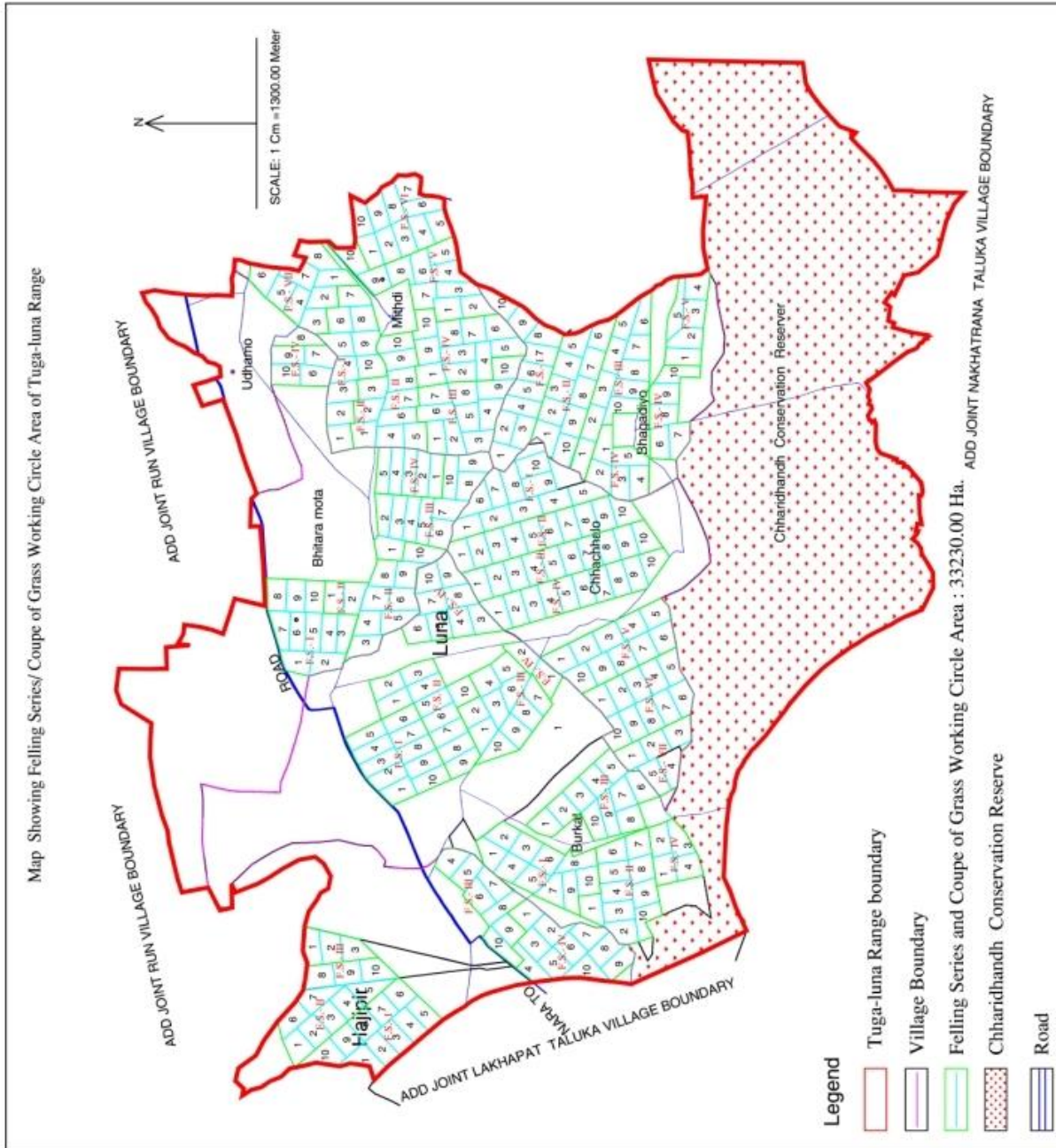
**Figure 2.2: Map showing the Felling series and Coupe of Grassland Working Circle in Bhirandiyara Forest Range of Banni Protected Forest**



**Figure 2.3: Map showing the Felling series and Coupe of Grassland Working Circle in Sarado Forest Range of Banni Protected Forest**



**Figure 2.4: Map showing the Felling series and Coupe of Grassland Working Circle in Sargu Forest Range of Banni Protected Forest**



**Figure 2.5: Map showing the Felling series and Coupe of Grassland Working Circle in Tuga-Luna Forest Range of Banni Protected Forest**

### 2.3. General Characteristics of Vegetation

The primary vegetation present in the area are grasses and herbs in places associated with *Prosopis* and *Sueda*. The availability of grass differs with the density of *Prosopis* growth. In Banni grassland, annual as well as perennial grasses are available. A total of 189 species of plants belonging to 140 genera and 50 families found in Banni which include 89 species of herbs, 31 species of shrub, 12 species of climbers, 37 species of grasses, 6 species of sedges, and 17 species of tree are recorded from the grassland. Important varieties of grasses include; *Cenchrus* spp., *Sporobolus* spp., *Dicanthium* spp., *Aeluropus lagopoides*, *Chloris* spp., *Dactyloctenium aegypticum*, *Desmostachya bipinnata*, *Eragrostis* spp. etc.

The plant species are patchily distributed within the grassland due to the physio-chemical, edaphic, climatic factors and landscape features of the grassland.

### 2.4. Method of Treatment

The total working area of the Grassland Circle covers 76000 ha having dense as well as sparse grasslands in Banni. Grassland working circle falling under villages will further be divided into 27 working block/village and 760 coupe (Figure 2.1 and Table 2.1). The forest range wise distribution of block and coupe is shown in figure 2.2 and 2.5.

**Working Circle:** The plan period is for 10 years. The individual coupe for improvement will be worked annually as per prescription. The maintenance works will be continued for the plan period.

**Working Series:** The working block/series will be 27 as most of villages having the dense as well as sparse grassland areas.

**Working Coupes:** The coupes area will be about 100 ha for improvement works in each working block/series. On an average an area of 7600 ha will be covered per year during the plan period. The working will be done in 27 working block/village. The number of working series and coupes depends upon the area available in the village jurisdiction. The yearwise number of coupes and area to be undertaken under the Grassland Working Circle for grassland

development and management is given in table 2.2. The village wise list of working series and coupes are annexed at Annexure-IX. A treatment map will be prepared by the forest department for treating the coupe area, which will be duly approved by the Deputy Conservator of Forests or any other competent authority.

**Table 2.1: Blocks and Coupe under the Grassland Working Circle**

Sr. No	Forest Range	No.of Village/ Block falls in GWC	No. of Coupe	Area of GWC (in Ha.)
1	Tuga-Luna	7	332	33230
2	Sarado	8	176	17220
3	Sargu	5	80	8200
4	Bhirandiyara	7	172	17350
	<b>Total</b>	<b>27</b>	<b>760</b>	<b>76000</b>

**Table 2.2: Proposed yearwise working coupe and area to be taken up under Grassland Working Circle (GWC)**

Sl. No.	Year	No. of Coupe	Area to be taken up in GWC (in Ha.)
1	First	80	7875
2	Second	80	7875
3	Third	80	7885
4	Fourth	80	7885
5	Fifth	78	7675
6	Sixth	74	7375
7	Seventh	74	7375
8	Eightth	72	7305
9	Nineth	71	7375
10	Tenth	71	7375
	<b>Total</b>	<b>760</b>	<b>76000</b>

#### 2.4.1. Methodology for good grass areas

The area for development of good quality grass will be identified by surveying and assessment of the total grass areas. The area will be assessed based on occurrence of number of palatable species, growth, fodder value, diversity, and density. The good quality grass area will be demarcated in respective compartment and coupe within the Grassland Working Circle.

The unwanted growth like weeds, alien species, invasive species, un-palatable species in the good grass area will be identified and removed manually so as to allow other palatable grass species for better growth. It is utmost necessary to protect the good grass area from grazing and cutting till flowering and fruiting stage. Live fencing of area by *Euphorbia/Prosopis* will be made for the protection of the area from grazing. Regular monitoring and patrolling will also be carried out in the area.

Good quality of seeds of native and palatable species will be collected and sowed for gap filling in the area. Certain identified good grass area will be kept only for the collection of good quality seeds which will be utilized to develop other grass land areas.

#### 2.4.2 Methodology for degraded grasslands

The selected area will be closed for grazing and will be fenced by barbed wire fencing/trench or other natural vegetation. The land will be prepared by ploughing and suitable soil amendments will be implemented. Seeds or pellets of indigenous palatable grass will be sown. Some legume species suitable to the area will be shown to enhance the fertility of the soil. Minor treatment of the area like uprooting of new recruitment of *Prosopis* and other unwanted weed species may be undertaken in subsequent years after the treatment.

##### 2.4.2.1 Silviculture and Multispecies plantation

As a Silviculture initiative, some of the areas under degraded grassland will be treated/developed as a model/experimental plot for multispecies plantation including native and suitable palatable grass species, native shrub species and native tree species to provide fodder for the livestock and wildlife round the year.

### 2.4.3. Methodology for Saline land Management

Excess soil salinity causes poor and spotty stands of grasses, uneven and stunted growth and poor yields, the extent depending on the degree of salinity. The primary effect of excess salinity is that it renders less water available to plants, because the osmotic pressure of the soil solution increases as the salt concentration increases. Apart from the osmotic effect of salts in the soil solution, excessive concentration and absorption of individual ions may prove toxic to the plants and/or may also retard the absorption of other essential plant nutrients.

To improve crop growth in such soils the excess salts needs to be removed from the root zone. To remove soluble salts from the root zone, reclamation of saline soils methods to be adopted. Leaching is the most effective procedure for removing salts from the root zone of soils. Leaching is effective when the salty drainage water is discharged through subsurface drains that carry the leached salts out of the area under reclamation. Leaching may reduce salinity levels in the absence of artificial drains when there is sufficient natural drainage. Leaching should preferably be done when the soil moisture content is low and the groundwater table is deep.

For amendment of saline soil, gypsum will be used to the reclamation of salt-affected soils. As the large tract of land in the Banni grassland is facing problem of soil salinity with different degree, some experimental plots will be developed in initial stage. After the result of rate of soil saline reclamation in different degree of soil salinity, gypsum will be used in potential areas to reclaim the saline land within Grassland Working Circle.

Further, to manage the saline land, drainage treatment will be made in part of the saline tract by rejuvenating the natural drainage line of the grassland, and creation of new draining line after looking at the topography and water flow of the area. If the natural subsurface drainage is insufficient to carry the excess water and dissolved salts away from an area, open ditches will be created to flush the salt with water during the rainfall period.

Plantation of salt tolerant species native to the grassland is the effective measure for reclamation of saline degraded grassland within the grassland

working circle. In Banni many species of halophyte/salt tolerant species are found which will be used to manage saline land in long term basis. Salt tolerant grass and herbaceous species from the grassland will be identified and their seeds will be collected and will be planted in grass plots having moderate to high saline soils.

#### 2.4.4. Management of dense/sparse *Prosopis* areas of GWC

Some patches of the Grassland Working Circle are infested by the *Prosopis juliflora* over 30-40 years. These areas are low saline area and are suitable for good growth of grasses and other native vegetation. Over few decades, these areas are now fairly fertile and naturally treated by the *Prosopis* invasion due to dilution of soil salinity by leaf litter decomposition and nitrogen fixation by the rhizosphere present in the leguminous roots of *Prosopis juliflora*. As the *Prosopis juliflora* is an invasive species, it is a major threat for the native biodiversity and natural grass species which are vital and major fodder for the livestock, wild herbivore and grassland dependent insect species. These insects are also major prey for many species of birds, reptile and amphibians. Therefore, management of dense and sparse *Prosopis* is vital for the restoration of grassland and its dependent biodiversity.

Thus, patches of dense and sparse *Prosopis* need to be removed or uprooted in a phased manner to restore the grassland in GWC and also to be used for various purposes as the *Prosopis* is now a natural resource for the livelihood for some of the local communities over the years.

The wood and branches of *Prosopis* can be used for making charcoal, in handicrafts, firewood and as a timber by the local communities. Pods of the *Prosopis* can be used for making beverage, biscuit or cake for the livestock, and also used for making ayurvedic medicine. The shrubby forms of the *P. juliflora* will be used as a bio-fencing for the grass plots to prevent livestock from entering the restored grass plots within GWC. To use the *Prosopis* for various purposes, different stakeholders (local communities, Maldhari, GSFDC, Industries, etc.) will be involved in sustainable uses and harvesting of *Prosopis*.

Removal of pods on a regular basis is an important measure for the GWC to control the invasion of *Prosopis juliflora* in the good grass areas. Therefore,

removal of mature/ripen pods from the trees and collection of fallen pods is necessary from the dense or sparse *Prosopis* areas within the GWC. These pods will be removed or collected on regular basis by involving local communities or from some identified agencies to use it for various purposes.

Some research plots will also be identified for regular monitoring and technology development for using various parts of the *Prosopis* tree for industrial level new product development, marketing, and as a natural source of livelihood for the local communities and socio-economic development.

### **2.5. Harvesting & Storage of Grass**

After the ripening of grass seeds, grass from all the areas will be harvested annually. The grass will be harvested, collected, and transported to store in grass go-downs. Five go-downs are already present in Banni. It is proposed to construct another 15 grass go-down for scientific storage of the harvested grass fodder in the coming 10 years.

The yield of the grass will be regulated by area. Hence for the harvesting of grass, it will not be necessary to divide these areas into Felling Series and Coupes. However, the grass areas have to be comprehensively improved to produce good quality and quantity of grass. For this purpose, it is necessary to carry out improvement and developmental works in the area. During the year of good rainfall, the production of grass is high, but in scarcity years the scenario is quite opposite, hence the annual grass yield is not constant, and therefore the prediction of annual yield is not possible. Thus, the yield will be regulated area wise as well as year wise only.

### **2.6. Method of Harvest**

Harvesting of grass would be carried out departmentally. As the area is considerably vast and labor availability in the vicinity is also not sufficient; the use of machinery could be an alternative option for harvesting activities. Looking at the vastness of the area and the magnitude of work to be carried out in a stipulated time frame, the use of machinery will be much more cost-effective and viable also.

## 2.7. Harvesting Regulations

For harvesting and collection of grass, the following regulations would be implemented.

- i. The cutting of the grass will commence only after the seeds have fallen on the ground.
- ii. The cutting of grass will start from mid-October after carefully ensuring that it has completely dried up and the cutting process will be completed by the end of December.
- iii. Haphazard cutting of grass should be avoided. Grass cutting will be done in an orderly manner starting from one end of the area.
- iv. After cutting the grass, it should be allowed for drying for a couple of days and tied into small bundles which would be stacked in heaps and allowed to dry for a fortnight before they are transported for pressing and bailing. The pressing and bailing will be done at the site itself. The bails should be uniform in size and weight as far as possible.
- v. Grass cutting will be done 15 cm above the soil to ensure the tussock of the grass remains on the ground for sprouting in the subsequent years. This will ensure natural regeneration.
- vi. Smoking and kindling of fire inside the grassland area should be strictly prohibited.
- vii. It should be ensured that no grass is left standing or no heaps are spread over in the area at the end of the cutting season.
- viii. Only sharp implements will be used to cut the grass to prevent the root system of perennial grasses from being pulled out.

## 2.8. Control and records

The above-mentioned activities under the grassland restoration will be controlled and managed by the Deputy Conservator of Forests and Range Forest Officer. The regular monitoring of the grass-plot will be done by local forest staff. Each activity under the grassland restoration viz. land preparation, plantation, management, expenditure, etc. will be recorded in the plantation register as per prescribed norms.

## Chapter 3

## PROSOPIS WORKING CIRCLE (PWC)

## 3.1. Special Objectives of Management

*Prosopis juliflora* an alien species, planted as shelter belts along the northern fringes of Banni during 1960's has in due course of time invaded most part of Banni grasslands, and became a dominant tree/shrub species. Though *P. juliflora* is considered and termed as invasive alien species and a threat to local biodiversity, the species, if managed scientifically, it could play an important role in climate change mitigation and can generate considerable economy to the district as well as the state along with employment generation to local communities, and support alternative livelihood opportunities. Therefore, to manage the *P. juliflora*, a special *Prosopis* Working Circle was constituted under the working plan. The areas having the good woody growth of *Prosopis* and not falling under Grassland Working Circle has been earmarked in this working circle, to achieve the following objectives, keeping in view that the people residing in the vicinity of the forest are the major stakeholder in the forests.

Based on the principles of participatory management of *P. juliflora* and keeping in view of the people residing in and around the forest which are the major stakeholder in the forests, and their dependency on *P. juliflora* for the livelihood, the objectives of the management of the *Prosopis* Working Circle are:

- i) To undertake the management of the *Prosopis* Working Circle areas in the vicinity of the villages with the active participation of the village Panchayats and local communities.
- ii) To maintain *P. juliflora* as a optional biota for C-sequestration and thereby helps in climate change mitigation
- iii) Sustainable utilization and restocking the *Prosopis juliflora* area.
- iv) The good grass patches of equal or more than 5 ha within this working circle will be treated as Grassland Working Circle.
- v) To aware and educate the people about the benefits of the participatory management of *P. juliflora*.

- vi) To develop affinity between the Forest Department and local communities to create interdependence and understanding for present and future management of *Prosopis juliflora* area.
- vii) To create employment opportunities and utilize *P. juliflora* as a natural resource for generating permanent source of income for the nearby local communities.

### 3.2. Constitution of Working Circle

A sizable area of Banni is having the good woody growth of *Prosopis juliflora* are demarcated as Prosopis Working Circle. Based on the distribution of *P. juliflora* estimated through satellite imageries, a total of 24500 ha area has been earmarked in this working circle. The local communities residing in the vicinity of the Prosopis Working Circle area are considered as the major stakeholder of the forests.

### 3.3. General Characteristics of Vegetation

*Prosopis juliflora* is a hardy species survives which in and adapted to arid and saline areas, however; the density of this species is high in low saline soil areas of Banni. In Banni, *P. juliflora* has spread densely or sparsely over almost all the areas, *Prosopis* is an economically important plant species in the region and plays important role in the socio-economics of arid region, thus having multiple socio-economic and cultural uses. The pods of *Prosopis* after the seed removal forms a good feed for the livestock. Some researches indicated that pods of *Prosopis* can be used as a raw material for ethanol production (da Silva *et al.*, 2011). The *Prosopis* based charcoal has high demand in the market due to its high calorific value. The twigs, branches, and leaves can be compressed for the production of pellets which can act as a source of biofuel for various industries and even for energy generation. Even many Gujarat-based industries especially biomass-based power industries have shown interest in providing a backward linkage to existing *Prosopis* stock for using it as a raw material for high ended value products. The potential use of *Prosopis* in industries is so high that if it is properly explored it can generate considerable employment opportunities for the local people as well as for generating economy to the State. To provide the backward linkage of the resource use with industry, some tripartite agreements

between local community, industry, and Government could be evolved for optimum utilization of this resource and development of the area.

The conventional utilization of *Prosopis* especially for charcoal making has also good potential. Appropriate benefit-sharing agreement as per the Govt. Resolution of Joint Forest Management (JFM) could also be worked out.

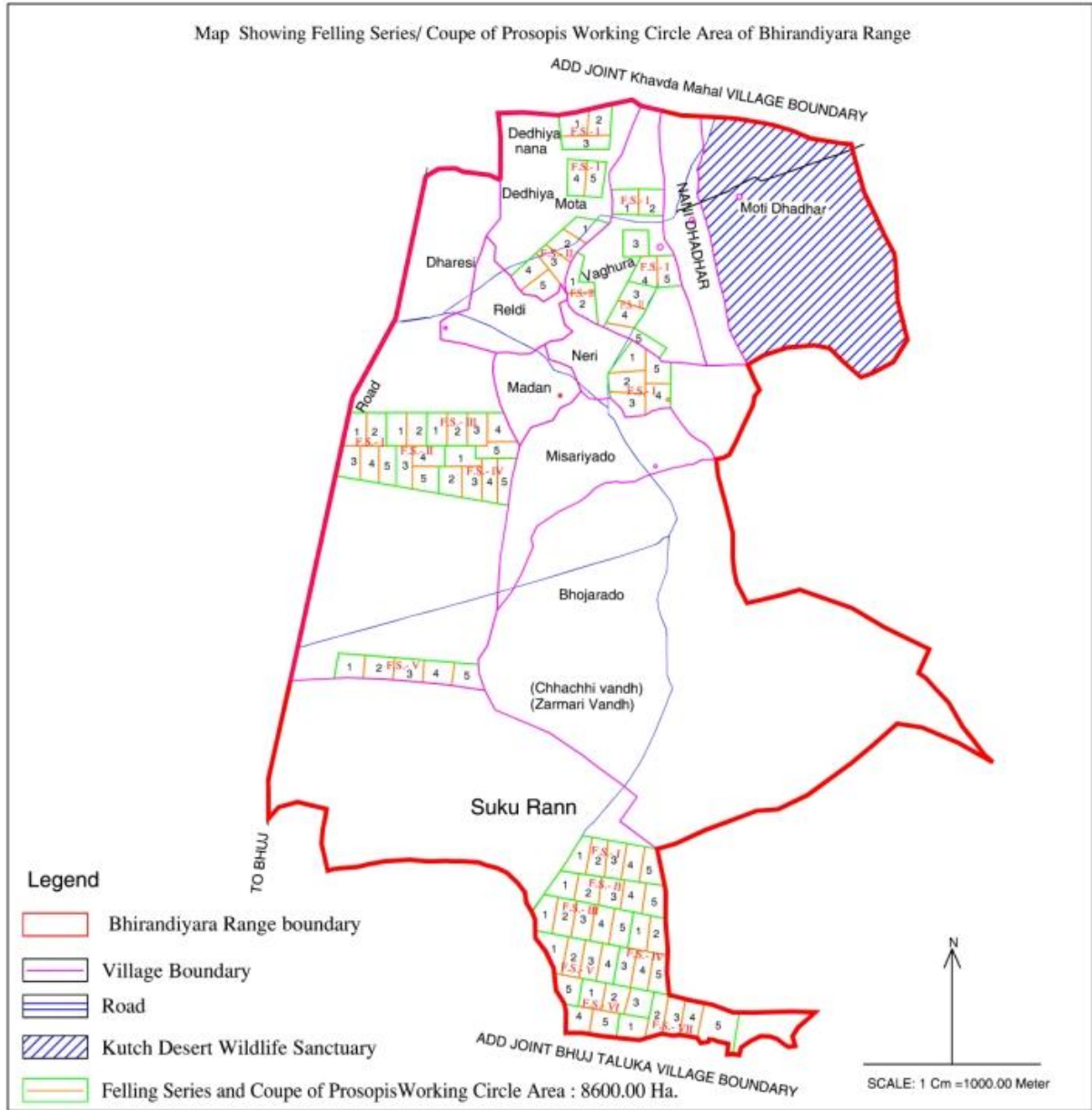
### 3.4. Felling Series and Cutting Sections

The area of *Prosopis* Working Circle (PWC) falling within each village boundaries are further divided into felling series and coupes (Figure 3.1). The forest range wise distribution of felling series and coupe is shown in figure 3.2 and figure 3.5. Since the working circle will be managed on a 5 years rotation basis, each felling series will have five coupes. The number of felling series and coupe in each villages will vary depending upon the area available in the jurisdiction of respective villages. In total there will be 18 number of villages and 243 numbers of coupes in this working circle (Annexure-XI). The average area of the coupe will be 100 ha and average area of felling series will be 500 ha each (Table 3.1). The yearwise proposed number of coupe and area to be undertaken for cutting and management of PWC is given in table 3.2. The details of the sequence of coupes are given in Annexure-IX.

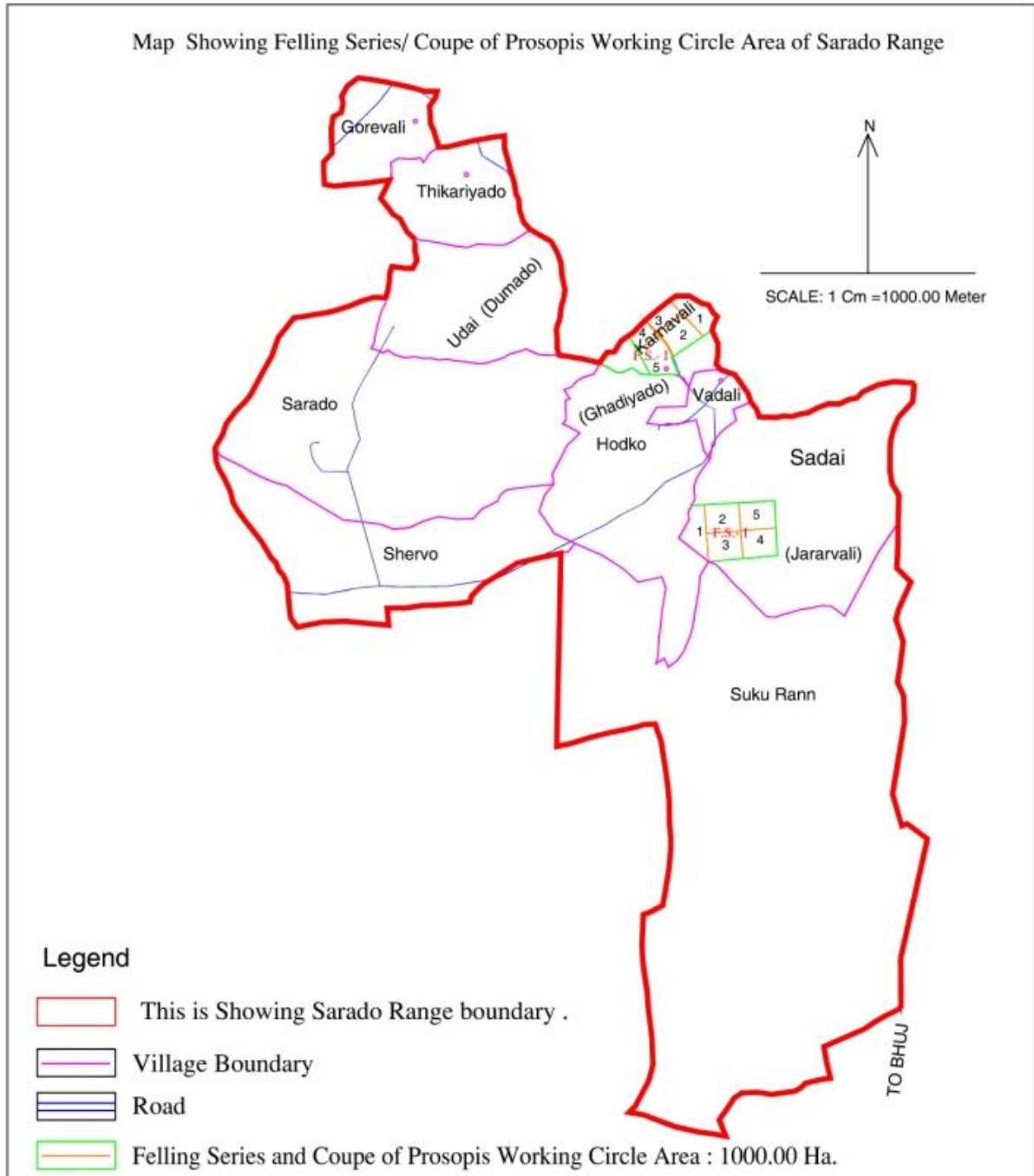
**Table 3.1: Distribution of felling series and coupe of *Prosopis* Working Circle**

Sr. No	Forest Range	No. of Village in PWC	No. of Coupe	Area of PWC (in Ha.)
1	Tuga-Luna	3	59	5900
2	Sarado	2	10	1000
3	Sargu	8	89	9000
4	Bhirandiyara	5	85	8600
		<b>18</b>	<b>243</b>	<b>24500</b>

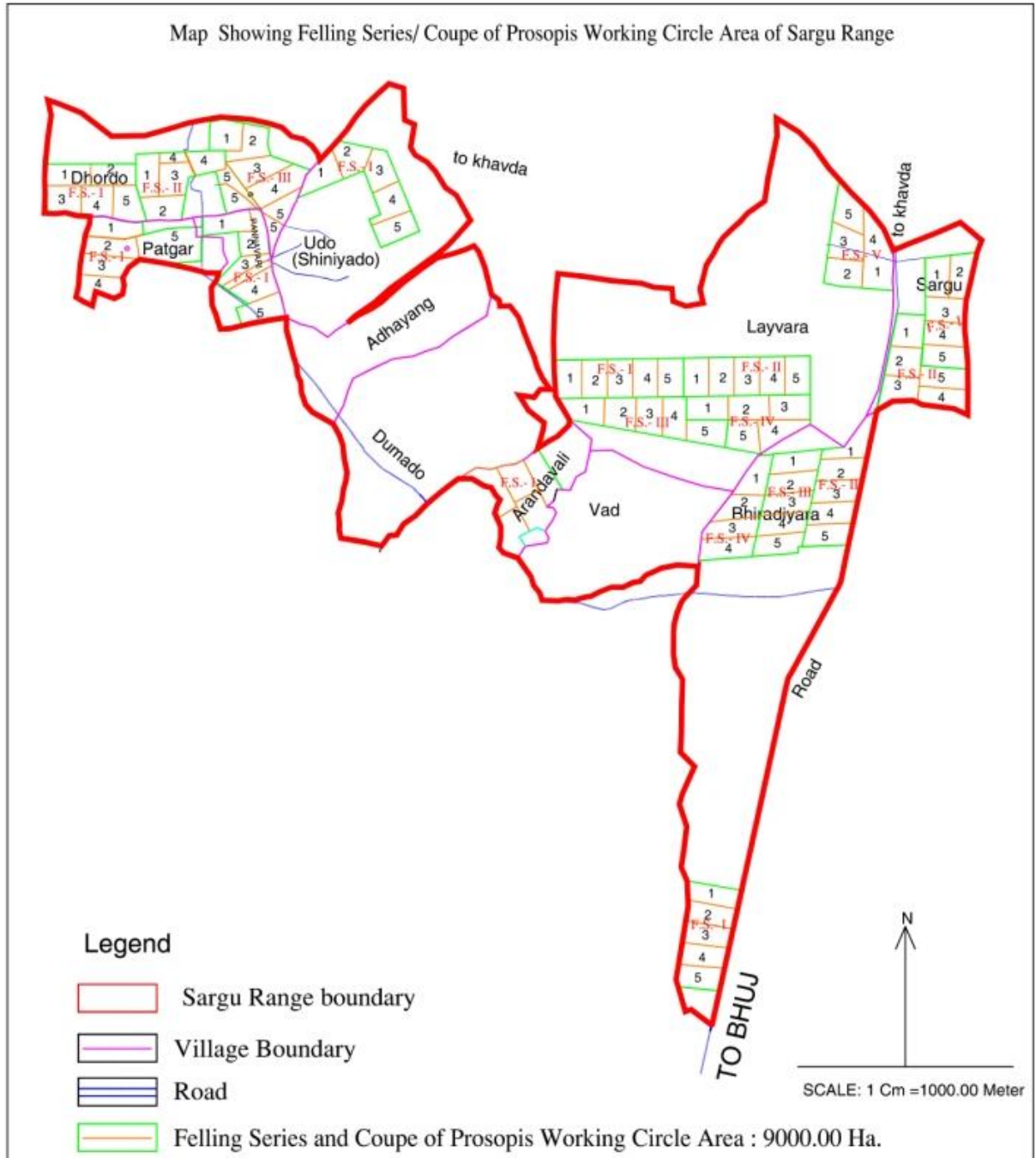




**Figure 3.2: Map showing the Felling series and Coupe of Prosopis Working Circle in Bhirandiyara Forest Range of Banni Protected Forest**



**Figure 3.3: Map showing the Felling series and Coupe of Prosopis Working Circle in Sarado Forest Range of Banni Protected Forest**



**Figure 3.4: Map showing the Felling series and Coupe of Prosopis Working Circle in Sargu Forest Range of Banni Protected Forest**

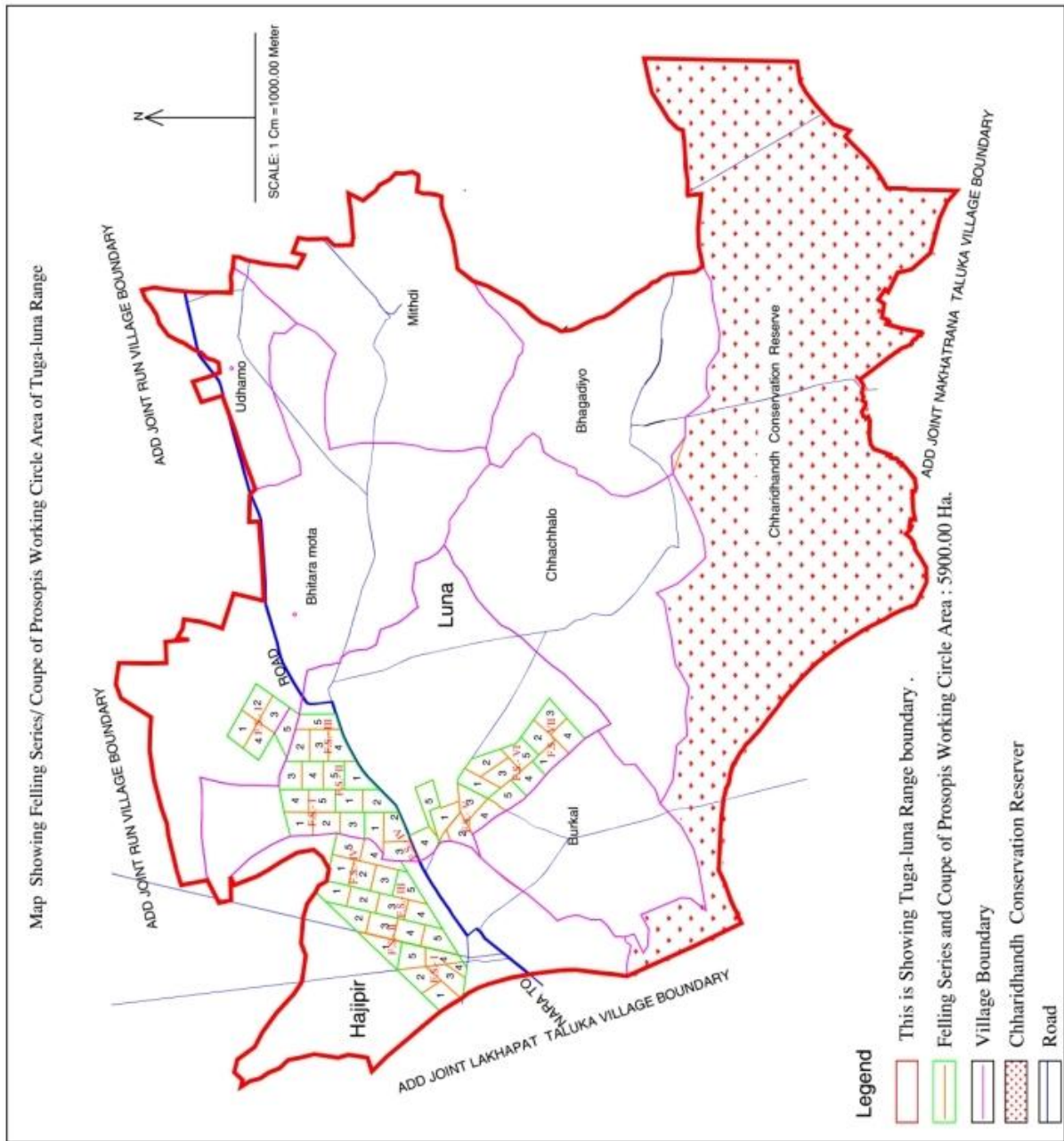


Figure 3.5: Map showing the Felling series and Coupe of Prosopis Working Circle in Tuga-Luna Forest Range of Banni Protected Forest

**Table 3.2: Proposed number of coupe and area to be undertaken in PWC for cutting and management of *Prosopis juliflora*.**

Cutting Cycle	Plan Year	No. of Coupe	Proposed Working area under PWC (in Ha.)
First Cycle	First	49	4900
	Second	49	4900
	Third	49	4900
	Fourth	49	4900
	Fifth	49	4900
	<b>Total</b>	<b>245</b>	<b>24500</b>
Second Cycle	Sixth	49	4900
	Seventh	49	4900
	Eight	49	4900
	Ninth	49	4900
	Tenth	49	4900
	<b>Total</b>	<b>245</b>	<b>24500</b>
<b>Gross Total</b>		<b>490</b>	<b>49000</b>

### 3.5. Method of Treatment/management

The treatment will be based on the following objectives;

- i. Protection of the existing forest cover by the *P. juliflora* in shelter belt areas against the advancement of the Rann. Cutting of *P. juliflora* or other associated vegetation in shelter belt is prohibited.
- ii. To regenerate/restore degraded, barren and saline areas within the PWC with suitable indigenous vegetative species through grass plantation and undertake soil moisture conservation amendments, if necessary.
- iii. Demarcation of Felling series and Coupes within the whole Prosopis Working Circle approved in the Working Plan of Banni Grassland Division.
- iv. Estimation of the number of *Prosopis juliflora* plants in each coupes along with the estimation of charcoal production out of it.
- v. To prepare Treatment Map for granting permission for the preparation of Charcoal from *P. juliflora* as per the guideline of Department of Forest and Environment, Govt. of Gujarat, dated 17.08.2010.

- vi. To execute Triparty Agreement between the Forest Department ( at the level of Range Forest Officer), Gram/village Panchayat and Gujarat State Forest Development Corporation Ltd. (GSFDC) or any other suitable agency to implement the charcoal production from *Prosopis juliflora* in Banni region.
- vii. To assess the demand of charcoal and accordingly planning to be made for production of charcoal through GSFDC or any other suitable agency, so as to maintain the demand and supply chain.
- viii. To check the quality and quantity of charcoal production through a competent Forest Official, and also to ensure/enforce checking of the illegal charcoal production in Banni.
- ix. To issue the transit pass by the forest department for transportation of charcoal as per the prevailing Rules, Circulars, Resolutions and Notifications of Government of Gujarat, time to time.
- x. Sustainable use of *Prosopis juliflora* in various purposes for livelihood development and socio-economic development of Banni and its surrounding areas.
- xi. To protect and prohibit cutting of *P. juliflora* in areas which provide healthier habitat for the wildlife.

### **3.5.1. Method of Harvest**

#### **3.5.1.1. Cutting Cycle**

The *Prosopis juliflora* has high level of coppicing power and if cut at ground level, it can mature and regenerate its woody biomass similar to that of before harvesting within a time frame of 4-5 years. Therefore, the area is to be managed for a coppice management system, a rotation period of five years is proposed.

To manage the *P. juliflora* maintain the demand and supply chain, one coupe of each felling series will be harvested from the ground surface each year. Thus, in five year cycle, all the coupes in each felling series will be harvested and regrowth of the first year harvested coupe and so on. For harvesting, only mature individuals of *P. juliflora* are allowed to cut for charcoal preparation and other uses for livelihood upliftment and socio-economic development. The young individual will be left for growth and attaining maturity.

The other uses for the *Prosopis* include; timber, handycraft making, firewood, pods for beverage, biscuit and cake for livestock, and medicinal uses.

### 3.5.1.2. Uses of *Prosopis* other than Charcoal making

*Prosopis juliflora* is one of the most economically and ecologically important tree species in arid and semi-arid zones of the world. *Prosopis* species vary widely in their productivity and their relative use and utilisation by humans, primarily pods for food and fodder, and wood for fuel and timber. Apart from it utilised as a source of fuel, fodder and occasional timber to varying degrees, it is a nitrogen fixing leguminous plant.

As a fuel it can be burnt directly as firewood, and as a timber it can be used as poles or roundwood or cut into boards and cants. The tree forms of *P. juliflora* will be used as potential of producing larger volumes of straighter branches and trunks have always had greater importance as sources of fuel and timber for local populations. *Prosopis juliflora* produce wood which is a very high quality fuel, having a high calorific value of approximately 4200-4800 kcal/kg (NAS 1980, FAO 1997).

The heartwood of *Prosopis* species is strong and durable, hard and heavy. The wood has a relatively high dimensional stability over other timbers meaning less shrinkage and cracking, and abundant wood elements give a high tensile strength (Tortorelli, 1956; Weldon, 1986). Therefore, it is suitable for making various handycraft items by the local communities over the years. With the tourism development in the area, its uses in handycraft will be a good avenue for the livelihood upliftment. The wood can be cut and worked for the production of household items and agricultural tools.

Branches or coppice shoots of various dimensions serve as posts for fencing, chosen in preference to those of other species because of availability, suitable size and durability.

The fruit produced by *Prosopis* species are legume pods, high in sugars, carbohydrates and protein. Pods have been a historic source of food for human populations where *Prosopis* species are found, increasingly becoming less important as a human food and more important as a livestock feed. Pods of

*Prosopis juliflora* are composed of an exocarp, a sometimes fleshy mesocarp, fibrous endocarps and hard seeds. The high percentage of mesocarp favoured as a source of food and feed for the livestock. In its native ranges, sweet pods preferred for human and animal consumption.

The leaves of *P. juliflora* is unpalatable while it has crude protein levels of 14-22%, crude fibre 21-23%, nitrogen free extract 43- 50%, calcium 1.5% and phosphorus 0.2% (Bhandari and Govil, 1978; Anttila *et al.*, 1993). In the scarcity period, the young or tender leaves are used as a feed by the buffalos.

*Prosopis* flowers are a valuable source of bee forage. The flowers produce copious quantities of pollen and nectar over relatively long periods of time, as a nutritive reward for potential insect pollinators. *Prosopis* honey is light yellow in colour and generally of good quality with a pleasant taste and only a slight aroma. In Banni the local communities collect honey from wild colonies. In the areas having dense or moderately dense *Prosopis*, commercial bee hives will be distributed to the local communities for apiculture. It will give a new livelihood option for the local communities.

*Prosopis* exudate gums are water soluble, liquid and yellow when fresh, slowly hardening and darkening in colour. Old gum, as found in resin pockets in the wood can be very hard, crystalline in structure and almost black in colour. The gum of *P. juliflora* is high quality and have good marketing value. In north America, *Prosopis* Gum, or bark covered with gum, are used to produce a *Prosopis*-derived paint for skin, pottery and leather or as a basketry dye (Felger, 1977). In India, the gum is said to have a bitter taste and is used increasingly in the manufacture of textiles and adhesives. Collection of *P. juliflora* exudate gum is an important activity in Gujarat, India, where trees are harvested in the dry season (March-June). Approximately 1 kg of gum can be collected in a working day (Tewari, 1998). Banni has huge source of gum, therefore, gum to be collected from the PWC in regular basis through local communities and marketing to be undertaken through the GSFDC.

Many medicinal uses have been recorded for extracts from *Prosopis* plant parts from studies on the ethnobotany. Further, research to be conducted involving

research institution for identification of its medicinal uses and use various plant parts for curing various diseases.

### 3.5.1.2. Yield Regulation

A Treatment Map of each coupe within the felling series will be prepared jointly by the Forest department and respective village panchayats, which will be further approved by the DCF or any other competent authority for execution or implementation of harvesting. The treatment map of the coupe will have broader activities for harvesting and restocking/filling of gap area. The good grassland patches of equal or more than 5 ha area falling in the coupe would be treated as grassland and SMC works within the treatment areas/grassland patches will also be made wherever required to manage or improve the grass patches.

### 3.5.1.3. Cutting Regulations

#### a. Role and Responsibilities of suitable agency/GSFDC

- i. Production of charcoal from *Prosopis juliflora* as per the tripartite agreement between Forest department, suitable agency /GSFDC and village panchayats.
- ii. Regular checking of the treatment area so as to ensure that no other species of plants are damaged and only *Prosopis juliflora* is to be harvested for charcoal production.
- iii. Maintenance of the records of charcoal production, labour records and stock records of charcoal go-downs.
- iv. Arrangement of working capital/labourer for charcoal production and payment for working capital/villagers/labourers.
- v. Coordination with the Forest Department/Gram panchayat/labourers in order to manage conflict if any.

#### b. Roles and Responsibilities of Village Panchayats:

- i. The Village Panchayats will organize the involvement of needy people of the villages for the participatory management of *P. juliflora*.

- ii. The respective Village Panchayats within the Banni Protected Forests will ensure that all local people/villagers get the opportunity to work and share the benefits arising from charcoal production in their village areas.
- iii. Panchayat will provide detailed list of villagers/labourers (Name, Address, Identity Proof and Bank account details) to the Forest Department and GSFDC/suitable agency.
- iv. Panchayat to ensure that all the villagers will get equal opportunity to get employment from the activities undertaken in the management of Prosopis Working Circle.
- v. Panchayat has to ensure that no other species of plants are exploited except *Prosopis juliflora* for fuelwood or charcoal production.
- vi. Packaging of all grades of sorted charcoal (unprocessed, dust/clay free) with a weight of in 40 kg in a gunny bag.
- vii. Work has to be done only in designated area of the Forest, preferentially barren land for charcoal making and it should be ensure that no chance of fire, no wild animal gets harm and no illegal activity takes place in the area.
- viii. Village panchayat will monitor to ensure that only the harvesting of mature individuals of *P. juliflora* for charcoal making is done and no immature/young individuals to be harvested.

**c. Role and Responsibilities of Forest Department:**

- i. The field staff of the concerned range will conduct regular meetings with the representatives of the respective village Panchayats and GSFDC/suitable agency.
- ii. Regular monitoring of the area / implementation works / Prosopis management / charcoal preparation.
- iii. Finalization of the rate of purchase of charcoal from primary collector before starting its production and intimation of the same to the Forest department.

**3.6. Regulatory Conditions:** The regulatory conditions between Forest Department, Village Panchayats, and local Communities are as below;

- i. No right on forestland will be given to anyone.
- ii. Only the benefits obtained through the implementation of the scheme are shared as per the provision of the "Agreement".
- iii. No work other than those mentioned in the approved working plan will be carried out in the forest area.
- iv. If removal of unwanted species will be carried out in the plantation area by village Panchayats, the firewood available from it will be given free of cost to the local villagers.
- v. There is no grazing in the area and it will be closed for 5 years.
- vi. The villagers would be entitled to collect dry fallen branches and minor forest produce.
- vii. Preference in labor oriented works will be given to the family members of Panchayats for employment generation.
- viii. No benefits will be rendered to any person who does not belong to the village Panchayats.

Before taking up any of the forest areas for PWC, an agreement will be entered between the village Panchayats and the concerned Range Forest Officer. This agreement will emphasize clearly the roles and responsibilities of Forest Department v/s Panchayats as per the activities. If at any moment during the agreement period, village Panchayats or its members violate any provision of the agreement, the Range Forest Officer concerned is authorized to ask for written explanations, and if during hearings he found the Panchayats or Panchayats members guilty he can cancel the agreement. If the village Panchayats feels aggrieved, it can represent to the Deputy Conservator of Forests concerned whose decision will be the final. Action will be done by joint responsibilities of all three parties. In a unavoidable situations, CCF Kachchh will be the final authority to take a final decision regarding this matter.

**3.7. Evaluation and Review:** For any project, periodical Evaluation and Review is a necessity for its successful and long-term sustenance. For this working circle, the working plan prescribes evaluation of the project after every five years. The review should be focused on bottlenecks and efforts should be done to provide appropriate mitigation measures to the participatory agencies from time to time for smoother implementation of the Working Plan.

**Chapter 4****BIODIVERSITY CONSERVATION (OVERLAPPING) WORKING CIRCLE****4.1. General Constitution of the Working Circle**

This overlapping working circle is constituted because biodiversity and wildlife are an integral part of any ecosystem and forest types. The prescription of this working circle cater to conservation, management, and enhancement of biodiversity (floristic and faunistic) and wildlife outside the Protected Areas inside Banni i.e. Kachchh Desert Wildlife Sanctuary and Chharidhandh Conservation Reserve. The forest areas of Banni are very rich in biodiversity and supports many unique wildlife species. The grassland has diverse types of grasses adapted to this saline tract. A proper correlation between the natural resources like biodiversity and wildlife and the people welfare in the grassland is existing; and therefore it is essential for evolving an appropriate management strategy to conserve biodiversity and use it sustainably. The constraints or limiting factors needs to be examined and accordingly efforts should be undertaken to mitigate them. The diversity of flora and fauna, their population, and habitats are affected by various biotic and abiotic factors which includes;

- i. Grazing by domestic livestock which may reduce food availability for wild herbivores.
- ii. Encroachment and land use change which may destroy the habitat of many species and wildlife.
- iii. Natural factors like erratic rainfall, drought, salinity intrusion and desertification may lead to the loss and degradation of habitats of species
- iv. Decreasing water depth level in wetlands which may affect the edaphic condition.
- v. Lack of protection and illegal hunting of any of wild animals may increase the threat of their extinction.

## 4.2. General Objectives

This working circle is created with the following objectives:

- i. To conserve and manage the biodiversity and wildlife, within the Banni grassland, and outside the Kachchh Desert Wildlife Sanctuary and Chharidhandh Conservation Reserve area and to ensure their survival, enhancement, and healthy population growth.
- ii. To enrich the wildlife habitat for ensuring adequate food, shelter and water availability, especially during the summer period and drought/scarcity years.
- iii. To maintain the savannah grassland ecosystem in the Banni area and restock the grassland with superior indigenous/native grass species
- iv. To protect the existing biodiversity and critical wildlife species from extinction.
- v. To restore the overall health of the habitat preferred by the wildlife, and its ecosystem.
- vi. To evolve a consensus on the basic issues for the conservation of forest and wildlife including soil and water
- vii. To motivate local people and their active participation in the protection of biodiversity.
- viii. To document and assess the status of the threatened flora and fauna and ensure its conservation priorities.
- ix. To regenerate degraded and barren areas with indigenous vegetative species and soil & moisture conservation works.
- x. To resolve human-animal conflicts and to elicit active role and community participation in the management of wildlife.
- xi. To involve local people in forest management through JFM and BMCs and People's participatory approach should be incorporated in the planning and management of biodiversity and forest resources.

### 4.3. Biodiversity of the Banni Protected Forest

Banni grassland is a more or less tableland, falling under the Desert Biogeographic Zone of the country that supports open scrub forest/savannah grassland forest which is a unique ecosystem provide diverse macro and microhabitats for a large number of floral and faunal species, survive and flourish over thousands of years. The adverse/dry climate and edaphic conditions intermixed with saline open land have turned this area in to an ideal dwelling place for native biodiversity and large number of migratory species visits during wintering season. As the grassland lies in a poor rainfall tract with erratic rainfall pattern, it has all kinds of floral components i.e. herbs, shrub and tree with a dominance of grasses and herbs, sparsely distributed shrubs and tree species, and the major faunal components i.e. amphibia, reptile, aves and mammal.

**4.3.1. Flora:** Banni grassland has a diverse kind of flora, specific to the savannah grassland ecosystem. A total of 189 species of plants belonging to 151 genera and 66 families were reported from the Banni which include 83 species of herbs, 47 species of grasses, 30 species of shrub, 13 species of climbers, and 16 species of tree. In the last few decades, *Prosopis juliflora*, an invasive alien species to this grassland has dominated this grassland.

**4.3.2. Mammal:** In Banni, the common mammals species found within and its fringe areas are Blue bull, Chinkara, Wild boar, Indian Hare, Bengal Fox, Desert fox, Desert cat, Jungle cat, Indian Jackal, Grey Wolf, Hyena, Wild Ass, Mongoose, Porcupine, etc..

**4.3.3. Avifauna:** Banni supports 262 species of avifauna. Some important bird species like Flamingos, Houbara Bustard, White-napped Tit, White-browed Bushchat, Grey Hypocolius, etc. are found in the grassland. Since the area falls in the Central Asian Flyway, especially under the Western Migratory route to the Indian sub-continent, plenty of migratory avifauna visits the Banni grassland during winter periods. Amongst the migratory birds Flamingos, Pelicans, Spoonbill, Storks, Cranes, and different type of Ducks and Waders are very common visitors. Some heronry site located in Banni, where species like Egrets, Cormorants, Herons, Spoonbills, and Ibises breed regularly.

**4.3.4. Herpetofauna:** The herpetofauna of this grassland includes Spiny-tailed Lizard (*Saara hardwickii*), Common monitor lizard and species of snakes such as Black Cobra, Vipers, Sand snake and Blind snake.

#### **4.4. Biodiversity Conservation Plan**

Biodiversity is the natural biotic capital of the earth which is fundamental for the fulfillment of human needs and vital for the continued existence of the planet. Biodiversity is the basic entity and foundation for our survival as well as sustainable development from the long history of our evolution. It encompasses the whole range of animals, plants and microorganisms on earth, along with the varied types of ecosystems in which they live are crucial for maintaining the quality of our lives. According to the Convention on Biological Diversity (CBD) “Biodiversity is the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within the species, between species and of the ecosystems”.

During the recent decades, the dwindling of biodiversity has higher consequences than other environmental dilemmas because the loss is irreversible. Therefore, the conservation of biodiversity becomes a global responsibility and is an essential aspect of sustainable development. Biodiversity supports innumerable ways to the human societies through ecological, economic, social, cultural, educational, scientific, and aesthetic services. Living organisms are an important part of the process that regulates the global atmospheric, climatic, hydrologic and biogeochemical cycles. Humans as a species have profound responsibility for altering the ecosystems that provide our evolutionary and ecological context.

The diversity of life on earth has never been static due to adding of species through evolution and elimination of the species through extinction. In the past, this process has taken over a long period and allows species to change or adapt; however, during recent decades, the environmental changes brought about by anthropogenic activities have accelerated the process of habitat destruction that subsequently decreased the opportunity of the species to migrate or adapt.

Biodiversity/Wildlife Conservation planning for this important grassland deals with the identification of the priority areas that contain species, habitats or processes essential to achieving the conservation goals of the grassland. The plan for the biodiversity conservation and wildlife management of the Banni protected forest area shall be under two broad categories; i.e. Ecosystem or Habitat/Niche related measures and species level diversity including flagship and threatened wildlife species related measures.

To achieve the goal of biodiversity and wildlife conservation in the grassland also include; social, economic, and political imperatives which influence conservation goals, targets, objectives, and outcomes. For this reason, it is essential at times to integrate the surrounding community into the conservation planning process.

#### **4.4.1. Habitat/Ecosystem Conservation Measures**

**4.4.1.1. Ecosystem/Habitat Analysis and Evaluation:** Banni is basically a savannah grassland ecosystem with various types of macro and micro-habitat which support biodiversity specific to grassland. Banni grassland is a dynamic ecosystem which changes over the seasons. In summer, it is an arid dry grassland while in monsoon, majority of its area is covered with shallow water and behaves like a wetland which attracts a large number of migratory birds during wintering season. In winter, during a normal rainfall year, majority of the low saline areas are covered with grasses while high saline areas have good growth of halophytic herbs and grasses.

The dynamicity of the grassland and heterogeneity of habitat of this grassland supports diversity of floral and faunal species to survive and co-exist. Therefore, to manage biodiversity scientifically, a bio-resource inventory of the Banni grassland will be made to identify macro and micro-habitats having rich biodiversity and wildlife and having potential to support and enrich biodiversity.

During inventorization factors playing a pivotal role in habitat evaluation such as identification of areas, soil quality, land use, land characteristics, vegetation, water sources, terrain would be considered. This will be done through existing

literature, maps and photographs, field surveys, GIS analysis, etc. This will help in assessing the existing bio-resources and important and potential habitat for threatened wildlife species. For the purpose of habitat suitability analysis of Banni, the habitat will be broadly categorized based on dominant vegetation types such as grassland, *Prosopis juliflora*, *P. juliflora* inter-spread with grassland, halophyte dominant areas, etc. based on the information obtained from the habitat and its bioresource inventory, the habitat restoration and improvement activities will be made.

Though, the landscape of this grassland is flat with few depression, some species are localized to particular habitat types and patchily distributed. Therefore, identification and mapping of such habitats and localized species is also pre-requisite to manage, such habitat for conserving localized species.

**4.4.1.2. Habitat Improvement-cum-Protection:** Upon analyzing and evaluating the habitat, measures for its protection measures and improvement works will be undertaken. The habitat which hold rich and abundant biodiversity will be prioritised for implementing protection measures. Similarly, the areas having rich diversity in past which are now degraded and the areas having potential to improve biodiversity will be preferred for improvement and restoration.

Banni was once a rich biodiversity area, now infested by *P. juliflora* which alter the habitat quality drastically due to its allelopathy effects and doesn't promote groundcover and thereby changed the biodiversity distribution and composition. Thus, areas, outside Grassland working circle and *Prosopis* working circle will be focused to remove or control the growth and further invasion of *P. juliflora*. After evaluating such habitat weeding/complete uprooting of *Prosopis* will be done to manage its invasion.

Further, all the pockets that support native grass species and are of moderate to high ecological significance should be improved. Ecosystem assessment was to be made to improve various habitats to enrich biodiversity and flow of the ecosystem services. Further, based on wildlife presence and dependency assessment, habitat protection and improvement work shall be made.

#### 4.4.2. Biodiversity Conservation Measures

**4.4.2.1. Biodiversity Conservation:** Biodiversity is the fundamental entity in any ecosystem which maintain the integrity of the landscape through its ecological services. It is known that area with higher species diversity is more stable compared to that with lower species diversity. Biodiversity is now under threat due to habitat loss, over-exploitation of resources, climatic vagaries, pollution, invasion by non-native species such as *Prosopis juliflora*, etc. Biodiversity conservation is vital for maintaining continuous supply of ecosystem services and it should be done through holistic approach so that vital ecological processes are to be maintained.

Fundamentally, biodiversity conservation are done through using *in situ* and *ex situ* conservation measures. In case of Banni, *in situ* conservation efforts are to be made through habitat protection, management and improvement of areas which are hotspot for biodiversity. Various strategies and ecosystem approach will be made to conserve native biodiversity of Banni which are as follows:

- i) Identification of biodiversity hot-spot, wildlife dominating areas, wildlife corridors within the grassland and its periphery
- ii) Conservation and management of important habitat of the Banni such as good grass patches, wetland, ecotonal zones, natural streams, highlands, etc.
- iii) Banni is basically a savannah grassland, therefore, conservation of wide varieties of native grass species needs to be restored and rejuvenated to support grass dependent species
- iv) Restoration or re-introduction or plantation of native species of grasses and herbs which are vital for the native biodiversity such as insects and birds.
- v) Priority to be given for protection of Rare, Threatened and flagship species of the grassland.
- vi) Protection of wildlife corridors which connect species movement in daily and seasonal basis with the nearby areas such as Kachchh Desert Wildlife Sancturay, Chharidhandh Conservation Reserve, Great Rann of Kachchh and other fringe areas.

- vii) Biodiversity and Wildlife Conservation research specific to the grassland ecosystem and regular monitoring of the major wildlife species.
- viii) Enforcement of various rules and legislation on Biodiversity, Forests, Wildlife and environment enacted by the central and state governments.
- ix) Organization of awareness generation programmes for the importance and conservation of biodiversity.
- x) Capacity building among the forest staffs and other stakeholders on conservation of native biodiversity and threatened wildlife.
- xi) Development of infrastructure, tools and technique for the Banni grassland Division.

**4.4.2.2. Wildlife Protection:** Protection of threatened, endemic and keystone species is to be primarily done to maintain the grassland biodiversity. Several faunal species as Chinkara (*Gazella gazelle*), Houbara Bustard (*Chlamydotis macqueenii*), Indian Wolf (*Canis lupus*), Caracal (*Caracal caracal*), Spiny-tailed lizard (*Sarra hardwickii*), Desert fox (*Vulpes vulpes pusilla*), Desert cat (*Felis lybica*), Lesser Florican (*Sypheotides indica*), Raptors, etc. are the flagship and keystone species of the Banni grassland. Regular patrolling by staff and monitoring of banni grassland is a pre-requisite to control poaching and illegal hunting of wild species, if any.

#### **4.4.2.3. Study on biodiversity and population dynamics of major wildlife species**

As wild animals inside the Banni are competing with the domestic livestock for fodder and water, population estimation and dynamics needs to be studied at regular intervals through census or other research methods.

Improving the habitat and providing sufficient protection will enhance the number of wildlife as well as subsequently leads to impact in the age and sex ratios of wildlife. Therefore, in order to understand how population changes, it is necessary to investigate influencing factors, causes, and processes that impact them positively and negatively on this matter. Reliable information on population dynamics, therefore, is central to all efforts to conserve, manage, and control wild animals.

Some elements of population dynamics which needs to be studied are as under;

- i. Population size, density, abundance and frequency
- ii. Age and sex ratio and composition
- iii. Population distribution in different parts of the grassland
- iv. Population growth in time and general health of the population.

Based on the studies, the concerned Deputy Conservator of Forests will prepare a detailed action plan for the conservation of biodiversity and major wildlife of the Banni area and undertake activities accordingly.

#### 4.5. Method of Treatment

##### 4.5.1. Afforestation

The native species of Banni have adapted to the local environmental conditions. Therefore, seeds should be collected locally from Candidate Plus Trees (CPT). The properly cleaned and dried seeds should be stored in a dry and clean place. The pre-treated seeds (if needed) to be stored in ideal condition before sowing them in mother bed or poly bags. The nursery site where the planting stock is to be raised should be centrally located with good access to a watering facility and bearing good shade trees. The nursery technique for some native species is given below:

***Salvadora spp.*** : A small tree is locally known as *Pilu* coming up well in saline and degraded areas. Two varieties of *Pilu* are found in this district namely; *Khari-jar* (*Salvadora persica*) and *Mithi-jar* (*S. oleoides*). The former grow well in saline soil and the latter grow in low saline areas. The fruits of these species are attract many birds.

Ripen seeds of *Salvadora spp.* Shall be collected in March-April. After drying and cleaning they should be stored in a dry place and later sown in ply-pots filled with soil mixed with farmyard manure. Watering should be carried out as per the requirement but should be reduced towards the planting time to make plant hardy to survive in Banni conditions. Bags should regularly be shifted to avoid root penetration. The seedlings so raised are planted during monsoon. At plantation time, bags should be carefully removed to avoid damages to the root system.

***Sueda nudiflora*:** One of the local species and preferred by the camel, buffalo, and other wildlife. The *Sueda nudiflora* and *Sueda fruticosa* can come up through seed sowing in medium to high salinity areas. In high salinity areas, with soil treatment, exotic species like *Acacia ampliceps*, *Acacia colie* and *Acacia vinosa*) and halophytes such as *Atriplex lentiformis*, *Atriplex stocksii* and *Atriplex amnicola* could be planted.

**Planting Technique:** In those areas already having root stocks of grasses or other local species, the planting of the above-proposed species should be done by digging of the pit that may be of ring size so that optimum *in-situ* rainwater can be conserved. If the area is almost barren or compact then it has to be ploughed and ridges are to be formed for leaching out the salinity and rainwater conservation. On ridges, more emphasis has to be given on the sowing of seed/seed pellets of grasses and shrub species especially *Sueda* spp. The nursery raised poly-pot seedlings must be brought to the planting site at the onset of monsoon and in the first shower on the monsoon. Polythene bags should be carefully removed, to avoid damage to the root system. While planting, the plant should be kept straight in the pit. Pits then will be filled with weathered soil and soil will be pressed firmly around the plant. If necessary, dug up soil may be mixed up with good soil imported from other areas. The planting site must be provided with soil and moisture conservation works as prescribed in the treatment map and approved by the Deputy Conservator of Forests concerned. Fencing is a must for the plantation areas.

**Watering:** Supportive irrigation/ watering is necessary during the initial stages.

**Soil Work and Weeding:** No weeding is required but soil working is essential and should be done in first year plantation thrice in the first year, twice in the second year and once in the third year respectively.

**Cleaning:** The entire area will be worked in the third year to reduce the number of shoots per plant to two. These two shoots may be intertwined at the top to support each other.

**Thinning:** No thinning is required in the plantation area.

**4.5.2. Wetland management:** Though, Banni is inherently a grassland, the major parts of this grassland is converted into wetland during monsoon which attracts large number of waterbirds specifically migratory birds. Banni has also a large number of small to large sized water bodies, seasonally filled with shallow water which act as an important habitat for large number of biodiversity and aquatic birds. These water bodies needs some management interventions to conserve dependent biodiversity and threatened wildlife for the entire year during good rainfall years.

**4.5.3. Bird perching mounds:** Due to inherent soil salinity, tree species are not grow in most of the water bodies except few *Prosopis*, *Salvadora* and *Tamarix* sps. These tree species provide resting, roosting and perching for large number of bird species in wetland areas. Therefore, for facilitating conservation of large number of waerbirds in medium to large sized wetlands, mounds can be created for perching and roosting for water birds and water dependent birds.

**4.5.4. Water points:** Banni is one among the water scarce areas of the state due to erratic rainfall. Due to water scarcity, large number of natural biodiversity and wildlife species migrate to other parts of the district. Therefore, in some areas within the grassland some water points should be developed specially in areas having rich diversity and population of wildlife to provide water during the water scarcity period.

**4.5.5. Public awareness:** Public awareness is one of the major conservation intervention and effective tool for biodiversity and wildlife. Various public awareness events and programme, celebration of important days (World Environment days, International Biodiversity Day, Wildlife Week, Earth day, etc.) should be organized by the Banni Division in various location such as school, fair, etc. to generate awareness among various stakeholders such as students, local villagers, maldharis, womens, etc. In addition, some awareness materials such as pomplates, posters, booklets, books, etc. to be prepared for awareness among stakeholders about biodiversity and wildlife heritage of this grassland.

**4.5.6. Tourism promotion:** Banni grassland is one among the major locations in the district for tourist. White Desert located in north-western fringe of Banni is a famous destination for large number tourist. In addition, Chharidhand Conservation Reserve is also an important eco-tourism place mainly for the bird watchers. To enhance and attract tourist some tourism promotion activities can be done in various parts of the grassland such as development of a Interpretation Centre in prime location of the grassland, construction of watch towers in major wildlife rich habitat, posters related to wildlife of this grassland to be placed in along roadside, etc.

### 3.7. Other Regulation

**Removal of Leaves:** Dry leaves of *Prosopis* falling on the ground will not be removed from the plantation area.

**Grazing:** Grazing activities will not be allowed in the plantation areas. In other areas, grazing will be allowed based on rotational grazing schedule only and will be regulated as per the capacity of the area.

**Fire Protection:** Required measures on fire protection will be done for the plantation areas.

**Maintenance:** All the plantations will be maintained for 5 years. Thereafter, a review will be carried out by the Deputy Conservator of Forests concerned and if felt necessary, maintenance may be extended further.

## Chapter 5

## Establishment and Labour

## 5.1. Reorganization of Division, Range, Round, and Beat

As mentioned in the present management chapter, Banni is under administrative control of the Revenue department. To manage the area as per the Working Plan, a full-fledged forest division was created with 5 Forest Ranges. The division headquarters is located at Bhuj, i.e. the Kachchh district headquarter. The details of the divisions are as given in table 4.1.

**Table 5.1: Detailed list of Range, Round and Beats under the Banni Grassland Division**

Sr. No	Forest Range	Round	Beat
1	Tunga (Luna)	Luna	Luna
			Hajipir
		Bhitara Mota	Bhitara Mota
			Mithadi
Chhachhalo	Chhachhlo		
	Bhagadiyo		
2	Sarado	Sarado	Sarado
			Shervo
		Udai	Udai
		Hodko	Hodko
Sadai			
3	Sargu	Sargu	Sargu
		Bhirandiyara (West)	Layvara
			Arandavali
		Bhirandiyara (West)	
Dhordo	Dhordo		
4	Bhiradniyara	Bhirandiyara (East)	Bhirandiyara (East)
		Bhojardo	Reladi
			Bhojardo
		Dethiya Mota	Dedhiya mota
Vaghura			
5	Berdo	Berado	Berado (Loadai)
		Udai(Neri)	Udai (Neri)
		Lakhara Velara	Lakhara Velara (West)
			Lakhara Velara (East)

## 5.2. Establishment and Manpower

The Banni Working Plan covers an area of 1,71,753.23 ha of the single compact block which is to be managed and administered by the Banni division under the direction of Chief Conservator of Forests, Kachchh Circle. The administrative unit would essentially require the following;

### 5.2.1. Manpower

S. No	Designation	Number of Posts
1	Deputy Conservator of Forests	1
2	Assistant Conservator of Forests	1
3	Range Forest Officer	6 (5+1)
4	Range Forest Officer (Survey)	1
5	Forester	15
6	Surveyer	1
7	Guard	25
8	Head Clerk	1
9	Accountant	4
10	Clerk	2
11	Peon	2
12	Driver	6

For administration and management of the Banni division, certain additional infrastructures and other facilities are required. The infrastructure would involve buildings, machinery, and equipment, vehicles, wireless sets, grass go-downs, etc.

## 5.3. Buildings

The number of offices and residential buildings required would be;

- a) Division Office : 1 No.
- b) Range Office : 5 Nos.
- c) E type quarter : 1 No.
- d) D type quarter : 2 Nos.

- e) C type quarter : 6 Nos.
- f) B type quarter : 40 Nos.

### 5.3.1. Grass Go-down

Five Go-downs have already been constructed during the last decade. There is a requirement of 75 additional grass go-downs need to be constructed for scientific storage of the grass fodder of 1.5 crore kg.

### 5.4. Other Requirements

- i. Vehicle : 7 no.
- ii. Wireless set : 20 no. (25watt.)
- iii. Wireless set : 70 no. (2 watt)
- iv. Weapon
  - a) Revolver : 6 no.
  - b) 12 bor gun : 50 no.

Other requirements may be proposed by the Deputy Conservator of Forests.

### 5.5. Survey and Demarcation

Survey and demarcation are one of the foremost and important tasks to be undertaken simultaneously with the implementation of the Working Plan. Demarcation of the Banni boundary have been done by the DLR, Bhuj-Kachchh and the demarcation of the village boundaries is ongoing. Since the area is very vast, it requires full-fledged enforcement of a survey team with necessary infrastructure facilities to undertake the task within a stipulated time frame.

The manpower requirement for this purpose is as below:

- i. Forest Settlement Officer : 1
- ii. Surveyor : 6
- iii. Other ministerial staff to support the office of FSO.
- iv. Jeep Driver : 1
- v. Other contractual staff : 5

Necessary survey equipments include total station survey, theodolite, compass, measure tapes, tripped, drawing board, chain ranging roads, etc.

## Chapter 6

## CONTROL AND RECORDS

**6.1. Control of Records**

It is noted that no proper control records are being maintained in the Range office or the Division offices since 1985. For proper management of forests, the maintenance of such records is mandatory.

The following records will therefore be maintained at all costs:

- i) Compartment histories
- ii) Control books
- iii) Control journals
- iv) Register of deviations

**6.1.1 Compartment Histories**

The following forms should be used for writing the compartment history for each compartment. These records will be maintained at both the offices in the range as well as in the division office.

- |           |   |
|-----------|---|
| CH Form-1 | Compartment Description along with a stock map to be revised by the Working Plan Officer (WPO at the expiry of the working plan)  |
| CH Form-2 | Compartment Enumeration to be filled up by the Working Plan Officer for the sampled area after the enumeration is over/by Dy. C.F. for the rest of the area at the time of working. |
| CH Form-3 | Trees marked for felling to be filled up by the Dy. C.F. at the time of working.  |
| CH Form-4 | Compartment out-turn to be filled up by the Dy. C.F. at the time of working.  |
| CH Form-5 | Compartment history to be filled up by the Dy. C.F. at the time of working.   |

**6.1.1.1 CH Form-1: Compartment Description.** The formats for recorded is as under:

(i) Identification

Division	Range	Block	Compartment

(ii) Management Details

Working Plan period			
Author WPO			
Working circle			
Felling series			
Periodic bloc			

(iii) Description

Title of description	Explanatory notes to write the description
Area (in Hectares)	Total as also under each species or type, blank unworkable etc.
Situation	As best as possible
Boundaries	N, S, E, W (mention boundary pillars, ridges, spurs, streams, etc.
Altitude	In meters. In case of hilly areas give lower and upper limits.
Aspect	Main aspect and variations if any
Gradient	Precipitous, very steep, moderate, gentle, etc.
Rock	Mention main underlying rocks including alluvial deposits
Soil	Texture, depth, permeability, drainage, surface compaction, humus, etc.
Growing stock	Natural, artificial, storey-wise composition, age class quality, stocking density, regeneration of principal species, etc.
Remarks	The effect of biotic factors should be especially dealt with.

The description will be signed and dated by the WPO. at the time of revision. Each heading will commence in a separate paragraph.



**6.1.1.5. CH Form No. 5: Compartment History.** The format is as under

Block ..... Compartment .....

Year	Event

**6.1.1.5.1.** The Dy.C.F. will be responsible for recording current events as they occur and will make entries on the separate sheet of the Form. The principal information, which the Dy. C.F. should record, is as follows:

Felling, Subsidiary Silvicultural operations, Plantations, with costs, Fire incidences and damage caused, damage by other factors such as Drought, Storm, Insect, Fungi, Grazing, etc. Remedial measures will be taken along with costs, Good seed or seedling years of important species. The entries should be brief and concise; the whole or part compartment that was involved should be made clear. For event timings- or months should be given.

**6.1.1.5.2.** The Deputy Conservator of Forests will submit to WPO in writing annually a certificate stating that the working plan prescriptions have been followed. No prescription has been left out, deviated, or violated and the compartment histories are updated and are in place. All necessary entries as indicated in the workingplan have been made for the present year.

**6.2. Control Book**

Abound control book, showing the details of control forms as prescribed in the National Working Plan code will be maintained for each working circle separately in the office of Deputy Conservator of Forests.

General prescriptions of the working plan have been written in a way that they are quite clear. What constitutes a deviation is clearly explained. Control form should be prepared to include each prescription, as well as all definite suggestions regarding other operations that have been left at the discretion of the Deputy Conservator of Forests.

The set of control form is given here to control all the important operations prescribed and suggested in this Working Plan. These forms will be submitted further for approval.

### 6.2.1. Formats of Control forms

The following two formats of control forms are hereby presented.

(i) **Coupe control form** : For the control of all silvicultural operations such as felling, subsidiary cultural operations, cleanings, thinning, burning, etc., which may be prescribed or suggested to be carried out in a given coupe for the duration of the working plan.

Working Circle-periodic block	Felling series cutting section		Localities prescribedLocalities (As carried out suggested)				Coupe Control Form		Remarks & sanction
							Coupe No.		
							Excess (+) or Deficit (-)		
Prescription in brief	W.P. para	Year due	Year	Block/ Compt.	Area	Volume	Area	Volume	
1	2	3	4	5	6	7	8	9	10

(i) **Felling Control Form** : For controlling and maintaining a record of all trees marked for felling and trees retained as seed bearers or to safeguard future yield.

Working Circle-periodic block		Felling series cutting section		Localities prescribed/ Localities suggested (with areas)				Coupe No.	Page
Block & Compartment	Area	Species	Diameter class	Trees marked	Unit factor	Volume marked	Trees retained	% trees retained	Remarks & sanction
1	2	3	4	5	6	7	8	9	10

The DFO will annually make entries in his copy of the control forms and send them together with the deviation statement in triplicate to the Working Plan Conservator through the Territorial Conservator. After the entries have been

checked and approved, the Working Plan Conservator will first get his copy completed and send the DFO's copy to the Territorial Conservator. The latter will then complete his copy and finally return the DFO's set for deposit in the latter's office till next year. The Working Plan Conservator will send three copies of the deviation statement to the PCCF for sanction. After the sanction, one copy each will be sent to the Territorial Conservator and the DFO for their record and the Working Plan Conservator will retain the third copy for his set of control forms.

The control forms should be submitted by the DFO to the Territorial Conservator on or before December 1 and the latter should send them to the Working Plan Conservator concerned on or before January each year.

The Deputy Conservator of Forests will submit in writing annually a certificate stating that the working plan prescriptions have been followed and the control forms are updated and are in place.

### **6.3. Control Journal**

Deputy Conservator of Forest will maintain a Control Journal during his field tours. Working Circle wise DCF will make comments in it whether the objectives of the Working Plan are achieved. Special reasons like drought, flood, or damage caused by other reasons should be mentioned. DCF will also make suggestions for modification in the method given in for better achievement of the objectives. As this journal will be very useful during revisions of the next Working Plan, all critical observations and suggestions regarding prescription would be recorded by the DCF personally in his handwriting taking personal interest during field visits itself and shows it during Conservator of Forests inspection on tours.

### **6.4. Register of Deviations**

Any large scale forest operation or occurrence of such events not prescribed in the Working Plan will constitute a deviation. Thus extensive felling by declaring the trees dead or dying trees or on account of fire, insect attack, or any other causes will constitute a deviation. Non-working of the coupe in the prescribed year or working it in a year other than that prescribed, or working in an area

different from that as mentioned in the Working Plan will constitute a deviation. Non-working of any prescription given in the plan will also constitute deviation.

A consolidated register of deviations, showing every case of deviation from the prescriptions of the Working Plan, including the justification for deviation and the authority sanctioning the deviations, will be maintained in serial order at the office of the Deputy Conservator of Forests concerned.

Following would be the format of Deviation Statement

Year .....

Division .....

Serial No. of deviation	Control book name, form no page	Reference to the working plan		Nature of deviation requiring PCCF's sanction
		Paragraph	Nature of prescription	

The DFO will forward through the Territorial Conservator typed copies of this form in triplicate yearly with his copy of control forms. No explanatory remarks are required on this form, but these should be given in the forwarding letter. One copy of the statement will be returned to the DCF and another to the Territorial Conservator after the deviations have been sanctioned by the PCCF. If the PCCF or the Working Plan Conservator's sanction has been obtained in advance, the sanction number and date should be quoted in the last column.

All deviations, which permanently alter the basis of management laid down in a working plan, will require prior sanction of the PCCF. All deviations, which do not permanently alter the basis of management and with the necessity of which he agrees, may be approved and sanctioned by the Working Plan Conservator on behalf of the PCCF. In the case where there is a difference of opinion between the Working Plan Conservator and the Territorial Conservator, the former will refer them to the PCCF for instruction. The PCCF/CF WP, as the case may countersign the deviation statement.

## Chapter 7

## Reference

- Fao (Food and Agriculture Organisation). (1997) *Especies Arboreas y Arbustivas para las Zonas Aridas y Semiaridas de America Latina*. FAO, Santiago, Chile.
- Nas (National Academy of Sciences). (1980) *Firewood Crops; Shrub and Tree Species for Energy Production*. Vol. 1. National Academy Press, Washington DC, USA.
- Tortorelli, L. (1956) *Maderas y Bosques Argentinas*. Acme Agency Press, Buenos Aires, Argentina.
- Weldon, D. (1986) Exceptional physical properties of Texas mesquite wood. *Forest Ecology and Management* 16:149-153.
- Anttila, L. S., G. M. Alakoski-Johansson and S. G. Johansson. (1993) Browse preference of orma livestock and chemical composition of *Prosopis juliflora* and nine indigenous woody species in Bura, eastern Kenya. *East African Agriculture and Forestry Journal* 58:83-90.
- Bhandari, D. S. and H. N. Govil (1978) Evaluation of fodder tree leaves for sheep and goat in semi-arid area of Rajasthan. *Journal of Nuclear Agriculture and Biology* 7:110- 113.
- Felger, R. S. (1977) Mesquite in Indian cultures of southwestern North America. pp. 150-176. In: *Mesquite: Its Biology in Two Desert Ecosystems*. (Ed.) B. B. Simpson. Dowden, Hutchinson and Ross, Stroudsburg, Pennsylvania, USA.
- Tewari, D. D. (1998) *Economics and Management of Nontimber Forest Products: A Case Study of Gujarat, India*. Oxford and IBH Publishing Co. PVT. Ltd, New Delhi, Calcutta, India.
- Mukesh H. Koladiya, Arun Kumar Roy Mahato, Nikunj B. Gajera and Yatin S. Patel. (2014) Distribution pattern of birds in Banni Grassland of Kachchh district, Gujarat, India. *Journal of Research in Biology* 4(1):1228-1239
- Mukeshkumar, H. Koladiya, Mahato, A. K. Roy and V. Vijay Kumar (2012) Activity Budgets of Sympatric Birds in Banni Region of Kachchh District, Gujarat, India. *Proc. Zool. Soc.*, 65(1):52-56.
- Nikunj B. Gajera, Arun Kumar Roy Mahato and V. Vijay Kumar (2013). Status, diversity and conservation of grassland birds in arid region of Kachchh. *International Journal of Recent Scientific Research* 4(3):166-170
- Koladiya, M.H., Mahato, A.K.R. and Pardeshi, M. (2014). Status of Avi-Fauna in Lakhara Wetland, Kachchh Biosphere Reserve, Gujarat, India. *CIBTech Journal of Zoology* 3(1):37-41
- Vijaykumar, V., Mahato, A.K.Roy and Patel, R.K. (2015). Ecology and Management of 'Banni' grassland of Kachchh, Gujarat. Pp. 42-53, In G. S. Rawat and B. S. Adhikari

(Eds.) *Ecology and Management of Grassland Habitats in India*. ENVIS Bulletin; Wildlife and Protected Areas, Wildlife Institute of India, Dehradun-248001, India, Vol. 17: 240pp

Mathur, M. and Sharma K. (2018) Modelling the Economics of Grassland Degradation in Banni, India, using System Dynamics. *Ecology, Economy and Society—the INSEE Journal* 1 (2): 31–65

Manjunatha, B. L., Shamsudheen, M., Sureshkumar, M., Tewari, P. and Yadav, O. P. (2019) Occupational structure and determinants of household income of pastoralists in Banni grasslands of Gujarat. *Indian Journal of Animal Sciences* 89(4): 453–458, April 2019/Article

Gautam N. Yadama (2013) Narrative Two- Land & Living *The Paradox of Kutch*. pp 95 In *Fires, Fuel, and the Fate of 3 Billion: The State of the Energy Impoverished*. Oxford University Press, New York.

Vinish Kathuria & S.P.Singh (2012) Economics of Invasive Alien species. 252pp. In J. R. Bhatt (ed) *Invasive Alien Plants: An Ecological Appraisal for the Indian Subcontinent*, MoEF, New Delhi.

Shah, R. (2006) Charcoal mafia threat to Banni grassland. *The Times of India*, Ahmedabad, 22 January 2006

Maheshwari, D.V. (2008) Felling of Gando Bawal banned in Kutch. *The Indian Express*, Bhuj, May 06, Wed May 07 2008

Mahurkar, U. (2006) Gujarat Government legalised the business of making charcoal from wild babool. *India Today*, August 7, 2006

Alban, L., Matorel, M., Romero, J., Grados, N., Cruz, G. and Felker, P. (2002) Cloning of elite, multipurpose trees of the *Prosopis juliflora/pallida* complex in Piura, Peru *Agroforestry Systems* 54: 173-182

Desertification and Land Degradation Atlas of India (Based on IRS AWiFS data of 2011-13 and 2003-05) (2016), Space Applications Centre, ISRO, Ahmedabad, India, 219 pages

Bharwada C., and Mahajan,V. (2006). Lost and forgotten: grasslands and pastoralists of Gujarat. *The Forsaken Drylands: A Symposium on Some of India's Most Invisible People*. (Eds. Singh, 2006). Pp 83 ([http://www.india-seminar.com/2006/564/564\\_c\\_bharwada\\_&\\_v\\_mahajan.htm](http://www.india-seminar.com/2006/564/564_c_bharwada_&_v_mahajan.htm))

Bharwada C., and Mahajan,V. (2012). Let it be Banni Understanding and Sustaining Pastoral Livelihoods of Banni. CESS Monograph 26. ISBN 81-922201-7-8. Published by: Centre for Economic and Social Studies, Hyderabad, 150pp.

Biswas, S. K. (1971) Note on geology of Kutch, *Quaternary Journal of Geology, Mineral Metal. Soc. India*, V. 43, pp. 223-235.

- Biswas, S. K. (1974) Landscape of Kutch – A morphotectonic analysis, *Indian Journal of Earth Science*, 1(2):177-190.
- Briggs, J.C. (2013). Invasion ecology: Origin and biodiversity effects. *Environmental Skeptics and Critics* 2(3): 73-81.
- CBD (2008). Invasive Alien Species Programme. <https://www.cbd.int/invasive/cop-decisions.shtml>. Accessed in 26 April 2017.
- Christina, S. (1992) Dynamics of savanna ecosystems. *J. Vegetation Science* 3: 293-300.
- Deepa G. J. and J. J. Lakshmapurkar. 2009. Soil Salinity versus *Prosopis Juliflora* Growth – A Case of Banni Grasslands. Proceedings of the National Symposium on Prosopis: Ecological, Economic Significance and Management Challenges, February 20-21, 2009, Organized by Gujarat Institute of desert Ecology, Bhuj-Kachchh.
- Dixit, A. M. (1997). Ecological degradation of Common Property Land Resources: Problems and Prospects. In: Sustainable regeneration of degraded lands, Eds. J. Parikh and S. Reddy. Tata McGraw – Hill Publ. Co. Ltd., New Delhi.
- Dixit, A.M., A. Rana, and K. Trivedi. (2009) Assessment of Wood Biomass and Carbon Sequestration of *Prosopis juliflora* Lands in Kachchh District with respect to Charcoal Making. Proceedings of the National Symposium on Prosopis: Ecological, Economic Significance and Management Challenges, February 20-21, 2009, Organized by Gujarat Institute of desert Ecology, Bhuj-Kachchh.
- Elfadl, M. A. (1997) Management of *Prosopis juliflora* for use in agroforestry systems in the Sudan. Tropical Forestry Reports 16, University of Helsinki, Helsinki, Finland.
- Elton, C.S. (1958). The ecology of invasions by animals and plants. London: Methuen and Co. Ltd.
- Fenner, M. (1985). Seed ecology. Chapman & Hall, London, UK. 151 p.
- Felker, P. (1979) Mesquite. An all purpose leguminous arid land tree. In: G.A. Ritchie (Editor), New Agricultural Crops. Westview Press: Boulder, CO.
- Felker, P., P. R. Clark, A. E. Laag and P. F. Pratt. (1981) Salinity tolerance of the tree legumes: mesquite (*Prosopis glandulosa* var. *torreyana*, *P. velutina* and *P. articulata*), algarrobo (*P. chilensis*), kiawe (*P. pallida*) and tamarugo (*P. tamarugo*) grown in sand culture on nitrogen-free media. *Plant and Soil* 61:311-317.
- Felker, P. and Clark, P.R. (1982). Position of mesquite (*Prosopis*) nodulation and nitrogen fixation (acetylene reduction) in 3-m long phreotophytically simulated soil columns. *Plant & Soil* 64: 297–305.

- Felker, P. (2003) Management, Use and Control of Prosopis in Yemen, Mission report, Project Number: TCP/YEM/0169 (A). 14 August 2003 (Revised)
- Ferrouki, L. (1994). An ecological ground water harvesting system under threat. A case study of the Banni pastoralist's knowledge in the grasslands of Kachchh district, Gujarat state, India. M.Sc Dissertation, Dept. of Soil Sciences, Swedish University of Agriculture.
- Gang, C., Zhou, W., Sun, Z., Li, J., Qi, J. and O, I. (2014) Quantitative assessment of the contributions of climate change and human activities on global grassland degradation. *Environ Earth Sci.* 72(11):4273-4282.
- Ganguli, B. N., Kaul, R. N. and Nambiar, K. T. N. (1964) Preliminary studies on desert top feed species. *Ann. Arid zone* 3: 33-37.
- GAU (1989) Status report, Vol. 1. National Agriculture Research Project, North West agro-climatic zone, Gujarat agricultural University, Sardar Krushinagar
- Government of India (1960). Five Year Plan – 1960-1965, 3<sup>rd</sup> Planning Commission, Chapter 22: Forests and Soil Conservation Forests. Chapter 22: Forests and Soil Conservation Forests. <http://planningcommission.nic.in/plans/planrel/fiveyr/3rd/3planch22.html>, Accessed in 8 February 2016.
- GUIDE (1998). Status of Banni grassland and exigency of restoration efforts. Gujarat Institute of Desert Ecology, Bhuj (Kachchh).
- GUIDE (1998). *Ecorestoration of Banni Grassland*. First Annual Technical Report by Gujarat Institute of Desert Ecology, Bhuj.
- IPBES (2015) Progress report on the implementation of the land degradation and restoration assessment (deliverable 3 (b) (i)). IPBES/4/INF/11 <http://www.ipbes.net/plenary/ipbes-4>
- Harsh, L. N., J. C. Tewari, N. K. Sharma and P. Felker. (1996) Performance of Prosopis species in arid regions of India. pp. 4.21-4.34. In: Prosopis: Semiarid Fuelwood and Forage tree; Building Consensus for the Disenfranchised. (Eds.) P. Felker and J. Moss. Center for Semi-Arid Forest Resources, Kingsville, Texas, USA.
- IUCN (2000) Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species, IUCN.
- Jadhav, R. N., Kimothi, M. M. and Kandya, A. K. (1992) Grassland Mapping & Monitoring of Banni (Kachchh) Gujarat using Remotely Sensed Data, *Int. J. Remote Sensing* 14(17):3093-3103
- Kadikar, P. (1994) Status of Banni (Kachchh, Gujarat) grassland by 2000 AD using multiple remote sensing satellite data, Dissertation, Gujarat University, Ahmedabad.

- Kainaat, W. and Jafri, L. (2015). Mesquite (*Prosopis juliflora*): Livestock Grazing, Its Toxicity and Management. *J. Bioresource Manage* 2(2): 49 -58.
- Lowe, S., Browne, M. Boudjelas, S. and De Poorter, M. (2004). 100 of the world's worst alien invasive species. A selection from the global invasive species database. ISSG, IUCN, in [http://www.issg.org/pdf/publications/worst\\_100/english\\_100\\_worst.pdf](http://www.issg.org/pdf/publications/worst_100/english_100_worst.pdf), accessed 9 January 2016.
- Kurien, V. (2007). India's Milk Revolution: Investing in Rural Producer Organizations. <http://documents.worldbank.org/curated/en/748851468771700148/pdf/308270IN0Milk01ion01see0also0307591.pdf>
- Lowry, E., Rollinson, E.J., Laybourn, A.J., Scott, T.E., Aiello-Lammens, M.E., Gray, S.M., Mickley, J. and Gurevitch, J. (2012) Biological invasions: a field synopsis, systematic review, and database of the literature. *Ecology and Evolution* 3: 182–196
- Mooney, H. A., B. B. Simpson and Solbrig, O. T. (1977) Phenology, morphology, physiology. pp. 26-43. In: Mesquite, Its Biology in Two Desert Ecosystems. (Ed.)B. B. Simpson. Dowden, Hutchinson and Ross, Inc., Stroudsburg, Pennsylvania, USA.
- Muthana, K.D and Arora, G.D. (1983) *Prosopis juliflora* (SW) DC, a fast growing tree to blossom the desert and its Utilization. In: The current state knowledge on *Prosopis juliflora* (eds. M.A Habit and J.C. Sadvedra). FAO, Rome, pp.133-144
- Mwangi, E. and Swallow, B. (2005) Invasion of *Prosopis juliflora* and local livelihoods: Case study from the Lake Baringo area of Kenya, ICRAF Working Paper – no. 3. Nairobi: World Agroforestry Centre
- Pandya, S.M. and Sidha, V.K. (1987) Seasonal variation in plant biomass and primary production in desert vegetation at Khavda of Kutch (Gujarat), India. *Tropical Ecology* 28:57-68
- Pasiecznik, N.M., Felker P., Harris, P.J.C., Harsh, L.N., Cruz, G. Tewari, J.C., Cadoret, K. and Maldonado, L.J. (2001) The *Prosopis juliflora-Prosopis pallida* Complex: A Monograph. HDRA, Coventry, UK. pp.172.
- Patel, V. J. (1986) Wastelands Development through Agro-Forestry, Vadodara: Gujarat Energy Development Agency
- Raizda, M.B and Chatterji, R.N. (1954) A diagnostic key to the various forms of introduced Mesquite (*Prosopis juliflora* DC). *Indian Forester* 80: 675-680
- Reddy, C.V.K. (1978) *Prosopis juliflora*, the precocious child of the plant world. *Indian Forester* 104: 14-18
- Safriel, U. and Adeel, Z. (2005) Dryland Systems. Pp. 623-662 in: Ecosystems and human well-being: current state and trends: findings of the Condition and

Trends Working Group. Edited by Rashid Hassan, Robert Scholes and Neville Ash. Island Press, Washington DC

- Sastry, K.L.N., Thakker, P.S. and Jadhav, R. (2003) Biodiversity threat through exotic species monitoring and management using Remotely Sensed data and GIS techniques - A Case Study of Banni (Kachchh) Gujarat, India. *6th Annual International Conference on MAP INDIA 2003*, New Delhi.
- Saxena, S.K. (1992) Banni grasslands and halophytes-a case study from India, pp 217-222 In: [Halophytes as a resource for livestock and for rehabilitation of degraded lands](#) (Eds. V.R.Squires and A.T.Ayoub), Kluwer Academic Publishers
- Sharma, D.K., Assari, R.V. and Vijaykumar, V. (2013). Forest & Wildlife of Kachchh. Published by Gujarat Forest Department and Gujarat Institute of Desert Ecology, Bhuj, India.
- Soil Survey Division (1986). Report on the reconnaissance soil survey carried out in Banni area in Kachchh district of Gujarat State. Soil Survey Division, Vadodara
- Tewari, J.C., Harris, P.J.C., Harsh, L.N., Cadoret, K. and Pasiecznik, N.M, (2000). Managing *Prosopis juliflora* (Vilayati babul): a Technical Manual. CAZRI, Jodhpur, India and HDRA, Coventry, UK. Pp. 96.
- Trivedi, R.K. (1965). Census of India, 1961, Volume V, Part-VI -No 3 and 4, Page: 1-113, Village Survey Monographs. 3. Bhirandiyara, Kutch. Mafatlal, Z. Gandhi at Nayan Printing Press, Ahmedabad, The Manager of Publications, Delhi.
- Vijay Kumar, V., Patel, P. S. and Gajera, N. (2011). Grasslands of Kachchh. *In: State of Environment of Kachchh (SoEK)*. (Eds.) K. Kathju, V. Vijay Kumar, G A Thivakaran, P S Patel and V. Devi. Published by Gujarat Institute of Desert Ecology (GUIDE), Bhuj-Kachchh and GEER Foundation, GoG, Gandhinagar as part of Gujarat Sthapana Day. ISBN 978-81-910659-9-2. Pp.113-132.
- Vaibhava, V., Inamdarb, A. B. and Bajaja, D. N. (2012) Above Ground Biomass and Carbon Stock Estimation from *Prosopis juliflora* in Banni Grassland using Satellite and ancillary data. *Proceedings of 33<sup>rd</sup> Asian Conference on Remote Sensing*, Pattaya, Thailand.
- WRD and CDO (1989). Report of the sub-committee for studying the problems and suggesting the remedial measures for the salinity ingress in the Banni area of Kachchh district. Govt. of Gujarat, Water Resources Department and Central Designs Organization, Gandhinagar.
- Ali, S. and Ripley, S.D. (1999) *Handbook of the birds of India and Pakistan*. Vol 10. Second edition. Delhi: Oxford University Press.
- Bhardwaj, G. S.; Sivakumar, K.; Jhala, Y. V. (2011). Status, distribution and conservation perspectives of Lesser Florican in the North-Western India: A Survey Report. Wildlife Institute of India.

- Corbet, G. B. and Hill, J. E. 1980. *World list of mammalian species*. British Museum, London, UK.
- Deomurari, A. 2007. Western India: Gujarat Kutch Birding and Wildlife Tour, November 2007.
- Dutta, S., Rahmani, A.R. and Jhala, Y.V. (2011). Running out of time? The great Indian bustard *Ardeotis nigriceps*—status, viability, and conservation strategies. *European Journal of Wildlife Research* 57 (3): 615-625.
- GES (Gujarat Ecological Society), MSU (Maharaja Sayajirao University) and GUIDE (Gujarat Institute of Desert Ecology). (2002). *Conservation of rare and End biodiversity of Gujarat*. Final Project Report submitted to Gujarat Ecology Commission, Vadodara. 428 p.
- Joshua, J., Sunderraj, S. F. W. and Joshi, P. N. (2008). *Status survey of threatened plants in Kachchh desert, Gujarat*. In: Rawat, G. S. (Ed.). 2008. *Special habitats and threatened plants of India*. ENVIS Bulletin: Wild life and protected areas, Vol. 11, No. 1. Wildlife institute of India, Dehradun, India.
- Lester, C.D. (1904). *The birds of Kachchh*. Bhuj, Kachchh: Kachchh Darbar.
- Mukherjee, S. K. 1998. Small Cats of India. Envis Bulletin. Wildlife Institute of India.
- Patel, R. (2015). Ecological study of threatened plants of western Kachchh, Gujarat. In *Advances in Plant Research*, Edited by S. I. Bhuyan and Kumari, S. 72-94 p.
- Prater, S.H. 1980. *The book of Indian animals*. Bombay Natural History Society. Oxford University Press. Bombay, India.
- Rahmani, A.R. (1992) *Threatened fauna of the Indian grasslands*. Pp. 143–150 in K. P. Singh and J. S. Singh, eds. *Tropical ecosystems: ecology and management*. New Delhi: Wiley Eastern
- Rahmani, A.R. (1996) Status and distribution of Stoliczka's Bushchat *Saxicola macrorhyncha* in India. *Forktail* 12: 61–77.
- Rodgers, W. A., Panwar, H. S. and Mathur, V. B. 2000. Wildlife protected area network in India: a review (executive summary). Wildlife Institute of India, Dehra Dun, India.
- Rohit Patel, Arun Kumar Roy Mahato, Yogesh B Dabgar and V Vijay Kumar (2013). Note on the Distribution of *Commiphora stocksiana* Engl. In Kachchh: A Rare Medicinal Plant of India Need Conservation. *Annals of Plant Science*, Vol. 3(2), pp. 614-616.
- Tikader, B.K. 1983. *Threatened Animals of India*. Zoological Survey of India, Calcutta, India.
- Tiwari, J. K. (2011). *Checklist of birds of Kachchh*. [http://www.cedobirding.com/index\\_files/Page910.htm](http://www.cedobirding.com/index_files/Page910.htm)

## Annexure I

## Banni Protected Forest Notification, 1955

Copy : APPENDIX 'B' h71  
Government of Kutch.

No. HR/155/55 The Secretariat  
Bhuj, 11th May 1955.

In exercise of the powers vested in him under Section 29 of the Indian Forest Act 1927 read with the Government of India, Ministry of States Notification No. 104-J dated 14th August 1950, the Chief Commissioner is pleased to declare the area specified in the schedule herebelow to be protected forest with effect from 1st June 1955 and that the provisions of Chapter IV of the said Act shall be applicable to it from the said date.

- SCHEDULE -

The area as "Banni" and bounded as follows :-

To the north by the Great Rann of Kutch and the Mahal of Khawada, to the south by boundaries of the talukas of Bhachau, Anjar, Bhuj, Nakhatrana and Lakhpatt to the east by the waste land between the taluka of Bhachau and Mahal of Khadir, and to the west by the Rann and the desolate portion to the west of kori creek.

By order.

K. V. Bhatt  
Secretary to the Chief  
Commissioner for Kutch.

## Annexure II

## FORESTS AND ENVIRONMENT DEPARTMENT

Sachivalaya, Gandhinagar, 28th February, 1986.

WILDLIFE (PROTECTION) ACT, 1972.

No. GH-AVN-41/86-WLP-1386-207-V2.—WHEREAS THE Government of Gujarat considers that the area, the limits of which are defined in the schedule annexed hereto, is of adequate ecological, faunal, floral, geomorphological, natural and zoological significance for the purpose of protecting, propagating and developing wildlife and its environment.

NOW, THEREFORE, in exercise of the powers conferred by section 18 of the Wildlife (Protection) Act, 1972 (53 of 1972), the Government of Gujarat hereby declare the parts areas of Great Rann (Part) and surrounding wastelands and forests of District Kachchh specified in the schedule annexed hereto as "KACHCHH DESERT WILDLIFE SANCTUARY."

## SCHEDULE

DISTRICT : KACHCHH

Sr. No.	Name of Taluka	Name of Village	Survey Number	Area			Boundaries of the Sanctuary
				Sec. 20 I. F. Act	Sec. 4 I. F. Act	Traverse Waste-land	
1	2	3	4	5	6	7	8
1	Rapar	Movana	881/1	2076.29	..	..	—North Area of Great Rann (Part)
2	..	Bela	993	0.18	..	3012.24	
3	Rapar	Jatavada	1563/1	..	6520.00	..	East-Boundary of Wild Ass Sanctuary of Dhrangadhra.
4	..	Lodrani	903	..	..	6472.00	
5	..	Balasar	630	..	..	6120.99	
South:-Taluka Rapar :							
6	..	Deshalpar	613	..	..	3052.39	Villages : Fatehgadh, Varijani, Anandsar, Dhrabada, Ghedi, Davari, Shanpar, Nandasar, Trambau, Jesade, Khengarpar, Kuda (Nilpar)
7	..	Surbavandh	77/A	..	..	332.00	
8	..	Lakdavandh	183	1181.82	..	623.00	
9	..	Ravmoti	1365	..	..	7923.00	
10	..	Suvai	861/1	..	..	2566.87	
Taluka Bhachau Villages : Anklvandh, Kakarava, Manfara.							
11	..	Vanoi	138	..	..	755.28	Davpar, Bangadi, Kumbhardi, Kabarau, Deshalpar.
12	Bhachau	Bharudia	880	..	..	1386.87	

PART IV-B

GUJARAT GOVERNMENT GAZETTE, 15-5-1986

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GUJARAT GOVERNMENT GAZETTE, 15-5-1986

PART IV-B

13	..	Khankhoi	349	..	..	1266.85	Taluka : Anjar, Village : Budharmora, Dhamanaka, Devisar, Khiraara.	PART IV-B GUJARAT GOVERNMENT GAZETTE, 15-3-1986
14	..	Chobari	1574	..	..	3510.00	Taluka : Bhuj, Village : Javaharnagar,	
15	..	Kadol	451	53.97	..	469.00	Vaga, Lodai, Dhrang, Dry Rann, Chachhi-	
16	..	Ner-Amarsar	487	..	..	409.14	vandh, Jarmari-vandh, Bhojarado, Misariado,	
17	..	Morgar	561	..	152.88	166.00	Neri, Dalharnani, Andhou, Goro Dounger,	
18	..	Baniyari	355	..	..	1545.47	(Tuga) Kunaria, Ratadia, Dinara-Mo'a,	
19	Bhuj (Banni)	Raiyado	Unsurved	..	..	..	Including in Village Lakhara- Velara.	
	..	Lakhara- Velara (Kharod, Godhriyado, Ghadiado)	Unsurved	..	..	21361.00	West Area of Great Mann Including in Paiki.	
21	..	Bardo	Unsurved	..	..	13206.00	Raiyado With area of village Lotthiya	
22	..	Lothiya	..	..	..	..	With village	

1	2	3	4	5	6	7	8	624
23	Bhuj (Banni)	Udai	Unsurved	..	..	2038.23	With area of village Lakhabo	GUJARAT GOVERNMENT GAZETTE, 15-5-1986
24	..	Lakhabo	..	..	..	..	With area of village Udai	
25	..	Dhadhar Moti	..	..	..	1456.48		
26	Bhuj (Khavada)	Sandhara	134	..	..	787.91		
27	..	Juna	238	..	3211.77	..		
28	..	Kala-Dungar	..	..	..	14371.43		
29	..	Kuran	273	..	1015.67	..		
30	Bhachau (Khadir)	Dhoravira	276	..	4200.85	..		
31	..	Kharoda	101	..	..	554.24		
32	..	Kalyanpar	174	..	..	1076.41		
33	..	Janan	236	..	..	3527.99		
34	..	Bapuari	40	..	..	406.78		
35	..	Bambhanka	186	..	..	1461.24		
36	..	Ratanpar	169	..	..	464.50		
37	..	Ganeshpar	237/1	..	..	1480.58		

IT-3-VI	38	„	Gadheda	56	..	..	3375.16
	39	„	Amrapar	223	..	..	2726.13
	40	„	Khadir (Chaparia (Rakhal)	..	2791.58	..	..
	41	„	Tragadi-Bet	..	323.75	..	..
	42	„	Great Rann Paiki	..	..	..	619307.00
			Total		7307.59	10900.33	732414.21

	ABSTRACT	H. A.	Sq. KM.
1.	Area under the Indian Forest Act, 1927, section : 30	7,307-59	73.08
2.	Area under the Indian Forest Act, 1927 section : 4	10,900-33	109.00
3.	Area of Travers waste land	1,13,107-21	1,131.07
4.	Area of Great Rann Paiki	6,19,307-00	6,193.07
	TOTAL AREA	..	7,50,622-13
			7,506.23

By order and name of the Governor of Gujarat,

BINDU GAMIT,  
Under Secretary to the Government.

PART IV-B

GUJARAT GOVERNMENT GAZETTE, 16.6.1986

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## Annexure III

FOREST AND ENVIRONMENT DEPARTMENT  
Sachivalaya, Gandhinagar. Dated 9<sup>th</sup> July, 2008.

## Notification

Wildlife (Protection) Act, 1972 (Amendment Act, 2006 (39 of 2006)):

No: GVN-2008(33)WLP-102003-341-W(641): Whereas the Government of Gujarat considers that the area within the limits of which is defined in the schedule annexed hereto, is of adequate ecological faunal, floral, geomorphological natural and zoological significance for the purpose of protecting, propagating and developing wildlife and its environment.

Now therefore, in exercise of the powers conferred by section 36-A(1) of The Wildlife (Protection) Amendment Act, 1972 (Amendment Act, 2006) the Government of Gujarat hereby declares its intention to constitute the area ~~Chharidhandh~~ **Chharidhandh wetland** in "Suka Rann Paiki" falling in Kachchh district specified in the annexed hereto as a "Conservation Reserve".

## SCHEDULE

District : Kachchh

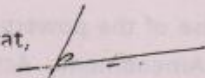
Taluka: Suka Rann(Bhuj)

Sr.No:	Name of the region	Area of the region		Boundary
		Acres	Ha.	
1.	Chharidhandh wetland (Suka Rann paiki)	56092.25	22700.00	<p><b>North:</b> Village boundary of Sirva, Bhagadia, Chhachhlo, Chhachhi and Hajipar of Banni area Ta. Bhuj.</p> <p><b>East:</b> Open west land of Suka Rann paiki and village boundary of Nirona Ta. Nakhtrana</p> <p><b>South:</b> Village boundary of Chhari- Fulai, Jhalu, Dador, vanga, Kharadia and Biber Ta. Nakhtrana</p>



				West:Village boundary of Nera Ta.Lakhpat.
	Total	56092.25	22700.00	

By order and in the name of Governor of Gujarat,

  
(Victor Mecwan)

Under Secretary to the Government  
Government of Gujarat

T.12  
16/7/08  
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Copy forwarded with compliments to:

- PS to Hon.Governor of Gujarat , Raj Bhavan, Gandhinagar.
- PS to Hon. Minister(Forest), Block No1,6th floor, New Sachivalya, Gandhinagar
- PS to Hon. Minister of State ( Forest), Block No 2, 6th floor, New Sachivalya, Gandhi agar.
- The Opposition Leader, Sardar Vithhalbhai Patel Bahvan, Gujarat Vidhansabha Bidg., Gandhinagar
- Principal Secretary, Forest & Environment Department, Block No14,8th floor, New Sachivalaya, Gandhinagar.
- PCCF, Dr. Jivraj Mehta Bhavan,Block.No.14, Gandhinagar
- Principal Chief Conservator of Forests (WL), Gujarat State, Dr.Jivraj Mehta Bhavan,Block.No.14,Gandhinagar.
- Conservator of Forests, Kutchchh
- The Manager,Government Press, Gandhinagar.

With a request to publish the notification in extraordinary Government gazette Part-IV –A and send 100 copies to this department and 100 copies to PCCF, Gujarat state, Gandhinagar.

The Accountant General, Rajkot /Ahmedabad.

The Finance Department, Sachivalaya, Gandhinagar

Financial Advisor, F&E Department, Sachivalaya, Gandhinagar.

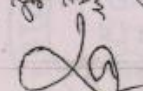
The Pay & Accounts Officer, Gandhinagar/Ahmedabad.

Subject file.



સાચી સંખ્યા 2-14-3283  
મુદ્રા 22-0-08

સાચી સંખ્યા 2-14-3283, મુદ્રા 22-0-08

  
(સાચી સંખ્યા 2-14-3283)  
મુદ્રા 22-0-08

17/08

## Annexure IV

## Demographic details of the villages in Banni Protected Forest

Sl. No	Gram Panchayat	Village	Human population	Livestock population
1	2	3	4	5
1	Luna	Hajipir	534	90
		Nana Luna	1629	1520
		Luna Mota		725
		Burkel	175	375
Total			2338	2710
2	Bhitara	Nana Bhitara	239	500
		Mota Bhitara		3000
		Udhmo	99	400
Total			338	3900
3	Chachlo	Chachlo	450	850
		Bhagadiyo	718	2250
Total			1168	3100
4	Sarado	Nana Sarado	1459	1300
		Mota Sarado		2800
Total			1459	4100
5	Mithdi	Mithdi	370	950
Total			370	370
6	Seravo	Seravo	434	1250
Total			434	1250
7	Gorevali	Gorevali	702	850
		Patgaar	123	400
		Pannavari	118	240
		Nana Udo	334	4501
		Siniyado	72	520
		Andhiyang	140	625
Total			1489	7136
8	Dhorado	Dhorado	303	221
Total			303	221
9	Hodko	Thikriyada	226	150
		Udai(Dumado)	27	60
		Karanvali	79	250
		Aeradavali	231	800
		Hodka	962	1050
		Ghadiyado		600

Sl. No	Gram Panchayat	Village	Human population	Livestock population
Total			1525	2910
10	Sadai	Jararvali	498	2000
		Sadai		100
		Vad		94
		Vadali		148
Total			740	3240
11	Dumado	Dumado	689	4200
Total			689	4200
12	Dadhhar	Vagura	189	540
		Nana Dedhiya	916	0
		Mota Dedhiya		652
		Nana Dadhhar	267	550
		Mota Dadhhar	351,00	700
Total			1723	2442
13	Sargu	Sargu	363	3150
Total			363	3150
14	Bhirandiyara	Layvara	0	0
		Reladi	219	1500
		Bhirandiyara	1658	6030
Total			1877	7530
15	Misaridiyado	Madan	190	450
		Neri	179	600
		Misriyado	549	6000
Total			918	7050
16	Bhojrado	Bhojrado	589	3500.0
		Udai	290	950
		Lakhabo		0
		Jarmarivandh		0
		Chachchivandh	251	450
Total			1130	4900.0
17	Berado	Berado	692	5500
Total			692	5500
18	Raiyado	Raiyado	495	665
		Kharod	150	2235
Total			645	2235
<b>Approx. Total</b>			<b>18201</b>	<b>63724</b>

## Annexure V

## Area under different working circle in past working Plan

Proposed area under different working circle in Banni Grassland Area. (Area in ha.)					
Sr. No.	Panchayat	Category			Total
		Grassland Working Circle	Protection cum Improvement Working Circle.	<i>Prosopis juliflora</i> Working Circle.	
1	Misariyado	3570.35	1785.19	1249.61	6605.15
2	Dadhhar	1456.42	7094.18	0.00	8550.60
3	Bhojardo	4607.78	8036.80	1292.42	13937.00
4	Chhachla	6773.04	0.00	5282.98	12056.02
5	Mithdi	2249.15	0.00	6067.45	8316.60
6	Sarado	2765.71	0.00	4435.57	7201.28
7	Servo	1488.60	0.00	2053.23	3541.83
8	Luna	13697.06	4397.97	5169.70	23264.73
9	Bhitara	6492.65	14310.16	1207.77	22010.58
10	Sadai	3183.14	3113.37	604.80	6901.31
11	Hodka	1444.07	1299.66	3032.54	5776.27
12	Dumado	2427.95	154.98	1188.15	3771.08
13	Goriwali	4321.21	1131.75	1646.18	7099.14
14	Bhirandiyara	9450.31	25219.15	3846.06	38515.52
15	Sargu	0.00	1379.82	0.00	1379.82
16	Dhordo	2824.30	2665.63	0.00	5489.93
17	Udai	0.00	0.00	4196.54	4196.54
18	Rann of Banni	569.30	9630.14	96.90	10296.34
<b>Total area of working circle.</b>		<b>67321.04</b>	<b>80218.80</b>	<b>41369.90</b>	<b>188909.74</b>
<b>Area of Kachchh Desert Sanctuary</b>					<b>38064.71</b>
<b>Area of Charidhundh conservation reserve</b>					<b>22700.00</b>
<b>Total area of Banni Grassland</b>					<b>249674.45</b>

## Annexure VI

## Soil quality of Banni Protected Forest during the year 2020

Sample Code	Moisture	WHC	pH	EC ( $\mu\text{S}/\text{cm}$ )	TOC (%)	Chloride (mg/kg)	Salinity (ppt)	Na (mg/kg)	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	SAR	TAP (mg/kg)	SO <sub>4</sub> (mg/kg)	TAN (mg/kg)
Pit 1 (0-15cm)	14.9	29.7	7.50	5891.67	0.20	9715	50	942	47	4804	806	3.31	9.4	97.6	923.8
Pit 1 (15-30cm)	17.6	30.7	7.45	5586.00	0.19	11346	50	891	43	4832	1394	2.91	5.9	28.3	875.8
Pit 1 (30-60cm)	18.7	21.7	7.85	5364.33	0.32	4999	50	833	50	4906	179	3.18	10.2	43.2	717.8
Pit 1 (60-100cm)	19.6	24.7	7.87	5476.00	0.38	4503	50	782	43	5004	602	2.78	9.1	62.5	607.8
Pit 2 (0-15cm)	16.3	30.7	8.01	681.07	0.13	674	20	141	21	3949	105	0.61	7.1	12.4	1253.9
Pit 2 (15-30cm)	8.0	27.2	7.75	952.07	0.17	1029	20	238	23	4305	279	0.95	6.5	19.1	707.1
Pit 2 (30-60cm)	14.7	25.9	7.55	2311.33	0.07	3972	20	362	15	5626	228	1.29	7.9	37.1	621.9
Pit 2 (60-100cm)	15.1	24.2	7.65	2393.33	0.16	1206	20	328	27	5724	290	1.15	9.0	56.6	548.5
Pit 3 (0-15cm)	8.2	26.7	7.81	5174.67	0.52	1702	30	247	50	3641	1184	0.91	9.8	58.3	703.7
Pit 3 (15-30cm)	13.7	23.2	7.12	5220.67	0.24	3900	30	562	50	3988	1408	1.95	7.9	110.1	610.6
Pit 3 (30-60cm)	15.4	29.2	7.46	5172.67	0.38	8935	50	908	31	4595	665	3.31	7.5	78.2	548.5
Pit 3 (60-100cm)	15.3	26.7	7.19	5237.67	0.13	11701	50	1064	28	4891	961	3.64	7.5	36.7	478.0
Pit 4 (0-15cm)	8.1	24.7	7.75	516.73	0.12	780	20	131	19	4286	105	0.54	11.4	13.6	616.8
Pit 4 (15-30cm)	10.7	25.7	7.64	719.10	0.82	1276	10	197	14	4613	65	0.79	5.7	27.8	796.8
Pit 4 (30-60cm)	12.4	26.7	7.50	1451.33	0.08	2234	20	253	12	4696	321	0.96	6.4	17.7	706.5
Pit 4 (60-100cm)	14.1	24.7	7.29	1162.33	0.16	4609	20	428	14	4592	1515	1.40	7.4	36.7	641.7
Pit 5 (0-15cm)	12.1	26.4	7.12	4427.33	0.42	3617	50	379	40	3496	1639	1.32	12.9	173.2	1028.2
Pit 5 (15-30cm)	15.4	27.7	7.77	3854.67	0.08	5957	40	636	37	5300	379	2.27	8.9	82.3	954.8
Pit 5 (30-60cm)	17.7	28.2	7.20	3447.33	0.17	3191	30	532	40	4159	179	2.19	6.1	51.9	853.3
Pit 5 (60-100cm)	17.4	25.4	7.45	3231.00	0.04	9219	40	862	37	4706	789	3.06	11.9	34.7	796.8
Pit 6 (0-15cm)	4.0	28.2	7.86	141.20	0.20	319	20	11	12	4103	81	0.04	8.7	2.7	760.1

Sample Code	Moisture	WHC	pH	EC ( $\mu\text{S}/\text{cm}$ )	TOC (%)	Chloride (mg/kg)	Salinity (ppt)	Na (mg/kg)	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	SAR	TAP (mg/kg)	SO <sub>4</sub> (mg/kg)	TAN (mg/kg)
Pit 6 (15-30cm)	7.0	23.7	7.32	157.80	0.13	106	20	13	10	4947	54	0.05	9.0	0.7	966.1
Pit 6 (30-60cm)	9.2	24.7	7.61	163.30	0.06	177	20	12	8	3681	200	0.05	9.9	8.9	8098.4
Pit 6 (60-100cm)	10.2	29.7	7.79	134.33	0.01	284	20	40	8	3860	81	0.17	7.9	1.9	7167.4
Pit 7 (0-15cm)	17.7	25.7	7.33	684.50	0.63	603	10	123	42	3545	54	0.56	8.5	87.1	875.8
Pit 7 (15-30cm)	16.4	27.7	7.75	1436	0.12	1808	10	360	47	4182	30	1.52	10.4	78.9	765.8
Pit 7 (30-60cm)	18.7	26.2	7.29	2751	0.42	2695	20	439	33	4682	80	1.74	6.4	59.2	695.3
Pit 7 (60-100cm)	20.3	28.7	7.24	1974	0.08	3652	20	342	23	5003	210	1.29	6.2	35.2	624.7
Pit 8 (0-15cm)	12.1	33.2	7.61	969	0.17	2801	20	251	42	3051	158	1.20	10.9	71.3	1282.1
Pit 8 (15-30cm)	13.2	31.9	7.68	860	0.24	2872	20	514	19	4040	233	2.13	11.6	56.7	1022.5
Pit 8 (30-60cm)	10.5	29.4	7.45	974	0.09	2695	30	704	22	4521	294	2.74	9.8	79.4	957.6
Pit 8 (60-100cm)	13.2	28.4	7.53	1169	0.12	1134	20	1042	30	5893	499	3.50	8.3	35.8	779.9
Pit 9 (0-15cm)	6.4	27.8	7.72	381	0.11	213	20	89	22	3149	161	0.42	7.9	9.9	1440.1
Pit 9 (15-30cm)	9.2	28.9	7.71	451	0.13	461	20	135	19	3299	92	0.63	14.6	8.5	1389.3
Pit 9 (30-60cm)	13.4	27.2	7.78	988	0.13	2127	20	348	28	3541	279	1.51	7.7	26.8	1310.3
Pit 9 (60-100cm)	18.7	26.7	7.52	2222	0.32	4255	20	412	42	6465	100	1.39	6.3	39.9	1132.6
Pit 10 (0-15cm)	3.5	33.2	7.79	179	0.12	425	20	9	14	3344	262	0.04	10.0	2.5	1225.7
Pit 10 (15-30cm)	3.9	35.1	7.90	331	0.04	355	20	13	8	3265	115	0.06	7.9	2.4	1115.6
Pit 10 (30-60cm)	6.1	38.9	7.66	486	0.05	709	20	30	5	3147	45	0.14	6.6	32.6	1025.4
Pit 10 (60-100cm)	7.6	42.2	7.85	656	0.27	674	30	25	4	3371	182	0.11	7.5	61.9	836.3
Pit 11 (0-15cm)	17.5	32.9	8.01	411	0.09	567	20	104	24	3264	119	0.49	7.4	24.4	641.7
Pit 11 (15-30cm)	21.9	31.7	7.97	2267	0.07	674	20	264	20	3139.20	52	1.28	7.5	9.6	712.2
Pit 11 (30-60cm)	21.7	33.7	7.79	3649	0.28	10283	40	646	22	3620	665	2.59	6.5	22.6	497.8
Pit 11 (60-100cm)	22.7	30.7	7.37	3416	0.16	8864	40	520	26	3737	947	1.97	5.6	13.2	379.3

Sample Code	Moisture	WHC	pH	EC	TOC	Chloride	Salinity	Na	K	Ca	Mg	SAR	TAP	SO <sub>4</sub>	TAN
				(µS/Cm)	(%)	(mg/kg)	(ppt)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Pit 12 (0-15cm)	8.9	36.7	7.09	4385	0.11	5319	50	565	41	2802	1018	2.33	11.4	133.9	957.6
Pit 12 (15-30cm)	11.4	34.7	7.23	6506	0.19	3191	70	791	43	3063	1742	2.83	9.8	155.6	904.0
Pit 12 (30-60cm)	13.1	33.8	7.60	174	0.09	6808	50	829	49	3433	1045	3.18	10.0	133.1	717.8
Pit 12 (60-100cm)	15.2	29.7	7.57	4604	0.03	7446	50	777	36	3756	514	3.15	7.9	9.5	494.9
Pit 13 (0-15cm)	4.9	27.7	7.79	948	0.19	603	30	17	28	2443	347	0.09	9.7	55.2	1225.7
Pit 13 (15-30cm)	10.3	29.2	7.45	174	0.22	284	30	32	18	2867	105	0.16	6.5	2.0	1242.6
Pit 13 (30-60cm)	18.6	38.2	7.86	680	0.25	319	30	162	26	3026	320	0.75	8.4	114.5	1042.3
Pit 13 (60-100cm)	16.4	37.2	7.66	729	0.25	638	30	347	48	3377	224	1.56	15.2	80.0	887.1
Pit 14 (0-15cm)	7.4	40.3	7.12	3168	0.68	6382	30	425	84	1744	329	2.45	10.7	138.9	926.6
Pit 14 (15-30cm)	11.3	36.7	7.17	4264	0.61	7801	40	693	87	3115	195	3.26	10.3	175.4	819.4
Pit 14 (30-60cm)	14.0	37.7	7.56	3991	0.61	9928	30	806	63	4171	134	3.35	10.7	52.0	717.8
Pit 14 (60-100cm)	11.4	38.2	7.91	1168	0.25	4255	10	332	43	4301	378	1.30	6.3	15.6	602.2
Pit 12 (0-15cm)	3.9	30.0	7.59	849	0.32	780	20	129	26	3479	246	0.57	6.8	42.8	1397.8
Pit 15 (15-30cm)	7.6	30.0	7.51	921	0.30	1064	20	187	20	3327	627	0.78	5.7	60.2	1259.5
Pit 15 (30-60cm)	11.5	27.2	7.67	1791	0.08	2695	30	342	18	3999	201	1.43	8.5	73.0	1104.3
Pit 15 (60-100cm)	10.8	26.2	7.57	2140	0.01	3900	30	373	13	3924	242	1.56	6.6	35.2	1008.4
Pit 16 (0-15cm)	13.5	38.2	7.00	2824	0.25	3546	50	345	10.	1784	1703	1.40	9.7	154.9	1228.5
Pit 16 (15-30cm)	10.3	34.2	7.16	1278	0.16	496	10	417	6	2950	450	1.89	6.6	118.9	1090.2
Pit 16 (30-60cm)	22.4	35.0	7.20	2918	0.20	5319	30	431	31	2504	220	2.22	10.9	147.5	1005.6
Pit 16 (60-100cm)	17.0	36.2	7.01	2710	0.20	7091	20	217	29	3017	116	1.05	10.6	78.9	813.8
Pit 17 (0-15cm)	6.2	28.2	7.42	1989	0.19	178	20	91	19	3034	95	0.45	10.	3.2	1028.2
Pit 17 (15-30cm)	11.5	35.2	7.78	1178	0.11	461	30	156	20	2992	77	0.77	9.7	14.8	974.6
Pit 17 (30-60cm)	13.9	27.7	7.43	1956	0.11	3191	30	385	25	3544	150	1.72	10.6	32.3	887.1

Sample Code	Moisture	WHC	pH	EC ( $\mu\text{S}/\text{cm}$ )	TOC (%)	Chloride (mg/kg)	Salinity (ppt)	Na (mg/kg)	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	SAR	TAP (mg/kg)	SO <sub>4</sub> (mg/kg)	TAN (mg/kg)
Pit 17 (60-100cm)	14.5	32.2	7.54	2901	0.14	6382	40	508	28	5360	525	1.77	6.3	26.6	740.4
Pit 18 (0-15cm)	3.2	26.7	7.75	176	0.12	213	20	10	14	3323	38	0.05	8.1	52.8	1310.3
Pit 18 (15-30cm)	4.2	27.7	7.92	129	0.11	248	20	11	8	5330	91	0.04	10.4	34.9	1180.5
Pit 18 (30-60cm)	5.9	34.2	8.08	195	0.08	319	20	26	6	5390	119	0.09	8.1	9.9	1141.0
Pit 18 (60-100cm)	7.3	30.2	7.81	192	0.03	213	20	64	5	3660	105	0.28	8.6	47.7	946.4
Pit 19 (0-15cm)	15.9	21.2	7.22	5713	0.13	7269	60	763	63	3413	1617	2.69	11.1	162.2	1194.6
Pit 19 (15-30cm)	18.9	24.7	7.52	4316	0.07	6914	40	824	46	4022	503	3.26	9.8	75.2	1115.6
Pit 19 (30-60cm)	20.6	28.2	7.23	4578	0.04	7020	50	799	45	4063	393	3.20	8.8	82.7	983.0
Pit 19 (60-100cm)	22.2	29.2	7.49	4810	0.04	6453	40	896	49	4053	642	3.45	7.5	77.1	864.5
Pit 20 (0-15cm)	7.8	34.2	7.20	2558	0.13	6028	20	529	66	3178	290	2.41	9.6	115.6	1366.7
Pit 20 (15-30cm)	9.2	32.2	7.31	4890	0.27	9219	50	708	68	3679	1676	2.43	6.7	128.9	1293.4
Pit 20 (30-60cm)	12.1	30.2	7.26	4213	0.13	7446	30	695	42	4080	239	2.86	7.6	93.8	1180.5
Pit 20 (60-100cm)	11.5	29.2	7.34	2138	0.25	2482	30	1004	60	4557	1417	3.33	14.2	45.7	1067.7
Pit 21 (0-15cm)	18.1	36.7	7.51	2021	0.25	7446	40	474	56	3754	592	1.90	13.3	99.7	1392.1
Pit 21 (15-30cm)	3.1	35.0	7.32	1587	0.18	5957	30	263	48	4181	162	1.09	11.3	109.4	1389.3
Pit 21 (30-60cm)	13.3	35.6	7.79	1232	0.21	4255	30	877	32	4637	361	3.34	12.1	142.1	1310.3
Pit 21 (60-100cm)	14.0	31.2	7.63	1446	0.23	4290	40	339	13	6347	225	1.14	10.8	123.0	1188.9
Pit 22 (0-15cm)	23.9	29.2	7.50	2775	0.13	6737	30	112	20	3800	908	0.42	17.9	72.2	1008.4
Pit 22 (15-30cm)	21.4	30.2	6.74	2889	0.30	922	50	120	14	5947	1869	0.35	11.2	170.8	920.9
Pit 22 (30-60cm)	16.7	32.2	7.25	1289	1.01	3546	20	112	12	3963	436	0.45	8.8	134.3	830.7
Pit 23 (0-15cm)	6.6	37.7	7.40	929	0.11	1276	20	165	24	4100	559	0.64	7.8	73.7	1406.2
Pit 23 (15-30cm)	9.7	33.7	7.53	1241	0.25	4751	30	247	38	5947	215	0.86	11.9	45.5	1259.5
Pit 23 (30-60cm)	11.2	29.7	7.51	2136	0.01	3617	30	389	30	6393	155	1.31	6.8	15.7	1149.5
Pit 23 (60-100cm)	10.6	27.7	7.58	3017	0.01	4538	30	555	41	4583	361	2.12	7.2	54.4	1008.4

**Annexure VII**Annexure – 1

District Inspector Land Record, Kachchh-Bhuj  
 Survey Bhavan, Seva Sadan, Mundra Road, Bhuj  
 Phone no/Fax no – 02832 – 230315

D S O/Banni Measurement/Green Tribunal Order/2019-20

Dt. 01/11/2019

To,  
 Deputy Collector & Forest Settlement Officer,  
 Bhuj – Kachchh.

Subject: Regarding the measurement of Banni area.

Ref: (1) Order of Hon'ble National Green Tribunal, in Appeal no: 366/18 (MA no: 1780/18)  
 (2) Shri Collector, Kachchh, Bhuj instructions given in the review meeting dtd: 14/10/2019  
 (3) Letter of Deputy Conservator of Forests, Bhuj dtd: 18/10/2019  
 (4) Letter from this office – D.S.O. / Banni Measurement/Green Tribunal Order dtd: 25/10/2019

Sir,

According to order made by Hon'ble National Green Tribunal in Appeal 366/18 (M.A.No. 1780/18) with reference of letter no-4 copy of the southern part of measurements of Banni Grassland area Map has been prepared (with co-ordinates) and submitted in two copies on dtd: 25/10/2019. Also a complete map of the measurements of the Banni Grassland area has been prepared and submitted in two copies. Also co-ordinate roll of each point is submitted for your reference.

The following are the details of the area measuring the Banni Grassland Area.

Sr.No.	Hector
1. Area of Banni	197633-63-13
2. Dry Desert Area	48873-51-15

**Total: 246507-14-28**

SD/-  
 District Inspector  
 Land Record, Bhuj

## Annexure VIII

## Range, Round and Beat area under Grassland Working Circle and Prosopis Working Circle of Banni Protected Forest

Sr. No	Range	Round	Beat	As per Revenue Village	Protected Forest Area	Grassland Working Circle (area in Ha.)	Prosopis Working Circle (area in Ha.)		
1	Tunga (Luna)	Luna	Luna	Luna	10622.45	4000	3400		
			Hajjipir	Hajjipir	7902.40	4000	2000		
			Burkal	Burkal	4568.96	3400	0		
		Bhitara Mota	Bhitara Mota	Bhitara Mota	11304.48	4000	500		
			Mithadi	Udhamo	2452.20	0	0		
			Chhachhlo	Mithadi	7250.26	6830	0		
		Chhachhlo	Chhachhlo	Chhachhlo	8178.54	6500	0		
			Bhagadiyo	Bhagadiyo	5649.92	4500	0		
			Chharidhandh	Chharidhandh	22700.00	0	0		
		<b>Total</b>					<b>80629.21</b>	<b>33230</b>	<b>5900</b>
		2	Sarado	Sarado	Sarado	Sarado	5342.56	4700	0
Shervo	Shervo				2921.72	2500	0		
Udai	Udai			Udai (Dumado)	Udai (Dumado)	2038.23	2000	0	
				Gorevali	Gorevali	904.52	400	0	
				Thikariyado	Thikariyado	1194.44	1000	0	
				Hodko	Hodko	2857.16	2200	0	
Hodko	Hodko			Karnavali	Karnavali	621.58	0	500	
				Suku Rann	Suku Rann	14148.2	3000	0	
				Sadai	Sadai	3697.54	1420	500	
				Vadali	Vadali	386.04	0	0	
<b>Total</b>					<b>34111.99</b>	<b>17220</b>	<b>1000</b>		
3	Sargu	Sargu	Sargu	SARGU	1402.16	0	1000		
			Layvvara	Layvvara	7620.56	0	2500		
		Bhirandiyara (West)	Arandavali	Arandavali	Arandavali	744.69	0	500	
				Dumado	Dumado	3100.44	2000	0	

Sr. No	Range	Round	Beat	As per Revenue Village	Protected Forest Area	Grassland Working Circle (area in Ha.)	Prosopis Working Circle (area in Ha.)
4	Bhirandiyara	Bhirandiyara (East)	Bhirandiyara (East)	Vad	1843.3	700	0
				Bhirandiyara (West)	5787.17	3300	1900
				Dhordo	2357.58	0	1500
				Pannavari	604.70	0	500
				Patgar	726.68	0	600
				Adhiyang	1508.72	1000	0
				Udo	2561.05	1200	500
				<b>Total</b>	<b>28257.05</b>	<b>8200</b>	<b>9000</b>
				Bhirandiyara (East)	10876.16	6500	2500
				Suku Rann	12025.33	1000	3600
				Reldi	1140.16	1000	0
				Madan	706.72	650	0
				Neri	2042.24	1500	500
				Bhojardo	15353.7	4700	0
Misariyado	2301.16	2000	0				
4	Bhiradhiyara	DETHIYA MOTA	Dedhiya Mota	Dedhiya Nana-Mota	2860.2	0	1000
				Vaghura	2692.83	0	1000
				Dadhhar Nani	1456.48	0	0
				Dadhhar Moti	5810.52	0	0
				<b>Total</b>	<b>57265.5</b>	<b>17350</b>	<b>8600</b>
5	Berdo	BERADO UDAI(NERJ) Lakhara Velara	Berado (Loadai) Udai (Neri) Lakhara Velara (West) Lakhara Velara (East)	Berdo	13206	0	0
				Udai (Neri)	11617.43	0	0
				Lakhara Velara	10223.45	0	0
			Lakhara Velara	11196.51	0	0	
			<b>Total</b>	<b>46243.39</b>	<b>0</b>	<b>0</b>	
			<b>Grand Total</b>	<b>246507.14</b>	<b>76000.00</b>	<b>24500.00</b>	

## Annexure IX

## Distribution of Felling Series/Block and Coupe of Grassland Working Circle

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
1	Tuga-Luna	Luna	I	1	100
2				2	100
3				3	100
4				4	100
5				5	100
6				6	100
7				7	100
8				8	100
9				9	100
10				10	100
					<b>1000</b>
11	Tuga-Luna	Luna	II	1	100
12				2	100
13				3	100
14				4	100
15				5	100
16				6	100
17				7	100
18				8	100
19				9	100
20				10	100
					<b>1000</b>
21	Tuga-Luna	Luna	III	1	100
22				2	100
23				3	100
24				4	100
25				5	100
26				6	100
27				7	100
28				8	100
29				9	100
30				10	100
					<b>1000</b>
31	Tuga-Luna	Luna	IV	1	100
32				2	100
33				3	100
34				4	100
35				5	100
36				6	100
37				7	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
38				8	100
39				9	100
40				10	100
					<b>1000</b>
<b>Luna Total</b>				<b>40</b>	<b>4000</b>
41	Tuga-Luna	Hajipir	I	1	100
42				2	100
43				3	100
44				4	100
45				5	100
46				6	100
47				7	100
48				8	100
49				9	100
50				10	100
					<b>1000</b>
51	Tuga-Luna	Hajipir	II	1	100
52				2	100
53				3	100
54				4	100
55				5	100
56				6	100
57				7	100
58				8	100
59				9	100
60				10	100
					<b>1000</b>
61	Tuga-Luna	Hajipir	III	1	100
62				2	100
63				3	100
64				4	100
65				5	100
66				6	100
67				7	100
68				8	100
69				9	100
70				10	100
					<b>1000</b>
71	Tuga-Luna	Hajipir	IV	1	100
72				2	100
73				3	100
74				4	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
75				5	100
76				6	100
77				7	100
78				8	100
79				9	100
80				10	100
					<b>1000</b>
<b>Hajipir Total</b>				<b>40</b>	<b>4000</b>
81	Tuga-Luna	Burkal	I	1	100
82				2	100
83				3	100
84				4	100
85				5	100
86				6	100
87				7	100
88				8	100
89				9	100
90				10	100
					1000
91	Tuga-Luna	Burkal	II	1	100
92				2	100
93				3	100
94				4	100
95				5	100
96				6	100
97				7	100
98				8	100
99				9	100
100				10	100
					1000
101	Tuga-Luna	Burkal	III	1	100
102				2	100
103				3	100
104				4	100
105				5	100
106				6	100
107				7	100
108				8	100
109				9	100
110				10	100
					1000
111	Tuga-Luna	Burkal	IV	1	100
112				2	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
113				3	100
114				4	100
					400
<b>Burkal Total</b>				<b>34</b>	<b>3400</b>
115	Tuga-Luna	Bhitara Mota	I	1	100
116				2	100
117				3	100
118				4	100
119				5	100
120				6	100
121				7	100
122				8	100
123				9	100
124				10	100
					1000
125	Tuga-Luna	Bhitara Mota	II	1	100
126				2	100
127				3	100
128				4	100
129				5	100
130				6	100
131				7	100
132				8	100
133				9	100
134				10	100
					1000
135	Tuga-Luna	Bhitara Mota	III	1	100
136				2	100
137				3	100
138				4	100
139				5	100
140				6	100
141				7	100
142				8	100
143				9	100
144				10	100
					1000
145	Tuga-Luna	Bhitara Mota	IV	1	100
146				2	100
147				3	100
148				4	100
149				5	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
150				6	100
151				7	100
152				8	100
153				9	100
154				10	100
					1000
<b>Bhitara Mota Total</b>				<b>40</b>	<b>4000</b>
155	Tuga-Luna	Mithadi	I	1	100
156				2	100
157				3	100
158				4	100
159				5	100
160				6	100
161				7	100
162				8	100
163				9	100
164				10	100
					1000
165	Tuga-Luna	Mithadi	II	1	100
166				2	100
167				3	100
168				4	100
169				5	100
170				6	100
171				7	100
172				8	100
173				9	100
174				10	100
					1000
175	Tuga-Luna	Mithadi	III	1	100
176				2	100
177				3	100
178				4	100
179				5	100
180				6	100
181				7	100
182				8	100
183				9	100
184				10	100
					1000
185	Tuga-Luna	Mithadi	IV	1	100
186				2	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
187				3	100
188				4	100
189				5	100
190				6	100
191				7	100
192				8	100
193				9	100
194				10	100
					1000
195	Tuga-Luna	Mithadi	V	1	100
196				2	100
197				3	100
198				4	100
199				5	100
200				6	100
201				7	100
202				8	100
203				9	100
204				10	100
					1000
205	Tuga-Luna	Mithadi	VI	1	100
206				2	100
207				3	100
208				4	100
209				5	100
210				6	100
211				7	100
212				8	100
213				9	100
214				10	100
					1000
215	Tuga-Luna	Mithadi	VII	1	100
216				2	100
217				3	100
218				4	100
219				5	100
220				6	100
221				7	100
222				8	130
					830
<b>Mithadi Total</b>				<b>68</b>	<b>6830</b>
223	Tuga-Luna	Chhachhalo	I	1	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
224				2	100
225				3	100
226				4	100
227				5	100
228				6	100
229				7	100
230				8	100
231				9	100
232				10	100
					1000
233	Tuga-Luna	Chhachhalo	II	1	100
234				2	100
235				3	100
236				4	100
237				5	100
238				6	100
239				7	100
240				8	100
241				9	100
242				10	100
					1000
243	Tuga-Luna	Chhachhalo	III	1	100
244				2	100
245				3	100
246				4	100
247				5	100
248				6	100
249				7	100
250				8	100
251				9	100
252				10	100
					1000
253	Tuga-Luna	Chhachhalo	IV	1	100
254				2	100
255				3	100
256				4	100
257				5	100
258				6	100
259				7	100
260				8	100
261				9	100
262				10	100
					1000

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
263	Tuga-Luna	Chhachhalo	V	1	100
264				2	100
265				3	100
266				4	100
267				5	100
268				6	100
269				7	100
270				8	100
271				9	100
272				10	100
					<b>1000</b>
273	Tuga-Luna	Chhachhalo	VI	1	100
274				2	100
275				3	100
276				4	100
277				5	100
278				6	100
279				7	100
280				8	100
281				9	100
282				10	100
					<b>1000</b>
283	Tuga-Luna	Chhachhalo	VII	1	100
284				2	100
285				3	100
286				4	100
287				5	100
					<b>500</b>
<b>Chhachhalo Total</b>				<b>65</b>	<b>6500</b>
288	Tuga-Luna	Bhagadiyo	I	1	100
289				2	100
290				3	100
291				4	100
292				5	100
293				6	100
294				7	100
295				8	100
296				9	100
297				10	100
					<b>1000</b>
298	Tuga-Luna	Bhagadiyo	II	1	100
299				2	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
300				3	100
301				4	100
302				5	100
303				6	100
304				7	100
305				8	100
306				9	100
307				10	100
					<b>1000</b>
308	Tuga-Luna	Bhagadiyo	III	1	100
309				2	100
310				3	100
311				4	100
312				5	100
313				6	100
314				7	100
315				8	100
316				9	100
317				10	100
					1000
318	Tuga-Luna	Bhagadiyo	IV	1	100
319				2	100
320				3	100
321				4	100
322				5	100
323				6	100
324				7	100
325				8	100
326				9	100
327				10	100
					1000
328	Tuga-Luna	Bhagadiyo	V	1	100
329				2	100
330				3	100
331				4	100
332				5	100
					500
<b>Bhagadiya Total</b>				<b>45</b>	<b>4500</b>
<b>Tuga-Luna Range Total</b>				<b>332</b>	<b>33230</b>
333	Sarado	Sarado	I	1	100
334				2	100
335				3	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
336				4	100
337				5	100
338				6	100
339				7	100
340				8	100
341				9	100
342				10	100
					1000
343	Sarado	Sarado	II	1	100
344				2	100
345				3	100
346				4	100
347				5	100
348				6	100
349				7	100
350				8	100
351				9	100
352				10	100
					1000
353	Sarado	Sarado	III	1	100
354				2	100
355				3	100
356				4	100
357				5	100
358				6	100
359				7	100
360				8	100
361				9	100
362				10	100
					1000
363	Sarado	Sarado	IV	1	100
364				2	100
365				3	100
366				4	100
367				5	100
368				6	100
369				7	100
370				8	100
371				9	100
372				10	100
					<b>1000</b>
373	Sarado	Sarado	V	1	100
374				2	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
375				3	100
376				4	100
377				5	100
378				6	100
379				7	100
					<b>700</b>
<b>Sarado Total</b>				<b>47</b>	<b>4700</b>
380	Sarado	Shervo	I	1	100
381				2	100
382				3	100
383				4	100
384				5	100
385				6	100
386				7	100
387				8	100
388				9	100
389				10	100
					<b>1000</b>
390	Sarado	Shervo	II	1	100
391				2	100
392				3	100
393				4	100
394				5	100
395				6	100
396				7	100
397				8	100
398				9	100
399				10	100
					<b>1000</b>
400	Sarado	Shervo	III	1	100
401				2	100
402				3	100
403				4	100
404				5	100
					<b>500</b>
<b>Shervo Total</b>				<b>25</b>	<b>2500</b>
405	Sarado	Udai (Dumado)	I	1	100
406				2	100
407				3	100
408				4	100
409				5	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
410				6	100
411				7	100
412				8	100
413				9	100
414				10	100
					<b>1000</b>
415	Sarado	Udai (Dumado)	II	1	100
416				2	100
417				3	100
418				4	100
419				5	100
420				6	100
421				7	100
422				8	100
423				9	100
424				10	100
					<b>1000</b>
<b>Udai (Dumado) Total</b>				<b>20</b>	<b>2000</b>
425	Sarado	Gorevali	I	1	40
426				2	40
427				3	40
428				4	40
429				5	40
430				6	40
431				7	40
432				8	40
433				9	40
434				10	40
					<b>400</b>
<b>Gorevali Total</b>				<b>10</b>	<b>400</b>
435	Sarado	Thikariyado	I	1	100
436				2	100
437				3	100
438				4	100
439				5	100
440				6	100
441				7	100
442				8	100
443				9	100
444				10	100
					<b>1000</b>
<b>Thikariyado Total</b>				<b>10</b>	<b>1000</b>

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
445	Sarado	Hodka	I	1	100
446				2	100
447				3	100
448				4	100
449				5	100
450				6	100
451				7	100
452				8	100
453				9	100
454				10	100
					1000
455	Sarado	Hodka	II	1	100
456				2	100
457				3	100
458				4	100
459				5	100
460				6	100
461				7	100
462				8	100
463				9	200
464				10	200
					1200
<b>Hodka Total</b>				<b>20</b>	<b>2200</b>
465	Sarado	Suku Rann	I	1	100
466				2	100
467				3	100
468				4	100
469				5	100
470				6	100
471				7	100
472				8	100
473				9	100
474				10	100
					1000
475	Sarado	Suku Rann	II	1	100
476				2	100
477				3	100
478				4	100
479				5	100
480				6	100
481				7	100
482				8	100
483				9	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
484				10	100
					1000
485	Sarado	Suku Rann	III	1	100
486				2	100
487				3	100
488				4	100
489				5	100
490				6	100
491				7	100
492				8	100
493				9	100
494				10	100
					1000
<b>Suku Rann Total</b>				<b>30</b>	<b>3000</b>
495	Sarado	Sadai	I	1	100
496				2	100
497				3	100
498				4	100
499				5	100
500				6	100
501				7	100
502				8	100
503				9	100
504				10	100
				<b>10</b>	<b>1000</b>
505	Sarado	Sadai	II	1	100
506				2	100
507				3	110
508				4	110
					<b>420</b>
<b>Sadai Total</b>				<b>14</b>	<b>1420</b>
<b>Sarado Range Total</b>				<b>176</b>	<b>17220</b>
509	Sargu	Dumado	I	1	100
510				2	100
511				3	100
512				4	100
513				5	100
514				6	100
515				7	100
516				8	100
517				9	100
518				10	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
					1000
519	Sargu	Dumado	II	1	100
520				2	100
521				3	100
522				4	100
523				5	100
524				6	100
525				7	100
526				8	100
527				9	100
528				10	100
					1000
<b>Dumado Total</b>				<b>20</b>	<b>2000</b>
529	Sargu	Vad	I	1	70
530				2	70
531				3	70
532				4	70
533				5	70
534				6	70
535				7	70
536				8	70
537				9	70
538				10	70
<b>Vad Total</b>				<b>10</b>	<b>700</b>
539	Sargu	Bhirandiyara (West)	I	1	100
540				2	100
541				3	100
542				4	100
543				5	100
544				6	100
545				7	100
546				8	100
547				9	100
548				10	100
					<b>1000</b>
549	Sargu	Bhirandiyara (West)	II	1	100
550				2	100
551				3	100
552				4	100
553				5	100
554				6	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
555				7	100
556				8	100
557				9	100
558				10	100
					<b>1000</b>
559	Sargu	Bhirandiyara (West)	III	1	100
560				2	100
561				3	100
562				4	100
563				5	100
564				6	100
565				7	100
566				8	200
567				9	200
568				10	200
					<b>1300</b>
<b>Bhirandiyara (West) Total</b>				<b>30</b>	<b>3300</b>
569	Sargu	Adhiyang	I	1	100
570				2	100
571				3	100
572				4	100
573				5	100
574				6	100
575				7	100
576				8	100
577				9	100
578				10	100
<b>Adhiyang Total</b>				<b>10</b>	<b>1000</b>
579	Sargu	Udo	I	1	100
580				2	100
581				3	100
582				4	100
583				5	100
584				6	100
585				7	100
586				8	100
587				9	200
588				10	200
<b>Udo Total</b>				<b>10</b>	<b>1200</b>
<b>Sargu Range Total</b>				<b>80</b>	<b>8200</b>

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
589	Bhirandiyara	Bhirandiyara (East)	I	1	100
590				2	100
591				3	100
592				4	100
593				5	100
594				6	100
595				7	100
596				8	100
597				9	100
598				10	100
					<b>1000</b>
599	Bhirandiyara	Bhirandiyara (East)	II	1	100
600				2	100
601				3	100
602				4	100
603				5	100
604				6	100
605				7	100
606				8	100
607				9	100
608				10	100
					<b>1000</b>
609	Bhirandiyara	Bhirandiyara (East)	III	1	100
610				2	100
611				3	100
612				4	100
613				5	100
614				6	100
615				7	100
616				8	100
617				9	100
618				10	100
					<b>1000</b>
619	Bhirandiyara	Bhirandiyara (East)	IV	1	100
620				2	100
621				3	100
622				4	100
623				5	100
624				6	100
625				7	100
626				8	100
627				9	100
628				10	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
					<b>1000</b>
629	Bhirandiyara	Bhirandiyara (East)	V	1	100
630				2	100
631				3	100
632				4	100
633				5	100
634				6	100
635				7	100
636				8	100
637				9	100
638				10	100
					<b>1000</b>
639	Bhirandiyara	Bhirandiyara (East)	VI	1	100
640				2	100
641				3	100
642				4	100
643				5	100
644				6	200
645				7	200
646				8	200
647				9	200
648				10	200
					<b>1500</b>
<b>Bhirandiyara (East) Total</b>				<b>60</b>	<b>6500</b>
649	Bhirandiyara	Suku Rann	I	1	100
650				2	100
651				3	100
652				4	100
653				5	100
654				6	100
655				7	100
656				8	100
657				9	100
658				10	100
<b>Suku Rann Total</b>				<b>10</b>	<b>1000</b>
659	Bhirandiyara	Reldi	I	1	100
660				2	100
661				3	100
662				4	100
663				5	100
664				6	100
665				7	100
666				8	100

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
667				9	100
668				10	100
<b>Reldi Total</b>				<b>10</b>	<b>1000</b>
669	Bhirandiyara	Madan	I	1	65
670				2	65
671				3	65
672				4	65
673				5	65
674				6	65
675				7	65
676				8	65
677				9	65
678				10	65
<b>Madan Total</b>				<b>10</b>	<b>650</b>
679	Bhirandiyara	Neri	I	1	100
680				2	100
681				3	100
682				4	100
683				5	100
684				6	100
685				7	100
686				8	100
687				9	100
688				10	100
					<b>1000</b>
689	Bhirandiyara	Neri	II	1	100
690				2	100
691				3	100
692				4	100
693				5	100
					<b>500</b>
<b>Neri Total</b>				<b>15</b>	<b>1500</b>
694	Bhirandiyara	Bhojardo	I	1	100
695				2	100
696				3	100
697				4	100
698				5	100
699				6	100
700				7	100
701				8	100
702				9	100
703				10	100
					<b>1000</b>

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
704	Bhirandiyara	Bhojardo	II	1	100
705				2	100
706				3	100
707				4	100
708				5	100
709				6	100
710				7	100
711				8	100
712				9	100
713				10	100
					<b>1000</b>
714	Bhirandiyara	Bhojardo	III	1	100
715				2	100
716				3	100
717				4	100
718				5	100
719				6	100
720				7	100
721				8	100
722				9	100
723				10	100
					<b>1000</b>
724	Bhirandiyara	Bhojardo	IV	1	100
725				2	100
726				3	100
727				4	100
728				5	100
729				6	100
730				7	100
731				8	100
732				9	100
733				10	100
					<b>1000</b>
734	Bhirandiyara	Bhojardo	V	1	100
735				2	100
736				3	100
737				4	100
738				5	100
739				6	100
740				7	100
					<b>700</b>
<b>Bhojardo Total</b>				<b>47</b>	<b>4700</b>

Sr. No	Range Name	Village Name/Block Name	Felling Series No.	Coupe No.	Coupe Area
741	Bhirandiyara	Misariyado	I	1	100
742				2	100
743				3	100
744				4	100
745				5	100
746				6	100
747				7	100
748				8	100
749				9	100
750				10	100
					<b>1000</b>
751	Bhirandiyara	Misariyado	II	1	100
752				2	100
753				3	100
754				4	100
755				5	100
756				6	100
757				7	100
758				8	100
759				9	100
760				10	100
					<b>1000</b>
<b>Misariyado Total</b>				<b>20</b>	<b>2000</b>
<b>Bhirandiyara Range Total</b>				<b>172</b>	<b>17350</b>
<b>Grassland Working Circle Grand Total</b>				<b>760</b>	<b>76000</b>

## Annexure X

Govt. of Gujarat Notification on Charcoal preparation from *Prosopis juliflora*

કચ્છ જિલ્લામાં ગાંડા બાવળ કાપવા અને ગાંડા બાવળના લાકડા તેમજ તેમાંથી બનાવેલ કોલસા અંગે વાહતૂક પાસ આપવા અંગેની સૂચનાઓ.

## ગુજરાત સરકાર

વન અને પર્યાવરણ વિભાગ

ઠરાવ ક્રમાંક: તરવ-૧૦૨૦૦૪-૨૦૩૩-ક,

સચિવાલય, ગાંધીનગર.

તારીખ: -૦૫-૨૦૦૮

6 MAY 2008

- સંદર્ભ :** (૧) વન અને પર્યાવરણ વિભાગનો તા.૧૩-૧૨-૨૦૦૪નો ઠરાવ ક્રમાંક: તરવ-૧૦૨૦૦૪-૨૦૩૩-ક.  
(૨) વન અને પર્યાવરણ વિભાગનો તા.૦૧-૦૪-૨૦૦૫નો ઠરાવ ક્રમાંક: તરવ-૧૦૨૦૦૪-૨૦૩૩-ક.

**ઠ રા વ :-**

સંદર્ભ ૧ અને ૨ માં દર્શાવેલ ઠરાવોથી રાજ્યમાં ગાંડા બાવળના લાકડા તેમજ તેમાંથી બનાવેલ કોલસા અંગે વાહતૂક પાસ આપવા અંગેની સૂચનાઓ બહાર પાડવામાં આવેલ છે.

ઉપરોક્ત ઠરાવોના અત્યાર સુધીના અમલીકરણના પરિણામો જોતાં કચ્છ જિલ્લા પુરતી નીચે મુજબની જોગવાઈ અમલમાં મુકવાનું ઠરાવવામાં આવે છે.

- (૧) કચ્છ જિલ્લામાં આવેલ બન્ની તરીકે ઓળખાતો વિસ્તાર નીચે જણાવેલ ચતુર્સિમામાં કચ્છ સરકારના તા.૧૧-૦૫-૧૯૫૫ના જાહેરનામાથી રક્ષિત વન તરીકે જાહેર થયેલ છે.
- |        |   |  |
|--------|---|--|
| ઉત્તર  | - | કચ્છનું મોટું રણ અને ખાવડા મહાલ.                             |
| દક્ષિણ | - | ભચાઉ, અંજાર, ભૂજ, નખત્રાણા અને લખપત તાલુકાની સરહદો.          |
| પૂર્વ  | - | ભચાઉ તાલુકો અને ખદીર મહાલની વચ્ચે આવેલ સરકારી ખરાબાની જમીનો. |
| પશ્ચિમ | - | રણ અને કોરીકીકની પશ્ચિમનો પ્રદેશ.                            |

આ વિસ્તારમાં ગાંડા બાવળ સહિતના તમામ વૃક્ષો કાપવા પર સ્પષ્ટ પ્રતિબંધ ફરમાવવામાં આવે છે. આ વિસ્તારના વૃક્ષોની વ્યવસ્થા વન વિભાગ પોતાના આયોજન મુજબ કરશે.

- (૨) બાંની વિસ્તારના કચ્છ જિલ્લાના અન્ય વિસ્તારો પૈકી જે વિસ્તારો રક્ષિત વન, અનામત ક્ષેત્ર, જંગલ, જંગલનારણ, રાષ્ટ્રીય ઉદ્યાન કે ભારતના વન અધિનિયમની કલમ ૪ હેઠળના વિસ્તારો તરીકે યથા રીતે ત્યાં પણ ગાંડા બાવળ સહિત કોઈપણ વૃક્ષના કપાણ કે અન્ય વ્યવસ્થા વગર તેની કામગીરી માત્ર વન વિભાગ જ કરી શકશે. અન્ય ધ્વારા આવા કપાણ પર પ્રતિબંધ મુકવામાં આવે છે.
- (૩) ઉપર (૧) અને (૨)માં દર્શાવેલ વિસ્તારો સિવાય કચ્છ જિલ્લાના અન્ય વિસ્તારોમાં ખાનગી માલિકીની જમીન પર તે જમીનના માલિકો કોઈ પરવાનગી વગર ગાંડા બાવળો દૂર કરી શકશે.
- (૪) ઉપર (૧)માં (૩)માં દર્શાવેલ જમીનો સિવાયની કચ્છ જિલ્લાની અન્ય જમીનમાંથી ગાંડા બાવળ દૂર કરવા માટે વન વિભાગની પરવાનગી લેવાની રહેશે.

સમગ્ર કચ્છ જિલ્લામાં ગાંડા બાવળ કે અન્ય વૃક્ષના લાકડા કે તેમાંથી બનાવેલ કોલસા અંગે વાહતૂક પાસ આપવાના અધિકારો માત્ર વન વિભાગના અધિકારીને રહેશે અને આવા કાયદેસરના વાહતૂક પાસ વગર તેને વહન કરી શકાશે નહિ.

સંદર્ભ દર્શિત ઠરાવોની અન્ય બાબતો યથાવત્ રહેશે.

ગુજરાતના રાજ્યપાલશ્રીના હુકમથી અને તેમના નામે,

પારેતોષ કિશ્ચિયન  
નાયબ સચિવ,  
વન અને પર્યાવરણ વિભાગ,  
ગુજરાત સરકાર.

પ્રતિ

- માન. રાજ્યપાલશ્રીના અગ્ર સચિવશ્રી, ગુજરાત રાજ્ય, ગાંધીનગર.
- માન. મુખ્યમંત્રીશ્રીના અગ્ર સચિવશ્રી, ગુજરાત રાજ્ય, સચિવાલય, ગાંધીનગર.
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- સર્વે માન. મંત્રીશ્રીઓના અંગત સચિવશ્રી, ગુજરાત રાજ્ય, સચિવાલય, ગાંધીનગર.
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- સર્વે માન. રા.ક. મંત્રીશ્રીઓના અગ્ર સચિવશ્રી, ગુજરાત રાજ્ય, સચિવાલય, ગાંધીનગર.
- અગ્ર મુખ્ય વન સંરક્ષકશ્રી, ગુજરાત રાજ્ય, ગાંધીનગર.
- અધિક અગ્ર મુખ્ય વન સંરક્ષકશ્રી, વિ. અને વ્ય., ગુજરાત રાજ્ય, ગાંધીનગર.

- અધિક અગ્ર મુખ્ય વન સંરક્ષકશ્રી, સા.વ.યો., ગુજરાત રાજ્ય, ગાંધીનગર.
- સચિવાલયના સર્વે વિભાગો, સચિવાલય, ગાંધીનગર.
- સર્વે જિલ્લા વિકાસ અધિકારીશ્રીઓ.
- સર્વે કલેક્ટરશ્રીઓ.
- મેનેજિંગ ડિરેક્ટરશ્રી, ગુજરાત રાજ્ય વન વિકાસ નિગમ લિ., બંગલા નં.૧૯૮/૪, ગ-૧ ટાઈપ, સેક્ટર-૩૦, ગાંધીનગર.
- ગવર્નમેન્ટ જનરલશ્રી, રાજકોટ, અમદાવાદ.
- વિકાસ કમિશનરશ્રી, ગુજરાત રાજ્ય, ગાંધીનગર.
- માહિતી નિયામકશ્રી, ગુજરાત રાજ્ય, ગાંધીનગર.
- વન અને પર્યાવરણ વિભાગની સર્વે શાખાઓ.
- સિલેક્ટ ફાઈલ.

## Annexure XI

## Details of Felling Series &amp; Coupes under the Prosopis Working Circle

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
1	Tuga-Luna	Luna	I	1	100
2				2	100
3				3	100
4				4	100
5				5	100
					<b>500</b>
6	Tuga-Luna	Luna	II	1	100
7				2	100
8				3	100
9				4	100
10				5	100
					<b>500</b>
11	Tuga-Luna	Luna	III	1	100
12				2	100
13				3	100
14				4	100
15				5	100
					<b>500</b>
16	Tuga-Luna	Luna	IV	1	100
17				2	100
18				3	100
19				4	100
20				5	100
					<b>500</b>
21	Tuga-Luna	Luna	V	1	100
22				2	100
23				3	100
24				4	100
25				5	100
					<b>500</b>
26	Tuga-Luna	Luna	VI	1	100
27				2	100
28				3	100
29				4	100
30				5	100
					<b>500</b>
31	Tuga-Luna	Luna	VII	1	100
32				2	100
33				3	100
34				4	100

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
					<b>400</b>
<b>Luna Total</b>				<b>34</b>	<b>3400</b>
35	Tuga-Luna	Hajipir	I	1	100
36				2	100
37				3	100
38				4	100
39				5	100
					<b>500</b>
40	Tuga-Luna	Hajipir	II	1	100
41				2	100
42				3	100
43				4	100
44				5	100
					<b>500</b>
45	Tuga-Luna	Hajipir	III	1	100
46				2	100
47				3	100
48				4	100
49				5	100
					<b>500</b>
50	Tuga-Luna	Hajipir	IV	1	100
51				2	100
52				3	100
53				4	100
54				5	100
					<b>500</b>
<b>Hajipir Total</b>				<b>20</b>	<b>2000</b>
55	Tuga-Luna	Bhitara Mota	I	1	100
56				2	100
57				3	100
58				4	100
59				5	100
					<b>500</b>
<b>Bhitara Mota Total</b>				<b>5</b>	<b>500</b>
<b>Tuga-Lina Range Total</b>				<b>59</b>	<b>5900</b>
60	Sarado	Karnavali	I	1	100
61				2	100
62				3	100
63				4	100
64				5	100
					<b>500</b>
<b>Karnavali Total</b>				<b>5</b>	<b>500</b>

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
65	Sarado	Sadai	I	1	100
66				2	100
67				3	100
68				4	100
69				5	100
					<b>500</b>
<b>Sadai Total</b>				<b>5</b>	<b>500</b>
<b>Sarado Range Total</b>				<b>10</b>	<b>1000</b>
70	Sargu	Sargu	I	1	100
71				2	100
72				3	100
73				4	100
74				5	100
					<b>500</b>
75	Sargu	Sargu	II	1	100
76				2	100
77				3	100
78				4	100
79				5	100
					<b>500</b>
<b>Sargu Total</b>				<b>10</b>	<b>1000</b>
80	Sargu	Layvara	I	1	100
81				2	100
82				3	100
83				4	100
84				5	100
					<b>500</b>
85	Sargu	Layvara	II	1	100
86				2	100
87				3	100
88				4	100
89				5	100
					<b>500</b>
90	Sargu	Layvara	III	1	100
91				2	100
92				3	100
93				4	100
94				5	100
					<b>500</b>
95	Sargu	Layvara	IV	1	100
96				2	100
97				3	100
98				4	100

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
99				5	100
					<b>500</b>
100	Sargu	Layvara	V	1	100
101				2	100
102				3	100
103				4	100
104				5	100
					<b>500</b>
<b>Layvara Total</b>				<b>25</b>	<b>2500</b>
105	Sargu	Arandavali	I	1	100
106				2	100
107				3	100
108				4	100
109				5	100
					<b>500</b>
<b>Arandavali Total</b>				<b>5</b>	<b>500</b>
110	Sargu	Bhirandiyara (West)	I	1	100
111				2	100
112				3	100
113				4	100
114				5	100
					<b>500</b>
115	Sargu	Bhirandiyara (West)	II	1	100
116				2	100
117				3	100
118				4	100
119				5	100
					<b>500</b>
120	Sargu	Bhirandiyara (West)	III	1	100
121				2	100
122				3	100
123				4	100
124				5	100
					<b>500</b>
125	Sargu	Bhirandiyara (West)	IV	1	100
126				2	100
127				3	100
128				4	100
					<b>400</b>
<b>Bhirandiyara (West) Total</b>				<b>19</b>	<b>1900</b>
129	Sargu	Dhordo	I	1	100
130				2	100
131				3	100

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
132				4	100
133				5	100
					<b>500</b>
134	Sargu	Dhordo	II	1	100
135				2	100
136				3	100
137				4	100
138				5	100
					<b>500</b>
139	Sargu	Dhordo	III	1	100
140				2	100
141				3	100
142				4	100
143				5	100
					<b>500</b>
<b>Dhordo Total</b>				<b>15</b>	<b>1500</b>
144	Sargu	Pannavari	I	1	100
145				2	100
146				3	100
147				4	100
148				5	100
					<b>500</b>
<b>Pannavari Total</b>				<b>5</b>	<b>500</b>
149	Sargu	Patgar	I	1	100
150				2	100
151				3	100
152				4	100
153				5	200
					<b>600</b>
<b>Patgar Total</b>				<b>5</b>	<b>600</b>
154	Sargu	Udo	I	1	100
155				2	100
156				3	100
157				4	100
158				5	100
					<b>500</b>
<b>Udo (Shinyado) Total</b>				<b>5</b>	<b>500</b>
<b>Sargu Range Total</b>				<b>89</b>	<b>9000</b>
159	Bhirandiyara	Bhirandiyara (East)	I	1	100
160				2	100
161				3	100
162				4	100
163				5	100

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
					<b>500</b>
164	Bhirandiya	Bhirandiyara (East)	II	1	100
165				2	100
166				3	100
167				4	100
168				5	100
					<b>500</b>
169	Bhirandiya	Bhirandiyara (East)	III	1	100
170				2	100
171				3	100
172				4	100
173				5	100
					<b>500</b>
174	Bhirandiya	Bhirandiyara (East)	IV	1	100
175				2	100
176				3	100
177				4	100
178				5	100
					<b>500</b>
179	Bhirandiya	Bhirandiyara (East)	V	1	100
180				2	100
181				3	100
182				4	100
183				5	100
					<b>500</b>
<b>Bhirandiyara (East) Total</b>				<b>25</b>	<b>2500</b>
184	Bhirandiya	Sukku Rann	I	1	100
185				2	100
186				3	100
187				4	100
188				5	100
					<b>500</b>
189	Bhirandiya	Sukku Rann	II	1	100
190				2	100
191				3	100
192				4	100
193				5	100
					<b>500</b>
194	Bhirandiya	Sukku Rann	III	1	100
195				2	100
196				3	100
197				4	100
198				5	100

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
					<b>500</b>
199	Bhirandiya	Sukku Rann	IV	1	100
200				2	100
201				3	100
202				4	100
203				5	100
					<b>500</b>
204	Bhirandiya	Sukku Rann	V	1	100
205				2	100
206				3	100
207				4	100
208				5	100
					<b>500</b>
209	Bhirandiya	Sukku Rann	VI	1	100
210				2	100
211				3	100
212				4	100
213				5	100
					<b>500</b>
214	Bhirandiya	Sukku Rann	VII	1	100
215				2	100
216				3	100
217				4	100
218				5	200
					<b>600</b>
<b>Sukku Rann Total</b>				<b>35</b>	<b>3600</b>
219	Bhirandiya	Neri	I	1	100
220				2	100
221				3	100
222				4	100
223				5	100
					<b>500</b>
<b>Neri Total</b>				<b>5</b>	<b>500</b>
224	Bhirandiya	Dedhiya Nana-Mota	I	1	100
225				2	100
226				3	100
227				4	100
228				5	100
					<b>500</b>
229	Bhirandiya	Dedhiya Nana-Mota	II	1	100
230				2	100
231				3	100
232				4	100

Sr. No	Range Name	Village/ Block Name	Felling Series No.	Coupe No.	Coupe Area in Ha.
233				5	100
					<b>500</b>
<b>Dedhiya Nana-Mota Total</b>				<b>10</b>	<b>1000</b>
234	Bhirandiya	Vaghura	I	1	100
235				2	100
236				3	100
237				4	100
238				5	100
					<b>500</b>
239	Bhirandiya	Vaghura	II	1	100
240				2	100
241				3	100
242				4	100
243				5	100
					<b>500</b>
<b>Vaghura Total</b>				<b>10</b>	<b>1000</b>
<b>Bhirandiyara Range Total</b>				<b>85</b>	<b>8600</b>
<b>Prosopis Working Circle Grand Total</b>				<b>243</b>	<b>24500</b>







SL. No	Factors	Weight	Rank	Over all	Area. sq. km
11	EC	04	2	08	2031.89
	Very High				
	High				
	Medium				
	Low				
12	Annual precipitation	03	5	15	1151.25
	High				
	Medium				
	Low				
13	Water holding capacity	03	5	15	317.44
	Very High				
	High				
	Medium				
	Low				
14	Infiltration rate	03	5	15	525.83
	High				
	Medium				
	Low				
15	Land use land cover	024	5	10	356.46
	Dense grassland				
	Sparse grassland				
	Water bodies				
	Barren land				
	Agriculture				
	Salt intruded areas				
	Built up areas				
	Others				
16	Geomorphology	024	5	10	344.23
	High level mudflats				
	Low level mudflats with saline depressions				
	Mid level mudflats				
	Lineaments				
	Shallow gullies				
17	Slope	024	3	06	6.94
	Moderate				
	Gentle				
	Flat				
18	Soil bulk density	02	3	06	478.88
	High				
	Medium				
	Low				
19	Cation exchange capacity	02	5	10	53.76
	High				
	Medium				
	Low				
20	Sodium adsorption ratio	02	3	06	348.02
	High				
	Medium				
	Low				

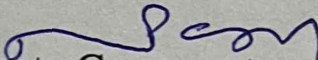
**Table 3.** Categorisation of factors influencing grassland suitability and the ranks and weights of thematic layers.

consistency ratio (CR): (1) the principal eigenvalue ( $\lambda$ ) was computed by the eigenvector technique (Table 4), and (2) the consistency index (CI) was calculated from the equation given below:

## Annexure- F

Area restored in Last Five in Banni Grassland


Sr. No.	Year	Area Restored (in Ha)
1	2020-21	850
2	2021-22	3900
3	2022-23	2400
4	2023-24	1300
5	2024-25	1300
Total		9750

  
Deputy Conservator of Forests  
Banni Grassland Division, Bhuj

**Annexure- G**

Grass collected in Last Five in Banni Grassland

Sr. No.	Year	Grass Collected (in lac kg)
1	2020-21	7.00
2	2021-22	6.25
3	2022-23	8.00
4	2023-24	12.00
5	2024-25	7.50
Total		40.75

  
Deputy Conservator of Forests  
Banni Grassland Division, Bhuj