Participatory Forests Management Plan (PFMP)

Miani Hor, District Lasbela, Balochistan
2022-2031

Forests and Wildlife Department Balochistan, Pakistan &
Village Community Organizations,

Miani Hor, Lasbela Forest Division

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Miani Hor, Lasbela - Balochistan

Endorsement

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Disclaimer:

This Participatory Forest Management Plan is not a funding commitment from Forests and Wildlife Department Balochistan. It is a proposal to be considered for future implementation of REDD+ Programme if funds are committed by the Balochistan government and/or any other donor(s). The success of this plan is contingent to the commitment of all stakeholders involved in the implementation of this plan. Benefit Sharing Mechanism and institutional setup for implementation of REDD+ approved by the Government of Balochistan will form the basis for implementing this Plan. Information on these aspects are suggestive and not binding on the Forests and Wildlife Department Balochistan and any other stakeholders mentioned in this document.

وضاحت

بلوچستان کا محکمہ جنگلات وجنگلی حیات اس منصوبے کے لیے مالی وسائل فراہم کرنے کا پابند نہیں ہوگا۔اس منصوبہ پر عمل درآمد کرنے کے لیے مالی اور انتظامی سفارشات دی گئی ہیں ۔تاہم ان پر عمل بلوچستان کے محکمہ جنگلات وجنگلی حیات کے بنائے گئے انتظامی و مالی رہنما اصولوں کے تحت ہوگا۔

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Acronyms

AGB	Above Ground Biomas
ANR	Assisted Natural Regeneration
BGB	Below Ground Biomass
CCO	Community Conservation Organizations (CCOs)
F&WD	Forestry & Wildlife Department
FCPF	Forest Carbon Partnership Facility
GIS	Geographic Information System
GOP	Government of Pakistan
LPG	Liquid Petroleum Gas
MW	Mega Watt
MoCC	Ministry of Climate Change
NCCP	National Climate Change Policy
NTFP	Non-Timber Forest Product
PFMP	Participatory Forest Management Plan
PFRA	Participatory Forest Resource Assessment
PSDP	Public Sector Development Programme
REDD+	Reducing Emission from Deforestation and Forest Degradation
TFCC	Planning Commission Task Force on Climate Change
t CO_2-eq	Tonnes Carbon dioxide (Carbon credit)
VFP&CC	Village Forest Protection & Conservation Committee
TBTTP	10 Billion Tree Tsunami Project

Executive Summary

Mangrove Forests of Miani Hor area are located in District Labella, Balochistan. Mangrove Forests of Miani Hor are one of the three sites selected by the Balochistan Forests and Wildlife Department in consultation with key stakeholders as a pilot site to demonstrate implementation of REDD$^+$ in the province. This is part of a larger project being implemented by the Ministry of Climate Change (MoCC), Government of Pakistan and the Provincial Forest departments in which a total of 15 Participatory Forest Management Plans are being developed for REDD+ implementation in all six entities of Pakistan.

The Government of Pakistan has joined global efforts to address deforestation and forest degradation to mitigate climate change and its impact by initiating REDD+ activities. REDD+ has three phases; i. Readiness, ii. Demonstration through implementation and iii. Result-based payments. The first two phases, when combined are known as the readiness phase. Pakistan has made substantial progress in meeting REDD+ readiness requirements. Pakistan has developed a National REDD+ Strategy in 2021. Whereas Balochistan Forests and Wildlife Department has developed a Provincial REDD+ Action Plan. This action plan is a decentralized framework for Balochistan to proceed with REDD+ implementation. Preparation of Participatory Forest Management Plans (PFMP) is an important step to implement this action plan by integrating REDD+ activities in forest management in various socio-ecological systems.

The local stakeholders of Miani Hor area were engaged in preparation of the present PFMP. The plan will guide the implementation process of REDD$^+$ by projecting business as usual and reduced emission scenarios derived from detailed participatory assessment of socio-economic circumstances, ecological condition, and challenges (drivers), and assessment of the forest resources which have been described in this plan. The plan also presents stakeholders' analysis with their roles and obligations use rights of forest dependent communities, conflict resolution and benefit-sharing mechanisms. This information is crucial for successful implementation of REDD$^+$.

The analysis of forest cover revealed that since 2010 Mangrove forests in Miani Hor area are increasing at the rate of 66.50 hectares per year sequestering 3457 tonnes CO_2-eq. This increase in forest cover is clearly a case of great encouragement not only for the Balochistan Forest and Wildlife Department but for all the stakeholders including local community. Besides Miani Hor area, Mangrove forests present along the Balochistan coastline are also increasing and following the path of restoration and improvement. The essence of REDD$^+$ intervention mentioned in this PFMP is expected to further improve the forest cover and achieve high/good densities. This end improvement and achieving high densities would be achieved through collaborative forest management efforts of the stakeholders. This plan has proposed distribution of carbon and non-carbon benefits accrued by the implementation of plan according to which 80% benefits will go to the Government, and 20% will go equally to the customary right holders and users. These benefits will only be distributed if the planned emission targets are achieved. The plan provides scenarios so that the stakeholders can enjoy results-based payment and benefits. The success of this plan, therefore, is contingent to the commitment of all the stakeholders involved. A specific and definitive distribution of benefits in case of REDD+ programme is yet to be developed by the government, which will form basis for sharing of benefits in the case of private forests. This proposed ratio will be finalized or confirmed only after finalizing Balochistan's benefit sharing mechanism.

The initial period of this plan will be 10 years; however, the plan will be a living document and open for annual reviews. A budget forecast to implement activities mentioned is also provided in this plan. The major focus of the plan will be on enhancing forest cover by reforestation and regeneration of forest blanks and reducing the demand for fuel wood from the forest through promotion of energy efficiency and alternate sources of energy.

The implementation of activities described in the plan will be guided by annual operational plans to be developed by the Balochistan Forest and Wildlife Department in consultation with the relevant stakeholders. The plan will be implemented by Mangrove Forest Level REDD$^+$ Implementation Committee and District Level REDD$^+$ Implementation Committee to be notified by the Balochistan Forest and Wildlife Department in consultation with the relevant stakeholders.

خلاصہ

بلوچستان کے ضلع لسبیلہ میں واقع میانی حور کی ساحلی جنگل محکمۂ جنگلات، جنگلی حیات کی جانب سے منتخب کردہ اُن تین مقامات میں سے ایک ہے جہاں ایک پائلٹ سائٹ کے طور پر اہم فریقین سے مشاورت کے ساتھ ریڈپلس کے نفاذ کا عملی مظاہرہ کیا جائے گا۔ یہ ایک بڑے منصوبے کا حصہ ہے جو وزارتِ موسمیاتی تبدیلی، حکومتِ پاکستان اور صوبائی محکمۂ جنگلات کے ذریعے لاگو کیا جا رہا ہے جس میں پاکستان کے تمام چھ علاقوں میں ریڈپلس پر عمل درآمد کی غرض سے مجموعی طور پر جنگلات کے شراکتی انتظام کے لیے پندرہ منصوبے بنائے جا رہے ہیں۔

حکومتِ پاکستان نے جنگلات کی کٹائی اور تنزلی سے نمٹنے اور موسمیاتی تبدیلی کے اثرات کم کرنے کے لیے ریڈپلس سرگرمیوں کا آغاز کر کے عالمی کوششوں میں شمولیت اختیار کی ہے۔ ریڈپلس کے تین مراحل ہیں۔ (i) تیاری (ii) عمل درآمد کے ذریعے مظاہرہ، اور (iii) نتائج پر مبنی ادائیگیاں۔ پہلے دو مراحل کو مشترکہ طور پر ریڈپلس کی تیاری کا مرحلہ کہا جاتا ہے۔ پاکستان نے ریڈپلس کی تیاری کی ضروریات کو پورا کرنے کے لیے خاطر خواہ پیش رفت کی ہے۔ پاکستان نے 2021ء میں ایک قومی ریڈپلس حکمتِ عملی تیار کی ہے۔ جب کہ بلوچستان کے جنگلات، جنگلی حیات کے محکمے نے صوبائی سطح پر ایک جامع ریڈپلس ایکشن پلان تیار کیا ہے۔ بلوچستان میں ریڈپلس پر عمل درآمد کو آگے بڑھانے کے لیے یہ ایکشن پلان ایک صوبائی فریم ورک ہے۔ مختلف سماجی ماحولیاتی نظاموں میں جنگل کے انتظام کے لیے ریڈپلس سرگرمیوں کو مربوط اور لاگو کر کے جنگلات کے شراکتی انتظام کے منصوبوں کی تیاری اس ایکشن پلان پر عمل درآمد کے لیے ایک اہم قدم ہے۔

مقامی فریقین نے جنگلات کے شراکتی انتظام کے منصوبے کی تیاری میں حصہ لیا۔ ریڈپلس پر عمل درآمد میں رہنمائی کے لیے اس منصوبے کے تحت دو مختلف منظرناموں یعنی موجودہ حالات اور اخراج میں کمی کا اندازہ لگایا جائے گا۔ اس مقصد کے لیے سماجی اقتصادی حالات کے تفصیلی شراکتی تجزیے، ماحولیاتی صورتِ حال اور چیلنجز اور منصوبے میں واضح کردہ جنگلاتی وسائل کا جائزہ لیا جائے گا۔ یہ منصوبہ فریقین کے کردار اور ذمے داریوں کے ساتھ اُن کے تجزیے، جنگلات پر انحصار کرنے والی لوگوں کے حقوق کے استعمال، تنازعات کے حل اور مشترک فوائد کے حصول کا طریقۂ کار بھی پیش کرتا ہے۔ ریڈپلس پر کامیاب عمل درآمد اور شراکتی سرگرمیوں کی تفصیلات کا تعین کرنے کے لیے یہ معلومات ضروری ہیں۔

جنگل کے رقبے کے تجزیے سے پتا چلتا ہے کہ 2010ء کے بعد سے میانی حور کے ساحلی جنگلات میں 66.50 ہیکٹر سالانہ کی شرح سے اضافہ ہو رہا ہے جس سے سالانہ 3,457 ٹن کاربن ڈائی آکسائڈ کا امجذاب عمل میں آ رہا ہے۔ یہ اضافہ واضح طور پر جنگلات کے رقبے میں مسلسل اضافے کی مثال ہے جو تمام فریقین کے لئے انتہائی خوش آئند ہے۔ اس PFMP میں شامل سرگرمیاں اگر مناسب طریقے سے لاگو ہوتی ہیں تو جنگلات کے مربوط انتظام کے لیے فریقین کی کوششیں اس رجحان کو مزید فروغ دیں گی۔

مجوزہ منصوبے کے مطابق اس منصوبے پر عمل درآمد سے حاصل ہونے والے کاربن اور نان کاربن محصولات میں سے 80 فی صد حکومت کو حاصل ہوں گے، جبکہ 20 فی صد جنگل کے استعمال کے حقوق رکھنے والوں اور صارفین کو ملیں گے۔ یہ فوائد صرف اہداف حاصل ہونے کی صورت میں تقسیم کیے جائیں گے اس لیے یہ منصوبہ فوائد میں کمی یا اضافے کا منظرنامہ پیش کرتا ہے تاکہ فریقین نتائج پر مبنی ادائیگی اور فوائد سے مستفید ہو سکیں۔ لہٰذا اس منصوبے کی کامیابی اس میں شامل تمام فریقین کے عزم پر منحصر ہے۔

حکومت کی طرف سے ریڈپلس پروگرام کے معاملے میں فوائد کی ایک مخصوص اور قطعی تقسیم فی الحال تیار نہیں ہوئی ہے جو جنگلات کے سلسلے میں فوائد کے اشتراک کی بنیاد بنائے گی۔ مشترک فوائد پر مبنی بلوچستان کے طریقۂ کار کے طے ہونے کے بعد ہی اس مجوزہ تناسب کو حتمی شکل دی جائے گی یا اس کی تصدیق کی جائے گی۔

اس منصوبے کی ابتدائی مدت دس سال ہوگی تاہم یہ منصوبہ ایک زندہ دستاویز ہوگا اور سالانہ جائزے کے لیے پیش ہوگا۔ اس منصوبے میں مذکورہ سرگرمیوں پر عمل درآمد کے لیے رہنمائی متعلقہ فریقین کی مشاورت سے صوبائی محکمۂ جنگلات کی طرف سے تیار کیے جانے والے سالانہ آپریشنل منصوبوں کی مدد سے کی جائے گی۔ اس منصوبے کو گاؤں اور ضلعی کمیٹیوں کے ذریعے لاگو کیا جائے گا اور اس کے بارے میں متعلقہ فریقین کی مشاورت سے صوبائی محکمۂ جنگلات کے ذریعے مطلع کیا جائے گا۔

CHAPTER I: INTRODUCTION

1.1 The Context of PFMP

Pakistan has been implementing REDD+ activities since 2010 to mitigate climate change through reduced carbon emissions from the forestry sector. The Government of Pakistan (GoP), Ministry of Climate Change (MOCC) is implementing a REED+ readiness programme funded by the Forest Carbon Partnership Facility (FCPF) of the World Bank. This Participatory Forest Management Plan (PFMP) is to demonstrate integration and implementation of REDD+ activities in forest management in various socio-ecological systems. The Participatory Forest Management Plans (PFMPs) translate REDD+ concepts and processes at practical level considering complex socio-economic conditions, burden of rights and concessions, as well as obligations in the forest. This is the reason that in addition to forest stock assessment, the preparation of PFMPs for REDD+ sites require a detailed assessment of the roles and rights of stakeholders in forest management and revenues so that trade-offs become clearer for redressal and communities are not deprived of their legitimate access to forest for their livelihoods. The core thrust of PFMPs in REDD+ perspective is to find contextually relevant options to address drivers of deforestation and forest degradation to mitigate global climate change. REDD+ also provides mechanisms for the enhancement, measurement, and trade of carbon.

The present PFMP provides information including description of the site, GIS supported forest stock assessment, socio-economic situation, analysis of stakeholders with their interests and influences, emissions reduction scenarios, future interventions with estimated budget and implementation mechanism and key challenges for implementation. The activities that will maintain forest as carbon pool have also been explained in this plan giving a lead and support role to stakeholders, as well as the expected outputs. It is expected that the implementation of the PFMP will enable the stakeholders of Mangrove Forest of Miani Hor to trade carbon credits in the national and international market in foreseeable future like any other product, by increasing and maintaining the carbon stock sequestered in the forest. The PFMP is envisaged to act as a road map towards implementation, monitoring, reporting and verification of resources improvement, and distribution of benefits among stakeholders.

A budget forecast to implement activities mentioned in PFMPs is also provided which seems to be a little bit non higher side because it includes the intervention for provision of water supply in the villages and installation of water infiltration plant. In the activities included for the restoration and improvement of Miani Hor area mangrove forests are also included in this PFMP.

These proposed activities will not only benefit the Mangrove Forest Ecosystem of Miani Hor but will also benefit of more than 19,500 inhabitants residing in 1,110 household of 3-three villages of Dam Bundar. In addition, to the resident community members residing in these 3-three villages, the proposed activities will also be beneficial to the migratory workers who are coming to Miani Hor area during fishing season. Moreover, the traders and fishermen visiting the area during the fishing season will also benefit from these proposed interventions. However, the most important aspect of this Participator Forest Management Planning process is that it would open the door of ecotourism in these forests and in this manner would contribute towards income generation.

1.2 Objectives of PFMP

The specific objectives of this plan are as under:

1. To promote sustainable Forest management in Mangrove Forests of Miani Hor.
2. To protect, improve forest health and enhance Carbon stocks in Mangrove Forests while addressing drivers of deforestation and forest degradation
3. To enable the Miani Hor Forest community and Forest Department staff to manage forests jointly and efficiently for multiple uses.

1.3 Methodology

A multi-disciplinary team consisting of two Participatory Forest Management experts, a sociologist, a GIS specialist, two Range Forest Officers, two Forest Guards and three community representatives (nominated by the community) collected data for preparation of the management plan. A team of experts comprising Range Forest Officer, Winder was assigned to collect the socio-economic data and simultaneously register the view of coastal community members towards participatory forest management. While collecting the socio-economic data, the local coastal communities, which were the major stakeholders in this entire process, were given the lead role while the team of experts intervened only where the need was felt. For materialization of this entire process, a training workshop cum meeting with the community members and village elders conducted on September 14, 2021, in the following coastal villages: Damb, Sonmiani and Bera.In the meeting besides the experts, resident community members and Range Forest Officer Uthal, Balochistan Forest and Wildlife Department also participated. In order to make the process participatory the experts used tools of Participatory Rural Appraisal (PRA).

The overall methodology for preparation of the plan has been guided by PFMP Manual (version 1.0, 2021) for practitioners prepared under Forest Carbon Partnership Facility (FPCF) of the Ministry of Climate Change (MOCC), Islamabad. A multi-layered methodology was adapted for the preparation of PFMP, which includes the following steps:

i. Selection of site in light of the REDD+ guidelines and procedure. Miani Hor was one of the three potential sites selected for preparation of PFMP.
ii. Participatory data collection. Local community of Miani Hor participated in providing socio-economic data and sharing details on forest-community interaction., They also participated in collecting forest resource assessment data. They also participated in identifying forest management activities and implementation mechanism. Under the Free Prior Informed Consent (FPIC), the community was briefed on relevant concepts, causes and effects of activities. They participated in identifying drivers of deforestation and forest degradation and demand of timber and firewood. The solutions to problems and demands of community were translated into interventions in prioritised order and listed. The exercise was conducted through PRA using spot observations, Focused Group discussion, mapping, semi structure interviews, transect walk and ranking.
iii. Participator Forest Inventory was conducted to collect data from 12 sample plots selected in Mangrove Forests. The location of sample plots is provided in following map (**Figure 1**). The sample plots were chosen through stratified random sampling among each forest stratum. The soil, topography, water availability, and status of vegetation vary spatially within a land-use category and the overall area proposed for the site. Trees, biomass stock, and growth rate are not distributed uniformly in a site. Therefore, a sampling design is followed for locating the sample

plots in each of the selected forest strata. The location of sampling plots could determine the biomass stock or growth rate estimates. Based on forest type and forest density, three forest stratum (>70%, 40%-70%, 10%-40% tree canopy cover) were formed to carry out the systematic stratified sample on the map.

iv. Sample points were nested circular plots of 17.64 m, 5.64 m, and 0.56 m radius. All living trees and standing dead woods with DBH above 5cm, and stumps were measured from the full plot of 17.84 meters (~1000 m^2). Fallen trees and stumps, dead wood with diameter above 5cm were also recorded from the plot. The plot included two subplots; 5.64 meters (~100 m^2) for collecting data of seedlings and shrubs and 0.56-meter plots (~1 m^2) for data on litter, leaves, grasses, etc. From a plot of 5.64 m, all seedlings were counted, and shrubs were cut down and fresh weight of the sample was recorded. This sample was clipped and collected in the bags to find out oven dried biomass in the lab. The above-ground non-tree biomass including leaves, litter, grasses, etc. collected from 0.56 m radius sub-plot and weighed. Soil organic carbon values were taken from the national forest inventory, carried out in 2018. The data from these samples was analysed for estimation of carbon stock. The coordinates of each sample plot were noted, and fixed-point photos were taken during the inventory

v. Data analysis and development of PFMP: The data were analysed, GIS map prepared and put together in the form of PFMP with a 10-year perspective including an annual forestry operational plan. The plan was reviewed individually, jointly and sent to experts for peer review.

vi. The plan was sent for endorsement by the Balochistan Forest Department and relevant community.

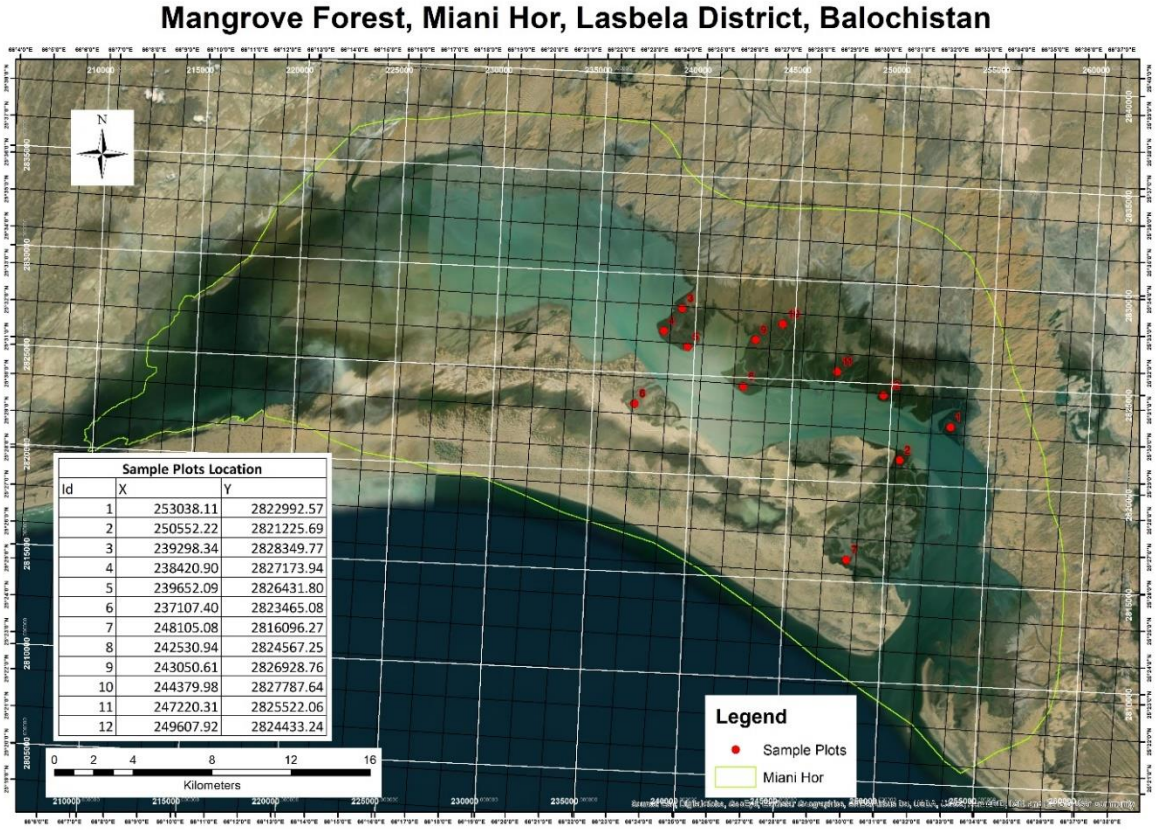


Figure 1: Locations of Sample Plot Centres

1.4 Policy Alignment

The objectives of the Participatory Forest Management Plan of Mangrove forests of Miani Hor were aligned with the following provincial, national, and global policies/strategies/commitments related to REDD+.

1.4.1 Global Commitment

"Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks (REDD+), is an essential part of the global efforts to mitigate climate change" [10].

1.4.2 National Commitments

Pakistan's report on intended Nationally Determined Contributions (NDCs) 2021, seeks 50% reduction of the national Green House Gas (GHG) emissions by 2030.

The National Climate Change Policy (NCCP) 2012 under Section 4.4 on Forestry Sector, states that the climate change is likely to have multi-faceted adverse effects on the ecosystem as a whole, particularly on the already vulnerable forestry sector in Pakistan. Mitigations in the forestry sector entail restoration of Pakistan's forests through sustainable forest management, with particular focus on how these are affected by climate change. This will not only benefit the State forests but forest dependent communities and the whole society in general. The most likely impacts of climate change will be decreased productivity, changes in species composition, reduced forest cover, unfavourable conditions for biodiversity, higher flood risks and the like, as portrayed in the Planning Commission Task Force on Climate Change (TFCC) Report (GoP, 2008).

National Forests Policy 2015

The Section 7 obligates the federal and provincial governments, which reads; "the UNFCCC Agreements on Reducing Emissions from Deforestation and Forest Degradation (REDD+) shall provide opportunities to forest-dependent communities to get non-market incentives for controlling deforestation as well as market-based cash receipts for quantified and verified emission reductions from forests. Goal 15 of the Sustainable Development Goals (SDGs) shall be pursued vigorously for compliance by Pakistan by tapping local resources as well as international funding".

Provincial Policies/ Commitments

Balochistan as such has not formulated the Climate Change Policy yet, and similar is the case with the Forest and allied resources i.e. rangelands and watershed management. Due to this very reason, Balochistan Forest and Wildlife Department seeks guidance from the policies formulated at the federal level in both, climate change as well as in forestry sectors. However, besides the Balochistan Forest and Wildlife Department also seeks guidance from the Rules of Business formulated at the provincial level. These Rules of Business for the Forest and Wildlife Department are annexed as Annex - ** in the present document. The activities reflected in this PFMP for the restoration and improvement of Mangrove forests of Miani Hor area, are in full alignment with the actions suggested in the national climate change and forest policy of Government of Pakistan as well as with the Rules of Business of Forest and Wildlife Department for managing forest and allied resources at the provincial level. In addition to the above-mentioned documents, the activities included in the current Participatory Forest Management Plan for the Mangrove forests of Miani Hor area Lasbela are also in alignment with the guidance provided in the Balochistan Conservation Strategy (BCS) and Balochistan Comprehensive Development Strategy (BCDS).

CHAPTER II: PARTICIPATORY FOREST MANAGEMENT PLANNING

The data and information gathered during PFMP survey through, participatory planning with communities were analysed, results compiled, and interventions identified (Annex 1, data). The results are presented in this chapter.

2.1 Ecological

2.1.1 Site description

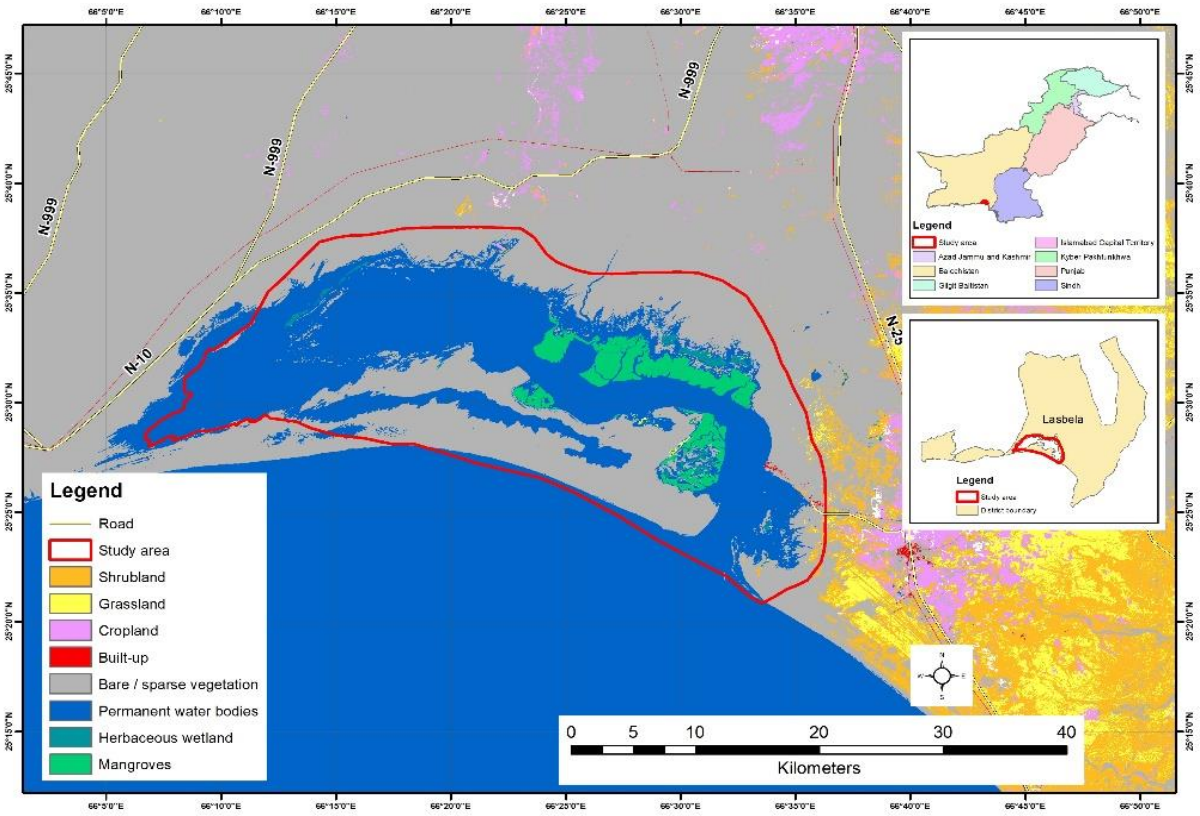
Miani Hor is located at a distance of 90 Km in the North of Karachi near Sonmiani Bay, and 35 Km from district headquarter Uthal in the South. Miani Hor falls in the administrative jurisdiction of Union Council Winder. Lasbela is one of the 33 districts of the province. It is one of the oldest districts of the province. It was declared as district in June 30, 1954. Lasbela takes its name from two words, “Las” meaning plain, and “Bela” meaning jungle. Lasbela falls in the administrative jurisdiction of Kalat Division, which is the largest Civil Division of the province. Lasbela is located in the south of provincial capital Quetta. Uthal is the district headquarter and is present at distance of 550 Km. Total area of the district is 15,153 sq. km. Miani Hor is part of district Lasbela, its major town Damb Bundar is famous for fishing business. The geographical location of Miani Hor determined through GPS is produced below:

Table 1: Geographical location of Miani Hor area, district Lasbela

Latitude:	25^0, 24’,48.883 N to 25^0, 35, 38.043 N
Longitude:	66^0, 25’, 2.173 E to 66^0, 3, 58.85 E

Figure 2 below provides current land cover of the PFMP site that shows most of the site is a permanent water body as expected for a mangrove ecosystem followed by bare/sparse vegetation and mangroves. In the east of the site human settlement and built-up areas are located and the surrounding area of the site mainly consists of bare land /sparse vegetation followed by shrubland, grassland and cropland in the east.

Figure 2: Map of PFMP Site and current land uses in the area



2.1.2 Climate

For Miani Hor area no separate data in terms of precipitation, temperature, wind speed and other climatic variables is available. Therefore, the climatic data of Lasbela district is used, which, due to close proximity to the Miani Hor, has same climatic conditions. Climate of Lasbela district is dry and humid in the coastal areas. Except for the peak summer months, which are very hot, there is not much variation in climate in the remaining months of the year. The daylight hours are long and solar radiation is very high, which is an indication for generation of solar energy. The wind velocity in the coastal areas and in the valleys is also high, with potential for generating wind energy. The combined effect of climatic and edaphic conditions prevailing in district Lasbela makes the area suitable for growing fruits such as papaya, cheeko, banana and also for cultivation of both Kharif and Rabi crops.

To have an idea about the maximum and minimum temperatures prevailing during the different months of the year, data of district Lasbela is produced below in Table 2:

Table 2: Mean Annual Temperature in District Lasbela

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1981											31.9	28.6	
1982	26.0	26.0	30.9	37.8	40.0	42.1	39.8	37.5	38.2	37.4	32.3	27.0	34.6
1983	26.6	26.3	31.1	35.4	41.0	42.8	40.0	36.1	37.5	37.7	32.8	27.8	34.6
1984	26.4	27.6	35.7	39.4	42.1	40.8	38.4	34.9	37.0	36.6	32.8	29.0	35.1
1985	26.6	31.0	36.2	36.1	39.6	40.5	36.6	36.1	36.6	37.4	33.7	28.3	34.9
1986	26.9	27.1	32.4	39.5	42.2	40.9	38.3	36.2	37.7	38.1	33.6	26.5	35.0
1987	27.8	30.0	33.2	38.6	39.2	42.0	40.2	39.1	37.9	38.5	35.2	29.5	35.9
1988	27.9	30.2	34.8	40.4	42.4	42.9	38.8	37.2	40.0	38.2	33.9	29.2	36.3
1989	26.6	28.5	32.8	38.6	41.5	40.8	38.2	37.3	37.6	37.4	33.7	27.2	35.0
1990	27.0	27.4	32.6	38.7	41.2	40.6	38.6	37.0	37.6	37.8	34.1	28.6	35.1
1991	26.1	27.3	26.4	38.4	39.8	43.5	39.6	37.9	36.7	38.2	33.3	28.7	34.7
1992	25.5	30.8	30.1	35.4	41.7	42.9	39.8	35.4	37.4	37.0	34.7	30.3	35.1
1993	26.9	32.0	33.2	38.1	42.4	42.2	40.1	39.3	39.3	38.2	35.2	31.2	36.5
1994	28.0	28.7	36.5	37.6	42.1	42.7	36.7	35.5	36.7	37.1	35.2	28.5	35.4
1995	27.4	29.9	32.3	37.3	43.3	42.7	37.9	37.2	38.7	38.4	34.2	28.2	35.6
1996	27.2	30.6	34.3	40.1	40.9	40.9	39.4	37.9	37.8	37.0	32.8	29.0	35.7
1997	26.1	30.0	30.7	35.6	39.1	39.4	39.7	37.8	37.9	34.0	30.8	26.9	34.0
1998	26.0	28.4	33.3	39.3	42.3	43.2	39.4	39.2	39.6	38.8	34.4	31.9	36.3
1999	26.5	28.4	33.5	41.0	41.6	41.2	39.3	37.8	37.2	39.7	34.5	30.1	35.9
2000	27.1	28.8	34.1	40.3	40.1	41.0	38.8	37.9	37.6	39.3	33.4	30.2	35.7
2001	27.6	30.3	35.1	38.4	40.9	40.5	37.0	36.9	37.9	40.0	30.5	31.0	35.5
2002	27.5	28.3	35.1	40.0	42.9	42.1	39.5	37.8	37.3	39.7	34.0	29.3	36.1
2003	28.4	29.1	34.5	39.8	40.7	41.2	37.3	36.5	36.7	38.9	33.1	28.4	35.4
2004	27.1	31.4	38.4	41.4	42.6	41.6	39.6	38.7	37.7	37.0	34.0	29.2	36.6
2005	25.5	26.5	33.2	38.2	40.0	41.0	39.0	38.2	39.3	37.5	34.2	30.0	35.2
2006	26.5	32.6	34.3	39.4	42.1	42.5	40.2	36.5	38.7	37.6	33.0	26.5	35.8
2007	27.2	29.9	32.1	39.6	42.0	40.4	38.0	37.8	38.9	37.7	35.2	27.8	35.5
2008	24.4	28.6	36.9	38.7	40.0	40.1	38.8	36.0	38.5	38.4	33.9	27.0	35.1
2009	25.5	29.8	34.7	38.7	44.0	42.5	26.8	39.0	39.0	39.3	33.2	27.6	35.0
2010	27.3	29.0	38.1	40.8	42.6	39.9	39.1	37.4	39.3	38.3	33.4	29.1	36.2
2011	27.5	28.4	35.0	38.0	41.6	41.0	39.6	37.0	35.2				
2012				38.1	40.8	40.5	39.2	38.1	37.6	37.1	33.5	28.9	
2013	26.9	28.6	34.4	36.5	41.5	40.4		36.0	38.0				
2014	26.3	28.3	32.0	39.0		41.7	39.0						

Miani Hor follows the same pattern in precipitation as prevails in district Lasbela, i.e., dry and humid of coastal zone. In Miani Hor, following data recorded for district Lasbela, is used The data for the rainfall received during the different months of the year is produced below in **Table 3**:

Table 3. Rainfall/precipitation data for Lasbela district, Balochistan

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Normal
1981											0.0	0.0	0	158
1982	0.0	12.0	9.0	14.0	24.0	0.0	9.0	16.0	0.0	0.0	0.0	6.0	90	158
1983	6.0	24.0	0.0	4.0	0.0	0.0	48.0	116.0	48.0	0.0	0.0	0.0	246	158
1984	0.0	0.0	1.0	0.0	0.0	0.0	50.0	89.0	3.0	0.0	0.0	0.0	143	158
1985	0.0	0.0	0.0	42.0	22.0	23.0	56.0	0.0	0.0	0.0	0.0	0.0	144	158
1986	0.0	6.0	2.0	0.0	0.0	5.0	1.0	19.0	0.0	0.0	15.0	0.0	47	158
1987	0.0	1.0	3.0	0.0	94.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	106	158
1988	0.0	0.0	0.0	25.0	0.0	0.0	131.0	27.0	0.0	0.0	0.0	0.0	183	158
1989	2.0	0.0	4.0	0.0	0.0	18.0	90.0	6.0	0.0	0.0	18.0	16.0	154	158
1990	0.0	24.0	24.0	0.0	0.0	8.0	0.0	61.0	0.0	0.0	3.0	0.0	120	158
1991	9.0	26.0	5.0	7.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	56	158
1992	23.0	5.0	50.0	0.0	16.0	0.0	78.0	79.0	0.0	22.0	0.0	0.0	273	158
1993	4.0	17.0	0.0	28.0	25.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0	100	158
1994	0.0	0.0	0.0	15.0	21.0	0.0	151.0	157.0	63.0	0.0	0.0	20.0	426	158
1995	4.0	0.0	0.0	0.0	1.0	1.0	193.0	0.0	0.0	8.0	0.0	0.0	206	158
1996	4.0	46.0	6.0	4.0	81.0	8.0	18.0	2.0	0.0	0.0	0.0	0.0	170	158
1997	22.0	0.0	48.0	1.0	34.0	77.0	0.0	63.0	10.0	50.0	4.0	0.0	308	158
1998	5.0	4.0	15.0	9.0	0.0	2.0	13.0	19.0	0.0	13.0	0.0	0.0	80	158
1999	0.0	50.0	25.0	0.0	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104	158
2000	26.0	0.0	0.0	0.0	8.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	38	158
2001	0.0	0.0	0.0	8.0	6.0	14.0	141.0	54.0	0.0	0.0	0.0	0.0	223	158
2002	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	9	158
2003	25.0	35.0	7.0	0.0	39.0	13.0	354.0	2.0	0.0	0.0	0.0	0.0	475	158
2004	4.0	0.0	0.0	0.0	0.0	16.0	4.0	0.0	0.0	0.0	0.0	1.0	25	158
2005	8.0	68.0	6.0	20.0	49.0	48.0	0.0	0.0	9.0	0.0	0.0	0.0	208	158
2006	0.0	0.0	0.0	3.0	20.0	0.0	8.0	63.0	15.0	18.0	0.0	54.0	182	158
2007	0.0	5.0	31.0	23.0	45.0	16.0	39.0	36.0	0.0	0.0	0.0	0.0	196	158
2008	7.0	0.0	0.0	0.0	10.0	12.0	10.0	88.0	2.0	0.0	0.0	124.0	254	158
2009	14.0	8.0	31.0	6.0	0.0	10.0	13.0	3.0	0.0	0.0	0.0	20.0	104	158
2010	2.0	7.0	0.0	0.0	0.0	13.0	59.0	37.0	0.0	0.0	0.0	0.0	117	158
2011	0.0	14.0	4.0	4.0	12.0	0.0	9.0	100.0	66.0	0.0	0.0	0.0	209	158
2012	1.0	1.0	0.0	29.0	52.0	13.0	0.0	0.0	21.0	66.0	0.0	0.0	183	158
2013	0.0	0.0	36.0	41.0	13.0	4.0	39.0	49.0	1.0	0.0	2.0	0.0	186	158
2014	0.0	0.0	14.0	18.0	62.0	39.0	47.0	0.0	12.0	0.0	16.0	0.0	208	158
2015	2.0	0.0	2.0	0.0	23.0	10.0	42.0	0.0	0.0	3.0	0.0	0.0	83	158
2016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
36												**AVG**	**157**	**153.611**

Average precipitation received during the year in the district Lasbela was calculated to 13 mm per month, with the major share received during the winters in the form of snow and rain. Monsoon showers are also received occasionally during July to September. While the total precipitation received in district Lasbela has been calculated to 157 mm.

2.1.3 Vegetation Types

Miani Hor is swampy lagoon lying on the coast of district Lasbela covering an area of 7471 ha. The lagoon itself is 60 km long and 4 to 5 km wide. Its mouth is 4 km wide. Two seasonal rivers Proali and Wiinder enters into this bay. Miani Hor is the only place in Pakistan where all three species of Mangrove i.e. *Avicennia marina, Rhizophora mucronata* and *Ceriops tagal* occur naturally. Miani Hor was designated as Ramsar Site in May 2001.

No flow water is available in these villages. Groundwater is brackish due to location of these villages in the proximity of sea. Ground water is only used for washing and other such uses. At the mouth of Porali River and Winder River, where there disgorges their flow into Arabian Sea and forms a vast estuary, Mangrove forests are present in the form of a vast green patch. Following three species of Mangrove are present in these forests: *Avicennia marina, Rizhophora mucronata and Ceriops taigal*. Mangrove forests of Miani Hor were previously spread over an area of 10000 acres. However, the continuous planting drive by the Balochistan Forest and Wildlife Department has increased its area now to 13000 acres. Mangroves suffer the following challenges drought and low rainfalls that are not bringing any fresh soil/nutrients in the estuary, cutting of trees and branches by local community for fuel wood and timber and heavy grazing by camels.

2.1.4 Changes in forests over time

Over the past 30 years, many changes have taken place in the Mangrove forests of Miani Hor area. Due to over exploitation many forested areas have changed to blanks and mud flats. The banks have also eroded at many places in the Lagoon. However, many areas have been replanted by the Balochistan Forest and Wildlife Department, which are now again turning into green patches. These changes mainly occurred because of the over-exploitation of Mangrove forests for the camel fodder and small timber. The Balochistan Forest and Wildlife Department has launched many projects for the restoration and improvement of mangrove forests. In this connection huge plantation drives have been undertaken Besides, international NGOs such as WWF, IUCN and Red Crescent have also conducted many successful campaigns for restoration of mangrove forests of Miani Hor area. Recently, planting in Miani Hor area has been carried out through the Ten Billion Tree Afforestation Project. All these initiatives have resulted in creating very impressive impact.

As compared to the past, the Mangrove Forest area of Miani Hor has increased by 3000 acres. In the past Mangrove forests were subject to a number of uses and as a result these were overexploited that resulted in the forest degradation. These uses of Mangroves included extraction of wood for firewood, fodder for the camels of resident community members and small timber that was used in making boats and other implements. As a result of this over-exploitation, many blank areas started appearing in this patch of Mangroves. These blank patches gradually increased and took the form of large mud flats in these mangrove forests. Appearance of these mud flats not only adversely affected the production of shrimps but also gave way to more bank erosion in the Miani Hor lagoon. Recently the sanitation water from the town of Sonmiani, Damb and Bhera is posing a greater threat to these mangroves. Besides, the erosion of coast is also emerging as threat to mangrove forest of Miani Hor.

2.2 Socio-economic Analysis

Findings of the participatory socio-economic and ecological analysis are reproduced in the succeeding sub-sections. The socio-economic data matrix is placed at Annexure-1.

2.2.1 Human Population

In Miani Hor area, there are 1,110 households residing in 3 – three villages. Total population of Miani Hor has been calculated to 19,500 individuals. Most of the families in the village live in joint family system wherein the entire family consisting of 4 to 6 brothers with their families live in single compound. The social structure of Miani Hor area like most of the villages of district Lasbela is tribal. Miani Hor area is inhabited by Laasi tribe, who speak Laasi and Sindhi languages.

All three villages i.e., Damb, Sonmiani and Bhera are located on the black topped road that connects the Miani Hor area with the Quetta – Karachi National Highway (RCD Highway). The nearby town is Winder, which is located at 12 to 14 km from Miani Hor. Villages have all the basic communication facilities available to them such as telephone, fax etc. Besides, the mobile phone facilities are available in these villages. Towers of many mobile phone companies have been installed in the vicinity of these villages. Installation of these towers has greatly facilitated the inhabitants of Damb, Sonmiani and Bhera villages in terms of boosting communication with their friends and relatives and also keeping update on the market prices/situation of fish during the peak fishing season.

As far as housing is concerned, most of the houses in Damb and Sonmiani villages are made of concrete and locally termed as pacca. However, in village Bhera, houses are wooden made. In Damb, 75% of the houses are pacca and only 25% are made of mud and locally known as kacha. Similarly in village Sonmiani, more than 60% of the houses are made of concrete and only 40% are made of mud (kacha). In village Bhera, most of the houses are wooden made and are categorized as kacha.

2.2.2 Health and education

Miani Hor area is located in the west of RCD Highway (Quetta to Karachi National Highway) at about 62 to 64 Km from the Uthal town. Due to close proximity of Miani Hor to the district headquarter Uthal and Karachi, and presence of a number of schools, the literacy rate in the area is much better than a few years ago. Main reason for this better literacy rate is the awareness about education and present of schools in the area. There are three main villages in the Miani Hor area viz. Damb, Sonmiani and Bhera. In all of the villages, Government educational facilities are present. In Damb and Sonmiani, Government Boy's High Schools are present. In village Bhera a Government Boy's Primary school is present for boys. As far as Girl's education is concerned, a Girls High School and a primary school is present in village Damb, while in village Sonmiani a Girls Middle school and Girls Primary Schools is present for girls. In village Bhera, two Girls Primary Schools are present for girls' education. Besides the schooling, most of the male and female of the villages in the valley also get the religious education in the Mosques. This has enabled them to read the Quraan and Urdu texts. Due to presence of schools, the literacy rate in the Miani Hor area is a bit high.

At present, there are 9 schools in the Miani Hor area. In all three villages of Miani Hor area, government educational institutions are present both for boys and girls. In Sonmiani, Government High Schools are present both for boys and girls. In addition to these Government run schools, a private primary school is also present. In Dam, a Government High School is present for Boys while a Government Middle School and a Government Primary School is present for girl's education. In village Bhera, a primary school is present for boys, while two primary schools are there for girl's education. In all of these schools teaching facilities are available and are fully functional. In Miani Hor area, basic healthcare facilities are present in all three villages in the form of Basic Health Unit, Civil Dispensary and Mother and Children Health Centre. A private clinic is also present in Sonmiani, where patients are treated for common ailments. All the Basic Health Units, Civil Dispensary and Mother Children Health Centre (MCH Centre) are functional and patients for common sicknesses and ailments are treated. However, for complicated, chronic and acute illnesses, patients are referred for treatment to Karachi.

2.2.3 Livelihood sources

Due to non-availability of land and water, no agriculture is practiced in these villages rather fishing is practiced for livelihoods. More than 90% of the working age male are engage in fishing profession. Some have their own boats, while other works with them as laborers.

During the meeting, the village inhabitants talked about the following issues they are facing in the fishing sector:

- Use of illegal fishing nets by the fishing trawlers.
- Fishing by large trawlers in the Sonmiani bay

Due to these reasons, the fishing in the Sonmiani Bay has badly suffered and the net revenues of the fishing boats/fleets have drastically dropped. The quantities of fish have also got decreased due to overfishing this has resulted in low catch.

In these villages of Miani Hor only camels are raised, which are fed the mangrove leaves as fodder. Resident informed following livestock related issues:

- Lack of awareness on livestock especially camels' nutrition, health and management
- Non-availability of animal healthcare services
- Lack of proper supplementary feed for feeding to the livestock
- Non-availability/deficiency of fodder for the camels
- Lack of marketing facilities for livestock and animal products

Inhabitants of all three villages are using gas cylinders and fuelwood as source of energy

As mentioned above, Miani Hor is located at a distance of 64 Km from the Uthal town, the district headquarters of District Lasbela. Due to dry and arid climatic condition and non-availability of any flow water, the entire area offers very limited opportunities for livelihoods. In Miani Hor, major livelihood source is fishing. In Damb area fishing commences in August and continues till next year May. Community members of Damb, Sonmiani and Bhera informed that majority of the inhabitants of Miani Hor area i.e. 90% are dependent on fishing, while some about 10% also earn their livelihoods through daily wage labour by working in the fishing sector. No other source of livelihoods is present in the area and during the slack season the fishermen are forced to borrow loans for their survival.

In Miani Hor area, ground water is present at a distance of 100 feet, but it is brackish and not suitable for drinking purposes. Therefore, water to the village inhabitants is provided by the Public Health Department through pipelines. In Sonmiani water is supplied through pipes from Winder, while in Damb water is supplied from Kurkera. In Damb village underground water is present at a depth of only 30 feet but it is brackish. In village Bhera, water through water supply scheme is not available, therefore, the inhabitant gets potable water through water tankers. Besides, a very old dug well is also present from where inhabitants fetch drinking water.

During the consultation for land use plan, it was revealed that all the land occupied by these villages, i.e., Damb, Sonmiani and Bhera belongs to the Government. They have not right over these lands. However, they have the right to construct houses/homes on these lands.

Due to absence of land ownership no land use conflicts exist in these villages. However, for resolving social conflicts other than land, the Local Jirga and Raj Dari system prevalent in the area is used.

2.2.4 Dependence on forests

During the consultation it was revealed that all the land occupied by these villages, i.e., Damb, Sonmiani and Bhera belongs to the Government. They have not right over these lands. However, they have the right to construct houses on these lands.

Local community members harvest small timber for boat making or other implements from the Mangrove forests of Miani Hor area. However, this practice is not prevalent on largescale. Balochistan Forest and Wildlife Department discourages this kind of practices. No commercial timber is extracted from Mangrove forests. Local community members sometime harvest dead, dry and fallen wood for fuel wood. However, this practice is also not prevalent on larger scale. In some areas of Mangrove forests that are close to the land, camels browse upon the trees, otherwise no grazing has been reported in these forests. However, community members do harvest Mangrove leaves from these forests for feeding to the camels and goats. Only leaves and succulent branches are harvested by local community members for feeding to their camels and goats. As such no grass is available in Mangrove forests. Local community members are using the Mangrove area for fishing. Damb and Sonmiani are very famous areas for fishing.

Majority of the resident community members in Miani Hor area i.e., 90% of the total population is busy in fishing for their livelihoods. Communities are now using gas cylinders and fuel wood purchased from outside as alternatives. Still threat to the mangrove forests as well as to the livelihoods of community exists if the community. In the notification of state forests, local community members have been given the rights for dead, dry and fallen wood collection. Besides, the priority for the contract and labour in the forestry activities.

2.2.5 Social and Power Structure

The social structure of Miani Hor areay like most of the villages of district Lasbela is tribal. Miani Hor area is inhabited by Laasi tribe, who speak Laasi and Sindhi languages. Most of the families live in a joint family system, due to this reason a strong social bonding is prevalent among resident of villages.

2.3 Stakeholders

The key stakeholders in the preparation of Participatory Forest Management Plan include: Resident Community Members of Miani Hor area, Balochistan Forest and Wildlife Department, Fisheries Department, District Administration, Pakistan Navy, Balochistan Coastal Development Authority, Migrants labourer to Damb and Sonmiani, Commission Agents, Transporters, Non-Government Organizations working in Miani Hor, donor agencies interested in management of Mangrove forests. Miani Hor area has also got high eco-tourism potential as it comprised unique combination of ocean, desert and forest ecosystem that present an eye-catching scenic beauty. Interest and Influence of Various Stakeholders. The analysis is presented in Annexure 2.

An overview of the stakeholder analysis findings is reproduced in the succeeding sections. The socio-economic data of Mangrove forests of Miani Hor have been reflected in Annex 2 that indicates the institutional dimensions that may be relevant in management of drivers of deforestation (Annex 2) and maintaining future trend in favour of REDD+. The following institutions are relevant to the management of Mangrove Forests of Miani Hor, District Lasbela:

Balochistan Forest and Wildlife Department

Balochistan Forest and Wildlife Department is the main custodian of Mangrove forests of Miani Hor. Besides regulation of forest produce, any agency that intends to implement interventions in mangrove

forest that is related to protection, restoration and conservation activities also come through Balochistan Forest and Wildlife Department. All the technical matter related to the planting of Mangrove seedlings/propagules/Wildlings and other matter related to disease and insect attacks are also referred to the Forest and Wildlife Department. Although so far only a piece of 600 acres has been declared as Protect Forests under the Forest Act of 1927, Balochistan Forest and Wildlife Department intends to bring the entire patch of 10,000 to 13,000 acres under the protective regime so that full scale restoration and implementation activities would be implemented in this patch. In this regard, the department has already initiated interventions through the Ten Billion Tree Tsunami Project (TBTTP).

Local Communities

In Miani Hor, communities living and around the Dam Bundar are the custodians of Mangrove forests. All the tribes/sub-tribes living in the 3-three villages of the area are considered as stakeholders and would be part of any consultative process aimed at the restoration and improvement of Mangrove Forests of Miani Hor area. These local community members are dependent upon these forests for small timber, fuel wood and fodder for their livestock (camels). However, no territory or area is marked for any specific village or tribe for any harvesting of a forest produce. Balochistan Forest and Wildlife Department is trying to involve the local communities in all the mangrove related endeavors such as collection and planting of propagules, wildlings and seeds.

Balochistan Coastal Development Authority (BCDA)

Balochistan Coastal Development Authority is one of the main departments of Government of Balochistan that is concerned with all the activities related to the Balochistan Coast. BCDA is also the main stakeholder and forest related institution.

Pakistan Navy

Pakistan Navy is one of the main stakeholders and relates to the Mangrove forests of Miani Hor. In implementation of activities related to the restoration and improvement of mangrove forests, Pakistan Navy also needs to be consulted due to its overall role in the management/protection of coast.

Conservation NGOs

International Union for Conservation of Nature (IUCN) and World Wide Fund for Nature (WWF) are also forest related institutions in case of Mangrove forests of Miani Hor. Both these agencies have played key role in highlighting the role of Mangrove forests along the Balochistan Coast. Besides, both these agencies have also undertaken many initiatives for the restoration and improvement of Mangrove forests in the Miani Hor area.

2.4 Stakeholders Analysis

Table 4: Influence and interest matrix of forest management and carbon pool

	Neglected players: Need special attention to safeguard their interests	**Major players:** Need to be fully involved
INTEREST High Score 2 and 3	Non-Governmental Organizations (NGOs), CARD and Donor agencies	Local Communities, Balochistan Forest and Wildlife Department
	Marginal players Low priority	**Risk factors** Need to be addressed
INTERST Low Score 0 and 1	Local Fish Market Suppliers, Fish Transporters, Livestock and Dairy Development Department, Fisheries Department, Pakistan Navy, Balochistan Coastal Development Authority, Balochistan Environmental Protection Agency	Balochistan Forest and Wildlife Department, local communities District Administration
	INFLUENCE Low Score 0 and 1	**INFLUENCE High** Score 2 and 3

While analyzing the data for the stakeholders for the Mangrove Forests of Miani Hor, it came up that the major players in forest management are those having major interests and influence on using and protecting carbon pools. Although the stakeholders themselves may not be aware of this fact since the concepts are new. However, they may need raising awareness about this, especially of the importance and benefits of management of carbon pools.

2.5 Analysis of drivers of deforestation, forest degradation and barriers to enhancement

A comprehensive review of the REDD+ mitigation actions including; deforestation, forest degradation, sustainable forests management, conservation and forest carbon stock enhancement, along with potential indicators, is placed at the Annex-5. An overview of the main drivers of deforestation and forest degradation, as emerged from the participatory analysis, is presented as follows;

In the past Mangrove forests were subject to a number of uses and as a result these were overexploited that resulted in the forest degradation. These uses of Mangroves included extraction of wood for **firewood, fodder for the camels** of resident community members and **small timber** that was **used in making boats and other implements**. As a result of this over-exploitation, many blank areas started appearing in this patch of Mangroves. These blank patches gradually increased and took the form of large mud flats in these mangrove forests. Appearance of these mud flats not only adversely affected the production of shrimps but also gave way to more bank erosion in the Miani Hor lagoon. Recently the sanitation water from the town of Sonmiani, Damb and Bhera is posing a greater threat to these mangroves. Besides, the **erosion of coast** is also emerging as threat to mangrove forest of Miani Hor.

The major drivers of deforestation and forest degradation include:

Drivers of Deforestation:

- Small timber extraction for boats making and other implements
- Coastal erosion

Drivers of Forest degradation:

- Firewood collection for cooking
- Uncontrolled Livestock grazing

Barriers to Forest Restoration:

- Uncontrolled grazing and lack of regeneration plans
- Availability of planting stock

2.6 Carbon stock assessment of Miani Hor Forests

2.6.1 Plot level Carbon Stock Estimation

Based on the field data carbon stock (tons per hectares) for Above Ground Carbon (AGB) and Below Ground Carbon (BGB) was worked out using the standard sets for tree species, tree DBH and height, and dry biomass of shrubs and litter (**Table 5**). The tree species level carbon stock is given in Annex - I. Based on this data individual plots level carbon stock values are given in Table 5. The estimated stock of carbon per hectares (ha) was then used to estimate the total carbon stock in the selected site of Maini Hor Forest.

Table 5 Plot level above and below ground carbon stock

Plot No.	Average of AGC (tonnes /ha)	Average of BGC (tonnes /ha)
1	0.453875035	0.239506512
2	0.879105904	0.417541597
3	0.477587672	0.239940163
4	0.379034319	0.194078501
5	0.638520242	0.313656758
6	0.978817919	0.469836176
7	0.219659418	0.116063109
8	1.301805976	0.607226786
9	0.7765885	0.384082237
10	1.475416503	0.697237707
11	0.492195561	0.251789477
12	0.407984466	0.237589321
Average	**0.731736108**	**0.358232641**

2.6.2 Forest Cover Assessment

The change in forest cover was assessed by using Landsat multispectral 30m spatial resolution satellite images on the path (150) and row (36) and google Earth Engine Cloud Computing platform for the classification of forest cover by applying Random Forest Machine Learning Algorithm. The analysis indicates an increase of 665 ha in forest cover in the past 10 years at an average rate of 66.5 hectare (ha) per year (**Table 6**).

Table 6: Forest cover assessment (2010 -2020)

No	Landsat Satellite Sensor	Landsat data acquisition	Forest Cover (ha)
1	Landsat-8	2020-02-11	4280
2	Landsat-5	2010-02-15	3615
Change in Forest Cover in last 10 years			665
Per year change in forest cover			66.50

Table 7 provides **three scenarios** of forest cover in the coming ten years that can be followed:

1. Adding 10% more forest cover in addition to the current average annual increase of 66.5 ha.
2. Adding 20% more forest cover in addition to the current average annual increase of 66.5 ha.
3. Adding 50% more forest cover in addition to the current average annual increase of 66.5 ha.

The above scenarios mean that the forest that is already growing annually on average by 66.5 ha (as observed in the last 10 years) and enhancing this growth by 10%, 73 ha of forest cover in total would be required to be added annually, which will increase the forest cover to 5151 ha instead of 5078 ha in the business-as-usual scenario by the year 2032. Similarly, in 20% and 50% scenarios, additional forest cover to be added annually will be 80 ha and 100 ha respectively that will increase the total forest cover to 5224 ha and 5444 ha respectively. The total area of the PFMP is 83000 ha and has a plenty of land available for increasing the forest cover.

Table 7. Forest Cover Scenarios based on trend in the past 10 years

Rate of change per year (ha)	66.50	6.7	13.3	33.25
Year	**Forest Cover (ha) - Business as usual**	**Forest Cover (ha) - 50% increase (66.5 + 6.7)**	**Forest Cover (ha)- 100% increase (66.5 + 13.3)**	**Forest Cover (ha) - 150% increase (66.5 + 33.25)**
2010	3615			
2011	3682			
2012	3748			
2013	3815			
2014	3881			
2015	3948			
2016	4014			
2017	4081			
2018	4147			
2019	4214			
2020	4280			
2021	4347	4347	4347	4347
2022	4413	4420	4426	4446
2023	4480	4493	4506	4546
2024	4546	4566	4586	4646
2025	4613	4639	4666	4746
2026	4679	4712	4746	4845

2027	4746	4785	4825	4945
2028	4812	4859	4905	5045
2029	4879	4932	4985	5145
2030	4945	5005	5065	5244
2031	5012	5078	5145	5344
2032	5078	5151	5224	5444
Additional Forest cover increase in addition to business as usual		73	80	100

These scenarios are presented visually in **Figure 3:** (Forest cover Scenarios)

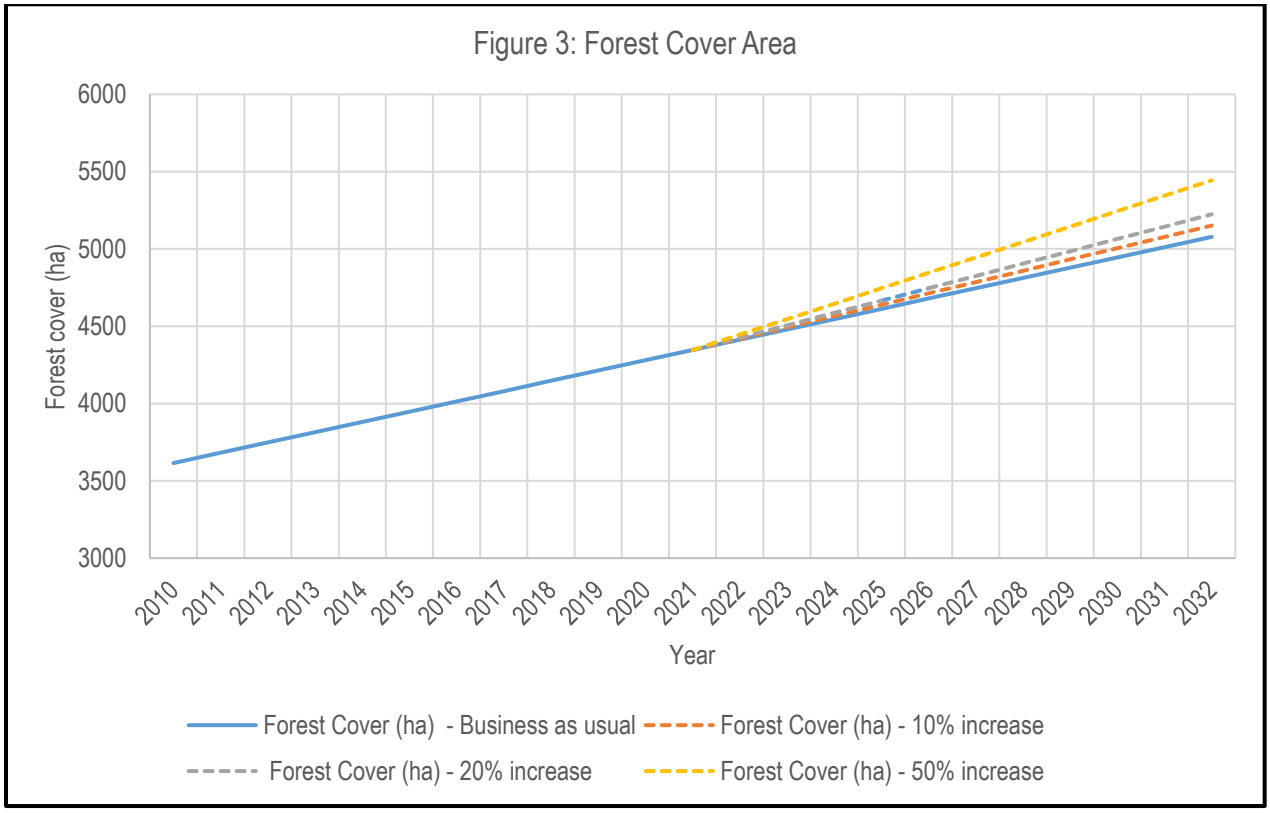
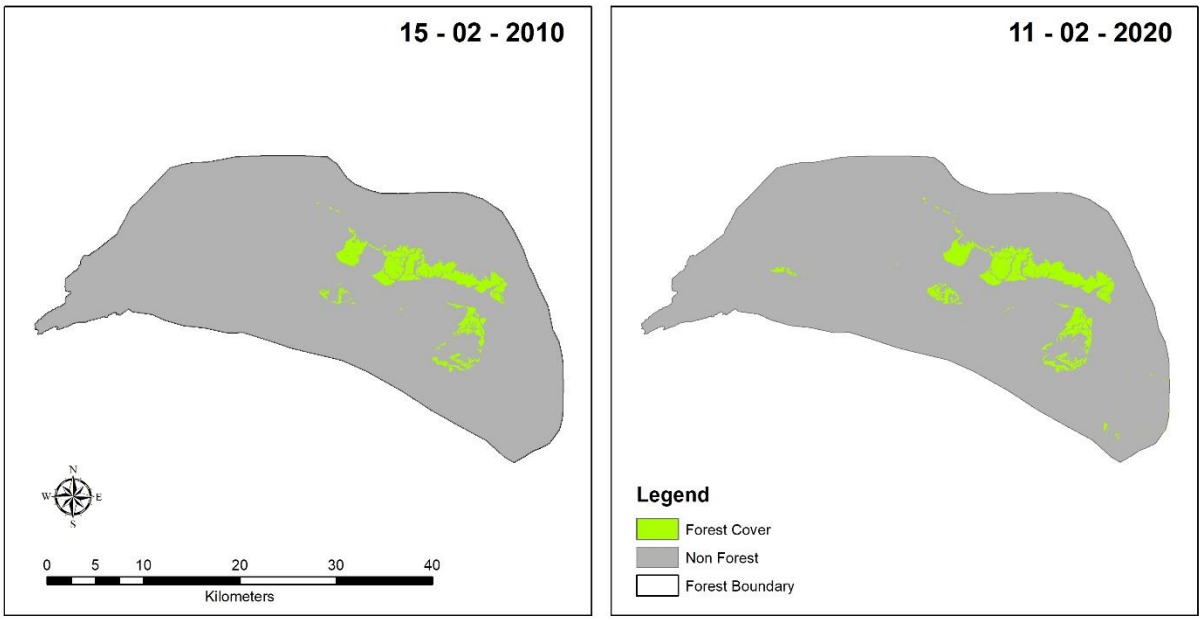


Figure 3. Forest Cover Scenarios

2.6.3 Carbon stock estimation and CO_2 emissions

The field data and biomass collected from 12 samples was used to calculate Above Ground Biomass (AGB) using locally developed allometric equations (Ismail et al, 2018) for 2010-2020 (**Table 8**). In Miani Hor Forest, the cumulative carbon stock in the carbon pools (above, below, deadwood, litter and soil) was estimated to as 51,251 tonnes back in 2010 which increased to 60,679 tonnes in 2020. This change corresponds to the increase in forest cover from 3,615 ha in 2010 to 4,280 ha in year 2020 reducing CO_2 emissions at the rate of 3,457 tonnes of CO_2 eq. per annum (see figure 4 and Table 8).

Figure 4



: Forest Cover Maps used for Change Analysis

Table 8: Carbon stock estimation (2010-2020)

Carbon pool	Mean carbon stock (tonnes C stock per hectare)	Forest Cover (ha)	Total C stock (tonnes C stock)	CO_2 (tonnes CO_2 eq)
2010 (2010-02-15)				
Above	0.73	3615	2,645.23	
Below	0.36		1,295.01	
Deadwood	4.40		15,908.48	
Litter	0.04		132.30	
Soil*	8.65		31,269.75	
Cumulative			51,251	187,919.49
2020 (2020-02-11)				
Above	0.73	4280	3,131.83	
Below	0.36		1,533.24	
Deadwood	4.40		18,834.94	
Litter	0.04		156.64	
Soil	8.65		37,022.00	
Cumulative			60,679	222,488.36
Rate of change per year				
2020-2010		**66.50**	**942.79**	**3,457**

* Soil Carbon Value taken from NRO Inventory

2.6.4 CO_2 Sequestration Scenarios from Forest Enhancement

This section presents the future CO_2 emissions sequestration scenarios applying 10%, 20% and 50% enhancement to current sequestration rate over the past 10 years due to forest cover increase (As per definition of forest adopted by Pakistan for REDD+). The current average CO_2 sequestration rate in Miani Hor is 3,457 tones CO_2 eq per annum because of forest cover increase which can be boosted further by

346 tones with 10% enhancement, 691 tones with 20% enhancement and 1728 tones with 50% enhancement of forest cover. Figure - 5 shows the enhancement trend under different scenarios.

Table 9: CO_2 Emissions Sequestration trend and Different Enhancement scenarios

Rate of change per year	3457	346	691	1728
Year	**Sequestration from Forest enhancement (tonne CO_2 eq) - Business as usual**	**Sequestration from Forest enhancement (tonne CO_2 eq) - REDD+ with 10% addition**	**Sequestration from Forest enhancement (tonne CO_2 eq) - REDD+ with 20% addition**	**Sequestration from Forest enhancement (tonne CO_2 eq) - REDD+ with 50% addition**
2010	3457			
2011	3457			
2012	3457			
2013	3457			
2014	3457			
2015	3457			
2016	3457			
2017	3457			
2018	3457			
2019	3457			
2020	3457			
2021	3457	3457	3457	3457
2022	3457	3803	4148	5185
2023	3457	4148	4840	6914
2024	3457	4494	5531	8642
2025	3457	4840	6222	10371
2026	3457	5185	6914	12099
2027	3457	5531	7605	13828
2028	3457	5877	8297	15556
2029	3457	6222	8988	17284
2030	3457	6568	9679	19013
2031	3457	6914	10371	20741
2032	3457	7259	11062	22470

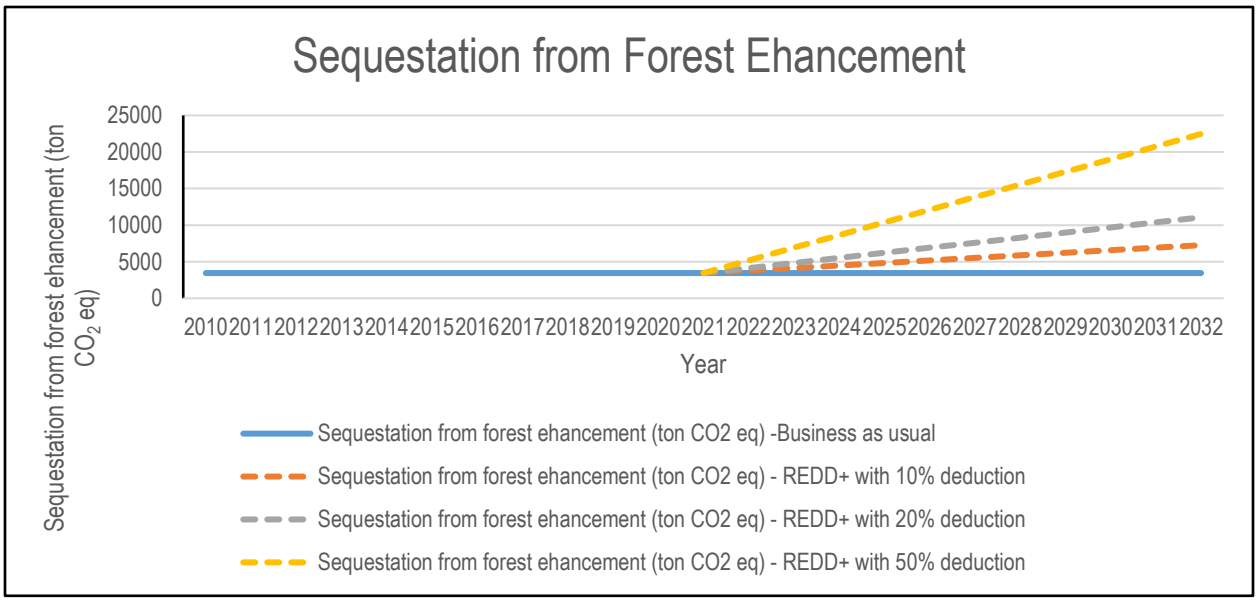


Figure 5: Emissions reduction scenarios – Forest Cover Increase

2.6.5 CO_2 Emissions Trend – forest degradation

Fuelwood and Timber consumption for the pilot site was estimated based on population of the area, population growth rate and per capita fuelwood and timber consumption statistics collected during the field survey. The total population of the pilot site in 2017 was 19,500 with a growth rate of 3.26 per annum. The fuelwood and timber consumption per capita per annum was calculated as 0.5 m^3 and 0 m^3 (Mangroves don't produce timber, wood extraction is only for firewood) respectively. Based on this data emissions from forest degradation are calculated and presented in the Table 10.

Table 10: Forest Degradation Emissions trend

Year	Population	Fuelwood Consumption (FC) (m^3/year)	Timber Consumption (TC) (m3/year)	Fuelwood Emissions[1] (FC*D*BEF2*CF*44/12) (tonnes CO_2 eq)	Timber Emission (TC*D*BEF2*CF*44/12) (tonnes CO_2 eq)	Emission from Forest Degradation (tonnes CO_2 eq) -Business as usual
2010	15462	7731	0	13902	0	13902
2011	15983	7992	0	14371	0	14371
2012	16522	8261	0	14855	0	14855
2013	17079	8539	0	15356	0	15356
2014	17654	8827	0	15873	0	15873
2015	18249	9125	0	16408	0	16408
2016	18864	9432	0	16961	0	16961
2017	19500	9750	0	17532	0	17532
2018	20136	10068	0	18104	0	18104
2019	20792	10396	0	18694	0	18694
2020	21470	10735	0	19304	0	19304
2021	22170	11085	0	19933	0	19933
2022	22893	11446	0	20583	0	20583
2023	23639	11819	0	21254	0	21254
2024	24410	12205	0	21947	0	21947
2025	25205	12603	0	22662	0	22662
2026	26027	13013	0	23401	0	23401
2027	26875	13438	0	24164	0	24164
2028	27752	13876	0	24951	0	24951
2029	28656	14328	0	25765	0	25765
2030	29590	14795	0	26605	0	26605
2031	30555	15278	0	27472	0	27472
2032	31551	15776	0	28368	0	28368

[1] Wood Density (D)

Avicennia marina	*0.65*
Rhizophora mucronata	*0.82*
Average	*0.74*

Biomass Expansion Factor: BEF2 1.35 (IPCC Table 3A.1.10)

CF = carbon fraction of dry matter 0.5

2.6.6 Net Emissions from Deforestation and Forest Degradation

The Table 11 below provides a net CO_2 sequestration scenario based on 10% forest cover enhancement in addition to existing positive trend and reducing emissions from forest degradation in an incremental manner annually from 5% to 25% with REDD+ activity. In this scenario, the net emissions from the forest will continue declining till 2026 due to cumulative effect of increasing forest cover and reduction in forest degradation due to REDD+ implementation but will again start climbing due to steady increase in population resulting in increase in demand for fuel and local use timber. The forest cover is increasing in the pilot site at a rate of 66.5 ha annually whereas the total area of the site is 83,000 ha and even with 50% enhancement the forest cover will increase to 5444 ha. So, a concerted strategy targeting more forest cover than 10% and focusing on reducing the demand for firewood would be needed to realize the full potential of CO_2 sequestration from the pilot site. Figure - 6 graphically presents the business-as-usual scenario and the REDD+ scenario.

Table 11. Sequestration Scenario from Forest Enhancement and Reducing degradation

Rate of change per year	3457					346	
Year	**Annual Sequestration from forest enhancement (tonnes CO_2 eq) -Business as usual**	**Annual Emission from Forest Degradation (tonnes CO_2 eq) - Business as usual**	**Net Emissions (tonnes CO_2 eq) - Business as usual**	**5-25% Reduction in Degradation emissions (tonnes CO_2 eq)**	**Net emissions from degradation (tonnes CO_2 eq)**	**Sequestration from forest enhancement (tonnes CO_2 eq) - REDD+ with 10% enhancement**	**Net total emissions from forest enhancement and reducing degradation (tonnes CO_2 eq) - REDD+ implementation**
	3457	13902	10445				
2011	3457	14371	10914				
2012	3457	14855	11398				
2013	3457	15356	11899				
2014	3457	15873	12416				
2015	3457	16408	12951				
2016	3457	16961	13504				
2017	3457	17532	14076				
2018	3457	18104	14647				
2019	3457	18694	15237				
2020	3457	19304	15847				

2021	3457	19933	16476				
2022	3457	20583	17126	1029	20583	3803	16780
2023	3457	21254	17797	1063	20191	4148	16043
2024	3457	21947	18490	2195	19752	4494	15258
2025	3457	22662	19205	4532	18130	4840	13290
2026	3457	23401	19944	5850	17551	5185	12365
2027	3457	24164	20707	6041	18123	5531	12592
2028	3457	24951	21495	6238	18714	5877	12837
2029	3457	25765	22308	6441	19324	6222	13101
2030	3457	26605	23148	6651	19954	6568	13386
2031	3457	27472	24015	6868	20604	6914	13690
2032	3457	28368	24911	7092	21276	7259	14016

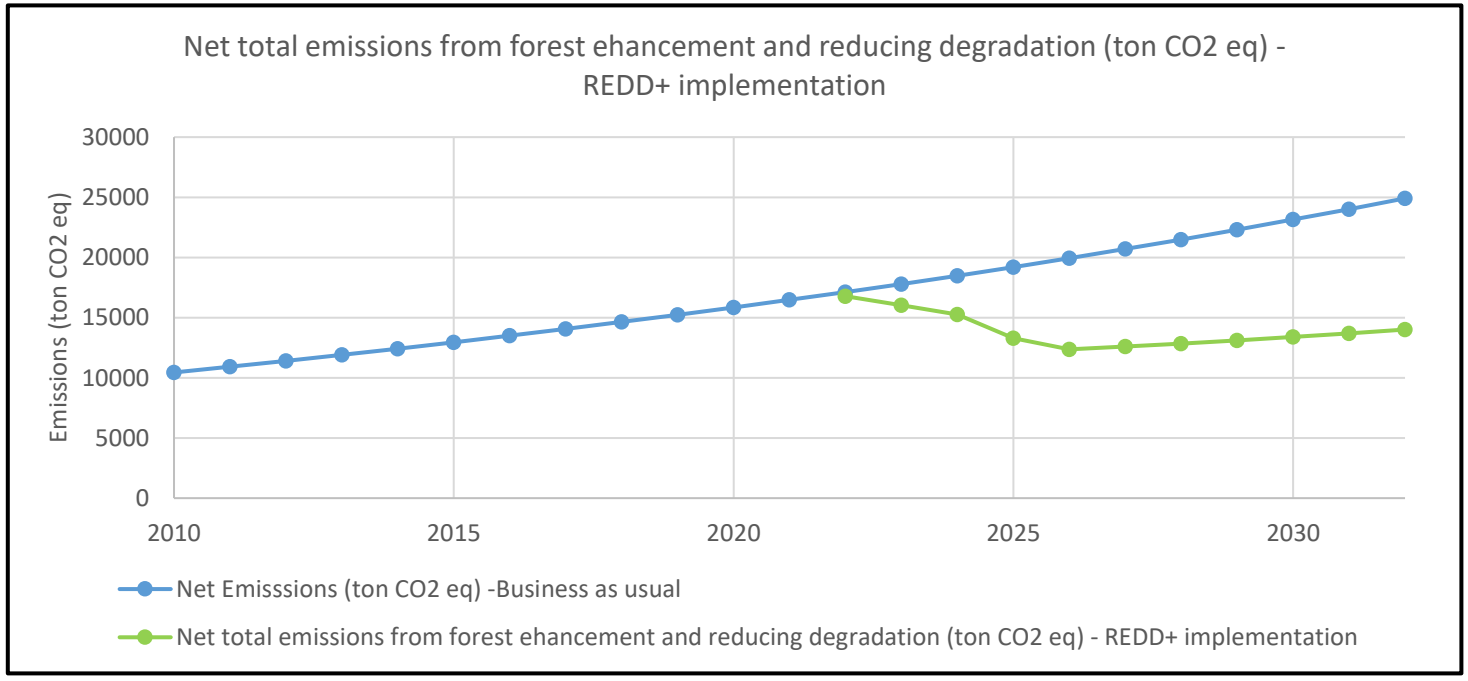


Figure 6: Sequestration scenarios – Forest Enhancement and Reduced degradation

CHAPTER III: PROPOSED INTERVENTIONS TO ADDRESS DRIVERS AND BARRIERS

In the wake of climate change and Blue Carbon Economy, Mangroves have emerged as one of the most important ecosystems along the Balochistan Coast. Due to population explosion of human and livestock and increase in the demand for forest produce such as fodder, fuelwood and small timber, pressures on the Mangrove forests has increased tremendously during the past decade and so. This has led to degradation of Mangroves especially those that are close to the town and cities. Mangrove forests at Miani Hor area, because of thier close proximity to Winder town and Hub City, have been subject to a high exploitation rate for fodder, fuel and small timber. Taking this fact into consideration, it has been felt that an integrated approach needs to be adopted in recommending interventions/activities through Participatory Forests Management Planning for the Mangrove Forests of Miani Hor area. All the interventions proposed for the restoration and improvement of Mangrove forests of Miani Hor have been grouped under the different outcomes and outputs. Detail of these interventions follows:

Interventions addressing different Drivers of Deforestation

Small timber extraction for boats making and other implements

- Community Organizations at village level to engage local communities in forest management and protection.
- Creating awareness among the people on the importance of these forests and potential revenues to be generated through REDD+ implementation.
- Promote planting of alternate local species for boat making and other implements

Coastal erosion

- Measures to control coastal erosion including planting on mud flats and blanks
- Measures to encourage Assisted Natural Regeneration / Artificial Regeneration.

Interventions addressing different Drivers of forest degradation

Firewood collection for cooking

- Promote energy conservation technologies particularly fuel-efficient cooking technologies
- Explore and promote alternate energy sources
- Supporting energy plantations

Uncontrolled Livestock grazing

- Capacity building of communities in grazing management and fodder production
- Introduction of appropriate grazing systems and planting fodder species
- Involving women in livestock production initiatives

Interventions addressing different Barriers to forest restoration

Uncontrolled grazing and lack of regeneration plans

- Develop participatory grazing management plans for regulating grazing in regeneration areas
- Develop forest regeneration plans in line with the grazing management plans

Availability of planting stock

- Raise nurseries to make planting stock available

The total indicative budget of the PFMP implementation is PKR 81,800,000 over the ten years period.

Ten years budgeting and operational planning of the PFMP is given in Table 12.

Table 12. Indicative operational plan and Estimated budget of PFMP for 10 years

S.N.	Activity	Unit	Unit cost	Operational Plan										Total units	Total cost
				1	2	3	4	5	6	7	8	9	10		
A	**Participatory Forest Management**														
1	Community Organizations at village level to engage local communities in forest management and protection.	No	500,000	5	5	5								15	7,500,000
2	Creating awareness among the people on the importance of these forests and potential revenues to be generated through REDD+ implementation	No	100,000	1	1	1								3	300,000
3	Measures to control coastal erosion including planting on mud flats and blanks	No.	30,000	10	10	10	10	10	10	10	10	10	10	100	3,000,000
4	Measures to encourage Assisted Natural Regeneration / Artificial Regeneration	No.	30,000	10	10	10	10	10	10	10	10	10	10	100	3,000,000
5	Raise nurseries to make planting stock available for forest restoration	No.	500,000	2	2	2	2	2	2	2	2	2	2	20	10,000,000
B	**Forest Regeneration**														
1	Establishment of nurseries for community planting to improve fodder and firewood availability	No	500,000	1	1	1	1	1	1	1	1	1	1	10	5,000,000
2	Supporting Energy Plantations and plantation of local species suitable for boat making, etc	ha	200,000	10	10	10	10	10	10	10	10	10	10	100	20,000,000

C	**Managed Rotational Grazing**														
1	Develop participatory grazing management plans and regeneration plans for regulating grazing in regeneration areas	No.	1,000,000	1										1	1,000,000
2	Capacity building of communities including women and demonstrations in grazing and livestock management and fodder production	No.	500,000		3	3	3	3	3					15	7,500,000
D	**Promotion of Sustainable Energy Technology**														
1	Explore and promote alternate energy sources	No	500,000		5	5	5	5	5	5				30	15,000,000
2	Promote energy conservation technologies particularly fuel-efficient cooking technologies	No. of persons	3,000		200	200	200	200	200	200				1,200	3,600,000
E	**Promotion & Value Addition of Non-Timber Forest Products (Trainings/Equipment's)**														
1	Introducing sustainable Fisheries practices	persons	50,000	10	20	20	20							70	3,500,000
2	Promotion of Tourism businesses	No	600,000		2	2								4	2,400,000
	Total														81,800,000

CHAPTER IV: IMPLEMENTATION MECHANISM FOR THE PFMP

4.1. Resources for implementation of interventions/activities

Balochistan Forest and Wildlife Department is the custodian institution of all the Mangrove forests in the province including the Mangrove forests of Miani Hor area. The department has already implemented many donor and Public Sector Development Programme funded projects in the Miani Hor for conservation of Mangrove forests. Balochistan Forest and Wildlife Department has also undertaken survey of Mangrove Forests of Miani Hor with the help of conservation NGOs. Taking into consideration the importance of Mangrove forests for protection of coast and fishing industry, Balochistan Forest and Wildlife Department will take a lead role towards securing necessary financial and human resources for implementation of project.

Besides, the Balochistan Forest and Wildlife Department, other key stakeholders identified in this plan will also make efforts towards resource mobilization.

A total of Rs. 52.14 million is required for implementation of activities contained in the Participatory Forest Management Plan of Miani Hor area. Arranging this amount is not an easy task in view of the availability of resources with the Balochistan Forest and Wildlife Department and Community Conservation Organizations (CCOs) especially under prevailing poverty in the communities. However, for provision of this very amount a number of other options would also be explored to support the activities included in the plan for conservation of mangrove forests, rehabilitation of natural resources present in Miani Hor area, increasing productivity of fishing and strengthening village infrastructures. Through implementation of the Participatory Forest Management Plan, it is expected that it will not only contribute towards conservation of Mangrove Forests but would also help in reducing poverty level in the villages of the area as a result of increased productivity in fishing sectors and generation of alternate income earning opportunities. Besides, the Participatory Forests Management Plan will also pave the way towards sustainable resource use. In the long run the implementation of activities through Participatory Forests Management Plan will help in improving the standard of living of the village inhabitants.

For implementation of the activities outlined in the plan, initially a donor conference would be called, where besides inviting the local donor agencies, the International NGOs especially those working in Balochistan would also be requested to participate. This will provide an opportunity for getting the funding for implementation of activities in different sectors. Another important area, which would be explored for the implementation of the Participatory Forests Management Plan of Miani Hor area, is through arranging coordination meetings with all those partner agencies that are already working in Union Council Dam, such as National Rural Support Programme (NRSP), CARD, International Fund of Agriculture Development (IFAD) working in the province would also be approached for securing financial support. In these meetings, the plan will be shared with these partners and the sectors where these organizations/agencies are working would be identified for future partnerships. This will provide a very conducive environment for partnerships among the different agencies working in the area of community/rural development and natural resource management/conservation. Another most important avenue for the implementation of activities is through the Ten Billion Tree Tsunami Project (TBTTP).

As inhabitants of villages of Manna valley would be forming a Community Conservation Organizations (CCOs) through/under the project, therefore, they would be working very closely with the project management. They would very actively participate in the preparation of annual/quarterly work plans. It would be thus an excellent opportunity for the project to implement the planned activities on

ground that has been identified in the CCOs meeting. Taking these facts into consideration, it would be to the great advantage of the Participatory Forests Management Plan to use the CCOs forum for implementation of the planned activities. Similarly, the Balochistan Forest and Wildlife Department will also play key role in arranging for funding through the Public Sector Development Programme (PSDP) of Balochistan. As the provincial Government of Balochistan has now got many opportunities available to it for natural resource management and rural/community development, therefore, it would not be a difficult task to get their consent for funding a plan where a lot of inputs in terms of survey and preparation of plan have already been added. In terms of resource mobilization for the plan, here it is very important to indicate here that as the plan has taken up an integrated approach towards the sustainable management of natural resources and community/rural development, therefore, a multi-dimension approach should be sought for securing funding/sponsoring purposes. In this mechanism, efforts would be put up to secure funding for implementation process from different organizations working in different sectors.

4.2. Suggested institutional mechanism for implementation of activities

Balochistan Forest and Wildlife Department in consultation with the Community Conservation Organizations will decide on formation/notification of suitable institutional mechanism for implementation of this plan. It is proposed d that a mangrove forest and district level REDD+ implementation committees may be notified by the Balochistan Forest and Wildlife Department that will oversee implementation of activities. The notifications will include description of responsibilities of Balochistan Forest and Wildlife Department, the respective CCOs, and any other relevant stakeholders.

4.2.1. Mangrove Forest Level REDD+ Implementation Committee (MFLRIC):

Balochistan Forest and Wildlife Department in consultation with the CCOs, would notify two committees viz.: A Mangrove Forest Level REDD+ Implementation Committee (MFLRIC) and the District Level REDD+ Implementation Committee (DLRIC). The MFLRIC will comprise representative from the CCOs and the Balochistan Forest and Wildlife Department. The community will nominate representatives for the MFLRIC to represent them. The representatives of the CCOs will be responsible to mobilize and ensure community support for implementation of activities contained in the Participatory Forest Management Plan. The Balochistan Forest and Wildlife Department will implement the plan activities through the Deputy Conservator of Forests Uthal and Rang Forest Officer Hub. These officers will be supported by the Deputy Ranger Forest, Foresters and Forest Guard in implementation process. The MFLRIC will be Co-chaired by a CCOs member nominated by the communities.

4.2.2. District Level REDD+ Implementation Committee (DLRIC):

The VLRIC in implementation of its activities will be supported by a District Level REDD+ Implementation Committee (DRIC). This committee will be chaired by the Deputy Conservator of Forests, while District Livestock Officer, District Agriculture Officer and Sub-Divisional Officer Public Health Engineering, CEO Card – NGO, a representative of CCO would be members of the committee. The responsibility of the DLRIC will be to monitor progress on implementation of activities and secure/extend support from the relevant actors including the government departments.

4.3 Benefit Distribution Mechanism

The implementation of the REDD+ interventions package and other support activities will increase the volume of carbon stock in the forest. The increase in carbon stock in the forest pool measured by variable means and the trade of carbon will generate substantial income for the stakeholders of Miani Hor area Mangrove Forests in due course of time. The income earned by trading carbon stock will be

distributed in proportions as per the use rights held by stakeholders in the protected Forest. The increase in income from the Carbon Trading would serve for stakeholders to place a higher value on standing trees than cut for other uses. Since the community will be reducing harvest for fuel wood and fodder for encouraging regeneration and voluntarily participate in restocking of forest, they will expect a major share from results base payments from reduced carbon emissions. An example is the 80:20 benefit sharing mechanism between the community and the Balochistan Forest and Wildlife Department from trophy hunting programme in Torghar, Dureiji and Shah Noorani areas of the province.

This plan has proposed distribution of carbon and non-carbon benefits accrued by the implementation of plan according to which 80% benefits will go to the Government, and 20% will go equally to the customary right holders and users. These benefits will only be distributed if the targets are achieved. The plan therefore provides scenarios to reduce or increase benefits so that the stakeholders can enjoy results-based payment and benefits. The success of this plan, therefore, is contingent to the commitment of all the stakeholders involved.

A specific and definitive distribution of benefits in case of REDD+ programme is yet to be developed by the government, which will form basis for sharing of benefits in the case of private forests. This proposed ratio will be finalized or confirmed only after finalizing Balochistan's benefit sharing mechanism.

CHAPTER V: CONFLICTS AND GRIEVANCES REDRESSAL MECHANISM

5.1 Conflict within the community

Traditionally, a jirga system resolves conflicts within the community in Miani Hor area and the decisions taken are acceptable to all the parties. Under REDD+ redressal, it is proposed that the same jirga should take lead role for resolving conflicts arising among the communities/villages regarding implementation of REDD+ activities. The structure and function of jirga system has been described in earlier section in this document.

5.2 Conflict between the two villages

The CCOs formed under/through the project with the help of jirgas/committee will settle any disputes between the two villages. Any unsettled disputes will be referred to the District Level REDD+ Implementation Committee (DLRIC). If conflicts are still not resolved, the matter will be taken up to the court of the formal judicial system.

5.3 Community's grievance towards Balochistan Forest Department

The REDD+ is a new mechanism for communities as well as for the Balochistan Forest and Wildlife Department, therefore both partners (Community and the Balochistan Forest and Wildlife Department) may be facing some conflict of interests in due course of time. In case of any such grievances arises, these will be dealt through the grievance redressal mechanism developed under the REDD+ obligation. This mechanism is also reflected well in Provincial REDD+ Action Plan.

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Annex 1: Socio-economic data of Mangrove Forests of Miani Hor, District Lasbela

I. Stakeholder group (name)	**Stakeholder Analysis of Miani Hor, District Lasbela**
II. General information	
Location of stakeholder groups (e.g., different villages/hamlets in and outside forest area) and names and indicate on map if possible	Miani Hor area, Union Council Sonmiani, District Lasbela.
III. Social organization in the forest area	
2. Traditional organizations (e.g., jirga)	
2.1. Organization (name; purpose; membership)	A local Jirga exists for conflict resolution in the Miani Hor area.
3. Formal organization (e.g., social; welfare organization or village development committee	
3.1. Organization (name; purpose; membership)	A Non-Governmental Organization CARD exists in the Sonmiani village for undertaking community development activities in the area
IV. Use of forest and forest area	
4. For what are you using the forest area?	
Timber for personal use like house construction, etc. (where; locate on the map)	Local community members harvest small timber for boat making or other implements from the Mangrove forests of Miani Hor area. However, this practice is not prevalent on largescale. Balochistan Forest and Wildlife Department discourages this kind of practices.
Timber for commercial selling (where; locate on the map)	**No commercial timber is extracted from Mangrove forests.**
Firewood (where; locate on the map)	Local community members sometime harvest dead, dry and fallen wood for fuel wood. However, this practice is also not prevalent on larger scale.
Grazing (where; locate on the map)	In some areas of Mangrove forests that are close to the land, camels browse upon the trees, otherwise no grazing has been reported in these forests. However, community members do harvest Mangrove leaves from these forests for feeding to the camels and goats.
Grass cutting (where; locate on the map	Only leaves and succulent branches are harvested by local community members for feeding to their camels and goats. As such no grass is available in Mangrove forests.
Other products in the Miani Hor area from the Mangrove forests include Shrimps & fish	Local community members are using the Mangrove area for fishing.
Forest areas related daily labor/employment (employed by whom; for what?)	(For collection and planting of propagules in the blanks and mud flats areas of Mangroves)

Tourism (what; where; locate on the map)	Very high potential exists for tourism in Miani Hor area, district Lasbela. However, it is still untapped. Taking into consideration the scenic beauty of Mangrove forests and conjunction of forests, sea and sand dunes
Hunting/Fishing	Damb and Sonmiani are very famous areas for fishing. Majority of the resident community members in Miani Hor area i.e. 90% of the total population is busy in fishing for their livelihoods.
5.What would it mean if you had no access to these forest products? (Any alternatives? Threat to livelihood?)	Communities are now using gas cylinders and fuel wood purchased from outside as alternatives. Still threat to the mangrove forests as well as to the livelihoods of community exists if the community
5. Rights and concessions in forest area	
6. Do you have formal, legal, or traditional, customary rights on forest products (use)? Which ones? If documented rights, where?	In the notification of state forests, local community members have been given the rights for dead, dry and fallen wood. Besides, the priority for the contract and labour in the forestry activities.
Timber (shares)	As explained above
Fodder: grass cutting/grazing	As explained above
Firewood	As explained above
Other products:	As explained above

Annex 2: Participatory Stakeholder Analysis

STAKEHOLDER	INTEREST in Forest Management		INFLUENCE on Forest management		Relevant forest carbon pools		Influence on forest carbon pools	
	Type of interest	Level of interest	Type of Influence	Level of influence	Type of carbon Pool	Level of interest	Type of influence	Level of influence
Local Community	Fuel wood, small timber, Fodder for Camels, Grazing (Camels)	3	Decision on use of forest resources i.e. Timber, fuel wood	2	Above and below ground	3	Use of carbon pools	2
Forest and Wildlife Department	Forest Management, Conservation of Biodiversity	3	Controlling management prescriptions, Decision on use	1	All five carbon pools	3	Legal framework and control mechanism	3
Fisheries Department	Fish, sea water and conservation of mangrove forests	2	Good relationships with community and BFWD,	1	Above and below ground	1	Lobbying	1 1
Livestock and Dairy Development Department	Fodder for community camels	1	Good relationships with community and BFWD	1	Above ground	1	Lobbying	1 1
District Administration	Management of forests	2	Good relationships with community and BFWD	2	All five carbon pools	2	Influence on use of carbon pools	2
Pakistan Navy	Sea water and Conservation of mangrove forests	1	Good relationship with BFWD	1	All five carbon pools	1	Legal framework and control mechanism	1
Balochistan Environmental Protection Agency (BEPA)	Sea water and conservation of mangrove forests	1	Good relationship with BFWD	1	All five carbon pools	1	Legal framework and control mechanism	1
Balochistan Coastal Development Authority (BCDA)	Sea water and conservation of forests	2	Good relationship with community and BFWD	1	All five carbon pools	1	Legal framework and control mechanism	1
Local Fish Market Suppliers	Mangrove forest conservation	1	Good relationship with community	1	Above ground	1	Lobbying	1
Fish Transporters	Mangrove forest conservation	1	Political Lobbyist	1	Above ground	1	Lobbying	1

CARD and other Non-Governmental Organizations (NGOs)	Forest conservation including water and soil conservation	2	Lobbyist	1	All five carbon pools	2	Lobbying	1
Donor Agencies	Forest management and biodiversity conservation	2	Lobbyist	1	All five carbon pools	2	Lobbying	2

***Scale**	**Level of interest**	**level of influence**
0	None	Negligible or ignored
1	Little	Little
2	Significant	Significant
3	High/vital for existence	Controller

Annex 3: Plot level Carbon Stock

Plot No.	Latitude	Longitude	Species Name	DBH (cm)	Tree height (m)	AGB (kg)	BGB (kg)	AGB (ton/ha)	BGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
1	25.5	66.54	Avicennia marina	28	8.1	468.8096	220.47	4.69	2.20	2.20	1.04
1	25.5	66.54	Avicennia marina	14.5	4.9	99.70204	51.16	1.00	0.51	0.47	0.24
1	25.5	66.54	Avicennia marina	20	7.8	212.4442	104.46	2.12	1.04	1.00	0.49
1	25.5	66.54	Avicennia marina	16	6.7	125.6822	63.65	1.26	0.64	0.59	0.30
1	25.5	66.54	Avicennia marina	19	9	188.2964	93.22	1.88	0.93	0.88	0.44
1	25.5	66.54	Avicennia marina	11	6.7	52.0564	27.70	0.52	0.28	0.24	0.13
1	25.5	66.54	Avicennia marina	18	7.7	165.8078	82.67	1.66	0.83	0.78	0.39
1	25.5	66.54	Avicennia marina	23	8	295.1417	142.46	2.95	1.42	1.39	0.67
1	25.5	66.54	Avicennia marina	17	5.1	144.9473	72.82	1.45	0.73	0.68	0.34
1	25.5	66.54	Rhizophora mucronata	12	4.6	29.62887	33.61	0.30	0.34	0.14	0.16
1	25.5	66.54	Rhizophora mucronata	7	5	7.179204	10.16	0.07	0.10	0.03	0.05
1	25.5	66.54	Rhizophora mucronata	6	6.1	4.78637	7.21	0.05	0.07	0.02	0.03
1	25.5	66.54	Rhizophora mucronata	5.5	4.8	3.807346	5.95	0.04	0.06	0.02	0.03
1	25.5	66.54	Rhizophora mucronata	6	5.6	4.78637	7.21	0.05	0.07	0.02	0.03
1	25.5	66.54	Rhizophora mucronata	7	6.1	7.179204	10.16	0.07	0.10	0.03	0.05
1	25.5	66.54	Rhizophora mucronata	6	7.1	4.78637	7.21	0.05	0.07	0.02	0.03
1	25.5	66.54	Rhizophora mucronata	6	3.4	4.78637	7.21	0.05	0.07	0.02	0.03
1	25.5	66.54	Rhizophora mucronata	8	5.2	10.19988	13.66	0.10	0.14	0.05	0.06
1	25.5	66.54	Rhizophora mucronata	6	2.9	4.78637	7.21	0.05	0.07	0.02	0.03
2	25.49	66.52	Avicennia marina	12	2	63.88044	33.61	0.64	0.34	0.30	0.16
2	25.49	66.52	Avicennia marina	29	1.8	509.1515	238.33	5.09	2.38	2.39	1.12
2	25.49	66.52	Avicennia marina	36	2.7	846.7359	385.17	8.47	3.85	3.98	1.81
2	25.49	66.52	Avicennia marina	28	2.2	468.8096	220.47	4.69	2.20	2.20	1.04
2	25.49	66.52	Avicennia marina	14	1.8	91.8023	47.32	0.92	0.47	0.43	0.22
2	25.49	66.52	Avicennia marina	15	3.3	107.9789	55.15	1.08	0.55	0.51	0.26
2	25.49	66.52	Avicennia marina	10	2.1	41.60083	22.42	0.42	0.22	0.20	0.11
2	25.49	66.52	Avicennia marina	9	1.9	32.46849	17.75	0.32	0.18	0.15	0.08

2	25.49	66.52	Avicennia marina	6	1.7	12.50907	7.21	0.13	0.07	0.06	0.03
2	25.49	66.52	Avicennia marina	8	1.9	24.61109	13.66	0.25	0.14	0.12	0.06
2	25.49	66.52	Avicennia marina	6	1.5	12.50907	7.21	0.13	0.07	0.06	0.03
2	25.49	66.52	Avicennia marina	9	1.4	32.46849	17.75	0.32	0.18	0.15	0.08
3	25.55	66.41	Avicennia marina	19	3	188.2964	93.22	1.88	0.93	0.88	0.44
3	25.55	66.41	Avicennia marina	9	3.2	32.46849	17.75	0.32	0.18	0.15	0.08
3	25.55	66.41	Avicennia marina	9		32.46849	17.75	0.32	0.18	0.15	0.08
3	25.55	66.41	Avicennia marina	11	4.7	52.0564	27.70	0.52	0.28	0.24	0.13
3	25.55	66.41	Avicennia marina	9	4.4	32.46849	17.75	0.32	0.18	0.15	0.08
3	25.55	66.41	Avicennia marina	26	4.6	393.8087	187.03	3.94	1.87	1.85	0.88
3	25.55	66.41	Avicennia marina	18	3.9	165.8078	82.67	1.66	0.83	0.78	0.39
3	25.55	66.41	Avicennia marina	7	5	17.97673	10.16	0.18	0.10	0.08	0.05
3	25.55	66.41	Avicennia marina	9	3.4	32.46849	17.75	0.32	0.18	0.15	0.08
3	25.55	66.41	Avicennia marina	16	2.9	125.6822	63.65	1.26	0.64	0.59	0.30
3	25.55	66.41	Avicennia marina	14	3.9	91.8023	47.32	0.92	0.47	0.43	0.22
3	25.55	66.41	Avicennia marina	14	3.7	91.8023	47.32	0.92	0.47	0.43	0.22
3	25.55	66.41	Avicennia marina	12	4.8	63.88044	33.61	0.64	0.34	0.30	0.16
4	25.54	66.4	Avicennia marina	9	4.5	32.46849	17.75	0.32	0.18	0.15	0.08
4	25.54	66.4	Avicennia marina	10	4.9	41.60083	22.42	0.42	0.22	0.20	0.11
4	25.54	66.4	Avicennia marina	10	5.4	41.60083	22.42	0.42	0.22	0.20	0.11
4	25.54	66.4	Avicennia marina	12	4	63.88044	33.61	0.64	0.34	0.30	0.16
4	25.54	66.4	Avicennia marina	6.5	3	15.10078	8.62	0.15	0.09	0.07	0.04
4	25.54	66.4	Avicennia marina	18.5	5.6	176.8466	87.86	1.77	0.88	0.83	0.41
4	25.54	66.4	Avicennia marina	19	7.1	188.2964	93.22	1.88	0.93	0.88	0.44
4	25.54	66.4	Avicennia marina	15	6.3	107.9789	55.15	1.08	0.55	0.51	0.26
4	25.54	66.4	Avicennia marina	12	4.2	63.88044	33.61	0.64	0.34	0.30	0.16
4	25.54	66.4	Avicennia marina	13	4.7	77.11561	40.14	0.77	0.40	0.36	0.19
4	25.54	66.4	Avicennia marina	17	4.6	144.9473	72.82	1.45	0.73	0.68	0.34
4	25.54	66.4	Avicennia marina	15	5.1	107.9789	55.15	1.08	0.55	0.51	0.26

4	25.54	66.4	Avicennia marina	20.5	3	225.1499	110.35	2.25	1.10	1.06	0.52
4	25.54	66.4	Avicennia marina	13	3.8	77.11561	40.14	0.77	0.40	0.36	0.19
4	25.54	66.4	Avicennia marina	10.5	4.9	46.66032	24.99	0.47	0.25	0.22	0.12
4	25.54	66.4	Avicennia marina	11	3.5	52.0564	27.70	0.52	0.28	0.24	0.13
4	25.54	66.4	Avicennia marina	6	3.2	12.50907	7.21	0.13	0.07	0.06	0.03
4	25.54	66.4	Avicennia marina	8	4.1	24.61109	13.66	0.25	0.14	0.12	0.06
4	25.54	66.4	Avicennia marina	9	3.8	32.46849	17.75	0.32	0.18	0.15	0.08
5	25.53	66.41	Avicennia marina	25	3.5	359.1005	171.43	3.59	1.71	1.69	0.81
5	25.53	66.41	Avicennia marina	8	3.8	24.61109	13.66	0.25	0.14	0.12	0.06
5	25.53	66.41	Avicennia marina	25	4.4	359.1005	171.43	3.59	1.71	1.69	0.81
5	25.53	66.41	Avicennia marina	17	1.7	144.9473	72.82	1.45	0.73	0.68	0.34
5	25.53	66.41	Avicennia marina	21	1.5	238.2817	116.41	2.38	1.16	1.12	0.55
5	25.53	66.41	Avicennia marina	17	3.1	144.9473	72.82	1.45	0.73	0.68	0.34
5	25.53	66.41	Avicennia marina	8	2.3	24.61109	13.66	0.25	0.14	0.12	0.06
5	25.53	66.41	Avicennia marina	9	2.7	32.46849	17.75	0.32	0.18	0.15	0.08
5	25.53	66.41	Avicennia marina	6	3.6	12.50907	7.21	0.13	0.07	0.06	0.03
5	25.53	66.41	Avicennia marina	7	1.8	17.97673	10.16	0.18	0.10	0.08	0.05
6	25.51	66.38	Avicennia marina	20	3.1	212.4442	104.46	2.12	1.04	1.00	0.49
6	25.51	66.38	Avicennia marina	20	3.3	212.4442	104.46	2.12	1.04	1.00	0.49
6	25.51	66.38	Avicennia marina	30	3.2	551.4194	256.96	5.51	2.57	2.59	1.21
6	25.51	66.38	Avicennia marina	25	3.6	359.1005	171.43	3.59	1.71	1.69	0.81
6	25.51	66.38	Avicennia marina	8	3.1	24.61109	13.66	0.25	0.14	0.12	0.06
6	25.51	66.38	Avicennia marina	7	2.9	17.97673	10.16	0.18	0.10	0.08	0.05
6	25.51	66.38	Avicennia marina	6.5	2.5	15.10078	8.62	0.15	0.09	0.07	0.04
6	25.51	66.38	Avicennia marina	27	3.4	430.3701	203.37	4.30	2.03	2.02	0.96
6	25.51	66.38	Avicennia marina	17	3.6	144.9473	72.82	1.45	0.73	0.68	0.34
6	25.51	66.38	Avicennia marina	7	2.1	17.97673	10.16	0.18	0.10	0.08	0.05
6	25.51	66.38	Avicennia marina	8	2.6	24.61109	13.66	0.25	0.14	0.12	0.06
6	25.51	66.38	Avicennia marina	30	2.9	551.4194	256.96	5.51	2.57	2.59	1.21

6	25.51	66.38	Avicennia marina	17	3.3	144.9473	72.82	1.45	0.73	0.68	0.34
7	25.44	66.5	Avicennia marina	17	4.3	144.9473	72.82	1.45	0.73	0.68	0.34
7	25.44	66.5	Avicennia marina	8	4	24.61109	13.66	0.25	0.14	0.12	0.06
7	25.44	66.5	Avicennia marina	9	3.9	32.46849	17.75	0.32	0.18	0.15	0.08
7	25.44	66.5	Avicennia marina	7	4.2	17.97673	10.16	0.18	0.10	0.08	0.05
7	25.44	66.5	Avicennia marina	13	3	77.11561	40.14	0.77	0.40	0.36	0.19
7	25.44	66.5	Avicennia marina	10	5	41.60083	22.42	0.42	0.22	0.20	0.11
7	25.44	66.5	Avicennia marina	11	4.7	52.0564	27.70	0.52	0.28	0.24	0.13
7	25.44	66.5	Avicennia marina	8	2.4	24.61109	13.66	0.25	0.14	0.12	0.06
7	25.44	66.5	Avicennia marina	6.5	2.3	15.10078	8.62	0.15	0.09	0.07	0.04
7	25.44	66.5	Avicennia marina	9.5	4.4	36.87219	20.01	0.37	0.20	0.17	0.09
8	25.54	66.4	Avicennia marina	40	6.8	1084.895	486.67	10.85	4.87	5.10	2.29
8	25.54	66.4	Avicennia marina	38	6	961.5788	434.29	9.62	4.34	4.52	2.04
8	25.54	66.4	Avicennia marina	31	4.7	595.6364	276.37	5.96	2.76	2.80	1.30
8	25.54	66.4	Avicennia marina	17	5.2	144.9473	72.82	1.45	0.73	0.68	0.34
8	25.54	66.4	Avicennia marina	17.5		155.176	77.66	1.55	0.78	0.73	0.37
8	25.54	66.4	Avicennia marina	9	4.9	32.46849	17.75	0.32	0.18	0.15	0.08
8	25.54	66.4	Avicennia marina	7		17.97673	10.16	0.18	0.10	0.08	0.05
8	25.54	66.4	Avicennia marina	5		8.146274	4.81	0.08	0.05	0.04	0.02
8	25.54	66.4	Avicennia marina	5.5		10.19368	5.95	0.10	0.06	0.05	0.03
8	25.54	66.4	Avicennia marina	7		17.97673	10.16	0.18	0.10	0.08	0.05
8	25.54	66.4	Avicennia marina	8	4.3	24.61109	13.66	0.25	0.14	0.12	0.06
8	25.54	66.4	Avicennia marina	27	6.4	430.3701	203.37	4.30	2.03	2.02	0.96
8	25.54	66.4	Avicennia marina	27	6.1	430.3701	203.37	4.30	2.03	2.02	0.96
8	25.54	66.4	Avicennia marina	19	6	188.2964	93.22	1.88	0.93	0.88	0.44
8	25.54	66.4	Avicennia marina	11	5	52.0564	27.70	0.52	0.28	0.24	0.13
9	25.54	66.44	Avicennia marina	17.5		155.176	77.66	1.55	0.78	0.73	0.37
9	25.54	66.44	Avicennia marina	20	6.8	212.4442	104.46	2.12	1.04	1.00	0.49
9	25.54	66.44	Avicennia marina	19	6.3	188.2964	93.22	1.88	0.93	0.88	0.44

9	25.54	66.44	Avicennia marina	12	7.4	63.88044	33.61	0.64	0.34	0.30	0.16
9	25.54	66.44	Avicennia marina	17	6.7	144.9473	72.82	1.45	0.73	0.68	0.34
9	25.54	66.44	Avicennia marina	16	6.2	125.6822	63.65	1.26	0.64	0.59	0.30
9	25.54	66.44	Avicennia marina	15	5.9	107.9789	55.15	1.08	0.55	0.51	0.26
9	25.54	66.44	Avicennia marina	16	4.8	125.6822	63.65	1.26	0.64	0.59	0.30
9	25.54	66.44	Avicennia marina	14	5.7	91.8023	47.32	0.92	0.47	0.43	0.22
9	25.54	66.44	Avicennia marina	21	4.9	238.2817	116.41	2.38	1.16	1.12	0.55
9	25.54	66.44	Avicennia marina	18	7.2	165.8078	82.67	1.66	0.83	0.78	0.39
9	25.54	66.44	Avicennia marina	21	4.8	238.2817	116.41	2.38	1.16	1.12	0.55
9	25.54	66.44	Avicennia marina	8	6	24.61109	13.66	0.25	0.14	0.12	0.06
9	25.54	66.44	Avicennia marina	27	8.1	430.3701	203.37	4.30	2.03	2.02	0.96
10	25.55	66.46	Avicennia marina	25	7.4	359.1005	171.43	3.59	1.71	1.69	0.81
10	25.55	66.46	Avicennia marina	46	7.7	1507.209	663.72	15.07	6.64	7.08	3.12
10	25.55	66.46	Avicennia marina	32	7.4	641.8252	296.55	6.42	2.97	3.02	1.39
10	25.55	66.46	Avicennia marina	29	9.1	509.1515	238.33	5.09	2.38	2.39	1.12
10	25.55	66.46	Avicennia marina	15	4.7	107.9789	55.15	1.08	0.55	0.51	0.26
10	25.55	66.46	Avicennia marina	18	4.8	165.8078	82.67	1.66	0.83	0.78	0.39
10	25.55	66.46	Avicennia marina	21	6.1	238.2817	116.41	2.38	1.16	1.12	0.55
10	25.55	66.46	Avicennia marina	14	3.2	91.8023	47.32	0.92	0.47	0.43	0.22
10	25.55	66.46	Rhizophora mucronata	7.5	5.1	8.60755	11.84	0.09	0.12	0.04	0.06
10	25.55	66.46	Avicennia marina	26	7.7	393.8087	187.03	3.94	1.87	1.85	0.88
10	25.55	66.46	Avicennia marina	10	6.7	41.60083	22.42	0.42	0.22	0.20	0.11
10	25.55	66.46	Avicennia marina	10	3	41.60083	22.42	0.42	0.22	0.20	0.11
10	25.55	66.46	Avicennia marina	38	8.3	961.5788	434.29	9.62	4.34	4.52	2.04
10	25.55	66.46	Rhizophora mucronata	10	5.6	18.34292	22.42	0.18	0.22	0.09	0.11
10	25.55	66.46	Rhizophora mucronata	11	5.3	23.56846	27.70	0.24	0.28	0.11	0.13
10	25.55	66.46	Avicennia marina	20	7.1	212.4442	104.46	2.12	1.04	1.00	0.49
10	25.55	66.46	Rhizophora mucronata	9	5.5	13.90357	17.75	0.14	0.18	0.07	0.08
11	25.53	66.48	Avicennia marina	18	6.9	165.8078	82.67	1.66	0.83	0.78	0.39

11	25.53	66.48	Avicennia marina	15	6.5	107.9789	55.15	1.08	0.55	0.51	0.26
11	25.53	66.48	Avicennia marina	13	5.1	77.11561	40.14	0.77	0.40	0.36	0.19
11	25.53	66.48	Avicennia marina	19	7.1	188.2964	93.22	1.88	0.93	0.88	0.44
11	25.53	66.48	Rhizophora mucronata	7	2.8	7.179204	10.16	0.07	0.10	0.03	0.05
11	25.53	66.48	Avicennia marina	20	6.2	212.4442	104.46	2.12	1.04	1.00	0.49
11	25.53	66.48	Avicennia marina	17	5.4	144.9473	72.82	1.45	0.73	0.68	0.34
11	25.53	66.48	Avicennia marina	6	3.4	12.50907	7.21	0.13	0.07	0.06	0.03
11	25.53	66.48	Rhizophora mucronata	7		7.179204	10.16	0.07	0.10	0.03	0.05
11	25.53	66.48	Avicennia marina	8		24.61109	13.66	0.25	0.14	0.12	0.06
11	25.53	66.48	Avicennia marina	21		238.2817	116.41	2.38	1.16	1.12	0.55
11	25.53	66.48	Avicennia marina	12.5	5.2	70.31906	36.80	0.70	0.37	0.33	0.17
12	25.52	66.51	Avicennia marina	11	3.9	52.0564	27.70	0.52	0.28	0.24	0.13
12	25.52	66.51	Avicennia marina	14	4.1/4.0	91.8023	47.32	0.92	0.47	0.43	0.22
12	25.52	66.51	Rhizophora mucronata	19	3.9	99.21799	93.22	0.99	0.93	0.47	0.44
12	25.52	66.51	Rhizophora mucronata	5	2.7	2.96319	4.81	0.03	0.05	0.01	0.02
12	25.52	66.51	Rhizophora mucronata	7	1.8	7.179204	10.16	0.07	0.10	0.03	0.05
12	25.52	66.51	Avicennia marina	15	2.8	107.9789	55.15	1.08	0.55	0.51	0.26
12	25.52	66.51	Avicennia marina	17	3.2	144.9473	72.82	1.45	0.73	0.68	0.34
12	25.52	66.51	Avicennia marina	19	1.6	188.2964	93.22	1.88	0.93	0.88	0.44