Participatory Forest Management Plan (PFMP)
Mulchand, Viran Forests of Tando Muhammad Khan & Thatta Districts

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Forest Conservation Committee
&
Forest & Wildlife Department
Government of Sindh, Pakistan

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Credentials

Writing and Data Analysis
Irfanuddin Ahmed Shaikh
Muhammad Sadiq Mughal
Shahzad Sadiq Gill
Hammad Gilani
Nadeem Bukhari

Data Collection Team
Community members of Mulchand & Viran Forests
Muhammad Sadiq Mughal
Irfanuddin Ahmed Shaikh
Muhammad Ali Uner
Hasnain Raza Dasti
Shoaib Kamboh
Gul Hassan Bhalkani

Peer Review
Riaz Wagan, CCF / Provincial Focal Person REDD+ Sindh
Arjumand Nizami

Technical assistance
Helvetas Swiss Intercooperation Pakistan
Forest & Wildlife Department, Government of Sindh

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<u>Endorsement</u>

1. **Chairman, Forest Conservation Committee**

2. **REDD+ Focal Person, Sindh Forest Department**

Disclaimer:

This Participatory Forest Management Plan is not a funding commitment from Sindh Forest and Wildlife Department. It is a proposal to be considered for future implementation of REDD+ Programme if funds are committed by the Sindh 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 Sindh will form the basis for implementing this Plan. Information on these aspects are suggestive and not binding on the Sindh Forest and Wildlife Department and any other stakeholders mentioned in this document.

وضاحت

سندھ کا محکمہ جنگلات، جنگلی حیات و ماہی گیری 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 سندھ کے محکمہ جنگلات، جنگلی حیات و ماہی گیری کے بنائے گئے انتظامی و مالی رہنما اصولوں کے تحت ہوگا۔

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Abbreviations

AGB	Above Ground Biomass
BGB	Below Ground Biomass
AGC	Above Ground Carbon
BGC	Below Ground Carbon
ANR	Assisted Natural Regeneration
FWD	Forests and Wildlife Department
FCPF	Forest Carbon Partnership Facility
GIS	Global Information System
GOP	Government of Pakistan
LPG	Liquid Petroleum Gas
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 form Deforestation and Forest Degradation
TFCC	Planning Commission Task Force on Climate Change
Ton/ha	Ton per hectare
10 BTTP	10 Billion Tree Tsunami Project

Executive Summary

Mulchand and Viran forest located in Tando Muhammad Khan and Thatta districts are selected by the Forest, and Wildlife Department (FD) in consultation with key stakeholders as pilot sites to demonstrate implementation of REDD+. This is part of a larger project being implemented by the Ministry of Climate Change, Government of Pakistan, and the Provincial Forest Department 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 REDD+ Readiness Phase. Pakistan has made substantial progress in meeting REDD+ readiness requirements. Pakistan has developed a National REDD+ Strategy in 2021. Whereas the Sindh Forests, and Wildlife Department has developed a Subnational / Provincial REDD+ Action Plan. This action plan is a decentralised framework for Sindh to proceed with REDD+ implementation. Preparation of Participatory Forest Management Plans is an important step to implement this action plan by integrating and implementing REDD+ activities in forest management in various socio-ecological systems.

The local stakeholders were engaged in preparation of this Participatory Forest Management Plan. The plan will guide the implementation 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 resource 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 determining an inclusive set of activities and successful implementation of REDD+.

The analysis indicates an increase of 555 ha in forest cover in the past 10 years at an average rate of 55.5 ha per year with sequestration potential of 3770 tonnes CO_2 eq annually. This increase is clearly a case of steady progress in forest cover. The activities included in this PFMP if properly implemented, will further enhance this trend 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 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 on 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 Sindh'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 implementation of activities described in the plan will be guided by annual operational plans to be developed by the provincial FD in consultation with the relevant stakeholders. The plan will be implemented by village and district committees to be notified by the provincial FD in consultation with the relevant stakeholders.

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خلاصہ

سندھ کے ضلع ٹنڈومحمد خان اور ضلع ٹھٹہ میں مولچند اور ویراں کے مقام پر واقع جنگل محکمۂ جنگلات، جنگلی حیات اور ماحولیات کی جانب سے منتخب کردہ مقامات میں سے ہیں جہاں پائلٹ سائٹ کے طور پر اہم شراکت داروں 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 لا گو 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 ذکر 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 مشترک 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 2021 ءمیں ایک قومی ریڈپلس حکمتِ عملی تیار کی ہے۔ جب کہ سندھ کے جنگلات، جنگلی حیات کے محکمے نے صوبائی سطح پر ایک جامع ریڈپلس ایکشن پلان تیار کیا ہے۔ سندھ 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 لا گو 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 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 داریے، جنگلات پر انحصار کرنے والی لوگوں کے حقوق کے استعمال، تنازعات کے حل اور مشترک فوائد کے حصول کا طریقہ 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 2011ء سے 2021ء تک ان جنگلوں کے رقبے میں 55.5 ہیکٹر سالانہ کی شرح سے اضافہ ہوا ہے جس سے سالانہ 3,770 ٹن کاربن ڈائی آکسائڈ کا انجذاب ہو رہا ہے۔ یہ اضافہ واضح طور پر جنگل کے رقبے میں مسلسل اضافے کی مثال ہے۔ اس PFMP میں شامل سرگرمیاں اگر مناسب طریقے سے لا گو 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 والے 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 تا کہ 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۔ یہ مشترک فوائد پر مبنی سندھ کے طریقہ 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 محکمے 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 لا گو کیا جائے گا اور اس کے بارے میں متعلقہ فریقین کی مشاورت سے صوبائی محکمۂ جنگلات کے ذریعے مطلع کیا جائے گا۔

1. 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 REDD+ readiness programme funded by the Forest Carbon Partnership Facility (FCPF) of the World Bank. The Khyber Pakhtunkhwa government is committed to pursue REDD+ under its Green Growth initiatives since 2013 to mitigate climate change effects. This Participatory Forest Management Plan (PFMP) is to demonstrate integration and implementation of REDD+ activities in forest management in various socio-ecological systems.

The PFMP translates 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 contribute to mitigate global climate change. REDD+ also provides mechanisms for the enhancement, measurement, and trade of carbon.

This PFMP provides information including description of site, GIS supported forest stock assessment, socio-economic situation, analysis of stakeholders with their interests and influences, emissions reduction scenarios, future interventions with indicative budget estimate, implementation mechanism and key challenges foreseen during implementation. The activities to maintain forest as carbon pool have been explained in this plan. It is expected that the implementation of the PFMP will enable the stakeholders of Mulchand and Viran Forests to trade carbon credits in the national and international markets in foreseeable future like any other product, by increasing and maintaining the carbon stock sequestered in the forest. The PFMP will thus act as a road map for implementation, monitoring, reporting and verification of resources improvement, and distribution of benefits among stakeholders.

The proposed activities include strengthening of social organization for communities to play a role in decision making such as designation of grazing and firewood collection areas, community watch and ward system, addressing land encroachment for agriculture, etc.

1.2 Objectives of PFMP

The specific objectives of this plan are as under:

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

1.3 Methodology

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-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 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. Viran and Mulchand was one of the two potential sites selected for preparation of PFMP in Sindh.

ii. Participatory Planning session were held with local stakeholders during the course of data taking and assessment. Local community of Mulchand and Viran participated in providing socio-economic data and sharing details on forest-community interaction. They also participated in collecting forest resource assessment data and 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. Participatory forest inventory was conducted in June 2021 to collect data from 11 sample plots selected in Viran-Mulchand 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 sampling on the map.

iv. Sample plots 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 17.84-meter 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 m2) 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, collected the sample in bags to find the oven dried biomass in the lab. The above-ground non-tree biomass including leaves, litter, grasses, etc. was collected from 0.56 m radius sub-plot and weighed and soil organic carbon values are taken from the national forest inventory, which was carried out in 2018 as the time required to detect a significant change in soil organic carbon is generally more than 10 years. The data from these samples was analysed for estimation of carbon stock. The coordinates of each sample plot were noted, and fixed-point photos taken during the inventory.

Viran Mulchand, Thatta District, Sindh

Sample Plots Location		
Id	X	Y
1	420319.7647	2764680.552
2	420745.4097	2764583.615
3	422274.586	2761868.105
4	424225.019	2769141.457
5	419309.7673	2766691.488
6	427254.9085	2760093.379
7	426594.7449	2762399.943
8	426245.2234	2763150.712
9	425648.7915	2763232.528
10	423216.5864	2759348.615
11	424442.0889	2764882.334
12	422312.108	2766112.756
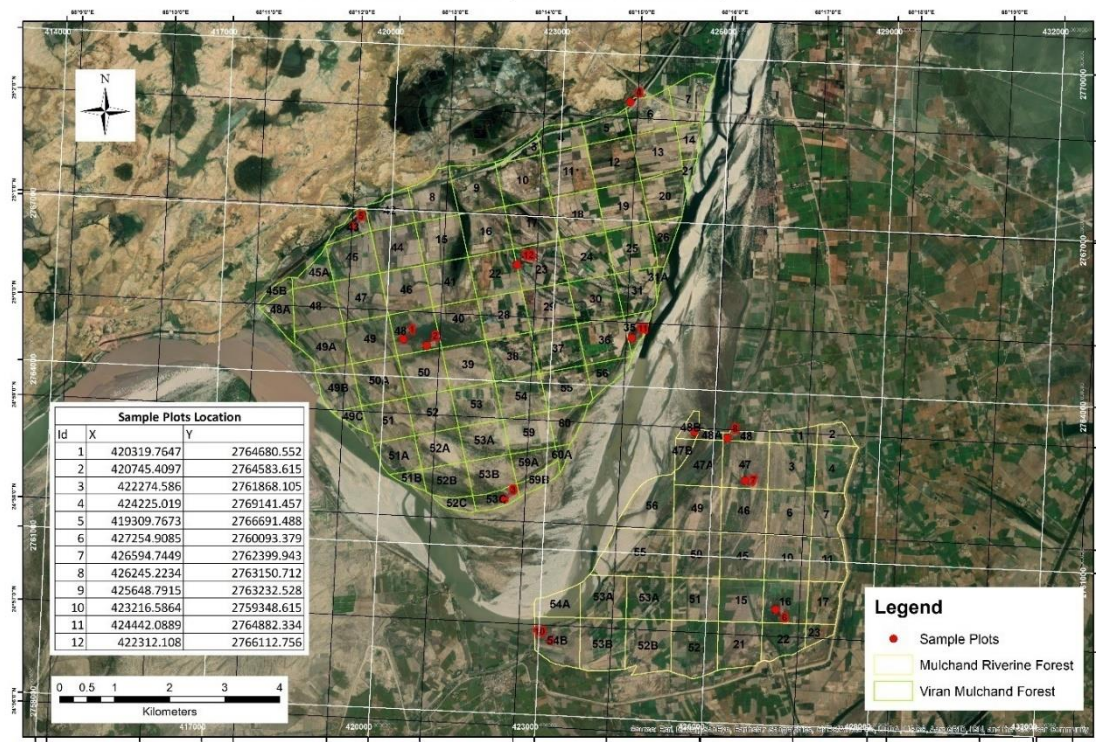
Figure 1. Location of sample plot

v. 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.

vi. The plan was sent for peer review and endorsement by the REDD+ focal person of the Sindh.

1.4 Policy Alignment

The objectives of this local PFMP are 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 (FAO, 2021). The REDD+ is a framework created by Conference of Parties (CoP) of UNFCC to incentivise developing countries either to reduce emissions of Green House Gases (GHGs) or to increase sink of CO2 in forest lands (UNFCC, 2021).

1.4.2 National Policies/commitments

Pakistan is an active member of the international negotiation forum on climate change and making efforts to reduce emission reduction suiting to the priorities of its citizens (GCISC, 2018). Pakistan's report on intended Nationally Determined Contributions seeks 20% reduction of the current national GHG emissions (GOP, 2017). From 2016 onwards, continued investments in nature-based solutions (Nbs) through the largest ever afforestation programs in the history of the country Ten Billion Tree Tsunami Program (TBTTP) will sequester 148.76 MtCO2e emission over the next ten years.

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. Mitigation in the forestry sector entails 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 state forests but forests dependent communities and the whole society in general. The impacts of climate change will be decreased productivity, changes in species composition, reduced forest area, unfavourable conditions for biodiversity, higher flood risks and the like, as portrayed in the Planning Commission Task Force on Climate Change (TFCC) Report (GoP, 2010).

Pakistan has also approved its National Forest Policy 2015 with a goal of expansion, protection, and sustainable use of national forests, protected areas, natural habitats, and watersheds for restoring ecological functions, improving livelihoods and human health in line with the national priorities and international agreements.

1.4.3 Provincial policies and commitments

The climate change policy of Sindh acknowledges the role of forests in mitigation and adaption and most particularly to improve resilience of communities and their livelihoods in future scenarios of changes in local climate. The activities mentioned in this PFMP to manage Viran & Mulchand Forests align well with the actions suggested in the climate change policy of Sindh for managing forests.

2. Participatory Forest Management Planning

2.1 Ecological data

2.1.1 Location

Sujawal District falls on the left Bank of River Indus downstream Kotri Barrage. Whereas Thatta District falls on the right bank of river Indus downstream Kotri Barrage. Both Thatta and Sujawal Districts are part of Hyderabad Civil division. The PFMP site consists of two locations Mulchand and Viran forests. Mulchand Forest is part of Afforestation Division, Tando Muhammad Khan on the left bank of Kotri downstream falling within Sujawal Civil district. Whereas Viran Forest is a riverine forest spread over 8493.5 acres on the right bank of Kotri downstream in Thatta District. Mulchand has a total Area of 5172.7 acres and is located at 24°57'18" Latitude and 68°15'59" Longitude. Viran Forest lies at 24°59'25" Latitude and 68°13'46" Longitude. Viran forest inundates during high Abkalani/Floods.

2.1.2 Site description

The PFMP sites of Viran and Mulchand forests fall within the dry tropical zone, the climate is harsh in summer and mild in winter. Summer temperature touches up to 50°C and goes down up to 8°C during winter.

A. Mulchand Forest

The basic unit area of Mulchand I.P. is 160 acres compartment. During past many years the problem of forcible encroachment was rampant in the forest but as a result of the interventions of Honourable apex / superior courts, this menace of encroachment has almost ended, and all the forest areas are retrieved and are being brought back under forest plantations through Annual Development Plan and other Federal Funded Programmes in phases. The impact of global climate change is also visible in this region, rise and fall in the temperature at an unexpected level, rainfall during the monsoon and out of season is also being witnessed during last many years.

B. Viran Forest

Viran is an inundation forest during high Abkalani /floods season. Viran has also been under heavy pressure of encroachments in the past, but as a result of the interventions and judgement of the honourable superior courts, the areas from the encroachers have been retrieved and is being planted through lift water in the suitable blank areas under the Federal Funding (Green Pakistan Programme) and provincial Annual Development Plan. It is likely that this forest along with Mulchand will be able to have good carbon stock during next 10 years if the situation goes on as it is. Basic area of the unit here too is 160 acres compartment like in Mulchand Riverine Forest.

2.1.3 Species

The climax tree vegetation area is Kandi (*Prosopis cineraria*) whereas Babul (*Acacia nilotica*) has been encouraged and introduced as sub climax specie of the region being desirable from economic and marketing point of view. *Acacia nilotica* is planted during Abkalani / flood season.
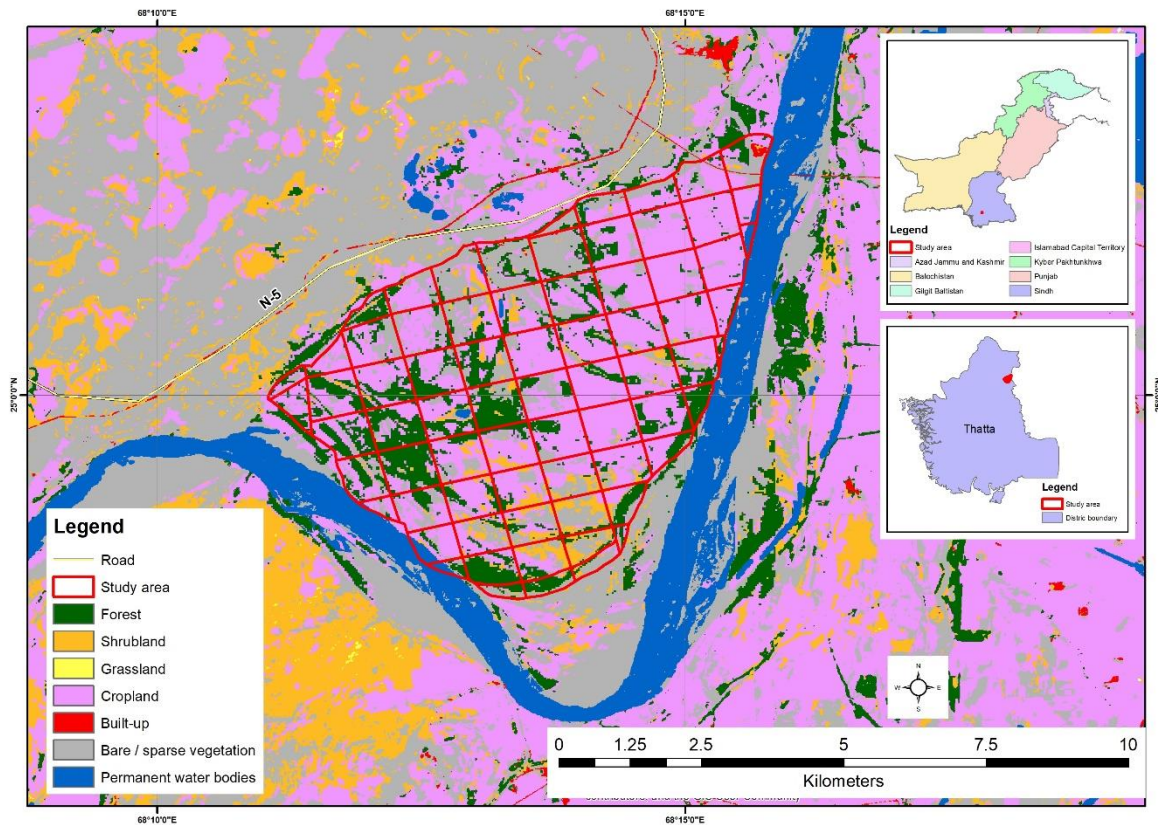
Figure 2. Land Use map of Mulchand, Viran Forest

2.2 Socio-economic data

Socio-economic data of Malchand and Viran forests was collected during Focus Group Discussion and key informant interviews. Summary of the data is given in **Annex 1**.

2.2.1 Demography

Sajawal district has a population of 696,262 and Thatta 803,789. Mulchand has a population of 2013 and Viran has 2172. Mulchand Forest of Sujawal District is about 48 kms from major town Sujawal. Viran Forest of Thatta District is 41 kms away from major town Thatta. The tribal composition is different in both the forest sites. Shoro, Mallah, Gandro tribes live in Viran whereas Palejo, Mallah, Gandro and Jakhra tribes live in Mulchand.

2.2.2 Health and education

The literacy rate of these areas is below 30%. A Rural Health Center is located in Jhirk Town adjacent to Viran Forest of Thatta District and Basic Health Unit in Bano Town of Sujawal District. Education facilities up to high school level are available in the government sector at Jhirk Village of Thatta District and Bano Village of Sujawal District. Both of the village are adjacent to the PFMP sites.

2.2.3 Livelihood sources

Overall: Mostly farmers are smallholders with land holding between 10 to 20 acres. Big landholders with more than 100 acres of land are also there in very small number. Wheat and paddy are the major Rabi and Kharif crops of Sujawal and Thatta districts. Vegetable production is also a major source of income for them and is being practiced specially in Thatta district. The major markets of Karachi and Hyderabad are near to them. Landless people reside in katcha constructed huts in the forests. They

work as daily wage labour in the local cement and sugar factories and a section of population is also involved in hotel industry in the local town. Very small number of inhabitants is working abroad as an overseas employee.

Livelihood Mulchand: The livelihood of the local inhabitants of Mulchand Forest is agricultural labour but their engagement with agriculture activities is conditional with the harvesting seasons which are Rabi & Kharif. After the harvesting seasons are over, they mostly work as daily wage labours in the nearby town or in the transport field. Part of the local villagers exclusively depend on rearing of livestock in the forest and collection of firewood/timber from the forests and further transportation to the market. During the era of agroforestry leases, which have just been stopped in the wake of court orders, the local inhabitants used to work as local farmers in the lease areas allotted to the lease holders of the forest for five years term.

Livelihood Viran: The people living in and around Viran forest are mostly involved in agricultural practices or work as daily wage labourers, whereas a segment of people is also involved in business as shopkeepers and vendors. The literacy ratio is very low up to primary or secondary level. The inhabitants of Mulchand Forest are involved as harvesting labour in agriculture. After the harvesting seasons are over, they mostly work as daily wage labour in the nearby town or in the transport sector. Part of the local villagers exclusively depend on rearing livestock in the forest and collection of firewood/timber from the forests and sell in the market. During the era of agroforestry leases which has just been stopped in the wake of court orders, the local inhabitants used to work as local farmers in the lease areas allotted to the lease holders of the forest for five years term.

2.2.3 Dependence on forests
Since Mulchand and Viran are Government Reserved Forests, as such the local communities have no rights over the forest produce or land except the rights of grazing in the open areas. Wood from these species has high calorific value for cooking. There are no alternative fuels, or they are expensive. Wood/coal is the major source of energy for the local inhabitants of in and around forests. Electricity is also available in the major towns around the forests (e.g., Bano and Jhirk of Sujawal and Thatta districts respectively). Natural gas is available in the district headquarters like Thatta and Sujawal.

2.2.4 Forest rights
Officially, there is a watch and ward by Forest Department and timber harvesting is based on permits issued by Forest department. Practically, however there are no control on timber harvesting in the forests and no watch and ward system is practiced to strictly curbs wood cutting. Illegal encroachment for cultivation and illegal cutting for firewood is leading to degradation.

2.2.5 Changes in forests over time
During the last 30 years, there has been a huge increase in illegal encroachment for cultivation, illegal cutting for timber and firewood and degradation in the forest cover due to less flood water. The minor forest products have decreased. People do not have alternative fuel, or it is very expensive for them. Therefore, firewood extraction has also been very high causing deterioration to the forests.

2.2.6 Stakeholder
The description of the main stakeholders is given below:

A. **Forest department**
   The forests of Viran and Mulchand are government Reserved Forests as such the rights local communities are limited. The department, therefore, is the key stakeholder for this forest site. Decisive responsibility lies on the shoulders of the forest department in its conservation, further propagation, and overall management. The department's role in significant in

identifying the potential sites for raising and maintaining the forest plantations raised through traditional regeneration operations carried out during flood season or raising of forestry plantations through lift irrigation inside the riverine forests. The forest set up also suffers due to unqualified staff and shortage of staff in the field.

The following institutions are relevant for management of above Forests.

B. Community forest institutions

During the course of analysis, it was observed that the local communities have now become more interested in protection of forestry growth realizing the importance of REDD+ in the overall uplift of socioeconomic conditions of the local communities. The local communities can play an important role in conservation. The cooperation and contribution made by the local communities and their coordination with the managers of the Forest Department carries immense importance and value in fulfilling these objects and goals.

C. Community at large / users

The main sources of earnings for landless local communities are the removal and illegal theft of forest trees to earn their livelihoods. Their role is critical to achieve success of REDD+ objectives. The women of the area do not play a major role in the management of forest. However, grazing of livestock is being supervised by the older women in the forest. In addition to this, the exercise of collection of fuelwood is undertaken by them to meet their domestic requirement and selling wood in the towns near the forests for cash.

D. Panchayat

The local people have formed their owned Panchayat committee based on their cast and creeds. The conflicts arising if any are taken up and discussed in these tribal based Panchayat under the arbitration through the notables of the areas. Any untoward incident of serious nature is either settled down during the internal negotiations between the local villagers through their cast-based panchayat for arbitration. In case issues are not settled, everybody is allowed to knock the door of law i.e., Police/Courts.

Forest, land and property related issues and problems are taken before the local elites or elected representatives for redressal. Any untoward incident is either settled down during the internal negotiations between the local villagers through arbitrations. In case such issues are not settled, people resort to formal justice system.

E. Forest Protection Committee

There are no formal/notified Village Conservation Committees in vogue. Since the nature of the forests is purely government owned, no formal role is played by the local committees in the management of forests. However, under the REDD+ programme the local communities have been mobilized to play their desired role in the process of conservations and further propagation of the natural resource on sustainable basis. Forests protection committee are slowly becoming active at the district level. These committees are functional and contributing their role in controlling forest wood theft incidents and attempts of unauthorized encroachment by the local people. These committees may be further empowered to play a constructive role in forest enhancement.

2.2.7 Stakeholder Analysis

The stakeholder analysis (**Annex 2**) was conducted with the purpose to obtain the information about major actors of forests, their influence, interest, contribution on forest resource utilization,

management of forest and their role in restoring the forest. The stakeholder analysis was conducted at two levels. (A) The influence and interests of stakeholders on the management of forest and (B) the influence and interest of the stakeholder on carbon pools. The analysis was conducted to determine as to what the stakeholders are contributing and what is their role in the management of forest.

Viran and Mulchand are government reserved forests as such the rights local communities are very much limited. However, their role and influence in the conservation and protection of forests cannot be denied. They may set the goals and achievements under REDD+ Programme in maintaining the carbon pools. The cooperation and contribution made by the local communities and their coordination with the managers of the Forest Department carries immense importance and value in fulfilling these objects and goals. Forest department can play handsome role in providing and helping the local communities with the alternative sources of energies and fuelwood so that their dependence on forest is reduced and carbon pools are well conserved and maintained throughout.

The stakeholders and their roles identified were further analysed by using the influence-interest matrix to explore their type and level of influence and interest in forest management and carbon pools. **Table 1** helps in understanding the actual influence and interests and may help identifying the need for increasing the involvement of specific stakeholders. It was found that the Forest Department and local community with irrigated land inside the forest are the major players with greater interest in forest management. The households with legal rights for grazing and collection of forest products but no irrigated land inside the forest and some of these who also harvest wood to sell for cash income fall under neglected players and need special attention to safeguard their interest. The law enforcement agencies also occasionally contribute to forest protection when called in events of forest offenses, but since the protection of forest is not their core area of responsibility they fall in the category of marginal players in the matrixes. The Ministry of Climate Change has a high interest, but until now direct little influence on local forest management and carbon pools on ground. This may change through REDD+ programme and the distribution of resources for carbon sequestration.

The Revenue department deals with matters related to land as records and decision related to land are entrusted with this department. The Revenue department has little interest in forest management and only get involved when there is a dispute regarding land ownership. Therefore, it falls in the category of marginal players.

Table 1. Interest influence matrix of forest management and carbon pools

	Neglected players: Need special attention to safeguard their interests	**Major players:** Need to be fully involved
INTEREST Height Score 2 and 3	Law & Enforcement Agencies, Illegal Harvesters	Forest Department Local community members with use rights and irrigated land and settlements inside the forest Local community with use rights and no irrigated land and settlements inside the forest
	Marginal players Low priority	**Risk factors** Need to be addressed
INTERST Low Score 0 and 1	Law enforcement agencies	Revenue department
	INFLUENCE Low Score 0 and 1	**INFLUENCE High** Score 2 and 3

The major players in forest management are those having major interests and influence on using and protecting carbon pools. The stakeholders themselves may not be aware of this since the concepts are new. They may need awareness raising about this, especially of the importance and benefits of management of carbon pools.

2.2.8 Analysis of drivers of deforestation, forest degradation and barriers to enhancement
As described earlier, Viran and Mulchand Forests are Reserved forests and the land and Forest belong to the government. Only grazing rights are admitted in the forest. In the area, the demand for fuelwood is more than the annual increment of forest. Also, the conversion of forest land for Agriculture is a major issue. The illegal extraction of timber and firewood from forests by local offenders is common to supplement their livelihoods. The analysis of major drivers of deforestation and forest degradation is provided in **Table 2**:

Table 2. Major drivers of deforestation and forest degradation and barriers to enhancement

Serial Number	Major drivers of degradation	Underlying causes	Degree of severity*
Deforestation			
1	Conversion of land for Agriculture	1. Lack of Alternatives 2. Poverty 3. Weak enforcement of rules	3
Forest Degradation			
1	Firewood extraction	1. No Alternative source of energy 2. Poverty, lack of affordability	3
2	Timber theft for selling in the market	1. To gain financial benefits 2. Weak enforcement of rules	3
3	Grazing	1. No demarcation of designated grazing areas 2. Small landholding to support fodder	2
Barriers to Enhancement			
1	Availability of Planting stock	1. Resource allocation for raising nurseries	1
2	Availability of Water	1. Reduction in irrigation water availability	3
Degree of severity: 1: low 2: medium 3: high			

Photo 1. Meeting with Communities During Social Economic Survey

Photo 2. Data Collection of Mulchand & Viran Forest

2.3 Carbon stock assessment of Viran-Mulchand Forests

2.3.1 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. The tree species level carbon stock is given in **Annex 3**. Based on this data individual plots level carbon stock values are given in **Table 3**. The estimated stock of carbon per hectares (ha) was then used to estimate the total carbon stock in the selected site of Viran-Mulchand Forest.

Table 3. Plot level above and below ground carbon stock

Plot No.	Average AGC (tonnes/ha)	Average of BGC (tonnes/ha)
1	0.74291312	0.18572828
2	2.643556738	0.660889184
3	0.051772813	0.012943203
4	0.396865402	0.099216351
6	0.046577389	0.011644347
7	1.19769784	0.29942446
8	0.321909079	0.08047727
9	0.670154507	0.167538627
10	2.002073947	0.500518487
11	10.66880152	2.667200379
Average	**1.219010059**	**0.304752515**

2.3.2 Forest Cover Assessment

The change in forest cover was assessed by using Landsat multispectral 30m spatial resolution satellite images on the path (152) and row (043) 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 555 ha in forest cover in the past 10 years at an average rate of 55.5 hectare (ha) per year (**Table 4**). The amount of carbon trapped in 5 carbon pools (above ground biomass, below ground biomass, soil organic carbon, deadwood and litter on forest floor) is here grouped into three carbon pools (above ground, below ground and soil).

Table 4. Forest covers assessment (2011 -2021)

No	Landsat Satellite Sensor	Landsat data acquisition	Forest Cover (ha)
1	Landsat-8	2021-11-04	750
2	Landsat-5	2011-05-02	195
Change in Forest Cover in last 10 years			555
Per year change in forest cover			55.5

Table 4a provides forest cover change in business-as-usual trend and 200% enhancement in addition to current forest cover increasing trend observed in the past 10 years. In Business-as-usual scenario forest cover is already increasing at a rate of 55.5 ha per annum. The total area under PFMP is 3,546 ha, based on the area available for increasing forest cover, in discussion with Forest department it is proposed to enhance the current forest cover increase by 200% per annum for the next 10 years thus increasing the forest cover to 2470.5 ha by the year 2032.

Table 4. a. Forest Cover Scenarios based on trend in the past 10 years

Rate of change per year	55.50	111.00
Year	Forest Cover (ha) - Business as usual	Forest Cover (ha) - 200% increase
2011	195.00	
2012	250.50	
2013	306.00	
2014	361.50	
2015	417.00	
2016	472.50	
2017	528.00	
2018	583.50	
2019	639.00	
2020	694.50	
2021	750.00	
2022	805.50	805.50
2023	861.00	972.00
2024	916.50	1138.50
2025	972.00	1305.00
2026	1027.50	1471.50
2027	1083.00	1638.00
2028	1138.50	1804.50
2029	1194.00	1971.00
2030	1249.50	2137.50
2031	1305.00	2304.00
2032	1360.50	2470.50

These scenarios are presented visually in figure 3.
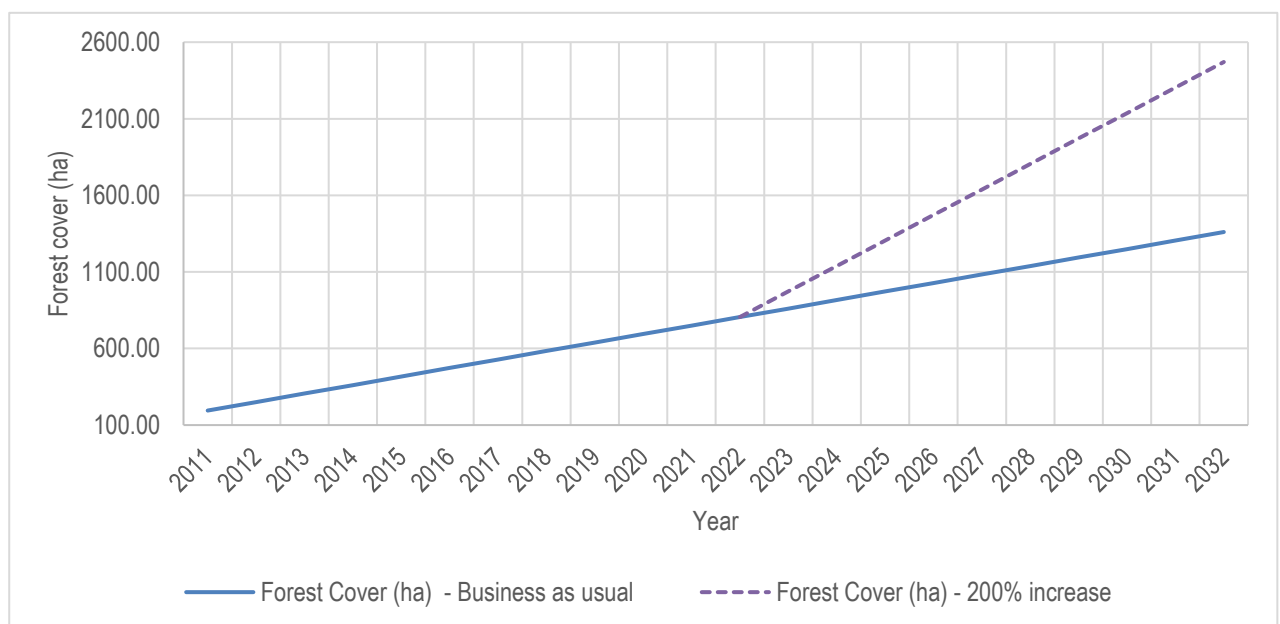
Figure 3. Forest cover scenarios

2.3.3 Total Carbon stocks estimation

The field data and biomass collected from 11 samples was used to calculate Above Ground Biomass (AGB) using locally developed allometric equations (Chave et al., 2014) for 2010-2021 (**Table 5**). In Viran-Mulchand forest, the cumulative carbon stock in five carbon pools (above, below, deadwood, litter and soil) was estimated to as 3,621.71 tonnes of Organic Carbon (Corg) back in 2011 which increased to 13,902.40 tonnes in 2021. This increase corresponds to the increase in forest cover from 195 ha in 2011 to 750 ha in year 2021 (**Figure 4 and Table 5**). The year-wise increase in carbon stock is provided in **Table 6.**

Figure 4: Forest Cover Maps used for Change Analysis
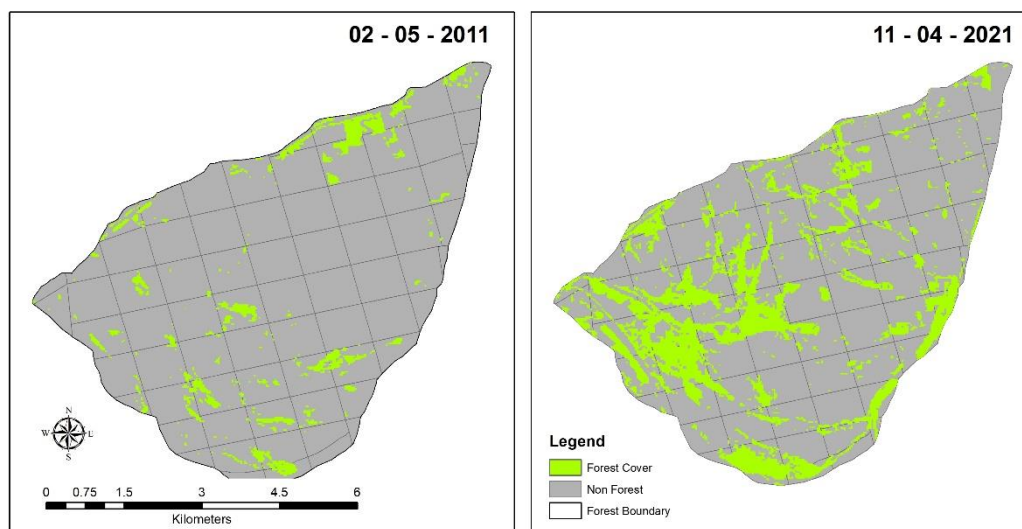
Table 5. Carbon stock estimation (2011-2021)

Carbon pool	Mean carbon stock (ton C stock per hectare)	Forest Cover (ha)	Total stock (ton C stock)	CO_2 (ton CO_2 eq)
2011 (2011-05-02)				
Above	1.22		237.71	
Below	0.30		59.43	
Deadwood	0.00	195	-	
Litter	0.05		9.57	
Soil*	17		3,315.00	
Cumulative			3,621.71	13,279.59
2021 (2021-04-11)				
Above	1.22		914.26	
Below	0.30		228.56	
Deadwood	0.00	750	-	
Litter	0.05		9.57	
Soil	17		12,750.00	
Cumulative			13,902.40	50,975.45
Rate of change per year				
2020-2010		**55.50**	**1,028.07**	**3,770**

* Soil Carbon Value taken from NRO Inventory

2.3.4 CO_2 emissions reduction Scenarios for deforestation

This section presents the future CO_2 sequestration scenarios applying 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 Viran Forest is 3,770

tonnes CO_2 eq per annum because of forest cover increase which will be boosted further by 1,885 tonnes annually with 50% enhancement. **Figure 5** shows the enhancement trend under different scenarios.

Table 6. CO_2 sequestration trend in business as usual and 50% enhancement scenarios

Rate of change per year	3770	1885
Year	**Sequestration from forest enhancement (ton CO_2 eq) -Business as usual**	**Sequestration from forest enhancement (ton CO_2 eq) - REDD+ with 50% enhancement**
2010	3770	
2011	3770	
2012	3770	
2013	3770	
2014	3770	
2015	3770	
2016	3770	
2017	3770	
2018	3770	
2019	3770	
2020	3770	
2021	3770	3770
2022	3770	5654
2023	3770	7539
2024	3770	9424
2025	3770	11309
2026	3770	13194
2027	3770	15078
2028	3770	16963
2029	3770	18848
2030	3770	20733
2031	3770	22618
2032	3770	24502
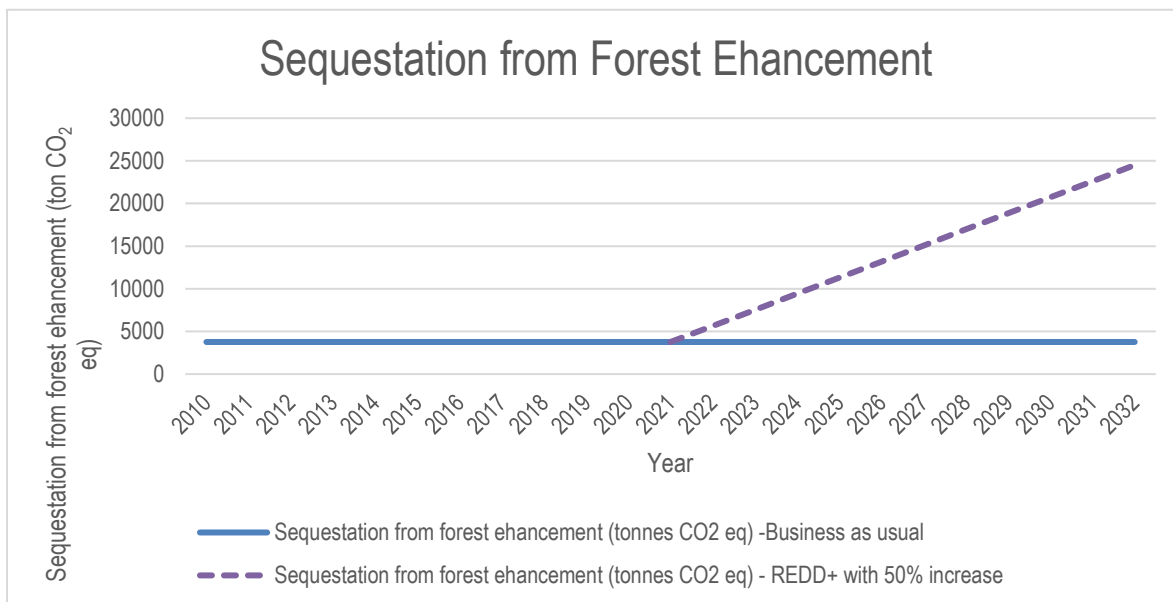
Figure 5. Emission reduction scenario – deforestation

2.3.5 CO₂ 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 4,186with a growth rate of 2.49 per annum. The fuelwood and timber consumption per capita per annum was calculated as 0.591 m^3 and 0m^3, respectively. Based on this data emissions from forest degradation are calculated and presented in the table 7.

Table 7. Forest degradation emissions trend

Year	Population	Fuelwood Consumption (FC) (m³/year)	Timber Consumption (TC) (m3/year)	Fuelwood Emissions[1] (FC*D*BEF2*CF*44/12) (ton CO_2 eq)	Timber Emission (TC*D*BEF2*CF*44/12) (ton CO_2 eq)	Emission from Forest Degradation (ton CO_2 eq) - Business as usual
2011	3598	2127	0	3049	0	3049
2012	3690	2181	0	3127	0	3127
2013	3784	2237	0	3207	0	3207
2014	3881	2294	0	3288	0	3288
2015	3980	2352	0	3372	0	3372
2016	4082	2412	0	3459	0	3459
2017	4186	2474	0	3547	0	3547
2018	4290	2536	0	3635	0	3635
2019	4397	2599	0	3726	0	3726
2020	4507	2663	0	3818	0	3818
2021	4619	2730	0	3914	0	3914
2022	4734	2798	0	4011	0	4011
2023	4852	2867	0	4111	0	4111
2024	4972	2939	0	4213	0	4213
2025	5096	3012	0	4318	0	4318
2026	5223	3087	0	4426	0	4426
2027	5353	3164	0	4536	0	4536
2028	5487	3243	0	4649	0	4649
2029	5623	3323	0	4765	0	4765
2030	5763	3406	0	4883	0	4883
2031	5907	3491	0	5005	0	5005
2032	6054	3578	0	5129	0	5129

[1]Wood Density (D)

Acacia nilotica	0.69
Calotropis procera	0.23
Prosopis juliflora	0.8
Tamarix dioica	0.64
Ziziphus jujuba	0.583
Average	0.59
Biomass Expansion Factor: BEF2	1.35 (IPCC Table 3A.1.10)
CF = carbon fraction of dry matter	0.5

2.3.6 Net Emissions from Deforestation and Forest Degradation

The **Table 8** below provides a net CO_2 sequestration scenario based on 50% enhancement to inclining trend in CO_2 sequestration due to forest cover increase and reducing emissions from forest degradation starting with 10% reduction in the initial years then gradually reaching 50% reduction by the 10th year in an incremental manner. In this scenario, the net emissions from the forest will continue declining due to cumulative effect of increasing forest cover and reduction in forest degradation due to REDD+ implementation.

Table 8. Sequestration scenario from forest enhancement and reducing degradation

Rate of change per year	3770					1885	
Year	Emission from deforestation (tonnes CO₂ eq) -Business as usual	Emission from Forest Degradation (tonnes CO₂ eq) - Business as usual	Total Emissions from deforestation and Forest Degradation (tonnes CO₂ eq)	10-50% Reduction in Degradation emissions (ton CO₂ eq)	Net emissions from degradation (ton CO₂ eq)	Sequestration from forest enhancement (ton CO₂ eq) - REDD+ with 50% enhancement	Net total emissions from forest enhancement and reducing degradation (ton CO₂ eq) - REDD+ implementation
2011	3770	3049	-721				
2012	3770	3127	-643				
2013	3770	3207	-563				
2014	3770	3288	-481				
2015	3770	3372	-397				
2016	3770	3459	-311				
2017	3770	3547	-223				
2018	3770	3635	-134				
2019	3770	3726	-44				
2020	3770	3818	49				
2021	3770	3914	144				144
2022	3770	4011	241	401	4011	5654	1643
2023	3770	4111	341	411	3700	7539	3839
2024	3770	4213	444	843	3371	9424	6053
2025	3770	4318	549	864	3455	11309	7854
2026	3770	4426	656	1106	3319	13194	9874

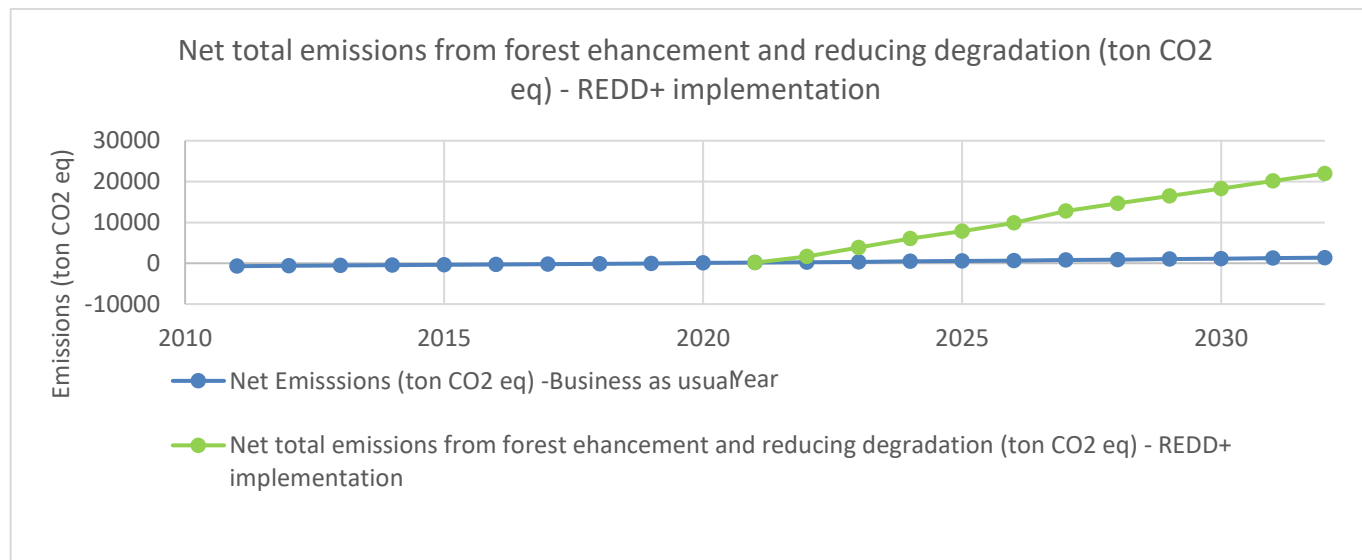| Rate of change per year	3770					1885	
Year	Emission from deforestation (tonnes CO$_2$ eq) -Business as usual	Emission from Forest Degradation (tonnes CO$_2$ eq) - Business as usual	Total Emissions from deforestation and Forest Degradation (tonnes CO$_2$ eq)	10-50% Reduction in Degradation emissions (ton CO$_2$ eq)	Net emissions from degradation (ton CO$_2$ eq)	Sequestration from forest enhancement (ton CO$_2$ eq) - REDD+ with 50% enhancement	Net total emissions from forest enhancement and reducing degradation (ton CO$_2$ eq) - REDD+ implementation
2027	3770	4536	766	2268	2268	15078	12810
2028	3770	4649	879	2324	2324	16963	14639
2029	3770	4765	995	2382	2382	18848	16466
2030	3770	4883	1114	2442	2442	20733	18291
2031	3770	5005	1235	2502	2502	22618	20115
2032	3770	5129	1360	2565	2565	24502	21938

Figure 6. Sequestration scenarios – forest enhancement and reduced degradation

3. Proposed Interventions

Several interventions have been proposed here based on the participatory forest inventory, socio-economic data, drivers of deforestation and stakeholders' analysis. The analysis ascertained that in order to achieve effective results for sustainable forest management and incremental Carbon sequestration, the activities required under this PFMP need to cater to the Mulchand and Viran Forest issues. The following interventions are, therefore, suggested for managing the Mulchand and Viran Forests as a REDD+ pilot site:

In order to address the drivers of Deforestation, **Conversion of land for Agriculture**, the following interventions are proposed

Land Conversion for Agriculture

1. Community based watch and ward / chowkidari system, appointment of community forest guards (four)
2. Training /exposure of forest officials and community in accordance with their roles in REDD+
3. Repair & maintenance Jeep-able compartment Roads (27Km in 10 Years) for inspection & supervision of Planting Activities.
4. Construction of Huts. (02 Nos. in 2nd Years only)

For addressing drivers of Degradation, **Firewood extraction, grazing and Timber theft for selling in the market**, following interventions are proposed:

Firewood extraction

1. Identify designated areas for firewood collection and planting fast growing fuelwood species
2. Support people with fuel efficient techniques / cooking stoves and solar energy
   a. Promotion of alternate energy sources
   b. Promotion of energy efficiency

Timber theft for selling

1. Promotion of alternative sources of livelihoods (e.g., entrepreneurship in energy efficiency, solar tech., etc)
2. Community based watch and ward / chowkidari system, appointment of community forest guards (four)
3.

Grazing Pressure

1. Identify and designate areas for grazing (Fencing and re-stocking)

For addressing barriers to enhancement, **planting stock and water availability**, following interventions are proposed:

Planting Stock Availability:

1. Enhancement site with dry afforestation technique including species like *Acacia Nilotica* (no need to plan nurseries), Planting in Blank Area (1110 Ha in 10 Years)

Water Availability:

1. Installations of Solar energy operated lift Pump & Bores (15 Nos. in 10 Years)
2. Pay of lift Pump Operator-cum-chowkidar (15 Persons for 10 Years)

Supporting activities:

1. Strengthen forest protection committee (is this the name indicated in the socio-economic data?) – this committee will also supervise grazing and firewood collection
2. Awareness raising dialogues with communities
3. Preparation for implementation of endorsed PFMP and periodical follow up meetings (communities and other stakeholders)
4. Notification of the relevant forums
5. Develop funding proposals to generate funding for PFMP activities

The total indicative budget of the PFMP implementation is **PKR 286,477,500.00**
(See justification of higher budget in the last paragraph in the section on introduction).

Ten years budgeting and operational planning of the PFMP is given in **Table 9**.

Table 9. Indicative operational plan and 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		
1.	Preparation for implementation of PFMP and periodical follow up meetings (community and other stakeholders.	Meetings	50,000	3	1	1	1	3	1	1	1	1	3	16	800,000
2.	Notification of forums	Notification	0	1	-	-	-	-	-	-	-	-	-	1	0
3.	Community based watch and ward / chowkidari system, appointment of community forest guards (four)	Guard	100,000	2	2	2	2	2	2	2	2	2	2	20	2,000,000
4.	Training /exposure of forest officials and community in accordance with their role in REDD+	Training exposure	200,000	1	2	2	-	-	-	-	-	-	-	5	1,000,000
5.	Enhancement site with dry afforestation technique / Planting in blank areas	Hectare	125,000 With 10% annual escalation	111	111	111	111	111	111	111	111	111	111	1110	219,187,500
6.	Installation of Solar energy operated lift pumps & Bores		1,500,000	1	2	1	2	1	2	1	2	1	2	15	22,500,000
7.	Pay of Lift Pump Operator-Cum-Chowkidar		25000 per month (300,000 per Year)	1	2	1	2	1	2	1	2	1	2	15	24,300,000
8.	Repair & maintenance Jeepable Compartment Roads	Kilometre	120,000	-	3	3	3	3	3	3	3	3	3	27	3,240,000

S.N.	Activity	Unit	Unit cost	Operational Plan										Total units	Total cost
				1	2	3	4	5	6	7	8	9	10		
9.	Identify and designate areas for grazing (Fencing and re-stocking)														
10.	Identify designated areas for firewood collection and planting fast growing fuelwood species														
11.	Construction of Huts	No.	1,000,000	-	2									2	2,000,000
12.	Community / youth motivational events	Events	50,000	2	2	2	2	2	2	2	2	2	2	20	1,000,000
13.	Trainings to promote alternative sources of livelihoods (e.g., entrepreneurship in energy efficiency, solar tech., etc)	Training	500,000	-	-	1	-	1	-	1	-	-	-	3	1,500,000
14	Support people with fuel efficient techniques / cooking stoves and solar energy	Trainings, Demonstrations and Entrepreneurs	1,000,000	1	1	1	1	1						5	5,000,000
15.	Develop funding proposals to generate funding for PFMP activities	Proposals	1,000,000	-	1	-	-	-	-	-	-		-	1	1,000,0000
\multicolumn{14}{c}{Total}														286,477,500

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4. Implementation Mechanism for the PFMP

4.1. Resources for activities

The Sindh Forest & Wildlife Department as custodian of the forest and having linkages with national and international funding sources will take a lead this activity. The key stakeholders identifying in this plan, especially the Sindh Forest & Wildlife Department will look for resources for implementation of activities identified in this plan. The Sindh Forest & Wildlife Department will submit proposals for potential funding sources including the Ministry of Climate Change, Public Sector Development Programme (PSDP), international donors and private sector investors.

4.2. Suggested institutional mechanism for implementation of activities

The Sindh Forest & Wildlife Department in consultation with the community will decide on formation/notification of suitable institutional mechanism for implementation of this plan. It is suggested that village and district level REDD+ implementation committees notified by the Sindh Forest & Wildlife Department will oversee implementation of activities. The notifications will include description of responsibilities of Sindh Forest & Wildlife Department, the respective communities, and any other relevant stakeholders.

VRIC: In consultation with the community the Sindh Forest & Wildlife Department may notify two committees. A Village REDD+ Implementation Committee (VRIC) and the District REDD+ Implementation Committee (DRIC). The VRIC may consist of representative from the community and the Sindh Forest & Wildlife Department. The community will nominate representatives for the VRIC to represent them. The representatives of the community will be responsible to ensure and harness community support for the implementation of activities. Representatives of the households having land and settlements inside the forest will be crucial for success of REDD+ activities. The Sindh Forest & Wildlife Department will assign duties of a Rang Forest Officer to represent the department in the VRIC. The VRIC may be Co-chaired by a community member nominated by the community and the RFO.

DRIC: The VRIC will be supported by a District level REDD+ Implementation Committee (DRIC) chaired by the Deputy Commissioner and consisting of Divisional Forest Officer, REDD+ Focal Person and two members nominated by the community including the Chair of the VRIC. The responsibility of the DRIC will be to monitor progress on implementation of activities and harnessing 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 Mulchand & Viran 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. Due to the income the stakeholders can be expected to value standing trees than cut for other uses.

Since the community will be reducing harvest of fuel wood, restrict grazing 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 FPWE Department from trophy hunting programme in

Gilgit-Baltistan. A specific distribution of benefits in case of REDD+ programme is yet to be developed by the Sindh Forest & Wildlife Department which will form basis for sharing of benefits.

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 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 on 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 Sindh's benefit sharing mechanism.

5. Conflict and grievance redressal mechanism

5.1 Conflict within the community

Traditionally, a *jirga* system resolves conflicts within the community and the decisions taken are acceptable for the parties. Under REDD+ redressal, it is suggested that the same *jirga* may take lead role to resolve conflicts arising among the community regarding implementation of REDD+ activities. The structure and function of *jirga* system will be formulated by Sindh Forest & Wildlife.

5.2 Community's grievance towards the Forest Department

The REDD+ is a new mechanism for communities as well as for the Sindh Forest & Wildlife Department, therefore both partners (Community and the Sindh Forest & Wildlife Department might be facing some conflict of interest 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.

References

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5. IPCC. (2021). Climate Change 2021: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland.

Annex 1. Socio-economic Data of Viran & Mulchand Forest

I. Stakeholder group (names)	Forest Department, Community
2. General information Location of stakeholder groups (e.g., different villages/hamlets in and outside forest area) and names and indicate on map if possible	Mulchand Forest
3. Social organization in the forest area	
A. Traditional organizations (e.g., jirga)	---
Organization (name; purpose; membership)	---
Organization (name; purpose; membership	---
Organization (name; purpose; membership	---
B. Formal organization (e.g., social; welfare organization or village development committee	---
Organization (name; purpose; membership)	---
Organization (name; purpose; membership)	---
4. Use of forest and forest area (for what are you using the forest area?)	---
Timber for personal use like house construction, etc. (where; locate on the map)	Yes, all over the forest
Timber for commercial selling (where; locate on the map)	Yes
Firewood (where; locate on the map)	Yes
Grazing (where; locate on the map)	Yes
Grass cutting (where; locate on the map	Yes
Other products, e.g., mushroom, pine nuts, pine needles, vegetables, stones, minerals, medicinal plants (where; locate on the map)	Yes
Forest areas related daily labour/employment (employed by whom; for what?)	For Forestry operations and Afforestation
Tourism (what; where; locate on the map)	No
Hunting/Fishing	Fishing and Illegal Hunting
What would it mean if you had no access to these forest products? (Any alternatives? Threat to livelihood?)	Costly substitute of food, energy, timber and minor
5. Rights and concessions in forest area	No Rights except right of way/grazing rights with permission as per rules.
Do you have formal, legal, or traditional, customary rights on forest products (use)? Which ones? If documented rights, where?	No
Timber (shares)	No
Fodder: grass cutting/grazing	No
Firewood	No
Other products:	No
6. Conflicts / disputes	

On different land uses: Describe nature of conflict, between which groups and put location on map if possible	Encroachment over forest land by land grabbers
Do they have effect on forest management? And how?	Inside the forests
On social issues: Describe nature of conflict, between which groups and put location on map if possible	None
Do they have effect on forest management? And How?	None
Existing Conflict resolution mechanisms: - traditional (e.g., jirga) - formal (court)	
7. Other Forest Management Projects	
Are there any other Forest Management Projects in the area? If so, which projects? What are their activities?	

Annex 2. Analysis of Stakeholders

STAKEHOLDER	INTEREST in Forest		INFLUENCE on Forest	
	Type of interest	Level of interest*	Type of influence	Level of influence*
Forest Department	Better Management	3	Controller	3
Adjoining village community of Basar Palijo	Grazing, Timber Fuel wood, NTFP, Water	3	Local control on forest benefits	1
Law & Enforcement Agencies	Law Enforcement	1	None	1
Forest Encroachers	Nil	2	Political in Nature	2
Illegal harvesters	Illegal Business/damage	1	Nominal	1
Revenue Department	General Interest	1	Little	1
Irrigation Department	Nil	0	Nil	0

*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	DBH1 (cm)	Tree height (m)	Wood Density (g/cm3)	AGB (kg)	AGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
1	68.21	25	*Acacia nilotica*	20	6	0.7629	102.8939	1.03	0.48	0.12
1	68.21	25	*Acacia nilotica*	20	5	0.7629	86.12093	0.86	0.40	0.10
1	68.21	25	*Acacia nilotica*	28	8.7	0.7629	285.185	2.85	1.34	0.34
2	68.21	24.99	*Acacia nilotica*	41	12.3	0.7629	841.7923	8.42	3.96	0.99
2	68.21	24.99	*Acacia nilotica*	39	9.5	0.7629	593.3621	5.93	2.79	0.70
2	68.21	24.99	*Acacia nilotica*	33	9.7	0.7629	437.0508	4.37	2.05	0.51
2	68.21	24.99	*Acacia nilotica*	28	11.6	0.7629	377.6304	3.78	1.77	0.44
3	68.23	24.97	*Acacia nilotica*	8	3.8	0.7629	11.01549	0.11	0.05	0.01
4	68.25	25.04	*Acacia nilotica*	20	4.9	0.7629	84.43945	0.84	0.40	0.10
6	68.28	24.95	*Acacia nilotica*	10	4.3	0.7629	19.21183	0.19	0.09	0.02
6	68.28	24.95	*Acacia nilotica*	6	2	0.7629	3.35784	0.03	0.02	0.00
6	68.28	24.95	*Prosopis juliflora*	8	3.3	0.7941	9.98147	0.10	0.05	0.01
6	68.28	24.95	*Prosopis juliflora*	6	3	0.7941	5.186983	0.05	0.02	0.01
6	68.28	24.95	*Prosopis juliflora*	8	3.5	0.7941	10.57147	0.11	0.05	0.01
6	68.28	24.95	*Prosopis juliflora*	8	3.5	0.7941	10.57147	0.11	0.05	0.01
6	68.28	24.95	*Prosopis juliflora*	8	3.5	0.7941	10.57147	0.11	0.05	0.01
6	68.28	24.95	*Prosopis juliflora*	6	3.3	0.7941	5.692645	0.06	0.03	0.01
6	68.28	24.95	*Prosopis juliflora*	9	3.7	0.7941	14.04557	0.14	0.07	0.02
7	68.27	24.98	*Acacia nilotica*	41	5.4	0.7629	376.9414	3.77	1.77	0.44
7	68.27	24.98	*Acacia nilotica*	41	5.4	0.7629	376.9414	3.77	1.77	0.44
7	68.27	24.98	*Acacia nilotica*	25	2.9	0.7629	78.23171	0.78	0.37	0.09
7	68.27	24.98	*Acacia nilotica*	38	5.4	0.7629	324.9805	3.25	1.53	0.38
7	68.27	24.98	*Acacia nilotica*	43	5.6	0.7629	428.6131	4.29	2.01	0.50
7	68.27	24.98	*Prosopis juliflora*	18	3	0.7941	44.28489	0.44	0.21	0.05
7	68.27	24.98	*Prosopis juliflora*	20	4	0.7941	72.03016	0.72	0.34	0.08
7	68.27	24.98	*Prosopis juliflora*	53	4.9	0.7941	588.4521	5.88	2.77	0.69
7	68.27	24.98	*Calotropis procera*	5	2.6	0.75	2.988672	0.03	0.01	0.00
8	68.27	24.98	*Acacia nilotica*	33	5	0.7629	228.8956	2.29	1.08	0.27

Plot No.	Latitude	Longitude	Species Name	DBH1 (cm)	Tree height (m)	Wood Density (g/cm3)	AGB (kg)	AGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
8	68.27	24.98	*Acacia nilotica*	20	4	0.7629	69.26671	0.69	0.33	0.08
8	68.27	24.98	*Acacia nilotica*	15	3	0.7629	29.83348	0.30	0.14	0.04
8	68.27	24.98	*Acacia nilotica*	23	4.9	0.7629	110.9245	1.11	0.52	0.13
8	68.27	24.98	*Prosopis juliflora*	30	5	0.7941	197.619	1.98	0.93	0.23
8	68.27	24.98	*Prosopis juliflora*	8	2	0.7941	6.12252	0.06	0.03	0.01
8	68.27	24.98	*Prosopis juliflora*	8	2.7	0.7941	8.206084	0.08	0.04	0.01
8	68.27	24.98	*Tamarix dioica*	10	3.6	0.6206	13.20537	0.13	0.06	0.02
8	68.27	24.98	*Tamarix dioica*	8	2.6	0.6206	6.217918	0.06	0.03	0.01
8	68.27	24.98	*Ziziphus jujuba*	10	3.1	0.8	14.62177	0.15	0.07	0.02
9	68.26	24.98	*Acacia nilotica*	23	7.3	0.7629	163.6814	1.64	0.77	0.19
9	68.26	24.98	*Prosopis juliflora*	30	6.7	0.7941	262.9559	2.63	1.24	0.31
9	68.26	24.98	*Prosopis juliflora*	20	5.4	0.7941	96.54285	0.97	0.45	0.11
9	68.26	24.98	*Prosopis juliflora*	18	3.2	0.7941	47.1641	0.47	0.22	0.06
10	68.24	24.95	*Acacia nilotica*	38	8	0.7629	476.9324	4.77	2.24	0.56
10	68.24	24.95	*Acacia nilotica*	10	2.8	0.7629	12.63949	0.13	0.06	0.01
10	68.24	24.95	*Acacia nilotica*	71	6.9	0.7629	1398.545	13.99	6.57	1.64
10	68.24	24.95	*Acacia nilotica*	64	9.4	0.7629	1544.328	15.44	7.26	1.81
10	68.24	24.95	*Acacia nilotica*	61	10.1	0.7629	1508.29	15.08	7.09	1.77
10	68.24	24.95	*Acacia nilotica*	41	6.2	0.7629	431.352	4.31	2.03	0.51
10	68.24	24.95	*Acacia nilotica*	23	3.5	0.7629	79.87422	0.80	0.38	0.09
10	68.24	24.95	*Prosopis juliflora*	13	6	0.7941	46.15155	0.46	0.22	0.05
10	68.24	24.95	*Prosopis juliflora*	8	2.6	0.7941	7.909315	0.08	0.04	0.01
10	68.24	24.95	*Prosopis juliflora*	5	3	0.7941	3.633733	0.04	0.02	0.00
10	68.24	24.95	*Prosopis juliflora*	3	1.2	0.7941	0.548169	0.01	0.00	0.00
10	68.24	24.95	*Prosopis juliflora*	10	5.2	0.7941	24.04986	0.24	0.11	0.03
10	68.24	24.95	*Prosopis juliflora*	5	2.8	0.7941	3.397105	0.03	0.02	0.00
11	68.25	25	*Acacia nilotica*	69	12	0.7629	2269.958	22.70	10.67	2.67