Participatory Forest Management Plan (PFMP)

Kalash Valley Forest Chitral

2022-2031

Kalash Valley Conservation Committee
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Forestry, Environment and Wildlife Department
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Disclaimer:

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

وضاحت

خیبر پختون خواہ کا محکمہ جنگلات، ماحولیات 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 خیبر پختون خواہ کے محکمہ جنگلات، ماحولیات وجنگلی حیات کے بنائے گئے انتظامی و مالی رہنما اصولوں کے تحت ہوگا۔

Table of Contents

Acronym 6
Executive Summary 7
1 Introduction 9
1.1 Objectives of PFMP 9
1.2 Methodology 10
1.3 Policy Alignment 11
2 Participatory Forest Management Planning 13
2.1 Ecological 13
2.1.1 Site description 13
2.1.2 Location 13
2.1.3 Vegetation type 14
2.1.4 Climate 14
2.2 Socio-economic data 15
2.2.1 Demography 15
2.2.2 Health and Education 15
2.2.3 Livelihood sources 15
2.2.4 Dependence on Forest 16
2.2.5 Forest rights 17
2.2.6 Changes in forest over time 17
2.2.7 Stakeholders 17
2.2.8 Stakeholder analysis 18
2.3 Analysis of drivers of deforestation and forest degradation and Barriers to Enhancement 19
2.4 Carbon Stock Assessment of Kalash Forests, Chitral 20
2.4.1 Plot level Carbon Stock Estimation 20
2.4.2 Forest Cover Assessment 21
2.4.3 Carbon stock estimation and CO_2 emissions 23
2.4.4 CO_2 Sequestration Scenarios from Forest Enhancement 24
2.4.5 CO_2 Emissions Trend – forest degradation 25
2.4.6 Net Emissions from Deforestation and Forest Degradation 27
3 Proposed Intervention 30
4 Implementation Mechanism for the PFMP 35
4.1 Resources for activities 35
4.2 Suggested institutional mechanism for implementation of activities 35
4.3 Benefit Distribution Mechanism 35
5 Conflict and grievance redressal mechanism 36
5.1 Conflicts within the community 36
5.2 Conflict between the two villages 36
5.3 Community's grievance towards the Forest Department 36

References 37
Annex 1. Socio-economic data 38
Annex 2. Participatory stakeholder Analysis Birir 40
Annex 3: Plot level Carbon Stock 41

Acronym

AGB	Above Ground Carbon
BGB	Below Ground Carbon
ANR	Assisted Natural Regeneration
FE&WD	Forestry, Environment & Wildlife Department
FCPF	Forest Carbon Partnership Facility
GIS	Geographic Information System
GOP	Government of Pakistan
KFCC	Kalash Valley Forest Conservation Committee
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	Tonnes Carbon dioxide (Carbon credit)
VFP&CC	Village Forest Protection& Conservation Committee
10 BTTP	10 Billion Trees Tsunami Project

Executive Summary

Kalash Valley Forest located in District Chitral of Malakand Civil Division is one of the three sites selected by the Forestry, Environment & Wildlife Department in consultation with Kalash valley stakeholders as a pilot site to demonstrate implementation of REDD+ activities in Khyber Pakhtunkhwa. Kalash is an ancient tribe of Pakistan residing in these forests having their own way of life, religion, language, rituals, and identity. Kalash is a well-preserved ethnic community of the Country. This management plan is part of a larger project being implemented by the Ministry of Climate Change Government of Pakistan and the Provincial Forest departments in which a total of fifteen Participatory Forest Management Plans have been developed for REDD+ implementation in all four Provinces, Gilgit-Baltistan and Azad Jammu and Kashmir.

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 the KP Forests, Environment and Wildlife Department has developed a Provincial REDD+ Action Plan. This action plan is a decentralised framework for KP to proceed with REDD+ implementation. Preparation of Participatory Forest Management Plans (PFMP) 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 PFMP. 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 successful implementation of REDD+.

The analysis of forest cover revealed that since 2011 the Kalash Forest is increasing at the rate of 74.4 hectares per year and sequestering 20,302 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 tend 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. The benefits will be shared as 60:10:30 ratio among owner communities, customary users to reduce degradation, and the Government. These benefits will only be distributed if the targets are achieved. The plan is founded on 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 KP'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 KP Forest Department in consultation with the relevant stakeholders. The plan will be implemented by village and district committees to be notified by the Forest Department, along with the relevant stakeholders.

خلاصہ

خیبر پختونخوا کے ضلع چترال میں واقع وادی کیلاش کے جنگل محکمۂ جنگلات، ماحولیات اور 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 خیبر پختونخوا کے جنگلات، ماحولیات اور جنگلی حیات کے محکمے نے صوبائی سطح پر ایک جامع ریڈپلس ایکشن پلان تیار کیا ہے۔ خیبر پختونخوا 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 2011ء کے بعد کیلاش کے جنگل میں 74.4 ہیکٹر سالانہ کی شرح سے اضافہ ہو رہا ہے جس سے سالانہ 20,302 ٹن کاربن ڈائی آکسائڈ کا انجذاب عمل میں آ رہا ہے۔ یہ اضافہ واضح طور پر جنگلات کے رقبے میں مسلسل پیش رفت کی مثال 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 60 فی صد مالکانہ حقوق کے حامل لوگوں کو حاصل ہوں گے، جبکہ 30 فی صد حکومت کو اور 10 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 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 خیبر پختونخوا 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۔

1 Introduction

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 requires 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 estimated budget and implementation mechanism and key challenges for 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 Kalash valley Forest 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 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 issuance of timber permits, transportation of timber, assistance in regeneration of forests, manage grazing, NTFP promotion, linkages and promotion of tourism and wildlife activities. Due to high dependence of Kalash tribes on livestock, relevant activities have been included to improve quality of and productivity of livestock. The area has a great potential for NTFP as a major source of livelihood. These include walnut, pine-nut, honey, wild cumin seed, and medicinal plants. Budget has been provided to sustainably manage these sources at local level. In order to reduce the pressure on natural forests alternative sources of energy such as solar energy, bio-mass technology, and energy efficient stoves/bio-briquette have been included.

1.1 Objectives of PFMP

The specific objectives of this plan are as under:

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

1.2 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.

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. Kalash valley was one of the three potential sites selected for preparation of PFMP.
ii. Participatory data collection. Local community of Kalash tribe 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 9 sample plots selected in Kalash Forest Valley. 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 KP Forest Department and relevant community.

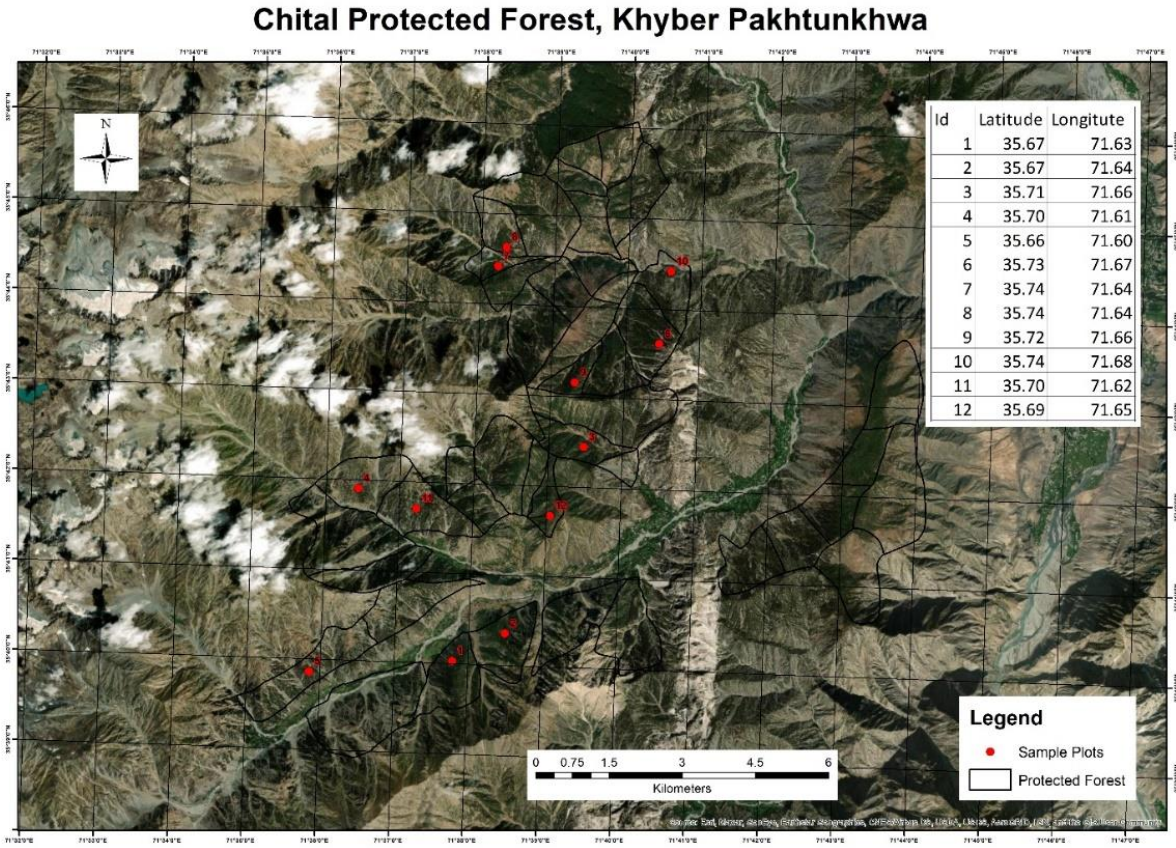


Figure 1. Location of sample plot

1.3 Policy Alignment

The objectives of this local PFMP are aligned with the following provincial, national, and global policies/strategies/commitments related to REDD+.

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 CO_2 in forest lands (UNFCC, 2021).

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 $MtCO_2e$ 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 most likely 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.

Provincial Policies/commitments:

Climate Change remains a pressing challenge for KP province due to its vulnerability to its ecological diversity and relatively low coping capacity. KP has announced the country's first Provincial Strategy for Financing Climate Actions in 2018. KP has already promulgated its Forest Policy 1999. The Green Growth Initiatives of the province to enhance climate resilience has a high emphasis on forestry interventions since 2013. The province also pioneered a Billion Trees Afforestation Project. A REDD+ Strategy was drafted, and Environmental and Social Management Framework (ESMF) was developed. The role of forests in mitigation, adaptation, enhanced resilience, and improved livelihoods is duly recognized in the Strategy. A Provincial REDD+ Action Plan has also been prepared for KP. Efforts are underway to identify Markets for sale of Carbon credits. Chitral has been identified as a pilot area. The activities mentioned in this PFMP to manage Kalash valley Forest align well with the actions suggested in KP REDD+ Strategy and Action Plan.

2 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

Kalash valleys falls under Ayun union council, which is part of Tehsil & district Chitral. The Kalash valley consisting of Bamborait, Rambur and Birir. Bomburait is the largest among these valleys connected with Nuristan Afghanistan on north and southwestern sides. The total area of Kalash valley forest selected for demonstration of REDD+ is about 10,832 hectares comprising 102 Forest compartments. The total area of designated forests (Protected forests) in the valley is 10,832 ha. Valley-wise detail is as under:

Table 1: Showing valley wise detail of forests

S. No	Valley	No of Compartments	Area (hectares)	Remarks
1	Bomburait	55	5814	There is dispute on ownership in few compartments of Achulgah forest between Kalash & Ayun village.
2	Birir	29	3371	
3	Rambur	18	1647	
Total		**102**	**10832**	

2.1.2 Location

The PFMP site is located at Latitude 35 42 2 N and Longitude71 41 29 E. Kalash valleys are the southern part of Chitral Forest sub-division. These are located in the southern gorges of the Hindukush Mountain range of Chitral District in Pakistan's KP Province. The Kalash valleys are connected to main Chitral town by jeepable roads via Ayun town. The valley roads often remain closed in winter due to heavy snow and in spring because of rainfall and land sliding.

As can be seen in the land cover map (Figure 2) below the major land cover in side the PFMP site is forests whereas outside the PFMP site is grasslands at the lower elevations and snow and rock dominate the higher elevations.

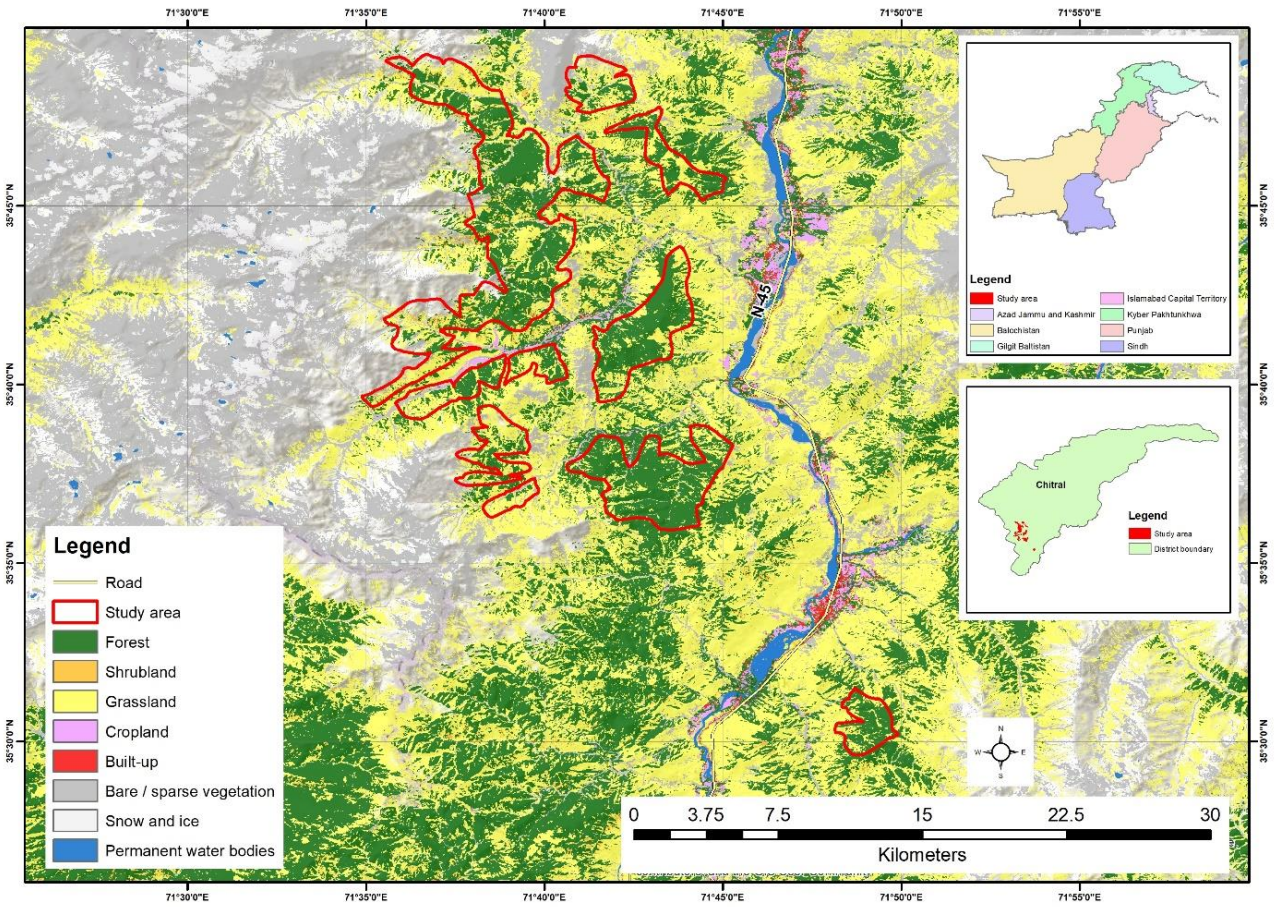


Figure 2. Location and Land Use Map of Kalash Forest, KP

2.1.3 Vegetation type

Bomburait valley is endowed with natural forests, pastures, surface water and wildlife. Coniferous forests are found on the upper slopes and their prevalence is determined by climatic factors. The upper tree line is limited by cold temperatures and the lower perimeter is affected by aridity. The trees comprise chir pine (*Pinus roxburghii*), blue pine (*Pinus wallichiana*), chilgoza pine (*Pinus gerardiana*), deodar (*Cedrus deodara*) and fir pine (*Abies pindrow*). Broad-leaved species are found on the lower slopes and near the stream banks. These include oak species (*Quercus ilex* and *Quercus dilatata*), birch (*Betula utilis*), ash (*Fraxinus xanthoxiloides*), *Viburnum nervosum*, *Viburnum cotinifolium*, *Lonicera* spp., walnut (*Juglans regia*), indigo plant (*Indigofera gerardiana*), wild almond (*Prunus amygdalus*), wild apple (*Mallus* spp.), willow (*Salix denticulata*) and poplar (*Populus ciliata*). The pastures found in Bamborait are sub-alpine woodlands at higher altitudes and dry temperate coniferous scrub and dry oak scrub at lower altitudes, which are grazed from mid-May to September. The wildlife includes Markhors, Snow leopard, Common Leopards and Foxes.

2.1.4 Climate

The elevation ranges from 1800m to 3800m above sea level. All the three valleys fall under dry temperate zone where summers are pleasant, and winters are intensely cold characterized by heavy snowfall during winter and some rainfall during spring and summer. Average annual precipitation is around 490mm which is increasing at 7% rate since 1981, mainly during monsoon. Average annual temperature is 17^0C

(average maximum during summer with 26^{0}C and minimum during winter below 0^{0}C). Temperature increase in southern Chitral is relatively significant with around 6% increase since 1981 (1^{0}C)[1].

2.2 Socio-economic data

Socio-economic data of the site was collected during Focus Group Discussions and key informant interviews (**Annex 1**). Summary of data is explained in this section:

2.2.1 Demography

Total population of Chitral district is 5.00786 million with 61619 households. Total population of Ayun union council Ayun is 28182 in numbers. Detail of each valley data is elaborated below:

- **Bomburait:** Total population of Bomburait valley is 13127 in numbers while the total number of households are 1498. There are 11 main villages among them the major villages are Karakal, Brun, Aneesh, Sheikhandeh, Batrik, Sarujal Kandisar and Qaziabad.
- **Birir:** Total population of Birir valley is about 6560 in numbers while the total numbers of households are 640. Main villages are Biow, Gree, Guzguru, Beshala, Aspar, Grabet gol and Sandik.
- **Rambur:** Rambur valley total population is 6998 in numbers while the total households are 798. Main villages of the valley are Kalashgram, Balanggoru, Grom, Chaitguru, Sheikhandeh bara and Sheikhandeh Payan. To provide health service to the inhabitants of the valley only civil dispensary is available. To meet the requirement of education only 1 GHS and 4 GPS are available. One basic health centre is available to cater the problem of livestock.

2.2.2 Health and Education

In Bamborait There is one GGHS, one GHS and seven GPS. There is only one basic health unit in Bomburait valley. For livestock one basic health centre is available.

As far as health facility is concerned only one civil dispensary exists covering the whole valley. In whole valley 1 GHS and 4 GPS exists catering the problem of education. Apart from this 2 community-based schools also present.

To cover the health-related issues of the community one civil dispensary exists in the valley. To cater the problem of livestock one basic health unit exists.

In Rambur to provide health service to the inhabitants of the valley only civil dispensary is available. To meet the requirement of education only 1 GHS and 4 GPS are available. One basic health centre is available to cater the problem of livestock.

2.2.3 Livelihood sources

The *Kelashi* people rely mostly on their natural resources for survival. Most of the families own some land, cultivated by irrigation, on which they grow maize, wheat, red bean, potato, millet, vegetables, walnut and fruit. Wheat is considered superior to other crops, while potato and red beans are commercially important. Most families have to buy grain to meet their needs and virtually no one produces surplus grain. The valleys are heavily dependent on livestock for dairy products, skins/hides/hair, meat, religious purposes and ploughing of land. Goats make up the majority of animals, followed by cows

[1] Nizami et al. 2020

and sheep. The animals are fattened on the alpine and lower elevation pastures; fodder/forage crops; hay; cereal and vegetable crop residues; and oak, willow, mulberry and apricot leaves. The area also has abundant timber resources and many of the unemployed males work as small-scale timber contractors to extract wood against government permits. Additionally, Chilghoza pine nut (Pinus gerardiana), morels (Morchella esculenta)2 and 'salajeet'[3] are extracted from the mountainside.

Off-farm income sources are tourism and employment. Over the last 20 years, Bomburait valley have become the principal tourist attraction of the district, owing to the unique culture, traditions and festivals of the Kalash people. Hence, many locals, mostly Muslims, have become involved in hoteling and trade. Some males are also employed in government service such as with line departments, police, border police and the Chitral Scouts.

Livestock deserve special attention here because they are an integral part of Kalash culture. The meat and dairy products are a necessary component during births, marriages, festivals and funerals and thus the Kalash who can afford to, keep large herds. To elucidate on one example, at the death of a Kalash man say in Bomburait valley, people from the other two valleys having Kalash inhabitants- Birir and Rambur- are also called and for three days' music and food abound. Between 40 and 70 animals are slaughtered (mostly goats) and an average of 160 kg cheese and 100 kg butter are consumed. When a Kalash woman passes away, the rites are shortened to one day, which include food but no music. The number of animals slaughtered is an attribute to the wealth of the deceased. However, a poor man is also departed ceremoniously by the community as a whole (the rich contribute more). Therefore, livestock are just as important for living as they are for dying.

Looking at wealth perceptions of the people, those with more assets, land, capital or livestock, are generally considered a part of the higher echelon of the community. However, in the Kalash, because livestock hold a special religious significance, wealth is strongly correlated with the number of animals. A person with a small and poorly kept dwelling but a herd size of a hundred will be considered as 'rich'. Notwithstanding the fact that a large herd size brings in significant quantities of dairy products for the household, the financial value of these animals is little since they are kept for religious ceremonies and thus rarely sold. In contrast, the few Muslims who keep a large number of livestock are wealthy because these animals are a financial investment.

2.2.4 Dependence on Forest

The people living around the forests and grazing lands depend considerably on income from them. Though local dependence on forests for livelihoods is decreasing, dependence for fodder, fuelwood and timber is increasing in population and lack of alternatives. The use of forest products varies directly with their distance from the forests. In addition to forest resource the residues of agriculture crop, fodder crops and grasses are another most important sources for livestock. Regarding the NTFP people are collecting and selling mushrooms, wild spinach, wild fruits, medicinal plants and needles and cones.

Due to great potential of Micro Hydel Power, a number of units were established through different organizations including PEDO (Pakhtunkhwa Energy Development Organization) through AKRSP. 150 KW

2 Morels are a type of mushroom of high economic and medicinal value.

3 'Salageet' is the local name for a black liquid that exudes from rocks and becomes hard after being exposed to air. It is used locally for arthritis and back pain and is also known for its aphrodisiac qualities.

power stations have been established in Bomburait and Rambur each. This is expected to decrease some pressure on the forest as the communities use raisin rich wood for lightening purposes.

2.2.5 Forest rights

All the forests in the Kalash valleys fall in the legal category of Protected Forest. The land belong to the provincial government and forests is encumbered with rights of local communities. The four main tribes of Kalashi, the Kalash (Black Kafirs), Khow, Gujur and Bashgali or Sheikhs residing in 23 hamlets of the three valleys have equal rights in forests and are entitled for royalty. The community is supposed to provide voluntary assistance to the FD in protection of forests in events like forest fire and check illegal trade of forest products. The local people exercise the following rights and concessions in the forests:

1. 60% share in the sale proceed of the forests goes to the entitled (generally the original owners of the agricultural lands)
2. Timber for construction and repair of residential buildings to the entitled-on permit to be issued.
3. Grazing of domestic livestock free of charge.
4. Grass cutting and lopping for fodder free of charge.
5. Collection of firewood free of charge.

2.2.6 Changes in forest over time

The whole area is open to uncontrolled grazing resulting in damages to seedlings and regeneration. Illicit cutting, lopping of trees, uncontrolled grazing and grass cutting put heavy pressure on forest resultantly decrease in forest cover. The distribution and quality of forest also affected badly. Moreover, due to successful implementation of BTAP and 10 BTAP in the area a considerable communal land area has been planted with fast growing fodder and fuel species. In addition, some patches of natural forests have been regenerated by establishing enclosures.

2.2.7 Stakeholders

Stakeholders were identified with their roles, influence, and interests in the forests (**Annex 2**). The main stakeholders are the government forest department and the user communities. The description of the main stakeholders is given below.

A. Community institutions

Traditional institutions:

With the aim to ensure their survival in this climatically unfriendly area, the Kalashis over the period have developed and adapted indigenous institutions/tools/organizations to carry out individual and obligatory communal services. Different tools/institutions with varying degree of composition have been established to perform different communal and household level tasks. Though with the passage of time especially after the Chitral state merger with mainland Pakistan as a regular district some of these institutions have been eroded, but, in remote parts of the district like Kalash valleys these are still followed to ensure prudent and sustained use of available resources. Some of the active traditional institutions in Kalash valleys are briefly summarized as below:

- **Mir Joyee** (Mir means elder and Joyee mean Channel: responsible for channel maintenance and repair)
- **Gram:** Village level Organization. Each household is member of Gram and by default is bound to carry out communal services like participation in dead and burial etc.
- **Moon:** It is obligatory communal services supervised by gram.
- **Muazin:** responsible for taking care of Mosque and announcements from Mosque

- **Paxali:** Ensure Controlled grazing
- **Sot Seri:** Controlled grazing in high pastures
- **Saq:** Used for Sagacious use of forests and associated resources

Of these indigenous institutions last three i.e., Paxali, Sot Seri and Saq are important for forest management and REDD+ implementation.

***Community Organizations**:*

- Community Based Organizations
- Village Development Committees/JFMC
- Village volunteers

In Kalash valleys the Village Development Committees (VDC) are formed under 10BTTP in order to protect and conserve the forest. These VDCs also considered as JFMCs and worked with the Forest Department in order to improve the forest cover. These committees recommend the locals for appointment as Naghebans for the conservation and protection of forests by establishing enclosures. Community based Organizations comprising of village elders are important to resolve emerging conflicts in the area.

B. Forest Department and other public sector actors

The land belongs to the provincial government. The provincial Forest department is the custodian of the government owned Protected Forest and is, therefore, the main stakeholder. The department protects the forest through its employee – the forest guards and the forest chowkidars supervised by the Rage Forest Officers and the Divisional Forest Officers. The department issues permit and takes cognizance of offences. The department also set aside areas for natural regeneration. Currently the department is implementing the 10 billion Trees Tsunami Project. Under this project the communities are supported in developing plantations as well as regeneration of natural forests. The department has established a REDD+ Cell in province to promote activities related to REDD+

The Revenue department is another player by controlling the land. The Revenue department however has very little role in the conservation and management of forest. Their services are required only when there is a dispute on the land ownership.

2.2.8 Stakeholder analysis

The stakeholder analysis was conducted to acquire information about major actors, and their interest and influence on forest resources utilization, management, or restoration (**Table 2**). The interest and influence explored through stakeholder analysis indicate who is doing what in managing forest and who has the legal rights in the forest. The stakeholders identified were categorized as primary and secondary based on the level of their participation and partnership in social, technical, financial, and legal aspects of forest management and REDD+.

Forest Department and local community are the major players with greater interest in forest management. The law enforcement agencies also occasionally contribute to forest protection when called in the 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 and other forestry development projects have a high interest in KP's forest resources, but until now 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 in future.

The Revenue Department deals with matters related to land as records and decisions related to land are entrusted with this department. The Revenue Department has little direct interest in forest management and only involves when there is a dispute regarding land ownership or distribution of share to respective shareholders/concessionists received from the forest department. Therefore, it falls in the category of low interest stakeholders.

Table 2. 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 High Score 2 and 3	Local community members who harvest trees for selling (Illegal harvesters) Ministry of Climate Change	Forest Department Local community members with use rights and concessions *10 BTAP*
	Marginal players Low priority	**Risk factors** Need to be addressed
INTERST Low Score 0 and 1	Law enforcement agencies Revenue Department	None
	INFLUENCE Low Score 0 and 1	**INFLUENCE High** Score 2 and 3

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

In Kalash valley most of the Forest is Protected Forest, where forest boundaries are clearly demarcated. The land and Forest belong to the Govt. and community has rights and concessions (Royalty) in the forest. Any violation like deforestation or encroachment is proceeded under Forest Ordinance 2002. However, **extraction of timber for construction of houses in the valleys and outside and smuggling are the major drivers of deforestation**.

Degradation of Forests is a common phenomenon in Kalash Valley Forest. These forests are under tremendous pressure to meet local use timber and firewood requirements of the community. The study (Zeb et al, 2019) titled "Identifying local actors of deforestation and forest degradation in the Kalasha Valleys of Pakistan" reported a decline of forest @90% in Bamborait, 75% in Rambur and 61% in Birir valleys for the period 1993 to 2015. The average wood consumption as per study is in line with the global average for both developing and developed countries (0.5 m^3 /person/year), their consumption of firewood for heating is an additional 1.5 m^3 /year/person or more for domestic use, plus another 1.5 m^3 /year/person for regional sale for the households surveyed. The major drivers as ranked in Table 3 below for degradation of Forests is **Cutting of trees for Firewood and local sale**. This is followed by **Cutting of trees for timber for construction and repair of houses of the local community**. **Other drivers of degradation are grazing in Forest, unplanned tourism activities and natural disasters including flood and landslides**.

Table 3: Major drivers of deforestation, Forest degradation and barriers to enhancement

Ranking	Major drivers	Underlying causes	Degree Of severity
Deforestation			
2	Cutting of Trees for Constructional Timber Local and outside	1. Lack of Alternatives 2. Permit system for outsiders	2
3	Timber Smuggling for greed and Profit making	1. High demand for Coniferous timber in Chitral	2
Forest Degradation			
1	Cutting of Trees for Energy/fuelwood	1. Lack of Alternate Energy Sources 2. Intense Climate 3. Poor Communication infrastructure	1
6	Unplanned Tourism activities	1. Lack of Coordination between Tourism and Forest Deptt 1. Lack of land use planning	3
5	Issues in Law enforcement	1. Lack of infrastructure and equipment 2. Lack of Staff and Training 3. Slow and Low punishment to Culprits	2
Barriers to Enhancement			
4	Grazing in Forest Area	2. 1.Large no. of Animal heads, a local & cultural requirement	3
7	Natural disaster of Flood and landslides	1. Lack of Disaster and Risk management activities 2. Lack of awareness and trainings	3

2.4 Carbon stock assessment of Kalash Forests, Chitral

2.4.1 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) were calculated using the standard sets for tree species, tree DBH and height, and dry biomass of shrubs and litter (**Table 4**). The tree species level carbon stock is given in Annex 1. Based on this data, individual plots level carbon stock values are given in Table 4. The estimated stock of carbon per hectares (ha) was then used to estimate the total carbon stock in the selected site of Bomburait Forest. Out of 12, data could be collected from 9 plots due to inaccessibility of the remaining plots (75%).

Table 4. Plot level above and below ground carbon stock

Plot No.	Average AGC (tonnes/ha)	Average of BGC (tonnes/ha)
1	4.061	1.015
2	3.315	0.828
3	4.252	1.063
4	2.146	0.536
6	2.925	0.731
9	3.648	0.912
10	2.452	0.613
11	2.836	0.709
12	2.956	0.739
Average	**3.22**	**0.81**

2.4.2 Forest Cover Assessment

The change in forest cover was assessed by using Landsat multispectral 30m spatial resolution satellite images on the path (151) and row (035) 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 744 ha in forest cover in the past 10 years at an average rate of 74.4 hectare (ha) per year (**Table 5**).

Table 5. Forest cover assessment (2010 -2021)

No	Landsat Satellite Sensor	Landsat data acquisition	Forest Cover (ha)
1	Landsat-8	2021-10-13	7952
2	Landsat-5	2011-10-02	7208
Change in Forest Cover in last 10 years			744
Per year change in forest cover			74.4

Table 6 provides **three scenarios** of enhanced forest cover in the coming ten years:

1. Adding 10% more forest cover in addition to the current average annual increase of 74.4 ha.
2. Adding 20% more forest cover in addition to the current average annual increase of 74.4 ha.
3. Adding 50% more forest cover in addition to the current average annual increase of 74.4 ha.

The above scenarios mean that the forest that is already growing annually on average by 74.4 ha (as observed in the last 10 years) and enhancing this growth by 10%, 82 ha of forest cover in total would be required to be added in the coming 10 yeas, which will increase the forest cover to 8,852 ha instead of 8,770.4 ha in the business-as-usual scenario by the year 2032.

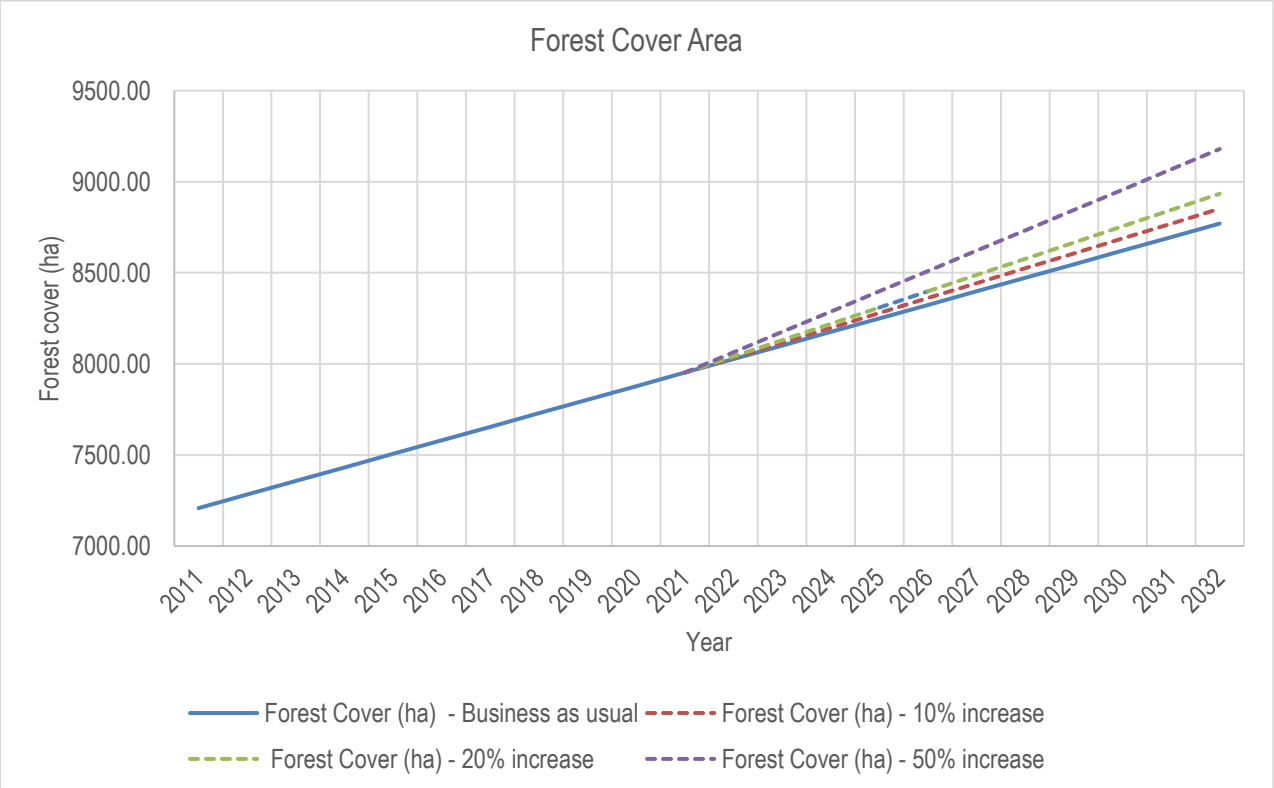
Similarly, in 20% and 50% scenarios, additional forest cover to be added will be 164 ha and 409 ha respectively that will increase the total forest cover to 8,934 ha and 9,180 ha respectively in the next 10 years. The total area of the PFMP site is 12,864 ha out of which 10,832 ha are protected forests as detailed in Table 1 earlier. However, plenty of land is available for increasing the forest cover.

Table 6: Forest Cover Scenarios based on trend in the past 10 years

Rate of change per year (ha)	74.4	7.4 additional	14.9 additional	37.2 additional
Year	**Forest Cover (ha) - Business as usual**	**Forest Cover (ha) - 10% increase (74.4 + 7.4)**	**Forest Cover (ha)- 20% increase (74.4 + 14.9)**	**Forest Cover (ha) - 50% increase (74.4 + 37.2)**
2011	7208.00			
2012	7282.40			
2013	7356.80			
2014	7431.20			
2015	7505.60			
2016	7580.00			
2017	7654.40			
2018	7728.80			
2019	7803.20			
2020	7877.60			

Rate of change per year (ha)	74.4	7.4 additional	14.9 additional	37.2 additional
Year	Forest Cover (ha) - Business as usual	Forest Cover (ha) - 10% increase (74.4 + 7.4)	Forest Cover (ha)- 20% increase (74.4 + 14.9)	Forest Cover (ha) - 50% increase (74.4 + 37.2)
2021	7952.00	7952	7952	7952
2022	8026.40	8034	8041	8064
2023	8100.80	8116	8131	8175
2024	8175.20	8198	8220	8287
2025	8249.60	8279	8309	8398
2026	8324.00	8361	8398	8510
2027	8398.40	8443	8488	8622
2028	8472.80	8525	8577	8733
2029	8547.20	8607	8666	8845
2030	8621.60	8689	8756	8956
2031	8696.00	8770	8845	9068
2032	8770.40	8852	8934	9180
Forest cover increase in addition to business as usual		82	164	409

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



2.4.3 Carbon stock estimation and CO_2 emissions

The field data and biomass collected from 9 samples was used to calculate Above Ground Biomass (AGB) using locally developed allometric equations (Ismail et al, 2018) for 2011-2021 (**Table 7**). In Chitral forest, the cumulative carbon stock in three carbon pools (above, below and soil) was estimated to as 536,423.33 tonnes of Organic Carbon (Corg) back in 2011 which increased to 591,792.22 tonnes in 2021. This change corresponds to the increase in forest cover from 7,208 ha in 2011 to 7,952 ha in year 2021 (figure 4).

Figure 4: Forest Cover Maps used for Change Analysis

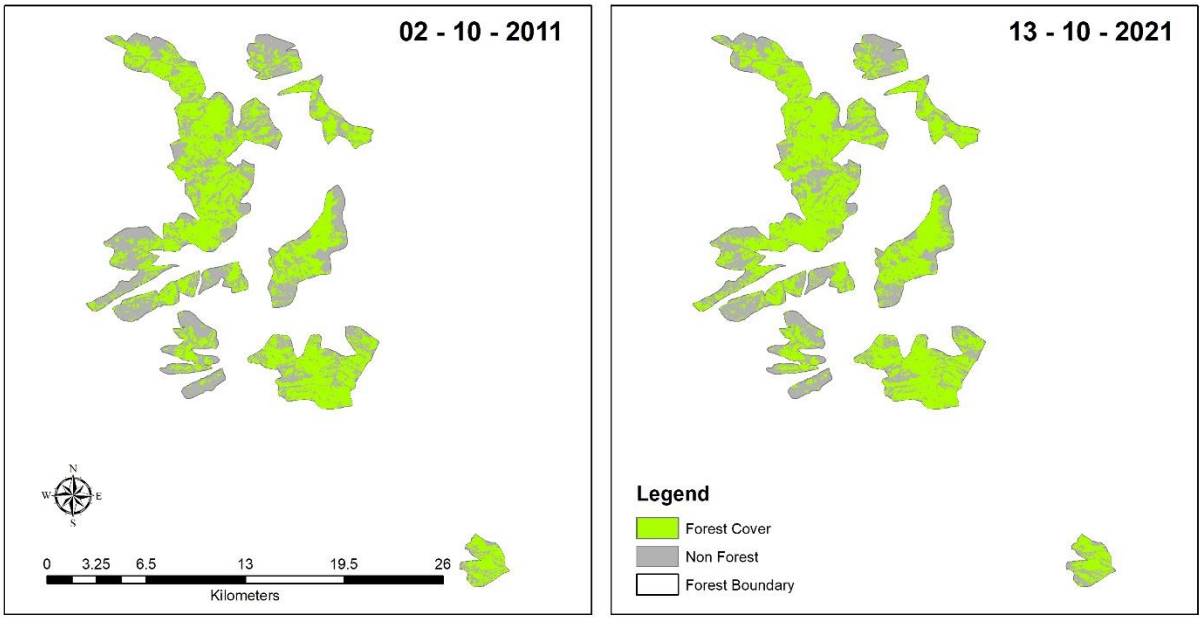


Table 7. Carbon stock estimation (2011-2021)

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)
2011 (2011-10-02)				
Above	3.22	7208.00	23,209.76	
Below	0.81		5,838.48	
Deadwood	0.87		6,255.62	
Litter	0.02		163.46	
Soil*	69.5		500,956	
Cumulative			536,423.33	1,966,885.54
2021 (2021-10-13)				
Above	3.22	7952.00	25,605.44	
Below	0.81		6,441.12	
Deadwood	0.87		6,901.32	
Litter	0.02		180.34	
Soil	69.5		552,664	
Cumulative			591,792.22	2,169,904.80
Rate of change per year				
2021-2011		74.40	5,536.89	20,302

*Estimation of soil carbon pools in the forests of Khyber Pakhtunkhwa Province, Pakistan, Anwar Ali

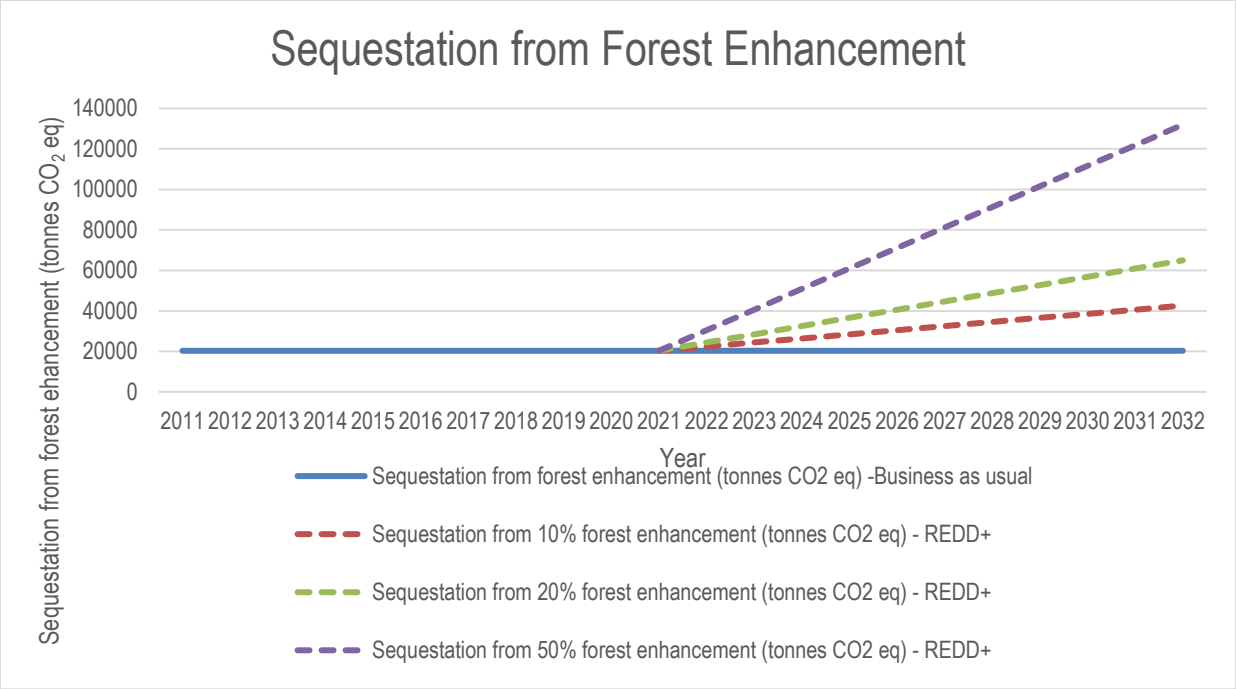
2.4.4 CO_2 Sequestration Scenarios from Forest Enhancement

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 the PFMP site is 20,302 tonnes CO_2 eq per annum because of forest cover increase which can be boosted further by 2,030 tonnes with 10% enhancement, 4,060 tonnes with 20% enhancement and 10,151 tonnes with 50% enhancement of forest cover. Figure 5 shows the enhancement trend under above mentioned scenarios.

Table 8: CO_2 Emissions Sequestration trend and Different Enhancement scenarios

Rate of change per year	20302	2030	4060	10151
Year	**Sequestration from Forest enhancement (tons CO_2 eq) - Business as usual**	**Sequestration from Forest enhancement (tons CO_2 eq) - REDD+ with 10% addition**	**Sequestration from Forest enhancement (tons CO_2 eq) - REDD+ with 20% addition**	**Sequestration from Forest enhancement (tons CO_2 eq) - REDD+ with 50% addition**
2011	20302			
2012	20302			
2013	20302			
2014	20302			
2015	20302			
2016	20302			
2017	20302			
2018	20302			
2019	20302			
2020	20302			
2021	20302	20302	20302	20302
2022	20302	22332	24362	30453
2023	20302	24362	28423	40604
2024	20302	26393	32483	50755
2025	20302	28423	36543	60906
2026	20302	30453	40604	71057
2027	20302	32483	44664	81208
2028	20302	34513	48725	91359
2029	20302	36543	52785	101510
2030	20302	38574	56845	111661
2031	20302	40604	60906	121812
2032	20302	42634	64966	131963

Figure 5: Emissions Reduction Scenarios – Forest Cover Increase



2.4.5 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 28,182 with a growth rate of 2.5 per annum. A study by Zeb et al, 2019 titled "Identifying local actors of deforestation and forest degradation in the Kalasha Valleys of Pakistan" reported average wood consumption being in line with the global average for both developing and developed countries (0.5 m^3/person/year), but their consumption of firewood for heating is an additional 1.5 m^3/year/person or more for domestic use, plus another 1.5 m^3/year/person for regional sale for the households surveyed. Based on this reference emissions from forest degradation are calculated and presented in the Table 9.

Table 9: Forest Degradation Emissions trend

Year	Population	Fuelwood Consumption (FC) (m^3/year)	Timber Consumption (TC) (m3/year)	Fuelwood Emissions[4] (FC*D*BEF2*CF*44/12) (tons CO_2 eq)	Timber Emission (TC*D*BEF2*CF*44/12) (tons CO_2 eq)	Emission from Forest Degradation (tons CO_2 eq) - Business as usual
2011	24210	36315	48421	45888	61184	107072
2012	24831	37247	49662	47065	62753	109818
2013	25468	38202	50935	48272	64362	112634
2014	26121	39181	52242	49509	66012	115522
2015	26791	40186	53581	50779	67705	118484
2016	27477	41216	54955	52081	69441	121522
2017	28182	42273	56364	53416	71222	124638
2018	28887	43330	57773	54752	73002	127754
2019	29609	44413	59217	56120	74827	130947
2020	30349	45523	60698	57523	76698	134221
2021	31108	46661	62215	58961	78615	137577
2022	31885	47828	63771	60435	80581	141016
2023	32682	49024	65365	61946	82595	144542
2024	33500	50249	66999	63495	84660	148155
2025	34337	51506	68674	65082	86777	151859
2026	35195	52793	70391	66709	88946	155655
2027	36075	54113	72151	68377	91170	159547
2028	36977	55466	73954	70087	93449	163535
2029	37902	56852	75803	71839	95785	167624
2030	38849	58274	77698	73635	98180	171814
2031	39820	59731	79641	75476	100634	176110
2032	40816	61224	81632	77363	103150	180513

[4] Wood Density (D)

Cedrus deodara	*0.43*
Pinus gerardiana	*0.5*
Quercus ilex	*0.64*
Average	*0.52*
Biomass Expansion Factor: BEF2	1.35 (IPCC Table 3A.1.10)
CF = carbon fraction of dry matter	0.5

2.4.6 Net Emissions from Deforestation and Forest Degradation

The Table 10 below provides a net CO_2 sequestration scenario based on 20% 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 due to cumulative effect of increasing forest cover and reduction in forest degradation due to REDD+ implementation. The net emissions from the site under this scenario will become zero by 2028.

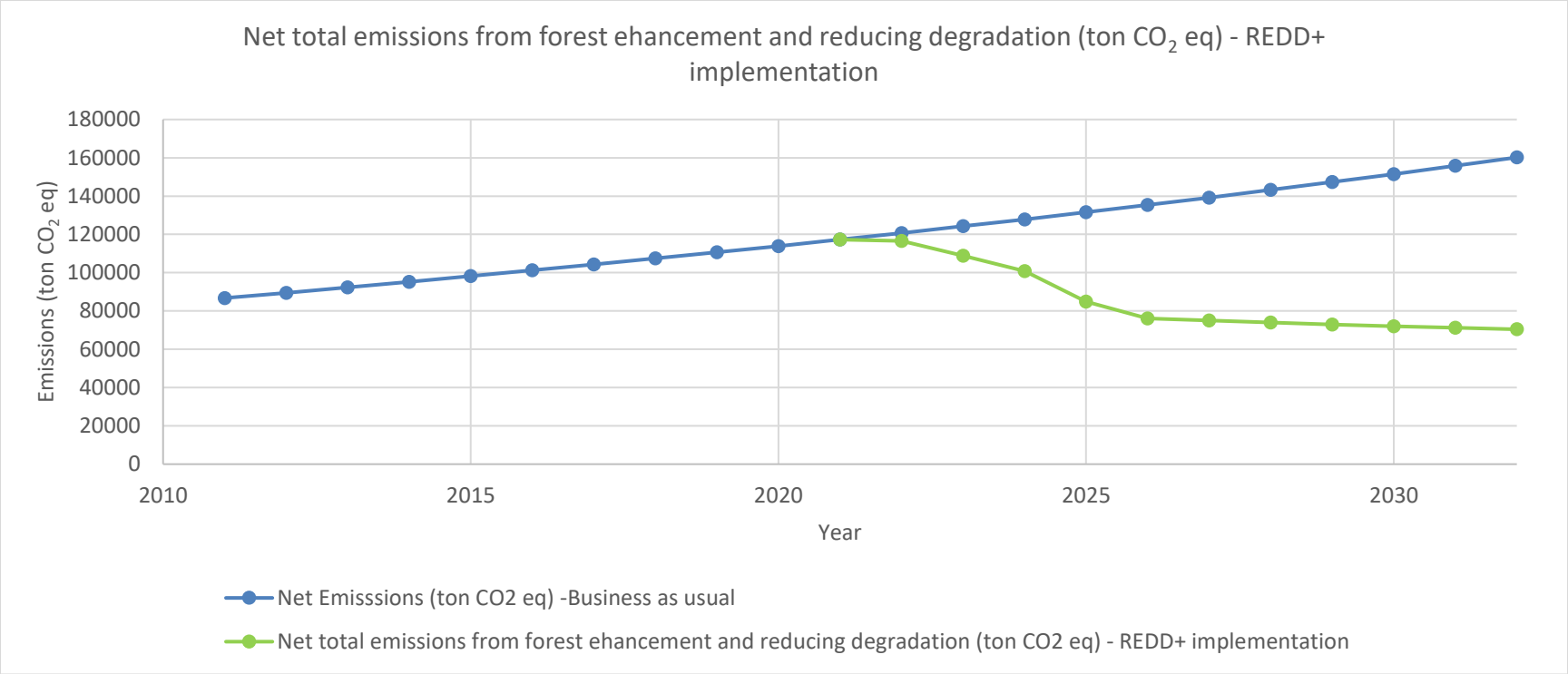
The forest cover is increasing in the pilot site at a rate of 74.4 ha annually whereas the total area of the site is 12,864 ha and even with 50% enhancement the forest cover will increase to 9,180 ha. So, a concerted strategy targeting more forest cover than 20% and focussing on reducing the demand for firewood can further sequester CO_2 emissions. Figure 6 graphically presents the business-as-usual scenario and the REDD+ scenario.

Table 10: Sequestration Scenario from Forest Enhancement and Reducing degradation

Rate of change per year	20302					4060	
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 20% enhancement	Net total emissions from forest enhancement and reducing degradation (tonnes CO_2 eq) - REDD+ implementation
2011	20302	107072	86770				
2012	20302	109818	89516				
2013	20302	112634	92332				
2014	20302	115522	95220				
2015	20302	118484	98182				
2016	20302	121522	101220				
2017	20302	124638	104336				
2018	20302	127754	107452				
2019	20302	130947	110646				
2020	20302	134221	113919				
2021	20302	137577	117275				117275

Rate of change per year	20302					4060	
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 20% enhancement	Net total emissions from forest enhancement and reducing degradation (tonnes CO_2 eq) - REDD+ implementation
2022	20302	141016	120714	7051	141016	24362	116654
2023	20302	144542	124240	7227	137314	28423	108892
2024	20302	148155	127853	14816	133340	32483	100856
2025	20302	151859	131557	30372	121487	36543	84944
2026	20302	155655	135353	38914	116742	40604	76138
2027	20302	159547	139245	39887	119660	44664	74996
2028	20302	163535	143234	40884	122652	48725	73927
2029	20302	167624	147322	41906	125718	52785	72933
2030	20302	171814	151513	42954	128861	56845	72015
2031	20302	176110	155808	44027	132082	60906	71177
2032	20302	180513	160211	45128	135384	64966	70418

Figure 6: Sequestration scenarios – Forest Enhancement and Reduced degradation


Net total emissions from forest ehancement and reducing degradation (ton CO_2 eq) - REDD+ implementation
Emissions (ton CO_2 eq)
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
2010
2015
2020
2025
2030
Year
Net Emisssions (ton CO2 eq) -Business as usual
Net total emissions from forest ehancement and reducing degradation (ton CO2 eq) - REDD+ implementation

3 Proposed Intervention

The following interventions have been identified as a result of a number of consultative meetings with local communities to address the drivers of deforestation and degradation in Kalash valley forest. 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 larger Kalash valley related issues. The proposed interventions addressing major drivers of deforestation and degradation have been reflected in the table.

Table: 11: Proposed interventions addressing major drivers of deforestation and degradation and Barriers to Enhancement

Serial Number	Proposed interventions	Drivers of deforestation and degradation and Barriers Addressed	Remarks
1	• Strengthening of Village Conservation and Protection Committee. • Assessment of Genuine Timber & Firewood need (Visits/Meetings). Facilitation in rights & concessions and distribution of benefits • Distribution of Fast-Growing Fodder Tree Species • Provision of Solar System • Provision of Biomass Energy Technology • Energy Efficient stoves and bio-briquette	**Cutting of Trees for Energy/fuelwood**	
2	• Strengthening of Village Conservation and Protection Committee. • Assessment of Genuine Timber & Firewood need (Visits/Meetings). Facilitation in rights & concessions and distribution of benefits • Assistance in Natural Regeneration	**Cutting of Trees for Constructional Timber Local and outside**	
3	• Establishment of Community Forest Check posts • Linkages, facilitation and promotion of tourism and Wildlife activities • Promotion & Value Addition of Non-Timber Forest Products (Trainings/Equipment's) • Raising fruit orchards • Distribution of fruit plants	**Timber Smuggling for greed and Profit making**	Through these interventions, the income of the locals will increase. The burden on forest will be reduced and eliminated.
4	• Rotational Grazing (Small Scale Application) • Rotational Grazing (Large Scale Application)	**Grazing in Forest Area**	These activities will give enough time to regenerate the fodder. Further by artificial insemination improved breed of domestic

Serial Number	Proposed interventions	Drivers of deforestation and degradation and Barriers Addressed	Remarks
	• Raising of improved breeding through artificial insemination • De-Worming		animals will reduce cattle heads and enhance quality & quantity of products.
5	• Strengthening of Village Conservation & Protection Committees.	**Issues in Law enforcement**	By empowering locals & their involvement in decision making will resolve this issue.
6	• Linkages, facilitation and promotion of Tourism and Wildlife activities	**Unplanned Tourism activities**	Coordinated efforts by locals will regulate the activities.
7	• Land slide and Gully Plugging	**Natural disaster of Flood and landslides**	Water and soil conservation activities will be carried out to reduce the impact of natural disasters.

The total indicative budget of the PFMP implementation is PKR 163,190,000 (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 12**.

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

				Operational Plan											
S. N.	**Activity**	**Unit**	**Unit cost**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total units**	**Total cost**
A	**Strengthening of Social Organization**														
1	Strengthening of Forest Conservation, Management & Protection Committees	No	5000	12	12	12	12	12	12	12	12	12	12	120	600,000
2	Establishment of Community Forest Check posts	No	100000		1	1								2	200,000
3	Facilitation in Rotational Grazing (Visits/Meetings)	No	5000	6	6	6	6	4	4	4	3	3	3	45	225,000
4	Assistance in Natural Regeneration	LS	5000	6	6	6	6	6	6	6	6	6	6	60	300,000
5	Assessment of Genuine Timber & Firewood need (Visits/Meetings) Facilitation in rights & concessions and distribution of benefits	LS	5000	6	6	6	6	6	6	6	6	6	6	60	300,000
6	Linkages, facilitation and promotion of Tourism and Wildlife activities	LS	5000	6	12	12	12	6	6	6	6			66	330,000
B	**Forest Regeneration**														
8	Raising of Nursery plants	No	10	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	600,000	6,000,000
9	Raising Energy Plantation	Hectare	200000	35	35	35	35	35	35	35	35	35	35	420	84,000,000

				Operational Plan											
S. N.	**Activity**	**Unit**	**Unit cost**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total units**	**Total cost**
10	Distribution of Fast-Growing Fodder Tree Species	No	10	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	180,000	1,800,000
11	Assisted Natural Regeneration	No	20000	9	9	9	9	9	9	9	9	9	9	108	21,600,000
C	**Managed Rotational Grazing**														
13	Rotational Grazing (Small Scale Application)	No	100000		3									3	300,000
14	Rotational Grazing (Large Scale Application)	Herdsman	20000		3	3	3	3	3					**15**	36,00,000
D	**Promotion of Sustainable Energy Technology**														
15	Provision of Solar System	No	1500000		5	5	5	5	5	5				**30**	45,000,000
16	Provision of Biomass Energy Technology	No	1000000		5	5	5	5	5	5				**30**	30,00,000
17	Energy Efficient stoves and bio-briquette	No	3000		200	200	200	200	200	200				**1200**	36,00,000
E	**Promotion & Value Addition of Non-Timber Forest Products (Trainings/Equipment's)**														
18	Walnut	No	60000		2	2								**4**	240,000
19	Pine nut	No	60000		2	2								**4**	240,000
20	Honey	No	60000		2	2								**4**	240,000
21	Medicinal Plants	No	60000		2	2								**4**	240,000

				Operational Plan											
S. N.	**Activity**	**Unit**	**Unit cost**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total units**	**Total cost**
F	**Livestock Extension Support**														
22	Raising of improved breeding through artificial insemination	No	1000	50	50	50	50	50						**250**	250,000
23	De-Worming	No	100	1000	1000	1000	1000	1000						**5000**	500,000
G	**Horticulture Promotion**														
24	Raising fruit orchards	No	100000		6	6	6							**18**	18,00,000
25	Distribution of fruit plants	No	25		3000	3000	3000	3000	3000					**15000**	375,000
H	**Soil and Water Conservation Activities**														
2	Land slide and Gully Plugging	ha	300000		5	5	5							**15**	450,000
	Total														**163,190,000**

4 Implementation Mechanism for the PFMP

4.1 Resources for activities

The FE&WD as custodian of the forest and having linkages with national and international funding sources will take a lead. The key stakeholders identifying in this plan, especially the FE&WD and the Kalash Valley Forest Conservation Committee and *jirgas* of Kalash, will jointly look for resources for implementation of activities identified in this plan. The FE&WD will submit proposals for potential funding sources including the Ministry of Climate Change, Annual Development Programme (ADP), international donors and private sector investors

4.2 Suggested institutional mechanism for implementation of activities

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

KFCC: In consultation with the community, the FE&WD may notify a committee namely Kalash Valley Forest Conservation Committee. The KFCC may consist of representatives from the community (VFP&CC) and the DFFW. The community will nominate representatives for the KFCC 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 FE&WD will ensure its representation through respective SDFO/RFO. The KFCC may be Co-chaired by a community member nominated by the community and respective SDFO/RFO.

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 Kalash Forest 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 financial and non-financial benefit, the stakeholders may be expected to value standing trees than to cut for other uses.

Since the community will reduce harvesting of trees for fuel, 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. A clear mechanism for distribution of carbon and non-carbon REDD+ benefits is in vogue and applied in past; the same mechanism will be applied. Taking the example of wildlife, (80:20 benefit sharing mechanism between the community and the FE&WD from trophy hunting in Kalash), the same may be adopted for NTFP benefit sharing. In this specific case, 30% benefits will go to the government and 60% to the community. 10% will go to the customary users as an incentive to reduce degradation.

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 KP's based benefit sharing mechanism.

5 Conflict and grievance redressal mechanism

5.1 Conflicts 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 has been described in earlier section in this document.

5.2 Conflict between the two villages

The KFCC with the help of *jirgas* will settle any disputes between two villages. Any unsettled disputes will be referred to the Divisional Forest Office. 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 the Forest Department

The REDD+ is a new mechanism for communities as well as for the DFFW, therefore both partners (Community and the DFFW) 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.

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I. Stakeholder group (name)	Forest Department, Community,
II. General information	**Kalash Valley Forests, Chitral**
Location of stakeholder groups (e.g., different villages/hamlets in and outside forest area) and names and indicate on map if possible	The user group community of this site consists of inhabitants of villages all three Kalash valley.
III. Social organization in the forest area	
2. Traditional organizations (e.g., jirga)	
2.1. Organization (name; purpose; membership)	**Paxali:** Ensure Controlled grazing
2.2. Organization (name; purpose; membership	**Sot Seri:** Controlled grazing in high pastures
2.3. Organization (name; purpose; membership	**Saq:** Use for Sagacious use of forests and associated resources
3. Formal organization (e.g., social; welfare organization or village development committee	**Yes**
3.1. Organization (name; purpose; membership)	Village Development Committee/JFMC for the protection of forests.
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)	Yes
Timber for commercial selling (where; locate on the map)	No
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?)	Yes / self-employment
Tourism (what; where; locate on the map)	Yes
Hunting/Fishing	Illegal hunting & Fishing by local community for personnel use
5.What would it mean if you had no access to these forest products? (Any alternatives? Threat to livelihood?)	LPG, timber, hydel, Solar
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?	Yes. Under regular land management, the local people have rights and concessions in the forests.
Timber (shares)	Timber as per need through permission from FD
Fodder: grass cutting/grazing	Yes
Firewood	Yes (dead fallen, and pruning of trees)
Other products:	Yes, extraction of deodar oil, medicinal plants, NTFP
VI. Control of forest area	
7. Who is controlling access to the forest area?	Forest Department, Community
8. What are forest control mechanisms? E.g., watch and ward; herdsmen; fencing; providing permits.	Joint watch and ward by FD and community. Timber harvesting is based on permits issued by FD.
9. Explain control mechanisms: Are there any traditional mechanisms like nagha; herdsman; watchman? How is it organized? Who pays for it?	Apart from Forest Guard appointed by Forest Department. Under 10BTTAP Naghebans are appointed through Village Development

Are there formal mechanisms like permits by FD; watch and ward by watchman or forest guard? How does it work?	Committees for protection and conservation of forests. On the demand of community, the FD has stopped issuing permits for commercial harvesting of forest.
VII. Changes over time in forest area	
10. What changes took place regarding the availability of forest products (timber; firewood; grasses; NTFP) during the last 30 years?	Illicit cutting, lopping of trees, uncontrolled grazing and grass cutting put heavy pressure on forest resultantly decrease in forest cover. The distribution and quality of forest also affected badly.. Moreover, due to successful implementation of BTAP and 10 BTAP in the area a considerable communal land area has been planted with fast growing fodder and fuel species. In addition to above natural forests have been naturally regenerated by establishing enclosures. BTAP and 10 BTAP have created income opportunity as well.
11.What are (according to you) the reasons for change?	Population increases, encroachments, rearing huge amount of cattle by Kalash people, illicit cutting of trees, forests are cleared for cultivation. The whole area is open to uncontrolled grazing seriously hampers the survival of regeneration.
12. Were there any efforts in the past for forest restoration and by whom?	Under BTTAP & 10 BTTAP the area was increased by natural & artificial regeneration.
VIII. Main problems	
13. What are the main problems in forest management with respect to:	
a. rights	Conflict between community and FD over permits issued by FD to outsiders.
b. different uses	None
c. control	Conflict between community and FD over permits issued by FD to outsiders.
d. managing drivers (of deforestation, degradation and forest enhancement)	Illegal harvesting of forest by local offenders. The demand for fuel wood is more that the annual increment of forest.
IX. Conflicts / disputes	
14. On different land uses: 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
15. 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
16. Existing Conflict resolution mechanisms: traditional (e.g., jirga) or formal (court)	Through local Jirga, revenue department, and court of law.
X. Other Forest Management Projects	
17. Are there any other Forest Management Projects in the area? If so, which projects? What are their activities?	Nil
XI. Recommendations	
18. What are your recommendations for forest management activities?	Area should be protected from grazing, cutting of tress supplemented by sowing & planting of the areas with active participation of local communities. Judicial implementation of local quota by the FD.

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
Forest Department	For management and conservation of Forests	3	Controller	3	All	3	Owner & Manager	3
Community	Grazing, Grass collection, lopping of forest trees for fodder, collection of fuel wood, Timber, Fuel wood collection, medicinal plants collection, Water	3	Local control on forest benefits	2	Above ground mass, dead wood, litter etc.	3	Rights & Concessions	3/2
Law Enforcement Agencies	Law enforcement	1	None	0	None	0	None	0
Revenue Department	Land management	1	little	1	Below ground biomass	0	Legal control of land	2
10 BTAP	Forest Enhancement	2	Significant	2	Biomass above ground	3	Decision on enhancement	3

Plot No.	Latitude	Longitude	Species Name	Tree Specie (Scientific Name)	DBH (cm)	Tree height (m)	AGB (kg)	AGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
1	71.62	35.66	Deodar	*Cedrus deodara*	73	33.4	3192.39	31.92	15.00	3.75
1	71.62	35.66	Deodar	*Cedrus deodara*	67	34.7	2825.06	28.25	13.28	3.32
1	71.62	35.66	Deodar	*Cedrus deodara*	56	30.4	1801.19	18.01	8.47	2.12
1	71.62	35.66	Deodar	*Cedrus deodara*	40	26.2	848.12	8.48	3.99	1.00
1	71.62	35.66	Deodar	*Cedrus deodara*	58	31.5	1984.50	19.85	9.33	2.33
1	71.62	35.66	Deodar	*Cedrus deodara*	49	28.6	1333.33	13.33	6.27	1.57
1	71.62	35.66	Deodar	*Cedrus deodara*	31	21.9	450.95	4.51	2.12	0.53
1	71.62	35.66	Deodar	*Cedrus deodara*	36	26.7	711.36	7.11	3.34	0.84
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	23	19.6	89.97	0.90	0.42	0.11
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	22	18.7	80.12	0.80	0.38	0.09
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	20	18	62.49	0.62	0.29	0.07
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	22	18.2	80.12	0.80	0.38	0.09
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	19	17.5	54.67	0.55	0.26	0.06
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	28	18.8	150.27	1.50	0.71	0.18
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	23	18.6	89.97	0.90	0.42	0.11
1	71.62	35.66	Chilgoza	*Pinus gerardiana*	21	17.3	70.97	0.71	0.33	0.08
2	71.64	35.67	Deodar	*Cedrus deodara*	66	27.2	2198.38	21.98	10.33	2.58
2	71.64	35.67	Deodar	*Cedrus deodara*	57	26.5	1640.56	16.41	7.71	1.93
2	71.64	35.67	Deodar	*Cedrus deodara*	43	24.8	920.82	9.21	4.33	1.08
2	71.64	35.67	Deodar	*Cedrus deodara*	48	26.2	1184.75	11.85	5.57	1.39
2	71.64	35.67	Deodar	*Cedrus deodara*	62	31.5	2242.61	22.43	10.54	2.64
2	71.64	35.67	Deodar	*Cedrus deodara*	33	22.4	516.29	5.16	2.43	0.61
2	71.64	35.67	Deodar	*Cedrus deodara*	36	23.2	625.39	6.25	2.94	0.73
2	71.64	35.67	Deodar	*Cedrus deodara*	32	22.7	493.96	4.94	2.32	0.58
2	71.64	35.67	Chilgoza	*Pinus gerardiana*	28	19.7	150.27	1.50	0.71	0.18
2	71.64	35.67	Chilgoza	*Pinus gerardiana*	24	18.2	100.53	1.01	0.47	0.12

Plot No.	Latitude	Longitude	Species Name	Tree Specie (Scientific Name)	DBH (cm)	Tree height (m)	AGB (kg)	AGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
2	71.64	35.67	Chilgoza	*Pinus gerardiana*	20	18	62.49	0.62	0.29	0.07
2	71.64	35.67	Chilgoza	*Pinus gerardiana*	22	18.2	80.12	0.80	0.38	0.09
2	71.64	35.67	Chilgoza	*Pinus gerardiana*	26	19.5	123.86	1.24	0.58	0.15
2	71.64	35.67	Chilgoza	*Pinus gerardiana*	28	19.8	150.27	1.50	0.71	0.18
2	71.64	35.67	Chilgoza	*Pinus gerardiana*	23	18.6	89.97	0.90	0.42	0.11
3	71.65	35.7	Deodar	*Cedrus deodara*	64	30.4	2300.82	23.01	10.81	2.70
3	71.65	35.7	Deodar	*Cedrus deodara*	54	29.5	1639.22	16.39	7.70	1.93
3	71.65	35.7	Deodar	*Cedrus deodara*	71	34.6	3133.64	31.34	14.73	3.68
3	71.65	35.7	Deodar	*Cedrus deodara*	39	26.2	809.65	8.10	3.81	0.95
3	71.65	35.7	Deodar	*Cedrus deodara*	47	31.5	1349.61	13.50	6.34	1.59
3	71.65	35.7	Deodar	*Cedrus deodara*	49	32.6	1503.33	15.03	7.07	1.77
3	71.65	35.7	Deodar	*Cedrus deodara*	31	25.9	525.92	5.26	2.47	0.62
3	71.65	35.7	Deodar	*Cedrus deodara*	36	26.7	711.36	7.11	3.34	0.84
3	71.65	35.7	Deodar	*Cedrus deodara*	38	19.6	591.65	5.92	2.78	0.70
3	71.65	35.7	Deodar	*Cedrus deodara*	23	8.7	111.93	1.12	0.53	0.13
3	71.65	35.7	Deodar	*Cedrus deodara*	38	18	547.22	5.47	2.57	0.64
3	71.65	35.7	Deodar	*Cedrus deodara*	31	18.2	380.58	3.81	1.79	0.45
3	71.65	35.7	Deodar	*Cedrus deodara*	33	17.5	411.74	4.12	1.94	0.48
3	71.65	35.7	Chilgoza	*Pinus gerardiana*	32	19.8	212.86	2.13	1.00	0.25
3	71.65	35.7	Chilgoza	*Pinus gerardiana*	27	19.3	136.67	1.37	0.64	0.16
3	71.65	35.7	Chilgoza	*Pinus gerardiana*	25	17.3	111.82	1.12	0.53	0.13
4	71.6	35.69	Deodar	*Cedrus deodara*	51	24.2	1231.07	12.31	5.79	1.45
4	71.6	35.69	Deodar	*Cedrus deodara*	42	21.5	773.74	7.74	3.64	0.91
4	71.6	35.69	Deodar	*Cedrus deodara*	24	18.8	245.23	2.45	1.15	0.29
4	71.6	35.69	Deodar	*Cedrus deodara*	32	21.2	463.95	4.64	2.18	0.55
4	71.6	35.69	Deodar	*Cedrus deodara*	41	25	850.06	8.50	4.00	1.00
4	71.6	35.69	Deodar	*Cedrus deodara*	37	19.4	558.15	5.58	2.62	0.66

Plot No.	Latitude	Longitude	Species Name	Tree Specie (Scientific Name)	DBH (cm)	Tree height (m)	AGB (kg)	AGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
4	71.6	35.69	Deodar	*Cedrus deodara*	36	20.5	558.33	5.58	2.62	0.66
4	71.6	35.69	Deodar	*Cedrus deodara*	32	18.7	413.54	4.14	1.94	0.49
4	71.6	35.69	Deodar	*Cedrus deodara*	24	16.7	220.00	2.20	1.03	0.26
4	71.6	35.69	Deodar	*Cedrus deodara*	28	18.2	315.80	3.16	1.48	0.37
4	71.6	35.69	Chilgoza	*Pinus gerardiana*	21	18.1	70.97	0.71	0.33	0.08
4	71.6	35.69	Chilgoza	*Pinus gerardiana*	24	18.4	100.53	1.01	0.47	0.12
4	71.6	35.69	Chilgoza	*Pinus gerardiana*	27	19.3	136.67	1.37	0.64	0.16
6	71.67	35.72	Deodar	*Cedrus deodara*	37	22.8	647.20	6.47	3.04	0.76
6	71.67	35.72	Deodar	*Cedrus deodara*	46	26.7	1114.97	11.15	5.24	1.31
6	71.67	35.72	Deodar	*Cedrus deodara*	49	27.5	1286.24	12.86	6.05	1.51
6	71.67	35.72	Deodar	*Cedrus deodara*	54	25.2	1418.78	14.19	6.67	1.67
6	71.67	35.72	Chilgoza	*Pinus gerardiana*	31	18	195.95	1.96	0.92	0.23
6	71.67	35.72	Chilgoza	*Pinus gerardiana*	37	19.6	310.83	3.11	1.46	0.37
6	71.67	35.72	Chilgoza	*Pinus gerardiana*	28	18	150.27	1.50	0.71	0.18
6	71.67	35.72	Chilgoza	*Pinus gerardiana*	26	17.7	123.86	1.24	0.58	0.15
6	71.67	35.72	Oak	*Quercus ilex*	24	15.6	353.96	3.54	1.66	0.42
9	71.65	35.71	Deodar	*Cedrus deodara*	43	22.4	838.79	8.39	3.94	0.99
9	71.65	35.71	Deodar	*Cedrus deodara*	42	22.5	806.66	8.07	3.79	0.95
9	71.65	35.71	Deodar	*Cedrus deodara*	63	29.5	2174.59	21.75	10.22	2.56
9	71.65	35.71	Deodar	*Cedrus deodara*	33	21.2	490.88	4.91	2.31	0.58
9	71.65	35.71	Deodar	*Cedrus deodara*	31	15	318.76	3.19	1.50	0.37
9	71.65	35.71	Deodar	*Cedrus deodara*	43	21.6	811.29	8.11	3.81	0.95
9	71.65	35.71	Deodar	*Cedrus deodara*	38	19	575.03	5.75	2.70	0.68
9	71.65	35.71	Deodar	*Cedrus deodara*	36	19.7	538.32	5.38	2.53	0.63
9	71.65	35.71	Deodar	*Cedrus deodara*	32	19.6	431.75	4.32	2.03	0.51
10	71.67	35.74	Deodar	*Cedrus deodara*	55	26.4	1531.25	15.31	7.20	1.80
10	71.67	35.74	Deodar	*Cedrus deodara*	47	21.9	967.14	9.67	4.55	1.14

Plot No.	Latitude	Longitude	Species Name	Tree Specie (Scientific Name)	DBH (cm)	Tree height (m)	AGB (kg)	AGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
10	71.67	35.74	Deodar	*Cedrus deodara*	32	19.8	435.79	4.36	2.05	0.51
10	71.67	35.74	Deodar	*Cedrus deodara*	39	20.2	637.90	6.38	3.00	0.75
10	71.67	35.74	Deodar	*Cedrus deodara*	43	25.7	951.41	9.51	4.47	1.12
10	71.67	35.74	Chilgoza	*Pinus gerardiana*	32	19.6	212.86	2.13	1.00	0.25
10	71.67	35.74	Chilgoza	*Pinus gerardiana*	27	16.8	136.67	1.37	0.64	0.16
10	71.67	35.74	Chilgoza	*Pinus gerardiana*	31	20.5	195.95	1.96	0.92	0.23
10	71.67	35.74	Chilgoza	*Pinus gerardiana*	29	19.6	164.67	1.65	0.77	0.19
10	71.67	35.74	Oak	*Quercus ilex*	23	12.7	291.68	2.92	1.37	0.34
10	71.67	35.74	Oak	*Quercus ilex*	21	13.4	267.82	2.68	1.26	0.31
10	71.67	35.74	Oak	*Quercus ilex*	30	15.2	468.21	4.68	2.20	0.55
11	71.64	35.67	Deodar	*Cedrus deodara*	55	26.2	1520.61	15.21	7.15	1.79
11	71.64	35.67	Deodar	*Cedrus deodara*	52	25.5	1338.37	13.38	6.29	1.57
11	71.64	35.67	Deodar	*Cedrus deodara*	34	22.8	554.26	5.54	2.61	0.65
11	71.64	35.67	Deodar	*Cedrus deodara*	43	24.2	900.38	9.00	4.23	1.06
11	71.64	35.67	Deodar	*Cedrus deodara*	45	25.6	1030.42	10.30	4.84	1.21
11	71.64	35.67	Deodar	*Cedrus deodara*	33	19.4	452.54	4.53	2.13	0.53
11	71.64	35.67	Deodar	*Cedrus deodara*	36	20.4	555.83	5.56	2.61	0.65
11	71.64	35.67	Deodar	*Cedrus deodara*	31	19.6	407.34	4.07	1.91	0.48
11	71.64	35.67	Deodar	*Cedrus deodara*	25	17.7	250.08	2.50	1.18	0.29
11	71.64	35.67	Deodar	*Cedrus deodara*	35	19.2	499.32	4.99	2.35	0.59
11	71.64	35.67	Chilgoza	*Pinus gerardiana*	20	18	62.49	0.62	0.29	0.07
11	71.64	35.67	Chilgoza	*Pinus gerardiana*	26	18.2	123.86	1.24	0.58	0.15
11	71.64	35.67	Chilgoza	*Pinus gerardiana*	28	18.4	150.27	1.50	0.71	0.18
12	71.65	35.69	Deodar	*Cedrus deodara*	68	30.4	2571.30	25.71	12.09	3.02
12	71.65	35.69	Deodar	*Cedrus deodara*	47	22.5	991.41	9.91	4.66	1.16
12	71.65	35.69	Deodar	*Cedrus deodara*	54	24.6	1387.79	13.88	6.52	1.63
12	71.65	35.69	Deodar	*Cedrus deodara*	39	21.2	666.79	6.67	3.13	0.78

Plot No.	Latitude	Longitude	Species Name	Tree Specie (Scientific Name)	DBH (cm)	Tree height (m)	AGB (kg)	AGB (ton/ha)	AGC (ton/ha)	BGC (ton/ha)
12	71.65	35.69	Deodar	*Cedrus deodara*	57	31.5	1922.22	19.22	9.03	2.26
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	32	19.6	212.86	2.13	1.00	0.25
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	21	5.9	70.97	0.71	0.33	0.08
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	36	20.7	289.39	2.89	1.36	0.34
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	38	19.6	333.21	3.33	1.57	0.39
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	23	8.7	89.97	0.90	0.42	0.11
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	34	18	249.32	2.49	1.17	0.29
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	32	18.2	212.86	2.13	1.00	0.25
12	71.65	35.69	Chilgoza	*Pinus gerardiana*	33	17.5	230.65	2.31	1.08	0.27
12	71.65	35.69	Oak	*Quercus ilex*	25	12.8	327.63	3.28	1.54	0.38
12	71.65	35.69	Oak	*Quercus ilex*	21	11.3	239.10	2.39	1.12	0.28
12	71.65	35.69	Oak	*Quercus ilex*	22	12.3	269.13	2.69	1.26	0.32


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