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"FORESTRY RESOURCE ASSESSMENT AND RESTORATION PLAN"

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'A CASE STUDY OF DRY TEMPERATE FORESTS OF INDUS KOHISTAN, KHYBER PAKHTUNKHWA

By:

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Abstract

The manuscript explains the objectives of the need of study and describes the study area mostly along the Indus River. It covers all the major forest types present in the area. It also covers the terrain and topography, geology, soils, climate and hydrology of the study area. The socioeconomic conditions are also discussed in detail. The forest types which have been identified falls in the Dry Temperate Zone with significant variations in tree species at different elevations, it also explains the legal status of natural resources in the area. Approach and methodology is given in detail which is used to prepare this plan. This also lists the major issues and threats to forest health, causes of degradation and climate change impacts. Most importantly in recommendation it describes the proposed mitigation and rehabilitation measures, including establishment of nurseries to supply seedlings, afforestation / reforestation, Block plantation trench sowing, non-timber forest products (NTFP) management. A participatory approach was applied for preparation of the management plan so that it is technically feasible, physically implementable and socially acceptable by the local communities. Therefore, extensive consultations were held with the forestry technical staff and local communities at all levels of field inventory and planning. Different mitigation and rehabilitation measures are suggested according to the prevalent locality factors in the short, medium and long terms. Major mitigation and rehabilitation measures proposed for practical implementation by the FMP are: 1) Raising of nurseries and establishment of forest plantations to counterbalance the pressure of fuelwood use on the natural forests, 2) Re-stocking of forest blanks and forest lands with low stocking density and rehabilitation of degraded forests through forest closures to help encourage natural regeneration, 3) Cultivation of fruit plants to help enhance the local economy, 4) Ensuring participation of local communities in conservation and development of natural resources and promote their skills and confidence for self-reliance.

Keywords: Forest health, Forestry Management, Forest resources, Forest resource assessment, Forest degradation, Forest Restoration

Introduction

The forest resources of the upper Kohistan are playing pivotal role in regional stability and providing integer of services i.e., soil protection, watersheds enhancement, home to wildlife, source of clean air and water, timber, fuel wood & food supplies, medicinal plant, grazing lands and goes on. Forest assessment is a concept to identify the green wealth

conditions and status through possible ways and to recommend its utilization and restoration plan as per the site conditions while keeping the future in mind.

It is very much needed to know about the resources and to avoid blind and unscientific utilization of natural resources which leads to resources losses and degradation. As per international guidelines the natural resources are like a bank account which should me well know and recorded for better management and utilization to maintain the sustainability. The non-recorded and non-assessed/unattended natural resources are unable to manage as per the natural resource management principals.

The restoration leads to the rejuvenation and rehabilitation of degraded forest/habitats. The restoration plan will be implemented as per the previous/original conditions of forests/habitats keeping the native conditions and engagement of local communities' and requirement will be instrumental. Local community's involvement will provide jobs opportunities which directly leads to the improvement of socioeconomic conditions and overall stability in the region, during the development of restoration plan consultation with local masses, concerned governmental and non-governmental institution was considered as integral part of restoration planning to build the ownership among the communities and get the activates practicable and implementable.

The dry forests of the upper Kohistan are under heavy natural and anthropogenic pressure. The local people are not supported by alternative sources to keep the forest conditions healthy, so the local in habitants are mostly dependent on these forests for construction, heating, and cooking purposes. Forest resources of the valleys are degrading swiftly and adding its part to climate change, global warming, local & regional floods, soil erosion, accelerated melting of glaciers, human wildlife conflicts and loss of biodiversity.

The dry temperate forests are highly important in terms of ecosystem services which are not quantitatively assessed in the area till date. In project area major forest species are oak, blue pine, deodar and chalghoza and locals are mainly dependent on these tree species for different purposes and these forests are home to variety of wildlife and medicinal plants, detailed assessments and planning/management is required to safeguard these resources, the restoration of green assets is critical and would be a game changer.

The major threats to the local forests in the study includes, over exploitation of forests, unsystematic grazing, timber smuggling, unscientific policies, weak law informant, no alternative sources of energy, flash floods, hunting & poaching, landslides, heavy snowfalls, Climatic variation and changes.

No such assessment was made in area for dry temperate forests in the study area even the responsible managers are not well known about the reality of forests health because of remote and harsh conditions, the presented effort is made in a unique way to assess the health of targeted forests and to plan/recommend its restoration activates as per the treatment and care required,

The current health status of target forests and the reasons of degradation and its mitigation/ restoration plan to rejuvenate the original forest cover to support the biodiversity resulting in the better life for all forms.

Main objectives of the Study

- Review and update the existing situation of Forestry resources in the targeted valleys and to explore the present Forestry situation
- Diagnose and analyze the threats to the forests of the study area through field surveys
- To restore and rejuvenate the density of existing degraded forests

METHODOLOGY

Study area

The study area is the Siyal valley (Sub-valley of Kandia valley) right of Indus River and Harban Valley left of Indus River, for the purpose the horizontal expansion of the study area is bordered up to 3,000 meters masl on either side of the River Indus, which covers the dry temperate forest type in the study area.

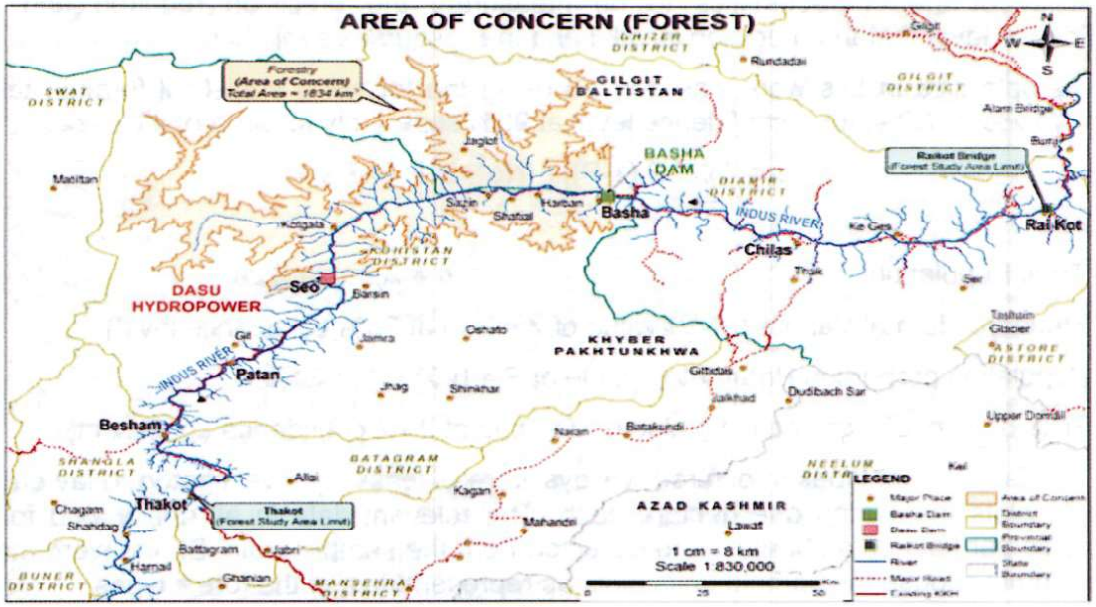

Figure-1: Study area (Harban and Kandia valley)

Degraded Forest Characterization

After in-depth discourse and consultations with GIS team, criteria to delineate degraded valleys were established on the following basis: "If forest cover in a valley is 30% or less of the total land cover, within the study area limits, that valley will be declared to be a Degraded Valley on the basis of the above-mentioned characteristic, which governs the principle of declaring a valley as degraded or otherwise. However, it may not be assumed that the original cover was 100% because of the rock outcrops, steep slopes, and dry climate. Land cover of any valley has been classified under different classes like barren area, agriculture area, built-up area (settlements), water bodies, etc. apart from forest cover.

Sampling Methodology

Given the different forest types in the Study Area and the altitudinal variations therein, and as discussed with the Non-Key International Consultant, a Stratified sampling method was adopted as devised by ***Newbold, 1984*** **"Allocation of Samples among Strata"**. It was deemed appropriate to perform stratified sampling for the field inventory in order to verify the ground truth / real time situation of forest degradation against the GIS-derived degradation level of high hill forests, as measured from medium resolution satellite imagery. All coniferous forest types were treated as one single stratum due to the inability of GIS to display different forest types within the coniferous ecosystem. However, Deodar forests were found to be the dominant entity. Important parameters considered for stratification were the prevalent eco-systems and altitudinal zonation of forest types. Sampling intensity was also adjusted based on stand heterogeneity.

Sample Size

The sample size in any study is determined by the type of study, objectives of the study, variability of the characteristics to be measured, the precision required and the confidence level that the precision is valid and the resources available.

The sample size in this work was derived using the following statistical formula taken from *Newbold, 1984*, for a confidence level at 95% separately for area of all leases.

$$n = \{NZ^2 P (1-P)\} / \{N\alpha^2 + Z^2 P (1-P)\}$$

Where;

N = Total Population n = Sample Size

Z = Standard Normal Variate (SNV)(value of Z =1.96 at 95% confidence level)

P = Population proportion Parameter (value of P = 0.5)

α = Error or level of significance (value of α = 0.05 at 95% confidence coefficient)

The available forest types in different valleys were extensively investigated to lay out 11 sample plots measuring one hectare each. The relevant data in all designated forest types, as per field data sheets, were collected from the sample plots. Efforts were made to randomly choose the sample units/plots as representative of the forest types.

Results and discussion

Soil

The entire area is mountainous with steep slopes. Topography of the area is mostly composed of rough and rugged slopes with few small scattered flat portions. The coniferous forests lie entirely on mild to precipitous hill slopes having elevation of 1200 to 3500 masl. Soil structure and composition overall varies from place to place and is highly reliant on the existing parent material, aspect, slope and nature of vegetation. In high altitudinal regions soil is deep on cooler aspects and in lower regions the soil is shallow, degraded and deprived of vegetation (Shah 1988).

Climate

The area experiences both subtropical and temperate type of climates; below 1,500 m, the former type is prevalent and above this altitude the latter is prominent. Rainfall is about 500-750 mm in the South and Southeastern part of the area and decreases to 250-375 mm towards North and Northwest. Winter starts from early November with the first snowfall on higher peaks and lasts till March. During these months, temperature falls below zero degree centigrade. The major portion of precipitation is received in form of snow. Summers are pleasant in the inner valleys while hot summers are experienced below 900 m altitude. No meteorological observatory has been established in the Upper Kohistan district. However, data recorded at Besham and Naran, the nearest stations are reproduced.

Social Amenities and Infrastructure

Generally, the surveyed areas have little access to roads and markets and other infrastructure is in a dilapidated condition, including hospitals and schools. The majority of the area lacks the provision of electricity, natural gas and water supply systems. Other facilities such as post offices and banks exist only in the main cities.

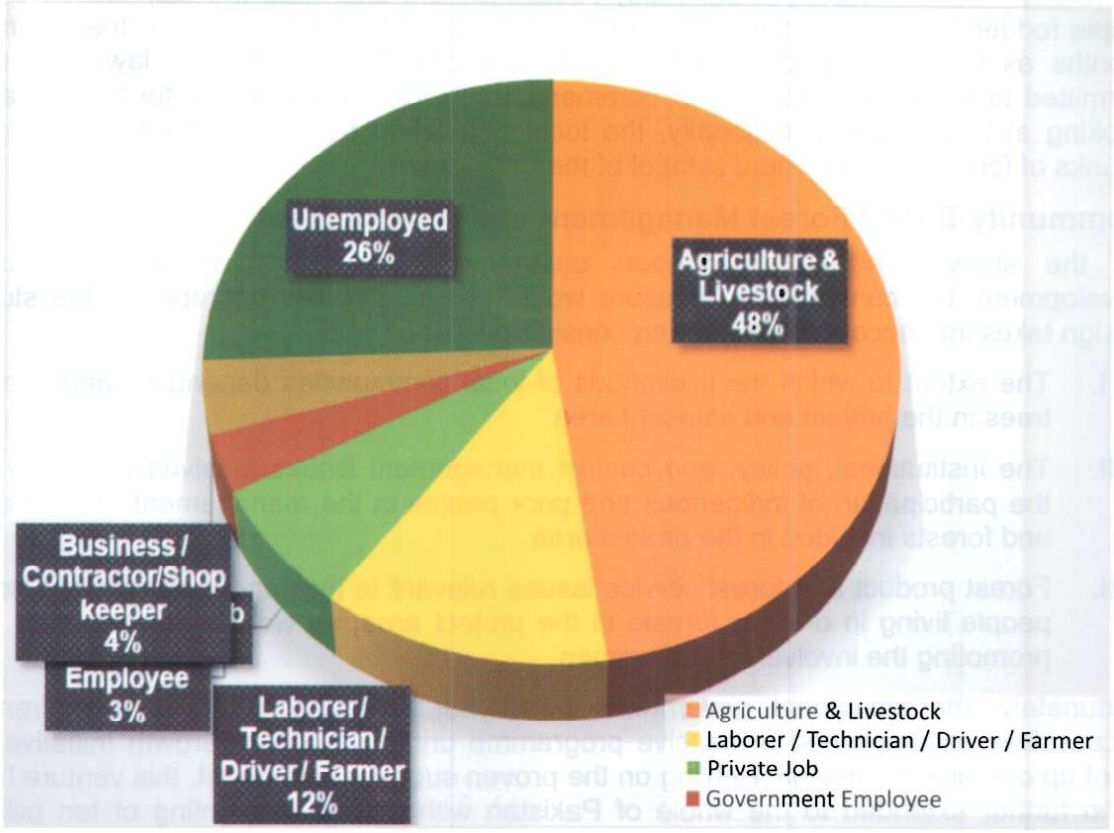

Figure-2: Socioeconomic status of the study area

Sources of Cooking and Heating

The main source of cooking and heating is wood. The daily average use of wood per household in summer has been calculated to be 20-40 kg, while in winter the use of wood increases to 60-80 kg per household per day.

Economic Importance of Forests

The local communities in the Study Area are largely dependent on the forest resources in all its forms and manifestations. Forests and livestock have always remained sources of their inherent livelihood dependence and subsistence economy. Wood and timber play a vital role all across their lives from cradle to grave. Wood is used in all stages of their life from heating and cooking to houses and mosque construction.

At times, the wood gains extreme importance when in the absence of all other alternate sources of energy in the area, the wood becomes a life-saving item in the cold winters when people are confined to their houses for months. The higher elevations of the study area become cold with consistently low temperature below 0°C and the wood heat sustains the dweller's body temperatures to maintain life. The wood is of high caloric value such as oak forests in the Study Area. Farmers also feed the Oak leaves as a staple fodder and the dried nutritious grasses collected from the forests in the summer months as hay making for stall feeding their cattle. As a customary law, it is not permitted to sell the oak forests for commercial purposes, but to use it for heating and cooking at local level. Traditionally, the local population feels pride for having larger chunks of forests as an evident symbol of their affluence.

Community-Based Forest Management and Development

As the study designed to support community-based forest management and development, the conservation measure would ensure that, as appropriate, the study design takes into account the following considerations:

I. The extent to which the livelihoods of local communities depend on and use of trees in the project and adjacent area

II. The institutional, policy, and conflict management issues involved in improving the participation of indigenous and poor people in the management of the trees and forests included in the project area

III. Forest product and forest service issues relevant to indigenous people and poor people living in or near forests in the project area, as well as opportunities for promoting the involvement of women

Fortunately, the incumbent government of Khyber Pakhtunkhwa (KP) has already successfully accomplished a massive programme under its Green Growth Initiative to plant up one billion saplings. Relying on the proven success of the past, this venture has been further extended to the whole of Pakistan with estimated planting of ten billion saplings in the coming five years (2018-2023) under the Green Pakistan Programme. These achievements have rather enhanced the will and commitment of the policy makers to focus on this important area of national and international importance especially, in the wake of dire consequences of global warming. These efforts are

greatly in line with the Bonn Challenge 2011, Aichi's Biodiversity Targets (2010-2020) and National Biodiversity Targets (2015-2020).

Forest Cover types

Dry Temperate Deodar Forest

This is a high-altitude forest ecosystem confined to the inner valleys of Kohistan and GB mountains ranges, which are beyond the reach of monsoon rains. Mean annual rainfall is 750 mm and mean annual temperature is 5 °C-15 °C.

This ecosystem is located at elevations between 1,700 and 2,300 meters amsl and with sporadic admixture of Kail, Fir/Spruce and *Quercus dilatata*; it extends up to 2700 meters amsl. Dominant tree species include Deodar (*Cedrus deodara*) with patches of Spruce (*Picea smithiana*), Blue Pine (*Pinus wallichiana*), and Chilghoza (*Pinus gerardiana*) in the wetter niches and sporadic growth of *Juniperous excelsa*. The broad-leaved associates include Oak (*Quercus ilex* or *Q. Baloot)*, *Acer caesium* and Sum (*Fraxinus xanthozoloides)*.

Dry zone Deodar forests represent a climax form and in Kandia-Uthor valleys, it consists of about 68% of the total coniferous stand by number of trees and 54% of the total coniferous stock by volume (Shah, 1987).

Density of the crop and its state of regeneration vary with the change in aspect, slope and soil condition. On moderately steep slopes with sufficient deep soil and adequate moisture availability, a high-density crop with good quality can be found as in Khwar, Kot, Mashbil, Siyal, Bagro, Kafar Banda and Karang of Kandia valley and Uthor Siri. The regeneration in these forests is adequate and established. Regeneration of deodar was found to be excellent and profuse on cool aspects where sufficient gaps had been created as a result of heavy felling in the past.

The excessive felling of the forest in the past carried out by the Kaka Khel Miagan in contractor system have eliminated large sized Deodar trees in almost all the accessible forests in parts of Thauti, Kafar Banda, Mashbil and Maidan as observed during the field survey. In the worked over areas, the crop ranges from young to sub-mature ages with sporadic occurrence of mature and over mature trees. Despite heavy cutting in the past, still there are stretches of normal forests with preponderance of mature forest stands in Kandiah valley.

Chilghoza (Pine Nut) Forest

The species is found sporadically all over the Study Area in varying proportions. It mainly occurs at an elevation between 2,100 to 2,800 meters amsl. In Gor Thak and Kiner areas on the East, Southeast and Northeast of Chilas town, the species exists in considerable proportion tending to from a pure belt. It, however, exists mixed with deodar, juniper and oak and sum. *Ephedra spp.*, *Pistacia* and *Berberis spp.* are found as undergrowth in this forest type. Chilghoza Pine (photo 5.5) has a tendency to regenerate well on dry precipitous locations amongst the Deodar forests away from habitation and grazing pressure. It, however, fails to regenerate satisfactorily under shade and in places close to habitation.

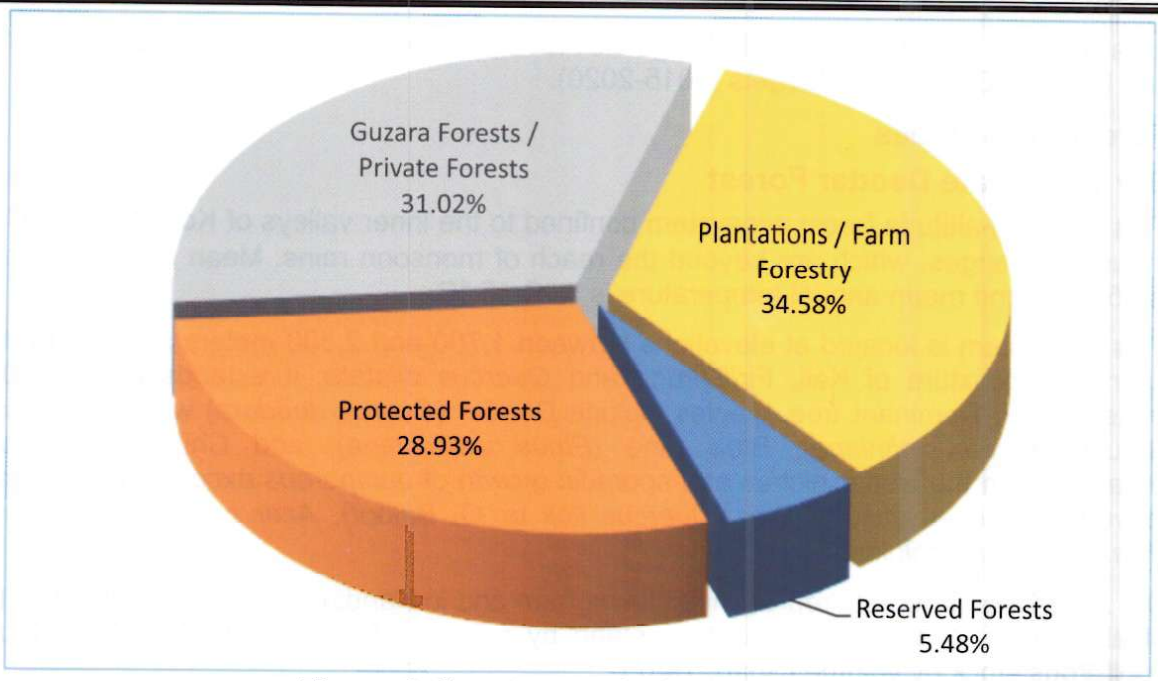

Figure-3: Forest status in the study area.

Dry Zone Blue Pine Forest

These forests occur between the elevations ranging 2,700 to 3,200 meters amsl on Northern aspects. A few pure Blue Pine forests. Such as Sumetal and Boyer forests, exist within this altitudinal range in the Study Area. An impressive elegant stand of pure Blue Pine offering enormous scenic beauty to the area along Babusar forest road had been felled in the recent past by tribal owners followed by a government policy that further encouraged the tendency of illegal cutting in the area. The condition of regeneration is good but free grazing and browsing in the forest area is a great impediment to establish adequate regeneration. The undergrowth flora is more or less the same as that of the dry zone Deodar Forest or Chilghoza forest. The forest in its commercial value ranks next to Deodar Forest as constructional timber.

Forest cover status

It should be emphasized from the standpoint of the vegetation cover, the targeted valleys were recorded degraded from a forest cover and timber yield point of view due to the mature and over-mature trees already harvested under the prescription of the existing management plans or by illicit exploitation of the forests under the unrealistic amnesty policies of the past. Therefore, these forests require proper conservation measures for several decades to come so that they can recover.

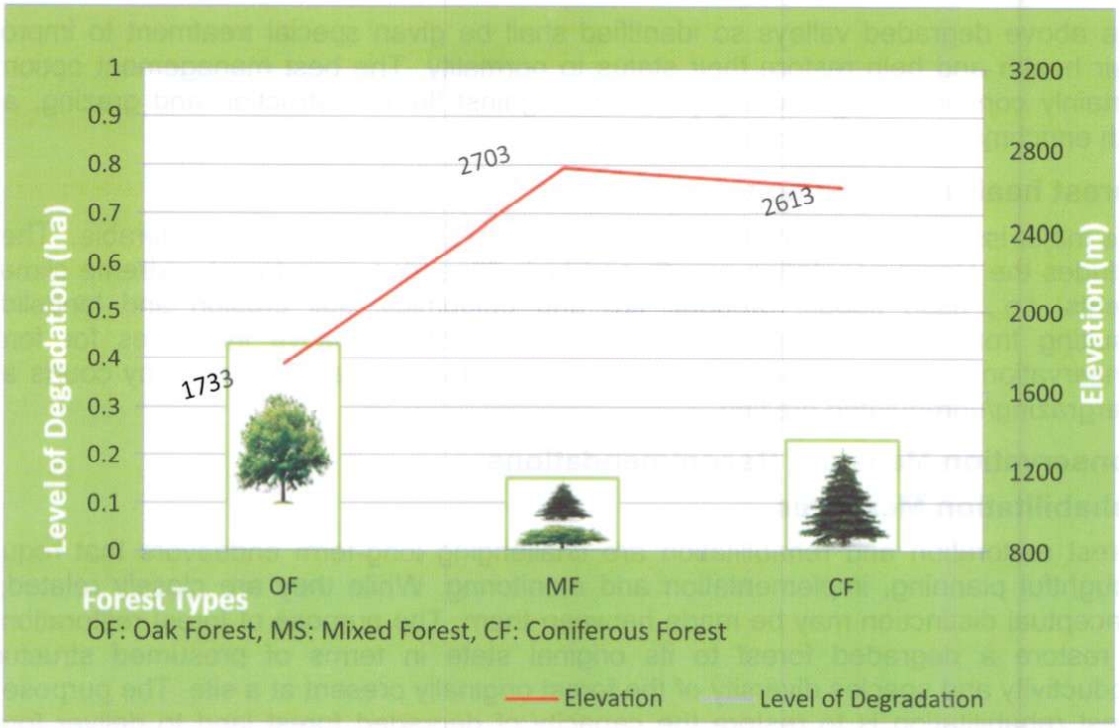

Figure-4: Forest degradation level in Siyal Valley Kandia

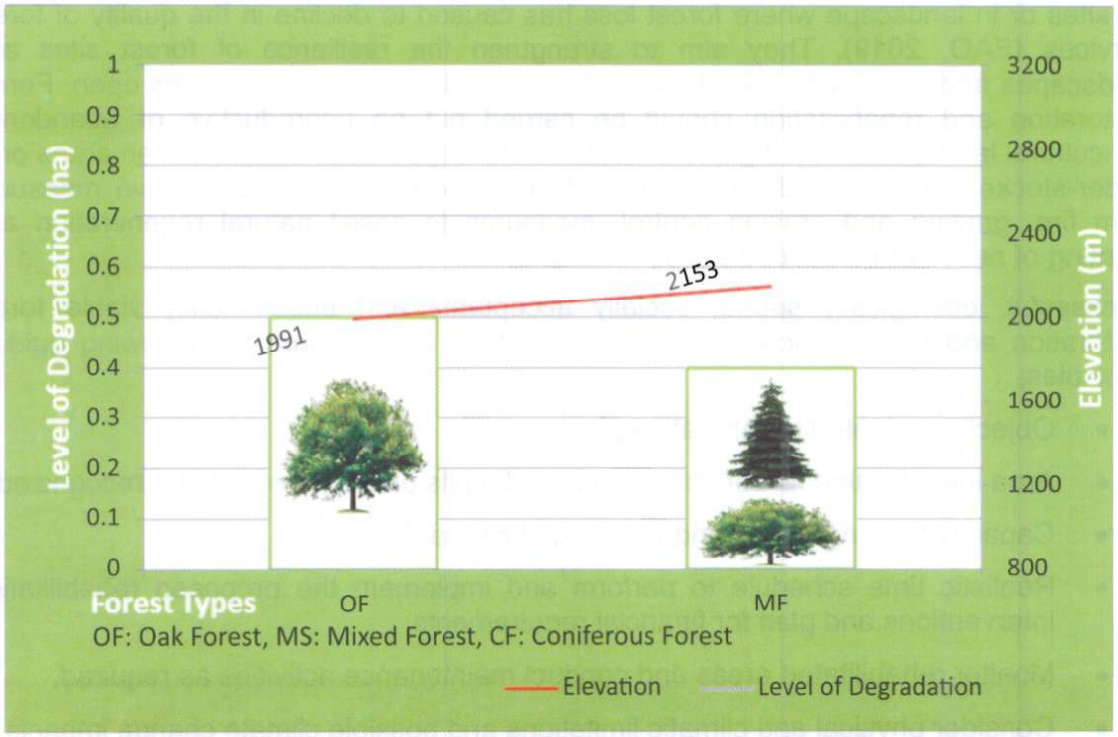

Figure-5: Forest Degradation in Harban Valley

The above degraded valleys so identified shall be given special treatment to improve their health and help restore their status to normality. The best management option is certainly conservation, including protection against floral destruction and grazing, and with enrichment planting of suitable tree species.

Forest health assessment

The major issues and threats to forest health in the Study Area are considerable. These includes the Rapid population growth and high dependency on forest, extreme climatic events, i.e., flash floods, drought, fire and epidemics, soil erosion and landslides resulting from massive logging operations, lack of alternative incentives for forest conservation, low cognizance and adjudication of forest-related offences by courts and overgrazing/unregulated grazing,

Conservation Measure/ Recommendations

Rehabilitation Measures

Forest restoration and rehabilitation are challenging long-term endeavors that require thoughtful planning, implementation and monitoring. While they are closely related, a conceptual distinction may be made between them. The purpose of forest restoration is to restore a degraded forest to its original state in terms of presumed structure, productivity and species diversity of the forest originally present at a site. The purpose of forest rehabilitation is to restore the capacity of degraded forest land to deliver forest products and services. Both forest restoration and forest rehabilitation are implemented on sites or in landscape where forest loss has caused to decline in the quality of forest services (FAO, 2019). They aim to strengthen the resilience of forest sites and landscapes and thereby to keep future land-use and management options open. Forest restoration and rehabilitation should be carried out on unproductive or abandoned agricultural lands, deforested grasslands, brush lands, scrublands and barren areas or in under-stocked or degraded forests. Forests may be restored by protective measures from fire, grazing and erosion control, measures to assist natural regeneration and planting of native or introduced trees.

Successful, ecologically sound, socially acceptable and economically viable forest restoration and rehabilitation initiatives should take into account the following guiding principles;

- Objective oriented rehabilitation plan,
- Area identification for rehabilitation including its present status to be recognized,
- Capacity building needs and planning of relevant training,
- Realistic time schedule to perform and implement the proposed rehabilitation interventions and plan for financial requirements
- Monitor rehabilitated areas and conduct maintenance activities as required,
- Consider physical and climatic limitations and possible climate change impacts.

Afforestation

Afforestation includes different techniques of planting and sowing to help improve a barren area with suitable vegetation cover. Rejuvenating an already degraded forest area is technically called Reforestation.

The marginal lands constituting the catchment areas of Indus cascade. Social organization shall precede the planting operations to settle roles and responsibilities of the beneficiary communities and the executing agency. The social bodies so constituted shall actively assist the implementing agencies in acquiring the community wastelands for afforestation activities and its subsequent protection, maintenance and development.

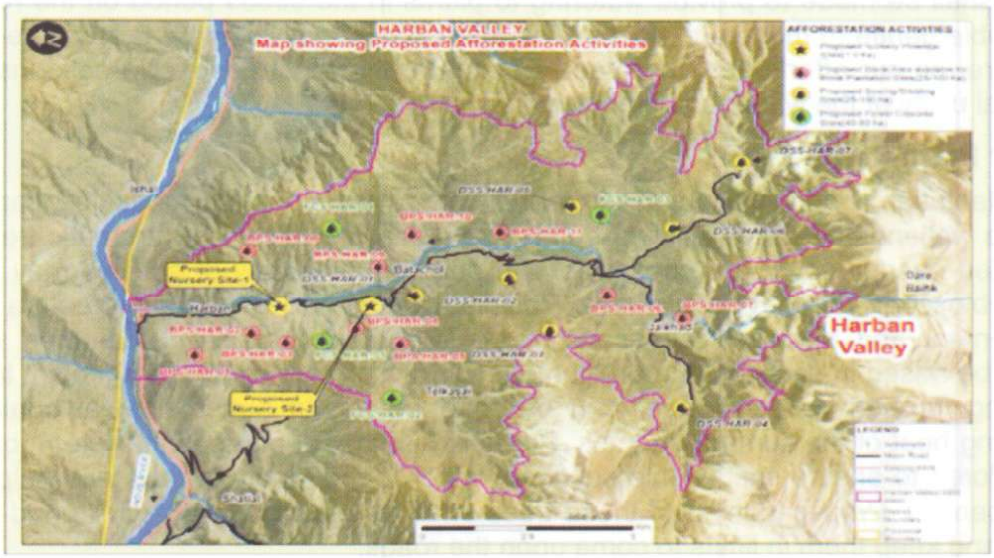

Figure-6: Harban valley proposed afforestation plan map.

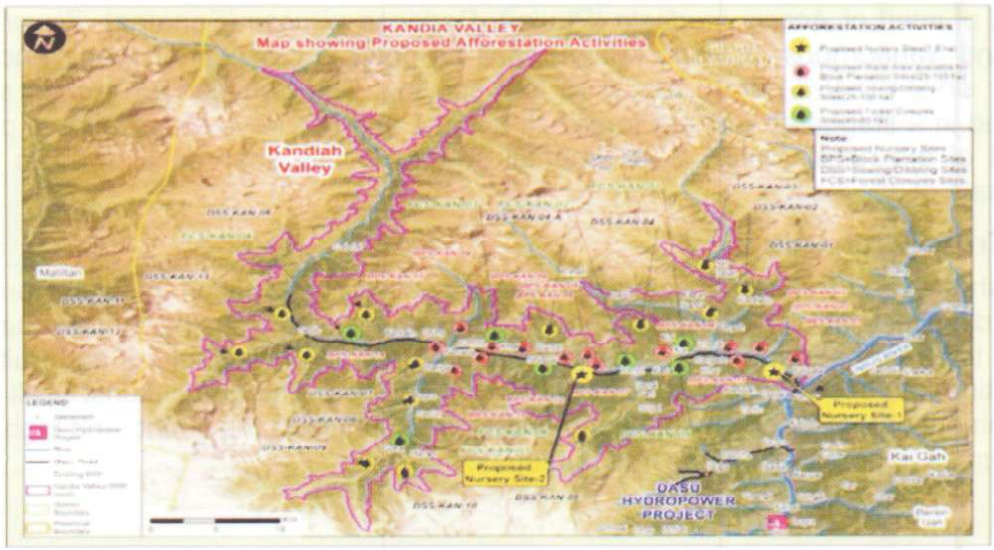

Figure-7: Kandia valley afforestation ongoing activities.

Block Plantation

Block plantation is defined as establishment of a large number of plants over a compact area to any extendible limit for the purpose. These plantations, according to the site suitability, may have pure stands of a forest type or a mix of energy plantation as well to ward off the pressure for fuelwood from the existing natural forests.

Planting of saplings shall be carried out twice a year in the spring and rare downpours received in the month of July and August with major reliance on natural precipitation except for limited water supply in the foothills. Preference would be given to the degraded watersheds. Whilst watering of plants on steep slopes is next to impossible, efforts shall be made to provide watering to plants in the stress period on the relatively accessible gentle to moderate slopes. The afforestation activities are tightly time-bound; therefore, all out efforts shall be made to capture the most conducive seasons to get maximal utility of the winter and summer rains.

Linear Plantation

Liner plantation is a kind of plantation that is carried out along the roadsides, canal side and the wetlands available as river delta. Evergreen, flowering and aromatic trees with controlled canopy cover are chosen for the purpose. A variety of species may include Cherry blossom, Citrus, Walnut, Olive, Robinia, Deodar and Chirpine to create a serene environment and attractive landscape in the rugged mountains. These tree species should be raised in sections of four kilometers with 3 meters spacing from plant to plant. Watering through water browser can be provided for its better survival against the scorching heat of the summer months. Possibility of the "drip irrigation system" can also be explored to ensure sustainable supply of water to the plants in rows and help curtail the expenses. Proper training of these trees shall be required to give it a good-looking shape and keep them in limits to come upon the roads.

Trench Sowing

Sowing of seed of *Acacia modesta* (Phulai), *Dodonea viscosa* (Sanatha), *Zizyphus spp* (Ber) and *Nannorhops ritchiana* (Mazri) shall be done in crescent-shaped trenches on steeper slopes (>45%) at 10 feet x 15 feet spacing. The trenches for sowing shall be designed in a staggered manner to arrest, harvest and conserve the maximum possible amount of the runoff water. Supplemental sowing in pits shall be allowed to ensure higher rate of success.

Fruit Trees/Orchards

Acute shortage of fruit trees was observed as against the situation in Gilgit Hunza and Chitral despite relatively similar climatic and soil conditions. Keeping in view the scope for fruit trees in the study area, a substantial programme of fruit culture and fruit plants distribution has been firmed up during the project period. The horticulturist shall ensure procurement of root stock, budding and grafting material from the sound and high-quality fruit sources to propagate in the fruit nurseries.

Conclusion

The following inferences are drawn from the analysis of primary and secondary data, discussion with the key forest officials and relevant communities, indigenous knowledge and personal field observations.

i. The results as analyzed and derived from the field data were in close conformity with the GIS-based estimates within allowable limits.

ii. The degraded forest valleys, having less than 30% vegetation cover, will require the special attention of area managers and must be brought under intensive care for remedial and development interventions. A failure to act in this way will take the area to a point of no return and bring about potentially permanent ecological imbalance.

iii. There is a dire need for the introduction of fast-growing tree species to cope with the enormous and growing demand for firewood for cooking and heating purposes. The potential for growing such trees on marginal lands at the lower elevations not capable of cultivation is apparent and should be exploited. Due to the limited scope of suitable land at the higher elevations, the natural biodiversity may not be impaired by a mix of exotic species.

iv. Any future plans to be prepared and implemented in the area to surmount degradation of forests should be long-term in view of the climatic and physical limitations and long gestation period of the forest species.

v. The non-timber forest produce was generally observed to be in poor condition due to uncontrolled grazing and unscientific methods of collection and extraction. The forests offer ample potential but need to be managed for NTFPs and other forest eco-services.

vi. Institutional strengthening and capacity building of staff and community activists should be carried out, after a gap analysis around the planned objectives, to create awareness and ownership.

References

Ahmed. I. and Iftikhar. M. May. 2014. Revised Working Plan for Government Managed Private Coniferous Forest of Chilas, Darel & Tangir Sub-Divisions. Diamer. District, Gilgit-Baltistan. Forest Department.

Aslam, M. H. and Yoshimura K. 2017. Sediment Yield in Jhelum River Basin with and without Climate Change in Pakistan. Journal of Japan Society of Civil Engineers, Ser. B1 (Hydraulic Engineering), Vol. 73, No. 4, I_85-I_90.

Bangash, A. Q. (1985-86 to 1999-2000). Revised Working Plan for the Kandia and Uthor Valley Forests of Kohistan Forest Division. NWFP Forest Department. Peshawar.

CSIR. 1950.The Wealth of India: A Dictionary of Indian Raw Materials and Industrial Products.New Delhi: Council of Scientific and Industrial Research. Government of India Press.

Iqbal, M. 1991.Non-Timber Forest Products: Their Income-Generation Potential for Rural Women in North West Frontier Province (Pakistan). International Labour Organization & Government of NWFP, Peshawar.

Khan, A. A. 1985.Survey of Crude Drug (Herbal) Markets in Pakistan. Peshawar: Pakistan Forest Institute.

Khan, A. A. and S.H. Zaidi. 1989. Propagation and regeneration technology of pharmaceutical and medicinal plants. Biological Sciences Research Division, Bulletin No. 8. Pakistan Forest Institute, Peshawar.

Khan, S. A. 1985.An Analysis of Supply Situation of Pharmaceutical and Medicinal Herbs in Pakistan. Karachi: Export Promotion Bureau, Government of Pakistan.

Khyber Pakhtunkhwa Wildlife and Biodiversity (Protection, Preservation, Conservation and Management) Act, 2015. Government of Khyber Pakhtunkhwa. Enacted 9 Jan 2015.

Newbold, P. 1984. STATISTICS FOR BUSINESS AND ECONOMICS. Prentice- Hall, Inc., Englewood Cliffs, New Jersey 07632. "Allocation of Sample Efforts among Strata" 770-71 P.

Pakistan Forest Institute. 2012. Land covers Atlas of Pakistan, Peshawar, PFI, Government of Khyber Pakhtunkhwa.

Qarshi I., and A. Hussain, 2011. Medicinal Plants of Qarshi Herb Garden, Volume-1.

Shah, H. (1987-88 to 2001-02). Working Plan for Seo Forest of Kohistan Forest Division. NWFP, Forestry Pre-Investment Center. Peshawar.

Strategic Plan for Biodiversity 2011 – 2020 and the Aichi Biodiversity Targets, Convention on Biological Diversity, 2010.

United Nations, 2017. Convention on Biodiversity