

Research Article

Analyzing the impact of forest harvesting ban in northern temperate forest. A case study of Anakar Valley, Kalam Swat Region, Khyber-Pakhtunkhwa, Pakistan

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Abstract

The devastating flood of 1992 due to policy shift of forest management to owners compelled the government to imposition of ban on green tree cutting and extraction of timber from the forest. The ban on one hand resulted in accumulation of huge volume of mature trees due to either disease, decay or dying affecting the soil and ecosystem while on the other hand adversely affected the livelihood of owners. The study was conducted to assess the amount of felled and decaying timber due to ban on harvesting to highlight huge economic loss to the owners and society. For this purpose, we analyzed volume of dead, dry and diseased trees in Anakar valley, Kalam District Swat. Twelve grids of 400 x 400 meters were taken for quantification where diameters at breast height were measured for all felled trees and local volume table was used for volume estimation. The study concluded that total volume of *Pinus wallichian* and *Abies pindrow* is 41.61 m³ and 1121.40m³ respectively (Total 1163.01 m³) in the study area which correspond to 5302.67 m³ for the whole coniferous forest of the country. The study concluded that unextracted and decaying timber is affecting the health of the forest through spreading of diseases and enhancing risk for forest fire in future along with huge economic loss both to the state and owners. The study will help the scientific community to know the impact of harvesting ban and investigate further its effect on soil and can be replicated at global level.

Keywords: Dead; Diseased; Decay; Dry; Kalam; Swat

Introduction

Forest is an important asset of the land that covers 4 billion hectares in the world constituting about 31 percent of the earth's surface. Tremendous yield including tangible, and intangible is obtained from these resources. The benefits obtained from

these forests are not limited only to material products but also provide other benefits like water conservation, protection of soil against erosion, pasture, recreational facilities. An average person may not be aware of these products. Habitat for animals, livelihood for human beings,

shelter, water, food, and fossil fuels are other benefits of forests. Similarly, forest is one of the world's largest storehouses of carbon besides its function of protection watersheds and reduces the amount of erosion and chemicals that reach waterways [1]. Unfortunately, Pakistan has 5.3% of forest cover which is far less than the required percentage of forest cover (25-30%). These forest resources have great diversity in composition and structure including coniferous, irrigated, riverine, scrub, coastal, mazri and linear plantation. Coniferous forest is the natural forest which constitute 40% of the whole forest cover of Pakistan that occurs in northern areas of

Punjab and KPK (Khyber-Pakhtunkhwa). Scrub forest is another category which constitutes 34.75% which function as protective cover for soil erosion and provide fuel wood and fodder for livestock holders. The forest cover percentage and type vary with provinces and the Baluchistan have largest geographical area, but its forest cover is not according to the mark. Forest cover of Khyber-Pakhtunkhwa (17%) is the highest that also contained species of economic importance in northern temperate forests. [2]. The (Table 1) shows the distribution of forests in various provinces of the country.

Table 1. showing detail of forest cover in Pakistan

S. No.	Province	Total land area (000 hectares)	Forest area (000 hectares)	Percentage
1	KP	10170	1410	13.9
2	Punjab	20630	630	3.1
3	Sindh	14090	680	4.8
4	Baluchistan	34720	720	2.1
5	GB	7040	770	11
6	AJK	1330	360	27
Total		87980	4570	5.2%

Source: Pakistan Forest Institute

Coniferous forest particularly situated in hilly areas of Pakistan and plays a very important role in watershed management and play role in reducing chances of flood [3]. One of the reasons of the inadequate forest resources is aridity condition (80%) of the country that support minimum vegetation due to insufficient rainfall. [4]. Soil and natural regeneration is adversely affected by aridity conditions leading forest degradation. Other factors that aid in forest degradation are absence of proper legislation (property right spheres, land tenure system) and distortion in timber trade and absence of clear-cut government policies and financial constraints to implement legislations [5]. The forest of Khyber-Pakhtunkhwa province is forested with trees of varying density and there is little realization of such biodiversity rich

resource which is at the risk of degradation [6]. The degradation of forest is a serious matter in Khyber Pakhtunkhwa. These forests have been degrading rapidly over the past three decades partly from commercial over exploitation and partly from tremendous social pressure due to inevitable socioeconomic needs. The situation became strikingly open to a wider public when a catastrophic flood of September 1992 brought miseries to human life. This loss of resources and human life was publicly attributed to degraded conditions of the forests in upper watersheds of KP. In response to such public discussion and opinion, the Government reacted immediately and abolished Forest Cooperative societies and imposed a general ban on all sorts of

commercial timber harvesting and suspended all ongoing working plans [7].

Study area

Swat District is situated in the northern part of Khyber Pakhtunkhwa (35.2227° N, 72.4258° E). The total area of Swat is 5,337 km² (kilometer square). It is situated at a distance of 160 km/100 miles away from Islamabad, the capital of Pakistan. Swat is bounded by district Ghizer of Gilgit Baltistan and Chitral district. The eastern side of Swat is Kohistan district, Shangla district and Buner district and protected area cover by southern boundary and west area is bounded to lower and upper Dir district. Saidu Sharif is the divisional head quarter of Mingora. Swat district covers about 20% of the forest. The major areas where conifer forest occurs are the northern areas of Kalam and Madyan. Due to suspension of working plans and ban on the extraction of timber from the forest, a large quantity of wood is decaying due to one or other reason. The most important reason is due to dead, dry and diseased. These trees are lying in various forests of Swat in the coniferous forest with varying quantity. This study has been designed to investigate the quantity of dead dying and decayed trees and its effect the health of forest in ANAKAR valley Kalam which is situated 99 km from the main city of Mingora Swat. There are 3 communities in Kalam and all the ownership of these forests belongs to them. These communities are Utroris, Kalamis and Ushuwals. Although proper demarcation has not been carried out in Kalam for this forest but the shares from the harvesting of the forest is distributed among these 3 communities. The (Fig. 1) is showing map of study area along with grid details.

Materials and Methods

The existing study was conducted in ANAKAR valley District Swat of Khyber-Pakhtunkhwa to estimate volume of the dead, dying, and decayed trees that accumulated due to ban on forest harvesting. The study area was clipped from the google earth Pro and the layers

were processed in Arc GIS 10.5 (Fig. 1). To properly assess the volume due to 3D (dead, decay and diseased), twelve grids of size 400 x 400 selected on random basis for measurements. To avoid overlapping of the grids, the minimum distance between two consecutive grids was not less than 300 meters in any case. Volume was estimated for two species of coniferous e.g. *Abies pindrow* (Fir) and *Pinus williciana* (Kail) by measuring diameter at breast height and using local volume table. The diameter of felled trees was measured by caliper. The reasons for the falling of the tree were also recorded. The data thus obtained was transferred to excel sheets for all the twelve grids and volume was calculated for the whole study area. The same volume was also generalized on whole coniferous forest of the country.

Results

Volume calculation of decay wood

The area is dominated by the *Abies pindrow* therefore, the result of the study indicated that decay volume of kail and Fir is 0.10 and 2.61m³ (cubic meter) per hectare in the study area. For the total study area of 429 hectares, the total volume thus becomes 1163.01 m³ (41.61 m³ and 1121 m³) respectively for *Pinus wallichiana* and *Abies pindrow* (Table 2). Similarly, according to Pakistan Forest Institute (Table 3), the total coniferous forest of the country is 1959000 hectares, so the total volumes of both the species becomes 5310810 m³

Reasons for wood decay

During the study, reasons for the decay of *Abies Pindrow* and *Pinus wallichiana*. in the study area was also recorded and reflected in (Fig. 2). The figure demonstrated high figure of 62 and 17 trees decaying due to over maturity of for *Abies Pindrow* and *Pinus wallichiana* respectively. Although other factors such as girdling and fire along with thunderstorm are also contributing toward decaying of trees but it has non-significant effect on the decaying trees.

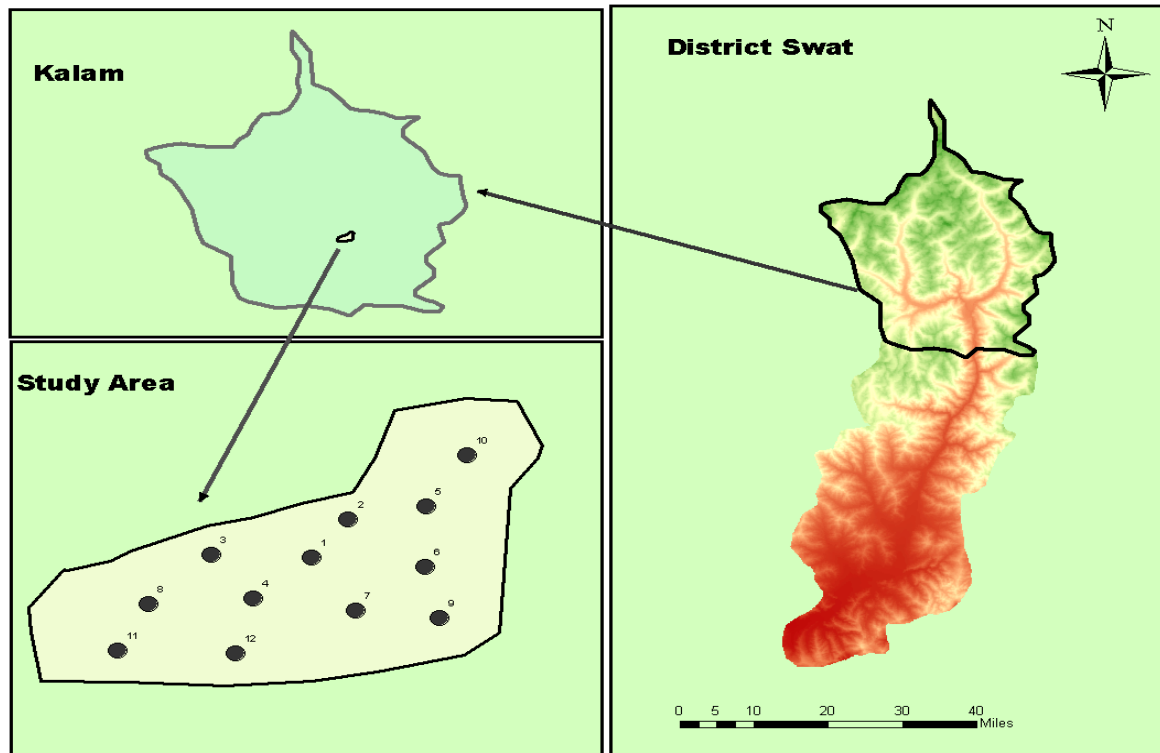


Figure 1. Showing map of study area along with grid details

Table 2. indicating volume of decay timber in the study area of Kalam (m3)

Tree sp	Dead Vol:/ha	Study area (ha)	Total decay volume	Total coniferous forest (000 ha)	Total volume (000 m ³)
Kail	0.10	429.00	41.61	1959	190.01
Fir	2.61	429.00	1121.40	1959	5120.80
Total			1163.01		5310.81

Table 3. showing forest types, total area and percentage (000ha)

S. No.	Province	Total land area	Forest area	%age
1	KP	10170	1410	13.9
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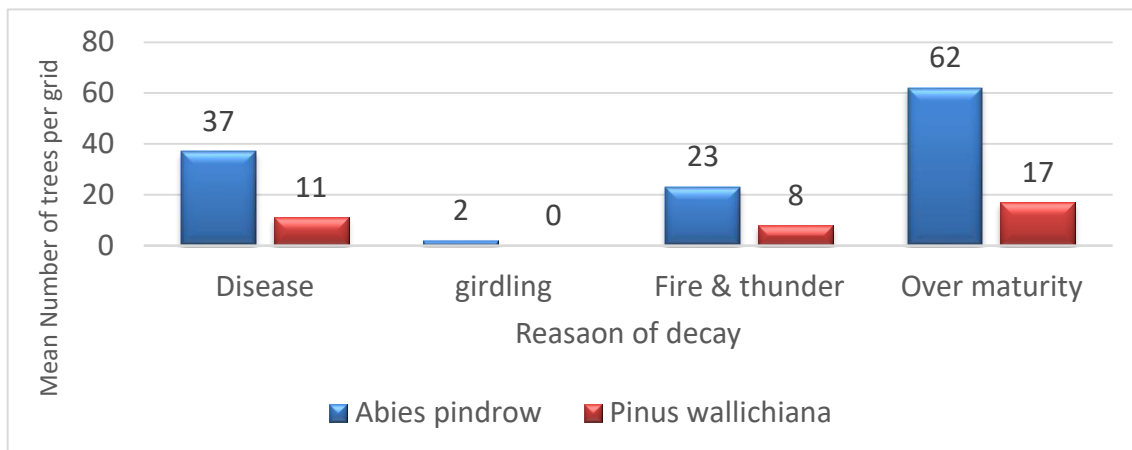


Figure 2. Showing detail of reason for dead, diseased and decay trees in study area

Discussion

There are various factors that contribute toward the decay and diseased trees in forest but according to this study, the major factor for decay timber volume is the over maturity of coniferous trees due to suspension of management plan since 1992 wherein all the silvicultural systems were banned. However, according to [8], from 1947–1992 these forests were harvested under proper silvicultural system, i.e., selection system due to low vegetation cover, steep terrain and also due to recreational activities in the area and Silvicultural systems and tending operations are important management tools for the optimization and utilization of forest resources that also promote edaphic and biotic factors for biomass production. In another study conducted by [9], who is of the opinion that silviculture or tending operation tends toward the improvement of the forest crop by providing species selection and reducing the canopy, as well as the intensity of damages. However, in our study area, as the trees reach maturity and complete their physical rotation its decomposition process starts due to disease, decay or dying one or other reason which lead to decay of the tree due to non-application of silviculture system. Based on the current study, the same situation of decaying trees has been visualized in the whole country. Biological agencies mostly have fungi and insects start growth in the over mature trees and then easily transferred to healthy ones thus affecting the overall status of the forest. Similar investigation has also been reported which clearly mentioned that brown rot fungi decay cellulose and leave lignin behind while white rot fungi decay both

lignin and cellulose of the tree. He derived these conclusions by using electron microscopy [10]. According to [11], the role of insects, particularly saproxylic species of beetle which cause decay of trees whose occurrence is much more in semi natural forest than in managed forest and the amount of dead wood is positively correlated with the increased density of this beetle. These results thus authenticate the findings of our result where huge amount of decaying trees are present due to over maturity and non-application of management system. According to Bigler and Veblen [12] litter and dead wood affect important processes in forest ecosystems such as nutrient and carbon cycling and are key influences on biodiversity and fire behavior. This finding also has a relationship with the unmanaged forest of our study area. The leaf and litter fall is much more in this forest which adverse effect on the decay of trees. Other factors such as snowfall, soil eroded, windfall has the highest in the study area which is prone to heavy snow fall and soil erosion and strong wind. The decay caused by the disease is due to unhygienic conditions due to non-extraction of such timbers. According to the geography of the area the area is mostly affected by thunder and fire while girdling is due to local communities for their own purpose because they are not allowed to cut even mature trees on permit due to ban on forest harvesting. However, the effect of these factors was not significant.

Conclusion and Recommendations

The study has concluded that huge number of dead, diseased and decaying timber is due to suspension of management plan and harvesting ban. The decaying wood is creating an

unhygienic situation thus paving way for various diseases and insect attacks that may affect the overall health of the forest resources. Thus, the study recommends application of proper management system with immediate extraction of decaying timber. The study may be replicated in other areas of coniferous forests to reflect the actual decay volume and to give recommendations for proper management at local as well as at international level. As the Government of Pakistan has banned on the harvesting and extraction of timber till a proper management system for these forest resources is in place, some measures for extraction of these decay timber may be taken by the Government to save other trees from such loss because such decay due to fungi may spread to other trees and in this way the whole forest become infected. Local people should be involved in the management of forest in the form of JFMCs which may help in the extraction of such timber without any loss. Such experiences have already been practiced in Lalku valley, Matta Swat of KPK. A proper working plan should be maintained, and timber may be extracted from time to time because the disease-causing agent easily attacks the over mature trees thus leading to decay of the timber in the forest. Forest Department should be vigilant, and any infected trees should be immediately removed from the forest to save other trees from such infection. FDC (Forest Development Corporation) which is corporation for the scientific and mechanized harvesting of the forest may be allowed to extract such timber as per rule in vogue.

Authors' contributions

Conceived and designed the experiments: S Muhammad, Performed the experiments: A Hamza, Analysed the data: K Mehmood, Contributed materials/ analysis/ tools: M Adnan, Wrote the paper: M Tayyab & S Muhammad.

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