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Anthropogenic Pressure on Forest Degradation and Deforestation for Fuel-Wood in Watersheds of Sirsi Taluk

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Abstract: ***The study was conducted in the watersheds of Sirsi taluk, Uttar Kannada district, Karnataka, India in the year 2016-2017 in order to assess the intensity of degradation and deforestation in forest. Sample plots (100*10 m) were laid near and away from the villages. The results indicate that 8.5 species were found lopped in watershed 5B1A5 and 9.8 in 4D4F5. It was 8.1 in the plots near the villages and 10.2 in the plots away from the villages. The number of trees lopped in watershed 5B1A5 was 30 and 29.4 in 4D4F5. It was 26.9 in the plots near the villages and 32.5 away from the villages. The volume of lopped wood was 0.756 m^3 in watershed 5B1A5 and 1.309 m^3 in 4D4F5. It was 0.958 m^3 in the plots near the villages and 1.107 m^3 away from the villages. The total number of stumps found in watershed 5B1A5 was 13.2 and 26.1 in watershed 4D4F5. It was 20.3 near the villages and 19 away from the villages. The volume of wood removed in watershed 5B1A5 was 0.954 m^3 and 3.705 m^3 in 4D4F5. It was 1.833 m^3 in the plots near the villages and 2.826 m^3 away from villages.***

Keywords: Fuel-wood, watershed, degradation, deforestation

1. Introduction

India is having 15 per cent of the world population supporting them with just 2.5 per cent of world's land area. The recorded forest area in India is about 76.5 million ha (23% of total land mass), however, the actual forest/tree cover is just about 19% of the total geographical area. The per capita forest area in the country is 0.08 ha as compared to the world average of 0.64 ha. The total removal of fuel-wood from forestland is estimated at 270 million tonnes annually. During the last two decades, India has witnessed annual depletion of forest cover at a rate of 235 km^2.The increasing population and rapid decrease in the forest cover, low growing stock, poor increment, low sustainable yield and increasing demand lead to shortage of fuel wood in the country. Fuel wood need is partly being met from agricultural residues, agro-forests and largely through unregulated and unsustainable extraction from the forests. The demand for fuel-wood is estimated to be 312 million tonnes against the production of 49 million tonnes [5]. The annual productivity of Indian forests is 1.36 m^3/ha compared to the world average of 2.5 m^3/ha [2].

Fuel-wood is the dominant domestic fuel for most of the rural people in developing countries of the Asia region. Fuel-wood refers to any source that comes from woody biomass. Fuel-wood is consumed in India in several forms-logs, billets, twigs, wood shavings, saw dust, *etc.* and is derived from a variety of sources (forests, own farms, roadside trees, scattered trees in villages, *etc.*). The most important use of fuel-wood is for cooking and water heating in most of the households in rural areas. The main source of fuel-wood includes dead and fallen wood from the forest. In order to meet the demand of fuel-wood which is not fulfilled by the deadwood available in the forest, even green trees are being lopped by the community for the fire-wood. This is one of the most important factors responsible for degradation of the forests [3].

Collection and use of biomass is largely influenced by socioeconomic and demographic factors of households. However, there exists a two-way relationship between fuel-wood collection and deforestation. Demand for fuel-wood from village is the prime cause of forest degradation. Fuel-wood scarcity is the result of the perpetuation of forest degradation as it is the main source of energy for local people and ultimately this puts pressure on the environment in the form of loss of biodiversity, climate change and so on.

The Uttar Kannada district of the Karnataka has about 76 per cent of its total geographical area under forests. Uttar Kannada is the most natural resource rich district of Karnataka. The district has five types of forests, they are: evergreen, semi-evergreen, moist deciduous, scrub and thorny forests and non wooded forests. The moist deciduous forests are rich in timber trees, e.g., *Dalbergia latifolia*, *Tectona grandis*, *Pterocarpus marsupium*, *Terminalia* species, *Lagerstroemia lanceolata*, *etc.*, which grow naturally. These forests are important for timber and fire-wood production. In the scrub and thorny forests, sandal and other NTFP species, fire-wood and timber species are grown. Unfortunately, these forests are subjected to heavy pressure from fire-wood extraction and grazing. The annual demand for fuel-wood in the State is around 28 million tonnns in 2001 [4].

Nowadays, pressure on forest is increasing due to higher demand of fuel-wood for various activities. Forest is being depleting because of exploitation and unsustainable harvesting. Thus, a study is necessary to understand pattern

of fuel-wood pressure on forest. Keeping these points in view, a study was conducted in two different watersheds of Sirsi taluk with the objective of assessing the anthropogenic pressure for fuel-wood near and away from the forest leading to forest degradation and deforestation.

2. Materials and methods

2.1 Study area

The study was carried out in the watershed area of Sirsi taluk, Uttar Kannada District during the year 2016-2017. District lies between 13°55` and 15°31` N latitude and 74°09` and 75°10`E longitude with an altitude of not more than 700 m. The total forest cover of the district is 8,271 sq. km (80 % of the geographical area) out of total geographical area of 10,291 sq. km. District has higher forest cover in Karnataka spread over 6,502 sq. km under dense and 1305 sq. km under open forests. Sirsi taluk lies between 14°21` and 14°51` Northern Latitude and 74°34` and 75°4` Eastern Longitude.

2.2 Selection of study sites

The demographic details of forests of watershed areas with respect to location, extent and their maps were gathered from Sirsi Forest Division. Line transect of 100 m × 10 m were laid out for estimating the intensity of lopping and wood removal with 0.01 per cent sampling intensity. The details of the selected study areas are given in Table 1.

2.3 Sampling method

In two watersheds, in order to assess the supply of fuel-wood from forest, sample plots in the forest which is located near the village and away from the village was laid with respect to each village. The five villages in each of the watershed were selected. Each sample plot was transect of size 100 m × 10 m plot. The data on disturbance factors leading to degradation and deforestation was assessed in each of transects by recording the observations regarding cut stumps and lopping intensity. Basal area of tree species was derived from diameter at breast height by using formula,

$$\text{Basal area} = \frac{\pi d^2}{4}$$

Where, d is diameter at breast height and expressed in square meter (m^2). The data collected for the study was statistically analyzed in the software AGRISTAT.

Table 1: Details of the study area selected

Watershed areas	*Villages selected*	*Population (No.)*	*Forest area (ha)*
Watershed area 1 (5B1A5)	Devnalli	28,051.000	600.370
	Jaddigadde	544.000	749.785
	Kadabala	598.000	144.692
	Muregar	183.000	330.396
	Vanalli	474.000	298.889
Watershed area 2 (4D4F5)	Bidralli	314.000	58.119
	Kabbe	532.000	27.072
	Kerekoppa	557.000	69.581
	Sugavi	936.000	436.381
	Narebail	455.000	164.392

Source: Population census, 2011

3. Results and Discussion

The results indicate that 8.5 species were found lopped in watershed 5B1A5 and 9.8 in 4D4F5. It was 8.1 in the plots near the villages and 10.2 in the plots away from the villages. The number of trees lopped in watershed 5B1A5 was 30 and 29.4 in 4D4F5. It was 26.9 in the plots near the villages and 32.5 away from the villages. The volume of lopped wood was 0.756 m^3 in watershed 5B1A5 and 1.309 m^3 in 4D4F5. It was 0.958 m^3 in the plots near the villages and 1.107 m^3 away from the villages. There was no with respect to the number of species lopped and volume of lopped wood in the village forests between the selected watersheds, between the plots laid near and away from the villages with five replications and, worked out through statistical analysis. The significant difference was found with respect to the number of lopped trees between the interactions of the watersheds and the plots laid near and away from the village (Table 2).

The total number of stumps found in watershed 5B1A5 was 13.2 and 26.1 in watershed 4D4F5. It was 20.3 near the villages and 19 away from the villages. The volume of wood removed in watershed 5B1A5 was 0.954 m^3 and 3.705 m^3 in 4D4F5. It was 1.833 m^3 in the plots near the villages and 2.826 m^3 away from villages. There was no significant difference found with respect to the number of stumps and volume of wood removed in the village forests between the selected watersheds, between the plots laid near and away from the villages and between the interactions of the watersheds and the plots laid near and away from the village, worked out through statistical analysis (Table 3).

Table 2: Intensity of degradation (tree lopping) in forest of different watersheds

Treatments	*No. of species lopped*	*No of lopped trees*	*Volume of lopped wood (m^3)*	
Watershed (5B1A5): W_1	8.5	30.0	0.756	
Watershed (4D4F5): W_2	9.8	29.4	1.309	
C.D. at 5%	**NS**	**NS**	**NS**	
Near village: M_1	8.1	26.9	0.958	
Away from the village: M_2	10.2	32.5	1.107	
C.D. at 5%	**NS**	**NS**	**NS**	
W_1M_1	8.2	33.2	1.068	
W_1M_2	8.8	26.8	0.444	
W_2M_1	8.0	20.6	0.848	
W_2M_2	11.6	38.2	1.770	
C.D. at 5%	NS	S.Em. ±	4. 20	**NS**
		C.D. at 5%	22.26	

Table 3: Intensity of deforestation near and away from village in different watersheds

Treatments	*No. of stumps*	*Volume of wood removed (m^3)*
Watershed (5B1A5): W_1	13.2	0.9540
Watershed (4D4F5): W_2	26.1	3.7050
C.D. at 5 %	**NS**	**NS**
Near village: M_1	20.3	1.8330
Away from the village: M_2	19	2.8260
C.D. at 5 %	**NS**	**NS**
W_1M_1	11.6	1.2080
W_1M_2	14.8	0.7000
W_2M_1	29.00	2.4580

W_2M_2	23.2	4.9520
C.D. at 5 %	**NS**	**NS**

NS – Non-significant

The volume of wood lopped was comparatively found to be more near the villages. The reason for this could be because of easy accessibility of wood for fuel within the shorter distance from village However, in one situation at watershed 5B1A5, the availability of number of plants, volume of lopped wood and volume of wood removed are more in forest near village..

The large number of tree species were lopped, indicate the dependence of people on forest for fuel needs, for which trees are lopped irrespective of the species. Through questionnaire it was also found that preferred fuel-wood species, if scarce or unavailable, the other species available in that patch of forest are harvested, seeing that required amount of fuel-wood is collected back home.

More number of trees lopped were found in plot away from village in Devnalli forest, may be due to the dependence of the hamlets situated away from the main village for fuel on forests (May be for *Garcinia* rind drying which is prominent in the village). The consumption of fuel-wood can be more in remote areas than in localities which are nearer to urban settlements due to the use of other alternative fuels [1]. Among all the selected villages of both the watersheds, the plot laid near the village of Muregar was found to have more number of trees lopped (66). Muregar village was found to have more demand for fuel-wood even after having considerable number of efficient interventions in the households of villages as it could replace only that quantity of wood used for cooking and in Muregar, fuel-wood was also used for arecanut processing and *Garcinia* rind drying, and this demand is observed in terms of lopping and stump cuttings in the forest.

The unsustainable fuel-wood removal in rural area is due to the reason that wood is the main source of energy and the demand for wood exceeds the annual growth from existing forests and other wooded lands [6]. In Uttara Kannada, most of the forest cover is fuel-wood surplus regions where the supply/demand ratio is currently more than 2 (compared to 8-9 in early 1990's). Dwindling resource base could be attributed to the decline in forest cover in the district [3].

The openness feature of the moist deciduous forest prevailing in the watershed 5B1A5 makes it easier for the villagers to enter and cut the trees in the forest. The semi-evergreen forest with high density makes it difficult for wood removal.

The highest volume of wood removed can be because of the villagers relying mainly on wood for fuel as very less interventions being adopted in the households of the village, which makes the available deadwood insufficient for fuel demand, leading to lopping of the trees and farther forest patch from the village is preferred by villager in order to escape from being getting caught by forest officials.

4. Conclusion

The forest of the study area is being exploited for mainly fuel-wood as the surrounding villagers are heavily dependent on fuel-wood for cooking, heating, *Garcinia* rind drying, arecanut processing, etc. These anthropogenic activities are adversely affecting the forest and causing forest degradation and deforestation. In order to reduce the deforestation and degradation, the forest department or government should come forward to provide energy sources such as Biogas, Solar cookers, LPG, improved chulla, etc to reduce the pressure on forest.

5. Future scope of work

Improvements:

1) Each hamlet and their utilized forest area need to be demarcated and the actual assessment of the fuel-wood pressure need to done.
2) Further, separating the annual cutting of the wood will help in assessing the exact quantity of wood removal every year which would help to support the families with government schemes

Limitation:

1) In this study area, hamlets were widely spread within the forest area and it made difficult to demarcate the forest near and away. Since the forest away from the village could be nearer to the village or vice-versa.
2) The wood removed at the base was counted but could not assess the year in which it was cut.
3) Percent of fuel-wood being used for house construction and furniture was not assessed.

Benefits:

1) Fuel-wood collected from the forest leading to degradation and deforestation was used for various purposes such as cooking, arecanut processing, *Garcinia* ring processing, water heating, etc.
2) It helps in conservation of biodiversity
3) Health improvement in the villagers because of clean energy

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