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RESEARCH ARTICLE

ASSESSMENT OF DEAD AND FALLEN WOOD AVAILABILITY IN FORESTS OF DIFFERENT WATERSHEDS OF SIRSI TALUK

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ABSTRACT

The study was carried out in the watershed areas (5B1A5 and 4D4F5) of Sirsi taluk, Uttar Kannada District during the year 2016-2017 to assess the quantity of available deadwood in the forests which could be used as fuel-wood by the nearby villagers. Five villages in each of the watershed were selected and transect line (100 m × 10 m) one near the the village and the other away from the village were laid. Total of 20 such plots were laid with 0.01 per cent sampling intensity. The volume of dead and fallen wood found available in the village forest was 1.8 m^3 in watershed 4D4F5 and 0.5160 m^3 in watershed 5B1A5. It was 1.4340 m^3 in transects away from the villages and 0.979 m^3 in transects near the villages of both the watersheds. The study concludes that the availability of the dead and fallen wood in the forests of the selected watersheds is insufficient in meeting the demand of fuel-wood from the nearby villages.

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INTRODUCTION

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 annual productivity of Indian forests is 1.36 m^3/ha compared to the world average of 2.5 m^3/ha (Pachauri and Mehrotra, 2002). The total removal of fuel-wood from forestland is estimated at 270 million tonnes annually. In meeting energy demands in India, particularly in rural areas, traditional fuels, e.g., fuel-wood, dung and crop residues play a key role. 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 main source of fuel-wood includes dead and fallen wood from the forest. In natural forests deadwood originates from tree mortality, which is either the result of inter-tree competition or senescence processes or it is caused by natural disturbances, which can differ in terms of quality and quantity. Small-scale events occur frequently and hence provide a continuous supply of deadwood (Rahman *et al.,* 2008). The quantity of deadwood and its decomposition in a particular forest ecosystem depends on many intrinsic (deadwood type, dimensions and tree genus) and extrinsic (climate, site conditions and disturbances) factors that drive the input of deadwood (Ramachandra, 2014). The mean production of deadwood available for harvesting per woody standing biomass is relatively constant from year to year. Annual production of harvestable deadwood is more related to stand biomass than rainfall. The relative consistency of production rates of deadwood has positive implications for sustainable use and harvesting strategies. There also exists a significant difference between species with respect to the mean proportion of the stem that is dead (Shackleton, 1998 and 2003). 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.

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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 (Ramachandra *et al.*, 2000). 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 (Ramachandra, 2014). Thus the study was conducted to assess the quantity of available deadwood in the forests which could be used as fuel-wood by the nearby villagers of different watersheds of Sirsi taluk, Uttar Kannada district, Karnataka.

MATERIALS AND METHODS

Study area

The study was carried out in the watershed areas 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.

Sampling method

The demographic details of forests of watershed areas with respect to location, extent and their maps were gathered from Sirsi Forest Division. 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.

Five villages in each of the watershed were selected. Each sample plot was transect of size 100 m × 10 m plot. Total of 20 such plots were laid i.e. 10 in each selected watersheds for estimating dead wood availability, with 0.01 per cent sampling intensity. The details of the selected study areas are given in Table 1. The girth of dead and fallen wood encountered in the plot was measured at three points: middle and at the two ends and volume was estimated by average cross section area and length of the wood.

Statistical analysis

The data collected for the study was statistically analyzed in the software AGRISTAT.

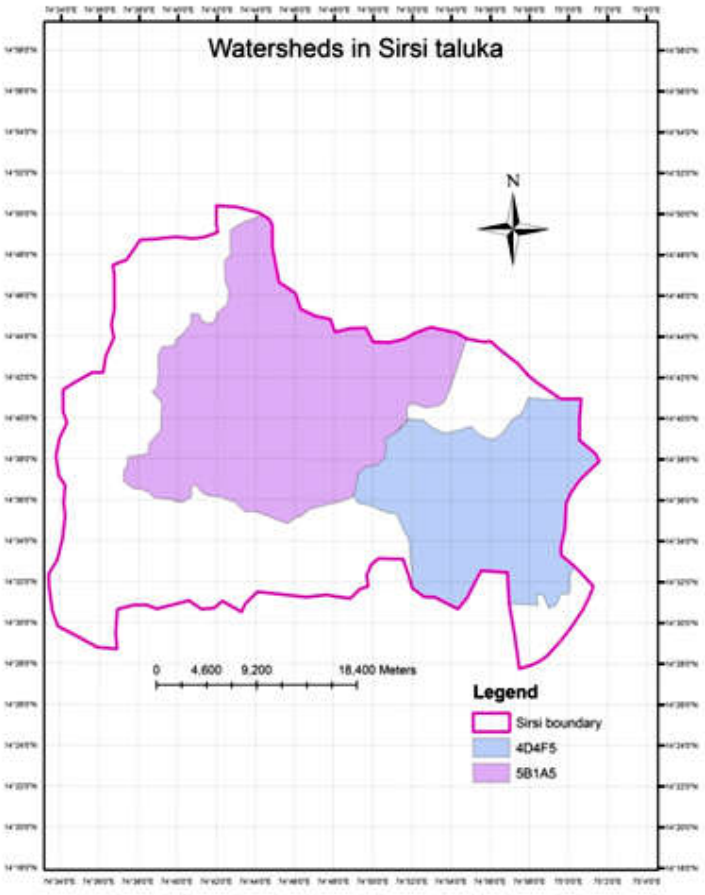

Figure 1. Study area

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. There are totally 5 watersheds in Sirsi taluk coded as 5B1A2, 5B1A4, 5B1A5, 4D4F4 and 4D4F5. The watersheds 5B1A5 and 4D4F5 were selected for study. The study area is depicted in Figure 1.

RESULTS AND DISCUSSION

The volume of dead and fallen wood found available in the village forest was 1.8 m^3 in watershed 4D4F5 and 0.5160 m^3 in watershed 5B1A5. It was 1.4340 m^3 in transects away from the villages and 0.979 m^3 in transects near the villages of both the watersheds. In watershed 5B1A5, the supply of fuel-wood was found to be 0.813 tonnes/year/person against the demand of 6.145 tonnes/year/person.

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

Table 2. Dead and fallen wood availability in the village forest

Water-shed area	Village	Volume of dead and fallen wood (m^3)		Volume of dead-wood per ha forest area (m^3)	Forest area (ha)	Total volume of deadwood in the village forest (m^3)
		Near	Away			
Watershed area 1 (5B1A5)	Devnalli	2.31	0.57	35.26	600.4	21169.04
	Jaddiga-dde	0.27	0.53	6.88	749.8	5158.52
	Kadabala	0.01	0.46	6.17	144.7	892.38
	Muregar	0.08	0.62	8.48	330.4	2801.76
	Vanalli	0.10	0.26	1.03	298.9	307.86
	Average	0.55	0.49	11.56	424.8	6065.91
Watershed area 2 (4D4F5)	Bidralli	6.17	0.68	37.06	58.12	2153.6
	Kabbe	0.01	4.13	20.68	27.07	559.85
	Kereko-ppa	0.29	6.13	30.75	69.58	2139.27
	Narebail	0.49	0.02	0.5	164.4	`413.77
	Sugavi	0.06	0.99	1.75	436.4	3820.52
	Average	1.40	2.39	18.15	151.11	2168.31

Table 3. Dead and fallen wood availability in the village forest

Factors	Volume of dead and fallen wood (m^3)
Watershed (5B1A5): W_1	0.5160
Watershed (4D4F5): W_2	1.8970
C.D. at 5 %	NS
Near village: M_1	0.9790
Away from the village: M_2	1.4340
C.D. at 5 %	NS
W_1M_1	0.5540
W_1M_2	0.4780
W_2M_1	1.4040
W_2M_2	2.3900
C.D. at 5 %	NS
NS – Non-significant	

In watershed 4D4F5, supply was 2.483 tonnes/year/person against the demand of 3.713 tonnes/year/person. The unavailable dead and fallen wood from forest i.e. 5.332 tonnes/year/person in watershed 5B1A5 and 1.229 tonnes/year/person in watershed 4D4F5 was either met by lopping of branches or green felling of the trees by the villagers which is highly unsustainable (Figure 2).

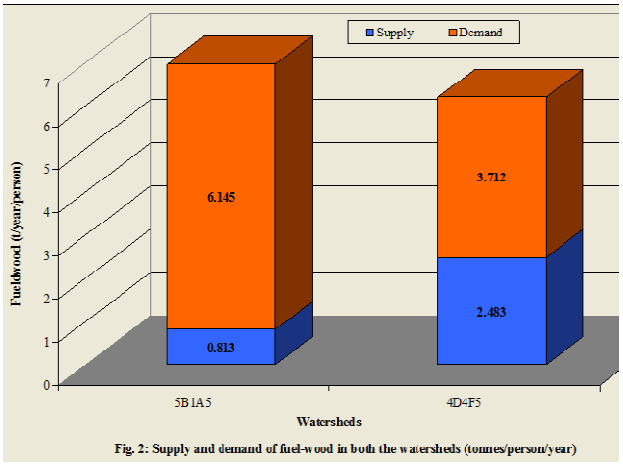

Fig. 2: Supply and demand of fuel-wood in both the watersheds (tonnes/person/year)

The volume of deadwood per ha was found to be more in watershed 4D4F5 (18.15 m^3/ha) than watershed 5B1A5 (11.56 m^3/ha). In 5B1A5, it was higher in near plot (0.55 m^3) than plot away (0.49 m^3). But in 4D4F5, it was more in plot away (2.39 m^3) than plot near the village (1.40 m^3). The volume of dead and fallen wood per hectare of forest was found highest in Bidralli village (37.06 m^3) followed by Devnalli (35.26 m^3) and Kerekoppa (30.75 m^3). The least was found in Narebail (0.5 m^3), followed by Vanalli (1.03 m^3) and Sugavi village (1.75 m^3) (Table 2). The total volume of dead and fallen wood in the forests of the villages was analyzed. It was found highest in Devnalli village, followed by Jaddigadde and Sugavi (21169.04, 5158.52 and 3820.52 m^3respectively). Least volume of dead and fallen wood was found in Vanalli, followed by Narebail and Kabbe (307.86, 413.77 and 559.85 m^3 respectively). In watershed 1 (5B1A5), except Devnalli, the volume of dead and fallen wood in the forests was found higher in the plots laid away from the villages across Jaddigadde, Kadabala, Muregar and Vanalli (0.53, 0.46, 0.62, and 0.26 m^3 respectively) as compared to the plots laid nearer to villages (0.27, 0.01, 0.08 and 0.1 m^3respectively). But in the plot nearer to Devnalli village was having higher volume of dead and fallen wood (2.31 m^3) than the plot laid away from

the village (0.57 m^3). In case of watershed area 2 (4D4F5), the volume of dead and fallen wood in the forest was found higher in the plots laid away from the villages across Kabbe, Kerekoppa and Sugavi (4.13, 6.13 and 0.99 m^3respectively) as compared to the plots laid near the villages (0.01, 0.29 and 0.06 m^3respectively). But in Bidralli and Narebail villages, the plot near the village was having comparatively more volume of dead and fallen wood (6.17 and 0.49 m^3respectively) than the plots way from the villages (0.68 and 0.02 m^3respectively) (Table 2). There was no significant difference found with respect to the volume of dead and fallen wood in the village forests between the selected watersheds, between the plots laid near and away from the villages with five replications and between the interactions of the watersheds and the plots laid at two different distances (near and away from the village) worked out through statistical analysis (Table 3). The supply of wood from forest, concerned with the availability of dead and fallen wood is higher in watershed 4D4F5, as compared to watershed 5B1A5.

The available dead and fallen wood is higher in forest away from village due to less pressure because of transportation problem and inconvenience in bringing the dead and fallen wood from forest away from the village. The availability of wood is more in watershed 4D4F5 due to the fact that total quantity of wood being used in watershed 5B1A5 is less than 4D4F5. In case of Devnalli, deadwood was 35.26 m^3, mainly due to the wood found naturally dead within the transect of plot laid near the village and huge tree of *Zanthoxylum rhetsa* which was found cut at stump level in plot laid away from the village. The least deadwood was found in Narebail (0.5 m^3), which could be due to the collection of all available dead and fallen wood by the villagers as the season of collection from forest had commenced which resulted in no deadwood being accounted during the transect survey. The mean production of deadwood available for harvesting per woody standing biomass was found to be relatively constant from year to year at approximately 17 kg/ha/year per ton live biomass, or 1.7 per cent per annum. Annual production of harvestable deadwood was related more to stand biomass than rainfall zone. The relative consistency of production rates has positive implications for sustainable use and harvesting strategies (Shackleton, 1998).

The quantity of deadwood and its decomposition in a particular forest ecosystem depends on many intrinsic and extrinsic factors that drive the input of deadwood and its decomposition process. Intrinsic factors include deadwood type, dimensions, and tree genus that determine basic tree and wood characteristics, while extrinsic factors include climate and site conditions, and disturbances (Merganicova *et al.*, 2012). In natural forests deadwood originates from tree mortality, which is either the result of inter-tree competition or senescence processes, or it is caused by natural disturbances, which can differ in terms of quality and quantity. Small-scale events occur frequently and hence provide a continuous supply of deadwood (Rahman *et al.*, 2008). 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 (Zanchi *et al.*, 2012). In Uttara Kannada district, 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 (Ramachandra *et al.*, 2014).

Conclusion

From the present study it can be concluded that in both the selected watersheds, the supply of fuel-wood from forest in the form of dead and fallen wood is insufficient to meet the demand of the nearby villages. The available dead and fallen wood was comparatively more in forest away from village due to less pressure by the villagers than in the forest near the village. 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. These forests are important for timber and fire-wood production. Unfortunately, these are subjected to heavy pressure from fire-wood extraction. This is one of the most important factors responsible for degradation of the forests. Thus, some actions has to be implemented in restricting the collection of only dead and fallen wood from the forest and preventing green felling and lopping of the trees.

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