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ASSESSMENT OF FUEL-WOOD AVAILBILITY IN SIRSI TALUK THROUGH GIS APPROACH

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ABSTRACT

The study was conducted in two watersheds (5B1A5 and 4D4F5) of Sirsi taluk, Uttar Kannada district, Karnataka, to assess the availability of fuel-wood from the forest in the form of dead and fallen wood. The field data was acquired through transect survey. The forest area of the concerned villages in the watersheds was determined by digitisation of the village maps using ArcGIS. Thus the fuel-wood availability in the form of deadwood from the entire forest was assessed. The results indicate that in both the watersheds, demand for fuel-wood is more than the supply. It was found to have more demand for fuel-wood in watershed 5B1A5 (6.145 tonnes/year/person) than watershed 4D4F5 (3.701). The supply of fuel-wood was comparatively more in watershed 4D4F5 (2.483 tonnes/year/person) than watershed 5B1A5 (0.813 tonnes/year/person).

***Keywords*: Arcgis, Deadwood, Demand, Transect, Watershed.**

I. INTRODUCTION

Fuel-wood is the dominant domestic fuel for most of the rural people in developing countries of the Asia region. Fuel-wood **r**efers to any source that comes from woody biomass. Wood fuels are still a major source of energy for people in developing countries. Wood fuels account between 50-90% of the fuel used (Bhattacharya, 2015). 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.). People in and around Sirsi depend upon fuel wood mainly for cooking, heating, arecanut processing, and NTFP processing. The tree species in Sirsi taluk used as fuel wood are *Randia spinosa*, *Diospyros melanoxylon, Eugenia gambolana, Terminalia tomentosa, Tectona grandis, Lagestromia lanceolata, Syzygium cumini, Terminalia paniculata*, etc. The estimated annual harvest of fuel wood here from these species along with the other species is around 4.2 tonnes per ha which is more than 8 times the level of production *(*Beerappa, 2008*).* Keeping these points in view the study was taken up in Sirsi taluka with the objective of assessing the quantity of fuel wood available from forest through remote sensing technique and demand from the farming community.

II MATERIAL AND METHODS

The present study was carried out during 2016-2017. The study was carried out in the watershed area of Sirsi taluk, Uttara Kannada District. District lies between 13°55` and 15°31` N latitude and 74°09` and 75°10`E longitude with an altitude of less than 700 m. The watersheds 5B1A5 and 4D4F5 were selected for study. The details of the selected study areas are given in table 1 and Fig. 1.

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 watersheds were selected. Each sample plot was transect of size 100 m x 10 m plot. 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. The total area of the forest in each village was assessed by digitising the village map with ARC GIS and total area for each of the village forest was estimated. The dead wood available in each transect was taken and total wood available for each of the village was estimated. The demand of the fuel- wood from villagers was estimated by personal interview and recorded the fuel wood demand through questionnaire.

II. RESULTS AND DISCUSSION

The availability of dead and fallen wood in the forest was observed by putting the transect plot of 100 m x 10 m transect each at near and away from the villages in two watersheds. The volume of deadwood per ha was found to be more in watershed 2 (18.15 m^3/ha) than watershed 1 (11.56 m^3/ha). In watershed 1, it was higher in near plot (0.55 m^3) than plot away (0.49 m^3). But in watershed 2, 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 (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 7).

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^3 respectively). 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^3 respectively). 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^3 respectively) as compared to the plots laid near the villages (0.01, 0.29 and 0.06 m^3 respectively). 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^3 respectively) than the plots way from the villages (0.68 and 0.02 m^3 respectively) (Table 7).

The available dead and fallen wood is higher in forest away from village due to less pressure because of transport problem and inconvenience in bringing the dead and fallen wood from forest away from the village. The availability of wood is more in watershed 2 due to the fact that total quantity of wood being used in watershed 1 is less than watershed 2. In case of Devnalli, deadwood was 35.26 m^3, mainly due to the naturally dead wood found within the transect of plot laid near the village and huge tree of *Xanthoxylon 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 of 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 could be relatively constant from year to year and the annual production of harvestable deadwood is related more to stand biomass. 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 results indicate that in both the watersheds, demand for fuel-wood is more than the supply. It was found to have more demand for fuel-wood in watershed 1 (6.145 tonnes/year/person) than watershed 2 (3.701). The supply of fuel-wood was comparatively more in watershed 2 (2.483 tonnes/year/person) than watershed 1 (0.813 tonnes/year/person). This is depicted in Fig. 2. In both the watersheds, demand for fuel-wood is more than the supply, because of the villagers dependent on fuel-wood as the main energy source and comparatively less interventions has been adopted. It was found to have more demand for fuel-wood in watershed 1 as villagers there utilize fuel-wood for arecanut and *Garcinia* processing, in addition to cooking and water heating. The supply of fuel-wood was comparatively more in watershed 2 as it mainly constitutes of moist deciduous forest and thus more dead wood can be available when compared to the semi-evergreen forest of watershed 1.

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IV FIGURES AND TABLES

Table 1: Details of the study area selected

Watershed areas	Villages selected	Population (No.)	Forest area (ha)
Watershed area 1 (5B1A5)	Devnalli	28051.000	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

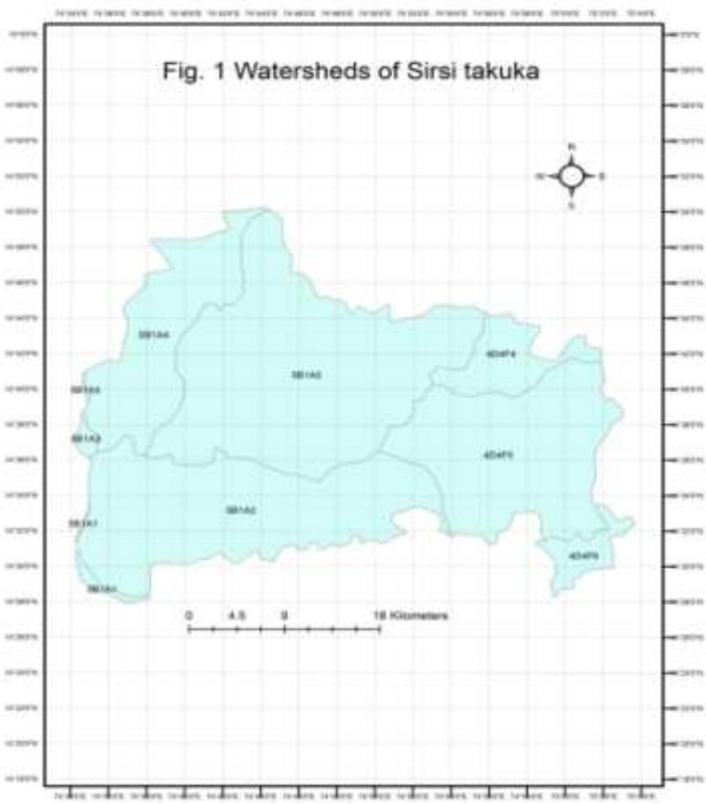

Fig. Watersheds of Siorsi Taluk

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Table 2: Dead and fallen wood availability in the village forest (m^3)

Watershed area	Villages	Volume of dead and fallen wood (m^3)		Volume of deadwood 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
	Jaddigadde	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
	Kerekoppa	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

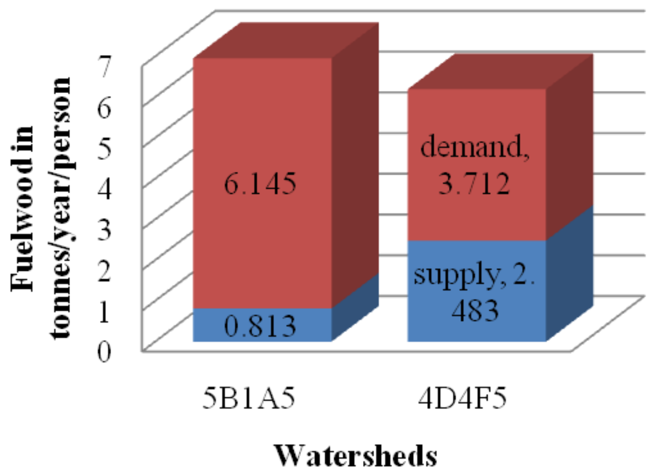

Figure 2: Supply and demand of fuel-wood in both the watersheds (tonnes/person/year)

V CONCLUSION

The availability of fuel-wood in the form of dead and fallen wood is insufficient to meet the demand from the adjacent villages. In order to meet the demand, illegal felling or green felling of trees taking place which is leading to forest degradation and deforestation. Thus, recommendations can be made on introduction of interventions like solar, biogas and LPG in the villages at subsidy rates by government to replace fuel-wood to 100 per cent. Another recommendation could be banning of *Garcinia* and Arecanut processing at household level, prevalent in the study area, as it consumes most of the fuel-wood and recommend for community level processing in the villages.

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