



ESTIMATED QUANTIFICATION AND VALUATION OF FUELWOOD COLLECTED FROM FOREST AREAS OF NARMADA FOREST DIVISION OF GUJARAT STATE, INDIA

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Abstract

The forest ecosystem is a primary source of fuel wood for forest dwellers as cooking energy and other purposes. The forest dwellers depend on the nearby forest area for taking fuel wood on headloads or otherwise. Therefore, an attempt has been done to estimate the quantity and monetary value of fuel wood being collected from the forest areas of Narmada Forest Division (NFD). This study was done in 31 forest villages covering 346 households through structured questionnaire interview based on the density classes of the forest and their dependence for fuelwood on the forest. It has been found that a total of 11 tree species are being frequently used as fuelwood. The investigation of the study showed that fuelwood collection was found to be 76561.79 Mt/annum with an estimated monetary value of Rs 114.7 million/annum. The fuel wood collection from forest areas having different density classes viz., Moderate Dense (MD), Open Forest (OF) and Degraded Forest (DF) found to be 3.39 mt/ha/annum, 1.54 mt/ha/annum and 0.31 mt/ha/annum, respectively Furthermore, estimation showed that per capita and per household's fuel wood consumption in the forest villages of NFD is 1.06 kg/day and 5.3kg/day, respectively. These benefits of forest are being used free of cost by the villagers of the forest areas.

Keywords: Fuel wood, quantification, valuation, NFD, Gujarat

Introduction

Human being depends on the forest for numerous services provided by the forest ecosystem (Joshi and Negi, 2011) and it also sustains life of 70% of terrestrial biodiversity and regulate water cycle, soil quality, reduce the risk of natural disasters such as flood and landslide and in addition to this, it directly and indirectly support the livelihood of over 1.6 billion people on the globe (Eliasch, 2008; Joshi and Negi, 2011). The forest ecosystem in India has been providing a variety of forest products, but the rising demands for these goods and services by the rapidly increasing population are excessive (Jain, 1993). Out of various goods and services, the fuel wood is one of the products of the forest ecosystem, which plays an important role in subsistence and survival of the forest dwellers. Fuelwood is a primary source of energy in the tribals areas which is being used for cooking meal, heating of home and in the preparation of charcoal

(MacDonald, *et al.*, 1998).

India's requirement of fuel wood have been estimated to be about 300 million m³ in 1990 and its projected demand was 385 million m³ at the end of century (Anonymous, 1985; Jain, 1993). Fuel wood is a type of source of cooking energy in India that fulfill 80% of total demand. With the increasing population, the pressure of fuelwood is likely to increase in coming year (Stalin, 2009). If fuel wood collection frequency remains high, then it will lead to degradation of growing stock in forest. Such kind of extraction is unsustainable because if current extraction of woody biomass extraction exceed current annual production of woody biomass production, perhaps it is going to be a sure indication of forest degradation (Murali, 2002; Yadav and Jangid, 2018).

Forest provide various tangible resources but only few of them get marketed (Bishop, 1999). However, review of various literature of fuelwood studies shows that maximum studies have been done on the

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consumption, not for its valuation aspects. No study has been carried out on the quantification and valuation of fuel wood in Narmada Forest Division (NFD). Valuation of these fuel woods can be very important in context of

local economy. Therefore, present study has been undertaken to estimate quantity of fuelwood collection and its value in NFD of Surat Forest Circle of Gujarat state to know its current status in their jurisdiction.

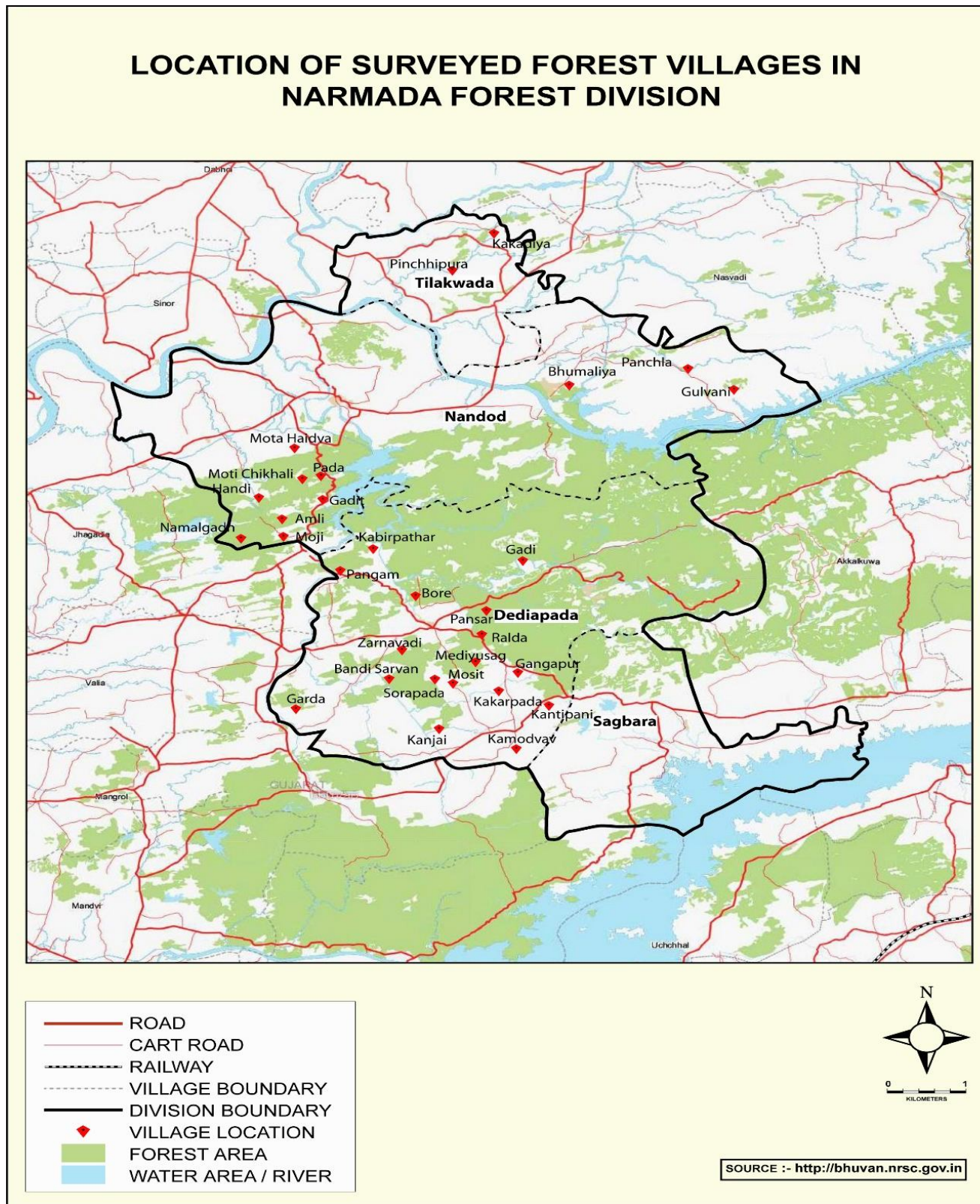


Fig. 1: Location of surveyed forest villages in NFD

Study area

NFD lies between latitude 21° 24' 43.33" N and 22° 02' 40.82" N and longitude 73° 45' 43.12" E 73° 45' 13.55" E. It shares its border with the state of Maharashtra in east and is bounded with Surat in South, Vadodara in the north and Bharuch in the west. District has four blocks (*talukas*) namely, Nandod, Sagbara, Tilakwada and Dediapada Fig. 1. NFD has two major forest types' viz., Southern Tropical Moist Deciduous Forest (3B/C1e) and Southern Dry Deciduous Forest (5A/C1b) in their jurisdiction which is spread over an area of 54056.62 ha. (excluding Shoolpaneshwer Sanctuary area).

Materials and methods

This study was started with RRA (Rapid Rural Appraisal) exercise to initiate primary level survey in selected household and villages for getting base line information. The selection of villages and households was done in such way that it represent, all forest density classes (Moderate Dense, Open Forest and Degraded Forest) and communities' dependency on forest (ADH-Acute Dependence Households, LDF - Low Dependence Households and NDF - No Dependence Households). The density classes were categorized based on the available classified satellite imagery at Gujarat Ecological Education and Research (GEER) Foundation. The dependency on the forest was categorized based the household dependency on forest for incom and village head opinion. A total of 10 % villages and households were selected to get information of total collection of fuel wood, as per method applied by Yadav *et al.*, (2018) for survey of NTFPs or NWFPs. Using this method, 31 forest villages out of 310 forest villages with 346 households were selected to complete primary level structured questionnaire survey in NFD. This study was carried out in spring season (February to March, 2012) and total 21 field days were used to complete study.

Analysis and extrapolation

All households level data was collected and extrapolated at village level and further at division level to estimate the total fuelwood collection in NFD. Following levels of assumptions were made based on survey and interview of the households and villages.

A. Household level assumptions and extrapolation

It has been assumed that a household spends total of 20-21 days/month for 10 month/year (200-210 days/year) to collect fuel wood in NFD. The assumption of fuel wood collection was done based on the opinion of local forest dwellers. Furthermore, it was found that forest dwellers collect fuel wood in all season except the two month of

rainy season.

B. Village level assumptions and extrapolation

All surveyed household were categorized in Acute Dependence Households (ADH), Low Dependence Households (LDF) and No Dependence Households (NDF) based on their dependency for fuelwood on the forest. Furthermore, average fuel wood collection in surveyed households was applied on total households in the villages and the village level information was used to extrapolate at division level.

C. Division level assumption and extrapolation

All village level information has been extrapolated at division level in such way that represent all forest density classes and dependence of communities on forest for fuelwood in NFD.

Results and Discussions

Dependency on forest for fuel wood

In NFD, a total of 7 major communities, namely, *Chaudhari, Kathodi, Kolghas, Gamit, Kotwaliya, Vasava* and *Bhil* were found to be involved in fuel wood collection. During households survey, it was revealed that a total of 77% tribal households were Acutely Dependence Households (ADH), 22 % Low Dependence Households (LDH) and 1% No Dependence Households (NDH) as given in Fig. 2. Their dependency on forest may be affected by factors like literacy rate, employment, income generation and others.

In the selected villages of NFD, the forest dwellers do not collect specific plant species for fuel, but whatever are found easily without much effort, that has been collected and brought to home. During the study, a total of 11 tree species were found being collected commonly Table 1 and these tree species were arranged as per calorific value as study done by Sharma *et al.*, (2012) and the calorific value was found in the range of 16.9 to 23.4 KJ/Kg. The tree species have been arranged in descending order of their calorific value. However, in

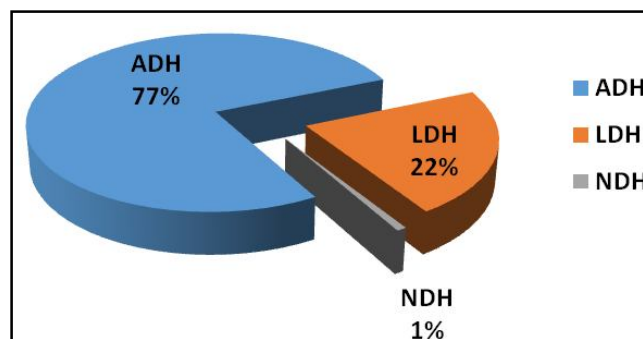


Fig. 1: Location of surveyed forest villages in NFD

the most of forest areas, the forest dwellers collect other life form also such as shrub (*Lantana camara* L., *Carvia callosa* (Nees) Bremek., *Helicteres isora* L., some climbers (Lianas) and herbs (some grasses ex. *Bambusa bamabos* L. Voss).

Key observation

In the field observation, it has been found that maximum fuelwood collection was carried out by group of women with average headload size of 22.5 kg. Some members of each households spend on an average 4-5 hours/day for fuelwood collection in morning (8.00am to 12pm) and evening (2.30pm to 5.30pm). The frequency of forest visit varied throughout year but mostly they collect fuel wood 20-21 day/months or 200-210 day/year (except rainy season).

Quantification and valuation of fuel wood

In the present study, work has been carried out in different forest villages falling in different density classes, viz., Moderate Dense (MD), Open Forest (OF) and Degraded Forest (DF). In analysis, it has been found that different density classes, viz., MD, OF and DF yield different quantity of fuelwood production which were 3.39 mt/ha/annum, 1.54 mt/ha/annum and 0.31 mt/ha/annum, respectively.

annum, respectively.

Total quantity of fuel wood collection was found to be 76568.78 mt/annum with an estimated value of Rs 114.7 million/annum. The valuation of estimated fuelwood collection was done based on the average price i.e. Rs.1.5kg observed in villages during the study. A similar study done by Forest Survey of India (FSI, 1981) about 4 decades back revealed average outturn and production of fuel wood in NFD was 85.32 tonnes which is less than the value in the present study. However, FSI estimate was based on the recorded fuel wood collection done by forest dwellers. Furthermore, estimation of wood collection in different density classes, i.e., MD, OF and DF was found to be 33838.47 mt./annum, 36267.79 mt./annum and 6362.52 mt./annum, respectively indicating value of Rs. 50.7 million/annum, Rs. 54.5 million/annum and Rs. 9.5 million/annum, respectively table 2.

Consumption of fuel wood

Estimated per capita fuel wood consumption in the forest villages of NFD is 1.05 kg/day Table 3 which is comparatively less than a study done by Joshi and Negi, (2011) in which it has been found to be 1.57 kg/capita in pine forest villages. The findings of this study are also

Table 1: The tree species used as fuel wood in NFD

S.N	Species name	Family	Vernacular name	Average calorific value (KJ/Kg)*
1	<i>Acacia nilotica</i> (L.) Delile	Mimosaceae	Desibaval	23.4
2	<i>Holoptelea integrifolia</i>	Ulmaceae	Kanji	22.03
3	<i>Acacia catechu</i> (L.f.) Willd.	Mimosaceae	Kher	21.97
4	<i>Tectona grandis</i> L.f.	Verbenaceae	Sag	21.68
5	<i>Terminalia crenulata</i> Roth	Combretaceae	Sadad	21.15
6	<i>Anogeissus latifolia</i> (Roxb.ex. DC.) Wall. ex. Guillem.& Perr.	Combretaceae	Dhavdo	21
7	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Behda	20.83
8	<i>Diospyros melanoxylon</i> Roxb.	Ebenaceae	Timru	20.7
9	<i>Butea monosperma</i> (Lam.) Taub.	Papilionaceae	Khakharo	20.49
10	<i>Lannea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Modad	17.14
11	<i>Desmodium ojeinense</i> (Roxb.) H. Ohashi	Fabaceae	Tivas	16.9

* (Sharma et al., 2012), KJ - Kilojoules, Kg.-Kilogram

Table 2: Total estimated fuel wood collection and its value in NFD

Density Class	Forest area of division in ha.	Total surveyed forest area in ha.	Total fuel wood collection in surveyed villages (kg/annum)	Per ha. fuel collection in different density Class (mt/ha/annum)	Total estimated fuel wood collection in division (Projected) (mt/ha/annum)	Total value (Rs. million)
MD	9981.85	12402.9	17566576	3.39	33838.5	50.7
OF	23550.5			1.54	36267.8	54.4
DF	20524.3			0.31	6362.52	9.5
Total	54056.6	12402.9	17566576	1.41*	76468.8	114.7

Value of fuel wood = Rs.1.5/kg (average price in villages observed during the study).

*Weighted average fuel wood collection per hectare forest area

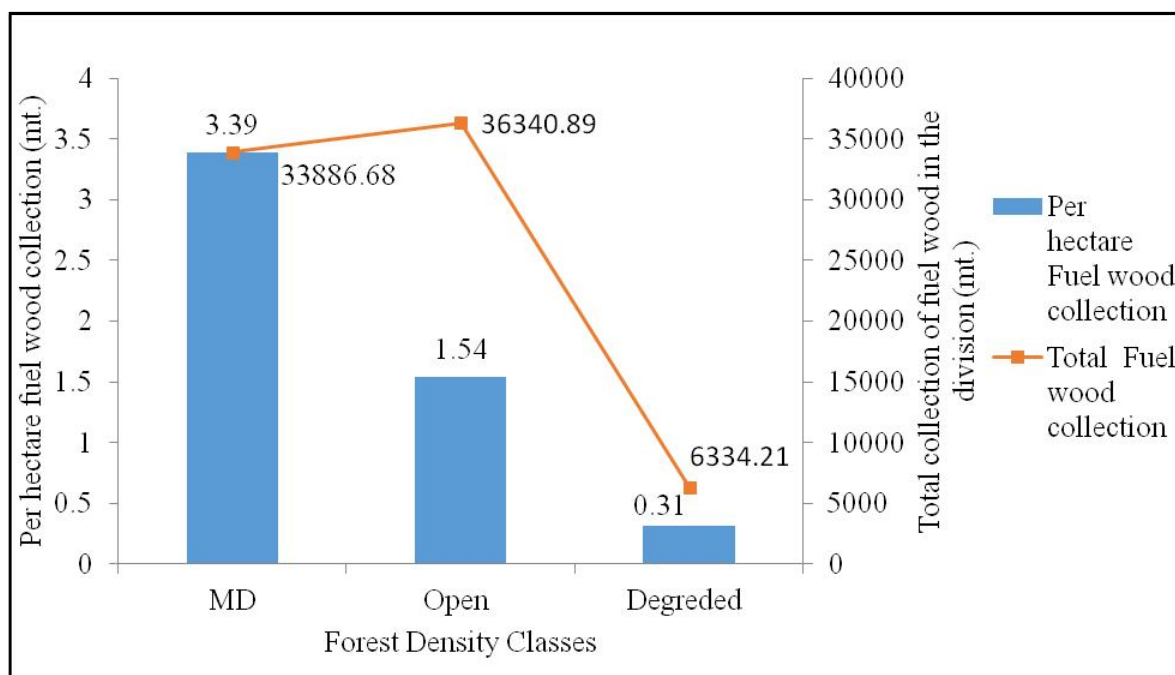


Fig. 2: Level of dependence of surveyed households in NFD

Table 3: Estimation of fuel wood consumption at households and per capita levels

Total Forest Villages	Total surveyed forest Villages	Total households in the division	Total population in forest villages	Consumption of Fuel wood (kg/households/day)	Consumption of Fuel wood (kg/capita/day)
314	31	39736	198987	5.3	1.05

comparable to the studies Bhatt, *et al.*, (1994); Mahat, *et al.*, (1987) and Reddy, (1981) in which they have recorded 1.49 kg/capita/day, 1.23 kg/capita/day and 0.9kg/capita/day, respectively. Another study in Western Ghat showed seasonwise per capita consumption during summer (1.44kg/capita/day), winter (1.43kg/capita/day) and monsoo (1.56 kg/capita/day), respectively (Ramachandra *et al.*, 2007). In this study, estimates of per hoshould consumption were found to be 5.3kg/day/annum. Per capita and per household consumption by forest dweller in NFD can be affected by various factors such as forest status in the area, landholding capacity, income of household, employment opportunities, source of income, season of collection, alternative availability of coking energy etc.

Conclusion

Fuelwood is a type of coking energy which is furnished by forest ecosystem. The requirement of this energy could increase, with the increasing population in NFD in future year as this energy is essential for their daily routine purposes. The study concludes that there is very huge amount of fuel wood collection in NFD which showed economic value Rs 114.7 million/annum. The study

revealed that these huge fuel wood collection are from MD (44.2%) followed by OF (47.4%) and DF (8.2%). Therefore, there should be a plan in the NFD to control fuel wood collection/consumption for sustainable management of the forest resource in the division.

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