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# Fuelwood extraction by indigenous, rural and urban poors do not risk trees and forest: a case study from Jharkhand, India

## Abstract

Wood biomass from forest is the major source of domestic energy in most of the developing countries. The present study was an attempt to document information on wood collection, consumption and species used for domestic energy needs by residents of both rural and urban villages in Ranchi district of Jharkhand state, India in different seasons round the year. Wood fuel is the major domestic fuel in the study area which is mainly collected from forests or non-forest lands or purchased. The fuel need is also supplemented by coal in urban localities. The consumption of wood and coal in both urban and rural areas increases during winter and gradually decreases from rainy to summer season. The quantity of wood consumption per family in study area varied from 2.5–6.5Kg/day in urban areas while it was 6.0–12.0Kg/day in rural areas. The wood of species *Mangifera indica*, *Syzigium cumini*, *Gmelina arborea*, *Madhuca indica* and *Dalbergia sissoo* were found mostly used for domestic energy purposes because of their availability. Firewood extraction by indigenous, rural and urban poor in our study area are no way causing loss to forest or threatening tree species to risk as they are using dead stems, twigs or branches of trees either from non-forest lands or from forest those species which are in lesser priority list of IUCN (International Union for Conservation of Nature). Instead, there should be capacity built for involvement of urban poor in more and more afforestation/reforestation programmes of multi-purpose species in non-forest lands and their rights safeguarded so that they can also use firewood solely for their domestic energy need and not supplement hydrocarbon fossils like coal.

**Keywords:** fuel wood, forest, energy, coal, cow dung, crop residue, timber species, forest vegetation, climate change, wildlife, bioenergy, afforestation, harvest and replant, environmental footprints, firewood

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## Introduction

During the past few decades, India has experienced many changes in its energy consumption pattern both in qualitative and quantitative terms.<sup>1</sup> This is mainly due to rising population growth and increase of economic and developmental activity. The household sectors is one of the largest users of energy in India, accounting for about 30 % of final energy consumption (excluding energy used for transport) reflecting the importance of the sector in total national energy scenario.<sup>2</sup> The pattern of household energy consumption represents the status of welfare as well as the stage of economic development. International Energy Agency predicts that population growth will render 2.7million people relying on plant base energy forms in the year 2030.<sup>1</sup> The rural and urban poor population mainly depend on plant biomass resources (cow dung, crop residue, fuel wood) as compared to hydrocarbons to fulfill their daily energy needs.<sup>3</sup> Fuel wood extracted from forest is one of the most important sources of energy in the developing and under developed countries.<sup>4-7</sup> Much of the fuel wood is now also being obtained from trees outside from forest, such as bush fellow, scrub, dead trees, pruning and lopping.

Unsystematic extraction of forest resources has alarmingly decreased the population of many woody species all across the globe.<sup>2,8,9</sup> This has also increased the gap between resources increment

and resources removal resulting in shortages and un sustainability of forest resources.<sup>2</sup> As the availability of forest resources is inadequate, forest cover is limited and forest productivity is diminishing. Forest resource developments through various interventions need to be designed to cope with the future pressure and stop the further forest degradation. Keeping these facts in view, the present study was conducted to explore the estimates of extraction and consumption of fuel wood in rural and urban villages in eastern region (Jharkhand) of India.

## Material and methods

The present study was conducted in Ranchi district of Jharkhand state, India from January, 2015 to December, 2016. The district with 5231km<sup>2</sup> areas is located between 23.35°N latitude and 85.23°E longitude with an average elevation of 651 m from mean sea level. Climate is tropical with three distinct seasons, summer, monsoon and winter. Average annual rainfall, mean minimum and maximum temperature were 1413 mm, 24°C and 37.2°C, respectively. 200 households were selected following stratified random sampling procedure<sup>11</sup> from ten villages, five each from rural and urban localities. The rural villages were inhabited by the indigenous communities only while the urban villages comprised of mixed population but majority were indigenous. Both open and close ended interview schedule along

with first hand field observation was used for gathering information related to fuelwood consumption, type of energy sources, preferred species and source of collection.<sup>12</sup> The survey was supplemented with participatory observations, plants identification with local names and necessary photographs for further identification.

## Results and discussion

### Quantity, species and seasonal patterns

Wood is the only source of domestic energy in the rural localities of the study area (Table 1) which is easily and freely available in the nearby forests due to prevailing legal rights of the indigenous community to use fuel wood from the forest.

The domestic energy need is also supplemented by cow dung in these localities but is negligible. In urban localities both wood and coal is used for domestic energy purposes with wood as major contributor (Table 1) which is either collected from non-forest woodlot, roadside plantations and scattered trees or purchased (mainly coal). The average quantity of consumption fuel material in rural localities was more than the urban localities throughout the year (Table 1). This is because of scarce availability of fuel wood in urban areas and that too is generally purchased. Changing seasons also influenced the quantity used of fuel material by the residents both in rural and urban localities. The quantity of wood and coal used for domestic fuel was higher in winter season which gradually decreased from rainy to summer season. In winter season residents used energy also for domestic heating along with cooking whereas in summer energy was used only for cooking. The daily average consumption of fuel wood per family in summer, rainy and winter season in rural localities was 6.75, 8.55 and 10.75 kg, respectively. Similarly in urban localities coal consumption was 1.77, 2.80 and 4.30 kg and fuel wood consumption was 2.84, 4.81 and 5.60 kg daily by a family, respectively in summer, rainy and winter season.

Sustainable utilization of forest and associated land resources is a complex issue that encompasses societal needs, ethical and cultural values, and economic status of communities. Fuelwood is renewable and its consumption can only be sustained if the rate of harvesting does not exceed the growth rate. The variety of fuelwood species used

by urban population is less as compared to rural populations (Table 2) (Table 3). In total, wood of 34 species represented by 19 families were used as fuel (Table 2) (Table 3) of which 17 species were used by urban residents and all 34 species by rural residents (Table 2) (Table 3). In urban localities fire wood collected or purchased were represented by four species from farm land, 10 species from roadside plantations and 17 species from market (Table 3). In contrast fuel wood collected by rural residents were represented by six species from farm land, 12 species from roadside plantations and all 34 species from the forests (Table 2) (Table 3). Most of the fuel wood (60 %) is purchased from the markets by the urban villagers and is supplemented by collection from road side plantations (30 %) and rest from farm lands (Table 3). In contrast major proportion of the fuel wood demand (75 %) of the rural residents is met from the forests and rest 25 % is met by collection from road side plantations.

This is because rural residents in addition to trees in their homestead and village surroundings could exploit tree species from the forest whereas urban residents used only trees of homestead and their village surroundings or roadside plantations. Moreover, rural villagers generally depend on fuel wood for these purposes as they have less access to other energy sources such as LPG, kerosene, coal etc.<sup>13</sup> In rural areas, the only cost of fuelwood collection is physical efforts and the time taken,<sup>14</sup> although for urban areas it is only for commercial purpose. The wood of species like *Mangifera indica*, *Syzygium cumini*, *Gmelina arborea*, *Madhuca indica* and *Dalbergia sissoo* were mostly used by the residents of the study area for their domestic fuel because of their availability in forest, homestead, and village surroundings as block or scattered plantations and in road side plantations also. *Mangifera indica* and *Syzygium cumini* are fruit species while *Gmelina arborea* and *Dalbergia sissoo* are common timber species. *Madhuca indica* is an important tree species of indigenous communities of Jharkhand as flower and fruit of this species is used to prepare local alcohol. These species are therefore abundantly planted in homesteads, village commons and as roadside plantations. Fabaceae was the most exploited family with 10 species and fortunately all these species were not in priority list of conservation as they are not threatened (Table 2).<sup>15</sup>

**Table 1** Utilization pattern of fuel (Kg/day/family) in urban and rural villages of Jharkhand.

Urban	Summer season		Rainy season		Winter season	
	Coal	Wood	Coal	Wood	Coal	Wood
Namkum	1.5	3.0	3.0	4.0	4.0	5.5
Ratu	1.75	2.5	2.5	3.25	3.75	4.5
Ghagra	2.0	2.75	2.75	3.5	4.25	5.5
Lalgutwa	1.5	2.75	2.5	4.0	4.5	6.0
Ormanjhi	2.1	3.2	3.25	4.5	5.0	6.5
Mean	1.77	2.84	2.80	4.81	4.30	5.60
Rural						
Rampur	0.0	6.0	0.0	8.0	0.0	10.0
Bero	0.0	6.25	0.0	7.75	0.0	9.5
Nagri	0.0	7.5	0.0	9.0	0.0	12
Mandar	0.0	6.75	0.0	8.5	0.0	11.5
Chanho	0.0	7.25	0.0	9.5	0.0	10.75
Mean	0.0	6.75	0.0	8.55	0.0	10.75

**Table 2** Plant species used as fuel wood in Jharkhand.<sup>3</sup>

Scientific name	Vernacular name	Family	IS	UV	RV	S
<i>Shorea robusta</i>	Sal	Dipterocarpaceae	LC	–	√	F
<i>Adina cordifolia</i>	Haldu	Rubiaceae	NE	–	√	F
<i>Albizia odoratissima</i>	Black Siris	Fabaceae	NE	√	√	R
<i>Acacia auriculiformis</i>	Akashmani	Fabaceae	LC	√	√	R
<i>Acacia catechu</i>	Khair	Fabaceae	NE	√	√	R
<i>Mangifera indica</i>	Aam,Mango	Anacardiaceae	DD	√	√	FA
<i>Syzigium cumini</i>	Jamun	Myrtaceae	NE	√	√	R
<i>Gmelinaarborea</i>	Gamhar	Lamiaceae	NE	√	√	FA
<i>Cassia tora</i>	Chakvad	Fabaceae	NE	–	√	R
<i>Oroxylum indicum</i>	Manduk or Bhootvriksh	Bignoniaceae	EN	√	√	R
<i>Terminalia arjuna</i>	Arjun	Combretaceae	NE	√	√	R
<i>Terminalia bellirica</i>	Bahera	Combretaceae	NE	–	√	F
<i>Madhuca indica</i>	Mahua	Sapotaceae	NE	√	√	FA
<i>Lagerstroemia parviflora</i>	Bakli	Lythraceae	NE	–	√	F
<i>Dalbergia sissoo</i>	Shisham	Fabaceae	NE	√	√	R
<i>Pongamia pinnata</i>	Karanj	Fabaceae	LC	√	√	R, FA
<i>Butea monosperma</i>	Palas	Fabaceae	NE	–	√	F, R
<i>Ipomoea fistula</i>	Thethar	Convolvulaceae	NE	–	√	F
<i>Azadirachta indica</i>	Neem	Meliaceae	NE	–	√	R, FA
<i>Ficus golmerata</i>	Gooler	Moraceae	NE	–	√	F
<i>Eucalyptus Sp.</i>	Gum tree	Myrtaceae	LC	√	√	FA
<i>Michelia champaca</i>	Champa	Magnoliaceae	LC	–	√	F
<i>Tamarindus indica</i>	Imli	Fabaceae	LC	√	√	R
<i>Tectona grandis</i>	Teak	Lamiaceae	NE	–	√	R,F, FA
<i>Cassia fistula</i>	Amaltas	Fabaceae	NE	√	√	R, FA
<i>Dalbergia latifolia</i>	Kala shesham	Fabaceae	NT	–	√	F
<i>Diospyros melanoxylon</i>	Kendu	Ebenaceae	NE	√	√	F
<i>Dillenia pentagyna</i>	Karmal	Dilleniaceae	NE	–	√	F
<i>Mallotus philippensis</i>	Sindur or Kumkum tree	Euphorbiaceae	EN	–	√	F
<i>Rubia cordifolia</i>	Madder	Rubiaceae	VU	–	√	R, F
<i>Schleichera oleosa</i>	Kusum	Sapindaceae	EN	√	√	F
<i>Terminalia tomentosa</i>	Asan or Saj	Combretaceae	NE	–	√	F
<i>Toonaciliata</i>	Toon	Meliaceae	LC	–	√	F
<i>Zizyphus mauritiana</i>	Ber	Rhamnaceae	NE	√	√	R, FA

IS– IUCN status; UV– urban village; RV– rural village; VU– vulnerable; EN– endangered; NE– not evaluated; NT– near threatened; LC– least concerned; DD– Data Deficient; S: source, F–forest, R–roadside, FA–farm

**Table 3** Fuel wood collection pattern origin (in per cent) and species wise (in numbers).

Name of area	Farm	Forest	Road side	Market
Urban Village	10	0	30	60
Rural Village	15	75	10	0.00
Mean	12.5	37.5	20	30
<b>Number of species</b>				
Urban Village	4	0	10	17
Rural Village	6	34	12	0

Fortunately, except five species which are vulnerable (*Rubia cordifolia*), near threatened (*Dalbergia latifolia*) and endangered (*Mallotus philippinensis*, *Oroxylum indicum* and *Schleichera oleosa*) all other 31 species were not in the priority list of conservation as their IUCN status is either least concerned (7 species) or not evaluated (22 species). Among the IUCN conservation priority species, only *Oroxylum indicum* and *Schleichera oleosa* were both used by rural and urban residents as fire wood. However, the residents of the study area used only dead trees or dried stems, branches and twigs as fuel wood from forest as was evidenced from our field observations.

An increased demand of biomass for consumptive use of rural communities has considerable impact on the forest vegetation and wildlife.<sup>16</sup> Indiscriminate withdrawal of forest resources is the main cause of forest degradation and environmental instability.<sup>8,9</sup> It is widely believed that wide spread use of plant biomass from forest for domestic energy by rural indigenous and urban poor population in developing tropical countries is one of the major drivers of deforestation in tropical countries causing loss of stored carbon and thereby climate change. Irrational use of natural resources has resulted in the lowering of forest quality and shortage of resources especially preferred firewood species. But looking into the species utilization pattern of fuel wood by the residents, the wide belief of deforestation due to fuel wood consumption seems to be unlikely in the study area. However, considering the exponential increase of population in the tropical countries, it is desirable to use, conserve and manage the forest sustainably for its proper utilization. Alternately, encouraging tree plantation programs of the popular species by involving the community itself in non-forest areas will also release the pressure from forest for fire wood exploitation. Institutional awareness programs to sensitize the residents are required for the species which are in need of conservation according to IUCN. Forest harvest is bioenergy which is clean, renewable energy and also is low in CO<sub>2</sub> emissions. It is environment friendly and sustainable alternative to traditional energy. Burning wood or its product and residues has no net greenhouse gas emission because the CO<sub>2</sub> produced is recycled by plants which absorb it for photosynthesis and cellular respiration. Wood combustion for energy saves greenhouse gas emissions which else would have been emitted by burning fossil fuels.<sup>18</sup> Moreover such savings from wood combustion are permanent.<sup>17</sup> Many forest related activities like collection of firewood for domestic energy instead of fossil fuel and managing forests to absorb and store more carbon can help to mitigate climate change.<sup>7</sup> This is because the amount of carbon released through harvesting and its combustion is small compared to forest fires, other natural disturbances and fossil fuels.

## Conclusion

Wood continues to be a major source of energy in the developing world and Ranchi area of Jharkhand, India is no exception. From our documentation, firewood and its species utilization pattern, it is clear that in no way firewood extraction by indigenous, rural and urban poors in our study area are causing loss to forest or threatening species to risk as they are using dead stems, twigs or branches of trees either from non-forest lands or from forest those species which are in lesser priority list of IUCN. Instead, urban poors should be capacity built for involvement in more and more afforestation/reforestation programmes of multi-purpose species in non-forest lands and their rights safeguarded so that they also use firewood solely for their domestic energy need and not supplement hydrocarbon fossils like coal. Industrialized developed world is also now considering wood as a source of clean renewable bioenergy. There should be a sustainable combination of harvest and replant. It is to recognize that woods have lighter environmental footprints and store carbon for longer periods but require sustainable management practices to lower greenhouse gas emission. It is better for the environment that the worlds demand increases for wood as energy from sustainably managed forests, plantations and woodlots rather than to rely on hydrocarbon or fossil fuels for energy.

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## Conflict of interest

Author declares there is no conflict of interest.

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