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Analysis of fuel wood extraction pattern for household energy needs in Dhirkot, Bagh, Azad Jammu and Kashmir, Pakistan

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ABSTRACT

The study noted that 90 percent of the peri-urban citizens with various age group of tehsil Dhirkot, district Bagh depend on firewood for catering. Huge fuel-wood removal from the local forests has resulted in decline of forest formation. The present study was planned to count fuel-wood utilization levels and examine the dynamics. This results show that people with smaller households use extra firewood per capita. This result point to that the household finances of scale are, certainly, linked with the utilization of firewood. The major source of energy is firewood in Pakistan >80 percent Pakistani family. In Jammu Kashmir satellite imagery analysis that 27 percent (821×10^3 ha) loss of forest. The state of Azad Jammu and Kashmir has about 93.7% housing units use wood to complete their cuisine and heating requirements the people of Azad Jammu and Kashmir use the great amount of firewood due to shortage of other fuel resources. The fuel-wood usage is one of the main reasons for the deforestation in the region. The most dramatic impact of deforestation is a loss of habitat of millions of species. The current study analyzed the firewood use example in Dhirkot. The data was collected through questionnaires survey. Study revealed that the preferred species used as fuel wood are *Pinus ruxburghii, Pinus wallichiana, Acacia arabica, Prunus* spp., *Curcuis incana* and *Olea ferogina.* The per capita fuel wood consumption was 4.6 kg/day.

Key woods: Fuel, Forest, Deforestation, Dhirkot, *Pinus wallichiana, Pinus ruxburghii*

INTRODUCTION

It was estimated that during 1990-2000, about three billion populace in the worldwide dependent on firewood for heating and cooking (Taylor *et al.*, 2011). Many countries report for most firewood utilization and more than 75% of firewood collected in many countries is for fuel (Tuanmu *et al.*, 2010; Knight and Rosa, 2012). Firewood has been the major source of energy in the household sector. The domestic survey exposed that 75% of the households have used wood as a major fuel for the cooking, 14% firewood used for water heating and 11% firewood used for room heating (Frischknecht *et al.*, 2015).

The situation is quite different by urban/rural divide; 90 percent in peri-urban areas have used firewood for cooking and heating but only 10 percent in urban areas (Revelle, 1976). It is merely after the detection of fossil fuels that the firewood has slowly been substituted. The switch over has achieved energy in early 1970s when the natural gas became accessible. For the reason that of high population growth; it is also the most highly growing region in terms of requirement and fuels. This high growth has placed a marvelous stress on business fuels deliver structure ensuing in load-shedding of the electricity, fuel shortages and natural gas which has forced the every country to resort to high imports of fuels with massive investments. Majority of the peri-urban masses still a lot rely upon biofuels i.e. firewood, crop residues and cow-dung (Van Kempen *et al.*, 2009).

The information on fuel wood consumption pattern in Himalayan region is rich (Bhatt and Sachan, 2004). More than half part of the western Himalayan forest have been vanished in this century (Joshi *et al.*, 2001).

In Himalaya, about 77.4 percent of total human inhabitants is rural (Rao and Pant, 2001). Firewood that is used and collected from close forests is only source of energy in the region (Dhanai *et al.*, 2015). Kerosene and electricity energy use consists of only 1.41 percent of the total.

At 8% loss in the eastern Himalayan and 23 percent in the western Himalayan have lost in 30 years (Shaheen *et al.*, 2011). It has been noted that tree cutting for firewood accounts for the major share of wood use in many countries causing fast deforestation (Kataki and Konwer, 2002).

The following objectives are studied in this research project:

- The currents research was planned to react to the absence of trustworthy data on firewood use and its effect on forest formation as a whole and firewood species mainly in Azad Jammu and Kashmir.
- The judgment of firewood utilization levels by village people of Azad Jammu and Kashmir and to assess the impact of climate, elevation, season and family members on firewood use.
- The present work centre of attention on the utilization and distribution patterns of firewood species, the quantity cut on seasonal basis and

knowledge on the preference of tree species by local communities at different altitudes.

MATERIALS AND METHODS

Study Area: The current study was performed in tehsil Dhirkot, district Bagh, Azad Jammu and Kashmir which is 25 km from Kohala, the entry point of Azad Kashmir and 132 km from Islamabad. Dhirkot is an attractive place of Azad Kashmir. It lies on latitude 33˚ to 57˚ N and longitude 73˚ to 36˚ E, having an area of 150 km2 (Khan, 2002) with an altitude of 5499 feet (1676m) from sea level. It is bordered on South by District Poonch, the North by District Muzaffarabad, on the East by Occupied Kashmir and West by Abbottabad and Murree. The climate of Dhirkot is mild one and is generally temperate and warm. The area receives significant amount of rainfall throughout the year. Maximum precipitation, with an average of 96 mm falls in July. Minimum precipitation with an average of 16mm falls in November. The hottest month of year is June with an average temperature of 24°C while January is the coldest month in the area. The area is rich in forest resources and the inhabitants are dependent on fuel wood for energy requirements.

Questionnaire was produced to obtain knowledge about domestic use of firewood. Structured and semi-structured questionnaires were used and the identification of major fuel wood species was depending on the group discussion, interviews and direct observations. The firewood species were recognized with help of native people. Interview was conducted with the people who are directly involved in the wood consumption.

Five villages were selected to investigate fuel wood consumption patterns. The usual family size is 7.4 per family. 94% people lives in rural areas. Most rural population depends on forests.

Socioeconomic information, including family size, preferred species, and dependence on fuel wood and extraction methods were acquired by administering 30 questionnaires at every site. The questionnaire sought the name of the plant preferred and quantity used. Local people were asked to name of the preferred species used, gathering time, distance travelled and time taken for their collection and types and sources of biomass energy.

The data was collected for two seasons i.e. summer and winter, at the same time, examination were also made in every household to measure the firewood used for various purposes e.g. heating, cooking and heating of water.

The wood bundles were weighed and the length of a stick, its diameter and total weight of one head load bundle weighed by certain instruments.

RESULTS AND DISCUSSION

Present study provides information on fuel wood consumption. Respondent were all female making 100%. Most of the people were in the age between 25 to 55 years. About 70% of the respondents told that no ban or law exist against deforestation.

Due to lack of education among aged people and no cheap alternative source of fuel, vegetation removal was common in study area. The loss of different plant species from deforestation result in destruction of local flora due to lack of enough gas and electricity.

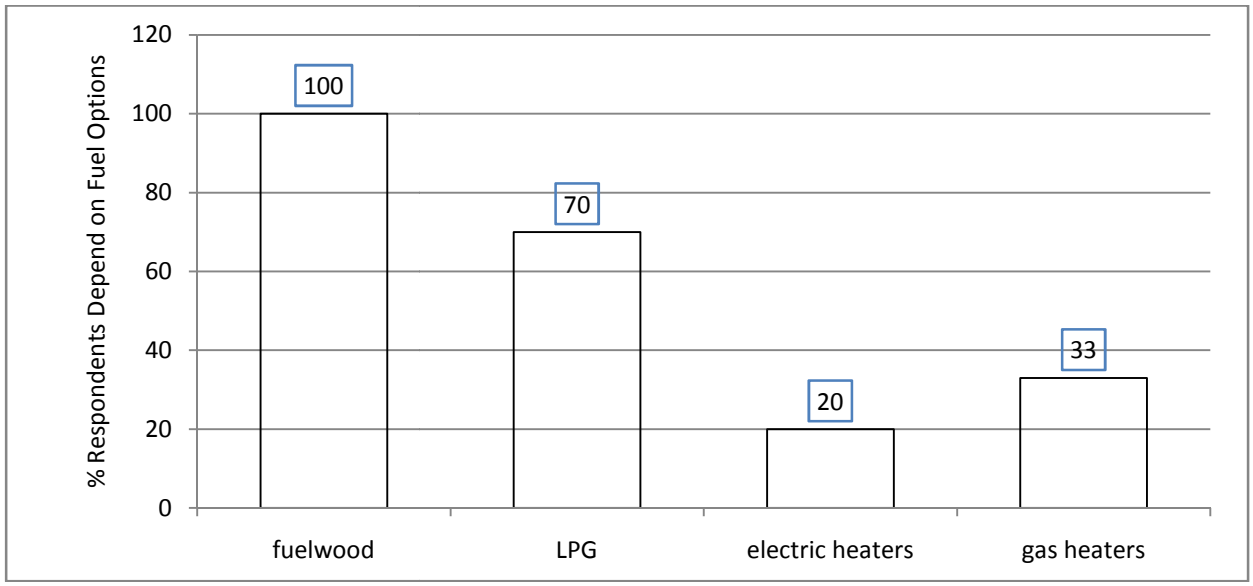

Figure 1: Types of fuel used in the study area.

Mostly four types of fuels are used for domestic purpose in village dhirkot Bagh AJK and these are fuelwood, LPG, gas heaters and electric heaters. The 100% people use fuel wood for domestic energy requirements.70% also use LPG (4.1). The use of electric heaters is 20 % and 33.33333% use gas heaters (Figure 1).

The fuel-wood and LPG usage is more as compared to electric heaters and gas heaters due to one basic reason for more consumption of fuel wood is free of cost as a result fuelwood consumption is more as compared to other sources. The other fuel sources are highly expenses and that's why their usage is in lesser amount.

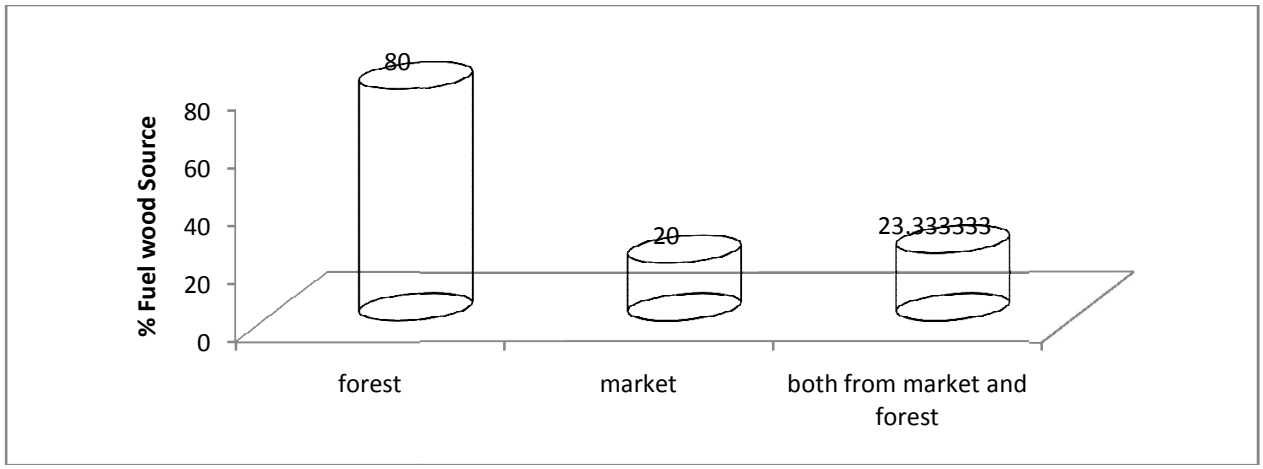

Figure 2: Fuel-wood sources.

Figure 2 represents the different sources of fuel.forest is the main source of fuel wood about 80% people used the foerst as a fuel (Fig 4.2) some people also obtain fuelwood from the market and their percentage is low because of cost and percentage is 20%, and some others peoples used both forest and market as a source of fuel and percentage is 23.33333%.

Table 1: The profiler of respondents.

Variables	**% Respondents**
Gender	
Female	100
Male	0
Age of respondent	
>20	17
≥30	33.333333
≥40	23.333333
≥50	30

The result of study shows that 100% respondents were female. Because female know about more fuel wood consumption. About 17% respondents were >20 years of age where is about 33.3333% belongs to the age group of ≥30 ,23.33333 belongs to the age group of ≥40 and 30% belongs to the age group of ≥50(Table 1).

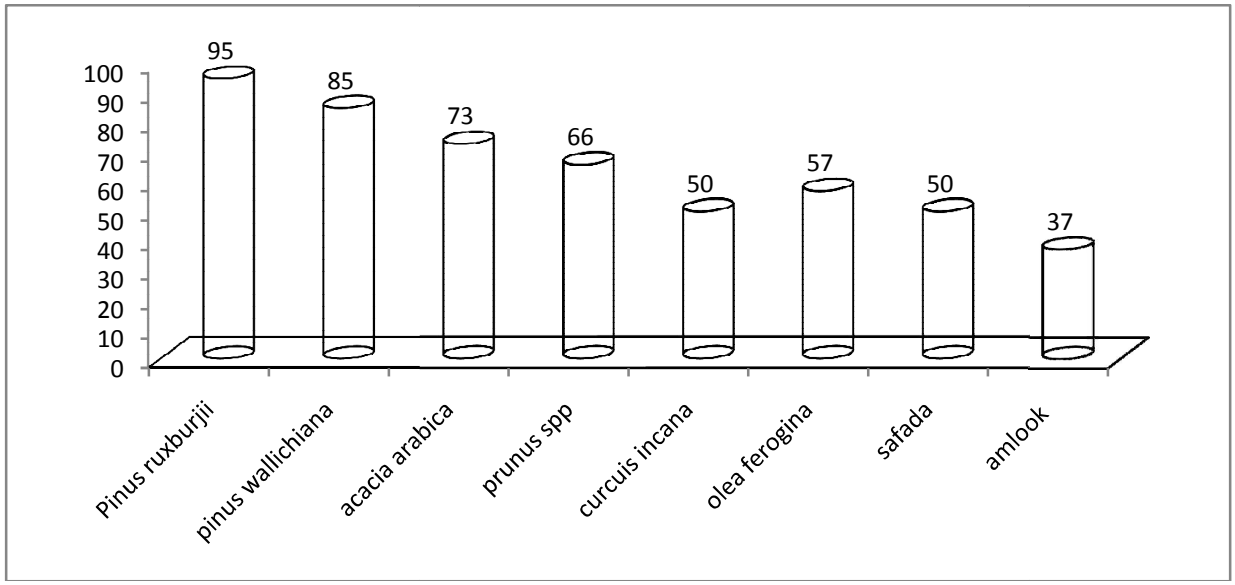

Figure 3: Preferred species used.

Figure 4 show the varius types of fuel wood species use for domestic fuel purposes. Mostly eight types of fuel wood species used as a fuel that are *Pinus ruxburghii, Pinus wallichiana, Acacia arabica, Prunus spp,Curcuis incana,Olea ferogina, Safada and Amlook.* The consumption of Pinus spp is more because this specie for fuel is more avaliable as compared to other and that's why its percentage is higher than the other fuelwood species.

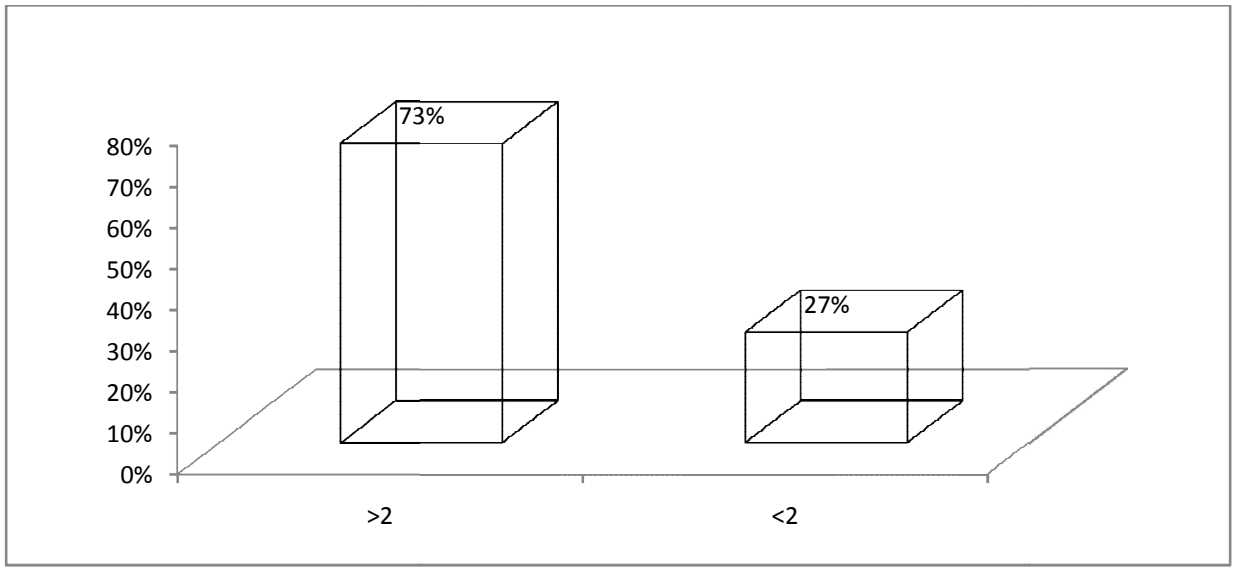

Figure 4: Daily head load consumption.

Figure 4 shown that daily headload fule consumption by different householdes. About 73% householddaily fuelwood consumption >2 however, 27% daily fuel wood consumption is <2.

Table 2: Way of collection.

Way of collection	% Reliance
Manually	50%
Automobile	60%
Both ways	83.3%

Table 2 indicates the way of collection of fuel wood. 50% respondent collects wood manually. 60% respondents use automobile for collection of fuel wood. 83.3% respondent use both way either by manually or automobile.

Table 3: Time for collection.

Time spent for collection	%Respondents
0-1hours	50%
30mintues	33%
20mintues	16%

Table 3 represents time spend for collection. About 50% respondents were says that they collect the fuel wood directly from forest in the 0-1 hours. 33% respondents were collected fuel wood in 30 minutes and 16% respondents were collected fuel wood in 20 minutes.

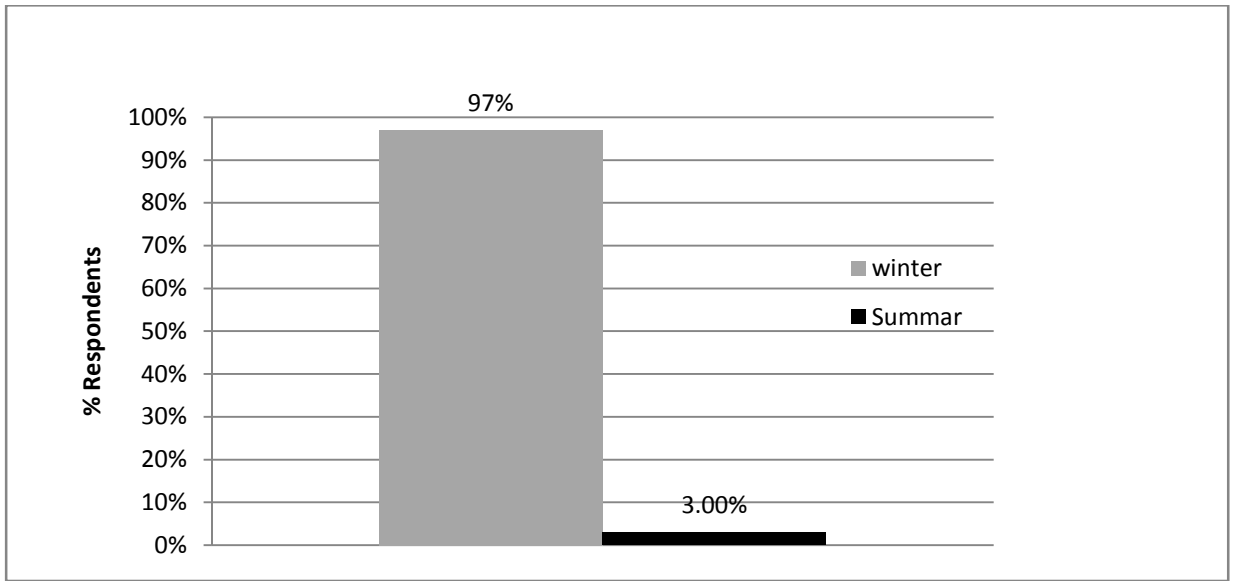

Figure 5: Seasons of fire.

Figure 5 elaborates the season of fire. 97% respondents was says season of fire is winter and 3% respondents were says season of fire is summer. 100% respondents was say causes of forest in fire is due to the human drive. Result analysis that human driven are responsible for causes of fire in forest. Humans actually caused the fire in forest mostly pedestrian smoker thrown the cigarette in dry grass which cause fire.

Table 4: Role of people during fire event.

Role of people during fire event	% Response
Active	67%
Passive	33%

This result analysis that about 67% respondents says during fire event in forest local community use water and tree's branches to extinguished fire. About 33% respondants says during fire event people do nothing (Table 4).

Table 5: Per capita fuel wood consumption.

Daily consumption	**No of household**	**per capita kg/per day**	**per capita kg /per year**
777 kg	194	4.6	1696.619282

From the consumptionin each of the sample households (Table 5) was derived for village showing an average household's consumption and other domestic purpose. The consumption of fuelwood represents the average amount of each fuel used by household in the sample, calculated on the basis of all household using the per day fuel consumption. The number of household is 194 in the first of all purposes. Per capita fuel wood consumption was therefore calculated from the household consumption data, and is displayed in (Table 5).

The average daily per capita consumption of firewood among the different sample households, in the per day 4.6 kg or1679 kg per year.

Table 6: Alternative fuel options.

Alternative fuel option	Respondent (%)
LPG	60%
Solar system	45%
Wind energy	32.33333%
Bio gas	35%
Natural gas	20%
Electric heater	15%
Hydro energy	10%
Coal	20%

Table 6 shows the alternative source of fuelwood. People also wants alternative sources of fuel other then fuelwood and their percentage is shows 60% respondents suggested LPG as a alternative fuel, 45% solar system, 32.3333333% wind energy 35% biogas, 20% natural gas,10% electric heater 15%, hydro energy 10% and coal 20%. If these alternative sources of fuels are available for them that they can reduce the consumption the fuel wood.

Conclusion: Amount of firewood use in villages of tehsil Dhirkot was analyzed where the forest is facing pressure due to activities of local people**.** The results of this study showed that the firewood use in the area is high dependent on its extraction from the forest. *Pinus roxburjii and Pinus walichiana* is the top one favored plant species use as firewood. These plant species are often extracted from forest for energy needs for the cooking as well as heating in area. The per capita firewood utilization was note to be 4.6 kg/per day in study area.

Recommendations: The energy rule should be complete to endorse wood energy planning to attain its sustainable use for all regions of civilization. Wood fuels are renewable forms of energy and also supply many other profits to native people. Alternative resources of energy must be commenced which contain the less amount of air pollutants. Must be held's the kind of programs by the EPA to motivate the people about awareness of deforestation and reforestation in the forest. Reforestation by people and forest committees should be carried out in Dhirkot on sites which are affected due to fuel-wood extraction. It must be our national vision to plant and care the trees.

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Authors' contributions: Irshad has designed project, collected data and written this article; while Gardazi supervised the project and Jadoon critically analysis this article and approved as final.

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