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RESEARCH ARTICLE

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Assesing the household fuel wood extraction and consumption situation in rural Kashmir, India

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ABSTRACT : The study examined the extraction and consumption pattern of fuel wood, socio-economic and forest resource characteristics and their relationship with extraction and consumption of fuel wood in rural Kashmir. Sample villages and representative households were selected using multi-stage random sampling for field study through structured interviews and personal observations. Correlation and multiple regression analysis was carried out to establish the relationship between socio-economic and forest resource parameters and fuel wood consumption. Results show that the total extraction of fuel wood in the sample villages was 224.64 tons annum^{-1}, which is mostly consumed in cooking (45.60 %). Of the total extraction, 26.17 per cent was secured from forests and rest (73.83%) from other sources. All the independent variables put together had contributed to 78.60 per cent (R^2 = 0.786) variation on the fuel wood consumption and the key variables *viz.*, family composition, size of land holding, housing status, frequency of forest visits and extent of agroforestry/ homestead plantation had significant contribution in influencing the fuel wood consumption. The fuel wood flow from forests to the sample villages is excessive as compared to the national estimates, creating threats to the biodiversity conservation and ecological stability of the adjoining forests of the area. The over-utilization of forest biomass by the local populace is leading to a depletion of forest resources and diminished biomass productivity, which in turn induce socio-economic and livelihood stress. Therefore, some alternative interventions are required to be implemented efficiently to keep pace with the current development and future challenges.

KEY WORDS : Fuel wood, Extraction, Consumption, Socio-economic characteristics, Forest resource characteristics

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INTRODUCTION

The energy use pattern in rural India is changing, with uptake of clean energy, but traditional fuels including fuel wood, crop residue and cow dung still constitute the main source of household cooking energy due to inadequate and unreliable supply of clean energy (Balakrishnan *et al.*, 2004; Das and Srinivasan, 2012). Fuel wood constitutes a vital input for all productive economic activities and meets the basic energy requirement in both domestic and traditional industrial sectors in rural India (NSSO, 2007-08). Approximately 2.5 to 3.0 billion people (40 to 50 % of the world's total) rely on fuel wood both for warmth and food preparation while in rural India; over 77 per cent households depend on fuel wood and wood chips for cooking (Jaiswal and

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Bhattacharya, 2013). Fuel wood accounts for the primary energy sources for cooking and space heating used by rural households (70 %) in developing countries (Mishra, 2008). A major consequence of inadequate supply of fuel wood is the burning of agricultural residue and animal dung, which otherwise would have been used for restoration of soil fertility and increasing food production.

Forests represent a key component of available national and regional biomass supply in rural India. According to one estimate, firewood accounts for over 54 per cent of all global harvests per annum, suggesting a significant forest loss (Jaiswal, 2011). In most Indian villages, local people are heavily dependent on forests mainly for fuel wood. Nearly 87 per cent of the households fulfill their fuel wood requirement completely from forest while rest procures it from various sources like home gardens, roadside trees, from agricultural farms (Jaiswal and Bhattacharya, 2013). In rural Kashmir forests, farm forestry, social forestry, homestead forestry and pasture are the major sources for fuel wood availability and cooking, heating, cottage industries and community functions are the major areas of fuel wood consumption (Banyal *et al.*, 2013).

Fuel wood collection is one of the most traditional activities which contribute to the forest degradation in the event of people adopting an unsustainable use of forests for these activities (Malhotra and Bhattacharya, 2010). As the forest resource is no longer sufficient to meet the fuel wood need of the rural population, other approaches to fuel wood production namely, farm forestry, community forestry and homestead forestry have been proposed as the potential solution to fuel wood supply shortages (Allen *et al.*, 1988). The decision on an approach for fuel wood production should be based on current patterns of fuel wood extraction and consumption, social and technical considerations and local conditions for encouraging new production. The household fuel wood extraction and consumption in rural sectors plays an important role in socio-economic, cultural, farming and geo-environmental conditions of a region. There is a need for holistic conservation initiatives, to have a clear description of the region in order to understand various socio-economic factors, forest resource production, use and dependence. This sort of an understanding is necessarily region specific and is frequently missing in many conservation initiatives. In order to effectively alter systems, it is first required that they are understood in a specific context (Sumati, 2006). Keeping the above facts under consideration the present study was designed to assess the household fuel wood extraction and consumption and their correlates in district Ganderbal of Kashmir.

EXPERIMENTAL METHODS

Study area :

The study was conducted in district Ganderbal of Kashmir during 2012-2013. The district lies on the geographical co-ordinates of 34°14’0" N and 74°47’0" E at an altitude of 1,619 meters above mean sea level in the undulated surface of Kashmir valley. The total geographical area of the district is 39304 ha, of which 10949 ha area is under forest, 5758 ha land put to non-agricultural use, barren and un-cultivable land is 3161 ha, permanent pastures and other grazing land is 1790 ha, cultivable waste land is 973 ha and net area sown is 16673 ha (irrigated, 10962 ha and un-irrigated, 5711 ha). The district has total human population of 297446 (158,720 male and 138,726 female) which is about 2.38per cent of total population of J&K (Anonymous, 2011), the literacy rate of 59.98 per cent (male 68.85 % and female 45.71 %), sex ratio of 874 female per 1000 males, family size of 6.62 and population density of 1148 per km^2. The district comprises of 84.19 per cent of rural and 15.81per cent of urban population living in 136 villages and 44831 households (Census of India, 2011).

Sampling technique and sample :

Multi-stage random sampling approach was employed to select the sample villages and the respondents for the study (Ray and Mondol, 2004). Fourteen sample villages *viz.*, Babosipora, Bandi Bagh, Gund Rahman, Dev Pora, Darend, Daraduder, Tangchatir, Gund Ari, Drag Tanga, Narayan Bagh, Badam Pora, Ahan, Danger Pora and Bagh Mahanand were selected out of the 136 revenue villages having around 10per cent sampling intensity in the district Ganderbal of Kashmir. A sample of 114 households having 10per cent of the total number of the households in the sample villages were drawn by simple random sampling for field survey. Household heads were treated as respondents.

Data collection and analysis :

The data on extraction and consumption pattern of

fuel wood and socio-economic and forest resource characteristics among the rural people were collected by personal interviews through a well structured pre-tested interview schedule, personal observations of the interviewer and participatory rural appraisal tools *i.e.*, key informant interview and focus group discussion (Mukherjee, 1993). The estimates of fuel wood extraction and consumption were made by requesting the respondents to weigh the amount of fuel wood they collect and use day-to-day. The average annual per capita fuel wood extraction and consumption were estimated by using weighing system and later multiplied by the total number of individuals in the households to calculate average annual fuel wood extraction and consumption among the surveyed population (Bijalwan *et al.*, 2011).

Measurement of variables :

The socio-economic and forest resource characteristics included were quantified using appropriate scales developed/ modified by the earlier workers (Venkataramaiah, 1990; Singha *et al.*, 2006) after certain necessary changes. These variables were; X_1= Age (chronological age in year); X_2= Education (0 = illiterate, 1 = below primary, 2 = primary, 3 = middle, 4 = high school, 5 = intermediate, 6 = graduate and above); X_3= Social participation (0 = no membership, 1 = membership of 1 organization, 2 = membership of more than 1 organization, 3 = office bearer of organization, 4 = public leader); X_4= Family composition (1 = nuclear, 2 = joint, 1 = up to 5 members, 2 = > 5 members); X_5= Size of land holding (0 = landless, 1 = up to 1.0 ha, 2 = 1.1 to 2.0 ha, 3 = 2.1 to 4.0 ha, 4 = > 4.0 ha); X_6= Livestock possession (0 = no livestock, 1= up to 5 livestock, 2 = 6 to 10 livestock, 3 = > 10 livestock); X_7= Housing status (0 = no house, 1 = hut, 2 = *katcha*, 3 = mixed, 4 = *pucca*, 1= 1 house, 2 = 2 house, 3 = > 2 house); X_8= Main occupation (1= wage labour, 2 = caste occupation, 3 = cultivation, 4 = business, 5 = service, 6 = any other occupation); X_9= Annual income (1 = up to Rs. 30000/ annum, 2 = Rs. 30001 to 60000)/ annum, 3 = Rs. 60001 to 90000/ annum, 4 = > Rs. 90000/ annum); X_{10}= Wealth status (1 = smokeless *chulha* (crude oven), 1 = stove, 1 = sewing machine, 1 = watch, 1 = cycle, 1 = radio, 1 = wooden furniture, 1 = pressure cooker, 2 = improved storage bin, 2 = tape recorder, 3 = scooter/ motor cycle, 1 = any other); X_{11}= Proximity to the forests (km); Frequency of forest visits (3= very frequently, 2= frequently, 1= occasionally, 0= never); X_{13}= Extent of farm/ homestead forestry (ha); X_{14}= Access to forest plantations (3= very often, 2= often, 1= seldom and 0= never) and X_{15}= Urban closeness (km). Suitable statistical tools like mean, frequency, percentage, linear correlation and multiple regression were used for analysis of the data as per standard procedure suggested by Snedecor and Cochran (1967). The multiple regression statistic was used to determine the effect of socio-economic and forest resource characteristics on extraction and consumption of fuel wood as follows:

$$Y = a + b_1x_1 + b_2x_2 + \ldots\ldots\ldots + b_nx_n + E_n$$

where, Y= fuel wood consumption, a = intercept, $x_1 - x_n$ = values of independent variables, $b_1 - b_n$= regression co-efficients, n = number of independent variables, *En* = Error term.

EXPERIMENTAL RESULTS AND ANALYSIS

The findings of the present study as well as relevant discussion have been presented under following heads :

Extraction and consumption pattern of fuel wood :

The total extraction of fuel wood from different sources in the surveyed population was found to be 224.64 tons annum^{-1}. Out of the total extraction, 58.80 tons annum^{-1} was secured from forests, 89.60 tons annum^{-1} from agroforestry, 31.92 tons annum^{-1} from social/ community forestry and rest 44.32 tons annum^{-1} from homestead forestry (Table 1). The per capita extraction of fuel wood in the study area was recorded to be 0.28 tons annum^{-1}.

The fuel wood collected is mostly consumed in cooking (153.33 tons annum^{-1}) followed by heating (127.43 tons annum^{-1}), cottage industries (25.32 tons annum^{-1}), household function (20.58 tons annum^{-1}) and rest 9.58 tons annum^{-1} for other purposes such as protection from wild animals, cremation, child birth, child christening etc. (Table 1). The average fuel wood consumption per household was recorded to be 2.95 tons annum^{-1}.

Socio-economic and forest resource characteristics:

The descriptive statistics for socio-economic and forest resources parameters of the sample households (Table 2) indicated that there was prevalence of middle aged (46.85) respondents having literacy up to secondary level (3.68), no membership or membership of only one

organization (0.81) and belonged to large family size and nuclear (3.12) family type. The size of land holding among most of the respondents (1.08) were marginal, engaged mainly in cultivation or business (3.46), having 6 to 10 livestock (1.98), one *pucca* house (4.95), medium wealth status (23.10) and gross annual income up to Rs. 60000/ annum (2.82). Majority of the respondents were having proximity of 5 to 10 km to the forests who visits the forests frequently (1.77) and access the forest plantation most often (2.38). The extent of agroforestry/ homestead forestry among most of the respondents (87.72%) was upto 0.30 ha and the urban closeness varied between 5 to 10 km.

Correlation and multiple regression analysis :

Out of fifteen independent variables, thirteen attributes namely, education, social participation, family composition, size of land holding, livestock possession, housing status, main occupation, gross annual income, wealth status, proximity to forests, frequency of forest visits, extent of agroforestry/ homestead plantation and access to the forest plantation had exhibited positive and significant correlation with the fuel wood consumption while the urban closeness have negatively significant association and there was non-significant relationship between age and the fuel wood consumption (Table 3). The regression analysis indicated that all the independent variables put together had contributed to 78.60 per cent (R^2 = 0.786) variation on the fuel wood consumption. The analysis of 't' values of regression co-efficient indicated that out of the fifteen independent variables of the people, family composition, size of land holding, housing status, frequency of forest visits and extent of agroforestry/ homestead plantation had significant

Table 1 : Fuel wood extraction and consumption of the sample households **(n =114)**

Extraction			Consumption		
Source	Quantity (tons annum^{-1})	Percentage	Purpose	Quantity (tons annum^{-1})	Percentage
Forests	58.80	26.17	Cooking	153.33	45.60
Agroforestry	89.60	39.89	Cottage industries	25.32	7.53
Social/ Community forestry	31.92	14.21	Heating	127.43	37.90
Homestead farming	44.32	19.73	Household function	20.58	6.12
-	-	-	Others (protection from wild animals, cremation, etc.)	09.58	2.85
Total	224.64	100 %	Total	336.24	100 %
X ± S.E.= 1.97± 0.03				= 2.95 ± 0.05	

S.E.= Standard error

Table 2 : Descriptive statistics for socio-economic and forest resources parameters of the sample households **(n=114)**

Characteristic	Mean	Std. dev.	95 % confidence interval for mean		Minimum	Maximum
			Lower bound	Upper bound		
Age (X_1)	46.85	11.52	44.71	48.99	22	69
Education (X_2)	3.68	1.47	3.40	3.95	0	6
Social participation (X_3)	0.81	1.07	0.61	1.01	0	4
Family composition (X_4)	3.12	0.77	2.98	3.26	2	4
Size of land holding (X_5)	1.08	0.42	1.00	1.16	0	3
Livestock possession (X_6)	1.98	0.89	1.81	2.15	0	3
Housing status (X_7)	4.95	0.79	4.80	5.09	3	6
Main occupation (X_8)	3.46	1.29	3.22	3.70	1	6
Gross annual income (X_9)	2.82	0.79	2.67	2.96	1	4
Wealth status (X_{10})	23.10	7.20	21.76	24.43	10	38
Proximity to forests (X_{11})	9.30	5.39	8.30	10.30	2.50	18
Frequency of forest visits (X_{12})	1.77	1.06	1.58	1.97	0	3
Extent of agroforestry/ homestead plantation (X_{13})	0.22	0.15	0.19	0.25	0	1
Access to the forest plantation (X_{14})	2.38	0.85	2.22	2.53	0	3
Urban closeness (X_{15})	9.78	4.00	9.04	10.53	2.00	17.50

contribution in influencing the fuel wood consumption. The fitted multiple regression equation for the fuel wood consumption should be written as :

$$Y = 1.391 - 0.006\ X_1 + 0.020\ X_2 - 0.019\ X_3 + 0.109\ X_4 + 0.219\ X_5 + 0.042\ X_6 + 0.083\ X_7 + 0.003\ X_8 + 0.052\ X_9 + 0.003\ X_{10} + 0.008\ X_{11} + 0.092\ X_{12} + 1.020\ X_{13} + 0.046\ X_{14} - 0.009\ X_{15}$$

where,

Y = Fuel wood consumption, $X_1 - X_{15}$ = Independent variables

On the whole, about 26.17 per cent of the fuel wood requirement is met from nearby forests and for rest 73.83 per cent of the fuel wood the people rely on other sources such as agroforestry, social/ community and homestead forestry. Fuel wood collection is mostly done by the women. The local inhabitants collect dead and dry tree lops and tops, twigs and branches, dry shrubs and leaves from the forests, agroforestry, social/ community and homestead forestry plantations. The important trees and shrubs mostly used as fuel wood are; *Populus species, Ulmus wallichiana, Robinia pseudoacacia, Malus domestica, Pyrus communis, Salix species, Morus alba, Morus serrata, Pinus wallichiana, Pyrus* spp., *Juglans regia, Celtris austrlis, Prunus armeniaca, Ailanthus excelsa, Catalpa bignonoides, Australis indica, Palatanus orientalis, Aesculus indica, Abies pindrow, Picea smithiana, Melia azedarach* and few others. Cooking and heating is the major area where 83.50 per cent of the total fuel wood is consumed whereas combined share of cottage industries, household function and other purposes in total fuel wood consumption is calculated to be 16.50 per cent only. The fuel wood is consumed mostly for cooking food and preparing feed for cattle and sheep, cottage industries namely, boiling of wicker willow, preparation of iron tools, bakery, pottery, hotels, tea stalls etc., heating like making of *kangri* charcoal, *hamam* etc., household functions e.g., festivals, feasts, child birth, child christening, death, marriage, washing clothes by boiling with detergents and fuel wood ashes and some other purposes such as protection from wild animals, cremation, covering of under roofs etc.

Fuel wood is the principal source of energy constituting maximum share in total bio-fuels (fuel wood, dung cake, biogas, charcoal and crop waste) consumption among the local people, constituting a vital input for all productive economic activities (Sarmah and Arunachalam, 2011). The local people generally depend on fuel wood for these purposes as they have less access to other energy sources such as LPG, kerosene, coal etc. (Bijalwan *et al.*, 2011). The major forms in which fuel wood is consumed in domestic works and rural industries are billets, twigs, wood shavings, saw dust and even leaves. In addition to fuel wood, people also rely on animal dung and crop residues for household energy requirements. This study reveals that substantial pressure on forests for meeting the fuel wood requirement of the local people due to the easy accessibility of forest

Table 3 : Correlation and multiple regression analysis of independent variables with the fuel wood consumption (n=114)

Independent variable (Code)	Co-efficient of correlation (r)	Regression co-efficient (b)	Standard error of 'b'	't' value
Age (X_1)	0.117	-0.006	0.002	-2.686
Education (X_2)	0.447*	0.020	0.021	0.936
Social participation (X_3)	0.557*	-0.019	0.031	-0.589
Family composition (X_4)	0.613*	0.109	0.043	2.541*
Size of land holding (X_5)	0.549*	0.219	0.076	2.887*
Livestock possession (X_6)	0.653*	0.042	0.044	0.955
Housing status (X_7)	0.505*	0.083	0.038	2.180*
Main occupation (X_8)	0.431*	0.003	0.023	0.121
Gross annual income (X_9)	0.487*	0.052	0.040	1.309
Wealth status (X_{10})	0.402*	0.003	0.004	0.848
Proximity to forests (X_{11})	0.541*	0.008	0.006	1.275
Frequency of forest visits (X_{12})	0.589*	0.092	0.031	2.996*
Extent of agroforestry/ homestead plantation (X_{13})	0.632*	1.020	0.208	4.903*
Access to the forest plantation (X_{14})	0.623*	0.046	0.042	1.093
Urban closeness s (X_{15})	-0.493*	-0.009	0.007	-1.226

a = 1.391; F = 23.938*; R^2 = 0.786; Multiple R = 0.886; Adjusted R^2 = 0.753; *indicate significance of values at P=0.05, respectively

resources and lack of low cost alternative sources of energy supply. The current production of fuel wood from forests, traditional agroforestry, community forestry and homestead forestry in the study area is inadequate and cannot combat the fuel wood demand of population in the on-going scenario (Islam *et al.*, 2011). Some alternative interventions are required to be implemented efficiently to keep pace with current development and future challenges (Banyal *et al.*, 2013).

The preponderance of middle aged respondents could be attributed to the facts that the middle aged people are generally enthusiastic, innovative and hard working with more experience, vigour, zeal, aptitude and challenge (Sinha *et al.*, 2010). The low literacy might be due to low socio-economic conditions of parents, lack of educational facilities in the area, higher involvement of boys and girls in livelihood earnings and ignorance towards education (Singh *et al.*, 2011). The social participation shows the grousing magnitude of interest and willingness of the respondents to be associated with various formal and informal organizations (Pandey and Mishra, 2011). Because of growing individualism people prefer to lead independent life with personal assets and proper accommodation in nuclear families. Consideration of child as an added asset to the family who can contribute by the way of labour and lack of knowledge of the benefits of small families might be the reasons for large sized families (Pal, 2011). The prevalence of marginal farmers in the surveyed area is due to the nuclear and neo-local structure of families in the community which urged early fragmentation of land from generation to generation and among married off-springs (Pal, 2011). Holding good number of livestock could be attributed to the fact that livestock rearing support agriculture and allied activities besides providing nutritional, social, economic, religious and recreational benefits to the people (Bijalwan *et al.*, 2011). The satisfactory housing status could be attributed to the fact that people traditionally expend a considerable sum in building good quality houses which acts as a sign of their socio-economic status (Bedia, 2014). The building of good quality houses are also a need to commensurate the geographical conditions of the area. Agriculture and business being the back bone of the economy in the area, most of the respondents either belong to farming families or dependent on business for their livelihood. The families engaged in other occupations and activities were also doing agriculture or business as their subsidiary occupation (Pal, 2011). The study established the preponderance of families having low gross annual income ranging between Rs. 31001 to 60000/ annum in the study area. The probable reasons for this might be that majority of the respondents are either farmer having small sized land holding or petty businessmen. Although different and varied types of domestic materials were possessed by the respondents, the overall picture was not satisfactory, especially in the context of the improved, modern and prestigious material resources. The main reasons for such scenario might be poverty, low literacy, lack of knowledge, lack of exposure, infrastructural insufficiency etc. (Gupta *et al.*, 2009).

The heterogeneity of sample households based on proximity to the forests has clear-cut impact in the magnitude of extraction and consumption of fuel wood (Sapkota and Oden, 2008). That's why the amount of fuel wood extraction and consumption varied greatly between proximate and distant households. The frequency of forest visits exerts a strong influence on appropriating fuel wood extraction and consumption from forests (Sapkota and Oden, 2008). The frequency of forest visits is more among the households highly dependent on forests while the frequency of forest visits is limited among the households having low dependency on forests for fuel wood extraction. The inequalities among households due to extent of agroforestry/ homestead forestry plantation differentiate apparently the scale of extraction and consumption of fuel wood (Singha *et al.*, 2006). The higher the extent of agroforestry/ homestead forestry plantation among the households, the lower will be dependency on forests for extraction of fuel wood and *vice-versa*. The availability of forest plantations *viz.*, wasteland plantations, road side plantations, canal bank plantations, river side plantations, community forestry, village woodlots, pasture land etc. in the nearby villages and level of access by the households to the forest plantations is a key factor influencing extraction and consumption pattern of fuel wood (Singha *et al.*, 2006). The rural-urban stratification has a strong association with the quantity of fuel wood extraction and consumption among the households (Chandra *et al.*, 2009). Hence, the higher the urban closeness of the households the lesser will be extraction and consumption of fuel wood and *vice-versa.*

The positively significant correlation between education and consumption of fuel wood is well articulated

by the facts that the education results in bringing desirable changes in human behaviour and helps the individual to move in right direction (Egeru *et al.*, 2010), the knowledge is built up through education, which makes the person aware of new innovations (Sood *et al.*, 2008). The social participation of the rural people paves the way for sharing their views and experiences with other members of the organization (Egeru *et al.*, 2010), clarifying their doubts and getting opinion from different people and enriching their knowledge (Prakash and Sharma, 2008). This is how the significant influence of this variable on consumption of fuel wood can be explained. The positive and significant relationship of family composition with the consumption of fuel wood could be attributed to the fact that the local people being an important member of their nuclear family might have taken up independent decision regarding any matter concerning to the livelihood generation for their family (Ajake and Enang, 2012) and the larger sized families were having more labour force available for more extraction of fuel wood (Larinde *et al.*, 2011). The involvement of local people of different age groups in extraction of fuel wood was more or less similar indicating that the variations in age has no influence on the extraction and consumption of fuel wood at all.

The co-efficient of correlation (r) of all the six economic variables of the local people namely, size of land holding, livestock possession, housing status, main occupation, gross annual income, wealth status with the consumption of fuel wood was recorded to be positive and significant. The persons who have big size of land holding will have good economic condition (Egeru *et al.*, 2010) and more scope for availability of fuel wood by encompassing appropriate combinations of farm enterprises (Prakash and Sharma, 2008). This might be the probable reason to have positive and significant association between size of land holding and the extraction and consumption of fuel wood. The main occupation of the local people exhibited direct bearing on the earning of money (Kumaresan and Devi, 2009), facilitating the possession of fuel wood among the local people that's why the higher the occupational pattern the higher will be extraction and consumption of fuel wood. The other economic attributes *viz.*, housing status, livestock possession and wealth status are the major indicators of physical capital possessed by the local people (Singha *et al.*, 2006) and the physical capital is a core contributor, a major part and the representative of the fuel wood possessions (Pal, 2011). These assets play an important role in their economy and help them to facilitate the other types of capitals to be owned and traded (Egeru *et al.*, 2010). The gross annual income of the local people are the prominent indicator of financial capital possessed by the local people (Sharma *et al.*, 2012) and the financial capital occupies central position governing the fuel wood resources possession (Sood *et al.*, 2008). The persons thus, who have higher gross annual income will also have higher fuel wood consumption.

All the forest resource characteristics *viz.*, proximity to forests, frequency of forest visits, extent of agroforestry/ homestead forestry plantation and access to the forest plantations have direct influence on extraction and consumption pattern of fuel wood among the local people, thus, the higher the custody of these variables the higher will be extraction and consumption of fuel wood in the area. That's why these variables had exhibited positive and significant correlation with the consumption of fuel wood. The negatively significant association of urban closeness with the consumption of fuel wood could be articulated to the fact that the urban people have some other alternatives of these forest resources dwindling their dependency on these resources.

The analysis of 't' values of regression co-efficient indicated that out of the fifteen independent variables of the people, family composition, size of land holding, housing status, frequency of forest visits and extent of agroforestry/ homestead plantation had the maximum contribution to the extraction and consumption of fuel wood and it turned out to be potential predictor in explaining the variation in the extraction and consumption of fuel wood. The family composition and housing status are the key variables determining the present and future demand of the fuel wood in the family, thus, the smaller family with lower housing status extract and consume lower quantity of fuel wood and the larger family having higher housing status requires higher quantity of fuel wood. The size of land holding of the people have direct influences on procurement of fuel wood needs of the family, the household with larger size of land holding can arrange large quantity of forest resources while the families having smaller size of land holding mitigate little quantity of forest resources. The frequency of forest visits and extent of agroforestry/ homestead plantation are the crucial variables having direct impact on mitigation of fuel wood needs in the families. The families with higher

custodian of these variables could arrange maximum amount of fuel wood whereas, families devoid of these variables were facing dearth of these forest resources. Similar results were reported by Singha *et al.* (2006).

Conclusion :

The findings of the present study led to conclude that despite inhabiting in resource rich areas, the socio-economic conditions of the people is away from the expected level and as such, there is still much scope to improve their quality of life. Nonetheless, the people are in prosperous position with regard to forest resource characteristics, which needs to be exploited efficiently and livelihood diversification based on the existing forest resources needs to be implemented as important strategy of socio-economic upliftment of the local people in the area. The entire population traditionally depends mostly on forest biomass and agroforestry plantations for fuel wood security having no any alternate source to replace the requirements in the region. The fuel wood flow from forests to the sample villages is excessive as compared to the national estimates, creating threats to the biodiversity conservation and ecological stability of the adjoining forests of the area. The over-utilization of forest biomass by the local populace is leading to a depletion of forest resources and diminished biomass productivity, which in turn induce socio-economic and livelihood stress. Therefore, some alternative interventions are required to be implemented efficiently to keep pace with current development and future challenges. Furthermore, the variables like education, social participation, family composition, size of land holding, main occupation, housing status, livestock possession, wealth status, gross annual income, proximity to forests, frequency of forest visits, extent of agroforestry/ homestead forestry plantation and access to the forest plantation of the people should be given due importance during decision making, planning, implementation and execution of strategies envisaged to relieve the pressure of fuel wood on forest as well as agroforestry plantations in the locality.

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