

The contribution of farm woodlots to household income diversification in Kashmir Himalayas

Authors' contributions

This work was carried out in collaboration with all the authors. Author TA designed the study, conducted the field survey and collected the data while the review of literature was carried out by the authors PAK, AAG and SM¹. The statistical analysis and drafting of the manuscript were managed by the author MAI, AAW and SM³. All authors read and approved the final manuscript.

ABSTRACT

The study investigated the household forest resource extraction and income diversification of farm woodlot land-use system in Ganderbal district of Kashmir. The study administered multi-stage random sampling technique to withdraw the sample of 163 woodlot owners from the 12 sample villages. Secondary data were collected from all the possible sources and primary data were collected through structured interviews, non-participant observations, woodlot inventories and rapid market assessment. The data were analysed using descriptive statistics including frequency, mean, percentage, range and standard deviation. The study documented four types of woodlots commonly established by the smallholder farmers and the growing stock of farm woodlots recorded were; Poplar (17.59 m³), Salix (21.30 m³), Robinia (20.92 m³) and Mixed (18.23 m³). The woodlot resources generated annual income of ₹ 71391.81/household (subsistence= 68.81%, cash= 31.19%); of which timber contributed the maximum share (56.99%) followed by fuel wood (16.26%), wicker (14.15%) and charcoal (12.60%). The average gross annual income was ₹ 138756.78/household which is differentiated as agriculture (20.12%), business (18.02%), woodlots (16.05%), livestock (13.24%), horticulture (10.26%), service (6.94%) and wage labour (4.03%). Nonetheless, the farm woodlot resources are the 3rd major contributor of household economy. Woodlot farming play a significant role in livelihood security by the production of forest resources for subsistence consumption, cash income, safety-nets and employments. The study confirmed that the farm woodlots are the key option for socioeconomic development, poverty reduction and livelihood security; hence, policy must be directed towards the income diversification through sustainable production, extraction and commercialization of the woodlot resources.

Keywords: Income diversification; woodlots; livelihoods; forest resources; rural economy.

1. INTRODUCTION

Woodlots have been recognized undoubtedly as a valuable component of farming systems that contribute to a changeover from subsistence-oriented farming to commercial-oriented farming system [1]. The woodlot farming contributes significantly to rural livelihood diversification by providing subsistence, cash incomes, safety-net and employment opportunities at household level [2]. The international donor agencies have funded on-farm woodlot farming jointly as one of the interventions to deal with high impoverishment and food insecurity of rural communities [3]. Woodlots secure a

variety of provisioning, regulating, supporting and cultural ecosystem services which are important not only at household level but at regional, national and global level [4]. Woodlots are wide spreading economic activity in the developing countries, mainly because of the forest degradation and high livelihood dependence on natural forests, introduction and commercialization of fast-growing trees and the consciousness of smallholder farmers on the economic returns from the plantations [5]. The private small-scale woodlot plantations constitute by far the considerable proportion of the overall tree cover that meet sizable demand of forest resources in the region [6]. They are primarily characterized by poor establishment and management practices with low productivity and negative ecological effects [7].

Growing trees at homefield in the form of farm woodlot is a traditional land-use system among rural households in Kashmir valley. A farm woodlot is a piece of land dedicated to tree planting usually located around a household or within a village [2]. A woodlot may be owned by a group of people, a home, or an individual. Hence, a woodlot is often located around a household or within a village, on a waste ground or beside a road. It is a place where the household members plant trees, has the rights over the trees planted and the members make their own management decisions [8]. Woodlots help in strengthening the local forestry sector as it includes the locals in management and diversify management strategies [9]. In Kashmir, the rural households generally, establish farm woodlots of *Populus deltoides* Bartr., *Salix alba* L., *Robinia pseudoacacia* L. as monocrop or mixed crop of several species and manage with short rotation of 10–15 years. The economic potentials of woodlots have led to expansion of plantations not only on marginal lands but also conversion of crop lands to woodlots [10]. Woodlot plantations at smallholders' farm level is becoming dominant activity in the temperate farming system as a component of livelihood diversification option both for subsistence and income generations [11]. Woodlots resources contribute to the state consumption of construction poles, timber, firewood, charcoal, posts, industrial woods and farm implements overwhelmingly.

With highly undulating topography, fragmented landholdings, low infrastructure and insurgency in UT of J&K, there is high risk and uncertainty to the economic activities. Globally, a number of studies have confirmed the inability of agriculture to fully support livelihood security [12-15] alone. Therefore, to reduce the effect of uncertainties on economic and social development, income diversification has gained importance. Income diversification is a strategy, which helps in economic development of a household. The strategy of diversification is a norm that makes use of various combinations of resources and assets in order to increase income. The income is used by household to meet their basic needs, raise their standard of living or welfare, and manage risk [16]. Under changing environment, most rural household avoid an extended period of dependence on only one or two sources of income [17]. A rural household with multiple income sources will experience less variability in total income than specialized households. The economic profitability and productivity of farm woodlot plantations for forest resource production has created popular acceptance of forest plantations as an attractive business for smallholder farmers in the region. However, less attention is

given on the economic valuation and livelihood contribution of woodlot resources extraction among smallholder farmers. Hence, this study was intended to document the forest resource production, consumption, marketing and livelihood contribution of farm woodlots in Ganderbal district of Kashmir.

2. MATERIALS AND METHODS

2.1 Study Area

The study was undertaken in district Ganderbal of Jammu and Kashmir Union Territory, located between 34.23°N Longitude and 74.78°E Latitude at an altitude of 1650 to 3000 meters above mean sea level (Fig. 1). The geographical area of the district is 39304 ha which is differentiated as forest (27.86%), non-agricultural use (14.65%), barren and un-cultivable land (8.04%), permanent pastures/ other grazing land (4.55%), cultivable waste land (2.48%) and net area sown (42.42%) [18]. The total human population in the district is 297446, of which 158720 are male and 138726 are female. The district has a literacy rate of 59.98%, sex ratio of 874 female per 1000 males, a family size of 6.62 and a population density of 1148/km². Of the total population, 84.19% lives in rural region and 15.81% inhabit in urban region. The rural population has occupied 136 villages and 44831 households [19]. The site encounters both temperate and sub-alpine conditions. The average temperature ranges from -5°C to 20°C and monsoon brings more than 700 mm of rainfall.

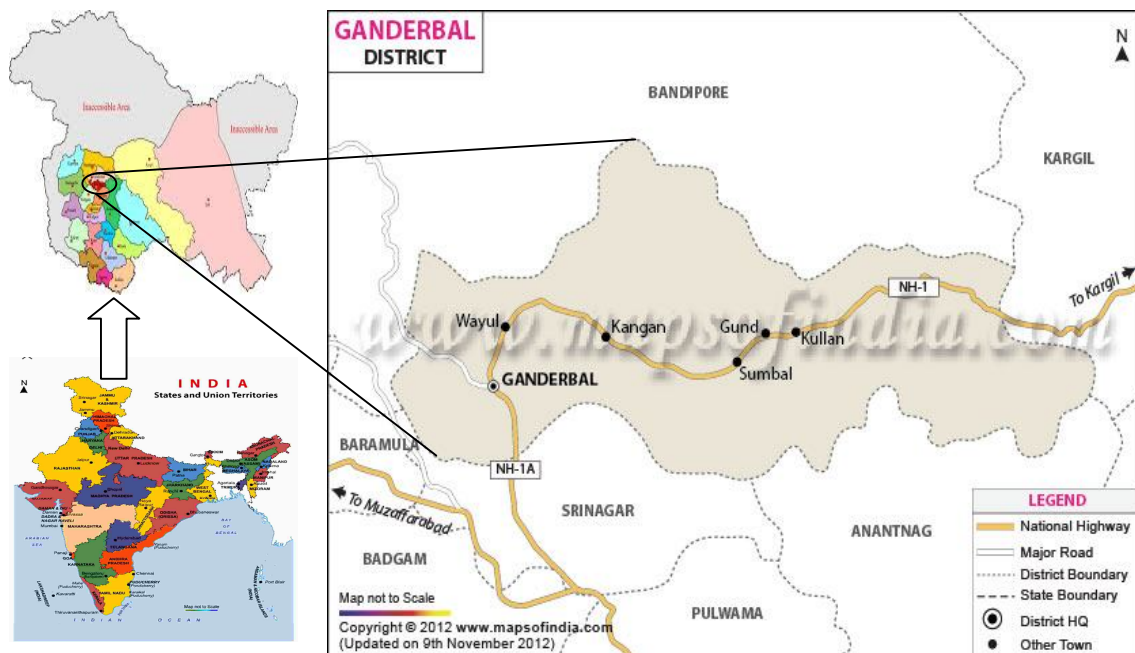


Fig. 1. Location map of the study area

2.2 Sampling Technique

Multi-stage random sampling technique [20] was applied to select the blocks, villages and farm woodlots. In the first stage, all four blocks including Lar, Kangan, Wakura and Ganderbal were

selected. In the second stage, of the 116 villages, twelve were sampled, including two (Kharani-Hama and Watal-Bagh) from Lar block, four (Gund-Ari, Drag-Tang, Tang-Chatir and Kij-Parah) from Kangan block, three (Lati-Waza, Gamwara and Koka-Gund) from Wakura block and another three (Kasti-pora, Chapper-Gund and Ghat) from Ganderbal block. In the third stage, all the 163 farm woodlots were selected from the sample villages.

2.3 Data Collection and Analysis

Data were collected from both secondary sources and primary field survey. The village level data on land use classification, land holding pattern, demography and forest resources were collected from secondary sources including line departmental records, village records, census reports, institutional technical reports, and national informatics centre (NIC). The household data were collected on the basis of structured interviews, non-participant observation, woodlot inventories and rapid market assessment. The interview schedule was structured based on relevant studies, preliminary survey, and dialog with experts and consultation with knowledgeable people. The interview covered household issues relevant to their socio-economy, woodlot characteristics, resources collected/produced households' involvement in production/collection/marketing, collection/year, consumption/year, sale of forest resources, rate and income (₹). The non-participant observation involved the data collection through personal watching, recording, and inspecting the behaviours in normal situations.

The woodlot inventories were carried out for the entire 163 woodlots to study the plantation's stand structure, composition, spatial distribution and characteristics [4]. Diameter at breast height (dbh) for woodlot trees was measured using diameter tapes at 1.37 m above ground. Total height of the trees was measured using clinometers. The volume of individual trees was estimated using the formula, $V = (\pi \times dbh^2 \times H \times 0.5) / 40000$, where V is the volume of tree bole (m^3), dbh is the diameter at breast height (cm) and H is the tree height (m). A form factor of 0.5 was applied to each tree in order to account for the taper effect of diameter and height measurements on tree volume [21-22]. The data were analysed by the simple descriptive statistics viz., frequency (f), percentage (%), average (x) range and standard deviation [23] on MS Excel software. The monetary values of the woodlot resources were estimated by a periodical market survey of the locality. Income is defined as the return for the labour and capital that a household owns utilised in self-employment or business activities (for example, wage labour) or sold in a market. Total household income is the sum of cash income and subsistence income. Subsistence income is defined as the value of products consumed directly by the household or given away to friends and relatives [24].

3. RESULTS AND DISCUSSION

3.1 Household Characteristics of Woodlot Owners

The socioeconomic characteristics of the woodlot owners (Table 1) indicated that most of the families were headed by middle-aged (mean value, 40.95) and low literate people (mean score, 2.79). Most of the sample families had large sized families (mean score, 1.82) and labor force of one worker (mean score, 0.22). Majority of the families had membership of at least one social organization (0.22). They

owned marginal size of land (mean score, 1.36), medium herd size (mean score, 3.47) and medium wealth status (mean score, 22.90). The main occupation was cultivation (mean score, 3.18) and the average gross annual income earned from different livelihood sources was ₹ 138756.78 in the sample households. The mean distance from forest was 6.20 kms and the people visited the forest occasionally (mean score, 1.37). The households possessed on an average 0.18 hectares of land area under trees. Generally, the people had mean urban closeness of 12.06 km and they seldom accessed alternative forestry sources like road side plantations, community forestry, pasture land or village woodlots.

The dominance of middle-aged family heads in woodlot resource production is attributed to the fact that these people are relatively more innovative, experienced, enthusiastic and laborious than the elder and youngsters. Low literacy among the rural people reflects low socio-economic status, scarcity of educational amenities, high livelihood concerns and unawareness towards schooling. People's low levels of interest and willingness to form alliances with social groups are the main cause of their low levels of social participation. The perception that children are a family's most valuable asset and can increase household income, as well as a lack of knowledge about family planning, may be responsible for the prevalence of large-sized families. Moreover, having big families contributes to the high family labour force. Because of neo-local and primary family structures in rural communities that led land disintegration from generation to generation and within married family members, marginal farms account for the majority of farms. Families with marginal farm land are unable to generate ample earnings for their households. To support the agriculture and generate additional earnings the livestock rearing was preferred as the most important subsidiary occupation. Although, the families possessed numerous varieties of traditional, crude and low-cost household physical wealth items but the overall scenario was unsatisfactory. Poverty, low socio-economy, illiteracy, unawareness and lack of exposure are the main reasons for such **grousing wealth situations.**

Agriculture is the backbone of the economy; hence, the largest numbers of rural households are engaged mainly in crop production for cash income, subsistence and food security. The families occupied in other economic activities, including livestock production, petty shops, trade, cottage industries, horticulture, etc., were also doing agriculture as their secondary occupation. The average annual income among the sampled families was inadequate because the contributions of the core livelihood sources to household annual income are very low. Probable reasons for such low gross annual income might be dominance of marginal farmers or petty businessmen, lack of scientific know-how, low crop production, scarce irrigation avenues, conventional tools and implements, monoculture cropping, inadequate fertility of soil and unpredictable climate that accumulate insignificant earnings to rural households [25-27].

The proximity to the forests has clear-cut impact in the magnitude of extraction and consumption of fuel wood, fodder, and small timber [28]. The close vicinity to forests, medium income, low literacy rate, high livestock fodder requirements and dependence on traditional ovens are some of the

contributory reasons for such frequent visit to forests. Poor households were highly dependent on the forests for fuel wood, fodder, timber and other NTFPs in order to sustain their day-to-day livelihoods. The size of land holding had a positive and significant association with the adoption of woodlot systems as reported by various studies [29]. Community forests or woodlots and other alternative forest resources provide the closest and most feasible alternative to forest resources especially during harsh weather like winter etc. hence, the dependence on the alternative forest resources is equally high as on the forests as they are supplementary to forests. The rural-urban stratification has a strong association with the quantity of woodlot resource like fuelwood extraction and consumption among the households [9]. Hence, the higher the urban closeness of the households the lesser is the extraction and consumption of woodlot resources and vice-versa.

Table 1. Household characteristics of woodlot farmers (N=163)

Variables	Explanation	Measurement description	Mean	Std. Deviation	Min	Max
Age	Age of household head in years	Number of years lived by the respondent	40.95	9.70	20	65
Education	Household head undergone in education	Illiterate= 0, Below primary=1, Primary=2, Middle=3, High school=4, Intermediate=5, Graduate & above=6	2.79	1.42	0	6
Family size	No. of family members in a household	2 = >5 members, 1 = < 5 members	1.82	0.39	1	2
Family Labour	No. of workers in a household	4 = >3 workers, 3 = 3 workers, 2 = 2 workers, 1 = 1 worker	0.22	0.51	0	2
Farm size	Land area under household management	4 = large (> 4.0 ha), 3 = medium (2.1 to 4.0 ha), 2 = small (1.1 to 2.0 ha), 1 = marginal (up to 1.0 ha), 0 = landless	1.36	0.74	1	4
Social Membership	Membership of household head in organizations	No participation=0, Membership of 1 organization=1, Membership of > 1 organization=2, Office bearer=3, Public leader= 4	0.22	0.51	0	2
Livestock possession	No. of livestock owned by the household	3 = >10 livestock, 2 = 6 to 10 livestock, 1 = <5 livestock, 0 = no livestock	3.47	3.15	0	14
Main occupation	Occupation in which an individual is engaged for six months or more in a year	6 = any other, 5 = service, 4 = business, 3 = cultivation, 2 = caste occupation, 1 = wage labor	3.18	1.31	1	6
Wealth status	Relative position of households in the community in respect of wealth/ physical assets	>30 = rich, 16-30 = medium, up to 15= poor	22.90	6.13	13	34
Annual income (X ₁₀)	Household income earned by all the on- farm and off-farm sources	₹/year	13875	177443.50	252	21102
Proximity to forest (X ₁₁)	Households distance to forest	Kms	1.20	6.82	73.5	75.75
Frequency of forest visits (X ₁₂)	Households visit to forest daily/weekly/ monthly/fortnightly/ half yearly or yearly	3= very frequently, 2= frequently, 1= occasionally, 0=never	0	0.89	0	3
Forest	Households land area	Area in hectares	0.18	0.24	0.02	1.25

resource possession (X ₁₃)	under trees							5	
Access to alternative forestry sources	Households access to wastelands, road side plantations, Canal bank, River side plantations, Community forestry, Village woodlots and pasture land	3=Most often, 2=Often, 1= Seldom, 0=Never	0.24	0.65	0	4			
Urban closeness (X ₁₅)	Households distance to urban areas	kms	12.06	5.86	5	22			

3.2 Growing Stock of Woodlots in the Study Area

Results (Table 2) indicated that the per household tree density ranged from 26.10 to 26.69 in the surveyed locality. The tree diameter ranged from 15.36 cm to 17.21 cm, the tree height ranged from 10.54 m to 11.40 m, the tree basal area ranged from 0.23 m²/household to 0.28 m²/household and the wood volume ranged from 17.59 m³/household to 20.92 m³/household in the sampled woodlots. The study documented four types of woodlots commonly established by the smallholder farmers in the locality. The woodlot plantations were established either as monoculture or poly-culture. Generally, the dominant tree species preferred for monoculture woodlot plantations were *Populus deltoides*, *P. nigra*, *Salix alba*, *S. triandra* and *Robinia pseudoacacia* whereas the polyculture plantations included cultivation of mixed species of *Morus alba*, *Ulmus villosa*, *Aesculus indica* and *Ailanthus altissima*. The choice of tree species is influenced by numerous social, psychological, communicative, and biophysical aspects that are specific to adoption of monoculture or mixed woodlots and allocation of land for plantations [30]. The choice of trees for woodlot farming is dependent on a variety of factors ranging from economic gain, subsistence consumption, safety net functions, land security, soil and water conservation, micro-climatic modification, climate shelter, preservation of rural heritage and traditions, risk coping intervention and ability to integrate well with other economies [31]. The main purposes for establishing woodlots in Kashmir are the production of wood for roofing, fuel wood and charcoal, fodder, leaf litter, fruit boxes, cricket bats, plywood, wicker crafts, construction, ladders, and poles for wooden fences [32].

Table 2. Growing stocks of different woodlots in the sample households (N=163)

Woodlots	Tree density (No./hh)	Tree diameter (cm)	Tree height (m)	Basal area (m ² /hh)	Volume (m ³ /hh)
Poplar	26.10	16.35	10.86	0.26	17.59
Salix	26.69	15.36	10.54	0.23	21.30
Robinia	26.39	17.21	11.40	0.26	20.92
Mixed	26.33	17.20	11.40	0.28	18.23

Note: hh=household

3.3 Economic Valuation of Woodlot Resources

The results (Table 3) indicated that the extraction and marketing of woodlot resources fetched a total income of ₹ 11636865.50/year (subsistence= 68.81%, cash= 31.19%) @ ₹ 71391.81/household/year.

Of the average household annual woodlot income, timber fetched the maximum share (56.99%) followed by fuel wood (16.26%), wicker (14.15%) and charcoal (12.60%) (Fig. 2). Tree browses and leaf litter were extracted only for household consumption not for sale. The resources collected from woodlots are used mainly for household self-consumption while a small portion is sold for income earnings. Timbers and fuel wood collected from woodlots play a vital role in household economy and energy security. The timber collected from woodlots were mainly consumed for building houses and repairing, huts, and fences, domestic furnishings, agricultural tools, scaffolding, ladders, electric/telephone props, etc. Hence, timber fetches a handsome return to the sellers after rotational harvesting. Therefore, the timbers and fuel woods are collected and sold in considerable quantity. Wicker handicraft is a prominent forest resources-based cottage industry that fetched substantial earnings among the sample households. As **livestock production is an important subsidiary occupation among the sample households; hence, fodder and tree browse are an integral forest resource that is collected/ produced, consumed and sold by the local people. There is high demand of fuel wood in rural households in Kashmir because fuelwood is mostly used for cooking, room and water heating and cottage industries [33]. Harvesting and selling** of woodlot resources is the main income component in rural families in Kashmir Himalaya. The woodlot resources provide both subsistence and cash income, which contributes substantially to household livelihood and energy security. The studies [34-36] across the globe have emphasized the potential role of household tree resources in meeting the food, livelihood, and health security besides cash income and safety net functions.

Table 3. Economic value of woodlot resources extracted in the sample households (N=163)

Tree resource	Sale (t/year)	Subsistence (₹/year)	income	Cash income (₹/year)	Total income (₹/year)
Fuel wood	98.35	1737540		590100.00	2327640
Tree browses	0.00	0.00		0.00	0.00
Timber ^Δ	1034.32	3271240		2068640.00	5339880
Charcoal	45.76	2998000		457600.00	3455600
Wicker	4.11	0.00		513750.00	513750
Leaf litter	0.00	0.00		0.00	0.00
Total	-	8006780.00		3630085.50	11636866.50
Average	-	49121.34		22270.46	71391.81

Note: $\Delta = m^3$

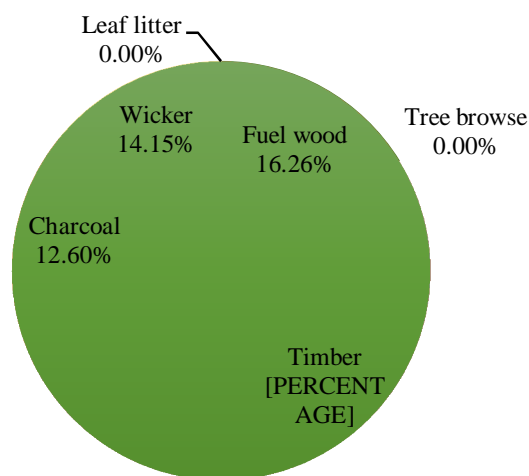


Fig 2. Income composition by different woodlot resources in sample households

3.4 Livelihood Sources and Contribution of Woodlots to Household Income Diversification

The annual gross income including all non-farm and farm income sources was ₹ 138756.78/household in the sample households (Table 4). Agricultural income contributed the major share (20.12%) which was followed by business (18.02%), woodlots (16.05%), livestock (13.24%), horticulture (10.26%), service (6.94%) and wage labour (4.03%) (Fig. 3). Hence, the woodlot resources are the third major contributor of rural household economy. Income diversification refers to the rise in income sources or the balance between the household's various sources of income. For rural households, income diversification is becoming an increasingly crucial strategy to reduce the vulnerability of the households to imminent agrarian crisis [37]. The total income of a rural household with many revenue sources will fluctuate less than that of specialised households. Families with a wider variety of income sources are in a better position than those with fewer sources of income. The number of earning activities and the distribution across quantities from each component change as income diversification increases.

Table 4. Household income diversification by woodlot resources (N=163)

Livelihood sources	Total income (₹/year)	Mean income (₹/year)	Standard Error
Agriculture	4550611.85	27917.86	1048.92
Horticulture	2320540.64	14236.45	534.88
Livestock	2994537.82	18371.4	690.26
Forest resources	2564808.07	15735.02	591.18
Business	4075647.40	25003.97	939.43
Service	1569644.45	9629.72	361.86
Wage labour	911479.41	5591.9	210.09
Woodlots	3630085.50	22270.46	836.74
Total	22617355.14	138756.78	5213.26

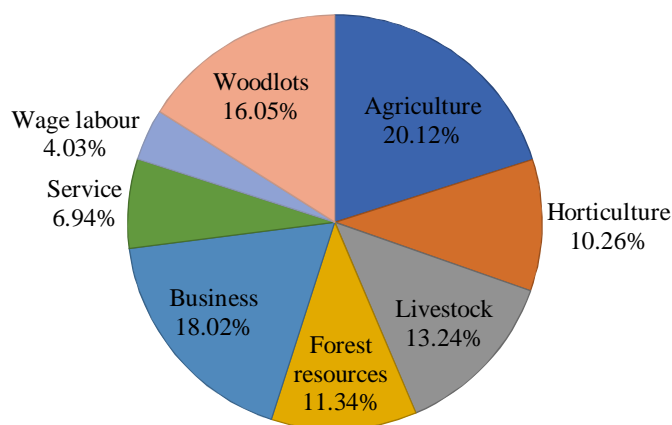


Fig 3. Income shares (%) by different livelihood sources in sample households

The study confirmed that the woodlot resources are a dominant constituent of rural economy since it accounts significant share in the total households' income. The production/collection of woodlot resources is the prominent livelihood intervention for survival, currency, and safety net since the alternative sources are lacking in rural Kashmir. In several households, the production/collection of resources through woodlot is just their complementary livelihood source on a part-time basis. Likewise, the woodlot resources are used by all categories of people in the society, whether poor or wealthy, literate or illiterate, rural or urban. However, the income accrual through the woodlot products is rather little but the involvement in the activities is a matter of self-respect, honour, and self-reliance. The income earned from the woodlot resources are spent to secure domestic basic needs in terms of children's education, healthcare expenditures, wedding expenses, agricultural investments, assets for entrepreneurial activities, savings as safety nets and others [34-35, 38-39].

4. CONCLUSION

The study led to conclude that the woodlots play a crucial role in rural livelihoods by providing various resources such as timber, fuel wood, wicker, tree browse, wicker, leaf litter and charcoal for domestic use. The income generated from the sale of woodlot resources contributes substantially to the gross annual income besides acting as safety net in cases of emergency. The study revealed that the woodlot resources are the third major contributor of rural household economy after agriculture and business. Such livelihood contributions of woodlots resources must be given due recognition in rural developmental schemes and land-use prioritizations to harmonize socio-economic development, poverty alleviation and livelihood security of the local communities. To help enhance the profitability and make woodlots more responsive, there is need for deliberate decision by farmers to add value and diversify products through processing and expand into existing market with stronger focus on wood industry and penetrate into non-traditional national and international market. Further, the potential opportunities for economic diversification through value addition of woodlot resources, fortunate

marketing and better commercialization should be explored. Moreover, capacity building and skill development of stakeholders on production of valuable forest resources, sustainable harvesting, value addition and commercialization should be strengthened. The major limitation of this research is the use of the primary data based on human behaviour which is influenced by socioeconomic, temperamental and psychological factors and the people's ability of understanding, recalling and verbal expression in furnishing the required information. The other limitation of the study is the language barrier between researcher and the farmers whereby, the third party has to translate which further creates information distortion and misinterpretation. Future research should focus on enhancing dual goals; profit maximization and carbon maximization of farm woodlots.

CONSENT

Prior Informed Consent (PIC) was taken from every informant to use and publish their knowledge.

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COMPETING INTERESTS

Authors have declared that no competing interests exist among the authors.

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