

Cultural Knowledge of On-farm Tree Plantation in Rural Communities of Gurez Himalaya, India

ABSTRACT

People's perceptions ~~on~~-of cultural knowledge of on-farm tree plantation have become fundamental elements of sustainable forest resource management. The study examined the people's knowledge on cultural practices of on-farm tree plantation and their socioeconomic determinants in rural communities of Gurez Himalaya in India. ~~Multistage~~-A multistage random sampling technique was used to select 337 households from 18 sample villages for the field survey. Data ~~was~~ere collected through personal interviews administering a structured interview schedule and non-participant observations. Data ~~was~~ere analyzed using simple descriptive statistics. Results indicated that the majority of the people ~~were~~ belonged to low socioeconomic status class as reflected by their household characteristics. Among the ten selected major cultural practices about on-farm tree plantation, ~~the~~ 'spot weeding' (WMS, 2.87; priority percentage, 12.83%) was ranked 1st while 'thinning' (WMS= 1.31; priority percentage, 5.85%) was ranked the 10th. Majority-The majority of the respondents (54.88%) had medium knowledge ~~on~~-of cultural practices for on-farm tree plantation followed by high (23.78%) and low (21.34%) classes. Adoption of tree plantation, the problem faced in tree cultivation, experience in tree cultivation, training exposure on tree cultivation and level of education had significant contributions ~~on~~-to people's knowledge ~~on~~-of cultural practices about on-farm tree plantation. The findings suggested that the trainings on cultural practices about on-farm tree plantation ~~is~~are-~~are~~ the-a crucial intervention for livelihood diversification, socioeconomic development and forest conservation; hence, need-based trainings must be planned and imparted to the individuals for improving the-tree resource production, harvesting and marketing.

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Key-words: Cultural knowledge, tree management, agroforestry, socioeconomic, Gurez, Himalaya, India.

1. INTRODUCTION

On-farm tree plantation has been invariably identified as an ideal, ecologically and economically suitable land-use system which aims to increase the total production per unit area besides maintaining or enhancing microclimatic amelioration [1]. On-farm tree plantation is an integrated and complex phenomenon because the productivity, adaptability and sustainability of the system mainly depends on the positive or negative effect of the social, economic and biophysical criteria [2]. To increase the forest resource production in terms of fuelwood, fodder, fruits, timber and other Non-Timber Forest Resources (NTFR), reduce land degradation and improve nutrient recycling in the on-farm plantation the

efficient management of trees through better cultural practices is imperative [3]. Essentially, the on-farm tree plantation has a finite amount of light, water and nutrients, hence, optimum utilization of these resources by various management interventions can be applied ~~to find fine tune to~~ the limited resources [4]. In on-farm tree plantations, mismanagement of light, water and nutrients, is the prominent reason ~~of~~ for lower productivity [5]. ~~The s~~Spot weeding, cleaning, application of fertilizers and manures, crown pruning, insect/ pest/ disease management, enrichment planting (tree wildings and seed collection), mulching, climber cutting, root pruning and thinning are the potential cultural practices for on-farm tree management [6].

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The knowledge and experience ~~on-of~~ the cultural practices ~~about-of~~ on-farm tree plantation forms a basis for culture or tradition that guides decisions in familiar and new situations [7]. Generally, the cultural knowledge about on-farm tree plantation is considered ~~as-a~~ primitive and inefficient approach to ~~solveing~~ solving the natural and social problems ~~by-of~~ the poor and ~~the~~ marginalized populations [8]. Yet cultural knowledge about on-farm tree plantation is an important intellectual property for ~~the~~ cost-effective, participatory and sustainable development of natural resources [9]. Knowledge ~~on-of~~ cultural practices about on-farm tree plantation also preserves valuable local practices, encourages community self-analysis, increases awareness and involves the stakeholders in feedback systems [10]. By studying cultural knowledge systems towards on-farm tree plantation, scientists/ extensionists have enhanced their knowledge ~~onf-~~ biodiversity conservation, ecosystem functions and forest resource production [11]. ~~In order-t~~To meet the current global challenges of climate change and food insecurity and to mitigate environmental challenges of deforestation and land degradation, revisiting the cultural knowledge about on-farm tree plantation is necessary because the scientific knowledge has independently failed to solve these problems [12]. The tree management cultural practices are carried out by the local people to get a desirable product, properly manage the tree canopy and roots to facilitate maximum resource utilization, management of organic residues for nutrient cycling, the proper method of harvesting tree resources and protection from biotic and abiotic stresses in Gurez Himalaya of India. The main objective of tree management cultural practices is to minimize the negative interactions and maximize the positive. The cultural knowledge about on-farm tree management is embedded in community experience and is often linked to spirituality in Gurez valley. Cultural knowledge about on-farm tree management has gained substantial recognition in recent decades but scaling up of the cultural practices in natural resource management is limited by the absence of clear documentation or sufficient data to establish baselines. Keeping these facts in view, the present study was undertaken to identify the cultural practices adopted by the people for on-farm tree management, assess the extent of knowledge about cultural practices of on-farm tree management and determine their distinguishing household socioeconomic characteristics.

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2. MATERIALS AND METHODS

2.1 Study site

Gurez Valley in India (Fig. 1) is situated at 34° 23' to 34°41'N latitude and 74°37' to 74° 46'E longitudes at an altitude of 2370 meters above MSL in Bandipora district of Jammu and Kashmir UT. The valley is surrounded on the north by Ladakh, south by Bandipura, east by Ganderbal and west by Kupwara. Razdan pass- the coldest and most dangerous peak located at 3557 m amsl connects the region with the rest of Kashmir and differentiates it on geographical, socio-cultural and linguistic lines. The valley is drained by the mighty Kishenganga River between Kaobal Gali in the east and Kanzalwan in the west with other aquamarine and crystal streams. The valley has an area of above 57842 hectares mostly mountainous with ranges of the Himalayas and lush forest cover inhabited by 31912 people [13]. Main The main occupations of the people are agriculture, livestock production and NTFR collection [14]. The valley has fascinating scenic beauty, abundant biodiversity and inimitable culture. It houses a unique Shina-Shina-speaking tribe of Dards inhabitants of Shina Communities who are ethnically and culturally quite distinct from Kashmiris. The mountainous terrain having lofty hills and peaks scattered by long flat grasslands are used by the migratory people to graze their livestock during the snow-snow-free summer months. The climate is temperate with four usual seasons; the heavy snow precipitation during winters keeps the valley snow-bound and inaccessible for almost six months. It has dense coniferous and broad-leaved forests mostly dominated by *Acer caesium*, *Abies pindrow*, *Pinus wallichiana*, *Picea smithiana*, *Juniperus macropoda*, *Taxus wallichiana* and *Betula utilis*. The vegetations at higher elevations is rather sparse and dotted mostly with moraines, boulders and slopes of varying steepness with few important shrubs like *Rhododendron anthopogon* and colorful flowering herbs such as *Bergenia ciliata*, *Dactylorrhiza hatagirea*, *Eremurushima lacius*, *Saussurea* spp. The vegetation starts growing from-in late April with the melting of snow and comes to its full bloom during June to September and starts dying out by the end of October.

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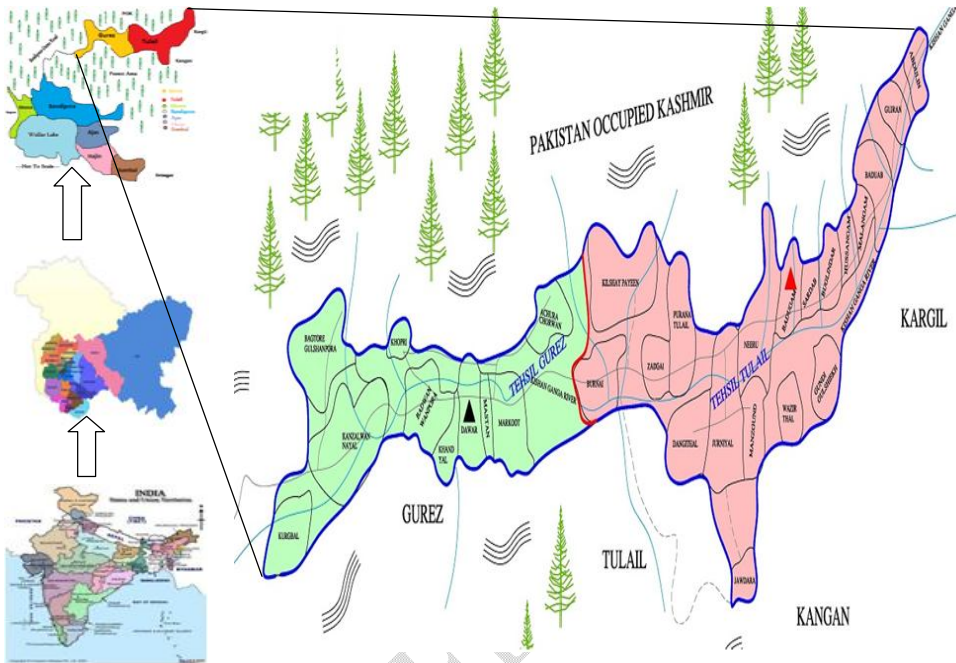


Fig. 1. Location map of the study area

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2.2 Sampling Procedure

Multi-stage random sampling technique [15] was employed to select the blocks, villages and the households. In the first stage, three blocks that included Gulshanpora, Dawar and Tilail were selected. In the second stage, eighteen (18) villages were sampled including two villages from the Gulshanpora block, four villages from the Dawar block and twelve villages from the Tilail block. In the third stage, a total of 337 households were withdrawn from the selected villages having 10% sampling intensity for the field survey. The households identified for assessing the cultural knowledge of on-farm tree plantation in rural communities of Gurez Himalaya were different in farming activities, land holding size and other different socio-economic attributes.

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2.3 Data Collection

Data were collected from the randomly selected households using a pre-tested structured schedule through personal interviews and participant observations [16]. The interviews were conducted at the

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respondent's residence/work-place by the investigators and the responses were recorded in the schedule. Utmost care was taken to make the respondents ~~to~~ understand ~~about~~ the objectives of the study and clarified their doubts in the **interview schedule**. For this purpose, an interview **schedule** was constructed for data collection from respondents in ~~the~~ light of the objectives of the study. For the present study, a list of 10 major cultural practices ~~about~~ on-farm tree plantation was prepared. The specific and relevant cultural practices ~~about~~ on-farm tree plantation were itemized through different reviews of literature, discussion with state extension functionaries, **KVK** staffs as well as investigators' own field experiences and were systematically incorporated in the **interview schedule**. The schedule was administered to the **indented** respondents for data collection. In this regard, the respondents were requested to give a tick (✓) in one of the four response categories namely, excellent, somewhat, very little and not at all provided against the identified cultural practices about on-farm tree plantation with their respective scores of 3, 2, 1 and 0. The socioeconomic variables were measured ~~on the basis of~~ based on the "Socio-economic status scale" developed by Venkataramaiah (1990) after updating for 2022 [17]. The household socio-economic variables included in the interview schedule were age, education, social membership, family composition, size of land holding, main occupation, housing status, farm power, farm implements, livestock possession, wealth status and gross annual income.

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2.4 Data analysis

~~In order to~~ To achieve the objectives and to get meaningful results, the data ~~was~~ analyzed by simple descriptive statistics viz., frequency, percentage, average, range, confidence interval and rank order [18] after coding with numerals using scoring techniques [17]. In this study, the respondent's responses were collected ~~in on~~ a 4-point continuum scale as excellent, somewhat, very little and not at all by assigning scores of 3, 2, 1 and 0 respectively. The results were calculated as ~~W~~weighted ~~M~~mean ~~S~~score (WMS) for each of the cultural practices identified for the on-farm tree plantation using a simple ranking technique.

$$\text{Weighted mean score (WMS)} = \frac{(\text{Excellent} \times 3) + (\text{Somewhat} \times 2) + (\text{Very little} \times 1) + (\text{Not at all} \times 0)}{\text{Total no. of Excellent} + \text{Somewhat} + \text{Very little} + \text{Not at all}}$$

The WMS of the cultural practices for the on-farm tree plantation ranged from 0 to 3. Data ~~was~~ processed and analyzed with **MicroSoft Office** Excel and Statistical Package for Social Sciences (SPSS) software and displayed through tables and graphs.

3. RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of rural people

The socio-economic variables averaged for the rural households (Table 1) specified the prevalence of middle-aged people (41.75 years) having low literacy (2.89), membership of only one organization (1.14), nuclear and large-sized families (2.90), marginal sized land holding (1.15), engaged mainly in agriculture (2.80), owning one mixed or pucca house (3.57), one pair of bullocks (1.04), low farm implements possession (9.64), 6 to 10 livestock (1.91), low wealth status (8.09) and gross annual income of ₹92811.24/year.

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Table 1. Descriptive statistics for socio-economic characteristics of sample households (N=337)

Characteristic	Mean ± SD	95% CI for mean (Lower-Upper)	Range (Minimum-Maximum)
Age	41.75 ± 9.53	40.17-43.33	25-56
Education	2.89 ± 0.93	2.73-3.04	2-6
Social participation	1.14 ± 1.20	0.94-1.34	0-4
Family composition	2.90 ± 0.88	2.76-3.05	2-4
Size of land holding	1.15 ± 0.53	1.06-1.24	1-4
Main occupation	2.80 ± 1.20	2.61-3.00	1-6
Housing status	3.57 ± 1.01	3.40-3.74	2-6
Farm power	1.04 ± 0.64	0.94-1.15	0-3
Farm implements	9.64 ± 3.78	9.01-10.27	4-17
Livestock possession	1.91 ± 0.56	1.82-2.00	0-3
Wealth status	8.09 ± 3.36	7.53-8.65	2-15
Gross annual income	92811.24 ± 32134.19	47381.15-74393.49	18000-105000

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Socioeconomic conditions of the people were observed to be far away from the desired level as reflected by the current analysis and hence, there was much scope to improve their quality of life by livelihood diversification through alternative sources. The socio-economic attributes of the rural people are usually assumed to have a significant influence on determining the on-farm tree ownership and associated cultural practices for its management [19]. They are the key determinants of household tree resources production, consumption and degree of dependence on tree resources [20]. They are directly or indirectly associated with household tree diversity, diverse use patterns, tree-based livelihood strategies and poverty-tree use linkages [21]. The households' socioeconomic characteristics demonstrated in the study can be a framework for tree-holding planning, tree resources management and improving economic conditions. The present analysis of the socio-economic conditions of the people can be a base for the planning and implementation of tree ownership-based developmental projects for livelihood security and diversifying tree-based economy.

3.2 People's knowledge about cultural practices of on-farm tree plantation

People's knowledge about the ten major cultural practices of on-farm tree plantation (Table 2) indicated that the **W**weighted **M**mean **S**score (WMS) ranged from 1.31 (rank 1st) to 2.87 (Rank 10th). **Apparently, it was observed is seen** that the respondents had the highest knowledge regarding spot weeding (WMS, 2.87; rank 1st) followed by cleaning (WMS, 2.85; rank 2nd), application of fertilizers and manures (WMS, 2.76; rank 3rd), crown pruning (WMS, 2.67; rank 4th), insect/ pest/ disease management (WMS, 2.38; rank 5th), **enrichment planting (tree wildings and seed collection)** (WMS, 2.21; rank 6th), mulching (WMS, 1.98; rank 7th), climber cutting (WMS, 1.82; rank 8th), root pruning (WMS, 1.51; rank 9th) and thinning (WMS, 1.31; rank 10th). The people viewed ~~the~~ 'spot weeding' as the very prominent cultural practice accounting for 12.83% of the total perceptions while the cultural practice 'thinning' received ~~the~~ lowest priority comprising 5.85% of the total perceptions (Fig. 2).

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Table 2. Cultural tree management practices, explanation and people's knowledge ranking (N=337)

Cultural practice	Explanation	Level of knowledge				Weighted mean score	Rank order
		Excellent	Somewhat	Very Little	Not at all		
Spot weeding	Uprooting or cutting back weeds are around the planted seedlings within about a 1-m radius.	294 (87.24)	43 (12.76)	0 (0.00)	0 (0.00)	2.87	1 st
Cleaning	Removal or topping of inferior growth including individuals of favoured species, climbers etc.	288 (85.46)	49 (14.54)	0 (0.00)	0 (0.00)	2.85	2 nd
Climber cutting	Regular cutting or uprooting of climbers to control them.	93 (27.60)	136 (40.36)	63 (18.69)	45 (13.35)	1.82	8 th
Root pruning	Cutting roots with a sharp object or trenching within 3 m of already established trees to separate root systems of trees and crops.	76 (22.55)	96 (28.49)	90 (26.70)	75 (22.26)	1.51	9 th
Crown pruning	Removal of live or dead branches or multiple leaders from standing trees for the improvement of the tree or its timber.	251 (74.48)	63 (18.69)	23 (6.83)	0 (0.00)	2.67	4 th
Thinning	Selective removal or killing of some trees to allow the remaining trees to maintain a steady growth rate or form.	52 (15.43)	86 (25.52)	114 (33.83)	85 (25.22)	1.31	10 th
Enrichment planting (tree wildings and seed collection)	Tree wildings are collected from natural forests and good mother trees scattered over the landscape and planted on farms or degraded forests. Sometimes seeds are gathered and germinated at home or in communal nurseries to supply seedlings.	149	128	43	17	2.21	6 th

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Insect/ pest/ disease management	Application of organic insecticide/ pesticides to control insect/ pest/ disease attacks.	191 (44.21)	95 (37.98)	41 (12.76)	10 (5.05)	2.38	5 th
Application of fertilizers and manures	Application of organic manures, cattle dung and various plant materials to improve the soil fertility.	265 (78.64)	64 (18.99)	8 (2.37)	0 (0.00)	2.76	3 rd
Mulching	Weeds and grass are cut and used to cover the soil.	122 (36.20)	124 (36.80)	54 (16.02)	37 (10.98)	1.98	7 th

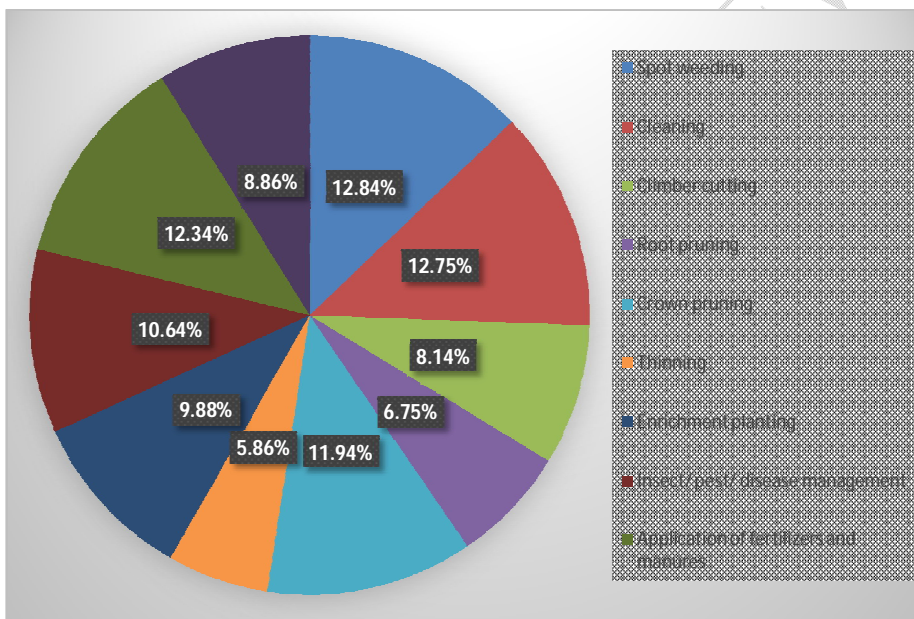


Fig. 2. Percentage knowledge towards cultural practices for tree management (N=337)

The people were found highly dependent on forest resources in their homesteads, agricultural fields and nearby reserved forests for meeting their basic needs and earning livelihoods. Higher adoption of appropriate cultural practices of on-farm tree plantation helps to increase knowledge on the cultural practices as well as minimize the tree-based losses [22]. People with higher knowledge regarding the cultural practices of on-farm tree plantation face low problems in tree cultivation and which encourage them to go for more tree resource production which ultimately helps to improve livelihood security [23]. People having long tree farming experience have more knowledge because the tree farming experience is helpful to increase knowledge, improve skills and change the attitude of the farmers [24]. It also builds

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the confidence of the people for making appropriate decisions timely. Training provides the structures, techniques, skills and awareness to manage time and workload efficiently, which might increase productivity and motivate farmers to increase their knowledge on cultural practices for tree management. Such consideration indicates that there is a necessity to provide enough training to the people for gaining the knowledge on cultural practices for tree management.

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Table 3. ~~Extent~~ The extent of knowledge about cultural practices for tree management among the respondents (N=337)

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Category	Scores	Respondents		Mean	SD
		Frequency	Percentage		
Low	< 16.08	35	21.34	20.32	4.24
Medium	16.09 to 24.56	90	54.88		
High	> 24.56	39	23.78		

~~Knowledge~~ The knowledge on cultural practices for tree management score of the people ranged from 6 to 26 against the possible range of 0–30 having an average of 20.32 and a standard deviation of 4.46 (Table 3). Among the sample households, most of the respondents (54.88%) had a medium level of knowledge about cultural practices for tree management followed by high (23.78%) and low (21.34%) levels. The mean score (20.32) of knowledge about cultural practices for tree management confirms that the overall knowledge level was moderate. Forestry is an important source of livelihood and way of life for a large number of households in the surveyed area; hence, people are aware with of the cultural practices for tree management. Knowledge is considered as a vision of an explanation in any aspect of the situation regarding tree cultivation. It is an act or state of understanding; a clear perception of fact or truth, that helps an individual to foresee the consequences one may have to face in future. It makes individuals to become rational and conscious about the related field. The studies [7,25,26] support the findings of the present research.

4. CONCLUSIONS

The findings of this study led to conclude that the fringe people had medium knowledge on cultural practices for tree management. Thus, there is a necessity to increase the knowledge of the people on cultural practices for tree management. The study also revealed that people's adoption of cultural practices for tree management had the highest contribution to their knowledge strengthening and

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confidence. Therefore, it may be concluded that individuals having more adoption of cultural practices for tree management had more knowledge compared to the non-adopters. People having more knowledge faced fewer problems in tree cultivation. People having long farming experience ~~on~~-in tree cultivation have more knowledge. Tree farming experience is helpful to increase knowledge, improve skills and change the attitude of the farmers. Training develops the farmer's knowledge, skill, and attitude in a positive manner. People having more training exposure had more knowledge ~~on~~-of cultural practices for tree management. ~~Level~~-The level of education of the people had ~~the~~-an important contribution to their knowledge ~~on~~-of cultural practices for tree management. Thus, it may be concluded that more educated tree growers had more knowledge ~~on~~-of cultural practices for tree management.

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REFERENCES

1. Islam MA, Mugloo JA, Raj A, Bhat GM, Wani AA, Gatoo AA, Malik AR, Pala NA, Murtaza S, Agroforestry strategy for revitalizing fodder security in Kashmir Himalaya, India. *Agricultural Research*, 202; 10(3): 1-11.
2. Islam MA, Wani AA, Bhat GM, Gatoo AA, Murtaza Shah, Anjum K, Atta U, Homestead tree resource production for rural livelihood security in Kashmir Himalaya. *Range Management and Agroforestry*, 2021; 42(2): 334-340.
3. Khadka D, Aryal A, Bhatta KP, Dhakal BP, Baral H, Agroforestry Systems and Their Contribution to Supplying Forest Products to Communities in the Chure Range, Central Nepal. *Forests*, 2021; 12, 358. <https://doi.org/10.3390/f12030358>
4. Tobias Plieninger, José Muñoz-Rojas, Louise E. Buck, Sara J Scherr, Agroforestry for sustainable landscape management. *Sustainability Science*, 2020; 15:1255–1266, <https://doi.org/10.1007/s11625-020-00836-4>
5. Dhakal A, Rai RK, Who Adopts Agroforestry in A Subsistence Economy? Lessons from the Terai of Nepal. *Forests* 2020; 11, 565; doi:10.3390/f11050565
6. Chavan, SB, Kumar N, Uthappa AR, Keerthika A, Handa AK, Sridhar KB, Singh M, Kumar D, Newaj R, Tree Management Practices in Agroforestry. In: Sood, K.K. and Mahajan V. (eds), *Forests, Climate Change and Biodiversity*, Kalyani Publishers, New Delhi, 2018; pp. 29-39.
7. Mulugo LW, Galabuzi C, Nabanoga GN, Turyahabwe N, Eilu G, Obua J, Kakudidi E, Sibelet N, Cultural knowledge of forests and allied tree system management around Mabira Forest Reserve, Uganda. *Journal of Forestry Research*, 2019; <https://doi.org/10.1007/s11676-019-00961-6>
8. Dar M, Qaisar KN, Ahmad S, Wani AA, Inventory and Composition of Prevalent Agroforestry Systems of Kashmir Himalaya. *Advances in Research*, 2018; 14(1): 1-9.

9. Islam MA, Sofi PA, Bhat GM, Wani AA, Gatoo AA, Singh A, Malik AR, Public assessment for socioeconomic and environmental services of agroforestry networks in Kashmir Himalaya, India. *International Journal of Current Microbiology and Applied Sciences*, 2017; 6(10): 410-420. DOI: 10.20546/ijcmas.2017.610.051
10. Islam MA, Masoodi TH, Gangoo SA, Sofi PA, Bhat GM, Wani AA, Gatoo AA, Singh A, Malik AR, Perceptions, attitudes and preferences in agroforestry among rural societies of Kashmir, India. *Journal of Applied and Natural Science*, 2015.; 7(2): 976-983. DOI: [10.31018/jans.v7i2.717](https://doi.org/10.31018/jans.v7i2.717)
11. Mfitumukiza D, Barasa B, Ingrid A, Determinants of agroforestry adoption as an adaptation means to drought among smallholder farmers in Nakasongola District, Central Uganda. *African Journal of Agricultural Research*, 2017; 12(23): 2024-2035.
12. Kumar Y, Thakur TK, Thakur A, Socio-Cultural Paradigm of Agroforestry in India. *International Journal of Current Microbiology and Applied Sciences*. 2017; 6(6): 1371-1377. DOI: <https://doi.org/10.20546/ijcmas.2017.606.161>
13. Census of India, A - 5 State Primary Census Abstract – 2011, India.
14. Anonymous, Directorate of Economics and Statistics, District Statistics and Evaluation Office, Ganderbal, Jammu and Kashmir, 2011.
15. Ray GL, Mondol S, *Research Methods in Social Sciences and Extension Education*, Kalyani Publishers, New Delhi, 2004; pp 66-76.
16. Mukherjee N, *Participatory Rural Appraisal. Methodology and Applications*, Concept Publishing Company, Delhi, 1993.
17. Venkataramaiah P, *Development of socio-economic status scale*, Ph.D. Thesis, Department of Agricultural Extension, UAS, Bangalore, 1990.
18. Snedecor G, Cochran WG, *Statistical Methods*. Iowa State Univ. Press, Ames, Iowa, USA, 1967; 17-36.
19. Mushi H, Yanda PZ, Kleyer M, Socioeconomic Factors Determining Extraction of Non-timber Forest Products on the Slopes of Mt. Kilimanjaro, Tanzania. *Human Ecology*, 2020; 48: 695–707.
20. Chittapur BM, Patil DK, Ecosystem services rendered by tree-based land use systems. *Indian Journal of Agricultural Sciences*, 2017; 87(11): 1419–29.
21. Pandey A, Sinha PR, Dhawan VK, Socio-economic study of poplar (*Populus deltoides*) based agroforestry model in Vaishali district of Bihar. *Journal of Pharmacognosy and Phytochemistry*, 2020; 9(1): 1739-1741.
22. Li Ruida, Zheng Hua, Zhang Cuiping, Keeler Bonnie, Samberg Leah H, Li Cong, Polasky Stephen, Ni Yongming, Ouyang Zhiyun, *Rural Household Livelihood and Tree Plantation*

- Dependence in the Central Mountainous Region of Hainan Island, China: Implications for Poverty Alleviation. *Forests* 2020, 11, 248; doi:10.3390/f11020248
23. Abebe S, Minale AS, Teketay D, Socio-economic importance of the bamboo resources in the Lower Beles River Basin, north-western Ethiopia. *Environment, Development and Sustainability*, <https://doi.org/10.1007/s10668-021-01938-4>
24. Tolessa T, The Socioeconomic Benefits of Fragmented Forests to Local Communities: A Case Study in the Central Highlands of Ethiopia. *Small-scale Forestry*, <https://doi.org/10.1007/s11842-019-09424-6>
25. Islam, M.A., Qaisar, K.N. and Bhat, G.M. 2017. Indigenous knowledge in traditional agroforestry systems of Kashmir valley: current challenges and future opportunities. *International Journal of Forestry and Crop Improvement*, 8(1): 68-77. DOI: 10.15740/HAS/IJFCI/8.1/68-77
26. Segnon AC, Achigan-Dako EG, Gaoue OG, Ahanchédé A, Farmer's Knowledge and Perception of Diversified Farming Systems in Sub-Humid and Semi-Arid Areas in Benin. *Sustainability*, 2015; 7: 6573-6592; Doi:10.3390/su7066573