



Appraisal Of Existing Agroforestry Systems In Sujanpur Tehsil Of Hamirpur District, Himachal Pradesh

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ABSTRACT

The present study was carried out in Sujanpur Tehsil of Hamirpur District, Himachal Pradesh with the aim to identify the existing agroforestry systems, to assess the demographic features and socio-economic status of farmers. Five different agroforestry systems were practiced by the farmers in the study area namely; Agrisilviculture (AS), Agrihorticulture (AH), Agrisilvihorticulture (ASH), Agrisilvipastoral (ASP) and Silvipastoral (SP). In medium and small category of farmers all five agroforestry systems were present while in marginal category of farmers silvipastoral system was absent. The average family size of sampled households was 4.40 individuals per family. Highest sex ratio was observed in medium farmers (1000) and lowest in marginal (886) farmer's category. The literacy rate was recorded highest (92.48) in small category of farmers. All category of farmers had adopted traditional milking methods instead of scientific milking methods. Overall average land holding was recorded 2.62 hectares in all sampled categories of farmers. The average land holding area was found maximum (1.48 ha) in medium followed by small (0.8 ha) and marginal (0.34 ha) categories.

Keywords: Agroforestry systems; socio-economic; literacy rate; livestock; land holding

INTRODUCTION

Agriculture is the most important sector of Indian economy. India is an agriculture based country, where more than 50 per cent of population depends upon agriculture. Indian agriculture sector accounts for 18 per cent of India's gross domestic product (GDP) and provides employment to 50 per cent of the country's work force (Madhusudhan, 2015). With immense increase in human population, pressure on basic property assets for fuel wood, food, timber and so on has increased significantly. This has prompted a huge gap between demand and supply of many wood items. This gap can be diminished by adopting reasonable agroforestry

practices. Agroforestry is a sustainable land management system which increases the overall yield of the land, combines the production of crops (including tree crops) and forest plants and/or animals simultaneously or sequentially on the same unit of land and applies management practices that are compatible with the cultural practices of the local population (King and Chandler, 1978). Agroforestry is not a new concept in Himachal Pradesh and other Himalayan regions but it has been practiced traditionally since a long time ago (Nautiyal *et al.*, 1998). Being a traditional land use system, agroforestry is capable of addressing a large variety of socio-economic needs in a sustainable manner. The agroforestry has brought improvement in socio-economic and ecological conditions of farmers by generating employment, increasing family income, enhancing the crop diversity and reducing dependency on natural forest. Comparative studies on agroforestry systems are however still lacking in Himachal Pradesh. Hence present study was undertaken to assess socio-economic status of existing agroforestry systems in Sujampur Tehsil of Hamirpur district, Himachal Pradesh.

METHODOLOGY

The present study was conducted in Sujampur Tehsil of Hamirpur District, Himachal Pradesh and its coordinate's lies between 31°83'25"N latitude and 76°50'52"E longitude. The altitude of study area is about 515m above mean sea level. The climate of Sujampur tehsil is mostly sub-tropical and receives an average annual rainfall of about 1600 mm. The average temperature of Sujampur Tehsil varies from 0° C in winter and 38° C in summer season. May and June are the hottest months. The methodology used for the study consisted of site selection, sampling procedure, identification of existing agroforestry systems, data collection, analytical framework and valuation.

The study site was selected by multi-stage random sampling technique in which seven panchayats (Banal, Bir-bagehara, Chabutra, Darla, Dera, Jol and Karot) were chosen and from each panchayat, two villages were selected. In each village, farmers were divided into three different categories on the basis of their land holdings as per classification of government of Himachal Pradesh *i.e.* marginal (<1 ha), small (1-2 ha) and medium (2-5 ha) and a random sample of three farmers from each category was taken as ultimate unit of study. The relevant information about the family structure, demographic features, livestock status, animal husbandry practices, land utilization pattern, tree inventory and crop production from various agroforestry systems was collected through pre-tested schedule by personal interviews with each head of the household and field visits. Agroforestry systems prevalent in the study area were identified on the basis of structure (nature and arrangement) and function (role of output) of components (Nair, 1985). The system type and system units were identified as suggested by Zou and Sanford (1990). System type was considered as a homogenous group whose major components were closely related economically, socially and environmentally, whereas a system unit was recognized as a basic functional unit with distinct crop combination and specific biological relationships among its major components that require similar management strategies. Hence, functional unit like food grains, vegetables and pulses in agriculture, specific fruit trees in horticulture, grasses in pasture and tree species in forestry component were described. Primary

and secondary components of each system type were identified after recognizing the structure of the system and specific function of the components.

RESULTS and DISCUSSION

Identification of agroforestry system types

Five different types of agroforestry systems were found (Table 1) in the study area viz. Agrisilviculture (AS) (33.15 %), Agrisilvihorticulture (ASH) (27.71 %), Agrihorticulture (AH) (15.76 %), Agrisilvipastoral (ASP) (13.58 %) and Silvipastoral (SP) (9.78 %) among different categories of farmers (Fig 1). Four agroforestry system types were identified in the marginal and five each in the small and medium categories of farmers. The most dominating agroforestry system among different category of farmers was agrisilviculture system (33.15%) and least dominating was silvipastoral system (9.78%). Under marginal category of farmers, agrisilviculture system was practiced by maximum number of farmers (43.18 %) while agrihorticulture and agrisilviopastoral systems were practiced by minimum number of farmers (11.36 %). Silvipastoral system was found absent in marginal farmer's category due to fragmented or small land holding. Agrisilviculture system was also found most dominating (32.25 %) whereas, silvipastoral system was found least dominating agroforestry system (11.29 %) under small category of farmers. Agrisilviculture system was adopted by maximum number of farmers (28.20 %) while silvipastoral system was adopted by minimum number of farmers (14.10 %) under medium category of farmers. Functional units under agricultural component were cereals viz *Triticum aestivum*, *Zea mays* and *Sesamum indicum*; vegetables viz *Pisum sativum*, *Curcuma longa*, *Solanum tuberosum*, *Allium sativum*, *Brassica oleracea* var. *botrytis*, *Brassica oleracea* var. *capitata*, *Brassica campestris*, *Solanum lycopersicum*, *Capsicum annuum*, *Spinacia oleraceae* and *Abelmoschus esculentus*. The silviculture components were *Grewia optiva*, *Melia azedarach*, *Ficus religiosa*, *Bauhinia variegata*, *Acacia catechu*, *Pinus roxburghii*, *Populus deltoids*, *Albizia lebbeck*, *Leucaena leucocephala* and *Toona ciliata*. The main fruit tree species included *Carica papaya*, *Citrus limon*, *Psidium guajava*, *Musa acuminata*, *Litchi chinensis*, *Mangifera indica* and *Morus alba*. The grass species were *Cenchrus ciliaris*, *Cenchrus setiger*, *Themada anathera*, *Panicum maximum* and *Setaria sphacelata*. Different combinations of forest trees, horticultural plants, agricultural crops and grasses were found in different existing agroforestry systems adopted by the farmers in the study area. Verma *et al.* (2011) identified seven agroforestry systems in sub-tropical region of Himachal Pradesh viz. agrisilviculture (AS), agrihorticulture (AH), agrisilvihorticulture (ASH), agrihortisilviculture (AHS), pastoralsilviculture (PS), pastoralsilvihorticulture (PSH) and pastoralthortisilviculture (PHS) and he revealed that the most pre-dominant agroforestry systems were agrisilviculture, agrihorticulture and agrisilvihorticulture system. Kaler *et al.* (2017) reported that the most prevalent agroforestry systems in cold desert region of Himachal Pradesh were agrisilviculture (AS) and agrihorticulture (AH).

Tiwari *et al.* (2018) revealed various agroforestry systems in north-western region of Himalaya such as agrisilviculture, agrisilvihorticulture, agrihorticulture, agrisilvipasture, silvipasture, pastoralsilviculture and pastoralsilvihorticulture system and he found that the predominant systems were agrisilviculture,

agrihorticulture and agrisilviculture system. Shukla *et al.* (2020) have identified five agroforestry systems in Ballia district of Uttar Pradesh viz. agrisilviculture (AS), agrihorticulture (AH), agrisilviculture (ASH), silviculture (SH), silvipastoral (SP) system and he found that the predominant system were agrisilviculture system. Gusain *et al.* (2021) reported that the highly practiced agroforestry system in northern plain region of Uttarakhand was agrisilviculture system. Sharma *et al.* (2021) identified five agroforestry systems in Bangana Tehsil of Una District, Himachal Pradesh viz. agrisilviculture (AS), agrihorticulture (AH), hortipastoral (HP), agrihortisilviculture (AHS) and silvipastoral (SP) system.

Demographic and socio-economic status of the farmers

Family structure of sampled households: The overall average family size was found to be 4.40 individuals. It was found to be maximum (4.76) in medium and minimum in small (4.11) farmer's category. Highest sex ratio was observed in medium farmers (1000) and lowest in marginal (886) farmers category. The overall sex ratio was 936 which was found to be lower than the state and national averages of 972 and 940, respectively (Anonymous, 2011). It clearly indicates that there was a difference on the gender of child.

Table-1: Existing agroforestry systems practiced by different categories of farmers in Sujanpur Tehsil of Hamirpur District (H.P.)

Serial no.	Agroforestry Systems	Number of families under different farmer's category practicing agroforestry systems			Total families
		Marginal	Small	Medium	
1.	AS	19 (43.18)	20 (32.25)	22 (28.20)	61 (33.15)
2.	ASH	15 (34.09)	17 (27.41)	19 (24.35)	51 (27.71)
3.	AH	5 (11.36)	10 (16.12)	14 (17.94)	29 (15.76)
4.	ASP	5 (11.36)	8 (12.90)	12 (15.38)	25 (13.58)
5.	SP	--	7 (11.29)	11 (14.10)	18 (9.78)
Total families in each category		44 (100)	62 (100)	78 (100)	184 (100)

Figures
in

parenthesis are percentages

Table-2: Family structure of sampled households under different categories of farmers in the study area

Particulars	Farmers category			Overall
	Marginal	Small	Medium	
Average family size	4.35	4.11	4.76	4.40
Adult male	1.73 (39.89)	1.61 (39.30)	1.92 (40.50)	1.75 (39.89)
Adult female	1.61 (37.15)	1.54 (37.57)	1.80 (38.00)	1.65 (37.57)
Children male	0.57 (13.11)	0.52 (12.71)	0.45 (9.50)	0.51 (11.77)
Children female	0.42 (9.83)	0.42 (10.40)	0.57 (12.00)	0.47 (10.74)
Sex ratio	886	922	1000	936

Figures in parenthesis are percentages

Sex ratio is known as gender ratio and can be determined by dividing the female population to male population multiplied by 1000.

Similar findings were observed by Kaler *et al.* (2017) in Kangra valley of north western Himalaya and reported that overall sex ratio in different altitudinal zones ranges from 844 in altitudinal zone II to 913 in altitudinal zone III. Massodi (2010) and Sharma (2012) also observed an average family size of 5 in Solan (H.P). Yadav *et al.* (2016) reported that the average family size lies between 4.3-5.0 individuals in different elevation zones of Kumaon Himalaya, Uttarakhand.

Educational status of sampled households:

Education plays an important role in development process and has positive impact on the managerial skills and decision making ability of the farmers. Education status helps in determining the farmer's awareness level by influencing the mechanism of suggested modern technologies pertaining to adoption of different agroforestry systems. Highest (92.48%) literacy rate was found in small category of farmers and lowest (87.43%) marginal category of farmers. Overall literacy rate was 90.28 per cent. Highest male literacy rate (88.89%) and female literacy rate (96.38%) were found under small category of farmers whereas, lowest male and female literacy rate (86.59%), (88.37%) were found under marginal category of farmers. Under medium category of farmers male and female literacy rate were found to be 88 per cent and 94 per cent respectively. The percentages of literate females were found higher than that of males in all categories. Overall literacy rate of females were found to be maximum 92.93 per cent than that of males 87.80 per cent. Similar findings were observed by Kaler *et al.* (2017) in Kangra valley of north western Himalaya, India reported that literacy rate in different zones ranging from 84.86 per cent in altitudinal zone I to 89 per cent in altitudinal zone III.

Employment status of sampled households:

Off-farm employment is an essential means by which farmers and their spouses can avoid household economic risks and maximize income during crop failure. The Overall, 33 males and 15 females were engaged in government services. Whereas, 117 males and 35 females were engaged in private services. Average annual income of ₹ 4,07,676 and ₹ 3,68,904 was observed in males and females under government services. Whereas, in case of private services, average annual income of ₹ 2,32,070 and ₹ 1,74,037 was recorded in males and females, respectively. Majority of males were found dominating in both the sectors and were found to be more interested in off farm cash generating activities whereas, females were more interested in the household and own farm activities. Kumar *et al.* (2018) reported that more number of males were found to be more interested in off farm cash generating activities, whereas, females were dominating in the household and own farm activities. Similar findings were reported by Sharma *et al.* (2021) in Bangana Tehsil of Una district, Himachal Pradesh.

Livestock inventory of the sampled households:

Livestock plays an important role in growth and sustainability of Indian economy. Highest number of average buffaloes per family (1.35) was recorded in medium followed by small (1.11) and marginal (0.90) categories of farmers. Maximum local breed of cows were found in medium (89.09%) followed by small (69.76%) and marginal (67.56%) category of farmers. Highest local breed of buffaloes were found in medium (87.71%) followed by small (82.97%) and marginal (73.68%) category of farmers. Maximum cows of improved breed (32.43%) were found in marginal and minimum (10.90%) in medium category of farmers. Whereas, maximum percentage of milching was found under buffaloes (92.98%) in medium and minimum (91.48%) in small category of farmers. In case of young stock maximum number of cows (42.85%) were found in marginal category of farmers and minimum (32.25%) in small category of farmers.

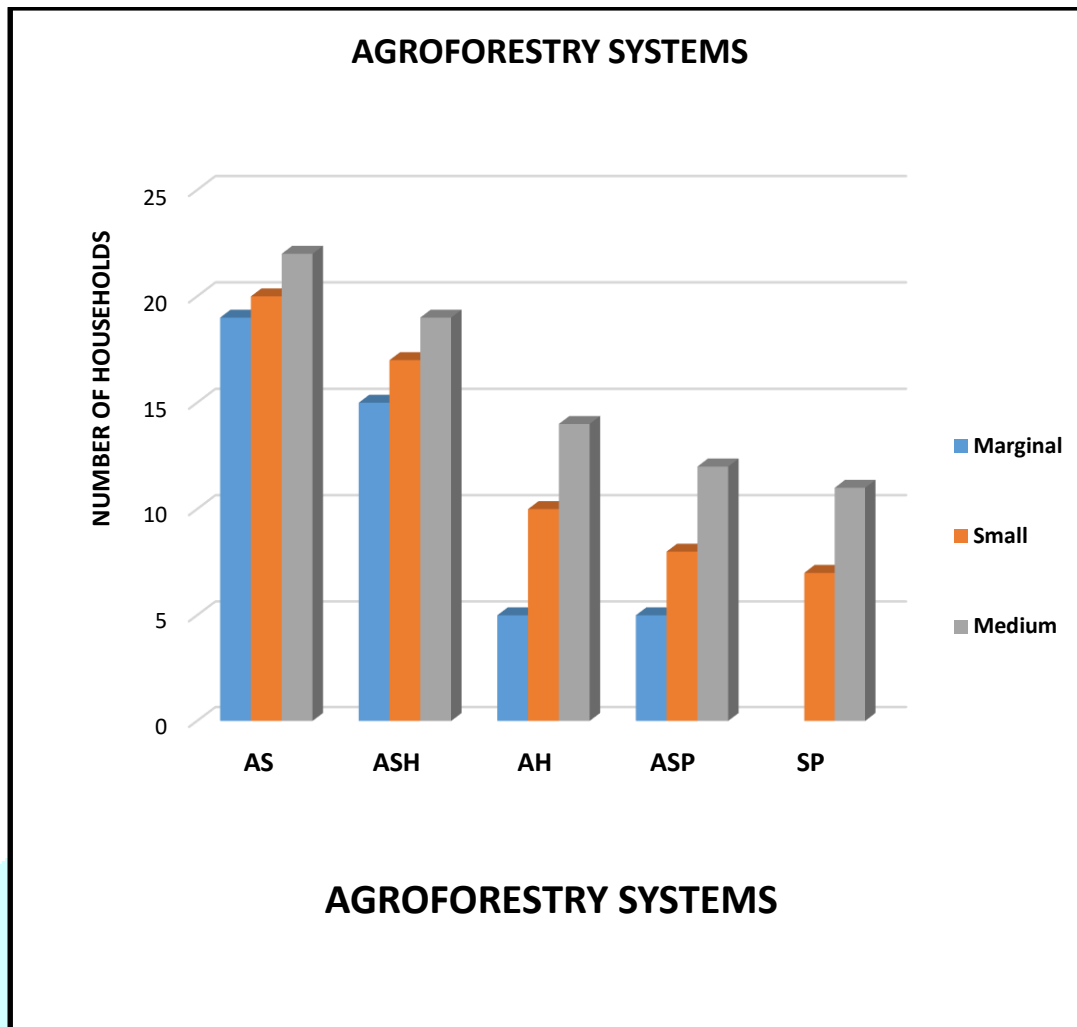


Fig-1: Agroforestry systems identified in the study area under different categories of farmers

Table-3: Education status under different categories of farmers in the study area

Particulars	Farmer's category			
	Marginal	Small	Medium	Overall
Illiterate	0.53 (12.56)	0.30 (7.51)	0.42 (9.00)	0.42 (9.69)
Primary	0.64 (14.75)	0.67 (16.18)	0.61 (13.00)	0.64 (14.64)
Middle	0.64 (14.75)	0.64 (15.60)	0.97 (20.50)	0.75 (16.95)
Matric	1.14 (26.22)	0.97 (23.69)	1.16 (24.50)	1.09 (24.80)
Senior secondary	0.61 (14.20)	0.80 (19.65)	0.69 (14.50)	0.7 (16.11)
Graduate and above	0.76 (17.48)	0.71 (17.34)	0.88 (18.50)	0.78 (17.77)
Literate	3.80 (87.43)	3.80 (92.48)	4.33 (91.00)	3.97 (90.28)
Male literacy rate (%)	86.59	88.89	88.00	87.80
Female literacy rate (%)	88.37	96.38	94.00	92.93

Figures in parenthesis are percentages; Primary- 1 to5; Middle- 6 to 8; Matric- 9 to 10; Senior secondary- 11 to 12; Illiterate- devoid of any education; Literacy rate - Ratio of literates to the total members multiplied by 100.

Table-4: Status of off farm employment among different categories of farmers

Component	Category			
	Marginal	Small	Medium	Total
Total number of families	42	42	42	126
Total members	183	173	200	556
Government service				
Number of male	12	6	15	33
Average annual income/person (₹)	402000	397992	423036	407676
Number of female	4	5	6	15
Average annual income/person (₹)	402000	373920	330792	368904
Private service				
Number of male	36	39	42	117
Average annual income/person (₹)	236196	216876	243140	232070
Number of female	7	12	16	35
Average annual income/person (₹)	134332	177980	209800	174037

Figures in parenthesis are percentages; The average annual income per person was calculated on the basis of total number of beneficiaries only.

Table-5: Livestock status of sampled households under different categories of farmers in the study area

Animal species	Number of animals	Average number/family	Local breed	Improved breed	Dry	Milch	Young stock
Marginal farmers (Total number of families having livestock= 40)							
Cow	37	0.88 (37.37)	25 (67.56)	12 (32.43)	6 (16.21)	31 (83.78)	6 (42.85)
Buffalo	38	0.90 (38.38)	28 (73.68)	10 (26.31)	3 (7.89)	35 (92.10)	4 (28.57)
Bullock	2	0.04 (2.02)	2 (100)				
Sheep	2	0.04 (2.02)	2 (100)				1 (7.14)
Goat	20	0.47 (20.20)	20 (100)			20 (100)	3 (21.42)
Total	99	2.33 (100)					14 (100)
Small farmers (Total number of families having livestock= 41)							
Cow	43	1.02 (33.07)	30 (69.76)	13 (30.23)	10 (23.25)	33 (76.74)	10 (32.25)
Buffalo	47	1.11 (36.15)	39 (82.97)	8 (17.02)	4 (8.51)	43 (91.48)	9 (29.03)
Bullock	2	0.04 (1.53)					
Sheep	4	0.09 (3.07)					2 (6.45)
Goat	34	0.80 (26.15)					10 (32.25)
Total	130	3.06 (100)					31 (100)
Medium farmers (Total number of families having livestock= 39)							
Cow	55	1.30 (36.66)	49 (89.09)	6 (10.90)	7 (12.72)	48 (87.27)	9 (37.50)

Buffalo	57	1.35 (38)	50 (87.71)	7 (12.28)	4 (7.01)	53 (92.98)	5 (20.83)
Bullock	2	0.04 (1.33)					
Sheep	2	0.04 (1.33)					2 (8.33)
Goat	34	0.80 (22.66)					8 (33.33)
Total	150	3.53 (100)					24 (100)

Values in parentheses are the percentages to the actual owners

Overall result of livestock status clearly revealed that buffalos were most preferred animal for domestication for milk purpose as compared to cows. More dependency on tractor of farmers may be the reason for minimum number of bullock. Local breeds of cow and buffalo was more preferred by the farmers as compared to improved breeds might be due to the disease resistant ability which reduces the veterinary costs. Similar findings on livestock status were also reported by Sharma *et al.* (2021) in Bangana Tehsil of Una district of Himachal Pradesh.

Land use pattern: Land use pattern is the arrangement for the uses of land for different purposes and it was directly linked to family livelihood, expenditure and accumulation. Data presented in Table- clearly indicates that total land holding in the study area was found 2.62 ha out of which, arable land was 2.07 ha and non-arable land was 0.52 ha. Irrigated and unirrigated land under arable land was found to be 0.64 ha and 1.43 ha respectively. Whereas, area under orchard was found to be 0.03 ha. Maximum arable land (1.14 ha) was found under medium category of farmers followed by small (0.66 ha) and marginal (0.27 ha) category of farmers.

Table-6: Land use pattern of farmers in the study area

Particulars	Land holding (ha)			
	Marginal	Small	Medium	Total land holding (ha)
Arable land (ha)	0.27 (77.32)	0.66 (82.16)	1.14 (76.57)	2.07 (78.68)
Irrigated	0.13 (36.84)	0.15 (19.34)	0.36 (24.11)	0.64 (26.76)
Unirrigated	0.14 (40.48)	0.51 (62.82)	0.78 (52.46)	1.43 (51.92)
Non-arable land (ha) (Pasture land)	0.07 (22.36)	0.13 (16.31)	0.32 (21.64)	0.52 (20.10)
Orchard		0.01 (1.51)	0.02 (1.77)	0.03 (1.09)
Total	0.34 (100)	0.8 (100)	1.48 (100)	2.62 (100)

Values in parentheses are the percentages to the total; 25 kanals=1 ha

Whereas, maximum non-arable land 0.32 ha was also recorded under medium category of farmers and minimum 0.07 ha under marginal category of farmers. Orchard land under small and medium categories of farmers was found to be 0.01 ha and 0.02 ha respectively. Whereas, there was no orchard land under marginal category of farmers. Total land holding 1.48 ha was found under medium category of farmers and minimum land holding 0.34 ha was found under marginal category of farmers. Results are in conformity with Kumar *et al.* (2018) in Kandaghat block of Solan District, Sharma *et al.* (2021) in Bangana Tehsil of District Una, Himachal Pradesh.

CONCLUSION

The average family size was found to be 4.40 persons per family in the study area and the overall sex ratio was observed as 936 which was found to be lower than the state and national averages of 972 and 940 respectively. Females were more literate than males and majority of the heads of the families were literate that showed better motivation towards adoption of new agroforestry technologies.

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