TRADITIONAL AGROFORESTRY SYSTEMS PRACTICED IN LAHAUL (LAHAUL & SPITI) AND KINNAUR DISTRICTS OF HIMACHAL PRADESH

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Introduction

India with a population of more than one billion has always been concerned with food security for its citizens. Besides basic needs of food, requirements of fuelwood, timber and fodder have equal importance. To feed the growing population, India followed the path of extensive agriculture, relinquishing the forests in favour of agriculture. This led to large scale deforestation and concomitant environmental problems.

Under the conditions of unending heavy pressure of human and livestock population, decreasing land to man ratio, acute shortage of food, fuelwood, fodder, timber and other tree-based products, continued land erosion, depletion of soil fertility and ecological imbalance, agro-forestry has a great scope as a practical solution to many of these challenging problems.

India has a long tradition of agro-forestry. Farmers and land owners in different parts of the country integrate a variety of woody perennials in their crop and livestock production fields depending upon the agro-climatic conditions and local needs.

In India a lot of work has been done in all the agro-climatic zones and a number of traditional agro-forestry systems have been identified and documented. From the Himalayan region, which is one zone of India, a number of traditional agro-forestry systems have been documented from Himachal Pradesh (H.P.) and Uttarakhand (Atul *et al.*, 1990) have identified three most extensively practiced agro-forestry systems in H.P.; these are agri-silviculture, agri-horticulture and agri-horti-silviculture.

Similarly, Dadhwal *et al.* (1989), Toky and Khosla (1989), Singh and Singh (1987) and Singh *et al.* (1980) identified the following agro-forestry system in Himalayan region along with the major type of benefits :

(a) Fruit trees in combination with agricultural crops and fodder trees for fruit and fodder production.
(b) Fodder trees with pasture for fodder production.
(c) Trees and grasses for soil conservation, fuel, timber and fodder.

Singh and Dagar (1990) have identified agri-silviculture systems, agri-horticultural system, agri-horti-

silviculture system, silvi-pastoral system and homesteads in Mussoorie hills in the Western Himalayas. Hence, efforts were made to identify the current tree-based models and their uses in District Kinnaur and Lahaul and Spiti of Himachal Pradesh.

Study Area

The work was conducted in the year 2006 in Lahaul area of District Lahaul & Spiti which lies between latitudes 32° 8' and 32° 59' North and longitudes 76° 49' and 77° 47' East in the Himalayas and Kinnaur District which lies between latitudes 31° 55' 50" North and 32° 05' 15" and longitudes 77° 45' and 79° 00' East.

Sampling Methodology

The study was conducted in Lahaul and Kinnaur districts of H.P. Within each study area, 5 villages were randomly selected for the purpose of study. Thus in all 10 villages were selected and within each village again 10 per cent sampling was done for collecting the information from the households and the information was collected by questionnaire method, informal interviews, transact walk along with the farmers and personal observations.

Results

Agro-forestry systems in the area are practiced by the farmers in order to meet their diverse needs from the same unit area. Systems identified are discussed hereunder.

Table 1 shows the current tree based models in Lahaul area. It reveals that on an average maximum area (7.15 bigha) was found under agri-silvicultural system and crops grown were Peas/Potato/ Rajmash/Cauliflower/Hops + Salix, followed by pastoral-silviculture (1.03 bigha) and crops grown were Grasses + Salix/Eucalyptus. Area under agri-horticulture system was 0.24 bighas and crops grown were Peas/Potato + Apple, area under agri-silivi-pastoral was 0.37 bigha and crops grown were Peas+Salix+Grasses, under pastoral-horticulture system area was 0.23 bigha and the crops grown were Grasses+Apple. Generally five agroforestry models i.e. agri-horticulture, agri-silviculture, agri-silvi-pastoral, pastoral-silviculture and pastoral-horticulture were prevalent in the area.

Most prevalent current tree based model in District Kinnaur was agri-horticulture. Average area under the model was 8.44 bigha (Table 1a) and crops grown were potato/peas/maize/Jau/ogla/fafra/ rajmash/urd/shimla-mirch/green chilies+ apple/almond/apricot. Average area under agri-silivculture system was 2.31 bigha and crops grown were rajmash/potato/peas/ ogla/fafra/shimla-mirch/cauliflowers/ Jau+salix/poplar. Area (average) under silvi-pastoral was 0.44 bigha and crops grown were grasses+salix/poplar/neoza pine/deodar. Area (average) under pastoral-horticulture was 2.2 bigha and crops grown were grasses+apple/ almond/ pears/plum/apricot. In nut shell, 4 agro-forestry models were observed in the area.

Table 2 shows the benefits of the tree based models. Ranking system was used for analyzing the benefits. On an average maximum benefits (41) were taken as fuel wood, followed by fodder (35.2), small timber (26.6), while minimum (8.6) benefits were taken as thatching material. Benefits of the models in District Kinnaur revealed

Table 1

Current tree based models and area (bighas) of Lahaul.

Villages (Lahaul)	Agri-horticulture		Agri-silviculture		Agri-silvi-pastoral		Pastoral-silviculture		Pastoral-horticulture	
	Area	Crops/ trees	Area	Crops/ trees	Area	Crops/ trees	Area	Crops/ trees	Area	Crops/ trees
1	2	3	4	5	6	7	8	9	10	11
Shakoli	0.01	Peas/ Potato+ Apple	5.8	Peas/ Potato/ Rajmash + Salix	0.07	Peas+ Salix+ Grasses	-	-	0.65	Grasses+ Apple
Hinsa	-	-	4.6	Peas/ Potato/ Maize/ Rajmash + Salix	0.28	Peas+ Salix+ Grasses	0.74	Grasses+ Salix	0.01	Grasses + Apple
Gorma	0.41	Peas+ Aple	10.2	Peas/ Potato/ Rajmash/ Cauliflower/ Hops + Salix	0.6	Peas + Salix + Grasses	1.01	Grasses + Salix/ Eucalyptus	0.4	Grasses+ Apple
Jhalma	0.8	Peas + apple	8	Peas/ Potato/ Rajmash+ Salix	0.5	Peas+ Salix+ Grasses	0.6	Grasses+ Salix	-	-
Labaring	-	-	7.2	Peas/ Potato/ Rajmash+ Salix	0.4	Peas + Salix+ Grasses	2.8	Grasses+ Salix	0.10	Grasses + Apple

Contd...

1	2	3	4	5	6	7	8	9	10	11
Total	1.22	Peas/ potato+ apple	35.8	Peas/ potato/ Rajmash/ Cauliflower/ Hops/ Maize + Salix	1.85	Peas + Salix+ Grasses	5.15	Grasses+ Salix/ Eucalyptus	1.16	Grasses+ Apple
Average	0.24	-do-	7.15	-do-	0.37	-do-	1.03	-do-	0.23	-do-

Table 1 (a)

Current tree based models and area (bighas) of Kinnaur.

Villages	Agri-horticulture		Agri-silviculture		Pastoral-silviculture		Pastoral-horticulture	
	Area	Crops/ trees	Area	Crops/ trees	Area	Crops / trees	Area	Crops / trees
1	2	3	4	5	6	7	8	9
Sangla	12	Potato/Ogla/ Fafra/Peas/ Shimla mirch+ Apple	0.55	Rajmash/ Potato/Peas/ Ogla+ Salix / Poplar	-	- -	3.8	Grasses + Apple
Kupa	14.6	Potato/Peas/ Ogla/ Fafra / Maize+ Apple/ Apricot	2.8	Rajmash/ Ogla/Fafra/ Potato+ Salix/ Poplar	-	-	3.2	Grasses + Apple/ Apricot/ Plum
Pooh	7	Rajmash/ Jau/Ogla/ Fafra/Potato/ Peas /Green chilies + Apple/ Almond / Apricot	1.4	Rajmash/ Peas / Shimla mirch/ Potato+ Salix/ Poplar	1	Grasses + Deodar/ Neoja	2.6	Grasses+ Apple/ Apricot/ Pear/ Almond

Contd...

1	2	3	4	5	6	7	8	9
Pooh	7	Rajmash/ Jau/Ogla / Fafra/Potato/ Peas /Green chilies + Apple/ Almond / Apricot	1.4	Rajmash/ Peas / Shimla mirch/ Potato+ Salix/ Poplar	1	Grasses + Deodar/ Neoja	2.6	Grasses+ Apple/ Apricot/ Pear/ Almond
Nako	-	-	5	Peas/ Potato/ Rajmash/ cauliflower / Jau/ Ogla + Salix/Poplar	-	-	0.4	Grasses + Apple
Rakcham	8.6	Potato/Peas/ Ogla, Fafra/ Rajmash/ Urd+ Apple	1.8	Ogla/Fafra/ Rajmash+Salix/ Poplar	1.2	Grasses + Salix/ Poplar/ Deodar	1	Grasses + Apple
Total	42.2	Rajmash/ Jau/ Ogla/ Fafra/Potato/ Peas / Green chilies/ Shimla mirch + Apple/Almond/ Apricot	11.55	Peas/ Potato/ Rajmash/ cauliflower/ Jau/Ogla / Fafra / Shimla mirch + Salix/ Poplar	2.2	Grasses + Salix/ Poplar/ Deodar / Neoja	11.0	Grasses+ Apple/ Apricot/ Pear/ Plum/ Almond
Average	8.44	-do-	2.31	-do-	0.44	-do-	2.2	-do-

Table 2

Benefits of the tree based models in Lahaul and Kinnaur

Benefits	Shakoli		Hinsa		Gorma		Jhalma		Labaring		Total	Average	
	Score	Ranks	Score	Ranks	Score	Ranks	Score	Ranks	Score	Ranks		Score	Ranks
Lahaul :													
Fuel	43	I	36	II	42	I	41	I	43	I	205	41.0	I
Fodder	27	II	42	I	34	II	32	II	41	II	176	35.2	II
Small timber	14*	III	28	III	26	III	32	III	33	III	133	26.6	II
Thatching material	-	-	4	V	16	IV	11	IV	12	V	43	8.6	II
Fruits	14*	III	6	IV	10	V	8	V	15	IV	53	10.6	II

	Sangla		Kupa		Pooh		Nakoo		Rakcham		Total	Average	
	Score	Ranks	Score	Ranks	Score	Score	Ranks	Score	Ranks	Score		Score	Ranks
Kinnaur :													
Fuel	31	III	34	II	48	II	44	I	39	III	196	39.2	II
Fodder	38	II	32	III	41	III	41	II	41	II	193	38.2	III
Small timber	7	IV	11	IV	18	IV			16	IV	52	10.4	IV
Fruits	68	I	65	I	71	I	-	-	57	I	216	52.2	I

that people takes maximum benefits in the form of fruits (52.2) followed by fuel (39.2), fodder (38.2).

Discussion

Natural ecosystems are often diverse in their species composition and efficient in conservation of site resources. The traditional agroforestry practices to some extent have helped people in meeting some of their diverse needs i.e. food, fodder, fuelwood and timber but the farmers with small land holdings and due to water scarcity especially in Pooh and Nakoo villages of Kinnaur District, results in low yield of food, fodder and fuelwood from the unit area. Five agroforestry systems were identified in Lahaul area of District Lahaul & Spiti and 4 models were identified in Kinnaur District. Six types of models were identified by Mughal and Bhattacharya (2002) in Kashmir Valley of J&K i.e. Agri-Silviculture, Horti-Silviculture, Horti-Pasture, Hort-Silvi-Agriculture and Kitchen gardens.

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SUMMARY

Traditional agroforestry systems prevalent in Lahaul area was agri-silvicultural system. Generally five agroforestry systems were identified i.e. agri-horticultural, agri-silvicultural, agri-silvi-pastoral, pastoral-silviculture and pastoral-horticultural. Whereas, in District Kinnaur most prevalent agro-forestry system was agri-horticultural. Four agroforestry models were identified i.e. agri-horticultural, agri-silvicultural, pastoral-silvicultural and pastoral-horticultural. Major tree species of the area were Salix, Poplar and Apple.

Key words **: Agro-forestry systems, Traditional, Lahaul, Kinnaur, Himachal Pradesh.**

व्यवहृत पारम्परिक कृषिवानिकी प्रणालियां

अनिता कुमारी, आर०एन० सहगल व शैलेन्द्र कुमार

सारांश

लाहौल क्षेत्र में प्रचलित कृषिवानिकी प्रणाली कृषि वनसंवर्धन प्रणाली रही है। सामान्यतः कृषिवानिकी की पांच प्रणाली मानी जाती हैं अर्थात् कृषि बागबानी, कृषि वनसंवर्धन, कृषि गोचारण, गोचारण वनसंवर्धन और गोचारण बागबानी। किन्नौर जिले की बहुप्रचलित कृषिवानिकी प्रणाली कृषि बागबानी है। चार कृषिवानिकी प्रतिरूप पहचाने गए हैं अर्थात् कृषि बागबानी, कृषि वनसंवर्धन, गोचारण वनसंवर्धन और गोचारण बागबानी। इनकी मुख्य पादप जातियां, सैलिक्स, पोपलर (वन पिप्पल) और सेव हैं।

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