Agroforestry Interventions for Improving Livelihoods of Subsistence Farm Households in the Hills of Nepal

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Introduction

Farmers in the hills of Nepal practice subsistence agriculture in miniature, fragmented landholdings. Declining soil fertility has resulted in declining yields of major staple crops and has been a serious land management constraint for sustaining agricultural production in the hills (Schreier et al. 1995; Vaidya et al. 1995). Hill farmers have increasingly been confronted with a dwindling supply of forest fodder due to increasing livestock population, depleting forest resources, and restriction on free fodder collection and livestock grazing. This paper assesses the potential role of agroforestry in promoting sustainable livelihoods in marginal mountain farms under the agroforestry project initiated by the Nepal Agroforestry Foundation (NAF).

Materials and Methods

The study involved three hill Village Development Committee (VDC) areas: Kumpur, Salang, and Nalang in Dhading district. More than 90% of the farmers in the district practise subsistence agriculture, with cultivated landholdings averaging 0.6 ha (CBS 1996). Livestock production is a key component of the farming system, averaging 5.1 livestock units (LSU) per household. Information on agroforestry was collected from a sample of 223 farm households (82 'project' and 141 'non-project') selected randomly from the wards of these VDCs.

Besides the household survey, soil samples were collected from project and non-project areas in Kumpur and Nalang. A total of 18 soil samples (10 project and 8 non-project) were collected randomly from the 0-20 cm deep plough layer. Samples were drawn from 10-12 different spots within the selected plot, were thoroughly mixed to form a composite sample and then analysed for eight soil properties: pH; organic matter (OM); total nitrogen (N); available phosphorous (P); available potassium (K); and sand, silt, and clay textural classes.

Results and Discussion

Soil fertility

Bari (rainfed upland) soils from project areas had higher amounts of OM, N, silt, and clay than non-project soils, and khet (irrigated land) soils from project areas had higher amounts of OM, N, P, and K (Table 1). This indicates the positive contributions of agroforestry to soil fertility. Bari soils had higher levels of P and K than khet soils ($p < 0.05$). Similarly, levels of OM content and N were significantly higher in khet (irrigated land) than bari (rainfed upland) soils ($p < 0.05$).

Table 1:Summary of soil test results by type and use of land

Soil type	Bari (*n*=10)			Khet (*n* =8)		
	Project	Non- project	F-value	Project	Non- project	F-value
pH	6.47	6.66	1.394	6.44	6.47	0.052
OM (%)	1.53	1.02	1.006	2.35	2.04	0.200
N (%)	0.073	0.048	0.985	0.115	0.10	0.172
P (kg ha^{-1})	69.43	87.39	0.480	46.77	30.88	0.219
K (kg ha^{-1})	154.06	158.72	0.023	150.2	94.08	2.269
Sand (%)	37.33	50.90	1.945	26.95	28.25	0.009
Silt (%)	39.33	28.00	2.341	50.00	49.50	0.002
Clay (%)	23.33	21.10	0.277	23.05	22.25	0.052

n = the number of composite samples; OM = organic matter; N = nitrogen; P = phosphorous; K = potassium

The practices of intensive fodder, firewood, and pole extraction had little impact on soil OM content. The problem of declining OM was more serious in bari than in khet. In bari, the problem was more acute in parcels located farther from homesteads.

Spatial distribution of farmland parcels and agroforestry species

The number of farm parcels per household ranged from 1 to 9, with an average of 4. On average, households owned more bari (2.9/household) than khet (0.9/household) parcels, and bari parcels were located closer (8 minutes) to the home than khet parcels (30 minutes).

Farmers managed land parcels differently depending on their size, distance from the home, and production potential. Available manure was applied more to parcels located closer to home, and these were also managed better. Consequently, the distant parcels have been gradually marginalised and their yields have decreased over the years. The cropping intensity for both bari and khet parcels was higher in project than non-project areas. Similarly, the cropping intensity was higher in bari parcels closer to homesteads (gharbari) parcels than those at a distance (Table 2). The parcels located near homes had higher yields than those located farther away. Similarly, concentration of agroforestry species was higher in parcels located closer to the farmhouse.

Table 2: Characteristics of landholdings and land parcels

Characteristics	Project (*n*=82)	Non-project (*n*=141)	Total (*n* =223)
Average land holding per household (ropani[1])	**14.2**	**16.30**	**15.50**
gharbari (homestead upland)	3.73	4.20	4.10
bari (dry upland)	5.20	8.10	7.00
khet (irrigated lowland)	4.70	3.50	3.90
home garden	0.17	0.10	0.13
kharbari (upland not used for field crops)	0.38	0.39	0.39
Average parcels per household	**3.30**	**4.10**	**3.80**
gharbari	0.88	0.98	0.94
bari	1.38	2.27	1.94
khet	1.00	0.81	0.88
Average distance from the house (minutes)			
gharbari	00	00	00
bari	7.13	7.90	7.60
khet	26.00	34.20	30.70
Average household size (number of persons)	**6.20**	**6.70**	**6.50**

Source: Field Survey 1998
n = number of samples; [1] 20 ropani = approx. 1 ha

Further, the average numbers of fodder trees, shrubs, fruit trees, and grasses planted and protected on bari were significantly higher ($p < 0.01$) for the project than non-project plots. Similarly, the number of firewood and bamboo species belonging on project land were significantly larger ($p < 0.05$) than for non-project land (Table 3). In addition to the species grown along the edges and sides, the project households had planted improved fodder species on khet terrace risers and bunds maintaining lower heights to minimise the negative effects of shading. Non-project households had only planted along the edges of khet plots.

Table 3: Average number of agroforestry species in bari and khet plots

Type of species	Bari			Khet		
	Project	Non-project	F-value	Project	Non-project	F-value
Fruit trees (*n*)	71(85)	12(136)	7.895**	29 (20)	16 (17)	0.567
Fodder trees (*n*)	32(155)	16(354)	10.74**	27(36)	15(20)	1.916
Shrubs (*n*)	76(104)	23(156)	7.533**	67(22)	73(9)	0.016
Fuelwood trees (*n*)	35 (90)	18(182)	4.225*	15(28)	22(18)	0.804
Grasses (bhari)	52 (57)	08(107)	10.36**	80(18)	20(12)	1.151
Medicinal herbs (*n*)	37 (17)	27(22)	0.309	02(02)	02(2)	1.419
Bamboos (*n* bushes)	04 (40)	01(56)	5.443*	11(08)	01(4)	1.310

* Significant at the 0.05 level; ** Significant at the 0.01 level.
Figures in parentheses are number of parcels. 1 bhari is about 40 kg

Farmers reported that they were motivated to undertake agroforestry by the income obtained by selling mulberry cuttings and NB 21 grass slips to the Nepal Denmark Watershed Management Project and other organisations, as well as diversifying their income though using mulberry leaves for silkworm rearing.

Conclusion

The promotion of agroforestry contributed to increased productivity, improved soil fertility, diversified income, and better use of marginal farmlands to improve livelihoods in the hills. The gradual decline in the cropping intensity and production capabilities of distant parcels owing to inequalities in inputs and management requires urgent attention to minimise further marginalisation. The planting of a higher number of agroforestry species is due to the NAF's motivation, extension, training, and the availability of planting materials, which implies an important role for institutions.

References

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