0842 SX297 P 273 #1 Im
J AGR ECON

PN FAN 273
ISN - 38337

THE IMPACT OF FORESTRY PROJECTS ON LIVESTOCK PRODUCTION: SOME EVIDENCE FROM NEPAL

R. L. J. Shrestha and D. B. Evans*
Australian National University†

Introduction

Recently in Nepal, as in other areas of the developing world, there has been growing concern about the rapid rate of deforestation and the problems that have resulted. Explanations of deforestation have focussed on the heavy dependence rural people have on the forest, particularly for fodder to feed their livestock and for fuelwood. The Nepalese government has recognised the problem and has begun to encourage forestry projects. To be successful, these projects require careful management plans, plans which could go astray if managers fail to recognise that reforestation could itself increase the rural demand for forestry products.

This research focussed on the interaction between reforestation and livestock production of a sample of households which had been affected by a reforestation project. In particular, the question of whether the increased availability of fodder could encourage families to keep more animals was explored.

The Sample

The Nepal Australia Forestry Project (NAFP) is a reforestation scheme centred on Chautara Village, Sindhu Palchok District. As well as helping to reforest public land, it encourages families to plant trees on their private land. Terraced farming is practised in the region, with 'pakho' land (unirrigated) terraced into hillsides, and 'khet' land (irrigated) found either in valleys or on the sides of hills near springs.

Four communities within a two hour walk of Chautara were identified. These were visited and a list of households owning livestock obtained. Forty families were selected randomly from this list for study.

Survey Technique

The survey was conducted in January-February 1982. At the first visit to each household, information about socio-economic variables such as family size and religion, and details about crop and livestock production were collected.

* Economist at Agricultural Projects Services Centre, Kathmandu, Nepal, and MADE Fellow at the Australian National University, Canberra, respectively. Acknowledgement is due to the Nepal Australia Forestry Project for its generous assistance.

† Development Studies Centre, MADE Programme, The Australian National University, GPO Box 4, Canberra, ACT 2601.

COPYRIGHT 84
AGR ECONOMICS SOC
ABERYSTWYTH SY23 SC

Then each household was visited every alternate day for three weeks. On these visits, an 'intensive questionnaire' was completed. Details were sought of the daily activity of all household members on the day immediately before the visit. The quantities of firewood and fodder collected and the returns provided to the family by livestock were recorded. Detailed information about ten days' activity were collected for each household using this method.

The Effect of Reforestation

No farm level data concerning Chautara households were available in time-series form, and analysis had to rely on the cross-sectional data that could be collected during a relatively short time of fieldwork. Two variables which varied on a cross-sectional basis, and which would be affected by the NAFP, were examined. They were:

(i) the number of fodder trees on a farmer's private land; and,

(ii) the time it typically took a family member to collect a load of fodder from the forest.

Both were expected to influence the number of livestock kept by households.

A positive relationship between the number of fodder trees a family owned and the number of livestock it kept was expected. If this was confirmed, it would suggest that efforts to introduce more privately-owned fodder trees could lead to an increase in the livestock population.

Secondly, reforestation on public land would make fodder more readily available and reduce the time necessary to collect it. This could encourage households to keep more livestock.

The Model

Regression analysis was used to test these relationships. Park (1979) noted that rural people often kept different types of livestock for different reasons. This implies that equations for the different types should be estimated separately. Three categories of livestock were used—buffaloes, cattle and goats. The independent variable was the number of weighted livestock units.*

Following Park (1979), Moore (1978) and Shah (1980), the availability of both land (measured as hectares per household) and labour were included as explanatory variables. Both were expected to have positive correlations with the number of livestock units.

Some types of jobs are sex- and age-specific in Nepal. For example, collecting fodder from the forest is almost entirely undertaken by women. Males and children collect fodder only occasionally. They supervise goats while they are grazing and look after the buffaloes on the farm. They appear to do similar tasks with these animals. However, in the case of cattle, males are required to do the ploughing while children supervise their grazing.

Shortages of different types of labour could therefore have different effects on the number of livestock. With cattle, for example, a shortage of women would mean less fodder collected, a shortage of men means no ploughing

* The weights suggested by Sharma (1982) were used. Cattle were taken as the base unit (equal to 1.0). Buffaloes were weighted at 1.25, calves at 0.5 and goats, sheep and pigs at 0.25.

could be undertaken and a shortage of children would make it difficult to supervise grazing cattle. There is no reason to expect that the marginal effect of these three types of labour on cattle numbers would be the same, so each must be included as a variable with separate influences on the number of cattle. Similarly, female labour must be included separately for goats and buffaloes, but male and child labour can be combined into a composite variable because they undertake similar tasks*. Another implication is that it would not be correct to estimate a single equation for total livestock units.

As separate regressions were estimated for the three groups of livestock, the possibility of substitutability or complementarity between groups was considered. A variable representing the number of other animals owned by a household was included in each equation. If different types of livestock are substitutes, this variable would be expected to have a negative sign. On the other hand, families with cash surpluses in the past may have acquired livestock of all types, in which case a positive relationship would be expected †.

A dummy variable for religion was also included. Other possible explanators, such as levels of past cash surpluses or remittances were not included due to a lack of data.

Results

Most of the few empirical studies in this area have used the linear form (Shah, 1980; Moore, 1978). An exception was Vaidyanathan (1980) who used the quadratic form. Both forms were tried as well as the Cobb-Douglas function.

The statistical fit of the Cobb-Douglas equations was very poor and many of the signs were difficult to interpret. These equations are not reported. The best linear and quadratic equations were selected by including the variables which maximised R^2 ‡. A key explaining all variables is found in Table 1.

Table 1 Explanation of Variables Appearing in Equations

Variable	*Description*	*Average Value*	*Standard Deviation*
X_1	Fodder trees/household	7.83	6.70
X_2	Males/household	2.08	1.53
X_3	Children 6-15 years/household	1.26	1.00
X_4	Males + Children/household	3.34	2.15
X_5	Females/household	2.21	1.70
X_6	Land area/household	0.33	0.23
X_7	Time taken to collect a load of fodder/household	3.89	2.73
X_8	Other livestock units/household, consisting of:		
	Buffalo units/household	1.52	1.04
	Goat units/household	0.89	0.71
	Cattle units/household	1.98	1.80
D	Dummy for religion		
	= 1 for Buddhists	25 families	
	= 0 for Hindus	15 families	

* Children were given a weight of 0.8 of an adult male when forming the composite variable.

† Data limitations prevented the estimation of a full simultaneous demand model.

‡ Variables which were highly collinear could not be included in the quadratic form together. They were tested individually.

The best equations for the three groups of livestock are reported in Table 2. The R^2 and $\bar{R}^2$ are not very high, but could not be expected to be high in equations of this nature. The number of livestock kept by families is influenced strongly by attitudes and traditions in addition to the variables included in the equation. Attitudes and traditions cannot be measured and therefore could not be included. The variation in Y explained by the regression will not therefore be high.

Table 2 Best Equations for Buffalo, Goat and Cattle Units†

Variable	*Buffalo Units*		*Goat Units*		*Cattle Units*	
	(*L*)	(*Q*)	(*L*)	(*Q*)	(*L*)	(*Q*)
Constant	0.80	1.12	0.34	−0.42	0.27	0.16
X_1	0.05*** (0.02)	0.05** (0.02)			0.06 (0.04)	0.21** (0.10)
X_2						0.87 (0.57)
X_3					−0.40 (0.26)	−0.71* (0.39)
X_4	0.18* (0.10)		0.18*** (0.07)	0.25*** (0.08)		
X_5		−0.58** (0.24)				
X_6	0.70 (0.61)	4.06*** (1.25)				
X_7			−0.06 (0.05)	−0.15** (0.07)	0.16 (0.14)	
X_8			0.17*** (0.04)	0.20*** (0.05)	0.46** (0.22)	0.39 (0.24)
$X_1 X_2$						−0.10** (0.05)
$X_1 X_3$						0.05 (0.06)
$X_3 X_5$						0.16 (0.16)
$X_5 X_6$				−0.30 (0.21)		
$X_5 X_7$		0.18*** (0.06)		0.26* (0.15)		
$X_6 X_7$		−0.99*** (0.32)				
D	−0.72*** (0.31)	−0.60* (0.31)	0.44** (0.21)	0.49** (0.21)		−0.70 (0.60)
R^2	0.33	0.46	0.43	0.47	0.26	0.35
$\bar{R}^2$	0.24	0.36	0.36	0.38	0.17	0.19
F	4.40***	4.67***	6.51***	4.92***	3.05*	2.11*

† *L* = Linear *Q* = Quadratic

Figures in parentheses are standard deviations, and

* significant at 10%

** significant at 5%

*** significant at 1%

This is not, however, of great importance. The purpose of the research was to determine if there was a significant relationship between the two variables influenced by the NAFP (X_1, X_7) and the livestock units. This can be judged by examining the signs and significance of the variables included in the best equations.

Even on this basis, however, the results with cattle were poor. Few variables were significant and many signs were not as expected. It was not, therefore, possible to discern any relationship between the number of cattle units and either X_1 or X_7 from these equations.

The linear equations showed that buffalo units were positively related to the number of privately owned fodder trees. Weak support can be taken from the quadratic equation. This implies that the efforts of the NAFP to increase the number of trees on private land could encourage farmers to acquire more buffaloes*.

The linear equation did not reveal any relationship between X_7 and buffalo units. The evidence of the quadratic form by itself must be rejected, particularly as some of the signs are difficult to interpret. This does not necessarily mean that the reforestation of public land will have no effect on buffalo units. However, the cross-sectional analysis provided no support for the hypothesis that it will.

With goats, all signs in the linear function were as expected. This provides weak evidence that a reduction in time spent collecting fodder (X_7) could lead to an increase in the number of goat units. Support is found in the quadratic equation.

Conclusions

This cross-sectional study found a relationship between two variables likely to be influenced by forestry projects in Nepal and the number of goats and buffaloes kept by households. No relationship between these variables and cattle units could be identified.

This might be because the equations used imply a form of optimising behaviour on the part of farmers. They imply that the farmer will adjust the number of livestock to his circumstances. There are strong reasons why this is not possible with cattle, and why, therefore, the equations were more useful with buffaloes and goats. Cattle are sacred to Nepalese and by law cannot be slaughtered. Unproductive cattle therefore have no market value, and once cattle become unproductive, farmers have to keep them. They cannot adjust the number of cattle they own on economic grounds. This is not true for the other animals.

These results could have serious implications for forest management. If the demand for fodder will be higher than anticipated, as implied by the results, more careful or restrictive forest management plans will be necessary.

Trees will reach maturity only if access to young plantations is prohibited for a number of years. Widespread community support is essential to the success of forestry projects in Nepal because it would be prohibitively expensive to police plantations in its absence. This support, however, could break down if forest managers do not anticipate that reforestation could itself lead to a greater demand for forest products.

* The number of trees cannot be regarded as a proxy for land holdings. The simple correlation coefficient between the two variables was 0.1819.

A further implication is that forestry projects by themselves may be insufficient to redress the trend to deforestation. Governments will have to think seriously about policies which reduce the importance of livestock to the farming community. This will not be easy in a country which is so heavily overpopulated with animals despite the acute shortages of feed. Accordingly it is an area in which research is urgently needed.

References

Department of Information, His Majesty's Government, (1974). *Mechi to Mahakali*, Central Development Region, Volume 2, Kathmandu, Nepal (in Nepali).

Moore, M. P. (1978). Some Micro-Economic Aspects of the Livestock Economy, *Indian J. agric. Econ.*, **33**, 67 - 77.

Park, J. H. (1979). Behaviour of Farm Resources in Livestock Production on Semi-Subsistence Farm Organisation, *Readings in Asian Farm Management*, (L. B. Thiam and S. Ong eds.), Singapore University Press, Singapore.

Shah, S. G. (1980). *Phewa Watershed: Animal Husbandry and Feed Resource Survey Result and Recommendation*, FAO/HMG of Nepal/UNDP, Kathmandu, Nepal.

Sharma, R. (1982). *Factors Affecting a Farmer's Decision to Invest in Livestock, Nepal*. Paper presented at the Conference on Livestock Development in Asia, Singapore.

Vaidyanathan, A. (1978). Aspects of India's Bovine Economy: Some Preliminary Results, *Indian J. agric. Econ.*, **33**, 1 - 29.