The Use of Socioeconomic Indicators in Resource Management

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Abstract

Socioeconomic indicators are an important component of understanding resource management, the constraints faced by farmers, and why the status of natural resources is changing. Within the middle mountains of Nepal, social, economic, and cultural factors such as population growth, ethnic traditions, land ownership, and farm economics influence how resources are managed and ultimately effect degradation. Household surveys were used to compile information from farmers about their socioeconomic conditions, including land ownership, food security, and agricultural assets. Farm gross margins were calculated to compare the economic status of households growing a variety of crops. On an individual crop basis, tomatoes and potatoes (both cash crops) were the most profitable, and households that included a cash crop in their rotation typically displayed the highest gross margins. Eighty-three percent of households growing at least one cash crop in their rotation had gross margins of greater than CDN$100[1] per year, while 36 per cent of households not growing vegetables had negative gross margins. Food security was also related to the amount of cultivated land owned by a household and to gross margins. The economic well-being of households is unevenly distributed and linked to land ownership and market-oriented production.

Introduction

To understand why farmers choose different management and cultivation practices, it is necessary to appreciate the intricacies of the system within which they are operating. Social and economic factors such as population growth, land distribution, agricultural assets, and farm income will influence how resources are managed and how they are distributed within communities. Degradation and the status of natural resources can be assessed by conducting semi-structured surveys among community members within watersheds. Baseline socioeconomic data can be compiled and analysed to characterise farm households and provide indicators, which may then be linked to the status of the biophysical resource use.

This study focused on determining population density and growth; ethnic distribution; land and livestock holdings, and how they influence food security; agricultural assets; and farm gross margins. The latter is a good indicator of poverty and reflects the quality of the resource system.

1 CDN$ 1 = NRs 47, US$ 1 = NRs 68 in July 1999

Household Surveys

Detailed surveys were conducted with 85 households in the Jhikhu Khola watershed (Figure 2) and the results compiled to provide information about the constraints on farmers (social, economic, and physical) and their aspirations (individual, household and village-wide). (The selection criteria are given in Schreier and Shah in this volume.) A semi-structured interviewing approach was used. Simultaneous and separate man/woman farmer interviews were conducted to incorporate a cross-check system and to compare the perceptions and problems of both men and women farmers. In most cases, the interview was conducted at farmers' homes with the women (female Nepali interviewer and woman farmer) holding their discussion indoors while the men (male Nepali interviewer and man farmer) talked out of earshot in the courtyard. Information on crop production, livestock operations, forest products, sufficiency status, ethnic distribution, and off-farm employment were compiled and analysed to evaluate household access to resources and indices of poverty.

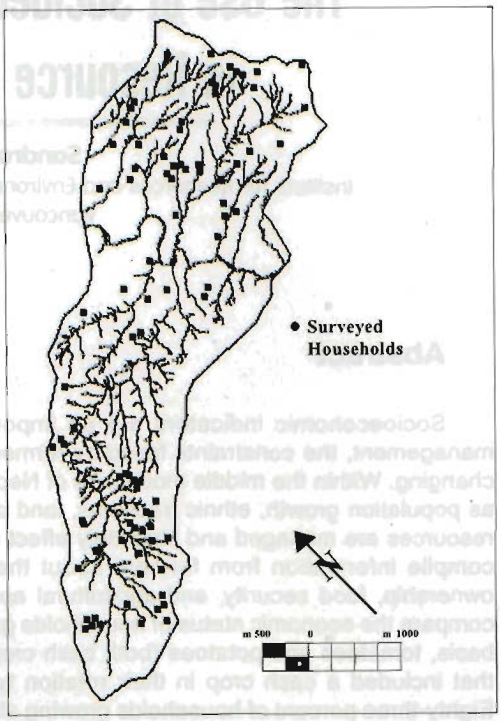

Figure 2: **Location of Households Surveyed, Bela Subcatchment, Jhikhu Khola Watershed**

Population growth, land distribution, ethnic distribution, and livestock holdings provide a good basic set of poverty indicators. Land and livestock comprise the main agricultural assets. Farm gross margins were determined from production information (crops grown, total production, and inputs) and together with agricultural assets were compared to food security.

Population Growth

To evaluate the current population and recent trends within the study area, a survey of constructed houses was undertaken for 1972, 1990, and 1995. The number of houses identified on 1972 and 1990 aerial photographs were counted and compared to the number of houses observed in the field in 1995. Population numbers were calculated from the number of houses, and the average family size (6.7 people per household) determined from household surveys. Figure 3 shows the recent changes in the number of houses and the calculated population. The number of houses in the study area increased from 1,104 in 1972 to 1,723 in 1995. The average population growth was estimated at 1.8 per cent per annum

between 1972 and 1990 and 2.6 per cent per annum between 1990 and 1995. The recent large increase is due to both population growth and immigration. These high population growth rates are a concern for resource degradation as all 'good' agricultural land is already under intensive production, forest resources are already limited, and agriculture is being forced to expand onto steep marginal upland slopes.

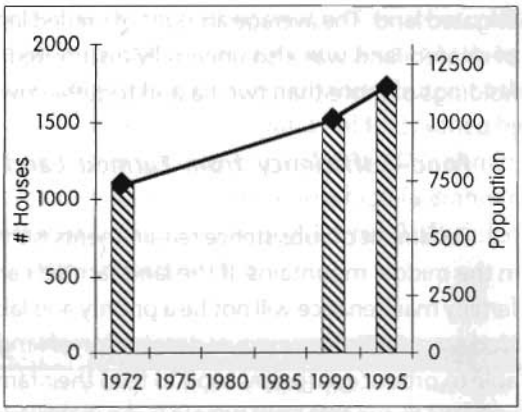

Figure 3: **Bela Population Dynamics 1972-1995**

Land Distribution

Historical land tenure policies have shaped agricultural development in Nepal. The feudal land tenure system (abolished by the 1957 Birta Abolition Act) resulted in a small minority of larger landowners possessing a substantial portion of the arable land. Land registration, implemented in 1963, encouraged the private registration of previously public lands through low tax rates, and resulted in increased pressure on the remaining public forest and rangelands. The Forest Nationalisation Act of 1957 probably accelerated deforestation as land with trees on it could not be registered as private land. The 1964 Nepali Lands Act strove to improve the status of land tenure for small-scale farmers by establishing a ceiling on land holdings and providing rights to tenants, but the programme has been largely ineffective (Seddon 1987; Regmi 1976).

Land ownership within the agrarian economy of the study area provides a major source of income, and inequity in land distribution translates to economic disparity. Farmers with limited access to land or poor quality land will have little economic incentive or ability to invest in soil fertility management (Blaikie *et al.* 1980). In the Bela household survey (n=85) the median land holding per household was 0.92 ha (1 ha = 19.7 *ropani*), but the amount of land varied significantly across different size categories (Figure 4). Land ownership was unevenly distributed with 53 per cent of the households owning only 25 per cent of the total agricultural land area (total holdings per household less than1 ha). Large landowners (holdings >2 ha) made up 15 per cent of households, but owned 36 per cent of the agricultural land. Two families owned no land. The average amount of irrigated land was 0.24 ha per household, but 24 per cent of households owned no irrigated land. Fifteen per cent of households had larger irrigated holdings (>0.5 ha) and owned 46 per cent of the

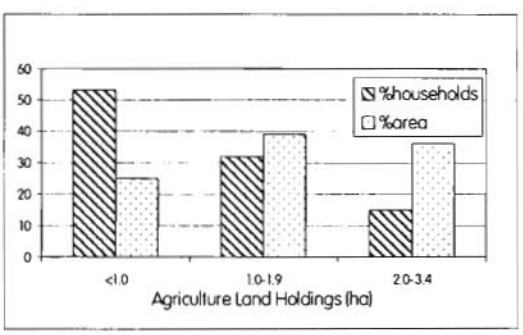

Figure 4: **Land Holdings in the Bela Subcatchment**

irrigated land. The average amount of rainfed land per household was 0.81 ha but ownership of rainfed land was also unequally distributed. Twelve per cent of households had rainfed holdings of more than two ha and together owned 32 per cent of the rainfed land.

Food–Sufficiency from Farmed Land

Fulfilment of subsistence requirements is the primary objective of the majority of farmers in the middle mountains. If the land farmed cannot provide a household's basic needs, soil fertility maintenance will not be a priority and labour will be diverted to off-farm employment (Seddon 1987). The unequal distribution of land suggests that some households may not be able to produce sufficient food to feed their families. As an indication of the amount of land required to support a household living in the Bela region, farmers were asked: "Does the land that you farm generate enough food and income to meet your family's basic needs?" Fifty-three percent of the households surveyed reported that the land they farmed was enough, while 13 per cent responded that the land they farmed was insufficient. Thirty-four percent of the responses from male and female farmers within one household were contradictory suggesting a marginal sufficiency status. The ratio of the land farmed to the number of people in a household for sufficient and non-sufficient households provides a rough estimate of the amount of land required to support each individual (Table 4). Among the households reporting that the land they farmed was not enough, the average ratio of land owned to the number of people was 0.13 ha per person, of which 0.02 ha per person was irrigated land. Among the households reporting that their land provided enough food and income, the average ratio was 0.20 ha per person, of which 0.05 ha was irrigated, more than double the amount of irrigated land held by the 'insufficient' group. In the Bela region, roughly 0.15 ha of land (0.03 ha irrigated and 0.12 ha rainfed) is required as a minimum for every person a household hopes to feed.

Table 4: **Per Capita Availability of Agricultural Land**

Sufficient	n	Per Capita Land Ownership (ha per person)		
		Cultivated Land	Irrigated Land	Rainfed Land
No	11	0.13	0.02	0.11
Marginal	29	0.15	0.03	0.12
Yes	45	0.20	0.05	0.15

Ethnic Distribution

The bulk of households were agriculturalists, but mercantile occupations were strong within some groups. Brahmins (priest caste) are the highest in the caste hierarchy and comprised 54 per cent of the sample. Chhetris are ranked second in the hierarchy and comprised six per cent of the sample. Agriculturalists and traders, who include indigenous tribal hill groups such as Newars, Danuwars, and Magars, comprised 26 per cent of the sample. Service groups made up six per cent, and Tamangs (a Tibeto-Burman community) eight per cent of the sample. Caste affiliation and ethnic distribution generally reflect the class structure and influence access to resources. High caste groups tend to be larger landowners, while low caste households have the poorest access to arable land. The

relationship between caste and land ownership is related to historic land tenure policy, with the state traditionally granting land to members of the ruling class and local notables. However, class relations are dynamic and land ownership was unequally distributed both across caste/ethnic groups and within each group (Table 5). Median land holdings varied by caste from 0 to 0.31 ha of irrigated land, and 0.2 to 1.42 ha of rainfed land. Brahmin, Newar, and Tamang families had the largest median holdings. The sample high (a Brahmin household) owned 1.12 ha (22 *ropani*) of irrigated land and 2.24 ha (44 *ropani*) of rainfed land, while two households (Danuwar and Chhetri) owned no land.

Table 5: Land Ownership by Caste/Ethnic Group

Caste	Sample No.	Irrigated Land per Household (ha)			Percent Owning Irrigated	Rainfed Land per Household (ha)			Per Cent Owning Rainfed
		median	min.	max.		median	min.	max.	
Brahmin	46	0.25	0	1.12	85	0.81	0.10	2.54	100
Newar	13	0.25	0	0.76	77	0.61	0.25	1.07	100
Tamang	7	0.31	0	0.81	71	0.41	0.15	2.14	100
Danuwar	9	0.05	0	0.20	67	0.20	0	1.02	89
Chhetri	5	0	0	0	0	0.46	0	0.71	90
Others	5	0.13	0.05	0.20	100	1.42	0.66	2.14	100
Median	85	0.20	0	1.12	76	0.71	0	2.54	94

Role of Livestock

Livestock, via the production of manure, are a major contributor to traditional soil management practices and through dairy provide an important source of income. Figure 5 shows the changes in the livestock holdings of surveyed farmers in the Baluwa region (n=27) from 1989 to 1996. The number of calves for both cattle and buffalo and the number of chickens decreased from 1989 to 1996, while the number of female cattle and buffalo

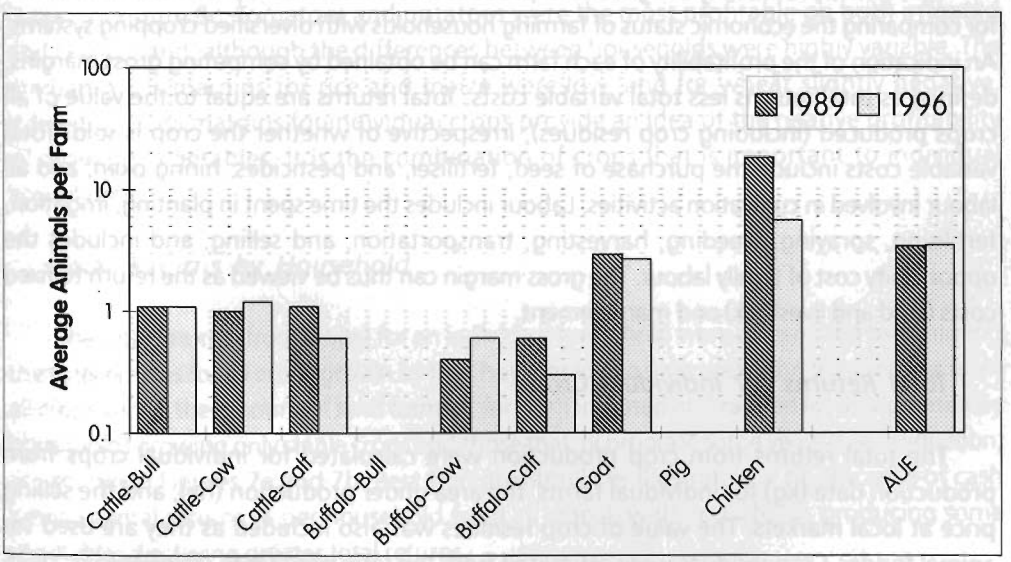

Figure 5: **Livestock Holding Dynamics in Baluwa**

increased slightly. The increase in female buffalo per household was related to the establishment of a local dairy collection centre that promotes the sale of milk. The number of TLUs (tropical livestock units) remained similar, however, indicating limited change in the potential nutrient supply from organic sources.

Agricultural Assets

The main agricultural assets of farmers in the region are land and livestock. Local land values differentiate land on the basis of quality, with poor rainfed land valued as low as CDN$ 4,700 per ha and good quality irrigated land valued at up to CDN$ 56,775 per ha. Average prices for rainfed (CDN$ 9,462 per ha) and irrigated (CDN$ 28,386 per ha) land thus provide a weighting mechanism to sum total land holdings in a manner which reflects not only value but production potential. Land values are summarised in Table 6. In general, the land values should be considered as rough estimates. The median land holding was valued at CDN$ 5,776 for irrigated and CDN$ 6,734 for rainfed land per household. While irrigated holdings accounted for less than 25 per cent of the land owned on an area basis, their value made up nearly 50 per cent of the total land values.

Table 6: **Total Land Values per Household in the Study Area**

	Irrigated		Rainfed		Total	
	ha	CDN$	ha	CDN$	ha	CDN$
minimum	0	0	0	0	0	0
median	0.20	5,776	0.71	6,734	0.92	12,508
maximum	1.12	31,768	2.54	24,050	3.36	52,932

Farm Gross Margins

The relative profitability of agricultural production between farms provides a mechanism for comparing the economic status of farming households with diversified cropping systems. An indication of the profitability of each farm can be obtained by computing gross margins, defined as total returns less total variable costs. Total returns are equal to the value of all crops produced (including crop residues), irrespective of whether the crop is sold. Total variable costs include the purchase of seed, fertiliser, and pesticides; hiring oxen; and all labour involved in cultivation activities. Labour includes the time spent in planting, irrigation, fertilising, spraying, weeding, harvesting, transportation, and selling, and includes the opportunity cost of family labour. The gross margin can thus be viewed as the return to fixed costs (land and livestock) and management.

Total Returns for Individual Crops

The total returns from crop production were calculated for individual crops from production data (kg) for individual farms, the area under production (ha), and the selling price at local markets. The value of crop residues was also included as they are used for animal fodder. Crop residues were estimated from the ratio of grain to residues (e.g., 1.25 for rice) and valued at 5-10 rupees per basket (25 kg) or CDN$ 0.007 per kg. The total returns

for individual crops grown under irrigated (*khet*) and dryland (*bari*) conditions are summarised in Figure 6a. On a per ha basis, the total returns were greatest for tomatoes and potatoes grown on both irrigated and rainfed fields. The median returns for tomatoes, potatoes, and wheat on irrigated fields were higher than returns from the same crops grown under rainfed conditions, indicative of the greater production potential of irrigated lands. For irrigated land, tomatoes and potatoes have the highest total returns, but rice grown during the monsoon is also an important crop as a relatively large amount of land is under rice cultivation. For rainfed land, tomatoes and maize make up the greatest proportion of total returns, reflecting the high returns per ha of tomatoes and the large area under maize cultivation.

Variable Costs for Individual Crops

The variable costs for individual crops were computed by summing the expenditures by individual farmers on seed, chemical fertiliser, pesticides, oxen, and labour. Variable costs were dominated by labour and oxen costs, and represent the opportunity costs of alternative activities. Labour costs were greatest for tomatoes and potatoes on a per ha basis, but labour inputs to rice and maize were significant on a total cost basis ($ per household). The purchase of chemical fertilisers contributed significantly to the variable costs of rice and potatoes on irrigated, and maize on rainfed, sites. The total variable costs for the dominant crops grown on irrigated and rainfed land are shown in Figure 6b. The costs were greatest for tomatoes and potatoes, and somewhat higher on irrigated fields.

Gross Margins for Individual Crops

Gross margins for the main crops grown in the study region were determined by subtracting the variable costs from the total returns for individual crops. The results are shown in Figure 6c. Tomatoes and potatoes were the most profitable on both irrigated and rainfed land, although the differences between households were highly variable. The median gross margins for rice and maize were low, and for wheat slightly negative. While the gross margins for individual crops provide an idea of the relative profitability of growing vegetables, it is the combination of crops that is important to individual households.

Total Returns by Household

The total returns (from crops) for an individual household were determined by summing the total returns for all crops grown by that household in a given year. The total returns from all crops versus the amount of land farmed, for both irrigated and rainfed land, separated by households growing only staple crops and those that incorporate some vegetable production, are shown in Figures 7a and 7b. Best fit regression lines illustrate the significance of cash crops to total returns ($ per household from all crops), with households producing some vegetables displaying greater total returns.

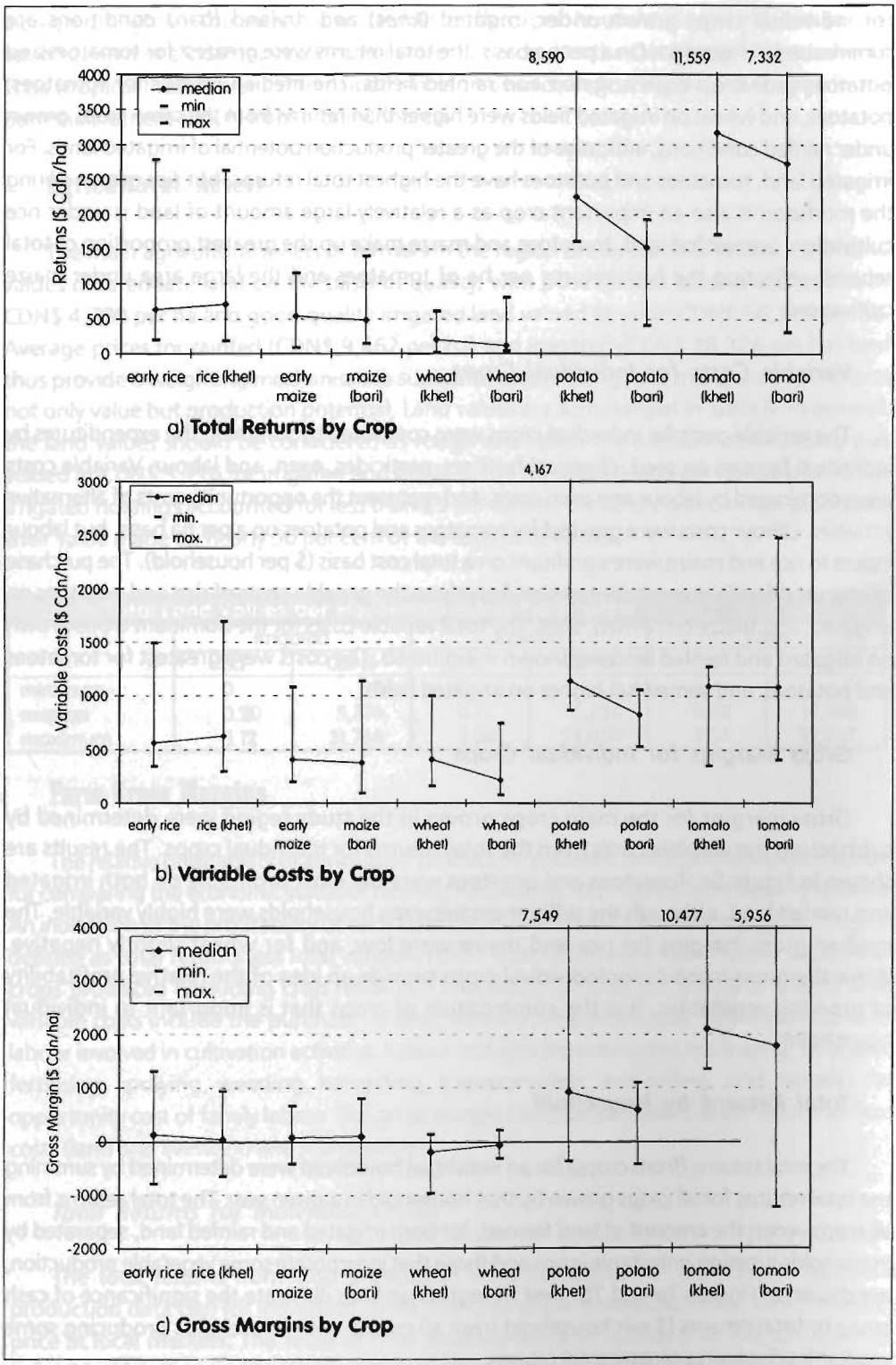

Figure 6: **Total Returns, Variable Costs and Gross Margins by Crop**

Variable Costs by Household

The variable costs for individual households were calculated by summing the costs of producing all crops grown by a household in a given year. The variable costs per household, separated by households growing only staple crops and those that incorporate some vegetable production, are shown in Figures 7c and 7d. The increase in variable costs diminished with the amount of land farmed, suggesting decreasing costs per *ropani* with larger farm size. The households reporting the highest costs did not always report the greatest returns.

Household Gross Margins

The total gross margins for a household were determined by summing the total returns less variable costs for all crops grown on all the land farmed by a household. Farm gross margins, based on all crops grown by a household, ranged from -CDN$ 566 to +CDN$ 1736 dollars per annum. Farm gross margins separated by households growing only staple crops and those that incorporate some vegetable production are shown in Figures 7e and 7f. The benefits of including vegetables within a households' farming system were significant. The highest gross margins were noted for households growing cash crops as part of their rotation, and for households with greater land holdings. Forty-one percent of the households surveyed included a cash crop in their rotation. However, households with negative gross margins included both vegetable growers and large landowners, reflecting crop failures and poor management. Of the households incorporating some vegetable production, only one had negative gross margins compared with 36 per cent of those not growing any vegetables. Eighty-three percent of the households growing at least one cash crop had gross margins greater than CDN$100 per year, while only 40 per cent of households not growing cash crops had comparable gross margins.

Gross Margins and Food Security

The gross margins for individual households provide a good indicator of economic well-being and are related to land holdings and household food security. Table 7 shows the percentage of households reporting that the land they farm is insufficient, marginal, or sufficient to meet their basic need requirements by category of household gross margin. Forty-five percent of the households reporting insufficient production had negative gross margins, while 55 and 56 per cent of marginal and sufficient households had gross margins of more than CDN$100 per year. Households that are not able to meet their basic need requirements also have the lowest per capita land ownership (Table 4), and none of these households had per capita gross margins above CDN$ 50 per year. While this indicator provides a good measure of household level economic well-being, the data requirements are high and selective use of the indicator is recommended. Data on labour requirements are tenuous, and the yield data reported by farmers need to be verified with quantitative crop cut data.

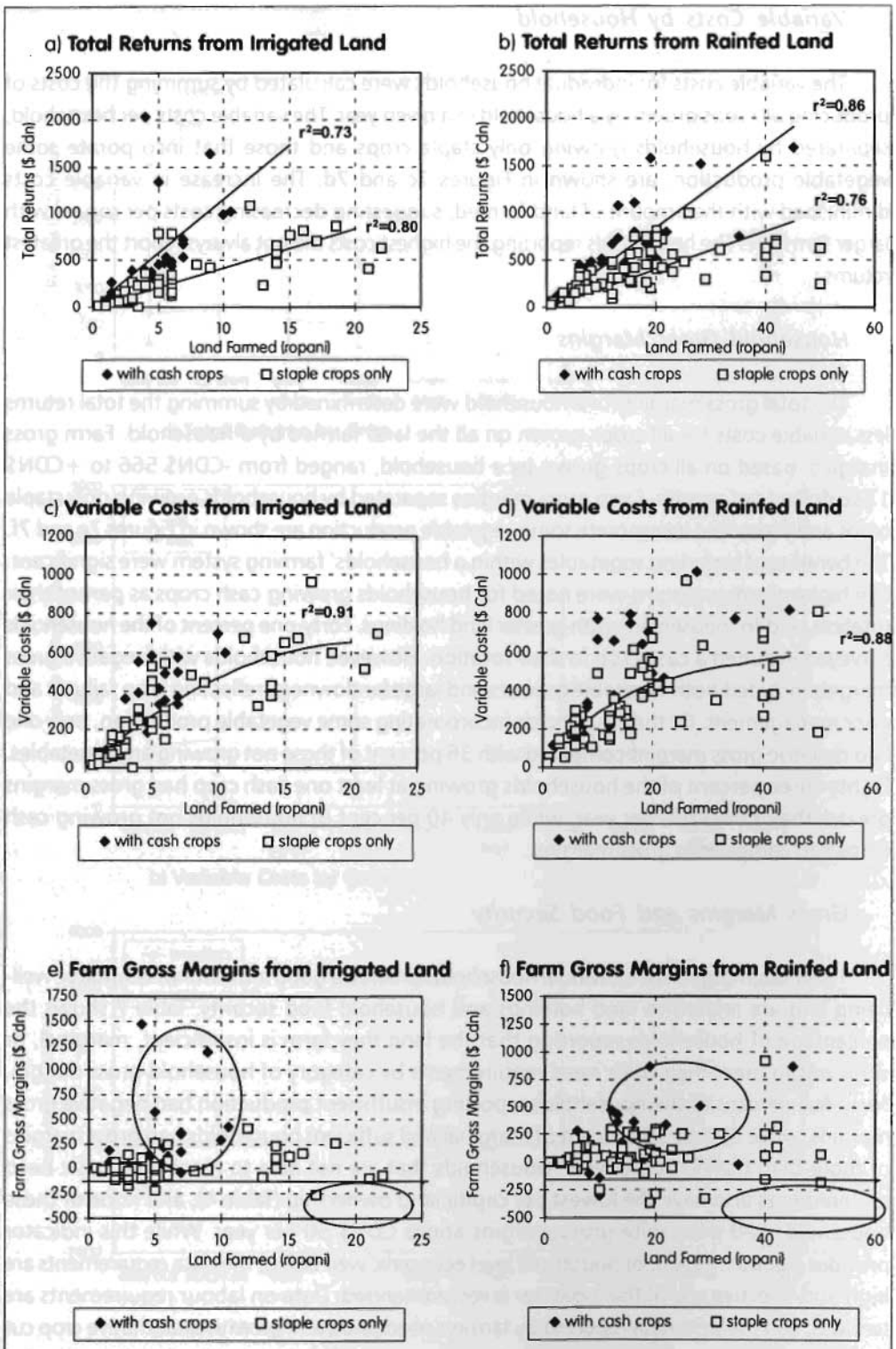

Figure 7: **Total Returns, Varible Costs and Gross Margins for Individual Households**

Table 7: **Self-sufficiency from Land Farmed Versus Household Gross Margins**					
Sufficient	n	Household Gross Margins (% households)			
		< CDN$ 0	CND $ 0-100	> CND$ 100	> CND$ 50 per capita
No	11	45	55	27	0
Marginal	29	17	83	55	28
Yes	45	31	69	56	22

Conclusions

The economic well-being of households in the study area is strongly tied to the quantity and quality of land owned, and reflects traditional versus market-oriented agriculture (vegetable and milk production). Population growth averaging 2.6 per cent per annum from 1990-1995 has resulted in a reduction in the per capita availability of land. Land holdings were highly skewed between households and provided a good indicator of economic disparity between households. Ethnicity and the caste hierarchy are often related to access to land and capital resources, but are not a surrogate for economic well-being. The Chhetri households sampled owned no irrigated land and one household was landless. Livestock are an important component of the farming systems, both in relation to organic matter management and off-farm income (Shrestha 1999). Agricultural assets (land and livestock) were also highly skewed ranging from CDN$0 to CDN$ 53,000 per household. Household gross margins provide a mechanism for assessing the relative profitability of agricultural production between farms, and highlight the importance of cash crop production within the farming system. Households that included a cash crop within their rotation typically had higher gross margins than households growing only staple crops. Gross margins were related to land ownership and household food security, and provide a good indicator of household economic well-being. However, the data requirements vary between indicators. No single socioeconomic indicator encompasses the complexity of relationships within household farming systems, but a series of indicators are useful to indicate trends and relationships.

References

Blaikie, P.; Cameron, J. and Seddon, D. (1980). *The Struggle for Basic Needs in Nepal*. Paris: OECD, Development Centre.

Regmi, M. (1976). *Landownership in Nepal*. Berkeley: University of California Press.

Seddon, D. (1987). *Nepal: A State of Poverty*. New Delhi: Vikas Publishing House Pvt.

Shrestha, B. (this volume). 'Milk Dynamics and Animal Feed Situation, Jhikhu Khola Watershed'. In Allen, R.; Schreier, H.; Brown, S. and Shah, P. B. (eds) *The People and Resource Dynamics Project: The First Three Years (1996-1999)*. Kathmandu, Nepal: ICIMOD.