

STUDY AREAS AND THEIR RESOURCE BASE

The general characteristics (e.g., physical location, topography, soil, climate, infrastructure) of each study area along with their existing resource bases which include human resources, farmland, livestock, forestry, pastureland, and water resource, are discussed below.

General Characteristics

Physical Location, Topography, and Soil

Ekle Gaon, selected for the Crop-dominated Farming Systems' (CDFS) study, falls under ward number three of Dhuskun *Panchayat* (former) in Sindhupalchowk district and is one of the many mountainous districts of the Bagmati Zone in the Central Development Region (CDR) of Nepal (see the country map of Nepal). One of the principal all-weather roads of Nepal, called the Arniko Highway, which links Kathmandu and the Tibetan Autonomous Region of the People's Republic of China, passes through "Bahrabise" a commercial hubhub of the region which is 86km northeast of Kathmandu Valley. Ekle *Gaon* is located at about three hours walk to the east of Bahrabise. The study site covers a large and wide area ranging from 1,050m at the river side called "*beshin*" to "*lekh*" at about 2,200m. However, the major settlement lies at an altitude from 1,600-1,700m.

The study site presents such a unique and long (about 1,200 m) uninterrupted series of verticle terraces of cultivated land with steep slopes (20-45°) that it interestingly delivers the message of a highly developed form of ethno-engineering. Soils are 50-100cm deep and well-drained. Loamy skeleton soils dominate the soil type in the area. The aspect of the site is generally south-facing.

Bhadaure village, chosen for the Horticultural Crop-dominated Farming System (HCDFS) study, is one of the many villages of ward number two of Naubise *Panchayat* (former) in Dhading district which is one of the eight hill and mountain districts of the Bagmati Zone under the Central Development Region (CDR). Naubise bazaar of Naubise *Panchayat* (former), which lies on the Pokhara Highway, is about 26km west of Kathmandu Valley and Bhadaure village is located 2 km east-north from Naubise bazaar. The site in general has a moderate slope with terraces from the top (1,050m) to the bottom (970m). The aspect of the area is west and south-facing. Soils are comprised of loam and silty loam with good drainage.

Yelung site, selected for the Livestock-dominated Farming System (LDFS) study, spreads over ward number five and six of Shyama Village *Panchayat* (former) and is adjacent to Jiri *Panchayat* (former) of Dolakha District, Janakpur Zone, (CDR). The northern part of Dolakha district borders the Tibetan Autonomous Region. Unlike many others, Shyama *Panchayat* (former) is quite large physically. It takes one complete day on foot even to cross one ward of the *Panchayat*.

"Beshin" is a local name for the area which is characterised by a hot and humid climate with rice as the main cultivated crop. The area is mostly near streams and river banks. "Lekh" is the area characterised by cold (e.g., temperate, sub-alpine) climate where potatoes, wheat, and barley are the major crops.

Yelung is three hours' walk from, and located to the east of, Jiri bazaar. The altitude of the site ranges from 1,600m to 3,000m with moderate to steep slopes of mountain terrains facing east to south-east. Well-drained, loamy textured soils are common in the area.

Climate

Ekle Gaon is characterised by a warm and temperate humid climate with a annual mean temperature of about 19°C and a total annual rainfall of about 2,230mm. The monthly minimum temperature ranges from 6°C in January to 19°C in July and the maximum temperature ranges from 18°C in January to 29°C in May. Rainfall is mainly concentrated in the monsoon months. About 90 per cent of the total annual rainfall occurs during June-September. Hailstorms in the area occur in two spells: first, during March-May, and second, during October-November, at an average interval of about two to three years. Frost, which occurs in some areas at higher altitudes during January-February, is not considered as a constraint to crop production by the farmers.

The climate of Bhadaure is subtropical and sub-humid, with an annual mean temperature of 21°C and total annual rainfall of about 1,585mm. The monthly minimum temperature ranges from 7°C in January to 21°C in July and the maximum temperature ranges from 19°C in January to about 35°C in June. The distribution of rainfall is highly seasonal. Of the total annual rainfall, about 88 per cent occurs during the five monsoon months (May-September). Hailstorms occur at an interval of three to four years, mostly during March-May and sometimes during October-November. Frost and snowfall do not occur in the area. However, dewdrops affect tomatoes and other vegetables during January-February.

The Yelung study site has a cool temperate climate. The annual mean temperature of the area is around 14°C. The monthly minimum temperature ranges from below freezing in January to about 17°C in July and the maximum temperature ranges from 13°C in January to about 23°C in June. The average annual rainfall of the area is about 2,139mm, of which about 87 per cent falls during the five monsoon months from May to September. Hailstorms occur in the area at an interval of three years, mostly during March-May. Both frost and snowfall are constraints for winter crops. Frost occurs during December-February while snowfall takes place during January-February at higher altitudes.

Existing Infrastructure

The CDFS study site is about six kilometres away from Barabhise and about eight kilometres away from Lamosangu, both of which are located on all-weather roadsides with four to five daily bus services to Kathmandu. There is a small farmer-managed irrigation system in the area which irrigates the lowlands in the monsoon only. The area has 11 *ghatta* (locally made water turbines), mostly seasonal for grinding grain.

Agricultural support institutions include a Small Farmers' Development Programme run by ADB/N, and a livestock Sub-centre at the site itself, and an agricultural sub-centre at Sunkoshi bazaar, about five km away in the same *Panchayat* (former). There is also one forest nursery very close to Barabhise and Lamosangu.

The HCDFS study site is about one kilometre away from the all-weather highway which connects Kathmandu with the *terai* and a number of western hill districts. There is a very high frequency of buses, trucks, and other vehicles on the highway and this facilitates the flow of goods and services in the area. There is a small farmer-managed irrigation system which irrigates most of the lowlands year round and some uplands in winter. There are two water turbines, one *ghatta*, and a hauler mill for grain processing.

Agricultural support services in the area are provided through ADB/N, the Commercial Bank, the Cooperative Society (*Sajha*), the agricultural sub-centre, and the livestock sub-centre located at Khanikhola, about three kilometres away from the site. In addition, there is one cooperative depot at Dharke (1.5 km), one private horticultural nursery at Khanikhola, one forest nursery at Misakot (6 km), and a horticultural farm at Dhunibeshi (3 km) in the Naubise *Panchayat* (former). Khanikhola and Dharke are the nearest market centres and most of the fruits and vegetables produced at the site are sold here. The site is relatively far better privileged in terms of accessibility and availability of inputs, services, and market facilities compared to other parts of the hills and mountains.

The LDFS or Yelung site is about five kilometres away from Jiri which is connected to Kathmandu by an all-weather road with two to three regular daily bus services. Access to the site from the roadhead at Jiri is only through foot trails. The site lacks irrigation facilities. There are about five *ghatta* for processing food grain.

The existing agricultural support services' institutions in the Shyama *Panchayat* (former) consist of one livestock sub-centre and three sub-branches of the Cherdung Cheese Factory which operate seasonally. There is one forest nursery in the *Panchayat*, and a livestock-breeding farm at Khimti in Ramechhap district which is about seven km away from the site. One livestock farm, one veterinary dispensary, and sub-branch offices of the ADB/N and Nepal Bank Limited, located at Jiri, also provide services to the farmers in the study area. Until now there is no institution, such as branches of the (AIC) Agricultural Inputs Corporation, even at Jiri, and this indicates that the priority of agricultural development is based on livestock development rather than on crops. The pattern and trend of agricultural institutional credit disbursement, as indicated by ADB/N records, also intimate the same.

Marketing Centres

Barahbise and Lamosangu are the two major marketing centres for the whole region of Sindhupalchowk district wherein Ekle *Gaon* lies. People come to these centres to buy essential goods and commodities ranging from clothing materials to food items.

In the case of the HCDFS site, Khanikhola and Naubise are the two major marketing centres in the area. However, many people from the study site go to Dharke - a small centre physically - but probably the biggest market centre in the area, particularly for vegetable growers who bring their fresh vegetables every morning (in season) carrying them on their backs. From there the vegetables are transported by vehicle to Kathmandu.

Jiri bazaar is the only marketing centre for the Yelung area. People come here with their surplus of agricultural products for sale and go back home with some essential daily commodities bought in Jiri. Livestock and their products (e.g., ghee, butter, meat, and eggs) are the major items that farmers sell in Jiri bazaar. Every Saturday there is a *hat/bazaar* in Jiri which remains active from 8.00 a.m to 12.00 noon or 1.00 p.m.

Resource Base

Human Resources

Family Size. The information on family size, economically active members, literacy rate, and population density are shown in Table 4.1. The average family size of the sample households is estimated at 5.07 members for Dhuskun, 7.13 members for Naubise, and 5.50 members for Yelung. Females constitute about 51 per cent of the family members in Dhuskun and Naubise and about 45 per cent in Yelung. In general, there is a positive correlationship between family size and landholding (Annex 2).

Education Status. The average literacy rate is computed at about 49 per cent, 64 per cent, and 48 per cent for Dhuskun, Naubise, and Yelung. Although the literacy rates for males and females are nearly equal in Naubise and Dhuskun, the female literacy rate is 20 per cent higher than males in Yelung (Annex 2). It is also found that, in general, the literacy rate is directly related to farm size.

Economically Active Members. The average number of economically active members per household ranges from 3.13 in Dhuskun to 3.77 in Yelung and 4.77 in the Naubise. The dependency ratio, i.e., the number of dependents per economically active member is highest in Dhuskun (0.62) followed by Naubise (0.49) and Yelung (0.46). The dependency ratio is found to be highest among large farmers in Naubise and among small farmers in Dhuskun.

Table 4.1: Demographic Features of Sample Households at Different Study Sites
(Per Household Averages unless Indicated Otherwise)

Particulars	Dhuskun	Naubise	Yelung
Family Size (Persons):			
Male	2.50	3.50	3.00
Female	2.57	3.63	2.50
Total	5.07	7.13	5.50
Economically Active Members (No.)	3.13	4.77	3.77
Dependency Ratio	0.62	0.49	0.46
Literacy Rate (%)	49.00	64.00	48.00
Population Density per ha of Cultivated Land (Persons)	9.39	7.35	19.64

Source : Household Survey, APROSC 1989.

Note : Details in Annex 2.

Population Density. The population density per hectare of cultivated land is calculated at about seven persons for Naubise, nine persons for Dhuskun, and 20 persons for Yelung. The population density seems to be inversely related to farm size, i.e., the larger the farm size, the lower the population density. Thus, population pressure on cultivated land is highest among marginal farmers and lowest among large farmers.

Occupations. Agriculture is the major occupation of the majority of economically active population for all the study sites. Table 4.2 reveals that the proportion of economically active members with agriculture as their main occupation is highest in Dhuskun (90%) followed by Yelung (75%) and Naubise (69%). The rest of the economically active members are engaged in study, services, business, or other economic activities.

Besides the primary occupations, the economically active members of the sample households are also involved in secondary occupations such as wage labouring, cottage industries, and business. During slack season when family members do not have adequate work on the farm, they engage in secondary occupations in order to generate additional income for their families. Opportunities for secondary occupations are observed to be highest in Naubise.

Table 4.2: Occupations of the Economically Active Members of the Sample Households

Particulars	Dhuskun	Naubise	Yelung
Primary Occupations:			
Agriculture (%)	90.00	69.00	75.00
Study (%)	0.00	28.00	17.00
Services (%)	5.00	3.00	1.00
Other (%)	5.00	1.00	7.00
Secondary Occupations:			
Cottage Industry (%)	12.00	46.00	3.00
Wage Labouring (%)	10.00	3.00	15.00
Business (%)	1.00	1.00	2.00

Source : Household Survey, APROSC 1989.

Farmland

Land Use. Farmland is the major production resource at all the study sites. Table 4.3 shows land use patterns at household levels at the study sites. The total available land per household is observed to be highest in Naubise (1.31 ha) followed by Dhuskun (0.79 ha) and Yelung (0.44 ha). The proportion of available land used for crop cultivation is estimated at about 74 per cent in Naubise, 68 per cent in Dhuskun, and 63 per cent in Yelung. Homesteads of the sample households occupy about 18, 28, and 29 per cent of the total land at the three sites respectively. Homesteads also include the land area used for kitchen gardens. The rest of the land is occupied by orchards and *kharbari* in Naubise, by *kharbari* in Dhuskun, and by forests and *kharbari* in Yelung. Although the proportion of land occupied by homesteads is observed to be higher among small farmers, the actual area covered by homesteads is higher among larger farmers.

Table 4.3: Land Use at Household Levels at Different Study Sites

Particulars	Dhuskun	Naubise	Yelung
Total Land per Household (ha)	0.79	1.31	0.44
Land Use Pattern:			
Homestead (%)	28.00	18.00	29.00
Crop Cultivation (%)	68.00	74.00	63.00
Orchard (%)	0.00	3.00	0.00
Forest (%)	0.00	0.00	7.00
<i>Kharbari</i> /Fallow (%)	4.00	5.00	1.00

Source : Household Survey, APROSC 1989.

Operated Landholding. The average size of operated landholding is estimated at 0.97 ha in Naubise, 0.54 ha in Dhuskun, and 0.28 ha in Yelung (Table 4.4). While lowlands constitute about 40 and 31 per cent of the total cultivated land in Naubise and Dhuskun respectively, there is virtually no lowland at the Yelung site. The share of rented-in land in the operated landholding is about 20 per cent in Naubise, 13 per cent in Dhuskun, and 11 per cent in Yelung. Rented-out land is recorded at 0.07 ha per household among the large farmers in Dhuskun site only. The share of rented-in land in operated landholding is found to be higher among marginal and small farmers compared to medium and large farmers at all the study sites.

Irrigation Status of Operated Land. The survey revealed that irrigation facilities are mostly perennial in nature in Naubise and seasonal in Dhuskun. Table 4.5 reveals that almost all the lowlands are perennially irrigated and about 20 per cent of the uplands are seasonally irrigated in Naubise, whereas only lowlands are seasonally irrigated in Dhuskun. No irrigation facilities exists in the Yelung site.

Table 4.4: Average Size of Operated Landholdings at Different Study Sites

Particulars	Dhuskun	Naubise	Yelung
Operated Landholding:			
Lowlands (ha)			
Uplands (ha)	0.17	0.39	0.00
Total Operated (ha)	0.37	0.58	0.28
	0.54	0.97	0.28
Share of Rented-in Land (%)	13.00	20.00	11.00

Source : Household Survey, APROSC 1989.

Table 4.5: Irrigation Status of Operated Land at Different Study Sites

Particulars	Dhuskun	Naubise	Yelung
Lowlands :			
Perennially Irrigated (%)	0.00	98.00	0.00
Seasonally Irrigated (%)	100.00	2.00	0.00
Uplands :			
Seasonally Irrigated (%)	0.00	20.00	0.00
Rainfed (%)	100.00	80.00	100.00

Source : Household Survey, APROSC 1989.

Fragmentation of Operated Landholding. The average number of parcels per farm is found to be highest in Yelung (12) followed by Naubise (5) and Dhuskun, (4). The average size of parcels is computed at about 0.21 ha in Naubise, 0.13 ha in Dhuskun and, 0.02 ha in Yelung (Table 4.6). The size of parcels seems to be positively related to farm size at all the study sites. The average distance to a parcel of lowlands from the homesteads is estimated at about 18 minutes' walk in the case of Naubise and 42 minutes walk in Dhuskun. Similarly, the average distance in the case of uplands is calculated at about 20, 15, and 31 minutes' walk from a parcel to the homestead at Naubise, Dhuskun, and Yelung respectively.

Table 4.6: Fragmentation of Operated Land and Its Distance from Homesteads

Particulars	Dhuskun	Naubise	Yelung
Number of Parcels per Household:			
Lowlands	1.34	2.27	
Uplands	2.72	2.37	11.90
Total	4.06	4.64	11.90
Size of Parcels (ha):			
Lowlands	0.13	0.17	
Uplands	0.14	0.24	0.02
Average	0.13	0.21	0.02
Distance from Homesteads (min):			
Lowlands	42.00	18.00	
Uplands	14.00	20.00	31.00

Source: Household Survey, APROSC 1989

Tenancy Systems. The information on the number of tenants and the tenancy systems at different study sites is presented in Table 4.7. Tenants, including owner-cum-tenants, account for about 40 per cent of the sample households in Naubise, 30 per cent in Dhuskun, and 23 per cent in Yelung. The remainder of sample households at all the study sites are exclusively owner-operators, except for one landless household in Dhuskun. While 50 per cent of the tenants were reported to have received tenancy rights for their rented-in lands in Naubise, none of the tenants have received tenancy rights in Dhuskun and Yelung. Thus, tenant farmers without tenancy rights do not have any assured incentive for long-term investment in the rented-in land because such land can be taken back by the landlords any time. Share-cropping is the most common system of tenancy in Naubise and Dhuskun. In this system, 50 per cent of the annual crop output is given to the landlords as rent for rented-in land by the tenants. In most cases, tenants themselves manage and supply all kinds of inputs required for the production of crops. Sometimes, the landlords share the cost of some inputs such as seeds and fertilizers. The fixed rent system of tenancy predominates in the Yelung site and is also found to some extent in Naubise. In this system, tenants have to pay predetermined rent, either in cash or kind, to the landlords for the rented-in land and, in return, they are entitled to receive all the crop outputs. Tenants have to bear all the input costs incurred in the production of crops.

Information on crop production in terms of their input-output coefficients, including cropping pattern, cropping intensity, FYM/compost and chemical fertilizer application, and crop yields are presented in Annex 3.

Table 4.7: Tenants and Tenancy Systems at Different Study Sites

Particulars	Dhuskun	Naubise	Yelung
Total Number of Sample Households	30	30	30
Exclusive Owner Operators (No.)	20	18	23
Owner-cum-Tenant Operators (No.)	8	10	7
Exclusive Tenant Operators (No.)	1	2	0
Landless (No.)	1	0	0
Tenancy System:			
- Share-Cropping (% of tenants)	100	67	0
- Fixed Rent System (% of tenants)	0	33	100

Source: Household Survey, APROSC 1989.

Livestock

Livestock Holding Size. Livestock are a very important part of the total resource base that the farmers hold. On average, a farmer maintains 3.39 head of cattle, 1.6 buffaloes, 2.44 goats, and 2.23 poultry (including 0.46 pigeons) in Naubise, whilst the figures for Dhuskun are 2.2, 0.86, 2.73, and 3.70, and for Yelung 2.2, 2.33, 2.96, and 2.20 respectively, including 0.07 sheep and 4.27 head of *chauri* (Table 4.8). Table 4.9 and 4.10 indicate that there is a positive correlation between farm family size and livestock holding, and, apart from in the case of marginal farmers in Dhuskun, the per capita livestock holding size is more or less the same.

Table 4.8 reveals that all farmers at all study sites, irrespective of their farm size, maintain a mixed herd where cattle, buffaloes, and goats seem to be the most popular type of animal raised. The farmers in Yelung also maintain sheep and *chauri* in addition to other types of animal. It is interesting to note that irrespective of the farm size all farmers are maintaining virtually the same number of animals at Yelung. This implies that livestock raising may be a function of the amount of fodder supply from public land.

Cattle, including *chauri*, constitute about 60 per cent of the total LSU and appear to be the most important animals to farmers at all study sites, followed by buffaloes, sheep, and goats. Needless to say, *chauri* are the favourite animals of the farmers in Yelung and these alone account for about 45 per cent of the total LSU.

Table 4.8: Average Livestock Holding Size Per Household By Type of Animal and Study Site
(in No.)

Animal	Dhuskun	Naubise	Yelung
Cattle	2.20	3.39	2.20
Buffalo	0.86	1.67	2.33
Goat	2.73	2.44	2.96
Sheep	-	-	0.07
Poultry	3.70	1.77	2.20
Pigeon	-	0.46	-
<i>Chauri</i>	-	-	4.27

Source : Household Survey, APROSC, 1989.

Table 4.9: Average Livestock Holding Size Per Household by Farm Size and Study Site
(in LSU)

Farm Size	Dhuskun	Naubise	Yelung
Marginal	1.60	-	7.17
Small	2.82	3.15	7.07
Medium	2.60	3.17	8.71
Large	4.24	5.74	-
Overall	2.70	4.19	7.41

Source : Household Survey, APROSC 1989.

Livestock Density. The average livestock densities per hectare of cultivated land are computed at 4.32, 5.00, and 26.64 LSU for Naubise, Dhuskun, and Yelung respectively. Table 4.10 clearly depicts that livestock farming is more important to small and marginal farmers than to larger farmers.

The highest determining factor for livestock raising in the hills and mountains is the fodder supply from public land or common property (e.g., forest, pastureland) rather than private land (e.g., cultivated land), although family size also does influence the holding size positively. Although the livestock holding size for larger farmers with a larger landholding size (Table 4.9), the density of livestock per hectare of cultivated land by farm size is just the opposite (Table 4.10). The densities among marginal and small farmers are more than two or three times higher than those of middle and large farmers. This clearly indicates that common property resources are much more important to small and marginal farmers than to larger farmers, apart from in Naubise where the CPRs virtually do not exist.

The importance of livestock raising is much higher in Yelung and Dhuskun than in Naubise as indicated by the fact that the share of livestock to total cash farm income are estimated at 98, 47, and 10 per cent respectively (Annex 4, Table 1). This has a direct relevance to the availability of fodder supply from the CPRs. If one hectare of CPR is available for about 2.5 livestock units (LSU) in Yelung then the estimated figures for Dhuskun and Naubise are about 5.0 and 20.0 LSU respectively*.

Table 4.10 also indicates that as the altitude of an area increases so does the importance of livestock raising. This is manifested by the livestock raising situation in Naubise, Dhuskun, and Yelung where the elevation is estimated at 1,000m, 1,000-2,500m, and 1,600-3,000m respectively.

Table 4.10: Livestock Density Per Unit of Cultivated Land by Farm Size and Study Site

Farm Size	Dhuskun		Naubise		Yelung	
	Average Size of Operated Landholding (ha)	Livestock Density (LSU/ha)	Average Size of Operated Landholding (ha)	Livestock Density (LSU/ha)	Average size of Operated Landholding (LSU/ha)	Livestock Density (LSU/ha)
Marginal	0.12	13.33	-	-	0.15	51.21
Small	0.40	7.05	0.36	8.75	0.37	19.11
Medium	0.73	3.59	0.79	4.01	0.63	13.83
Large	1.19	3.56	1.60	3.59	-	-
Overall	0.54	5.00	0.97	4.32	0.28	26.64

Source : Household Survey, APROSC 1989.

Livestock Production

Except for a few cross-breeds all animals are local and indigenous and thus their performances are genetically poor. Livestock production is also influenced by spatial and temporal dimensions. Buffaloes, for instance, which are kept mainly for milk production, produce about 1,065 litres per 300 days lactation in Naubise and 595 litres in Yelung during the same lactation period. The proportion of cross-breed buffaloes is much higher in the former study site than in the latter. The milk yield rate is not reported in the case of Dhuskun, not because there were not many animals in the study area but because no single sample household had a buffalo at the milking stage. Table 4.11 also reveals that cows produce a very small amount of milk.

* It is roughly estimated that about 200 households are using 600 ha of CPRs in Yelung and 240 and 245 farm households are estimated to have used 130 ha and 50 ha of CPRs at Dhuskun and Naubise study site respectively.

This is the reason why farmers prefer cattle for draft power and manure production. Because it is seasonal in nature, almost two-thirds of the total annual milk production takes place during one-third of the year (June/July - September/October).

Goats and sheep are also important animals and are raised mainly for meat and wool. Although goats are small in size (about 20 - 25 kg live weight at maturity) and slow in growth, they are prolific and hardy - suitable for the rough terrain of the mountains. Unlike in many other countries, goats are not maintained for milk production in Nepal. Sheep and goats are also being used as pack animals, particularly in the high mountains. They can carry a load of 5-10 kg. Both the wool (about 0.3-1.0 kg per animal per year) and meat production (25-30 kg live weight of adult animals) of sheep are very low owing to inadequate nutrition level and poor genetic make up.

Table 4.8 reveals that a few poultry are raised by the households at all study sites. However, their egg and meat production is very low because they are of indigenous breed. On an average, one layer produces 30-50 eggs per year and the live weight of one bird is 1.0-1.5 kg.

The sample households did not report keeping *yak*, which can be found at high altitudes, ranging from 12,000 - 15,000/16,000 ft, and do not generally descend below 10,000 ft. But *chauri*, a cross-breed of *yak/nak* and hill cattle, seems to be quite a popular animal, particularly in Yelung. In this area, *chauri* are kept mainly for milk production in small herds of 10 animals, otherwise, as per the farmers' version, they are not economical since, unlike in many other areas, *chauri* are not used for transportation purpose. Farmers were found to have maintained a maximum herd of 22 *chauri* (all adult females) mainly for milk production. Table 4.11 indicates that, on average, one female *chauri* produces about 300 litres of milk per 180 days lactation period.

Table 4.11: Milk Yield Per Lactation Per Animal By Study Site
(in Litres)

Animal	Dhuskun	Naubise	Yelung	Lactation Per for all study sites (days)
Cattle	125	428	254	204
Buffalo	-	1065	595	300
<i>Chauri</i>	-	-	307	180

Source : Household Survey, APROSC 1989.

Animal Feed

Animal feed, in the context of the hills and mountains, has been recognised as probably the most crucial element behind the low productivity of livestock. They remain half-fed most of the year, except during summer and the rainy season (June/July to September/October), particularly in the case of the Naubise and Dhuskun sites. About 80 per cent of the total feed supply is available during this time period in Naubise and under 45 per cent in the Dhuskun area. It is a difficult to give this type of account in the case of Yelung because it is cumbersome to assess both the quality as well as the quantity of green fodder made available through grazing during that time period, since it accounts for a major share of the total feed supply. However, based on observation and discussion with key informants, there is abundant green fodder during that time period and some proportion of the fodder is wasted due to lack of conservation practices.

Green fodder is simply cut and carried from private lands during summer and the rainy season when green grasses are adequately available. However, this also takes place on public land, for short time periods, when the demand for labour for agricultural activities is highest. This prevents the grazing of animals, particularly in the Naubise and Dhuskun areas. Farmers, instead, prefer to resort to stall-feeding practices which demand less labour than grazing, especially when grasses are widely available. An increase in the rate of school-going children has also adversely affected livestock farming and this problem is compounded because one self-help activity, a traditional indigenous management practice that saves labour by the co-herding the animals of four or five farm households by one individual on a rotation basis, has slowly ceased to exist.

The intensity of stall-feeding is, in fact, increasing over time because of intensive cultivation practices to meet increased food demands. Cultivated land in the past used to be kept fallow at least for four or five months in a year and this permitted grazing. Currently, grazing takes place mainly on forest and pastureland during winter in Dhuskun and Naubise. Whereas in Yelung, grazing takes place almost throughout the year.

Table 4.12 depicts that the livestock production in Naubise virtually depends on private lands (e.g., cultivated land, homesteads, etc) which contribute about 90 per cent of the total feed supply in the form of green fodder (e.g., grasses, weeds, and tree fodder), dry fodder (e.g., crop by-products - sprays, stover, etc), and concentrated feed - *khole**. The table also implies that as the elevation of the area increases the proportion of animal feed supply from private land decreases and the contribution of common or public land (e.g., forest, pastureland) increases (from about 10 per cent in Naubise to 90 per cent in Yelung) and so does the importance of livestock keeping. Therefore, the livestock production system is closely associated with accessibility to forest and pastureland which provide low-cost inputs in the form of green fodder. This is further corroborated by Table 4.13; the share of concentrated feed- a high cost input - is very low (less than 1%) in the livestock-dominated farming system study sites, compared to 'Naubise' (horticultural crop-dominated farming site) where the figure is 10 per cent of the total feed supply.

Table 4.12 also clearly shows that the animal feed deficit is a general norm in all study sites, ranging from one-third to one-half of the total requirement. For detailed information regarding fodder supply from different sources, and the assumptions made for computing the demand and supply of animal feed, see Annex 5.

Table 4.12: Total Annual Animal Feed Supply Per Household By Source and Study Site
(TDN in kg)

Source of Supply	Dhuskun	Naubise	Yelung
Cropland	1334 (68)	2193 (90)	572 (9)
Forest/Pastureland [1]	619 (31)	220 (9)	5629 (90)
Market [2]	11 (1)	11 (1)	33 (1)
Total Feed Supply	1964 (100)	2424 (100)	6234 (100)
Total Feed Requirement	2916	4525	8003
Balance (in percentage)	(-33)	(-46)	(-22)

Source: Household Survey, APROSC 1989.

Note : Figures in parentheses are percentages of the total feed supply. Negative figures indicate deficit.

* About 1kg of cereal grain (e.g., maize, wheat, paddy, millet, barley) is boiled with 4 or 5 litres of water and some salt-called *khole*-and is given to milking and draft animals.

Table 4.13: Proportion of Animal Feed Supply by Types of Feed and Study Site

- TDN in kg
- proportion in %

Types of Feed	Dhuskun		Naubise		Yelung	
	TDN	Proportion	TDN	Proportion	TDN	Proportion
Green Fodder	738	24.9	591	41.5	858	13.7
Dry Fodder	1845	62.3	369	25.9	242	3.9
Concentrates	54	1.8	244	17.0	41	0.7
Grazing	327	11.0	220	15.6	5093	81.7
Total	2965	100.0	1424	100.0	6234	100.00

Source : Household Survey, APROSC 1989.

Animal Disease

Internal parasitic diseases are more prevalent and serious and directly affect the productivity of animals in terms of reduced amount of milk and meat. The mortality rate of particularly small ruminants is very high because of this disease. Some other virus diseases also cause multiple deaths of animals and poultry and occur from time to time because of weak government, animal-health support programmes.

Forestry

There is a very limited area under forests at the Bhadaure study site. Only about two hectares of forest are being freely utilised. Most of the 50 ha of accessible forests (Annex 6) are either completely controlled by the Government or *Panchayat* (former). This is so because of the degraded vegetative cover of the forest which is now undergoing a process of improvement. There are small patches of forest, including the *Baluwa danda*, *Machendra*, and *Kaldhara forests*.

The crop-dominated farming system study site, observed in Ekle Gaon, seems to be relatively better off as far as the existence of a forest resource base is concerned. Unlike Naubise *Panchayat* (former), land use data in Dhuskun were not available. However, efforts were made to estimate the area under forests with the help of key informants, and thus the validity of the data presented here is subject to confirmation. Altogether about six patches of forest covering an area of about 130 hectares seem to be accessible or under use in the study site. Out of these three patches, 86 ha are categorised as *Panchayat* (former) protected forest (PPF), a *Panchayat* (former) forest (PF), covering about 22 ha of the area, and the remaining two patches of about 25 ha are informally recognised as community forest. Most of the area under PPF has been newly afforested whereas the PF (completely controlled by the former *Panchayat*) has about 50 per cent of good vegetative cover. At present, the distance to the forests from the villages ranges from one to five kilometres. Forests are the source of fodder, fuelwood, and timber. Some of the local names of the available trees are - *khashru*, *ghurbiso*, *jhingaune* and *katus* for fodder; *babiyo*, *kimbu*, *salimo*, *furke*, for green grass; *angeri*, *gurans*, *mahuwa*, for fuelwood trees; and *utis*, *chilaune*, *sal*, *lapsi*, *faledo*, for timber. *Banmara* is a widely available plant which can be used only as bedding material for livestock.

- 1) It is estimated that about 10 per cent and 20 per cent of the total feed requirements (1,080 kg TDN per LSU per year) in Naubise and Dhuskun respectively have been met through grazing on fallow land, in forests, on grazing land. In Yelung the figures are estimated at 50 per cent in the case of cattle, buffaloes, sheep, and goats and about 80 per cent in the case of *chauri* which remain on grazing land and alpine pastureland throughout the year.
- 2) Some cereals and pulses are also being purchased from the market for the animals feed.

Yelung study site is particularly rich in common property resources (e.g., forest, pastureland). However, it has become extremely difficult to estimate the area under the resources due to the unavailability of scientifically measured data. In this area, forest and pastureland are synonymous, therefore they will be discussed in the subsequent section - although some dense forests do exist in this area, for example - Cherdung forest with about 200 hectares is at a distance of about 2.3 hours' walk.

Pastureland/Grazing Land

There is virtually no pasture or grazing land at Naubise site. Animals graze along the stream and river banks. All available land has already been brought under cultivation. In the case of Dhuskun site, there are small and sporadic patches of pasture and grazing land inside the forest area itself and they are being intensively used because of the lack of reasonably adequate areas for animal grazing. Therefore, both study sites face serious problems in livestock grazing. The available limited area, suitable for grazing land, is also slowly being destroyed and used for cultivation.

However, the Yelung study site still has a large proportion of pastureland and meadows in relation to its total physical area. According to information from key informants, pastureland accounts for over 600 hectares. '*Khark*', a local name for pastureland meadows, provides a good source of animal feed in the form of green grass. This is being used throughout the year whenever and wherever possible and tree fodder has been considered a supplemental feed, particularly during winter when fodder scarcity arises. '*shiru*' and '*khashru*', local names for green grass and tree fodder respectively, are widespread. Some clover grasses are also sporadically available, particularly during the summer and rainy seasons. This is the residual effect of efforts that were made 10-12 years ago to improve the whole pastureland, through broadcasting clover seeds, by the Swiss Development Cooperation (SDC)-assisted government livestock development farm located at Jiri.

The livestock-dominated farming study site (Yelung) is a cluster of a few villages which are surrounded by forests and pastureland within a distance of a quarter of an hour to one hours' walk. A rough estimation indicates that about 2,000-2,500 ruminants (e.g., cattle, buffaloes, sheep, goats, and *chauri*) are using the whole pastureland area. This indicates that one hectare of pastureland is available for about four ruminants or about 2.5 LSU.

Water Resources

Yelung and Naubise sites appear to be better off in water resources compared to Dhuskun. There is no major river in any of those study areas. A small river system, consisting of Mahesh *Khola**, Khani *Khola*, and Naubise *Khola*, which are permanent in nature, are located within the periphery of one to two kilometres in distance from the Naubise study site. However, Mahesh *Khola* appears to be of prime importance to the people as far as the use of water is concerned. Dabi *Khola*, in the Dhuskun area, flows along the lower part (at an altitude of about 1,100m) of the study area which is three to four kilometres in distance from the main villages (at an elevation of 1,600m-1,800m) where the majority of the people reside.

* *Khola* is a local name for a small river which is permanent in nature.

There are also two or three small streams that can be used only during summer or the rainy season, because they are temporary in nature. Khimti, Yelung, and Lohara Kholas are the principal small rivers in the Yelung area. However, Yelung Khola which flows from the centre of the study area, is most important to the people since it can be used throughout the year. At present, the khola is being used to run 'ghattas' (water mills) and to irrigate land. In addition, there are a few streams which are used seasonally.

The available water resources are used for drinking water, irrigation, and to run water mills ('ghatta') in all study areas. Power generation has not taken place so far in any area. The existing water resources are yet to be meaningfully tapped.