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## **Assessment of Food Self-Sufficiency and Food Security Situation in Nepal**

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### **Abstract**

Realizing the importance of food self-sufficiency in achieving the household food security, this paper tried to assess the food self-sufficiency situation in village areas of Nepal. Agriculture was the main source of livelihood and Bahun/Chhetri was the dominant ethnic group. Involvement of households in agriculture was found declining with the attainment of higher level of education resulting into higher concentration of illiterate and just literate manpower in this sector. The major resource determining food self-sufficiency of households, land holding and coverage of irrigation was higher among Bahun/Chhetri ethnic group and in Tarai ecological region. The better irrigation coverage together with relatively high access to production resources led to the higher crop yield among Bahun/Chhetri ethnic group and in Tarai. Thus, Tarai was experiencing surplus food crops production, which was merely enough to fulfill the deficit of Hills and Mountain regions. Food self-sufficiency was achieved among 72% of households in Tarai region while the figure of Mountain region was only 11%. Similarly, the highest proportion (53%) of Bahun/Chhetri households achieved food self-sufficiency compared to mere 10% of Occupational caste households. Together with small land holding and low productivity, production shift from food crops to cash crops were also the major factors responsible for food self-insufficiency. Purchasing was the most dominant means to fulfill the deficit food. About 20% of food self-insufficient households were unable to meet minimum level of food security threshold income for deficit months. This constituted 10.2% of sample households, who were in chronic food insecurity situation. The incidence of chronic food insecurity as well as poverty gap was the highest in female-headed households, Mountain region, Occupational caste, daily wage laborers and small landholders. Education received the highest priority for the cash income expenditure followed by food items and agriculture promotion. This expenditure patterns show the positive indication to move towards food self-sufficiency and ultimately to food security if provided with better off farm employment opportunities and better market for both farm produces and essential inputs.

### **1. Introduction**

Nepal is an agrarian country. Agriculture is the main source of livelihood for 65.7 % of its population. Agriculture sector generates employment opportunity for majority of rural households contributing 38.3% of total gross domestic product (MOAC, 2005a). In contrast to this huge dependency on agriculture, still 46 out of 75 districts in

the country are experiencing food deficit situation. Among these, 13 districts (out of 16) are from the Mountain and 33 (out of 39) are from Hills (CBS, 2003a). However, due to surplus production in Tarai, the country in overall is producing surplus food revealing the country to be self-sufficient in food production. (ProPublic, 2002 and MOAC, 2005b).

This signifies that the country is self-sufficient in food at macro level and has enough food to feed its all people. At district level, however, 61.3 % of districts are facing food deficit situation. The case is similar at household level as well. Only 39.8 % households in the country are self-sufficient in food production (CBS, 2003b). The rest have to meet the food demand from the external sources. Borrowing and purchasing from the income earned within district, outside district but within the county and outside country are the important means to fulfill the household food demand (CBS, 2004).

Considering the notion of Sen (1981), food self-sufficiency is mainly related to production-based entitlement. Besides production-based entitlement, one can also acquire food through trade, trade-based entitlement. Borrowing and purchasing is the common form of trade-based entitlement in Nepal. Food self-sufficiency, a production based entitlement to acquire food is regarded as a principal indicator of food security in developing countries like Nepal where access of rural households to the food is limited due to inadequately developed marketing channel (Osmani, 1998 and Thomson and Metz, 1998). Together with this limited non-farm employment opportunities also justifies the importance of food self-sufficiency, study to understand the food security situation. Thus, food self-sufficiency at household level in developing countries like Nepal resembles the food security status of the households in greater extent. Food self-sufficiency, however, in the country is still inconsistent and is fluctuating over time (Osmani, 1998 and MOAC, 2005b). More importantly the overall growth rate of food production in the country has not kept in pace with population growth rate (Maharjan, 2003). Therefore, understanding food self-insufficiency is considered to be critical to cope with the problem of food insecurity (Alaimo *et al.* 1998). Together with food self-sufficiency, income level study of households dealing with trade-based entitlement will also help to understand food security situation, particularly whose calorie requirements are not met by the own farm production.

Thus, realizing the importance of food self-sufficiency in achieving the food security goal of the country the study was intended to 1) assess the food self-sufficiency situation in village areas<sup>1</sup> of the country, 2) analyze the effect of various socioeconomic factors on food self-sufficiency at household level, and 3) analyze the reason for food deficit and means to fulfill the deficit food. Together with this, the study also tried to relate the food-self sufficiency with the income level of households to assess the food security situation. The study, therefore, considered the production-based entitlement as the first step of analysis and trade-based entitlement as the second step. Trade-based entitlement will be confined to those whose production entitlement is not sufficient to meet the calorie requirement of households.

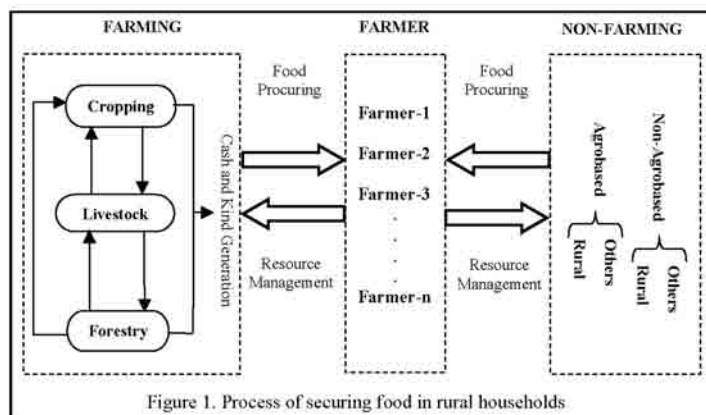
## **2. Means for securing food in rural Nepal**

Agriculture sector in the country is still subsistence in nature making the people dependent on agriculture to meet their daily needs, especially food (Maharjan and Khattri-Chhetri, 2005). The majority of farms in Nepal operate mixed farming system integrating crop and livestock with the forest resources. Each of these components is interdependent and well integrated with each other using products and by products of the other in an efficient way.

All these three components of farming in integration supply food, fuel, clothing, shelter, labor and other needs of farmers (Majarjan, 2003). This procured goods specially foods are consumed directly. Others non-food items including some surplus or even deficit foods (distress sell) are indirectly consumed by exchanging them with various foods and or cash for meeting their food needs and other basic needs. This has been practiced in a systematic way by sustainable management of locally available resources through community participation.

This integrated nature of farming, however, is changing rapidly. Cash income generation through the introduction of cash crops including food crops at commercial level has become more and more prevalent nowadays. In recent years, rapid population growth and degradation of the resource base especially land and forest is creating greater hardship in procuring food from their own production (Adhikari and Bohle, 1999). In addition, the mounting challenges of education, employment, health care, transportation and communication services in rural areas have forced rural people to migrate in urban areas for an improved livelihoods (Bhandari, 2003). This led to the shift from farm activities to non-farm activities. These non-farm activities within the region and beyond are both agro-based as well as non-agrobased. Non-farm agrobased activities include food and agro processing and marketing activities, and non-farm non-agrobased activities mainly includes involvement in service sectors, which are private and governmental, business and laboring within the region and beyond (Maharjan, 2003).

Thus, kind and cash derived from farming with the management of resource available and the cash derived from non-farming sector are the important means of procuring food in rural Nepal. Figure 1 reflects the basic relationship among various components of Nepalese farm households and the way of procuring food. The figure served as conceptual framework for this study.



Source: Maharjan, 2003.

### 3. Methodology

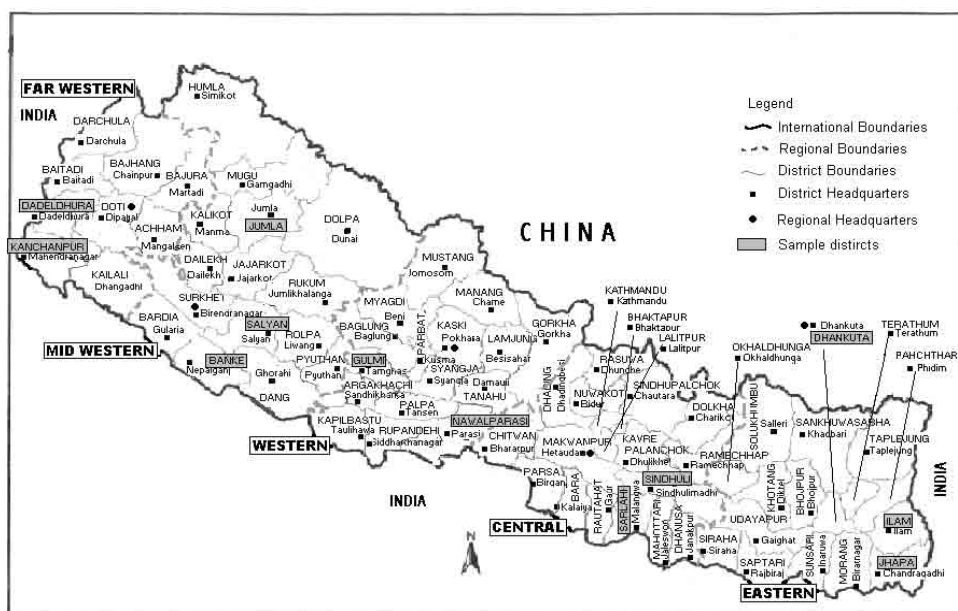
Twelve districts were selected through the stratified random sampling techniques representing each of the five development regions<sup>2</sup> and three ecological zones<sup>3</sup> (Figure 2). The Village Development Committees (VDCs) adjoining to the headquarters of the districts were selected for the study. These VDCs were purposively selected to solicit the food securing means that people tend to choose beyond agriculture when they are self-insufficient and there are seemingly more such opportunities in those VDCs. Thus, the study may have limitations in

representing the hinterland of the country. All the population of the sampled districts constituted the study population for the research. Thus, for simplicity non-probability sampling techniques was used to select the respondents. Forty respondents from different VDCs of each sampled district were randomly identified with the help of District Agriculture Development Office together with the agriculture service centers and sub centers of the respective districts and VDCs. However, the complete responses were received only from 430 respondents (Table 1). The survey was conducted in the year 2003 using pre-tested structured questionnaires for collection of primary data. These data were supplemented by the data and information obtained through observations, informal group discussions and secondary sources, as well.

**Table 1.** Sample size and food balance of the sample districts by development regions

Development Regions	Districts	Sample size	Food balance
Eastern (n = 116)	Ilam (Hill)	37	Negative
	Dhankuta (Hill)	40	Negative
	Jhapa (Tarai)	39	Positive
Central (n = 57)	Sindhuli (Hill)	29	Negative
	Sarlahi (Tarai)	28	Positive
Western (n = 77)	Gulmi (Hill)	39	Negative
	Nawalparasi (Tarai)	38	Positive
Mid Western (n = 104)	Salyan (Hill)	39	Positive
	Banke (Tarai)	29	Positive
	Jumla (Mountain)	36	Negative
Far Western (n = 76)	Kanchanpur (Tarai)	38	Positive
	Dadeldhura (Hill)	38	Positive
Total		430	

Source: CBS, 2003a



**Figure 2.** Map of Nepal showing sample districts

Data on socioeconomic characteristics, food crops production, food self-sufficiency, perception on reasons for food self-insufficiency, means to fulfill deficit food and preferred areas of expenditure of cash income were collected. Results were summarized using descriptive statistics mainly frequency and cross tables.

Food self-sufficiency was measured through total calorie available for consumption to households from their own farm production and requirement based on adult equivalent<sup>4</sup> of respective households for a year. The major food crops namely, rice, wheat, maize, millet, barley and potato were taken into consideration for the estimation of calorie availability (CBS, 2003a). The basic standard calorie requirement of 2144 kcal/person/day in the Tarai and 2344 kcal/person/day in the Hills and Mountain based on CBS (2003a) was considered for the study. It is estimated that 87.3% of this calorie is generally available from the food crops (Gautam, 1993). The food crops requirement, thus, was estimated at 2046.3 kcal/person/day for Hills and Mountain, and 1871.7 kcal/person/day in Tarai. Therefore, food self-sufficiency was calculated based on the food crops requirement and available from self-production. Calculation of calorie available, requirement, balance and food self-sufficiency months was based on equation 1, 2, 3 and 4, respectively.

$$\text{Calorie available } (CA_i) = a_1 \text{paddy}_i + a_2 \text{maize}_i + a_3 \text{wheat}_i + a_4 \text{millet}_i + a_5 \text{barley}_i + a_6 \text{potato}_i \text{----- } 1$$

Where,

$CA_i$  = Calorie available in  $i_{th}$  household

$x$  = Conversion factor from paddy to rice i.e. 0.6175

$a_1$  = Calorie conversion factor of paddy i.e. 345 kcal per 100 gm

$a_2$  = Calorie conversion factor of maize i.e. 342 kcal per 100 gm

$a_3$  = Calorie conversion factor of wheat i.e. 346 kcal per 100 gm

$a_4$  = Calorie conversion factor of millet i.e. 309 kcal per 100 gm

$a_5$  = Calorie conversion factor of barley i.e. 336 kcal per 100 gm

$a_6$  = Calorie conversion factor of potato i.e. 97 kcal per 100 gm

$\text{paddy}_i, \text{maize}_i, \text{wheat}_i, \text{millet}_i, \text{barley}_i$  and  $\text{potato}_i$  = Food crops produced in  $i_{th}$  household

$$\text{Calorie requirement } (CR_i) = (\text{scr} * 0.873) * \text{famsize}_i * 365 \text{----- } 2$$

Where,

$CR_i$  = Calorie requirement of  $i_{th}$  household

$\text{scr}$  = Standard calorie requirement i.e. 2144 kcal/person/day in Tarai and 2344

kcal/person/day in Hills and Mountain

$\text{famsize}_i$  = Family size of  $i_{th}$  household (adult equivalent)

$$\text{Calorie balance } (CB_i) = CA_i - CR_i \text{----- } 3$$

Where,

$CB_i$  = Calorie balance of  $i_{th}$  household

Food self-sufficiency is simply calculated dividing calorie available by monthly calorie requirement of the given household (equation 4)

$$\text{Food self-sufficiency months } (FSS_i) = CA_i / (CR_i / 12) = (CA_i / CR_i) * 12 \text{----- } 4$$

Where,  $FSS_i$  = Food self-sufficiency month of  $i_{th}$  household

In this analysis, household with food crops calorie requirement fulfilled for 12 months or more were considered as food secured. Those unable to meet their food crops calorie requirement were considered as food self-insufficient households. In case of food self-insufficient households' income was then taken as basis to assess their food security status. For this, the minimum threshold income of Rs 300 per month per person at 1988/89 constant price converted into the value at 2003 using yearly inflation rate of the country was taken into consideration to assess the poverty (Koirala and Thapa, 1997 and IPRAD, 2005). Magnitude of poverty was assessed through head count index and poverty gap index to consider both the number of poor people and depth of poverty (Ravallion, 1992). Thus, it is considered as the combined measure of incidence of poverty and depth of poverty (equation 6). The closer the value move towards 1 higher will be the depth of poverty.

$$PG = \frac{1}{n} \sum_{i=1}^{q=n} \left[ \frac{z_i - y_i}{z_i} \right] \text{ ----- 6}$$

Where,

PG = Poverty gap

$z_i$  = Food security income threshold level for  $i_{th}$  household (equation 7)

$y_i$  = Income of  $i_{th}$  household

q = Total number of poor households

n = Number of poor households

$$z_i = (12 - FSS_i) * I * FS_i \text{ ----- 7}$$

Where,

$FS_i$  = Family size of  $i_{th}$  household

I = Monthly minimum threshold income level per person (Rs. 895.1 at 2002/2003/ constant price)

## 4. Result and discussion

### 4.1 Socioeconomic characteristics

Majority (88.8%) of the sampled households were male headed (Table 2). Bahun/Chhetri (*Indo Aryan* origin) was dominant ethnic group (79.3%) followed by Mongoloid (*Tibeto Burman* origin), Occupational caste (*Damai, Kami, Sarki, Kalwar, Poda, Muslim*), and Newar (Indigenous). This clearly indicates that the Bahun/Chhetri was widespread throughout the country, especially in the village areas adjacent to headquarters of district. This was mainly due to better opportunities offered by nearby city areas like market and infrastructure accessibility with low cost of living compared to urban areas. In addition, Bahun/Chhetri represents 87% of participation in state bureaucracy (Pradhan and Shrestha, 2005). Dominancy of Bahun/Chhetri in state bureaucracy also led to high concentration of these caste groups in vicinity of administrative centers. These caste/ethnic group notably constitutes 80% of total migrants migrated most often from remote rural areas to relatively accessible rural and urban areas (CBS, 2003a). Thus, distribution of caste/ethnicity reported in this study might not resemble the actual distribution of caste/ethnicity in the country, where Bahun/Chhetri constitutes around 30% of total population (CBS, 2004).

**Table 2.** Distribution of sampled households based on social characteristics

Attributes	Frequency (n=430)	Percentage
<b>Household head</b>		
Male	382	88.8
Female	48	11.2
<b>Caste/ethnicity</b>		
Bahun/Chhetri	341	79.3
Mongoloid	40	9.3
Newar	18	4.2
Occupational caste	31	7.2
<b>Education</b>		
Illiterate	34	7.9
Non-formal and primary education	186	43.3
Secondary education	142	33.0
College education	68	15.8
<b>Occupation</b>		
Agriculture	392	91.1
Business	15	3.5
Service	21	4.9
Daily wage	2	0.5
<b>Family size-adult equivalent (Average family size = 5.8)</b>		
Small (<5)	174	40.5
Medium (5-10)	241	56.0
Large (>10)	15	3.5

Source: Field Survey, 2003

Education is crucial for adoption of any improved technology in agriculture, which ultimately aids to food self-sufficiency. Most (43.3%) of the households were literate (able to read and write through non formal and primary education). Similarly, 33% attended secondary education and 15.8% attended college education, whereas 7.9% were illiterate, unable to read and write (Table 2). Agriculture was most dominating occupation with 91.1% of households engaged in it. This indicates that agriculture still remained important source of livelihood for majority of the people in village areas of Nepal. Average family size, adult equivalent, was 5.8 persons per household. Majority (56%) of households had 5-10 members in their family i.e. medium size family, followed by small size family.

Medium size farm was the dominating one with holding between more than 0.5 to 2 ha. This medium size farm constituted 73.9% of the households followed by small (15.6%), and large (10.5%) (Table 3). Average size of holding was 1.17 ha per household, which is higher compared to national average of 0.8 ha (CBS, 2003b). Irrigation is vital for agriculture, however 30% of households had land without any sort of irrigation. Though 70% of farmers had access to irrigation facility, only 33.3% of the total land, however, was irrigated. Livestock ranging from cattle to poultry i.e. buffalo, cattle, sheep, goat, and poultry were common for all households. Livestock holding was, thus, calculated by livestock standard unit (LSU<sup>5</sup>), which help to aggregate the number of different



types of livestock into a standard one. The average livestock holding size was 5.27 LSU and 39.1% households had greater than 0 to 5 LSU, whereas 20.7% of households did not hold any livestock.

**Table 3.** Distribution of sampled households based on economic characteristics

Attributes	Frequency (n=430)	Percentage
<b>Land holding (Average landholding = 1.17 ha)</b>		
Small (<0.5 ha)	67	15.6
Medium (0.5-2 ha)	318	73.9
Large (>2 ha)	45	10.5
<b>Irrigation accessibility</b>		
Accessible (Average holding = 0.39 ha)	301	70
Non-accessible (Average holding = 0.78 ha)	129	30
<b>Livestock holding (Average LSU holding = 5.27 LSU)</b>		
No livestock	89	20.7
Above 0 - 5 LSU	168	39.1
Above 5 – 10 LSU	139	32.3
Above 10 LSU	34	7.9

Source: Field Survey, 2003

#### 4.2 Education and occupation

Education is crucial for development of any sector. Bhattarai and Narayanamoorthy (2003) reported the largest marginal positive impact of rural literacy on agricultural yield. The direct relationship of technical change and agricultural yield led to this conclusion. Education facilitates adoption of improved technology, selection of appropriated mix of crop and input, and timely application of these inputs including the farmers' ability to effectively process market, and price information and farm managerial decision.

In this study, involvement of respondents in agriculture was found declining with the attainment of higher education. Table 4 clearly depicts that for illiterate people in villages, there were no other option than to depend on agriculture and daily wage laboring. Out of 34 illiterate respondents 33 were engaged in agriculture composing 8.4% of agriculture dependent households. Similarly, high proportion of respondents who were literate (attained non-formal or primary education) and attained secondary school education constituted 46.7% and 34.7% of households dependent in agriculture, respectively. In contrast to this 10.2% of respondents involved in agriculture attained college education. Service and business sector comprised the highest proportion (90.5% and 60% respectively) of college education attained respondents. This resembles that the higher education level offers the people with varieties of opportunities.

At the same time higher proportion (i.e. 58.8%) of college education attained respondents involved in agriculture was reported mainly due to the limited off farm employment opportunities. However, almost all of them showed little interest in agriculture and expressed their desire to quit this sector as soon as they find opportunity in service sectors. Gylfason (2000) and Adhikari (2000) also reported negative relationship of the education attainment of the youth and educated people with the involvement in agriculture, which they consider a serious concern for future agriculture development. Therefore, FAO (2002) and FAO (2005) recommended for a successful policy of bringing

educated persons into agriculture to accelerate agricultural production. Sufficient incentives to attract educated people in agriculture are thus important for development of this sector.

**Table 4.** Education occupation cross tabulation

Education	Occupation				Total
	Agriculture	Business	Service	Daily wage	
Illiterate	33 (8.4)	-	-	1 (50)	34 (7.9)
Non-formal and primary education	183 (46.7)	2 (13.3)	-	1 (50)	186 (43.3)
Secondary education	136 (34.7)	4 (26.7)	2 (9.5)	-	142 (33)
College education	40 (10.2)	9 (60)	19 (90.5)	-	68 (15.8)
<b>Total</b>	<b>392 (100)</b>	<b>15 (100)</b>	<b>21 (100)</b>	<b>2 (100)</b>	<b>430 (100)</b>

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage

#### 4.3 Resource Distribution

Mainly land, livestock and labor were important farm resources. Regarding land distribution, Bahun/Chhetri had the highest average landholding of 1.24 ha per household. This ethnic group also comprised the highest proportion of respondents (75.7%) having access to irrigation (Table 5). In contrast to this, with the average holding of 0.87 ha, only 38.7% of farmers from Occupational caste had access to some sort of irrigation. Remaining 61.3% of them were completely devoid of irrigation, which is crucial for agriculture. Regarding the land distribution under irrigation availability, only 33.3% of land was irrigated. This proportion was the highest in case of Bahun/Chhetri with 56.5% of their land under irrigation, followed by Newar (42.5%), Mongoloid (33%) and Occupational caste with the lowest of 24.1%. Similar was the case for livestock holding. In case of family size distribution, however, Occupational caste had the largest family size, but with low level of holding and education they were either engaged in off farm activities like daily wage labor or engaged in agriculture as agricultural labor.

**Table 5.** Resource distribution among different ethnic groups

Attributes	Caste/ethnicity											
	Bahun/Chhetri			Newar			Mongoloid			Occupational caste		
	Freq	%	Ave	Freq	%	Ave	Freq	%	Ave	Freq	%	Ave
<b>Landholding (ha)</b>												
Irrigated	258	75.7	0.7	10	55.6	0.4	16	40	0.3	12	38.7	0.21
Non irrigated	83	24.3	0.54	8	44.4	0.54	24	60	0.61	19	61.3	0.66
<b>Total</b>	<b>341</b>	<b>100</b>	<b>1.24</b>	<b>18</b>	<b>100</b>	<b>0.94</b>	<b>40</b>	<b>100</b>	<b>0.91</b>	<b>31</b>	<b>100</b>	<b>0.87</b>
<b>LSU holding</b>	277	81.2	5.5	12	66.7	4.6	33	82.5	4.7	19	61.3	3.7
<b>Family size</b>			6.8			5.4			5.7			7.0

Source: Field Survey, 2003

Freq = Frequency, % = Percentage, Ave = Average land holding (ha)/per household

#### 4.4 Food crops production and requirement

The main food crops of the country rice, maize, wheat, barley, millet and potato were taken into consideration to assess the food self-sufficiency situation of households (CBS, 2003a). In overall, rice supplied 49% of calorie available from food crops followed by maize (25.9%), wheat (17.7%), potato (3.9%), millet (2.1%) and barley (1.4%) (Table 6). The share of rice to calorie available from food crops was the highest in Tarai and the lowest in Mountain. Almost 61% of the total calorie available was supplied by rice in Tarai. Proportion of rice to total calorie available in Mountain was 33.8%, which seems higher compared to 16% reported in CBS (2003a). The present study confined to only one district i.e. Jumla of Mountain, which is well-known for high altitude rice cultivation may be reason behind the result. In contrast to this, share of potato to total calorie available to households was the highest in Mountain and the lowest in Tarai. This shows the importance of potato in Mountain. Potato contributed 13.5% of total food crops calorie supplied to households in Mountain compared to 1.1% in Tarai.

**Table 6.** Calorie supplied from food crops produced in each ecological zone

Ecological zones	Sources of calorie supplied (Million calorie)						Total Calorie available
	Rice	Maize	Wheat	Millet	Barley	Potato	
Mountain	45.6	14.7	17.2	14.2	24.9	18.2	134.91
% share of crop	33.8	10.9	12.7	10.6	18.5	13.5	100.0
Hills	294.6	267.8	148.7	24.1	0.3	44.0	779.52
% share of crop	37.8	34.3	19.1	3.1	0.04	5.6	100.0
Tarai	557.3	191.2	158.3	-	-	10.0	916.8
% share of crop	60.8	20.9	17.3	-	-	1.1	100.0
<b>Overall</b>	<b>897.5</b>	<b>473.7</b>	<b>324.2</b>	<b>38.3</b>	<b>25.2</b>	<b>72.2</b>	<b>1831.23</b>
% share of crop	49	25.9	17.7	2.1	1.4	3.9	100

Source: Field Survey, 2003

Regarding food balance Mountain and Hills were suffering food deficit in terms of calorie requirement and availability. Tarai, on the other hand, had fairly surplus calories, sufficient enough to meet the deficit of Hills and Mountain. Mountain was suffering negative balance of 39 persons, which constituted around 18% of sample population (Table 7). This was also equivalent to around 18% deficit of total food crops calorie requirement. The proportion of negative balance in Hills was little bit lower with 13.1% deficit. This negative balance of Mountain and Hills was fairly covered by 25.1% surplus of Tarai. Therefore, in overall there was only 3% surplus in calorie available for consumption

**Table 7.** Food balance in each ecological zone

Ecological zones	Total Calorie available for consumption (in Million kCal)	Total Calorie requirement (in Million kCal)	Balance (in Million kCal)	Balance in adult equivalent
Mountain	134.9	163.8	-28.9	-39 (17.6)
Hills	779.5	896.8	-117.3	-157 (13.1)
Tarai	916.8	732.9	183.8	270 (25.1)
<b>Overall</b>	<b>1831.2</b>	<b>1793.6</b>	<b>37.6</b>	<b>74 (3.0)</b>

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage of sample population

#### 4.5 Yield of food crops

Yield of all the food crops was found slightly higher compared to national average except potato. The highest yield was reported in Tarai for each of the food crop with the overall yield of 3.2 ton per hectare (Table 8). Better access to infrastructure like road, irrigation, credit, agriculture extension service and timely availability of essential inputs like fertilizers and pesticides might have resulted in relatively higher yield of food crops in Tarai. In contrast to this, lack of irrigation facility and transportation facility hindering timely availability of essential inputs and other factors might have resulted into lowest yield in Mountain region of the country. Newar and Bahun/Chhetri with better access to these inputs were able to get the highest level of yield. Occupational caste, on other hand, had the lowest overall food crops yield.

**Table 8.** Yield of food crops (ton/ha)

Attributes	Crops						
	Rice	Maize	Wheat	Millet	Barley	Potato	Overall
<b>Ecological zones</b>							
Mountain	2.1	2.2	1.8	1.6	1.3	5.8	2.1
Hills	2.8	2.0	1.7	1.6	1.5	8.4	3.0
Tarai	3.4	2.3	2.0	-	-	9.4	3.2
<b>Caste/ethnicity</b>							
Bahun/Chhetri	3.0	2.1	1.9	1.6	1.4	8.8	3.0
Newar	2.8	2.3	2.0	1.9	1.3	7.8	3.2
Mongoloid	2.8	2.0	1.7	1.4	-	7.5	2.9
Occupational caste	2.6	1.9	1.7	1.7	1.2	6.4	2.6
<b>Overall</b>	<b>3.0</b>	<b>2.1</b>	<b>1.9</b>	<b>1.6</b>	<b>1.3</b>	<b>8.3</b>	<b>2.9</b>

Source: Field Survey, 2003

#### 4.6 Food self-sufficiency situation

Food self-sufficiency is one of the important determinants of food security and can be used to assess the food security situation in household level. Household is said to be food secured when it has access to the food needed for a healthy life for all its members, and when it is not at undue risk of losing such access due to poor production, high food price, inadequate wages, and or inadequate access to market (ACC/SCN, 1991). Thus, food self-sufficiency in

household level in case of developing countries where access of rural households to food is limited due to inadequately developed marketing channels is the best determinant of food security (Thomson and Metz, 1998).

Rice, wheat, maize and potato were the major food crops grown in the country. Besides, millet and barley were also grown in some extent in the country, especially in Hills and Mountain. Food self-sufficiency was measured based on production of the food crops in own farm that is available for consumption to meet the standard calorie requirement.

On an average the food self-sufficiency of 12.5 months was recorded (Table 9). Food self-sufficiency situation was found poor among 4.4% of households having food self-sufficient for less than 3 months. Farmers' interest towards cash crop in Eastern Development Region and small size of land holding in Far Western Development Region contributed to food self-insufficiency in farm households. Similarly, small landholding with relatively low proportion of land under irrigation on the part of Occupational caste resulted this situation.

Central Development Region showed the strong position in terms of household food self-sufficiency with 73.7% of households producing enough food. Mid Western Development Region, on the other hand, showed the awful situation; only 31.7% were able to produce sufficient food. Ecologically, Tarai showed the best position, where 72.1% were able to produce sufficient food. In contrast to this, only 11.1% households in Mountain region was able to produce sufficient food to meet the household calorie requirement.

With the higher land holding under irrigation and small family size almost 50% of Newar households were food self-sufficient for more than equal to 12 months. Similarly, 53.4% of Bahun/Chhetri were able to produce food crops sufficient for more than 12 months in their own farm. The figure was the lowest in case of Occupational caste. Only 9.7% of households from Occupational caste were able to produce food crops sufficient for more than equal to 12 months.

Relating food self-sufficiency with education, about 61% of household heads having secondary and college education met household calorie requirements from their own farm. This was mainly due to their better understanding of knowledge and adoption of modern agriculture. While only around 39% of households head that were illiterate and just literate were able to produce sufficient foods.

Though agriculture was the main occupation for 392 sample households (i.e. 92.1%) only 50.2% among them were able to produce enough food to meet food crop calorie requirement of households. Households involved in business and service were also able to derive food in their land either through renting out land or through involvement of some member in agriculture. All large farmers having more than 2 hectares of land were able to meet their household food crops calorie requirement. In case of small farmer however, only 4.5% of them were able to produce sufficient food for more than equal to 12 months.

**Table 9.** Cross tabulation of food self-sufficiency with various social factors.

Attributes	Food self-sufficiency					Total
	<3 months	3-6 months	>6-9 months	>9- <12 months	≥ 12 months	
<b>Overall</b>	<b>19 (4.4)</b>	<b>50 (11.6)</b>	<b>68 (15.8)</b>	<b>84 (19.6)</b>	<b>209 (48.6)</b>	<b>430 (100)</b>
<b>Development Regions (Average food self-sufficiency months = 12.51)</b>						
Eastern	9 (7.8)	21 (18.1)	11 (9.5)	15 (12.9)	60 (51.7)	116 (100)
Central	-	2 (3.5)	6 (10.5)	7 (12.3)	42 (73.7)	57 (100)
Western	-	5 (6.5)	10 (13.0)	20 (26.0)	42 (54.5)	77 (100)
Mid Western	1 (1.0)	9 (8.7)	31 (29.8)	30 (28.8)	33 (31.7)	104 (100)
Far Western	9 (11.8)	13 (17.1)	10 (13.2)	12 (15.8)	32 (42.1)	76 (100)
<b>Ecological zones</b>						
Mountain	-	2 (5.6)	19 (52.8)	11 (30.6)	4 (11.1)	36 (100)
Hills	14 (6.3)	42 (18.9)	37 (16.7)	48 (21.6)	81 (36.5)	222 (100)
Tarai	5 (2.9)	6 (3.5)	12 (7.0)	25 (14.5)	124 (72.1)	172 (100)
<b>Caste/ethnicity</b>						
Bahun/Chhetris	13 (3.8)	35 (10.3)	44 (12.9)	67 (19.6)	182 (53.4)	341 (100)
Newar	1 (5.5)	4 (22.3)	3 (16.7)	1 (5.5)	9 (50.0)	18 (100)
Mongoloid	-	3 (7.5)	12 (30.0)	10 (25.0)	15 (37.5)	40 (100)
Occupational caste	5 (16.1)	8 (25.8)	9 (29.0)	6 (19.4)	3 (9.7)	31 (100)
<b>Education</b>						
Illiterate	3 (8.8)	6 (17.6)	5 (14.7)	9 (26.5)	11 (32.4)	34 (100)
Non-formal and	11 (5.9)	26 (14.0)	35 (18.8)	38 (20.4)	76 (40.9)	186 (100)
Secondary education	4 (2.8)	14 (9.9)	18 (12.7)	27 (19.0)	79 (55.6)	142 (100)
College	1 (1.5)	4 (5.9)	10 (14.7)	10 (14.7)	43 (63.2)	68 (100)

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage

**Table 10.** Cross tabulation of food self-sufficiency with various economic factors

Attributes	Food self-sufficiency					Total
	<3 months	3-6 months	>6-9 months	>9- <12 months	≥ 12 months	
<b>Occupation</b>						
Agriculture	18 (4.6)	43 (11.0)	61 (15.6)	73 (18.6)	197 (50.2)	392 (100)
Business	1 (6.6)	3 (20.0)	4 (26.7)	4 (26.7)	3 (20.0)	15 (100)
Service	-	3 (14.3)	3 (14.3)	6 (28.6)	9 (42.9)	21 (100)
Daily wage	-	1 (50.0)	-	1 (50.0)	-	2 (100)
<b>Land holding (Average land holding = 1.17 ha)</b>						
Small (<0.5 ha)	18 (26.9)	29 (43.3)	12 (17.9)	5 (7.4)	3 (4.5)	67 (100)
Medium (0.5-2 ha)	1 (0.3)	21 (6.6)	56 (17.6)	79 (24.9)	161 (50.6)	318 (100)
Large (>2 ha)	-	-	-	-	45 (100)	45 (100)

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage

#### 4.7 Reasons for food self-insufficiency

Small size of land holding (43.9%) followed by low yield (38.9%), land rented out (14.9%) and production shift from food crops to cash crops were perceived as the major factor responsible for food self-insufficiency (Table 11). Smallholding of land with limited access to irrigation resulting into lower yield was the major problem causing the deficit food crops production in own farm among majority (71.5%) of the Occupational caste. Though the yield was highest for Bahun/Chhetri, 44.7% of Bahun/Chhetri producing insufficient food in their farm perceived low yield as the main reason for deficit food crops production followed by small holding (35.2%) and production shift from food crops to cash crops. This was mainly because they believe that they can increase production by increasing the yield through better management of irrigation and modern inputs rather than increasing land holding.

Low yield was severe problem in Mountain region where 59.4% of respondents perceived it to be factor responsible for deficit food production in own farm, which was also reflected by the figures in Table 8. The proportion of farmers perceiving low yield as responsible factor for this was 39.0% and 25.0% in Hills and Tarai, respectively. Production shift from food crops to other crops like vegetable, fruits, and spices including land rented-out to explore off-farm income put threats on self-food sufficiency. This trend was higher in Tarai. About 27% of the respondents in Tarai perceived this kind of production shift to be responsible for declined food production in own farm. The figure for Hills was 17.7%. In contrast to this, none of the respondents from Mountain perceived this to be factor responsible for food self-insufficiency. This is mainly due to limited access to infrastructure and off-farm income opportunities in these regions (Table 11).

**Table 11.** Reasons for food self-insufficiency for food self-insufficient households

Attributes	Reason for food self-insufficiency				Total
	Low yield	Small land holding	Production shift from food crops to other crops	Land rented out	
<b>Caste/ethnicity</b>					
Bahun/Chhetri	71 (44.7)	56 (35.2)	3 (1.9)	29 (18.2)	159 (100)
Newar	1 (11.1)	7 (77.8)	1 (11.1)	-	9 (100)
Mongoloid	6 (24.0)	14 (56.0)	1 (4.0)	4 (16.0)	25 (100)
Occupational caste	8 (28.5)	20 (71.5)	-	-	28 (100)
<b>Ecological zones</b>					
Mountain	19 (59.4)	13 (40.6)	-	-	32 (100)
Hills	55 (39.0)	61 (43.3)	2 (1.4)	23 (16.3)	141 (100)
Tarai	12 (25.0)	23 (47.9)	3 (6.3)	10 (20.8)	48 (100)
<b>Overall</b>	<b>86 (38.9)</b>	<b>97 (43.9)</b>	<b>5 (2.3)</b>	<b>33 (14.9)</b>	<b>221 (100)</b>

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage

The major crops replacing food crops were cardamom, tea, vegetables, and ginger in Ilam. In Dhankuta cardamom, ginger, vegetables and citrus were found to be responsible for replacement of major food crops. Tea, vegetables, ginger, sugarcane, areca nut and banana are the major crops that were replacing the food crops in

Jhapa. Similarly, ginger and citrus in Sindhuli and, turmeric, vegetable, and sugarcane in Sarlahi were replacing major food crops. Coffee and ginger in Gulmi; and, vegetable, sugarcane and banana in Nawalparasi were the main crops replacing food crops. Ginger and vegetable in Salyan, vegetables and banana in Banke and, vegetable and apple in Jumla were replacing major food crops. In Kanchanpur, vegetable and banana and in Dadeldhura, vegetable and ginger were replacing these food crops. The shift in cultivation in cash crops from food crops created threats to self-sufficiency with increasing dependency in market. However, increased dependency of households on market for acquiring food tends to be less well off in terms of food security than those who had achieved food self-sufficiency (Osmani, 1998). The replacement of food crops by these cash crops was mainly due to low return from food crops. These cash crops had a better market and higher returns compared to food crops.

#### 4.8 Resolving food self-insufficiency

Purchasing from market by the income derived from various off-farm and on-farm activities was the only mean to fulfill the deficit food for 93.8% of food self-insufficient households (Table 12). Similarly, borrowing, which was either paid by working or paid at the time of harvesting was another important means to fulfill deficit food for 3.6% of food self-insufficient households.

**Table 12.** Means to fulfill deficit food for food self-insufficient households

Attributes	Means to fulfill deficit food			Total
	Purchasing	Food for work	Borrowing	
<b>Caste/ethnicity</b>				
Bahun/Chhetri	149 (93.8)	5 (3.1)	5 (3.1)	159 (100)
Newar	8 (88.9)	-	1 (11.1)	9 (100)
Mongoloid	25 (100.0)	-	-	25 (100)
Occupational caste	24 (85.8)	2 (7.1)	2 (7.1)	28 (100)
<b>Ecological zones</b>				
Mountain	22 (68.7)	7 (21.9)	3 (9.4)	32 (100)
Hills	138 (97.9)	-	3 (2.1)	141 (100)
Tarai	46 (95.8)	-	2 (4.2)	48 (100)
<b>Overall</b>	<b>206 (93.2)</b>	<b>7 (3.2)</b>	<b>8 (3.6)</b>	<b>221 (100)</b>

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage

Market dependency on Mountain was found low compared to Hills and Tarai. More than 95% of food self-insufficient households in Hills and Tarai met their deficit food by purchasing compared to 68.7% in Mountain. Jumla was the district in the Mountain where the food for work program was running and 7 out of 34 food self-insufficient households were procuring deficit food by participating in the program. Borrowing was another important means for 9.4% of food self-insufficient household in Mountain to procure deficit food.

#### 4.9 Income and food self-insufficiency

As purchasing was the main source to fulfill household food demand, cash income was the best way to assess the food security status of any household. A World Bank recognized Rs. 300 per month per person at the 1988/89 constant prices as the threshold income for food security (Koirala and Thapa, 1997). This threshold income for



food security for the year 2003 using yearly inflation rate of the country reached to Rs 895.14 per month per person (IPRAD, 2005).

The minimum food security threshold income level for household varied according to the food self-sufficiency period and family size. Almost 20% of the food self-insufficient households were unable to meet the food security threshold income level in overall (Table 13). Proportion was the highest in Mountain where 25% of food self-insufficient households were unable to meet this requirement followed by Hill (22%). Lack of commercialization in agriculture in Mountain with low yield and limited off farm employment opportunities were the major determining factors for this. Similarly, small size of land holding, very limited irrigation access resulting into low food crop yield, together with lack of skill that limits the off-farm income opportunity on daily wage laboring with minimum wage rate resulted into 28.6% of respondent from Occupational caste unable to meet minimum food security income threshold level. All the respondents involved in business and service were able to

**Table 13.** Food security threshold income attainment among food self-insufficient households

Attributes	Ability to meet minimum level of food security threshold income		Total
	Able	Unable	
<b>Household head</b>			
Male	160 (82.5)	34 (17.5)	194 (100)
Female	17 (63.0)	10 (37.0)	27 (100)
<b>Ecological zones</b>			
Mountain	24 (75.0)	8 (25.0)	32 (100)
Hills	110 (78.0)	31 (22.0)	141 (100)
Tarai	43 (89.6)	5 (10.4)	48 (100)
<b>Caste/ethnicity</b>			
Bahun/Chhetri	127 (79.9)	32 (20.1)	159 (100)
Newar	9 (100)	-	9 (100)
Mongoloid	21 (84.0)	4 (16.0)	25 (100)
Occupational caste	20 (71.4)	8 (28.6)	28 (100)
<b>Occupation</b>			
Agriculture	152 (77.9)	43 (22.1)	195 (100)
Business	12 (100)	-	12 (100)
Service	12 (100)	-	12 (100)
Daily wage	1(50)	1 (50)	2 (100)
<b>Category of household based on land holding</b>			
Small	48 (75.0)	16 (25.0)	64 (100)
Medium	129 (82.2)	28 (17.8)	157 (100)
Large	-	-	-
<b>Overall</b>	<b>177 (80.1)</b>	<b>44 (19.9)</b>	<b>221 (100)</b>

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage

**Table 14.** Food insecurity incidence and poverty gap in relation to the total sample

Attributes	Sample size	Food insecurity incidence	Poverty gap index
<b>Household head</b>			
Male	384	34 (8.9)	0.33
Female	48	10 (20.8)	0.47
<b>Ecological zones</b>			
Mountain	36	8 (22.2)	0.60
Hills	222	31 (14.0)	0.43
Tarai	172	5 (2.9)	0.39
<b>Caste/ethnicity</b>			
Bahun/Chhetri	341	32 (9.4)	0.42
Newar	18	-	-
Mongoloid	40	4 (10.0)	0.41
Occupational caste	31	8 (25.8)	0.59
<b>Occupation</b>			
Agriculture	392	43 (11.0)	0.43
Business	15	-	-
Service	21	-	-
Daily wage	2	1 (50.0)	0.63
<b>Land holding category</b>			
Small	67	16 (23.9)	0.47
Medium	318	28 (8.8)	0.40
Large	45	-	-
<b>Overall</b>	<b>430</b>	<b>44 (10.2)</b>	<b>0.45</b>

Source: Field Survey, 2003

Note: Figures in parentheses indicate percentage of sample size

meet the income threshold level to meet the deficit food. However, 22.1% and 50% of food self-insufficient households involved in agriculture and daily wage laboring were unable to meet the food security income threshold level. Higher proportions of small farmers were unable to meet their income threshold level compared to medium size farmers.

In overall, 10.2% of the households were unable to meet the household calorie requirement from their own food crops production as well as income threshold to fulfill the deficit food, i.e. they were chronically food insecure (Table 14). Almost 21% of the female-headed households were chronically food insecure. Similarly, low level of holdings together with very less access to infrastructure like road, irrigation and limited off farm opportunities led to high incidence of chronic food insecurity in Mountain. In case of caste/ethnicity the highest proportion (25.8%) of households from Occupational caste were suffering chronic food insecurity. They were followed by mongoloid. Newars with better explored off farm opportunities were able to meet the income threshold level. Cent percent of the respondents involved in service and business were food secured through combination of own farm production as well as cash income. Whereas, 11% of the household involved in agriculture and 50% of household involved in daily wage laboring were unable to meet the food security level even through the combination of own farm

production and cash income. Approximately 24% of households from small landholding category were under chronic food insecurity. Whereas all of the farmer under large land holding category were food secured.

Poverty gap index, the combined measures of incidence of poverty and depth of poverty, was higher in the household headed by the female (Table 14). Similarly small land holding and lack of transportation resulting into very confined market access coupled with low yield and lack of off-farm income opportunity resulted to higher poverty gap in Mountain. Occupational caste getting low social privileges in terms of land holding, LSU holding, irrigation access had the higher depth of poverty. Newar with better exploration of off-farm opportunity, however, were found to meet the minimum income threshold to fulfill the family calorie requirement. Also the households involved in business and service were able to secure food security in combination with self-food production and income. Whereas the households involved in daily wage laboring had the highest poverty gap index of 0.63 i.e. able to earn only 37% of income necessary to fulfill the deficit calorie requirement. Food self-insufficient small farmers were able to meet only 53% of their income threshold to fulfill deficit calorie and of medium farmers were able to meet 60% of the threshold. In overall, poverty gap index of 0.45 indicated that the food self-insufficient households were able to earn only 55% of total food security threshold income.

#### 4.10 Expenditure preference

Food, education, agriculture promotion, health, and religious and cultural ceremony were major areas of cash income expenditure. Ranking of these areas with indexing showed that education was the area, which got the highest priority for expenditure followed by food, agriculture promotion, and health (Table 15). These areas influence food security in positive direction (Smith, 1998). Thus, this trend of expenditure signifies households moving towards sustainable level of food security resulted by the improved knowledge on agriculture brought by the higher level of education. In addition, the higher level of education provides the possibilities of better off farm opportunity resulting into higher level of income thereby increases the access to food. Similarly, expenditure preference of cash income in agriculture promotion activities like investments on improved seed, fertilizer, pesticides, mechanization, improved breeds, concentrate to feed animal, etc. help to increase the household food production as well as the total income.

**Table 15.** Expenditure preference

Caste/ethnicity	Preference ranking				
	Food	Education	Agriculture promotion	Health	Religious and cultural ceremony
Bahun/Chhetri	II	I	III	IV	V
Newar	III	I	II	IV	V
Mongoloid	II	I	III	IV	V
Occupational caste	I	II	III	IV	V
<b>Overall</b>	<b>II</b>	<b>I</b>	<b>III</b>	<b>IV</b>	<b>V</b>

Source: Field Survey, 2003

## 5. Conclusion

The study showed that agriculture was predominant economic activity, and Bahun/Chhetri were predominant ethnic group in village areas in the periphery of administrative centers-headquarters. Majority of households had medium level of family size, land holding and livestock holding. Resource distribution specially land holding, irrigation availability to those lands, livestock holding differed according to caste/ethnicity. Bahun/Chhetri had the highest level of resource possession while the Occupational caste had the lowest. Higher proportion of household from Central Development Region was able to produce more than enough food to meet the household demand. In case of Ecological zone, Tarai was able to do that. Most of households having irrigation, higher land and higher livestock holding were able to produce sufficient food in their own farm.

Low yields, small size of land holding and production shift from food crops to other crops were the main reasons for insufficient food production in own farm. Low yield was the major hindering factor to achieve food self-sufficiency, especially in Mountain and Hills. Not only this but also lengthened crop-growing periods relatively affecting mountain regions in terms of food production potentials, and high energy and food need due to cold climate were the important reasons. Production shift from food crops to other crops though had negative impact on food self-sufficiency, the increased income from those crops guaranteed access to the food items. Purchasing from market, borrowing paid either by agricultural labor or at the time of harvest, and involvement of food for work program helped to raise the possibility to meet the food demand. When this was not met, only option left to them was to either cut their meal or borrow grains within the village or use the edible forest foods or migrate in other area in search of better opportunity both in terms of income and access to food.

Due to low agricultural yield and limited opportunity for off farm income activities higher proportion of respondent from Mountain and Occupational caste was unable to meet minimum income threshold for food security. All the households involved in business and services were managed to meet calorie requirement through the combination of own farm produce and income. However, around 10% of household involved in agriculture was unable to meet the income threshold level for food deficit months, i.e. they were suffering chronic food insecurity. Poverty gap index revealed the higher depth of poverty among the household headed by female. Poverty gap was the highest in the Mountain and among Occupational caste as well among the daily wage laborer. Depth of poverty was found negatively associated with farm category based on land holding and livestock holding. Poverty gap was decreasing with the higher land holding. High preference for expenditure of cash income in education, followed by food items, agriculture promotion and health shows the positive indication to move towards food self-sufficiency and ultimately to food security.

The study indicated that with the low level of infrastructure development for marketing process coupled with low level of self-sufficiency Hills and Mountain seek the special attention to deal with the problem of food insecurity. Thus, yield increasing strategy in one hand helps to achieve food self-sufficiency, while on the other hand, focus on crops with high market value or better exposure to off farm activities to the people of Mountain and Hills focusing on deprived group help to increase access to food through increased income. In the mean time market access to both farm produce and essential input must be smoothen.

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## Endnotes

<sup>1</sup> Village, which is also synonymously used, as rural areas are usually defined as the areas that do not fall under the category of urban area. However, there is no commonly accepted definition of urban area. This can be often defined only in terms of other labels like urban centers, major cities, administrative centers or municipalities. Thus, for the study purpose, urban areas are defined as the headquarters of respective districts, which is also an important administrative center. Headquarters in Nepal may not necessarily be Municipality. Vicinity of headquarters was regarded as village areas for this study. All of these areas fall under VDC, the lower tier of administrative division in the country.

<sup>2</sup> To implement the concept the regional development that was introduced in 1972, the country is divided into 5 development regions (Second highest tier of administrative division) from east to west (Eastern, Central, Western, Mid Western and Far Western Development Regions) and development policies are implemented according to these administrative divisions

<sup>3</sup> Based on physical diversity, the country is divided into three broad physiographic areas; Mountain, Hills and Tarai. All three regions extend from east to west parallels to each other as continuous ecological belts. Mountain ranges from 4,877 to 8,848 m above mean sea level and covers 35% of country's geographic areas. The region is very rugged and only about 2% of land is cultivable. The region is sparsely populated due to high altitude and cold climate and comprises a mere 7.3% of total population. Hills with the range of 610 to 4877 m above mean sea level constitutes 42% of total land area of Nepal and 44% of total population. Only about 10% of land in Hills is cultivable. Tarai is a plain area with the altitude ranging from 60 to 610 m above mean sea level. Though it constitutes only 23% of total land area it is home for 48.7% of total population. Around 40% of land area is under cultivation in Tarai. Tarai region is granary of Nepal.

<sup>4</sup> Adult equivalent is aggregate measure of family size that standardize consumption unit within the household taking account age and sex of household members (Appendix 1)

<sup>5</sup> LSU is aggregates of different types of livestock kept at household in standard unit calculated using following equivalent; 1 buffalo = 1 cattle, 1 sheep and goat = 0.33 cattle and 1 poultry = 0.1 cattle (CBS, 2003b)

**Appendix 1.** Conversion factor to compute adult equivalents

Age group	Adult equivalence		Age group	Adult equivalence	
	Male	Female		Male	Female
Under 1 Year	0.33	0.33			
1-1.99	0.46	0.46	12-13.99	0.96	0.84
2-2.99	0.54	0.54	14-15.99	1.06	0.86
3-4.99	0.62	0.62	16-17.99	1.14	0.86
4-6.99	0.74	0.70	18-29.99	1.04	0.80
7-9.99	0.84	0.82	30-59.99	1.00	0.82
10-11.99	0.88	0.78	60 and over	0.84	0.74

Source: Gamba, P. (2005) as per World Health Organization