FOOD SECURITY OF WOMEN FARMERS:
The Impact of Climate Change

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Food Security of Women Farmers: The Impact of Climate Change

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Samata Bhawan,
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Women's Rehabilitation Centre
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Acronyms

ADB	:	Asian Development Bank
ADS	:	Agriculture Development Strategy
AFU	:	Agriculture and Forest University
AICD	:	Agriculture Information and Communication Department
AGDP	:	Agriculture Gross Domestic Product
BIFs	:	Bio-intensive Farming Systems
CBS	:	Central Bureau of Statistics
CTEVT	:	Council for Technical education & Vocational Training
COP	:	Conference of Parties
DADO	:	District Agriculture development Office
DLSO	:	District Livestock Service Office
EU	:	European Union
FAO	:	Food and Agriculture Organisation
FGD	:	Focus Group Discussion
GDP	:	Gross Domestic Product
GESI	:	Gender Equity and Social Inclusion
GoN	:	Government of Nepal
HH	:	Household
HDI	:	Human Development Index
HICAST	:	Himalayan College of Agricultural Sciences and Technology
IAAS	:	Institute of Agriculture and Animal Science
ICT	:	Information Communication Technology
ICIMOD	:	International Centre for Integrated Mountain Development
IPCC	:	Intergovernmental Panel on Climate Change
KII	:	Key Informant Interviews
LAPA	:	Local Adaptation Program of Action
LDC	:	Least Developed Countries
MDG	:	Millennium Development Goal
MIS	:	Management Information System
MOAD	:	Ministry of Agriculture and Development
MOPE	:	Ministry of Population and Environment
MOF	:	Ministry of Forest
NARC	:	Nepal Agriculture Research Council
NAPA	:	National Adaptation Program of Action
VDC	:	Village development Committee
WFP	:	World Food Program
WOREC	:	Women's Rehabilitation Centre

Abstract

Climate change has a major impact on food security in Nepal. Almost all women farmers in the country depend upon agriculture as a major source of income to enhance their food security. There has thus far been no systematic study about the impact of climate change on food security of women farmers. Therefore to fill this lacuna, the present study was conducted in five Village Development Committees with 150 households of Udayapur district in Nepal. The present research aims to study the perception of farmers about climate change, the impact of climate change on agriculture and food security. It also documents the adaptation strategies that farmers practice. The study also attempts to study the agricultural policies through a gender perspective and identify the gaps in the policy. Both primary and secondary sources were used for data collection. The production of the major food crops like wheat, maize, rice, fruits fresh vegetables and livestock has been in relative decline since the past several years. Sometimes total crop failure occurred due to drought, excessive rainfall or an epidemic of insects, pests and diseases. The change in the climatic pattern has resulted in decreased crop productivity that increases food insecurity of the people. Farmers use different adaptation measures to cope with the adverse effect of climate change. These helped to minimise crop losses and improve the food security situation of women farmers by preventing crop loss. The national agricultural policy was found lacking in gender sensitivity. Based on the analysis of the data, recommendations have been made to the government.

Key words: Women Farmers, Food Security, Climate Change, Agriculture, Policies

1. Introduction

1.1 Background

Climate change is one of the major global challenges of the century. According to the definition of the Inter-Governmental Panel on Climate Change (IPCC), "Climate change is the change in climatic condition over time occurred either due to anthropogenic or nature induced causes, which remains for decades or even longer period of time showing distinct variation in its mean" (IPCC 2007a). Taking 1850 as the base year, there has been a rise in temperature of 0.8°C over a period of 150 years. The impact of climate change, like rise in sea level; change in precipitation pattern; shift in pattern of vegetation in higher altitudes and retreat of glaciers can already be seen in different regions around the globe. The predictions are that climate change will trigger extreme climatic events and increase the number of climate refugees. The rise in temperature and climate-induced hazards such as drought, flood and soil degradation would result in a decline in agricultural productivity impacting food security (IPCC 2007).

Data recorded from 1975 to 2005 shows that the mean temperature is increasing at a linear rate of 0.04°C per year in Nepal. The rate of increase of temperature is less in lower altitudes and more in higher altitudes (APN 2005). Significant variability in precipitation was observed on annual and decadal time scales in Nepal but distinct long term trends were not found (Shrestha *et al*. 2000). The second largest glacial lake in Nepal Himalayas, the Imja Glacial Lake at the height of 5000 MASL is one of the glacial lakes at risk. The size of Imja Lake expanded by 28 percent between 1992 and 2002 (Rai, 2007, July). According to MOPE (2004) based on greenhouse gas emission inventory in 1994/95, the energy sector releases the highest amount of carbon dioxide, while the agriculture sector releases the highest amount of methane. Nepal is a signatory to conventions on climate change, yet a policy on climate change is lacking in the country (Regmi and Adhikari 2007).

The climatic and altitudinal variations in the country have led to greater biodiversity and diverse ecosystems. Nepal is one of the most underdeveloped countries, where 24.1 percent of the total population earns less than 1 dollar per day (MOF 2008). The agriculture sector dominates the Nepalese economy where 65.7 percent of the population is directly dependent on agriculture for its livelihood (MOAD 2013). Enhancing agricultural productivity is an important means of improving food security and alleviating poverty in the country. However, the development of the agricultural sector is not satisfactory as the growth rate of AGDP is low. The growth rate of AGDP from 2001/02 to 2011/12 is 3.4 percent, which is lower than average growth rate of total GDP which is 3.9 percent (MOAD 2013). Agriculture in Nepal is dependent on weather patterns and is mainly rain fed. The change in climate, particularly rise in temperature and changes in rainfall pattern, pose a greater risk to agriculture. As agriculture is completely dependent on climate, even

short term extremes of weather badly affect agricultural output in the country. Inadequate infrastructure; poor social development; weak institutional capacity; high degree of dependency on natural resources and agriculture makes the Nepalese economy more sensitive to climate variability (Alam and Regmi 2004).

The effects of climate change are universal; however everyone is not equally affected. Women and men in rural areas in developing countries are especially vulnerable as they are highly dependent on local natural resources for their livelihood. Generally women are more vulnerable to the effects of climate change as compared to men as they constitute the majority of the world's poor and are more dependent for their livelihood on natural resources which are threatened by climate change. In addition, women face social, economic and political barriers that limit their coping capacity. Women charged with the responsibility to secure water, food and fuel for cooking and heating face the greatest challenges. Limited mobility coupled with unequal access to resources and to decision-making processes contributes to women in rural areas being disproportionately affected by climate change. It is important to identify gender-sensitive strategies to respond to the environmental and humanitarian crises caused by climate change. However, it must be remembered that women are also effective agents of change in relation to both mitigation and adaptation. Women have a strong body of knowledge and expertise that can be used for climate change mitigation, disaster reduction and adaptation strategies. As stewards of natural and household resources, women's responsibilities in households and communities positions them well to contribute to livelihood strategies adapted to changing environmental realities (www.un.org/womenwatch).

1.2 Problem statement

The adverse impact of climate change is challenging human life in many ways, particularly since Nepal as an agrarian country is identified as particularly vulnerable to the impact of climate change (Adger *et al*. 2004). Extreme climatic events like erratic rainfall causing floods and landslides have adversely affected agricultural production (Regmi and Adhikari 2007). The geological characteristics and topographic variations in combination with heavy rain result in floods, landslides and debris flows (ICIMOD 2007). The country has experienced an increased number of rainy days and higher volume of rainfall (Baidya *et al*. 2008; MOPE 2004). The increased intensity of rainfall is expected to result in a rise in the incidents of landslides and floods. This leads to greater loss of lives, damage to physical infrastructure and disturbs socio-economic development (ICIMOD 2007).The extreme climatic occurrences would have a devastating impact upon the poor due to the destruction of infrastructure needed to cope with change, increasing their vulnerability (Mirza 2003).The change in climatic conditions would affect the food security in the country in a major way (Bhandari, 2008). In this situation, farmers have followed some adaptation and mitigation measures based on local knowledge and

traditional practices (Marahatta and Khanal 2006). It is important to seek adaptation strategies to cope with the effects of climate change on agriculture in order to secure and improve agricultural production (Care Nepal 2009).

1.3 Rationale of the study

The high rate of male out-migration in search of employment overseas results in women in poor communities doing all the field and household chores. Food security and sustainable livelihood is linked to the performance of the agricultural sector especially to productivity. It provides both a direct and indirect source of sustenance which determines on-farm and off-farm income as well as the food security index. The impact is felt both upstream and downstream of farming on activities like supply of inputs, credit services and technical assistance, processing, transportation and marketing of crops and other farm products. The observed trend of change in temperature, rainfall pattern and increase in extreme climatic events has led to loss of lives, decrease in agricultural yield and damage to property. Extreme climatic events hamper people's adaptive capacity and undermine their resilience. Various adaptation measures have been adopted in different parts of the world to cope with climate change impacts. Such measures can be introduced in Nepal, taking into account local factors such as physical topography, socio-economic conditions and institutional factors.

1.4 Research objectives

The objectives of the research were:

- To identify and document the understanding on impact of climate change on food security; adaptation practices followed by women farmers and areas for strengthening capacity of women farmers for mitigation of climate impacts.
- To review existing agricultural plans and policies of the government, study their implementation and identify the major gaps from the women farmers' perspective.

1.5 Research questions

The study focused on the following research questions:

- What are the trends of climate change?
- How do women farmers perceive climate change?
- What is the impact of climate change on agriculture and food security?
- What are the adaptation measures followed by women farmers to cope with adverse effects of climate change?
- Do women farmers know about the LAPA and NAPA?

2. Literature review

2.1 Introduction to Climate Change

Climate change refers to change in climatic conditions over a time period either due to natural variability or due to anthropogenic factors. IPCC defines climate change as "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer". It is now realized that the negative impact of climate change is increasing and will continue to rise at astonishing rates in coming days, setting new records in recent human history (Adger *et al.* 2003).

According to the IPCC the mean global surface temperature increased by 0.74° C during the 20th century. Since 1971, land surface temperatures have been increasing at an alarming rate of between 0.23 and 0.28°C per decade. This continuing trend, coupled with changes in the rainfall pattern and greater frequency of extreme weather events are likely to have adverse effects on the world's population. The impact of different scenarios of climate change on bio-physical soil and crop growth determinants of yield are evaluated on a 5′×5′ latitude/longitude global grid; secondly, the extent of potential agricultural land and related potential crop production is computed. The detailed bio-physical results are then fed into an economic analysis, to assess how climate impact may interact with alternative development pathways. Key trends over this century for food demand and production, trade as well as key composite indices such as risk of hunger and malnutrition are computed. This modelling approach connects the relevant bio-physical and socio-economic variables within a unified and coherent framework to produce a global assessment of food production and security under climate change.

Some of the impacts of climate change observed globally are as follows:

- Increase in temperature
- Increase in extreme climatic events
- Spread of diseases
- Rise in sea-level
- Melting of glaciers
- Threats to biodiversity
- Phenological and Biological changes

2.2 Climate change and agriculture in the global context

The natural forces and anthropogenic activities (land use changes and emissions of greenhouse gases) are the causes of global climate change (Ines & Hansen, 2006).

The consequences of climate change in the global context are: increased frequency of droughts, heavy precipitation, decrease in the number of cold days and nights (increase in the number of hot days and nights), and heat waves (Agrawal *et al*. 2010). The impact of climate change like temperature rise, glacier melting, sea level rise, change in precipitation patterns, shifting of the crops, extinction of crop species, increased incidence of pests and diseases has been witnessed in different regions in the world and is already well documented. Climate change impact is severe in developing countries because of rain-fed farming systems and weak capabilities in technological adaptations (Ogallo *et al*. 2000). Increasing temperature and consequent droughts constitute major limitations to food production (Barnabas *et al*. 2008). Climate change impacts on agriculture extend significantly to the development challenges of ensuring food security and reducing poverty in developing countries (Thornton *et al*. 2009). For example, the timing and amount of rainfall across large parts of Africa and Asia determines the food security situation of households as well as the need for searching for alternative sources of food and income (Dow & Downing 2011). Crop yields are predicted to fall by up to 30 percent in Central and South Asia due to climate change, leading to risk of hunger in several countries (UNFCCC 2007).

2.3 Impact of climate change on agriculture

Climate change continues to have an impact on agricultural productivity all over the world (You *et al*. 2005; Slingo *et al*. 2005). Agriculture is highly sensitive to climate and production processes are impacted by any type of change. Significant changes such as droughts, rise in sea- level and increasing irregularities in rainy season patterns have already had immediate impact on food production, distribution infrastructure and incidence of food emergencies. Livelihood assets, opportunities and human health in both rural and urban areas have also been affected by climate change. This will ultimately affect food security (FAO 2007a).

The global impact of climate change on sensitive sectors as agriculture and forestry is becoming an increasingly important issue (Southworth *et al*. 2002). Climate change alters the weather conditions (temperature, solar radiation, precipitation) and has a significant biophysical effect on agricultural productivity (Nelson *et al*. 2014). Agricultural production is highly sensitive to climate change; high temperature and changing rainfall patterns influence the crop yield (Baez *et al*. 2013). Recent trends of rising atmospheric carbon dioxide alter the crop yield quantity and quality (Ainsworth & McGrath 2010; Porter & Semenov 2005).

Agricultural production is correlated with climatic factors, particularly with rainfall, temperature, atmospheric carbon dioxide (CO2) and solar radiation (Ines & Hansen 2006). Fluctuations in the precipitation patterns, increasing temperature and atmospheric carbon dioxide and the high incidence of extreme weather events affect agricultural productivity (Walthall *et al*. 2012).

Temperature increase accelerates crop development and shortens the growth period, thus impacting crop phenology and dry matter production (Lal *et al*. 1998). Average crop yields in hotter and drier weather conditions are generally low and the variability is high (Kim & Pang 2009). Temperature increase accelerates the evaporation as well as transpiration processes, thereby creating a situation of low moisture for the plants. The higher temperature leads to increased evapo-transpiration and reduces soil moisture availability (Pant 2009).

The agriculture of developing countries in Asia will be highly affected by the increasing thermal stress, droughts and floods and there will be less food production and increasing hunger (Easterling *et al*. 2007).

Agriculture in Nepal is totally dependent on weather and climate. Increasingly unusual changes such as rise in temperature, irregular monsoon precipitation and rainfall patterns are being noticed in Nepal. This has led to crop failure which decreases agriculture production and affects food security. It further adds to a range of factors that contribute to increase in vulnerability. Local level impacts like loss of local plant and animal species, changes in cropping patterns, scarcity of water due to drying up of wells and decrease in agriculture productivity have been noticed in Nepal (Regmi *et al.* 2008).

2.4 Adaptation

According to the IPCC, adaptation is defined as "The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation attempts to cope with the effect phenomenon of climate change" (IPCC TAR 2001a). Smith and Wandel (2006) state that "any system that is exposed and sensitive to climatic factors is more vulnerable and the system having more adaptive capacity is less vulnerable, other things remaining the same". They describe two types of adaptation measures:

i) Autonomous adaptation: the unconscious attempt of the farmer to solve the problem due to climate change. This step is taken after the effect of climate change has been felt. This is characterized by change in the natural and the human systems. For example the changes in the varieties, adjustment in the sowing and harvesting date due to high amount of rainfall.

ii) Planned adaptation: the action undertaken before the effect of climate is experienced, for example replacement of the old crop varieties by new ones. The coping ability of disadvantaged and marginalized groups of people in developing nations against climate change is low. Tutoring the rural, disadvantaged and marginalized people will help them to adopt various adaptation measures against the harmful effect of climate change and enhance food security situation by increasing agricultural productivity (Cruz *et al.* 2007).

Adaptive measures practiced in the western hilly region were found to be 40 to 60 percent for crops like maize, wheat, legumes, grains, fodder, improved varieties of fruits improved rice, finger millet, potato and barley varieties.

2.5 Agriculture, Climate and Food Security

Agriculture is an important component for sustaining the livelihood of poor and marginalized people all over the world. Thirty six percent of the world's population is dependent on agriculture to ensure food security. In most countries of the Asia and Pacific region about 50 to 60 percent of the population is directly involved in agriculture. In sub-Saharan Africa about two thirds of the active population derives their livelihood from agro-based industries. If agricultural production declines due to rapid climatic change then income too reduces, livelihood is threatened and a large number of people become susceptible to food insecurity (FAO 2008).

Climate change has differential impact in various regions of the world and the shortage or availability of food varies from place to place. Direct changes in the agro-ecological conditions and indirect effect on the growth and dissemination of incomes along with the increased requirement for agricultural crops affect the availability of food. Climate change has a positive impact on the temperate zone and negative impact in the tropical zone. This means that the availability of the food due to the impact of climate change is higher in the temperate zone but lower in the tropical zone of the country. This is because the crops in the tropical zones reach close to their maximum temperature resistance where dry-land and rain-fed agriculture prevails (McCarthy 2001).

The food production in terms of food availability is higher in developed countries whereas the production rate declined in the developing countries of the world (Rosenweig and Parry 1994).

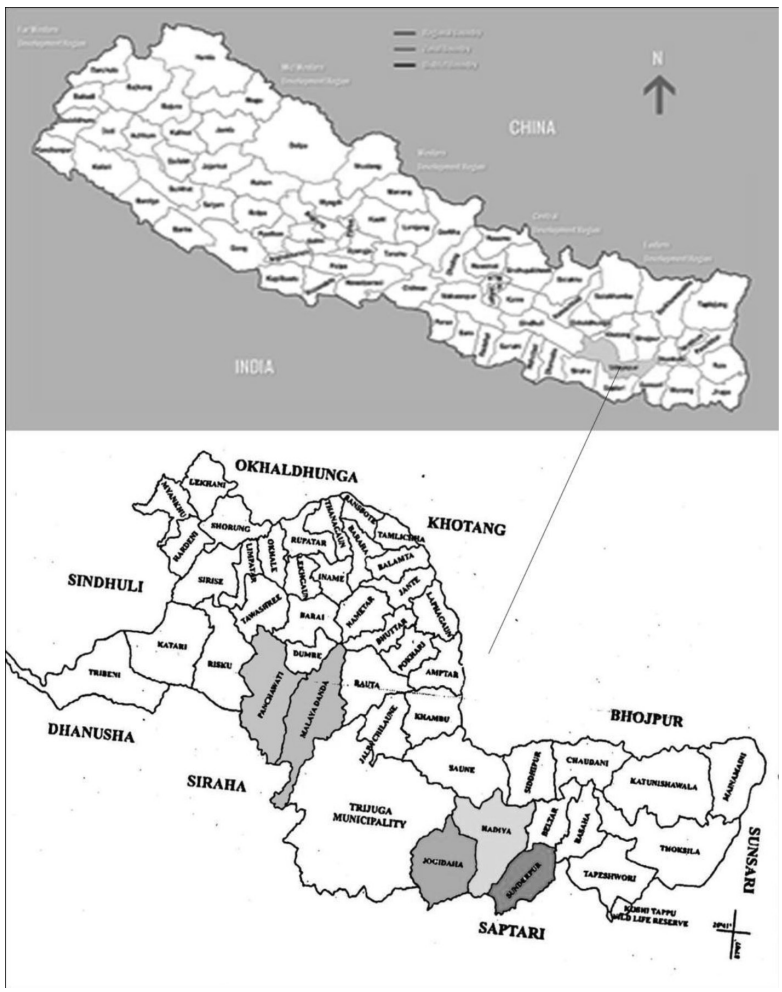
The impact of climate change weakens the food security of households relying completely on agriculture to sustain their livelihood. The availability as well as productivity of the food crops has been declining because of water stress due to increased temperature and reduced amount of rainfall (Fischer *et al*. 2002 and Tao et 15 *et al*. 2004). Food availability in the hills and mountains, as well as amongst indigenous peoples remains a chronic problem in Nepal.

The capacity of individuals, societies and countries to purchase different types of foods in terms of quality and quantity is referred to as "access to food". Climate change has a great impact on the access to food resources of the world as most people live in the countryside and practice farming as their major occupation. Agriculture is a major source of income for rural poor. People cultivate limited variety of crops and this does not lead to food security. Therefore people need to sell their agricultural products so that they can have

access to other type of food resources and attain food security. Generally, climate change has a negative effect on crop productivity which reduces yield, lowers the income of people and limits access to other foods. This leads to food insecurity for people in many parts of the world. Due to low productivity the people have less affordability. The allocation and preferences of food in most areas of the earth is uneven which leads to inaccessibility of food (Schwartz and Randall 2003). It can be safely concluded that access to food is highly affected by climate change.

3. Methodology

This study was conducted in the *Terai* region of the country. The *Terai* region is called the "granary of Nepal" as it contributes a large share of the national agricultural production. The *Terai* region accounts for about 34 percent of the total land under cultivation, or 56 percent of the total cultivated land in the country (CBS 2008). The *Terai* region of the country is more vulnerable to climate change (Alam & Murray 2005) since it has the highest risk of flooding particularly during the monsoon season, which reduces agricultural productivity and disrupts economic activities (Dulal *et al*. 2010a; Dulal *et al*. 2010b). In recent years, *Terai* region has witnessed an increase in the frequency of erratic rainfall, floods, drought, heat waves, cold waves and hailstorms. The study covers Udayapur district of *Terai* region, the Eastern development region of the country. The study covers five VDCs viz., Hadiya, Sundarpur, Jogidaha, Panchwati and Bhalyadanda as these are most affected by floods (Personal interaction with DADO).



Criteria for selecting study sites:

- An area that has experienced floods in recent years.
- Households are dependent on agriculture as major occupation.

3.1 Research design

3.1.1. Data collection techniques

Both primary and secondary data were collected. The primary data was collected from January to March, 2015. The methodology and data types are explained here:

Primary data collection

Primary data was collected through a Household Questionnaire Survey, Focus Group Discussion (FGD) and Key Informant Interviews (KII). The objectives of collecting the data for research were shared with the respondents. This facilitated getting accurate data.

Key informant interviews

Interviews were conducted with experts working on agriculture and climate change in Udayapur district. The organizations that were approached for key informant interviews include District Agriculture Development Office, District Development Committee, District Soil Conservation Office and the Red Cross society. The interviewee was selected on the basis of long term work in the district. A check list was prepared to ensure that crucial information was not get left out from the data. The time allotted for collecting the information from the household survey was approximately one hour, the KII was about 45 minutes and FGD was 1.5 hours.

Focus Group Discussions (FGD)

To assess perceptions about climate change and its impact Focus Group Discussions with women farmers were organized. The FGDs mainly focused on collecting information on socio-economic conditions, natural disasters, observed environmental changes, impact of climate change on agriculture and food security and adaptation strategies followed by the women farmers.

Household survey

The household survey was conducted using structured questionnaires to gather detailed information on the impact of climate change on agriculture and food security and the adaptation measures adopted by women farmers to cope up with the adverse effect of climate change. Both open and close ended questions were included in each section. The questionnaire was pre-tested in some of the households at the site and modified on the basis of feedback.

Transect Walk

The transect walk was conducted in each of the VDCs to study the impact of climate change on agriculture and food security of women farmers and the practices adopted to cope with the adverse effect of climate change. (A transect walk is a systematic walk along a defined path (transect) across the community together with the local people to explore the agriculture fields by observing, asking, listening, looking and producing a transect diagram conducted during the initial phase of the fieldwork.)

Agricultural Calendar

Women farmers have made some changes in the cropping calendar to adjust to the changing climate patterns. Cropping calendars before and after adaptation to the climate pattern changes were prepared after discussions with women farmers during FGD.

Enumerators for the household survey

Five enumerators were hired to conduct household surveys. The enumerators were from the Himalayan College of Agricultural Sciences and technology (HICAST) and had experience of collecting data for their graduate level theses. They were briefed and guided by the WOREC staff that had been working in the study districts/VDCs for a long period of time and had close contact with most of the women farmers.

Sample size

Thirty respondents were interviewed from each VDC. The total sample size was 150. The study focused on and selected only women farmers to document their perception of the impact of climate change on their food and nutritional security.

Secondary data

Journals, working papers, published and unpublished project reports, seminar/workshop papers and e-materials were strong secondary data sources. Information was also collected from organizations working on climate change in Nepal

3.2 Data processing and analysis

3.2.1 Data processing

The data collected through structured questionnaires were reviewed and the identification number for each was confirmed to avoid confusion while doing data entry. All the data were defined into variables as far as possible and entered into the data sheet of SPSS - 17.0 versions.

3.2.2 Data analysis

Both descriptive and analytical methods were used to analyze the quantitative and qualitative field data collected from various sources.

Qualitative data

The qualitative data was collected from documenting women farmer's perception of the impact of climate change on agriculture, food security and the adaptation strategies followed to cope with the adverse effect of climate change.

Quantitative analysis

Descriptive statistics: Primary data obtained from field observation, focus group discussions, key informant interviews, discussion with agriculture development workers and officers and household questionnaire surveys were analyzed quantitatively. Statistics like sum, mean and relative frequency were used for descriptive analysis of women farmers' perception, climate change impacts and adaptation related data.

4. Results and discussions

4.1 Socio-economic characteristics of the respondent's household

Socio-economic characteristics of the respondents' household determine the farming systems and activities. Socio-economic characteristics such as ethnicity, age, sources of income and annual income have been scrutinized during the research.

4.1.1 Ethnicity of the respondents

The study revealed that there were eight ethnicities residing in the study areas. The community was dominated by Brahmin/Chhetri (37.33%), followed by Hill Dalits (20%) and Hill Janjatis (15%). The Terai Dalit and Terai Janjatis were 2 and 1 percent respectively.

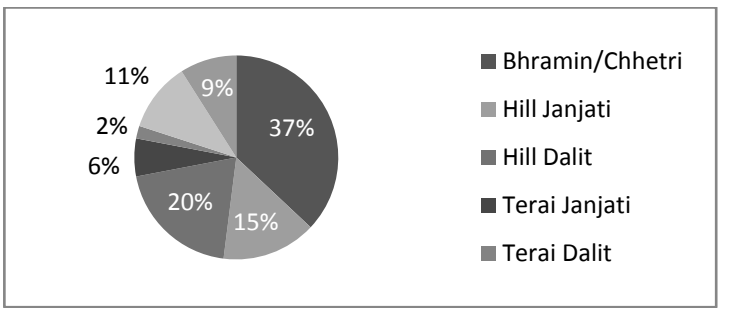


Figure: 2 Ethnicity of respondents

4.1.2 Age distribution

The study showed that 35 percent of the respondents were from the age group of 51-60 years. The age group of 41-50 constituted 27percent of the respondents, closely followed by the age group of 31-40 years representing 24 percent of the respondents. The age group of 71-80 years at 1 percent was the smallest among the respondents. The graph shows that 86 percent of the total number of respondents came from economically active age groups.

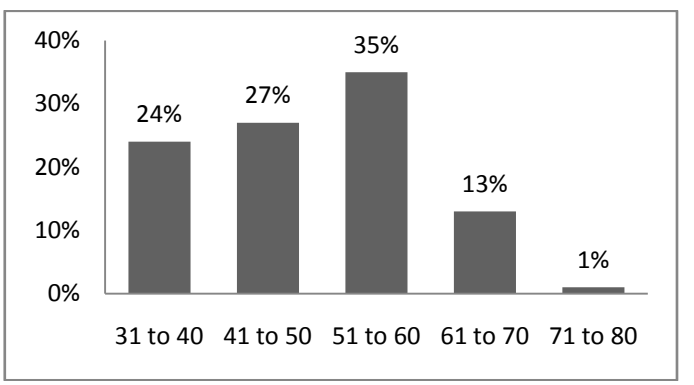


Figure 3: Age distribution of the respondents

4.1.3 Employment status

The female respondents in the study were completely dependent on agriculture for sustenance and livelihood. The study showed that women had to fulfil a dual role. Women had to perform all the household chores like cleaning, washing, cooking and raising children, and also do all the farming activities. In addition members of the family were found to be engaged in other occupations as listed in Table 1:

Table 1: Employment status of the respondent's households

Occupation	Percentage
Service	18
Business	22
Wage labour	36
Remittance	24

The above table shows that 36 percent of the people within the respondents' households work as wage labour, 24 percent had gone abroad to earn their livelihood and support the family, 22 percent were engaged in business (small shops) and 18 percent were in service.

4.1.4 Annual Income

Annual income of the household determines the ability to purchase essential commodities and ensure a sustainable livelihood. The annual income of the household ranged from NRs 7,000 to NRs. 1, 50,000. The households with high income could purchase food from the market, change the crop varieties and purchase fertilizers which in turn increased their income. The annual income was used especially to manage any crisis which occurred within their household because of the damage suffered due to hazardous climatic events.

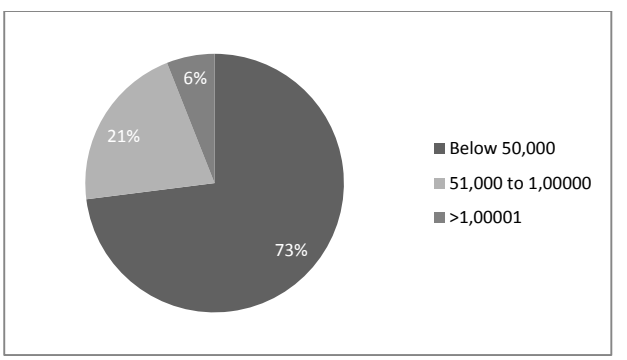


Figure 4: Annual income of the households

4.2 Physical assets

4.2.1 Types of houses

The types of houses define the economic status of the family. The houses are also kept as collateral in many cases where money may be urgently required due to a family emergency. The type of house determines the amount of loan an individual gets form the bank or landlords. The study looks into the types of houses owned by respondents

85 percent of the respondents have traditional houses and 15 percent have modern houses. Altogether 82 percent have single storey houses and 18 percent have multi storey houses. The construction materials used for building the houses are mud, bricks, bamboo and timber. The roofing materials used were *khair (*moderate size deciduous tree used for roofing the houses), slate, corrugated steel or cement.

The construction material used for the house reflected the economic status of the family. The houses with cemented roofs belonged to the wealthiest, followed by corrugated steel, slate and then *khair*. The number of floors of the house also determined the economic status of the family. The respondents were of the view that cemented roofs offered better protection against storms than slate, corrugated steel and *khair*. Roofs made from *khair* need to be changed once every five years, and at times are prone to leakage during torrential rainfall.

An inquiry as to the head of the household, disclosed that almost all the houses were registered in the name of men.

From a woman's perspective, a house had much more significance than merely providing security to family members. The houses also provided shelter for poultry/small animals and were used for storage for cereals, fruits, vegetables, post-harvest work and so on. Women farmers shared that ownership of house in their own name is an economic necessity and would contribute to empowerment and better living conditions. The house could also be used as collateral to borrow money from the bank and landlords during emergency situations to tide over crises.

4.2.2 Land holding

Land holding determines financial security and reflects the identity and status of a household in society (Thapa and Niroula 2008). Therefore, land is a crucial asset for every household. The land area holding includes both the area of the dwelling house and for agriculture. The study revealed that the land area used for the dwelling house was less than that used for farming in respect of all the households. Usually, the land is used as collateral for loans either from the bank or from the landlords.

Altogether 83 percent of the respondents have agricultural land both for farming and for housing. Only 17 percent have land only for housing. The average land holding size was found to be 0.36 hectare. The minimum land holding size was found to be 0.06 hectare and the maximum land holding size was found to be 1.6 hectare. The study shows that the average land holding size was found to be less than the national average land holding which is 0.79 hectare (CBS 2004).

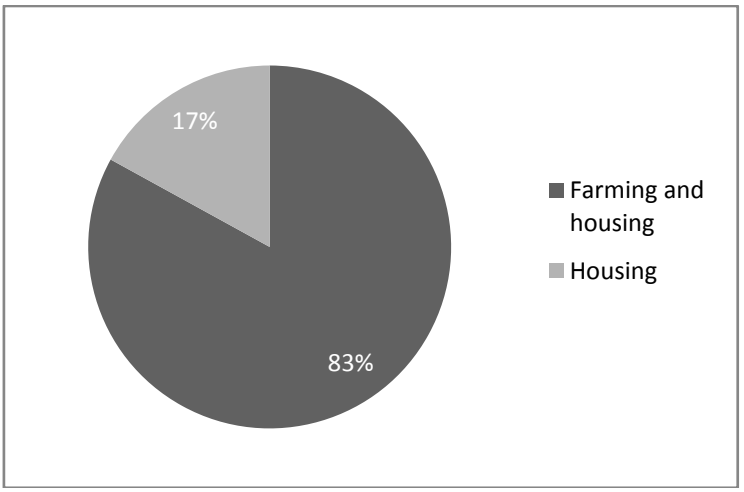


Figure 5: Land holdings of the respondents

4.3.3 Ownership of agricultural tools

The study revealed that all the households had agricultural tools required to operate the agricultural lands and do farming practices. The common agricultural tools are *halo* (plough)*, kodalo, kuto, chande, dante, chande, hasiya, kodali and khurpi (*varieties of sickles). Some farmers use tractors to plough the field. However, mostly the tractors were already booked by the commercial farmers and were unavailable to the households.

4.3.4 Livestock holding

Livestock is an important asset of Nepalese women farmers and well integrated into the farming system. The main reason behind raising livestock is for increasing soil fertility. Livestock are also reared for immediate income to solve the emergency needs of the households. The different types of livestock raised include oxen, cows, buffaloes, goats, pigs, and poultry. The main reason for rearing oxen and buffaloes is for ploughing the land, threshing of the harvested crops and traction. Cows and female buffaloes are reared for milk. Goats, pigs and poultry are reared for meat, eggs and as an immediate source of income.

The percentage of respondent households having at least one animal is 97.2 percent. Small livestock such as goats, pigs and poultry are the dominant livestock in the study areas. The average holding size of the goats in the study districts (4.8 goats per household) is higher than the national average of 4.2 goats per household (CBS 2004). The number of cows per household in the study districts is on an average 1.3 , which is slightly lower than the national average of 2.7 cows per household (CBS 2004).

4.3.5 Irrigation

Irrigation is a sensitive component for farming as it determines the amount of production for any type of crop. Irregular and insufficient irrigation reduces the yield drastically. Therefore, a reliable source of irrigation source is one of the prime concerns of the farmers. A large proportion of land in Nepal is still un-irrigated; however, the irrigated land also does not have year-round irrigation facility (CBS 2004). The farmers usually irrigate the crops during the critical period to avoid loss of the crop. The major sources of irrigation were tube-wells, streams and ponds. Water is pumped by a motor and used to irrigate the fields. Farmers were asked about their perception about increase or decrease in the amount of water in the water sources. 71 percent of the respondent farmers said that the amount of water had decreased and the remaining 29 percent said it was the same. The FGD and KII revealed that land topography, water availability, size of the farm and economic condition of the farmers are the key determinants for the farmers with regard to irrigation facilities.

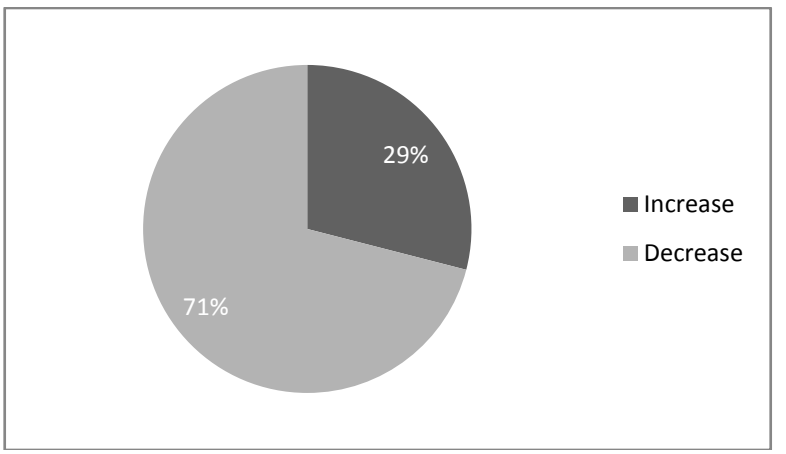


Figure 6: Increase or decrease water

4.4 Farmers' perception about climate change

Increasing trend of change in temperature and precipitation extremities have been observed in Nepal in many places (Baidya *et al.* 2008). However, there is spatial variation in the changing trend of temperature and precipitation which correlates with elevation.

The increase in maximum temperature is more prominent in higher altitudes as compared with lower altitudes. Rise in extreme climatic events such as drought, torrential rain and floods have also been reported (Baidya *et al.* 2008). Since agriculture in the country depends on weather, women farmers have to wait till the onset of monsoon precipitation to start a new agricultural year. The changes in temperature and erratic rainfall have affected crop production in Nepal (Malla 2008). In this context, it is important to assess the perception on climate change and its impact on agriculture and food security along with the adaptation strategies adopted by the women farmers to cope with the situation (Bryan *et al*. 2009). The study attempts to document the perception of women farmers with regard to climate change though the reasons and science underlying the change may not be clear to them. Household surveys, FGD and KII were conducted to get an idea of women farmers' perception with respect to climate change.

4.4.1 Change in temperature

The study showed that a large percentage (95 percent) of respondents perceived increase in temperature in both summer and winter, that is, warmer summer and warmer winter. The winter was felt to be warmer and shorter than earlier. The women farmers observed an increase in mosquitoes and their appearance even in the months of October to December. The women farmers added that few years back they could relax in the sun during the months between October and January which seems impossible these days due to heat. The FGD and KII revealed an increase in number of hot days. The respondents shared their perception that the number of hot days had increased, the number of cold days had decreased and that the nights had become less cool than earlier.

The women farmers were of the view that increased temperatures have led to longer and more frequent droughts. Of the total respondents 63 percent perceived an increase in the period and frequency of drought whereas the remaining 37 percent did not give any opinion on changes in frequency of droughts. The social impact of drought is reflected in a rise in unemployment and loss of savings (Yevjevich *et al.* 1977).

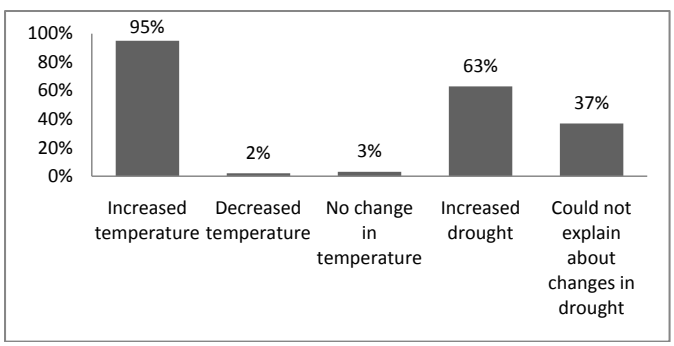


Figure 7: Changes in temperature

4.4.2 Changes in rainfall

The respondent women farmers were asked whether they perceived changes in the amount and frequency of rainfall. The research showed that the individual's perception of climatic changes does not take a view with regard to long term changes but is based on recent and short term changes (Bryan *et al.* 2009). The women farmers were asked whether they perceived an increase, a decrease or no change in the total annual amount of rainfall. Of the total population 24 percent perceived an increase in the amount of rainfall, 65 percent perceived a decrease in the amount of rainfall and the remaining 11 percent perceived no change in the amount of rainfall.

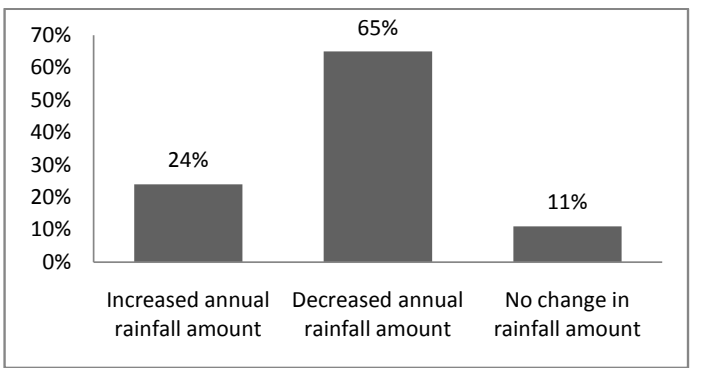


Figure 8: Changes in rainfall

The participants of the FGD felt that the rainfall pattern was more erratic and rainfall intensity had increased in recent years. Some respondents mentioned that there was no rainfall at the times when it was needed for the crops. A key informant interview observed that there had always been variation in annual rainfall in the monsoon season. The respondent added that a major indicator of climate change was a gradual decline in winter rain in the district leading to low agricultural productivity and food insecurity.

4. 5 Impact of climate change

4.5.1 Sources of water

The increase in temperature is one of the main causes for reducing water availability. All the respondents shared that increase in temperature has led to drying up of water resources. The increased temperature has also reduced soil moisture. The women farmers observed that erratic rainfall has lead to increase in the frequency of floods. This led to increased sand in the nearby land areas, decreased soil fertility and agricultural productivity causing food insecurity. This in turn led to increased socio-economic and psychological stress of women farmers.

The FGD and KII disclosed that climate change has increased water uncertainty. The respondents have observed the drying up of water resources like streams and wells. As the water table has declined, farmers need to do deep boring to use the ground water for irrigating their crops. Very few farmers have done deep boring, and the rest have been facing shortage of water for irrigation leading to decline in agricultural production and decrease in annual income.

4.5.2 Agriculture

Rice is the main staple food crop grown in the study areas. The rice is grown under rain-fed conditions and the cultivation of rice is dependent on monsoon rainfall. Women farmers are involved at each stage from seeding and ploughing the land to the threshing of the crops. Erratic rainfall has had a direct impact on the growth and development of the rice crop and has lowered production. Increased and prolonged drought has led to a higher incidence of insects, pests and diseases. This has led to an increase in the use of chemical fertilizers and pesticides. Though aware that the excessive use of chemical fertilizers and pesticides has decreased soil fertility, women farmers were not in a position to stop due to lack of alternatives for the production of rice.

Women farmers did not take any precautions and were exposed to chemical fertilizers and pesticides in the course of agricultural operations. Disturbance in menstrual cycles, white discharge, uterine cancer, miscarriage and infertility can be correlated to increased exposure to chemical fertilizers and pesticides. The respondents reported that ten to fifteen years back, women were healthy even after giving birth to even seven-eight children, while now women suffer poor health after giving birth even to two or three children. The water requirement of rice is high during the initial seedling, panicle initiation and flowering stages. As there is shortage of water, farmers could not provide sufficient water which led to decreased production. The continuous drought during the rice planting season every year also contributed to decreased production. Women farmers have not been able to come up with any alternatives except planting the rice later than the actual planting time, leading to huge economic loss.

Wheat is another staple food crop grown in winter season. Though wheat is a winter crop with less water requirement, yet it has been affected by the change in climate. The critical requirement of water for wheat is between 22 and 30 days after sowing and women farmers accordingly manage the irrigation. Rain after the irrigation of wheat at the critical stage is over, has resulted in increased soil moisture and decreased wheat production. The climate change has adversely affected other winter crops like potatoes, *sarson* (mustard), lentil, *rayo* (rape seed) and chickpea and has led to decrease in production. Rainfall immediately after irrigating crops like garlic and onion also resulted in decreased production due to increased soil moisture. The respondents also reported that climate

change has resulted in improper germination of the vegetables crops especially cowpea, bitter gourd, okra, cauliflower and cabbage.

Jack fruit and mangoes are the major fruit crops of Udayapur which contribute to income, ensuring food security and sustainable livelihood for women farmers. Climate change has impacted the flowering and fruiting of these fruit trees and increased drought has resulted in the cracking and excessive dropping of the fruit from trees.

Climate change has resulted in loss of agro-biodiversity. All the women farmers reported that the local crop varieties cannot give good production in the changing climate. Therefore they have shifted to the hybrid varieties, though the taste is not like that of the indigenous varieties. However to survive and ensure food security of the members of the household, women farmers are forced to increase the use of improved and hybrid varieties. The initial costs of improved and hybrid seeds are high and they need more chemical fertilizers and pesticides compared to the local seeds resulting in increased economic burden. Most of the local varieties were reported to be already extinct.

Increased incidence of insects, pests and diseases including new species was uniformly reported. The study found that insects which cause major damages to crops like snails, beetles, cutworms and white grubs increased, while the population of beneficial insects like ladybirds, and earthworm decreased. An increased incidence of snakes was reported.

The farmers reported that increased temperature, high wind and erratic rainfall have adverse impact on the health of animals. Climate change has affected the behaviour, health, milk production and reproductive capacity of the animals. The area chosen for the study area is quite dry and does not have sufficient grass for animals to graze. Fodder is not easily available, so farmers are not able to provide it to the animals on time. At times of scarcity, farmers use hay as feed for the animals.

The impact of climate change on the situation of women and girls is reflected in the finding that 35 percent of the girls dropped out to help their mothers in household chores and agricultural operations.

The FGD and KII disclosed that men have better chances of being employed as agriculture labour or as manual labour in cement factories or other companies. Women do not get opportunities easily to work in the cement factory and companies. Women labourers got less wages as compared to their male counterparts. The average rate of wage labor for men is NRs. 300 while for female labourer it is NRs. 200.This has led to higher workload for women who stay behind to work as wage labour in adjoining fields or in adjoining villages while shouldering care activities. Modernisation has contributed to income and decision making vesting even more with men. Women do not have and have not been given any opportunity to acquire skills for alternative livelihoods.

Migration of the male farmers has increased, leaving behind women and girls to shoulder work and care responsibilities. Women generally fetch firewood, water and fodder for the household, which is becoming increasingly difficult in the wake of stressed resources. The FGD and KII disclosed that women have lesser ability than men to deal with climate change impacts. They have been trying to adapt to climate change, however this has increased the work burden on women. The FGD and KII clearly show that women must be central to all climate solutions as they have a broader interface with natural resources.

The FGD and KII showed that men have more access to productive resources such as land, credit and extension services. In case of crop failure due to climatic conditions, men migrate abroad in search of better employment opportunities. However, women farmers are unable to do so due to gender-based discrimination and patriarchal structure. The women are left behind to struggle to feed and look after their families. In many instances, women have to sell their resources like gold, silver or use up personal savings to help meet food security needs and plan for the next crisis.

Sixty four percent of the respondents did not receive any training on climate change and its impact on agriculture. The remaining 34 percent received orientations and training on climate change, its impact on agriculture and how to cope up with climate change from WOREC, Nepal. However, the respondents felt that they need much more training so that they can adapt to the negative effects of climate change and work to ensure a sustainable livelihood for them.
The agriculture policy promoting industrial and chemical agriculture has led to environmental degradation and loss of biomass resources. It has overlooked women's knowledge, skills and practices related to cultivation of food crops.

The study revealed that the primary beneficiaries, i.e. The women farmers did not know about LAPA and NAPA. This makes it clear that the strategies developed by the government have not been successfully implemented at the local level.

4.5.3 Impact of climate change on food security

Agriculture is important for food security in two ways: it produces the food people eat; it also provides the primary source of livelihood. Climate change affects agriculture and food production in complex ways. It affects food production directly through changes in agro-ecological conditions and indirectly by affecting growth and distribution of incomes, and thus impacts the demand for agricultural produce. Decrease in agricultural production and low income have been identified as consequences of small land holding size, climate variability and dependency on rain-fed irrigation, as well as lack of access to market, information sources and alternative employment (Niroula 2005). This has affected the pillars of food security like food availability, food access and food diversity.

Food availability

Food availability, an important pillar of food security is highly affected due to adverse impact of climate change on agriculture as mentioned in the section above (3.5.2). Out of the total respondents, 78 percent reported decrease in crop productivity due to erratic rainfall, prolonged droughts, decrease in water availability and increased incidence of insects, pests and diseases. The decrease in staple food crops like rice and wheat has resulted in unequal distribution of the major cereal and vegetable crops in the district. This has led to staple crops like paddy, pulses and vegetables being imported into the district from neighbouring districts, especially Siraha.

Food access

The ability of individuals and communities to purchase different types of food both in terms of adequate quantity and quality is referred to as food access in this study. Climate change was observed to have a great impact on the access to food in the district. Agriculture is not merely the source of food production but also a source of income. Farmers cultivate only certain and limited types of crops which cannot make them food secure. They need to sell their agricultural products so that they can have access to other type of food resources as per their aspirations and become food secure. About 73 percent of the farmers reported that they have faced decrease in the level of income and increase in food prices. Decreased productivity has created a situation of having to compete for food in the market and resulted in an increase in food prices and food insecurity for the people in the study area. Low productivity has led to uneven allocation and preferences of food and has created food inaccessibility in the area. In conclusion, climate change has had a high adverse impact on access to food, as reported by Schwartz and Randall (2003).

Food Use and Vulnerability

Variability in the weather pattern and increase in the occurrence of extreme situations like increased temperature, erratic rainfall and change in relative humidity directly affects the use of food and food vulnerability, especially of people who directly depend upon agriculture to sustain their livelihood.

The study found that climate change has an equal impact on the use of food, i.e. food diversity. Low agricultural productivity hinders consumption of a balanced and nutritious diet and may have a negative impact on the health of the people. Eighty five percent of the farmers reported that they often eat the same type of food.

4.5.4 Food security situation of the households

The overall food security situation of the household was classified by dividing the households into four categories (a) mildly food insecure (b) moderately food insecure (c) severely food insecure and (d) food secure. Those families who could afford food

for eight months to less than twelve months were categorized as mildly food insecure, families who could afford food for four months to less than eight months were categorized as moderately food insecure and families who could afford food for less than four months were classified as severely food insecure.

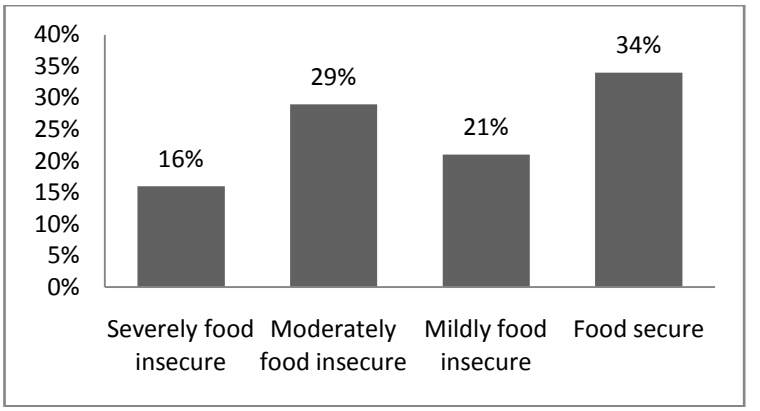


Figure: 9 Food security of the households

The graph above shows that 66 percent of the households were food insecure. Of the total insecure households 29 percent were moderately food insecure, 21 percent were mildly food insecure and 16 percent were severely food insecure. The FGD and KII revealed that lower agricultural inputs, prolonged drought, increased temperature and erratic rainfall were the factors contributing to food insecurity.

4.5.5 Adaptation strategies

Nepal is highly vulnerable to climate change for two main reasons. First, a higher number of extreme climatic incidents are likely to occur resulting in more loss of lives, properties and sources of livelihood. Second, already facing a resource crisis, Nepal is not in position to afford huge costs of implementing adaptation measures, and is likely to remain trapped in the vicious cycle of poverty. In this situation farmers have undertaken different adaptation measures to cope with the adverse effects of climate change. In general, farmers would adapt cropping systems to reduce the adverse impacts of climate change (Lobell & Field 2007). However, Hamill *et al*. (2008) state, citing Burton (2004), that people without resources are in state of 'adaptation deficit', so they are unable to adapt to threats posed by climate change. The farmers have adapted to changes in rainfall and temperature over long periods of time (OECD 2012). The community's ability to cope up with the effect of climate change is determined by their education and awareness on environment (Biggs & Watmough 2012). The treasure of community knowledge and the strength of bio-diverse farming system contributes to the farmer's confidence in being able to sustain at times of climate crisis. The farmers in the *Terai* region are using their own skills and experiences to adapt with the effect of climate change (Maharjan *et al*. 2011). The adaptation measures adopted by farmers are:

a. River bed cultivation

During heavy floods, farmers experienced deposition of sand on their agricultural lands. Therefore, rice and wheat could not be cultivated on the land. Instead, the farmers started cultivation of vegetable crops of cucurbits family like pumpkin, squash, cucumber, watermelon, bottle gourd and bitter gourd. The households received training on riverbed farming. The people residing near the riverbed are trained on riverbed cultivation by WOREC, Nepal. This riverbed cultivation has helped the farmers to compensate their economic loss. The orientation given to the farmers on market linkages and business planning has helped them to make profit from riverbed cultivation. Altogether 23 percent of the farmers have adopted riverbed cultivation.

b. Mulching

Mulching is one of the common practices followed by farmers to conserve soil moisture. The farmers shared that the use of the straw to conserve the soil moisture has solved the problem of dryness in the soil. Of the total population 45 percent respondents practiced mulching operation.

c. Crop rotation

Farmers have been practicing crop rotation, crop diversification, mixed farming, changes in crop varieties and changes in the cropping calendar. Some farmers are practicing from their experience while others have received orientation and training on these practices. Altogether 52 percent of the respondents have been practicing crop rotation. Farmers reported that crop rotation limits insect pests and manages soil fertility.

d. Crop diversification

Farmers reported that crop diversification has helped to minimize production risk by promoting agro-based enterprise. Farmers have been cultivating multiple crops which have increased their production. This statement is supported by Waha *et al.* (2013) that multiple cropping systems provide more harvest security for farmers. Altogether 26 percent of the total respondents practiced crop diversification.

e. Irrigation management

Water requirement is critical for good crop production but due to erratic rainfall and prolonged drought as a result of climate change, farmers have been facing the problem of shortage of water for irrigation. The water in the river and streams has also dried up. Therefore the farmers have been practicing plastic pond in few of the places. The construction of plastic ponds enhances the resilience of farming communities and is useful to adapt to climate change (Pandey *et al*. 2003). Farmers have also been making good drainage systems to remove excess water from the

field. Altogether 75 percent of the farmers practice one or the other method of irrigation management.

f. Migration

Migration has been one of the easiest and most acceptable means to cope up with the adverse effect of climate change. Almost all the respondents want to send their household members for employment outside the country. They are not aware about safe ways of migration. As an immediate response to cope with the impact of climate change especially flood, farmers migrated within the district. However in the long run most migrated to foreign countries. About 27 percent of the people migrated for employment abroad as their land was taken away by floods and due to low production and income. Some among those who migrated faced problems abroad as they were not given the job and salaries which had been promised.

g. Adoption of improved crop varieties

Adoption of improved crop varieties is the most common measure adopted by farmers to cope with low production due to the adverse effect of climate change. Almost half of the respondents reported that they had been using improved varieties, while the remaining half cited lack of financial capital and knowledge as the reasons for not adopting improved crop varieties. The farmers showed a keen interest to shift to seasonal vegetable cultivation from cereal crops like rice and wheat as this would bring in more income.

5. Review of Agricultural Policies, Plans, Implementation and Gaps in Nepal

5.1 The context of the agricultural sector

Nepal is a least developed agrarian country where 66 percent of the economically active population is engaged in agriculture; and the contribution of agricultural sector to the national GDP is about 36 percent (MoAD, 2013). Majority of the rural population (83 percent) resides in the rural areas primarily relying on agriculture and agro-based enterprises for food and nutritional security, livelihood and socio-economic progress. In Nepal, 44 out of the total 75 districts are regarded as food deficit districts. Poor access to resources, services, income generating opportunities and agricultural inputs are considered the main reasons for the food deficit. Rajbhandari (2001) has pointed out that all the factors in the vicious cycle of poverty are primarily responsible for food insecurity in Nepal. In order to address these issues the foremost comprehensive strategy would be to increase agricultural production, improve food distribution system and economic empowerment of the most disadvantaged groups of the population. Agricultural Development Strategy (ADS) has accurately stressed on the need for ensuring food and nutritional security through improved governance as one of the important outcomes of the strategy (ADB 2013).

It is a truism that the ever-increasing application of technology has led to considerable advancement of economic activities in the industrialized countries. Even the developing countries have now recognized the role of technology as a strategic variable for economic progress and have initiated steps for integration of technological considerations into their national development planning process. However, such desired integration still remains problematic. One of the persistent problems may be the fact that economic planners have been and are still treating technology as an exogenous variable, conveniently viewed as a black-box (Sharif 1988). In Nepal, the time has come to open up this “black-box” in such a way as to begin complementary techno-economic policy analysis from gender equality and social inclusion (GESI) perspective.

The Government of Nepal (GoN) has been emphasizing increased production and productivity to meet the growing demand for food arising due to increasing population. It is also looking at the potential for safer food value chain opportunities with quality agribusiness promotion. This has evoked the formulation of strategies to support agricultural commercialization, promotion of high value commodities with certified quality and employment generation with higher income for the small holder farmers. Market oriented quality improved products have remained a thrust for farm enterprise development in the recent years. In order to promote higher food production the GoN has been emphasizing on agriculture extension services.

The FAO-TCP/NEP/3001 provided support for the development of training-of-trainers kit for agricultural cooperative enterprise development. These projects worked through the producer groups with support for marketing skills. However they relied heavily on the District Agricultural Development Officers (DADO) who were not fully trained on the quality certified value chain marketing processes. The gaps between research, training and extension activities at the local level and among the concerned institutions (DOA, DLSO, NARC, IAAS, HICAST, AFU, CTEVT) have had been widely felt as drawbacks to providing an effective and timely agriculture extension service required for higher production and marketing of high quality agricultural products from grassroots to national level. There is an urgent need of small holder farmer-focused participatory decentralized planning and monitoring mechanism to fill these gaps.

Nepal is classified as a "low income, food deficit country" (Rajbhandari, 2000). Agriculture is central to the national economy of the country with nearly 80 percent households and two-thirds of the national labour force depending on this sector for livelihood. The Constitution of Nepal has named food security as one of the fundamental rights of people. National data refer that poverty level in Nepal has declined by almost one third since 1995 (from 42 percent to 23.8 percent in 2012/13). However, the incidence of poverty is relatively high in the rural areas. Annual production is not sufficient for around 60 percent of the households to feed their family members. Around 20 percent households face food deficiency for more than half the year. Unavailability of food has become one of the reasons for consuming unsafe commodities as the food deficit family has no choice except to grab whatever is available. This has lead to an adverse effect on the health of poor families. Ever-increasing number of patients with various diseases is an indicator of the deteriorating health conditions. It has raised concerns for not only supply of food for consumption but "safer food" for consumption. Safer crop production and marketing has been considered important for reducing risk of consumption of unsafe food. The Department of Food Technology and Quality Control (DFTQC) is entrusted with the responsibility of supervising and enforcing legislations to maintain the safety and food quality standards. It is mandated to monitor food quality/contamination/nutrient values at the processing plants and retail market. In order to enhance awareness about the need for producing and consuming safer food, the Agricultural Information and Communication Department (AICD) is entrusted with the role of disseminating information about the importance of ensuring safer and more nutritious crop production and livestock production. This step should be taken as a good start from the perspective of nutrition security and public health. It has been argued that the farmer-to-farmer (FtF) agriculture extension service mechanism should address these issues at the grassroots level.

Least developed countries like Nepal have a limited capacity for agricultural policy analysis and have limited resources for capacity strengthening. This calls for reorganizing methods of training programs by identifying the factors that would enhance policy

analysis capacity needs. The constraints and challenges faced by the organizers of the training courses in re-designing them for meeting the constantly changing policy environment in Nepal need to be emphasized within the broader framework of GESI.

5.2 Food security and climate change in Nepal

Nepal is a country highly vulnerable to food security issues which impact health, nutrition, livelihood and overall national security. The Food and Agricultural Organization considers Nepal to be a low-level food security country. Over 50 per cent of all households in Nepal are not food sufficient for even half the year (FAO 2010). Food security is one of the basic Human Rights, which needs to be assured by the state. Such provision has been made in the Interim Constitution of Nepal. The state is made accountable for not being able to make policy decisions at national level and develop frameworks to solve this vital problem. The UN General Assembly held in New York (October, 2009), stressed the need of addressing food security in the global perspective. In the least developed countries (LCDs) like Nepal the problem is more acute.

The European Union (EU) has cited several major reasons for food insecurity in Nepal. The first is unequal land distribution (access and control over productive land resource), which means that the average land holdings provide insufficient acreage to feed families. Other reasons include low soil productivity; insufficient agricultural inputs (such as irrigation), lack of access of farmers to commodity markets and poorly developed agricultural infrastructures.

Nepal faces food insecurity and has been struggling hard for attaining sustainable livelihood for its people since the past four decades. The population growth rate is at an average of 2.2 percent while food production is fluctuating from a high growth rate of 5 per cent in 1981-85 to 2.2 percent in 1991-95 and 2.5 percent in 1996-2000 (MoAD, 2013). The per capita food availability, which had been growing strongly at 2.1 percent in 1981-85 and 3.2 percent in 1986-90, has shown a negative growth rate in recent decade (Mahbul, 2011). The situation is most serious in Peripheral Mountain areas of the middle hills (47 percent) The country is now a net food importer: the deficit reached 151,000 mt (3.6 percent of requirements) in 1997 A.D. This indicates significantly negative trends. Food Security Assessment Report of the Ministry of Agriculture and Cooperatives (MOAC) indicated that the estimated food grain shortage in the year 2006/07 was almost 190,000 mt. Food inadequacy was the highest in the eastern region (47 percent) and lowest in the central region (22 percent). Food deficiencies are most pronounced in hill and mountain-areas with thirteen out of the sixteen mountain districts and twenty-one out of the thirty-nine hill districts having a severe food deficit. Nineteen of twenty-four districts in the mid- and far- western regions of Nepal are food deficit.

It has been estimated that at present approximately 3.4 million Nepalese require food assistance and 6.4 million are chronically food insecure (FAO 2008). As domestic food production is insufficient to meet per capita calorie needs, Nepal has become a net importer of food. Reliance on imported foods has made the resource poor and marginalized communities and households increasingly vulnerable to price shock. The majority of Nepal's population depends on smallholder subsistence or conventional farming for livelihood. Many households operate on landholdings that are inadequate to produce enough food required for survival. Certain families, particularly those from lower caste groups, manage landholdings within the *adhiya* (share cropping on 50-50 percent basis) system; and are obliged to turn over a significant portion of their harvest to the wealthier or higher caste members holding the land. According to Vaidya (1999) food insecurity is thus the problem of the resource-poor people. They are the ones who are compelled to make major reductions in consumption when scarcity drives up the price of food, which in turn reduces their real income so that they can only reduce food consumption. Currently, Nepal produces barely enough food to meet the national requirement. The food production imbalance has eroded the national food security. The food deficit situations in the districts are gradually getting intensified due to low growth rate in the agriculture sector. Both crop and livestock sectors have stagnated, worsening food deficiency in the districts. Today 55 of the 75 districts of Nepal are declared food deficit districts. If for instance we look at Humla district, people are forced to live in conditions of semi-starvation due to food deficiency (Adhikari 1999). Citing a case from Sankhuwasabha, Gurung (2002) has reported that some remote areas have special problems related to food security. Food deficits are attributed to factors such as limited arable land, poor soil, lack of access to improved seeds and other agricultural services, arising partly because of the low availability of land and partly due to the gender biases of national planners. In addition increase in the number of households headed by women as a result of male out-migration has contributed to the problem of food deficits (Gurung 2002). According to Mike *et al.* (2004) food sufficiency has been improving in the mid-hills, but it has reached a plateau. However, more people are suffering from acute food shortages due to land fragmentation, population growth and decreasing soil fertility. The situation was compounded because smooth implementation of the food distribution system was affected by the political conflict in Nepal. Bajracharya (1983) emphasizes that reduction in forest cover is the consequence of the need of the increasing subsistence population to develop more agricultural terrace or grazing areas to ensure the production of more food and fuel wood. The mountain or Himalayan region (35 percent) is suitable for eco-tourism, but is the most food deficit region.

Rapid population growth and infrastructure problems have reduced food security. According to Bajracharya (1983) the problems of food security in Nepal include: lack of appropriate food supplies; food grain storage problem; persistent decline in food production and negative impact of chemical fertilizers on soil structure and fertility. Loss of indigenous

knowledge, practices and medicinal plants, lack of old seed varieties, lack of social market for agricultural products at the local level are other factors listed by Bajracharya.

Agricultural productivity is growing very slowly in Nepal as compared with other South Asian countries. For example, between 1961-63 A.D and 1997-99 A.D paddy yields in Nepal grew at an annual average rate of 0.6 percent compared with 1.41, 1.43, 1.79 and 1.97 percent, respectively in Bangladesh, Sri Lanka, India and Pakistan. Poor agricultural performance has led to a rapid deterioration in the balance of trade in food. In 1975/76 A.D Nepal exported food grains worth Rs 5,959 million. It declined to Rs 1 million in 1989/90. This is a dramatic change compared to the year 1981 when only 8 of the 75 districts faced food deficiency while 40 districts had surplus. Since the early 1990s, the food status of Nepal changed and instead of being an exporter it became net importer of food. Nearly, about 45 districts of Nepal had deficiency in food (OCHA 2008). The intensity of poverty is dramatically increasing in Nepal. The recommended minimum calorie requirement for an adult in the country is 2,250 kilocalories per person per day. This is also the limit of the poverty line (NHDR 1998). It is pertinent to point out that food security does not only mean an increase in the aggregate food supply. It applies to physical and economic access as well as entitlement to food for all.

Lack of access to productive resources and skill development opportunities has left a sizable section of the population in poverty; this widespread poverty has become the major cause for food insecurity. Food insecurity and hunger remain widespread in Nepal, not only in food deficit districts but within marginalized communities even in the districts with surplus food production. Food and financial crisis are gradually increasing. Nationally, 47 percent of the land-owning households have access to only 15 percent of the total cropped land with an average size of less than 0.5 ha, whereas the top 5 percent of the HHs have control over nearly 37 per cent of land. Most *Dalits* are landless. A recent rough estimate by World Food Program (WFP) has stated that the minimum amount of land required for HHs self-sufficiency is approximately 0.54 ha (OCHA 2008). The situation of food insecurity in Nepal is depicted in Table 2.

Some remote hill and mountain areas of Nepal produce less than half of the food they need without having other sources of income to purchase food. They have to depend on scarce wage jobs and off-farm employment. A high rate of unemployment and underemployment has thus hampered economic access to food. Traditional foods both fermented and non-fermented are equally important for food security based on preservation, cultural and ethical practices. More than 65 percent of the population of Nepal is engaged in agriculture. Due to the diversified ethnic communities (more than 60 castes), culture and heritage different methods of food preservation and consumption patterns are in practice. Common traditional fermented foods are *Dahi* (curd)*, Mahi* (fat separated and diluted curd)*, Jaand* (fermented boiled cereal)*, Raksi* (alcohol processed from fermented cereals like rice,

millet, maize, etc), *Masyaura* (a sun-dried product of black gram paste mixed with vegetables or tubers), *Gundruk* (sun-dried product after fermenting the broad leaf mustard) and *Sinki* (sun-dried product after fermenting the radish (root and leaves) or rape/mustard leaves). These food items are not only important components of cuisine among various ethnic groups in Nepal, but also the source of household income. It should be noted that local women are adept in preparing such food items; and can play an important role in economic empowerment of rural women (Rajbhandari and Shrestha 2014).

Table 2 Food insecurity in Nepal

SN	Status of food insecurity	Remarks
1	People's need of immediate food assistance	2.5 million
2	People at risk becoming food insecure due to rising food prices	4.5 million
3	Average HHs income spent on food (extreme poor in rural areas)	59% (78%)
4	Food price increase in last 12 months	30-60%
5	Districts food-deficient in 2007 (based on local production)	42 (out of 75)
6	Estimated (rough) minimum amount of land needed for food self-sufficiency for mountain, hills and Terai	0.64 ha, 0.55 ha, and 0.45 ha
7	Estimated number of HHs with less than 0.5 ha Mountains (Hills/Terai)	47 % (49.2% / 41.3%)
8	Land owned by top 5% of landowners	37%

(Source: OCHA, 2008)

Vulnerability to food insecurity is also on the rise in Nepal because of climate change. Climate change is posing more difficulties particularly in low land or disaster prone areas (Rajbhandari and Shrestha 2014). Several studies show that changing weather patterns have significantly posed challenges for livelihood with the community experiencing resource degradation; food scarcity, lack of basic services and increasing social inequalities. The climate variability and change has become an additional burden to the resource-poor people especially in the mountains who are already living in a poor environment. Poverty makes people more vulnerable and excluded with predictions of additional risks to livelihoods and further inequity in the future. Major impact of climate change in poor communities has resulted in a worsening situation with regard to the following aspects:

- Land degradation
- Competition in exploitation of natural resources
- Pushing more people into hunger.

In view of the above scenario of food security, it is likely that the problem of food grain in Nepal will grow more acute due to the possible impact of climate change. It is estimated that there will be great shortage of food grains (300-400 thousands metric tons) due to untimely rainfall in Nepal. The underlying causes ascribed to it are global warming, green house gas emission effect, atomic testing and emission of pollutants (Rajbhandari and Shrestha 2014).

All the major indicators of food security show that Nepal is exceptionally food insecure. The growing incidence of poverty and food insecurity in Nepal is an outcome of the economic process of a worsening income distribution pattern among the rural households and amongst men and women. Lack of employment opportunities has further contributed to the deterioration of the situation of poverty, food insecurity and lack of adequate livelihoods in Nepal (Rajbhandari 2001). Alongside these weaknesses and challenges, Nepal has rich natural resources with high biological value of wetlands with rich biodiversity. Similarly, fresh water originating from the Himalayas has created many wetlands with beautiful natural environment. These are the resources that should be paid due consideration while planning a food security policy and strategy (Rajbhandari and Shrestha 2014). These facts indicate that Nepal has a good prospect of diversifying and increasing agricultural and food production or acquisition through wetland management and conservation for alleviating poverty and attaining sustainable livelihood (ibid). Many programs have been conducted to resolve the problem of food insecurity. Recently, the World Bank has announced a grant assistance of USD $ 46.5 million to Nepal under the third round of grant from the Global Agriculture and Food Security Program (GAFSP) to help small farmers increase their income and improve food security. It has been anticipated that GAFSP funds will enhance household food security among the poorest households in most food-insecure regions through increased agricultural productivity, household incomes and awareness about health and nutrition in the mid-western and far-western development regions.

Loss of indigenous seeds and plant/animal genetic resources, encroachment of wetlands, use of chemical inputs like fertilizer and pesticides are the major factors of degradation of wetland bio-diversity (Rajbhandari and Shrestha 2014). Similarly, chemically intensive agriculture has caused soil degradation (fertility, structure, soil micro-organism population); increased problems of salinity; and water logging (Rajbhandari 1999, 2002). Incidence of malaria and other water-borne diseases are gaining significance in catchment areas of wetland. Ground water resources are being adversely affected qualitatively by the excessive use of mineral fertilizers and pesticides (Swaminathan 1990). It is thus clear that conventional agriculture is not a sustainable and eco-friendly system. As farming has a direct relationship with food security, livelihood and poverty alleviation, our concern about alternative sustainable farming system approaches seems quite pertinent (Rajbhandari 2011). There is a strong inversely proportional relationship between agricultural productivity, hunger and poverty. Three quarters of the world's poor lives in rural areas

and makes its living from agriculture. Hunger and the child malnutrition are higher in the rural areas than in urban areas. Moreover, higher proportion of the rural population obtains its income from subsistence farming for livelihood. Higher levels of malnutrition are rampant in rural areas. Hence, improvements in agricultural productivity aimed at the small scale farmers will benefit the rural poor. Bio-intensive farming system (BIFS) is a holistic sustainable approach that addresses the issues of hunger, food insecurity and livelihoods from the perspective of small farmers and women (Rajbhandari 2002, 2011). Therefore, bio-intensive farming system has a positive effect in improving household food security and livelihoods, while simultaneously adapting to impacts of climate change (Rajbhandari 2006).

5.3 Agricultural planning, policy and legislation in Nepal

Nepal has progressively achieved a significant number of its development targets since the introduction of its first development plan in 1956. Nepal's current Three Year plan aims at creating a prosperous, peaceful and just Nepal by transforming the country from a least developed country (LDC) into a developing nation within two decades. High economic growth, peace and good governance are at the core of the current three year plan which commits to a long-term vision of ending "all forms of discriminations and inequalities such as legal, social, cultural, linguistic, religious, economic, ethnic, physical, gender and regional". Moreover, as the chair of the LDCs, Nepal has in recent years played a pivotal role in advancing the global LDC agenda and bringing out the Istanbul Program of Action (IPoA).

In recent decades, the Government of Nepal has taken important reform initiatives, especially in regard to policy and legal reform in order to progressively shape the inclusion and non-discrimination agenda. For example, legislative reform has kick-started a gradual transformation in the areas of gender equality and women's empowerment, ensuring greater economic security for women, protecting them from violence, safeguarding their sexual and reproductive rights and amplifying their voices in decision making. Women's representation in the legislative body dramatically increased to 33 percent (in the first Constituent Assembly) from 2.9 percent in 1992 (in the then parliament). The Nepal Law Commission was formed to continue to recommend legal reform as per needs. Laws related to foreign employment and migration were reformed. A youth employment policy was introduced and initiatives to ensure social protection for elderly citizens were also undertaken. The introduction of gender responsive budgeting and the formation of the *Dalit* and Women's Commissions are other examples of reform initiatives in Nepal aimed at addressing discrimination and inequality.

In addition to these important policy and legislative reforms, the implementation of periodic plans has resulted in significant achievements especially in developing physical infrastructure and in the social sectors. Using the national poverty line of about USD 230 a year, the poverty incidence for Nepal in 2011 was estimated at 25 percent (CBS, 2011).

However, there are significant differences across groups: the incidence of poverty in urban areas is 15 percent compared to 27 percent in rural areas; 42 percent of *Dalits* are poor compared to 23 percent of non-*Dalits*; and the likelihood that a household headed by an illiterate person is poor is four-and-a-half times greater than that of a household headed by a person who has completed Grade 11 (Ibid). Using 2006 data, the Multidimensional Poverty Index indicated that nearly 65 percent of Nepal's population is considered poor (UNDP 2011). Nepal intends to reduce poverty to 21 percent by 2015. It requires targeting poverty alleviation with sustainable agriculture technologies and food security initiatives.

Over the years, the government has focused on broad-based economic growth and poverty alleviation. In the past two decades Nepal's overall economic growth along with the associated reduction in poverty has been encouraging. Growth in gross domestic product (GDP) has averaged four percent per year between 1990 and 2009 and poverty has fallen by 39 percent. This progress suggests that Nepal is firmly on track to achieve the Millennium Development Goal (MDG) to halve poverty by 2015. The overall decrease of the population living below the poverty line from 42 percent in 1996 to 25.4 percent in 2013 is an important achievement. The poverty gap ratio also declined by almost 50 percent, an indication that those who remain poor have experienced a significantly lower degree of poverty.

Nepal has recorded the fastest overall progress on the Human Development Index (HDI) compared to any other country in the world during the last three decades. Its progress towards the Millennium Development Goals (MDGs) on reducing poverty and improving education, gender equality and health has been impressive. The country's Gini coefficient [1] was the highest in Asia until 2008, when it was estimated to be 0.45, but has since then fallen to 0.32 in 2011 (CBS, 2011). However, progress has been uneven and inequalities remain a challenge on Nepal's development path. Similar progress in overall terms has been made for most of the other MDGs. Increases in literacy and school enrolment rates, increases in average life expectancy and reduction in child and maternal mortality rates are other significant achievements. Several MDG targets were also achieved in education and various targets on gender equality and health have been achieved or are projected to be reached by 2015. Nepal is expected to achieve six out of eight MDGs by 2015. While persistent challenges remain in achieving some of the MDG targets, especially those related to ensuring full employment, universal access to reproductive health and access to improved sanitation, there is ample evidence that meaningful progress has been made in improving the overall well-being of Nepal's population.

These overall development gains are all the more impressive given the fact that Nepal is undergoing a complex transition after a decade-long internal armed conflict. Since the signing of the Comprehensive Peace Agreement (CPA) on 21 November 2006, there

1 Gini coefficient is a measure of statistical dispersion intended to represent the income distribution of a nation's residents, and is the most commonly used measure of inequality.

have been a number of historic achievements. These include maintenance of the ceasefire, Constituent Assembly elections in 2008, the peaceful declaration of Nepal as a federal democratic republic, the discharge from the Maoist army of 4,008 verified minors and late recruits in 2010, the release of 7,365 personnel from Maoist army cantonments through 'voluntary retirement' in 2012 and the clearance of all minefields. Other CPA commitments await full implementation, such as the final integration or discharge of remaining Maoist army personnel, finalization of a new constitution, establishment of transitional justice commissions and substantive movement on conflict-related crimes. It is equally urgent that Nepal makes fast progress on the long-term structural reforms that are at the heart of the CPA. There is a pressing need to increase delivery on aspirations for the transformation of Nepal in terms of rights, equality, inclusion and embarking upon the fundamental political, socio-economic and governance transformations outlined in the CPA. These include new measures to uphold universal human rights, the rule of law and an independent judiciary; to ensure social justice and equality; to address land reform and property return; to ensure people's right to information and participation in governance and to build an impartial, competent and fair administration through a restructured inclusive federal state. In this spirit, the long-term vision statement of the current Government development plan focuses on addressing "all forms of discrimination and inequalities" (GoN, 2014) and for its part, the UNCT decided its Country Analysis (CA) for Nepal (the first step in an UNDAF formulation process) should similarly put people at its core—a 'country analysis with a human face'.

The UNCT used a "Country Analysis" to investigate the situation of vulnerable groups in Nepal to identify the structural causes of vulnerability and to better understand which groups are particularly susceptible to future shocks that could substantially reverse the development gains achieved over recent years. The Country Analysis explored the different types of vulnerabilities that Nepali people face through a set of different lenses related to poverty, human development, exclusion and individual protection. Improving human well-being requires a comprehensive understanding of the realities that specific groups, e.g. the marginalized groups and women face in society. Some of these realities are based in history and are deeply rooted in common socio-cultural practices fuelled by patriarchy. Others emanate from political processes and past and current conflict dynamics.

Sluggish economic growth: Lack of employment or alternative livelihood opportunities is a major root cause for vulnerability. This is particularly so for disadvantaged groups which do not own economic resources such as land. Declining returns on agricultural production and a stagnating manufacturing sector are severely impacting marginalized groups that have traditionally depended on agriculture, as well as those who have moved to urban areas and abroad in search of opportunities for livelihood. A diversified and vibrant economy that can absorb today's labour force including youth, people with

low human capital and those from rural areas is urgently needed. A failure to create a diversified and vibrant economy will further drain Nepal of its biggest asset- its people.

Unequal distribution of economic resources: The distribution of economic resources has long been inequitable. While initially most of this inequity was related to land distribution—land having traditionally been a major source of power and status in the country's agrarian setting—inequitable access to economic resources has only worsened with the advent of the manufacturing and services industries. Inequitable or for some, non-existent access to economic resources has significantly and negatively impacted many marginalized groups in Nepal. A particularly challenging task is bridging the divide between rich and poor. The issue of resource distribution and redistribution warrants major initiatives so that the economic marginalization of vulnerable groups can be addressed.

Weak institutional capacity: Even where the State is actively working to address the problems faced by marginalized groups, it often lacks the appropriate institutional capacity to effect substantive change. If we take a look at the areas of health, education, land reform or natural resources, state agencies designated to enforce laws or execute policies and programs often perform below the required efficiency and effectiveness due to lack of human and financial resources and a high turnover of staff. Alongside, the capacity, accountability and responsiveness of local bodies must be further strengthened, as they are the focal point for socially inclusive service provision and can greatly contribute to generating public goods for economic development.

5.4 Formulation and implementation of agricultural policies, acts, regulations, orders, plans and programs

The GoN has formulated policies, acts, regulations, orders, as well as plans and programs for the development of the agriculture sector in the country. A brief write up of the laws, policies, plans and programs follows:

5.4.1 Policies, acts, regulations, and orders

In the past, agriculture development programs were mainly guided by the government directives and the periodic plans. Various attempts have been made to formulate agriculture strategies and perspective plans. The Agriculture Development Strategy (ADS) formulated by the Asian Development Bank initiative in 1983 was the first attempt in this direction. However, it could not be implemented due to various reasons. In 1995, the GoN in association with John Mellor and Associates formulated a twenty year Agriculture Perspective Plan, 1995-2015 (APP). This has been the major guideline for agriculture development of GoN up to the present. The GoN formulated National Agriculture Policy, 2004 (NAP) implemented in November 2004 is the current agriculture development strategy. All agricultural development plans, programs and projects are guided mainly by NAP.

The ADS document (ADB 2013) has stated that most policies in Nepal are supportive of agriculture. However numerous policies have been left at a draft stage, have not been implemented and often lack supporting legislation and resources. Various factors contributing to this situation are :

a. Limited implementation capacity;
b. Limited financial resources;
c. Poor coordination;
d. Lack of supporting legislation and
e. Lack of monitoring and evaluation.

Various policies, acts, regulations and orders are in place in Nepal to support higher and safer crop production, food security initiatives and related activities/enterprises and are listed below:

a. Policies

At present the following ten policies have been formulated and are being implemented:

- National Agriculture Policy, 2004
- Agri-business Promotion Policy, 2006
- Agro-biodiversity Policy, 2007
- National Seed Policy, 2000
- National Fertilizer Policy, 2002
- Irrigation Policy, 2003
- National Tea Policy, 2000
- National Coffee Policy, 2003
- Dairy Development Policy, 2007
- Agriculture Perspective Plan, 1995-2015

b. Acts, Regulations and Orders

Acts and regulations have been formulated whenever there is a need for legalizing the provisions made in the policy. These laws have to be passed in the parliament which requires rigorous exercise and substantial time. The GoN can promulgate orders to mitigate and address emergency situations. Declaration of Bird Flu Control Order, 2064 in 2006 is such an example. Currently, there are eighteen acts, nine regulations and six orders related to agriculture development as listed below:

Acts

- Food Act, 2023 (3rd Amendment 2049)
- Substitution of Mothers' Milk (Sales and Distribution) Act, 2049
- Iodized Salt (Production, Distribution & Sales) Act, 2055
- Feed Act, 2033 (Amended in 2055)
- Patent Design and Trade Mark Act, 2022 (Amended in 2048)

- Aquatic Animal Protection Act, 2017 (Amended in 2055)
- Contract Act, 2056
- Seed Act, 2045
- Pesticide Act, 2048 (1st Amendment 2064)
- Plant Protection Act, 2064
- Animal Health and Animal Service Act, 2055
- Animal Slaughter House and Meat Inspection Act, 2055
- Cooperative Act, 2048
- Nepal Agriculture Research Council Act, 2048
- Nepal Veterinary Council Act, 2055
- National Tea and Coffee Development Board Act, 2049
- National Dairy Development Act, 2048
- National Cooperative Development Board Act, 2049

Regulations

- Food Regulation, 2027 (4th Amendment 2054)
- Feed Regulation, 2041
- Seed Regulation, 2054
- Pesticide Regulation, 2050
- Irrigation Regulation, 2056 (1st Amendment 2060)
- Animal Health and Animal Service Regulation, 2056
- Animal Slaughter House and Meat Inspection Regulation, 2057
- Cooperative Regulation, 2049
- Nepal Veterinary Council Regulation, 2057

Orders

- Chemical Fertilizer (Control) Order, 2055
- Seed and Milk Development Committee (Constitution) Order, 2052
- Kalimati Fruit and Vegetable Market Development Committee (Constitution) (3rd Amendment) Order, 2063
- Cotton Development Committee (Constitution) Order, 2037
- Animal Feed Production Development Committee (Constitution) Order, 2041
- Bird Flu Control Order, 2064

National agricultural policy

Despite the priority accorded to agriculture under the various Nepalese Developmental Plans, the National Agricultural Policy (NAP) was formulated only in 2004. This policy envisages the sustainability of agricultural production and the transformation of subsistence farming into a commercial and competitive system. Food security and poverty alleviation are the current challenges while at the same time agriculture is vital for addressing these challenges and for sustained economic growth of the country. There are three major objectives outlined for the agriculture sector under the National Agricultural Policy (NAP 2004):

A. Increasing production and productivity to ensure food security and alleviate poverty;
B. Making agriculture competitive in the regional and world markets with the development of prerequisites for agricultural commercialization and diversification and
C. Conserving and managing natural resources for environmental sustainability.

In a nut shell, the thrust of the NAP is to promote sustainable agriculture and natural resource management for good quality, diverse agricultural products for higher income generation, ensuring food security, alleviation of rural poverty and contributing to the national economy. In the process natural resources (land, forest, biodiversity and water) should be conserved and managed sustainably without any detrimental impact on the environment. However, these objectives are poorly addressed in the government programs.

FAO had extended its support to the consolidation and gap analysis of agriculture related policies in 2001 and 2003 in two phases. In 2001, a TCP/NEP/0165 project was implemented to assess agriculture policies and legislations so as to determine the improvement needs facilitating agricultural production. It was followed by a second phase (TCP/NEP/0165) project to assist the GoN in drafting priority legislations in support of emerging agriculture sector needs. It resulted in a compiled version of Agriculture Related Policies, Acts and Regulations published by the MoAD in 2065B.S.

National agricultural plans and programs

The first periodic plan was launched in 1956. Up to the year 2011, nine Five Year Plans and Three Year Plans (including the recent TYP 2067/68-2069/70) have been implemented. The recent periodic plan is the 12th Plan. The past periodic plans focused on different aspects ranging from infrastructure development, integrated rural development to social development, basic needs fulfilment and poverty alleviation. Some important achievements have been realized after the implementation of the periodic plans. These include reduction in population below poverty line (25.4 percent) and reduction in child and maternity mortality rate. Simultaneously, there was an increase in literacy rate, enrolment in the school and in the average life expectancy (64.1 years). There has been substantial reduction in population below poverty line from 31 percent to 25.4 percent during the last Three Year Interim Plan (2064/65-2066/67). The reduction in population below poverty line has been mainly due to increase in wage rate in agriculture and non-agriculture sectors, increase in urbanization, an economically active population and increase in remittances.

A prerequisite for advancing equity in society is to improve human well-being and the overall quality of life. While Nepal continues to make progress on most of the MDGs, with particularly notable achievements in the areas of education and health, critical inequities persist. There remains a need to support the GoN in its efforts to address equity of access to basic essential social services with a focus on disadvantaged groups.

The achievement of basic human rights as well as the MDGs by 2015 remains a key priority for the UNCT and the GoN. The foundation is the fundamental need to meet the rights of all Nepali people to basic services, with a particular focus on those groups that have so far been deprived of access to such services. Despite political instability, Nepal has continued to make overall progress on the MDGs with impressive progress in some areas. In September 2010, Nepal was given an MDG award for outstanding national leadership, commitment and progress towards achieving the MDG on improving maternal health. The HDI has been steadily improving with an increase of over 100 percent, from a score of 0.210 in 1980 to 0.428 by 2010.

Despite Nepal's remarkable progress towards realization of its MDGs, significant challenges remain with respect to socio-economic inclusion and advancement of the population in general and vulnerable groups in particular. Such challenges include the limited availability of productive employment and income opportunities, inadequate access to productive assets and insufficient social protection. UNCT initiatives under Outcome 2 will attempt to address these gaps, targeting mainly MDGs 1, 3 and 7 and combining support for the GoN and relevant stakeholders to achieve results in the following areas: inclusive labour and economic development policies and programs; access to microfinance, productive assets, environment-friendly energy services and natural resources; safe labour migration and the productive use of remittances and adequate social protection including food security.

Due to a combination of factors including ongoing political instability, poor infrastructure and low levels of investment in most sectors of the economy including agriculture, energy and industry, Nepal is not in a position to provide sufficient levels of economic opportunities to substantially improve the livelihood of a population of 26.6 million. A quarter of the population (nearly 6.7 million) lives below the poverty line. Despite recent improvements, Nepal's malnutrition rates are also among the highest in the world, with prevalence of chronic malnutrition among 50 and 60 percent of children under five in the mid- and far-western hills and mountains. While most people of working age have work- either they do not have enough working hours or are not paid enough to lift themselves and their families out of poverty. The critical elements for the sustainable and long-term development of Nepal's economy and society are an enabling environment for increasing access to and the creation of more and better quality jobs (access to economic opportunities), while simultaneously addressing short-term needs and objectives (economic empowerment and adequate social protection).

The planned development of agriculture sector began with the establishment of Department of Agriculture (DoA) in 1951. In 1965, DoA was transformed into five departments as Department of Agriculture Extension, Department of Fishery, Department of Horticulture, Department of Animal Health and Department of Agriculture Research and Education. Over the years these departments have been restructured several times.

Currently, there are four departments: Nepal Agricultural Research Council (NARC), Boards, Committees and Corporations under the Ministry of Agriculture and Cooperatives (MoAC).

MoAC is at the apex for formulating policies and programs as well as for the overall coordination of agriculture development programs in the country. The Ministry formulates and implements agriculture development plans, programs and projects through its departments, regional directorates, service and sub-service centre level offices. MoAC is an umbrella organization for NARC, corporations, companies, boards, committees and departments. The Ministry is headed by the Minister and has five divisions. Each division is headed by the Joint Secretary. The sections in each division are headed by senior officers. The sections look after specialized tasks through internal and external coordination with other ministries and departments. Four departments viz. Department of Agriculture (DoA), Department of Livestock Services (DLS), Department of Food Technology and Quality Control (DFTQC) and Department of Cooperatives (DoC) have been established mainly to carry out agriculture extension activities and service delivery to the farmers and entrepreneurs in the country.

NARC was established with the main responsibility of carrying out agricultural research. Since Nepal has diverse climatic and physiographic zones, research in a few research stations is not sufficient to represent the wide variation in different regions. Therefore for the wider coverage of innovations four Regional Agriculture Directorates, eighteen Agriculture Research Centres and fifty Location Specific Research Stations have been established in various parts of the country.

5.5 Agricultural policy and reform mechanism

A comprehensive capacity building strategy for undertaking serious agricultural policy analysis and research in the Ministry of Agricultural Development (MOAD) has suffered significantly over the past two decades due to the following factors:

(i) policy instability: the rate of turnover in agricultural policies has been high with many policies formulated and abandoned in rapid succession;
(ii) policy inconsistencies: each problem has been viewed in isolation leading to inconsistency among policies;
(iii) narrow base of policy formulation: policies have lacked grassroots support and the level of farmers' involvement in the formulation of policies has been minimal;
(iv) poor implementation of policies: bureaucrats and implementers have formulated policies as an end in themselves rather than being a means to desired ends, contributing to high policy turnover rates that intensify the problems of policy implementation;

(v) weak policy coordination: redundancies and general inefficiencies in resource use among agencies and ministries together with inadequate monitoring and evaluation for policy implementation have led to situations where policies and programs lose sight of their original goals;

(vi) lack of information feedback: without clear specification as to the role of the stakeholder, appropriate information has not been taken into account to take corrective measures in the national agricultural and rural development policies; and

(vii) inadequate physical infrastructure: MOAD does not have sufficient apparatus for agricultural data collection, analysis, and computerization and lacks a well-developed management information system (MIS) as well as tools , e.g. ICTs for proper storage of data.

It is important to evaluate the strengths, weaknesses, opportunities, threats and risks to address capacity gaps in agricultural policy analysis and to upgrade research; training; extension; production; processing and marketing in the agricultural sector. SWOT analysis based on secondary sources presents a picture of the various factors under consideration.

5.5.1 Strengths

1) Nepal has an extensive public research system with five Directorates, fifteen Divisions, Fourteen Crop and Commodity Research Programs, four Regional Research Centers, eighteen Research Stations and fifty Research Sites under the Nepal Agricultural Research Council (NARC).
2) There are three universities viz. Tribhuvan University (IAAS, Colleges in Dang and Baitadi), Purbanchal University (HICAST, NPI) and Agriculture and Forestry University (Rampur Agriculture Campus) offering higher education degrees and conducting research and training activities in agricultural and animal sciences.
3) The government has an extensive network for agriculture and livestock service centres throughout the country.
4) Building linkages among these institutions based on appropriate synergies and the institutions' comparative advantages can help in significantly augmenting agricultural productivity while simultaneously addressing the needs of smallholder farmers including women farmers.

5.5.2 Weaknesses

Two sets of public institutions that are directly involved in building capacity for agriculture are the national agricultural research council (NARC) and extension (DoA, DLS) systems and the higher education systems like universities and colleges in agriculture. The Nepalese public research and extension centers are currently affected by numerous constraints such as:

1) Insufficient and unreliable funds that limit the potential for relevant research;
2) Absence of a national research policy that results in a lack of coordination and a duplication of research efforts; and
3) A top-down research and extension approach that is disconnected from farmer's needs and has demonstrated limited accountability.

Furthermore the linkages between research and the extension system are weak or non-existent due to the following reasons:

1) Research is often conducted to advance researchers' careers rather than in response to specific demand of the farmers.
2) Public extension systems suffer from a lack of coordination among service providers from local to central levels of government.
3) Non-participatory methods of extension, such as training and visit (T&V) are often followed without taking into account the technology needs of women farmers.

In spite of the above weaknesses in research and extension systems, there are opportunities for improving the functioning of these institutions through better networking, partnership and collaborations.

5.5.3 Opportunities

Opportunities exist for improving the policy analysis as well as the research, education and extension capacity of the agriculture sector in Nepal. This includes revamping the higher education programs, providing specialized training, supporting monitoring and evaluation, establishing a management information system (MIS) with the use of information communication technology (ICT) and improving export markets at regional and international levels.

In regard to skill development, universities can ensure that the next generation of policy analysts, policymakers, researchers, and extension workers are trained in specific disciplines so that existing gaps are addressed. Such disciplines may include accounting and management, leadership development, ICT in agriculture, women empowerment, Farmer-to-Farmer agricultural extension, sustainable agricultural production systems and techniques, agro-processing, agri-business and marketing management apart from the core disciplines in agricultural and animal sciences. Development of the above courses would facilitate problem-solving research and teaching that addresses the lack of productivity in agriculture and food insecurity (IFPRI, 2008). At the same time innovative research programs could be developed within the universities and colleges of agriculture or Nepal's national research system (NARC) to address the knowledge gaps in production, processing, extension and marketing.

The ADS roadmap calls for significant strengthening of policy analysis capacity within the public staff of key institutions such as Ministry of Agricultural Development; Ministry of Federal Affairs and Local Development; Ministry of Women, Children and Social Welfare; Ministry of Irrigation and Ministry of Environment, Science and Technology. The national focus on capacity strengthening could provide sufficient funding and opportunities for civil servants to be trained in policy analysis, interpretation and communication as well as program management.

5.5.4 Risks

There are several risk factors that can affect the performance of the agricultural sector in Nepal and render policies ineffective such as:

- an unstable political climate;
- investment insecurity;
- non-standardized product quality and
- non-competitive nature of agricultural products in the export market due to low production and high marketing cost as well as lack of adequate storage and processing facilities.

5.6 Policy gaps

As the agriculture extension system in Nepal includes a complex network of institutions, the reform process should aim for a more effective and outcome-oriented extension system especially from a women's perspective. There can be no blueprint for a uniform standard reform measure in Nepal as there are a wide variety of farming systems with diverse ecosystems and the multi ethno-social fabric of society. This provides potential for a large number of micro-enterprises. The process to address policy reform in Nepal for ensuring an efficient, effective, relevant and impact-oriented service system should give due consideration to all the relevant factors and issues from the smallholder farmer's and women farmer's perspective.

The extension system is poorly equipped to innovate in natural resources management and climate change. Soil fertility management, water conservation technologies, agro-forestry, quality control and certification, climate change adaptation and mitigation measures should be part of the extension agenda in addition to conservation and promotion of agro-biodiversity. Capacity of research, education, training and extension services should be enhanced to fulfil the goals of agricultural development. The issue of agricultural human resources development in the private and public sector needs to be urgently addressed.

Production inputs, agricultural credit and marketing are binding constraints for agricultural development in Nepal. Inputs are relatively more accessible in the *Terai*; hills and remote areas have paucity of input dealers to complement extension with

technical advice. The private input suppliers should be linked with research organizations (like NARC, IAAS, HICAST, AFU) and local extension agencies (like DADO and DLSO) to support effective extension services delivery. Agricultural credit is not earmarked to support agriculture development objectives. Micro-finance intermediaries are few in the rural areas and even fewer in remote places. Saving and credit cooperatives are mostly located in urban areas and working capital is a limiting factor in the rural setting. Agriculture marketing is underdeveloped in Nepal. Rural markets provide opportunity for producers to earn cash incomes. Access to inputs and credit and rural market development are crucial for effective extension service delivery.

5.6.1 Environmental sustainability

Environmental analysis is not so prevalent in agricultural and rural development projects in Nepal. One of the main constraints to taking on board environmental issues is weak leadership at the ministry and legislative levels in the decision-making processes. Budgetary constraints in conducting environmental impact assessments, low level of information communication, poor understanding of environmental issues related to the use of synthetic pesticides are some of the other constraints. Inconsistent government policies, weak linkages between researchers and policymakers, limited monitoring of program/project implementation and high poverty levels contribute to the lack of adequate attention to environmental sustainability in agricultural policy.

5.6.2 Human and institutional capacity

In addition to physical and financial capacity, human resources as well as institutional capacity play an important role in the increase of agricultural productivity. The ADS document shows the limited capacity of the concerned institutions in policy analysis, planning, service delivery, and implementation. There is little analytical work and output related to policy. The document concludes that formulation of policy occurs often without adequate or evidence-based analysis. The implementation of policy is insufficiently monitored and evaluated or is delayed until it is too late to make adjustments and corrections. Limited human resources to serve large farming communities with inadequately trained or semi-skilled service providers has resulted in poor quality of service delivery and inability to meet the service demand of a large population of the farmers as well as of potential agribusiness enterprises. Institutional capacity to implement policies and programs is constrained by lack of hardware and investment funds to carry out programs as well as frequent changes, limited skills and inadequate human resources. Accountability and transparency in program implementation needs considerable strengthening and the inclusion of the linking monitoring and evaluation systems to performance evaluation and incentives. These are some of the important points that should be paid due consideration in policy analysis for effective implementation of the agricultural development strategies in Nepal (ADB, 2013).

5.6.3 Physical and financial capacity gaps

Capacity strengthening of existing human resources is limited due to declining budget for training. Limited financial incentives and physical facilities to the service providers, particularly in remote areas have also contributed to inadequate service delivery.

The GoN has expressed its commitment to commercialize and modernize Nepalese agriculture for ensuring food security as a Human Right and substantially reduce poverty by 2020. However, agriculture and agribusiness investments are constrained by lack of suitable policies (e.g. contract farming), competition with state enterprises and cooperatives, lack of services and infrastructure to support value chain development (e.g. business incubators, agro-industrial parks), absence of agricultural insurance and a transparent and stable tax and incentive system to promote innovation and reduce risk (ADB, 2013).

The key issues are how to increase financial incentives and infrastructure as an incentive to provide service in remote areas and how to increase sustainable and profitable investment in agriculture and agribusiness that could accelerate growth, commercialization and modernization of Nepalese agriculture. These issues need to be addressed by formulating appropriate policies.

5.6.4 Mainstreaming gender into agriculture and rural development

While women in Nepal play a significant role (70 percent of total labour force used in farming) in agriculture and rural development, women farmers continue to have no voice to influence agricultural and rural development policies. It has been widely recognized that addressing gender inequality in all its dimensions would require strategic partnerships both within central government (ministries and departments) and among the different levels of government (district and village). Partnerships would also need to be broadened to include women's organizations in civil society, donors and UN agencies to implement commitments to gender equality. The National Women Commission (NWC) could conduct critical analysis, develop baseline indicators and provide status reports to guide the implementation of the National Gender Policy. The MOAD and the NWC would require additional resources to address the agricultural and rural development challenges faced by women, particularly women farmers.

The Agricultural Development Strategy document (Final Draft) has pointed out that budget allocations are often silent over how to enhance women's strategic positions through recognizing women as independent and autonomous farmers, ensure women's access and control over means of production, enhance leadership competencies and acceptance as well as improve women's position in different structures of the government, non-government and private sectors (ADB, 2013). The ADS document needs to be adequately considered, specially keeping in mind the provision in the Interim Constitution allocating 33 percent of positions to women. There is a policy gap in addressing this issue that needs agriculture and food security.

6. Conclusion

Climate change will worsen the living conditions of farmers who are already vulnerable and suffer food insecurity. Hunger and malnutrition will increase. The study shows that the farmers perceive changes in the climate which have directly affected water resources and agricultural production. Rise in temperature, more drought and erratic rainfall have been observed by farmers. This in turn has led to less agricultural production due to decreased soil moisture, increased incidence of pests and diseases including unidentified pests, decrease in beneficial insects such as lady bird and earthworms, environmental pollution, reduced livestock health, changes in flowering and fruiting time and fruit drop. The farmers do not have any information on NAPA and LAPA. Few farmers have received training on impact of climate on agriculture. The majority of the farmers were found to be food insecure in the study areas. The pillars of food security such as food availability, food access and food utilization were directly affected by climate change and increased the vulnerability of farmers. Farmers have adopted technologies such as river bed farming, mulching, crop rotation, crop diversification, irrigation management and adoption of new varieties to escape the negative impact of climate change to ensure food security and sustainable livelihood. The knowledge and experiences of minimizing adverse effects have to be documented, modified as needed and replicated so that farmers are equipped to cope with the negative impact of climate change. The need to bring gender justice in agriculture is critical with feminization of agricultural labour and with the increase in the total area cultivated by small and marginal farmers. The climate change and agriculture policies were not found to be gender friendly. Recommendations based on the study have been formulated to enunciate gender friendly policies.

7. Recommendations

1. Gender issues should be taken into consideration while formulating policies with regard to climate change, agriculture and food security as women contribute more than men in agricultural activities. This is necessary to sustain organic and low-input agriculture because in the present context women are more engaged than men in the agriculture sector.

2. There is an urgent need to have a dialogue on women's empowerment, agriculture, climate change, food security and sustainable livelihood at the local, national and international levels.

3. The Ministry of Women and Children, Health Ministry, Ministry of Environment Sciences and Technology and Ministry of Agriculture and Development should together formulate policies to address the issues of women farmers, climate change, agriculture and food security.

4. Vocational trainings coupled with disaster risk management trainings can be means for helping to cope up with the adverse effect of climate change.

5. Adaptation strategies followed by farmers should be documented, modified and replicated in applicable places.

6. Implement LAPA at local level.

7. Flood and drought resistant varieties of cereal and vegetables should be developed as per the agro-climatic condition.

8. Farmers should be trained about the impact of climate change, focusing on adaptation and mitigation strategies.

9. The government should take a holistic approach that considers every aspect of food security livelihood including institutional arrangement and infrastructure development of the community.

10. Empowerment of the communities is essential for improving food security and sustainable livelihood of people. Vocational training coupled with disaster risk management training can be a means for helping to cope up with the adverse effect of climate change.

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