

# Food security amidst climate change in Nepal

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## Summary

*Climate change will hit hardest on the food security in Nepal through various aspects. Number of food deficient population has increased remarkably in the recent decades due to various reasons. Global predictions show slight increase in the food production with respect to estimated climate change but our food production having based on the rain fed depending on the weather pattern, even small and short period weather extremities will badly effect the production and supply. Lesser availability of surface and sub surface water for irrigation particularly during non monsoon seasons will adversely affect on the winter crop production combined with flood damages to the arable lands in summer. Vulnerability to the infrastructures will affect food supply and access particularly in the mountain region where people are already in the surge of price hikes. Coping capacity at the local and national level is very low. On the other hand people lack flexible strategies of livelihood options as alternatives for household income. There is lack of proper information on the potential impacts at all levels. Field level studies are urgent for different sectors including agriculture. This article tries to highlight the urgent need of further exploration and preparedness to curb potential adverse impacts with adaptation measures.*

## Introduction

It has been a common knowledge that climate change hits hardest to the poor people. Nepal is at the forefront of the climate change impacts. The rate of increase in average annual mean temperature is higher than the earth's average. The country is more sensitive to any type of change as there are five major climatic zones almost similar to global climates and a number of micro climatic areas within these major climatic zones. This variation in climate is due to variation in altitude increasing from south to north resulting into different climatic, vegetation and varieties of ecosystems. With being the same watershed for such different climatic zones, the vulnerability to each change spreads thereby leading to more severe associated impacts in other regions in the downstream throughout the whole watershed. The country that lacks the capacity to cope with a single flood stress is at the forefront of climate change induced disasters. Combined with other anthropogenic factors like deforestation, faulty agricultural practices and insufficient strategies to cope with, climate change impacts have adversely affected the livelihood of the community in which food security is most important.

Agriculture is the mainstay for the large majority (>85%) of the population, but on the other hand it is subsistence in production, depends heavily in nature, and is based on the traditional knowledge and practices. Any changes, therefore, will affect a lot in the food security. In this paper food security situation of the country within the context of changing climate has been analysed.

## Food and Food Security in Nepal

Food security has been defined as “access by all people at all times to enough food for an active, healthy life” (World Bank, 1986; Cited In: Sacks and Rosenzweig, 2007). The World Food Summit (1996 and 2002) organized by the Food and Agricultural Organization highlighted the basic right of all people to an adequate diet. Although “access” is only factor major in the food security in general, food security in Nepal could be better analysed as the

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food production, and access - reach and affordable capacity - of the people to the available food. In common, it is dependant on the local production, if not, on the access and affordability respectively. Persisting poverty and faster growth in population than food production have exacerbated food insecurity in general, and a number of other reasons in particular. The number of food insecure population increased from 3.5 million (19 percent of the population) to 5 million (23 percent of the population) between 1995 and 2002 (FAO, 2003: Cited in FAO, 2004). Incompetent production is one major factor, besides access and affordability, where impacts of climate change have embedded to catalyse the deteriorating factors to food productions and other livelihood assets.

Agriculture represents the largest sector of the Nepalese economy and provides the principal livelihood for over 80 percent of all working adults (CBS, 1996). Nepal's economy is overwhelmingly dependent on agriculture. Heavy dependence on agriculture makes Nepal's economy very sensitive to climate variability (World Bank, 2002). Over 40% of the GDP is dependent on agriculture (MOAC, 2007). Forest, apart from its own services, provides highest input to the agriculture in terms of livestock feeds, manure, wild food, watershed health and so on. However, agriculture is characterised by low-productivity subsistence production and has been in relative decline since the 1980s. Per capita cereal grain availability has fallen from 198 kg in 1991 to an estimated 186 kg in 1997 (UN, 1999), with great variation among regions and many districts have large food deficits. Approximately 40% of the country's GDP came from agriculture in 2000, down from 52% in 1990. Recent food production scenario has been changed remarkably with overall reduction by 3.35% on cereals and other crops as compared with 2001 baseline (MOAC, 2007). The rate of decrease is in increasing order. Rice which is the main source of food in Nepal and has 20.75% contribution in the GDP has been decreased by 12.55%. There is mixed response from other crops such as vegetables which have 9.71% contribution in the GDP has increased by 6.67%. This reveals the food security situation in the country. There is much disappointing scenario - where population increases by 2.25% annually; food production decreases with the greater rate. There is great regional variation even within this spectrum. People in the mountains suffer more with declining production and lack of access due to poor development infrastructures like road for transportation. Impact of climate change alone is not definitely the reason but has significant stake on it. Subsequent chapters try to analyse the role of climate change in food security in Nepal.

Global average surface temperature has increased by 0.76° C since industrial revolution about 150 years ago (IPCC 2007a). The rate of global temperature change is outside of any change experienced in the last 10,000 years and most likely much longer (Coach, 2007). With this in background, number of warmer days has been noticed increased, weather extremities have been increased; erratic pattern of rainfall has taken place, polar ice is melting and glaciers are retreating faster than ever before. This is not just the matter of physical change and statistics; it has huge impact on both the aquatic and terrestrial ecosystems. Food security is the most important issue amidst climate change since agricultural production is an important player in both biophysical and socioeconomic worlds; it is very much dependent upon environmental variables and also an important agent of environmental change.

### **Potential impacts of climate change on food security**

As temperature increases, sea level rises and nature of precipitation changes, undoubtedly crops are affected most. Food is derived from crops or the animals that feed on crops. Climate change is not uniform globally; varies in different regions but is a global environmental issue. This article is confined within the scope of food security, particularly in

Nepal. Agriculture is the main base of food security in Nepal. Besides, it provides employment, income and economic base as 41% of the country's GDP comes from agriculture (Gill, 2003). Climate change affects agriculture through its impact on crop yields; forests which feed on the agriculture are vulnerable to the change on forest composition, geographic range of forest, forest health and productivity. Similarly the water resources – water supply, water quality, composition of water Species and natural areas- loss of habitat and species.

### **Impacts of rising temperature on food security**

Global food production potential is likely to increase with increases in global average temperature up to about 3°C, but above this it is very likely to decrease (IPCC, 2007a). There are, however, regional and local variations both in negative and positive impacts. Further warming has increasingly negative impacts in all regions. Short-term adaptations may enable avoidance of a 10 to 15% reduction in yield (ibid). But the temperature is not alone the factor of production. It is uncertain that what could happen when there is not sufficient water to maintain increased evapotranspiration, extreme weather events like hail and storms, cold and heat waves which are likely to increase due to the increasing temperature. And there is another issue whether this benefit of warming can reach to poor and subsistence farmers and least developed countries to feed on the growing population. Already there are regional variations on climate change observed and projected, with not much hopeful messages to the farmers who are dependent on the rainfall which has already being unfriendly to them particularly in South Asia.

If increases in temperature exceed 1.5–2.5°C which is likely then around 20–30% of plant and animal species are likely to be at increased risk of extinction (IPCC, 2007b). This will certainly be combined with the impact of globalization on seeds and varieties selection. As the base of indigenous varieties has been deteriorating with genetically modified seeds, climate change will enhance the rate of extension of indigenous species and varieties which have better capacity to sustain the adverse environmental consequences in the longer term. It is obvious that smallholder and subsistence farmers will suffer complex, localized impacts of climate change combined with the globalization of market opportunities.

### **Impact of climate change in precipitation**

Global analyses with GS Model conclude that erratic pattern of precipitation has adverse impact on production (Sacks, L., and C. Rosenzweig, 2007; IPCC 2007a; IPCC 2007b). Precipitation data available in Nepal are not enough to analyse accurate precipitation scenario for long in the past. The meteorological stations throughout the country are not sufficient enough to provide the efficient representation of the information. Many stations have to rely on the manual measurements. Within available information precipitation has been noticed fluctuated for the past 30 years or so (Shrestha *et al*, 2000). Based on the experienced shared by the farmers in different workshops, visits and interactions the author has information that farmers have also experienced this and are aware on the adverse impacts on production. They noticed that it does not rain as usual but when comes it comes too much to create flood. This implies that there is greater rainfall in fewer rain storms.

The crop yields have strong association with the amount of rain it receives on right time. The reduction of rice production in the past years can be closely linked to the abnormal rainfall received in those years. Agricultural production, of which 36.5% is rain fed until 2002 (DOI, 2007), and mainstay of over 80% Nepalese (CBS, 2001) is badly affected by the change in

precipitation. In the early 1960s Nepal had the highest level of agricultural productivity in South Asia, but by the early 1990s, its agricultural productivity was the lowest in the Subcontinent (Tiwari, 2002). However, there are other factors as well to count to the end result of production.

### **Climate related risks and water availability**

Greater downpour disturbs the normal recharge and discharge system of landscape and causes greater overland flow and less recharge of the ground thereby resulting in flood during monsoon season and prolonged drought in the dry season. This has ultimately adverse effect on the crop production in Nepal. Moreover, arable land is reduced due to flood. As the result, production is adversely affected. Nepal has experienced these events more frequently and with greater magnitude in the recent years. This unusual pattern of rainfall has also induced damage of infrastructure be faster. This makes transportation of food products, along with other effects, difficult and expensive sometimes beyond the range of access and affordability of poor people.

Climate change has also created risks to the food security of the large number of population. Glacier retreat and glacier lake outburst flood (GLOF) are the most important and widely discussed issues as the potential risks. Compared to other sectors under impacts of climate change in Nepal, more studies have been carried out on glacier, their retreat and formation of glacial lakes which are vulnerable to outburst. With melting of glaciers, risk of GLOF, water availability will rise and decrease sharply; it has effect on irrigation, power supply and aquatic ecosystem (IPCC, 2007b).

Studies (WECS, 1993; Kadota et al, 1997; Kadota et al, 2000; Mool et al, 2001 Cited in Bajracharya et al, 2007) on glaciers in Nepal have shown that they are retreating and the number and size of glacier lakes are increasing along with increase in temperature. Glacier AX010 in Sharing Himal retreated by 30 m from 1978 to 1989 (Fujita et. al. 2001), and majority of glaciers in Khumbu region retreated by 30 to 60 m from 1970s to 1989 (Yamada et. al. 1992). Glacial Outburst Flood (GLOF) is the main hazard out of increasing sizes and numbers of glacial lakes. Nepal has already experienced a number of disasters from such GLOFs with a lot loss such as Dig Cho GLOF in 1985 washed away Namche Hydro Power Plant, cultivated land, bridges, houses, livestock and people (Bajracharya et al, 2007)..

Vulnerability to the development infrastructure like roads bridges etc can have negative impact on food accessibility. GLOFs affect food security by swiping away of much important agricultural lands situated in the banks of river. Most of the fertile and densely populated fields are in the banks of rivers in Nepal. On the other hand in the long run, available water for irrigation and hydropower is reduced which imposes combined effect of water stress on the food production in the country. This potential impact of climate change has possibly the greatest impact on the country's economy because of disasters and down stream effects of the flash flood in terms of damage to livelihood assets and development infrastructure along with its associated and aftereffects.

Similarly severity of extreme climate events, together with increases in risks of fire, pests, and disease outbreak have significant consequences on food and forestry production, and food insecurity (UNFCCC, 2007). Due to drought and extreme hot weather forest fire has become annual phenomena. Flood damages have been annual event in the mid hills and the Terai in recent years. Anthropogenic activities such as fragile geology, faulty agriculture practices other than climate change might have greater stake but climate change has played conducive environment to create adverse impacts in greater scale (Box 1). Experience of the

author working with communities to cope with the adverse impacts of climate change reveals that risk is higher to the communities who are not well equipped to deal with. There are associated impacts of such extreme events on human health, natural resources and social cohesion.

*Box 1 Farmers are already in trouble*

Hukum Singh Gurung (58), a resident of Kabilash in Chitwan, Nepal had managed his vegetable farm with drip irrigation system to cope with the limiting water resources available. In April 2007, there was huge hail storm in the village. The hailstones were so big people never had seen before. His drip irrigation pipe was broken at all along with damages to his zinc plate roof. “I had never seen such big and damaging hail stones in my life” he exclaimed with sadness at his face. Apart from pipe which cost about \$ 31, he lost his whole crops of vegetable that would give him about \$ 300. The story repeats to all farmers in the locality. It’s of no use how favourable other factors are on other days; extreme weather events are enough to cause a great loss within a short period. In the earlier week there was a wind storm which uprooted hundreds of trees in their neighbouring community forest.

### **Coping capacity**

Nepal is among the poorest countries in the world with an annual per capita income of approximately US\$ 230. The level of absolute poverty is among the highest in Asia, and has increased from 33 percent of the population in 1977 to 42 percent in 1995/96 (Gill, 2003). More than nine million people, accounting for about 40 percent of the population, are currently estimated to live below the national poverty line which is set at approximately Nepalese Rupees (NRs) 4400 (\$77) per capita per annum and is based on calorie intake, housing and various non-food standards (ADB, 2002). The Human Development Index (HDI) rank of Nepal in 2001 was 143 out of 175 countries indicating a low life expectancy at birth, low educational attainment and a low standard of living (UNDP, 2003). Approximately 85 percent of the total population living in rural areas basically dependent on agriculture, poverty is much more prevalent, intense and severe (FAO, 2004). Within rural areas, poverty is worse in mountainous areas, especially in the most remote mid- and far-western hill and mountain districts where as much as 70 percent of the population is poor and local food production sometimes covers just three months of annual household needs. The potential impact of climate change is seen higher in these reasons. Households in some areas face seasonal food shortages every year; conditions of famine are frequently and regularly reported from the north-western Karnali Region (UNDP, 2002). Within the population as a whole, certain groups – particularly women and girls, children, tribal and members of lower caste communities – are especially vulnerable to food insecurity.

The lack of options and flexibility in their livelihood strategies constrains their ability to make positive livelihood choices and reduces their ability to withstand or adapt to shocks and stresses such as droughts, floods and other adversities. In hill and mountain districts, the Government estimates that soil losses range from 5-10 tonnes per hectare on well-managed land to high rates of 40-200 tonnes per hectare on degraded land, and that these losses are raising riverbeds in the Terai by 15-30 cm per year and increasing the risk of flash flooding in the low-lying plains (UN, 1999). Deforestation has reduced access to an important source of food, fuel wood, fodder and income for vulnerable households in the Terai and Hill Region, contributing to increased vulnerability to food insecurity. Given the role of forests in providing about 80 percent of total fuel needs and 50 percent of fodder requirements, as well as their contribution of approximately 15 percent towards total GDP through NTFPs,

deforestation is therefore of critical concern which combines with the impacts of climate change as a crucial combination.

Information on adaptation is available in plenty in literatures but superficial ideas full of jargons. Locally available practical solutions which farmers are really seeking for are rare as the information on where and how climate change is causing problems on food security. Adaptation which is urgent and only option for poor is overwhelmed within its numerous definitions. The variations in definitions indicate the various approaches that are possible understanding adaptation (Schipper, 2007). Therefore, site specific studies and strategies are necessary for particular sector and communities. The process of adaptation has been greatly understood as the means to reduce vulnerability and the government efforts are concentrated to react to the disasters rather than prevent and reduce the impacts. Enabling communities to better understand the impacts of climate change and encouraging them to find innovative solutions to reduce vulnerability and develop adaptive capacities is important for Nepal.

Micro level information on impacts of climate change is still lacking. Farmers are not in the position to judge whether and how much a particular factor is responsible for their food insecurity. Studies on the climate change impacts are confined in the high mountain regions and glaciers. Impacts on the mid hills and low lying areas are based on the logical analysis rather than the systematic field observations. As the climate change is of global scope, new and growing science, embedded by international political and socioeconomic agenda it has been more complicated and interlinked largely with other disciplines and issues. It is hard to segregate and analyse the impacts independently. Global concerns are growing rapidly but the efforts to curb are very slow.

## **Conclusion**

Overall, climate change has adverse impact on food security (production, access and affordable capacity). Particularly poor and marginalized people and developing countries are more vulnerable due to low coping capacity. There is regional variation on the impacts. Nepal lacks adequate field based information on the impacts. Specific information is still limited on different sectors of agriculture and natural resources and the planner and the development workers have to rely on the potential impacts while developing activities on reducing vulnerability of food insecurity and increasing the resilience to the adaptation processes. Field based studies are more important and urgent for designing appropriate coping or benefiting mechanisms. Strategies and investments on the research and piloting adaptation process would really benefit people to have some options on food security amidst climate change.

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