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# ADAPTATION STRATEGIES OF FOOD SECURITY FOR CLIMATE CHANGE

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**Abstract**

The Rupa lake area in Lekhnath Municipality of Kaski district, at Rupa Lake basin areas of Nepal was selected to explore the impacts of climate change on livelihoods in term of food security. 20% of the wetland dependent communities constituted of sample household (HHs). Semi-structured questionnaire was taken for focused group consultations. It was found that majority of population (87%) of lake basin is dependent on agriculture for food security. There is a year-round food security for 50% of sample HHs, with 22% of this having surplus food. About 5% of HHs has food security for less than three months where as 19% HHs have food security for more than six months. Within this scenario, over 90% HHs responded to climate change in the form of rise in temperature (74%); unpredictable rainfall (77%); shift in rainfall (64%); and phonological changes (51%). About 74% of households are aware about the effect of climate change and had adopted different strategies to resist against the effect of climate change. Out of the 74% of HHs, more than 50% of the household use chemical fertilizers and agricultural inputs and other means to cope small shop (business), service, labor and remittance against the climate change.

Keywords: Food security, climate change, wetland, adaptation, Environment

## Introduction

Nepal is a food deficit, land locked and least developed country having a population of more than 27 million. According to Nepal Living Standard Survey III, 19.7 percent people in the country live below poverty line which is decreasing since 2005 because of remittance flow in the country. About 49% percent of under-five children are chronically malnourished (website nccsp). Globally, Nepal ranks 145$^{th}$ out of 187 countries in terms of its Human Development Index (Human Development Report, 2014).

Annual population growth rate of the country is 2.2 percent. It is estimated that the country's population in 2025 will reach 40.5 million and will have difficulty to fulfill the food requirements (FAO, 2010). Looking this scenario, Nepal will face serious food insecurity in future.

Nepal is a country facing food insecurity very acutely. The growing incidence of poverty and food insecurity in Nepal is an outcome of the economic process which affect income distribution pattern in the rural households. Besides these weaknesses and challenges, Nepal has a rich natural resource with high biological value of wetlands that include high biodiversity of plant and animal genetic diversity. Similarly, fresh water originating from the Himalayas creates many wetlands with beautiful natural environment. These facts indicate that Nepal has a good prospect in diversifying and increasing agricultural production through wetland management and conservation for alleviating poverty and attaining sustainable livelihood.

In Nepal, wetlands are important resources in term of biological, hydrological, social, economic, religious and cultural values. Wetlands conservation in Nepal has a time series story that started from 1950s. So many wetlands are either in government forests or in public lands. With this journey, Nepal makes active wetlands conservation after its commitment in the Ramsar Convention (1971) followed by the establishment of Koshi Tappu Wildlife Reserves in 1978, the first Ramsar site in Nepal.

ICIMOD (International Center for Integrated Mountain Development) conduct study on glaciers and glacial lakes. The study is based on the digital data and images. It shows that there are about 2,323 glacial lakes and 3,252 glaciers in Nepal's Himalayas. These lakes and glaciers cover the total area of 5,428 km$^2$ of which glacial lakes alone occupy only 75 km$^2$ of the total glacial areas (Bhandari, 2009).

National Lake Conservation Development Committee (NLCDC) has spotted 5358 lakes in Nepal. Nevertheless, a comprehensive profile of Nepal's wetlands is missing even until the turned up of Biodiversity Strategy (2002); Water Resource Strategy (2002); National Wetlands Policy (2003) and draft National Strategy of Lake Conservation and Development (2010). Nine wetlands are already designated under the Ramsar sites in Nepal having seven of these within the Protected Areas system. Proposed study area is also included in proposed Ramsar Site. About 10 percent of different ethnic communities like *Jangar, Tharu, Jalahari, Majhi, Satar, Mushar, and Brahman* are dependent on wetland resources.

**Table1. Scenarios of Food Insecurity in Nepal**

| SN | Status of Food Insecurity | Remarks |
|---|---|---|
| 1 | People 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**

According to Assessment of Food Security of Nutrition Situation in Nepal by Food Agriculture Organization for 2008- 2009, it is estimated that Hill and Mountain regions are particularly food deficit areas and more vulnerable to drought. The low agricultural production is largely due to the predominance of rain fed agriculture, traditional farming practices, limited agri-input, inadequate technical advice for farmers due to poor extension services, poverty and limited availability of credit, and frequent droughts and floods. However, situation is not found in the Western region of Hills areas Kaski District. The estimated ecological food security situation requirement for 2008 to 2009 is more than production. The requirement amount of food is 630208 mt. but production will be 762084 mt. It shows the surplus amount will be 131876 mt. of food production (FAO, 2010).

Bio-intensive farming system promotes practice of scientific crop rotation, integrated plant nutrient management, integrated pest management that ultimately increases the crop biodiversity and yield efficiency along with conservation/revitalization of the crop land. This type of farming system will be more useful to maintain wetland biodiversity. This system will also improve food security and livelihoods situation of the small farm households of wetlands (Rajbhandari, 2011). This farming system is using in this areas.

Agriculture, forestry, and fisheries are highly sensitive to climate. Climate change is very likely to have a serious impact on their productive functions. As a consequence, production of food, animal fed, fiber, energy, or industrial crops, livestock, poultry, fish and forest products may decrease. Similar situation is found in Rupa Lake basin area. Therefore, people are adopting different means to cope the climate change for food security and livelihood.

Rupa Lake is the third biggest lake of Pokhara valley. It supports a number of flora and fauna species. The lake is under pressure from diverse anthropogenic factors. Water birds of Rupa Lake face a number of threats including trapping/hunting, fish farming using nets, habitat destruction by soil erosion, sedimentation and agricultural conversion, human disturbance, water pollution and eutrophication. Therefore, the major focus of the study is to address the issues related to food security and adaptation strategies for livelihood in the context of climate change in Rupa lake area of Kaski district.

## Materials and Methods

This study was carried out in 2012 in Kaski district at Rupa Lake areas. It was conducted by collecting both primary and secondary data. Primary data are questionnaire, consultation workshop, focus group discussion, and direct observation in field.

Individual meetings or workshop was conducted during survey interacting with different stakeholders. Interview and discussion was carried out in VDCs involving VDC leaders, village elders, different stakeholders and communities. In the meantime, community expectation from the lake was collected during discussion. Wetland Inventory, Assessment and Monitoring Tool (WIAM) was used for overall assessment of lake (WIAM, 2011). WIAM tool gives overall pictures and status of Lake areas, surrounding population status and dependence on lake.

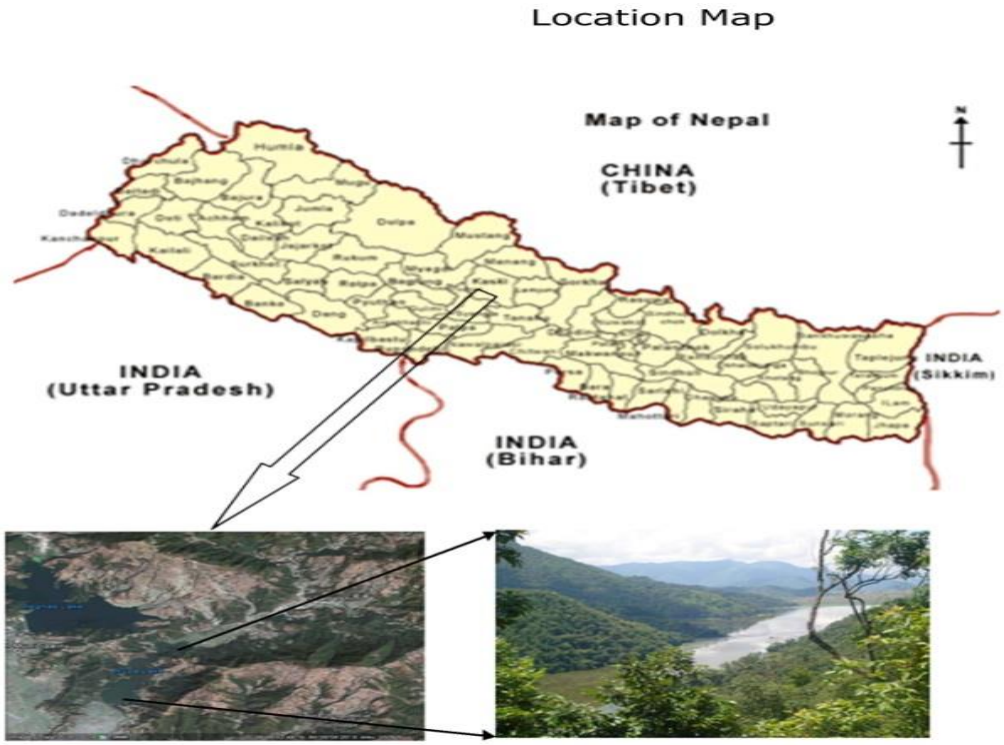


**Figure1. Location Map of Rupa Lake**

Rupa is a small advancing eutrophic Lake that falls in 4 VDCs and wards 10 & 11 of Lekhnath Municipality in Kaski district of Nepal ($28^0$08'39.72"N and $84^0$06'29.29"E). It covers an area of 115 ha with marshes and paddy field along its shores in its basin of 30 $km^2$. Samples were taken within impacted areas of wetland (2 km radius of core lake area and dependency to the lake areas). 20% of HHs was surveyed. *Sisteni, Upper Talbesi, Chaur, Devisthan, Stream Side (Khola Chau), Sundari Dada, Lower Talbesi, Jamankuna Bhangara,* and *Simaldada* settlements were sampled as study site. Out of the 532 HH, 9 settlements of 70 HH were selected as sample for study. Stratified random sampling technique was used for the questionnaire. The questionnaire was concentrated on adaption strategies in agriculture in the context of climate change from people prospective.

Major question asked to household survey were as follows:

1. Have you observed impacts of climate change in the last 30 years such as Raise in temperature, Unpredictable rainfall, Shift in rainfall pattern, Flash flood, Unpredictable drought, Phonological changes in plants, Others (specify).
2. What are impacts of climate change in your food security system in the last 30 years (decreased food production, threats to livestock, increased vulnerability, do not know)?
3. How did you cope over climate change impacts on food security systems in the last 30 years? (more crop cycle, vegetable production/selling, hybrid seeds, drought resistant seeds, water resistant seeds, improved agriculture tools/practices, improved irrigation facilities/outreach, chemical fertilizers/pesticides, soil mulching, increased inputs of compost and bio-manure, improved food storage practices/system, hybrid livestock, leasing more lands). Similarly, major following questions were asked for focus group discussion.

1. What is the role of Rupa Lake for food security in the context of climate change?
2. What are the dependency of local people on the Lake for livelihoods, e.g. food, fodder, fuel wood, and other NTFP products?
3. What is the food resources used for food security?
4. Is there any food crop you obtain from Lake?
5. Does the Lake supports to maintain the climatic condition?
6. What are the indirect resources used, e.g. as irrigation and bio-fertilizer?
7. How the Lake contributes in food as nutritional security point of view?
8. How men and women contribute in Lake Conservation?

**Picture1. Individual HH survey**

**Picture 2. Focus group discussion**

## Result and Discussion

Of the total sample household, 92% of the respondents showed their response towards the climate change impacts and its effects on agriculture. Rise in temperature (74%), unpredictable rainfall (77%), shifting in rainfall pattern (64%) and phonological changes (51%) were major indicator of climate change. They were directly observed by more than 50% of the respondents from people prospective in the study area. Following figure 1 showed the climate change in last 30 years.

Fifty percent had food security in the research areas. Among them 22% of this having surplus food. About 5% of HHs had food security for less than three months and 19% HHs had food security for more than six months (figure 2).

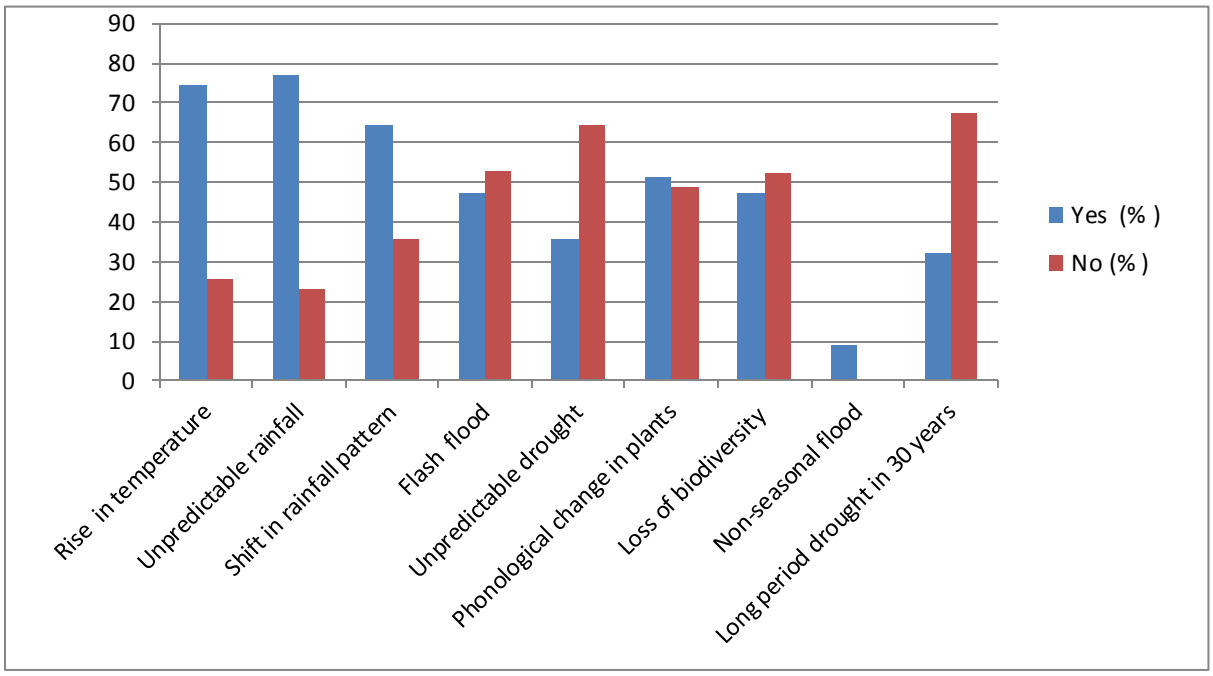


**Figure 2. Observed Impact climate change in the last 30 years**

Climate change impact in agriculture is very crucial in agricultural productivity. In relation to agriculture production more than 54% responded that agriculture production was in decreasing trend and 12% responded that production was as it is. It means it is negative impact in provision of food to the people. It creates the serious consequences on the level of food production and food security. Therefore, subsistence farmers had adopted different strategies to cope with climate change because of the less food production in the study area. About 74% of households were aware about the effect of climate change and had adopted different strategies to resist against the effect of climate change. Out of the 74% of HHs, more than 50% of the household used chemical fertilizers and agricultural inputs to cope against the climate change and to increase the production yields. Some households were unknown and did not adopt any types of strategies. Most common strategies were use of hybrid seeds, chemical fertilizer, use of bio-gas and change in agriculture farming system. Beside these measures, most of the people had alternative source of income such as small shop (business), service, and labor. More than 60% people's main source of income was remittance. The community had adopted afforestation programme for conservation of forest and mitigates the climate effect. Therefore, they had focused on conservation of the community forest surrounding the wetland (figure 3).

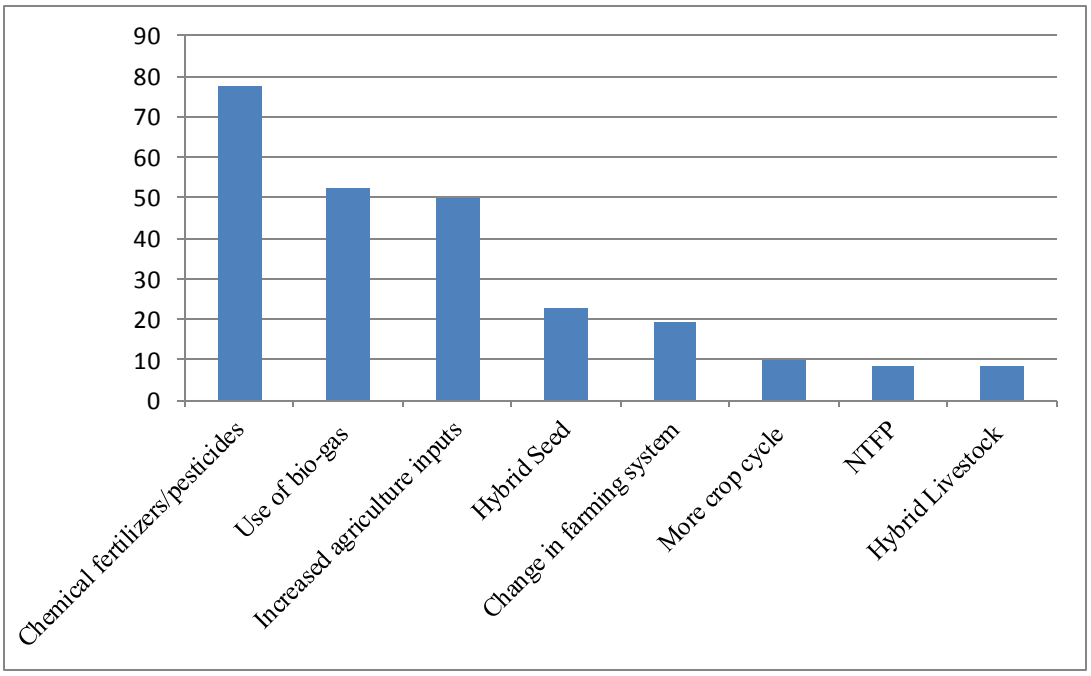


**Figure 3. Adaptation Strategies of Climate Change for Food Security (%)**

## Conclusion

Maintaining environmental quality and food security are the major challenges of the twenty first century, which are directly and indirectly related with wetland dependent communities like Rupa lake areas. From many experiences participatory integrated wetland management has become the accepted approach in managing wetlands. Community role in the conservation activities is quite appreciable if it goes hand in hand for sustainable utilization of wetland resources and seeks alternatives to reduce the pressure on wetland which is done by active participation of Rupa lake areas communities. Through different activities and policies based on local participation, we can be optimistic on the point that once the people are made aware, educated and trained, they will be able to understand the importance, threats and possible solutions for conservation and management of wetlands. Hence, it is imperative to educate the local communities about the value of wetlands (especially for the threatened Ramsar sites) and its wise use of wetland. Rupa Lake has also been proposed for Ramsar sites.

Bio-intensive farming system promotes practice of scientific crop rotation, integrated plant nutrient management, integrated pest management that ultimately increases the crop biodiversity and yield efficiency along with conservation/revitalization of the crop land. This type of farming system will be more useful to maintain wetland biodiversity and using in research areas. Furthermore, extensive bio-intensive farming system is needed to promote for

widespread adoption in Rupa lake. That will also develop farming enterprise and vegetable production. It will be good for sustainable livelihood and food security in wetlands.

The impacts of climate change in the context of livelihood and food security are not yet visible at community level. It may be because, most of the communities in Rupa lake basin are not aware to differentiate generic impacts and the impacts of climate change in food security, or improved lake-basin environment (Rajbhandari and Shrestha, 2013). Therefore, it is necessary to address micro-climate issues such as surface temperature, soil moisture and so on which needs further investigation to educate the local communities.

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