

### Nepal's Declining Agriculture Production in Changing Climate

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In recent years, the changing climate and its impact on human lives has been a hot issue of debate worldwide. Whatever the temporal and spatial impacts of climate change on earth, there has been a consensus that poor countries will suffer more than developed countries. It is also assumed that the agricultural production of poor countries, which depend on traditional agricultural practices, will have more food shortages due to the impact of climate change. The development activities of developed countries can be seen to be responsible for the current rate of global warming and it is believed that a significant reduction in the amount of green house gases may help to reduce the impact in the future. The aim of this article is to discuss the impact of climate change on agriculture worldwide, especially in poor countries. This article has also tried to suggest some adaptive measures to reduce the loss in Nepalese agriculture.

#### Climate change and agriculture in Nepal

Nepal is a country of great diversity which is also reflected in its agriculture sector. Many local varieties of crops and fruit trees grow within the short span of 200 kilometres from the south to the north of the country.

Climate related changes are observed throughout the country. These changes include a rise in temperature, drying of water resources, amount and changes in rainfall pattern and loss in agricultural production. As in the past, the country's economy is still dependent on agriculture with a large percentage of the poor population depending on traditional agriculture practices. It has been estimated that nearly 65 percent of the population is employed in the agricultural sector contributing

approximately 38 percent of the total GDP. The ever-increasing population of Nepal and the growing demands for food, inadequately contributed by 27 percent of the total land, has created pressures on natural resources, forcing people towards various non-farm activities. In recent years, a large percentage of the fertile land of the Terai has been converted into urban areas causing more pressure on the remote hilly and mountain areas for food production. Rice production, the most important crop of Nepal, is still dependent on the monsoon rain and unfortunately the recent changes seen in the monsoon has further deteriorated the rice production.

The traditional farming practices, with indigenous knowledge that has been inherited through the generations, cannot be ignored in the Nepalese context especially in the mountains. If the indigenous knowledge of farming with local varieties of crops is adopted and incorporated with modern farming practices, then it may help to reduce food shortages to some extent, in Nepal in the future.

#### The Global scenario

The Intergovernmental Panel on Climate Change (IPCC) has suggested that there will be a rise in the earth's temperature by 1.0 to 3.5 degrees Celsius by 2100. Average precipitation will also rise as much 10 to 15 percent because a warmer atmosphere holds more water (Crosson, 1997). The IPCC report estimates climate change impacts on grain production at the global level both in the developed countries (DCs) of North America and Europe, as well as in the least developed countries (LDCs) of Asia, Africa and Latin America. There are two main factors identified for the loss in grain production. The first factor is "physical" that will warm the higher latitudes more than the tropics, benefiting most of the DCs situated in the northern latitudes, as their agriculture would benefit from the longer growing seasons that the warmer climate would bring. On the other hand, most LDCs occupy terrain in the tropics where the negative effects of a warmer climate would not be significantly beneficial. The second factor is "eco-structural" which is also more in favour of DCs as they have greater economic resources than LDCs, which can be used in helping farmers to adjust to the changing climate.

#### How agriculture is going to be affected worldwide?

Following are some of the major impacts of climate change that are expected to occur in agriculture:

- The life cycle of grain and oilseed crops will likely progress more rapidly, with increased CO<sub>2</sub> and temperatures but later may fail. Especially horticultural crops will be significantly affected;
- Northward migration of many current crops along with weed species, especially C<sub>3</sub> invasive weeds, is most likely to occur as they respond more positively to increased CO<sub>2</sub> concentration. "Glyphosate", the most commonly used herbicide worldwide, is likely to lose its efficiency in future;
- Crops and animals will be more prone to various diseases due to earlier springs and warmer winters. Warming will also favour the survival rate of pathogens and parasites.
- The productivity of livestock is most likely to be negatively affected with increased temperatures;
- Ruminants are more likely to be adversely affected, as the current management system will be inefficient against temperature rises, whereas non-ruminants might benefit.



Disappearing glaciers. Photo: Mohan Devkota

## Predicted effects of climate change on agriculture over the next 50 years

Climatic element	Expected changes by 2050's	Confidence in prediction	Effects on agriculture
CO2	Increase from 360 ppm to 450 - 600 ppm (2005 levels now at 379 ppm)	Very high	Good for crops: increased photosynthesis; reduced water use
Sea level rise	Rise by 10 -15 cm increase in south and offset in north by natural subsistence/rebound	Very high	Loss of land, coastal erosion, flooding, salinisation of groundwater
Temperature	Rise by 1-2oC. Winters warming more than summers. Increased frequency of heat waves	High	Faster, shorter, earlier growing seasons, range moving north and to higher altitudes, heat stress risk, increased evapo-transpiration
Precipitation	Seasonal changes by ± 10 percent	Low	Impacts on drought risk, soil workability, water-logging, irrigation supply, transpiration
Storminess	Increased wind speeds, especially in north. More intense rainfall events.	Very low	Lodging, soil erosion, reduced infiltration of rainfall
Variability	Increases across most climatic variables. Predictions uncertain	Very low	Changing risk of damaging events (heat waves, frost, droughts and floods) which affect crops and timing of farm operations

Source: *Climate change and Agriculture, MAFF (2000)*

- There will be a significant impact in livestock operations due to a longer forage production season and reduced need for winter season forage. Livestock will also benefit by shifting of rangeland and pasturelands;
- There will be an increasing demand on irrigation as there will be a greater soil water deficit, but it may provide better working conditions in wetter regions and may lead to reduced erosion;
- Wetland ecosystems are more likely to be affected by changed rainfall patterns.

### Adaptive measures to cope with climate change impacts on Nepal's agriculture

Nepal's current agricultural practice depends on traditional agricultural methods and is entirely monsoon dependent. If developments achieved in the past in its agriculture sector are evaluated, the results are very discouraging. The main reasons for the decline in agricultural production include conversion of agriculture land into urban areas, loss of farmers' interest in traditional agriculture methods, unsatisfactory support from the government, poor irrigation facilities and temporary migration of younger generation to foreign countries. It is very hard to predict how much Nepal's agriculture sector will be affected by global climate change in future and how the country will feed the hungry mouths of its people. Following are some suggested adaptive measures that can help to reduce the negative impacts on agriculture and provide food security in Nepal in the future:

- Develop mountain irrigation facilities by encouraging local communities to construct irrigation ponds and collect monsoon water to irrigate winter crops. Improve irrigation efficiency and conserve soil moisture through appropriate tillage methods.
- Develop/import new crop varieties that are heat and drought resistant and are better adapted to new

atmospheric and climatic conditions. Local varieties of crops that have been cultivated for many years in the diverse topographical and climatic conditions of Nepal should not be neglected in this regard.

- Import of genetically manipulated crop varieties with higher yields.
- Choose crop varieties with a higher harvest-index (the fraction of total plant matter that is marketable).
- Encourage farmers to cultivate Phaseolus beans, onions and sweet corn which are most likely to grow well in higher temperatures and provide benefit commercially.
- Introduce late-maturing crop varieties or species that are more suited to high temperatures.
- Switch cropping sequences: sowing and harvesting earlier.
- Provide access to new pasture and rangelands at higher elevations to expand livestock farming but also replace animals with improved breeds.
- Import new technologies of improved methods of agriculture and livestock farming to mountain people.

Only carefully considered changes in agricultural policies and import of suitable technologies can help the country to fight climate change and reduce its negative impacts on agriculture in future.

### References

Crosson, P (1997) *Impacts of Climate Change on Agriculture*. Climate Issues Brief No. 4, Resources for the future.

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