

Climate Change Impact on Agriculture of Pakistan- A Leading Agent to Food Security



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Submission: November 03, 2017; Published: November 15, 2017

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Introduction

Pakistan being an agro-based economy is at threat due to the global climatic changes. The country ranks 12th among the Countries of the World that are expected to be severely affected by climate change. The country is sensitive to both increases in temperature and changes in precipitation. These could increase vulnerabilities for agriculture, forest and water resources upon which depend a large part of the economy and livelihoods. Increases in temperatures due to climate change could particularly alter bio-physical relationships for crops/livestock/fisheries/forests such as shortening of the growing periods, changing the species patterns, increasing thermal and moisture stresses, changing water requirements, altering soil characteristics, and increasing the risk of pests and diseases. The effects of climate change on agriculture and other natural resources may vary across the diverse agro-ecological regions. In the dry western mountainous areas, the increase in temperatures could enhance the process of de-glaciations by affecting our water resources on which the country depends for agriculture and energy production. These mountainous areas are already under severe pressure due to various natural and anthropogenic (human) activities. Consequently, there is an ongoing process of environmental degradation in such areas.

The major human induced factors causing environmental degradation in the mountainous areas are: mismanagement/overexploitation of natural resources, deforestation and unsustainable agricultural practices (cultivation on steep slopes and forest encroachment for agriculture land). Global climatic changes (i.e. increases in temperature and changes in precipitation) are expected to further enhance the ongoing process of watershed degradation and would seriously endanger the sustainability both of mountainous areas as well as sub-mountain and downstream plain areas in Pakistan in general and Khyber Pakhtunkhwa (KP) in particular. Some of the regions of the country over higher latitudes (including Chitral) that cover about 17 percent of the total area are short of heat and therefore may benefit from rising temperatures.

Rise in temperature could well enhance crop growth and faster maturation that allow earlier planting and earlier harvesting of the winter crops. Crop yields are expected to increase in these areas as well as expansion of the crop area because of increase in temperature. Double cropping would also be possible utilizing both winter and summer seasons. Forest species pattern may change. Fast growing species are expected to replace conifers. These higher latitude areas are however vulnerable to frequent flash floods causing heavy losses to land, agricultural properties and livelihoods assets. In the lower latitude areas, climate change will well reduce crop and livestock yields due to heat and water stresses especially the increases in temperature. The lower latitudes will also be affected by climatic hazards such as droughts and floods the frequency of which has already increased in these areas since the last two decades perhaps due to climate change. Timely preparation and adaptation to climate change is needed not only to tap positive opportunities but also to reduce the adverse impacts of climate change in all sectors of the economy in general and agriculture, livestock, forest and water resources in particular. This would include among others for example the re-orientation of research and development to develop appropriate technologies, introduction of appropriate species/varieties and other management practices for crops, livestock and forestry etc. to tap the future potentials and opportunities arising from climate change. At the same time efforts would be needed to introduce measures (structural and non-structural including bio-engineering measures) to protect natural resources from climate related hazards that are expected to increase due to climate change and may well outpace the positive impacts of these climate changes.

The Climate Change Phenomenon

Some gases like CO₂, Methane, N₂O, Chlorofluorocarbons (CFCs) exist naturally in the atmosphere. These are called Green House Gases (GHGs) that form a blanket surrounding the earth and keeps the earth warmer. Without these gases the earth's atmosphere could have been -15 °C and life on earth would

have not been possible. This is called the Green House Effect. The concentration of these GHGs is increasing mainly due to the unsustainable human activities (fossil fuel burning, depletion of sinks like forests etc.) and enhancing the Green House Effect causing rise in global temperatures of the earth. The phenomena of a rise in global temperatures of the earth and other associated climatic changes as caused by the enhanced Green House Effect is called "Global Warming" and in broader term "Climate Change". According to the 3rd Assessment report of Inter-governmental Panel on Climate Change (IPCC 2001), the average global temperature has increased by 0.6 °C during the 20th Century. Future increases in global temperature are expected in the range of 1.4 - 5.8 °C and in South Asia, average annual temperatures could rise between 3.5 to 5.5 °C by the end of the 21st century. The IPCC 2007 report further concludes that the rise in global temperature of 2 - 4.5 °C is almost inevitable during the 21st century. The effects of climate change/global warming have been noticed throughout the world since 1990. The last two decades were found to be the warmest in instrumentally recorded period (1861-2010).

Linkages between Climate Change and Disasters

Climate Change is also bringing climatic variability/extreme climatic events, the frequency of which could be measured over a shorter period of time (2 - 5 years or less than a decade). The present climatic variability (extreme climatic events) has increased in recent years leading to hydro meteorological disasters, which is a major concern world-wide. Storms, Floods, Droughts, and Cyclones have become frequent all over the world in recent years, resulting in loss of lives and livelihoods - exacerbating poverty. The increasing frequency of climate variability/extreme events is also a major concern for Pakistan as it is the major cause of climatic disasters. The frequency of hydro-meteorological disasters has already increased since 1990s all over the world in general and in Pakistan in particular. The country is vulnerable to these climatic disasters because it has a high climatic and geographic diversity, a large part of our economy lies in the vulnerable sector (i.e. agriculture) and the majority of the rural population is poor and therefore less resilient to climatic hazards. Given that one of the major threats posed by climate change is an increase in the climatic variability that increases the risks of extreme climatic events/ hydro-meteorological disasters, it necessitates to work towards both adaptation to climate change as well as Disaster Risk Reduction (DRR) especially to avoid the risks of disasters caused by extreme climatic events.

Climate Change Impact on Agriculture

Climate change is likely to exert adverse impacts on productive resources and ultimately on agricultural productivity of the country. The major climatic stresses that will exert pressure on agriculture are: increasing temperatures in arable areas; changes in rainfall patterns (becoming irregular and

severe); increased variability of Monsoon; changes in availability of irrigation water; severe water-stressed conditions in Arid and Semi-arid areas; extreme events, such as floods, droughts, heat waves, cold waves, cyclones, etc. Communities most vulnerable to climate change in Pakistan are small land holders that form more than 80% of the total farming community. The farmers in arid and hyper-arid regions and those living in the mountainous and coastal areas are more exposed to the climate change and extreme events. The impacts of climate change on agriculture include; Shortening of Growing Season Length (GSL), heat stress at critical reproductive stages and increased water requirements of crops. These factors cause a decrease in yield in arid and semi-arid regions by about 6 -18%.

I. Impact on Forests

Climate change will also cause loss of biodiversity and shifting of forest areas northwards (to cooler places). Expected precipitation will have positive impact on the forests in the northern watersheds. Frequency of forest fires will increase due to increased heat and erratic rainfall causing damage to regeneration and plantation areas. Species composition may change with the changed ecology. 4.3 Impact on Pests and diseases. There will be enhanced risk of proliferation of pests and diseases under climate change. Some insect pests and diseases proliferate under high rainfall conditions (e.g. Bollworms of Cotton, Wheat Rust and Root Rot diseases), some thrive under warm and moist conditions (e.g. thrips and sucking pests) while others under dry conditions (e.g. locusts).

II. Impact on water resources

Climate Change will lead to irrigation water shortages due to changes in river flows as a result of glacial melt. Erratic and uncertain pattern of rainfall will affect arid and hyper-arid areas. Increased evapo-transpiration as a result of high temperatures will increase water demand of crops (by 10- 30%). Climate change will also affect glaciers. The Glaciers all over the world are receding fast due to global warming. Shrinking Glaciers have serious implications for sustainable water supply. Glacial melt in the Himalayas is projected to increase flooding within the next two to three decades. This will be followed by decreased river flows as the glaciers recede. The formation of Glacial Lakes and their outburst (GLOFs) has also been threatening the lives and livelihood of local population.

III. Impact on Livestock

Climate change will impact livestock productivity especially due to high temperatures. These include physiological stress on animals, productivity losses (milk and meat), stress on conception and reproduction; climate related disease epidemics, reduced productivity of fodder crops, decreased quality and palatability of forages and increased water requirements of animals and fodder crops.

IV. Impact on fisheries

At higher elevations, fisheries are likely to be adversely affected by lower availability of oxygen due to a rise in surface air temperatures. In the plains, the timing and amount of precipitation could affect the migration of fish species from the river to the floodplains for spawning, dispersal, and growth. Future changes in ocean currents, sea level, sea water temperature, wind speed and direction, and predator response to climate change will substantially alter fish breeding habitats, food supply for fish and ultimately the abundance of fish populations. Areas under mangrove forests which are the breeding ground/hatching places for fish are decreasing rapidly due to climate change.

V. Impact on disasters

The increasing frequency of flash floods in hilly areas will cause river bank cuttings and landslides, damaging houses, agriculture lands, roads & properties. Thus, while the increased temperature will have a positive impact on crop yields in the mountainous areas, the negative impacts will be more pronounced in the mountains as well e.g. enhanced deglaciations, overall increasing trend in rainfall leading to surface runoff, soil erosion, landslides, avalanches, biodiversity loss etc. The sedimentation loads from the mountainous regions are already causing silting of dams downstream and reducing the capacity of water reservoirs of the mountainous regions.

Climate Change Impacts on Food Security

During the last two decades, 200 million have been lifted out of hunger and the prevalence of chronic malnutrition in children has decreased from 40 to 26 percent. In spite of this progress, according to the World Bank, 702 million people still live in extreme poverty and, according to this year's report on the State of Food Insecurity in the World (SOFI), 793 million people are undernourished. Among the most significant impacts of climate change is the potential increase of food insecurity and malnutrition. But, how exactly?

Increasing the Risk of Hunger: Climate change exacerbates the risks of hunger and under nutrition through:

- a) Extreme weather events: Climate change increases the frequency and intensity of some disasters such as droughts, floods and storms. This has an adverse impact on livelihoods and food security. Climate-related disasters have the potential to destroy crops, critical infrastructure, and key community assets, therefore deteriorating livelihoods and exacerbating poverty.
- b) Long-term and gradual climate risks: Sea-level will rise as a result of climate change, affecting livelihoods in coastal areas and river deltas. Accelerated glacial melt will also affect the quantity and reliability of water available and change patterns of flooding and drought.

Food Security and Nutrition: Climate change affects all dimensions of food security and nutrition

A. Food availability: Changes in climatic conditions have already affected the production of some staple crops, and future climate change threatens to exacerbate this. Higher temperatures will have an impact on yields while changes in rainfall could affect both crop quality and quantity.

B. Food access: Climate change could increase the prices of major crops in some regions. For the most vulnerable people, lower agricultural output means lower incomes. Under these conditions, the poorest people -who already use most of their income on food -sacrifice additional income and other assets to meet their nutritional requirements, or resort to poor coping strategies.

C. Food utilization: Climate-related risks affect calorie intake, particularly in areas where chronic food insecurity is already a significant problem. Changing climatic conditions could also create a vicious cycle of disease and hunger. Nutrition is likely to be affected by climate change through related impacts on food security, dietary diversity, care practices and health.

D. Food stability: The climatic variability produced by more frequent and intense weather events can upset the stability of individuals' and government food security strategies, creating fluctuations in food availability, access and utilization.

Food Insecurity and Climate Change Vulnerability map

The Food Insecurity and Climate Change Vulnerability map, produced by the UN World Food Programme (WFP) and the Met Office Hadley Centre, illustrates how strong adaptation and mitigation efforts will prevent the worst impacts of climate change on hunger globally and help make people less vulnerable to food insecurity (Figure 1).

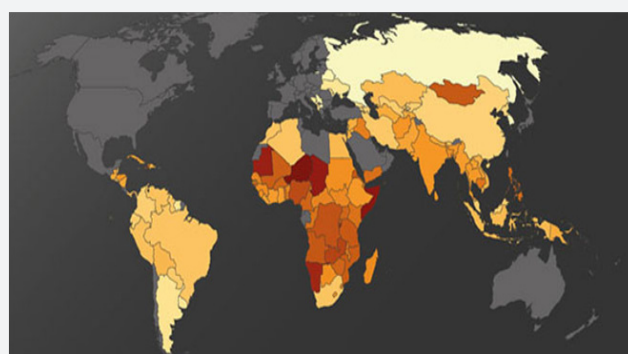


Figure 1: Food Insecurity and Climate Change Vulnerability map.



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DOI: [10.19080/IJESNR.2017.06.555690](https://doi.org/10.19080/IJESNR.2017.06.555690)

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