Chapter 10
Inter Linkages of Water, Climate, and Agriculture

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ABSTRACT

Climate is the primary determinant of agricultural productivity and evidence shows possibility of shifts in earth's climate. Concern over the potential effects of long-term climatic change on agriculture has been raised over the past decade. Change in the climatic conditions on the globe created threat to the availability water for agriculture production. The present chapter is an attempt to distil what is known about the likely effects of climate change on water availability to agriculture for food security and nutrition in coming decades. Apart from few exceptions, the likely impacts of climate change on agriculture water resources in the future are not understood in any great depth. There are many uncertainties as to how changes in various environmental parameters will interact with the availability of water and further agriculture production. The future consequences of water resources on agriculture are discussed and summarized. Possible mitigation and adaptations to changing water availability for agriculture are also discusses.

INTRODUCTION

The world population, which took more than 50,000 years to reach the first billion, has just surpassed 7 billion. Even if fertility continues to decline at the world level and with it population growth rates, the United Nations projects that the world population could reach 9.3 billion by 2050 and surpass 10 billion by the end of the century (United Nations, 2011). If fertility were to be higher than in that projection, the population may surpass 10 billion by 2050 and may be several billions higher by 2100.

To feed a growing world population, we have no option but to intensify agriculture and crop production. Further, numerous factors shape and drive the agricultural sector and climate is the primary determinant of agricultural productivity. Given its inherent link to natural resources, agricultural production is also at the compassion of uncertainties driven by climate variation, including extreme events such as flooding and drought. The fundamental role of agriculture in human welfare, concern has been expressed

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by federal agencies and others regarding the potential effects of climate change on agricultural productivity. Interest in this issue has motivated an extensive of research on climate change and its impact on agriculture production over the past decade.

There may be increasing threat to agriculture production due to climate change which is now largely accepted as a real, pressing and truly global problem. There is also increasingly aware that the risks of climate change are so great, that ignoring or delaying in addressing them would be far more costly than not doing so. Climate change is now global problem for the agriculture production and food security on the globe.

The long-term climatic risk to agricultural assets and agricultural production may be linked to availability of water which is known with great uncertainty. There may be threat to risk of loss of rural livelihoods and income due to insufficient access to drinking water. The risk of alarms for agricultural irrigation and reduced agricultural productivity, particularly for farmers and pastoralists in semi-arid regions. There may be risk of loss of terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for human being and their livelihoods. In general agriculture production and food security may face serious consequences due to inadequate water resources. Apart from this increasing demand for water from urban, industry, etc. has exaggerated the problem in many folds. From the available literature overall demand and supply relationship with linkage to risk for overall development is compiled and presented in Figure 1.

It is well known fact that agriculture production is dependent on set of climatic conditions. Climatic resources are the deciding factor for successful cultivation of any crop and which cannot be manipulated by the human beings. The availability of water for irrigation and the source of the water both are climate dependent factors. Both shortage and excess of water will interfere the agriculture production to greater loss. The latest reports (FAO, 2013) of statistics of utilization of world land says that thirty percent of the earth's land is used for crops and pastures and seventy percent of all abstracted freshwater is directed towards irrigation to produce the food that people and livestock need for a stable food supply. This large-scale utilization of land and water resources is increasingly threatening environments. Further-

Figure 1. Water demand and supply relationship