ICID Young Professionals e-Forum (IYPeF)

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Climate Change Impacts on Irrigation and Drainage

Background Note for Discussion
15-30 April 2018

Introduction

There is strong evidence that climate is already changing around the globe. In particular, changes in rainfall patterns and temperatures may impact the amount and timing of water availability. These changes could impact agriculture (e.g. Tsugihiro et al. 2018) and other systems–such as hydropower–and could have broad economic effects. In light of these possible consequences, projecting the impacts of climate change is a growing research topic. In particular, for the last several decades researchers have been expanding understanding of climate change impacts on food security, including dimensions such as irrigation, plant yields, and supply chains (Adams, et, al 1990; FAO, 2009).

Scientific evidence for global warming is now certain (IPCC, 2013). It is witnessed by unprecedented rates of increases in atmospheric and sea temperatures, and is largely driven by rapid increases in atmospheric carbon dioxide. Corroboration for these warming trends is found directly and indirectly. Continuous observations of increasing temperatures over the last several decades are the most direct evidence. The dramatic loss of glaciers in the world's high mountains and rising sea levels are also indirect evidence, and provide an evidence of future impacts.

Climate change is projected to increase the circulation of water between the ocean, atmosphere, and land. This is caused by rising temperatures, which increase evaporation rates. Rainfall is predicted to increase in the tropics and higher latitudes, but decrease in the mid-latitudes and interior sections of large continents, which are already arid or semi-arid. Water-scarce areas of the world will generally become drier and hotter. Both rainfall and temperatures are predicted to become more variable, with a consequent higher incidence of droughts and floods, sometimes in the same place. Runoff patterns are harder to predict as they are governed by land use as well as uncertain changes in rainfall amounts and patterns (FAO, 2009). The difficulties in extreme weather event projections further create challenges for adapting agricultural activities to climate change (Tsugihiro et al. 2018).

The main discussion surrounding climate change is precisely how much it will change and what can be done to adapt to impacts–or better, mitigate the causes. Mitigation activities are more effective the sooner that they begin. Nonetheless, adaptation will be needed to protect livelihoods and food security in the developing countries that are expected to be the most vulnerable, even

under moderate climate change scenarios. The overall challenge of climate policy will be to find an efficient mix of mitigation and adaptation solutions that limit the overall impacts of climate change and simultaneously improve resilience of vulnerable communities (e.g. Tsugihiro et al. 2018). This includes recognizing that many mutually re-enforcing synergies exist between specific mitigation and adaptation solutions that can lead to more efficient allocation of "climate response" resources. Importantly, many of these synergies exist in the forestry and agriculture sectors and are of great relevance to rural livelihoods in developing countries (FAO, 2012).

It has been estimated that developing countries will bear 70 to 80 percent of the costs of climate change damage (FAO, 2009). At the same time, current estimates of total cost required to reduce greenhouse gas (GHG) emissions and stabilize temperature increases to 2 ˚C (corresponding to an atmospheric carbon dioxide content of 450 parts per million) would be less than 1 percent of predicted global gross domestic product (GDP) in 2100. Further assessment of adaptation costs by sector have also been made, notably Iglesias et al. (2005) and FAO (2009), which show that mitigation is viable if proper incentives are put in place.

There are significant differences in the policy nature underlying mitigation and adaptation actions. Mitigation actions involve reducing GHG emissions or enhancing carbon sinks. Adaptation actions involve implementing targeted policies and investing in human capacity and infrastructure to reduce vulnerability. The benefits of adaptation actions will be realized almost immediately and will matter most under a moderate to severe climate change scenario. Additionally, many actions that improve climate resilience will also promote good development, and are thus "win-win" options. Mitigation actions have wide-reaching positive benefits compared to climate change scenarios, including improving health, decreasing ecosystem vulnerability, and benefiting agriculture in many vulnerable areas. Yet, a policy challenge with mitigation is that the cost must be paid now, but the positive impacts will only be realized decades from now (FAO, 2012).

Where rainfall volume increases and becomes more intense (for example the Indian monsoon and humid tropics), a greater proportion of runoff will be concentrated as floods. Water from floods moves across the land more quickly compared to when precipitation occurs as a large number of small rainfall events. Without further investment in infrastructure, this will reduce groundwater recharge and cause a lower percentage of rainfall to be usable.

Higher evapotranspiration will increase the water required to grow crops. Rainfed farming will become even more challenging due to the higher water requirements and greater variability in year-to-year precipitation. Farmers relying solely on rainfed agriculture also tend to be economically vulnerable.

Changes in water circulation will impact irrigation. About 40 percent of the world's irrigation is supported by flows originating in the Himalaya and other large mountain systems (for example, the Rocky Mountains in the western United States and Tien Shan in Central Asia) (FAO, 2009). Climate change will alter the timing of water availability from mountain areas. Greater seasonal

and inter-annual storage capacity may also be needed in many areas to offset changes in the hydrologic cycle and variability of precipitation. As summarized by Watanabe et al. (2018), adaptation and mitigation inherently requires multidisciplinary actions which consider agro-climatological, technical and socio-economic issues.

Objectives

This discussion on the topic of "*Climate Change Impacts on Irrigation & Drainage"* has the following objectives:

1. Ensure all Irrigation and Drainage Young Professionals understand climate change phenomena.
2. Share insights on impacts of climate change in young professional's country.
3. Elaborate on successful adaptation and mitigation measures that are being practiced in their region.
4. Describe the importance of climate change research, scenario development, data availability, and data accuracy on informing decisions about mitigation of climate change impacts.
5. Discuss the role of governments, international donors, institutions, and agencies to implement potential adaptation and mitigation measures.

Expected outcomes

1. How will climate change impact irrigation and drainage in various countries?
2. What further research efforts need to be undertaken to clarify the impacts of climate change on irrigation and drainage?
3. Which mitigation and adaptation practices need to be adopted to decrease the impact of climate change on the irrigation and drainage sector?
4. What role can Irrigation and Drainage Young Professionals play to minimize impacts of climate change on irrigation and drainage in their countries?
5. What role can governments, donor communities, and institutions fill to implement successful adaptation and mitigation measures?

Discussion Mentor

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