PRODUCING ENOUGH FOOD IN A CLIMATE INSECURE WORLD

This article focuses on the challenges related to water, climate change and food security. The article summarizes recent food production and food security trends and provides an overview of how climate change, through impacts on global hydrology, could impact food production, and consequently food security, in some key farming systems. However, as climate change is but one of many drivers of agriculture, climate change impacts need to be appreciated in relation to specific farming systems in order to identify appropriate adaptation measures. The article highlights key drivers and presents possible responses, emphasizing that the scope of policy response will need to be broad if water institutions are to be effective in coping with climate change.

Approximately 60% of global food production is derived from rainfed farming systems. The remaining 40% is derived from irrigated agriculture practised on 20% of the world's arable land. This split between rainfed and irrigated production sets the scene for a deeper consideration of the possible impacts of future climates on global food production and possible adaptation strategies.

The annual variability in temperature and precipitation are fundamental aspects for agricultural production, but they are just one sub-set of inputs for food production. Fertilisers, pesticides, labour, mechanisation, storage and marketing systems all influence food production and availability to a lesser or greater degree depending upon the farming system. Nonetheless, soil moisture deficits and weather related crop damage still remain the most prevalent constraints to primary agricultural productivity. Any view of the anticipated impacts of climate change on food production needs to maintain a measured perspective of the relative importance of climatic factors in plant growth and plant/animal disease. It should also be stressed that farming systems are inherently adaptive. They have never been technically or socially rigid and fixed. Rather, they have been opportunistic, using available natural resources, technologies, institutions and market mechanisms to respond to changing human demands and environmental changes. Hence, a consideration of the implications of food production in relation to agricultural water management requires a systemic appreciation of precisely where water is instrumental in maintaining agricultural productivity.

Introduction

Numerous recent publications point to the anticipated impacts of climate change on water and agriculture. However, global analysis of specific impacts on agricultural growth remains limited.

Tubiello and Fischer (2007) couple an agro-ecological zone model to a global food trade model for a non-mitigated and a mitigated scenario to examine the impacts on rainfed agriculture. Fisher et al.(2007) deploy the same modelling approach to examine the possible impacts on irrigation water requirements. The resulting projections of agricultural growth, food insecurity and irrigation water requirements under mitigation assumptions are highly mixed with regional 'winners' and 'losers'. However, even with temperature and CO2 forcing effects taken into account at global scale, the distinction between rainfed and irrigated production and their relative contribution to agricultural production has to be made. Soil moisture deficits in rainfed systems cannot be negotiated, and the production risk is a direct function of rainfall. As soon as irrigation technology is applied, the production risk is buffered by the availability of water withdrawn from store or from flows. Under these circumstances, crop yields are raised and cropping intensities can be doubled or tripled.

It is important to emphasize that climate change impacts on rainfed agricultural production are transmitted through soil moisture deficits and temperature increases. However, for irrigated production the primary impacts are transmitted through the overall availability of water resources.

Even if the two production systems are subject to the same set of demand drivers (population growth, income growth), the factors of supply and the points of competition over water resources tend to be quite different. Rainfed agriculture does not have to compete for rainfall. Irrigated production, on the other hand, will continue to compete with other productive sectors and will have to account for its use not just in economic terms, but increasingly in social and environmental domains.

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