



# Climate change, water and food security

As a consequence of climate change, farmers will face growing unpredictability and variability in water supplies and increasing frequency of droughts and floods. However, these impacts will vary tremendously from place to place. Scientists expect that elevated temperatures will benefit agriculture in the northern latitudes, while large parts of the arid and semi-arid tropics will face declining rainfall and runoff – an ominous trend for the mostly food-insecure countries located there.

## The current situation

Many intensively exploited river basins in key food producing regions are already operating at the limit of their resource base. These are worrying indicators of what is yet to come, given the dependency of urban dwellers on agricultural production and the proportion of people whose livelihoods depend on agriculture and related activities – more than two thirds in sub-Saharan Africa.

Worldwide, agriculture represents about 70 percent of water withdrawal; in sub-Saharan Africa 87 percent. But the demands of rapidly growing urban areas increase the pressure on the quality and quantity of local water resources. In addition, water is increasingly needed for environmental purposes like the replenishment of wetlands.

## How food security will be affected

Water management is fundamental to maintain the stability of global food production. Reliable access to water increases agricultural yields, provides a stable supply for many key agricultural products and higher incomes in the rural areas that are home to three-quarters of the world's hungry people. Without sustainable water management across river basins, lakes and associated groundwater aquifers, local, regional and global food security is at risk. Drought is the single most common natural cause of severe food shortages in developing countries. Floods are another major cause of food emergencies. To the extent that climate change increases the variability of rainfall and increases the frequency of extreme weather events, it will hinder food security.

Changes in precipitation, evaporation of water from the soil and transpiration (water vapour given off by plants) are expected to reduce runoff by 2060 in some parts of the world, such as the Near East, Central America, northern Brazil, the western margin of the Sahara and southern Africa. In contrast, runoff will increase, for example, in northern Europe, northern China, East Africa and India. Runoff is important to replenish the water of rivers and lakes and therefore also for irrigation and maintaining ecosystem services.

Hardest hit will be rainfed agriculture – which covers 96 percent of all cultivated land in sub-Saharan Africa, 87 percent in South America and 61 percent in Asia. In marginal semi-arid zones with prolonged dry seasons, the risk of crop failures will increase. Where stability of production cannot be assured, people will be forced to migrate. By the 2080s, land unsuitable for rainfed agriculture in sub-Saharan Africa due to severe climate, soil or terrain constraints may increase by 30 to 60 million hectares.

But irrigation in large river basins and deltas are also at risk from a combination of reduced runoff, salinity (Indus), increased flooding and sea level rise (Nile, Ganges-Brahmaputra, Mekong, Yangtze), and urban and industrial pollution. These stresses on some of the prime productive land will reduce the agricultural output, biodiversity and the natural ability of ecosystems to recover – with possible negative impacts on millions of farmers and consumers across the world as food supply becomes progressively constrained.

The impacts of climate change will be uneven between countries and regions. China, with 140 million undernourished people, should gain 100 million tonnes in cereal production, while India, with 200 million

## Key facts

- By 2025, 1.8 billion people will live in countries or regions with absolute water scarcity.
- Himalayan snow and ice, which provide vast amounts of water for agriculture in Asia, are expected to decline by 20 percent by 2030.
- By 2080 climate change is likely to have these impacts:
  - Seventy five percent of Africa's population could be at risk of hunger.
  - Seventy five million hectares of land currently suitable for rainfed agriculture being lost in sub-Saharan Africa.
  - Agricultural Gross Domestic Product will fall by up to 8 percent in sub-Saharan Africa and by 4 percent in Asia.
  - Demand for irrigation will grow by 5 percent to 20 percent worldwide.

undernourished, is expected to lose 30 million tonnes. Mozambique is projected to lose more than 25 percent of its agricultural productive capacity, while all scenarios show North America gaining 3 percent to 13 percent in agriculture value due to climate change.

## What can be done?

Areas projected to experience lower precipitation will need to improve water storage, management and productivity. Large irrigation schemes will need to adapt to changes in water supply regimes and support will be needed for small-scale, field-based water control measures.

Five policy responses are key:

1. Include adaptation and mitigation measures for agricultural water management in national development plans.
2. Promote technical and management measures to improve the flexibility of rainfed and irrigated agriculture and reduce water losses in irrigated production systems.
3. Improve knowledge on climate change and water, and share good practice among countries and regions.
4. Promote risk management in national policies through better monitoring networks and innovative insurance products.
5. Mobilize adaptation funds to meet the challenges of water and food security under climate change.

## Nile basin countries plan for climate change

A rise in temperature of three degrees Celsius could strain water supplies for an additional 155 to 600 million people in the Near East, already one of the most water-stressed regions in the world. The impacts in the Nile River basin will include increased flooding from rising sea levels in the delta along with increased exposure to water shortages. Irrigation systems are already under environmental strain from salinity, water logging and overexploitation of groundwater.

In response, an FAO project is promoting equitable use of water resources among the 10 Nile basin countries. Countries cross-reference water data with socioeconomic and environmental information to assess how projected water use patterns will affect water resources. The hope is that a strengthened common knowledge base will enhance the ability to allocate water in a way that is seen as effective and fair and that fosters rural development, poverty alleviation and regional cooperation.

## Projected climate change impact on agricultural Gross Domestic Product (GDP) and cereal production in 2080

Region	Percent change in agricultural GDP	Percent change in cereal production
World	-1.5	-1.4
Developed	-0.5	+2.8
North America	+7.5	+1.3
Europe	-14.7	-3.4
Developing	-1.9	-3.9
Sub-Saharan Africa	-4.9	-0.6
Asia	-4.3	-8.6
Latin America	+3.7	+15.9
<b>Change in world market prices</b>	All crops: +10.5	Cereals: +19.5

Source: International Institute for Applied Systems Analysis

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