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2105 First Avenue South  
Minneapolis, Minnesota 55404

USA

[iatp.org](http://iatp.org)

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# Food, Water and Climate Challenges

By Shiney Varghese

Food prices rose 4 percent in the United States last year, the highest rise since 1990.<sup>1</sup> All over the world food prices are on the rise. At the spring meetings of the International Monetary Fund and the World Bank finance ministers wanted to focus the world's attention on food crisis rather than the credit crisis.<sup>2</sup> There are many factors contributing to this current crisis, including the rising price of oil, deregulated agricultural markets, financial speculation, and biofuels. Another key factor is climate change, which is affecting crop yield and food production.<sup>3</sup> It is time for us to get serious about understanding the way climate change affects water resources for food production and conversely the way agricultural water use is leading to climate change.

In January, scientists at the Scripps Institution of Oceanography in the U.S. published an article in the journal *Science* that said what many climate change experts had already been saying for some time: global warming is responsible for the extreme changes that we see in the hydrological cycle in the western U.S. Moreover, the scientists from Scripps found that up to 60 percent of the climate-related trends of river flow, winter air temperature and snow pack between 1950 and 1999 are human-induced.<sup>4</sup>

While the Scripps scientists analyzed data for the western United States, similar changes have been happening around the world in the second half of the twentieth century. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007) found that "climate and freshwater systems are interconnected in complex ways and that any change in one of these systems induces a change in the other."<sup>5</sup> The IPCC further concluded that the changes in precipitation patterns and glacier melts are projected to significantly affect water availability for an entire range of socially valued water uses, including human consumption, agriculture and energy generation.

The most dramatic effect of climate change is likely to be on agricultural production. The impact is already manifesting itself in countries such as Australia. The global price of wheat hit its highest level in decades in December, partly due to Australia's drought.

Irrigated agriculture accounts for almost 70 percent of world water withdrawals and close to 90 percent of the total consumptive water use (the portion that is lost to the immediate environment for use).<sup>6</sup> Existing irrigation and drainage infrastructures have been designed for stable climate conditions. They are very likely inadequate to cope with extreme climatic variations in precipitation and reduced water supply reliability and availability, as well as floods. On the other hand, since irrigation accounts for such a large percentage of total water withdrawals, any reduction in irrigation water use (either through introducing water use efficient technologies or through changing agro-ecological practices) will go a long way in coping with climate-related water stress especially, in water-stressed regions.

While irrigated agriculture accounts for 40 percent of global food production, the remaining 60 percent of world's food crops are produced by those practicing rain-fed agriculture. Such agriculture covers more than 80 percent of global agricultural land.<sup>7</sup> In these regions, particularly those without local water conservation measures, crop productivity depends solely on sufficient precipitation to meet both evaporative demand and soil moisture needs. Any variation in precipitation patterns and temperature increases can affect crop productivity substantially. The IPCC predicts that in some countries, "yields from rain-fed agriculture could be reduced by up to 50 percent by 2020."<sup>8</sup> This would most certainly affect food security in many communities and nations.

But it is not only that climate change-related water stress will affect agriculture. The converse is also true: current water use patterns and associated practices contribute to climate change. It is noteworthy that the two sectors in the world that use the most water, chemical intensive agriculture and fossil fuel-based energy production, are also the biggest contributors to global warming, which in turn further increases water stress in many regions. For example, agriculture, as it is practiced now, sequesters much less carbon than it used to because of land use changes. A recent report by Greenpeace, "Cool Farming: Climate Impacts of Agriculture and Mitigation Potential," found that "industrial, chemical-intensive agriculture degrades the soil and destroys the resources that are critical to storing carbon, such as forests and other vegetation."<sup>9</sup>

There are a number of ways in which national agricultural, trade and energy policies affect both water resources of a nation and climate change at the global level. Let us take a brief look at irrigated agriculture. Irrigation water use increased dramatically in most parts of the world in the second half of 20th century. This was abetted by the building of massive water systems including dams, reservoirs, aqueducts, pipelines and canals that brought water to otherwise water scarce regions. This growth in irrigated agriculture is part of an unprecedented expansion of chemical intensive agriculture that was originally sold as a way to feed the world and also to increase export earnings through commodity-based trade.

The pursuit of export-led growth in agriculture has also been dependent on intensive use of fossil fuel-based chemical inputs, contributing greatly to climate change. In addition, the transport of agricultural commodities around the world and intensive agricultural practices (such as confined animal feedlots and indiscriminate fertilizer-use) also contributes to greenhouse gas (GHG) emissions. According to the World Bank's 2008 report on agriculture, intensive agriculture directly contributes about half of the global emissions of two of the most potent non-carbon dioxide GHGs: "Nitrous oxide emissions from soils (from fertilizer application and manures) and methane from enteric fermentation in livestock production." Each account for about one-third of the farm sector's total non-carbon dioxide emissions and are projected to rise with increased meat consumption becoming a norm in emerging economies.<sup>10</sup>

Agricultural practices geared towards growing export-oriented monoculture crops are chemical intensive and have resulted in high levels of pollution in local water systems. In addition, nitrogen (N) used in fertilizers leaches into water courses increasing the indirect nitrous oxide emissions downstream. This model of production has intensified water use, both in terms of the water going into the growing of the commodities themselves, but also in terms of inter-basin water transfers.

Protecting our waters in local watersheds and wetlands and using them judiciously in support of local agricultural systems and livelihood practices, rather than continuing with the current strategy of promoting export-oriented, monoculture, industrial, water-guzzling agricultural systems, is key to reducing the water sector's direct contributions to climate change. Moreover local practices that conserve and enhance local water availability to ensure resilience of rain-fed agricultural systems are necessary as an adaptation mechanism, to meet climate challenges and to help meet food security goals, two of the biggest challenges for developing countries today. It is time to reevaluate our agricultural policies that promote water and energy intensive agriculture.

We will have to make some major changes in our agriculture systems to address some of the upcoming climate challenges. Doing so will help us cope with extreme changes in the hydrological cycle and resultant food and water crises many communities and nations are sure to face. Effective and sustainable water management in agriculture in support of healthy food systems needs to be part of the climate solution.

*Shiney Varghese is a Senior Policy Analyst at the Institute for Agriculture and Trade Policy.*

## Endnotes

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