# Earth Science Data and Models for Improved Targeting of Humanitarian Aid

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Humanitarian assistance to developing countries has long focused on countries that have political, economic and strategic interest to the United States. Recent changes in global security concerns have heightened the perception that humanitarian action is becoming increasingly politicized. This is seen to be largely driven by the 'global war on terror' along with a push by donors and the United Nations for closer integration between humanitarian action and diplomatic, military and other spheres of engagement in conflict and crisis-affected states (HPG 2010). As we enter an era of rising commodity prices and increasing uncertainty in global food production due to a changing climate, scientific data and analysis will be increasingly important to improve the targeting of humanitarian assistance. Earth science data enables appropriate humanitarian response to complex food emergencies that arise in regions outside the areas of current strategic and security focus.

As the climate changes, new places will become vulnerable to food insecurity and will need emergency assistance. Earth science data and multidisciplinary models will enable an information-based comparison of need that goes beyond strategic and political considerations to identify new hotspots of food insecurity as they emerge. These analyses will improve aid targeting and timeliness while reducing strategic risk by highlighting new regions at risk of crisis in a rapidly changing world. Improved targeting with respect to timing and location could reduce cost while increasing the likelihood that those who need aid get it.

## Markets and Food Insecurity

In food-insecure regions, many farmers both consume their product and sell it in local markets. This exposes farmers to climate variations, because when they produce less their income goes down while their costs go up to maintain basic food consumption. Large-scale hunger can ensue, even when there is sufficient food in the market that has been imported from elsewhere. In Africa 95% of all food consumed is grown on the continent (Funk et al. 2008). Thus when there are wide spread declines in production, food security crises can occur, particularly for the most disadvantaged and marginalized portions of society.

A severe drought in the summer of 2009 caused a failure of the harvest in most of Niger in West Africa. A serious food crisis followed the drought, resulting in the loss of assets, animals and other forms of savings, and left behind high levels of household debt. Niger's total population is 15.29 million with an annual growth rate of 3%. The population living below the poverty line of 1$ per day is estimated to be 65% while 20% is reported to be undernourished, one of the highest rates in the world. According to the UN's World Health Organization, only 9% of the population has access to improved sanitation. In 2010 as a result of the severe drought, Niger's last harvest could meet less than a quarter of the country's annual food requirements.

The general malnutrition and severe acute malnutrition rates reached very high levels in both the rural and the urban populations following the 2009 drought. In June 2010, 17% of the children in the country were suffering from global acute malnutrition. This figure was 36 percent higher than the previous year (Senahoun et al. 2011). Interviews of farmers and herders revealed that they considered the crisis to be as serious as the famine years of 1973 and 1984, and that the impact would linger for many years. In 2009-2010, 22 percent of the total population was either highly or extremely food insecure. The country's vulnerability to future shocks, such as rising food prices, social and political unrest will remain heightened (FEWS 2011), requiring ongoing monitoring of production and local food prices. Satellite remote sensing allowed an early indication of a failed harvest a month before the harvest and six months before the actual production figures were released by Niger. Thus remote sensing provided sufficiently early warning to enable humanitarian assistance to be mobilized and delivered when it was needed.

Changes in climate, coupled with the likely doubling of the local population (particularly in Africa) and an addition of at least two billion more people to feed globally in the next two decades, make it very likely that food prices will continue to rise (Brown et al. 2009). The advent of large-scale use of food commodities in biofuels means that the surplus previously seen in countries such as the United States is rapidly disappearing (Cassman and Liska 2007; Gilland 2002). Higher food prices will affect not only urban populations in the developing world, but also most small farmers, the majority of whom are net grain purchasers. Thus monitoring local production in regions with low purchasing power is a key part of understanding vulnerability across societies.

If resources are to be mobilized for such vulnerable countries as Niger, evidence needs to show not only that weather conditions that cause human suffering, but also that the overall food security situation needs an immediate and prompt response. USAID is the largest provider of food assistance in the world, with the Food for Peace Title II food aid program providing 2.4 million tons of food, valued at $2.6 billion, benefiting over 60 million people in 44 countries worldwide in 2009. These resources are delivered through direct food transfers, cash-assistance programs, locally-purchased food and medical assistance. Earth science data plays a key role in identifying where the assistance is needed and providing enough notice to enable prompt delivery.

**Monitoring Global Agricultural Production**

To effectively monitor agricultural growing conditions, earth observations of rainfall, temperature and other conditions form the basis of knowledge of conditions in which food is grown. Earth science models that integrate observations with an understanding of ecosystem functioning enable global assessments of regions that will experience widespread production declines as a result of adverse weather. Decision makers in the US government increasingly need information that is reliable, reproducible and comparable across regions and economies. When combined with deep knowledge of local context and an understanding of the causes of food insecurity, global agricultural production monitoring can be a powerful tool that can provide earlier early warning (Brown et al. 2007).

Food security crises caused by droughts, floods and other severe events will affect more populations and in new places in the near future. New regions will become vulnerable to food crises due to what would previously be considered small and isolated droughts. Tajikistan is a country that was food secure before geopolitical changes, now reduced agricultural productivity and a shrinking economy has left it vulnerable to drought. In 2011, the food security situation for poor non-agricultural households in remote areas of the country was dire because of high prices of basic staple foods. Fuel and food prices have continued to increase past their five-year high in most of the country and will continue to pose the main threat to households' food security. The context in which weather-related shocks occur are as important to monitor as the weather itself.

The situation in Tajikistan is emblematic of the importance of earth science data and models that allow continued monitoring of food production in the country, to ensure a rapid and appropriate response if a drought were to occur this year. Satellite remote sensing observations and models enables improved decision making for humanitarian action. By quantifying the risk to livelihoods of droughts, floods and other weather-related hazards, data enables an improved understanding of the comparative risks and humanitarian assistance needs across diverse regions. This data will reduce uncertainty, improve accuracy and timeliness, and increase fact-based decision making, opening up humanitarian space in an era of politicization.

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