Submission by the United States of America

Issues Related to Agriculture

5 September 2013

At the thirty-eighth session of the Subsidiary Body for Scientific and Technological Advice held in Bonn, Germany from June 3-14, 2013 on Agenda item 9, Issues relating to agriculture, the Draft conclusions proposed by the Chair reads, in part, "The SBSTA invited Parties and admitted observer organizations to submit to the secretariat, by 2 September 2013, their views on the current state of scientific knowledge on how to enhance the adaptation of agriculture to climate change impacts while promoting rural development, sustainable development and productivity of agricultural systems and food security in all countries, particularly in developing countries. This should take into account the diversity of the agricultural systems and the differences in scale as well as possible adaptation co-benefits."

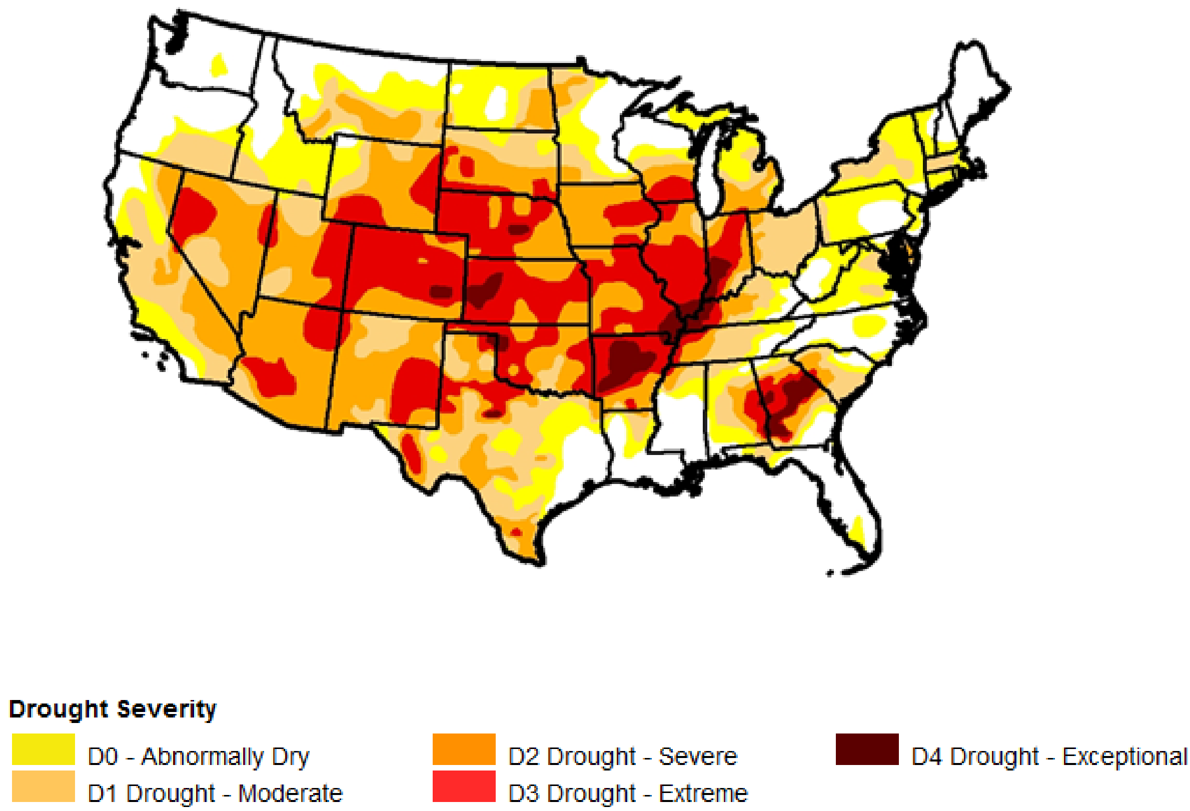
Introduction: 2012 Drought and Impacts

The United States welcomes the opportunity to submit, pursuant to FCCC/SBSTA/2013/L.20, its views and experiences on the adaptation of agriculture to climate change. The issue of extreme weather events, including drought, is becoming even more critical to climate change adaptation strategies for many countries. This submission will review some ways in which U.S. farmers adapted to the 2012 drought, as the lessons learned may be applicable to others.

The 2012 United States drought ranked among the most costly weather-related disasters in U.S. history. Precipitation deficits for the period May through August 2012 were the highest since official measurements began in 1895, eclipsing the driest summers of 1934 and 1936 that occurred during the height of the Dust Bowl. The United States Department of Agriculture designated 2,245 counties in 39 states as disaster areas due to drought, or 71 percent of the land area of the contiguous United States. By July 2012, 64 percent of the contiguous U.S. was in moderate to exceptional drought. More than 56 percent of the wheat crop and 60 percent of livestock were within drought-affected areas. Corn yield was reduced by 27 percent.

Despite these conditions, producers used a variety of practices and technologies to prevent even greater losses. Conservation practices such as cover crops and careful water management technologies ameliorated the effects of the drought. Producers' experiences also highlighted the need for geographically specific information and drought prediction and warning.

Drought Map of the Contiguous 48 United States on July 24, 2012
Source: U.S. Drought Monitor



Conservation Practices

Conservation programs are important means of addressing natural resource concerns associated with drought including diminished water availability for crop and livestock production, deteriorating plant conditions for grazing, decreased water quality, decreased plant cover resulting in increasing erosion, and diminished soil quality. Cover crops, crop rotation, conservation tillage, and other soil carbon building conservation practices can increase the available water holding capacity of the soils, while strategic water application and efficient irrigation can improve water management. These conservation practices fall into three major groups:

- Water management: efficient irrigation systems and management, water storage, strategic water application, livestock watering facilities
- Land management: prescribed grazing, conservation tillage or no-till, buffer and filter strips near water sources

- Crop management: crop rotations, drought tolerant crops, shift to less water-dependent cropping, cover cropping to enhance soil carbon and available water holding capacity

In Indiana, cover crops and no-till had significant benefits in 2012, nearly doubling yield compared to similar fields. Elsewhere, cover crops increased yields, in some cases from 30 bushels per acre to 180 bushels per acre. These practices increase soil biology, moisture, organic matter, and aggregate stability over time.

Experiences from the 2012 drought showed that some conditions can make conservation assistance more effective. These include:

- Building on existing partnerships that deliver conservation assistance
- Incentivizing, promoting, and advocating for conservation on the ground
- Providing flexibility to accommodate variability across field, farm, and county boundaries
- Researching, with producer engagement, the effects of conservation practices at the local level

Technology

New technologies played an important role in reducing the impact of the drought. A recent study found that if 1988 seed and management technologies had been used in 2012, the drought would have caused a 37 percent loss in corn production across the US[1]. The actual loss that occurred in 2012 was closer to 13 percent, and corn yields were 41 percent higher in 2012 than in 1988. Relevant technologies include:

- Tillage systems: Increased adoption of conservation tillage or no-till to reduce evaporative losses, to increase the water holding capacity of the soils, and to promote deeper penetration of moisture into soil profile
- Better equipment: Wider availability of improved equipment for soil-bed preparation, planting, harvesting and application of crop chemicals
- Water management: Better management of water, advanced drainage systems, and some increases in irrigated acres
- Planting changes: Earlier planting dates and/or higher plant populations
- Crop protection chemicals: Continued development and introduction of more effective crop protection chemicals and improved application methods that preserve yield in the presence of increased weed, pest, and disease pressure
- New technologies for higher yields: New diverse, broadly adapted and widely-tested germplasm help maintain yield potential under environmental stress

[1] Elliott, et al., 2013: http://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=1655092

Drought-tolerant crops and water management particularly show how technology can help during drought, although not indefinitely. Drought-optimized varieties produce higher yields as a result of physiological traits such as increased root growth. The tradeoff is that such plants often have lower yields than conventional varieties when there is sufficient water, although careful application of conservation practices may help new seeds under better conditions.

Likewise, irrigation has expanded areas where crops can be grown, has reduced variability, and can help farmers manage drought risks. Irrigation is most effective as a year-round, holistic practice. During the growing season in the drought, farmers practiced triage (abandoning a portion of the crop while watering the most favorable area), managing drought-related pests, and continuously monitoring to address water needs in a timely manner. In the off season, farmers increased irrigation efficiency and/or uniformity, switched to crop mixes that require less water, reduced tillage, and reduced the irrigated area through fallowing or crops with different life cycles. Despite these efforts, many irrigation systems could not provide sufficient water to offset the impacts of the 2012 drought. This suggests that reducing irrigated acreage may be necessary over the long term in drought-prone areas.

Information and Technology Needs

Producers need relevant information to apply conservation practices in their areas. For example, producers who use conservation practices such as cover crops need a tracking system in which they can enter their parameters to compare the most efficient ways to manage cropping. In the case of cover crops, a system would include the type of cover crop, the time when the cover crop is killed, the cash crop, the yield, precipitation during the growing season, irrigation (if any), and applied nutrients.

Improved drought preparedness is another requirement for coping with future drought. This includes forecasting, early warning, and preparedness, as well as research. Forecasting predictions issued from a single source would improve producers' decision-making abilities. Forecasting tools should rely on real-time data at a farm-level scale in order to inform planting decisions. Accurate weather forecasting is necessary to ensure that appropriate seeds are available across the country. In seasons when drought is predicted, seed producers must anticipate demand for drought-tolerant seed varieties in an effort to produce enough to meet that demand. Drought mitigation includes actions taken in advance of a drought that reduce potential drought-related impacts on crop. Early information provided by an early warning system is vital to reducing damage from drought impacts. In the years just before the 2012 drought, scientific improvements allowed the United States to better monitor drought in real time, which in turn provided better forecasting and allowed policymakers to plan further in advance. These efforts include:

- National Integrated Drought Information System: NIDIS is an interagency, interstate effort to establish a national drought early warning information system with improved coordination of monitoring, forecasting, and impact assessment efforts. As a proactive effort, NIDIS provides a better understanding of how and why droughts affect society by working with communities and existing networks on drought assessments, drought early warning systems, climate outlook forums, education and outreach, and preparedness.
- The United States Drought Monitor synthesizes indices and inputs from 270 experts across the country on a weekly basis. This representative scientific consensus helps inform the public and decision-makers. The Drought Monitor is currently used as a trigger mechanism for both State and Federal drought response measures.

Research is ongoing both to improve the ability to predict droughts and to predict at smaller scales. These efforts include:

- Improved understanding of drought development mechanisms
- Improved assessment of drought monitoring based on verification metrics
- Impacts of decadal scale variations on seasonal forecast reliability
- Improved satellite estimates of snow cover (e.g. snow-water equivalent)
- Improved satellite estimates of soil moisture

Further development and dissemination of other technologies will also yield valuable adaptation strategies to address increasingly variable growing conditions. These range from simple on-farm practices like treating corn stover with quicklime to increase its feed value to more expensive technologies. For example, Landsat satellites provide free, globally available data at subfield resolutions, thus facilitating drought monitoring of individual crops and fields. However, Landsat is the only source of data at this scale, and it provides data only every 16 days. Additional sources of data would enhance early detection plant stress conditions develop and would allow earlier implementation of drought management strategies.

Broadly, producers, planners, and policy makers will all need more information about water availability as growing conditions continue to vary. Technologies that will provide more information about where water is coming from, how much is available, and how to reduce its use while maintaining adequate production will be required.

Summary of Observations and Lessons Learned

- Although the 2012 drought had serious negative impacts for crop production, those impacts were in many ways less severe than expected, particularly when comparing the 2012 drought to the 1988 drought. Two of the most important factors contributing to reduced drought impacts were improved soil health as a result of appropriately applied conservation practices and technological advances such as improvements in crop breeding. Together, these improved soil moisture holding capacity and the ability of major crops to use that soil moisture even when it was present in limited quantities.

- Voluntary, incentive-based conservation practices are widely viewed as an important way to engage in drought preparedness, to respond to certain drought impacts, and to mitigate long-term drought impacts. Increasing technical assistance for adaptation will help farmers prepare for drought and weather fluctuations expected to occur as climate variability increases. Adaptation practices are important not only from a risk-management perspective, but also from a natural resource management perspective.

- Technology and conservation practices have interacted in important ways to reduce drought vulnerability. Newer seeds are well-positioned to take greater advantage of healthier soils. Newer seeders allow farmers to plant seeds more precisely, leading to greater viability, even with greater residue left on the fields.

- Although collecting and calibrating on-the-ground data is a challenge, this information is necessary to improve prediction accuracy. It is important that programs and authorities continue to be empowered to provide funding for this type of research, observation, and data management.

- Increasing and improving available data is critical. Coordinating data provides a national perspective on weather trends, technology and policy needs. Consolidating this data in central locations would greatly improve ease of access and use.

- Improving the way farm-level data are collected, recorded and used in research and on-farm research trials is necessary to refine predictions, to encourage farmer-led actions to improve crop outcomes, and to inform policy approaches to natural resource and adaptive management in a variable climate. While collecting these data requires farmers' participation, farmers will also benefit from the research they support.