TESTIMONY OF
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My name is Roger S. Pulwarty and I am the Director of the National Integrated Drought Information System (NIDIS) at the National Oceanic and Atmospheric Administration (NOAA). It is my honor to be here today. Thank you for inviting me to speak about our program, report on the information and data that have been made available to local, state and regional water decision-makers, and how we can improve the information for anticipating and managing current and future drought conditions.

The NIDIS was established via the NIDIS Act of 2006 (Public Law 109-430, hereafter NIDIS Act), which builds on longstanding efforts among agencies and institutions that have historically focused on drought risk assessment and response. The NIDIS Act prescribes an interagency approach, led by NOAA, to "Enable the Nation to move from a reactive to a more proactive approach to managing drought risks and impacts." Our goals are to (a) improve public awareness of drought and attendant impacts and (b) improve the coordination and capacity of counties, states and watershed to reduce drought risks proactively.

An important feature of the weather conditions in 2012 was the *persistence* of the areas of dryness and warm temperatures, the *magnitude of the extremes*, and the *large area* they encompassed. Broad sectors were affected and continue to be affected by the 2012 drought. Impacts include, but are not limited to, the reduction in crop yields and commerce on major river systems. The summer drought of 2012 contributed to an unusually high number of acres in the United States (U.S.) burned by wildfires. According to the National Interagency Fire Center, there were over 9.2 million acres charred in wildfires in 2012 as of December 20th. A spokesman for the National Interagency Fire Center in Boise said, "Since 1960, when we began keeping good records, surpassing 9 million acres burned has only happened three times: this year, 2006 and 2007."

The Colorado Basin experienced only 44% of its annually expected runoff for Water Year 2012. The basin also experienced the second driest ten-year period in the streamflow record. Media reports carried news such as "Ski resorts in Colorado were seeing fewer visitors because of below normal snowfall. Skier visits to the 21 resorts in Colorado Ski Country USA were down 11.5% through the end of 2012, compared to the previous year. At Loveland Ski Area, just 40 of the 93 runs were open during the third week of January."

The dry weather (which lowered moisture supplies), coupled with intense spring and summer heat (which increased evapotranspiration and, thus, moisture demand), depleted soil moisture, lowered streamflow (May, June, July, August), reservoir and stock pond levels, and ravaged crops and livestock. By year's end, low river levels threatened commerce on the vital Mississippi River shipping lanes.

It is as yet uncertain as to whether the economic impacts of the 2012 drought will exceed prior events. The 1988 drought inflicted $78 billion in losses and the 1980 event caused $56 billion in losses (adjusted for inflation to 2012 dollars)[1]. While an independent insurance company has estimated that the costs of the 2012 drought to be in excess of $35 billion with agriculture accounting for most of the losses[2], it is important to note that drought related impacts over the past year cross a broad spectrum of economic and environmental services sectors from wildfire to energy, tourism and recreation.

In my testimony I will highlight what we know about the following questions and issues:

How did we get here? Status and antecedent conditions.
Is this drought like others? Why has it been dry/drier than normal?
What are the impacts and where are they occurring?
What information is being provided and by whom? Are information needs being met?
How bad might it get and how long will it last?
How is NOAA working with other Federal agencies such as the USDA?

Information for this testimony is drawn from NIDIS and its supporting partners including NOAA's Climate Prediction Center, NOAA's Earth System Research Laboratory's Physical Sciences Division, NOAA's National Climate Data Center, NOAA's River Forecast Centers, and NOAA's Regional Integrated Sciences and Assessments, the National Drought Mitigation Center (NDMC) at the University of Nebraska Lincoln, the U.S. Army Corps of Engineers, the Department of the Interior (U.S. Geological Survey (USGS), the Bureau of Reclamation), the U.S. Department of Agriculture (USDA)'s Office of the Chief Economist and Natural Resources Conservation Services, National Aeronautics and Space Administration (NASA), the National Interagency Fire Center, the Western Governors Association and Western States Water Council, Regional Climate Centers, State Climatologists, and State and Tribal Water Resources Departments, among others.

Drought in the U.S.: How did we get here? And have we been here before?

Drought is part of the American experience. Severe, long-lasting droughts have occurred in the Southwest during the 13th century, and in the central and lower Mississippi Valley in the 14th through 16th centuries. The great Civil War drought of 1861-1864 led to the first water rights agreement in the West - in the San Luis Valley in the state of Colorado where I live. In the 20th century, droughts in the 1930s (Dust Bowl era) and 1950s were

[1] http://www.ncdc.noaa.gov/billions/events.pdf
[2] Aon Benfield Reinsurance Group's Annual Global Climate and Catastrophe Report

particularly severe and widespread. In 1934, 65% of the contiguous United States was affected by severe to extreme drought. These extreme events, including droughts of shorter duration but nevertheless severe such as in 1977, have been felt throughout economies, ecosystems, and livelihoods, and certainly shaped much of the planning and practice surrounding modern water resources management and related decisions.

Since 2000, the total U.S. land area affected by drought of at least moderate intensity has varied from as little as 7% of the contiguous U.S. (August 3, 2010) to as much as 46% of the US land area (September 10, 2002). Based on weekly estimates of the areal extent of drought conditions since 2000, the average amount of land area across the United States affected by at least moderate-intensity drought annually has been 25%.
As mentioned earlier, an important feature of the weather conditions in 2012 was the *persistence* of the areas of dryness and warm temperatures, the *magnitude of the extremes*, and the *large area* they encompassed.

Figure 1 (attached) shows the progression of drought conditions since 2010 to the present. 2012 began with about 32% of the contiguous U.S. in moderate to exceptional drought with three areas of moderate to exceptional drought in the Southern Plains and moderate to extreme drought in the Southeast — with areas of moderate to severe drought in the Upper Mississippi Valley and moderate drought in the Far West. As the year progressed, the western drought expanded to link with the Southern Plains drought area and new drought areas developed along the East Coast, pushing the national drought area to 38.2% by May 1st. Drought re-intensified suddenly in May and strengthened through July and August, which inhibited summertime convection/rainfall and some locations experienced exceptionally dry conditions with 30-60 days having no precipitation event. One of the causes of this drought re-intensification was the unusual high pressure that reduced the southward push of cold fronts from the North that typically serves to organize rainfall during this time. An interagency task force on drought that includes NOAA, NASA, and works with NIDIS, is researching the cause of this re-intensification. Dryness during the late spring began to take its toll in the agricultural heartland by summer as drought intensified and expanded to cover much of the country from the Central Rockies to the Ohio Valley, and the Mexican border to the Canadian border, by the end of August. This solid mass of drought, which stretched from border to border and (by now) West Coast to Mississippi River, persisted through the fall. According to the U.S. Drought Monitor (USDM – maintained by the USDA, NOAA, and the NDMC, the area in drought peaked at about 65.5% on September 25 (a new high in the 1999-2012 USDM record) and ended the year at 61.1%. The areas in extreme to exceptional drought reached maximum coverage on August 7, at 24.1% of the U.S. Since the end of summer, soil moisture conditions remained depleted since the mid-West was going through its normal drier season.

2012 ended as one of the driest years on record having had much of the country over or near 60% in moderate to extreme drought. Only 1934 had more months with more than 60% of the contiguous U.S. in moderate to severe drought.

Year Month and % Area under Moderate or stronger drought conditions over the U.S.

1934 May 73.1 Jun 74.1 Jul 79.9 Aug 77.5 Sep 70.2 Oct 67.7
1939 Dec 62.1
1954 Jul 60.4 Dec 59.5
2012 Jul 62.8 Aug 60.0 Nov 60.0 Dec 61.8

The 10 driest years ranked in order of their summer (May-August) rainfall in the mid-West deficits are: 2012, 1934, 1936, 1901, 1976, 1913, 1988, 1953, 1911, and 1931. The deficit in rainfall over the mid-West in 2012 was -34.2 mm, which was about 53% of the region's long-term mean rainfall (73.5 mm). This deficit broke the record of -28.4 mm observed in 1934. In May and June (Figure 1, attached), a zonal ridge of high pressure anomalies inhibited the typical southward push of cold fronts from Canada that often serve to organize widespread rains.

When the month-to-month variability is averaged out a consistent pattern becomes evident — the drought years 1955 and 1956 are the closest historical analogs to the geographical pattern of drought in 2012, and 1998 (the second warmest year on record) and 2006 (third warmest year on record) are the closest historical analogs to 2012 for the spatial temperature pattern. The average temperature nationwide during the six month period from January-June 2012 was 52.9 degrees Fahrenheit, or 4.5 degrees above average.

Many local records were also set this past year. For instance, on June 26, Red Willow, Nebraska set a temperature record of 115 degrees, eclipsing the 114-degree mark set in 1932. 28 states east of the Rockies set temperature records for the six-month period, putting further pressure on agricultural irrigation requirements and direct plant crop stress, on energy demands for cooling and water storage management.

The following summarizes key features of the 2012 drought as experienced across different regions of the U.S. over the year (Figure 1, attached):

- Persistent and anomalous heat resulted in the warmest month ever in July 2012, and 2012 was ranked as the warmest year on record for the contiguous U.S.
- During the May – July growing season, dry weather dominated across the agricultural areas in the Central Plains to the Midwest.
- The anomalous warmth increased evaporation and intensified drought conditions during the growing season.
- As the year progressed, the western drought expanded to link with the Southern Plains drought area and new drought areas developed along the East Coast.
- Record heat and near-record dryness occurred in Colorado, contributing to numerous wildfires.
- Several states had record dry seasons: Arkansas (April-June and other seasons), Kansas (May-July), Nebraska (June-August and other seasons), and South Dakota (July-September).
- The prolonged dryness in parts of the Southeast gave Georgia the driest December-November 24-month period (December 2010-November 2012) on record.

- Several river basins have experienced unusually dry conditions during 2012, with the Upper Colorado having one of its driest years in the 1895-2012 period in the record.
- The spatial pattern of drought this year closely overlaid the agricultural area of the U.S. heartland, and the excessive temperatures and lack of rain during the critical growing season severely reduced corn and soybean crop yield.
- The extreme severity of the dryness and evapotranspiration demand over the growing season resulted in a rapid increase in the percent area of this agricultural belt experiencing moderate to extreme drought (as defined by the Palmer Drought Index) and moderate to exceptional drought (for the Midwest and High Plains as defined by the USDM).

The Southern U.S. Drought 2011-2012

As early as the summer of 2010, NOAA's Climate Prediction Center (CPC) predicted that La Niña conditions would increase the potential for drought formation across the southern United States. The forecast for drought formation was verified, and the Fall 2010 drought was one of the most severe multiple-year droughts on record. It continued into the following year with the 2011 Water Year in Texas being the driest in 100 years. Just looking at agricultural-related impacts, losses were close to $9 billion[3].

The data, tools and experience from NIDIS activities were brought to bear during the onset of drought in the Southern U.S. in Fall 2010. NIDIS, with NOAA's National Environmental Satellite and Data Information Service (NESDIS) and the National Weather Service (NWS), in partnership with the States of Texas, Oklahoma, New Mexico, and other partners, conducted a series of drought information outlooks related to that drought. The drought information outlooks are a new approach to improve communication and delivery of drought early warning information for planning and risk management. The research, impacts assessments, and coordinating mechanisms supported by NIDIS improved coordination and usability of drought information in Texas. NIDIS engaged local partners such as the regional weather and climate offices and state climatologists to lead this effort together with researchers and products from NOAA's Earth System Research Laboratory, the NWS Climate Prediction Center (CPC) and other Federal entities. From this research, it became clear that La Niña was a critical initiator but not the main driver of ensuing drought severity and duration, which highlighted the need for additional research. This work has gained attention in national media, including the Wall Street Journal on January 2, 2012), which carried one of the outlooks created by NIDIS.

The National Drought Status and Outlook for U.S. Regions through April 2013 (Figures 2 and 3, attached)

The NWS forecast products utilized to create the summary and outlook include the Hydrometeorological Prediction Center's (HPC) 5-day Quantitative Precipitation Forecasts(QPF) and 5-day Mean Temperature prognoses, the 6-10 Day Outlooks of

[3] "Impact of the 2011 Drought and Beyond" Report (Texas Comptroller report)
Link: http://www.window.state.tx.us/specialrpt/drought/pdf/96-1704-Drought.pdf

Temperature and Precipitation Probability, and the 8-14 Day Outlooks of Temperature and Precipitation Probability, valid as of late Wednesday, February 6, of the USDM release week.

The NWS forecast is available at: http://www.cpc.ncep.noaa.gov/products/forecasts/.

Dryness Categories:

D0 ...Abnormally Dry...used for areas showing dryness but not yet in drought, or for areas recovering from drought.

Drought Intensity Categories:

D1 ... Moderate Drought ; D2 ... Severe Drought ; D3 ... Extreme Drought ; D4 ... Exceptional Drought

Drought or Dryness Types:

S ... Short-Term, typically <6 months (e.g. agricultural, grasslands)
L ... Long-Term, typically >6 months (e.g. hydrology, ecology)

The Northeast: Below normal temperatures and virtually no precipitation across the region are leading to no changes with regard to the remaining D0.

Mid Atlantic: After back-to-back wet weeks for most of the region, drying and cool temperatures this past week, resulted in a status quo depiction on the map.

The Southeast**:** The Southeast also turned predominantly dry and warmer. One major difference between 1934 and 2012 was in the Southeast United States-which was not significantly affected during the "Dust Bowl" but is experiencing continuing dry conditions today. The most notable changes occurred in Georgia, South Carolina and Florida. The border region along the Savannah River between Georgia and South Carolina saw an expansion of extreme drought (D3) to the coast along with a deepening of severe drought (D2) in southern South Carolina and southern Georgia. Florida saw a 1-category expansion in abnormally dry areas (D0) across most of the Florida Peninsula along with moderate (D1) and severe drought expansion (D2) also noted in the Panhandle. In addition, there was also a slight pushing south and west of moderate drought (D1) and severe drought areas (D2) in southern Alabama where recent rains have missed and the dry trend continues to intensify. Drought conditions remain through much of the Apalachicola/Chattahoochee/Flint River Basin (ACF). From 2 to 5 inches of rain in the upper part of the basin in past weeks providing some relief, but less than 0.5 inch fell in the lower half of the basin. There have been no significant tropical events in the basin for the past three years. Although streamflows have increased in the lower basin, they remain near historic low levels for this time of year as do ground water levels in Southern Georgia. Lake Lanier has also begun to see near normal inflows. Despite this relief, much of ACF remains under extreme (D3) or exceptional (D4) drought conditions. Streamflows on the Flint River show some recovery, however, they remain at or near historical lows at many locations. For the 3-month streamflow forecast, all locations have the greatest probability for below normal flows.

The South: Very warm temperatures (10 to 15 degrees above normal was commonplace) and dryness marked weather conditions across most of the region. Those conditions, coupled with a return to a drier season, leads to mostly minor shifts and slight deterioration across most of Texas and southwestern Oklahoma as well. Arkansas remains unchanged from last week but the recent wet pattern continues to indicate improved conditions, particularly in central and northeastern reaches.

Midwest: There was some late period precipitation across northeastern Iowa, northern Illinois and southern Wisconsin this past week, but given the deficits, lack of impacts and frozen top soils, it is not enough to move the drought off its mark, so it has remained at status quo.

The Plains: The region remained unseasonably warm except for the Dakotas, but all shared in the all-too-common persistent dryness with no major precipitation outbreaks occurring last week. As such, the drought is firmly entrenched into February. The relative lack of winter snow in back-to-back years will certainly place a much greater emphasis on the need for well above-normal spring rains if the region is to have any real chance of recovering from this drought. No changes of note on the map this week in what is now becoming the epicenter of the 2013 drought.

The West: The West saw a mixed set on both the temperature and precipitation fronts last week as much of the Rocky Mountain spine region and the Southwest experienced well above normal temperatures. The Pacific Northwest remained the exception by staying cooler and wetter. Across central Arizona, anywhere from 2-4 inches of precipitation or more were observed, bringing about 1-category improvements to the moderate to extreme drought (D1-D3). Longer-term dryness/drought is still a concern, but this system provided some much needed moisture. Northwestern New Mexico shared in the same system, but not nearly to the degree seen in central Arizona and southwestern Colorado. However, this was enough to remove the extreme drought (D3) intensity category from New Mexico, although many basins are still running below normal with regard to snow water equivalent (SWE) levels, meaning the severe drought (D2) remains. Similarly, for southwestern Colorado, the system helped boost SWE values, but not enough to move them out of severe drought (D2) given the chronic dryness stretching back to last winter. Ample rains along the southern coast of California lead to a 1-category improvement from D1 to D0, or moderate to abnormally dry, and a push of the moderate drought D1 category westward off the coast from San Diego to Santa Barbara. Finally, well to the north in and around the Idaho Panhandle and northwestern Montana, precipitation last week led to a trimming of the abnormally dry region (D0), primarily on the Montana side of the Divide, although the D0 is still left intact (albeit in a diminished state given the lagging SWE). For the Colorado Basin a second year of lower than average flows seems in the offing unless conditions change dramatically. Snowfall has been low for a 2nd winter in a row. This does not bode well for the runoff season since 42% variance of CO River runoff is related to Fall moisture. The next two weeks show above-average chances for moisture in northern CO in particular, but not nearly enough to make up for lost ground. Given the continuing Pacific Decadal Oscillation-Atlantic Meridional Oscillation

setup for drought, a projection of drier than normal conditions is justified for over next few months.

Hawaii, Alaska, and Puerto Rico: The rains of recent weeks have brought some improvements to parts of the Hawaiian Islands and this trend seems to still be occurring, but this week's map remains unchanged as local impact assessments continue to weigh short-term improvement vs. the long-term chronic drought that has persisted since 2008. Conditions remain unchanged in Alaska and on Puerto Rico.

Looking Ahead:
The NWS HPC 5-Day forecast calls for a potential storm system to bring moisture to the Pacific NW and into the northern Rockies. Another system will push eastward, bringing with it good chances for 1-2 inches of rain, or more, to the Gulf Coast region, and up the Appalachian spine into the Northeast. Temperatures are expected to be above normal across most of the West and central-southern Plains. Below-normal readings will be most pronounced in the Great Lakes region and unseasonably cool weather is expected to encroach across the rest of the East Coast and down into Florida.
The Climate Prediction Center's 6–10 day outlook (February 5 thru February 9) is showing a strong likelihood for above-normal temperatures across the Southwest, South, Great Plains and Midwest. The New England region and north coast of California and south coast of Oregon can expect below-normal readings. As for precipitation, the wet trend is expected to continue across a good portion of the Desert Southwest and within the Midwest and Northeast. Drier conditions are to be expected along the Gulf Coast and into the coastal Carolinas, enveloping all of Florida as well.

Since the beginning of 2013, drier and colder weather prevailed over the West after a relatively wet December. In the Great Basin and central Rockies, 2-week temperature departures averaged 10 to 20 degrees F below normal. Farther east, however, a series of slow-moving cold fronts embedded with surface lows brought surplus precipitation to the southern Plains (eastern New Mexico and Texas), parts of the central Plains (western Oklahoma and central Kansas), and the lower Mississippi, Tennessee, and Ohio Valleys, providing some relief from the drought. Portions of the northern Rockies and Plains and upper Midwest also saw above normal year-to-date precipitation. Temperatures in the eastern half of the Nation have quickly moderated after a cold start to the year. Elsewhere, mostly dry weather exacerbated drought conditions in the Southwest, central Plains and western Corn Belt, and eastern Gulf and southern Atlantic Coasts. In Hawaii, shower activity has increased during the past 2 weeks, mostly falling on windward locations and northern islands.

According to the CPC, a much drier pattern is expected over the upcoming three months across the southern third of the Nation (from central California to the eastern Gulf Coast). This limits the prospects for further drought improvements during the latter end of the wet season in California, Nevada, and western Arizona, and in fact, increases the probabilities for drought development and deterioration in the tri-State area. This also marks a change from recent wet conditions in the southern Plains and western Gulf Coast as drought development and persistence is forecasted for Texas by the end of April.

Similarly, drought development and persistence is possible in the eastern Gulf Coast States, but less likely further north. Thus, the National Wildland Significant Fire Potential Outlook indicates Spring pre-greenup potential and long term drought may keep parts of the West and the Southeast in above normal wildland fire potential for April-May. In contrast, enhanced probabilities of surplus precipitation and subnormal temperatures across the northern U.S. (from the northern Rockies eastward to the upper Midwest and into the western Corn Belt) increase the odds for drought improvement. Some improvement is possible across the middle Mississippi Valley and the Piedmont, the latter area from wetness forecast for the rest of the month. With odds favoring subnormal Feb-Mar-Apr rainfall, drought conditions should persist across the leeward sides of Hawaii's southern islands and possibly expand toward windward sides during the latter end of the winter rainy season.

NOAA and the USDA: Working together to increase the Nation's Resilience to Drought

The number of watershed, state, and local drought and water plans using NOAA-based information has significantly increased since NIDIS was initiated in 2007. Part of the support that NIDIS has generated and the ability of the program to meet the needs of the Nation are a result of the strong partnerships that the program has with other agencies, outreach organizations, and an enabling set of programs and observational capabilities. NIDIS called on these partnerships in December 2012 and convened a National Drought Forum (hereafter, "Forum") hosted at the National Governors Association Hall of States here in Washington D.C. The Forum was co-chaired by Dr. Robert Detrick, the NOAA Assistant Administrator for Oceanic and Atmospheric Research and Dr. Donald Wilhite, founder of the University of Nebraska National Drought Mitigation Center (NDMC). The Forum featured keynote addresses from Secretary Vilsack (USDA), Gov. Brownback of Kansas and the NOAA Deputy Administrator Dr. Kathryn Sullivan. The Forum was co-sponsored by the National, Mid-Western, Southern and Western Governors Association, the U.S. Army Corps of Engineers, and the Department of the Interior and saw significant participation at high levels by these agencies and by regional and local agriculture, health, and water managers. The goals of the Forum were: "To understand the extent of 2012 drought impacts and response in 2012, and help provide new information and coordination for improving the nation's drought readiness for 2013 and in the future."

Among other issues, discussions at the National Forum highlighted the need to:

- Increase public awareness of this year's drought and potential impacts for next year;
- Increase technical assistance for the communication and use of drought-related information in impacted communities including efforts through the NIDIS regional early warning systems in partnership with NDMC; and
- Ensure sustained support for monitoring programs and equipment critical to understand and respond to drought, e.g. the National Resources Conservation Service SNOwpack TELemetry (SNOTEL) sites; and the Water Census led by the USGS.

Recommendations from the Forum are being finalized across the multiagency and multistate planning team and should be circulated to participants in the next week. NOAA will be happy to provide a copy of the Forum Report to this Committee after its review is completed. Through the Economic Development Administration and NIDIS, the Department of Commerce (DOC) is working closely with USDA and other agencies within the National Disaster Recovery Framework for Drought, with a strong focus on the recovery needs and sustainability of rural communities. Critical preliminary efforts will be built on the DOC-USDA Memorandum of Understanding (MOU) announced at the Forum and signed by the Secretary of Agriculture and the Acting Secretary of Commerce in December 2012. This MOU is aimed at improving cross-agency collaboration on drought risk reduction. The agreement is intended to (1) strengthen Commerce's and Agriculture's development and delivery of relevant local and regional drought information services to agricultural, forestry, rural economies, and related sectors; and (2) foster improved understanding by end-users in these sectors of the value and use of weather and climatological information and its integration with social and economic information, in planning and operational activities for farming and forestry communities.

To achieve a more comprehensive vision of a truly "national integrated drought information system" requires improvements that NIDIS has already begun to address. These include:

- Improving the understanding and predictability of droughts across a variety of timescales for seasonal, to interannual and decadal time scales including the role of precipitation events in reducing drought duration and intensity;
- Improving collaboration among scientists and managers to enhance the public awareness and effectiveness of observation networks, monitoring, prediction, information delivery, and applied research;
- Improving the national and regional drought information framework by transferring successful approaches (information development, products, capacity, and coordination) to areas covered by the drought portal, but not yet having active early warning systems;
- Improving coordination between institutions that provide different types of drought early warning**;**
- Developing impact indicators to form part of a comprehensive early warning system; and
- Working with the private sector and others on guidance and standards for developing value-added products to support drought plans.

Included at the end of this written testimony is a brief Appendix that provides examples of ongoing regional and local drought-related efforts between the USDA and NOAA.

Thank you for the opportunity to be with you today.

APPENDIX: Examples of ongoing regional drought-related efforts between USDA and NOAA

The USDM[4] sets the standard for communicating location and intensity of drought to a broad audience. The map summarizes and synthesizes information from the local and state level to the national scale, making it the most widely used gauge of drought conditions in the country. Policy makers use it to allocate relief dollars, states use it to trigger drought response measures, and media rely on it. The map is produced in partnership with numerous agencies including NOAA, including the Climate Prediction Center, the National Climatic Data Center, and the Western Regional Climate Center; the U.S. Department of Agriculture's Office of the Chief Economist, including the Joint Agricultural Weather Facility and the World Agricultural Outlook Board; and the National Drought Mitigation Center at the University of Nebraska-Lincoln. Support for the USDM is provided on a voluntary basis through in-kind contributions of time and expertise. There is no devoted funding or budget for this process.

NIDIS Regional Climate Outlook Forums

Climate Outlook Forums bring together a diverse group of stakeholders, including many from the agricultural community, on a seasonal basis to focus and discuss current drought conditions and the potential for changes in those conditions. Current and future drought impacts in all economic sectors are discussed with an eye on possible strategies for mitigation. Strategies for communicating with vulnerable and at risk populations, as well as the media, are examined. These climate outlook forums result in regional outlooks and summaries of ongoing and potential conditions related to drought including water resources, wildfires, etc. that are released jointly by NOAA and the Western Governors Association.

From 2010 through 2012, several Climate Outlook Forums were conducted with the support of NIDIS:

- Albany, GA
- Austin, TX
- Fort Worth, TX
- Upper Colorado River Basin
- Upper Mid-West
- Lake Lanier, GA
- Lubbock, TX
- Santa Fe, NM

NIDIS is supporting efforts to reinforce and expand this activity in other regions of the country, utilizing the Regional Drought Early Warning System. The results of these appear on www.drought.gov and other partner websites, such as www.westgov.org.

Education and Outreach Webinars with Preparedness Communities

[4] http://drought.unl.edu/AboutUs.aspx

These following NIDIS supported activities are designed to delve more deeply and comprehensively into specific aspects or impacts of a drought disaster. The audiences for these educational activities to increase awareness include the regional stakeholders, agricultural commodity groups, as well as the media, with a goal of sustaining information and processes that will reduce or mitigate impacts on an ongoing basis. The goal of this outreach is intended to build capacity outside time of crisis.

Drought preparedness advice and planning are carried out by water-dependent managers such as State Engineers, Water Availability Task Forces, farmers, agribusinesses, land managers, city councils, and others. However, the results of drought-related research, including data analyses, are not always disseminated in a timely fashion or through easily accessible or compatible modes for incorporation into risk management.

Identification and development of drought triggers and indicators requires active engagement among research, information brokers, and stakeholders in various sectors responsible for managing drought-related risks. Many of the lessons learned following drought events can be documented with post-drought assessments to ensure that these critical lessons are not lost. Post-drought assessments are a key step within the drought planning process, and NIDIS is learning from existing networks, such as Cooperative Extension, and has been engaged by the American Planning Association to help address and reduce the urban impacts of drought. One key product developed specifically in response to this need by NIDIS, the Sectoral Applications Program, and the NDMC, is a Drought-Ready Communities guidebook to improve drought planning.

California Fallow Lands Project
Despite the importance of fallowed acreage as a drought impact variable, there is no source of timely, objective information on the extent of fallowed acreage during the main growing season (April – September) to guide decision making with respect to requests for county drought disaster designations, state emergency proclamations, and water bank operations. The NIDIS California Central Valley activity is developing a fallowed land monitoring capability for the Central Valley of California, a rich agricultural region, to identify changes in farming practices during drought. Monthly county tabulations, maps, and GIS files are derived from automated processing of Landsat digital satellite imagery. Data from the Landsat satellite archive are processed for historical context. Such a capability will identify the extent of changes in fallowed acreage due to water shortage during drought. Shortage of water for irrigation and crop production is a principal impact of drought in the Central Valley, and this activity will provide a source of timely, objective information on the extent of fallowed acreage to guide decision making, such as for local water transfers, county drought disaster designations, or state emergency proclamations

Southern Climate Impacts Planning Program (SCIPP) project working with USDA's Farm Service Agency (FSA)
Through funding from NOAA's NIDIS Program, the SCIPP, which is part of the NOAA Regional Integrated Sciences and Assessments program at the University of Oklahoma,

has been assisting the Oklahoma FSA office in assessing agricultural drought impacts in Oklahoma to inform FSA programs in the state. SCIPP is also working with partners in agriculture in Texas.

NOAA's Climate Prediction Center (CPC) and USDA's Risk Management Agency (RMA) Pasture, Rangeland, Forage (PRF) Pilot Insurance Program
A collaborative effort between USDA, NOAA, and USGS results in the modification of the Pasture, Rangeland, and Forage Pilot Insurance Program, which uses two separate indices - the Rainfall Index and the Vegetation Index. These innovative pilot programs are based on vegetation greenness and rainfall indices, and are designed to give forage and livestock producers the ability to buy insurance protection for losses of forage produced for grazing or harvested for hay. The Rainfall Index uses NOAA's CPC data. Insurance payments, made under this program through the Federal Crop Insurance Corporation are calculated using NOAA CPC data for the grid(s) and index interval(s) that have been chosen to be insured. The Vegetation Index uses data from the USGS. The Pasture, Rangeland, Forage Rainfall Index and Vegetation Index pilot programs are being tested by RMA in select counties and States.

NOAA's Rio Grande/Bravo Basin (RGB) Early Warning System Project
In response to the ongoing and intensifying drought in this region, affecting a variety of economic and environmental sectors, NOAA is working with regional stakeholders to develop a drought early warning information system. The U.S. and Mexico are both engaged in a wide variety of climate and weather observational and monitoring activities in the RGB. Utilizing this bilateral coordination, NOAA and its stakeholder partners are supporting efforts to identify and prioritize mutual needs for drought related data, products, and services, including in the areas of monitoring, reporting, research, and forecasting. This emerging regional collaboration will support water resource managers, agricultural interests, and other constituents within the basin as they respond to future drought events and build capacity to respond to other climate extremes.

The intent is to link up the Rio Grande/Bravo Drought Early Warning Information System with other relevant basin activities such as the new USDA Conservation Reserve Enhancement Program (CREP) established in RGB, to help conserve irrigation water and reduce groundwater withdrawals.

Drought Monitoring Gaps Assessments and Surface Water Supply Index Development
A partnership between USDA's Natural Resources Conservation Service (NRCS), the State Colorado, and NIDIS (via the Colorado Climate Center) to revise and improve one of the key hydrologic drought indicators utilized by Colorado in managing, responding, and recovering from drought. The project is focused on increasing the spatial resolution of the Surface Water Supply Index (SWSI). The analysis increases the number of watersheds from 7 to 30 that are being actively monitored for drought conditions. The revised SWSI provides a more stable month-to-month transition and eliminate some of the erratic shifts sometimes produced by current index.

Utah and Wyoming have already adopted a SWSI similar to this revised Colorado SWSI. A transition to this technique in Colorado will improve cross-state comparisons of drought severity. This consistency would assist with the coordination of drought categories used in the USDM, which is a prime example of cross-agency collaboration.

ATTACHMENT: FIGURES

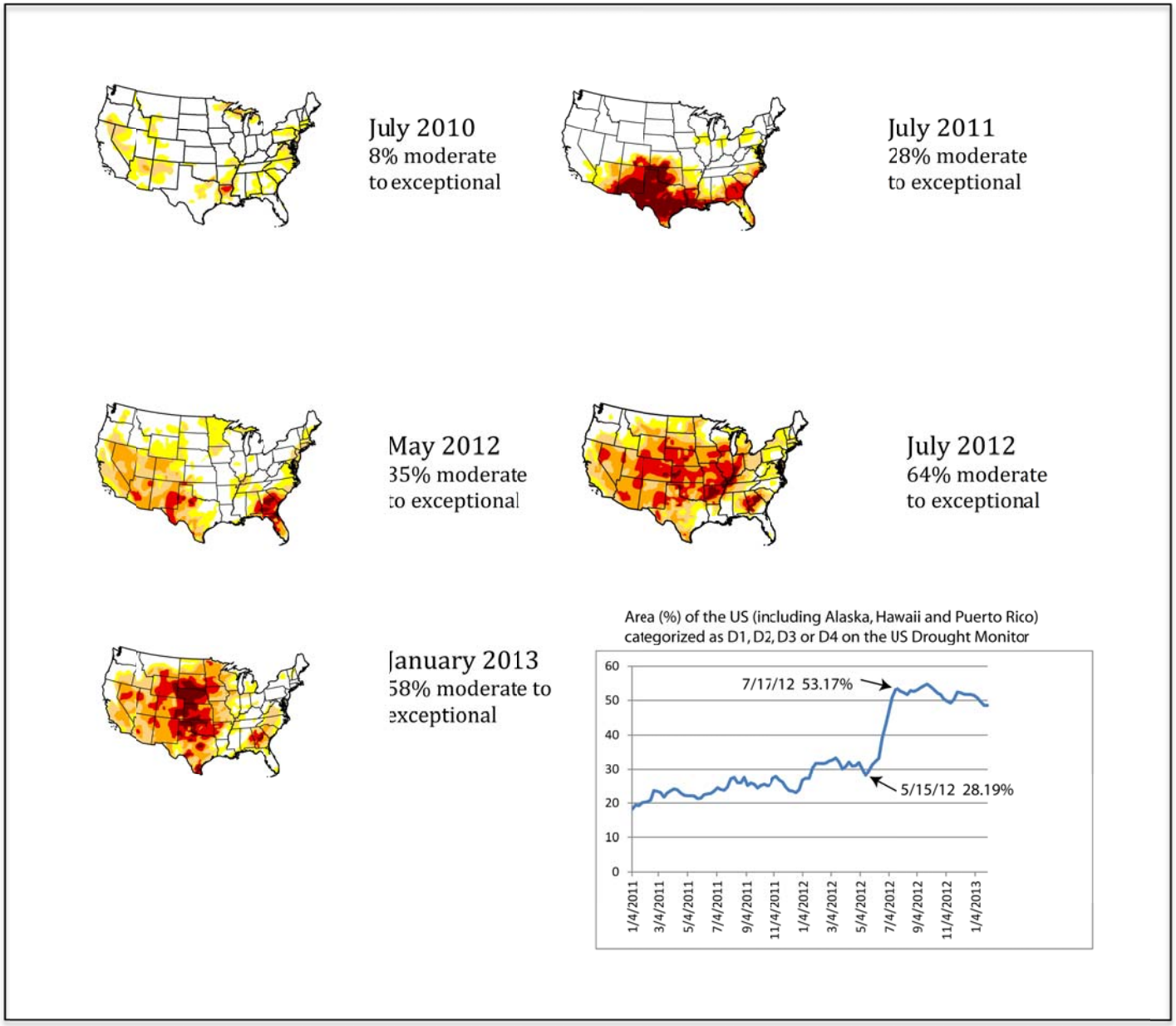

Figure 1. How did we get here? Antecedent conditions and status (Source, NIDIS and NDMC, 2013)

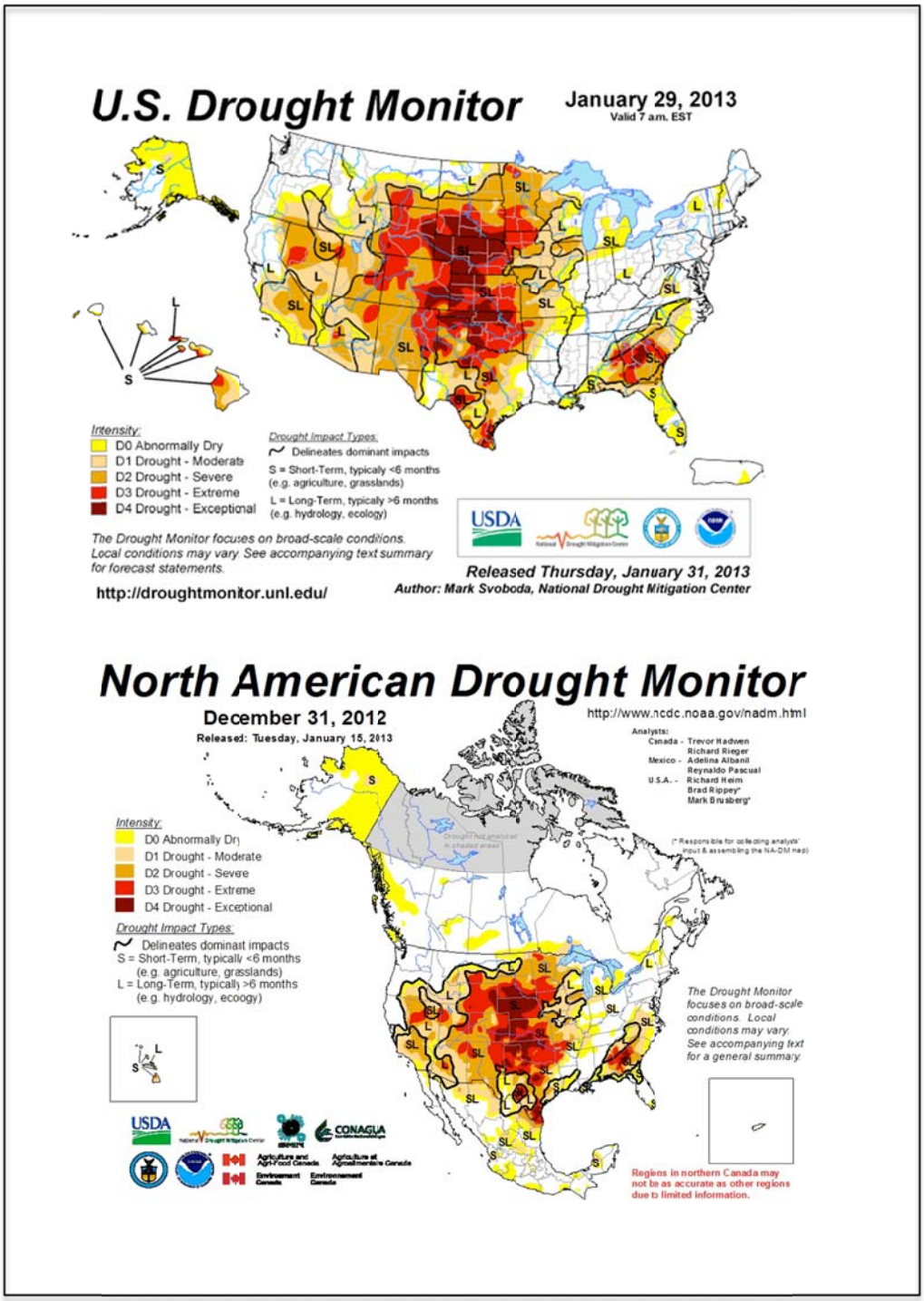

Figure 2. (a) The US Drought Monitor. January 29, 2013, and (b) The North American Drought Monitor December 31, 2012 (available from NIDIS www.drought.gov)

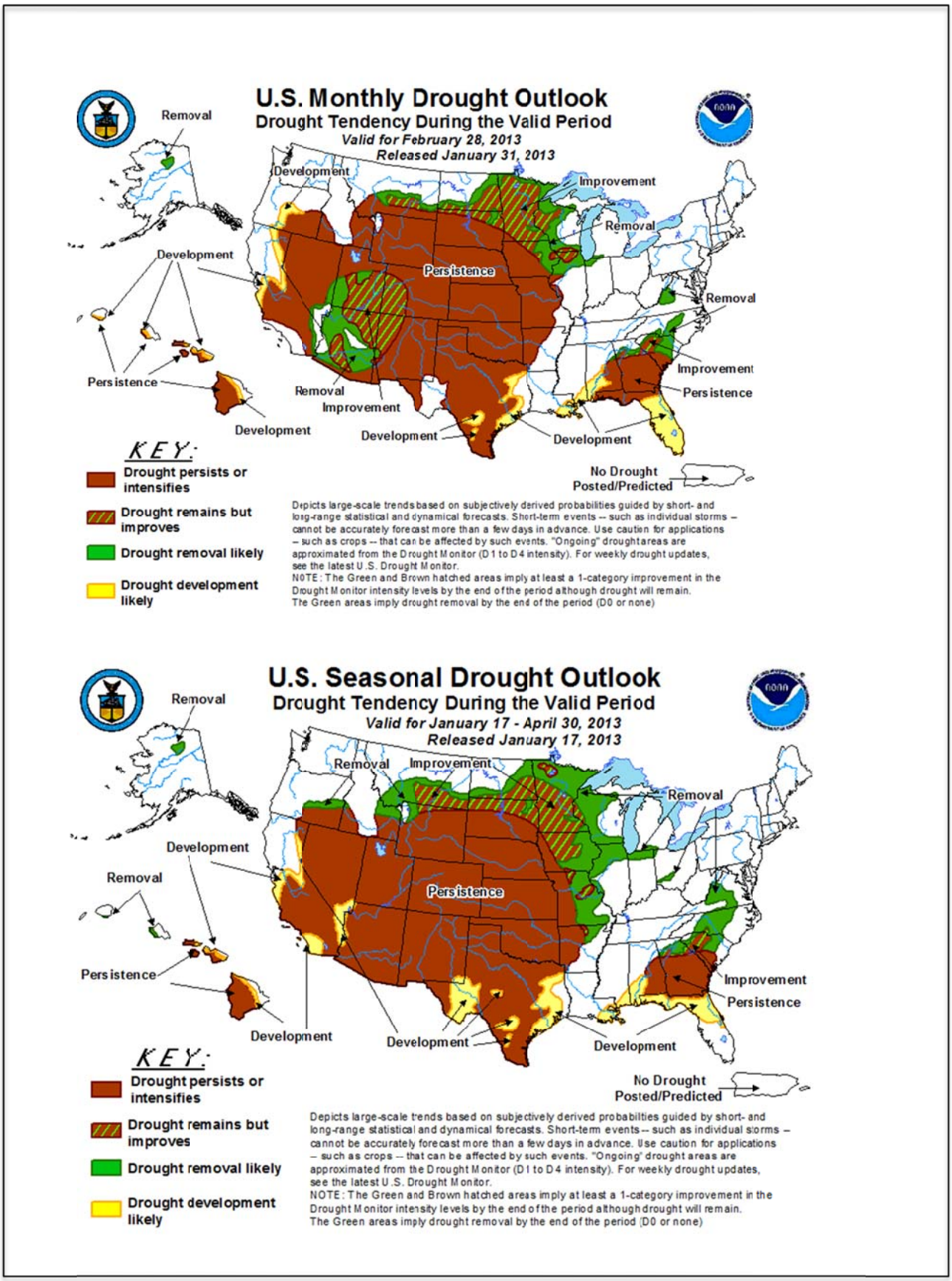

Figure 3: The Seasonal Drought Outlook (a) 1 month through February 28, 2013, and (b) three months through April 30, 2013. Source: NOAA CPC