NEW AND ENHANCED TOOLS FOR MONITORING AND ASSESSING DROUGHT

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1. INTRODUCTION

With a new National Integrated Drought Information System (NIDIS) on the horizon (WGA, 2004), the NDMC has been working to enhance and develop several tools through our partnerships with NOAA, USDA, USGS, the Regional Climate Centers, and many others.

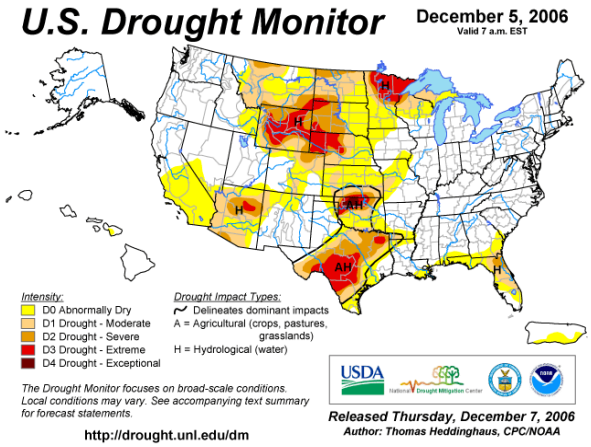
The U.S. Drought Monitor (USDM) (Svoboda et al. 2002) and North American Drought Monitor (NADM) products, introduced in 1999 and 2003, respectively, have served as the flagships in these efforts and have helped lead us to develop new and enhanced products and tools along the way. They have also served as models of success in fostering collaboration across agencies, between agencies and states and other local entities, and ultimately between countries; as we all know, drought doesn't constrain itself to geopolitical boundaries. Another critical observation is that these products and many other tools are only as good as the data going into them. To better track droughts in the future, we need better-quality data and timely access to it; we also need more resources to maintain our observing networks across all agencies, states, and countries.

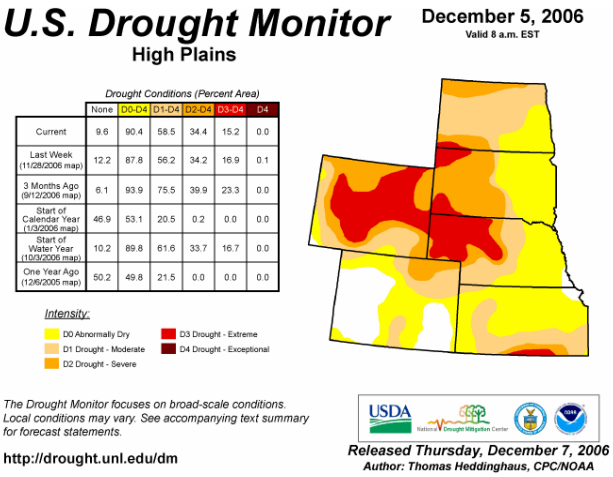
2. ASSESSMENT TOOL ADVANCES

2.1 A U.S. Drought Monitor Makeover

An enhanced USDM (http://drought.unl.edu/dm) was launched by the NDMC in September 2006. With support from USDA/Risk Management Agency, the NDMC began to develop a more responsive tool based directly on customer requests. This information was solicited via many workshops conducted by the NDMC for USDA and through input garnered at the annual Drought Monitor Forums held in the United States, Canada and Mexico over the past several years.

Having seen only minor cosmetic changes since its inception in 1999, the enhanced USDM (Figure 1) has several new features worth noting, along with more to come. Of note: 1) the user can now click on the weekly map to zoom into a region. Once at the regional view, they can then click on a state if they choose; 2) County lines are provided at the state level views in direct response to user needs for both better referencing where they are in relation to the drought and for use in several USDA programs, which have used the USDM to determine drought program eligibility at the county level. Instead of guessing, the public can now see what the decision makers see without having to know or use a GIS. All views are set up for easy printing; 3) weekly statistics of the % area in each USDM category (D0-D4) for the current period are available for the USDM and for each region and state back to 2004 for comparison purposes.





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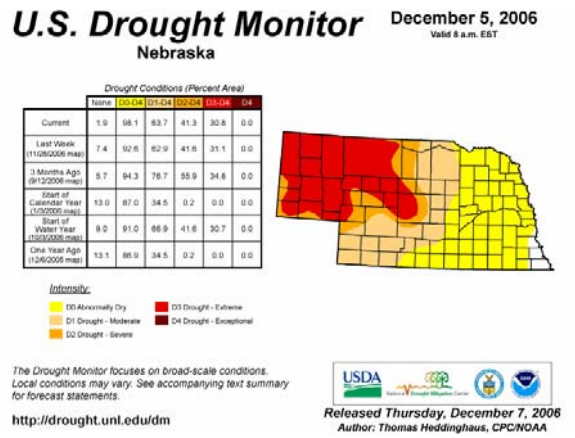

Figure 1. The USDM at national, regional, and state views, including sample statistical tables.

These changes are the first wave in a series of enhancements scheduled for the tool over the next year or two. The aim is to provide a robust and interactive USDM/Decision Support System (DSS) that can serve as a major portlet that will be fed into the NIDIS Portal, which is scheduled to launch in early 2007. Features to be built and integrated into the USDM include: spatial overlays, sub-state views, drought impact information, site specific drought atlas (climatologies) information, statistics, trends, and even an alerting feature for those who want to sign up.

2.2 Drought Impact Reporter and Economic Impact Methodologies

After releasing the Drought Impact Reporter (DIR) (http://droughtreporter.unl.edu) in July of 2005, the NDMC was already thinking about how to make the DIR better. Through feedback from colleagues and users, we have set about adding more features while maintaining the DIR's simple ease of use. The goal is to build on this model, which is the only national drought impact database of its kind. More impact category designations, declarations and intuitive impact entry options for users is the goal for a DIR version 2 release set for summer of 2007.

In addition, work is underway to develop better methodologies for cities, states, and countries to estimate drought losses. This problem is not just confined to the past; many governments do not even attempt to estimate the impacts of drought, which typically are among the most costly of all natural hazard losses.

The goal is to work with states and others in developing a consistent methodology or reporting interface and then archiving this in our national impacts database housed at the NDMC.

2.3 Drought Atlas

The goal of the Drought Atlas is to provide usable tools and products for users at all levels by giving them the ability to visualize and assess their exposure to drought. The first National Electronic Drought Atlas (NEDA) (Werick et al. 1994) was compiled by the Army Corps of Engineers back in 1994 (http://www.iwr.usace.army.mil/iwr/atlas/Atlasintro.htm).

The NDMC has started the process of creating an updated drought atlas that will include up-to-date current and much more historical data, more stations in the analyses, and more visual products. With a backbone based on the NOAA/Regional Climate Centers' Applied Climate Information System (ACIS), this station level analysis will complement the USDM and provide current drought analysis plus history and frequency analyses for thousands of stations across the country. An updated hydrology component using the latest streamflow data will also be included. This "living" atlas will be housed on the NDMC's website (http://drought.unl.edu) and be updated frequently. In addition, a CD-based version (with less frequent updates and distribution) will be available and distributed for those without Internet access.

2.4 Gridded SPI and PDSI User Mapping Interface

A joint project between the NDMC and the High Plains Regional Climate Center (HPRCC) led to the September 2006 launch of a new mapping tool for the Standardized Precipitation Index (SPI). Plans for the inclusion of the PDSI will follow in late 2006 or early 2007. This tool (http://drought.unl.edu/monitor/spi-dailygridded.html) has brought about improvement in both the spatial resolution and temporal availability of objective indicators (drought indices) for assessing conditions at the local level. The analysis is based on the Applied Climate Information System (ACIS) climate database housed at the HPRCC and other regional climate centers. The interface allows the user to choose a time frame and thousands of stations with SPI/PDSI drought index values computed and fit to an approximate 40km^2 grid (sub-county) over the entire United States. The station data and subsequent index calculations and suite of maps are updated every day. Plans are underway to generate and archive these maps. Previous efforts were generally limited to monthly station or climate division calculations.

2.5 VegDRI and VegOUT

The VegDRI and VegOUT tools produce maps at a fine resolution (1km^2) that present the spatial patterns and relative severity of drought-induced vegetation stress over large areas. The current model, and semi-operational maps, covered 7 states in the northern Plains in 2006 and will expand operationally to 15 states (Great Plains and Midwest) in 2007, with plans for expansion over the entire country by 2008-09. The model is based on a data mining method that incorporates more than just a standard Normalized Difference Vegetation Index (NDVI) in that other bio-physical input parameters are included (precipitation, water holding capacity, irrigation, land cover/use, start of season and Percent Average Seasonal Greenness) to determine when stress is likely due to drought vs. flooding, hail, pest infestation, and other causes. Future plans call for state views, change maps, trend graphics and statistics.

The VegOUT product will incorporate precipitation scenarios that depict the potential VegDRI levels in the coming 2-, 4- or 6-week periods. Mid-range forecasts and the VegDRI will be utilized for verification, and future plans hope to determine the relationship between vegetation (range, crops, and forests) and lag/response to longer-term climate teleconnections with episodic events such as ENSO and other oceanic oscillations.

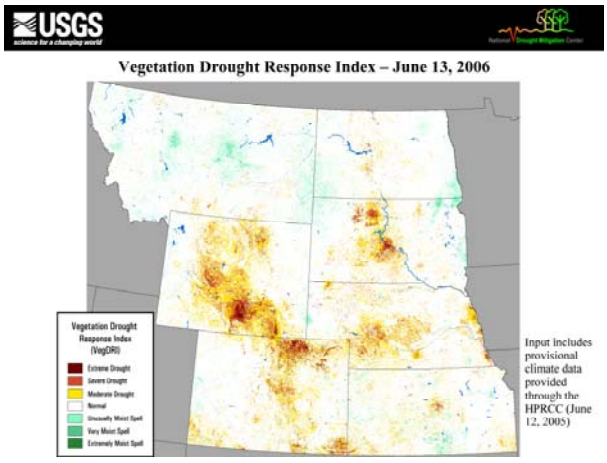

Figure 2. The VegDRI for June 13, 2006

2.6 Other Tools

As an attempt to fill the void in providing a national comprehensive water resources outlet, the USGS, USDA/NRCS, NOAA/NWS, and NDMC collaborated to set up a web portal called the Water Monitor (http://watermonitor.gov). Hosted by USGS, this site plays an important role by allowing people to access critical water supply information from many federal agencies.

The Regional Climate Centers (as a part of NOAA and the National Climatic Data Center) maintain a valuable interface to the data behind the Applied Climate Information System (ACIS). The data from this database is housed between all six of the centers and is the direct conduit to daily data updates for thousands of stations around the country. Derivative maps are posted daily at: http://www.hprcc.unl.edu/products/current.html. In addition, data from ACIS is used to drive the NWS's web-based **N**OAA **O**n-line **W**eather **Data** (NOWData) at the field office level, which allows their customers to tap into this powerful database containing the most up-to-date climate data from many networks, including the NWS's Cooperative Observer Program (COOP). Finally, AgACIS is expected to come on-line soon with exciting new deliverables added to the mix in the way of snow and soil moisture data made available by USDA/NRCS from the SNOTEL and SCAN networks. These networks begin to address the critical gaps we have for higher elevation climate and sub-surface moisture data across the United States.

This year, the National Weather Service (NWS) launched a nationwide hybrid precipitation analysis tool (http://www.srh.noaa.gov/rfcshare/precip_analysis_new.php), led by the NWS River Forecast Centers. The aim of this experimental tool is to provide daily updates and archives of radar data that is combined with observed gauge data on-the-fly at a 4 km^2 resolution for the entire country. The user can choose various regions and time frames to analyze.

3. SUMMARY AND CHALLENGES

With the Internet and timely delivery of real-time data and products, an integrated drought monitoring system is now a real possibility. However, many challenges still exist:

1) Customer needs versus scientific comfort. The users continue to call for higher resolution analysis down to the county (or sub-county) level. Can we ensure that "no county will be left behind?" Can new tools and methods "fill in the gaps" that exist in our observing networks in order to give us objective data to base our analysis on?
2) Can everyone share ownership in such a collaborative process? This will be essential if NIDIS is to succeed.

3) Perhaps even more critical than network expansion is the fundamental need to support and maintain our existing networks across all agencies and states. These networks are essential in providing the data needed for both operational and historical analyses.
4) Can we transfer any of these tools and methodologies into the international North American Drought Monitor realm? Cooperation and coordination become even more critical in building on the success this project has enjoyed thus far.
5) We need to take more of our objective indicators and derivative products down to a finer resolution by incorporating more station-based analysis in new tools. How can we take the "potential" found in radar hybrids, remote sensing, gridded indicators, and interpolations and "apply" them?
6) The tools, data, products, message, etc. must be easy to understand and/or derive for all decision makers and users. The design of future portals and other deliverables must keep this essential objective in mind.

You can find out more about these tools and all of our activities by visiting the NDMC website at: http://drought.unl.edu.

4. REFERENCES

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