In 2012, Midwestern Heat and Drought were a BIG story.

Aug 7, 2012
By spring 2013, the drought story shifted onto the Plains.

**U.S. Drought In 2013 Hurts Cattle Ranchers With Dry, Poor Wheat Crop**

* Wheat pastures wither as drought persists
* Cattle moved to feedyards sooner than expected
* Record high cattle, beef prices seen this year

By Theopolis Waters

CHICAGO, Jan 14 (Reuters) - Oklahoma rancher Kent Donica has given up. The drought that has the region has won.

Since last September, Donica has sold nearly all of his 800 cattle because there is no pasture to nearby to make ends meet until it rains again.

Last autumn he had hoped his winter wheat crop would feed his cattle and keep his ranching business alive. But the worst dry spell in half a century stopped the wheat crop from sprouting properly, depriving cattle of a valuable feed source.

In 2013, Drought Is Worsening In Midwest and Plains States, Despite U.S. Winter Weather

* Light showers not enough to ease drought
* U.S. hard red winter wheat in Plains at risk
* Corn, soybean crops grown in the west also at risk

By Sam Nelson

CHICAGO, Jan 28 (Reuters) - Dry weather continues to plague the drought-stricken U.S. Plains and western Midwest with only light showers and snowfall expected this week, an agricultural meteorologist said on Monday.

"The Plains and the northwest Midwest will still struggle with drought, there's not a whole lot of relief seen," said John Dee, meteorologist for Global Weather Monitoring.

Dee said there would be some light rain in the eastern portions of Kansas, Oklahoma and Texas late Monday and Tuesday, with heavier rainfall seen for the eastern and southeastern Midwest late Tuesday and Wednesday.
In early 2014, drought-impact stories emanated from the West.

The monthly snow survey, anticipated snowmelt to supplement water supplies, despite a few good dumps the state eased water managers' worries.
This talk will concentrate on how the U.S. Drought Monitor is created, including the weekly process, methods, and tools used by the authors to come up with the final drought depiction that has seen increased exposure over the last several years.

A drought update will follow this presentation…

U.S. Drought Monitor

February 18, 2014
(Released Thursday, Feb. 20, 2014)
Valid 7 a.m. EST

Drought Impact Types:
~ Delineates dominant impacts
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
David Miskus
NOAA/NWS/NCEP/CPC

http://droughtmonitor.unl.edu/
History of the USDM
The US Drought Monitor didn’t always look like this...
1999 - The very first U.S. Drought Monitor!!
It was experimental, and developed partially in response to intensifying dryness in the eastern U.S. and across portions of the West. The map was created in CorelDRAW (basic drawing software).
Summer, 1999 - Authors refined the map areas and tweaked the colors, altho it is readily apparent there weren’t any Arts Majors on the team!
Aug 11, 1999 - The revised map was presented to senior-level government officials at a White House Briefing. They liked it so much...
...the following week, it went operational, making this the first “official” U.S. Drought Monitor! This might have be the fastest Experimental to Operational product in government history!
By September, 1999, the format began to resemble the map we see today, although it remained clear that artistic flair was lacking (Note drought scale!)
The color issue was finally resolved in mid-September, 1999; The USDM still had a “Watch” and Forecast component.
December, 2000 – Forecast Component is dropped, D0 goes from “Watch” to “Abnormally Dry” (going into and coming out of drought) & authors put their names on the map.
The Fire ("F") Impact type was dropped in early 2003 b/c fire is not really a good drought indicator; too many other factors that have nothing to do with drought can lead to wildfires.
August, 2003 - authors make a transparent switch from CorelDRAW to GIS (Geographic Information System) to create the map. There was a steep learning curve, but made the USDM a leader on the GIS front and would pay big dividends down the road.
I joined the USDM team in August, 2008.
2008-2011 - Several authors, including yours truly, began incorporating GIS weather and hydrological data directly into the map-editing process; consequently, accuracy and detail increase over the next several years – no more “eyeballing” it!
Not even the famed D.C Earthquake could stop the USDM, which happened to hit on a Tuesday as I was saving Draft 2. Laura (co-author) was not actually my backup; my backup was evacuated with me in D.C.
September, 2011 - authors changed the Drought Impact Types from “A” (Agricultural) and “H” (Hydrological) to “S” (Short-Term) and “L” (Long-Term), removing ambiguity and confusion that was repeatedly reported.
Early 2013 - the National Drought Mitigation Center took over the final map production so the map is 100% consistent week to week in projection, size, and colors. (USDM authors still modify drought areas)
Late 2013 - the NDMC changed the final map layout to make sure the non-CONUS areas are clearly depicted as being as such, and are on their own scale.
<table>
<thead>
<tr>
<th>Drought Category</th>
<th>Color</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4, Exceptional Drought</td>
<td>🟠布拉</td>
<td>once per 50 to 100 years</td>
</tr>
<tr>
<td>D3, Extreme Drought</td>
<td>🔴</td>
<td>once per 20 to 50 years</td>
</tr>
<tr>
<td>D2, Severe Drought</td>
<td>🟢</td>
<td>once per 10 to 20 years</td>
</tr>
<tr>
<td>D1, Moderate Drought</td>
<td>🟡</td>
<td>once per 5 to 10 years</td>
</tr>
<tr>
<td>D0, Abnormally Dry</td>
<td>🟠</td>
<td>once per 3 to 5 years</td>
</tr>
</tbody>
</table>

The drought categories are associated with historical occurrence/likelihood (percentile ranking).

It is not anecdotal or subjective, like “It’s really, really dry!!” or “I don’t remember it ever being this dry... we have to be D4!!!”
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Possible Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0</td>
<td>Abnormally Dry</td>
<td>Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered</td>
</tr>
<tr>
<td>D1</td>
<td>Moderate Drought</td>
<td>Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested</td>
</tr>
<tr>
<td>D2</td>
<td>Severe Drought</td>
<td>Crop or pasture losses likely; water shortages common; water restrictions imposed</td>
</tr>
<tr>
<td>D3</td>
<td>Extreme Drought</td>
<td>Major crop/pasture losses; widespread water shortages or restrictions</td>
</tr>
<tr>
<td>D4</td>
<td>Exceptional Drought</td>
<td>Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies</td>
</tr>
</tbody>
</table>
Schedule & Process
Requirement: Authors **must** work at a regional or national “center”, government or academia/research. There are currently 11 authors, and all are **volunteers**.
The authors take 2-week turns, although cases arise where they do a 3-week shift. The reason: After two weeks, you are spent.

Each author typically has two 2-week shifts per year.
The authors take 2-week turns, although cases arise where they do a 3-week shift. The reason: After two weeks, you are spent. Each author typically has two 2-week shifts per year.
The ongoing joke for the authors:

*You can count on death, taxes, and never getting out of your USDM shift.*

You can put it off, but you will do your time!

Our scheduler, Dave Miskus at NWS-CPC, makes sure of it!!
The two-week shift is broken down into two separate weekly cycles, with deadlines set in stone, except for Thanksgiving and any potential major holiday which happens to fall on the official release day.
The first and most important thing for the USDM community is to know the data “period”; the data cutoff – i.e. rain has to have fallen by this time to be included in that week’s analysis – is:

7 am EST (8 am EDT) *Tuesday morning.*

This is done to (a) provide a consistent, week-to-week product and (b) provide the author a 24-hour window to assess the data and come up with a final map by Weds evening.
A first draft is emailed to the USDM contributors, aka "Listserv", usually by COB Monday. This map is a work in progress, and provides the impetus for that week’s discussion.
Tuesday is very busy, with dozens (hundreds?) of emails, several conference calls, and sometimes individual phone calls. I usually send out Draft 2 after getting all of the info, altho it remains a work in progress.
By Noon, EST Weds, we send out a near-final draft, and we close the door on changes to the map ~ 2 pm, EST. Sometimes late, key input will make the cut... and before we finalize, we send out any updates in subsequent drafts, but 2 pm is our “it’ll have to wait until next week” deadline.
A final map is sent out ~3-4 pm to make sure there are no errors or other egregious mistakes. The author then composes a national narrative, broken down by regions, highlighting the past week’s weather and USDM changes.
By 5 pm EST on Weds, all the files are compressed and sent to the Drought Mitigation Center, who then confirms receipt before the author is free to go.
On Thursday, at 8:30 am, ET, the official USDM Map and Narrative are released on the NDMC website.
The cycle repeats the following week (week 2 is usually easier). Keep in mind the author’s primary job responsibilities do not get put on hold.

The diagram shows the workflow with:
- Draft 1 due by 7 am on the 7th of April
- Draft 2 due by 2 pm on the 21st of April
- Draft 3 due by 8:30 am on the 28th of April

The final map and files are sent on the 4th and 5th of April, respectively.

The url for the drought monitor is: http://droughtmonitor.unl.edu/
So how exactly is the USDM edited/created every week?

http://droughtmonitor.unl.edu/
So how exactly is the USDM edited/created every week?

7 am
Draft 1

Data cutoff

Draft 2

2 pm
Input cutoff

Draft 3

8:30 am
Final Map

Final Files

Sent

The drought monitor is created/edited in GIS software (ArcMap); GIS stands for Geographic Information System.
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In short, data in GIS has an embedded geographic reference, which means the files can be shared from user to user, and they will display in exactly the same place, size, and shape. Consequently, any changes made to the drought data – also known as shapefiles – can be transferred to the next author or other parties seamlessly.
The drought areas, or drought shapefiles, are actually 5 separate drought files which are overlaid on top of each other to give the illusion of one “drought map”; We are actually editing 5 different drought files.

As authors, we need to be VERY careful when hitting DELETE; There is NO UNDO DELETE option in GIS if you hit [SAVE]!!!
One big advantage of editing the drought areas in GIS is there is a wealth of weather and hydrological data also available in GIS format; we can bring the data directly into the “Drought Monitor” to assist with the final drought depiction. More on this later.
The Importance of Local Expert Input

- The U.S. Drought Monitor Team Relies on Field Observation Feedback from the Local Experts for Impacts Information & “Ground Truth”
  
  - Listserver (~350 Participants: 2/3 Federal, 1/3 State/Univ.)

- Local NWS & USDA/NRCS Offices

- State Climate Offices

- State Drought Task Forces

- Regional Climate Centers

The primary means of communication with our “eyes in the field” is thru email; The email “Group” is called the **USDM Listserver**
All states now have at least 1 “official” participant except Rhode Island.

Total: 345 (does not include 1 participant from Canada)
While we are doing much of our drought work using GIS software, our main method of correspondence is through email – the “_listserv”. The email traffic can get overwhelming at times.
The "hole" of D2 between MCN and ATL likely needs to start being filled in some. Was wondering if the D3 over Macon could be nudged northward to cover Monroe County.

Perhaps some increase in the amount of D3 for Mitchell County is in order? Similarly, can the D3/D2/D1 be pushed southward some in Grady County in southwest GA? Arguably, you can extend the D1 eastward near TLH in north FL to cover northern Leon County which would assist you here. Other than that, consider GA a "wrap" for the week.

Based on our Texas coordination call this morning, recommendations are below. We're being especially sensitive to short-term drought in the winter wheat areas of the state. We project that October-November will rank somewhere between 2nd and 4th driest on record for Texas.

I'm a little concerned that the eastern sections of the Appomattox Basin in Virginia have slipped out of D1. Precip departures, especially over 90 days, are not horrible, but there is still a deficit. And with streamflows running quite low, groundwater running low, and a drought watch in effect, I think that the D1 should be expanded eastward to include all of Buckingham, all of Campbell, Cumberland, southwest Powhatan, and Amelia Counties.

South Florida - Here there are differing opinions on whether or not to introduce D0 to Collier and Monroe counties. While these areas, especially coastal Collier County, have been dry in the short term, the wet season was very good and hydrologic systems are in good shape.

These actual email snippets are a very small sample of the type of detailed information and suggestions we receive. County lists are actually preferred, altho we recv everything from highways to mountain ranges to river basins. In GIS, it’s all very doable
Some folks provide us with a detailed graphic depiction of what they would like to see done.
The Colorado group sends out a full presentation to back up their suggestions after their Conf Call.

Drought and Water Discussion

Fig. 9: March 13th release of U.S. Drought Monitor for the UCRB.

On the current depiction of the U.S. Drought Monitor (USDM) map (Fig. 9), the USDM author has decreased the area of D2 in the Wasatch range in the UCRB based on recent precipitation. In the northern CO mountains (Grand County), it is recommended that the D1 be adjusted slightly and expanded eastward along the Continental Divide (Fig. 9, solid black line). This will set up a very sharp gradient at and west of the Divide, which is representative of conditions in that area and will match better with SNOTEL precipitation percentiles.

In northeast CO, a further expansion of D0 is recommended (Fig. 9, dashed black line). In the past 30 days, this area has experienced little to no precipitation, much warmer than average temperatures, low relative humidities, high winds, and wildfire dangers. 30-day SPIs are very low, VIC soil moisture shows drying, and D0 will better represent that short-term dryness being experienced there.

Status quo is recommended for the rest of CO and the rest of the UCRB.
Some are more to the point!

make D1
Ultimately, authors make the final call, as our name is on the map; we often get questions/press interviews once the map is released.

Need to be able to support our depiction with data or impacts.

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http://droughtmonitor.unl.edu/

Author: Eric Luebehusen, U.S. Department of Agriculture
Tools, Data, & Methodology
The USDM tries to capture both Short-Term (6 months or less) and Long-Term Drought on a single map, concentrating on IMPACTS. This is the most daunting task facing the authors. To assist, we have a myriad of products and data at our disposal....
Authors use a gridded precipitation dataset called “AHPS” – Advanced Hydrological Prediction Service – which supplies total precipitation, precipitation departure, and percent of normal at numerous timescales.

Data - [http://water.weather.gov/precip/](http://water.weather.gov/precip/)
To assess potential short-term “improvement”, we look at 7-day precipitation data; note drought area outlines. Even though we’re working on the map thru Weds, we stop data “valid date” at Tuesday.
We rely on this high-resolution gridded precipitation data at many timescales; here, the last 3 months’ of precipitation expressed as a percent of normal is depicted. Short-term dryness is most pronounced on the southern Plains and in the West.
As we change the timescale (now the past 6 months), differences start to arise in areas that are wet vs areas that are “dry”, especially in the nation’s mid-section. For an illustration, let’s take a closer look at the Midwest...
In the **central Corn Belt**, mostly a “Long-Term” (L) component to the drought exists, while in the **western Corn Belt**, mostly a “Short-Term” (S) component to the drought exists.
We cross-check the gridded data (which uses radar) with station data. Station data are often superior in areas where terrain interferes with radar beams, or where/when snow is the dominant precip type.
The USGS also “ranks” the current streamflows to give a historical perspective (a percentile). A percentile value of “1” indicates the lowest flow on record, while a value of “100” indicates the highest streamflow on record.
While we don’t have a soil moisture sensor network, we do have modeled soil moisture to aid the authors. This model (NLDAS) is supplied by the National Weather Service in GIS format.
This is a good time to step back and point out that the U.S. is not a homogeneous climate; Regionally variant wet and dry seasons need to be factored in when doing the USDM.
The Mid-Atlantic is one of the few areas in the country that has a consistent year-long wet signal, which makes it difficult for the region to stay in drought for a prolonged period.
This signal extends down the East Coast into southern Georgia, at which point a sharp transition occurs...
Southern Florida sees a summer-time tropical climate, while dry winters and springs do not carry the same weight in the USDM since that is their “dry season”.

Southern Florida Cumulative Precipitation (mm)

- Fall
- Winter
- Spring
- Summer

Graph showing cumulative precipitation with years 2014, 2013, and average lines.
In the Corn Belt, the dry winter signal is present, but not as pronounced.
Not far away, a climatological bone-dry winter signal is evident... so a lack of moisture in the winter has minimal impact, while a dry summer will easily carry over into the following year.
Conversely, the valleys of the Pacific Northwest rely heavily on winter-spring rain and snow.
Even more pronounced is the dependence of western water supply on the “Water Year” – October thru April – to make it through the hot, dry, and high-water demand periods of the summer and early fall.
The western Water Year (October-April), especially the latter half, is the period where most drought assessment and change occur from the Rockies to the Pacific Coast.
The USDA’s Natural Resources Conservation Service (NRCS) operates hundreds of SNOWpack TELEmetry (SNOTEL) sites to help water managers, officials, and the general public gauge the water-supply prospects for the upcoming spring and summer.
USDM authors can plot the data in GIS to aid with the drought depiction. This map shows the snow-water equivalent (SWE), as a percentile ranking, of the western snowpack. Prospects are bleak.
USDM authors can plot current water-year station precipitation data in GIS (here, percent-of-normal precipitation since October 1 is plotted).
We also incorporate remote-sensing data to look for impacts; the 4 km Vegetation Health Index (VHI) highlighted the abysmal wheat and pasture conditions across the srn High Plains and lower Four Corners in June, 2013.
With more input from local experts and higher-resolution datasets, the level of detail in drought depiction has increased considerably over the past 7 years.
In conclusion, the end user sees this map. What goes on behind the scenes is far more involved... and entails cooperation from hundreds of local, regional, and nation experts, as well as a myriad of data types and sources. All this work is done by volunteers; there is no Drought Monitor budget.
Now that you had a glimpse at how we create the U.S. Drought Monitor, it’s time to turn the page and look at the **Current Drought** situation and the **Weather Outlook**.