

OKLAHOMA DROUGHT PLAN ADVISORY MEETING:

Summary Report

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1. Introduction

Drought is a prevalent characteristic of Oklahoma's climate, having impacted the environment, society, and economy repeatedly throughout history. One such event occurred between October 1995 through May 1996, which was the century's driest October through May period on record at the time (Sandbo *et al.*, 2008). Impacts rippled throughout the state—wheat production was the lowest it had been in the previous 25 years, many producers claimed bankruptcy, and there was an estimated \$1 billion in losses (Sandbo *et al.*, 2008; Khand *et al.*, 2018). In order to minimize potential impacts and adequately respond to similar drought events in the future, state emergency officials and water resource planners recommended the development of a state drought plan to Governor Keating (DMT, 1997). Executive Order 96-24 was ultimately issued, which created the State Drought Task Force and resulted in the 1997 Oklahoma Drought Management Plan. The 45-page document focused on response and highlighted the tasks and responsibilities of the Oklahoma Drought Management Team (DMT), the sequence of response actions, drought indices, and the capabilities and responsibilities of related agencies.

On June 6, 2018 the Oklahoma Climatological Survey hosted an Oklahoma Drought Plan Advisory Meeting to discuss updating the plan that was made more than 20 years prior. The meeting was held at the National Weather Center in Norman, Oklahoma and was attended by various collaborating agencies (local, state, and federal), across all sectors (*view Appendix C*). The meeting was an opportunity to bring people together, spur momentum, build relationships, and determine the best approach to updating the plan. The one-day event centered around discussion of the 1997 plan, drought monitoring, communication, response, collaboration, and suggestions for an updated plan that would reflect current practices. The meeting was a significant step toward updating the original State Drought Management Plan. This report provides a summary of the meeting details, discussion outcomes, key takeaways, and next steps.

2. Discussion Questions and Meeting Format

The Oklahoma Drought Plan Advisory Meeting provided a day full of open dialogue, steered by an outline of specific questions; relationship building; and strategizing. The meeting commenced with introductions and a broad overview of the 1997 plan by the State Climatologist and Assistant State Climatologist before moving into the breakout sessions, which comprised the majority of the meeting. At the beginning of each session, the participants were separated into roundtable groups of roughly eight people. Facilitators, appointed to each group ahead of time, lead discussion based on the outlined questions (*see Appendix B*); however, conversations had the flexibility to form organically and stray from the outline. At the end of each breakout session, a moderator opened the floor to all participants, expanded the conversation, and had each group

share their discussion outcomes with the rest of the attendees. Near the close of the meeting, a final session was dedicated to discussing additional comments, ideas, concerns, and next steps for drafting an updated plan. Throughout the day, thorough notes were taken by dedicated note-takers, which were summarized for this report.

It is worth noting the reasoning and aim behind the predetermined session questions. The breakout session questions were delineated into two main focus areas: 1) Monitoring, and 2) Communication, Response, and Collaboration. The two breakout topics were selected to cover the most critical components that would be included in the updated plan, as well as the components that have changed the most significantly since 1997. With the passing of more than 20 years since the original plan, many drought monitoring techniques, data, and tools have advanced. Communication practices have also changed, especially with the creation of social media and new technologies. In addition, by addressing response and collaboration, we garnered a better understanding of agency operations, capabilities, and relationships, which would help define response actions. The questions and subsequent discussion produced relevant and vital information that could be used in an updated drought plan.

3. Morning Breakout Discussion: *Monitoring*

a. Tool Evaluation for Monitoring Drought

Among the various agencies represented at the drought plan advisory meeting, each had specific tools and data sets they used that were relevant to their sector, with many agencies also sharing common resources. The various drought monitoring tools mentioned included the United States Drought Monitor map; the Climate Prediction Center's drought outlooks; the Oklahoma Climate Survey and Oklahoma Mesonet's data observations and data summaries; the United States Army Corps of Engineers' water control data system; the United States Geological Survey's surface water and groundwater data; and NASA's GRACE tool, which provides satellite imagery, remote sensing, and developing data sources.

Overarching data sets found to be crucial across the board were soil moisture, rainfall, water quality and quantity, and sector-specific impacts. Other important indicators more unique to certain sectors included well data and paleoclimate data for the water sector; dead versus living vegetation classifications, the Keetch-Byram Drought Index, and fire severity for the forestry sector; and the National Weather Service and Storm Prediction Center's outlooks and Quantitative Precipitation Forecast graphics for the operations and emergency management sectors.

The reoccurring themes revealed throughout this question were 1) The significance of on-the-ground truths for impact assessment, 2) The significance of communication among field-staff, stakeholders, and other agencies for information on conditions and impacts, and 3) The US Drought Monitor is a good starting point for painting a broad picture; however, most monitoring comes directly from data sources, communication, impact assessment, and in-house data portals/products (e.g. OWRB Drought Portal and bulletin, USGS Water and Groundwater Watch, and Bureau of Reclamation drought monitoring index).

b. Performance of Tools

Conversation predominantly revolved around performance of the US Drought Monitor, its limitations, and data needs.

The Drought Monitor sufficiently provides a broad picture of drought conditions; however, it comes with a number of limitations. Some of these limitations listed were that the Drought Monitor is very agriculture focused, there is a lag effect related to water resources in which it is slow to respond, there is a lag between impacts and drought designation, drought is defined differently among sectors, and it blends impacts and indices, which hides details.

Speaking generally about drought tools, some weaknesses include knowing when areas are coming out of drought; only capturing certain sector impacts depending on whether the tools look at short- or long-term drought; misinterpretation of data by users; not addressing different geographic regions, which is vital for planning; and that most tools haven't been utilized for response actions.

These latter weaknesses and challenges exposed some needs, which were comprised of economic assessment of impacts and potential response actions that can be used to advocate for funding; continued partnerships with the media using these tools; educational outreach on data sets and products; seasonal models; and impact/management specific tools.

c. Adjustments to Monitoring Techniques

Since the 1997 plan was developed, there have been many technological improvements and advancements in prediction, monitoring, forecasting, drought tool development, and computing. All of these advancements have made drought monitoring easier, but there are still additional steps taken by agencies to verify information, keep information up to date, and to help with decision-making and planning. A common practice is the comparison of current drought events to previous drought events in order to gauge potential progression of drought, severity of drought, and to help with the planning and management of water resources. In addition, communication, input, and visuals provided by locals continue to be crucial in identifying areas that are improving or degrading and how different sectors are being impacted.

d. Desired Tools and Data

The predominant needs highlighted during discussion boiled down to 1) Predictive tools, 2) Sector-specific impact tools, and 3) Education and communication. More specifically, there is a need for improved forecasting in the medium range (~3-6 months out) and tools that can predict severity and the end of drought. This would provide advanced notice of worsening conditions and allow for more timely response and engagement with other agencies and government officials.

With regard to improving education and communication, it would be beneficial to educate individuals and agencies on the various drought resources, drought tools, conditions, and interpretation of products and product limitations. Additional focus should be placed on improving communication and exchange of information with the public, congressional offices, and media partners, as well as improved translation and dissemination of information for planning and decision-making.

Other desired products include flash drought tools, economic/cost-benefit impact analysis, population vulnerability analysis, and a drought portal or single resource for accessing tools.

4. Afternoon Breakout Discussion: Communication, Response, and Collaboration

a. Sources for Drought Information

Many comments reiterated what was discussed during the morning session; however, this topic question expanded on sources of drought information outside of data products. Key sources mentioned were 1) Information provided by, and collaboration with, other agencies, 2) Communication with individuals/agencies on the ground that can report impacts, and 3) Social media, or a combination thereof.

The primary agencies upon which people rely for information are the National Weather Service, Climate Prediction Center, Oklahoma Climatological Survey/Mesonet, and the US Army Corps of Engineers. The Oklahoma Water Resources Board is an additional resource that publishes an OWRB drought monitoring bulletin and houses the Drought Portal, a single location in which you can access information from various drought sources.

Communication with on-the-ground individuals and agencies continues to be one of the primary sources of drought information and impact reports. Some of these sources include field staff, water managers, county commissioners, farmers, ranchers, friends, social media, TV media, news stories, and newspapers. In general, social media is becoming common practice, but there are some agencies and sectors that utilize it more than others, such as those in emergency management and operations. It was noted that information is shared more frequently and easily via social media as conditions worsen and there is an increased need for agency coordination and impact information. With the growing use of social media, however, there is agreement that the validity of information must be considered as interpretations of conditions and reliability may waver.

b. Agency Response to Information

Agencies deal with and respond to information in different ways, but in general, there are central indicators that drive response, timing of response, and communication. Media requests, drought severity, drought declarations, data (e.g. soil moisture, rainfall, timing of rainfall, temperature, etc.), and local relationships were all said to trigger action and increase response. For example, response action is triggered at the NWS Amarillo office when drought reaches D1, moderate drought; the US Army Corps of Engineers Tulsa District starts sharing information with stakeholders when reservoirs hit the 75% threshold; and the Department of Agriculture puts irrigation regulations in place when lake and reservoir levels are at 14% of normal. The more critical the conditions are, the more likely information is shared and acted upon.

Information gathering and action can be collaborative or internal. Although many agencies work collaboratively to garner information, some have said they usually work internally and only seek outside information as it becomes needed for decision-making. This supports the notion from many that most actions are response-driven and not done in preparation. For the faction that do take preparedness actions, past operational adjustments have included changes to staffing, equipment handling, and increases in public communication.

Specific *response* actions involve providing aid; money management; managing water resources; communicating with constituents; conserving resources; increasing awareness outreach; providing comments on drafts and writing reports; culminating data for aid; and seeking out grants for funding, which sometimes doesn't become available until drought is declared.

Response challenges discussed were knowing which hat/role to wear when, and making sure not to respond outside of their agency role for fear of warranting a negative response from other agencies.

c. *Response to Inaccurate Reflection of Information*

In reference to the US Drought Monitor, inaccurate information rarely impacts day-to-day decision-making as it just acts as a general guidance. Most agencies rely on in-house data products or various other sources to collect and verify information. In the event internal drought assessments deviate from the Drought Monitor's assessment, operational agencies either do not mention the Drought Monitor at all, or try to explain the differences between the two assessments. Other agency responses to these deviations have been to contact the Oklahoma State Climatologist to inform them of additional information or impacts they have observed on their end, communicate the differences to partner agencies with which they are collaborating, or, in some cases, contact the Drought Monitor authors directly. When these differences occur and individuals are unable to receive funding based on the Drought Monitor's drought level, organizations have been known to internally ramp up their own programs and educational outreach services. Conversely, a few agencies have mentioned that they take a hands-off approach with the assumption that the Drought Monitor captured information they were unable to, and others have said they likely wouldn't even notice inaccuracies or discrepancies.

d. State and Federal Agency Interaction

Many agencies that deal with operations, conservation, and water have continuous communication with other state and federal agencies, including recurring planning meetings and briefings. However, the level of engagement often depends on 1) The severity of drought, 2) When support is needed for planning and decision-making (e.g. dam releases, outlooks, addressing potential health risks, calls for funding, the need for financial information in the agriculture sector, etc.), and 3) When impact information is needed from the ground.

Communication and requests for information from collaborating agencies and the media increase as drought worsens. This includes discussions with the Oklahoma legislature over drought conditions and potential issues that will arise. This collaboration and communication also assists with coordinating, prioritizing, and conserving resources, as well as avoiding conflicting interests and priorities with stakeholders.

There is room for improvement and a number of challenges that arise when working with other agencies. For example, the State Climatologist sometimes has a difficult time getting information about drought conditions. Another challenge, especially among federal agencies, is keeping information consistent with other groups in the agency. A number of other barriers and challenges include: disagreements with drought monitor authors; political differences among agencies; differing agendas among agencies; lack of a common operating system or framework to communicate with agencies; coordinating with elected officials on provision of assistance; and exaggeration of conditions by the media.

Despite the latter difficulties, most agencies still agree that they work well together. Continuing collaboration and communication will help preserve resources in the future, assist with funding, and allow the sharing of information and impacts. Existing relationships among agencies should be taken advantage of and there is a need to show private and public agencies what the impacts are of drought, and then communicate the message effectively.

e. Challenges Encountered with Other Agencies/Entities

Many of the challenges discussed were echoes of what was mentioned previously. A handful of issues encountered include getting regulatory agencies to take action; juggling which role to play when working with other agencies (regulatory hat vs. collaborative hat); rules that inhibit agency flexibility; and new personnel not knowing the history of the agency and what has been done in previous droughts. The fact that agencies are driven by their own agendas was also reiterated. The primary challenge,

however, boiled down to communication issues. It would be helpful if there was a more formal communication structure in place to get information to the Oklahoma Climate Survey/State Climatologist as this special relationship is very beneficial.

5. Group Share and Next Steps

The closing session was an opportunity for attendees to voice final comments and suggestions for the updated state drought plan. This section summarizes and reflects those comments.

The plan can be taken in several directions, but it needs to include some information about coordinated response—interagency coordination and coordination with several partners, laying out relationships, and institutionalizing interactions. Documentation will help with consistency when there are personnel or position changes within agencies, as well as assigning roles by position, not to specific people. Ensuring the appropriate triggers are included is needed to know when action should be taken locally versus at the state level. The plan needs to outline what actions are going to be taken, by whom, and when. There is a lot of room for improvement as the current plan does not reflect current practices. The purpose, goal, and audience of the new plan needs to be further flushed out.

Format:

Regarding the format of the plan, it should be completely rewritten, general, and short, broken down by region that would then include more specific information and a detailed drought plan tailored to each region. It is not known how precisely the regions will be defined, but they should reflect the geographic region and conditions (precipitation, hydrology, geology, types of water use). Different regions often have different sectors/local economies, all of which are impacted differently and at different times by drought. The regional sections could include which categories or sectors are most impacted in that region (i.e. food crops, non-food crops, grazing land, municipal, industrial). Furthermore, if the plan is written on this scale, it is critical to think of county commissioners as the first line of defense as true planning would start at more local levels. The question remains how these regional boundaries would pair with geopolitical divisions. Overall, the suggested format would help address regional differences and be much more effective in planning and response.

Key takeaways:

- 1. The new format of the plan should include a state level response plan with additional regional plans.**
- 2. The new plan must include thresholds/impacts that trigger specific response actions, by whom, and when**
 - More inclusive of different sector impacts, not just the U.S. Drought Monitor which is heavily ag focused and only used as general guidance**
- 3. The plan should include mitigation strategies**
- 4. The plan must include water quality**

- 5. Need to improve communication with the public, congressional offices, stakeholders, media, and collaborating agencies (must continue during non-drought times)**
 - **A formal communication structure for drought messaging and impacts would be helpful**
- 6. Need educational outreach on drought communication, indices, and tools**
- 7. Social media should be considered in the plan as it is used in communication**
- 8. Need a minimum of one meeting per year to keep things operational, continue momentum, and to strengthen relationships, communication, and collaboration**
- 9. Local contacts that provide ground truths for drought impacts are crucial**
- 10. Predictive tools and sector-specific impact tools would be very beneficial in drought planning**

Who should participate in crafting the updated plan?

- Current drought committee chairs
- The Oklahoma Department of Environmental Quality would like to be included in drafting the plan, especially from a drinking water standpoint
- The Oklahoma Water Survey would be happy to assist
- Continue discussion with all agencies involved, including Municipal League, County Commissioners Association, and Rural Water.

Moving forward, the Oklahoma Drought Plan Advisory Meeting Summary Report from June 6, 2018 will be shared with all collaborating agencies and meeting attendees. Following a review and edits from attendees, the meeting summary can be used as a guide for updating the 1997 Oklahoma State Drought Response Plan.

Acknowledgements

We would like to extend our deepest gratitude to our participants for their valuable and constructive contributions as we begin efforts to update the 1997 Oklahoma State Drought Response Plan. We are also beyond grateful for the facilitators, moderators, note-takers, and presenters as this meeting would not have been possible without their support and assistance. Finally, a special thanks goes to the Southern Climate Impacts Planning Program, a NOAA RISA team, and the National Integrated Drought Information System for their funding, support, and encouragement.

Appendix A: Meeting Agenda

Oklahoma Drought Plan Advisory Meeting

Wednesday, June 6, 2018

9:30 a.m. – 3:00 p.m.

National Weather Center

120 David L. Boren Blvd., Norman, OK 73072

Room: 3910 (3rd Floor)

AGENDA

9:30 – 10:00 am: Registration and Coffee

10:00 – 10:15 am: Welcome and Introduction

10:15 – 10:30 am: Broad Overview of 1997 Drought Plan

10:30 – 11:30 am: Morning Breakout Session: *Monitoring*

- What tools do you use to monitor the drought and recovery? Does this include the Drought Monitor?
- How did those tools perform, both going into and coming out of drought?
- Did you make adjustments to monitoring techniques along the way?
- Were there tools or types of data that you wish you had access to during the event?

11:30 – 12:00 pm: Open Discussion Covering Morning Breakout Session

12:00 – 1:00 pm: LUNCH (provided)

1:00 – 2:00 pm: Afternoon Breakout Session: *Communication, Response, & Collaboration*

- What are your go-to sources for drought information? (T.V., social media, friends, etc.)
- How does your agency respond to that information?
- If you saw something not accurately reflected in the Drought Monitor, what would you do with that information?
- How do you interact among state and federal agencies during drought?
- Do you interact with some agencies during drought and not during other times? Why?
- What challenges do you encounter when working with other agencies/entities?

2:00 – 2:30 pm: Open Discussion Covering Afternoon Breakout Session

2:30 – 3:00 pm: Group Share and Next Steps



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Appendix B: Full List of Breakout Questions

Morning Breakout Session Questions:

1. What tools do you use to monitor the drought and recovery? Does this include the Drought Monitor?
2. How did those tools perform, both going into and coming out of drought?
3. Did you make adjustments to monitoring techniques along the way?
4. Were there tools or types of data that you wish you had access to during the event?

Afternoon Breakout Session Questions:

1. What are your go-to sources for drought information? (T.V., social media, friends, etc.)
2. How does your agency respond to that information?
3. If you saw something not accurately reflected in the Drought Monitor, what would you do with that information?
4. How do you interact among state and federal agencies during drought?
5. Do you interact with some agencies during drought and not during other times? Why?
6. What challenges do you encounter when working with other agencies/entities?

Appendix C: Participant List

June 6, 2018 Oklahoma Drought Plan Advisory Meeting Attendee List (Norman, OK)		
	Name	Organization
1	Alex Laney (<i>note-taker</i>)	Oklahoma Climate Survey
2	Andrew Hautzinger	US Fish and Wildlife Service
3	Bill Wentroth	Oklahoma Department of Wildlife
4	Bryan Painter	Oklahoma Department of Agriculture, Food, and Forestry
5	Cody Knutson	National Drought Mitigation Center
6	Dale Frech	Assoc. of County Commissioners of Oklahoma
7	Daniela Spade (<i>note-taker</i>)	Southern Climate Impacts Planning Program
8	David Andra	DOC/NOAA/National Weather Service - Norman
9	Drew Daily	Oklahoma Forestry Services
10	Elizabeth Weight	NOAA/National Integrated Drought Information System
11	Gary McManus	Oklahoma Climate Survey
12	Greg Estep	Tulsa District, U.S. Army Corps of Engineers
13	Jaclyn Alger (<i>note-taker</i>)	Oklahoma Mesonet
14	James Cuellar (<i>note-taker</i>)	Southern Climate Impacts Planning Program
15	Jason Vogel	Oklahoma Water Survey
16	Julie Cunningham	Oklahoma Water Resources Board
17	Kevin Kloesel	Oklahoma Climate Survey
18	Kyle Brehe	Southern Regional Climate Center
19	Leah Kos	Southern Climate Impacts Planning Program
20	Lt Col LeeAnn R. Tumbelson	Oklahoma National Guard Emergency Operations Center
21	Major Rick Childers	Tulsa District, U.S. Army Corps of Engineers
22	Mark Shafer	Oklahoma Climate Survey/Southern Climate Impacts Planning Program
23	Matt Varonka	USGS Oklahoma Water Science Center
24	Meaghan Bresnahan	US Environmental Protection Agency
25	Michael Gittinger	National Weather Service - Amarillo
26	Mike Abate	Tulsa District, U.S. Army Corps of Engineers
27	Monica Mattox	Oklahoma Climate Survey
28	Monique Sellers (<i>note-taker</i>)	Oklahoma Climate Survey
29	Nathan Kuhnert	U.S. DOI Bureau of Reclamation
30	Nicole McGavock	National Weather Service - Tulsa
31	Owen Mills	Oklahoma Water Resources Board
32	Rachel Riley	Southern Climate Impacts Planning Program
33	Randy Taylor	Oklahoma Cooperative Extension Service
34	Saba Tahmassebi	Oklahoma Department of Environmental Quality
35	Scott Sproat	Oklahoma State Department of Health
36	Sharon Gordon-Ribeiro	US Department of Housing and Urban Development
37	Shellie Chard	Oklahoma Department of Environmental Quality

38	Somer Erickson	Federal Emergency Management Agency
39	Steve Palladino	Oklahoma Emergency Management
40	Todd Lindley	National Weather Service - Norman
41	Trey Lam	Oklahoma Conservation Commission
42	William Tolbert	US Department of Housing and Urban Development

Appendix D: Summarized Participant Notes by Topic

Morning Discussion:

a. Tool Evaluation for Monitoring Drought

Water:

- In-house products (USGS, BoR)
- Drought portal and bulletin (OWRB) which includes drought monitor, reservoir storage info from US Army Corps of Engineers, CPC seasonal drought outlooks, Oklahoma Climate Survey's departure from normal rainfall maps, and streamflow conditions from the USGS
- Drought Monitor shows different drought stages
- Products that show specific measurements and impacts, such as lake elevations and soil moisture
- Talk to lake managers
- Look at water quality
- Get input from conservation offices
- Satellite imagery and remote sensing help look at larger scale
- New resources being developed that use remote sensing, land use data, and surface water (NASA's GRACE)
- USGS Water Watch provides surface water data and gauge data, including hydrographs to see which areas are being affected by drought
- USGS Groundwater Watch provides well data
- Bureau of Reclamation drought monitoring index determines need for emergency relief funding
- BoR interested in drought cycles as well to help predict if/when we are entering a drought and estimate its severity, so they look at paleoclimate data and tree ring data

Ag, Wildlife, and Forestry:

- Drought monitor, soil moisture, the Mesonet, specific impacts to agriculture, and reports from counties about what the environment looks like there and what impacts they are seeing
- Look at impacts on fisheries, specifically lake levels and impacts on streams which are different than effects seen in the agriculture sector
- Drought monitor is limited with regard to being able to see impacts on different sectors (crops and cattle in agriculture, wildlife protection and management, fisheries) and these sectors have different impacts depending on time of year
- Fisheries focused on real-time data such as rainfall which has an immediate impact
- Drought monitor is broad synopsis of drought and observations
- In forestry, drought indication is based on dead versus live vegetation classification as well as soil moisture. This data and the data from the drought monitor communicates potential impact of future wildfires to state government

- Drought monitor helps understand potential fire severity and impacts to ecology, structures, and life
- Drought monitor is just a snapshot; use other environmental indicators for more details on drought
- Some drought indices don't accurately communicate impacts
- Different definitions of drought with different impacts (i.e. meteorological or agricultural)
- Impacts lag behind rainfall observations; a little too slow in responding
- Ground truths are needed to better understand and communicate impacts
- Difficult to understand drought monitor for transitional seasons such as growing and harvesting seasons
- Fire severity is a good indicator of drought
- Impacts linger from drought, despite rainfall amounts
- Different sectors focus on short-term or long-term trends and effects
- Drought monitor is a good review and collective reference for drought, but need to use other tools
- Oklahoma Mesonet's "consecutive days without rainfall" map is a helpful tool and provides a look at rainfall deficits
- KBDI during growing season

Operations, Army Corps of Engineers, and Emergency Management:

- Use internal/in-house products and reservoir gauges. Tulsa District Army Corps of Engineers start talking about drought conditions and water management once reservoirs get to 75-80%
- Utilize information from the National Weather Service, Mesonet, drought monitor, fire weather, tropical weather sites, and the storm prediction center and severe weather outlooks
- CPC outlooks, QPF graphics, departures from drought monitor, soil moisture maps
- Drought monitor much more of an agricultural focus
- Monitors conservation storage, reservoir inflows, lake levels, Mesonet data for day to day operations
- Facilitate with stakeholders
- Local information and impacts from media stories
- Drought monitor is great for communication, looking at trends and a snapshot and good at starting discussions
- Drought monitor, however, is slow to respond and not accurate in reflecting the response depending on group/sector needs and focus; lag effect related to water resources
- Drought monitor is a good initial, broad tool, but it is followed up with more detailed tools depending on need of group

- Drought monitor blends together all different definitions of drought; data and tools are interpreted and used differently depending on sector, misunderstanding of product sometimes
- Information needs to be translated and disseminated to group users for planning and preparation for mitigation

b. Performance of Tools

- Tools haven't really been utilized for response actions
- Economic impacts would be useful for receiving funding
- Need to see a good partnership with media who use the drought index; luckily there is public recognition and respect of the drought monitor by media which is a success story of the tool
- Drought portal like OWRB's is great with consolidation of info but may be overwhelming with so many things and may be hard to understand by those who don't use it regularly or are non-experts
- Hard to balance looking at short- and long-term drought; only capture certain sector impacts based on whether you are looking at the short or long-term drought
- Drought tools don't always address different geographic regions which is what is needed for planning; different focuses within different regions; difficult to plan and manage at a state-level
- Tools are good, but not as helpful with when we are coming out of drought
- Would like seasonal type of model that combines soil moisture, aquifer levels, forage to predict if your acres will support cattle (impact/management specific tools)
- Need to work with media to clarify use of products and understanding of what values mean
- Need to recognize different types of drought and how it impacts different sectors
- There is different timing of impacts (ag first impacted, then reservoir, then social) and a large lag between when we see these impacts and drought designations
- Harder to gauge coming out of drought than going in
- Drought defined differently by everyone
- Miss details in a drought monitor that blends so many things
- PDSI is so supply-demand oriented, it loses its punch when there is no demand
- Snow pack monitoring needs to be better, but that is improving (before, very little made it to OK)
- Drought monitor is an attention getter and very broad, which many incorrectly interpret

c. Adjustments to Monitoring Techniques

- Technological improvements and advancements in prediction, monitoring, forecasting, drought tools, and computing
- Do drought comparisons between current event and previous events to gauge potential progression of current drought conditions (helps with short-term predictions a few weeks to a month out)
- This comparison of current to past events helps water supply reservoir managers with resource planning and making decisions regarding sanctions and restrictions
- To tell which areas are improving or degrading, additional tools and feedback from locals who can provide ground truths are analyzed for these identified areas. Local input is vital.

Operations:

- Continue to analyze impacts to agriculture, water evaporation, aquifers, etc.; rely on visuals; and work on personal experience to make decisions

d. Desired Tools and Data

- Need to know when coming out of drought not just when going in
- Need improvement of prediction tools for medium range (~3-6 months)
- Flash-drought tools
- Economic-based impact analysis, cost-benefit analysis of drought response actions to help garner funding support and justify action
- More advanced notice of worsening drought conditions, which could make response and engagement with the governor more timely
- Increase and improve communication and exchange of information with public, congressional offices, and media partners as well as education and awareness of conditions and tools available
- Drought portal or single resource to get to other tools and resources (one stop shop)
- Drought monitor equivalent for different uses: ag, fire, water availability, etc.
- Resource or database with drought impact stories- need to know impacts as soon as possible, especially for Impact Assessment and Response Committee
- A way to know how long the drought will last and how severe it will be
- Valuable to know where most vulnerable populations are
- EMs need drought training to more effectively use tools (trained drought spotter network?)(SE)
- Need meeting or way for drought monitor authors to educate users on limitations and indices used

Afternoon Discussion:

a. Sources for Drought Information

- Drought monitor is a good general source
- National Weather Service
- Climate Prediction Center- for outlooks, ENSO
- Oklahoma Mesonet- rainfall, soil moisture
- Corps of Engineers- lake levels
- OWRB drought portal combines a lot of these sources
- Many use a combination of all of these resources and drought indices
- Social media used to disseminate information, especially by NWS; often used as a preparedness tool in emergency management
- Social media is heavily filtered for some agencies and their PR
- Primarily get info from field staff, water managers, county commissioners, farmers/ranchers, friends, etc. who report impacts; impacts include water table impacts, ag impacts (+ economic impacts)
- Communicate information and impacts via email with sources
- Increase in reports during crisis situations and more involvement with individuals as drought becomes severe
- Social media is easier to use when there is already a known, extreme issue
- OK Dept. of Wildlife has an information education division to seek out reports
- Coordinated effort between State Dept of Health and DEQ to relay messages about safety health risks
- Certain reservoir levels trigger dissemination of information by Tulsa District US Army Corps of Engineers (triggers vary by sector needs)
- Impact reports from TV media, news stories, newspapers
- Soil shifting/data, lake levels, ground water, information from lake managers to assess drinking water implications
- Internally tracks water systems
- Social media big part of operations for some, not others. Some have Public Information Officers
- Media follows some of these departments and puts it out on their social media
- Validity of social media information needs to be considered; perceptions vary; need to make sure it is reliable but experts can tell (find secondary sources to back it up as well)

b. Agency Response to Information

- Media requests and local relationships drive and trigger response
- As drought severity increases, educational programs and response increase
- Information shared and acted on more if the situation is more critical

- For some agencies, information received is more internal; not systematically going out and seeking it but rather finding data and information as it becomes needed for decision-making.
- For other agencies, information is collaborative
- It's a challenge to make sure we are all staying in our own lanes. Sometimes doing something outside of our role can warrant negative responses. We wait for official resources that have been vetted so individual agencies and organizations don't have to take ownership, but rather direct people to a central resource.
- Gather resources from other agencies and field staff to pool together and help each other.
- Respond by accumulating data that can be used for aid
- Provide aid, money management, water resources, communicate with constituents
- Email correspondence with sources and provide comments in drafts and reports
- Conserve resources
- Increase awareness depending on severity
- Response based on soil moisture, rainfall, timing of rainfall, temperature, atmospheric moisture, and other data
- Impact, relationship, drought-declaration, media, and data driven response for many
- Additional funds sought during drought; grant processes started when drought declared
- D1 level triggers response in NWS Amarillo
- Tulsa Army Corps of Engineers start sharing information with stakeholders when reservoirs hit 75% threshold
- Response and Reaction-based more than preparedness for most
- In ag and forestry, drought can dictate preparedness level i.e. staffing, equipment handling, public communication
- NWS interacts more frequently during drought, responding with more frequent briefings, additional graphics on web/social media, respond to briefing requests (collaboration with other agencies)
- Dept of ag puts regulations in place to prevent farmers from irrigating when lakes and reservoirs are down to 14% of normal
- Provide water services in the event of shortages depending on kind of drought

c. *Response to Inaccurate Reflection of Information*

- Doesn't really impact day to day decision making.
- Don't see too many departures but really just use it as an initial general guidance and then continue doing their own thing. Look at other indicators.
- In operations, don't even mention departures from DM, or try to explain it if they can
- Ramp up own programs if they can't get funding based on DM level and will focus on educational outreach
- Some take hands-off approach and assume DM knows or sees something they don't

- Will contact State Climatologist if they see discrepancies and also to inform him of additional information or impacts
- In Texas, they contact DM directly
- Communicate differences to their partners (FEMA) and say there is information not being included
- Many wouldn't notice inaccuracies or discrepancies

d. State and Federal Agency Interaction

- Operational, conservation, water, and federal agencies have constant communication (NWS, OEM); level of engagement with other agencies, however, sometimes depends on severity of drought, increases in crisis or when it is more severe
- Threshold of severity seems lower than it used to be to start response
- More briefings and communication with agencies upon request
- NWS: provide support to agencies as they try to make decisions for future planning of resources (dam releases, planning and funding, etc.)
- Briefings, fire meetings, outlook talks for ag agencies,
- Have to keep information consistent with other groups in their agency (NOAA)
- State Climatologist has a hard time getting information about conditions
- Many agencies collaborate with other state agencies, federal agencies, and the public when lake levels are low or they are instituting new gauges in rivers, lakes, streams, and reservoirs; this includes for coordinating, prioritizing, and conserving resources and for planning purposes
- Discussions with the government and legislatures are spurred when there are known issues of an upcoming drought for communicating plans
- Work with other agencies to get more information about impacts and speak with people that can provide ground truths
- USDA provides financial information regarding drought such as quality of water and food for cattle
- Communicate more with media as conditions worsen
- Communication and coordination are needed among stakeholders to avoid conflicts of interest and priorities
- Communication about drought is needed to help reserve resources for the future
- Some disagreement with Drought Monitor authors who may not understand site-specific characteristics. It also is more geared toward agriculture and doesn't reflect hydrological impacts as well. Political differences among agencies can lead to challenges
- Communication challenges with agencies- need common operating system or framework to make it easier
- Challenging to work with elected officials who may only look at the one drought monitor map which is very broad

- Media sometimes chooses most dramatic examples when many areas are not as severely impacted
- Partake in planning board meetings for drought resiliency (Tulsa US Army Corps)
- Some communication challenges and issues with groups trying to push their own agenda, but in general, most work well together
- Collaboration helps with likelihood of receiving funds
- Need to show private and public agencies what the impacts are of a drought and then communicate the message effectively.
- DEQ, OWRB, Dept. of Ag, Conservation Commission always in contact; Health Dept included if water related health risk.
- Existing relationships with agencies that they are able to take advantage of during drought

e. *Challenges Encountered with Other Agencies/Entities*

- Communication issues
- Agency priorities may differ
- Some regulatory agencies may be slow to act
- New personnel coming in that don't know the history of the agency and what's been done
- No flexibility, must follow what the book says
- Challenge juggling which role you should play (regulatory hat vs collaborative hat) when working with other agencies
- What communication structure is in place if we don't have Gary? Benefit from this special relationship (make it more formal, just contact OCS in general?)

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