



DROUGHT MONITORING INSIGHTS FROM THE **NEW MEXICO** DROUGHT MONITORING WORKING GROUP

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INTRODUCTION

Drought monitoring identifies the presence and severity of drought. Different drivers of drought—such as lack of rainfall, high temperatures, and water consumption—translate into different drought experiences across geographies and time scales. Drought monitoring maps do not always match local drought conditions or community experiences with drought due to the many complex ways drought can present across a landscape or impact people and the environment. This presents a challenge for drought planning and responses. Equity and justice issues also arise when drought monitoring renders invisible the drought experiences of communities or households to drought planning and responses.

This report focuses on the drought monitoring process in New Mexico to understand current challenges in drought monitoring and identify opportunities for strengthening the monitoring process. The New Mexico Drought Monitoring Working Group (NM DMG) is tasked with monitoring drought conditions across New Mexico to inform drought responses and to provide input into the US Drought Monitor. This report draws on interviews and a survey with current and former members of the NM DMG as well as drought researchers familiar with drought monitoring in the state.

DROUGHT MONITORING

The main drought monitoring tool in the U.S. is the United States Drought Monitor (USDM), which depicts drought conditions across the country. The USDM is jointly produced by the National Drought Mitigation Center, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA). To identify the presence and severity of drought, the USDM uses a convergence of evidence approach and draws from three different data sources:

1. drought indicators such as rainfall, streamflow, and soil moisture,
2. drought impact data that include descriptions of local conditions and observed impacts on communities and ecosystems, and
3. feedback from community and state-level experts that provide local context and integration of different drought data.

Members of the USDM drought monitoring team categorize the severity of drought conditions according to 5 categories: abnormally dry (D0), moderate drought (D1), severe drought (D2), extreme drought (D3), and exceptional drought (D4). The USDM authors collaborate with state-level climate experts, such as the state climatologist, to identify drought conditions.

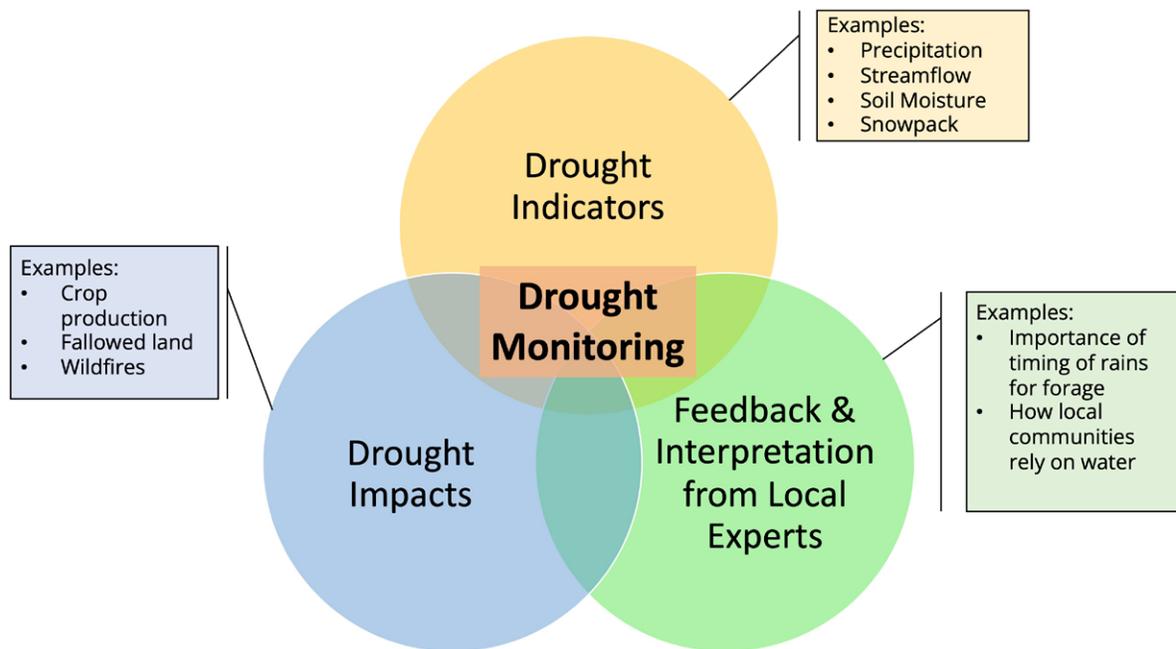


Figure 1: The convergence of evidence approach to drought monitoring, adapted from the US Drought Monitor, <https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx>.

THE NEW MEXICO DROUGHT MONITORING WORKING GROUP

The 2018 New Mexico Drought Plan¹ identifies the agencies and organizations responsible for drought governance and sets recommended drought mitigation actions for agriculture, drinking water, water quantity, wildfire, and watersheds. The NM DMWG, under the joint chairs of the State Climatologist and the National Weather Service, is responsible for convening climate, water resources, and natural resource professionals from state and federal agencies to present and analyze available climate and hydrology data as well as drought impacts. Agencies that are represented in the NM DMWG include the National Weather Service, US Bureau of Reclamation, US Army Corps of Engineers, Natural Resources Conservation Service, US Geological Survey, NM Office of the State Engineer, NM Department of Agriculture, USDA Farm Service Agency, the Navajo Nation, and others.

According to the Drought Plan's operational framework, the DMWG is tasked with reporting on drought conditions to the New Mexico Drought Task Force and the State Drought Coordinator. The State Drought Coordinator is to provide updates, priorities, and support for the Drought Task Force and liaison with communities and agencies. Though this role is outlined in the NM Drought Plan, funding challenges have prevented filling this position, so the NM DMWG's Chairs serve the State Drought Coordinator function. In addition to providing drought information to the New Mexico state agencies, the NM DMWG provides input and feedback to the USDM.



¹ <https://www.ose.nm.gov/Drought/droughtplan.php>

DROUGHT MONITORING CHALLENGES AND OPPORTUNITIES IN NEW MEXICO

01. *While there are a wide variety of drought indicators available for New Mexico, there remain significant gaps in the availability of indicator data.*

The DMWG reported using a variety of drought indicators (see Table 1). However, large stretches of land are not well covered by instruments and weather stations, creating gaps in drought data. A DMWG member explained that **“data is always the prime challenge. Fifth largest state, 47th in population, 47th/45th or somewhere in there. So, you have a massive area, you’ve got little data and so this is the classic geographic problem - where do you fill in that data? The science is just filling in the data. The remote sensing helps. We’ve got generally pretty good radar-based precipitation estimates. We’ve got some areas that we don’t. We’ve got an okay gauge network, but in many areas, we don’t.”** The changes in topography across the state contribute to climate variations and microclimates that further exacerbate the data gaps. Another DMWG member pointed out that existing drought indicators do not always represent conditions for a specific location. They explain, “With some of the indices that are based on rainfall, you have the nearest station being 80 miles away in a totally different climate. And that’s what they’re extrapolating from.” The gaps in drought indicators present a significant challenge to identifying drought conditions at a local scale, especially in parts of the state that are not well covered by existing networks. DMWG identified the need for more data on shallow aquifer storage changes, open-ET data for agricultural lands, more extensive soil moisture mapping, and groundwater information.

New Mexico Drought Indicators
Adjusted long-term weather datasets
ENSO models
Estimated/forecast precipitation
Evaporative Demand Drought Index (EDDI)
Groundwater
National Resources Inventory (NRI)
Precipitation (rain gauges)
Reservoir storage volumes
Snowpack (Snotel)
Soil moisture data
Standardized Precipitation Index (SPI)
Standardized Precipitation/ET index (SPEI)
Streamflow
Temperature and precipitation outlook
US Seasonal Drought Outlook
Vegetation index (NDVI)
Water supply forecasting
Watershed modeling

Table 1. Drought Indicators used by NM DMWG, derived from presentations, interviews, and survey.



02. **New investments in data sources are addressing gaps in drought indicators.**

The ZiaMet Weather Station Network provides real-time weather and sub-surface soil conditions. The Community Collaborative Rain, Hail & Snow Network (CoCoRaHS)—a community-based network of volunteers who take precipitation measurements and report them on the CoCoRaHS website—allows NM DMWG members to increase their coverage of drought conditions across the state.



03. **Drought impacts, including qualitative descriptions of drought conditions, are significant when drought indicators fail to depict local drought experiences.**

DMWG members reported using drought impact data such as agricultural data on livestock and crops, native grass growth, and wildfire conditions. Drought impacts provide an important complement to drought indicators. One DMWG member explained: ***“Sometimes it could be our equipment that's not reading things right. It's malfunctioning or something like that, or our stream gauges aren't working, and we don't have information for that area. So, it's kind of a combination of people's perspective on the ground, and then the data.”***

Impact data also provides a crucial perspective on the experiences of communities and their livelihoods. For example, remote sensing is used to monitor the impact of drought on plant growth. However, ranchers are dependent on rains that support forage for livestock. While remote sensing maps may indicate plant growth, it might be growth from invasive plants and not the plants needed for forage. A DMWG member clarified ***“With the drought from the last two monsoons, the greenness maps look great, but that's the wrong vegetation that came up. Some of the invasives, how do we convey that, and provide that institutional knowledge that individual farmers and ranchers have.”*** Impact data aligned with the local context and priorities provides insight into how drought affects regionally important economic and social activities.

04. **Drought monitoring requires considering different forms and types of droughts.**

Drought monitoring is particularly complex as different types of droughts present differently across time and space. As a DMWG member put it, **“You could ask an ecologist the same question as a farmer, and they may have a different experience of drought and capturing that is tough one.”** Knowing which data to prioritize in drought monitoring requires understanding how drought presents itself locally. A DMWG member explains that **“Not everything works in every season, or every time of year. So, filtering through the gigs of data that we now sift through, figuring out what was the most important, put it in perspective, that’s challenge number one.”** Integrating drought data is particularly challenging when drought indicators and impacts don’t align. The consequence is a potential mismatch between the depicted drought map and the actual lived experiences of people facing drought. As some drought relief programs, such as the Livestock Forage Disaster Program, are tied to drought categories in the US Drought Monitor, these mismatches can have consequences for community members.

05. **When there are potential drought mismatches, DMWG members rely primarily on drought indicators.**

Several DMWG members described the necessity for quantitative data in drought monitoring that they can defend. Several members described themselves as objective “honest brokers” of drought information. A DMWG member elaborated **“I can’t make up data. Even though, you said it’s worse. I can’t just say it’s, ‘D4.’ I got to have the numbers. And until the numbers show up, that’s as far as I can go.”** Another member said, **“We have to be able to justify this when Congress calls. When we get a subpoena to go to the Hill, we have to be able to justify the data.”** Several DMWG members felt they lacked an objective and measurable process for analyzing drought impacts – especially when analyzing socioeconomic drought. Some expressed concern that some community members might exaggerate drought impacts as financial drought relief aid is tied to the USDM drought categories.

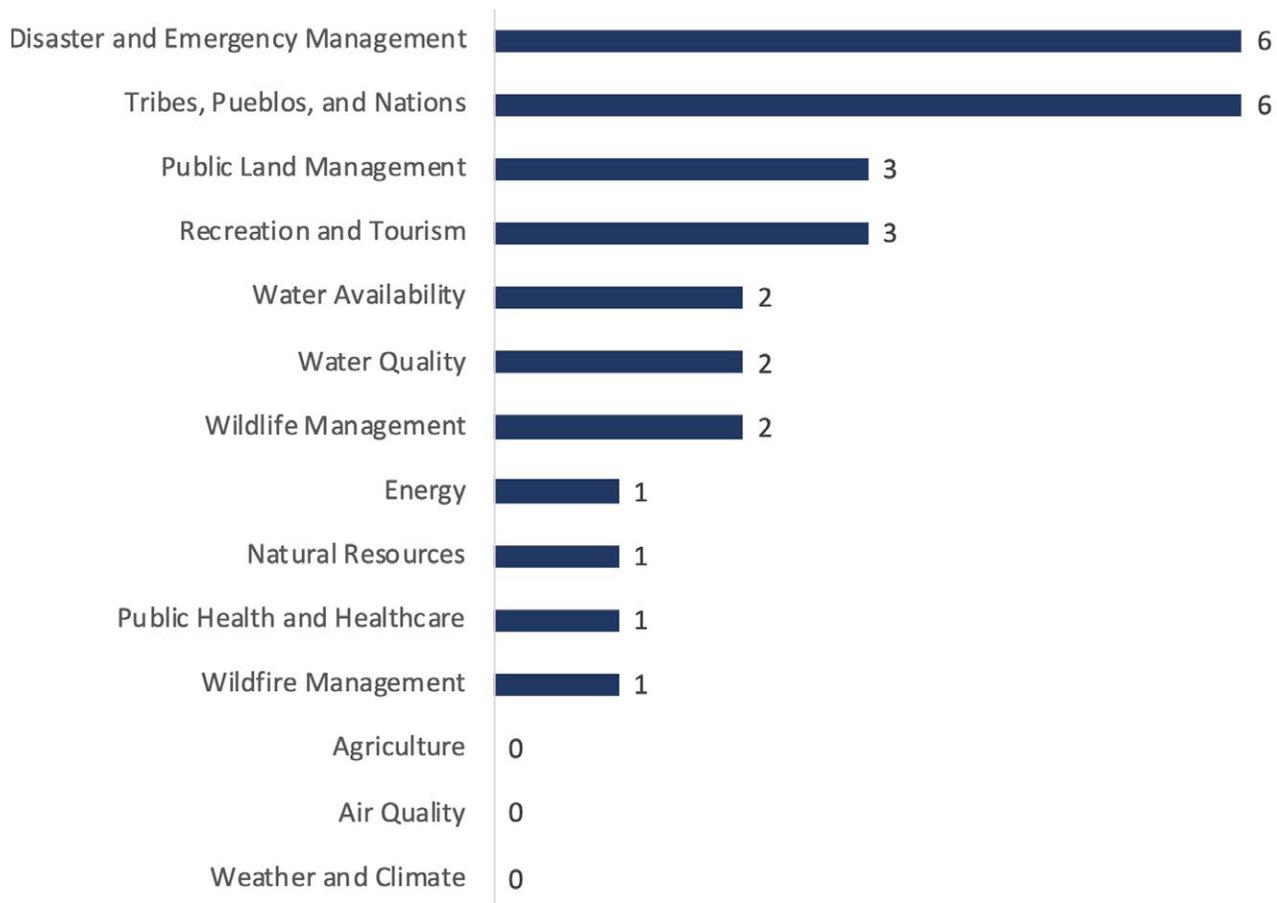
06. Establishing and maintaining relationships with different stakeholders and communities remains a challenge in the collection of drought impacts.

A drought monitoring system responsive to societal needs requires robust engagement with local experts and communities. These engagements provide the knowledge and the expertise to validate drought indicators and drought impacts. Discussions with NM DMWG identified several barriers to community engagement on drought. Time to invest in community engagement and knowing who to contact in communities were identified as significant challenges. Several NM DMWG members expressed that community engagement is not within their job scope.

07. Increasing representation from different economic and planning sectors, communities, and groups on the NM DMWG was identified as a pathway for increasing engagement and equity in drought monitoring.

There is strong representation in the group from agriculture as well as climate and weather experts. NM DMWG members identified the need for greater representation from Disaster and Emergency Management as well as Tribes, Pueblos, and Nations (see Figure 2). Increased representation from diverse groups allows for a more diverse inclusion of drought impacts.

Figure 2: What sectors can be better represented at the monthly NM DMWG meetings?



08. **There is a need for more trust-building with different communities, Tribes, Pueblos, and Nations**

Discussions on community engagement highlighted that the lack of trust in government agencies affects the collection of information on drought impacts. One NM DMW member described the challenges in discussing drought impacts with some communities, **“There is not a lot of trust in the government. Some places have some, but some are very much - You’re from the government, so I’m not going to release much.”** Another interviewee pointed out that building drought-monitoring relationships can be a **“social challenge or a legacy challenge that is going to take healing on a different level to rectify. And trust – a different level of trust.”** There was an acknowledgment in several discussions that the history and violence of colonization and exploitation, including the appropriation of lands from Indigenous groups and land grant communities, continue to shape mistrust of government and scientific researchers in the region.

10. **There are several ongoing efforts to increase community drought engagement in New Mexico.**

The Southwest Drought Learning Network² is a knowledge exchange network that connects climate service providers with resource managers across the Southwest. Activities include webinars and workshops on drought information and drought adaptation. Tribal Drought workshops, such as the one hosted by the South Central Climate Adaptation Science Center³, provide forums for engagement on drought designed for Tribes, Pueblos, and Nations. These community engagement efforts are potential pathways for increasing community engagement and participation in drought monitoring.

09. **Community engagement goes beyond the collection of drought impacts, it requires drought monitoring groups to invest time in listening to communities and acknowledging the societal inequities that structure the experiences of drought.**

Some NM DMWG members explained that building trust and forging stronger relationships with New Mexico communities requires an openness to difficult discussions around drought. As one NM DMWG member explained **“So a lot of people don’t want to discuss that type of stuff. I don’t even want to discuss that type of stuff, because people get mad and it is people’s lives. People have put all of their money, their time, their effort. Sometimes it’s something that’s been passed on from generation to generation. You don’t want to talk about that, but you have to discuss it. Those are the hard things that are not being addressed I think.”** An acknowledgment that historical injustices continue to shape water rights, water use, and livelihoods in the region can be an important step in trust-building.

² <https://dln.swclimatehub.info>

³ <https://southcentralclimate.org>

CONCLUSION

Drought responses occur in multiple forms—farmers make decisions on irrigation for crops, ranchers decide where to move cattle for better forage, communities make decisions for community water systems, and state and federal agencies respond with drought response and relief programs. These decisions are different forms of drought governance that are improved with drought monitoring systems that effectively identify the extent and severity of drought. Drought monitoring systems that are aligned with drought decision-making can lead to more effective and equitable outcomes.

The NMDMWG provides a case study to understand some of the challenges and opportunities in drought monitoring. Gaps in drought data and challenges in capturing local drought experiences present challenges for drought monitoring in New Mexico. Integrating diverse sources of drought data is not always a simple process, especially when there are mismatches between drought indicators and drought impacts.

There are several ongoing efforts to address these drought monitoring challenges in New Mexico.

Opportunities for strengthening of drought monitoring include:

Continue investments in drought indicators

The expansion of ZiaMet and CoCoRaHS are significant steps in addressing gaps in drought indicators. NM DMWG members indicate that investments in more drought data such as groundwater recharge and soil moisture are important for drought decision-making relevant to the New Mexico context.

Continue investments in community engagement

Greater engagement with diverse communities across the state will increase the availability of drought impact data. Funding the position of the State Drought Coordinator outlined in the 2018 New Mexico Drought Plan is a step that can significantly bolster drought monitoring. There is a need for community engagement that is designed for trust-building between drought researchers, state agencies, and local communities. Increasing engagement with diverse communities also allows for a drought monitoring system that is sensitive to existing inequities and can inform a more just and equitable drought response.



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