


# Evolution of the Southwest Drought Learning Network

## Collective Response to Exceptional Drought

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**ABSTRACT:** The 2018 exceptional drought over the Colorado Plateau motivated unprecedented responses by individuals and organizations. Some of these responses made clear that proactive adaptive measures were fundamental to drought resilience. Climate service organizations (CSOs) supporting and observing these responses realized the utility of a network to share and document successful drought responses. In February 2020, a small group of CSOs and resource managers (RMs) met to envision the Southwest Drought Learning Network (DLN) to align with other existing efforts, but with the specific goal of enabling peer-to-peer learning to build resilience to future droughts. Since then, the network has grown into five organized teams focused on specific aspects of building drought resilience. Team activities include sharing case studies to help others learn from past experiences, hosting monthly drought briefings that introduce drought data and management tools, identifying information needed to support critical management decisions, innovating and sharing new and traditional drought monitoring technologies, and building drought resilience with indigenous communities. The network allows for collaboration and leveraging partner resources and strengths. The DLN website (<https://dln.swclimatehub.info/>) hosts more information about network teams and activities. This innovative network continues to grow in response to management needs and water scarcity in the region. For the benefit of others who may be considering a similar network and supporting peer-to-peer learning, we document the history, process, and lessons learned regarding the Southwest DLN.

**KEYWORDS:** Climate change; Hydrologic cycle; Adaptation; Agriculture; Climate services; Decision support

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Between 1980 and 2021, drought was the third costliest natural disaster with each event costing an average of \$9.8 billion nationally (NCEI 2023). In the Southwest region of the United States, recent drought impacts are unprecedented. Water has long been scarce in the region, but the recent drought (2000–21) in the Southwest represents the driest period since at least 800 CE (Williams et al. 2022). This extended drought is leading to unprecedented low water levels in Lake Mead and ensuing water cuts in 2022. Managing water in the region is difficult during the best of times and drought can put added strain on land, water, and other resource managers (RMs). Recent drought in the Southwest has caused agricultural losses, unprecedented wildfire, reduced tourism, altered animal migration patterns, and poor air quality (National Drought Mitigation Center 2022; Lisonbee et al. 2022). Beyond biophysical and economic distress, drought can impact mental health and increase stress for individuals responsible for tribal, federal, state, and local land and water management and for communities coping with drought impacts.

Challenging Southwestern drought is exemplified by the exceptional drought, which hovered over the Colorado Plateau during most of 2018. Conditions spurred by this extended, exceptional drought led regional climate service organizations (CSOs) and RMs to recognize a gap in drought services. RMs and others were responding to drought conditions by taking specific actions, such as hauling water, implementing shortage sharing agreements, and planning for likely wildfire. CSOs and RMs recognized the need for an effective and reproducible way to document and share drought responses and effectiveness of those responses to build future drought resilience. Documenting and quantifying drought impacts has been challenging, leading to anecdotal or undocumented impacts (Lackstrom et al. 2013). We need novel and creative means to fill knowledge gaps related to both drought impacts and responses to drought impacts. During the 2018 drought, several CSO were already working to provide climate information and services within the region, but there was a recognized need to facilitate coordination among a broader, more integrated network.

One solution to the gap in documenting drought response emerged as the development of a collaborative, peer-to-peer learning network. CSO recognized that some resilience to drought can be achieved by sharing lessons learned from past droughts with peers (IPCC 2014; Leal Filho et al. 2022) and that peer-to-peer learning may build drought resilience in the Southwest. However, no single CSO could build the needed network in isolation. Therefore, in 2019 three of the groups who were actively providing drought information within the Southwest collaborated on a framework to encourage all CSOs in the region to learn from RMs and RMs to learn from each other to share lessons from previous droughts. Those three groups were the U.S. Department of Agriculture’s (USDA) Southwest Climate Hub (SWCH), the National Drought Mitigation Center (NDMC) at the University of Nebraska–Lincoln and the Intermountain West Drought Early Warning System [part of the NOAA’s National Integrated Drought Information System (NIDIS)].

In this article, the initial DLN partners (SWCH, NDMC, and NIDIS) provide a comprehensive summary of the steps taken to initiate a Drought Learning Network (DLN) and evolution of the network over the first few years. Here we share documented RM drought needs, key elements of the first DLN meeting held to envision the network, and preliminary network evaluation. The final section of this article describes some network activities and intended impacts.

### **Drought needs from resource managers**

In preparation for the first DLN meeting in February 2020, NDMC and SWCH surveyed 324 federal, tribal, state, county, NGO, and private RMs (35% response rate) working predominantly in agriculture, forestry, and wildlife to identify drought information needs. When asked about their role regarding drought management, most were advice givers (31%), followed by decision-makers (19%), and communicators (12%).

The survey identified types of information needed by managers and how managers seek and find information. Most sought was information about how to manage the effects of drought (53%), how to communicate drought to the public (46%), and how to find technical (49%) and financial (48%) assistance. Managers were most likely to seek information online or through interactions with colleagues or networks. Most survey respondents (95%) expressed interest in best practices and lessons learned by other RMs during recent droughts, highlighting the need for a peer-to-peer network. Their preferred learning methods were broad, including in-person workshops, presentations, field visits, webinars, a clearinghouse, fact sheets, and email lists.

Some of the challenges reported in the survey included balancing resource and economic decisions, coping with communication and conflict (e.g., urban versus agriculture water use), and conflict between conservation and producer needs. Survey respondents also shared what worked well during drought. These include a focus on response, improving soil health, 2014–18 Farm Bill programs (U.S. Congress 2018), and cross-jurisdiction coordination.

### **Meeting to envision a regional Drought Learning Network**

RM survey responses led to the primary goal of the inaugural meeting: to collectively envision a functional network where RMs and CSOs learn from one another to meet some of the regional needs. Prior to the meeting, regional CSOs and drought experts identified potential gaps and needs for discussion (Table 1). Participants (~30) representing federal, state, tribal, municipal, and other management organizations attended the meeting. During this inaugural meeting, experts in peer-to-peer networks from University of Colorado Department of Environmental Studies, the RE-AMP network ([www.reamp.org/](http://www.reamp.org/)), and the Fire Adapted Communities Network shared their experiences. These invited speakers discussed the fundamentals of launching a network. Main recommendations included 1) building a voluntary, multiorganizational, and cross-jurisdictional group while linking people across place and scale; 2) mapping the network; 3) creating a shared vision; and 4) leveraging current tasks into the network so members utilize their time well. In the last few hours of the meeting participants were asked to address one pressing drought issue in small teams and identify priority activities and solutions. From this activity, five DLN teams emerged: *Case Studies*, *New Mexico Pueblos*, *Beginning Farmers and Ranchers*, *Water in Utah*, and *Projections-to-People*.

Participants left the inaugural “envisioning” meeting with a shared understanding of network goals, objectives, and teams. Participants defined the DLN as a service for members to learn from one another and work together to better accomplish shared goals. Operationally, the DLN supports ongoing partner efforts in ways that are peer-to-peer, nonduplicative, and respectful of partner contributions, crediting accomplishments to participating organizations and the DLN. For example, NIDIS facilitates the Drought Early Warning System (DEWS) for

**Table 1. Suggested gaps or network components designed to facilitate the collection, storage, and sharing of information about drought action and efficacy among resource managers.**

Need	Goal	Progress
Sharing management practices	Develop and share case studies to capture a specific event, action, and effectiveness	An active team produces case studies as part of a platform that existed prior to DLN formation
Resilience reporter	Online location for RMs to report drought response efforts and capture specific information including cost, efficacy, and evaluation of response	Some platforms exist to document drought impacts, but more is needed to capture specific information
Drought management database	An open database to document drought response and efficacy	Since 2013, NDMC has maintained a searchable database of reports and news stories on drought mitigation and response actions; the database could be used as one source for archiving case studies and management activity reports
Hive mind listserv	An <i>Ask An Expert</i> forum with rapid responses from the community for members of the public (city, county focus) and RMs	Under consideration, but not yet developed
Impact calendar	Sharing of specific information could be planned around anticipated and observed impacts	Informally implemented through planned activities but could be more intentionally considered
Presentation library	Webinars, presentations, and workshop summaries designed to provide information about various components of drought or for specific phases; videos or presentations by managers could be commissioned and shared	Under consideration
Drought maps	In the Hawaii drought knowledge exchange (Longman et al. 2022) managers wanted localized information outlining how current drought compared to historic drought in their area via maps and calendars	Similar maps may be relevant for managers in the Southwest
In-person meetings	Periodic in-person meetings including manager and research co-led field tours	We hosted an in-person meeting in June 2022
Network coordinator	Consistent DLN coordinator to infuse new ideas into the network and meet the needs of RMs	We have an informal network coordinator and biweekly coordination meetings

the Intermountain West region and conducts early warning activities in five main areas of work. Rather than operate in these early warning sectors, the DLN informally strengthens the tie between partners who have drought information (observations, forecasts, research) and those that need drought information within the DEWS. In this way, the DLN helps connect RMs with their DEWS network and drought information coordinator, thus enabling and supporting both DEWS and DLN ongoing efforts. Collaboration between CSO enhances regional climate resilience (Averyt et al. 2018; Schafer et al. 2016) and DLN structure fosters impactful collaboration to this end.

### Network evaluation

The network is still in its early stages and some measurable impacts are yet to be evaluated or realized. The premeeting survey of RMs provides a solid foundation to evaluate success because we can ask the same people about how the network supports drought related needs. Within the network we use project management software to collaborate and monitor the number of people and organizations participating, the latest team activities, and completed tasks. In 18 months (February 2021–August 2022), the network grew from 66 people representing 33 organizations to 119 people representing 41 organizations.

We also evaluate network progress via website hits, number of workshops and webinars hosted, the number of participants joining drought briefings, and the number of case studies published and accessed. Future evaluation may include periodic surveys about informational needs by specific groups of RMs during different stages of drought and how well the DLN provides this information.

### Network success and lessons learned

**Lesson 1: Leverage existing resources and organizations.** Many CSOs across the region were working individually to reach and support the same people. In addition, the magnitude and duration of drought increased regional drought needs over the past few decades. These conditions were leading to stakeholder, RM, and CSO fatigue. In response, the network looked for opportunities to collaborate, leveraging existing resources to meet shared goals. For example, DLN members realized that an existing case studies framework through the Collaborative Conservation and Adaptation Strategy Toolbox (CCAST) could serve as the foundation for sharing lessons learned and that became integral to the “sharing management practices” team.

**Lesson 2: Provide shared network and team leadership.** From the inception, the network consisted of a small, structured leadership team (at present this consists of NDMC, SWCH, and NIDIS). The leadership team shares managerial burdens, rotates responsibilities in conducting meetings, and collaboratively plans annual meetings. Initially, the leadership team also participated in all five project teams, which was unsustainable.

Hence, the network adopted a structure like a constellation model (Surman and Surman 2008) consisting of self-directed, self-formed teams (Fig. 1). From network outset, the structure of the DLN continued to evolve based upon member experiences and team focal topics.

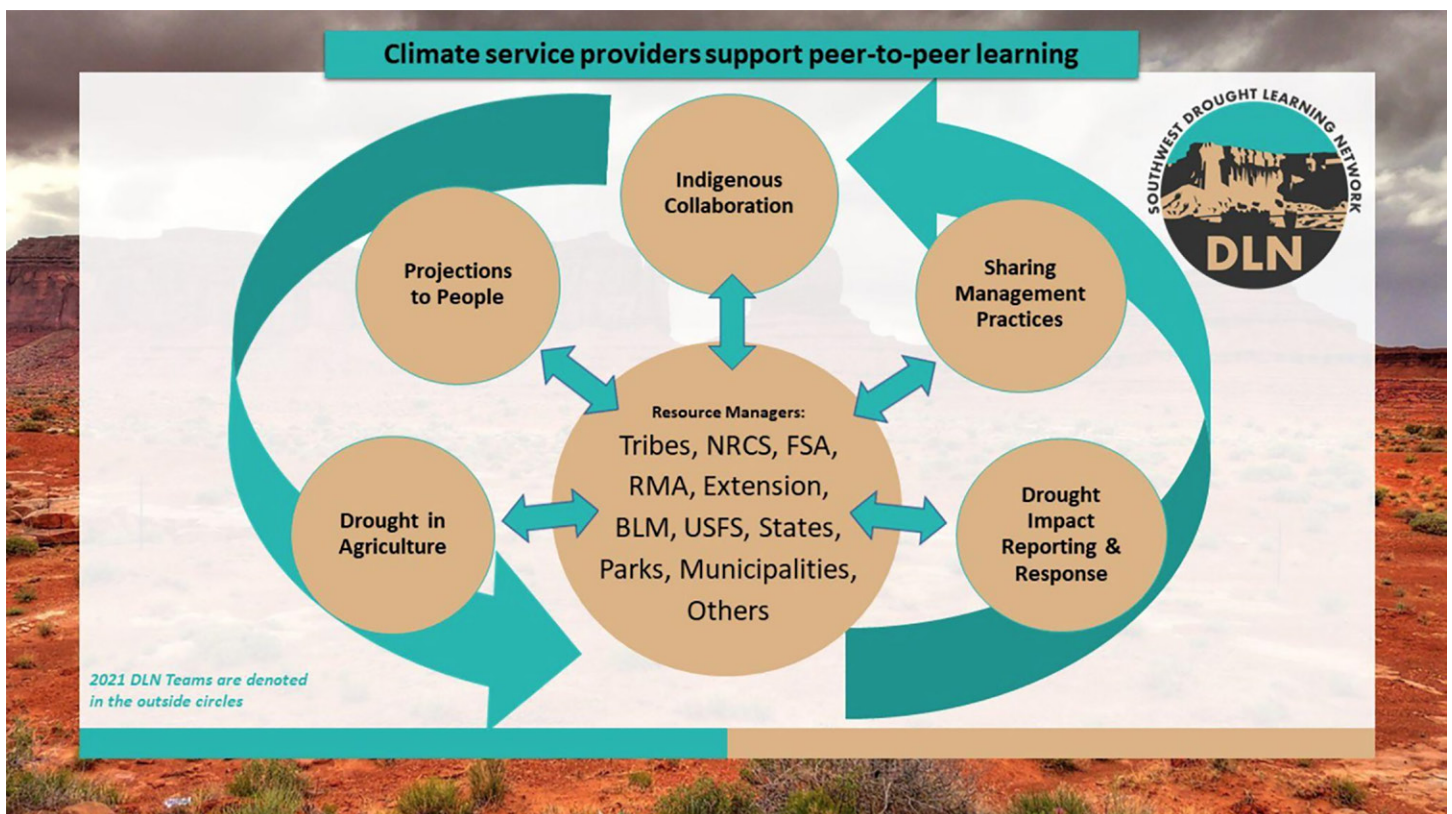


Fig. 1. 2021 Southwest Drought Learning Network self-directed teams designed to provide information to resource managers (central to all activities) and learn from resource managers about drought impacts and needs (internal blue arrows). Teams learn from each other via quarterly virtual meetings and in-person annual meetings (external blue arrows).

Within each team there is designated leadership that plans the scope of the work. Self-directed and formed team leadership created more empowerment among network members. Each self-led team hosts regular virtual meetings that are open to all DLN members. During the all-network quarterly and annual meetings, and in monthly emails, teams report activities and share requests. Members assume and rotate leadership roles while minimizing undue burden on a specific individual or organization.

**Lesson 3: Streamline communications.** At the second annual meeting, held virtually in March 2021, participants were asked about lessons learned over the course of the first year of the DLN. The need for improved communication stood out. DLN members reported occasions when they were unaware of another team's event and other instances where teams overlapped in their efforts. The DLN took three concrete actions to bolster internal communications: 1) provide monthly email communications with team reports and upcoming events, 2) utilize a shared communications platform, and 3) designate one person from each team as the communication liaison to update the team activities on the shared platform calendar. Since these changes, communications continue to improve within the network.

**Lesson 4: Acknowledge the iterative process.** During the first year, we learned as a community that network flexibility best serves regional needs. Some teams have a discrete goal, which when completed, leads to the revision of the team. One example of this occurred within the *Water in Utah* team. That team was initially envisioned to increase drought monitoring and reporting in Utah. During the first year of the DLN, the team worked with Utah resource planners to conceptualize, develop, and host a workshop designed to build drought monitoring and reporting. Following the successful workshop, organizers realized the need for similar workshops in other states. Thus, the *Water in Utah* team transitioned to a *Drought Impact Reporting* team to better serve regional needs in subsequent years. The iterative, flexible, and agile framework continues to guide DLN teams, with internal leadership and the flexibility to dissolve, refine, and launch new teams as needs arise. With this approach, the DLN allows for flexibility and adaptability.

### **Network activities and impacts**

The network is young, and progress was slowed by pandemic-related travel restrictions. Therefore, the intended impacts of the DLN are only recently starting to be realized, but progress has been made to serve multiple gaps (Table 1). Three examples of network activities and impacts are included within this section. These are near-term efforts striving to meet long-term outcomes, and network impact evaluation will be a focus of the DLN in coming years.

The *Sharing Management Practices* team leveraged the CCAST framework to build and then distribute drought management practice examples by coordinating with managers to document, write, and distribute management practice stories. The team also participated in a 2021 program that linked federal interns with projects, leading to a team of 10 college interns from across the country assisting in case study authorship. Nine case studies have been published with three more under review. The hope is that sharing what worked within one community will foster resilience in another. The team also coordinates with the *Come Rain or Shine* Podcast that has created 15 drought-related podcast episodes since 2020.

A second broad impact of the DLN is that the network minimizes duplication and broadens communication. CSOs collaborate via the network to establish needed drought activities while minimizing individual effort. For example, monthly drought briefings are cohosted by the *Drought Impact Reporting* team and informed by the broader DLN. To date

the team has recorded and shared more than 20 drought briefings, which average 100 attendees and 230 postevent views each month.

The DLN afforded CSOs the opportunity to identify communities that may need targeted support. For example, there are programs to support farmers and ranchers in times of drought, but new farmers and ranchers may not be aware of these existing support structures. The DLN invited an existing organization, the Quivira Coalition's New Agrarian Program (Quivira Coalition 2022), to participate in the network with this particular community in mind. This collaboration manifested in annual drought education offered to the New Agrarian Program via the DLN.

## **Conclusions**

Despite creation weeks prior to the COVID-19 pandemic, the network succeeded through remote work. Streamlined communication, quarterly virtual meetings, team organization and leadership, and the increase in drought magnitude continued network momentum over the past several years. All work of the DLN occurs within self-directed teams that develop, continue, and dissolve based upon drought needs in the Southwest. NIDIS, SWCH, NDMC, and the other regional SCOs continue to provide leadership and drought information within the region, but the nimble organizational structure of the DLN offers the flexibility needed to collaboratively respond to drought needs in the hottest and driest region of the United States. While some examples of disaster networks exist (i.e., Fire Science Exchange Network), a multistate network focused on drought and fostering peer-to-peer knowledge exchange is novel.

There is more work to be done as drought continues in the Southwest. Potential growth opportunities for the DLN exist for both a broader, more integrated network of CSOs, RMs, and individual CSO efforts to build drought resilience in the region. Some of these opportunities include a drought reporter for RMs, a resource manager listserv, and an online library. One worthwhile challenge is in documenting the overall impacts of the DLN. For example, the network is designed to support peer-to-peer knowledge exchange but documenting which peer-to-peer interactions occurred because of the DLN and which of these built drought resilience is challenging. Nonetheless, collaboration and coordination have broadened member reach to underserved groups, knowledge of innovations, and understanding of RMs needs. The DLN helped teams secure additional support via a cadre of interns, successful funding applications, and resources for tribal outreach. CSOs are already reaching more people with less effort and partner fatigue in the Southwest via collaborative efforts of the DLN. Our aim is that CSO and RMs will be more effective in preparing for and responding to drought by collaborating through the DLN toward the vision of more resilient Southwestern landscapes and communities.

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