American Planning Association

Creating Great Communities for All

Falling Dominoes: A Planner's Guide to Drought and Cascading Impacts

An American Planning Association Report

CONTENTS

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American Planning Association
Creating Great Communities for All

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INTRODUCTION

Climate projections suggest persistent droughts over the continental United States that are longer, cover more area, and are more intense than what has been experienced in the 20th century (Fourth National Climate Assessment 2018). Unlike hurricanes, which have a clear beginning and end, drought is a slow on-set hazard and its effects are not felt at once and can only be partially anticipated. Further, drought has unique characteristics that exacerbate other hazards, like wildfire and flooding.

This guide makes the case for establishing drought as a priority for local planning. Planners are central in influencing land-use patterns and helping communities guide how development and redevelopment occur. Planners do this by planning at all scales, creating land-use regulations, and reviewing development projects. This provides opportunities to address drought.

Planners can use this guide to familiarize themselves with drought as a unique hazard and learn about the interrelatedness of drought to other hazards, which this document calls "cascading hazards." The guide examines drought's "cascading effects," including impacts on health, the economy, and more. Also included are "points of intervention," which is where planners can use planning tools to reduce risk to drought and its cascading impacts. The guide emphasizes the integration of drought into the network of local plans, like the comprehensive plan, and offers advice on how to consider drought and its effects in the risk assessment of the hazard mitigation plan. Finally, effectively communicating drought to the public and decision makers is highlighted.

Chapter 1 introduces concepts of drought, including definitions, impacts, drought monitoring, drought and climate change, and associated (cascading) hazards.

Chapter 2 highlights recommended practices for aligning and integrating drought into local planning, identifies barriers to drought planning, discusses the context and scale of drought, and outlines local planning interventions to address drought vulnerability.

Chapter 3 describes integrating drought into local government planning mechanisms and identifies five key areas of intervention to translate ideas into intentions and intentions into actions.

Chapter 4 outlines the Hazard Mitigation Plan, including conducting a risk assessment, developing a mitigation strategy, and identifying mitigation actions, considering future land use and examples of drought's integration into the Hazard Mitigation Plan.

Chapter 5 explores communicating drought with decision makers and the general public and describes overcoming challenges.

DROUGHT BASICS

In the most general sense, drought is a period of lower-than-average precipitation that results in a water shortage. According to the Federal Emergency Management Agency (FEMA), drought is a slow-onset hazard that can last for months or years. Droughts occur throughout the country, and in any year at least one region is experiencing drought conditions.

Unlike other hazards, drought is typically known as a creeping phenomenon because of its slow onset, which makes it difficult for a community to know when they are entering or leaving a drought period and how long it will last—months or years. Drought conditions often remain unnoticed until water shortages become severe and impacts become evident as they progress over time.

Drought is a relative condition, meaning its impacts are not the same from one community to the next. It's based on the amount of rain a region or community is used to receiving to meet their water needs. The amount of precipitation required in a desert area is not the same as in a humid environment. Therefore, it's important to understand how much precipitation a location normally receives, and at what point a deficit begins to affect the local environment and water resources that people depend on to meet their needs—what conditions define drought for your community or region. Drought and water planners use indices like the Standardized Precipitation Index and the Palmer Drought Severity Index to track dry and wet climate situations.

When nature fails to deliver expected quantities to a given area over an extended period, communities must make adjustments to secure adequate water supplies. How well they are adapted for periods of drought and prepared to adjust or recognize the need for adjustments before it's too late is a critical factor in determining the effects of drought. Those preparations provide a major opportunity for planning.

Drought as a Natural Hazard

Drought is a natural phenomenon that has unique characteristics that make it different from other hazards. First, drought does not have a uniform definition and its effects are relative to local climate and water availability. This means that drought will look different from one region to the next. Second, drought conditions are not consistent across scales. For example, crops may be failing due to lack of precipitation on farms, while water is still flowing from the tap in homes. Third, drought can cover large geographic areas with impacts that span multiple jurisdictions, states, and countries. Finally, most obvious drought impacts are nonstructural, resulting from reduced water availability. These factors result in economic losses but can also contribute to a decline in the quality of life, public health, or ecosystems over time.

Drought Impacts

Drought's effects vary based on circumstances and geography. In the western United States, where much water comes from snow gradually melting in spring and summer, and where extensive systems of reservoirs and water transport exist, cities may have longer lead time and more options for coping with drought. By contrast, in the normally wetter eastern part of the country, where water use depends more on surface water being regularly replenished, drought may have more immediate consequences.

The National Drought Mitigation Center maintains an online archive of drought impacts across many sectors, collected mainly from media accounts, called the Drought Impact Reporter. Searching the archive to see how drought has affected a particular spot over time can provide a valuable start for historic research.

- ***Water***: When water, in the form of precipitation—rain, snow, sleet or hail—isn't replenished, ground and surface water quality is impacted, and water isn't available for farming, manufacturing, or use in everyday activities, like bathing, cooking, and washing dishes.
- ***Health***: In addition to the effects on the quantity and quality of drinking water, drought can compromise food and nutrition and increase incidents of illness and disease. Drought is linked to increases in heat-related, waterborne, and cardiorespiratory illnesses, as well as mental health conditions.

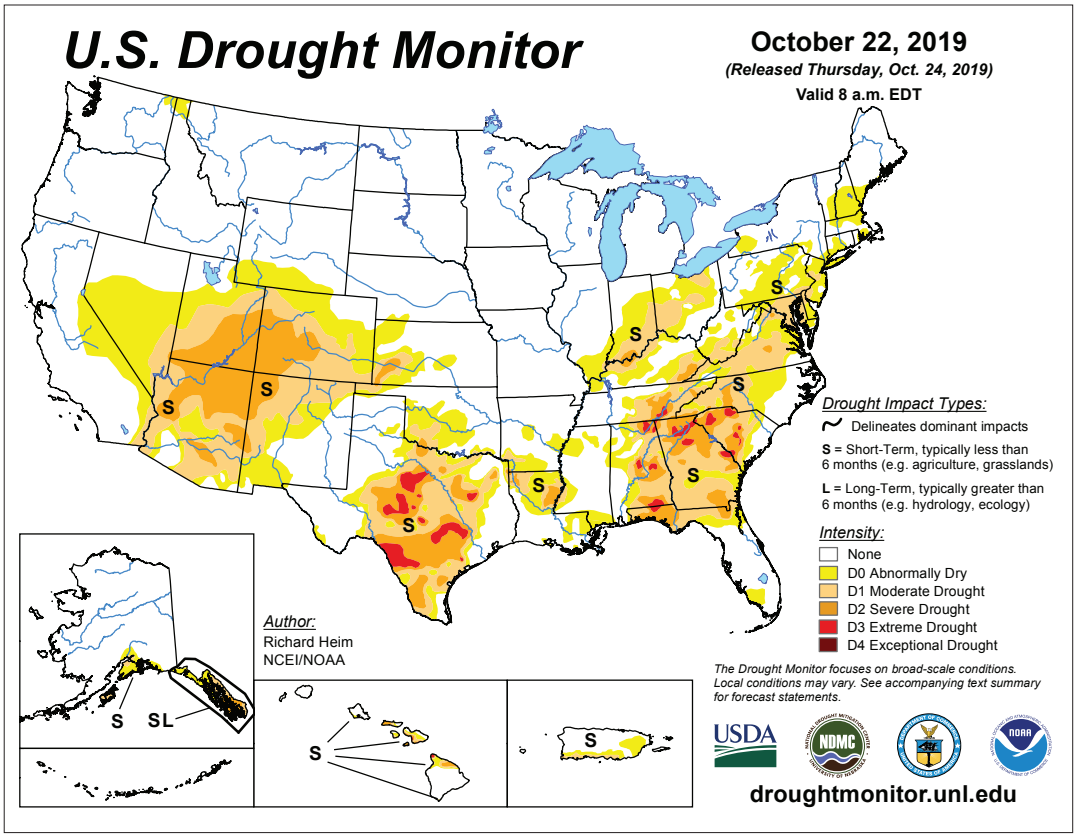


Figure 1. Managed by the National Drought Mitigation Center, the U.S. Drought Monitor is released every Thursday, and shows the parts of the United States that are in drought. Decision makers can use this map to trigger drought responses, such as water restrictions. Source: National Drought Mitigation Center

Decreases in water during drought can lead to reduced availability of electricity, and hospitalized and elderly people can be at increased risk for injury or death.

- ***Environmental***: In addition to water quality issues, low water levels resulting from drought have a significant impact on ecosystems. When water levels are low in lakes, rivers, and other water bodies, their ability to flush out contaminants diminishes, causing an increase in waterborne pollutants. Coastal areas experience saltwater intrusion when habitat is lost or altered due to drought.
- ***Built Environment***: While impacts to the built environment aren't as dramatic as those from other hazards, like wildfires, drought has a significant effect on buildings and infrastructure. When buildings are located on expansive soils, for example, the foundation can be compromised as soil moisture decreases and clay-based soils contract. Municipal water supply and delivery, municipal wastewater, transportation systems, and parks and recreational facilities are also impacted by drought. There may even be situations where water-intensive industries relocate and agricultural production shifts to different locations due to lack of water.
- ***Economic***: Water is essential to the production of goods and services and when the water supply is depleted or disrupted reduced productivity or closures can impact supply chains. Industries that are directly affected by drought include agriculture, recreation, energy, tourism, timber, and fisheries, among others. Drought can have wide-ranging impacts that include job losses, business failures, and lost investments.

Drought Monitoring

Another key component of drought planning is monitoring—knowing when your community is in a drought. Anyone planning for drought creates an operational definition based on one or more local indicators, such as a key stream gauge or reservoir level for municipal water supplies. Contact your local or regional water supply agency to learn about local indicators that define drought in your community or region.

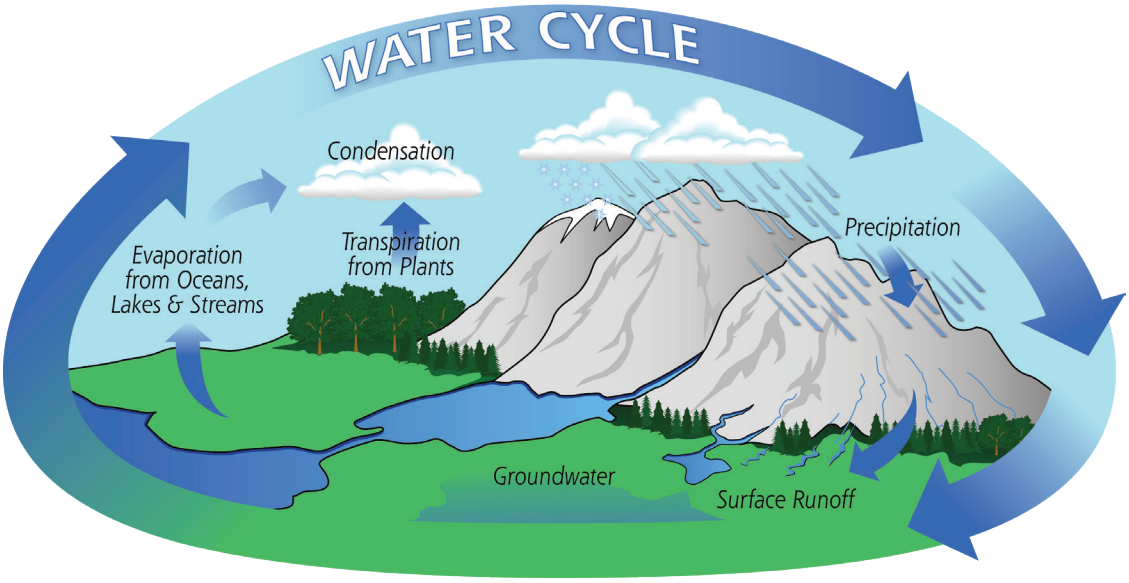


Figure 2. Water evaporates from land and sea and eventually returns to earth as precipitation—drizzle, rain, sleet, and snow. During extreme weather events like drought, when there is a shortage of precipitation, surface and subsurface water evaporate into the air. When rain does come, water runs off from the ground into rivers and streams with the soil remaining dry, leading to increased vulnerability to wildfire, among other effects. Paradoxically, warmer air holds more water vapor, which can lead to more intense rainstorms—causing flooding, mudslides, and cascading impacts. Source: NASA, FLICKR (CC BY 2.0)

The U.S. Drought Monitor is the most visible way to tell when your community is in a drought, but its broad-brush depiction is not detailed enough for local decision-making by itself. Since the Drought Monitor is released every Thursday, it is a useful for monitoring and triggering drought responses. It is often used by water utilities who typically monitor reservoir or groundwater levels or streamflow rates at certain points to gauge their water supplies.

Farmers, ranchers, and other land managers often have their own rain gauges and pay close attention to the levels of their irrigation and domestic wells. Requests for water conservation may be pegged to certain thresholds or triggers, that is, when water reaches or falls below a certain level or rate.

Drought and Climate Change

Nearly every climatic region on the planet experiences variation—some years are wetter, and some are drier—and climate change is making the extremes more frequent and more pronounced. Municipal water providers may ask people to curtail water use, farmers may irrigate more or sell their water to cities, fish and wildlife may lose habitat, and outdoor recreation may suffer.

Many regions and sectors across the United States already experience significant impacts from climate change effects, and many of these are projected to increase. By the middle of this century, annual losses in the United States due to climate change could reach hundreds of billions of dollars (Fourth National Climate Assessment 2018).

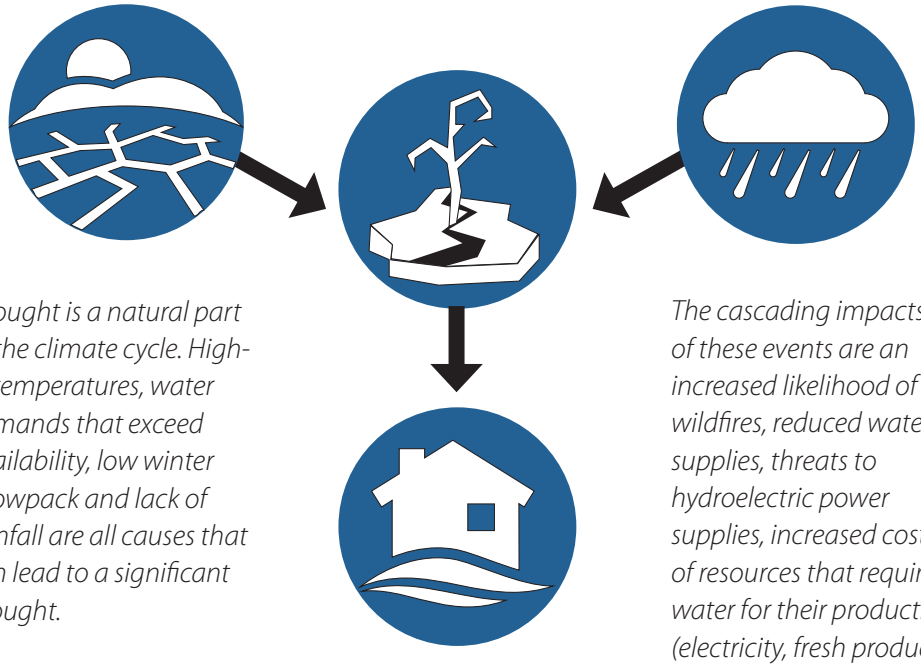
Climate change has increased precipitation in some areas and contributed to drought in others.

Drought and Cascading Hazards

Natural disasters don't necessarily happen in isolation. When different natural hazards overlap, such as a drought and a flood, or when one follows another closely in time, it can lead to cascading hazards, with the second event compounding the first one. Drought is particularly likely to be part of a cascading hazard because it can cover a large area and go on for a long time.

Drought and Cascading Impacts

Natural hazard events do not necessarily happen in isolation



Drought is a natural part of the climate cycle. Higher temperatures, water demands that exceed availability, low winter snowpack and lack of rainfall are all causes that can lead to a significant drought.

The cascading impacts of these events are an increased likelihood of wildfires, reduced water supplies, threats to hydroelectric power supplies, increased cost of resources that require water for their production (electricity, fresh produce, etc.), crop losses, and possible economic and job losses in the energy, agricultural, mining, tourism, recreation, and fishing industries.

Figure 3. Source: Federal Emergency Management Agency

How Can My Local Government Reduce My Risk?

- ✔ Develop improved drought monitoring and early warning systems
- ✔ Develop a drought emergency plan
- ✔ Develop agreements for secondary water sources that may be used during drought conditions
- ✔ Develop water retention and detention structures
- ✔ Provide tax credits for low-flow and increased efficiency infrastructure for residents and developers
- ✔ Harvest rainwater
- ✔ Require water conservation during drought conditions
- ✔ Retrofit water supply systems to improve efficiency and minimize leaks
- ✔ Educate the public on water saving practices
- ✔ Incorporate permeable surfaces into future design plans
- ✔ Prevent overgrazing

2012 Drought in Nebraska

The 2012 drought that included much of the Central Plains region was one of Nebraska's worst droughts in modern history (along with the multiyear droughts of the 1930s). At its peak, the entire state was in some level of drought, according to the U.S. Drought Monitor (2018). One of the main factors that made the 2012 drought historic was the associated extreme heat. That year was the driest and hottest on record for the state of Nebraska (based on 118 years of record) (Fuchs et al. 2015). Seven locations within the state set new high temperature records, ranging from 105 to 115 degrees Fahrenheit. The combination of drought and high temperatures caused crop losses, biodiversity loss in streams, and higher water demands reducing supplies and strained community infrastructure, leading to water main breaks and well pump failures.

Drought and Extreme Heat

Drought and extreme heat often occur together; a drought can make a hot day hotter, while a heat wave can make dry conditions even drier (Kaplan 2015). Periods of extreme heat increase evaporation, leading to reduced water availability in soils and surface water supplies. Furthermore, periods of drought can cause extreme heat due to lack of water in the atmosphere, soils, and rivers, where decreased water availability in the system reduces the amount of evaporation happening at the surface, which cools the ground and ambient air. With reduced evaporation, temperatures can quickly increase, leading to periods of extreme heat (Mazdiyasni and AghaKouchak 2015). Furthermore, extreme heat can increase water demands, in which human activities can reduce water supplies leading to human-caused drought (EPA 2015).

Extreme heat affects both the environment and society. In terms of health, extreme heat alone can increase the likelihood of experiencing heat stroke, respiratory illness, cardiovascular disease, and dehydration (Climatenexus 2018). An increase in crime has also been reported, along with reduced energy production (McGregor et al. 2007). In terms of environmental impacts, drought and extreme temperatures can affect aquatic habitat and animals by reducing stream and reservoir levels and increasing water temperatures, resulting in loss of aquatic life. The combination of reduced soil moisture and heat stress can also be especially hard on trees, crops, and other vegetation (Castillo et al. 1997).

Drought and Wildfire

Although wildfires can occur during normal conditions, concurrent periods of drought and extreme heat create conditions that increase the likelihood and intensity of wildfires. Decreased soil moisture and increased temperatures stress vegetation and increase plant mortality, providing fuel for fires (USDA 2016). Reduced ponds, streams, and reservoir levels can also limit withdrawal sources for fighting wildfires. The extreme conditions can also increase the likelihood of shrub and tree mortality by wildfire in previously fire-adapted ecosystems, in addition to habitat and infrastructure losses and threats to animal and human life (Stephens et al. 2018).

Researchers have found an increasing trend (from 1984 to 2011) in the number of large fires or total large fire area per year over the western U.S. (WMA 2018). The trends were most significant for southern and mountain ecoregions, coinciding with trends toward increased drought severity. The increase in wildfires is also being attributed to a spike in air pollution across the West.

2017 U.S. Wildfire Season

In July 2017, the U.S. national fire preparedness level was a five (on a scale of one to five) (WMA 2018). At the end of July, 90 large fires had burned nearly one million acres within 14 states. Hot and dry weather conditions in several of the states caused extreme fire behavior, affecting large fires in California, Nevada, Oregon, and Idaho and forcing many towns to be evacuated.

Figure 4. The Mud Creek landslide near Big Sur, California, dumped about six million cubic yards (five million cubic meters) of rock and debris across California Highway 1 on May 20, 2017. Two weeks prior to the collapse, workers in the state's transportation department had noticed small mudslides and closed the highway as a precaution. The damage took more than a year and $54 million to repair. Source: NASA Earth Observatory

Drought and Flooding

Drought, along with wildfires and land subsidence that can both stem from drought, can all increase flood risk. Extended drought and wildfire can stress and reduce the amount of vegetation. When it does rain, the reduction of vegetation can increase flooding due to faster runoff rates, compared to normal conditions when abundant vegetation slows runoff and increases water absorption into the ground (Castillo et al. 1997).

The area where a wildfire has taken place will also be covered in ash rather than bare soil. Ash material is water-repellent compared to bare soil and combines with the bare soil over time (MacDonald 2018). After the mixing of bare soil and the water-repellent ash, the new topsoil layer will not absorb precipitation as well as bare soil under normal conditions. This new topsoil layer, along with reduced vegetation, can increase runoff rates and quickly lead to a flooding event. This is especially true when wildfires burn in hilly or mountainous areas where the hillside gradient and increased runoff rate produce fast moving water down toward the lower elevations.

Flooding can also be caused by land subsidence, a sinking of the ground's surface with little or no horizontal motion, which can become greater during drought conditions. Subsidence changes the elevation of the ground surface, which can change surface water runoff patterns or alter floodplains. This can lead to flood events in areas that did not have flooding issues before the subsidence (Wanamaker 2018).

2010 Fourmile Canyon Fire Near Boulder, Colorado

The Fourmile Canyon Fire in Boulder County, Colorado, burned 10 square miles (23 percent of the watershed) in early September 2010 (USGS 2012). The following year the U.S. Geological Survey (USGS) analyzed water flow and quality samples on Four Mile Creek to better understand wildfire's effects on water quality. What they found is that heavy rainfall events in July 2011 resulted in peak streamflow that was three times greater than previously recorded from similar thunderstorms, producing short-term flash floods. The study also revealed significant effects to water quality. During and after high-intensity thunderstorms, turbidity, dissolved organic carbon, nitrate, and some metals increased by one to four orders of magnitude within and downstream of the burned area.

Apart from the physical infrastructure losses and threats to public safety associated with flooding, drought or wildfire conditions prior to flooding can also cause water quality deterioration from the increased soil and ash particles in the runoff. On farmlands, drought conditions prior to flooding may also cause a surge of farm chemicals applied to crops to enter streams through runoff (Love 2013). These factors can affect the water quality for aquatic life, animals, and humans who are all dependent on the water source.

Drought, Landslides, and Mudslides

A landslide, in this case, refers to any mass movement of earthen material, including rock falls, slope failures, mudflows, and debris flows. There is not necessarily a direct cause and effect from droughts causing landslides. Rather, droughts can indirectly cause land and mudslides through a cascade of natural hazards. For example, as described previously, drought can cause dry conditions and increased fuel loads for wildfires which, in turn, can increase the likelihood of flooding. The ash-infused topsoil, which is water repellent, and loss of vegetation can increase runoff and take large amounts of earthen material with them, causing devastating impacts to populations in the path of the landslide event (MacDonald 2018).

These landslide and mudslide events have the potential for causing the loss of infrastructure and life. From an environmental standpoint, they may also affect the water quality of downstream rivers and streams and the habitat for both land and aquatic flora and fauna. They also alter the topography of the landscape, which can modify surface and ground water flow patterns (Sassa and Canuti 2009).

Drought and Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the earth's surface because of subsurface movement

2018 Montecito, California, Debris Flows

On January 9, 2018, a debris flow hit the town of Montecito in Santa Barbara County, California. This landslide claimed the lives of 20 people, destroyed more than 500 homes, and caused more than $400 million in damage. The Montecito disaster "wasn't just about drought; it wasn't just the fire; it wasn't just the rain. It was the compound effect" (Hayden 2018). Years of drought created dry conditions which led to 2017 being the most destructive wildfire season in California's history. This included the Thomas Fire in December of 2017, which was the largest wildfire in California history and included Santa Barbara County. In the early hours of January 9, an estimated 0.5 inches of rain fell within a five-minute period on the burned landscape, causing mud and boulders from the Santa Ynez Mountains to flow down creeks and valleys into Montecito. The debris flows were up to 15 feet high, containing mud, boulders and tree branches moving at estimated speeds of up to 20 miles per hour into the lower areas of Montecito. The fire-affected landscape reduced rainfall infiltration and facilitated formation of the debris flows (MacDonald 2018).

of its materials (Galloway et al. 1999). Drought does not typically cause land subsidence directly; rather, a leading cause of land subsidence is over-pumping groundwater supplies, which often occurs during drought periods. When water is removed from the ground, the water pressure is subsequently reduced. Without the water to hold up the weight of the soil above it, the land surface subsides, and the aquifer layers become more compact, resulting in an overall reduction in the pore space of the soils. Some aquifer systems can "rebound" if water is pumped back into it; however, more often than not, this vertical deformation results in permanent changes to the aquifer system (Wanamaker 2018).

Land subsidence can occur from groundwater pumping during normal, non-drought periods. However, a drought and the increase in pumping can cause land subsidence to take place at a faster rate. Land subsidence occurs in nearly every state in the United States to some degree, and its effects fall into two categories: those on infrastructure and those on natural systems (USGS 2017a). According to the USGS, subsidence can directly damage roads, railways, bridges, pipelines, buildings, and wells. The delivery of water through conveyance structures (canals) that are designed to transport water by gravity can also be reduced by even minor gradient changes resulting from land subsidence. Natural system effects include loss of aquifer storage and topography changes, which can cause changes in water drainage, streamflow, and erosional/depositional patterns.

The San Joaquin Valley, California

The San Joaquin Valley in California has a historical land-subsidence problem that dates back to the 1920s, due to excessive pumping of groundwater for agriculture (USGS 2017b). From the 1920s to the 1970s, the land had subsided more than one foot, with some areas seeing as much as a 28-foot decline in elevation. During times of reduced water availability due to drought (i.e., 1976–1977, 1986–1992, and 2012–2015), groundwater pumping increased, leading to additional subsidence. The resulting land subsidence reduced the freeboard (the measurement from the maximum water level to the uppermost portion of the channel) and flow capacity of the Delta-Mendota Canal—as well as the California Aqueduct and other canals that transport floodwater and deliver irrigation water—requiring expensive repairs.

CHAPTER 2: DROUGHT RESILIENCE PLANNING: RECOMMENDED PRACTICES

Hazards are occurring more frequently, with increasing severity. Drought isn't just an isolated natural hazard with just a handful of minor impacts; drought can precipitate, worsen, or create the conditions necessary for a wide variety of other natural hazards, like wildfire, mudslides, and flash floods. For many planners, drought may seem to be one of the more challenging natural hazards to effectively plan for; yet, given its clear impact on local communities, planners are in a unique position to influence solutions to drought vulnerability through planning.

Resilient communities think about risk and vulnerability to hazards—in this case, drought and cascading hazards—and integrate solutions through everyday planning tools. Integrating drought mitigation considerations into routine planning processes is an effective way to set systems in place and build community resilience and facilitate a more rapid recovery from drought and accompanying hazards.

Aligning and Integrating Drought Mitigation Into Local Planning

The key to ensuring that drought is addressed by local governments is through plan integration. Hazards should not be exclusive to a hazard mitigation or emergency response plan, but deeply integrated into the elements of a comprehensive plan, a zoning code, and other related plans and policies that are used locally. Drought integration is no different. Given drought's relationship with associated hazards such as wildfire and flash floods, integration is essential to the health and well-being of communities.

There are several ways to ensure alignment between local planning and drought mitigation. A community may already be taking on hazards that are closely related to drought. It is important to remember that drought isn't simply an isolated hazard where governments issue water restrictions to respond to drought impacts. Drought is deeply related to a host of other natural hazards that may be high on the community's list of priorities.

If your community is already planning for wildfire or taking mitigative actions in the wildland-urban interface, which is a zone of transition between wildland (unoccupied land) and human development, then your community is acting to address a hazard closely linked with, and often worsened by, drought. Given the connection to potential drought impacts, in the form of related natural hazards or water conservation standards,

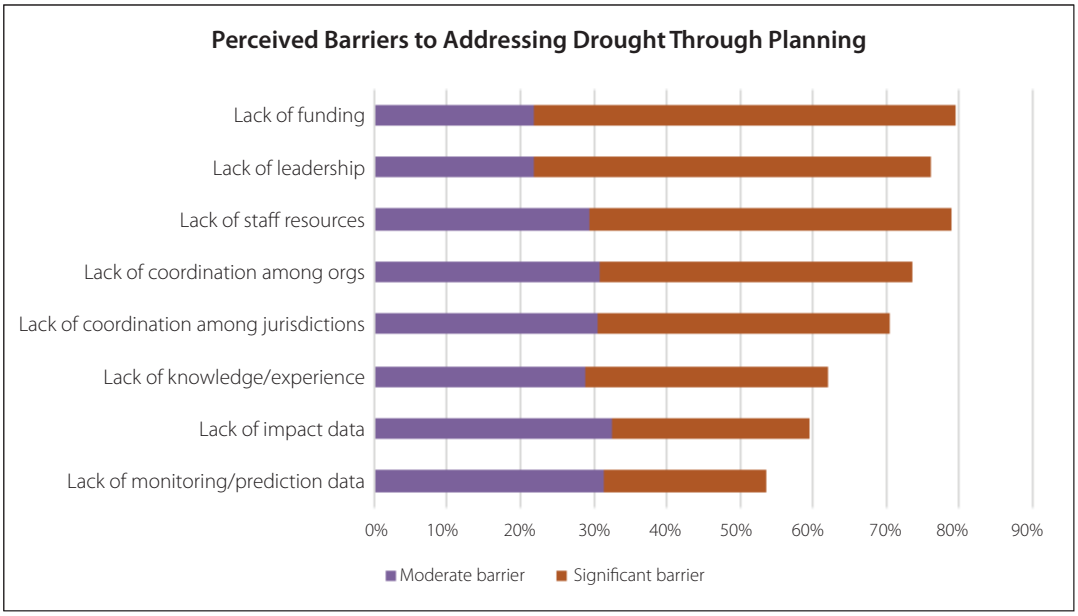


Figure 5. In a 2018 survey, APA members identified the biggest perceived barriers to addressing drought through planning. Funding needs include resources for implementing mitigation actions and for developing a plan. Source: APA

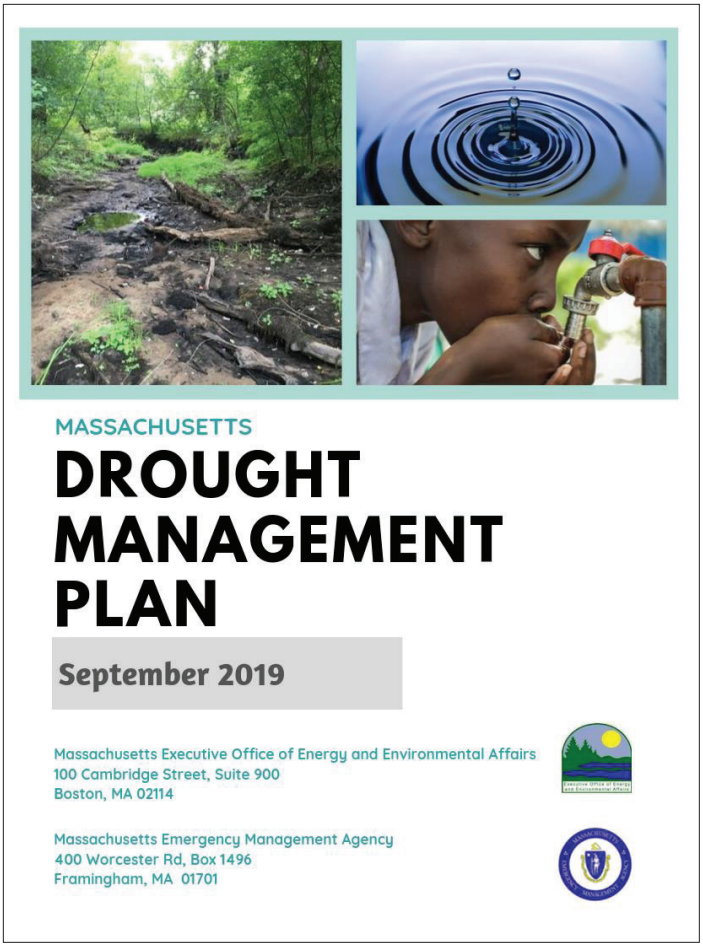


Figure 6. The State of Massachusetts Drought Management Plan includes information on drought indices, responsible state agencies, and the role of local governments in mitigating, planning for, and responding to drought. Source: State of Massachusetts

these policies can be a foundation upon which more robust drought mitigation planning efforts can build.

Addressing Barriers to Drought Planning and Integration

In 2018, the American Planning Association and the National Drought Mitigation Center surveyed APA's membership to assess planners' knowledge of drought and local attitudes toward mitigating drought through a long-term risk reduction lens. The survey identified barriers that are well known to practitioners. As the list of what planners are asked to plan for expands, so too do gaps in knowledge. Yet familiarity with these barriers also means that planners have likely developed strategies and tactics for coping with resource limitations, maneuvering around barriers, and facilitating those key connections that effect change. These skills are essential items in the planner's toolkit. Barriers to effective planning tend to be heightened when considering natural hazards, and perhaps even more so when planning for drought. According to the survey, barriers to more integrated drought planning include:

- Funding
- Staff capacity and resources
- Lack of knowledge about drought
- Demands of interdepartmental collaboration
- Difficulties in cross-governmental collaboration with federal, state, regional, and other local entities
- Little understanding of drought (and its related hazards) among the public
- The distinct lack of a drought onset in contrast to other natural hazards
- Diffuse and difficult to understand impacts
- Drought's relationship with other natural hazards like wildfire and flooding

The State of Colorado Water Conservation Board has developed a robust Drought Planning Toolbox of drought information, direct guidance for local municipalities for their drought planning efforts, water supply and drought monitoring indices, and potential funding mechanisms for local drought planning activities. Colorado Water Conservation Board's resources also include a Municipal Drought Management Plan Guidance document. It's a tool that water providers and local governments can use in developing local drought management plans.

Establishing Context and Scale

Given the regional (and supraregional) scale of drought, it can be difficult to establish just how it can specifically impact your community. Therefore, understanding your local context and thinking about how drought can impact people, property, the local econo-

my, natural resources, and the built environment is the key to addressing it.

Repurpose Existing Plans and Ongoing Efforts

If your community is in the midst of a comprehensive planning effort, this can be the perfect opportunity to incorporate drought considerations into your work. Existing and recently updated plans can help in this effort as well. This basic information gathering can help to establish a frame of reference for understanding and contextualizing drought information and data that will come later.

Think Multi Hazards

Establishing context also includes developing an understanding of the other natural hazards that may threaten your community. This is particularly important with regard to hazards that can be worsened by drought conditions.

- What is the local wildfire and flood risk?
- Are there any historic fires or floods for you to reference? What were their impacts? Were these floods and wildfires preceded by drought?
- Are parts of your community in the wildland-urban interface or a flood zone?

This effort doesn't need to end in a comprehensive understanding of localized drought vulnerability. It can, however, help planners consider the community context from the perspective of drought impacts.

Looking for Guidance

In our conversations with planners, accessing, interpreting, and using hazards-related data and information was identified as a major barrier. This seems to be a particular stumbling block with regard to drought-related data. These anecdotal reports were also borne out by our survey findings. There are reliable sources of drought data and information that are useful on the local level. Additionally, planning efforts undertaken at larger scales, such as county, river basin, or state, may be help communities interpret this data in a local context.

State and Regional Plans

Drought data can be challenging to find at a local scale, although the National Drought Mitigation Center's (NDMC) Drought Risk Atlas, the U.S. Drought Monitor or Drought.gov are good places to start. Data on drought impacts are also challenging to find, although State Hazard Mitigation Plans include descriptions of drought risk, impacts, and more. Your local water utility

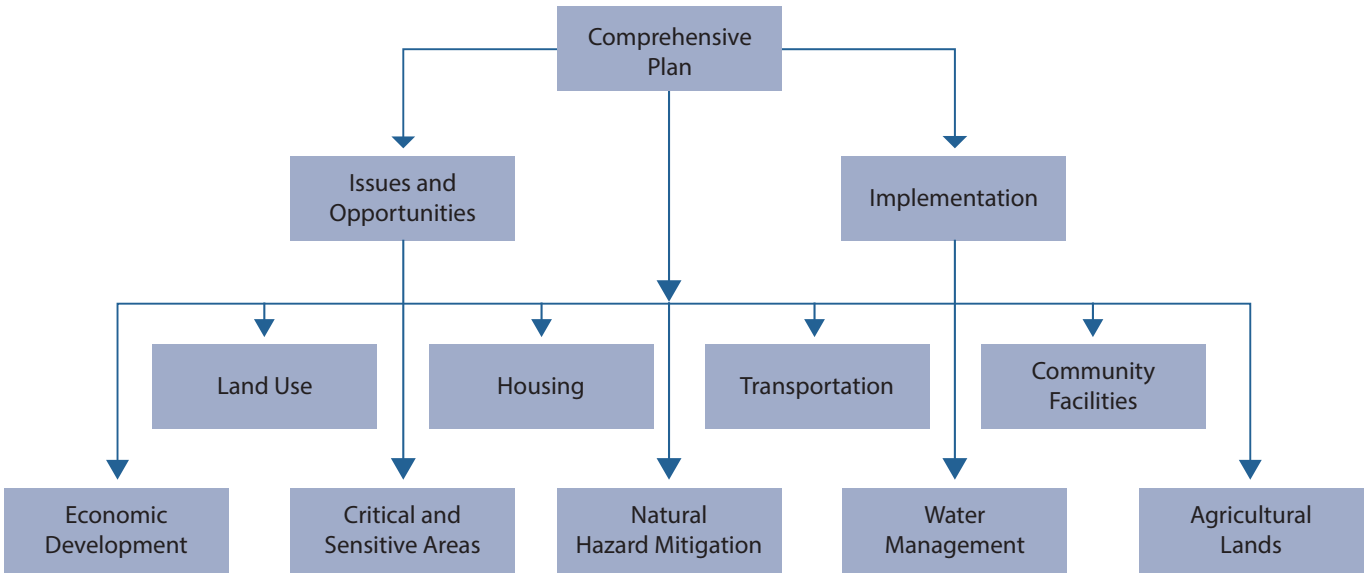


Figure 7. Hazards impact the built environment; therefore, drought and cascading hazards should be integrated into the comprehensive plan and addressed in integrated context in all community plans. Plan integration means that regulations, policies, codes, plans, and programs consider hazard mitigation and leverage opportunities to reduce risk between and among planning efforts. Source: APA

or state climatologist may be able to provide insight on either locally relevant climate data or drought impact data. These efforts to scale down drought and impact data can point the way forward for planners to more substantively address drought in their local planning efforts. Strategies for achieving this include:

- Looking for guidance in state or regional plans, policies, or initiatives that provide more actionable information for local communities
- Drawing inferences from the available information and assessing local risk based on the community's particular context within the drought region

Many states have stand-alone drought plans, and an increasing number address drought in multi-hazard, water or other plans. Regional plans are sufficiently broad so as to incorporate regionally scaled drought data, but also specific enough to provide actionable guidance to local municipalities. If relatively up to date, these plans can provide data and information relevant to the context of your region.

The NDMC maintains an updated and comprehensive list of state drought plans. This list also includes emergency management and state water management plans that include a drought element or focus.

Regional Water Authorities and Local Water Management Districts

Resilient communities build upon existing efforts and develop linkages across jurisdictions, organizations, and scales. Utilizing data and information developed by water resource management agencies is critical to understanding and planning for drought locally.

Regional water authorities and management districts are essential to understanding potential drought actions and planning efforts that can be undertaken locally. They are likely to have a comprehensive understanding of water supply, distribution, access, and the impacts of drought upon the system as a whole. Local water management districts may be critical in understanding local water infrastructure and in establishing the links between stormwater management and drought. These plans and resources are likely to have undergone a robust process of data gathering and assessment and can be a reliable and useful source of data and information for local planning purposes.

The Nevada Water Authority's 2018 Water Resource Plan and Budget

This is an example of how the plans of a regional water authority may be beneficial in local planning efforts. The plan outlines for the region:

- Current water supply
- Potential future impacts
- The influence of climate change upon water resources and drought
- Impacts of the regional economy upon water supply and natural resources
- County population projections and their impacts upon regional demand

While this information will need to be interpreted in the local context, it does represent a valuable source of ready-made, contextually appropriate, and rigorously applied data. It likely doesn't require significant number-crunching or processing. This can be enormously useful to planners, particularly when they try to integrate drought resilience, mitigation, or adaptation into local plans and procedures. Seeking out what is already there will enable you to focus on the planning measures your community can take to mitigate drought and its impacts.

Five Strategic Points of Intervention

Although reducing the effects of drought and its cascading impacts is challenging, planning tools and strategies that are commonly used by planners offer opportunities to mitigate drought and its cascading impacts. During day-to-day government operations, planners engage in many activities, but those that are key to planning functions that offer the greatest potential for making a difference include five central areas: visioning; plan making; standards, policies, and

incentives; development work; and public investments (Klein 2011). These comprise the strategic points of intervention, or areas where planning processes translate ideas into intentions and intentions into actions.

Visioning

Visioning is a community activity intended to produce a common vision, accompanied by goals, for the future. Ideally, it is broadly based and highly inclusive in order to achieve, if not consensus, then at least widespread buy-in among the various stakeholders and subgroups within the community. Visioning and goal setting are often the first steps in a comprehensive, subarea, or functional planning process.

When undertaking visioning exercises, planners can advance the integration of drought and water resource issues into long-term community plans. When community residents are made aware of how drought and water resource mitigation fit into the overarching community vision, they are more likely to support efforts to address drought vulnerability.

- Effective visioning may help expand the window of opportunity to marshal support for change.
- Achieving a meaningful vision to enhance resilience typically requires effective direction and a solid framework for transforming ideas into action.
- The vision of the future of the community should somehow relate to policies already in place or be added to the existing comprehensive and other plans the community has adopted.

Plan Making

Planners lead, facilitate, and participate in a wide range of plan making processes, including the local comprehensive plan and various types of subarea and functional plans. Plans identify priorities, set goals, and define strategies to achieve goals. Planners use different plan types for a variety of purposes.

- ***The Comprehensive Plan.*** Some plans may specifically address drought, while others address hazards more generally or focus on climate in a broader sense. The comprehensive plan is likely the planning scale at which planners feel most comfortable. It is also the primary document out of which other local plans, policies, and processes are expected to flow. Therefore, as a foundational document for the community, integrating drought and cascading hazards into the comprehensive plan can pay dividends for subarea and functional plans.
- ***The Climate Adaptation Plan.*** The value of a climate adaptation plan is that it identifies the primary risks of climate change in a community and outlines the steps to adapt to those risks. The plan has the benefit of providing a local context for global and regional data. The question of downscaling impacts—extrapolating local projections from a regional or global climate model—can be challenging. The climate adaptation plan provides some context for these impacts at the local scale. Presumably, this would provide the same kind of context for drought impacts (and wildfire, flood, etc.) in a variety of plans and processes.
- ***The Hazard Mitigation Plan.*** Given that each state has a FEMA-approved Hazard Mitigation Plan (HMP) and considering that nearly 87 percent of the nation's population lives in a community with a current mitigation plan, the HMP is an ideal plan to use to address drought to reduce future risk. The next chapter provides details on addressing drought in the HMP.
- ***Water Management Plans***. Water Management Plans provide information about current water uses and chart a course for water efficiency improvements, conservation activities, and water-reduction goals. U.S. Environmental Management Agency Water Management Plans include emergency and drought contingency plans that describe how the community will meet water needs during a drought. This information can be used to target sites that have or may have water availability risks to help prioritize sites for water-efficiency projects.

Standards, Policies, and Incentives

Planners write and amend standards, policies, and incentives that have an influence on what, where, and how land and buildings get preserved (McCann and Rynne 2010). Zoning, subdivision regulations, design guidelines, landscaping, and building codes are some of the "carrots and sticks" that can be used to build communities of lasting value (Klein 2011).

The Zoning Code and the Subdivision Ordinance. Zoning ordinances and subdivision regulations can be used to implement comprehensive plan policies and goals that relate to drought mitigation and water resource management. Land-use regulations and design guidelines can be used to protect water sources or require subdivision and site designs that minimize stormwater runoff and water pollution. Ordinances can lower development density in aquifer recharge areas and reduce water leakage and pressure loss by reducing the separation of residential units. Performance standards for water use and wastewater disposal are increasingly more common, especially in response to drought conditions in the western states (Cesanek, Elmer, and Graeff 2017).

Although there can be pressure to locate new development in areas that are known to be at risk from hazards, communities must balance competing interests when reviewing proposed developments that advance economic development and public safety. Methods communities use to address development pressure include cluster subdivisions, density bonuses, and transfer of development rights.

Landscaping Regulations. Landscaping regulations establish minimum standards for the amount and types of landscaping, the location of landscaping, buffer and screening standards, and fence requirements, among others. Many also include standards for tree preservation, water efficiency and conservation, and low-impact development (Colorado 2017). These standards reduce risk to drought and offer co-benefits, meaning they can also address vulnerability to other hazards that impact local communities.

Landscaping regulations help reduce risk to drought. Landscaping reduces the amount of impervious surface on a site, allowing replenishment of groundwater supply. Designating appropriate plant species for a dry climate can improve the water efficiency of a site, which is important during periods of prolonged drought (Colorado 2017).

Development Work

Planners play an important role in the development of their community. Planners often have opportunities to influence the outcomes of development or redevelopment projects. They can serve as leading team members on public-private partnerships that result in new development or redevelopment, and they take a leading role in reviewing and making recommendations on a wide variety of private development plans.

Providing input on more sustainable designs for new development, especially where there are water resource constraints, rather than assuming the water and sewer utility will take care of whatever is needed, is essential early in the planning process. The plan review process has many opportunities to share information about more sustainable water management with project developers and ensure that performance standards and resource limits are respected. Approaches include nonimpervious cover requirements, on-site stormwater management, stream buffers, wetland protection and enhancement, and on-site or district wastewater reuse (Cesanek, Elmer, and Graeff 2017).

Public Investments

The local capital improvements program (CIP) is an important tool for planners, but it is often overlooked. CIPs include important public improvements such as sewer lines, water supply and storage facilities, and wastewater treatment facilities. FEMA considers CIPs as one of the primary vehicles through which structural hazard mitigation measures get prioritized and funded. FEMA identifies key benefits of integrating hazard mitigation into capital improvement plans including:

- It leverages funding to implement hazard mitigation measures.
- It helps ensure that public expenditures for capital improvements are consistent with hazard mitigation goals, objectives, and policies .
- It provides the opportunity to review and consider the impact of proposed improvements on hazard vulnerability, either directly or indirectly, through supporting private investment in land development.
- It helps guide new growth to safer areas.

CHAPTER 3: DROUGHT AND THE HAZARD MITIGATION PLAN: BUILDING SAFER AND STRONGER COMMUNITIES

FEMA defines mitigation as the effort to reduce loss of life and property by lessening the impact of disaster, and indicates that it's most effective when implemented under a comprehensive, long-term mitigation plan. The Disaster Mitigation Act (DMA) of 2000 outlines FEMA's mitigation planning requirements. The DMA requires state, local, and tribal governments to prepare an HMP as a precondition of receiving certain types of nonemergency federal hazard mitigation funding, with the goal of reducing disaster losses. Mitigation plans are based on assessments of hazards, vulnerabilities, and risks, which require public and stakeholder engagement and participation.

Because drought is a complex hazard, many local HMPs may not identify it as a hazard—and when it is identified, it is often not profiled or analyzed to the same degree as other hazards. Similarly, mitigation actions specific to drought are often lacking or limited. With expectations that drought and extreme weather events will occur more frequently and with greater severity in the future, local hazard mitigation plans should include a robust assessment of drought vulnerability.

The FEMA Local Mitigation Planning Handbook (2013) provides guidance on the requirements for local mitigation plans, which is applicable for both new and updated plans that are required every five years. Updated plans reflect changes in development, community priorities, and progress with mitigation efforts.

HMPs for states and tribal governments have their own requirements and regulations and differ in key areas. For example, considering the consequences of changing weather patterns on applicable hazards is required for state and tribal plans. Therefore, state and tribal governments' HMPs include a summary of the probabilities of future hazard events as well as changing future conditions. As drought is a hazard potentially exacerbated by climate change, it is often included and addressed more in-depth within state and tribal plans than local HMPs, thus making state plans a ripe source of drought information. Some state plans, particularly in the western states, consider drought as one of the most significant and far-reaching hazards. For example, Colorado and South Dakota have developed drought mitigation plans that function as hazard-specific extensions to meet the same criteria as HMPs.

Recommended Tasks for Developing a Local Hazard Mitigation Plan

(Based on FEMA's Local Mitigation Planning Handbook)

Task 1: Determine the Planning Area and Resources.
Task 2: Build the Planning Team.
Task 3: Create an Outreach Strategy.
Task 4: Review Community Capabilities.
Task 5: Conduct a Risk Assessment.
Task 6: Develop a Mitigation Strategy.
Task 7: Keep the Plan Current.
Task 8: Review and Adopt the Plan.
Task 9: Create a Safe and Resilient Community.

Hazard Identification and Risk Assessment

A key component of the multi-hazard mitigation plan is the Hazard Identification and Risk Assessment (HIRA). The HIRA process is conducted so that a community, state, or tribe can define, profile, and quantify risk. The HIRA determines impacts of hazards to a

FEMA's Recommended Steps for Conducting a Risk Assessment

1. Describe hazards.
2. Identify community assets.
3. Analyze risks.
4. Summarize vulnerability.

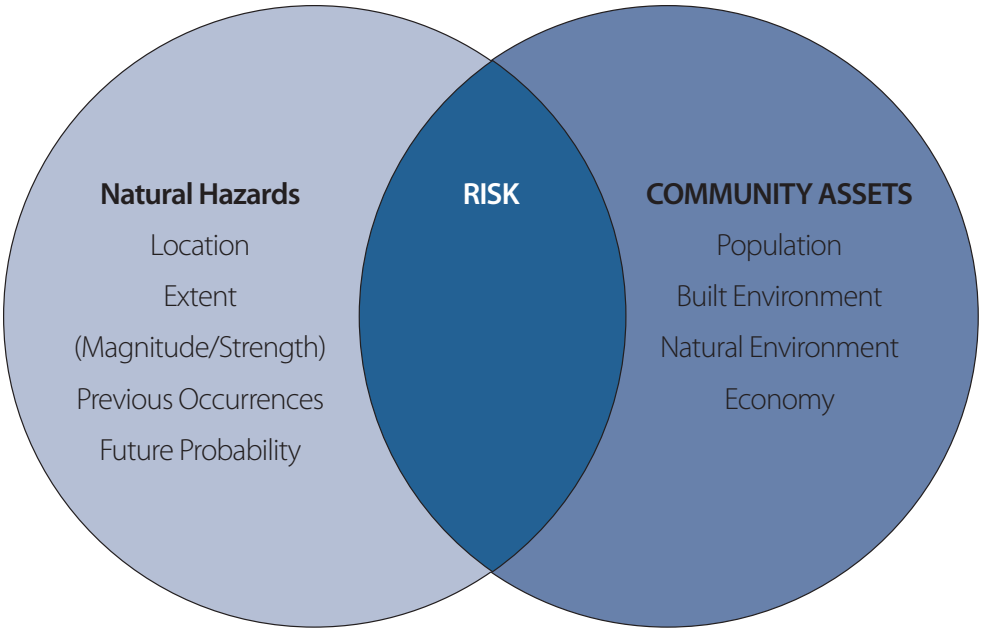


Figure 8: FEMA uses this diagram to illustrate the concept of risk and the relationship between hazards and community assets. Source: Adapted from the USGS and the Oregon Partnership for Disaster Resilience Models

community in terms of affected buildings, critical facilities and infrastructure, populations, economy, and the natural environment. The HIRA provides a foundation for the rest of the mitigation planning process, upon which mitigation actions can be based and prioritized to reduce risk to hazards. In a broader context, the HIRA can inform emergency preparedness and response priorities and plans, comprehensive plans, and overall decision making.

The Local Mitigation Planning Handbook contains key definitions and terminology related to the risk assessment phase. Overall, this risk assessment portion of the mitigation planning process can be summarized into four key steps shown on page 19.

Local HMPs should describe drought in the local and regional contexts, including considerations of possible impacts on populations, the built and natural environment, and the economy, followed by analyzing vulnerability to these assets and arriving at overall risk that water scarcity and cascading impacts from drought can cause in a community as described in Chapter 1. In many instances, the drought vulnerability assessment in the HIRA is limited to impacts on agriculture. This is largely because agriculture tends to be most obviously affected by drought, and because there is often available data (crop losses, crop insurance statistics, livestock statistics) that can be quantified. In rural areas with an agriculture-based economy this may be a good indicator of vulnerability. Drought has a variety of impacts and the HMP should address all impacts.

Resources for Drought Risk Assessment

Another challenge with drought vulnerability assessments is a lack of quantitative information upon which to calculate expected or annualized losses from drought. A blend of quantitative analysis and qualitative discussion is often needed to fully characterize drought vulnerability. Drought hazard mitigation plans for the State of Colorado and State of South Dakota are good examples of comprehensive vulnerability assessments using a blended quantitative/qualitative approach.

Online resources continue to emerge and provide guidance to planners and government entities on drought and its impacts. There is no standard approach when it comes to addressing drought in mitigation plans, but the table on page 21 is a list of how the National Drought Mitigation Center's tools and others can be used to inform the HIRA.

Mitigation Strategy

The mitigation strategy is the primary purpose of a hazard mitigation plan. It helps the community guide and prioritize mitigation actions to reduce potential losses identified in the risk assessment and leverage a

Resources for Drought Risk Assessment	
Tool or Resource	**HIRA Component/s Supported**
Drought Monitor (NDMC)	Inform the hazard profile Inform the definition of drought "extent" (magnitude/severity)
Drought Impact Reporter (NDMC)	Inform the analysis of past and historic impacts Includes information on sector impacts
Drought Risk Atlas (NDMC)	Inform the likelihood/probability of drought in a given area
National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information Storm Events Database	Contains spatial and tabular records of various historic weather and climate-related events (e.g. floods, droughts, storms)
U.S. Army Corps of Engineers	Dam and levee datasets, flood study reports, statistics to profile hazards and conduct vulnerability assessments
Homeland Infrastructure Foundation-Level Data (HIFLD)	Open source datasets related to infrastructure and homeland security layers useful for critical facility and structural vulnerability assessments
US Geological Survey National Hydrography Dataset (NHD)	Physical sciences, streams, stream gauge, and statistical data and records
U.S. Department of Agriculture Agencies	Farm Service Agency, Risk Management Agency, and others with statistics and historic records of indemnity payments due to drought or other hazards for the vulnerability assessment and profile sections
U.S. Forest Service (USFS) Bureau of Land Management (BLM) National Park Service (NPS) Fish and Wildlife Service (FWS)	Wildfire and related forest and environmental data (e.g., endangered species) from the USFS, BLM. NPS, and FWS
U.S. Environmental Protection Agency	WATERS and other geospatial datasets on impaired waters for risk assessment
U.S. Census Bureau	Demographic and community survey statistics for vulnerability assessment and community profile sections
Drought Threat and Hazard Identification and Risk Assessment (THIRA) (National Integrated Drought Information System (NIDIS)/UNL)	General resources specific to drought when writing a HIRA andTHIRA
U.S. Climate Resilience Toolkit Social Vulnerability Index	Decision makers can use this index—with an online mapping feature and downloadable data—to identify communities that may need support in preparing for hazards or recovering from disaster.
Spatial Hazard Events and Losses Database for the US (SHELDUS) Arizona State University	Date of an event affected location (county and state) and the direct losses caused by the event (property and crop losses, injuries, and fatalities) from 1960 to present. Database includes insured crop losses (indemnity payments). Insured crop losses cover the period from January 1989 to present. (subscription-based service)

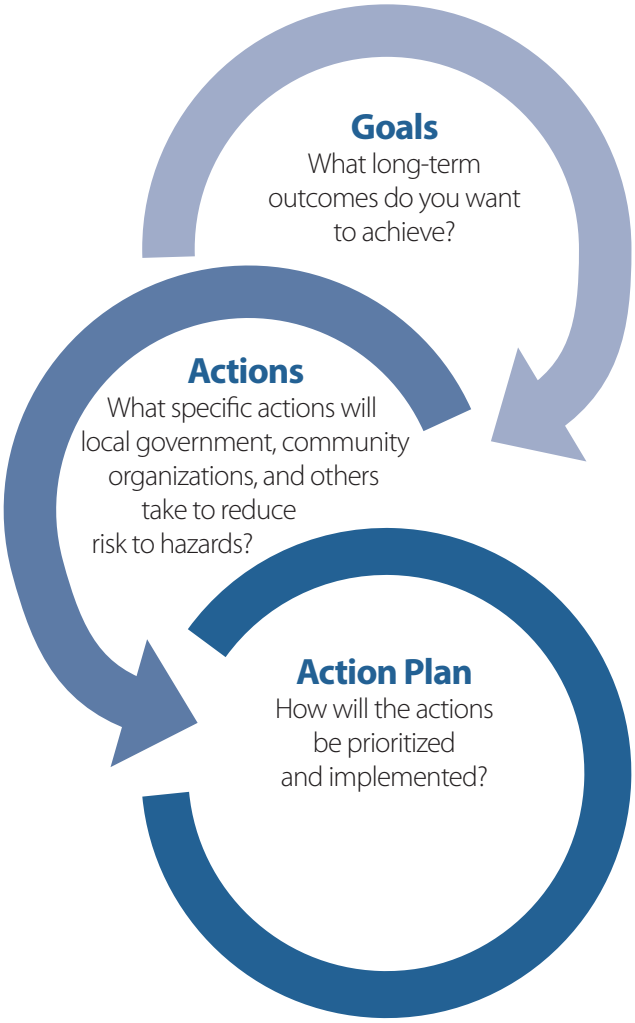


Figure 9. The Hazard Mitigation Plan's mitigation strategy provides a framework to identify, prioritize, and implement actions to reduce risk and losses from hazards. It sets priorities and addresses how the mitigation actions will be implemented and administered. Source: FEMA

community's resources and abilities identified in the capability assessment. The mitigation strategy is comprised of three required elements: mitigation goals, mitigation actions, and an action plan. The mitigation strategy is an opportunity for a community to address the hazards identified in the HIRA process and integrate hazard mitigation throughout a community's government operations.

In hazard mitigation plans, goals are broad-based public policy statements. Goals are long term and future oriented and provide guidelines for what the community wants to achieve through the mitigation planning process. When developing or updating mitigation goals, FEMA suggests taking the following into consideration: the results of the HIRA, findings from public outreach efforts, community goals stated in other community plans, and the goals stated in the state's hazard mitigation plan. Once goals have been established, the planning team should next select and identify mitigation actions to help achieve the goals.

Mitigation actions are specific projects or processes the community will implement to reduce the impacts of hazards identified in the HIRA. Typically, a mitigation planning committee will review the capability assessment, the plan's goals, and the vulnerabilities in the risk assessment as the basis to identify and select appropriate mitigation actions. Each community has a unique set of capabilities, including authorities, policies, programs, staff, funding, and other resources available to accomplish mitigation and reduce long-term vulnerability. The primary types of capabilities are planning and regulatory, administrative and technical, financial, and education and outreach. Reviewing previous mitigation actions and discussing progress in implementation is a good starting point for communities that are updating their hazard mitigation plan.

Some communities may not address drought within the mitigation plan because they feel that drought cannot be "mitigated," but there are several options to address drought as discussed in the previous chapter. FEMA's 2013 Mitigation Ideas document is a good resource for the planning committee when discussing new mitigation actions. The document categorizes actions into four primary categories shown in the table on page 23.

Once the planning team has identified potential actions, the next step in the planning process is to evaluate and prioritize the actions. This is done as a relative priority in terms of high, medium, or low. There are several ways a planning team may choose to evaluate actions. FEMA suggests that communities assess each mitigation action with the following considerations in mind:

- Life safety
  - How effectively will the action protect lives and prevent injuries?
- Property protection
  - How significant will the action be at

eliminating or reducing damage to structures and infrastructure?

- Technical
  - Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
- Political
  - Does the public support the mitigation action? Is there the political will to support it?

When evaluating actions, FEMA emphasizes the importance of a **benefit-cost review,** which is when the benefits of the proposed action versus the costs are weighed; this is particularly important if an action is going to be considered for federal grant funding, which requires a **benefit cost analysis** calculation to weigh the cost-effectiveness of the proposed project. Local governments can identify their own methods of prioritizing actions. For example, the planning team for Boulder, Colorado, chose to use smart growth principles, among other methods, to evaluate potential actions. They also used resiliency principles and scoring criteria (*Colorado Hazard Mitigation Plan* 2018).

The result of this prioritization activity is a mitigation action plan. The mitigation action plan will list the following for each action:

- The assigned prioritization of each action
- Description of the action
- The office or department that will be responsible for implementation
- Cost and available funding mechanisms or resources
- Estimated date of completion

If a community is updating its existing hazard mitigation plan, any progress made or challenges that occurred in the previous action plan are noted in the updated mitigation action plan. The result of developing a mitigation action plan is a community's mitigation strat-

Sample Drought Mitigation Actions

Mitigation Action Categories	Drought Specific Mitigation Actions
Local plans and regulations	• Incorporate drought tolerant or xeriscape practices into landscaping ordinances to reduce dependence on irrigation • Integrate drought planning within other planning efforts • Develop a drought contingency plan
Structure and infrastructure projects	• Groundwater recharge/aquifer storage and recovery • Invest in water infrastructure to expand water supplies or reduce system losses
Natural systems protection	• Increase rangeland drinking water tanks and windmills to reduce drought impacts to livestock and wildlife • Watershed protection including wildfire mitigation to protect municipal water supplies
Education and awareness programs	• Enhance data and information for analyzing drought vulnerability • Convene a drought task force frequently to discuss data collection, current state, progress of ongoing projects, and so on for affected social and economic sectors • Encourage agricultural modifications to lessen the impacts of drought such as crop rotation, introduction of drought resistant crops, no till, etc. • Increase or maintain surveillance and monitoring activities for drought specific public health issues (e.g. West Nile surveillance, private well testing for water quality)

	City of Boulder Action	Responsible Office	Schedule	Status	Priority	Estimated Cost	Potential Funding	Links to Goals
Multi-Hazard Actions								
1	Enhance critical facility data	Risk Management	Implemented annually or as funding becomes available	New 2018	Low	$10,000 initial + $3,000-$5,000/year	Staff time and city funds	2,3
2	Emergency back-up power	Facilities and Asset Management	2022	New 2018	High	$400,000 per building for generator; $75,000 per building for quick connect	City's general fund, capital fund	2
3	Hazard education	Boulder OEM, Fire, Police, CRS	Annually 2018–22	New 2018	Medium	$10,000	Staff time and city funds	1,2,3
4	Increase outdoor and individual warning systems capacity available	Boulder Planning	2018	New 2018	High	$100,000	Public/ private partnership	1
5	Outreach efforts associated with BoCo911Alert.com	Boulder OEM	2018–20	Continuing	High	$10,000	Staff time and city funds	1
6	Develop updated city continuity of operations and emergency evacuation plans	CMO/ Department heads	2018	Continuing	High	Staff time, $50k–100k	Grants	1,2,3
7	Prepare pre-disaster FEMA forms	Boulder OEM	2013	Continuing	Low	Staff time	Staff time	1,2,3
8	Increase public awareness of flood risk and safety measures	Boulder OEM/ Public Works	2018 and Annually	Continuing	High	Staff time	Staff time	1,2,3
9	Enhance outdoor warning system	Boulder OEM	2018–20	Continuing	Low	$25,000 per siren, $250,000 total	City funds	1,2
10	Maintain urban tree canopy	City Parks and Recreation, Forestry Division	2018	Continuing	High	$200,000 city funds	City funds, grants, partnerships	2

Figure 11: An excerpt from Boulder, Colorado's HMP Action Plan. From the City of Boulder Multi-Hazard Mitigation Plan. (2018)

egy, or steps the community is going to take to mitigate their risk and reduce potential losses. To have a thriving and successful mitigation program, the mitigation strategy should be incorporated into existing planning mechanisms and future community planning efforts.

Future Land Use

Considering potential hazard impacts to future land uses and current development is a federal requirement for local hazard mitigation plans. The mitigation strategy is also required to have actions that consider minimizing impacts to existing and future development. Local planners can provide valuable input to inform these aspects of hazard mitigation plans. As previously noted, land use also affects water use. Specific to drought, local planners have the role of creating future land-use plans as well as reviewing current development plans, as such they take into consideration water supply availability, current water consumption rates, and water supply in their community.

The local public works or utilities department may also be involved in water supply reliability planning. The plans and water supply infrastructure that consider growth, while factoring in the potential impacts of drought conditions, can help to mitigate the effects of drought in a community.

The hazard mitigation planning process is commonly led by the community's emergency manager, but local planners should be heavily involved in the plan's development and, at a minimum, participate in the process as a member of mitigation planning committee. Planners make critical decisions on future development in a community. As such, planners have a unique understanding of the communities they serve and can play an important role in the coordination and integration of hazard information into existing planning mechanisms, which planners often have the responsibility of developing and implementing. Another requirement is having a process in place to integrate the mitigation plan with other planning mechanisms.

The knowledge of current and future land use is important to capture in a community's hazard mitigation plan. This allows for a robust risk analysis by overlapping land-use data, growth/development expectations, natural resource availability, and other key aspects with hazard data. The results are planners and emergency managers understanding where vulnerable areas are located; therefore, creating a mitigation action plan that is tailored to the community's greatest risk. Planners also have working knowledge of local land-use regulations and can ensure that existing ordinances related to drought and water supply are captured in the plan's capability assessment. Planners can also recommend where these existing capabilities may need to be expanded or improved upon.

Due to local planners' larger understanding of the community they serve, including the community's long-term vision, planners should participate early in the development or update of a hazard mitigation plan. Many communities hire consultants to assist with mitigation plans. Planners should be involved in the request for proposal process for the hazard mitigation plan so the planner's knowledge is captured early in the process. Actively involving local land-use planners early in the hazard mitigation planning process and throughout will result in a holistic plan as well as a strong local mitigation program.

Examples of Drought's Integration Into the Hazard Mitigation Plan

The effects of drought on a community and the sectors previously noted will vary greatly depending on the geography and climate of the community. The following are some examples of plans that address drought within the hazard mitigation plan including the HIRA, capability assessment, and mitigation strategy from various part of the United States.

State Plans

State hazard mitigation plans for Colorado and South Dakota are good examples of how drought can be holistically incorporated in a multi-hazard context within a mitigation plan and how to derive detailed risk assessments at the county level. These states have stand-alone drought mitigation plans as attachments to the multi-hazard plans. Their approach included conducting detailed drought vulnerability assessments, introducing monitoring and early warning tools and detailed phases or stages of drought to be able to respond during various kinds of events, and educational and outreach activities.

Colorado's Overall Socioeconomic Vulnerability Scores by County

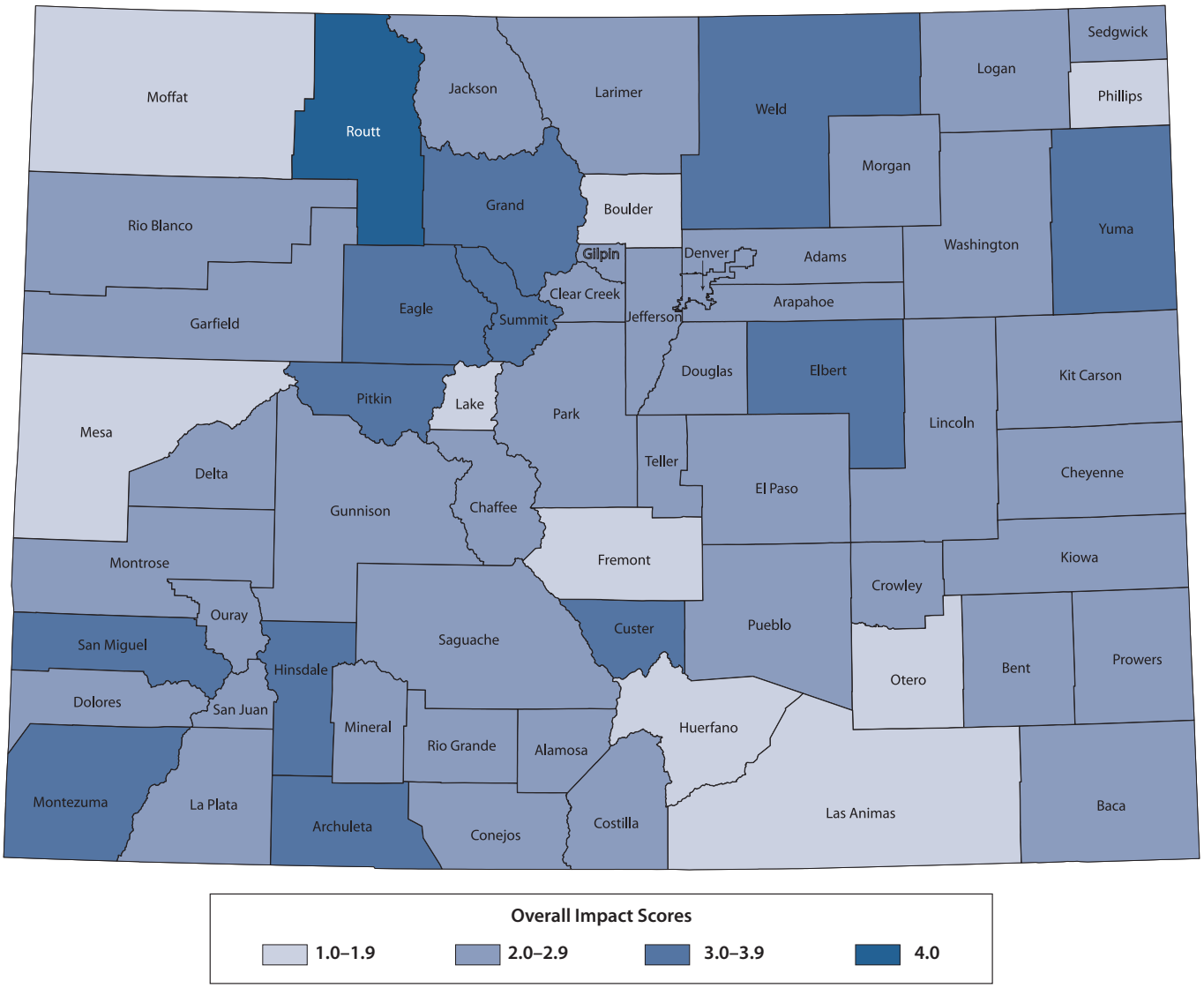


Figure 10. Colorado's Hazard Mitigation Plan *includes a vulnerability assessment that analyzes a variety of variables to measure the state's risk to drought. The map shows that some counties may be at higher risk than others based on unique local characteristics. Because of this analysis, mitigation actions specifically addressing drought vulnerability are included in the state's mitigation strategy. Counties indicated in darker blue have higher vulnerability. Source:* State of Colorado Hazard Mitigation Plan, *2018*

Addressing drought as a cascading hazard is well portrayed in these state mitigation plans. For example, in the *State of Colorado Hazard Mitigation Plan* the vulnerability assessment for drought was particularly thorough. Colorado analyzed sectors of the economy that are heavily impacted by drought and end up cascading into additional impacts and hazards. Calculations of vulnerability to the sectors considered a wide array of variables such as natural resources, state revenue and assets, visitation statistics, population growth, and the socioeconomic vulnerability index (among many others). The results were comprehensive indices showing certain counties may be at higher risk of drought than others based on their unique characteristics, leading to a detailed mitigation strategy and long-term drought

management approach. See the figure 10 (on page 26) for an example of the drought vulnerability assessment results.

Local Plans

Fresno County, California, updated its multijurisdictional hazard mitigation plan which includes information on impacts from the recent severe multiyear drought. Widespread tree mortality in the Sierra foothills is included as a cascading impact of the drought; land subsidence from increased groundwater withdrawal was another drought impact, which in turn has affected levee systems and increased flood hazards. The mitigation strategy includes compliance with state-level groundwater management regulations and related planning.

The Twin Platte Rivers Natural Resources Conservation District Hazard Mitigation Plan includes a succinct hazard risk assessment for drought, including a list of problem sectors and typical impacts for the Nebraska community. The mitigation strategy includes a groundwater recharge action for an irrigation district.

Tribal Plans

The Oglala Sioux Tribe in South Dakota is an example of a Native American community that has addressed drought effectively in its *Multi-Hazard Mitigation Plan*, developed in conjunction with Shannon County (now known as Oglala Lakota County). The plan approaches the profiling of the hazard and vulnerability assessments by introducing the U.S. Department of Agriculture Risk Management Agency's indemnity payments for agricultural losses due to drought, as well as discussions of historical records of the Palmer Drought Severity Index-related climatic variations through other monitoring services (particularly how those variations have affected their community and how drier conditions seem to be more prevalent in recent times). Other NDMC resources are well used throughout the plan, not just to address drought alone but also in the context of secondary impacts and cascading hazards.

CHAPTER 4: RISK COMMUNICATION AND DROUGHT

Communicating drought and its risks and impacts to the general public, local stakeholders, and elected officials—within local government and across jurisdictions— is one of the more complicated aspects of integrating drought into local planning. As has been discussed elsewhere in this guide, drought, with its imprecise impacts and broad scale, is often difficult to pin down at the local level. How can a planner unbundle the concept of drought from "it hasn't rained in a while"? What options exist to discuss drought as both a partial product of the built environment and as a hazard deeply connected to the ways we manage (or mismanage) our water and its associated and sometimes cascading risks like wildfire, flash flood, or mudslides? Perhaps more meaningfully, how can the community planner discuss drought with a local resident concerned about water restrictions, the quality of community open space, or the health of the wildland-urban interface?

Communicating drought risks, impacts, mitigation actions, and drought's overall connection to the local built environment can be challenging. Yet planners are often asked to be prepared to field calls, disseminate materials, speak knowledgeably, and work with the community. Similarly, they are also asked to coordinate between local departments, elected officials, and outside agencies. The planner may be looked to for leadership, asked to negotiate compromises, or investigate the role of the local landscape in a prolonged drought buffeted by wildfire and flood.

The discussion goes beyond the frame of dealing with communicating drought to the public to communicating drought and building partnerships with other local departments and across jurisdictions. Therefore, this chapter will have two primary subsections: (1) Communicating Drought and Cascading Hazards With Decision Makers and (2) Communicating Drought and Cascading Hazards With the Public.

The ultimate goal of risk communication is to get someone to take an action to reduce risk from hazards, in this case drought and cascading impacts. It's important to recognize that decision makers aren't homogenous—they are individuals with different perspectives; therefore, listening to what they care about and what they respond to is key. Since risk communication is not a one-time thing, what is learned during each conversation can help tailor future conversations to what the audience finds most important. To successfully communicate drought:

- Develop and identify communication goals and objectives.
- Avoid doom and gloom and focus on opportunities and benefits of taking action.
- Make a business case and focus on losses avoided when proposing mitigation solutions.
- Discuss impacts and focus on important assets that may be jeopardized due to drought and cascading impacts.
- Technical and scientific facts alone are not sufficient for risk communication—it's important to provide a compelling narrative, grounded in people's values.
- Present technical information in plain-English.
- Offer long- and short-term options, including how similarly sized communities have addressed drought risk.
- Leverage relationships with drought and water experts to present facts and technical information in a concise manner.
- Discuss drought's impact on the local community but identify state and regional strategies that would align with local efforts.

Planners are uniquely suited to bridge gaps and enable connections on a wide variety of topic areas. Hazards planning, given its complex relationship with local land use, is one of these areas. Fire and flood can reveal the structural failures of the local built environment and give planners the opportunity to reevaluate how we plan, build, and adapt to stressors. Drought, however, lacking clear triggers or thresholds for action, is a bit more complicated. Yet drought's relationship to other natural hazards and its connection with regional water resource management represents an opportunity for planners to take action across departments, agencies, and jurisdictions.

The Planner's Role as an Internal Consensus-Builder and Coordinator of Efforts

The primary strategy for building partnerships is finding the connections between local land-use planning and regional water resource management. These connections have developed considerably over the last decade, particularly in the realm of sustainable development and climate adaptation and mitigation. These types of efforts, which deliberately bridge the individual elements one might see in a comprehensive plan (transportation, open space, land use, etc.), carry a range of co-benefits that are likely to pay dividends toward drought planning efforts.

An integrated framework for land use and regional water resource management is an ideal mechanism for realizing drought resilience and mitigation planning aims. Yet this ideal is often out of reach for the community planner seeking only a way to better address the risk and impacts of drought on their community. Fortunately, there are also a range of far more accessible potential actions, all building upon the planner's existing role as coordinator of efforts.

Inform and Connect. Planners tend to be uniquely clued into the policies and programs of other departments and agencies. The planner is able to report to their city manager how an upcoming stormwater upgrade may be impacted by climate change-influenced cycles of drought and extreme rain outlined in a new regional report, is helping to build a stronger base for action.

Coordinate. Beyond making connections between isolated policies and programs related to drought and water resources management, planners should play a critical part in mapping out intergovernmental and cross-jurisdictional roles and responsibilities. Planners familiar with the comprehensive planning process may already have a clearer understanding than most of the structure of local, state, and federal governments, the role of quasi-governmental entities, such as regional water authorities, and how these groups interact. Understanding these interactions is critical in determining how local land use may influence onset of drought conditions and in establishing the actions necessary to respond to drought locally.

Act. Even in the absence of a broader and more coordinated regional framework for drought planning, planners can still act to form interdepartmental teams and task forces. Forming an in-house drought, climate, or water resource management task force can be a critical step in effectively communicating drought and hazard risk across local government. Planners and the planning office are particularly well-suited to organize and lead this effort, especially given the ability of planners to cut across departmental and focus area boundaries.

Who Should Be Included So Drought Planning is Considered?

Determining who to talk to is just as important as figuring out how to say it. In the course of informing, connecting, coordinating, and acting to enable drought communication in your city or town, establishing the departments that should be involved in a local drought planning effort is a major element in bridging local silos.

Who should be involved in a drought, water resources, or climate planning effort will likely vary according to the location, but some general offices or departments are critical regardless of location or internal governmental structure. In establishing the list of who to involve in such an effort, remember the multiple hazards that are often precipitated by drought. Fire and public works departments are as important to involve as the regional water utility.

- ***Planning and Zoning.*** How does the built environment influence drought? How can zoning and land use enable mitigation of drought conditions and its impacts? Are there areas of concern for cascading hazards, such as wildfire that zoning can help to mitigate or avoid?
- ***Emergency Services.*** Emergency response in periods of drought is vital to pre-drought planning activities. Police and fire services can help to inform actions well in advance.
- ***Parks and Recreation.*** The local parks department can play an outsized role in taking both mitigative and response actions to drought. As the manager of often many acres of public land and water resources, and with an ear to the ground among members of the public, the parks department can help to take direct actions to mitigate drought impacts and monitor drought conditions across the municipality.

Resilient communities collaborate across departments, and across jurisdictions, to share knowledge and effectively integrate disaster risk reduction into plans, policies, and other local planning mechanisms for long-term disaster risk reduction. Source: APA.

- ***Public Works.*** Drought and related hazards can have a considerable impact upon municipal infrastructure. The public works department can monitor the wide-ranging impacts of drought upon local infrastructure, advise critical actions for mitigation of future drought, flash flood, or wildfire, and can often provide a sorely needed technical perspective on the toll that drought can take upon municipal services.
- ***Social Services.*** Drought's impacts on residents should not be underestimated. Prolonged drought can severely impact the mental health of residents (particularly in agricultural communities); heatwaves that often accompany drought may disproportionately affect disadvantaged urban residents; and drought-influenced hazards such as wildfire impact far more than just property. Social and other supportive services agencies should be deeply engaged in drought planning efforts to mitigate the impact of drought on humans, protect the well-being of residents, and better understand the under-explored and unexpected consequences of drought and related hazards.

Again, there may be many more local agencies and departments to involve. Keeping the lines of communication open, enabling connections in advance of drought, and coordinating often disparate actions are well within planners' skill set. As professionals practiced in working within and across jurisdictions, local planners are well placed to communicate drought risks and impacts that enable efficient and effective preparation and response.

Communicating Drought and Cascading Hazards with the Public

Planners as the Front Line in Community Outreach

In many communities, planners are one of the primary contacts between stakeholders and the local government. If the planner or planning office already has built a strong reputation among community groups, residents, and other local entities, they may be seen as a problem-solver, a sounding board, or simply as the most easily accessible ear. During community outreach and public engagement efforts, they may need to field questions and concerns on a wide variety of topics, sometimes just tangentially related to community planning. While there are clear challenges inherent in the planner's assumed ability to solve or mediate every problem, there are significant opportunities with regard to conveying and collecting information on drought and associated hazards.

This section focuses on the planner's role as the front line in community outreach, during official outreach events and in unofficial correspondence (calls, emails, etc.) with stakeholders and residents. This section will also discuss will the opportunities inherent to this role.

Challenges in Communicating Drought and Associated Hazards With the Wider Public

Compared with other natural hazards, drought is particularly difficult to discuss with residents and stakeholders. Its effects on the built environment are either indirect (often in the form of associated hazard impacts such as wildfire, flood, etc.) or nebulous and long term (foundation cracking, water supply and conveyance, etc.). Drought, as has been discussed elsewhere in this guide, is also impactful over large regions and lacking a clear onset for action. It is also difficult to clearly explain just how the built environment (partic-

ularly when patterns are deeply engrained and protected by the community) contributes to water usage issues and the development of drought conditions.

Historically, dealing with drought has been the domain of state government, which tends to kick into action upon drought's onset. Yet the impacts are felt locally. A wildfire, flash flood, or mudslide can devastate a community. How can planners connect the disparate and wide-ranging impacts assessed on a regional or state level with local actions that can be addressed by locals, stakeholders, and city government?

Drought Risk Communication

A well-coordinated effort is critical to ensure effective and efficient communications with the public and community stakeholders on the topic of drought. *Planning for Drought*, PAS Report 574 (Schwab 2013) suggests ways to discuss drought, associated hazards, and their many potential impacts upon the community. These include:

To garner public support for drought mitigation, planners should communicate early and often. A local outreach program to build support and the development of a regional interagency public communications program is key to implementing a successful local risk reduction program. Source: APA

- ***Build upon existing efforts and messages.*** Water suppliers, water resource management agencies, and other regional entities may already have messaging tailored for discussing water-related issues. Critically examining, understanding, and tailoring them for the local context can be a terrific first step in simplifying and unifying messaging around drought.
- ***Use a wide variety of outreach methods.*** How your municipality interacts with the public depends upon how drought is (or isn't) currently affects the community. Drought response in the midst of a prolonged drought will require a coordinated all-hands-on-deck effort across social media, city websites, and in public meetings. For drought planning efforts, more tightly targeted messaging before, during, and after meetings or events related to the planning exercise may be best.
- ***Educate and simplify.*** Drought is complicated, but discussions around impacts can be simplified for more productive and efficient conversations with the public and stakeholders. A good first step for planners is developing a stronger understanding of how drought and existing water resources are affected by the built environment, and how drought (and related hazards) can impact the built environment. Then put a sincere effort into developing basic, plain-language messaging on what this means for the general public.
- ***Use visuals and translate.*** Conveying the message of drought impacts is as important as understanding it. How many words are required? Is a colorful graph or chart better? Is an example using pictures from another community effective? Do communications need to be translated from English into other language used locally?
- ***Remember the other hazards.*** Drought is a natural hazard with its own exclusive impacts. However, these impacts can be diffuse and difficult to convey in a meaningful and effective way. Yet drought can precipitate a wide variety of other natural hazards that do have clear triggers and considerable impacts upon people, property, and public space. Have flash flood, mudslide, or wildfire been historic issues? If so, these can be a productive entryway into connecting familiar and deeply impactful hazards with the conditions created by prolonged drought.

SUMMARY

To reduce risks from drought and cascading impacts, these hazards must be integrated into plans, regulations, and standards that communities use in the planning and development process.

There are five important areas where communities can integrate drought risk reduction principles into the documents, processes, and programs that guide the future of communities: visioning, plan making, standards, policies, and incentives, development work, and public investments (Klein 2011). These comprise the strategic points of intervention, or areas where planning process translate ideas into intentions and intentions into actions.

Although reducing the effects of drought and its cascading impacts is challenging, planning tools and strategies that are commonly used by planners offer opportunities to mitigate drought and its cascading impacts. Although climate change is expected to have considerable impacts on water and other local assets, the best solution is for communities address these risks now and integrate solutions into plans and local processes. In doing so, communities will find themselves at an advantage with reliable water supplies and effective management of those supplies.

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APPENDIX: DROUGHT RESOURCES

1.0 Agencies and Organizations

Federal Emergency Management Agency (FEMA):
https://www.fema.gov
FEMA coordinates the federal government's role in preparing for, preventing, mitigating the effects of, responding to, and recovering from all domestic disasters, whether natural or man-made, including acts of terror. One of FEMA's main strategies for preparing for and reducing disasters is planning.

National Drought Mitigation Center (NDMC):
https://drought.unl.edu
NDMC's mission is to reduce the effects of drought on people, the environment, and the economy by researching the science of drought monitoring and the practice of drought planning. The agency collaborates with and learns from decision makers at all levels—individual ranchers, communities, regions, watersheds, tribes, states, and the federal government. They organize and present workshops, webinars, and other capacity-building activities in close cooperation with local partners.

NOAA National Integrated Drought Information System (NIDIS):
https://www.drought.gov/drought
NOAA's National Integrated Drought Information System (NIDIS) program was first authorized by Congress in 2006 (Public Law 109-430) with an interagency mandate to coordinate and integrate drought research, building upon existing federal, tribal, state, and local partnerships, in support of creating a national drought early-warning information system. NIDIS's goal is to improve the nation's capacity to manage drought-related risks by providing the best available information and tools to assess the potential impacts of drought, and to prepare for and mitigate the effects of drought.

Bureau of Reclamation:
https://www.usbr.gov/drought
The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public, specifically the American West. The Bureau of Reclamation's WaterSMART program offers opportunities for enhancing water supplies at the state, tribal, and local level. As part of this effort, its Drought Response Program supports a proactive approach to drought by assisting water managers to develop and update comprehensive drought plans and implement projects that will build long-term resiliency to drought.

Bureau of Indian Affairs (BIA) Tribal Resilience Program:
https://www.bia.gov/bia/ots/tribal-resilience-program
The BIA Tribal Resilience Program provides federal resources to tribes to build capacity and resilience through leadership engagement, delivery of data and tools, training, and tribal capacity building. Direct funding supports tribes, tribal consortia, and authorized tribal organizations to build resilience through competitive awards for tribally designed resilience training, adaptation planning, vulnerability assessments, supplemental monitoring, capacity building, and youth engagement.

American Water Works Association (AWWA):
https://www.awwa.org
AWWA is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, it is the largest organization of water supply professionals in the world.

National Oceanic and Atmospheric Administration (NOAA) Regional Climate Centers:
https://www.ncdc.noaa.gov/customer-support/partnerships/regional-climate-centers
The Regional Climate Center (RCC) Program provides climate services to six regions in the United States. NOAA's National Centers for Environmental Information (NCEI) manages the RCC Program. The service provided by the RCCs has evolved through time to become an efficient, user-driven program that exemplifies many of the components that have been cited for effective regional climate services. As operational climate service providers, the RCCs fill three main niches: 1) provision and development of sector-specific and value-added data products and services; 2) establishment of robust and efficient computer-based infrastructure for providing climate information; and 3)sSeamless integration and storage of non-NOAA climate data with traditional NOAA data sources.

U.S. Environmental Protection Agency (EPA):
https://www.epa.gov
EPA works to ensure that Americans have clean air, land, and water. National efforts to reduce environmental risks are based on the best available scientific information; federal laws protecting human health and the environment are administered and enforced fairly, effectively, and as Congress intended. Environmental stewardship is integral to U.S. policies concerning natural resources, human health, economic growth, energy, transportation, agriculture, industry, and international trade, and these factors are similarly considered in establishing environmental policy. All parts of society—communities, individuals, businesses, and state, local, and tribal governments—have access to accurate information sufficient to effectively participate in managing human health and environmental risks; contaminated lands and toxic sites are cleaned up by potentially responsible parties and revitalized, and chemicals in the marketplace are reviewed for safety.

U.S. Department of Agriculture (USDA):
https://www.usda.gov/topics/disaster/drought
USDA has the science-based solutions and technical experts on the ground today to help farmers and ranchers through drought and to prepare our country for weather events in the future. USDA offers technical and financial assistance to farmers and ranchers to cope with drought across the nation.

USDA Climate Hubs:
https://www.climatehubs.usda.gov
The USDA Climate Hubs link USDA research and program agencies in their regional delivery of timely and authoritative tools and information to agricultural producers and professionals.

U.S. Geological Survey (USGS):
https://www.usgs.gov
The USGS provides science about the natural hazards that threaten lives and livelihoods, the water, energy, minerals, and other natural resources we rely on, the health of our ecosystems and environment, and the impacts of climate and land-use change. Their scientists develop new methods and tools to enable timely, relevant, and useful information about the Earth and its processes.

Climate Adaptation Science Centers (CASC):
https://www.usgs.gov/land-resources/climate-adaptation-science-centers
The mission of the CASCs is to deliver science to help fish, wildlife, water, land, and people adapt to a changing climate. The network is comprised of eight regional CASCs.

American Planning Association (APA):
https://www.planning.org
APA provides leadership in the development of vital communities for all by advocating excellence in planning, promoting education and resident empowerment, and providing our members with the tools and support necessary to ethically meet the challenges of growth and change.

2.1 Tools and Resources for Drought Monitoring

U.S. Drought Monitor:
http://droughtmonitor.unl.edu
Produced through a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the U.S. Department of Agriculture, and the National Oceanic and Atmospheric Administration, the monitor provides a "big picture" perspective of conditions across the nation. The site offers a synthesis of multiple indices and impacts that represents a consensus of federal and academic scientists attempting to track drought.

NOAA National Integrated Drought Information System:
Drought.gov:
This site provides links to tools related to drought monitoring, impact reporting, and drought outlooks.

Outlooks and Forecasts:
https://www.drought.gov/drought/data-maps-tools/outlooks-forecasts

Tools:
https://www.drought.gov/drought/data-maps-tools/tools

Impacts:
https://www.drought.gov/drought/data-maps-tools/impacts

National Drought Mitigation Center
Drought Impact Reporter:
http://droughtreporter.unl.edu/map
This comprehensive national database of drought impacts experienced across the United States launched in July 2005. It allows users to report drought impacts such as crop loss, livestock loss or need to sell, fish kills, dry wells, and community water supply challenges.

Drought Risk Atlas:
http://droughtatlas.unl.edu
This interactive historical database calculates multiple drought indices and various sources of climatological data to help decision makers better understand drought in their region.

U.S. Geological Survey
Drought Watch
http://waterwatch.usgs.gov/new/?map_type=dry-w&state=ks
The U.S. Geological Survey provides information on seven-day average streamflow measured at long-term gauging stations and compares them with normal flows.

NOAA National Centers for Environmental Information (NCEI):
Climate Division Historical Data:
http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#
NCEI provides graphs showing time series of precipitation, temperature, and SPI and PDSI at the climate division level.
(Note: Before 2015, NOAA climate data was housed in the National Climatic Data Center (NCDC). That data has been moved to NCEI, but some of the old NCDC data sets still say "NCDC" in the web links, while the webpage itself will say NCEI.)

Drought Termination and Amelioration:
https://www.ncdc.noaa.gov/temp-and-precip/drought/recovery/overview

Current drought reduction:
https://www.ncdc.noaa.gov/temp-and-precip/drought/recovery/current.
Select from the options to view precipitation needed to end or ameliorate drought as it currently exists across the contiguous United States.

Projected Palmer hydrological drought index:
https://www.ncdc.noaa.gov/temp-and-precip/drought/recovery/projected.
The NOAA National Weather Service's Climate Prediction Center produces official monthly and seasonal temperature and precipitation outlook products. This information was converted into projected monthly temperature and precipitation values for future months, then the projected values were used to compute projected future PHDI values.

Evaporative Demand Projections:
https://www.ncdc.noaa.gov/temp-and-precip/drought/recovery/eddi.
The Evaporative Demand Drought Index is an experimental drought monitoring and early warning guidance tool. It examines how anomalous the atmospheric evaporative demand ("the thirst of the atmosphere") is for a given location and across a time period of interest, which is a precursor signal of water stress.

NOAA National Weather Service
Climate Prediction Center
U.S. Seasonal Drought Outlook (and other seasonal outlooks):
https://www.cpc.ncep.noaa.gov.
Provides current U.S. drought monitor, and monthly forecast and three-month forecast for drought based on precipitation and temperature forecasts for the United States. Also provides temperature and precipitation outlooks at different shorter time frames: six to 10 days, eight to 14 days, three to four weeks, one month, and three months.

2.2 Tools and Resources for Drought Planning

National Drought Mitigation Center
Drought planning website:
https://drought.unl.edu/droughtplanning/Planning-Home.aspx.
Learn about drought planning with access to state information on drought planning.

Drought Ready Communities:
https://drought.unl.edu/droughtplanning/About-Planning/PlanningProcesses/Drought-ReadyCommunities.aspx.
A guide that provides the user step-by-step instructions to understand local drought risk and take steps to reduce that risk. PDF available at https://drought.unl.edu/archive/Documents/NDMC/Planning/DRC_Guide.pdf.

Federal Emergency Management Agency
Threat and Hazard Identification and Risk Assessment (THIRA):
https://www.fema.gov/threat-and-hazard-identification-and-risk-assessment.
The THIRA helps communities understand their risks and determine the level of capability they need in order to address those risks. The outputs from this process lay the foundation for determining a community's capability gaps as part of the stakeholder preparedness review.

Hazard Mitigation Planning (HMP):
https://www.fema.gov/hazard-mitigation-planning.
A plan created to profile hazards that pose potential harm to a jurisdiction. These plans outline how hazards have impacted a jurisdiction in the past to develop mitigation actions to reduce future harm.

U.S. Bureau of Reclamation
Drought Response Program:
https://www.usbr.gov/drought/index.html.
Provides links to different drought response information.

What can be done?
https://www.usbr.gov/mp/drought/efforts.html.
Provides possible actions and choices people can make to reduce their water use to preserve water resources.

U.S. Environmental Protection Agency
Water Fact Sheet for Drought:
https://www.epa.gov/sites/production/files/2017-02/documents/ws-ourwater-fact-sheet-drought.pdf.
Guide to provide the reader information on how to conserve water during a drought.

Drought Response and Recovery; A Basic Guide for Water Utilities:
https://www.epa.gov/sites/production/files/2017-10/documents/drought_guide_final_508compliant_october2017.pdf.
A document that helps utilities prepare for drought by setting up appropriate response actions for a community.

Build Resiliency to Drought:
https://www.epa.gov/green-infrastructure/build-resiliency-drought.
Webpage that provides information and resources for implementing infrastructure that increases water storage rather than current practices that lead to water loss from runoff.

United States Department of Agriculture:
Latest drought announcements:
https://www.usda.gov/topics/disaster/drought
Provides updated list of current drought monitoring, impact, and planning events.

American Planning Association
Planning and Drought (Schwab 2013):
https://planning-org-uploaded-media.s3.amazonaws.com/publication/online/PAS-Report-574.pdf.
Helps planners, public agencies, and local officials see the crisis on the horizon and get ready to meet it. This resourceful guide connects the dots between drought and land-use planning, water management, public health, and the local economy.

3. Funding

Federal Emergency Management Agency
Hazard Mitigation Grant Program (HMGP):
https://www.fema.gov/hazard-mitigation-grant-program.
HMGP helps communities implement hazard mitigation measures following a presidential major disaster declaration in the areas of the state, tribe, or territory requested by the governor or tribal executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters. HMGP provides funds to states, tribes, and local communities after a disaster declaration to protect public or private property through various mitigation measures. Hazard mitigation includes long-term efforts to reduce the impact of future events. HMGP recipients (states, federally recognized tribes, or territories) have the primary responsibility for prioritizing, selecting, and administering state and local hazard mitigation projects. Although individuals may not apply directly to the state for assistance, local governments may sponsor an application on their behalf.

Pre-Disaster Mitigation (PDM) Grant Program:
https://www.fema.gov/pre-disaster-mitigation-grant-program.
The goal is to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding in future disasters. This program awards planning and project grants and provides opportunities for raising public awareness about reducing future losses before disaster strikes. Mitigation planning is a key process used to break the cycle of disaster damage, reconstruction, and repeated damage.

Guidance document for both HMGP and PDM Grant Program:
https://www.fema.gov/media-library-data/1424983165449-38f5dfc69c0b-d4ea8a161e8bb7b79553/HMA_Guidance_022715_508.pdf.

U.S. Bureau of Reclamation

WaterSmart:
https://www.usbr.gov/watersmart
Through WaterSMART, the bureau will continue to work cooperatively with states, tribes, and local entities as they plan for and implement actions to increase water supply through investments to modernize existing infrastructure and attention to local water conflicts.

Drought Response Program:
https://www.usbr.gov/drought
This program supports a proactive approach to drought by providing assistance to water managers to develop and update comprehensive drought plans and implement projects that will build long-term resiliency to drought.

Bureau of Indian Affairs Tribal Resilience Program:
https://www.bia.gov/bia/ots/tribal-resilience-program
The BIA Tribal Resilience Program provides federal resources to tribes to build capacity and resilience through leadership engagement, delivery of data and tools, training, and tribal capacity building. Direct funding supports tribes, tribal consortia, and authorized tribal organizations to build resilience through competitive awards for tribally designed resilience training, adaptation planning, vulnerability assessments, supplemental monitoring, capacity building, and youth engagement.

State and local agencies may also offer funds to support drought planning.

American Planning Association

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