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Contributions and comments came from:
National Integrated Drought Information System (NIDIS) Program Office
Andrea Carson, U.S. Army Corps of Engineers
Harvey Hill, Johnson-Shoyama Graduate School of Public Policy, Saskatoon, Saskatchewan, Canada
1. Introduction

Drought is the second costliest natural disaster in the United States with each event costing the economy approximately $9.7 billion (Smith, 2012). Agricultural losses are typically widely publicized during a drought, but impacts occur across a variety of sectors. For example, during recent droughts communities have experienced residential wells running dry, reduced air and water quality, damaged infrastructure (due to dry and/or subsiding land), economic distress and escalated mental health issues due to increased financial burden, and decreased recreational opportunities (NDMC, 2018). By taking action to prepare for drought, communities can help to ensure that critical water needs are met during dry spells, minimize drought’s impact on people and the environment, and increase the efficiency of response actions.

To help communities engage in planning, the National Drought Mitigation Center (NDMC) and the National Integrated Drought Information System (NIDIS) (NDIS Program Implementation Team, 2007) have promoted the use of drought scenario exercises as an innovative way to engage community leaders, decision-makers, government staff, and stakeholders in collaborative discussions of planning and policy-oriented issues. Drought exercises (e.g., workshops, tabletop exercises, and games) that use scenarios — structured accounts of conditions and events that may evolve during a drought — get people together to plan and manage activities for a hypothetical drought. For example, these exercises offer a way to educate the public; stimulate creative thinking for mitigation, response, and adaptation strategies; learn about differing views and perspectives of drought; identify gaps and vulnerabilities; foster better communication and relationships among stakeholders; clarify agency/organizational roles and responsibilities; test and improve coordination among organizations involved in drought response; and practice making drought management decisions and using operational tools.

Although scenario-based exercises hold great potential for supporting drought planning, no resources exist on how they might be used and what outcomes communities might expect from organizing one. The variation among types of exercises in terms of cost, size, scope, complexity, and approach can make it difficult for community leaders and others charged with planning to determine the exercise type that best fits their community’s goals and objectives. To address this, the NDMC has worked with federal, state, and community partners to research and evaluate exercise design, function, and success in meeting intended outcomes under differing levels of resources. Our experience and findings are reflected in this document.

Objectives

This reference document is intended for use by professionals working in the field of drought, individuals or groups charged with planning, and communities, agencies, and organizations looking for ways to increase drought preparedness through the engagement of stakeholders, decision-makers, community leaders, and government or organization staff. It aims to serve as a starting point, describing the types of scenario-based exercises, the contexts in which they are being used in drought preparedness efforts, and the costs and outcomes of select past exercises. Specifically, this guide is designed to assist the reader in:

1. learning about drought and the benefits of drought preparation;
2. discovering how drought scenario-based exercises contribute to drought preparedness;
(3) exploring the various types of drought scenario-based exercises;
(4) considering which exercise type(s) meets the needs of a community, agency, or organization;
(5) understanding the exercise development process; and
(6) examining past exercises through a series of case studies.

This guide is not intended to serve as a “how to” manual for developing scenario-based exercises or as a decision support tool for providing you with a clear-cut answer as to which exercise type you ought to use. To be effective, scenario-based exercises should be tailored to local and regional issues as well as the specific needs and resources of your community, agency, or organization and it is not possible for a guide to take these unique issues and needs into account. See the Exercise Development Process for suggestions on how you can include local information through the use of tools, experts, and stakeholder interviews.

Format
This guide has been divided into six sections, which correspond to the guide objectives, together with a glossary of terms that may be specific to the fields of drought or planning and references for more information. These sections and a brief description of what they include are shown in Table 1. Throughout the document, you will also find clearly-identified links to external sources of information, tips for exercise development, and exercise examples, all of which are based on NDMC experiences.

<table>
<thead>
<tr>
<th>TABLE 1: OUTLINE OF DOCUMENT CONTENTS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1 Introduction</td>
</tr>
<tr>
<td>Provides an overview of the document objectives and format.</td>
</tr>
<tr>
<td>Section 2 Drought and the Benefits of Preparation</td>
</tr>
<tr>
<td>Introduces non-drought professionals to drought, the drought planning process, and drought scenario planning and exercises.</td>
</tr>
<tr>
<td>Section 3 Exercise Types</td>
</tr>
<tr>
<td>Describes the types of drought scenario-based exercises, their uses, and tips for holding a successful exercise.</td>
</tr>
<tr>
<td>Section 4 Exercise Selection Considerations</td>
</tr>
<tr>
<td>Presents considerations to aid in selecting the type of exercise that best meets the needs of a community, agency, or organization.</td>
</tr>
<tr>
<td>Section 5 Exercise Development Process</td>
</tr>
<tr>
<td>Provides an overview of the necessary groundwork for designing a successful drought scenario-based exercise.</td>
</tr>
<tr>
<td>Section 6 Past Exercises</td>
</tr>
<tr>
<td>Demonstrates the use of scenario-based exercises to meet drought preparedness objectives and serves as a resource for comparing past exercises in terms of their cost, scope, and outcomes.</td>
</tr>
<tr>
<td>Glossary &amp; References</td>
</tr>
<tr>
<td>Defines terms, acronyms, and abbreviations specific to this reference guide and identifies the valuable references used in its creation.</td>
</tr>
</tbody>
</table>
2. Drought and the Benefits of Preparation

Drought Basics
In its most general sense, drought can be defined as a deficit of expected water availability that results in water shortages for some activity or group. This deficit can result from a shortfall in precipitation over an extended period of time, from inadequate timing of the precipitation in relation to the need for it, or from a negative water balance due to increased potential evapotranspiration caused by high temperatures (Poljanšek et al., 2017). Moving beyond this fundamental definition, drought quickly becomes a complex phenomenon because it is vastly different from other hazards. For example, drought has no universally accepted definition. Instead, it is a relative term, defined differently by different regions and users. Because precipitation amount and seasonality differ from region to region, drought means different things to people in each region. Because drought also includes a demand component, through the impact of water shortfalls, the meaning of drought also can vary by sector (Box 1).

Other characteristics that distinguish drought from other hazards include the following (Wilhite and Glantz, 1985; Wilhite and Pulwarty, 2005; Wilhite, 2012; Wilhite et al., 2014):

- **Definition:** Drought has no universally accepted definition, creating differing opinions regarding its presence and severity.
- **Frequency:** Policy makers often view drought as a rare, random phenomenon rather than a normal part of climate.
- **Timeframe:** The onset and end of drought is difficult to determine, and scientists and policy makers often disagree on the criteria for declaring when a drought begins or ends. Drought can also take place over long time periods, such as months to years, leading to long periods of reduced water availability and uncertainty as to when the drought will end (Mishra and Singh, 2010).
- **Impacts:** Drought impacts are frequently spread over a larger geographical area, may take weeks, months, or even years to see because the effects of reduced water availability do not happen instantaneously (Mishra and Singh, 2010), and are often less obvious than impacts for other natural hazards since drought seldom causes structural damage.
- **Management:** The responsibilities for managing and protecting water resources cross political boundaries and are divided among all levels of government.

Additionally, no two droughts are alike. They differ in terms of their intensity, timing, duration, spatial extent, and magnitude of the impacts, or negative effects, associated with these differences. Ultimately, drought’s unique characteristics increase the complexity of effectively preparing for and responding to drought.

*Learn more at: [https://drought.unl.edu/Education/DroughtIn-depth.aspx](https://drought.unl.edu/Education/DroughtIn-depth.aspx)*
The Effects of Drought

Water is one of the most essential commodities for the survival of humans, plants, and animals. The connectedness between these means that a drought can have disastrous and far-reaching consequences, referred to as drought impacts. Drought impacts are classified as direct and indirect (Figure 1). Direct impacts occur as a direct or immediate result of reduced water availability. For example, low soil moisture can result in decreased agricultural production. Indirect impacts occur as a consequence of a direct impact or result from a complex pathway (Figure 2). These are also known as secondary impacts. For example, a drought directly reduces a farmer’s crops. Reduced yields can lead to job and business losses in agriculturally-based communities, resulting in further impacts such as stress or depression. Increased irrigation demands may also increase strain on water resources required for energy production, leading to blackouts or higher energy costs. Not all impacts of drought are negative. For example, companies selling water efficiency and moisture-monitoring systems may see a boost in sales during a drought (Daniels, 2015).
While agricultural losses are typically widely publicized during a drought, impacts can occur across a variety of sectors (National Drought Mitigation Center, 2018) (Figure 3). Because direct impacts of natural hazards are easier to quantify than indirect impacts of natural hazards, it can be difficult to fully capture all of the losses that take place during a drought. For example, the National Center for Environmental Information’s (NCEI) billion-dollar disasters list, from 1980 to present, shows that drought is the second costliest natural disaster in the United States after tropical cyclones, in terms of monetary losses and loss of life (NOAA NCEI, 2018). However, these losses are primarily due to agricultural losses (Smith and Katz, 2012). If all direct and indirect impacts were included, losses from drought would be substantially higher.
Preparing for Drought

Droughts are inevitable. They occur in nearly all types of climate, but when and with what severity they will occur is unpredictable. Taking action to prepare for future droughts can help minimize their negative effects by ensuring that critical water needs are met during dry spells, in turn minimizing the impact of a diminished water supply, increasing the efficiency of emergency response actions, and reducing the reliance on financial assistance (Wilhite et al., 2014).

Learn more at: [http://drought.unl.edu/Planning/Impacts.aspx](http://drought.unl.edu/Planning/Impacts.aspx)
Research and experience shows that the best way to prepare for drought and reduce losses is to have a drought risk management plan in place, that is a plan that contains preparedness and mitigation measures, in addition to response actions (Shepherd, 1998; Wilhite and Pulwarty, 2005; Wilhite et al., 2000; Knutson et al., 2007; Fontaine et al., 2014). In fact, a recent report by the Multihazard Mitigation Council (2017) found that every $1 invested in hazard mitigation avoids $6 in losses in the future.

Drought planning can take place through a variety of planning mechanisms. For example, it can be addressed in a stand-alone drought plan or be a component or annex of other plans such as multi-hazard mitigation plans, climate action plans, water or land use management plans, or local comprehensive plans. Regardless of the context in which drought planning takes place, all drought planning processes should ideally contain the key components shown in Box 2 (Wilhite et al., 2000; Wilhite and Pulwarty, 2005; Schwab, 2013).

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**Scenario Planning and Exercises**

One way to address drought’s complexity and planning challenges is through the use of scenarios. Scenarios are plausible stories that describe what would happen to people, the environment, and infrastructure during a disaster. A scenario generally consists of three basic elements (Figure 4): (1) a narrative, which provides the general context of the event; (2) events that allow participants to demonstrate their ability to meet the exercise objectives; and (3) technical details necessary to depict the scenario conditions (e.g., timing information, maps, data, other supporting information) (Columbia University, 2006; City and County of San Francisco, n.d.). For drought, the technical details could include drought impact information, climate and hydrologic data, and relevant policies (Box 3). Some scenarios are based in reality, using real data and river basin characteristics, while others are created in a fictional setting.

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**For every $1 spent on drought preparation, you save $6.**

--Multihazard Mitigation Council (2017)

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Learn more at: [http://drought.unl.edu/Planning.aspx](http://drought.unl.edu/Planning.aspx)
**Scope, scale, and leadership:** Planning teams should identify the purpose and objectives of the drought plan as well as the geographic or political boundaries. Effective leadership is important for initiating the drought planning process, coordinating plan development, and implementing the plan during times of drought.

**Engagement process:** Effective engagement ensures that the right people are brought together to understand drought-related concerns and impacts, resolve conflict, and generate collaborative solutions.

**Information gathering:** Information gathering is necessary to evaluate drought risk, inventory water sources and demands, identify the resources and groups at risk during periods of water shortages, assess the underlying causes for the vulnerabilities, and ascertain the limitations and constraints of the plan.

**Monitoring and early warning:** Planning for and managing drought requires monitoring a variety of hydrological and climatological variables to detect the emergence and likely severity of drought. This early warning can reduce impacts if the information is effectively communicated and tied to mitigation and response actions.

**Identifying mitigation and response actions:** Planning can help reduce the anticipated effects of the next drought through the implementation of mitigation actions (proactive programs that reduce vulnerability to future droughts) and response programs (actions undertaken when drought conditions worsen).

**Putting the pieces together and writing the plan:** Putting the strategies into a plan allows individuals to see what can be expected during a drought event, eliminating uncertainty.

**Plan evaluation and modification:** A drought plan should not be a static document. Periodic testing, evaluating, and updating keeps the plan responsive to needs and helps document lessons learned from past droughts.

**BOX 2: COMPONENTS OF THE DROUGHT PLANNING PROCESS.**
Overview: An intense drought developed in the Platte River Basin in Nebraska and lasted about 5 years, causing devastating impacts to multiple sectors. It developed in the Nebraska Panhandle and gradually spread eastward throughout the basin, reaching its greatest intensity and spatial extent in Years 4 and 5 (Figure 1). Basinwide, the 5-year average temperature departure was 2-5°F above normal and precipitation was 25-70% of normal (Figure 2). During the peak of the drought, the average temperature was 8°F above normal and precipitation was 10% of normal. The information below describes the drought at three points in time throughout its duration.

Scenario Point 1
Drought developed during the past year in western Nebraska. Mountain snowpack in the headwaters of the North Platte River in Wyoming was 30% of normal for the season. A mild winter and early spring caused mosquito eggs to hatch early, and dry conditions throughout the spring and summer contributed to an outbreak of West Nile Virus in the area. Water supply suffered, as flows on the Platte decreased, nitrate concentration increased, and water infrastructure damage occurred in Scottsbluff. Hot, dry, and windy conditions in May caused fires to break out and spread across Garden County, threatening 50,000 acres and the Crescent Lake National Wildlife Refuge. Water supplies near the fire were lacking due to drought conditions. Pasture conditions suffered and ranchers used the hay hotline. Reductions in rainfed crop yields occurred.

BOX 3: EXAMPLE DROUGHT SCENARIO WITH SCENARIO COMPONENTS LABELED (UNIVERSITY OF NEBRASKA PUBLIC POLICY CENTER, 2018).
Scenario-based exercises are structured, interactive activities designed for engaging decision-makers, stakeholders, planners, and emergency managers in the process of planning and managing mitigation and response activities for a hypothetical drought (i.e., the drought scenario). In general, exercises help participants better understand drought, the implications of water shortages, and the strategies and trade-offs necessary for reducing vulnerability and minimizing losses.

Scenario-based exercises can help stakeholders and decision-makers be proactive in preparing for drought through their contribution to one, multiple, or all of the planning process components (Box 2) (Wollenberg, et al, 2000; Bathke et al., 2012; Collins et al., 2016). The extent of this contribution depends on the purpose of the exercise, available resources, time allotted for exercise development and play, the frequency of the exercise (e.g., once or repeated), and the component of the drought plan being addressed (Table 2).

Finally, drought scenario exercises can be, and have been, used in all parts of the country as well as internationally. While exercises can be used during periods of normal rainfall as well as during periods of drought and drought recovery, not all types may be appropriate. For example, because the public may perceive that a game is inappropriate during an actual drought emergency, a tabletop exercise may be a better choice for assessing response actions to potential deteriorating conditions.

<table>
<thead>
<tr>
<th>Drought plan component</th>
<th>Contribution of scenario-based exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope, scale, and leadership</td>
<td>Clarify agency and organizational roles and responsibilities</td>
</tr>
<tr>
<td>Engagement process</td>
<td>Create opportunities for public education, conflict resolution, and collaboration</td>
</tr>
<tr>
<td>Information gathering</td>
<td>Help identify resources and groups vulnerable to drought</td>
</tr>
<tr>
<td>Monitoring and early warning</td>
<td>Identify thresholds or triggers for response actions</td>
</tr>
<tr>
<td>Identifying mitigation and response strategies</td>
<td>Explore mitigation and response strategies and their consequences</td>
</tr>
<tr>
<td>Putting the pieces together and writing the plan</td>
<td>Create components of a plan or link existing components into a planning process</td>
</tr>
<tr>
<td>Plan evaluation and modification</td>
<td>Test plan procedures and identify strengths and weaknesses</td>
</tr>
</tbody>
</table>
3. Exercise Types

Scenario-based exercises vary widely in cost, size, scope, complexity, and approach. Following the typology set by the Department of Homeland Security (DHS), exercises, can generally be classified into discussion- and operations-based exercises (Department of Homeland Security, 2013). Discussion-based exercises, such as workshops, tabletop exercises, and games, focus on participant discussion of planning and policy-oriented issues, while operations-based exercises, such as functional exercises, simulate a disaster in the most realistic manner possible, short of moving real people and equipment. While DHS exercises typically focus on emergencies and hazards that fall within a discrete time frame and location (such as hurricanes, earthquakes, critical power failures, and chemical spills), many of the exercise formats have been applied to drought. This section outlines the general application of the DHS classification of exercises as they relate to drought preparedness and response activities.

Workshops

A scenario-based workshop (Box 4) is a participatory method in which the attendees engage in discussion, produce a collaborative plan of action, or build a specific product related to drought management (e.g., a list of planning resources, identification of groups to engage in the planning process, etc.). In a workshop, the drought scenario is used to emphasize the relationship between the effects of drought and decision points (Street, 1997). They can also direct attention to vulnerabilities and gaps in policy and provide a forum for exchanging ideas and interacting with planning experts when time and resources are constrained. Workshops are characterized by their ability to create dialogue among participants, generate new knowledge surrounding an issue, or gather information about participants’ attitudes and understanding of a particular topic.

You may want to convene a workshop if your objective is to:

- Build a specific product, such as a list of planning resources
- Develop a component of a drought plan
- Identify and prioritize uncertainties in water resources planning
- Find solutions or create a consensus vision in response to planning challenges and opportunities

While many organizations conduct workshops related to drought risk management, most of them do not use scenarios. One example of a scenario-based workshop is the Drought THIRA (Threat and Hazard Identification and Risk Assessment) Workshop held in the North Platte River Basin (Figure 5). In this workshop, drought scenarios were used to help participants in the North Platte River Basin answer the questions “What do we need to prepare for?” and “What resources do we need to be prepared?”
Games
Games (Box 5) are a type of scenario-based exercise in which participants cooperate or compete to achieve goals related to drought management. In a game, the scenario is used to pose challenges to the players, stimulate collective learning, and create opportunities to explore and experiment with mitigation, adaptation, and response strategies (Department of Homeland Security, 2013). The hands-on nature of games can make learning and collaboration more fun and compelling than a typical workshop since participants think of drought management as a game rather than a real-world challenge and with players rather than competing stakeholders (Schmidt et al., 2015). Games are an innovative way to engage community leaders, decision-makers, government staff, and a wide variety of stakeholders (including those that don’t usually participate in the decision-making process) in collaborative discussions of planning and policy-oriented issues. Additionally, they can provide a safe environment for learning, experimenting with decisions, negotiation and consensus building (Carson et al., 2018). While games vary in terms of cost, size, scope, and complexity, common features include a scenario and related challenges, rules, roles, procedures or steps of play, feedback or scoring, and gaming materials (Table 3).

You may want to consider a game if your objective is to:

- Promote team building
- Increase knowledge about the complexities of water resources management
- Improve cross-sectoral communication and collaboration
- Learn about the values and viewpoints of stakeholders with competing interests
- Generate innovative mitigation, adaptation, and response strategies
- Simulate or evaluate the costs and benefits of different courses of action
Many organizations have developed scenario-based games for drought risk management (Figure 6), including Agriculture and Agri-food Canada, the U.S. Army Corps of Engineers, the National Drought Mitigation Center and private consulting firms. A popular format is the Invitational Drought Tournament (Hill et al., 2014). Many versions of this game exist (see section 6. Past Exercises), varying in cost, scope, and complexity. For example, some versions use scenarios set in a fictitious watershed to minimize conflict and encourage open discussion while others included complex hydrologic modeling of real watersheds and interactive decision-support systems designed to support community problem-solving (Carson et al., 2018). Despite any differences, a common feature is that the participants work in interdisciplinary teams to develop comprehensive drought management strategies that minimize environmental, social, and economic impacts.

Another example of a drought scenario-based game is Ready for Drought?, developed by the National Drought Mitigation Center. This game is a drought adaptation of the award-winning Extreme Event (National Academy of Sciences, 2018), a role-playing game in which participants work together to build community resilience to a natural hazard. In this prepackaged game, participants are assigned sector roles and fictional communities. Communities vary in size and the challenges that they face as the result of a drought scenario. During the game, participants prioritize resources, build coalitions, and assess and respond to the impacts of a drought, while practicing critical thinking and improving civic literacy related to drought resilience.

<table>
<thead>
<tr>
<th>Game element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario</td>
<td>Story line and sequence of drought-related events that challenge players</td>
</tr>
<tr>
<td>Steps of play</td>
<td>Order in which the game unfolds</td>
</tr>
<tr>
<td>Rules</td>
<td>Regulations governing game play</td>
</tr>
<tr>
<td>Roles</td>
<td>Characters assigned to game participants</td>
</tr>
<tr>
<td>Scoring</td>
<td>Basis for awarding points</td>
</tr>
<tr>
<td>Game materials</td>
<td>Objects necessary for game play, highly dependent upon game complexity.</td>
</tr>
</tbody>
</table>

To explore case studies and find examples of drought scenario-based games, see Section 6: Past Exercises.
Game Overview

**Scope:** Multi-sector or multi-agency  
**Duration:** 2 to 8 hours  
**Participation:** Stakeholders and/or agency or organizational staff  
**Required resources:** Low to high  
**Planning stage:** Developing or existing plan

*When implementing a game, it is helpful to (1) encourage open discussion, (2) have a scoring matrix, (3) recognize small accomplishments or incremental goals, (4) offer incentives or provide prizes and rewards for motivation, and (5) allow ample time for feedback.*

BOX 5: SUMMARY OF DROUGHT SCENARIO-BASED GAME CHARACTERISTICS.

Tabletop Exercises

Tabletop exercises (Box 6) are facilitated group discussions in which representatives from agencies and organizations meet in a classroom or in breakout groups to discuss the implementation of a plan (Department of Homeland Security, 2013). In this type of exercise, a scenario is used to trigger discussions about participants’ roles, responsibilities, coordination activities, and decision-making that takes place during a drought. Tabletop exercises are a low-cost, low-stress environment in which to test a drought plan, familiarize participants with the plan, or review the effect of plan actions on other concurrent events.

You may want to consider a tabletop exercise if your objective is to:

- Train new personnel or promote understanding of new concepts
- Sharpen group problem-solving skills
- Improve coordination among agencies and organizations
- Prevent the loss of institutional memory that can result from the relative infrequency of drought
- Identify strengths and weaknesses of an existing drought plan
- Discover gaps in resources

Tabletop exercises specific to drought have been developed by the National Drought Mitigation Center, the Environmental Protection Agency (EPA), state and local governments, universities, and private consulting firms. Examples include the Hualapai Nation tabletop exercise (Figure 7) conducted by the National Drought Mitigation Center and the State of South Carolina Drought and Water Shortage tabletop exercise. In the Hualapai Nation exercise, tribal representatives worked through the process of implementing their drought plan in an effort to test plan implementation, increase collaboration among tribal agencies, and educate personnel about Bureau of Reclamation and tribal interactions during drought (Knutson et al., 2007). More recently, the State of South Carolina conducted a tabletop exercise.
to review the plans and procedures that govern responses to drought and water shortages on state, basin, and local levels; improve awareness of roles and responsibilities in state drought response activities; identify key mission areas for state support functions; and collect ideas and strategies for future exercises (Altman and Lackstrom, 2018).

To view examples of drought scenario-based tabletop exercises, see Section 6: Past Exercises.

**Tabletop Exercise Overview**

**Scope:** Multi-sector or multi-agency  
**Duration:** one-half to one day  
**Participation:** Agency or organizational staff  
**Required resources:** Low to medium  
**Planning stage:** Developing or existing plan

When conducting a tabletop exercise, it is important to include reference materials such as plans, maps, and other relevant materials (such as demographics and water demand); use effective communication skills to facilitate discussions and problem solving; and be aware of relevant organizational responsibilities (FEMA, 2016).

Box 6: Summary of drought scenario-based tabletop exercise characteristics.

**Functional Exercises**

A functional exercise (Box 7) is a single or multi-agency activity designed to simulate a disaster or emergency in the most realistic manner possible without moving people, equipment, or resources to an actual site (Department of Homeland Security, 2013). All activity is verbal. A functional exercise is more complex than a tabletop exercise. In a functional exercise, a scenario provides background information and events to drive activities rather than discussions. In a functional exercise, participants are asked to take action — make decisions, simulate the deployment of resources, and respond to the changing developments — in a realistic, real-time environment. Functional exercises are typically focused on validating and evaluating the coordination, capabilities, and function of the plans, policies, procedures, and staff members involved in drought risk management.

You may want to consider a functional exercise if your objective is to:

- Assess the adequacy of plans, policies, and procedures
To date, the only known functional drought exercises are those that have been conducted by the Interstate Commission on the Potomac River Basin (Figure 8). This organization has held an exercise annually since 1981 to practice communications and simulate water supply operations for the three major water utilities in Washington, D.C., and the adjacent suburbs in Maryland and Virginia as they would occur during an actual drought (ICPRB, 2019).

To explore case studies and find examples of drought scenario-based functional exercises, see Section 6: Past Exercises.

**Functional Exercise Overview**

- **Scope:** Multi-agency
- **Duration:** Hours, days, or weeks, depending on the purpose
- **Engagement:** Agency or organization staff with decision-making authority or response obligations
- **Required resources:** Medium to high
- **Planning stage:** Existing

*When conducting a functional exercise, it is important to (1) remain focused on the objectives, (2) identify training moments, (3) allow participants to decide among the full range of responses normally available to them during an emergency, and (4) not constrain the participants’ ability to make decisions, communicate, and carry out responsibilities (FEMA, 2016).*

**TIP**

**BOX 7: SUMMARY OF DROUGHT SCENARIO-BASED FUNCTIONAL EXERCISE CHARACTERISTICS.**
4. Exercise Selection Considerations

In the drought world, there’s a saying that “all droughts are local,” meaning that drought looks different based on where and when it occurs, how long it lasts, and who it affects. That being said, selecting an appropriate drought scenario-based exercise that takes into account the unique drought planning and response needs of individual communities, agencies, and organizations is a highly individualized process that cannot be fully captured in a guide or document. Instead, the decision should be based upon conversations among the potential exercise organizers or development team. Contacting others who have experience with drought scenario-based exercises (Section 6: Past Exercises) can also provide valuable insight.

To assist with the selection process, some of the main factors that you will need to consider are outlined in this section.

Objectives and Outcomes
Selecting an appropriate drought scenario-based exercise to meet the needs of your community, agency, or organization should begin with a discussion of the general exercise objectives and desired outcomes. This helps ensure that the results of the exercise are relevant and that you make the best use of your available resources. Potential objectives for each exercise type are described in Section 3. While all exercise types may be beneficial for educational purposes or increasing communication and collaboration other objectives and outcomes are suited to specific exercise types. For example, if your objective is to brainstorm mitigation and response actions, a workshop or game may be the best choice. Sample objectives and outcomes for past events and the effectiveness of the exercise in meeting the selected outcomes can be found in the Comparative Analysis of Case Studies section.

Resources
Once your team has decided upon its desired objectives and outcomes, consideration should be given to any resource constraints such as budget, personnel, time, and technology, so that the right balance can be created for selecting the most appropriate type of exercise (Figure 9). Direct costs (Table 4) of organizing a scenario-based exercise vary depending on the type of exercise and the complexity of the scenario. In general, the more realistic the scenario and associated exercise, the greater the cost. In addition to complexity, the capacity required to plan, develop, and evaluate a scenario-based exercise depends on the development team’s experience and workload. The design and planning of an exercise requires significant local input to ensure plausibility and appropriateness, and to solicit buy-in for backing and participation. If agency/organizational staff do not have the expertise or time, you may need to contract with other organizations or private consulting firms. More complex scenarios and exercises require longer

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planning times, while those that are less complex require shorter planning times. The available resources influence the potential outcomes, the complexity of the design, and the materials used by participants during the event (Figure 10). For example, costs for the Invitational Drought and Multi-hazard Tournaments have ranged from approximately $20,000 to $200,000 (Example Exercises). Those on the low end of the spectrum used low-tech options, such as paper-based game play, and focused on communication and collaboration, while those on the high end used highly customized hydrologic models and/or decision support tools and had a greater focus on quantifiable outcomes.

TABLE 4: POTENTIAL RESOURCE REQUIREMENTS NEEDED TO CONDUCT A DROUGHT SCENARIO-BASED EXERCISE.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial</td>
<td>Participant travel and accommodation expenses, venue rental, exercise materials and supplies, refreshments, facilitator fees, model or tool development, prizes</td>
</tr>
<tr>
<td>Personnel</td>
<td>Staff time for developing, conducting, and evaluating the exercise</td>
</tr>
<tr>
<td>Time</td>
<td>Amount of time available for developing, conducting, and evaluating the exercise</td>
</tr>
<tr>
<td>Technology</td>
<td>Computer models, decision-support tools, laptops or tablets, projectors, and sound systems for use during the exercise</td>
</tr>
</tbody>
</table>

Participation
Consideration should also be given to who needs to be involved in the exercise to meet the desired objectives and outcomes or to address the drought management challenge(s) that will be simulated in the exercise. For example, if your objective is to improve coordination capabilities for drought response actions, you would want to include agency and organizational staff that have drought management responsibilities. In this case, tabletop or functional exercises would likely be the most appropriate choices. Alternatively, if you would like to include a diverse group of stakeholders, a less formal event such as a game may be a better option. In this case, you also want to consider which sectors (e.g., natural resources, health, governance, etc.) should be included.

Planning Stage
While scenario-based exercises have been used in all parts of the planning process (Box 2), not every exercise is suitable for every stage. For example, if you are developing a plan, a workshop would be a good choice to help identify potential planning resources or groups that may be vulnerable to drought. On the other hand, if you have recently modified your plan and you want to test or evaluate it for strengths and weaknesses, you could select either a tabletop or a functional exercise.

Interaction with Experts
Some exercises are more suitable to interactions with drought or planning experts. For example, the structure and/or pace of tabletop exercises, games, and functional exercise do not provide participants with much opportunity to engage with experts. Alternatively, workshops can be designed to create opportunities for intensive discussion and exchanges with subject matter experts, who can provide technical expertise and input when developing or revising a drought plan.

Participation Format
Another factor to consider is the desired learning format of the exercise. Workshops, tabletops, and games are discussion-based while functional exercises ask participants to take action — make decisions,
simulate the deployment of resources, and respond to changing developments. Research shows that adults learn by doing (Knowles et al., 2011), so exercises that incorporate task-oriented activities may be more compelling. While functional exercises may be the most relevant to participants’ jobs or roles in drought management, active participation such as brainstorming, negotiation, and consensus building can be incorporated into discussion-based exercises.

Realism and Atmosphere
Exercises have varying levels of realism. Exercises conducted around a conference table or in a seminar room (i.e., workshops, tabletops, games) are, by definition, less realistic and more relaxed compared to operations-based exercises (i.e., functional exercises) that simulate real-time decision-making. While the environment in which the exercise takes place may not be realistic, the scenarios incorporated into workshops, tabletops, and games can be factually based, using real data and river basin characteristics. Realistic exercises are often deemed the “gold standard” in exercise development; the more realistic an exercise’s scenario, the greater the potential that the exercise will address the uncertainties, challenges, and failures (e.g., coordination problems between agencies, technology outages, etc.) that may occur during an actual drought (Jackson and McKay, 2011). While valuable, highly realistic exercises and scenarios are generally more expensive and take longer to plan. Trade-offs in realism are often necessary due to resource constraints and other concerns. For example, exercises used for public education or training may want to relax realism to avoid overwhelming participants and keep the focus on the key messages and learning outcomes. When determining the level of realism to include in an exercise, consider the objectives and desired outcomes.

![FIGURE 10: POTENTIAL EXERCISE OUTCOMES BY RELATIVE COST (ADAPTED FROM HILL, 2018).](image-url)
Exercise Selection Matrix

Table 5 presents a matrix of exercise type versus considerations to assist in the selection process. Additional considerations specific to Invitational Drought Tournaments can be found in the Comparative Analysis of Case Studies.

TABLE 5: MATRIX OF POTENTIAL CONSIDERATIONS FOR DETERMINING A TYPE OF EXERCISE.

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Workshop</th>
<th>Game</th>
<th>Tabletop</th>
<th>Functional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification of problems and/or mitigation and response actions</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education or training</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Consensus building</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Collaboration or coordination</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Plan evaluation and modification</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low to medium</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Medium to high</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Participation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General stakeholders</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Agency or organizational staff</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Planning stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Interaction with experts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Learning format</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinking and discussing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Doing</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Realism and atmosphere</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less realistic and more relaxed</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>More realistic and tense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Exercise Development Process

Although exercises vary widely by type and format, most follow the same general framework for development (Figure 11). This section provides an overview of the groundwork necessary to help you develop a successful drought scenario-based exercise.

Step 1: Assemble an Exercise Development Team
In designing and developing individual exercises, a planning team is necessary to schedule planning meetings; identify and develop exercise objectives; identify participants; plan and conduct the evaluation; design the scenario; create documentation, guidelines, and exercise materials; and coordinate logistics. Effective leadership is important to manage all aspects of exercise development, including helping the team stay on task, managing the budget, ensuring that objectives are met, and generating buy-in among decision-makers and participating organizations, agencies, and stakeholders. Although an exercise can be led by anyone, this task is typically undertaken by an agency (at any level of government) or partner organization.

While the size and representation of the development team depends on the scope and complexity of the exercise, representation should include someone who (Figure 12):

- Is knowledgeable about local, regional, and state issues; policies; and key players
- Is familiar with the potential mitigation and response actions
- Can oversee the scenario development
- Can handle logistics and administrative details
- Can develop and administer evaluation materials
- Can create exercise materials such as handbooks, visual aids, etc.
- Can organize and facilitate participant engagement

Step 2: Clarify the Objectives and Outcomes
After a general discussion of exercise objectives and desired outcomes during the exercise selection process, clarifying the objectives and desired outcomes will aid in the exercise development process by helping to identify who should be involved, determining the scenario complexity, and guiding the

![Diagram of Exercise Development Process]

FIGURE 11: GENERAL PROCESS FOR DEVELOPING A DROUGHT SCENARIO-BASED EXERCISE. AFTER (FEMA, 2016)
evaluation. Objectives should be written in a format that is clear, measurable, and observable. For example, if the objective is education, the specifics would include: Whom is the education directed toward? What is the focus of the education — general water management issues, mitigation strategies, or something else? What criteria will be used to determine the level of education that took place? Examples of exercise objectives tied to scenario complexity and evaluation-based outcomes can be found in the case studies section of this guide.

Step 3: Determine the Scope and Participation
The exercise scope describes the extent of the exercise and includes parameters such as the targeted planning area, including duration of the exercise, players involved, and level and details of involvement. To help focus your exercise, it is important to have realistic limits in terms of what you can accomplish given your resources, the complexity or contentiousness of the issues, and the type and relationship of the intended participants.

Considerations for determining scope and participation include (Figure 13):
- What personnel time and budget can you commit to developing, conducting, and evaluating the exercise?
- What is your timeline for developing the exercise?
- What are the issues that you plan to address and what is their level of complexity?
- Who needs to be involved and how should you address the issues in terms of sector and role (leadership, decision-making, response, etc.)?
- What is the target planning area for the exercise?
- How long will it take to effectively address the exercise objectives (exercise duration)?

Step 4: Develop the Evaluation Plan
Exercise evaluation is the process of understanding the effectiveness of the exercise, determining if it has achieved its intended objectives, and measuring its outcomes or any changes that resulted from holding the exercise. Having evaluation in mind early in the development process can help ensure that the exercise is designed to meet its objectives. Evaluation can also facilitate greater transparency and a sense of shared responsibility among the exercise development team.
An evaluation plan outlines the goal and purpose of the evaluation and the information that is to be gathered. Having a plan ensures that the exercise development team agrees upon the objectives of the exercise and the evaluation itself (Martin, 2015). Tasks for developing an effective evaluation are outlined below (Figure 14).

**Figure 14: Tasks for developing an effective evaluation.**

**Task 1: Create the evaluation team**
An effective evaluation requires a wide variety of skills, so you may want to create an evaluation team (CDC, 2012). Team members can include internal program staff, external stakeholders, consultants, or contractors with evaluation expertise. The knowledge and skills necessary for effective evaluation include (Figure 15):
- Experience in the evaluation methods
- Ability to engage a wide variety of stakeholders
- Innovation while working within budget and/or time constraints
- Reporting and communicating the findings

**Task 2: Identify the evaluation objectives**
Several types of evaluations can be conducted. Process evaluation, which helps assess whether the exercise functioned as expected, and outcome evaluation, which assesses the progress toward achieving the exercise’s intended outcomes, are two of the most common types that are applicable to drought scenario-based exercises.

Process evaluation can help improve the exercise design, explain successes and failures of the exercise, and assess whether the exercise would have similar outcomes with different groups of participants. Information collected for process evaluation may include:
- Demographic characteristics of exercise participants
- Communication with participants before, during, and after the exercise
- Participants’ experience during the exercise in terms of location, pace, and involvement.

As organizers identify whom they want to engage, the evaluation should focus on that same group of individuals. In addition, as organizers specify the level of engagement they expect participants to have in the process, the evaluation questions should be developed to answer whether participants have actually engaged in the intended level (Box 8).
Outcome evaluation can help demonstrate the exercise’s impact and help you communicate successes to others. This is necessary for buy-in to the planning process and for obtaining support from policy makers and funding agencies. Outcome evaluation questions (Box 9) should be developed to align with the objectives and outcomes agreed upon by the exercise development team, such as whether the exercise is intended to educate, identify issues or solutions, improve communication or coordination, or shape a plan. Objectives specify what you hope to achieve by conducting the exercise, while outcomes describe the benefits or changes that occurred as a result of the exercise. Each exercise outcome should have a corresponding evaluation objective (University of California Division of Agriculture and Natural Resources, 2018). While outcomes will vary, general information collected may include changes in participants’ knowledge, skills, attitudes, and behaviors (Table 6). Outcome evaluation may need to take place at multiple points in time since not all changes will be apparent immediately (Table 7).

**Example Process Evaluation Questions**

**Communication:** Was the information you received valuable and did it prepare you for the tournament? Was the team responsive to your needs and questions?

**Exercise play:** Were the design, pacing, game, and story appropriate? How would you rate the balance of information presented vs. entertainment? How did the portrayal of the scenarios measure up to your experience addressing drought-related issues?

**Engagement process:** Did you read materials, actively participate in small groups, contribute ideas, help in building consensus, volunteer to stay involved after the exercise?

**Example Outcome Evaluation Questions**

**Education:** What did participants learn? How did perceptions about practices or budgets change?

**Identifying issues or solutions:** Did the overall process identify strengths and weaknesses in existing plans, policies, decision-making processes? Did the exercise identify training needs?

**Improving communication or coordination:** Did the exercise experience improve communication and coordination efforts now and into the future? Did any new collaborations emerge?

**Shaping a plan:** Did plans, policies, decision-making processes change as a result of the exercise?

**Task 3: Select evaluation methods**

The next step requires matching the evaluation objectives with methods for collecting the data. Evaluation methods produce quantitative data, qualitative data, or a combination of the two. Quantitative methods provide data in numerical form, while qualitative methods reveal perspectives, perceptions, and behaviors. The method depends on the evaluation objective, the target audience, experience and/or expertise of the evaluation team, the feasibility of the method, and the intended use of the results.
Sample methods and their purpose are shown in Table 8.

**TABLE 6: EXAMPLE EXERCISE OUTCOMES MAPPED TO INFORMATION COLLECTED DURING AN EVALUATION.**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Expected Change in Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying problems and/or mitigation and response actions</td>
<td>None</td>
</tr>
<tr>
<td>Education or training</td>
<td>Knowledge or skill</td>
</tr>
<tr>
<td>Consensus building</td>
<td>Attitude</td>
</tr>
<tr>
<td>Collaboration or coordination</td>
<td>Attitude and behavior</td>
</tr>
<tr>
<td>Plan evaluation and modification</td>
<td>Behavior</td>
</tr>
</tbody>
</table>

**TABLE 7: EXAMPLE EVALUATION QUESTIONS AND CORRESPONDING TIME SCALE.**

<table>
<thead>
<tr>
<th>Outcome: Increase Communication &amp; Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time scale: SHORT-TERM</td>
</tr>
<tr>
<td>Point in time</td>
</tr>
<tr>
<td>Question</td>
</tr>
</tbody>
</table>

**TABLE 8: EVALUATION METHODS AND THEIR PURPOSE.**

<table>
<thead>
<tr>
<th>Method</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests</td>
<td>Measure knowledge, awareness, and/or skills</td>
</tr>
<tr>
<td>Surveys</td>
<td>Provide self-reported data on knowledge, skills, attitudes, beliefs, and behaviors</td>
</tr>
<tr>
<td>Observations</td>
<td>Collect information by watching or listening to the exercise</td>
</tr>
<tr>
<td>Interviews</td>
<td>Obtain data and narrative information to better understand actions, motivations, beliefs, etc.</td>
</tr>
<tr>
<td>Focus groups</td>
<td>Gather a range of perceptions and opinions about the exercise.</td>
</tr>
</tbody>
</table>

*Task 4: Collect data*

The next step in the evaluation process is to collect the data that will inform the evaluation. Your choice of data collection method will vary based on your question of interest, exercise design and resources, and involvement of the exercise participants or others from whom you seek data. Considerations for data collection include:

- When will the data be collected — before, during, and/or after the exercise? If medium- or longer-term objectives are important, data collection should take place on a time scale that would realistically capture any long-term changes that result.
- Who will collect the information — internal staff or an external evaluator?
- Who is the target — all participants or just a sample?
**Task 5: Analyze the data**

Analysis strategies should be matched to the type of questions that you are trying to answer. For example, quantitative methods rely on statistical approaches to identify information such as frequencies, means, ranges, and other more complex factors. Qualitative data analysis may involve the use of qualitative coding software to assist with systematizing, organizing, and analyzing qualitative data.

**Task 6: Learn from the evaluation**

The ultimate purpose of evaluating an exercise is to use the information for improvement and to share lessons learned. A comprehensive report will identify your outcomes of interest and any indicators or measurements that show how your exercise achieved your outcomes of interest, as well as recommendations for improvement, necessary follow-up activities, and plans for dissemination.

**Step 5: Develop the Scenario**

The scenario should be a plausible event scaled to the exercise objectives and desired outcomes. For example, a tabletop exercise designed to test the implementation of a drought plan may consist of a simple narrative describing conditions during a drought that would trigger agency actions, whereas a game designed to evaluate risks and trade-offs may include complex hydrologic modeling and web-based tools so that participants can test drought mitigation and response actions that are highly quantified and customized. Regardless of the exercise type and scenario complexity, scenario development includes three key tasks as described below (Figure 16).

**FIGURE 16: TASKS FOR CREATING A SCENARIO.**

**Task 1: Gather background information**

Gather background information to evaluate drought risk, create an inventory of water sources and demands, identify the resources and groups at risk during periods of water shortages, assess the underlying causes for the vulnerabilities, and examine anything else that would help ascertain the limitations and constraints of your drought plan. Potential sources of background information are described below.

- The U.S. Drought Monitor’s time series feature can be used to identify the region’s drought history back to 2000 (NDMC 2019b).
- Other drought indices, such as the Standardized Precipitation Index, may have longer periods of record (depending on the individual monitoring station) and can be found using the National Drought Mitigation Center’s Drought Risk Atlas (NDMC, 2019c).
- Because instrumental records (~150 years) provide a limited picture of the extent and severity of historical droughts, paleoclimate data, such as tree rings, can be used to extend records of past droughts and to put more recent droughts into a longer time frame. Links to many of the
available data, indices, and impacts can be found on the National Integrated Drought Information System’s (NIDIS) website.

- The NDMC’s Drought Impact Reporter (National Drought Mitigation Center, 2018) is a database of drought impacts from a variety of sources such as media, government agencies, and the public. A tutorial for how to use the Drought Impact Reporter can be found at http://drought.unl.edu/tutorials.aspx.

- Supporting information from federal, state, and local agencies — such as socio-economic information from the U.S. Census Bureau, agricultural statistics from the U.S. Department of Agriculture, public health information from the Centers for Disease Control and Prevention or state agencies, wildfire history from numerous agencies, and reports from state drought task forces and committees — can also be useful.

Examples of how some of these sources of information were used to build a drought scenario are shown in Table 9.

Task 2: Developing the scenario components
As described in the section Scenario Planning and Exercises (and shown in Box 3), the scenario components include a narrative, events, and technical details.

- The narrative provides the general context for the event. Start by creating an outline, which will eventually become your narrative.

- Identify the events and a timeline of their occurrence. Events should be designed to prompt responses and actions by the participants and should facilitate the achievement of the exercise objectives (e.g., wells running dry, West Nile outbreak, reduced power generation, etc.).

- Add the technical details to the timeline (Table 10).

The events and technical details can be identified by examining the historical record (as in Box 2), constructing models, or using a combination of the two. Using the historical record and other readily available data and information (as in Table 9) generally involves the fewest resources. More complex scenarios (e.g., scenarios that use models to project future changes in climate and water resources, determine associated risks, and identify opportunities for adaptation) typically take more time and involve the support of expert analysis or private consulting firms.

Task 3: Setting the guidelines
The scenario guidelines include the expectations, the order in which the scenario unfolds, and any limitations. For example, participants may be asked to address the scenario without considering effects such as cost or interstate compacts.
### TABLE 9: EXAMPLE BACKGROUND INFORMATION USED TO BUILD THE SCENARIO SHOWN IN BOX 2.

<table>
<thead>
<tr>
<th>Example background information</th>
<th>Source</th>
<th>Potential scenario use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area-based drought time series back to 2000</td>
<td><a href="https://droughtmonitor.unl.edu">https://droughtmonitor.unl.edu</a></td>
<td>Identify drought length and severity at varying spatial scales (e.g., state, county, river basin) back to 2000.</td>
</tr>
</tbody>
</table>

Example:

![Graph showing drought percentages over time](content.png)

<table>
<thead>
<tr>
<th>Station-based drought and climate information</th>
<th><a href="https://droughtatlas.unl.edu">https://droughtatlas.unl.edu</a></th>
<th>Identify the average drought duration for a station.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location: Scottsbluff, NE</td>
<td>Time period: 1908-2016</td>
<td></td>
</tr>
<tr>
<td>Number of droughts: 19</td>
<td>Average duration: 59 weeks</td>
<td></td>
</tr>
<tr>
<td>Drought severity level: -1.5 (severe drought) on the 12-month Standardized Precipitation Index</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drought impacts</th>
<th><a href="https://droughtreporter.unl.edu">https://droughtreporter.unl.edu</a></th>
<th>Identify events within the scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Nebraska Public Power and Irrigation District reducing releases from Lake McConaughy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low water, warm water temperatures killing fish in Platte River in south central Nebraska</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric power generation levels below peak production for Central Nebraska Public Power District</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low water levels prevent installation of boat docks in Butler County, Nebraska</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County roads in the Nebraska Panhandle becoming deteriorated during the drought</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Socio-economic data</th>
<th><a href="https://www.census.gov">https://www.census.gov</a></th>
<th>Identify vulnerable populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of the population, by county, over the age of 65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interviews and surveys with local sectoral representatives</th>
<th>Identify worst-case scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Department of Natural Resources identified locations vulnerable to water quality issues during a drought</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 10: EXAMPLE TECHNICAL DETAILS TO INCLUDE IN A DROUGHT SCENARIO.

<table>
<thead>
<tr>
<th>Technical detail</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td>Water demands may be higher at given times of year</td>
</tr>
<tr>
<td>Duration</td>
<td>Droughts of different durations stress communities in different ways</td>
</tr>
<tr>
<td>Location</td>
<td>Affects the types of impacts and deployment of resources</td>
</tr>
<tr>
<td>Local information</td>
<td>Using data that represents your area will make the scenario more realistic for your participants, leading to group interactions and discussions that are geared to making your jurisdiction more prepared for drought.</td>
</tr>
</tbody>
</table>

**Step 6: Exercise Materials**

The exercise materials are anything that you need to facilitate and conduct the exercise (Figure 17). Exact materials will vary depending on the type, size, and cost of the exercise, but may include:

- Schedule or agenda
- Registration form
- Photo release form
- Facilitator guides
- Name badges
- Role descriptions
- Overview presentations
- Scenario descriptions including narratives, maps, etc.
- Displays, playbooks, handouts, and decision-support tools
- Background information such as demographics, geography, climatology and hydrology, and regulations

**Step 7: Conduct the Exercise**

This is the phase where the actual execution of the exercise takes place. Tips include:

- Arriving early to the location to ensure that furniture is arranged as desired, equipment is ready and working, and participant information is laid out
- Introducing the moderator and facilitator
- Providing a brief synopsis of the day
- Conducting an icebreaker to help participants get to know each other and buy into the purpose of the exercise
- Paying attention to time management

![FIGURE 17: EXAMPLE HANDOUT FOR A SCENARIO-BASED GAME.](Image)
Examples of drought scenario-based exercise toolkits can be found by visiting the following websites:


6. Past Exercises

This section demonstrates the use of scenario-based exercises to meet drought preparedness objectives and serves as a resource for comparing past events in terms of their cost, scope, and outcomes. Past events are presented in three ways: (1) a listing of example exercises with links to external resources for those who want to delve deeper; (2) case studies with key information extracted to allow for comparisons between events, and (3) a comparative analysis of case studies that informs lessons learned and recommendations for developing tournaments and workshops at lower and higher resource levels.

Example Exercises

While it would be impossible to identify all drought scenario-based exercises, we have compiled a list of exercises to demonstrate the numerous contexts in which exercises have been used in the process of planning and managing drought mitigation and response activities (Tables 11, 12, 13, and 14). The following information, when available, is provided for each example:

- Date: Month and year when the exercise took place
- Objectives: Identifies what the development team hoped to achieve with the exercise.
- Development team: The agencies and organizations that participated in exercise development.
- Scenario: A general identification of the scenario.
- Location: City and state where the event was held.
- Materials: The data, software, knowledge, and equipment needed to develop and conduct the exercise.
- Cost: The estimated amount spent to develop and conduct the exercise.
- References: Information used to complete the example tables and sources for more information.

Note: The information included in each example is limited to that which is included in agency and organization websites, reports issued by the exercise development teams, and scientific or trade journal articles.
<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Objectives</th>
<th>Organizers and Developers</th>
<th>Scenario</th>
<th>Location</th>
<th>Materials</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Platte River Basin Drought THIRA*</td>
<td>February 2011</td>
<td>Education, increased collaboration</td>
<td>University of Nebraska Public Policy Center, National Drought Mitigation Center, High Plains Regional Climate Center</td>
<td>5-year drought with multi-sector impacts</td>
<td>Kearney, NE</td>
<td>Paper-based game materials</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

**Resources**

(University of Nebraska Public Policy Center, 2018), available: [http://droughtthira.unl.edu](http://droughtthira.unl.edu)
<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Objectives</th>
<th>Organizers and Developers</th>
<th>Scenario</th>
<th>Location</th>
<th>Materials</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calgary Invitational Drought Tournament</td>
<td>February 2011</td>
<td>Education/ systems thinking</td>
<td>Agriculture and Agri-Food Canada, Canadian Water Resources Association, Environment Canada, Provinces of Saskatchewan, Alberta, British Columbia, Universities of Alberta and Saskatchewan, Intersol Consulting</td>
<td>Drought</td>
<td>Calgary, Alberta</td>
<td>GIS maps, Facilitators, risk assessment scoring, scenario set in a fictional location, paper-based game play</td>
<td>unknown</td>
</tr>
<tr>
<td>Saskatoon Invitational Drought Tournament</td>
<td>April 2012</td>
<td>Test quantitative tools</td>
<td>Agri-Food Canada, Canadian Water Resources Association, Environment Canada, Provinces of Saskatchewan, Alberta, British Columbia, Universities of Alberta and Saskatchewan, Local facilitation Consulting firm</td>
<td>Drought</td>
<td>Saskatoon, Saskatchewan</td>
<td>Systems Dynamics model, GIS, assessment of potential for incorporation of stochastic information, scenario set in a fictional location, paper-based game play</td>
<td>unknown</td>
</tr>
<tr>
<td>Resources</td>
<td>(Hill H. H., 2014), available: <a href="https://www.sciencedirect.com/science/article/pii/S2212094714000188">link</a></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(Strickert et al., 2015), available: <a href="https://www.researchgate.net/publication/281975425_Scoring_System_for_The_Invitational_Drought_Tournament">link</a></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Hill et al., 2013), available: <a href="http://www.wmo.int/pages/prog/wcp/drought/hmndp/documents/presentations/13.03-HMNDP-Session7-Hill.pdf">link</a></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><a href="https://www.youtube.com/watch?v=JJUvkFGzRc4">https://www.youtube.com/watch?v=JJUvkFGzRc4</a></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tournament</td>
<td>Month</td>
<td>Purpose</td>
<td>Participants</td>
<td>Location</td>
<td>Resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
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<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
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<td>---------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Colorado Drought Tournament</strong></td>
<td>September 2012</td>
<td>Education, increased collaboration and networking.</td>
<td>National Oceanic and Atmospheric Administration, National Drought Mitigation Center, Public and Private organizations and individuals in Colorado</td>
<td>Denver, CO</td>
<td>Resources available: <a href="https://www.drought.gov/drought/node/877">https://www.drought.gov/drought/node/877</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Okanagan Invitational Drought Tournament</strong></td>
<td>November 2012</td>
<td>Test usefulness of the tournament framework in a real world policy context; increased communication and collaboration; provide fun and engaging environment</td>
<td>Agriculture and Agri-Food Canada, University of British Columbia, Okanagan Basin Water Board, Province of British Columbia, Intersol Consultancy, private sector, watershed interest groups</td>
<td>Kelowana, British Columbia</td>
<td>Resources available: <a href="http://www.obwb.ca/workshops/okanagan-invitational-drought-tournament/">http://www.obwb.ca/workshops/okanagan-invitational-drought-tournament/</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
<td>Objectives</td>
<td>Organizers</td>
<td>Location</td>
<td>Expert Knowledge, Climate Data, Hydrologic Data, Water Demand Data, Crop Condition and Soil Moisture Reports, Play Book, Projector and Screen</td>
<td>Cost</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Lower Platte South Natural Resources District Drought Tournament</td>
<td>February 2015</td>
<td>Increase understanding of informal drought response protocols; generate response strategies for the district drought plan</td>
<td>JEO Consulting Group, Inc., HDR Inc., National Drought Mitigation Center, Lower Platte South Natural Resources District</td>
<td>Lincoln, NE</td>
<td>Expert knowledge, climate data, hydrologic data, water demand data, crop condition and soil moisture reports, play book, projector and screen</td>
<td>$10,000</td>
<td></td>
</tr>
<tr>
<td>San Antonio Watershed Multi-hazard Tournament</td>
<td>September 2015</td>
<td>Test the tournament framework for multiple hazards; education on regional water management issues, drought, flood, and water quality</td>
<td>U.S. Army Corps of Engineers, The San Antonio River Authority, The National Drought Mitigation Center</td>
<td>Floresville, TX</td>
<td>GIS, expert opinion, regulations and policies regarding the San Antonio River, Excel spreadsheet decision-support tool, table facilitator</td>
<td>$50,000</td>
<td></td>
</tr>
<tr>
<td>Caribbean Drought Tournament</td>
<td>November 2015</td>
<td>Link the drought tournament concept to drought forecasts</td>
<td>Caribbean Institute for Meteorology and Hydrology (CIMH), University of Arizona, International Research Institute for Climate and Society</td>
<td>St. Kitts</td>
<td>Drought forecasts, GIS, paper-based game play</td>
<td>unknown</td>
<td></td>
</tr>
</tbody>
</table>

**Resources**

(National Drought Mitigation Center, 2016), available: [https://drought.unl.edu/Publications/News.aspx?id=236](https://drought.unl.edu/Publications/News.aspx?id=236)


(IRI Climate and Society, 2016), available: [https://www.youtube.com/watch?v=tckSCGXFYVo](https://www.youtube.com/watch?v=tckSCGXFYVo)
<table>
<thead>
<tr>
<th>Event Type</th>
<th>Month</th>
<th>Description</th>
<th>Partners and Resources</th>
<th>Focus Areas</th>
<th>Location</th>
<th>Tools and Resources</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa Multi-hazard Tournament*</td>
<td>September 2016</td>
<td>Education; evaluate strategies for flood, drought, and water quality management</td>
<td>U.S. Army Corps of Engineers Institute for Water Resources and Rock Island District, Iowa State University, University of Iowa, University of Nebraska, Lincoln, Natural Resources Conservation Service, USDA, NOAA, USGS, The City of Cedar Rapids, UNESCO HELP, The Nature Conservancy, and Sandia Labs</td>
<td>Flood, drought, and nitrate levels in exceedance of acceptable levels</td>
<td>Cedar Rapids, IA</td>
<td>SWAT model, IoWaDSS Decision-Support tool, scenario set in actual location</td>
<td>$200,000</td>
</tr>
<tr>
<td>North Platte Natural Resources District Drought Tournament*</td>
<td>December 2016</td>
<td>Education, increased collaboration and networking, generate innovative strategies for drought planning</td>
<td>North Platte Natural Resources District, National Drought Mitigation Center</td>
<td>Drought</td>
<td>Scottsbluff, NE</td>
<td>Water and climate information, paper-based game play, scenario set in actual location</td>
<td>$20,000</td>
</tr>
<tr>
<td>Kansas Drought Tournament*</td>
<td>December 2016</td>
<td>Education and awareness of drought challenges and resources</td>
<td>Hydrologics, Kansas state agencies, NOAA National Integrated Drought Information System, National Drought Mitigation Center, U.S. Army Corps of Engineers</td>
<td>Drought</td>
<td>Emporia, KS</td>
<td>Hydrologic modeling, scenario set in a fictional location, Excel spreadsheet based decision support tool</td>
<td>$150,000</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th><strong>Texas Multi-hazard Tournament</strong></th>
<th><strong>June 2017</strong></th>
<th>Education; evaluate strategies for flood, drought, and water quality management</th>
<th>Water Resources and the Fort Worth District, U.S. Army Corps of Engineers, The San Antonio River Authority</th>
<th>Flood and water quality at extreme events at the 2, 10 and 100 year annual storm</th>
<th>San Antonio, TX</th>
<th>Hydrologic modeling, Iowa Decision-Support tool adapted to San Antonio River, HEC Flood Impact Assessment Model, GIS</th>
<th>$200,000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resources</strong></td>
<td><strong>None available</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>The Drought Game</strong></td>
<td><strong>April 2018</strong></td>
<td>Education</td>
<td>National Drought Mitigation Center, University of Nebraska-Lincoln School of Natural Resources</td>
<td>Drought</td>
<td>Lincoln, NE</td>
<td>Paper based game materials</td>
<td>$50, excludes development costs</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td><strong>None available</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TABLE 13: EXAMPLE DROUGHT-SCENARIO-BASED TABLETOP EXERCISES. *DENOTES EXERCISES FOR WHICH AN EVENT SUMMARY OR CASE STUDY HAS BEEN DEVELOPED.**

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Objectives</th>
<th>Organizers and Developers</th>
<th>Scenario</th>
<th>Location</th>
<th>Materials</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hualapai Drought Exercise</td>
<td>October 2005</td>
<td>Increase awareness of drought plan, test drought plan implementation; networking among agencies</td>
<td>National Drought Mitigation Center</td>
<td>Drought</td>
<td>Hualapai Nation</td>
<td>Expert opinion, climate data, drought plan, worksheets, flip charts</td>
<td>$2,000</td>
</tr>
</tbody>
</table>

**Resources**


### Table 14: Example Drought-Scenario-Based Functional Exercises.

*Denotes exercises for which an event summary or case study has been developed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Objectives</th>
<th>Organizers and Developers</th>
<th>Scenario</th>
<th>Location</th>
<th>Materials</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate Commission on the Potomac River Basin metropolitan area Drought Exercise</td>
<td>Annually for more than 20 years</td>
<td>Test and improve communication among organizations; test operational tools; practice operational decision-making</td>
<td>Interstate Commission on the Potomac River Basin</td>
<td>Vary from year-to-year</td>
<td>Washington D.C. metropolitan area</td>
<td>Exercise guide, email, telephone, computers, web based tools, forecasts and predictions, spreadsheets, training materials</td>
<td>Not available</td>
</tr>
</tbody>
</table>
Case Studies

The case studies presented in this section are geared to extract key information to assist in comparing events. These case studies provide information regarding the exercise duration, scope, evaluation, and funding sources and are limited to those in which the NDMC collected evaluation data. Each summary is divided into the following sections:

- Exercise type: Identifies whether it was a workshop, game, tabletop, or functional exercise.
- Exercise duration: The length of time it took to conduct the exercise.
- Development team: The agencies and organizations that participated in exercise development.
- Cost: The estimated amount spent to develop and conduct the exercise.
- Funding Source: The agencies, entities, or organizations that sponsored the exercise.
- Objectives: Identifies what the development team hoped to achieve with the exercise.
- Participants: The approximate number of participants and list of organizations, agencies, and sectors that participated in the exercise.
- Scope: The planning scale and inclusiveness of the exercise.
- Scenario: A brief overview of the scenario components.
- Agenda: An outline of the event.
- Materials: The data, software, knowledge, and equipment needed to develop and conduct the exercise.
- Participant roles: The characters that the exercise participants were assigned.
- Outcome evaluation: A summary of the evaluation time frame, methodology, and outcomes.
- References: Information used to develop the case study.
- Additional Information: Point of contact to obtain more information about the exercise.

Note: The information provided in these case studies is limited to that which is included in agency and organization websites, reports issued by the exercise development and evaluation teams, and scientific or trade journal articles.
North Platte River Basin Drought THIRA

**Exercise type**
Workshop

**Exercise date and location**
April 2017
Kearney, NE

**Exercise duration**
1 day

**Development team**
University of Nebraska Public Policy Center, National Drought Mitigation Center, and High Plains Regional Climate Center

**Approximate cost**
$20,000. Excluding staff time for exercise development drops the cost to approximately $3000 for catering, facilities, and travel.

**Funding source**
NOAA Sectoral Applications Research Program (SARP)

**Objectives**
- Determine the usefulness of the Department of Homeland Security’s THIRA process for drought planning
- Educate participants on the multi-sector impacts of drought
- Identify drought preparedness capabilities and required resources
- Increase collaboration in the planning process

**Scope**
Sub-state, multi-sector

**Participants**
Approximately 40 representatives including stakeholders and decision-makers in natural resources, energy, municipalities, emergency management, and recreation and tourism sectors, as well as facilitators, coordinators, and developers.

**Participant roles**
- Discussion group member
- Facilitators
- Drought experts
Scenario
The scenario was set in the North Platte River Basin with participants engaging in group discussions focused on 16 of the 32 core capabilities identified in the National Preparedness Goal. Participants could attend four groups, with each group focusing on a different core capability. Based on a scenario consisting of a 5-year drought with challenges such as wildfires, dust storms, West Nile, water supply and quality, decreased agricultural production, heatwaves, and power outages, participants identified desired preparedness, response, and recovery capabilities.

Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 9:00 AM – 3:00 PM | Welcome and overview of the day  
Introduction to drought scenario  
Setting desired outcomes for core capability areas (facilitated small group work)  
Working lunch  
Continuation of desired outcomes  
Review, evaluation, and next steps |

Materials
Hydrologic data, climatic data, GIS, expert opinion, flipcharts, socio-economic data

Outcome evaluation
Time Frame: short-term (before and immediately following); long-term (9 months following the workshop)
Method: pre-, post-, and post-post survey and interviews

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Short-term (n=25)</th>
<th>Long-term (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased extent of collaborating with other organizations in drought planning</td>
<td>83% increased slightly, moderately, or strongly</td>
<td>50% increased slightly, moderately, or strongly</td>
</tr>
<tr>
<td>Increased familiarity with the multi-sector impacts of drought</td>
<td>Increased, on average, by .33 of a category on a 5 point familiarity scale</td>
<td>Increased, on average, by .50 of a category on a 5 point familiarity scale</td>
</tr>
<tr>
<td>Workshop was helpful for advancing drought planning</td>
<td>96% agree</td>
<td>n/a</td>
</tr>
</tbody>
</table>

References
(University of Nebraska Public Policy Center, 2018)
NDMC participation in the development, evaluation, and facilitation of the event

Additional information
Deborah Bathke, National Drought Mitigation Center, dbathke2@unl.edu
Iowa Multi-hazard Tournament

Exercise type
Game

Exercise date and location
September 2016
Cedar Rapids, IA

Exercise duration
1 day

Development team
U.S. Army Corps of Engineers Institute for Water Resources and Rock Island District, Iowa State University, University of Iowa, University of Nebraska, Lincoln, Natural Resources Conservation Service, USDA, NOAA, USGS, The City of Cedar Rapids, UNESCO HELP, The Nature Conservancy, and Sandia Labs

Cost
$200,000

Funding source
U.S. Army Corps of Engineers
City of Cedar Rapids, IA

Objectives
- Increase the participants’ awareness of policies, strategies, and resources to reduce drought, flood, and water quality risks
- Evaluate the impacts of mitigation strategies for different climate conditions
- Build relationships and potential partnerships between stakeholders

Scope
Sub-state, multi-sector

Participants
Approximately 60 participants, representing entities ranging from federal, state, and local governments to non-governmental organizations, farmers, and academia, attended the tournament.

Scenario
Participants worked within teams to select appropriate adaptation options for the scenarios under the constraints of time, budgets, state and municipal regulations, and technical aspects. Game challenges took place over four rounds and included: (1) the selection of water management strategies and adaptation options for a 20-year planning period for a (2) flood, (3) drought, and (4) climate change. The scenario was set in the Cedar River Basin and was based upon hydrologic modeling and climate information.
Agenda

MORNING OF TOURNAMENT

7:30 – 8:20 Registration and Coffee/Tea
Welcome and Introductions
Selection of Team Names
Review of Agenda and Multi-Hazard Tournament Process
Initial Set-Up: Scenario Introduction, Decisions, Press Release Justification [65 minutes]
Initial Set-Up: Presentation & Scoring [50 minutes]

11:25 LUNCH – PROVIDED FOR PARTICIPANTS
Snacks and coffee/tea breaks will be provided throughout the morning and afternoon sessions.
Lunch will be ordered from a local restaurant in Cedar Rapids.

AFTERNOON OF TOURNAMENT

Announcement of Scores
Turn 2 & 3: Scenario Introduction(s), Decisions, & Press Release Justifications [70 minutes]
Turn 2 & 3: Presentation & Scoring [50 minutes]
Health Break [15 minutes]
Announcement of Scores
Final Turn: Scenario Introduction, Decisions, Press Release Justification [50 minutes]
Final Turn: Presentation & Scoring [50 minutes]
Reflection & Evaluation
Announcement of Scores & Award Presentation
Closing Comments and Next Steps
5:00 Adjourn

Materials
Expert knowledge, climate and hydrologic data, hydrologic model, web based decision-support system,
drought impact data, play book, computers and monitors

Participant roles
- Multi-sector team player
- Team facilitator
- Announcer
- Referee
Outcome evaluation
Time Frame: short-term (before and immediately following); long-term (3 months following)
Method: pre-, post-, and post-post survey

<table>
<thead>
<tr>
<th>Reported outcomes</th>
<th>Percentage in agreement (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-term</strong></td>
<td></td>
</tr>
<tr>
<td>Increased awareness of the hazard planning process</td>
<td>43</td>
</tr>
<tr>
<td>Increased likelihood of using climate information in decision making</td>
<td>52</td>
</tr>
<tr>
<td>Met new potentially beneficial contacts</td>
<td>95</td>
</tr>
<tr>
<td>Increased knowledge of other’s interests with regard to water</td>
<td>85</td>
</tr>
<tr>
<td>Identification of collaboration opportunities</td>
<td>63</td>
</tr>
<tr>
<td>Learned information that would inform future water-related decisions</td>
<td>71</td>
</tr>
<tr>
<td><strong>Long-term</strong></td>
<td></td>
</tr>
<tr>
<td>Sought additional education or training as a result of the tournament</td>
<td>62 and 22, respectively</td>
</tr>
<tr>
<td>Pursued new collaborations</td>
<td>62</td>
</tr>
<tr>
<td>Considered changes to plans, policies, or procedures</td>
<td>62</td>
</tr>
<tr>
<td>Begun enacting changes to plans, policies, and procedures</td>
<td>14</td>
</tr>
</tbody>
</table>

References
(Carson et al., 2018)
(US Army Corps of Engineers, 2016)
NDMC participation in the development, evaluation, and facilitation of the event

Additional information
Jason Smith, U.S. Army Corps of Engineers, Jason.T.Smith2@usace.army.mil
Rolf Olsen, U.S. Army Corps of Engineers, J.Rolf.Olsen@usace.army.mil
Andrea Carson, U.S. Army Corps of Engineers, Andrea.L.Carson@usace.army.mil
Deborah Bathke, National Drought Mitigation Center, dbathke2@unl.edu
Exercise type
Game

Exercise date and location
November 2016
Scottsbluff, NE

Exercise duration
1 day

Development team
North Platte Natural Resources District, National Drought Mitigation Center

Cost
$20,000

Funding source
North Platte Natural Resources District

Objectives
- Educate stakeholders on the multi-sector impacts of drought
- Engage stakeholders in the planning process
- Generate strategies to inform the District’s drought policy

Scope
Regional, multi-sector

Participants
Approximately 30 participants, representing sectors such as agriculture, the media, business, economic, recreation, water supply and irrigation, social services, education, and the facilitators and development team.

Scenario
Participants worked within their teams to identify vulnerabilities, address those vulnerabilities through mitigation and response strategies, identify partnerships and resources need to implement the strategies, and present the strategies for scoring. Game challenges took place over three rounds with progressive decreases in water supply. The scenario was set in the North Platte Natural Resources District and was based upon hydrologic data and climate information to reflect increasingly worse conditions as compared to 2012, the region’s most recent exceptional drought as defined by the U.S. Drought Monitor.
### Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>Welcome and introductions</td>
</tr>
<tr>
<td>09:30</td>
<td>Introduction to the tournament, information available and general instructions</td>
</tr>
<tr>
<td>09:50</td>
<td>Q&amp;A</td>
</tr>
<tr>
<td>10:00</td>
<td>Round instructions</td>
</tr>
<tr>
<td>10:10</td>
<td>Round instructions</td>
</tr>
<tr>
<td>11:00</td>
<td>Individual team discussion and plan development</td>
</tr>
<tr>
<td>11:30</td>
<td>Presentations (6 minutes per team)</td>
</tr>
<tr>
<td>11:30</td>
<td>Facilitated discussion, referee and team scoring</td>
</tr>
<tr>
<td>12:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>13:30</td>
<td>Lunch</td>
</tr>
<tr>
<td>13:00</td>
<td>Round instructions</td>
</tr>
<tr>
<td>13:10</td>
<td>Round instructions</td>
</tr>
<tr>
<td>13:40</td>
<td>Individual team discussion and plan development</td>
</tr>
<tr>
<td>13:40</td>
<td>Presentations (4 minutes per team)</td>
</tr>
<tr>
<td>13:40</td>
<td>Facilitated discussion, referee and team scoring</td>
</tr>
<tr>
<td>14:15</td>
<td>Break</td>
</tr>
<tr>
<td>14:30</td>
<td>Round instructions</td>
</tr>
<tr>
<td>14:30</td>
<td>Round instructions</td>
</tr>
<tr>
<td>14:40</td>
<td>Individual team discussion and plan development</td>
</tr>
<tr>
<td>15:20</td>
<td>Presentations (4 minutes per team)</td>
</tr>
<tr>
<td>15:20</td>
<td>Facilitated discussion, referee and team scoring</td>
</tr>
<tr>
<td>15:40</td>
<td>Tournament wrap-up</td>
</tr>
<tr>
<td>15:40</td>
<td>Conclude scoring tallies</td>
</tr>
<tr>
<td>16:00</td>
<td>Announce winning team</td>
</tr>
<tr>
<td>16:00</td>
<td>Facilitated discussion, referee and team scoring</td>
</tr>
<tr>
<td>16:00</td>
<td>Final discussion</td>
</tr>
<tr>
<td></td>
<td>Conclude scoring tallies</td>
</tr>
</tbody>
</table>

### Materials

- Expert knowledge
- Climate and hydrologic data
- Hydrologic model
- Drought impact data
- Maps
- Flip charts
- Playbook
- Calculators

### Participant roles

- Multi-sector team player
- Team facilitator
- Facilitator
- Referee

### Outcome evaluation

**Time Frame:** (before and immediately following)

Method: pre- and post-survey
<table>
<thead>
<tr>
<th>Reported outcomes</th>
<th>Percentage in agreement (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased awareness of the hazard planning process</td>
<td>75</td>
</tr>
<tr>
<td>Increased likelihood of using climate information in decision making</td>
<td>70</td>
</tr>
<tr>
<td>Learned information that would inform future water-related decisions</td>
<td>75</td>
</tr>
<tr>
<td>Willingness to engage in future discussions of drought mitigation and response strategies</td>
<td>100</td>
</tr>
</tbody>
</table>

**References**

(North Platte NRD and NDMC, 2016)
(Bathke et al., 2017)
(North Platte Natural Resources District, 2019)
NDMC participation in the development, evaluation, and facilitation of the event

**Additional information**
Deborah Bathke, National Drought Mitigation Center, dbathke2@unl.edu
Texas Multi-hazard Tournament

Exercise type
Game

Exercise date and location
June 2017
San Antonio, TX

Exercise duration
1 day

Development team
Water Resources and the Fort Worth District, U.S. Army Corps of Engineers, The San Antonio River Authority

Cost
$200,000

Funding source
U.S. Army Corps of Engineers Silver Jackets Program

Objectives
- Increase the participants’ awareness of policies, strategies, and resources to reduce drought, flood, water quality, and riparian degradation hazards
- Evaluate the impacts of mitigation strategies for different climate conditions
- Build relationships and potential partnerships between stakeholders

Scope
Sub-basin, multi-sector

Participants
Approximately 50 participants, representing sectors such as water resources, planning, agriculture, natural resources, recreation and tourism, public health, energy, education and others.

Scenario
Participants worked within teams to select appropriate adaptation options for the scenarios under the constraints of time, budgets, state and municipal regulations, and technical aspects. Game challenges took place over two rounds and included: the selection of adaptation options and water management strategies and for (1) current conditions and (2) future conditions (2, 10, and 100-year planning period) for a flood, drought, and water quality and watershed degradation. The scenario was set in the San Antonio River Basin and was based upon hydrologic and environmental quality modeling and climate information.
**Agenda**

**MORNING OF TOURNAMENT**

10:00 AM Start

Welcome and Introductions
Selection of Team Names
Review of Agenda and Multi-Hazard Tournament Process
Discussion of Metric Weights
Current Conditions: Scenario Introduction, Adaptation Options, Justification Preparation
Current Conditions: Justification Presentation and Scoring

**11:25 LUNCH – PROVIDED FOR PARTICIPANTS**

Lunch will be ordered from a local restaurant.

**AFTERNOON OF TOURNAMENT**

Current Conditions: Annunciation of Scores
Future Conditions: Scenario Introduction, Adaptation Options, Justification Preparation
Future Conditions: Justification Presentation and Scoring
Reflection and Evaluation
Announcement of Scores
Closing Comments and Next Steps

2:00 PM Adjourn

**Materials**

Hydrologic and water quality modeling, Iowa Decision-Support tool adapted to San Antonio River, HEC Flood Impact Assessment Model, GIS

**Participant roles**

- Multi-sector team player
- Team facilitator
- Facilitator
- Referee

**Outcome evaluation**

Time Frame: short-term (before and immediately following); long-term (6 months following)
Method: pre-, post-, and post-post surveys

<table>
<thead>
<tr>
<th>Reported outcomes</th>
<th>Percentage in agreement (n=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased awareness of the hazard planning process</td>
<td>92</td>
</tr>
<tr>
<td>Met new potentially beneficial contacts</td>
<td>96</td>
</tr>
<tr>
<td>Increased knowledge of other’s interests with regard to water</td>
<td>96</td>
</tr>
<tr>
<td>Identification of collaboration opportunities</td>
<td>76</td>
</tr>
<tr>
<td>Learned information that would inform future water-related decisions</td>
<td>80</td>
</tr>
</tbody>
</table>

**References**

(Teague, 2017)
(Hackett and Carson, 2018)
(Hill, 2018)
NDMC participation in the evaluation of the event

Additional information
Rolf Olsen, U.S. Army Corps of Engineers, J.Rolf.Olsen@usace.army.mil
Andrea Carson, U.S. Army Corps of Engineers, Andrea.L.Carson@usace.army.mil
Deborah Bathke, National Drought Mitigation Center, dbathke2@unl.edu
Kansas Drought Tournament

**Exercise type**
Game

**Exercise date and location**
December 2016
Emporia, KS

**Exercise duration**
1 day

**Development team**

**Cost**
$150,000

**Funding source**
National Integrated Drought Information System

**Objectives**
- Educate stakeholders on the multi-sector impacts of drought
- Increase awareness of drought challenges and the resources available during drought

**Scope**
State, multi-sector

**Participants**
49 participants, representing local and tribal governments, state and federal agencies, business, academia, NGOs, Conservation Districts, and Water Assurance Districts. Sectors included water resources, natural resource conservation, hazards planning and management, community and regional planning, forestry/fire management, recreation and tourism, and energy.

**Scenario**
Participants worked within their teams to select appropriate mitigation, response, adaptation options for the drought scenario under the constraints of time, budgets, state and municipal regulations, and technical feasibility. The game consisted of two rounds (see agenda) – a morning session in which teams competed against each other and an afternoon session in which teams worked collaboratively, as a single group, to agree on the best set of options. The scenario was set in a fictional basin set in Kansas and was based on real data from a hydrologically, geologically, and geographically similar region in eastern Kansas.
Agenda

9:00 – 9:15 Welcome and introductions
9:15 – 9:30 Big picture overview of the tournament
9:30 – 10:00 Description of the scenario and how to play
10:00 – 12:00 Competitive session: finding options
12:00 – 12:30 Presentation of team options, results, and voting
12:30 – 1:30 Lunch
1:30 – 3:00 Collaborative session: pushing
3:00 – 3:30 Presentations to full groups
3:30 – 4:00 Closing and thanks

Materials
Expert knowledge, climate and hydrologic data, hydrologic model, Excel spreadsheet decision support tool, water use and response strategies, playbook, scoring ballots

Participant roles
- Multi-sector team player
- Team facilitator
- Facilitator
- Referee
- Fans

Outcome evaluation
Time Frame: short-term (before and immediately following)
Method: pre- and post-survey

<table>
<thead>
<tr>
<th>Reported outcomes</th>
<th>Percentage in agreement (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased awareness of the hazard planning process</td>
<td>64</td>
</tr>
<tr>
<td>Increased likelihood of using climate information in decision making</td>
<td>36</td>
</tr>
<tr>
<td>Met new potentially beneficial contacts</td>
<td>100</td>
</tr>
<tr>
<td>Increased knowledge of others’ interests with regard to water</td>
<td>96</td>
</tr>
<tr>
<td>Identification of collaboration opportunities</td>
<td>72</td>
</tr>
<tr>
<td>Learned information that would inform future water-related decisions</td>
<td>64</td>
</tr>
</tbody>
</table>

References
(Hydrologics, 2016)
(Haigh, 2016)
(Kansas Water Office, 2015)

Additional information
Kansas Water Office, kwo-info@kwo.ks.gov
Ready for Drought? The Drought Game

**Exercise type**
Game

**Exercise date and location**
May 2018
Lincoln, Nebraska

**Exercise duration**
1 hour 45 minutes

**Development team**
The National Drought Mitigation Center and the School of Natural Resources at the University of Nebraska-Lincoln

**Cost**
$50 for printing game materials. Excludes staff time for game development.

**Funding source**
National Integrated Drought Information System

**Objectives**
- Test the functionality of The Drought Game
- Educate participants on the importance of multi-sector and cross-community communication when enhancing the resilience to drought
- Engage people in discussions about drought in fun and competitive environment

**Scope**
Missouri River Basin DEWS, multi-sector

**Participants**
40 people mostly University of Nebraska – Lincoln students (undergraduate and graduate), faculty and NDMC staff including facilitators and game developers.

**Scenario**
Players began by selecting a role in one of six sectors that were identified as critical for addressing drought mitigation and impacts: private citizens, community groups, government agencies, decision makers, responders, and business and industry. Participants met as sectors to select resources (from a predetermined list) to help make their community more resilient to a drought. Next, participants were grouped into fictional communities representative of those that could be found in the Missouri River Basin Drought Early Warning System region [https://www.drought.gov/drought/regions/dews](https://www.drought.gov/drought/regions/dews). Communities included one person from each sector. Each community encountered a different challenge that their team needed to solve. Challenges included a West Nile Virus outbreak, power outage, decline in reservoirs and streamflow, water pump
failure, pasture degradation, and decreased water quality. Communities were allowed to trade resources freely, building cooperation and resilience of the entire area.

**Agenda**

<table>
<thead>
<tr>
<th>ROLE SELECTION</th>
<th>RESOURCE SELECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Players select roles from one of six sectors.</td>
<td>Sectors meet to discuss and select 12 out of 24 resources. Resources are distributed among the players in that sector.</td>
</tr>
</tbody>
</table>

**DROUGHT RESPONSE PHASE**

Players take resources back to their community to solve a drought related challenge. Resources can be freely traded.

**RECOVERY PHASE**

Scoring and discussion of communities’ ability to solve their challenge.

**ADAPTATION PHASE**

Discussion and reflection of how the game relates to an actual drought. Discussion points: resource selection, strategies, sharing of resources, learning outcomes.

**Materials**

Downloadable template (in development) of the *Ready for Drought? The Drought Game*, sticky notes of six different colors, flip charts with printed challenge boards.

**Participant roles**

- Community member/multi-sector team player
- 1 facilitator and 3 helpers

**Outcome evaluation**

Time Frame: short-term

Method: discussion during the game and a questionnaire administered one week later

**Short-term outcomes (based on written responses)**

- **Increased** understanding of the importance of multi-sector communication and community collaboration
- Increased knowledge of the resources needed to plan for and respond to drought
- Increased awareness of differing perspectives of drought

**References**

The game was based, with permission, on the Extreme Event Game (National Academy of Sciences, 2018).

**Additional information**

Deborah Bathke, National Drought Mitigation Center, dbathke2@unl.edu
Comparative Analysis of Case Studies

Overview

When selecting a drought-scenario-based exercise, the development team not only needs to consider the different types of exercise, but also the varying levels of complexity, resource requirements, and technological sophistication that can exist within each exercise type. Learning from past events can help the team assess the potential value of their resource investments in terms of participants’ experience and exercise outcomes.

In the case studies section above, we provide key information for numerous exercises to allow readers to make their own assessments of the value and outcomes associated with varying resource levels. In this section, we summarize overall trends in participant evaluations related to the outcomes and participant experiences from a workshop and four games (i.e., invitational drought or multi-hazard tournaments). This qualitative study allows us to draw lessons learned and recommendations for developing workshops and games at both lower and higher price points. Our intent is not to assess the merit or worth of these exercises, but rather to use the findings as evidence of best-practices to inform others.

Findings in this section are based upon NDMC evaluations of four game-based scenario exercises held in 2016 and 2017, including the Iowa Multi-hazard Tournament, North Platte Natural Resources District (NRD) Drought Tournament, Texas Multi-hazard Tournament, and Kansas Drought Tournament, and the evaluation of the North Platte River Basin Drought THIRA workshop, to which the NDMC contributed. Each evaluation included pre- and post-event (i.e., immediately following the event) surveys. Additionally, three events included follow-up (i.e., post-post) surveys to help gauge longer-term outcomes (Table 15). The evaluations provide information that may help others set expectations and objectives for their exercises. While we made efforts to administer similar survey questions to participants of the events, ultimately the event organizers made the final decision, limiting the extent to which we were able to standardize and replicate the surveys.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Evaluation Method(s)</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Platte River Basin Drought THIRA</td>
<td>pre-, post-, and post-post (9 months) surveys</td>
<td>25</td>
</tr>
<tr>
<td>Iowa Multi-hazard Tournament</td>
<td>pre-, post-, and post-post (6 months) surveys</td>
<td>21</td>
</tr>
<tr>
<td>North Platte Natural Resources District</td>
<td>pre- and post-surveys</td>
<td>20</td>
</tr>
<tr>
<td>Drought Tournament</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texas Multi-hazard Tournament</td>
<td>pre-, post-, and post-post (6 months) surveys</td>
<td>25</td>
</tr>
<tr>
<td>Kansas Drought Tournament</td>
<td>pre- and post-survey</td>
<td>25</td>
</tr>
</tbody>
</table>

The four games were played as multi-round tournaments, with group-based competition at the core, while the THIRA exercise was conducted as an interactive workshop. Common objectives among all of the exercises included education about water resources management and improving collaboration and
coordination. Additionally, the games generally included objectives related to the identification of problems and management strategies and building consensus around diverse stakeholder interests (Table 16).

### TABLE 16: SUMMARY OF EVENTS INCLUDED IN THE COMPARATIVE ANALYSIS.

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Iowa Multi-hazard Tournament</th>
<th>Kansas Drought Tournament</th>
<th>Texas Multi-hazard Tournament</th>
<th>North Platte NRD Drought Tournament</th>
<th>North Platte River Basin Drought THIRA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of exercise</strong></td>
<td>Game</td>
<td>Game</td>
<td>Game</td>
<td>Game</td>
<td>Workshop</td>
</tr>
<tr>
<td><strong>General Objectives</strong></td>
<td>Increasing awareness (e.g., informing, educating) around water resources management</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Building relationships, partnerships, collaboration, and coordination</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Evaluating and building consensus around appropriate strategies</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Engaging stakeholders in planning and decision-making</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Scenarios</strong></td>
<td>Flood, drought, climate change</td>
<td>Drought</td>
<td>Flood, drought, climate change</td>
<td>Drought</td>
<td>Drought</td>
</tr>
<tr>
<td><strong>Number of tournament rounds</strong></td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Technology used to interact with scenario</strong></td>
<td>Web-based decision support tool</td>
<td>Web-based decision support tool</td>
<td>Web-based decision support tool</td>
<td>Flip charts and calculators</td>
<td>Handouts, presentation, flipcharts</td>
</tr>
<tr>
<td><strong>Approximate cost of event</strong></td>
<td>$200,000</td>
<td>$150,000</td>
<td>$200,000</td>
<td>$10,000</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

Participant perceived outcomes

To explore participants’ perception of the success of drought scenario-based exercises in meeting the intended objectives, we synthesized data collected through pre-, post-, and post-post exercise surveys. Findings are described in terms of four generalized exercise objectives: (1) increasing awareness around water resource management; (2) building relationships, partnerships, collaboration, and coordination; (3) evaluating and building consensus around appropriate mitigation, adaptation and/or response strategies; and (4) engaging stakeholders in planning and decision-making.

1. Increasing awareness (e.g., informing, educating) around water resources management:

We measured this outcome through pre- and post-tournament self-assessments of familiarity with impacts and/or mitigation and response strategies and participant recommendations related to educational outcomes. Many participants agreed that they were more familiar with the process of planning for hazards than they were before participating in a tournament (Table 17). A smaller percentage
agreed that they would be more likely to use climate information in decision-making and planning after participating in the tournament than before their participation. Comments indicated that participants felt that the tournament was a good format for education with comments such as “I realized how little I knew about water resources” (North Platte NRD Drought Tournament participant), and “I did not really think about the big picture and planning structure that is required to implement this in a financially responsible way that is adequately relayed to public for voting and acceptance” (Texas Multi-hazard Tournament participant). Evaluations from the THIRA workshop showed evidence that this lower-cost format was also useful for educational purposes, with participants reporting increases in familiarity with drought impacts.

TABLE 17: PERCENT OF PARTICIPANTS AGREEING WITH STATEMENTS RELATED TO EDUCATIONAL OR TRAINING OUTCOMES.
NOTE: THE NORTH PLATTE NRD EVALUATION DID NOT INCLUDE AS SIMILAR QUESTION.

<table>
<thead>
<tr>
<th>Evaluation Question</th>
<th>Iowa Multi-hazard tournament</th>
<th>Kansas Drought Tournament</th>
<th>Texas Multi-hazard Tournament</th>
<th>North Platte NRD Drought Tournament</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am more familiar with the process of planning for hazards than before the tournament.</td>
<td>43%</td>
<td>64%</td>
<td>92%</td>
<td>75%</td>
</tr>
<tr>
<td>I am more likely now to use climate information to help me make decisions and plan than before the tournament.</td>
<td>52%</td>
<td>36%</td>
<td>n/a</td>
<td>70%</td>
</tr>
<tr>
<td>I learned information that will inform my future decisions related to water</td>
<td>71%</td>
<td>64%</td>
<td>80%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Educational outcomes were dependent upon the goal of the exercise and the related scenario components. For example, the THIRA workshop, which focused on participants identifying response capabilities for drought-related challenges, increased familiarity with drought impacts such as wildfires, economic health, energy and transportation infrastructure, and public health. On the other hand, the Iowa and Texas Multi-hazard Tournament, which focused on evaluating costs and trade-offs of mitigation strategies under different climate extremes, increased participant familiarity with options associated with water quality, flood control, and drought mitigation. In Iowa, this included strategies such as adjustments to municipal well intakes, relocation of structures, conservation campaigns, water system efficiency, municipal nitrate removal technology, and bioreactor nitrification. In Texas, familiarity increased with locally-applicable strategies, such as elevating and relocating structures through planning and zoning processes and enacting policies to encourage on-site storm water management. We did not find evidence that higher cost events result in better educational outcomes.

Evaluation results also indicate that participation in tournaments may inspire individuals to seek additional education for topics addressed in the exercise. For example, six months after both the Iowa tournament and the Texas tournament, a majority of survey respondents said they had sought more information about water quality, flood, or drought mitigation. This question was not included in the evaluation of the THIRA workshop, limiting the extrapolation of results to this exercise type.

While participants self-reported learning at the tournaments, they were less likely to recommend using this format for educational purposes than they were for other purposes (Table 18). Participants in the Iowa, Kansas, and Texas tournaments ranked the following in the bottom half of recommended purposes:
learning about the hazard planning process, identifying needs for additional training, and learning about climate impacts. The slightly lower rank in recommendation may indicate that a less complex, shorter-duration format may be preferred by participants, if the organizer’s objective is primarily educational. One participant commented, “...8 hours of a person’s day are requested the day of the game, very few people will spend much time. Given the expectation that a greater knowledge ... would be developed...I do think a 2 hour lecture or forum focused on these topics would deliver a lot more” (Iowa Multi-hazard Mitigation Tournament participant).

TABLE 18: PERCENTAGE OF PARTICIPANTS WHO RESPONDED YES TO THE SURVEY QUESTION, “FOR WHICH OF THE FOLLOWING PURPOSES WOULD YOU RECOMMEND USE OF THE DROUGHT OR MULTI-HAZARD TOURNAMENT TO OTHERS?” NOTE: A SIMILAR QUESTION WAS NOT INCLUDED IN THE EVALUATIONS FOR THE NORTH PLATTE NRD DROUGHT TOURNAMENT OR THE NORTH PLATTE RIVER BASIN DROUGHT THIRA.

<table>
<thead>
<tr>
<th>Evaluation Question</th>
<th>Iowa Multi-hazard Tournament (n=21)</th>
<th>Kansas Drought Tournament (n=25)</th>
<th>Texas Multi-hazard Tournament (n=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving communication among stakeholders</td>
<td>71%</td>
<td>96%</td>
<td>88%</td>
</tr>
<tr>
<td>Networking among stakeholders</td>
<td>71%</td>
<td>84%</td>
<td>88%</td>
</tr>
<tr>
<td>Increasing levels of trust among stakeholders</td>
<td>52%</td>
<td>84%</td>
<td>84%</td>
</tr>
<tr>
<td>Identifying the costs and trade-offs among various strategies for solving problems</td>
<td>62%</td>
<td>72%</td>
<td>84%</td>
</tr>
<tr>
<td>Creating new collaborations to address common problems</td>
<td>67%</td>
<td>72%</td>
<td>80%</td>
</tr>
<tr>
<td>Identifying strengths and weaknesses in various strategies for solving problems</td>
<td>52%</td>
<td>76%</td>
<td>76%</td>
</tr>
<tr>
<td>Learning about the hazard planning process</td>
<td>43%</td>
<td>64%</td>
<td>84%</td>
</tr>
<tr>
<td>Identifying needs for additional training</td>
<td>48%</td>
<td>64%</td>
<td>76%</td>
</tr>
<tr>
<td>Developing hazard mitigation/response plan(s) focusing on drought, water quality, or flooding hazards</td>
<td>48%</td>
<td>52%</td>
<td>76%</td>
</tr>
<tr>
<td>Evaluating the financial investments needed to solve problems</td>
<td>33%</td>
<td>56%</td>
<td>76%</td>
</tr>
<tr>
<td>Learning about climate impacts</td>
<td>33%</td>
<td>48%</td>
<td>80%</td>
</tr>
<tr>
<td>Conducting vulnerability assessments related to drought, floods, and/or water quality</td>
<td>29%</td>
<td>44%</td>
<td>76%</td>
</tr>
</tbody>
</table>

2. Building relationships, partnerships, collaboration, and coordination

Many of the tournaments listed “building relationships and collaboration” specifically as an objective. Evaluations show that collaboration and relationship-building are among the most positively experienced outcomes reported by participants. Post-tournament evaluation results from the Iowa, Kansas, and Texas tournaments and the THIRA workshop indicate that almost all participants met new, potentially beneficial contacts and learned about another person’s interests with regard to water. Additionally, most said they
discussed potential collaborations or had identified potential opportunities to collaborate (Table 19). Participants in the Iowa, Kansas, and Texas tournaments were more likely to say that they would recommend using the tournament format for creating new collaborations to address common problems and improving communication, networking, and levels of trust among stakeholders than for almost any other use (Table 18).

Participation in tournaments also appears to positively affect long-term coordination. Six months after the Iowa tournament, a majority of survey respondents had identified opportunities for coordination with other agencies and/or pursued potential collaborations. When asked about the impact of the tournament on partnerships and collaboration, participants responded, “Hopefully, improved knowledge and access between technical and policy folks” (Texas Multi-hazard Tournament participant), "Collaboration, a more holistic approach to problem solving" (North Platte River Basin Drought THIRA participant), and "It brought people together, all aspects of this community" (North Platte River Basin Drought THIRA participant).

TABLE 19: PERCENT OF PARTICIPANTS AGREEING WITH STATEMENTS RELATED TO RELATIONSHIP-BUILDING OR COLLABORATION OUTCOMES. NOTE: A SIMILAR QUESTION WAS NOT INCLUDED IN THE NORTH PLATTE RIVER BASIN DROUGHT TOURNAMENT.

<table>
<thead>
<tr>
<th>Evaluation Question</th>
<th>Iowa Multi-hazard Tournament</th>
<th>Kansas Drought Tournament</th>
<th>Texas Multi-hazard Tournament</th>
<th>North Platte River Basin Drought THIRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet or interact with local, regional, state agency representatives and emergency management?</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>60-88%</td>
</tr>
<tr>
<td>Meet a person you didn’t know before who could be a beneficial contact in the future?</td>
<td>95%</td>
<td>100%</td>
<td>96%</td>
<td>N/A</td>
</tr>
<tr>
<td>Discuss potential projects or collaborations?</td>
<td>75%</td>
<td>56%</td>
<td>56%</td>
<td>N/A</td>
</tr>
<tr>
<td>Learn about another person’s interests with regard to water management that will be useful to you professionally?</td>
<td>85%</td>
<td>96%</td>
<td>96%</td>
<td>N/A</td>
</tr>
<tr>
<td>Identify potential opportunities to coordinate efforts?</td>
<td>63%</td>
<td>72%</td>
<td>76%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

3. Evaluating and building consensus around appropriate strategies

Evaluating and building consensus was listed as an objective of the Iowa Multi-hazard, Texas Multi-hazard, and North Platte NRD Drought Tournaments. Participant surveys show moderate evidence for using the tournament format to evaluate strategies and build consensus. Pre- and post- tournament comparisons (Table 20) showed that the North Platte Drought Tournament changed some participants’ opinions on the helpfulness of various strategies for drought. Additionally, the tournament appeared to sway consensus between “would help a little” and “would help a lot,” most notably with regard to planting drought-tolerant species, restricting crop watering, and fallowing farm fields.
The Iowa and Texas tournaments asked participants’ pre- and post-tournament perceptions of the top three strategies for simultaneously protecting and enhancing water quality, minimizing flood damages, and minimizing drought damages. Participants in the Texas tournament prioritized the same strategies (i.e., policies to encourage on-site storm water management, capital improvement projects to modify the floodplain, developing open space with recreational opportunities) after participating in the tournament as they did before participating. Conversely, participants in the Iowa tournament shifted some of their prioritizations. Participants increased their support for planting cover crops and maintained their vote for changing land cover from row crops to wetlands as top three strategies, but were no closer to consensus on the third top priority after the tournament than they were prior to the tournament.

After the tournament, most participants said that they would recommend this format for identifying the strengths and weaknesses and costs and trade-offs of various strategies for solving problems (Table 18). Slightly fewer said that they would recommend tournaments for evaluating the financial investments needed to solve problems. While variations existed among the evaluations of the Iowa, Texas and the North Platte NRD tournaments, our findings do not indicate a difference between higher-cost (i.e., Iowa and Texas) and lower-cost (i.e., North Platte NRD) tournaments in their effectiveness for evaluating and building consensus among appropriate strategies.

Increased coordination and collaboration may also have the long-term effect of building cross-sector consensus. Comments regarding tournament accomplishments included that it “Brought many different groups together to problem solve a scenario. Bring [sic] much more perspectives” (North Platte NRD Drought Tournament participant) and “It allowed some individuals to come together to talk about an issue we would not have done otherwise” (North Platte NRD Drought Tournament participant). One participant from the Texas Multi-hazard Tournament said, “The tournament provided great foundation in developing [a] regional/area wide strategy concept. This strategy forces us to think outside our own backyard and see impacts from other areas that eventually affect us.”

4. Engaging stakeholders in planning and decision-making:
Only one tournament in our evaluation, the North Platte NRD Drought Tournament, included “engaging stakeholders in the planning process” as a specific objective. This tournament was specifically planned as the first stage in development of a drought plan for the NRD. Ideas generated during the tournament became conversation starting points for stakeholder meetings held later in the planning process. When participants were invited to participate in the development of the drought plan, most said they were either somewhat or very interested in contributing to the official drought planning process, participating in further discussions about mitigation and response strategies, participating in monthly sessions about addressing drought-related vulnerabilities, and taking responsibility for the implementation of a specific mitigation or response activity (Table 21). While it was not possible to conduct a follow-up survey months after the North Platte tournament, planning staff of the NRD indicated that some drought tournament participants engaged in the drought planning stakeholder group throughout the resulting planning process.
TABLE 20: NORTH PLATTE NRD DROUGHT TOURNAMENT PARTICIPANTS’ PRE- AND POST- TOURNAMENT PERCEPTIONS OF THE HELPFULNESS OF VARIOUS STRATEGIES FOR LESSENING DROUGHT HARM.

<table>
<thead>
<tr>
<th>Evaluation question</th>
<th>Pre-tournament/Post-tournament n = 21/18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Would not help at all</td>
</tr>
<tr>
<td>Planting drought-tolerant species in yards and fields</td>
<td>0%/0%</td>
</tr>
<tr>
<td>Installing water-saving fixtures in homes and businesses</td>
<td>0%/5%</td>
</tr>
<tr>
<td>Restrictions on watering crops</td>
<td>5%/5%</td>
</tr>
<tr>
<td>City-wide water conservation campaigns</td>
<td>0%/5%</td>
</tr>
<tr>
<td>Drilling new water supply wells</td>
<td>46/31%</td>
</tr>
<tr>
<td>Fallowing farm fields</td>
<td>11/24%</td>
</tr>
<tr>
<td>Distributing bottled water supplies</td>
<td>35/37%</td>
</tr>
<tr>
<td>Restrictions on watering lawns</td>
<td>0/11%</td>
</tr>
<tr>
<td>Relocating structures</td>
<td>50/38%</td>
</tr>
</tbody>
</table>

TABLE 21: PERCENT OF NORTH PLATTE NRD DROUGHT TOURNAMENT PARTICIPANTS INDICATING INTEREST IN ENGAGING IN THE PLANNING PROCESS.

<table>
<thead>
<tr>
<th>Participate contextual data, information or feedback to an official drought planning process</th>
<th>Not at all interested</th>
<th>Somewhat interested</th>
<th>Very interested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate in discussions that will define the most feasible and comprehensive local mitigation and response strategies to address drought hazards</td>
<td>13%</td>
<td>63%</td>
<td>25%</td>
</tr>
<tr>
<td>Participate in monthly sessions, which would be used to plan how climate data, drought-related information and local capacity will be employed to address drought-related vulnerabilities</td>
<td>0%</td>
<td>61%</td>
<td>39%</td>
</tr>
<tr>
<td>Assume a leadership role on a drought planning subcommittee (ex. sector-based committee, topical committee)</td>
<td>28%</td>
<td>50%</td>
<td>22%</td>
</tr>
<tr>
<td>Assume a leadership role on the main planning committee responsible for the development of a comprehensive drought plan</td>
<td>61%</td>
<td>28%</td>
<td>11%</td>
</tr>
<tr>
<td>Take responsibility for the implementation of a specific mitigation or response activity prescribed as part of a drought plan</td>
<td>65%</td>
<td>29%</td>
<td>6%</td>
</tr>
</tbody>
</table>

For tournaments not specifically geared toward plan development (i.e., Iowa, Texas, and Kansas), participants did see value in using these events as part of the planning process. Between 29 and 76 percent said that they would recommend using a tournament for conducting vulnerability assessments and between 48 and 76 percent said that they would specifically recommend using a tournament for developing hazard mitigation or response plans (Table 18). Regardless of whether planning engagement was an explicit objective, evaluation results provide other evidence that tournaments have the potential to impact the decision-making and planning involvement of participants and their respective agencies.
and organizations. For example, most tournament participants agreed that they learned information during the exercise that would inform their future decisions related to water (Table 17). Additionally, six months after the tournaments were held, some participants in the Iowa and San Antonio tournaments said they had either considered or begun enacting policy changes (Table 22). One person said they used what they learned to begin “actively promoting the strategy of regional mitigation concept rather than localized project development” and another had used what they learned in drafting an improved floodplain ordinance (Iowa Multi-hazard Tournament participants).

**TABLE 22: PERCENT OF PARTICIPANTS WHO SAID THEY HAD DONE EACH OF THE FOLLOWING AS A RESULT OF THE TOURNAMENT, SIX MONTH AFTER**

<table>
<thead>
<tr>
<th>Evaluation Question</th>
<th>Iowa Multi-hazard Tournament</th>
<th>Texas Multi-hazard Tournament</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considered changes to policies or decision making processes related to water</td>
<td>62%</td>
<td>19%</td>
</tr>
<tr>
<td>Enacted changes to policies or decision making processes related to water</td>
<td>14%</td>
<td>6%</td>
</tr>
</tbody>
</table>

**Lessons learned and best practices**

Participant experiences can also be used draw lessons learned and recommendations for other teams developing scenario-based exercises in the future. This section includes tips and recommendations based upon NDMC’s evaluation results, research findings, and experience.

1. **Balance resource investment and technology with the goals and objectives of the exercise**

Stakeholder groups require varying degrees of investments in tailored, realistic scenarios and technology-based decision-support interfaces. For example, if the goal is to engage diverse stakeholders who are not experts in water management, a less complex exercise may be a better choice. This allows the exercise to focus on discussion and exploration, without overwhelming participants or shifting their focus to understanding the technology or the computer models. On the other hand, stakeholders who are already involved in drought or water management may benefit most from more complex and realistic scenarios that use high tech options (e.g., web-based or GIS interfaces) and highly quantified risks, trade-offs, and response options. Participants with experience in drought and/or water management may find overly-simplified scenarios to be unrealistic.

2. **Include pre-event materials**

Sending out information ahead of the exercise lets participants know what is expected of them, provides clarity on the rules and/or guidelines, and helps them prepare for the exercise. The more complex the exercise, the more pre-event communication is needed. Materials should be concise and high-level. A pre-event webinar outlining the agenda, demonstrating tools, and showing example scenario components can help the day of the event run more smoothly.

3. **Consider the time available**

Drought scenario-based exercises can run from as little as an hour to multiple days. It’s important that your goals and objectives for the exercise match the time available. If everything in the exercise is new to participants, you will need to allow time for clarification, questions, etc. For drought and multi-hazard tournaments, one day has generally been seen as appropriate length for achieving the communication and education goals. Some participants have expressed support for two days, particularly if the tournament or exercise includes complex modelling and the decision-support tools.
For example, a participant in the Kansas Drought Tournament suggested that two days — one to understand the model and one to play the tournament — would help increase understanding of the processes and decisions being made. The recommended length of the exercise also depends on how many rounds or scenarios need to be processed; trying to squeeze in too much left some participants feeling rushed or overwhelmed.

4. Create an engagement plan
This can help ensure that the right mix of information and engagement is used to meet the exercise objectives.

5. Set the appropriate tone
Create a safe and open environment so that the participants will feel comfortable and share their views openly and honestly.

6. Account for conflict
In basins or regions where water use is contentious and/or supply is limited, it is important to incorporate options and avenues for conflict resolution. Additionally, in these situations it is unlikely that the use of data will work, so organizers should consider using fictional data when developing the exercise. Having stakeholders and decision-makers from conflict-prone areas, work on the same team or toward the same goal is more likely to produce successful results.

7. Emphasize the role of the facilitator.
The facilitator can help keep the discussion focused and energized, create an environment where all have a chance to participate, and set the appropriate tone for discussions.

8. Integrate social and cultural considerations.
Participants bring a variety of cultural experiences, attitudes, and values. Use the exercise as a way to build and strengthen relationships by providing a forum for sharing viewpoints, encouraging collaboration, and participating in constructive dialogue to create outcomes that are generally more acceptable and culturally desirable (Daniell, 2014).

9. Incorporate uncertainty and ambiguity.
Participants will want certainty and quantitative information; however, these are not always available in the real world.

10. Encourage innovation:
The solutions to challenges may not yet be known.
Submit, Correct, or Update an Example Exercise or Case Study

In an effort to expand the number of examples and case studies available, we invite individuals and organizations to submit information regarding exercises in which they have participated. By submitting this information, you give the NDMC permission to include your exercise on our website and in related resources. The level of detail provided will be used to help us determine how your exercise is referenced (example vs. case study).

Please use the following template when submitting information. Items with an asterisk denote the minimum required information.

*Exercise name*

*Exercise type*
What type of exercise did you hold -- workshop, Game, Table Top Exercise, or Functional Exercise?

*Exercise date and location*
When and where did the exercise take place?

*Exercise duration*
Approximately, how long did the exercise last in hours or days?

*Development team*
What agencies and organizations helped with the development of the exercise?
The actual names of the team members are not needed.

*Cost*
Estimate the amount spent to develop and conduct the exercise.

*Funding source*
What agencies, organizations, or entities sponsored the exercise?

*Objectives*
What did you hoped to achieve with the exercise?

*Scope*
What was the extent of the exercise? This includes parameters such as the targeted planning area addressed, inclusiveness (multi-sector, agency, multi-agency) and any limitations of the exercise.

*Participants*
Provide an approximate number of the participants and list of the organizations, agencies, and sectors that participated in the exercise. Actual participant names are not needed.
Scenario*
Provide a very brief description of the storyline or the conditions and events that the participants had to respond to during the exercise. Also, indicate whether the scenario was set in a real or fictional location.

Materials*
What materials were required to develop and conduct the exercise? This could include data, knowledge, and equipment. Examples for development include local knowledge such as hydrologic models, GIS analysis, and data types. Examples for conducting the exercise include: decision-support tools, maps, flip charts, calculators, etc.

Participant roles
What characters were the participants assigned to during the exercise? For example, did they play themselves in their actual positions and sectors; did they play a member of a planning committee, or something else?

Outcome evaluation
Provide a general indication when (immediately following the exercise or at a later date) and how the information was collected – survey, interviews, etc. Also, describe the benefits or changes that occurred as a result of the exercise. When possible provide a measurable benefit that can be used to gauge the success of the exercise.

References*
Any reports, information, or websites that others can access to find more detail.

Additional information*
With whom can the National Drought Mitigation Center follow up? Also, indicate if you’d like this information to be publically available to readers of the case study.

Attachments:
Attach any photos, summary reports, or references for inclusion with the website. By attaching these, you agree to give permission to the National Drought Mitigation Center to display or link to these as part of the case study.

Have questions? Want to submit, correct, or update an example exercise or case study?

Contact the National Drought Mitigation Center at ndmc@unl.edu.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>adaptation</td>
<td>An action or strategy to prepare for and adjust to new conditions.</td>
<td>(Bierbaum et al., 2014)</td>
</tr>
<tr>
<td>case study</td>
<td>Descriptive research into a single person, group, or event.</td>
<td>(Calhoun, 2002)</td>
</tr>
<tr>
<td>climate</td>
<td>The slowly varying aspects of the atmosphere-hydrosphere-land surface system, typically characterized in terms of averages, frequencies, and extremes.</td>
<td>(Glickman and Zenk, 2000)</td>
</tr>
<tr>
<td>climate action plan</td>
<td>A plan to address climate change impacts at the local scale.</td>
<td>(Stone et al., 2012)</td>
</tr>
<tr>
<td>Climate data (also referred to as climatological data)</td>
<td>The many types of data – instrumental, historical (such as diaries or crop records), proxy (such as tree growth rings) – that constitute the major source of information for climate studies.</td>
<td>(Glickman and Zenk, 2000)</td>
</tr>
<tr>
<td>comprehensive plan</td>
<td>A guidance document that integrates the wide range of decisions that a community must make about future growth and development. Also known as a master or general plan.</td>
<td>(Kelley, 2012)</td>
</tr>
<tr>
<td>consensus building</td>
<td>Practice in which stakeholders come together to address a policy issue of common concern, seeking consensus rather than majority rule. Also called collaborative problem solving.</td>
<td>(Innes and Booher, 1999)</td>
</tr>
<tr>
<td>core capability</td>
<td>Set of critical elements necessary to meet the National Preparedness Goal by addressing the greatest risks to the nation.</td>
<td>(FEMA, 2018)</td>
</tr>
<tr>
<td>decision-support tool</td>
<td>Information tool used to connect climate science with policy implementation.</td>
<td>(Feldman and Ingram, 2009)</td>
</tr>
<tr>
<td>drought</td>
<td>A deficit of expected water availability that results in water shortages for some activity or group.</td>
<td>(National Drought Mitigation Center, 2019)</td>
</tr>
<tr>
<td>drought impacts</td>
<td>The complex effects of a drought hazard on physical and social systems.</td>
<td>(National Drought Mitigation Center, 2019)</td>
</tr>
<tr>
<td>drought plan</td>
<td>Actions taken by individual citizens, industry, government, and others before drought occurs to reduce or mitigate the impacts and conflicts that can arise from drought.</td>
<td>(Schwab, 2013)</td>
</tr>
<tr>
<td>Drought Impact reporter</td>
<td>An interactive web-based tool designed to compile and display drought impact information across the United States in near real-time from a variety of sources such as media, government agencies, and the public.</td>
<td>(National Drought Mitigation Center, 2018)</td>
</tr>
<tr>
<td>Drought Risk Atlas</td>
<td>An interactive web-based tool that provides historic drought and climate data for stations across the United States.</td>
<td>(National Drought Mitigation Center, 2019c)</td>
</tr>
<tr>
<td>emergency managers</td>
<td>Individuals who create the framework within which communities reduce vulnerability to hazards and cope with disasters.</td>
<td>(FEMA, 2018)</td>
</tr>
<tr>
<td>evaluation</td>
<td>A systematic determination of how a program is operating, whether it is working as intended, or if it has</td>
<td>(Martin, 2015)</td>
</tr>
</tbody>
</table>
achieved its objectives and to identify areas for improvement. A group of individuals that manages and is responsible for exercise design, development, conduct, and evaluation. (Department of Homeland Security, 2013)

facilitation A process where an individual assists a group in solving problems and making decisions, without directly contribution to the process or discussion. (WebFinance Inc., 2019)

focus group A group of people brought together for an in-depth discussion of a problem or issue of concern. (Calhoun, 2002)

functional exercise An activity designed to validate and evaluate capabilities and functions during a disaster or emergency. This type of exercise is conducted in the most realistic manner possible without moving people, equipment, or resources to an actual site. (Department of Homeland Security, 2013)

game An activity that often involves two or more teams in which participants compete to explore consequences and achieve goals related to planning or managing a disaster. (Department of Homeland Security, 2013)

geographic information system (GIS) A computer system that analyzes, manages, and displays spatial or geographic data. (Mitchell and Minami, 1999)

hazard Potentially damaging physical event, social and economic disruption, or environmental degradation. (FEMA, 2018)

historical record The collection of past climate data. (van Kooten, 2013)

instrumental record Weather data that are observed by instrumentation, such as temperature data that are measured by a thermometer. (van Kooten, 2013)

institutional memory The collective knowledge and learned experiences of a group. (IGI Global, 2019)

jurisdiction An area with unified decision-making authority. (WebFinance Inc., 2019)

land use management plan A plan to manage the development of land. (Kelley, 2012)

mitigate/mitigation Actions taken by individual citizens, industry, government, and others before a disaster to lessen its impact. (FEMA, 2018)

model/modeling A tool for simulating or predicting the behavior or a system such as the atmosphere or hydrologic cycle. (Glickman and Zenk, 2000)

multi-hazard mitigation plan A plan to reduce loss of life and property by lessening the impact of different types of disasters. (FEMA, 2019)

objectives A specific result that a person or program aims to achieve within a given timeframe and with available resources. (WebFinance Inc., 2019)

Preparedness The state of being ready to monitor and respond to a hazard, including the early warning signs. (FEMA, 2018)

qualitative methods Used in evaluation processes where feedback is collected in a more open-ended format. These methods can be done through open-ended questions, focus groups, interviews, and general observations. (CDC, 2012)

quantitative methods Used in evaluation processes where a defined set of data is collected and analyzed. These methods can be done through telephone, paper, or online surveys. The data can be statistically analyzed as well. (CDC, 2012)
resilient
The ability of a system to be disrupted, absorb shocks, adapt and recover after a disaster. (Adger, 2006)

risk management
In the context of disaster management, an approach that emphasizes actions and activities that take place before an event such as mitigation, preparedness, and prediction and early warning activities. (Wilhite et al., 2000)

river basin
The total area drained by a river and its tributaries. (Glickman and Zenk, 2000)

scenario
An outline or model of the simulated events used in a disaster preparedness exercise. (Department of Homeland Security, 2013)

scenario-based exercise
Structured, interactive activities designed for engaging decision-makers, stakeholders, planners, and emergency managers in the process of planning and managing mitigation and response activities for a disaster. (Department of Homeland Security, 2013)

scope

stakeholder
An individual, group or organization that is impacted by the outcome of a project. They have an interest in the success of the project, and can be within or outside the organization that is sponsoring the project. (Calhoun, 2002)

threat
A thing likely to cause damage. May result from natural disasters, technological hazards, and human caused incidents. (Department of Homeland Security, 2016)

tabletop exercise
A facilitated group discussion in which representatives from agencies and organizations meet in a classroom or in breakout groups to discuss the implementation of a disaster plan. (Department of Homeland Security, 2013)

THIRA
Acronym for the Department of Homeland Security’s Threat and Hazard Identification and Risk Assessment process, which is a four-step process designed to help communities identify capability targets and resource requirements necessary to address the risks that a community may face. (Department of Homeland Security, 2016)

U.S. Drought Monitor
A weekly map of drought conditions across the U.S., jointly produced by the National Drought Mitigation Center, the National Oceanic and Atmospheric Administration, and the U.S. Department of Agriculture. (NDMC, 2019b)

vulnerability
The state of susceptibility to harm from exposure to a hazard or disaster. (Adger, 2006)

workshop
A participatory method in which the attendees engage in discussion with a focus on achieving or building a specific product. (Department of Homeland Security, 2013)
References


University of California Division of Agriculture and Natural Resources. (2018). *A Toolkit for Assessing IPM Outcomes and Impacts*. Retrieved February 2, 2018


