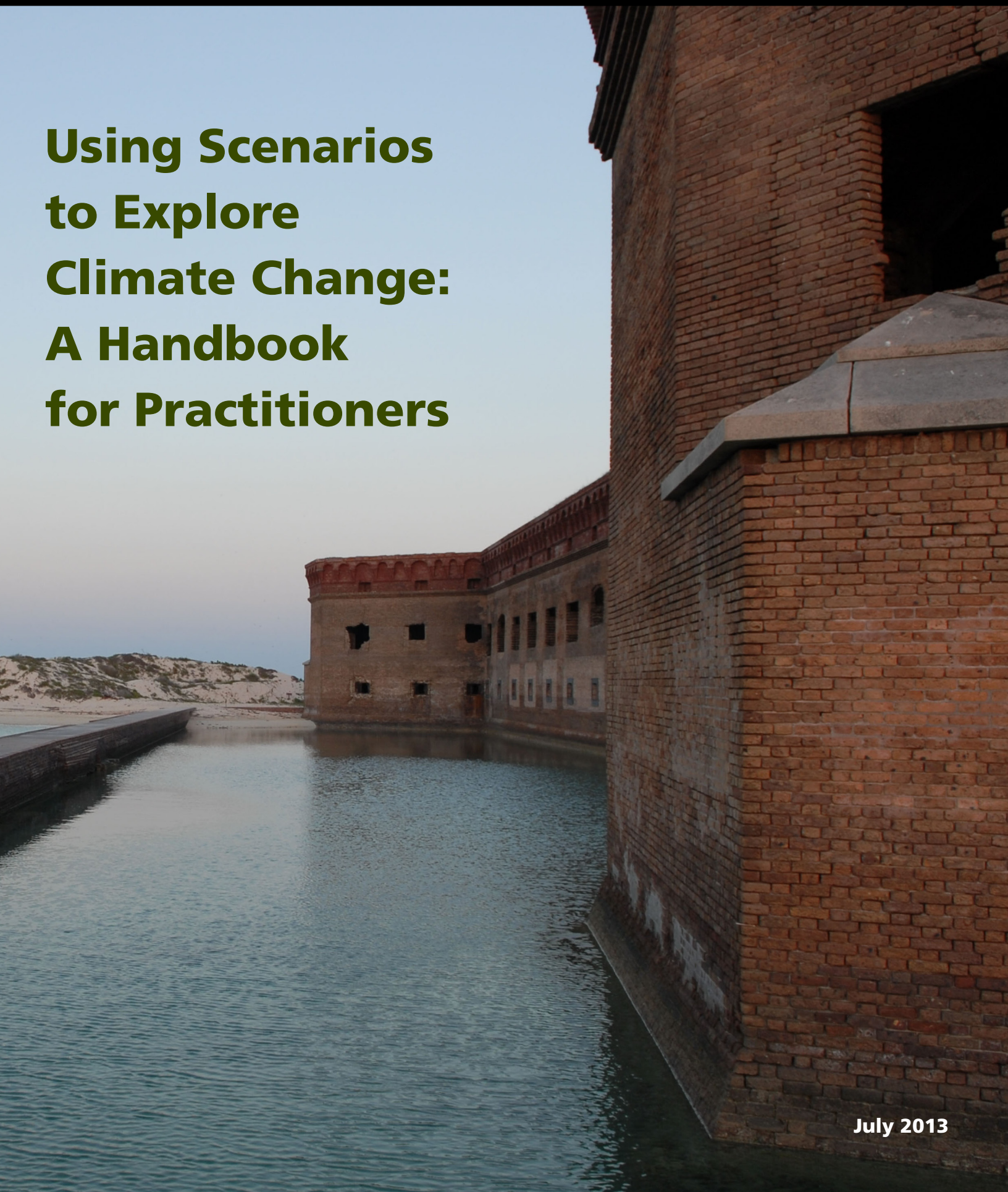
National Park Service
U.S. Department of the Interior

Climate Change Response Program

Using Scenarios to Explore Climate Change: A Handbook for Practitioners



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Grizzly Bears in Alaska. Photo courtesy of Bob Winfree.

Since you never know what lies around the next corner with climate change, scenario planning is a tool to help parks prepare for this uncertainty.

Cover: Fort Jefferson, Dry Tortugas National Park
All photos courtesy of the National Park Service unless otherwise noted.

Contents

Executive Summary: Addressing Climate Change in the National Parks

National park environments are characterized by dynamic landscapes. Tides ebb and surge along shifting coastlines. Wildfires and diseases invade forests. Wind and water erode historic structures. Plant populations adapt, animals migrate to survive, and humans adjust. However, a rapidly changing climate is triggering even more alterations, forcing cautious confrontation and thoughtful response.

Leading by Example

Careful stewardship of natural and cultural resources is being challenged by the accelerated rate at which scientific information must be acquired, understood, and conveyed. Successful action in the face of climate change requires not only greater understanding of scientific data, but also using this understanding to adaptively lead by example in park operations, facility management, and communications.

Climate change adaptation requires us to continue to learn from the past, but be "forward looking," anticipate plausible but unprecedented conditions, and expect surprises. In this context, we must revisit our management goals and "desired conditions," since frequently these describe our expectations based on historic conditions. To that end, scenario work explores and describes characteristics of several plausible futures, enabling managers to consider how to define and meet their goals (desired conditions) under changing, and new circumstances.

Meeting the NPS MIssion

As the national parks approach their second century of preservation, urgent consideration of how climate change and other environmental factors affect long-term goals is necessary to meet the National Park Service (NPS) mission. Developed under the National Park Service Climate Change Response Strategy, this guide is part of an interdisciplinary, cross-cutting approach to addressing climate change. The overall program supports NPS efforts to understand climate science in national parks and surrounding areas and to adapt to a changing climate to promote the resiliency of our cultural and natural heritage. Actively engaging ourselves and our audiences in park stewardship is a key ingredient of the climate change communication strategy and an integral component in addressing the effects of climate change.

To learn more about the National Park Service Climate Change Response Strategy, visit www.nps.gov/climatechange

Developing Climate Change Scenarios

This handbook describes the five-step process for developing multivariate climate change scenarios taught by the Global Business Network (GBN) during a series of training workshops hosted by the National Park Service in 2010 and 2011. The authors created this guide as a reference for workshop participants who possess some familiarity with scenario planning. The process featured in this manual is not a definitive method for building climate change scenarios, since many valid methods exist to develop climate change scenarios. The technique presented here is just one effective and proven approach.

A Five-Step Scenario Building Process

Detailed instructions are provided on how to accomplish each step of the five-step scenario building process. Appendices include a hypothetical scenario exercise that demonstrates how to implement the process, some early examples of how national parks are using climate change scenarios to inform planning and decision making, and advice on designing and facilitating scenario workshops.

This *Handbook for Practitioners* may be used as a reference when designing scenarios and scenario exercises. The process is flexible, not rigid. Participants are encouraged to explore or develop new techniques. Building scenarios is a dynamic, flexible, iterative practice that you can tailor to fit your needs.

In multivariate climate change scenarios, critical forces often include a mixture of climate varibles and sociopolitical forces.

Steps in the sand at Olympic National Park, WA.

Scenario Building Process Summary

Scenarios are a tool that managers can use to test decisions or develop strategy in a context of uncontrollable and uncertain environmental, social, political, economic, or technical factors. The National Park Service began working with GBN in 2007 to develop a science based, easily replicated, and logical process for building scenarios that inform short- and long-term decisions associated with climate change.

The process involves one or more workshops organized by a core group of individuals, and attended by key stakeholders. In advance of the workshop(s), core team members interview workshop participants and stakeholders to understand the assumptions, perspectives, and important management challenges associated with climate change. The participants and core team then identify specific questions or issues to explore using scenarios.

Producing Realistic Outcomes

To provide a scientific foundation for the scenarios, scientists supply data regarding projected future climate trends and effects and their associated degree of certainty. Depending on the goals of workshop participants, this information may be combined with additional data, like sociopolitical or socioeconomic factors identified by experts, that could influence impacts or affect future multivariate scenarios. While the resulting scenarios tend to be exploratory, they are extremely effective at prompting managers to consider their reactions to climate change in the context of realistic allowances and restrictions (i.e., budget limitations, public support, or political feasibility).

With the resulting scenarios, managers can assess relative risk, test important decisions, develop strategies or contingency actions, and identify key indicators that signal variations in social, political, economic, or biophysical landscapes. Managers should use the scenarios for strategy development, maintain them as part of ongoing conversations about the future, and monitor the environment. As conditions change and new information is developed, managers may wish to create new scenarios with additional selections of meaningful variables.

Climate Variability:
Variations in average climate beyond individual weather events due to natural internal processes within the climate system, or because of variations in natural or human-caused external forcing. (IPCC 2001)

A 2006 flood in Mount Rainier National Park closed many park roads, campgrounds, and facilities to visitors for an extended period of time until repairs could be made.

Why Should We Use Scenarios?

Climate change will cause dramatic alterations to national parks, preserves, and other protected areas. In many places, the impacts of climate change are already affecting facilities, operations, natural resources, cultural resources, and park visitation. Ninety-six percent of NPS land and 84 percent of National Park System units are in areas of observed 20th-century warming *(Gonzalez 2011)*. The San Francisco tidal gauge at Golden Gate National Recreation Area has recorded a sea level rise of 5.5 inches per century, which scientists have attributed to climate change *(Gonzalez 2011)*. Scientists have also attributed many shifts in winter ranges of bird species, forest biomes, and small mammal ranges in national parks to climate change *(Gonzalez 2011)*.

At Mount Rainer National Park in Washington, floods occur more frequently. A 100-year event in 1972 now has a recurrence interval closer to a 12-year event *(Beason et. al. 2011)*. In the past decade alone, this increase in flooding caused tens of millions of dollars in damage to park infrastructure *(Beason et. al. 2011)*.

At Everglades National Park, scientists have documented an increase in water levels of 0.1 inches a year from 1952 to 2010, which is higher than the average global rate of sea level rise of 0.07 inches a year from 1961 to 2003 *(Stabenau et al. 2011)*. Moreover, the February 2007 report of the Intergovernmental Panel on Climate Change (IPCC) projects that sea level rise between 7 inches to 23 inches could occur by the end of this century. If this projection proves true, saltwater pushed landward by rising seas would transform 10 to 50 percent of the park's freshwater marsh *(Kimball 2007)*.

Addressing Landscape-scale Challenges

How should the National Park Service react to these mounting, landscape-scale challenges? We know that the climate is changing, and climate models can provide information on the types of impacts that may affect a landscape, like changes in precipitation or average annual temperatures. However, what models cannot do, is reveal exactly when, where, or how these impacts will occur, nor can they predict how extreme events might interact with complex natural systems to cause dramatic changes on a landscape.

For example, in the Four Corners region of Arizona, New Mexico, Colorado, and Utah, abnormally severe droughts and extreme temperatures from 2000 to 2003 weakened piñon pine trees that dominate the landscape, paving the way for a bark beetle invasion. By the end of 2003, bark beetles fully occupied the area, and a large number of the piñons were dead *(National Research Council 2008)*. Land managers in the Four Corners region will struggle with the consequences of this unexpected, rapid, and large-scale ecological change for decades.

We cannot precisely predict how climate change will affect national parks and protected areas. However, protected area managers can apply the most current information on climate change, explore uncertainties, develop strategies to guard against future risk, and identify indicators that allow us to recognize changes early. Such actions may allow us to react to future challenges with speed and confidence. The NPS has found that scenarios offer an effective method for achieving these objectives.

Extreme Event:
Meteorological conditions that are rare for a particular place and/or time, such as an intense storm or heat wave. An extreme climate event is an unusual average over time of a number of weather events, for example heavy rainfall over a season. (Australian Greenhouse Office. 2003)

Reviewing Scenario Thinking

What Are Scenarios?

A scenario is essentially a plausible, internally consistent story about the future that challenges us to consider how we would operate under novel conditions. Many ways exist to define scenarios. However, nearly all definitions agree on one thing: scenarios are not forecasts or predictions.

A Few Definitions of Scenarios

The International Panel on Climate Change (IPCC)
A scenario is a coherent, internally consistent and plausible description of a possible future state of the world. It is not a forecast; rather, each scenario is one alternative image of how the future can unfold. *(IPCC 2011)*

The United States Global Climate Research Program (USGCRP)
Scenarios are plausible alternative futures—each an example of what might happen under particular assumptions. Scenarios are not specific predictions or forecasts. Rather, scenarios provide a starting point for examining questions about an uncertain future and can help us visualize alternative futures in concrete and human terms. *(USGCRP 2011)*

The Global Business Network (GBN)
Scenarios are stories about how the future might unfold for our organizations, our communities and our world. Scenarios are not predictions. Rather, they are provocative and plausible accounts of how relevant external forces—such as the future political environment, scientific and technological developments, social dynamics, and economic conditions—might interact and evolve, providing our organizations with different challenges and opportunities. *(GBN 2011)*

Shell International
A scenario is a story that describes a possible future. It identifies some significant events, the main actors and their motivations, and it conveys how the world functions. Building and using scenarios can help people to explore what the future might look like and the challenges of living in it. *(Parson et al. 2007)*

View from Lake McDonald in Glacier National Park, MT.

What Is Scenario Thinking?

Scenario thinking (or scenario planning) is a structured process by which groups can organize perceptions, assumptions, and complex information about how the future may evolve. Groups can then use the scenarios to explore unknowns, test strategies, generate new ideas, improve organizational flexibility, or inform decision making in situations of risk, uncontrollability, complexity, and uncertainty. Many scenario practitioners find that the process, when used frequently, becomes more than just a method for structuring information. It progresses into a technique for thinking about change, preparing for the future, stimulating creativity, and coping with uncertainty. *(GBN 2011 and Parson et al. 2007)*

What Is the Purpose of Scenario Thinking?

Scenarios provide an excellent tool for organizing information and exploring the future. They prove extremely useful when organizations evaluate challenging choices or make difficult short- and long-term strategic decisions *(GBN 2011)*. For example, national park managers may wish to use scenarios to test strategic choices or management actions when considering questions like: Will we need to manage differently if new trends in rainfall patterns and drought result in an entirely new fire regime? What if rising temperatures and drought combine and allow non-native pest species to spread far more rapidly than in the past? What if sea level rise and storm surges significantly damage our resources and infrastructure, or permanently inundate portions of our park at a time when there is little funding for conservation activities?

Origins of Scenarios

The United States military began using scenarios after World War II to consider possible actions of opponents, and to test a range of counter responses to those threats *(Schwartz, 1991)*. Following this original military application, Royal Dutch Shell began using scenarios for strategic planning. Because of its farsighted scenarios on global oil prices and geopolitics, the oil company was able to anticipate price shocks that rocked the oil industry during the 1970s. When the crisis occurred, Royal Dutch Shell quickly employed contingency plans, and dramatically improved its position in the global oil industry while its competitors suffered *(Schwartz 1991)*.

Since the initial corporate application by Royal Dutch Shell, many of the world's top companies have adopted scenarios to improve decision making in uncertain economic, social, and political conditions. More recently, scientists and resource managers have used scenarios to navigate uncertainty in the fields of conservation and natural resource management *(Peterson et al. 2003)*.

Scenarios provide an excellent tool for organzing information and exploring the future. Image: fern leaf.

Scenarios for Climate Change and Resource Management

Resource managers recognize that global climate change will bring unprecedented and highly consequential changes to protected areas and their surrounding landscapes. Climate models can provide managers with data about changes at global and regional scales; however, precise rates of change, specific local impacts, and compounding effects are impossible to predict.

This uncertainty has prompted many resource management and climate research organizations to use scenarios when making climate sensitive decisions. The U.S. Global Change Research Program (USGCRP) defines five distinct types of scenarios commonly used in climate change scenario analyses *(Parson et al. 2007)*. These range from high-level, global scenarios for worldwide emissions to landscape-level impact scenarios that combine downscaled climate model outputs with local social, economic, cultural, and population variables.

Five Types of Scenarios for Climate Change

Emissions Scenarios for Climate Simulations
Emissions scenarios present potential future paths of greenhouse gas emissions or other climate disturbances and often serve as inputs to climate models. An example would be the Intergovernmental Panel on Climate Change emissions scenarios that show carbon dioxide (CO2) emissions increasing over time as a function of global population growth, economic development, and technological change.

Emissions Scenarios for Exploring Alternative Energy or Technology Futures
Emissions scenarios also help determine the levels of social change, energy resource mixtures, and technology development needed to meet emissions or atmospheric CO2 concentration targets.

Climate Change Scenarios
Climate change scenarios describe potential future climate conditions. These scenarios often use emissions assumptions and computer models to produce outputs that describe future changes on a regional scale. A good example is regional climate projections for future temperature and precipitation regimes.

Scenarios of Direct Biophysical Impacts
Biophysical impact scenarios describe important, large-scale climate-related effects that can trigger many other changes, such as sea level rise. Many sea level rise scenarios combine factors including coastal topography, ecosystems, and land use with sea level rise projections to illustrate the range of potential impacts on coastal ecosystems, infrastructure, and settlements.

Multivariate Scenarios for Impact Assessment
Instead of considering impacts in isolation, multivariate scenarios link climate change impacts to other changes and stresses, such as local socioeconomic (political, technical, economic, demographic) trends. Multivariate scenarios are often exploratory, and can be very useful when considering climate change impacts and implications on smaller scales.

For more information on the five types of climate change scenarios see *Parson et al. (2007)*.

The Intergovernmental Panel on Climate Change is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. (www.ipcc.ch)

Scenario Thinking in the National Park Service

In 2007 the National Park Service began working with partners to develop a science based, user-driven scenario thinking process to help resource managers make better decisions regarding climate change. While many climate scenarios used by the IPCC or USGCRP often examine high-level impacts and broad regional trends, the NPS focused attention on developing multivariate, local-level impact scenarios to address climate change concerns of park managers.

The NPS emphasizes participation and clarity when creating scenarios, and encourages user involvement throughout the process. The NPS works with scientists and managers to combine current climate model outputs with external sociopolitical factors that define a park's operational environment. The resulting multivariate scenarios allow managers to consider how they may react to the impacts of climate change in the context of physical, social, political, environmental, operational, and economic variables that strongly influence decision making.

Comments by Managers on the Value of Scenario Thinking

The following quotes are from participants in NPS Scenario Thinking exercises:

"The greatest utility [of scenarios] is in creating a wedge into the discussion to overcome initial hurdles to get people talking about climate change. There is a tendency for resource managers or others I work with to be paralyzed by the uncertainty. But if they frame things in a scenario context it helps them to get over that mental hurdle and helps them to start to tackle some of these issues."

"I think it helps to get people thinking broadly and collaboratively without having to possess every fact."

"Climate change is hovering around us, but in the periphery of our thinking. There are too many issues to deal with and not enough time. At the simplest possible level it got us engaged and forced us to think about it."

When to Use Scenarios

Managers often use scenarios to inform decision making in uncontrollable situations characterized by uncertainty. Scenarios are flexible enough that managers can create them to fit the scope, scale, and time dimension of almost any project, challenge, or decision *(Peterson et al. 2003)*. Park managers might use scenarios to explore challenges ranging from discrete operational decisions, (e.g., "Should we continue to rebuild this storm-damaged road along the coast?") to long-term strategic, organizational questions (e.g., "What do we do if our core resources move outside our boundaries?").

Guiding Principles of Scenario Thinking and Best Practices

Following are a few basic guiding principles and best practices to develop a successful scenario exercise.

Fundamental Principles of Scenario Thinking

Take the Long View
When creating scenarios, look beyond the short-term or daily concerns that may affect your organization. Instead, focus the scenarios on exploring underlying assumptions and large-scale uncertainties that can influence or shape the future.

Use Outside-in Thinking
Consider how developments in the outside world, such as societal interests, climate change impacts, national leadership, etc., may affect the organization. Many organizations conduct planning exercises based on what they can control, and essentially think from the "inside-out." Although thinking from the "outside-in" may be uncomfortable at first, it can inspire more open and imaginative thoughts about a range of potential changes and strategies that were invisible before.

Include Multiple Perspectives
Engage people who provide a diverse array of views, attitudes, perspectives, and expertise in scenario thinking exercises. Including multiple perspectives can help challenge common assumptions, and illuminate suppositions or blind spots.

Fundamental Principles of Scenario Thinking *(GBN 2011 and Scearce and Fulton 2004)*

Best Practices

First Establish the Goals of the Project
Neglecting to clearly establish the goals of the project is the main reason scenario projects fail *(Van der Heijden 2005)*. Before beginning an exercise, ask why the organization should create scenarios in the first place. Numerous reasons may exist to conduct a scenario exercise: to explore areas of uncertainty, to develop and test strategies, or to generate unique insights about ambiguous developments *(Van der Heijden 2005)*. The important thing is to articulate the purpose of scenario work at the outset of the project, so that you may structure the exercise for success.

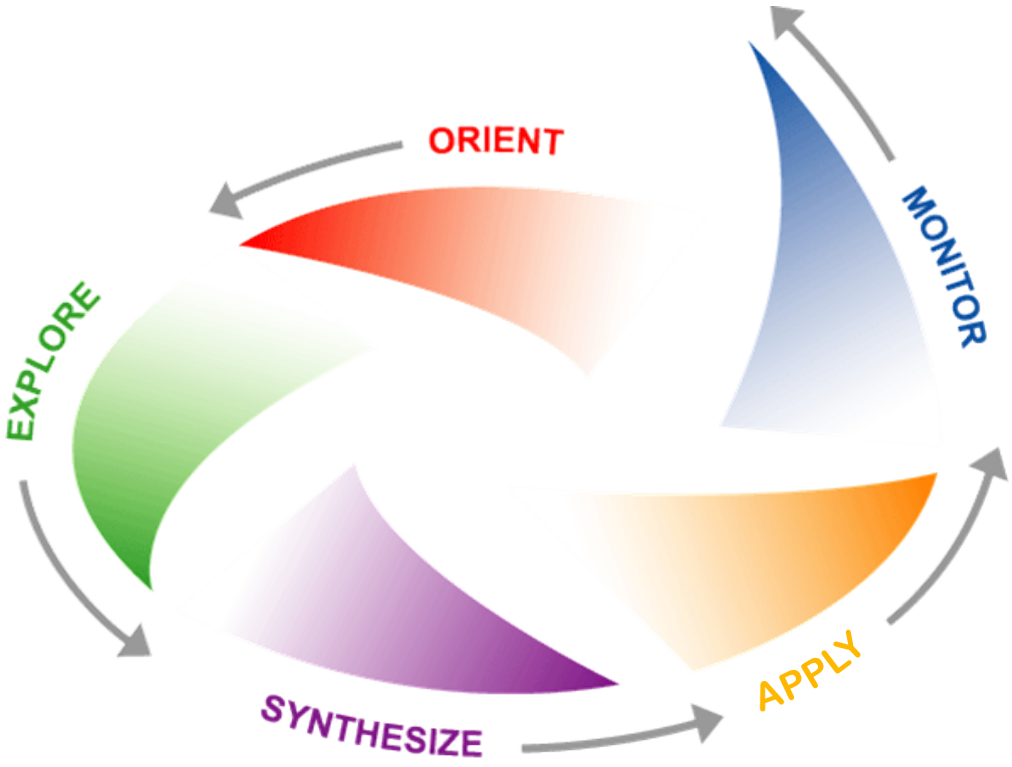
Don't be Afraid to Break the Rules
Practitioners often describe scenario thinking as an art or craft, because there are many ways to put it into practice (*Van der Heijden 2005)*. Choose an approach, and modify steps of the process to fit your specific needs and goals. Consider how elements such as the importance of the issue, the timing of the decision or uncertainty, the need for scientific validation, or the availability of decision makers may require you to tailor the process.

The Five Step Process

The five-step scenario process described in this guide is a systematic way to gather and synthesize information into scenarios, and use those scenarios to create strategies, explore uncertainties, test decisions, and monitor change. Typical scenario projects include between 15 and 20 participants, representing a cross section of disciplines from within and outside the organization *(Garvin and Levesque, 2006)*. The development and active use of scenarios is an ongoing endeavor; projects commonly take three or more months to complete and require preliminary research, planning meetings, one or more workshops, a series of debriefing or strategy meetings, and monitoring *(Garvin and Levesque, 2006)*.

The following sections provide a detailed description of one scenario building process separated into five phases: Orientation, Exploration, Synthesis, Application, and Monitoring. Each section includes a brief overview and important elements of the phase, and a list of products needed before beginning the next phase.

Figure 1: Five Step Scenario Planning Process (Copyright GBN 2010) Orient, Explore, Synthesize, Apply, Monitor.



The Five Step Process.
Illustration copyright GBN.

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PHASE ONE: ORIENTATION – ESTABLISH THE PROJECT

Goal: To set up the project for success

1. Establish the purpose of the project.
2. Specify the issue or "strategic challenge" to explore using scenarios.
3. Determine desired outcomes.
4. Recruit a core team of individuals to assist with project work.

The core team will conduct interviews with stakeholders and managers to identify perspectives on the project purpose and the strategic issue. Using this information, the core team will articulate a "focal" question to guide the remaining phases of the exercise.

During the orientation phase, core teams typically determine the project schedule (i.e., how many workshops to hold, where to hold them, etc.) and begin recruiting workshop participants.

Phase One Orientation Products

1. An understanding of the purpose, desired outcomes, and scope of the project.
2. A core team to help with the exercise.
3. A statement that describes the strategic challenge.
4. A clearly articulated focal question.
5. A draft or final project schedule.
6. A draft or final list of other project participants (e.g., to attend workshops or review findings).

Elements of the Orientation Phase

A. Establish the Project Purpose and Desired Outcomes

Before initiating a scenario project, think about why you want to use scenarios, the goals of the project, and the ideal outcomes. Consider these questions:

- Will the scenarios inform a broader decision-making or planning process?
- Is the development of scenarios the objective, or is the goal to "stress test" actions or strategies against the scenarios?
- Who will use the scenarios?
- What kind of deliverable will the audience expect? What will they do with it? Who will produce it?

These objectives will define the project purpose and desired outcomes, and the choices you make throughout the process. Define them early to make the project succeed. Set the scope of the project to help manage expectations. Avoid addressing too many concerns. Take time to clearly define a purpose and desired outcomes.

Project Purpose Statement Examples:

- To explore how this park can adapt to the impacts of climate change.
- To consider how future technology may change visitor experience.
- To explore future visitor use and infrastructure demands.

Desired Outcome Examples:

- Climate change scenarios that can be used to test project proposals.
- Ideas for new interpretive and communication products that help the park remain relevant to the public.
- A set of robust actions to help the park achieve long-term goals.

B. Recruit the Core Team

The core team is typically a diverse, interdisciplinary, enthusiastic group of four to seven people who are familiar with scenario thinking, and can help organize and facilitate the process. The core team is often responsible for research, scenario workshop facilitation, and behind-the-scenes logistical work. When the core team is in place, conduct orientation meetings to discuss the project schedule, set the scope of work, determine roles and responsibilities, and set dates for additional meetings.

The core team will:

- Develop the strategic challenge and focal question.
- Conduct interviews and research.
- Identify and recruit workshop participants.
- Communicate information to participants and arrange workshop logistics.
- Participate in or facilitate webinars and workshop sessions.
- Produce workshop deliverables and follow up with post workshop activities.

C. Identify the Strategic Challenge

When the exercise begins, the core team should determine the specific issue, decision, or question driving the scenario project. In other words, the core team should answer the question, "What is the specific problem or challenge we want to address?" The answer to this question, often called the "strategic challenge," is the complex uncertainty that lacks an easy answer or solution. The strategic challenge is the difficult problem that "keeps managers awake at night." The core team uses the strategic challenge to guide background research and interviews with stakeholders and to create the focal question that guides remaining phases of the scenario exercise.

Use the project purpose to begin articulating the strategic challenge. In some cases, the strategic challenge may be similar to the project purpose. In other instances, the team may need to deliberate more deeply to communicate the strategic challenge clearly.

Strategic Challenge Examples:

- How can we protect a species when the disappearance of its habitat from the park is inevitable because of climate change?
- How can we apply rapid advancements in communication technologies to engage park visitors in the subject of climate change?
- How can we ensure visitor access to facilities as the effects of climate change threaten park infrastructure?

D. Conduct Background Interviews and Research

The core team should conduct background interviews with decision makers, stakeholders, and experts to refine the strategic challenge. The team should collect information on the physical, social, political, technological, or economic forces that cause uncertainty.

Before conducting background interviews, establish the timeframe of the scenario exploration (e.g., 5, 10, 50 years, etc.). During interviews, ask open-ended, exploratory questions, and keep the scope of the questions broad. Provide interviewees enough information to respond. Allow ideas about the future to develop through conversation and reflection. One goal of the interviews is to learn about the interviewee's assumptions, expectations, and perspectives on the strategic challenge. Another goal is to allow interviewees to discover insights for themselves. Good scenario interviews include an interviewee who experiences learning, perhaps by articulating previously unexpressed ideas.

Be aware that the orientation stage is a process of discovery. It is common for new information from interviews or research to prompt changes in the strategic challenge. Interviews may even highlight a bigger, previously unforeseen issue, which is more urgent and important to explore using scenarios.

Background Interview Question Examples *(Scearce and Fulton 2004)*:

- If you could have any question answered about the world in the next "x" years, what would you want to know to better understand how to deal with the strategic challenge?
- What are the greatest uncertainties that could affect the strategic challenge over the next "x" years? What are the certainties?
- If you looked back "x" years from now and told the story of how your organization succeeded in dealing with the strategic challenge, what would have happened? Why?
- If you looked back "x" years from now and told the story of how your organization failed to deal with the strategic challenge, how would this go? Why?
- What are the most important strategic issues facing your organization on the immediate (12-24 month) horizon?
- What would you like your personal legacy to be? What do you fear it might be? To what do you aspire?
- As we close this conversation about the future, are there any other questions or issues that we should discuss?

E. Articulate the Focal Question

Based on the strategic challenge and the interviews, the core team will create the focal question, which the core team and participants use to guide the process. The focal question is typically broad enough to capture both the strategic challenge and the uncertainties that affect the environment in which the decision must be made *(Leidtka et al. 2007)*.

For example, Joshua Tree National Park's strategic challenge may be to preserve the Mojave Desert ecosystem and key species like Joshua trees. However, in order to preserve these resources, park managers need to know how climate change could affect the park. Accordingly, the focal question for this project may be "How could the effects of climate change impact Joshua Tree National Park over the next 50 years?"

Focal Question Examples:

- How could technology influence the way visitors experience national parks over the next 10 years?
- What threats to infrastructure could challenge the park over the next 20 years?

A focal question is essential to begin the scenario thinking process. The core team may edit and rewrite the question as new information arises. The team should also present the focal question to the participants before the scenario workshop to enable participants an opportunity for feedback or suggestions.

Tips: Distinguish between the Project Purpose, Strategic Challenge, and Focal Question.

- **Project Purpose: What do we want this project to achieve?**
- **Strategic Challenge: What is the specific problem or challenge we want to address?**
- **Focal Question: What is the broader context that will allow us to explore both the strategic challenge and the forces that may affect it?**

F. Recruit Project Participants

The core team should assemble a participant group of 15 to 20 individuals to participate in the project. Include individuals within the organization who can offer valuable and divergent perspectives on the strategic challenge, and whose conclusions are vulnerable to future uncertainties. For example, a climate change scenario exercise at a national park may include facility managers, interpreters, natural and cultural resource managers, law enforcement rangers, park leadership, etc.

Experienced scenario practitioners will deliberately recruit individuals who can offer authority, information, and creative perspectives, as well as individuals with key insights to enable the workshop to progress. These individuals often include:

Decision Makers
Decision makers offer valuable perspectives and experience. Their presence at the workshop is vital. If decision makers are going to use scenarios to inform decisions, they must understand the forces that may affect the future, and carefully consider how conditions presented in the scenarios could affect their operations *(Schwartz 1991)*.

Experts
Experts bring information and credibility to technical conversations, but they should be relied upon with caution. Experts build a practice and reputation by expressing their opinions about facts. Scenario thinking is about unknowns and exploration. Some experts may believe they possess every answer. Work to recruit experts who hold strong opinions, but remain flexible.

Creative Thinkers
Creative or interdisciplinary thinkers are extremely helpful at scenario workshops. They propose fresh, unconventional ideas and make observations that challenge conventional wisdom (i.e., "groupthink"). Original perspectives often help to broaden narrow conversations *(Schwartz 1991)*.

When recruiting participants, state expected time commitments up front. It can be difficult to maintain consistency if participants disengage or leave the process. Even if you conduct a small scenario exercise, try to include a few decision makers, subject matter experts, and creative thinkers—at a minimum.

"How could the effects of climate change impact this park over the next 50 years?" This query was explored during the scenario planning workshop held at Joshua Tree NP, CA. Photo courtesy of Angie Richman.

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PHASE TWO: EXPLORATION – CRITICAL FORCES AND POTENTIAL IMPACTS

Goal: To identify and analyze the critical forces, variables, trends, and uncertainties that may affect the strategic challenge and the focal question.

The core team and subject matter experts typically perform this research in the months or weeks preceding the first workshop. Many core teams involve participants in the exploration phase using webinars, presentations, or conference calls, as participants often provide valuable input that can help direct the research. Core teams should deliver any required reading or background materials to participants during the exploration phase.

Phase Two Exploration Products

1. Tables and charts that capture the critical "driving" forces, variables, uncertainties, and impacts that may affect the focal question.
2. Graphics, maps, or influence diagrams to facilitate discussions (optional).
3. Any materials or background information that participants should review before the workshop.

Elements of the Exploration Phase

A. Identify the Critical Forces that Affect the Strategic Challenge

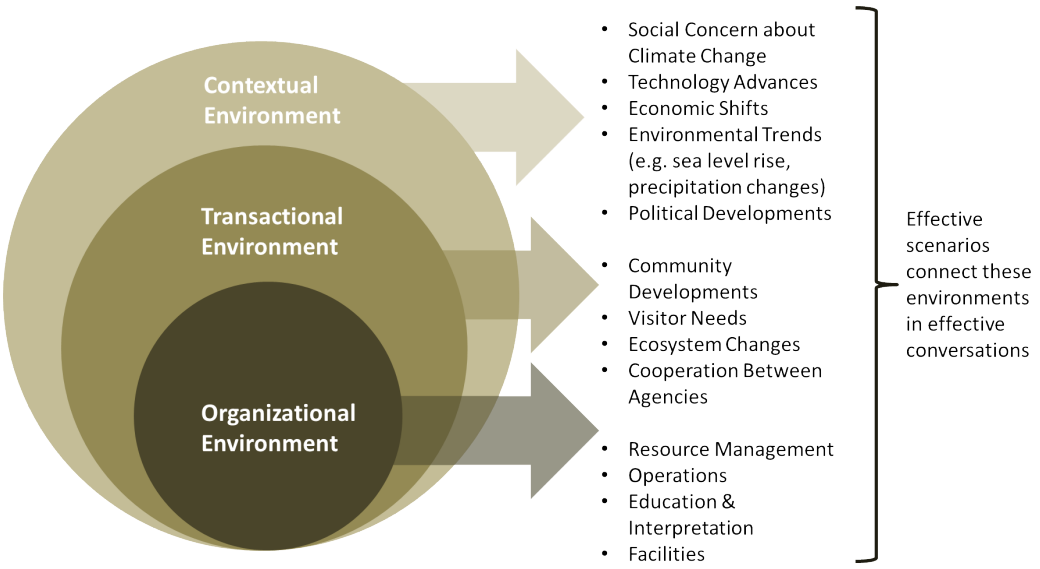
Core teams often work with subject matter experts from universities, agencies, or the private sector to identify the '"critical forces" (i.e. drivers, climate variables, or external influences that are within the scope of the focal question) that could significantly affect the strategic challenge. The core team and subject matter experts synthesize this information into tables and charts for use at the workshops to create scenarios and scenario narratives.

Critical forces are typically found in the environment outside of an organization's immediate boundaries. They are the social, political, international, economic, or environmental factors that are important to the strategic challenge, and that the organization cannot control. In multivariate climate change scenarios, critical forces often include a mixture of climate variables (such as temperature, precipitation, storm frequency) and sociopolitical forces (funding, support, political leadership).

When researching critical forces, many scenario practitioners recommend taking an "outside-in" approach, i.e. considering the large-scale forces that may affect the strategic challenge and focal question, before examining more local or immediate concerns *(Figure 2)*.

Monitoring in Great Sand Dunes National Park, CO.

Figure 2: Outside-in view to identify uncertainties (Copyright GBN 2010)



A multivariate climate change scenario project might consider social, political, economic, and environmental critical forces including:

- Projected sea-level rise.
- Projected changes in the frequency and intensity of extreme storm events.
- Projected changes in precipitation.
- Projected changes in temperature.
- The ability of local and national leadership to take action on climate change.
- The degree of social concern around climate change.
- Cooperation between land management agencies.
- Regional economic forecasts.
- Local population projections.
- Technology developments for mitigation and adaptation.
- Future budget projections.
- Visitor needs and expectations.
- Ecosystem changes.

Some core teams enlist multiple researchers and experts to assemble critical forces, especially if the forces are from unrelated disciplines. For example, in NPS climate change scenario projects, the core team recruited researchers from universities or federal agencies who could describe environmental critical forces (precipitation projections, sea level rise, and modeled future storm intensity) from standard IPCC emissions scenarios and climate change models. The team also worked with NPS managers to identify social and political critical forces that could affect park management in the future, such as future population demographics or economic forecasts for the region. The researchers and core team synthesized these forces into tables and charts for the workshop, and in some cases, produced supplementary information such as area maps, flowcharts, graphics, or influence diagrams. *(For example, see Figures 7, 8 and 9 in Appendix I.)*

Tip: Identify Critical Forces.

- **Use tools such as the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis to verify that you have explored all the areas where critical forces may exist. *(You can find examples of these tools on the internet at: http://en.wikipedia.org/wiki/SWOT_analysis).***

B. Identify Potential Impacts

The core team may work with researchers to uncover how the critical forces might affect the strategic challenge. As with the critical forces, researchers should synthesize the impacts into tables, charts, or graphics *(for an example, see Figure 9 in Appendix I)*. The core team and participants use this information when building scenarios and creating scenario narratives.

The impacts, like the critical forces, may encompass physical, social, political, international, economic, or even institutional effects. For example, if sea level rise is a critical force for a coastal park, impacts may include loss of beach and habitat, inundation of archeological resources and infrastructure, changes in hydrology and nearshore geomorphic processes, loss of recreation opportunities and revenue, and changes in access.

Peer reviewed research offers an excellent source of data on potential impacts. Core teams should work to facilitate communication between researchers to promote information sharing and determine critical forces.

C. Engage with Participants Before a Workshop

During the exploration stage, a series of webinars, conference calls, or pre-meetings can help familiarize participants with the scenario thinking process and establish workshop logistics, thus maximizing workshop time for developing scenarios, actions, and strategies. In many scenario exercises, core teams introduced participants to critical forces and impacts before the workshop(s) to reduce the review required at the workshop. Most participants appreciate the opportunity to contribute during the exploration phase, and feel a greater sense of involvement after the exercise.

Core teams should supply participants with any required reading or background materials before the workshop, and send a reminder about expectations a few weeks before the workshop. If conducting pre-meetings, webinars, or conference calls, take careful notes or record the sessions, so participants who are unable to attend can access the material, and attend the workshop prepared to create scenarios.

Scenario planning workshop held in Alaska, 2010.

3

PHASE THREE: SYNTHESIS – CREATING THE SCENARIOS

Goal: To produce a small number of scenarios from the critical forces and impacts identified during the exploration phase.

Scenarios should be plausible, address the focal question, stimulate creative thinking about the strategic issue, and challenge preconceived notions about the future.

Depending upon the project design, the synthesis phase may last from days to months. Synthesis usually starts at the first workshop, where the core team and participants build scenarios from critical forces, and select three to five final scenarios. Work continues after the workshop as the core team validates scenarios and develops scenario narratives.

Phase Three Synthesis Products

Three to five plausible, relevant, challenging, and divergent scenarios that the core team and participants can use to inform, inspire, and test actions or strategies.

Elements of the Synthesis Phase

A. Divide Critical Forces into Predetermined Elements and Critical Uncertainties

To begin the synthesis stage, the group (core team and participants) divides the critical forces into two categories known as "critical uncertainties" and "predetermined elements." The categories reflect the amount of confidence the group has in available data and projections regarding critical forces, and how important the forces are to the focal question. This process occurs as a facilitated exercise at a workshop or before the workshop in pre-meetings or webinars.

In the NPS scenario exercises, "critical uncertainties" were variables very important to the focal question for which available information was limited or characterized by many unknowns or significant uncertainties. Alternatively, the "predetermined elements" were forces important to the focal question for which available information included a high degree of confidence about the direction and magnitude of future changes.

For example, sea ice and extreme precipitation events may be two very important critical forces (i.e., climate variables) for a park. Researchers may possess high confidence that sea ice will decrease at a park, and that the decrease will be comparable to recently observed changes. In this situation, sea ice decrease would likely be a predetermined element. However, researchers may have less confidence in the projections on extreme precipitation events, especially if models disagree about future frequency and magnitude of the changes. In this situation, extreme precipitation events may be a critical uncertainty.

Critical uncertainties provide the foundation for the scenario set. Building the scenarios based on critical uncertainties, rather than predetermined elements, maximizes the differences between the scenarios, which is a fundamental attribute of a good scenario set. Predetermined elements typically become elements of all scenarios in a set.

To begin identifying the "most important" critical forces, ask:

- Which of the forces are the most significant and why?
- Which could cause the greatest impacts or have a profound effect on the focal question?
- Which have the ability to tip the future in one direction or another?

Some critical forces, like climate variables, may have a confidence or probability figure that represents scientific uncertainty. Other variables, like economic conditions, may not. To assess the uncertainty of variables without confidence figures, ask:

- Which of these variables are the most unpredictable?
- Which could change in a rapid or dramatic fashion?
- Which depend on a number of unknown or unknowable factors?

Be aware that dividing critical forces into categories is a subjective exercise. There are not many "right" answers. The objective is to surface assumptions, spark conversations, and create shared understanding. Separating variables may require time when working with a large group, as individuals discuss the importance or uncertainty of each variable. After dividing the critical forces into predetermined elements and critical uncertainties, the group can begin building scenario frameworks.

Tip: Divide Critical Forces into Predetermined Elements and Critical Uncertainties.

- **If the group has trouble separating forces into "uncertain" and "predetermined" categories, record the critical forces on sticky notes and arrange them on a wall by order of importance. Place the "least" important forces on the left. Place the "most" important forces on the right. Move the forces up or down based on their level of uncertainty. It may take time, but in the end, the forces on the upper right hand side will prove most important and the most uncertain. *(Chermak 2011)***

B. Build Scenario Frameworks and Choose Scenarios

After dividing critical forces, the group can begin to assemble scenario frameworks (i.e., the skeletons or foundations that later become the final scenarios). This process should occur during a scenario workshop.

Several methods exist to build scenarios. Some approaches allow groups to freely associate critical uncertainties and create scenarios based on intuition, while other techniques impose a systematic process to fit the critical uncertainties into an established framework. The core team and facilitators select the method. Each approach produces scenarios the group can use to explore the strategic challenge.

A common introductory method for scenario building is the two-by-two (2x2) matrix process, which is explained below. For more advanced techniques, see *Van der Heijden (2005)*.

Establishing Endpoints for Your Critical Uncertainties

Before creating scenarios, establish endpoints for the critical uncertainties (Figure 3). Think of the uncertainties as a continuum of possibilities ranging between two extremes (Scearce and Fulton 2004). For example, will leadership around climate change be coordinated and consistent or uncoordinated and inconsistent? Will sea level rise by 7 or 23 inches in a location?

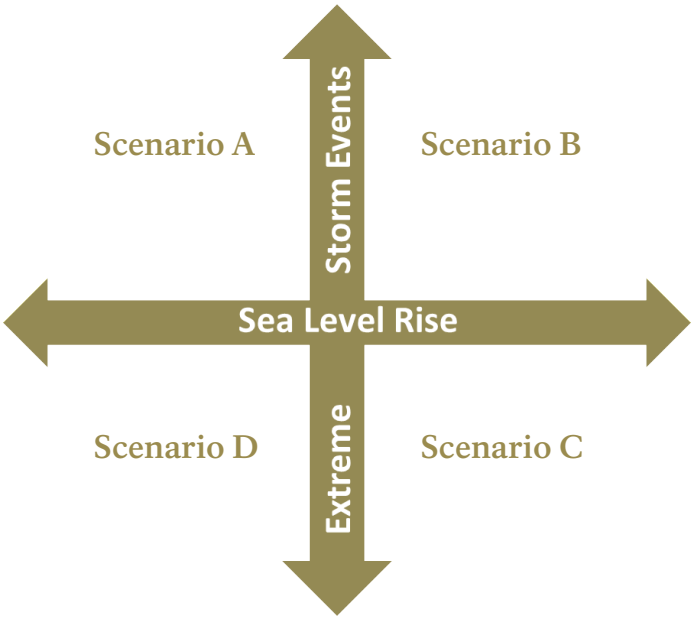
Figure 3: Endpoints on Critical Uncertainties

The Classic 2x2 Scenario Matrix Framework
The scenario matrix is one of the easiest and most effective ways to create a scenario set. To start building a matrix, choose three to five critical uncertainties from the list that are the "most important" and the "most uncertain" (i.e., they have the potential to tip the future in one direction or another).

Cross two of the critical uncertainties to form an x and y axis (Figure 4). The intersection of the uncertainties will create four quadrants, with each quadrant representing an independent scenario. Repeat this process to create several scenario matrices. Try different combinations of critical uncertainties until you have four or five draft matrices.

Figure 4: The Classic Scenario Matrix as Framework (Copyright GBN 2010).

- Construct a matrix from two critical uncertainties
- Try many different combinations of critical uncertainties before settling on a final matrix
- Use axes of the chosen matrix as driving forces to deduce four scenario logics or stories
- Make sure the final matrix is constructed from two independent uncertainties
- Iterate, discuss, and avoid settling too soon on a final matrix



When creating matrices, be aware that group composition and opinions regarding uncertainty and importance will influence driver selection. Try to select unrelated drivers and check that each quadrant forms a plausible, distinctive, challenging scenario relevant to the focal question.

When building candidate matrices, consider:
- Is there a theme or "high concept" in each of the quadrants?
- Are the four scenarios created by the framework plausible?
- Are they relevant to the focal question?
- Do they represent a broad range of possibilities and potential futures? Are the uncertainties independent and divergent?
- Do the scenarios challenge our assumptions about the future?

Typically, only one or two viable matrices will emerge. However, there may be more than one "right" scenario framework for a group or a focal question. In situations with several interesting matrices, form breakout groups to examine the matrices more closely. Following this review, participants should discuss the findings, and either select a final matrix, break into teams to pursue different matrices, or alternatively, restart the process and create a new set of candidate frameworks.

The following questions will help groups decide which scenarios to select. (*GBN 2009*)

- Do any of the scenarios seem close to "conventional wisdom" or how most people think the future will evolve?
- Does the evidence suggest any of these scenarios are most "likely to happen," and thus should command the attention of the management team?
- Which scenarios are important, but have not been considered to date (i.e., have been "off the radar")?
- Which scenarios best highlight some of the most important issues that management must face in the future?

Regardless of the method, creating scenarios is essentially a trial-and-error exercise that requires careful thought and iteration. Take time to experiment with several different combinations of critical uncertainties before selecting final scenarios.

Tip: Build Scenario Frameworks and Choose Scenarios.

- **If the group experiences an impasse, revisit the predetermined elements vs. critical uncertainties discussion or adjust (split, combine) uncertainties to create new critical uncertainties. Check that drivers are not interrelated (e.g., increase in temperature and decrease in snowpack) or just small changes in amount (e.g., slight increase in average precipitation). These types of drivers tend to make poor axes, and result in weak scenarios.**

Advanced Techniques: The Nested 2X2 Matrix

In the nested matrix approach, scenario builders place a 2x2 matrix within a second 2x2 matrix, to create 16 scenarios. The nested matrix can be very useful for exploring different types of uncertainties, such as specific environmental changes within the context of a larger political landscape. However, nesting matrices creates additional dimensions and complexity in the scenarios, which can prove challenging to manage *(see Figure 13 in Appendix I for more detail)*.

Advanced Techniques: Toggles and Wild Cards

Experienced groups may incorporate additional elements to make scenario sets more divergent. Groups can include toggles (an element that shifts from one state to another) in a scenario set to make a scenario more dynamic. For example, the Pacific Decadal Oscillation (PDO) is a North Pacific climate pattern that shifts from warm to cool phases on an inter-decadal scale, affecting climate across the United States. An individual climate change scenario (i.e., one from a set of four) could include a shift in the PDO from warm to cold, to differentiate it from the others in the group.

Wild cards are unexpected, high-impact events (like catastrophic wildfires) that scenario builders employ to create additional divergence or help uncover strategies that may not emerge from the more logical structure of a scenario framework *(Scearce and Fulton 2004)*. For example, within a matrix, two scenarios may have high risk for catastrophic wildfire. Consider what would happen if the wildfire occurred in one and not the other.

C. Identify Scenario Impacts

Once the group has chosen a set of scenarios, through either a matrix approach or an alternative technique, it should explore and document the potential impacts or effects that could occur within each scenario. The group uses the impacts identified during this exercise to develop scenario narratives, inform and inspire actions, and create a monitoring system to track how the environment is changing.

When identifying impacts, focus on cataloging the first-order effects caused by critical uncertainties, such as inundation in low-lying areas in a sea level rise scenario, or the extirpation of a species whose thermal tolerance is well documented. Groups should refrain from inferring or speculating how critical uncertainties could influence second- and third-order factors, such as public attitudes or local tourism. The group will systematically explore these secondary and tertiary effects, known as implications, during the application phase.

To complete this activity, facilitators can divide the group into smaller breakout groups, and instruct each group to focus on a single scenario. Breakout groups highlight the important first-order physical, biological, environmental, and operational effects that could occur within the scenarios, starting with the impacts identified by researchers and catalogued in the impacts table.

Tip: Identify Scenario Impacts.

- **Parsing out scenario impacts and implications can often be a difficult process. Think of impacts as things you are confident will happen in a scenario, and implications as things your intuition or experience tells you may happen. If you find yourself thinking, "If X happens, then Y will probably happen, too" or "If A and B both happen, then it seems reasonable to assume that C and D will also happen" you are probably discussing implications. Try to keep the impacts limited to effects your research indicates can or will happen, but do not worry too much if some impacts identified during this exercise actually become implications.**

D. Describe Scenarios in Detail and Develop Scenario Narratives

The specific quality that a message needs to be successful is the quality of "stickiness." Is the message—or the food, or the movie, or the product—memorable? Is it so memorable, in fact, that it can create change, that it can spur someone to action? *(Gladwell, 2000)*

The core team develops scenario narratives following the initial workshop; however, workshops can be structured so participants compose the initial scenarios. To begin writing scenarios, document the themes, high concepts, details, and memorable elements of each scenario. Arrange them into bulleted summaries or narratives. Many scenario builders choose to capture scenarios as narratives or stories, because "stories can capture and order a lot of complexity, can explain why things happen in a certain way, and can give meaning and perspective to events" (Schwartz 1991). Stories can also leave lasting messages with readers, and are very easy to share with large groups *(Scearce and Fulton 2004)*.

Stories provide an excellent method for communicating scenarios, but writing them requires substantial time. In some cases, instead of creating a full narrative, writers choose to create short, vivid descriptions of the scenarios.

When communicating scenarios through narratives or short descriptions:

- Look beyond the basic interactions of uncertainties. Consider describing how the world evolved into the future state, along with the internal dynamics of that state.
- Include characteristics and elements from predetermined elements in stories to create additional richness, substance, and depth.
- Focus on creating scenarios that are rich in evocative images and details, are internally consistent, and include changes over time *(Liedtka et al. 2007)* and *(Hodgson 2007*). Create detailed descriptions that contain colorful, memorable imagery, plots, first-person perspectives, timelines, and stories about individuals that live within the scenarios.
- Avoid writing "good vs. bad" scenarios and "high, medium, and low" scenarios. Good vs. bad scenarios tend to be simplistic. It is likely that any future will include elements of both good and bad, so try to ensure that your scenarios reflect this. High, medium, and low scenarios often cause scenario users to gravitate towards the middle scenario.
- Maintain focus on describing the impacts and elements within the scenarios. The group will explore response actions during the next stage of the scenario thinking process.

The core team can start the narrative development process at a workshop, and may work afterwards to complete the scenario descriptions and narratives. Before finalizing the scenarios, the core team should ask a few key participants to check that scenarios remain consistent with discussion that occurred during the workshop.

E. Reviewing Scenarios for Plausibility and Consistency

Following the workshop, the core team should meet with experts to review scenarios for plausibility and consistency. This is an important step that helps ensure the scenarios created at the workshop are tenable. The reviewers may be the same experts the core team interviewed during the orientation phase. Alternatively, they may be uninvolved experts who can provide an unbiased perspective on the scenarios.

When reviewing scenarios for plausibility and consistency, ask these questions:

- Are the scenarios consistent with the existing data, science, and evidence?
- Do the scenarios represent a plausible description of what might happen in the future?
- Will they withstand scrutiny? Is there anything fundamentally wrong with them? Are they internally consistent?
- Do they capture the key uncertainties discussed at the workshop?

Following expert reviews, the core team may conduct additional research or interviews to answer questions that developed during the review or workshop. Present new scenarios to the participants before starting the application phase if the scenarios changed during the review period.

Be careful not to assign probability or likelihood to the scenarios during the review process, as this can prematurely narrow the field of exploration. Groups will often devote less time to scenarios deemed less probable. Low-probability, high-impact scenarios often provide the greatest challenge, and stimulate the most creative and innovative ideas. Treat the scenarios as equally plausible until the final stages of the application phase, when groups discuss actions, strategies, or investments to implement.

4

PHASE FOUR: APPLICATION – USING THE SCENARIOS TO INFORM ACTIONS AND STRATEGIES

Goal: To answer the "so what?" questions: What do these scenarios mean for our organization? What do they mean to the focal question and strategic challenge? What do we do about it? *(Liedtka et al. 2007)*

The core team and participants begin the application phase by exploring the implications (i.e., opportunities, challenges, consequences) each scenario could present for the strategic challenge. All participants use the scenarios and implications to test, inform, or inspire actions and strategies. The core team and participants often explore implications and develop draft actions or strategies during a workshop, but the decisions about when to implement actions and strategies remain ongoing.

Phase Four Application Products

A list of actions, strategies, or areas for additional research based on the conversations initiated by scenarios.

Elements of the Application Phase

A. Identify Scenario Implications

Groups begin the application phase by reviewing scenario narratives and considering the second- and third-order effects that can be inferred within each scenario. These may include bottlenecks, challenges, shortages, emergent needs, or new capabilities.

Begin this process by considering how impacts within scenarios could affect the broader world, local environment, organization, focal question, and strategic challenge. Implications may include elements such as the condition of national gross domestic product (GDP) or park budgets, the perspective of local political or social systems, public interest and park visitation levels, changes in the frequency or type of emergencies, changes in diseases and vectors, etc.

When identifying implications, ask:

- What would the conditions of each scenario imply for the organization?
- What are the specific consequences in each scenario for the strategic issue? Does each scenario lead to new challenges and pressures? Any new opportunities?

Implications developed during this step inform actions and strategic priorities *(Scearce and Fulton 2004)*. To explore implications, facilitators frequently separate participants into breakout groups, with instructions to describe the implications of an individual scenario. Breakout groups record implications on color-coded post-it notes, and place the notes on a large chart or printout, one color per scenario *(see Figure 15 in Appendix I)*. Alternatively, facilitators or breakout groups can capture implications more informally, using transcriptions from brainstorming sessions or large notepads to document conversations.

After breakout groups finish exploring individual scenarios and developing implications, the larger group can reconvene to review the results and determine if implications repeat across scenarios, if patterns emerge, or if implications differ significantly between the scenarios (*Scearce and Fulton 2004*). This initial analysis can help highlight important factors to consider when developing actions.

B. Develop, Test, and Prioritize Actions

After considering scenario implications, actions are developed. Begin this exercise by reviewing implications and discussing what actions the organization could take to prepare for the scenarios, as well as how the organization would act differently to adapt to new environments.

To develop actions, examine each scenario and ask:

- What would we do now if we knew the future would evolve like this?
- What can we do in the near term?
- Are there any current actions we would stop taking?
- Are there any urgent actions that we would undertake immediately?
- What would we need to do to continue to operate successfully in this future?

Groups often use a process similar to the implications exercise to develop actions (i.e., separating into breakout groups, capturing actions on post-it notes and posting them on a large printout). *(See Figure 16 in Appendix I.)* However, some groups choose to discuss actions in large groups, or capture them informally using transcriptions or large notepads.

After developing an initial suite of actions, the group can reflect on where it focused attention, and ask these questions:

- Are there scenarios that need additional thought or actions?
- Is there particular energy in one place or another? Why is that so? What could that mean?

Once the group completes an initial review of the actions, facilitators can lead a discussion to compare and contrast the actions across scenarios, noting actions that repeat, that are markedly different, or that the group would like to prioritize. During this process, facilitators should also search for actions that perform well under all scenarios (often called "no-regrets" or "robust" actions), current actions the organization should continue doing (often called "no-brainers"), and actions that are unlikely to make sense in any future scenario (often called "no-gainers"). The no-regrets, no-gainers, or no-brainers are often among the immediate, tangible, and powerful scenario outcomes.

For example, a park may have plans to restore a stream bank. Under each scenario, this action will provide refuge for important species and improve the ecosystem's resilience to change. This action would be a robust or no-regrets action. In another example, a park may be planning a multimedia campaign on a technology platform that becomes obsolete under all of the scenarios. This would be an example of a "no-gainer" action. Finally, a park may be elevating electrical and heating, ventilation, and air conditioning (HVAC) because of repeated flood damage—and under each scenario, floods become more frequent and severe. This would be an example of a no-brainer action that the park would want to continue.

Wind Tunneling

Groups can use scenarios to generate and prioritize actions, policies, and strategies. They can also use scenarios to test them. Think of scenarios as a wind tunnel, similar to the wind tunnels that engineers use to test aircraft. Consider actions, policies, or strategies as model aircraft. As you run the models through the wind tunnel, you may see that under certain conditions they perform well, while in others, the wings come off *(The Management Lab, 2013)*.

C. Using the Scenarios to Inform Strategies

Strategy development (selection of a suite of relevant actions) will involve analysis and considerations beyond scenarios. The test of an appropriate strategy is not only whether it is "robust" against various future possibilities. Decision makers must also consider whether the strategy is feasible and achievable given the organization's current resources, capabilities, and culture. If not, a further set of considerations apply: Should we invest to develop these capabilities, change the culture, etc.? This discussion may begin at the workshop and will likely continue afterwards during ongoing strategic conversations.

The following questions can help when considering management options and strategies based on scenarios (Marcus 2009).

- Will our current strategy succeed should the world turn out like this (each scenario)?
- Where are the most urgent requirements for change in our approach to the future? What aspects of our current strategy should we keep under review? What elements are we very confident about?
- Should we gamble on what appears to be the most probable outcome? Should we pursue a robust route and prepare a strategic initiative to deal with every contingency?
- Should we delay taking action until further clarity emerges? Should we commit to a certain course of action for now, but have back-ups, just in case?
- Or are things so open that we can try to shape the future? Can we define what occurs to our advantage?

Use scenarios for strategy development by keeping them part of ongoing conversations about the future. The more an organization can institutionalize scenarios, the more uses and applications scenarios will have. It is a common mistake for organizations to create a set of scenarios, and then forget about them when making decisions.

Tip: Use Scenarios to Inform Strategies.

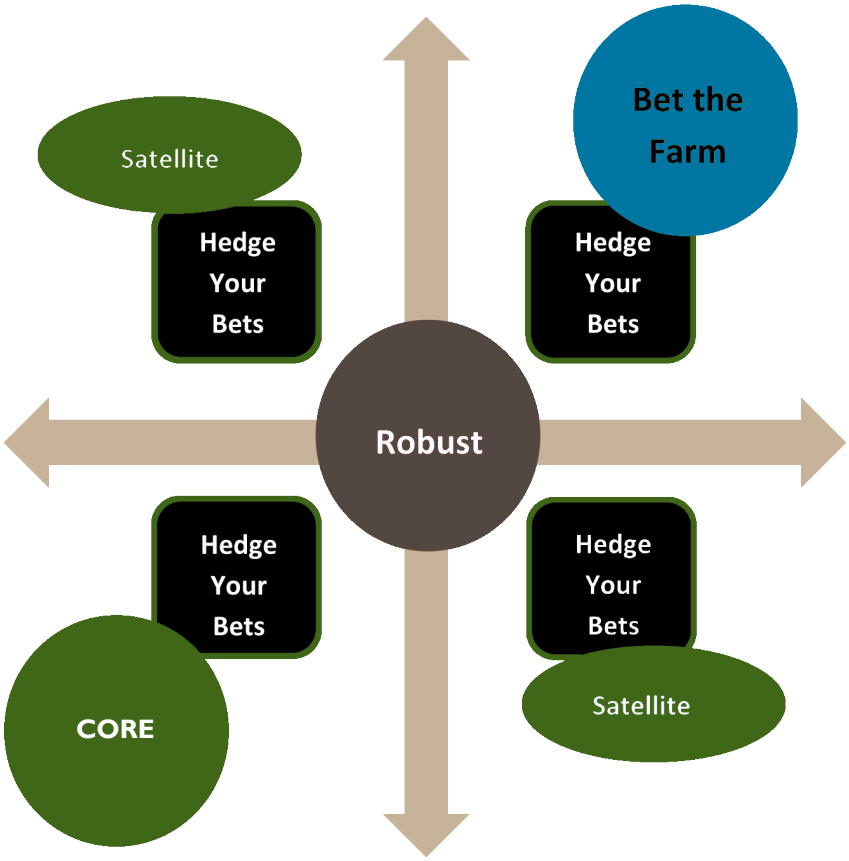
- **Keep a large copy of the scenarios in your organization's meeting room and use the scenarios when discussing relevant actions or strategies. Ask the group questions like: Will the action hold up well in all the scenarios? Does it make sense in every scenario?**

Using Scenarios to Map Strategy

Groups can use a scenario matrix to map actions, assess strategic moves, and highlight areas of risk. To start mapping a strategy, print a large copy of the matrix and record actions on a set of sticky notes. Place the actions, one by one, on the scenarios. If actions are useful in more than one scenario, cluster them in the center or between the scenario borders. Place actions that are specific to only one scenario solidly within that scenario.

Observe how the actions map to the scenarios. Are there actions clustering around the center of the scenarios that you could form into a "robust" strategy? Are there a few actions in each scenario that would collectively allow you to "hedge" against all the scenarios? Are you confident that one of the scenarios will transpire, but want to pursue a few actions in alternate scenarios just in case, which could lead you to a "core/satellite" strategy? Or, are you certain that one of the scenarios is the way the future will evolve, and want to focus on that scenario in a "bet the farm" strategy? *(See Figure 5)*.

Figure 5: Using Scenarios to Map Strategy (Copyright GBN 2010).



Lighthouse at Point Reyes National Seashore, CA. Photo courtesy of Don Weeks.

5

PHASE FIVE: MONITORING – WATCHING FOR CHANGES IN THE ENVIRONMENT

Goal: To identify important indicators that can signal changes in the environment as the future unfolds.

Following the workshop, individuals monitor the scenarios over time, collect new information on uncertainties, and adjust strategies as the world evolves. If significant changes occur, then the group may wish to revisit the scenario process, and create new scenarios. Also, following the workshop or final meetings, the core team will produce workshop deliverables and distribute them to the participants.

Phase Five Monitoring Products

1. A list of indicators and early warning signals for continued research and monitoring.
2. A monitoring strategy.
3. Workshop deliverables that include the scenarios, implications, actions, indicators to monitor, and the monitoring strategies.

Elements of the Monitoring Phase

A. Select Indicators to Monitor

Indicators are metrics or events that signal when the broader environment is changing or when the world is tracking towards or away from a scenario, which individuals can track over time. The core team and participants can identify indicators during or after the workshop, but the core team should include a list of indicators with the deliverables.

Indicators for a climate change scenario exercise may include the arrival of new species on a landscape, alterations in species migration patterns or changes in phenology, variations in infrastructure repair frequencies, evolution of new technologies, or even changes in public mood, national leadership, or organizational policy.

When identifying indicators to monitor, examine the scenarios and ask:

- What would be the early signals if this scenario was evolving? What are the first things we would begin to see? Where would we first see indications of these events?
- Where are there distinct bifurcation points between the scenarios?
- Are there specific trends or indices we can monitor? Are there fields we should pay closer attention to?
- Do we have the capacity to monitor this? Can we build it? Do others already monitor it?
- Within the scenarios, are there any small "upstream" changes that will lead to major changes "downstream"? (e.g., changes in mountain snowpack affecting desert rivers, the price of gas deterring visitors, urban heat waves encouraging visitors to rural parks).

B. Scan and Monitor Changes in the Environment

Organizations track indicators in a variety of ways. Some organizations designate specific people to track indicators. Other organizations use meetings to discuss indicators with a group. Some ask the entire staff to pay attention to certain trends and report when things change. There is no right way to monitor indicators, but the group may wish to develop a strategy or delegate responsibility for tracking indicators at the workshop.

These are two common methods for tracking indicators:

- Scanning–A broad, systematic sweep of the entire external environment (social, political, environmental, economic, and technological trends) that might signal new developments.
- Monitoring–A regular review and synthesis of specific trends and indicators that are important and relevant to the focal question.

While scanning and monitoring, individuals should also seek newly emergent critical forces that could affect the organization. If the existing scenarios become obsolete, or newer, more important critical uncertainties emerge, the group may consider revisiting the scenario thinking process.

Tips: Scan and Monitor

- **If the organization cannot dedicate people to scan or monitor, consider posting a copy of the scenarios on a bulletin board in a place like the lunchroom. Employees can post newspaper clippings, scientific articles, or personal experiences that may indicate how the world is unfolding *(Scearce and Fulton 2004)*.**
- **Use social media to undertake the same process. Post the scenarios on-line (intranet or internet) and encourage colleagues to link to journals, articles, or experiences that may indicate how things are changing.**

C. Communicate Scenarios and Workshop Outcomes

Communicating workshop results can be difficult, especially in organizations new to scenarios, but it is important to disseminate the information throughout the organization. The group may discuss strategies for communicating the outcomes at the workshop, or individuals may develop their own methods after the workshop concludes.

Many scenario users find that when presenting workshop results to audiences, it is easiest to introduce the work by telling the vivid, entertaining scenario stories to the audience. A presenter can work backwards to explain the phases of the process, how the scenarios were developed, and the information used to develop the stories. Management actions created using the scenarios are important to convey when communicating workshop outcomes, as are the impacts, implications, actions, and strategic recommendations.

Numerous methods exist to communicate scenarios to external audiences. PowerPoint presentations that include graphic recordings, images, video or audio summaries are popular. Some groups go beyond traditional presentations to produce physical exhibits, dramatizations, websites, blogs, and journals.

D. Workshop Deliverables

The core team will produce workshop deliverables following the final workshop or meetings and distribute them to the participants. Deliverables should include the scenarios, implications, actions, strategies, and indicators to monitor. The deliverables may also contain any useful supporting documentation, such as critical forces and impacts tables, maps or diagrams.

Pinnacles NM used scenario planning to help them rehearse for a range of uncertain climate futures. Image of California Condor pipping egg at Pinnacles NM. Photo courtesy of Gavin Emmons.

Future changes in precipitation and fire patterns in Sequoia and Kings Canyon National Parks is uncertain. Park Managers engaged in sceanio planning to be prepared regardless of what the future brings.

APPENDIX I - A HYPOTHETICAL SCENARIO EXERCISE FROM THE SOUTHWEST ALASKA BIOREGION

The following example illustrates how a hypothetical core team used the five-step process to build a set of nested, multivariate climate change scenarios for the southwest Alaska bioregion. The example draws from past scenario training workshops and later scenario work done by the NPS Alaska Region in 2011. Although much of this information derives from actual experiences, the following case is not a final product. Contact the NPS Alaska Regional Office or the NPS Alaska Regional Science Advisor for more information on scenario exercises in Alaska.

1 Orientation Phase

The Core Team, Goals, Scope, and Structure of the Exercise

Faced with developing long-term stewardship strategies and strategic plans for the Southwest Alaska national parks, and concerned about how climate change might affect the natural resources, cultural resources, and infrastructure, NPS staff decided to conduct a scenario workshop to explore how climate change could impact the region.

Three months before the workshop, the NPS staff assembled a core team that included NPS planners, managers, and scientists; university and agency affiliates; and Global Business Network (GBN) facilitators. The core team described two primary goals for the project. First, the team wanted to build a set of scenarios it could use to test plans and strategies. Second, the team desired a range of "no-regrets" actions it could implement in the future. The core team's desired outcomes for the project were a set of nested, science-based, multivariate climate change scenarios, a list of no-regrets actions, and a deliverable that encapsulated the steps of the process, workshop materials, scenarios, implications, actions, and indicators.

With the goals and desired outcomes defined, the team determined the scope of the project. The team selected Southwest Alaska bioregion (which includes Kenai Fjords National Park, Alagnak Wild River, Aniakchak National Monument, Katmai National Park, and Lake Clark National Park) as the geographic focus. A 100-year time horizon was selected as the temporal focus to reflect the time period used in most IPCC climate change research.

Because of budget, travel, and time constraints, the core team decided to conduct a one-workshop scenario exercise. The team held five webinars to introduce participants to the scenario process, climate variables, and impacts. A three-day workshop followed to develop the scenarios along with some early implications, actions, and indicators. After the workshop, the team conducted calls with participants to review and validate the scenarios and develop additional implications, actions, and indicators.

The Strategic Challenge and the Focal Question

During the orientation phase, the core team conducted a series of conversations about the issues and challenges climate change could create for the Southwest Alaska bioregion. From these discussions, the core team stated the strategic challenge as: How can the National Park Service best manage the resources and values of the Southwest Alaska national parks in the face of climate change?

The core team understood that the best way to manage the resources of an area threatened by climate change depends on how climate change affects the landscape. As a result, the team stated the focal question as: How might the effects of climate change impact Southwest Alaska over the next 50 to 100 years?

Recruiting Participants

Once the core team established the strategic issue and the focal question, the members recruited a mix of key experts, decision makers, and creative thinkers to attend the workshop. The core team used a matrix *(Figure 6)* to ensure that participants included decision-makers, experts, and creative thinkers from a diverse array of fields, backgrounds, functions, agencies, communities, and tribal groups.

Figure 6: Example Participant List

Name	Climate Science	Regions	WASO	Park	Rangers	Inter-Agency	Fire	Ecology	Cultural Resources	Science & Monitoring	Planning	Facilities & Transportation	Water	Interp & Education	Position / Expertise	Agency, Region, Park
Dr. L Von Drake	X					X									Climate Scientist	NOAA
Captain Caveman			X						X						Cultural Resources	NPS
Ranger Smith				X	X		X				X				Superintendent	NPS
Ranger Rick				X				X						X	Chief of Natural Resources	NPS
W.E. Coyote				X								X			Facilities Manager	NPS
R. Runner		X										X			Transportation Manager	NPS
S. Bear						X	X								Fire Ecologist	USFS
Dr. Lorax						X		X							Forest Pathologist	USFS
S. Squarepants						X							X		Oceanographer	USGS / Undersea University
Professor X										X					Remote Sensing	Xavier University

2 Exploration Phase

The core team enlisted subject matter experts to research the climate change critical forces and impacts that could affect Southwest Alaska. The team then worked with the experts to present the critical forces and impacts to participants through a series of webinars and reading assignments before the workshop. During the exploration phase, the core team also conducted interviews with NPS staff to assemble a list of social, political, and technical critical forces that could affect how the NPS responds to climate change.

Climate Critical Forces (i.e., Climate Change Variables Tables

Using the latest IPCC regional climate projections and downscaling results, university-based climatologists created a table of climate-related critical forces (climate variables such as temperature, precipitation, degree of sea level rise, etc.) that could affect the Southwest Alaska bioregion *(Figure 7)*. For each variable, the climatologists included information on recent trends, expected changes, synoptic signs, and scientific confidence in the projections. Most of the regional projections for Southwest Alaska came from the IPCC Special Report on Emissions Scenarios (SRES) scenario A1B; however, some information originated from models based on A2, B1, A1B, and A1F1 scenarios.

Figure 7: Excerpt from Southwest Alaska Climate Variables "Drivers" Table *(Weeks et al. 2011)*.

Climate Variable	General Change Expected	Specified Change Expected and Reference Period	Size of Expected Change Compared to Recent Changes	Patterns of Change	Confidence	Source and Context
Temperature	Increase	2050: +3°C ± 2°C 2100: +5°C ± 3°C	Large	More pronounced in north and in autumn-winter	>95% (sign) very likely	IPCC 2007, SNAP 2010
Precipitation	Increase	2050: +10-25% ± 15% 2100: +20-50% ± 20%	Large	Greater overall percentage increase in north	>90% (sign) very likely	IPCC 2007, SNAP 2010
Pacific Decadal Oscillation (atmospheric circulation)	Decadal to multidecadal circulation anomalies affecting Alaska	Unknown	Large (comparable to climatic jump in 1970s)	Major effect on Alaskan temperatures in cold season	Natural variation essentially unpredictable	Hartmann and Wendler 2005
Extreme Events: Temperature	Warm events increase, cold events decrease	2050: increase 3-6 times over present conditions for warm events; decrease 1/5-1/3 of present conditions in cold events 2100: increase 5-8.5 times present conditions in warm events; decrease 1/12-1/8 present conditions in cold events	Large	Increase in frequency and duration of extreme hot events; decrease in extreme cold events (winter)	Modeled and observed; very likely	Abatzoglou and Brown, Timlin and Walsh 2007
Extreme Events: Precipitation	Decrease / Increase	2050: -20% to +50% 2100: -20% to +50%	Large	Increase in frequency and contribution, especially in winter Modeled and observed	Modeled and observed; uncertain	Abatzoglou and Brown
Extreme Events: Storms	Increase	Increase in frequency and intensity	Any increases exacerbated by sea ice reduction and sea level increase	Increases at southern periphery of Arctic; little information for central Arctic	>66% likely	Loehman 2007

Social, Political, Technical, and Economic Critical Forces

Before the workshop, the core team conducted a number of interviews with NPS employees, managers, and superintendents to identify the sociopolitical forces that could affect the NPS response to climate change. During these interviews, the core team asked questions such as:

1. What are the main challenges regarding climate change within your park unit?
2. What are some of the barriers you face in responding to this challenge?
3. What are some opportunities you foresee in working toward and responding to climate change?
4. What are the political challenges decision makers might face when addressing climate change?
5. Do you foresee any organizational obstacles that might impede efforts to mitigate climate change?
6. If you could answer three questions about the future, what would you want to know to better understand how climate change will affect your park unit?

From the interview results, the core team developed a list of 27 social, technical, political, and economic critical forces *(Figure 8)*.

Figure 8: Sociopolitical Critical Forces Excerpt from *GBN (2009)*.

Potential Social, Political, and Technological Critical Forces
1. Rate and magnitude of GHG emissions
2. Position of administration
3. Intensity of impacts on average American citizen
4. Political stability of oil-producing and quickly developing nations
5. Population growth and development of energy demand
6. Regional population shifts and consequent development
7. Public perception of federal lands and their purpose
8. Leadership (local, state, national, international)
9. Budgets (for science, management and park operations)
10. Degrees of cooperation between agencies, sectors, etc.
11. Energy availability and cost
12. Levels of global conflict
13. Public reaction to rate of temperature and sea-level change
14. Media portrayal
15. Sense of public ability to make a difference
16. Degree to which climate change is a partisan issue
17. Economic prosperity
18. Knowledge of climate change
19. Threshold changes and wildcards
20. Federal agricultural policies
21. Urban planning policies
22. Sequestration and technology developments
23. Power of national or international carbon regulation
24. Concern of society about natural systems
25. Social and environmental movements
26. Resource scarcity
27. Global health concerns

Climate Change Impacts Tables

Working with additional subject matter experts (biologists, ecologists, geologists, hydrologists, etc.) the core team gathered information on how climate change impacts may affect the Southwest Alaska bioregion. The team then compiled this information (peer-reviewed scientific literature, current research, expert opinions, and historical observations) into climate change impacts tables *(Figure 9)*.

Figure 9: Example Climate Impacts Table from Southwest Alaska workshop courtesy of Robert Winfree, Science Advisor, NPS Alaska Regional Office, 2011.

Resource		Potential Impacts
Sector	Subsector	
Atmosphere	Precipitation	Projected increase in avg. annual precip. for all AK park units. Relative portions of moisture deposited as snow, ice or rain changes. Many areas will experience drying conditions despite increased precipitation due to higher temps. and increased rates of evapotranspiration. More freezing rain events affect foraging success and survival of wildlife, travel safety, and utility transmission.
Cryosphere	Ice/Snow	Snow and ice season shorter with later freeze-up/snowfalls and earlier spring snowmelt/ice breakup. Most glaciers diminish as warming continues. Glacial outwash (silt, sand, gravel) accumulates as glaciers melt and recede affecting aquatic productivity in positive and negative ways, and form deposits that complicate shallow-water navigation. Glacial lakes and glacially dammed lakes fail with increasing and unpredictable frequency creating flash flooding risks to visitors, residents, park staff and infrastructure.
Biosphere	Vegetation	Increase in growing season and large-scale land cover changes. Some terrestrial models suggest potential for large-scale conversions of low tundra to shrubs, then to conifers, and from conifers to deciduous forests, or perhaps grass. Other models indicate increasing lichen, decreased sedges and increases in deciduous and evergreen shrubs.
	Fisheries	Fish disease such as Ichthyophonus increase with rising temps. Models indicate that temp. increase in streams in south-central AK will be around 3°C. Some existing salmon waters may become unsuitable for migration, spawning and incubation. New stream habitats become available for colonization by fish (and wildlife) as glaciers decline. Ocean acidification affects fisheries. Pteropods and crustaceans (food for salmon) may decline with ocean acidification.
Other	Customary and Traditional Knowledge	The predictive uses of traditional ecological knowledge (TEK) will change as unprecedented changes develop (changes in fire frequency, freeze/thaw, species, transportation modes, etc.) from a changing climate.

Participant Review of Climate Change Variables and Climate Change Impacts Tables

Participant Review of Climate Change Variables and Climate Change Impacts Tables
During introductory webinars, the core team solicited feedback from participants on the critical forces (sociopolitical and climate variables) and the climate change impacts tables.

3 The Synthesis Phase

The core team began workshop preparation several months in advance. Team members located workshop space and made room reservations early. On-site work began a day early to set up the room, print handouts and exercise templates, and address last-minute details. Facilitators determined the workshop structure during the orientation phase and finalized the annotated facilitator and participant agendas in the weeks before the workshop.

Process and Materials Review

Facilitators began the first day of the workshop with a series of review presentations on the process of scenario thinking, purpose of the exercise, strategic challenge and focal question, and climate change variables and impacts tables.

Divide Variables by Confidence and Importance

Following the initial presentations, participants spent several hours in breakout groups separating the variables by degrees of uncertainty and importance. Facilitators used a two-stage process to separate the climate variables, and used an enlarged version of Figure 10 to record the discussion. The facilitators began the exercise by working with participants to divide the variables into categories they labeled as "Uncertain" (i.e., critical uncertainties) or "High Certainty" (i.e., predetermined elements) based on the confidence column in the climate variables tables *(Figure 7)* and the professional opinions of the participants. Following this initial conversation, participants discussed which climate variables could have the greatest impact on the landscape over the next 50 to 100 years, and therefore were the "most important" to consider.

Figure 10: Excerpt from Climate Variable Selection Table from the *Southwest Alaska workshop developed by SNAP and NPS (2011).*

Climate Driver	Uncertainty	High Certainty	Importance
Temperature Increase	X		X
Precipitation Increase	X		X
Freeze-up Date		X	
Length of Growing Season		X	
Sea Level	X		
Water Availability	X		
Relative Humidity	X		
Wind Speed (separate from Aleutian Low)	X (duration)	X (increase)	
Pacific Decadal Oscillation	X		
Extreme Evetns: Temperature		X	
Extreme Evetns: Precipitation	X		
Extreme Evetns: Storms		X	X
Ocean Acidification (-0.1 to -0.4 pH)	X		X

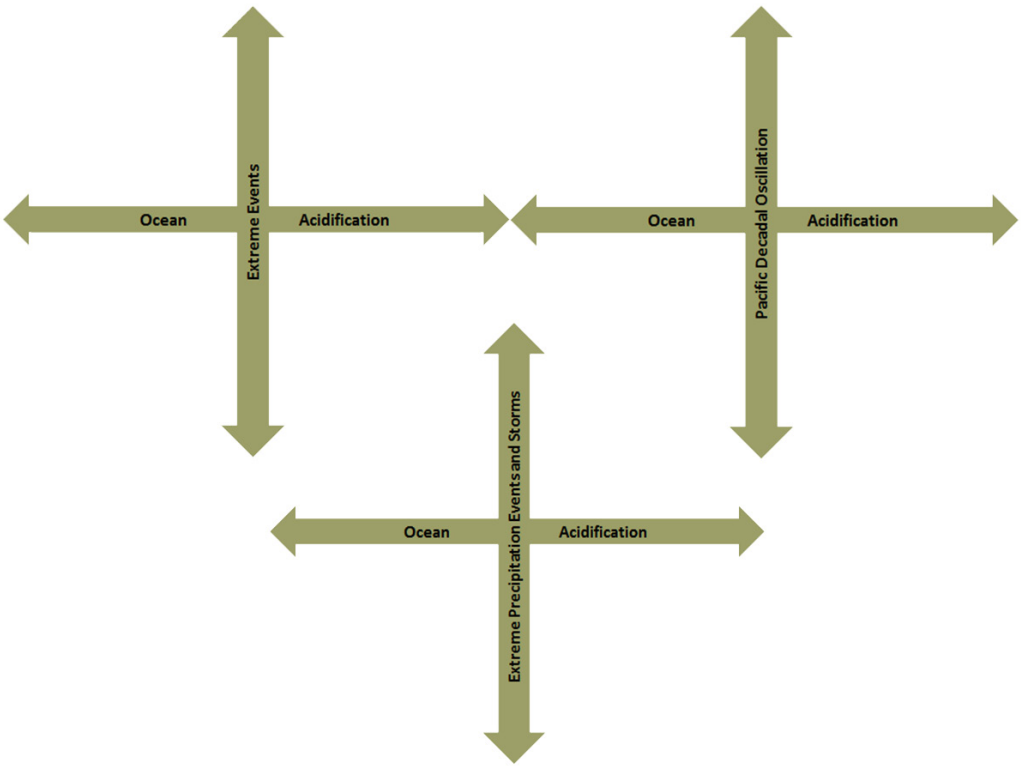
Build and Choose Biophysical Scenario Matrices

After dividing the variables into categories, participants selected those that were both "Uncertain" and "Important" to create draft scenario matrices. The group chose the variables of ocean acidification, extreme storm events combined with extreme precipitation, Pacific Decadal Oscillation, and temperature increase as draft axes. Using a trial and error process, the group developed several draft scenario matrices *(Figure 11)*.

Once the group assembled the draft matrices, facilitators separated participants into breakout groups and assigned each group a matrix. In the breakout groups, participants carefully reviewed each matrix for its plausibility, its relevance to the focal question, the level of challenge it posed to the organization, and the degree of differentiation between the four scenarios.

Following this review, the breakout groups presented their findings to the larger group. After additional discussion and deliberation, the group voted to select "Ocean Acidification vs. Extreme Precipitation Events and Storms" as the final biophysical scenario matrix.

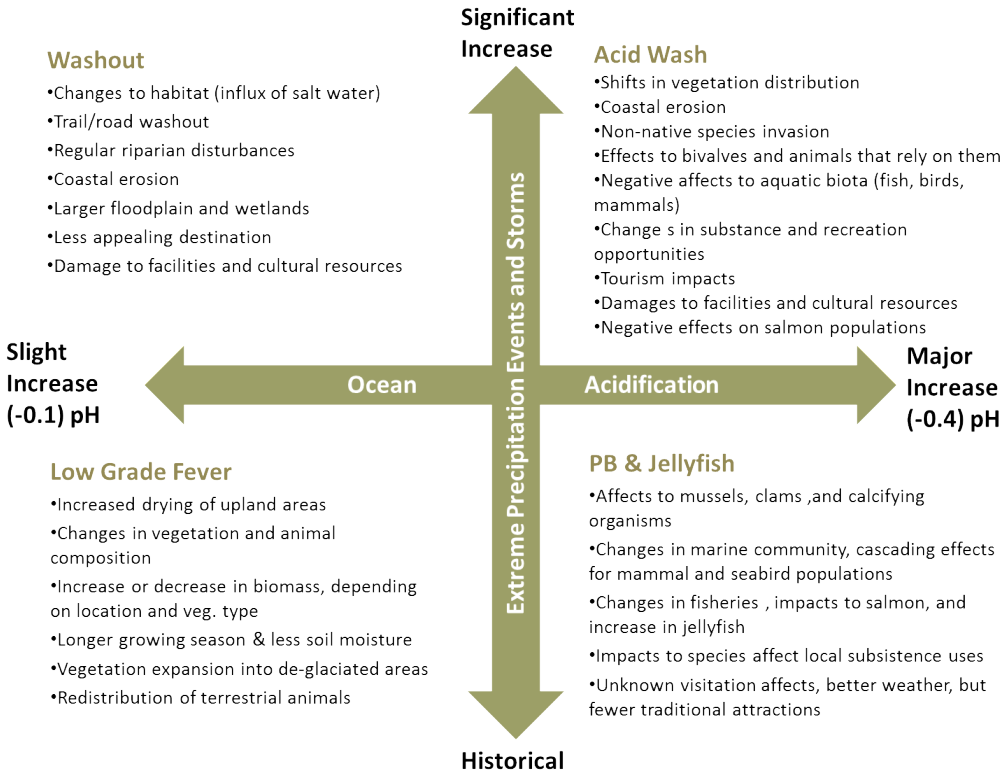
Figure 11: Candidate Matrices *(SNAP and NPS 2011)*



Describe Impacts in the Climate Matrices

After choosing the final matrix, participants spent several hours exploring and documenting the key themes, high concepts, climate impacts, and conditions of each quadrant. Particular attention was paid to the unique impacts to natural resources, facilities, cultural resources, and visitor experience that distinguished each quadrant. Participants used an enlarged matrix *(Figure 12)* and post-it notes to record the discussion. The group also developed creative names that captured the essence and distinguishing characteristics of the scenarios.

Figure 12: Southwest Alaska Climate Matrix with Impacts *(SNAP and NPS 2011)*.



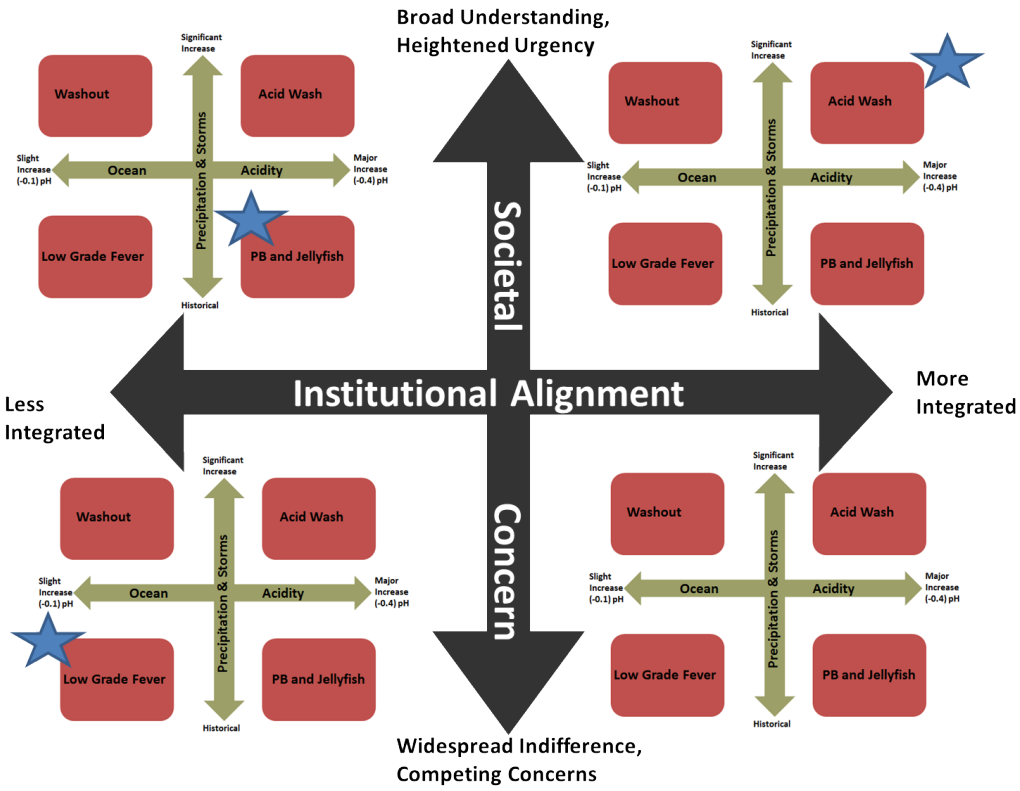
Nesting Scenarios in a Sociopolitical Matrix and Selecting Final Scenarios

To explore sociopolitical influences, the group nested the biophysical matrix within a sociopolitical matrix created by the core team before the workshop.

The core team used the social, political, technical, and economic critical forces identified during the exploration phase *(Figure 8)* to create two composite critical forces that formed a 2x2 sociopolitical matrix when crossed. The first force, labeled the "Institutional and Political Alignment," represented the degree that institutions could collaborate and the amount of leadership support and funding that would be available for climate change actions. The second force, labeled the "Degree of Societal Concern about Climate Change," represented the amount of public interest in climate change, and whether or not it was an important issue, or just a competing concern.

Nesting the biophysical matrix within the sociopolitical matrix allowed the group to consider sixteen vastly different, but plausible, biophysical, political, economic, and societal environments *(Figure 13)*. Participants discussed the sixteen scenarios and their importance to the focal question and strategic challenge before selecting three final scenarios to explore in deeper detail.

Figure 13: Nested Scenarios *(SNAP and NPS 2011)*.

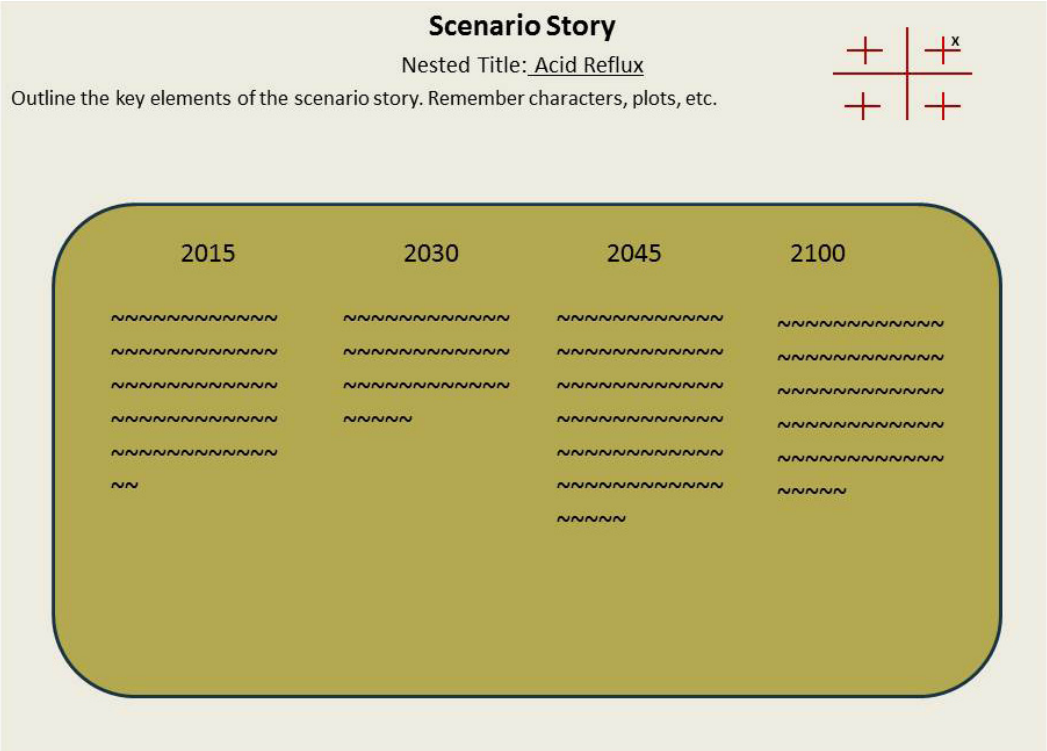


Create Scenario Narratives

After selecting scenarios, participants separated into three breakout groups, with each group responsible for developing one scenario narrative. The groups described how the sociopolitical and biophysical critical uncertainties could interact over time to shape the future. A large printout was used to capture the conversation *(Figure 14)*. Groups referenced the climate change impacts tables to identify the physical effects of the critical uncertainties and discussed how effects may combine, compound, or amplify within the scenarios. Some of the groups elected to produce short, but vivid narrative descriptions of the scenarios with the limited time available.

Scenario planning workshop at Catoctin Mountain Park, 2012.

Figure 14: Creating a Scenario Story.



Excerpt from Nested "Acid Reflux" Scenario Story.

"Acid Reflux" is a nested scenario where by 2100, Southwest Alaska is experiencing an increase in storminess and precipitation, a high (-0.4 pH) increase in ocean acidity, and the Pacific Decadal Oscillation is in a warm phase. Average temperature in Southwest Alaska has increased by 4^{0} C, leading to a greater number of extreme temperature events than during the early 2000's. Extreme storm events are also more frequent and intense by 2100, delivering more rain to Southwest Alaska. The growing season is 40 days longer than the early 2000's, and freeze–up does not occur regularly in coastal areas.

Storm events cause frequent flooding at Kenai Fjords National Park, and Exit Glacier Road washes out regularly. Glaciers have receded dramatically across Southwest Alaska. Former moraine areas are heavily vegetated and many glaciers are no longer visible from trails and roads. Increase in ocean acidity has resulted in profound changes in marine ecosystems. However, there is broad public interest and concern about the impacts of climate change. State, local, and federal governments are well organized, and have funding dedicated to climate change adaptation.

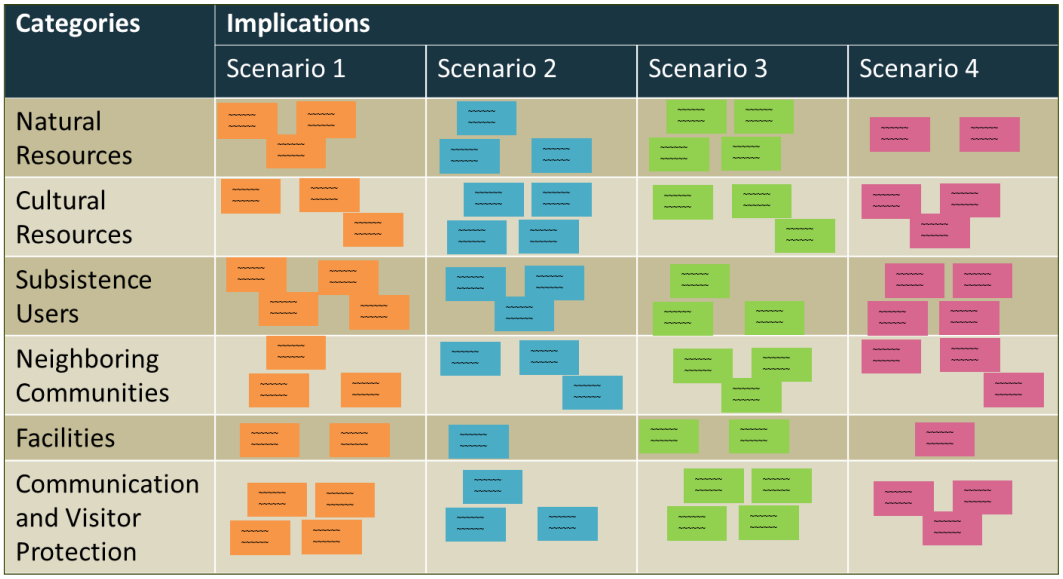
Exploring Scenario Implications

Following narrative development, facilitators divided the participants into breakout groups, and assigned a scenario to each group. Facilitators instructed the groups to contemplate the implications of their scenario by considering the following questions:

- What is the broader environment of this world like?
- What effects will these scenarios have on the Southwest Alaska bioregion?
- What pressures and opportunities will the Southwest Alaska bioregion face from these impacts?

During these sessions, breakout groups used a large table *(Figure 15)* with columns for natural and cultural resources, subsistence users, neighboring communities, facilities, park communication, and visitor protection to focus attention on implications to important resources and park operations. Groups recorded the implications of their scenarios on post-it notes, and placed them in the appropriate categories on the table. Facilitators then reconvened the group and reviewed the implications for repetition, patterns, or significant differences between the columns.

Figure 15: Capturing Scenario Implications



Implications from "Acid Reflux" Scenario

Natural Resources
- Coastal erosion
- Shifts in the marine food web
- Decline of benthic community
- Unknown glacial dynamics
- Extremely wet conditions

Cultural Resources
- Flooding and losses of known and unknown historic sites
- Exposed cultural resources from ice retreat

Subsistence Users
- Losses in fish and game
- Shifts in traditional lifestyles

Neighboring Communities
- Shifts in tourism and fishing industry
- Increased number of emergencies

Facilities
- Flood risk and damage to roads/infrastructure from slides, erosion and floods
- Access to roads and trails more frequently compromised

Communication and Visitor Protection
- Heightened media and public involvement
- Risk of message confusion
- Increased number of emergencies

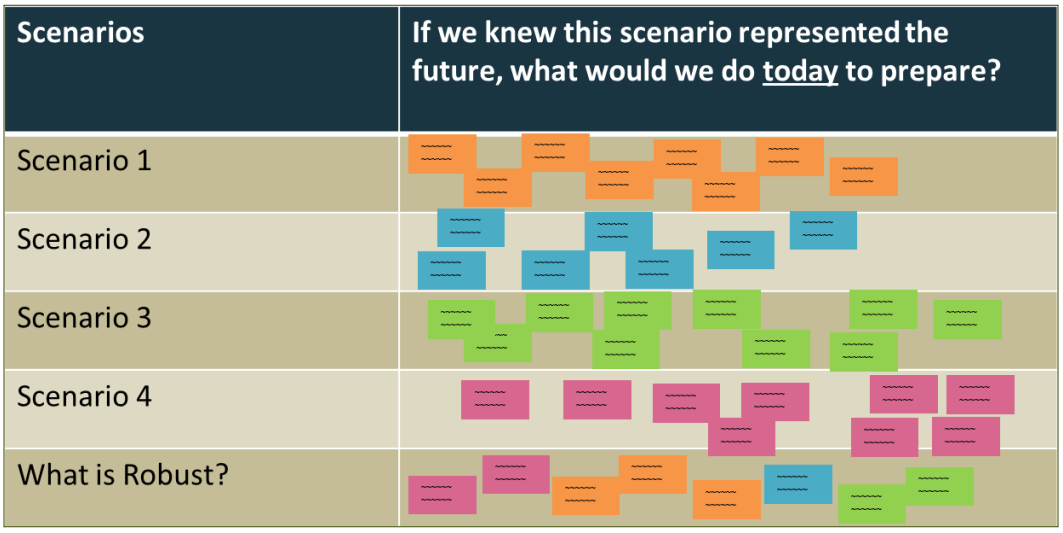
Develop Actions and Identify Robust Actions

Following the implications exercise, participants again separated into breakout groups to focus on individual scenarios. Facilitators instructed participants to develop actions "as if they knew the scenario represented exactly how the future would evolve." This prompted the following questions:

- What actions could or should the NPS take if faced with this situation?
- How do current park decisions, strategies, or policies fare in these scenarios?
- Are there gaps in these strategies? Areas of vulnerability? New options to consider?
- Are there things the NPS currently does, which no longer make sense?

Within breakout groups, participants discussed actions, recorded their ideas on color-coded post-it notes, and pasted them onto a large printout *(Figure 16)*.

Figure 16: Capturing Scenario Actions



Potential Park Actions in "Acid Reflux" Scenario

- Add additional civil engineers to staff.
- Monitor ocean acidification and marine ecosystems.
- Build only portable infrastructure near glaciers, rivers, and coasts.
- Document vulnerable cultural resources.
- Secure additional collection space for relocated artifacts.
- Move campsites away from highly vulnerable or risky areas.
- Communicate landscape changes to public.

After developing actions for all four scenarios, the group reviewed, revised, edited, and in some cases, eliminated actions. Participants then searched the table for robust or "no-regrets" actions that repeated across scenarios. These actions were identified for further research and consideration.

Example of Robust Management Actions Common to All Scenarios

- Create seamless datasets.
- Provide science outreach to multiple audiences.
- Collaborate with researchers and monitoring programs to track changes in PDO and ocean acidification.
- Model and promote energy-efficient technologies.
- Increase connections between research and monitoring.
- Conduct coastal and marine ecosystem monitoring.
- Build portable, flexible structures.
- Cooperate with private and public entities, and reimagine how institutions can work together to solve common problems.

5 The Monitoring Phase

Following the action planning exercise, the group spent the remainder of the workshop discussing indicators to monitor and monitoring strategies.

Participants understood that the National Park Service monitors a suite of physical, biological, and chemical indicators in Southwest Alaska through the NPS Inventory and Monitoring Networks. As a result, the group's monitoring strategy was to use existing NPS capacity to track changes in the physical environment. However, two critical elements of the scenarios, nearshore ocean acidification and species assemblages, were not part of the NPS monitoring program. The group discussed how to monitor these metrics within the Southwest Alaska bioregion, either by extending or enhancing current monitoring protocols; collaborating with neighboring agencies like USGS and NOAA; requesting additional funding; or recruiting students from universities.

The group also discussed strategies to monitor the environment beyond NPS Inventorying and Monitoring Networks. One superintendent positioned a large copy of the matrix in the park's lunchroom and invited staff to attach journal articles, newspaper clippings, or personal experiences that indicated evolving scenarios. Another superintendent placed a copy of the scenarios in the park's meeting room, which allowed staff to discuss the scenarios at regular intervals, as well as "wind tunnel" important actions or decisions during meetings. The group also committed to discuss the scenarios during annual leadership meetings.

At the end of the workshop, the group made plans to develop additional implications actions and monitoring strategies after the core team validated the scenarios with additional experts.

Moving from the planning stage to action, sustainable park infrastructure at Assateague Island NS was put in place. It was designed for a barrier island, where sea level rise and increase storm frequency are projected. This vault toilet mounted on a wooden deck allows easy relocation during storm events.

Joshua Tree NP. Photo courtesy of Angie Richman.

Climate change may impact the habitat of the desert tortoise.

APPENDIX II
EARLY EXAMPLES OF HOW PARKS ARE USING SCENARIOS

Kenai Fjords National Park

Kenai Fjords National Park Background

Kenai Fjords National Park (KEFJ) is a landscape that boasts immense glaciers, dramatic fjords, temperate rain forests, and rocky coasts. The Harding Ice Field, the dominant geological feature in the park, covers over half of the park's 608,000 acres with ice several thousand feet thick.

The sculpted landscape of KEFJ reveals a long history of change. Ancient glaciers carved its deep fjords, and ocean storms and earthquakes continue to reshape the land. In some cases, seismic events dramatically alter the environment in a matter of minutes, as the Good Friday Earthquake did in 1964, when it dropped the shoreline by six feet in 3.5 minutes (NPS 2010).

Although the majority of KEFJ lies underneath a mantle of ice, the park supports a variety plant and animal species. Whales, bears, otters, seals, and eagles all flourish in this productive, yet harsh environment. Today, the speed and scale of changes occurring at KEFJ are causing great concern among park staff. Many ecosystems that depend upon the glacially dominated system are at risk as the climate changes and glaciers recede.

Alaska Scenario Workshops

The NPS chose KEFJ as a case study for an NPS Climate Change Scenario Planning Training Workshop held in Anchorage, Alaska, in August 2010. Consultants from the Global Business Network (GBN) facilitated the workshop, which included university and state agency scientists, park staff, and representatives from neighboring land management agencies. The participants created scenarios regarding how ocean acidification, extreme precipitation events and storms, and a shift in the Pacific Decadal Oscillation could affect park resources over the next 100 years.

Following the initial training workshop, the NPS Alaska Region began application of climate change scenario planning for the Southwest Alaska Network in 2011 as part of a two-year project to complete climate change scenario planning for all Alaska Inventory and Monitoring Networks by 2013. Contact the NPS Alaska Regional Office, the NPS Alaska Regional Science Advisor, or the University of Alaska Fairbanks Scenarios Network for Alaska Planning for more information on this project.

Applications of Scenarios to Management

Using Scenarios to Inform Park Planning and Decision Making
Kenai Fjords National Park is developing a graphical representation of the scenarios for display in the park's administrative meeting area. This display will allow staff to use the scenarios during meetings, and will prompt decision makers to consider climate change when discussing both short- and long-term actions.

The park is using the scenarios to "wind tunnel" responses to environmental effects such as storm impacts and flooding that already affect the region (or may become worse).

Using Scenarios to Inform Resource Stewardship and Monitoring
Workshop participants identified nearshore ocean acidification as one of the critical uncertainties for the region; however, most ocean acidification monitoring near the park occurs in the offshore setting. Because the workshop highlighted the importance of nearshore acidification to the park's resources, KEFJ is looking for opportunities to monitor this variable.

Using Scenarios to Inform Infrastructure, Transportation and Operational Decisions
Park staff are using scenarios as they explore strategic responses to long-term challenges, such as future visitor expectations, or services the park can expect to offer as the environment continues to change.

Using Scenarios to Work with Partners
Many tribal partners invited to the workshops expressed strong interest in the scenario process. Some indicated they would like to maintain connections with the NPS group conducting scenarios and work with the NPS to conduct scenario exercises in tribal communities and coastal villages.

Using Scenarios for Communication and Education
Park staff are interested in developing interpretive displays that use scenarios to demonstrate how climate change may impact the park. Staff members intend to teach interested local community members about how to use scenarios to plan for climate change.

Assateague Island National Seashore

Assateague Island National Seashore Background

Assateague Island National Seashore (ASIS) is a barrier island that extends 36 miles along the coast of Maryland and Virginia. Congress established the national seashore in 1965 to preserve and protect the unique coastal resources, natural ecosystem conditions, and processes of the island; to provide high quality, resource-based recreational opportunities compatible with resource protection; and to educate the public on the values and significance of the area.

More than half of the island's 48,000 acres are comprised of nearshore or estuarine waters, and the geography of the island is in a state of constant flux. Powerful storms dramatically alter the shoreline in a matter of hours, and waves wash over the beaches, reshaping the island from ocean to bay. The park provides habitat for a number of aquatic and terrestrial species, including an iconic herd of wild horses descended from animals brought to the Island over 300 years ago. The park is also a major recreational outlet for people in Virginia, Maryland, and Washington DC, who visit to enjoy fishing, sunbathing, surfing, and swimming.

Assateague Scenario Workshop

Because of Assateague's dynamic nature, and its vulnerability to storms events and sea level rise, the NPS selected the park as a case study for an initial scenario workshop held in April, 2009. The Global Business Network facilitated the workshop, which included scientists from universities and state agencies, park staff, and representatives from the neighboring land management agencies who share jurisdiction over the island.

Before developing the climate scenarios, park staff prepared a list of questions and issues to explore using scenarios, including the following:

- How can ASIS provide recreational opportunities when traditional infrastructure is threatened?
- Which species and habitats are at greatest risk from climate change?
- How will climate change alter the existing drivers of estuarine dynamics?
- What resource information will be most useful for adaptation?
- Are there feasible adaptation and protection strategies for ASIS?
- What social and political pressures may influence how ASIS adapts to climate change, and how can the park mitigate them?

To answer these questions, participants created scenarios about how sea level rise and intense storms could affect the park over the next 40 years. The workshop report (*GBN 2009*) captures a summary of the process and outcomes, and is available through the NPS Climate Change Response Program.

Applications of Scenario Planning

Using Scenario Results to Inform Park Planning and Decision Making

- The park used the scenarios to inform its new general management plan. In the plan, the park explored alternatives that require providing only minimal day use infrastructure or moving vulnerable operations and infrastructure to protected locations if existing island facilities are lost to sea level rise and storms.
- Because of the impacts sea level rise and storms may have on the park, ASIS may produce an alternative transportation plan, which would allow the park to explore using ferry services and boat landings to access the park if bridges, roads, and parking lots on the island become impossible to maintain.

Using Scenarios to Inform Resource Stewardship

- Workshop results highlighted the serious threat climate change poses to the park's salt marsh, and confirmed that the park's effort to enhance the resiliency of this habitat is an appropriate action. Workshop results also supported the park's work to minimize ecosystem stressors it can control, such as invasive plants, predation of threatened and endangered species, and nutrient discharge into the estuary.

Using Scenarios to Inform Monitoring

- During the workshop, participants recognized that groundwater resources at ASIS, which are critical to the survival of the wild horses, may be highly vulnerable to climate change. At the time of the workshop, the park was not monitoring groundwater. However, because of the scenario exercise, the park has incorporated groundwater into its monitoring program.
- The scenarios and monitoring discussion reinforced the importance of key data sets the park should continue collecting, like shoreline and salt marsh migration.
- The scenarios raised many questions about biological responses to climate change at ASIS, although the park's vital signs monitoring programs measured only physical resources. The workshop provoked discussions on how the park could monitor biological signals of landscape-level change, such as species shifts or changes in phenology.
- Through the scenario process, the park identified the need for additional tools, including models that more accurately describe the relationship between accelerating rates of sea level rise and geomorphic change, models that improve the understanding of species and habitats at risk, and sensitive early indicators of climate change.

Using Scenarios to Inform Infrastructure, Transportation, and Operational Decisions

- Recognizing that sea level rise and storm surge threaten the park's maintained dunes and infrastructure under all scenarios, the park has decided to expand its use of portable infrastructure. The scenarios also validated the park's practice of using native materials to rebuild parking lots subject to frequent storm damage.

Using Scenarios to Inform Communication and Education

- The scenarios developed during the workshop give interpreters compelling, science-based stories about how climate change may affect the park to include in climate change exhibits for the visitor center.
- The scenarios provided staff with a common understanding of how climate change may affect the park, which has facilitated internal communication and discussions on long-term planning and strategy.

Park scientists even work under water to understand how future climate change scenarios will impact fragile coral reefs at Virgin Islands NP.

APPENDIX III – DESIGNING WORKSHOPS

There is no ideal or universal design for scenario projects. Depending on the group, question, or time constraints, some aspects of the process may be more relevant than others. However, the five core steps provide a useful organizing framework for customizing projects.

Due to the volume of information the group must discuss, most scenario exercises require at least one participatory workshop, and in many cases, two workshops are necessary. The two-workshop structure allows time to review the scenarios with experts and to ensure the scenarios are fully plausible. In addition, a two-workshop approach allows a full second workshop to carefully discuss scenario implications and develop creative response actions.

Recommended Structure for a Two-Workshop Scenario Planning Exercise

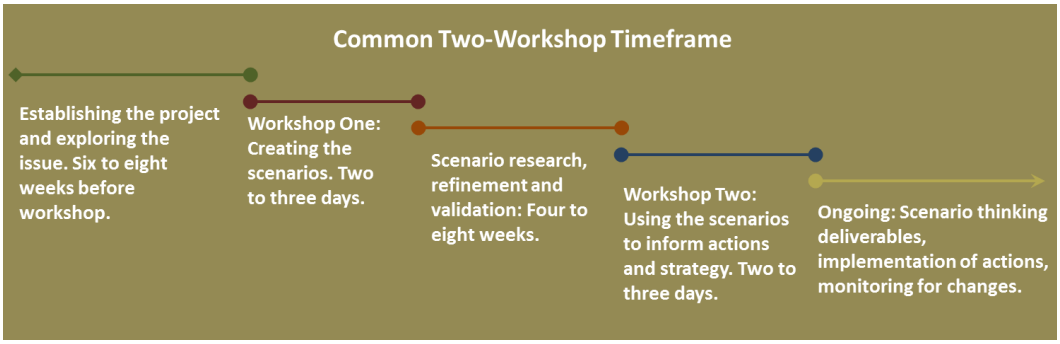
Recommended Structure for a Two-Workshop Scenario Planning Exercise

In the two-workshop approach *(Figure 17)*, the core team should spend six to eight weeks before the first workshop on the first two phases of the scenario process, *Establish the Project (Orient)* and *Explore the Issue (Explore)*. The first workshop focuses on the third phase in the process, *Scenario Synthesis (Synthsize)*.

During the four to eight weeks between the first and second workshop, the core team should work with experts to validate the scenarios generated in workshop 1, conduct any additional research, and create detailed scenario narratives.

At the second workshop, participants use the scenarios to develop management implications and actions during the *Application (Act)* phase, and identify indicators to monitor during the *Monitoring (Monitor)*phase. Following this workshop, the core team will produce deliverables that describe the scenarios, potential actions, and indicators to monitor. The core team may also work with participants on follow-up items or an action plan.

Figure 17: Two-Workshop Timeframe



Recommended Structure for a Single Workshop Scenario Planning Exercise

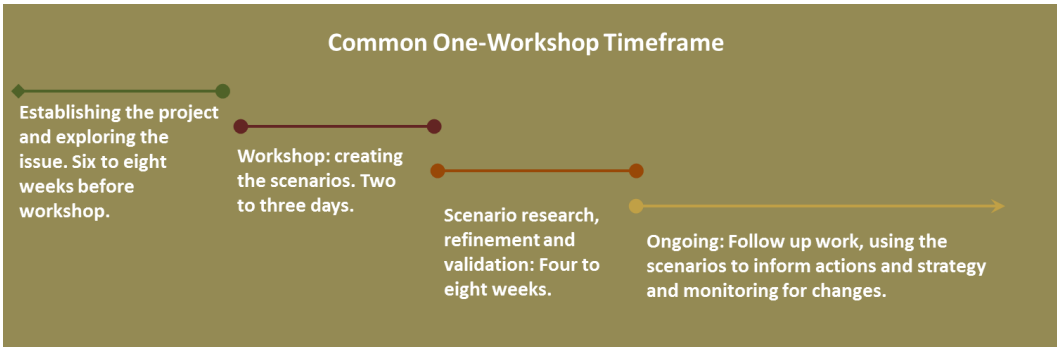
Recommended Structure for a Single Workshop Scenario Planning Exercise

Groups often use a single workshop exercise when meeting more than once is impractical *(Figure 18)*. In a single workshop exercise, the pre-workshop requirements are nearly identical to those of a two-workshop exercise. The only difference is the core team may schedule additional conference calls, webinars, presentations, etc., so participants arrive at the workshop ready to create scenarios.

If using a single workshop approach, the group should spend most of the workshop creating scenarios. Facilitators can conduct an early discussion about implications, actions, and indicators to monitor at the workshop, but recognize this discussion is more effective with validated scenarios.

Have a robust communications network in place so that after the workshop you can share important materials, notes, transcripts with participants to continue engaging the group. After validating the scenarios, conduct webinars or conference calls with the participants to discuss actions, strategies, and indicators to monitor, and use the scenarios during ongoing strategic conversations.

Figure 18: One-Workshop Timeframe



Tips for Designing Workshops

Whenever possible, conduct workshops over the course of two days. If you can only devote eight hours to the workshop, consider working from "lunchtime to lunchtime" to include an overnight break from the process.

Wind Cave National Park hosted one of the first scenario planning workshops and participants explored what climate change will mean for the local bison herd.

APPENDIX IV - FACILITATING A SCENARIO WORKSHOP

The Workshop Space

Conduct scenario workshops in an offsite location that can accommodate 15 to 20 people. The workshop space should include a main area for plenary sessions that is capable of housing sub-groups in the same room. If possible, reserve a second breakout room to help avoid the disruptive atmosphere that develops when several groups work in the same area.

Consider the quality of the workshop space, as this can often improve or diminish creativity and productivity. Facilitators also regularly recommend arranging tables in clusters that seat five to seven people to promote discussion.

Pay attention to the room's amenities beyond the space. Have plenty of flip charts, white boards, and markers to capture conversations, and keep them available for spontaneous breakout groups. Try to secure a room with natural lighting and views to foster a stimulating and creative atmosphere.

Workshop Ground Rules

Ground rules set the tone for the scenario workshop, and facilitators should establish them early. The common ground rules listed below are a useful starting point, but expect to develop new rules as needs, goals, and audiences change.

Scenario Workshop Ground Rules *(Global Business Network, 2009)*

- Be open to new ideas: challenge your own assumptions and ask clarifying questions.
- Suspend disbelief.
- Be creative and have fun.
- Remain both future- and strategy-oriented.
- Full participation: actively listen, contribute, leave "room" for others, and stay with the group (i.e., no gadgets, no multitasking, be on time.)
- Balance advocacy and inquiry.
- Be open and honest: no false consensus, no attribution of ideas and comments (i.e., who said what) outside of the room.

Leading the Group

Before the workshop, prepare instruction graphics for each exercise. If possible, learn about the workshop participants. Understanding personal histories, viewpoints, or relationships can be helpful when facilitating exercises.

Because of frequent shifts in focus, scenario workshops can be challenging to lead, but the facilitator must balance good discussion and progress through the process. Create an agenda graphic for the workshop. Present it early and refer to it frequently.

Recognize that the agenda will probably shift as the workshop progresses and new understanding develops. Identify which points of the process the group should focus on generating ideas (developing actions) or fostering agreement (matrix selection) and try to keep conversations focused. Remember to be flexible and make corrections to the original agenda as needed. Sometimes tangential discussions can unlock valuable learning.

In addition, always schedule a "second thoughts" period each morning to let participants reflect on the previous day's learning. Insights from second thoughts sessions often prove immensely valuable and can provide dividends throughout the workshop.

Facilitators Agenda

Maintain an annotated facilitator's agenda with notes and time cues separate from the participants' agenda. A facilitator's agenda detailed down to five or ten minute blocks can be beneficial, but avoid being inflexible about time, and let good conversations continue if they are proving valuable.

Within the agenda, vary the pace and style of activities to keep energy levels high. Use energy boosters (games, walks, etc.), reflection time, small group activities, and plenary dialogue as needed.

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