

Climate Change Response Program

Natural Resources Stewardship & Science

National Park Service
U.S. Department of the Interior



A bridge on Route 186—a major access point for the Schoodic Institute at Acadia National Park—collapsed as a result of torrential rainfall in June 2021. Photo by Natasha Foutch.

TRAINING AID

What *might* happen? How to make the most of scenario planning.

Scenario planning is a tool for grappling with the uncertainties of tomorrow by asking a simple question: What *might* happen? We cannot know what will happen, but we can prepare for what might happen. The National Park Service (NPS) has been using scenario planning since 2007 to help parks prepare for what might happen as a result of climate change.

Since then, the NPS Climate Change Response Program developed improved methods to provide park-specific climate projections to support scenario planning. Facilitated discussions with scientists, park staff, and other subject matter experts produce scenarios that are plausible (based on best available science), relevant (focused on a management question), and divergent (characterize a broad range of future conditions).

As an unfortunate testament to their plausibility and relevance, a number of imagined, worst-case scenarios were “scooped by reality” in recent years. As our world changes rapidly in new and novel ways, we must increasingly be ready for such events. Doing so requires that we work through mental barriers that might prevent us from properly considering high-risk scenarios.

Our rational minds are often hijacked by myriad fallacies, biases, and mental shortcuts. Among them is **optimism bias**, wherein people often overestimate the probability of positive events, and/or underestimate the probability of negative outcomes. In moderation, optimism bias fortifies us against depression and despair. But left unchecked, optimism bias can promote risky behaviors or disincentivize taking proper precautions.

“Optimism is like red wine. A glass a day is good for you, but a bottle a day can be hazardous.”

*-Manju Puri & David Robinson in *Optimism & Economic Choice**

Optimism bias transcends education, experience, and background—it seems we all like to hope for the best! But when we recognize and account for optimism bias, we are better able to anticipate challenges and avoid risk. In the context of scenario planning, tempering optimistic tendencies prepares us to better envision a full range of plausible futures, and consider management options with greater urgency. The following case studies may be helpful as you begin to envision your future scenarios.

THE DIXIE FIRE, LASSEN VOLCANIC NATIONAL PARK

In June 2021, staff and leadership at Lassen Volcanic National Park (LAVO) engaged in a scenario planning process to inform revision of the park's Fire Management Plan. Workshop participants developed scenarios considering how hot and arid the next 20 years might be and how well the park could 'live with fire' during that time. The worst-case scenario—titled “Smoky & Stressful”—imagined a future in which the entire park burned in a single event.

“Fire science and real-world observations led us to prepare for and expect sustained, high-intensity, wildfire runs.”

– LAVO staff, personal communication, 2022

A June 30, 2021 internal report for LAVO staff documented the scenario planning work. Less than two weeks later, on July 13th, the Dixie Fire started in a canyon 35 miles southwest of LAVO. Within a month, 69% of the park (73,240 acres) had burned. When the fire was fully contained four months later, it was the largest single fire in California history.

Similarities between what the park experienced and what park staff envisioned just weeks before were striking. Many aspects of how the Dixie Fire played out at LAVO were well within the bounds of what NPS staff imagined. Fortunately, proactive fire mitigation measures employed by the park in earlier years limited the ultimate extent and impact of the fire.

STORMS & FLOODING, ACADIA NATIONAL PARK

Acadia National Park (ACAD) is home to miles of historic carriage roads and trails constructed between the late 1800s and early 1900s. The historic Maple Spring Trail, for example, is a masterwork of the Civilian Conservation Corps from the 1930s.

In 2015, ACAD used scenario planning to envision possible adaptation strategies in response to climate impacts. Park staff imagined futures with frequent and intense rainfall, longer wet spells, shorter dry spells, reduced snowpack, and earlier melting. At the time, these scenarios felt useful for long-term planning.

“The big storm was exactly one of the scenarios we played out. We totally foresaw this as a thing that could happen.”

– ACAD staff, personal communication, 2021

Less than six years later, five inches of rain fell in just three hours on June 8, 2021. A significant portion of the Maple Spring Trail washed out, along with footbridges and sections of several other historic trails and roads. A subsequent ACAD news release called it “one of the most exceptional weather events in the park's history.” Barely a month later, a subsequent storm brought another 3 inches of rainfall over the course of a day. Some carriage roads were closed for months, and the Maple Springs Trail suffered extensive damage.

Park managers are actively seeking climate-informed options to address damage from the storms of 2021. The park now sees consideration of future scenarios as an urgent need for the present, rather than input only for long-term management.



The Dixie Fire destroyed wooden portions of the historic Mr. Harkness Fire Lookout in Lassen Volcanic National Park. NPS Photo

Tempering Bias

We may find it uncomfortable to imagine a “worst-case” scenario. But we are better prepared to act when we work to **think about the unthinkable**.



Exceptional flooding removed three layers of surface from multiple sections of carriage roads in Acadia National Park. NPS Photo.

Tempering Bias

We may want to downplay the severity or magnitude of extreme scenarios. But we should be ready to **think bigger** when considering the future.

PERMAFROST LOSS & LANDSLIDES, DENALI NATIONAL PARK

A 92-mile road provides visitor access into Denali National Park (DENA). Near the midpoint, a 100-yard stretch of the historic road crosses a slow-moving rock glacier. Dubbed the Pretty Rocks Landslide, this stretch has regularly required moderate maintenance since the 1960s.

In 2014, DENA hosted a scenario planning workshop focused on two key climate variables: precipitation and the length of the warm season. The most extreme scenario envisioned a future with a large increase in precipitation and a much longer growing season. Workshop participants imagined the loss of permafrost, longer fire seasons, changes in wildlife populations, and more “shoulder” season visitation—all by 2040-2050, based on earlier modeling.

“It’s like building a road on a conveyor belt.”

– DENA Park staff, personal communication, 2022

Shortly following the workshop, road crews noticed an uptick in the rate of movement along the Pretty Rocks Landslide. A rapid rise in mean annual temperature—coupled with unusually heavy rainfall events—was melting permafrost and exacerbating landslide activity in the area. Regular monitoring revealed the pace of movement increased from inches per year to inches per day by 2019. On August 21, 2021—when it became evident maintenance could not keep pace with deteriorating conditions—the park was forced to close road access west of the Pretty Rocks Landslide.

DENA proposes spanning the landslide area with a bridge, which will better withstand rapidly changing conditions and restore visitor access to the western half of the Denali Park Road.



A displacement of approximately 14 vertical feet occurred over two weeks at Pretty Rocks Landslide in Denali National Park in 2021. NPS Photo

Tempering Bias

We may hope difficult futures are a distant concern. But experience shows it’s better to imagine such changes happening **sooner rather than later.**

TREE MORTALITY, SEQUOIA & KINGS CANYON NATIONAL PARKS

Sequoia National Park (SEKI) was established in 1890 to protect treasured groves of giant sequoias. The trees are highly fire-adapted and historically were understood to be practically immune to pests and diseases. Between 2011 and 2017, SEKI undertook several scenario planning processes focused on fire management and the protection of giant sequoia groves. Participants envisioned that in about 20 years the parks might see moderate climate change impacts including reduced giant sequoia regeneration.

But participants did not imagine that the mature giant sequoias would soon be impacted. Most thought it would take closer to 80 years to see significant impacts from climate change on the mature giant.

“[Sudden disturbance events] are the ones that caught us off guard. They came on more fast and furious than we thought.”

– SEKI former staff, personal communication, 2021

In 2014-2015, California experienced a severe, record-breaking “hot drought.” Since then, hundreds of giant sequoias died, both inside and outside the parks. Attributing death to a specific cause is difficult, as extreme drought and warmer temperatures have multiple interacting effects on pests and fire behavior.



Firefighters on the KNP Complex in Sequoia National Park used fire-resistant structure protection wrap to cover the base of the General Sherman Tree, and raked burnable plant material out of the surrounding area. NPS Photo.

The first bark beetle infestation of a living sequoia was documented in 2017, and the park subsequently identified at least 38 beetle-killed giant sequoias. Several sudden disturbance events have also caused significant tree mortality. In 2020, the Castle Fire burned 12 giant sequoia groves in SEKI, roughly 13% of the grove area in the parks. And only one year later, the KNP Complex Fire burned 78,675 acres in SEKI.

By thinking through scenarios, SEKI was better prepared to manage tradeoffs and triage where necessary to protect top-priority resources.

Tempering Bias

We may believe extreme, complex scenarios to be improbable. But as rapid changes bring novel conditions, we must **give fair attention** to “worst-case” scenarios.

SUMMARY AND NEXT STEPS

Optimism bias can manifest during scenario planning, but can also influence *how we subsequently prioritize management action*. Past experience shows the value of taking reasonable, proactive steps in anticipation of worst-case scenarios. Strategies that help temper optimism bias in planning and decision-making include:

- **Think about the unthinkable:** We are better prepared to act when we proactively confront the possibility of worst-case realities.
- **Think bigger:** Don’t downplay the severity or magnitude of extreme scenarios. Anticipating extremes boosts our capacity regardless of what happens.
- **Plan for sooner rather than later:** It’s better to imagine difficult futures happening sooner than anticipated, and recognize signs of extreme change.
- **Give fair attention to the improbable:** Strive for objectivity in interpreting the best available information for scenarios to help prepare for extreme, complex events.

For more about optimism bias, check out *The Optimism Bias: A Tour of the Irrationally Positive Brain*, by Tali Sharot.

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