



Planning for a Changing Climate and the RAD Framework: Climate Change Adaptation in the US National Park Service

TransParkNet Meeting 2024
Háldi Transboundary Area
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Climate Change Response Program



Climate Change Response Program



NPS Image, <https://www.nps.gov/orgs/ccrp/index.htm>

Climate Impacts to Parks



Joshua Tree

National Park

NPS Image



Glacier

National Park

NPS Image



Yellowstone

National Park

NPS Image



Dry Tortugas

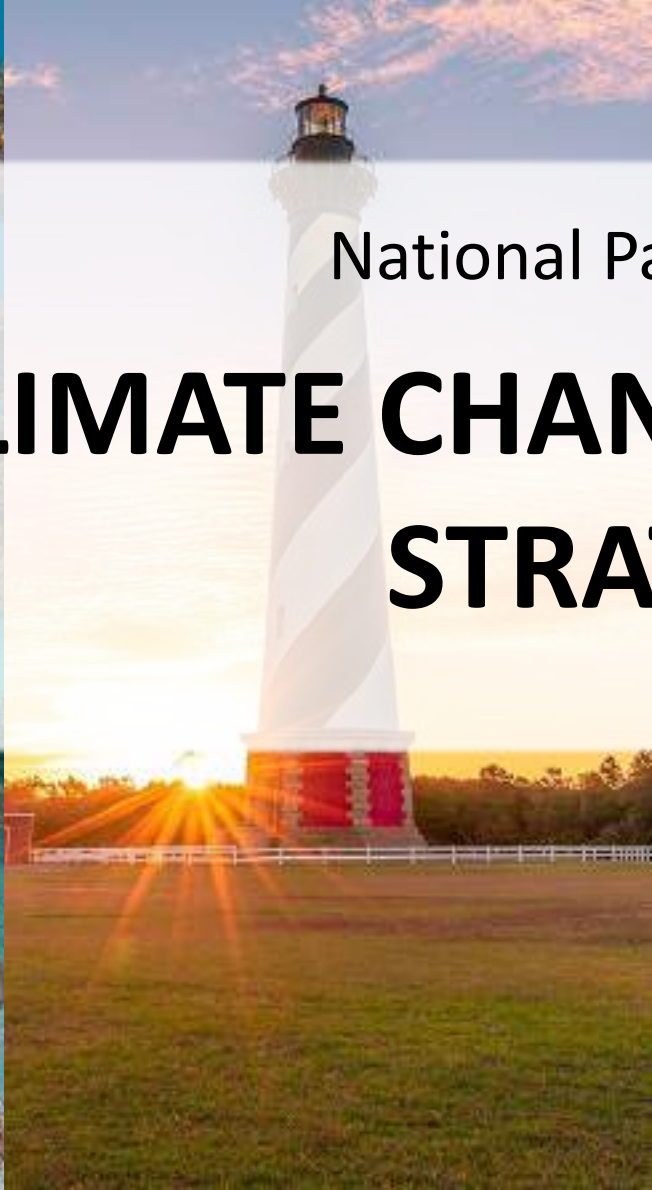
National Park

NPS Image



National Park Service

CLIMATE CHANGE RESPONSE STRATEGY



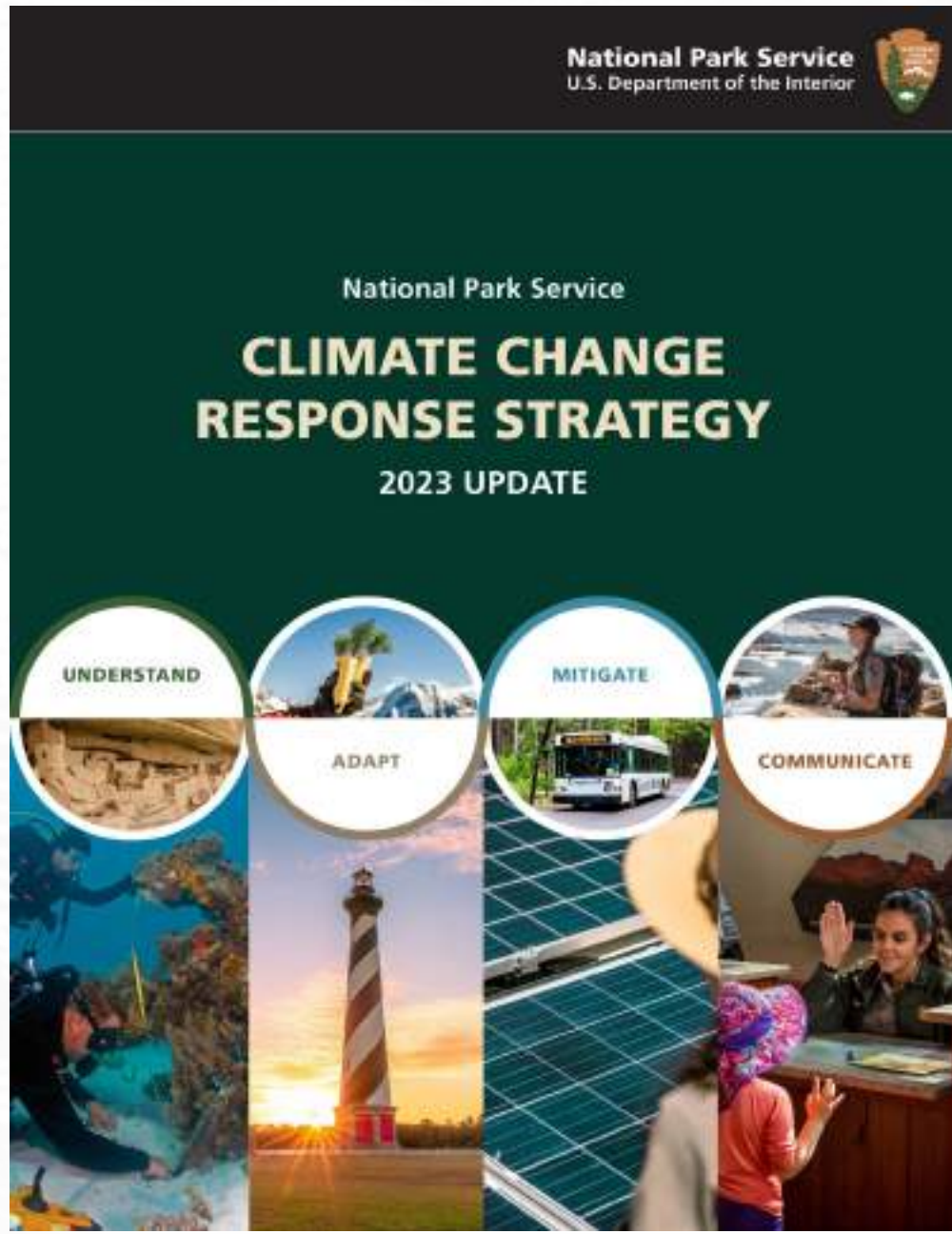
A comprehensive response to climate change



UNDERSTAND
the science



ADAPT
to the change



MITIGATE
the cause

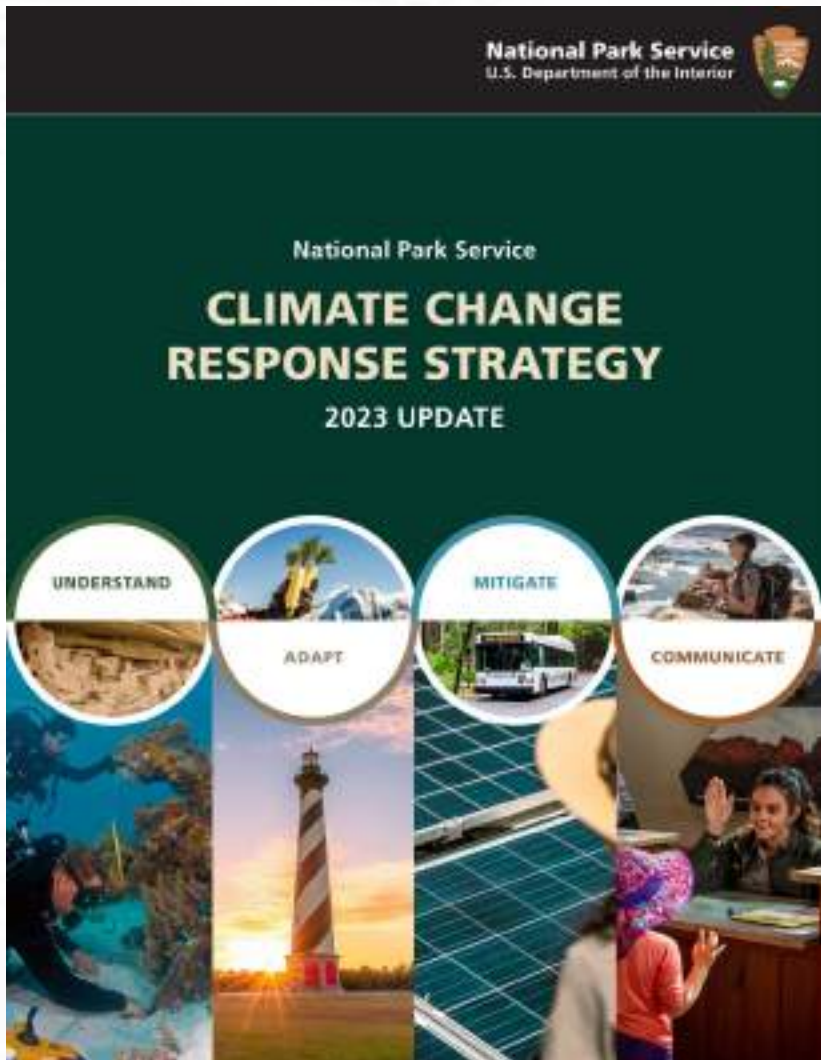
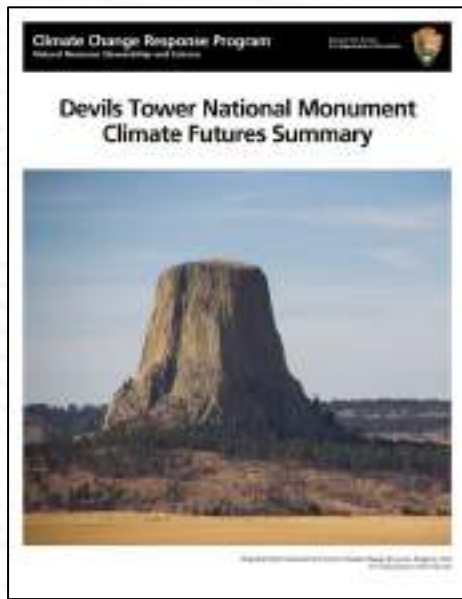


COMMUNICATE
about the issue

A comprehensive response to climate change



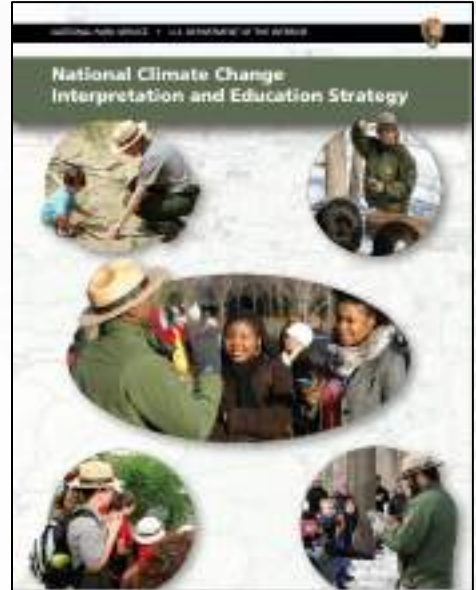
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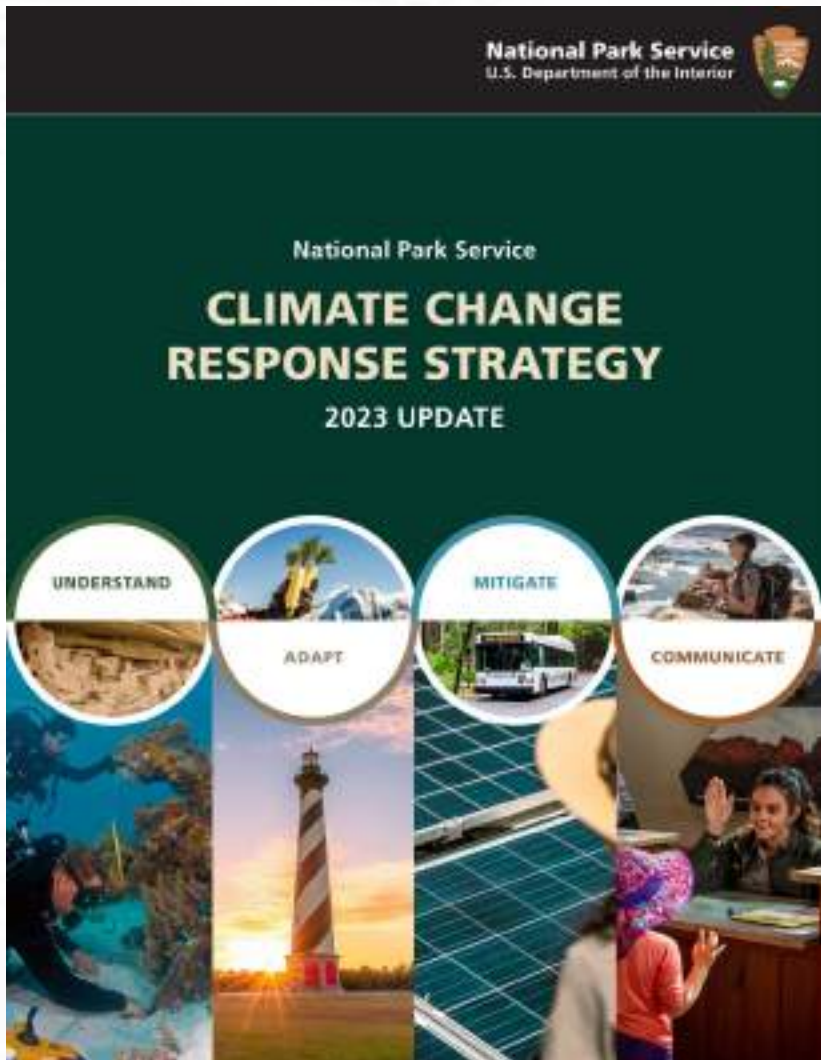
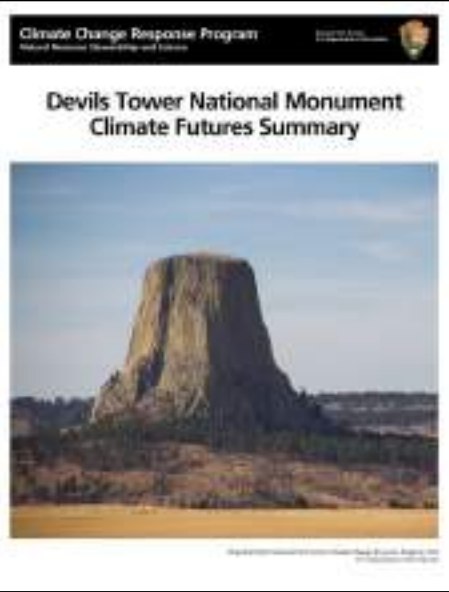


COMMUNICATE
about the issue

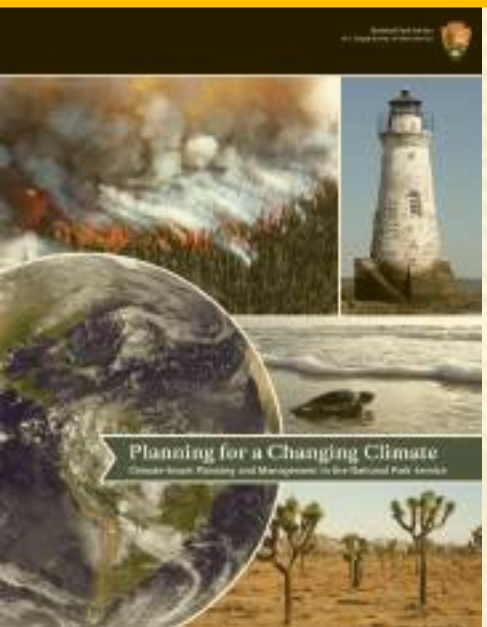
A comprehensive response to climate change



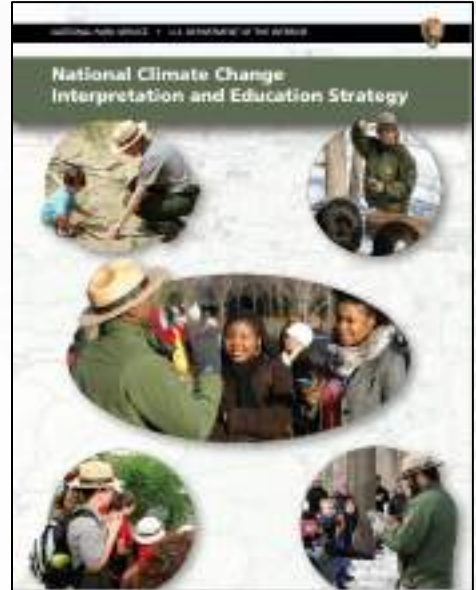
UNDERSTAND
the science



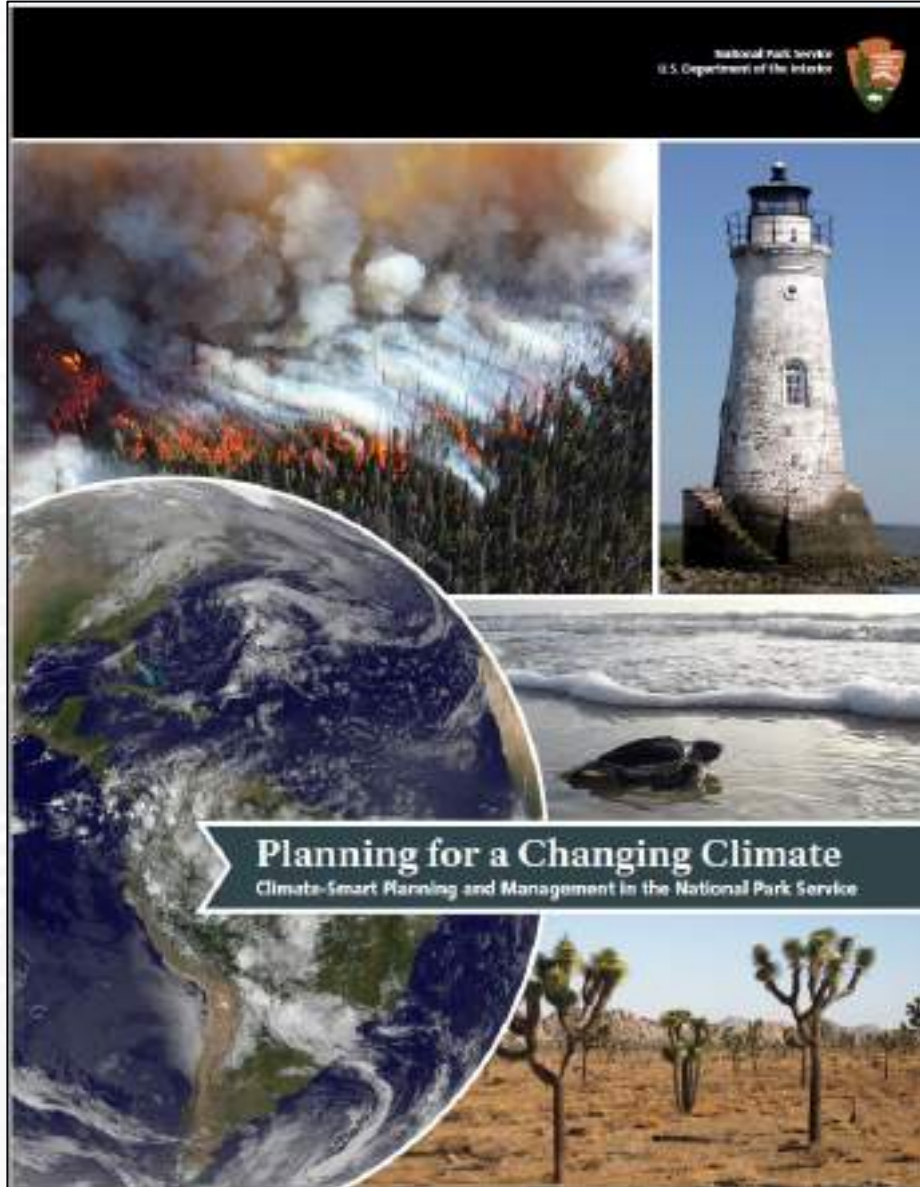
MITIGATE
the cause



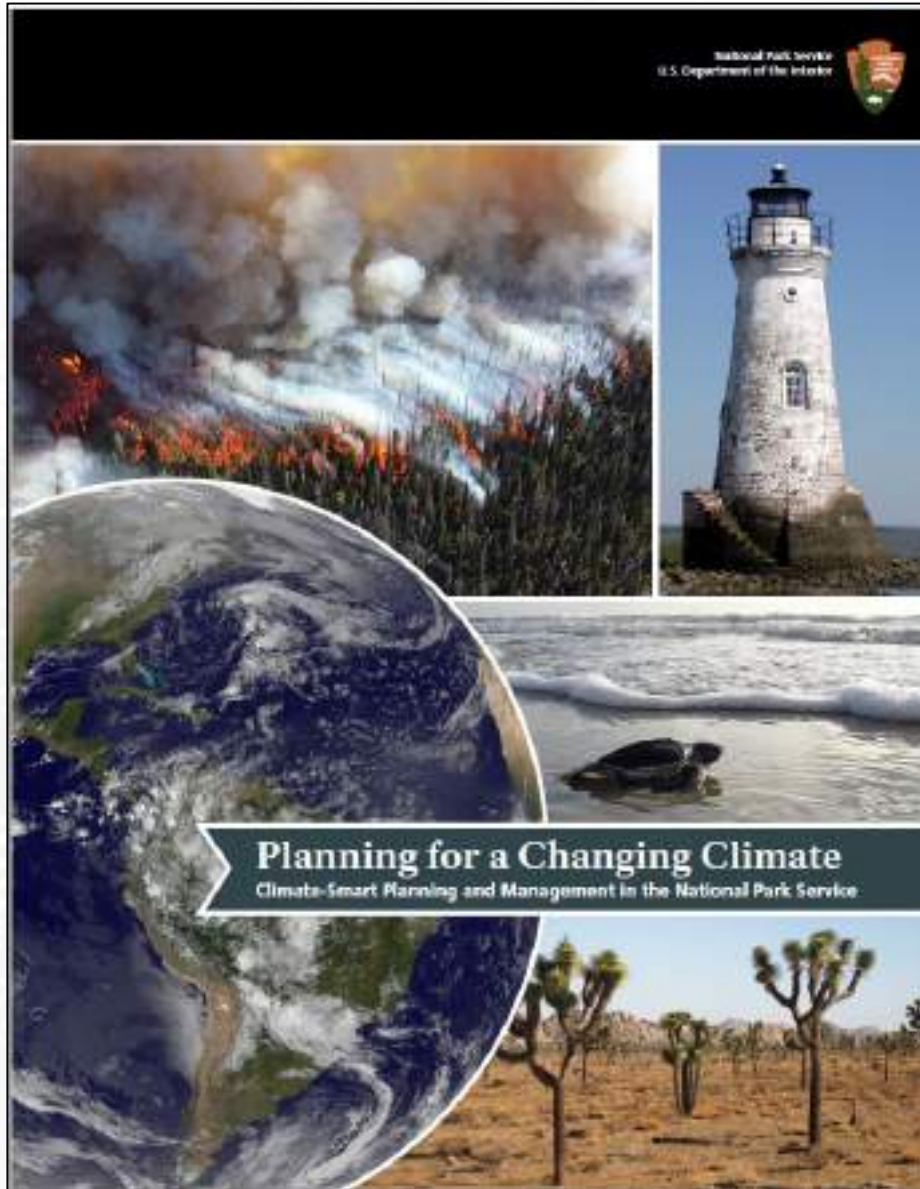
ADAPT
to the change



COMMUNICATE
about the issue



- Fundamental components of adaptation planning:
- Develop forward-looking goals
 - Consider more than one scenario
 - Manage for change, not just persistence



Fundamental components of adaptation planning:

- Develop forward-looking goals
- Consider more than one scenario
- Manage for change, not just persistence

The NPS adaptation planning process

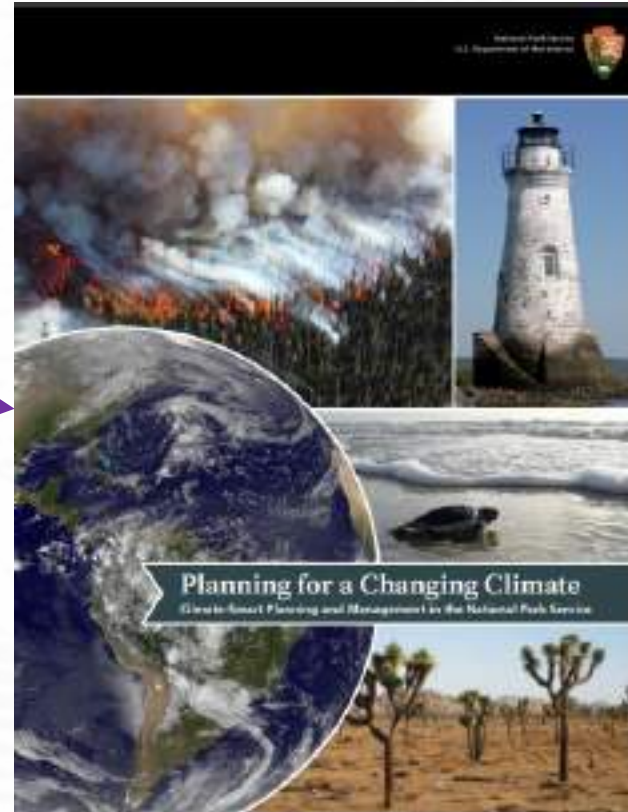
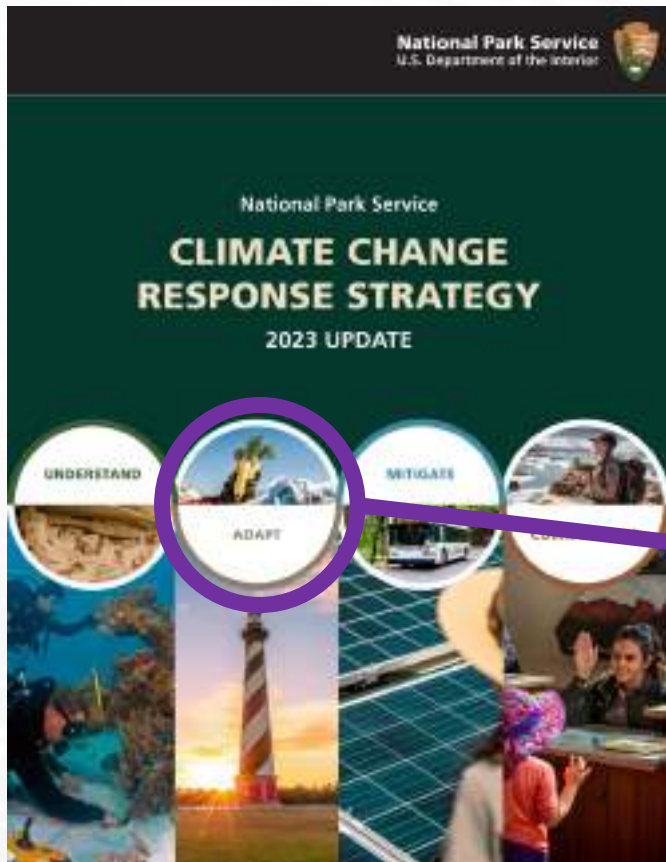


The NPS adaptation planning process



**RESIST-ACCEPT-DIRECT
(RAD) FRAMEWORK**

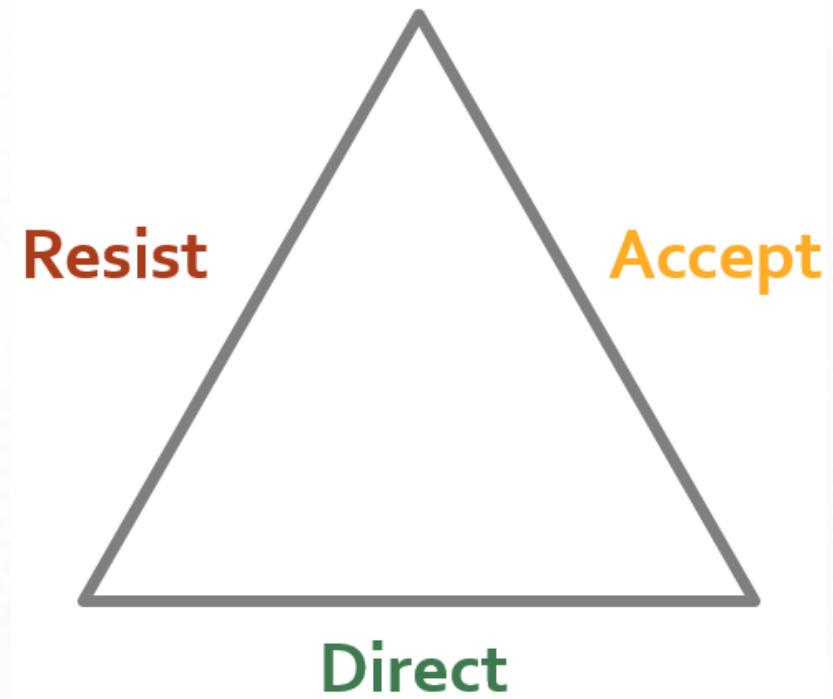
The context for RAD

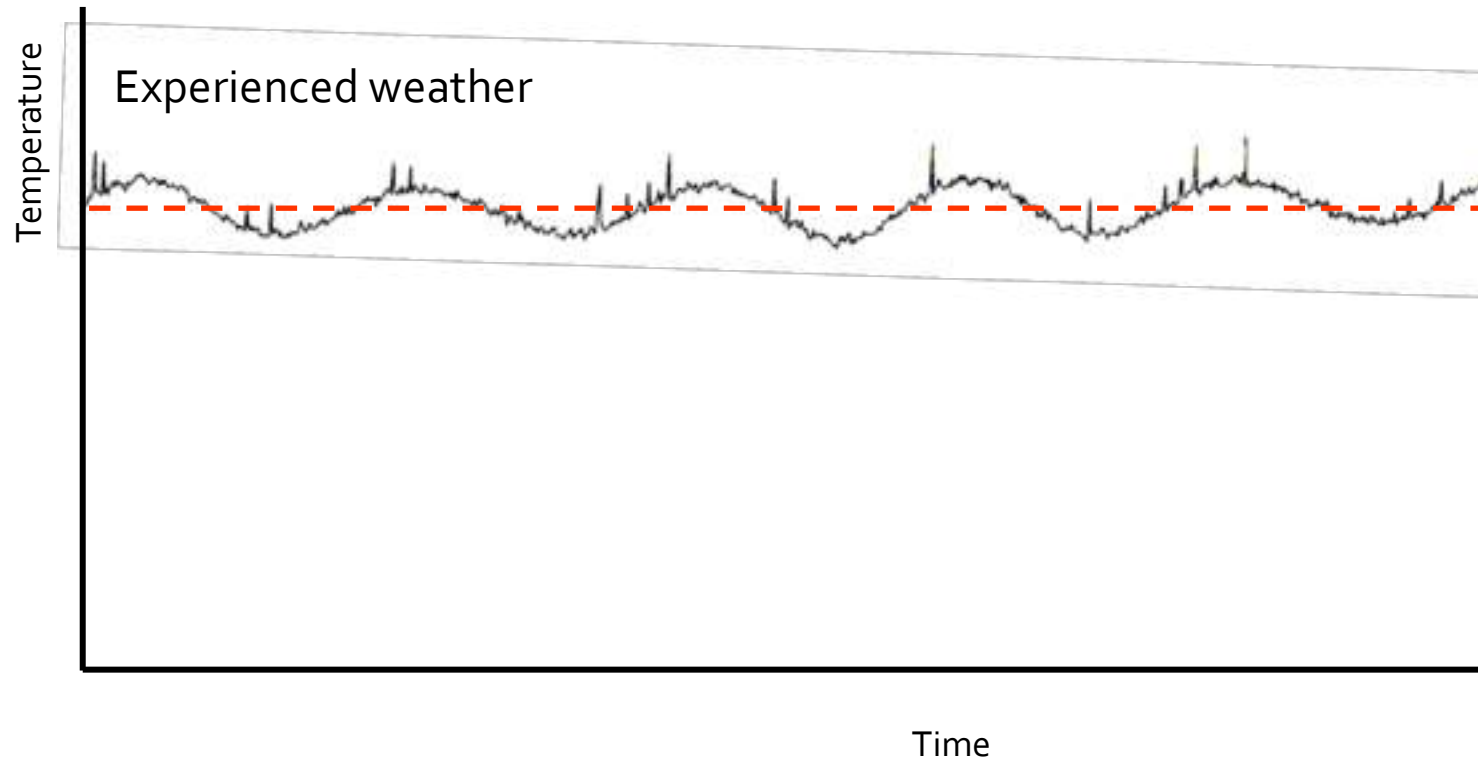


RAD

Framework

The need for a new framework

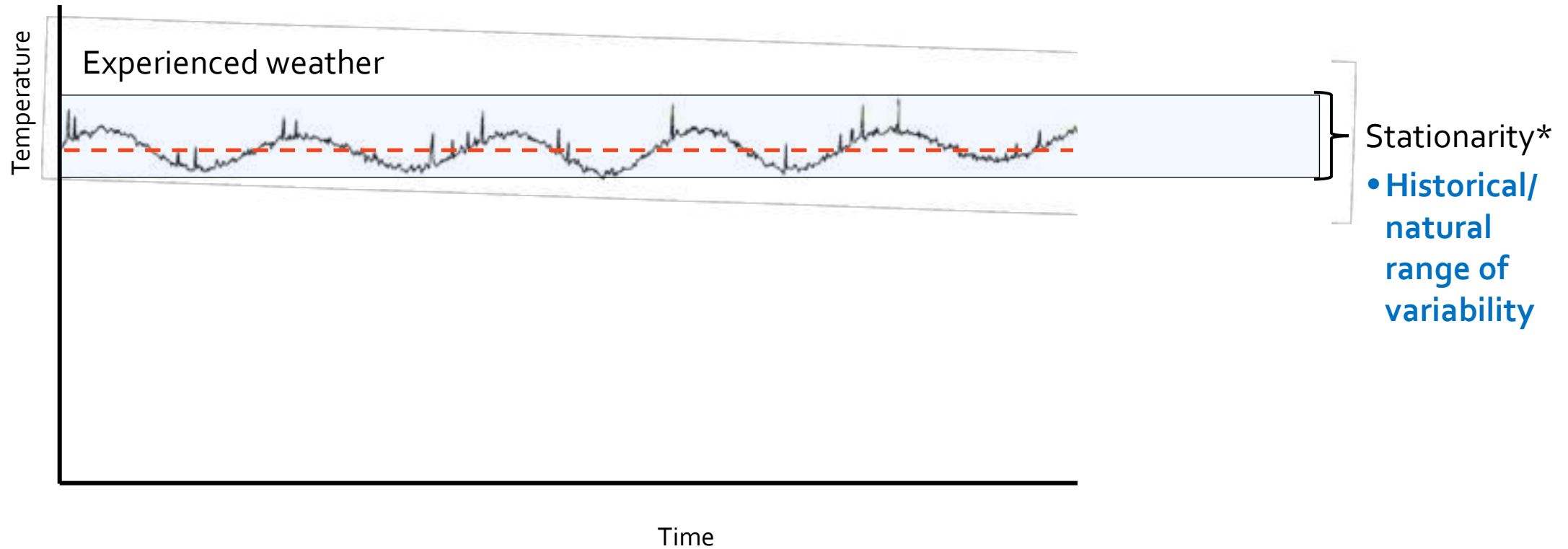




*“the idea that natural systems fluctuate within an unchanging envelope of variability”

(Milly et al. 2008. Stationarity is dead: Whither water management? *Science* 319: 573–574)

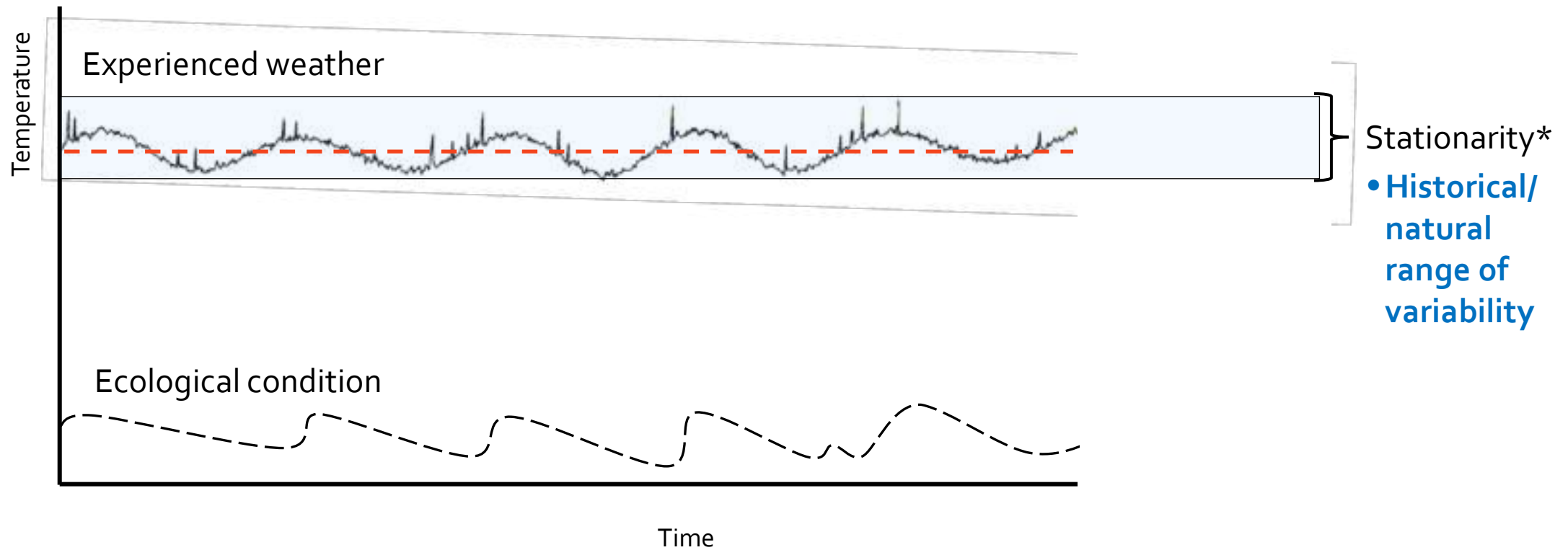




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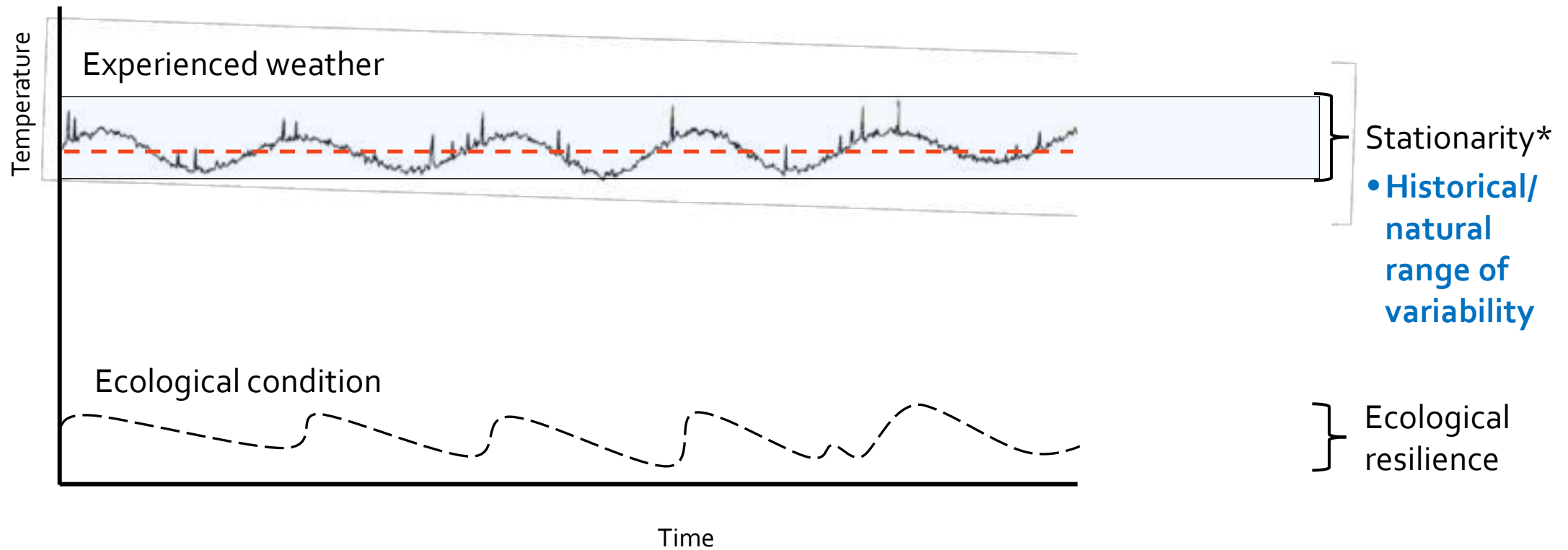




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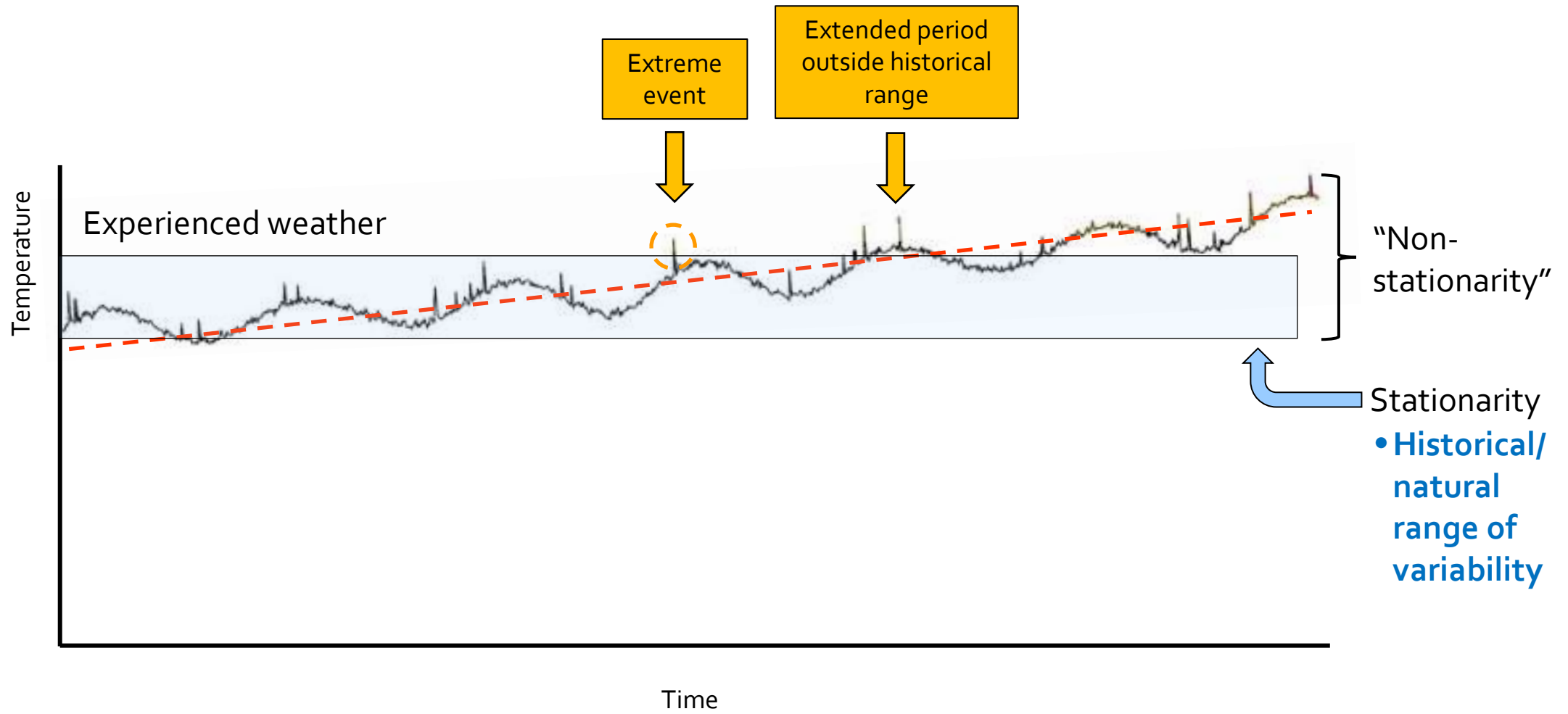
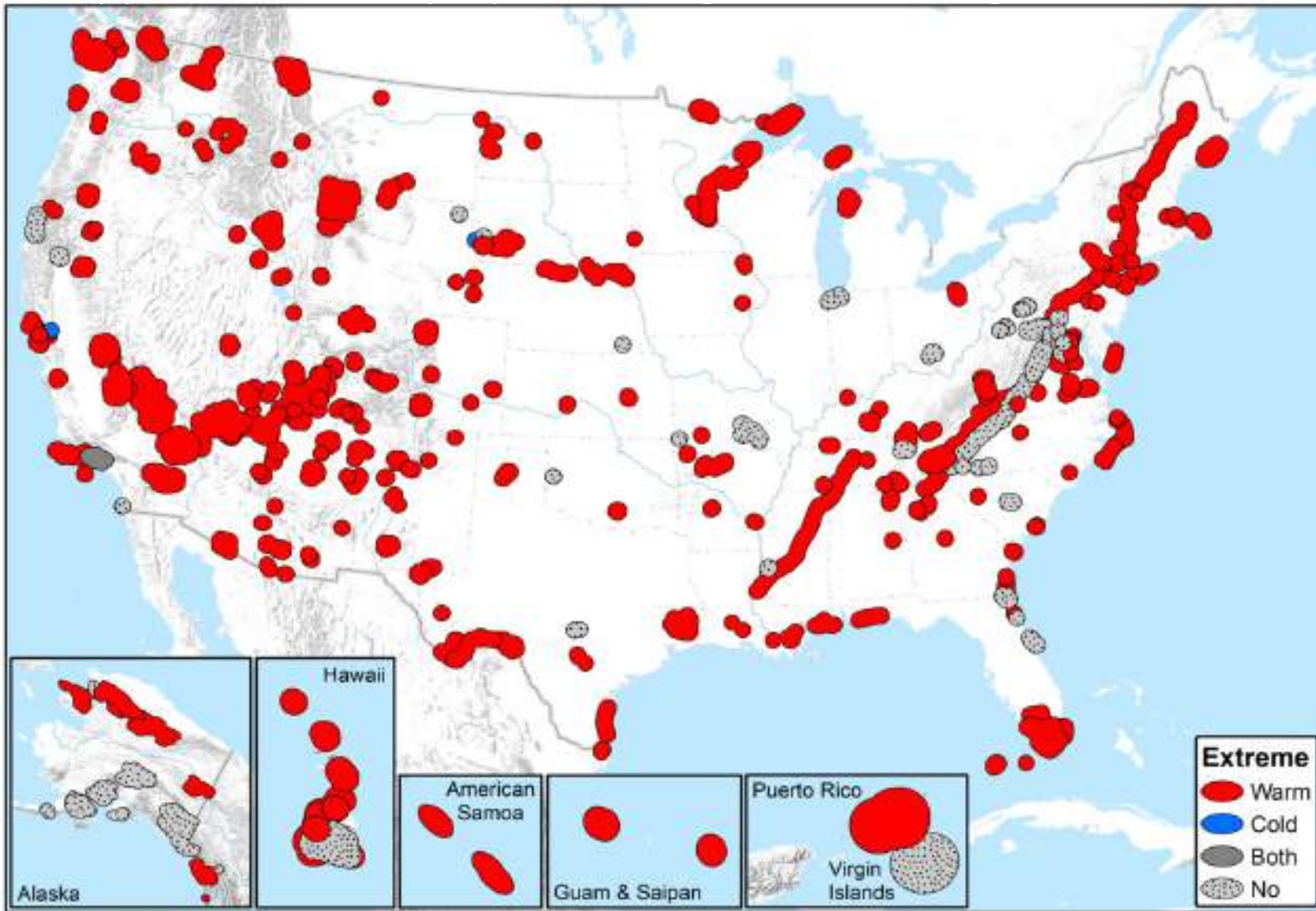


Figure Credit: Gregor Schuurman, NPS





81% (235 of 289) of parks already extremely warm



Drought is **here to stay** in the Western U.S. How will states adapt?

Drought "is not a temporary condition we can expect to go away, but rather something we have to deal with," one expert said.



Image credit: NBC News, <https://www.nbcnews.com/now/video/megadrought-in-western-u-s-pushing-lake-mead-to-first-time-water-shortage-114609221866>



Are warmer winters **here to stay?**

News

Top Stories

February 5, 2020



Image credit: Glue Magazine, Ottawa, <https://glueottawa.com/2020/02/05/are-warmer-winters-here-to-stay/>



NOAA: Record-setting high-tide floods **here to stay**

By Hannah Kacerey | 09/14/2020 10:58 PM EDT



NOAA found that record-breaking high-tide flooding is expected to continue into next year. Minor flooding at high tide during a winter storm in Seaside, Mass., is shown here. (Scott Elmer/Getty)

Image credit: E&E News, <https://www.eenews.net/articles/noaa-record-setting-high-tide-floods-here-to-stay/>



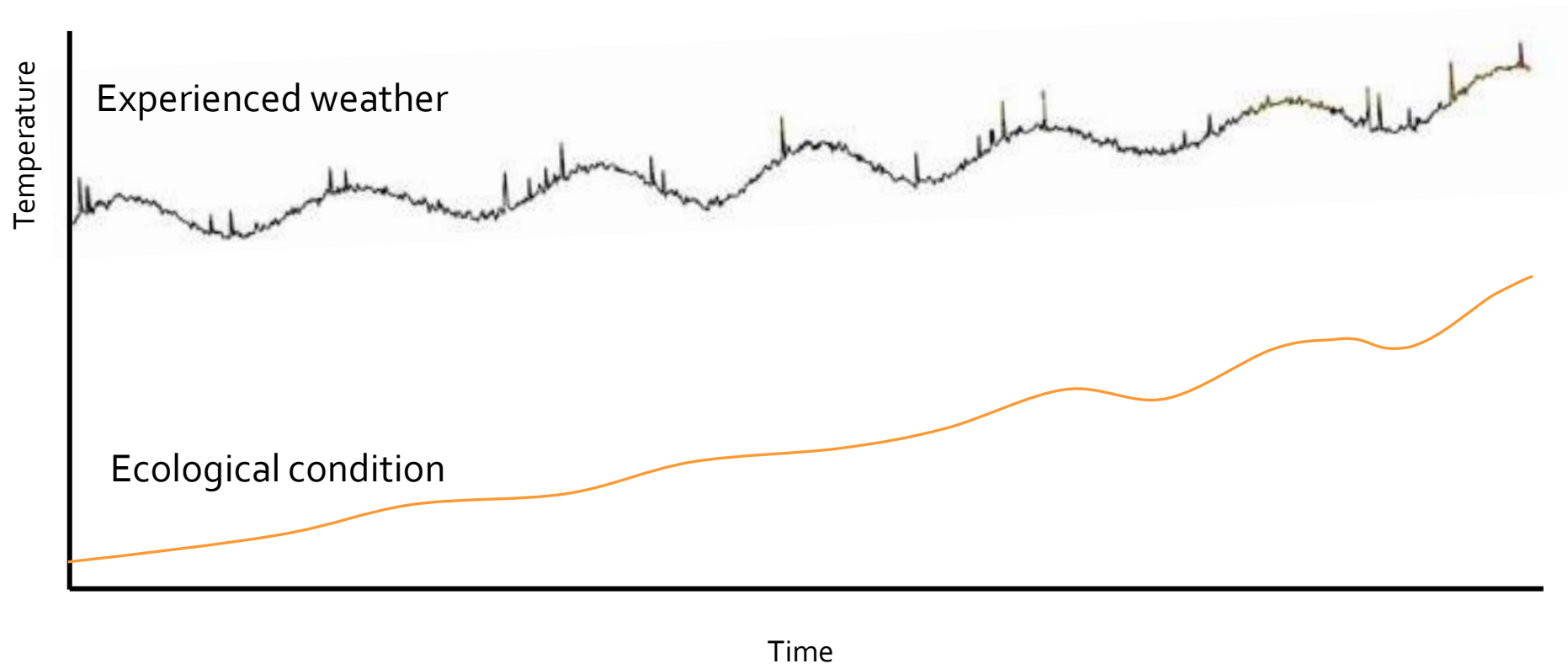


Figure Credit: Gregor Schuurman, NPS



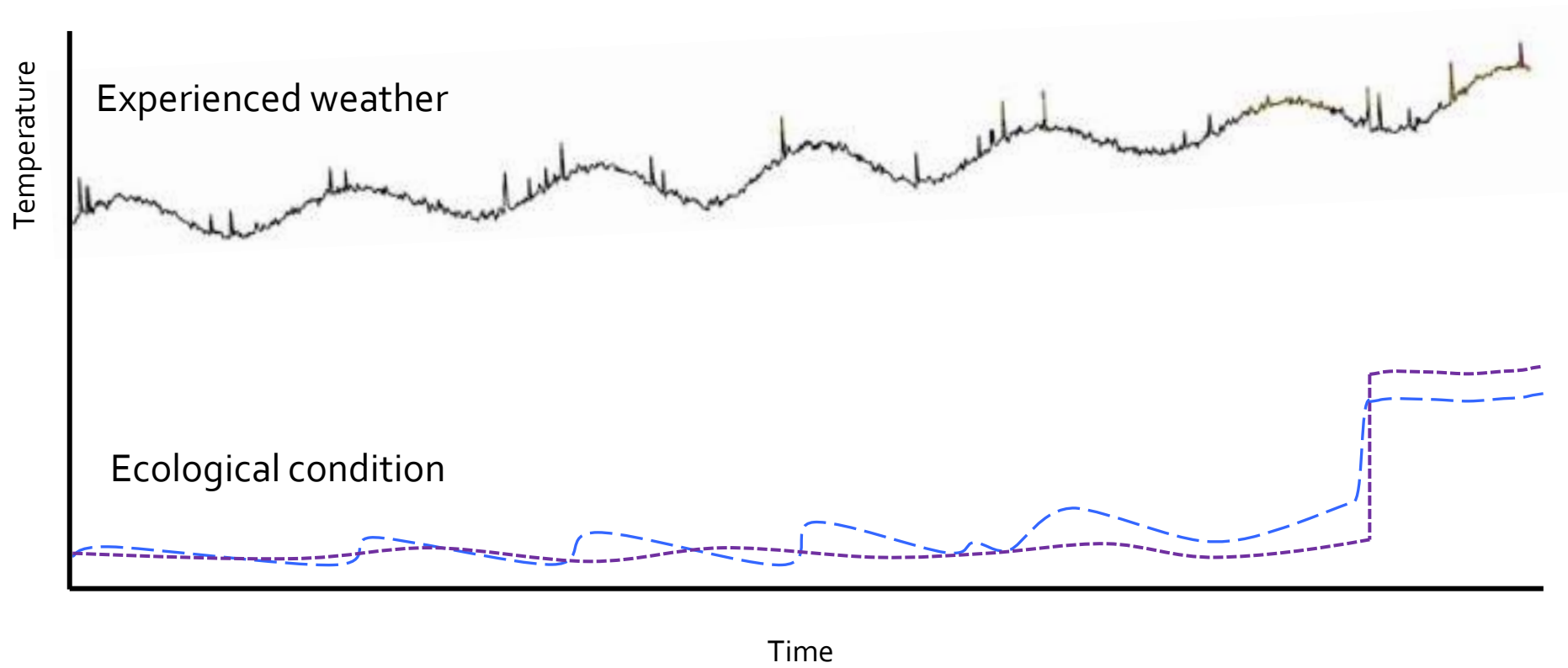


Figure Credit: Gregor Schuurman, NPS



Seascape: the state of our oceans
Canada

Seascape: the state of our oceans is supported by

About this content:

Leyland Cecco in Toronto

Thu 8 Jul 2021 05:00 EDT



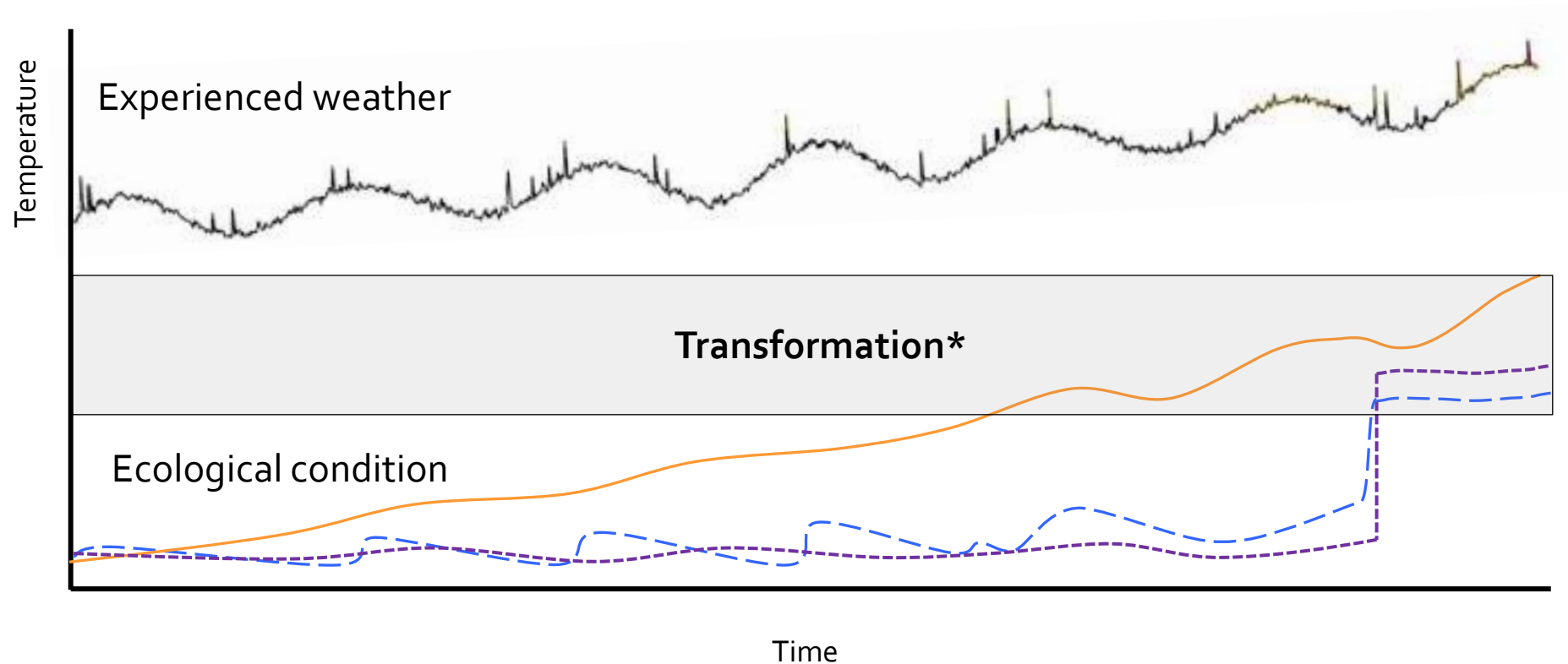
'Heat dome' probably killed 1bn marine animals on Canada coast, experts say



▲ Dead mussels at the waterline in British Columbia. Photograph: Christopher Hanley

British Columbia scientist says heat essentially cooked mussels: 'The shore doesn't usually crunch when you walk'



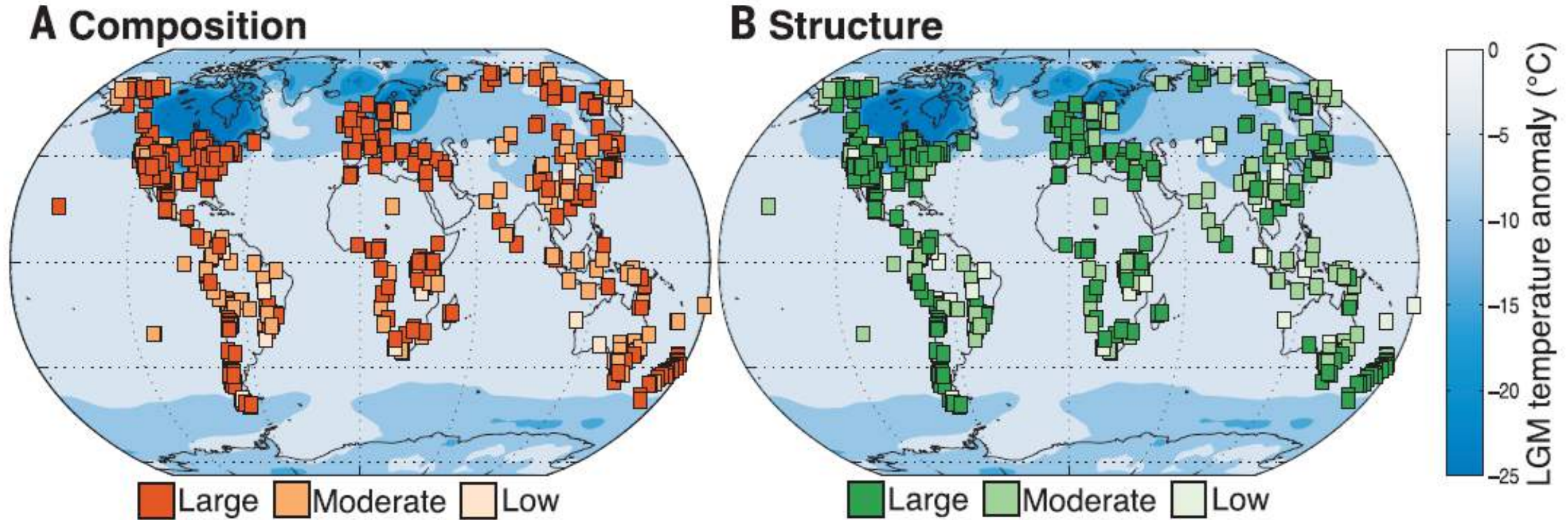


- Ecological transformation: “the dramatic and effectively irreversible shift in multiple ecological characteristics of an ecosystem, the basis of which is a high degree of turnover in ecological communities”

Quote from: Crausbay, Shelley D., et al. "A science agenda to inform natural resource management decisions in an era of ecological transformation." *BioScience* 72.1 (2022): 71-90, <https://doi.org/10.1093/biosci/biab102>



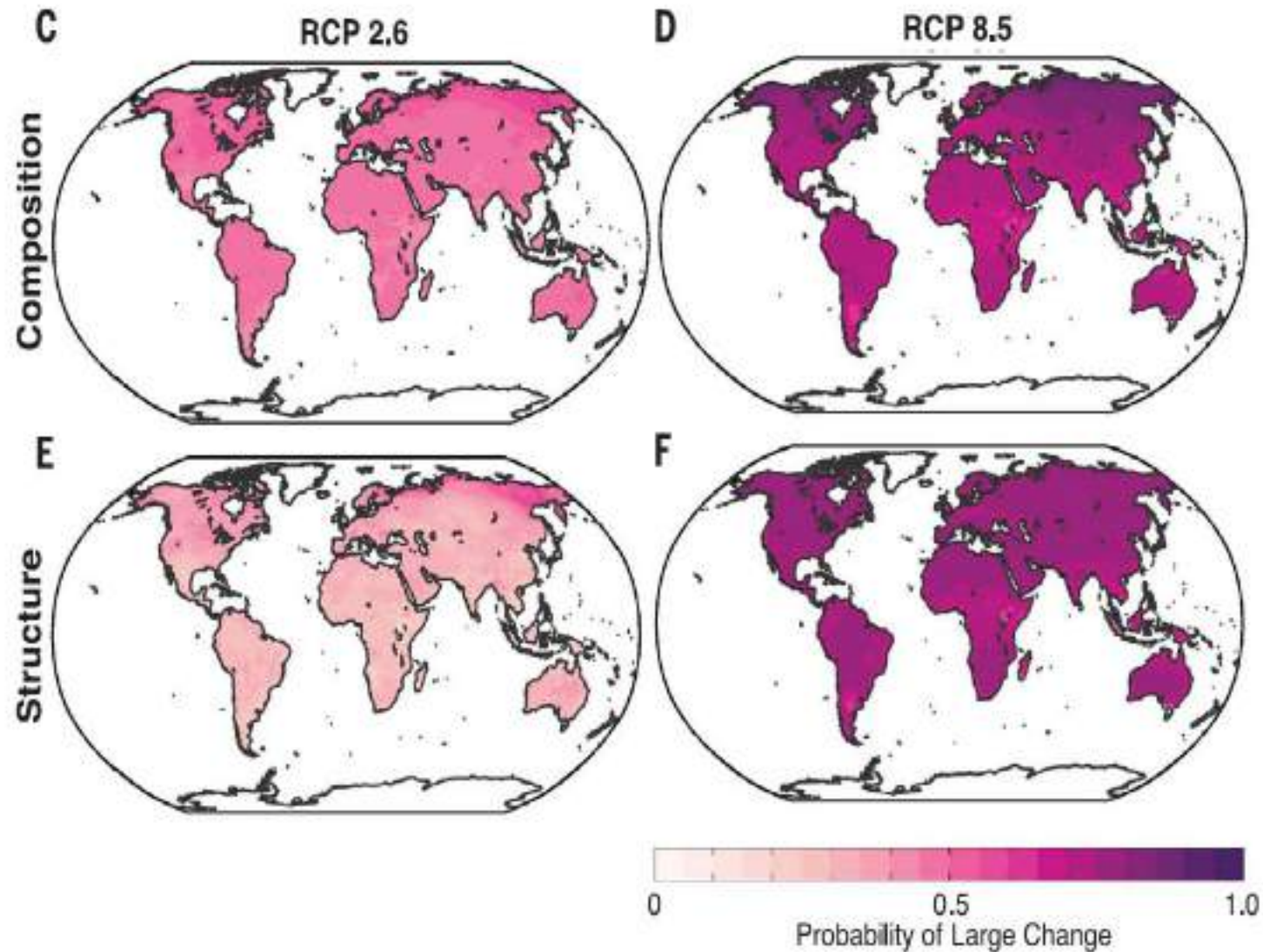
Ecological transformation in the paleorecord



Paleo-transformations were pervasive
when climate change was rapid



Ecological transformation in the future



The threat of future transformations is pervasive

Figure Credit: Nolan, Connor, et al. (2018). Past and future global transformation of terrestrial ecosystems under climate change." *Science* 361.6405: 920-923, <https://doi.org/10.1126/science.aan5360>



Vegetation trajectories

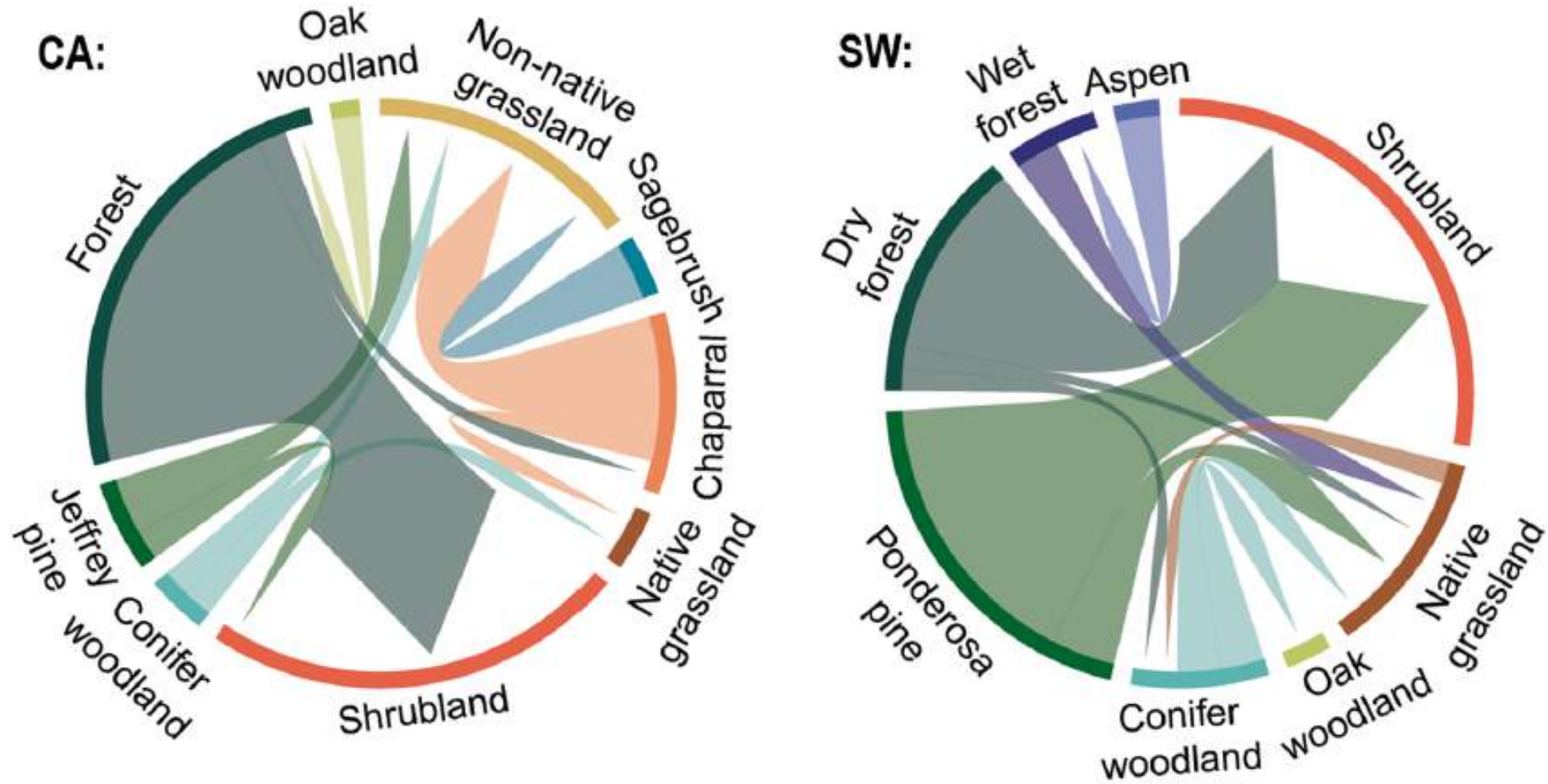
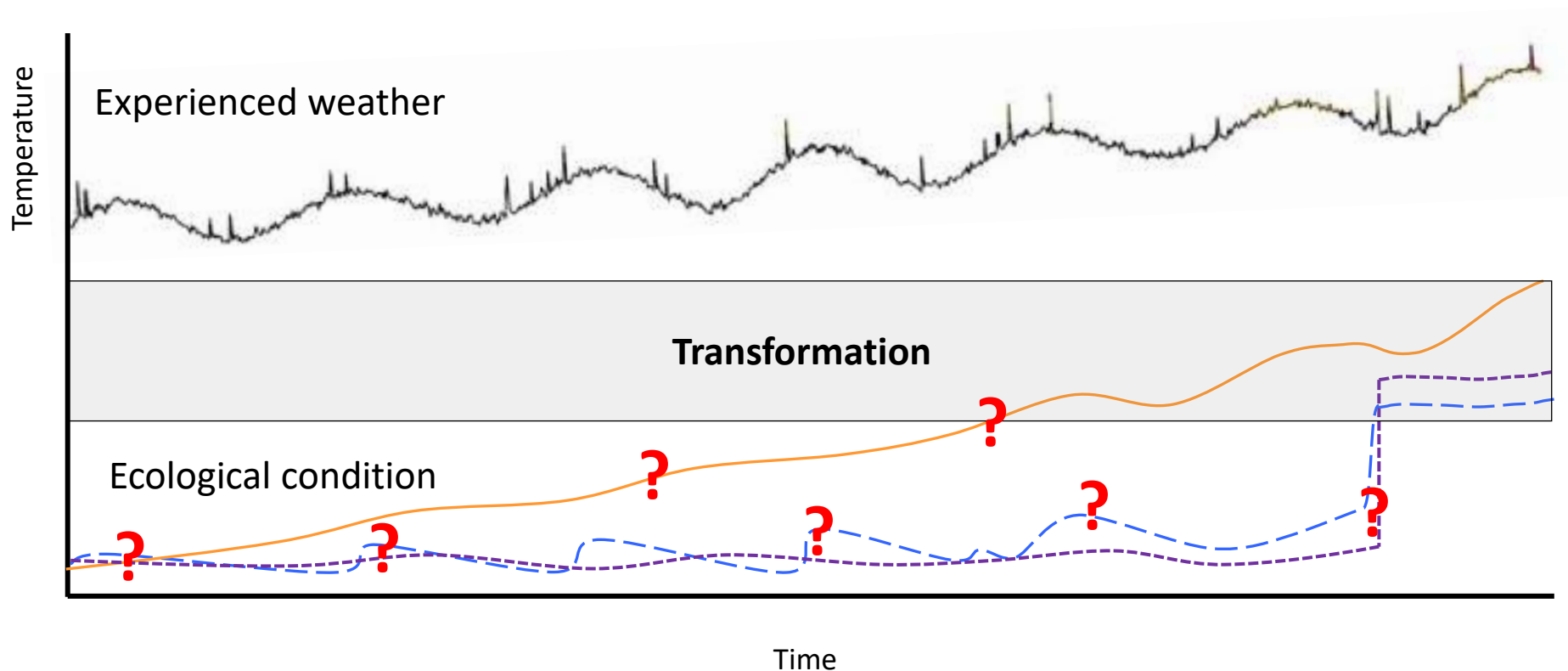


Figure Credit: Guiterman, C.H., *et al.* Vegetation type conversion in the US Southwest: frontline observations and management responses. *Fire Ecology* 18, 6 (2022). <https://doi.org/10.1186/s42408-022-00131-w>



Key points:

1. Systems vary in proximity to transformation
2. But many are on a strong human-driven ecological trajectory or face increasing prospects of large, abrupt ecological change



This reality challenges the historical natural resource conservation paradigm

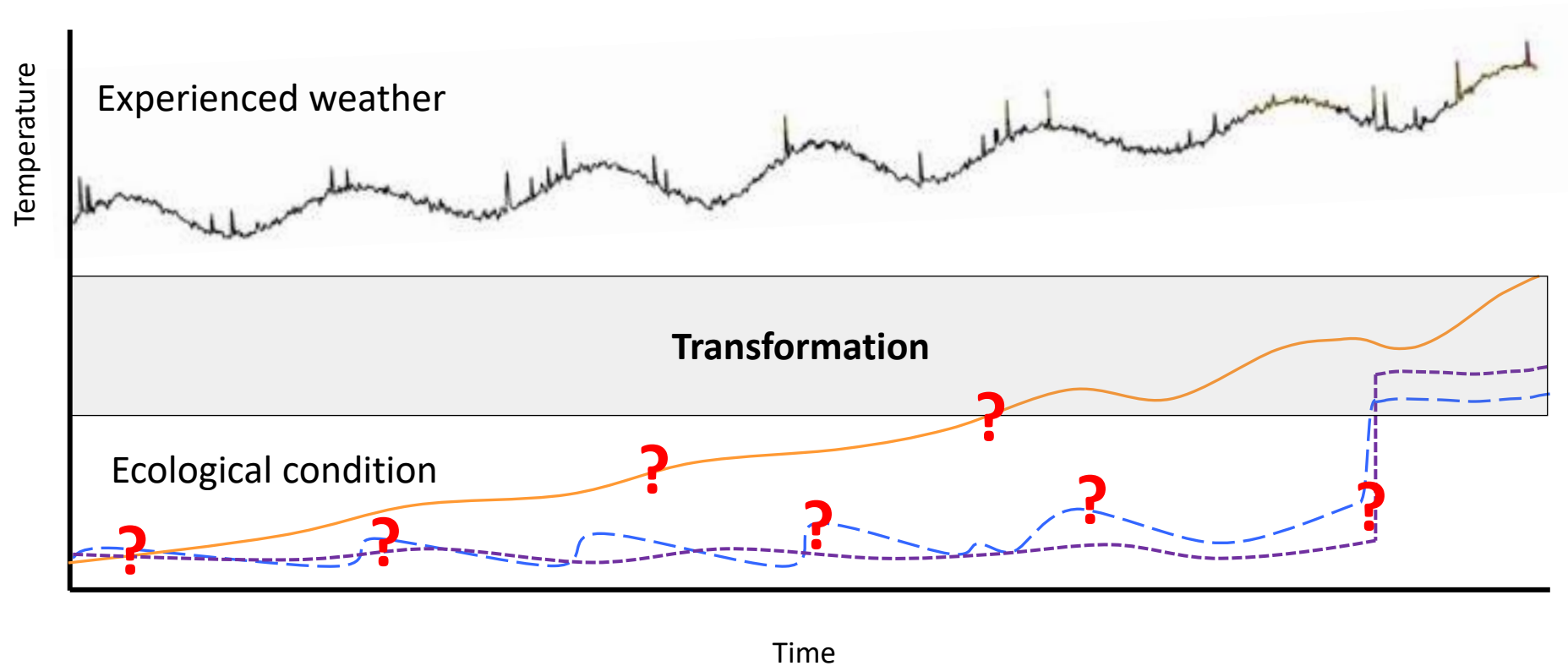


Figure Credit: Gregor Schuurman, NPS



This reality challenges the historical natural resource conservation paradigm

Special Section on the Resist–Accept–Direct Framework

**Navigating Ecological Transformation:
Resist–Accept–Direct as a Path to a
New Resource Management Paradigm**

“Natural resource managers and conservation practitioners are working in a world very different from that in which most agencies and management traditions formed...”

Quote from: Schuurman, G.W., et al. (2022) Navigating Ecological Transformation: Resist–Accept–Direct as a Path to a New Resource Management Paradigm, *BioScience*, Volume 72, Issue 1, January 2022, Pages 16–29, <https://doi.org/10.1093/biosci/biab067>



How to make unavoidable choices strategically?



The RAD Framework

Resist

Work to maintain or restore the condition and function of resources/assets/values **based upon historical or acceptable current conditions**



Accept

Allow the condition and function of resources/assets/values to change, **without intervening to alter their trajectory**

Direct

Actively shape change in the condition and function of resources/assets/values **towards preferred new conditions**

The RAD Framework

Adapt(ation)

Resist

Work to maintain or restore the condition and function of resources/assets/values **based upon historical or acceptable current conditions**

Accept

Allow the condition and function of resources/assets/values to change, **without intervening to alter their trajectory**

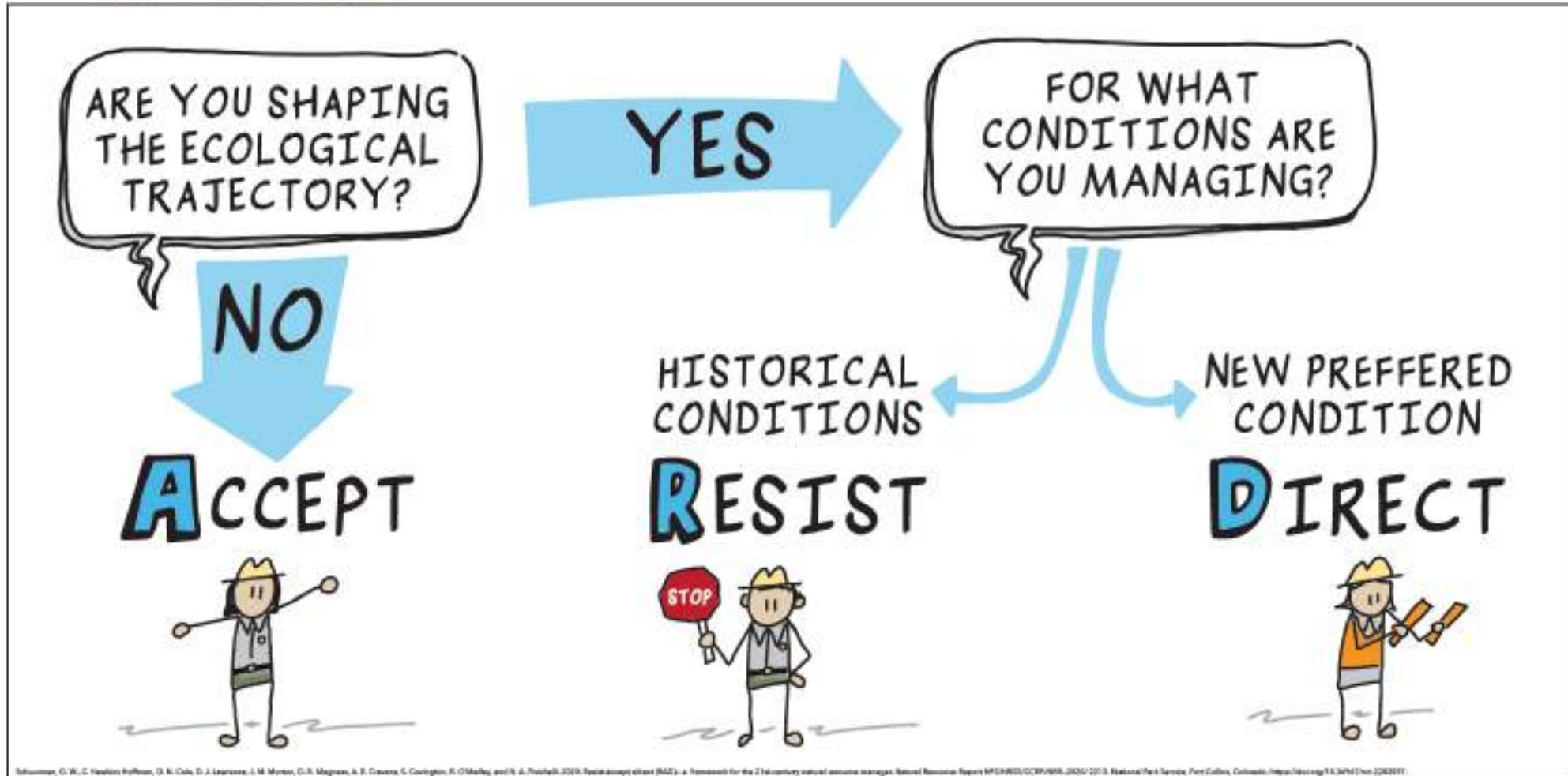
Direct

Actively shape change in the condition and function of resources/assets/values **towards preferred new conditions**

The RAD framework



RAD FRAMEWORK



Mitchener, G.W., C. Haslins-Riffner, D. R. Cole, D. J. Learners, L. M. Moran, D.S. Magrass, & E. Coopers, C. Corrigan, R. O'Malley, and S. A. Pridemore. 2009. Resist-accept-direct (RAD): a framework for the 21st-century natural resource manager. Natural Resource Report NPS/OWD/CPP/RRR-2009/2013. National Park Service, Fort Collins, Colorado. <https://www.nps.gov/owd/cpp/rrr/2009/2013/>



How to make unavoidable choices strategically?

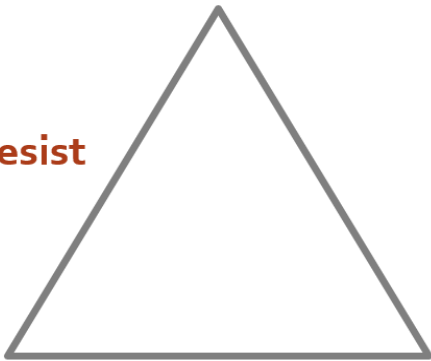
“In this place at this time, my response to climate change is to _____ (resist/accept/direct) this change by _____ (insert adaptation action) as a means of attaining _____ (insert goal).”



RAD in action



Resist



RAD in action



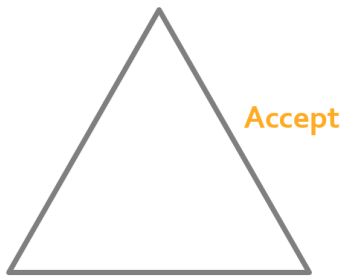


NPS Image



“So, black locust here, historically, we’ve considered it invasive. It comes in and it will take over a whole field,” said Davis. “But it is naturally present just south of here, like in southern Ohio and Kentucky. So, in the past we’ve been fighting that tree in some sites. And now we’re trying to, like, not so much, because it’s probably on its way.”

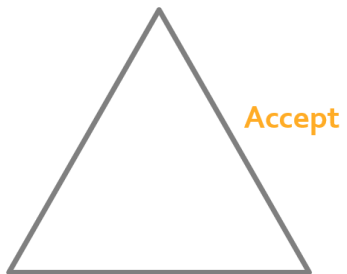
Cuyahoga Valley NP ecologist Chris Davis



Quote and image from: Eddings, A. (2021, September 22). Cuyahoga Valley National Park Struggles With The Effects Of Climate Change. *Ideastream Public Media*.
<https://www.ideastream.org/news/cuyahoga-valley-national-park-struggles-with-the-effects-of-climate-change>



NPS Image



Climate-tracking species are not invasive

Applying an invasive framework to native species that are shifting their ranges in response to climate change adopts an adversarial, local and static paradigm that is often at odds with protecting global biodiversity.

Mark C. Urban

Climate change is already altering local species abundances, affecting ecosystems, inducing extinctions and shifting species ranges along elevational and latitudinal gradients^{1,2}. Biologists and managers increasingly must decide how to protect biodiversity and ecosystems from climate change, including when and how to preserve local populations and what

a Invasive species

Novel community

Rhinacrostoma

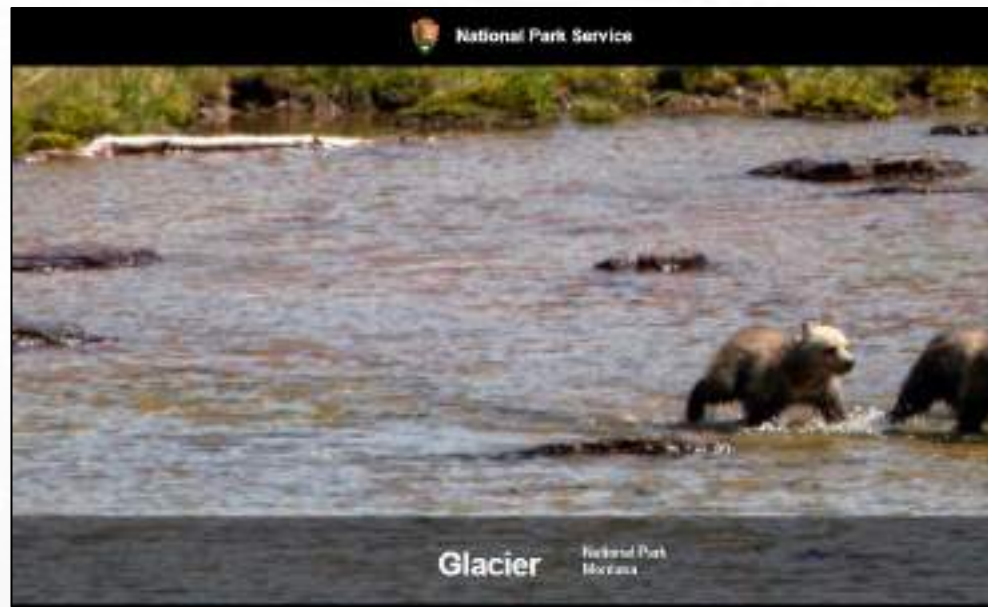
b Climate-tracking species

Community A -> community B

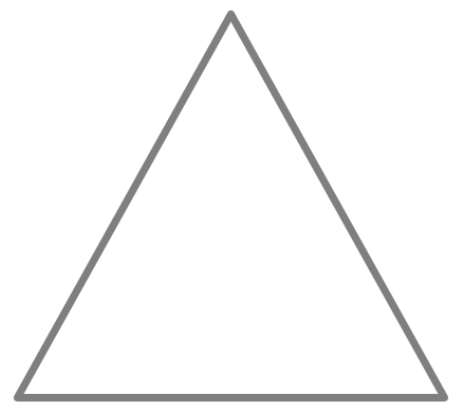
Alysiotriton opacum

Urban, M.C. (2020). Climate-tracking species are not invasive. *Nature Climate Change* **10**, 382–384 (2020). <https://doi.org/10.1038/s41558-020-0770-8>

RAD in action



NPS Image



Direct

Image Credit: Chis Downs, NPS

RAD natural resource stewardship in action



NPS Image

“Do we resist it? Do we accept it? Do we direct it? We’ll do all three,” he said. “It just depends on the situation.”

Superintendent Kevin Schneider



Quote and image from: Hotakainen, R. (2021, November 5) National parks face tough calls battling climate change. *E&E News*, <https://www.eenews.net/articles/national-parks-face-tough-calls-battling-climate-change/>



Learn more about RAD and RAD application in the NPS on the NPS RAD framework web page

Resist-Accept-Direct Framework

What is RAD?

Park managers today face growing challenges. As climate change interacts with other stressors such as land use change, pollution, and nonnative species, ecosystems are changing beyond the bounds of historical variability. These changes are increasingly difficult to resist. Thus, managers are thinking more broadly about how to effectively conserve resources in this rapidly changing world. In this context, the **resist-accept-direct (RAD) framework** helps decision makers make informed, purposeful, and strategic choices. This tool is simple and flexible, complements other important climate change adaptation approaches, and applies to a wide range of decisions that managers must make as they steward transforming ecosystems.

In short, one can respond to the trajectory of change by **resisting** (working to maintain or restore based upon historical or acceptable current ecosystem conditions), **accepting** (allowing an ecosystem to change without intervening), or **directing** (actively shaping ecosystem change toward preferred new conditions).

Consider the analogy of a sailboat being pushed away from its home port by strong winds (right). Each option differs in terms of costs and outcome:

- To **accept** is to lower the sails and allow the boat to move with the winds, arriving wherever they lead.
- To **direct** is to use the winds, via sails and rudder, to steer the boat to a specific new, preferred destination, both far from home port and from where the winds alone would take it.
- To **resist** is to lower the sail and fight the prevailing winds, using a motor to attempt to return to home port.



Learn more about RAD and RAD application in the NPS on the NPS RAD framework web page

RAD in Action

Showing results 1-7 of 7

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Resisting, accepting, and directing change in parks



Click the link above to read some in-depth examples of national parks choosing to resist, accept, and direct change.

Sites Inventory and Monitoring Division, Natural Resource Stewardship and Science Directorate, Pacific Island Inventory & Monitoring Network, Capitol Reef National Park, Cuyahoga Valley National Park, more »

Haleakalā National Park: Resisting climate-enhanced threats of avian malaria



Hawaii is home to some of the most diverse and unique wildlife on the planet, including the Hawaiian honeycreepers, a group of forest birds found nowhere else in the world. Unfortunately, human-assisted arrival of avian malaria—worsened by climate change—and other factors have brought Hawaiian honeycreepers to the brink of extinction. Read more about how Haleakalā National Park is using innovative methods to save the 17 remaining species of Hawaiian honeycreepers.

State Climate Change Response Program, Inventory and Monitoring Division, Natural Resource Stewardship and Science Directorate, Pacific Island Inventory & Monitoring Network, Haleakalā National Park

CUYAHOGA VALLEY NATIONAL PARK

Climate Impacts in Cuyahoga Valley



Northeast Ohio gets seven more inches of annual precipitation than it did in 1968, according to the US Army Corps of Engineers. This often falls as rain during storms that have become more frequent and more intense. Temperatures are warming, too. Climate change affects all aspects of life in the valley, across America, and globally. Learn more about how Cuyahoga Valley and other national parks are responding with a Resist-Accept-Direct (RAD) approach.

What is (and isn't) RAD

- RAD is not about embracing all change, going with the flow, or giving up. It's RAD, not AD.
- RAD is and must be social. RAD application involves real people with different value sets.
- RAD is not policy. RAD is not a process. RAD is a thinking and communication tool.



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Questions?
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