Rio Grande National Forest Adaptation Workshop

October 25-27, 2022

Rio Grande Water Conservation District

USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

USDA

FOREST SERVICE
DEPARTMENT OF AGRICULTURE

NIACS
Northern Institute of Applied Climate Science

FOREST AND RANGELAND STEWARDSHIP
COLORADO STATE UNIVERSITY

Land Acknowledgement

Introductions

- Name
- Organization
- One thing you are looking forward to in this workshop

Workshop Goals

- Consider climate change impacts and vulnerabilities of South-Central Colorado, and how those might affect the ability to meet project goals and objectives.
- Identify adaptation actions that help address climate vulnerabilities while meeting goals and objectives.
- Discuss how to monitor adaptation actions for success.

Agenda - Tuesday, October 25, 2022

10:00	Welcome & Introductions - Andy Kelher & Judi Perez, RGNF
10:45	Overview of USDA Climate Hubs, NIACS, Adaptation Workbook, and Adaptation Menus - Courtney Peterson, NIACS & Lauren Kramer, SW Hub
11:00	Rio Grande National Forest – Forest Plan Overview - Judi Perez, RGNF
11:40	Stretch Break
11:45	Big Picture: Administration Priorities, Agency Policies, and Regional Plans - Donna Shorrock & Brian Ratcliffe, USFS Rocky Mountain RO
12:15	Adaptation Workbook Step 1: Where are you working and what do you care about?
12:45	Lunch on your own
1:45	Climate Change Trends & Climate Change Vulnerabilities – Presentation Recap - Lauren Kramer, SW Hub
2:15	Adaptation Workbook Step 2: Assess Climate Change Impacts
3:15	Break
3:30	Adaptation Workbook Step 3: Challenges & Opportunities for Meeting Management Objectives
4:30	Adjourn for the day

Agenda - Wednesday, October 26, 2022

8:00	Welcome Back, Reflections from Day 1
8:15	Presentation on Adaptation Concepts & Introduce Adaptation Menus
9:00	Adaptation Workbook Step 4: Identify Adaptation Approaches and Tactics
10:00	Break
10:15	Adaptation Workbook Step 4 - Adaptation Approaches and Tactics Large Group Discussion
11:15	Existing Monitoring Networks and Efforts on the Rio Grande National Forest - Judi Perez, RGNF
11:30	Adaptation Workbook Step 5: Identifying Metrics for Monitoring and Evaluating Effectiveness
12:15	Lunch on your own
1:15	Large Group Monitoring Discussion
2:00	Telling Your Adaptation Story – Group Work Time
3:00	Presentation Time – Each group shares climate impacts and adaptation strategies in 5 minutes or less.
4:30	Adjourn for the day

RMRS Supervisory Research Rangeland Scientist Linda Joyce at the 2016 Rio Grande National Forest Climate Change Revision workshop (photo by Molly Roske).

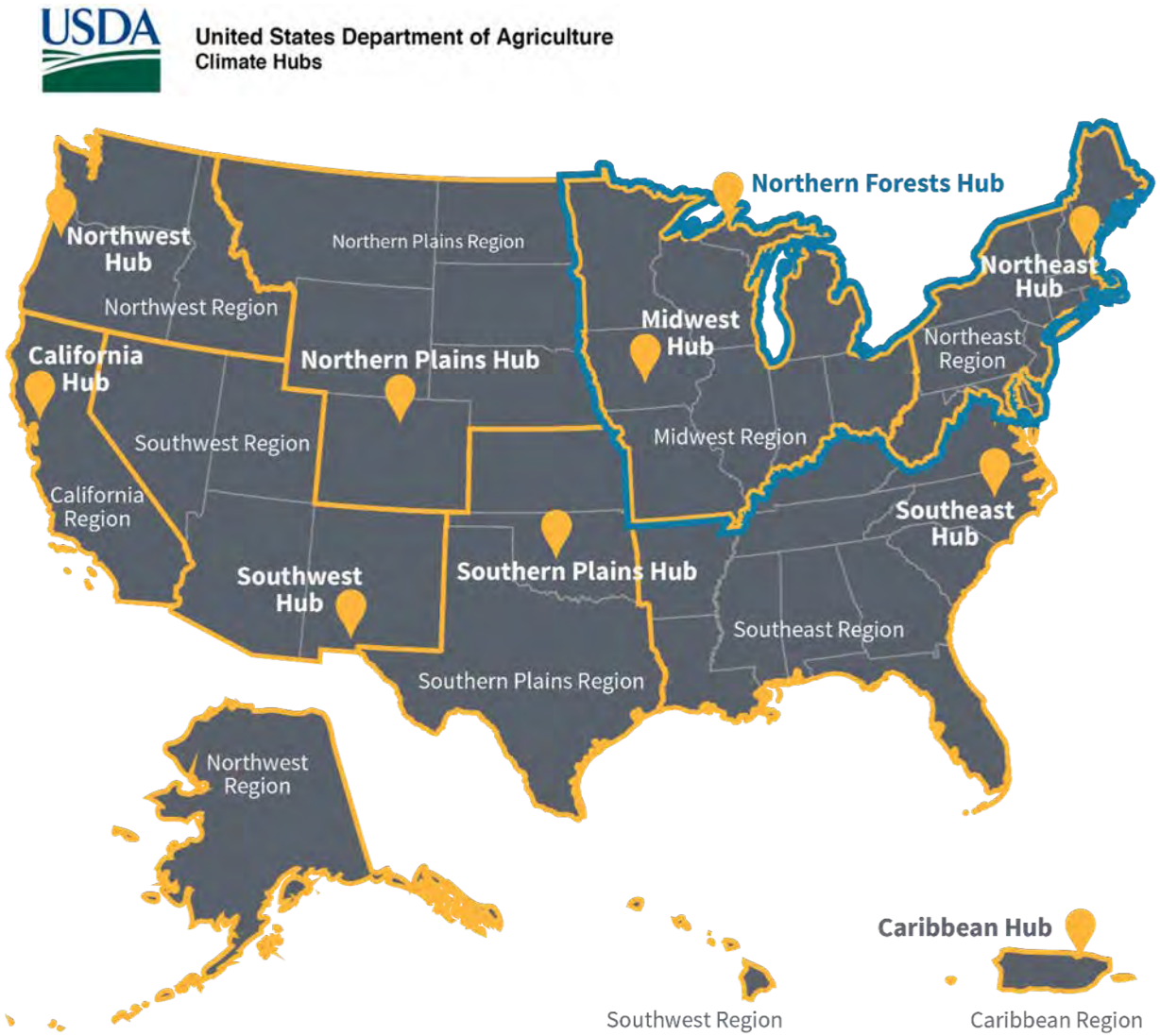
Agenda - Thursday, October 27, 2022

- Meeting time TBD pending weather.
- Bring field gear and sack lunch.
- Wrap-up by 3:00 p.m.

Workshop Guidelines

- Focus on what matters
- Contribute your thinking and experience
- Listen to understand and connect ideas
- Honor everyone’s time
- Equal airtime - all participate, no one dominate
- Be present - mentally and physically

USDA Climate Hubs



Hubs Mission:

- Develop and deliver science-based, region-specific information and technologies to agricultural and natural resource managers that enable climate-informed decision-making, and to
- Provide assistance to implement those decisions

www.climatehubs.usda.gov/hubs

Northern Institute of Applied Climate Science

Climate

Carbon

The Northern Institute of Applied Climate Science (NIACS) develops synthesis products, fosters communication, pursues science, and provides technical assistance in climate change adaptation and carbon management.

Multi-institutional collaborative chartered by USDA Forest Service, universities, and non-profit and tribal conservation organizations

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American Forests™

Great Lakes Indian Fish & Wildlife Commission

NCASI

Michigan Technological University
1885

The University of Vermont

University of Minnesota

Michigan State University

Process: Climate Adaptation Workbook and Adaptation Resources

- Flexible 5-step workbook designed for a variety of landowners with diverse goals
- Works at project level
- Centers around manager's expertise, and judgement
- Creates **clear rationale** for actions by connecting them to **broader adaptation ideas**
- **Does not make recommendations**
- **Includes:**
  - Adaptation workbook
  - Adaptation strategies for different resource areas (menus)

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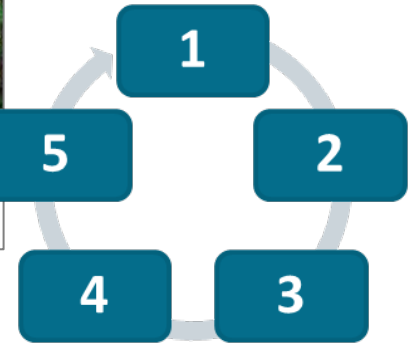
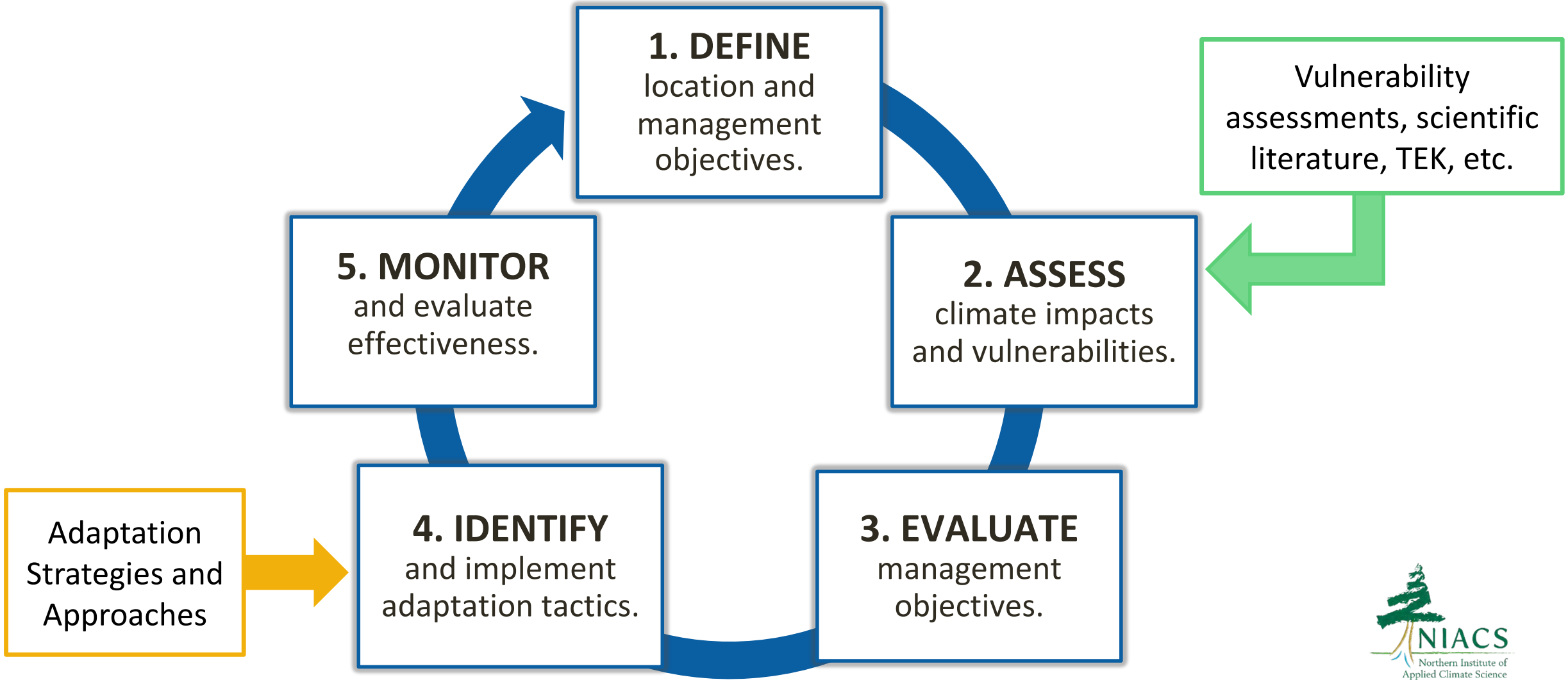


Swanston et al. 2016
(2nd edition)

Download at: www.nrs.fs.fed.us/pubs/40543 or use online at www.AdaptationWorkbook.org

Adaptation Workbook



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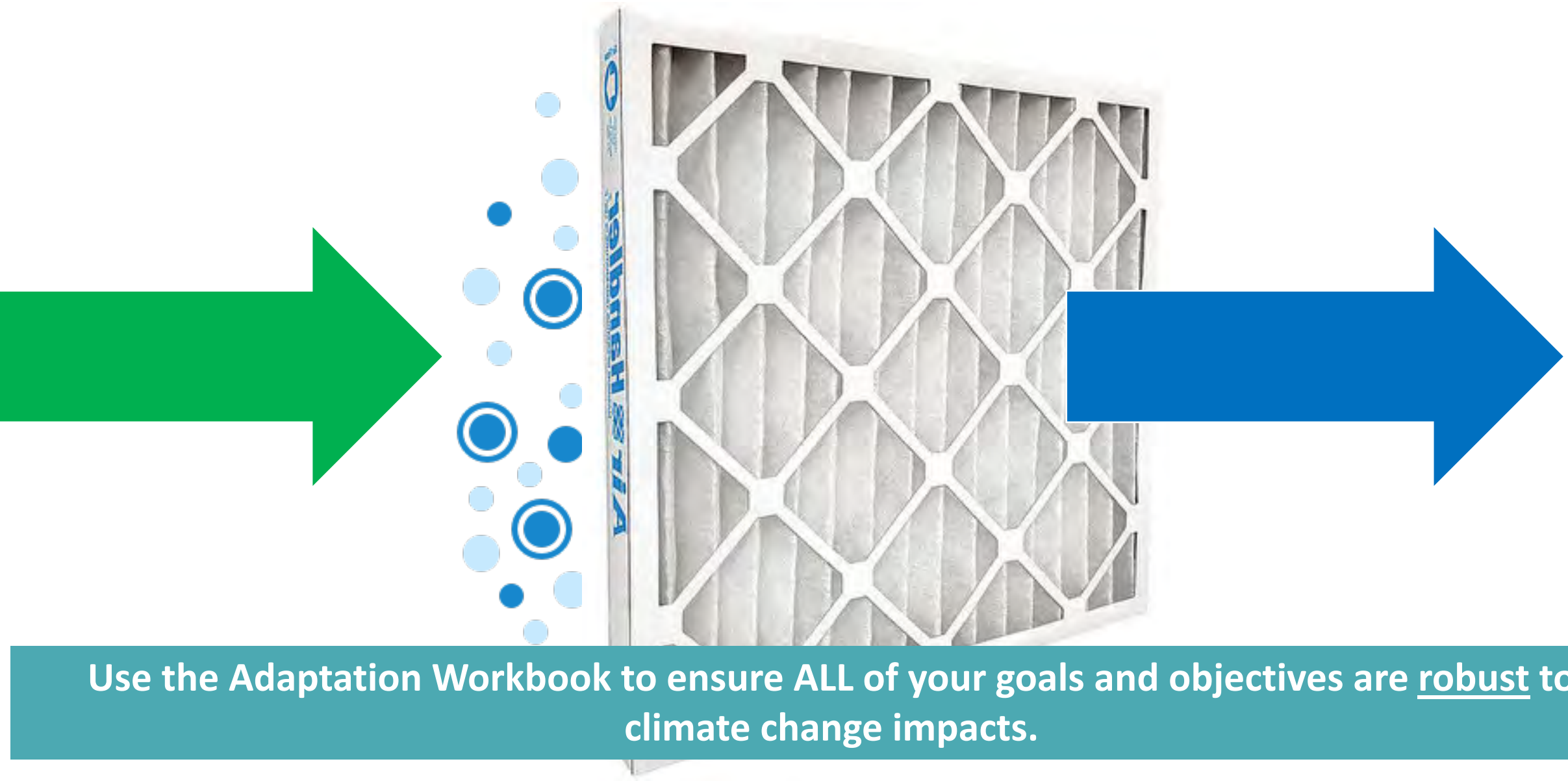
Download at: www.nrs.fs.fed.us/pubs/40543 **or use online at** www.AdaptationWorkbook.org

Adaptation Workbook = Climate Change Filter



Use the Adaptation Workbook to ensure ALL of your goals and objectives are <u>robust</u> to climate change impacts.

Adaptation Actions Can Be…

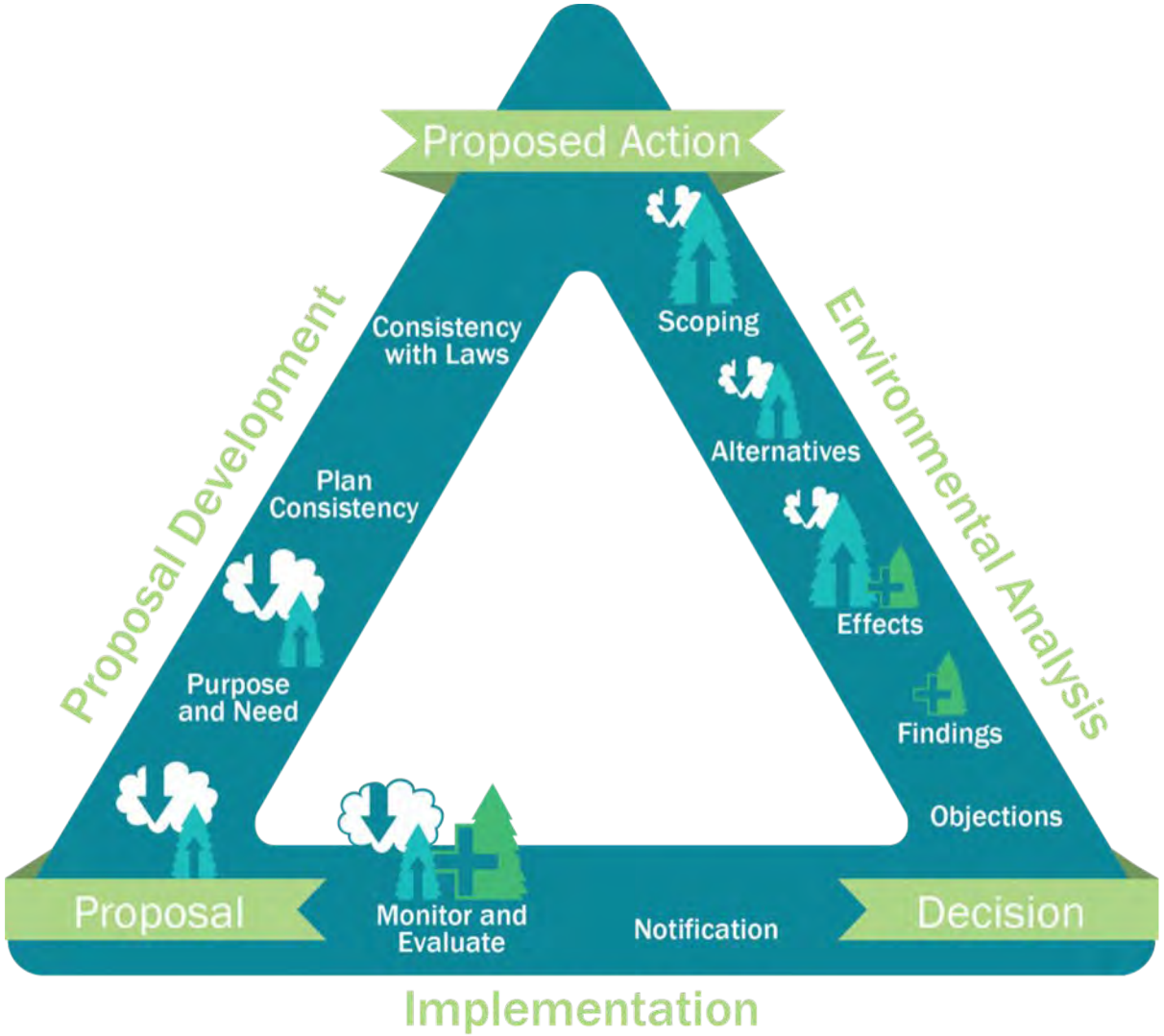
Same actions– *climate change just makes them that much more important*

Small "tweaks" *that improve effectiveness*

New & different *actions to consider, even some that may seem* ***wild & crazy***

**individual results will vary*

Outcomes



- A robust consideration of climate change
- Tangible record - transparency & accountability

Source: https://www.fs.usda.gov/ccrc/topics/nepa

Intentionality

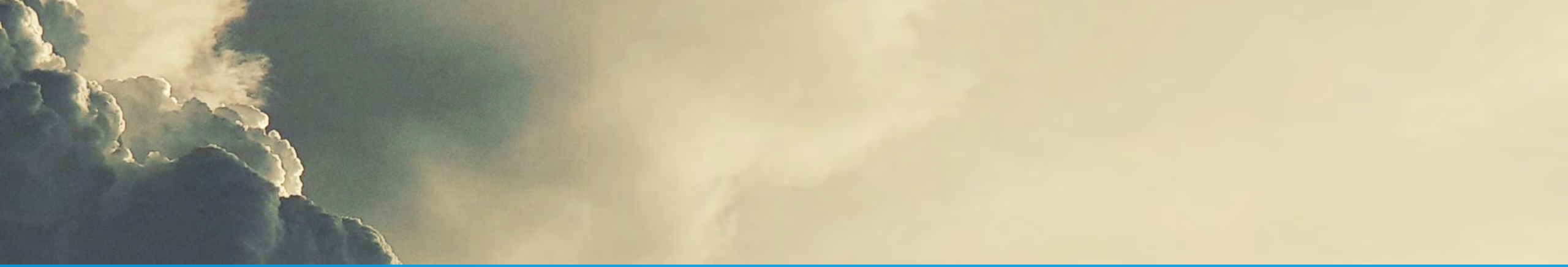
- Explicitly consider and address climate change
- Sure we might get lucky…
- Intentionally assessing risk and vulnerabilities **makes our plans more robust!**

Photos: https://www.fs.usda.gov/main/riogrande/about-forest/about-area

Rio Grande National Forest - Forest Plan Overview

Judi Perez, Rio Grande National Forest


Break



THE BIG PICTURE: ADMINISTRATION PRIORITIES, AGENCY POLICIES, AND THE REGIONAL CLIMATE PROGRAM

Rio Grande Climate Adaptation Workshop | *October 25, 2022*

OVERVIEW

- National Direction
- USFS Climate Organization
- R2 Regional Climate Program
- Q&A

CLIMATE POLICY AND INITIATIVES

Executive Orders (E.O.)

- **E.O. 14008** – ***Tackling the Climate Crisis at Home and Abroad***
  - Calls for a 'whole of government' approach to prioritizing the climate crisis in domestic and foreign policy. Requires each Agency to submit a climate plan.
- **E.O. 14057** – ***Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability***
  - Sets ambitious goals and timelines for reducing emissions, requires agencies to develop adaptation and resilience plans, and more.
- **E.O. 14072** – ***Strengthening the Nation's Forests, Communities, and Local Economies***
  - Directs federal agencies to use sustainable forest and land management that is science-based, conserve old-growth, support indigenous traditional ecological knowledge, and more.

CLIMATE POLICY AND INITIATIVES

2022 Bipartisan Infrastructure Law

- The BIL Program Direction states that "the Forest Service will tackle climate change and climate adaptation by expanding the restoration of impaired natural functions of forest, grassland, and aquatic ecosystems."
- The Agency will work to ensure BIL-funded projects consider climate risks, develop climate adaptation actions, and support efforts to reduce greenhouse gas emissions.

CLIMATE POLICY AND INITIATIVES

Inflation Reduction Act (IRA)

- The funding in the Inflation Reduction Act includes $2.15 billion for management of the National Forest System, including funding for hazardous fuel reduction or vegetation management projects on NFS lands, for inventorying and protecting old-growth and mature forests on NFS lands, and for improving environmental reviews.

CLIMATE POLICY AND INITIATIVES

Secretarial Memorandum 1077-004 – Climate Resilience and Carbon Stewardship of America's National Forests and Grasslands

- June 23, 2022: calls for the Forest Service to "develop outcome-based performance measures and systems for tracking and reporting progress" on climate resilience, climate adaptation, and carbon stewardship, among others.
- Performance measures are being designed to ensure that Agency activities address climate change.

CLIMATE CHANGE AND THE FOREST SERVICE

- Healthy forests and grasslands help mitigate climate change by removing carbon dioxide from the atmosphere and storing it in plants and soils.
- Impacts from climate change, extreme weather, and other disturbances threaten our ability to deliver our mission.
- To stay healthy and vigorous, our National Forests and Grasslands will need to adapt quickly to the changing climate.
- The Forest Service is incorporating the best ecological and climate science into its management to ensure that National Forests continue to produce the benefits that the American people enjoy.
- Our work expands beyond our public lands and jurisdictional boundaries to assist private, tribal, and state organizations

USFS CLIMATE ADAPTATION PLAN

- USFS Climate Adaptation Plan (July 2022)
- Presents a comprehensive approach to integrating climate change adaptation into the Forest Service's operations and mission
- Identifies six climate vulnerabilities with accompanying focus areas and supporting activities
  - Shifting Fire Regimes
  - Extreme Events
  - Chronic Stressors
  - Disruption in Delivery of Ecosystem Services
  - Disproportionate Impacts on Disadvantaged Communities & Tribes
  - Threats to the Agency Mission, Infrastructure, and Operations

FS Climate Adaptation Plan Fact Sheet

AGENCY CLIMATE ORGANIZATION

- The WO Office of Sustainability and Climate (OSC) is lead by Director Chris Swanston, the USFS Climate Advisor
- Other OSC staff include: Climate Adaptation Specialists, two Sustainable Operations Coordinators, a Carbon specialist, several GIS specialists, and more.
- Each NFS Region has one or more Climate Change Coordinators (Donna and Brian in R2)
- Within each Region, every NFS unit also has a climate coordinator (Judi on the RGNF)

R2 CLIMATE PROGRAM

Carbon and Climate in NEPA	Carbon White Papers	Sustainable Operations	Regional Climate Plan
Climate Action Tracker (CAT)	Climate Change Vulnerability Assessments	Climate Adaptation Workshops	Community of Practice

QUESTIONS?

Contact Info:

Donna Shorrock (Donna.Shorrock@usda.gov)

Brian Ratcliffe (Brian.Ratcliffe@usda.gov)

Alison Foster (Alison.Foster@usda.gov)

RESOURCES: CLIMATE CHANGE IN THE USFS

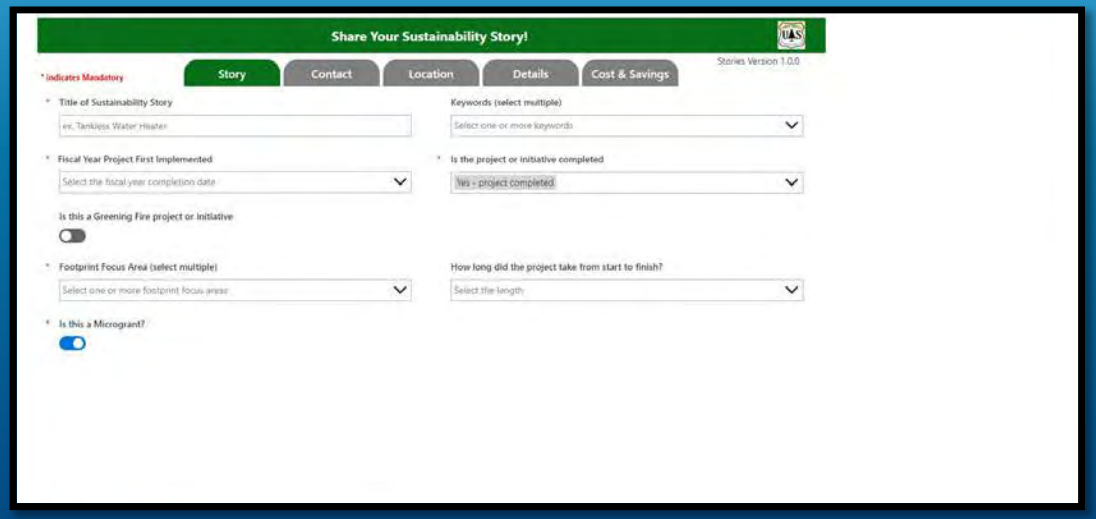
- Forest Service Climate Change Public-Facing Website
- Office of Sustainability and Climate SharePoint Page
- Managing forests in a changing climate: Article by Leslie Brandt, OSC
- Forest Service Climate Adaptation: key messages, talking points, and communication resources

RESOURCES: CLIMATE ADAPTATION

- Compendium of Adaptation Approaches, USFS Climate Change Resource Center
- Climate Tools and Data, OSC
- Adaptation Library, Adaptation Partners
- Forest Adaptation Resources, Northern Institute of Applied Climate Science
- Adaptation Workbook, Northern Institute of Applied Climate Science
- Climate Change Vulnerability Assessments story map and dashboard, OSC
- PALS tip sheet for adaptation projects

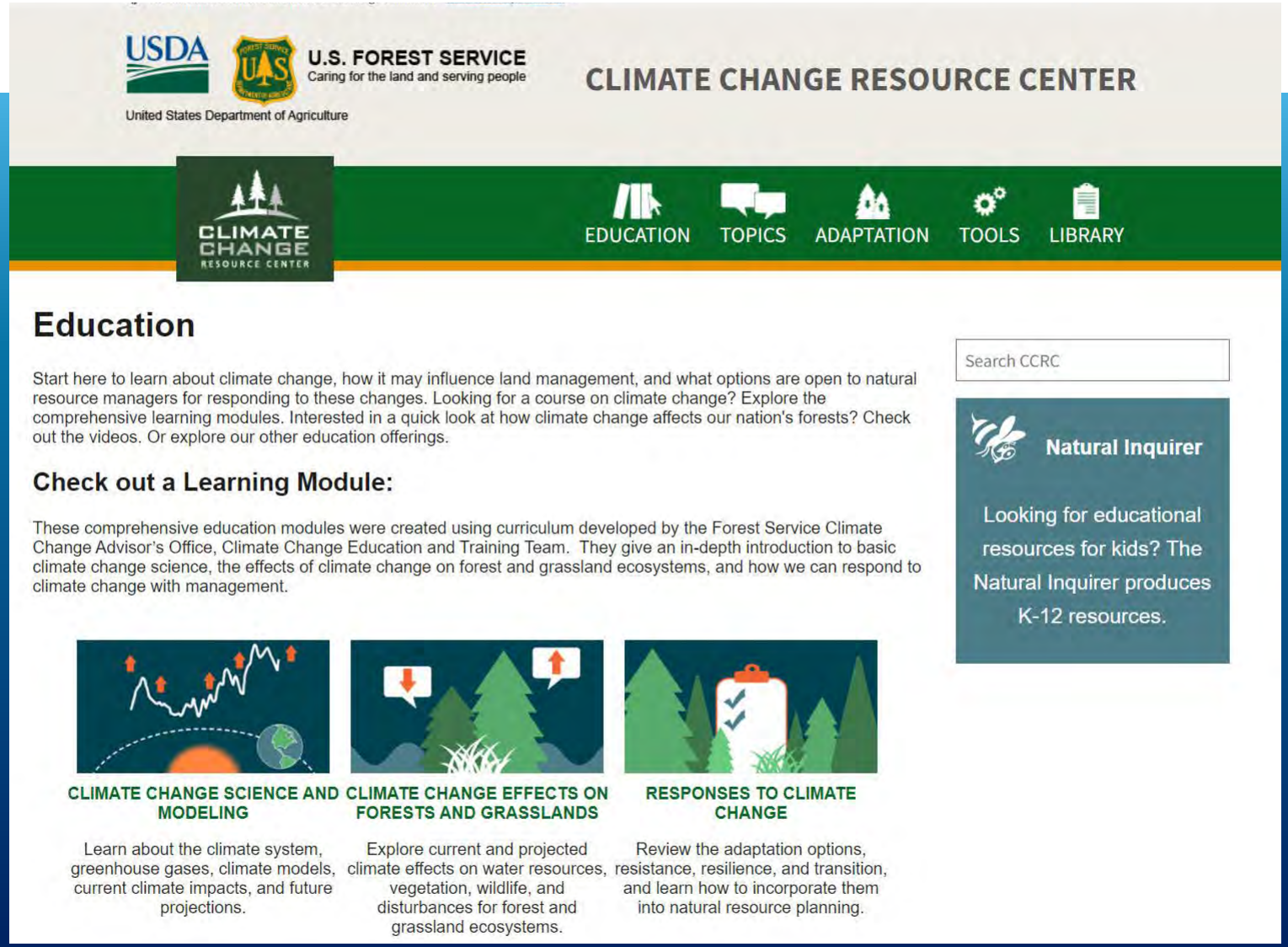
RESOURCE: SUSTAINABLE OPERATIONS

- Sustainability Stories application
- https://usdagcc.sharepoint.com/sites/fs-eu-liso/SitePages/sustainability-stories-home.aspx



RESOURCE: EMPLOYEE TRAINING

- The Climate Change Resource Center
- https://www.fs.usda.gov/ccrc/education



RESOURCES: CLIMATE ACTION TRACKER (CAT)

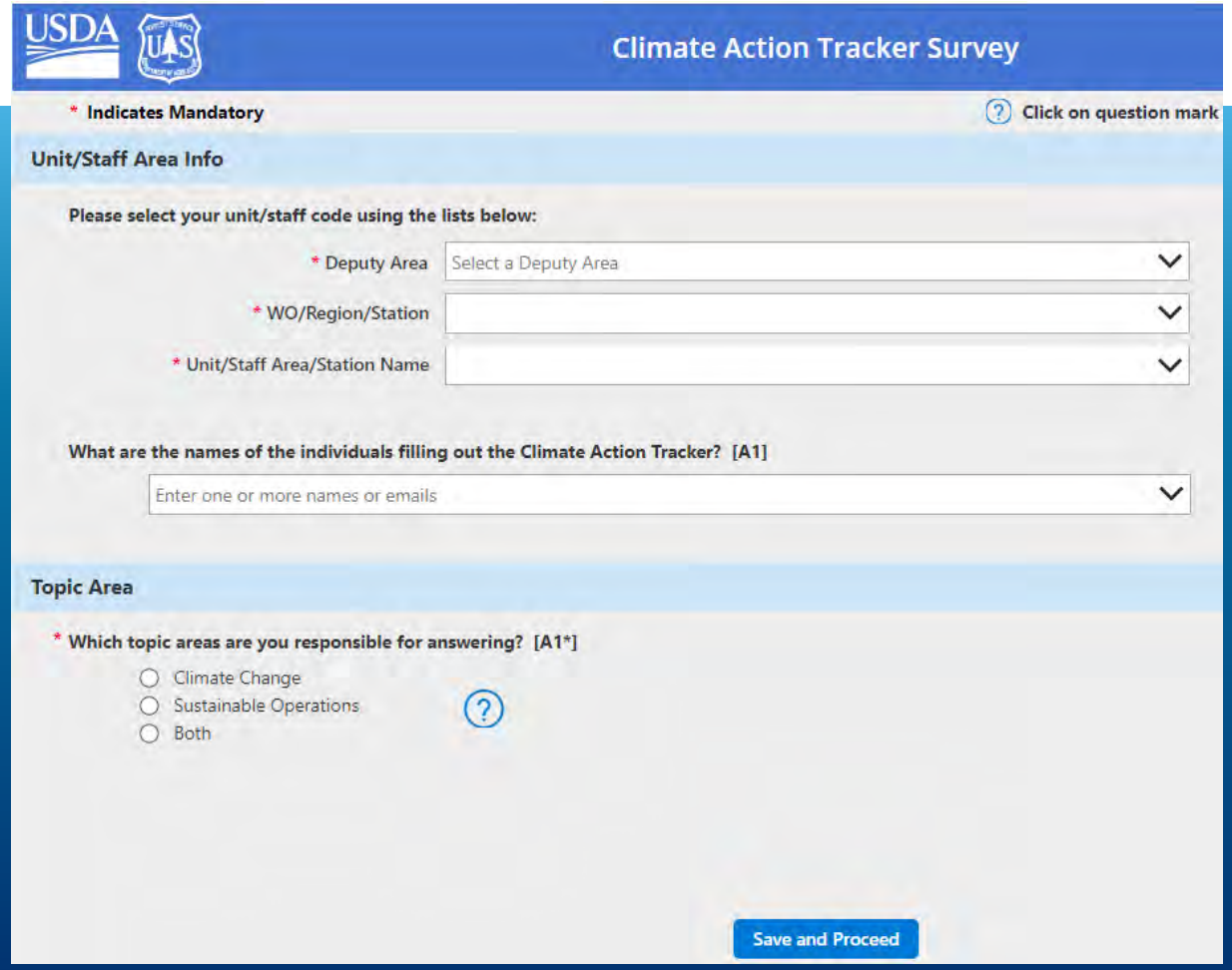
Mechanism for measuring and reporting progress towards Agency climate goals (replaces "Sustainability Scorecard")

Regional Deadline: **November 25, 2022**

Several adaptation-related CAT questions

Examples:

- *How many signed NEPA decisions explicitly incorporated climate change adaptation strategies to address climate vulnerabilities and/or impacts into the purpose and need, proposed action, and/or decision document?*
- *Which of the following current plans have explicitly incorporated climate change vulnerability assessments and/or adaptation strategies? (select all that apply)*
  - Land Management Plan, Watershed Restoration Action Plans, Comprehensive River Management Plan, Wilderness plan, etc.



***For more information*: Climate Scorecard (sharepoint.com)**

RESOURCE: CLIMATE-READY INFRASTRUCTURE

- Transportation Resiliency Guidebook
- https://www.volpe.dot.gov/FS-Transportation-Resiliency-Guidebook

OFFICE OF SUSTAINABILITY AND CLIMATE (OSC) CONTACTS

- FS Climate Advisor and (Acting) Director: Chris Swanston
- Deputy Director: Dixie Porter
- Executive Assistant: Krizia Campbell
- Supervisory Climate Adaptation Specialist: Leslie Brandt
- Climate Adaptation Specialist: Andy Bower
- Climate Adaptation Specialist: Todd Ontl
- Climate Adaptation Specialist (fire focus): Connie Flores
- Climate Adaptation Specialist (fire focus): Brooke Hagarty
- Climate Adaptation Specialist (NEPA focus): Kristen Schmitt
- Climate Adaptation Specialist (NEPA focus): Tanya Skurski
- Sustainable Operations Coordinator: Jennifer Hayes
- Sustainable Operations Coordinator: Kelly Jaramillo
- Carbon Specialist/Natural Resource Management Specialist: *vacant*
- Natural Resource Specialist/Carbon Specialist: Lauren Onofrio
- Public Affairs Specialist: Aurora Cutler
- Program Analyst/Data Manager: Erik Johnson
- Geographic Information Systems Specialist: Nathan Walker
- Geographer (Resource Assistant): Mark Adams
- GIS Specialist (Resource Assistant): Keren Crum
- GIS Specialist (Resource Assistant): Mary Powers
- Climate Data Specialist (ACES Program): Michael Cummings
- Carbon Specialist (ACES Program): Richard Birdsey
- Soil Scientist (ACES Program): Richard Pouyat

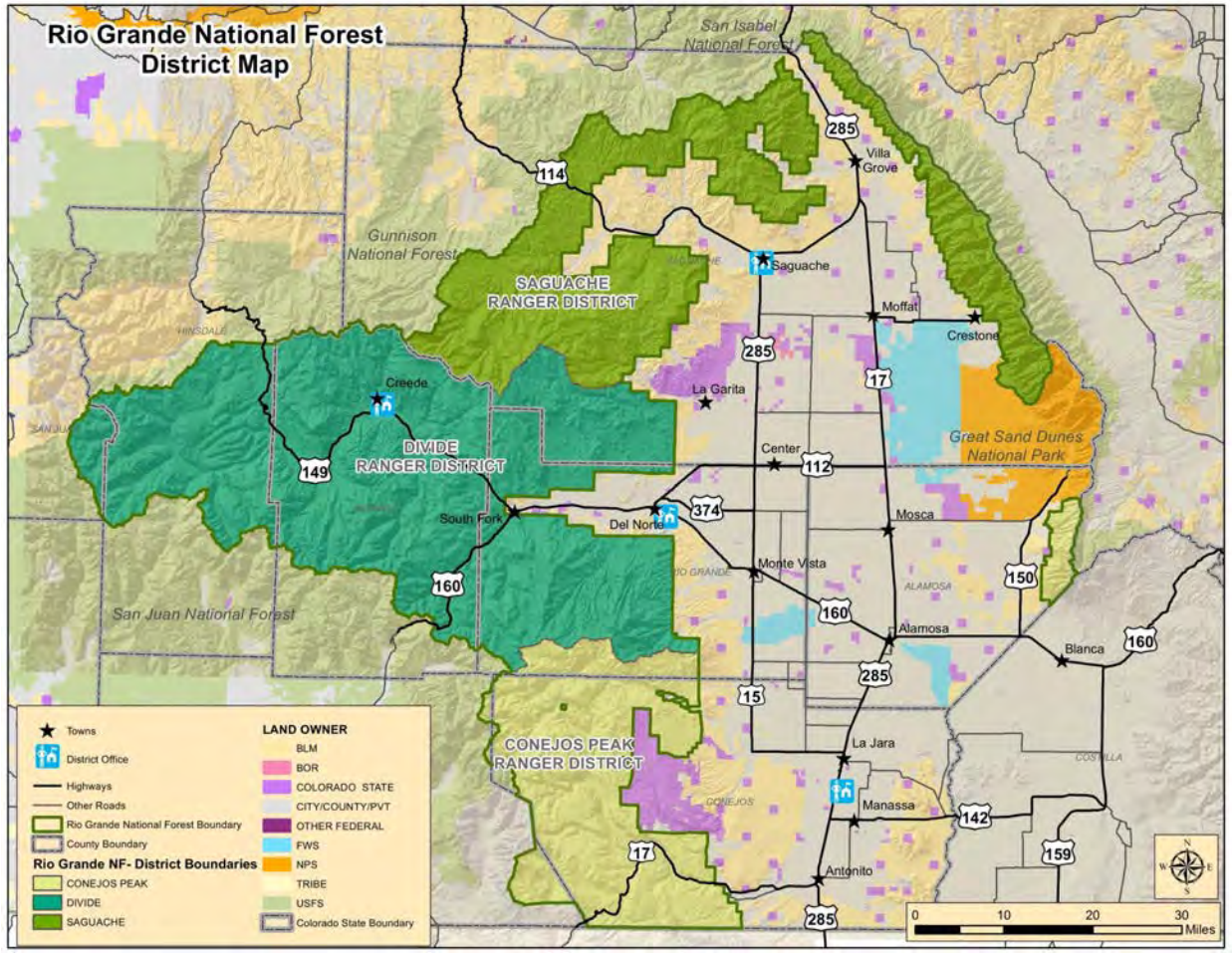
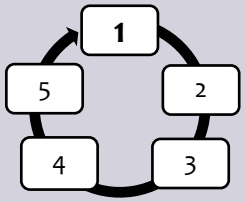
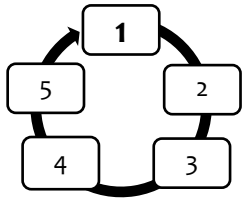


Photo: https://www.fs.usda.gov/contactus/riogrande/about-forest/contactus

A photo from the field trip during the planning phase of the workshop showing the Rio Grande National Forest (RGNF) and private lands surrounding the RGNF (photo by Linda Joyce).



Step 1: Where are you working and what do you care about?



Step 1: Define area of interest, management goals and objectives, and timeframes.

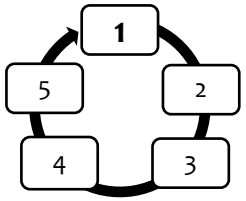
Key Questions:

- Define the project location and describe what you value most about your district or program area on the RGNF.
- What are achievable outcomes and measurable actions (i.e. your management goals & objectives)?
- Is there a project timeframe?

Photos: Dixie National Forest, USDA Forest Service

Key Definitions

- **Location:** Describe the geographic location and unique features of your district on the Rio Grande National Forest
- **Management Topics:** List the major management topics for your district which could include major ecosystem types, management topics, or other relevant categories (e.g. Land, Water, People or High-elevation forests, subalpine-fir forests, etc.)
- **Management Goals:** a broad, general statement, usually not quantifiable, that expresses a desired state or process to be achieved
- **Management Objectives:** a concise, time-specific statement of measurable planned results that correspond to pre-established goals in achieving a desired outcome
- **Time Frames:** List approximate time frames for implementing management actions and for achieving goals and objectives



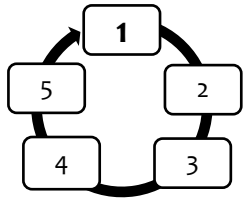
Step 1: Define area of interest, management goals and objectives, and timeframes.

Example:

Location & Management Topic	Management Goals	Management Objectives	Time Frame
Arapaho-Roosevelt: Mixed-Conifer forests	Maintain fire in fire-adapted ecosystems	Implement a prescribed burn every 15 years to reduce stand competition and remove ladder fuels.	15 years
Colorado State Park: Wildlife Management	Enhance habitat conditions in subalpine forests	Increase structural diversity through a series of forest regeneration harvests.	30 years
Wisconsin DNR: Lazy River	Increase stream connectivity along the Lazy River	Remove 10 highest-priority structures that impede natural flows or create barriers to aquatic organisms.	15 years
RMNP: Recreation Safety & Access	Improve accessibility for visitors	Remove dead and dying trees within the viewshed of the scenic overlook.	10 years

Step 1 Responses

- Maintain and restore sustainable, resilient terrestrial ecosystems
- Protect and restore watershed health, water resources, aquatic ecosystems, and the systems that rely on them
- Actively contribute to social and economic sustainability in the broader landscape and connect citizens to the land
- Be prepared to respond to continued or more frequent droughts concerning rangeland management.
- Mixed-conifer forests: Maintain mature to old forest conditions through fire management.
- Maintain fire in fire-adapted ecosystems
- Spruce-fir forests: Maintain and restore sustainable, resilient ecosystems
- Restore old forest conditions and establish a mix of age classes
- Alpine: Maintain alpine dependent species
- Maintain/increase resilience of native plant communities to invasion of non-native invasive species.
- To the extent feasible, maintain ecological conditions to support viable populations of all occurrences of SCC plants on the forest by ensuring the structure, composition & function of all veg types on the forest meet the needs of SCC plants i.e. alpine, wetland/fen, etc.)



Step 1: Define area of interest, management goals and objectives, and timeframes.

Discussion:

- Describe the project location and describe what your district values most about this landscape (e.g., wildlife, clean water, recreation opportunities).
- What are your overarching management goals & objectives?
- Any changes or additions you would make?

Lunch – Be back at 1:45

The Climate of the Rio Grande National Forest

Future Projections

Lauren Kramer

USDA Southwest Climate Hub, ARS

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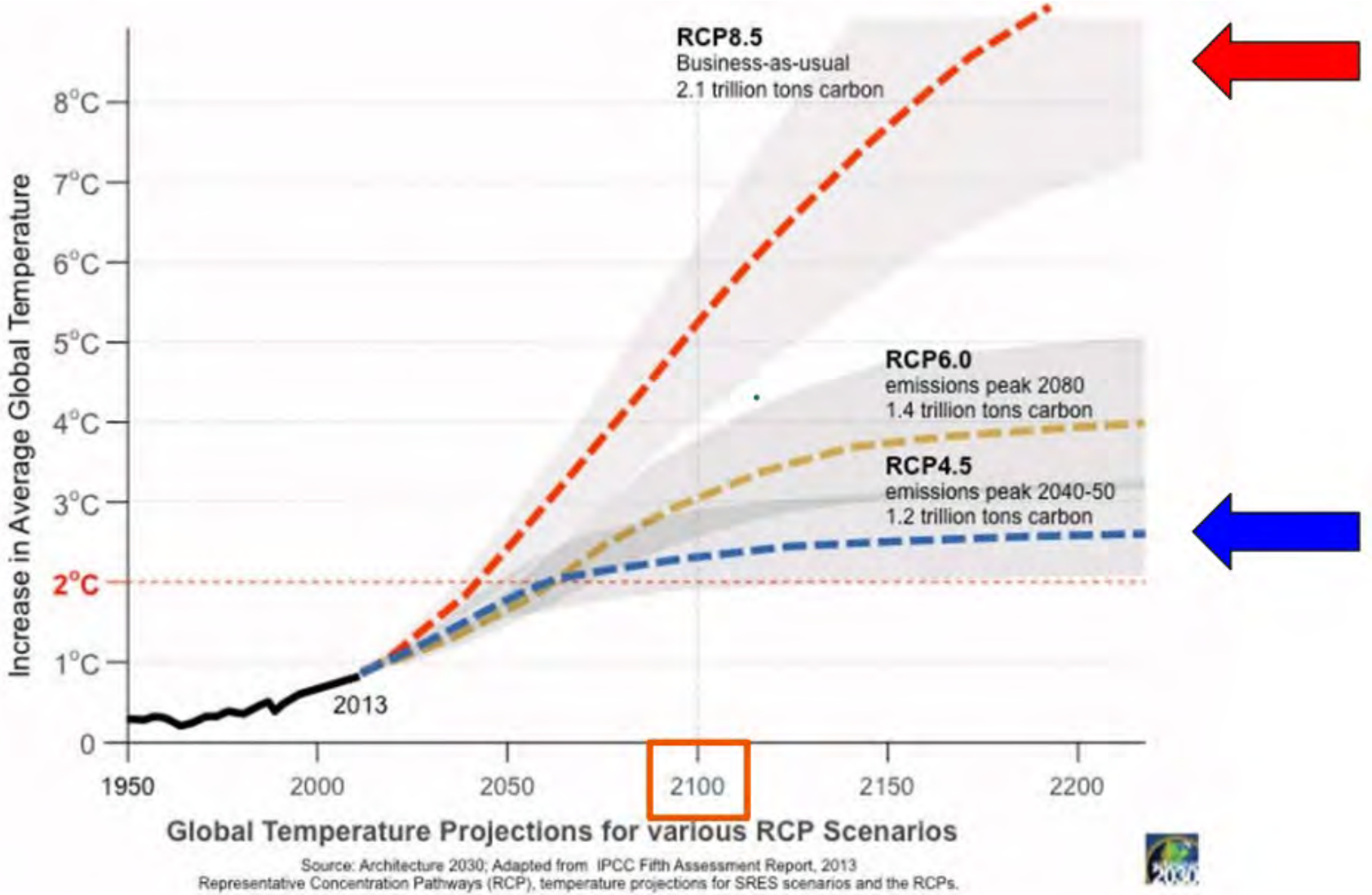
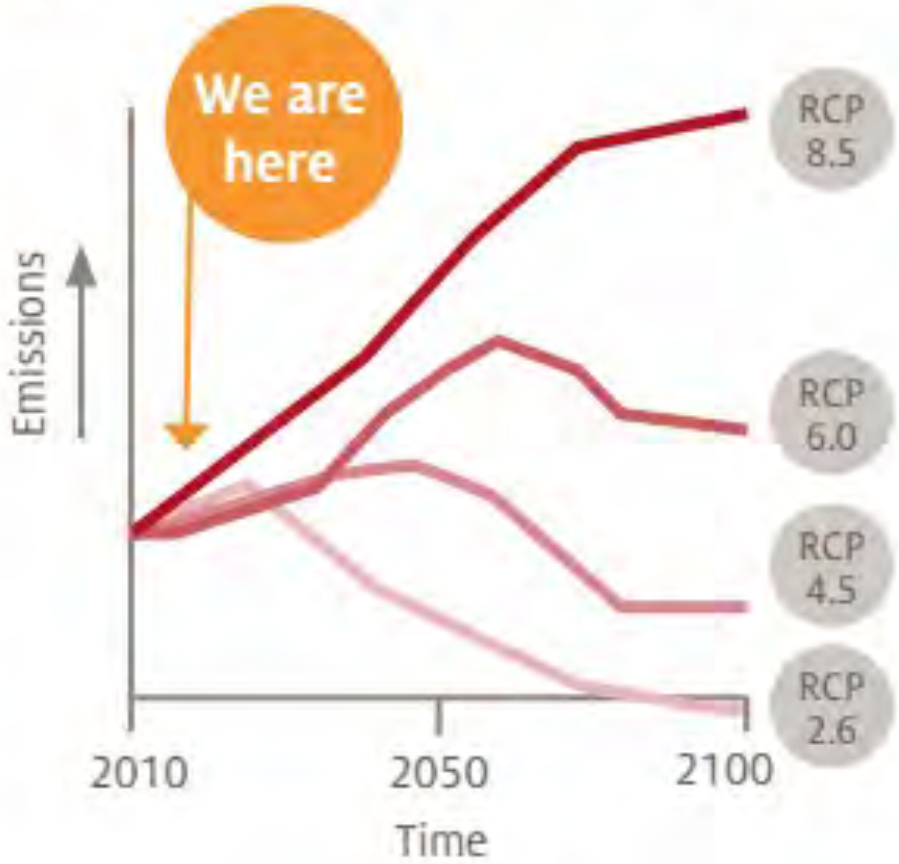
Future Emission Scenarios



IPCC Fifth Assessment Report (2013)

We can use the RCPs to plan for the future

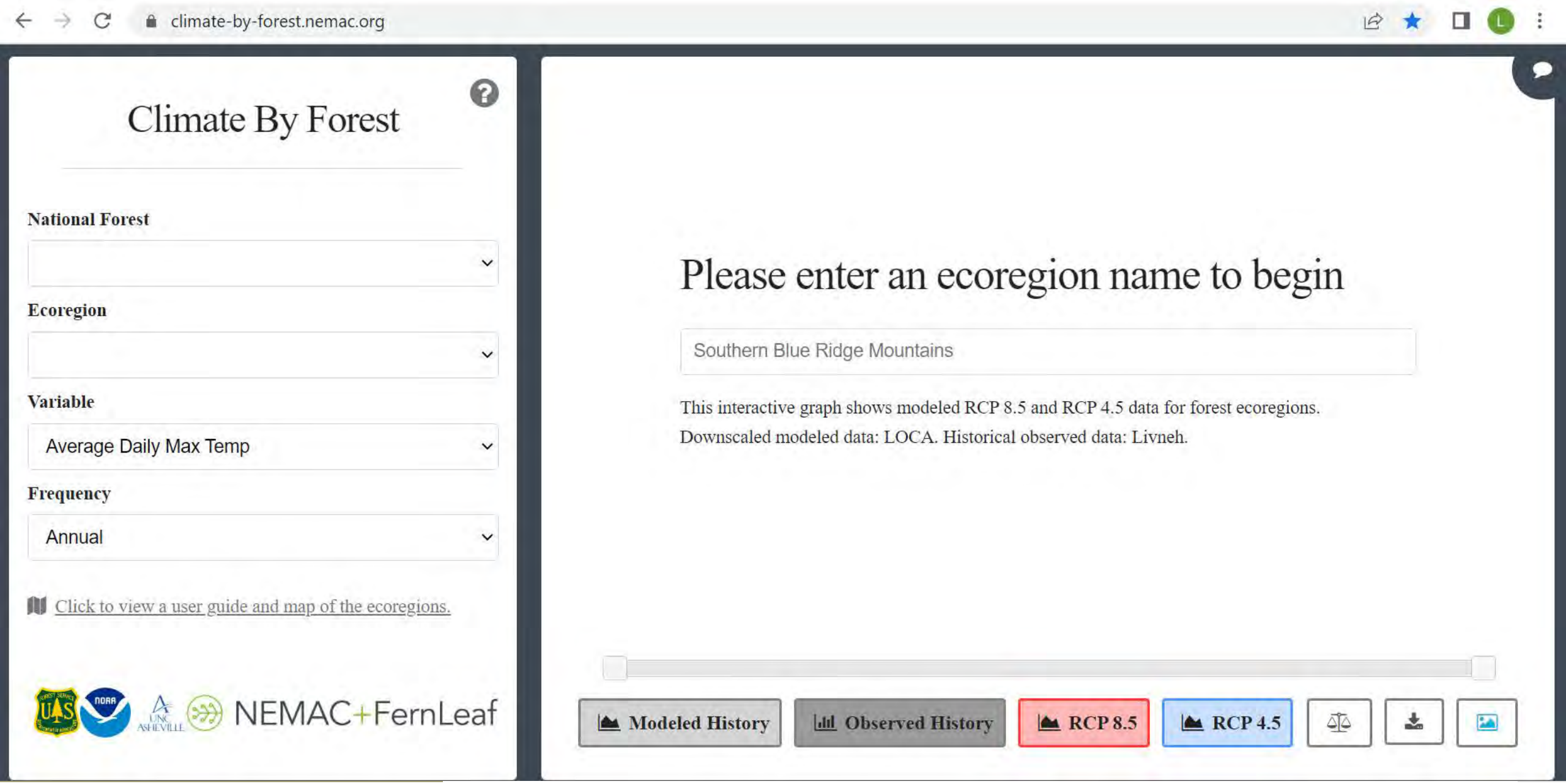
Scientists use the RCPs to model climate change and build scenarios about the impacts. You can use these scenarios to plan for the future.



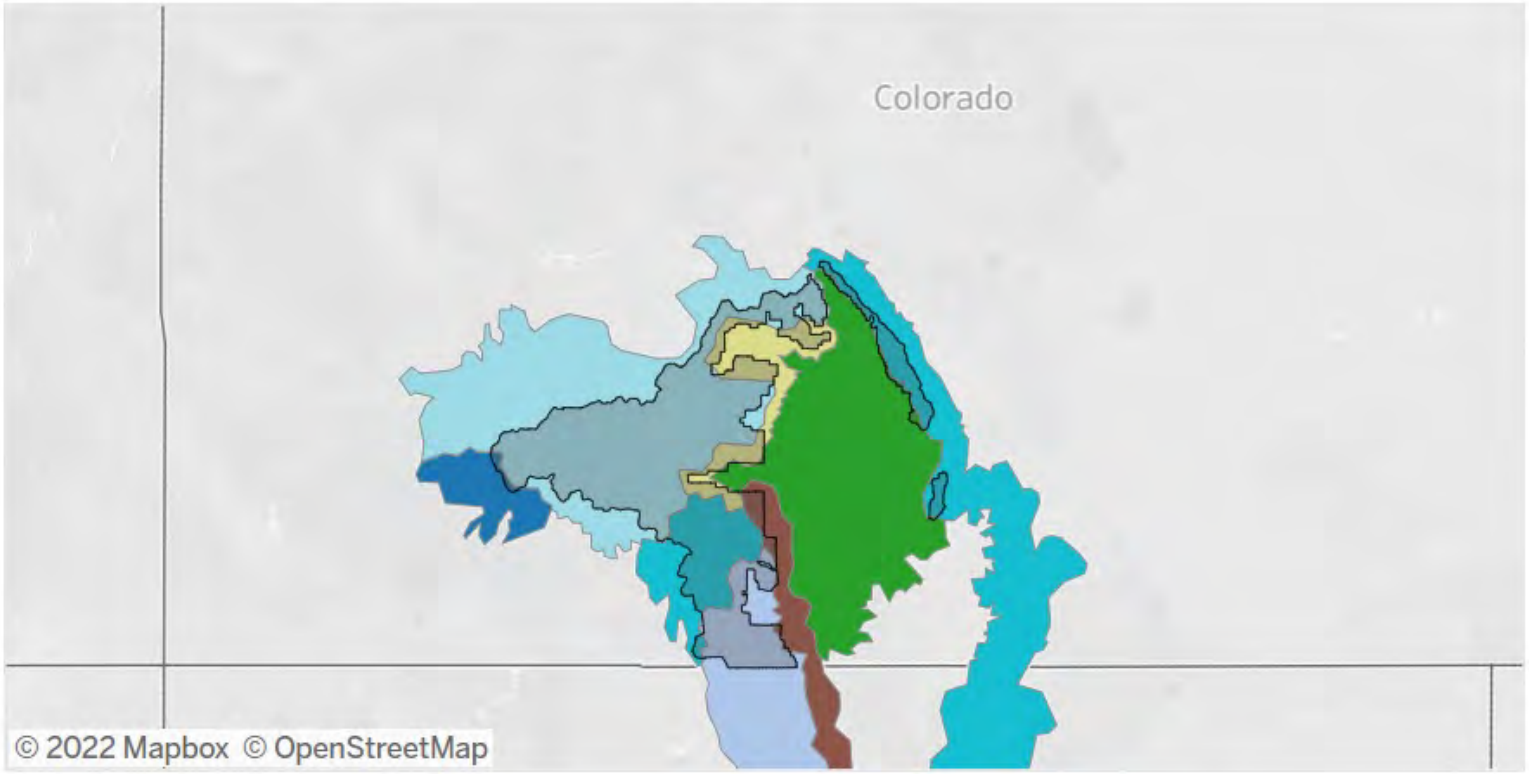
If we follow the RCP 8.5 pathway, **more adaptation** will be needed.

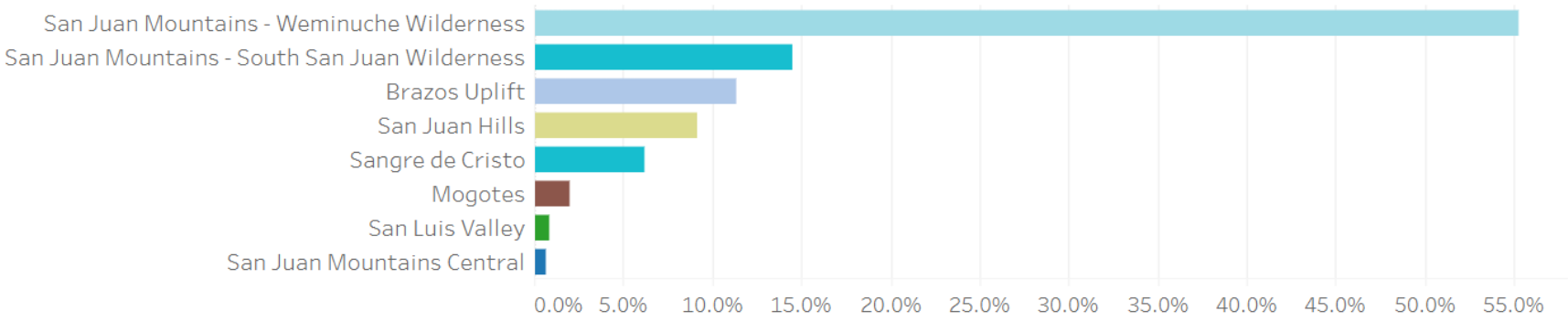
If we follow the RCP 2.6 pathway, **less adaptation** is needed.

RCP 8.5 leads to much greater temperature increases, and this means greater impacts and greater costs. To adapt to these changes will also cost more. A balance must be struck between the cost of impacts and the cost of adaptation.


climate-by-forest.nemac.org
Climate By Forest
National Forest
Ecoregion
Variable
Average Daily Max Temp
Frequency
Annual
Click to view a user guide and map of the ecoregions.
NEMAC+FernLeaf
Please enter an ecoregion name to begin
Southern Blue Ridge Mountains
This interactive graph shows modeled RCP 8.5 and RCP 4.5 data for forest ecoregions.
Downscaled modeled data: LOCA. Historical observed data: Livneh.
Modeled History
Observed History
RCP 8.5
RCP 4.5

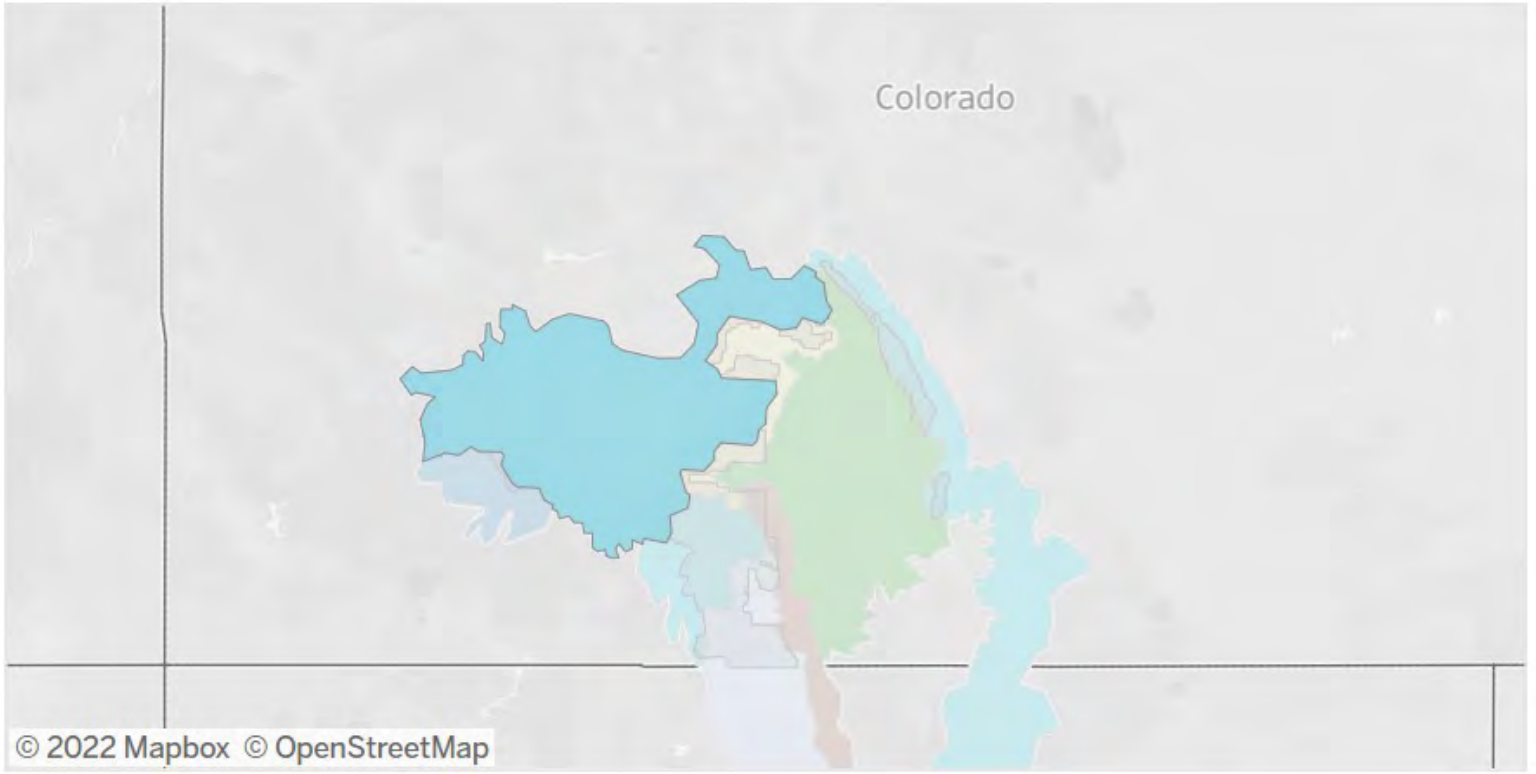
Rio Grande National Forest Ecoregions

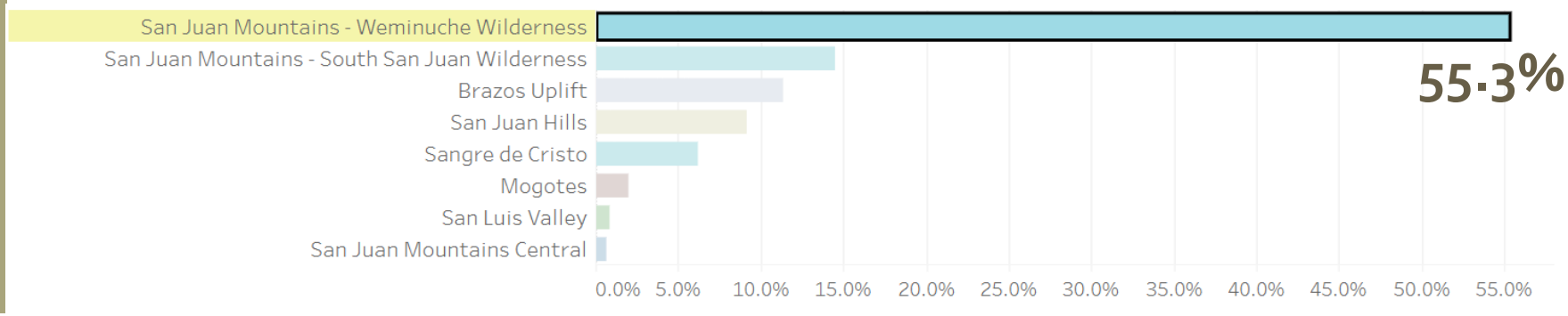




https://climate-by-forest.nemac.org/

San Juan Mountains – Weminuche Wilderness





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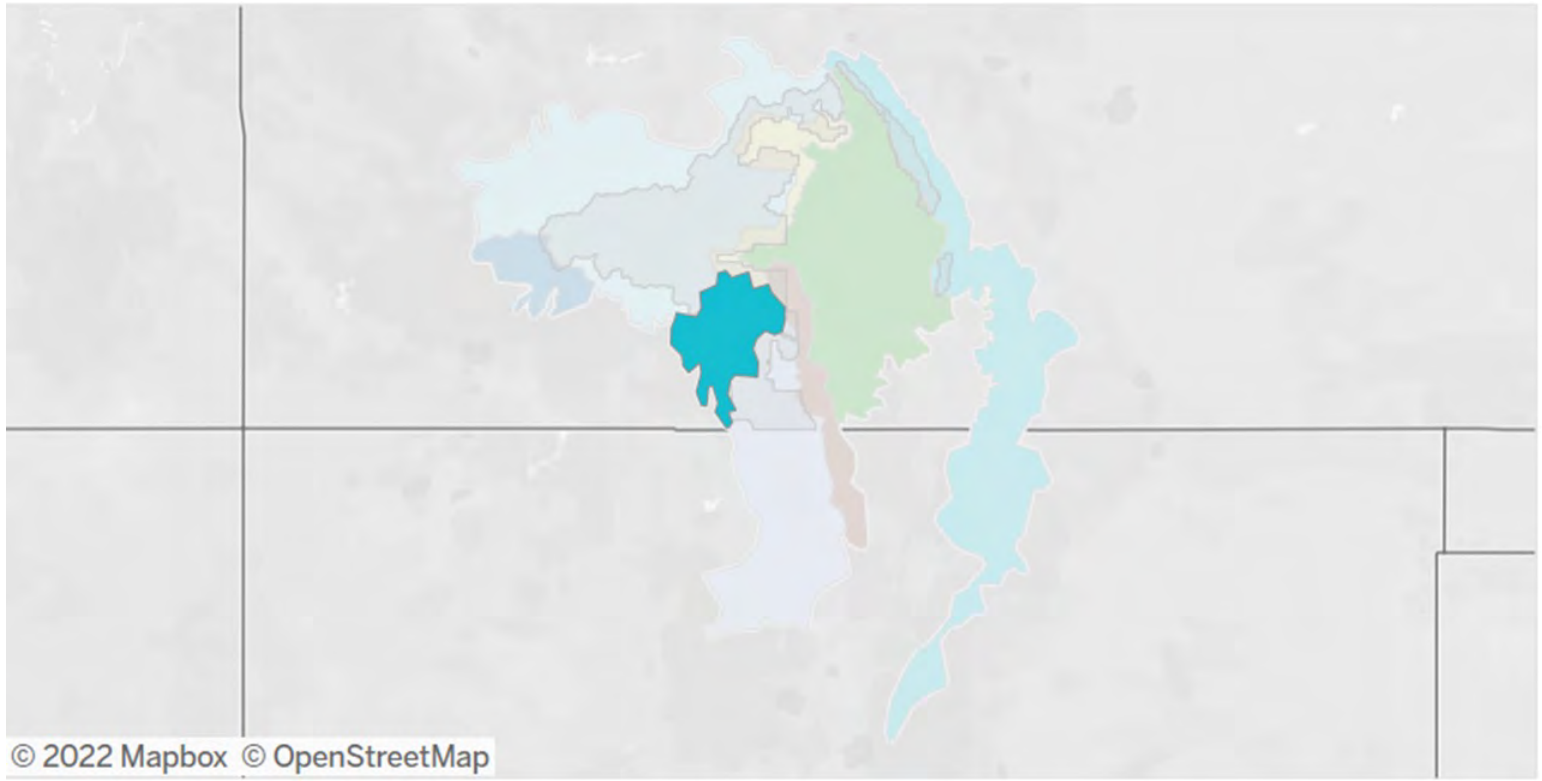
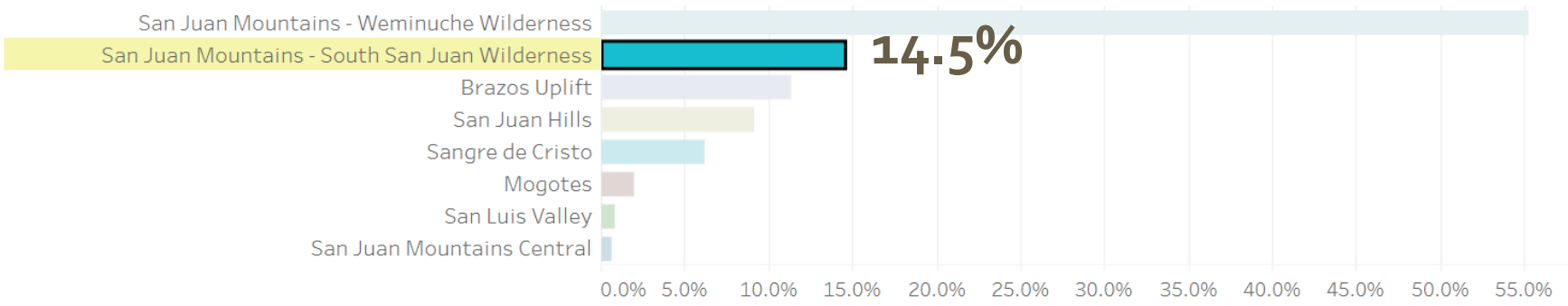
https://climate-by-forest.nemac.org/

San Juan Mountains – South San Juan Wilderness





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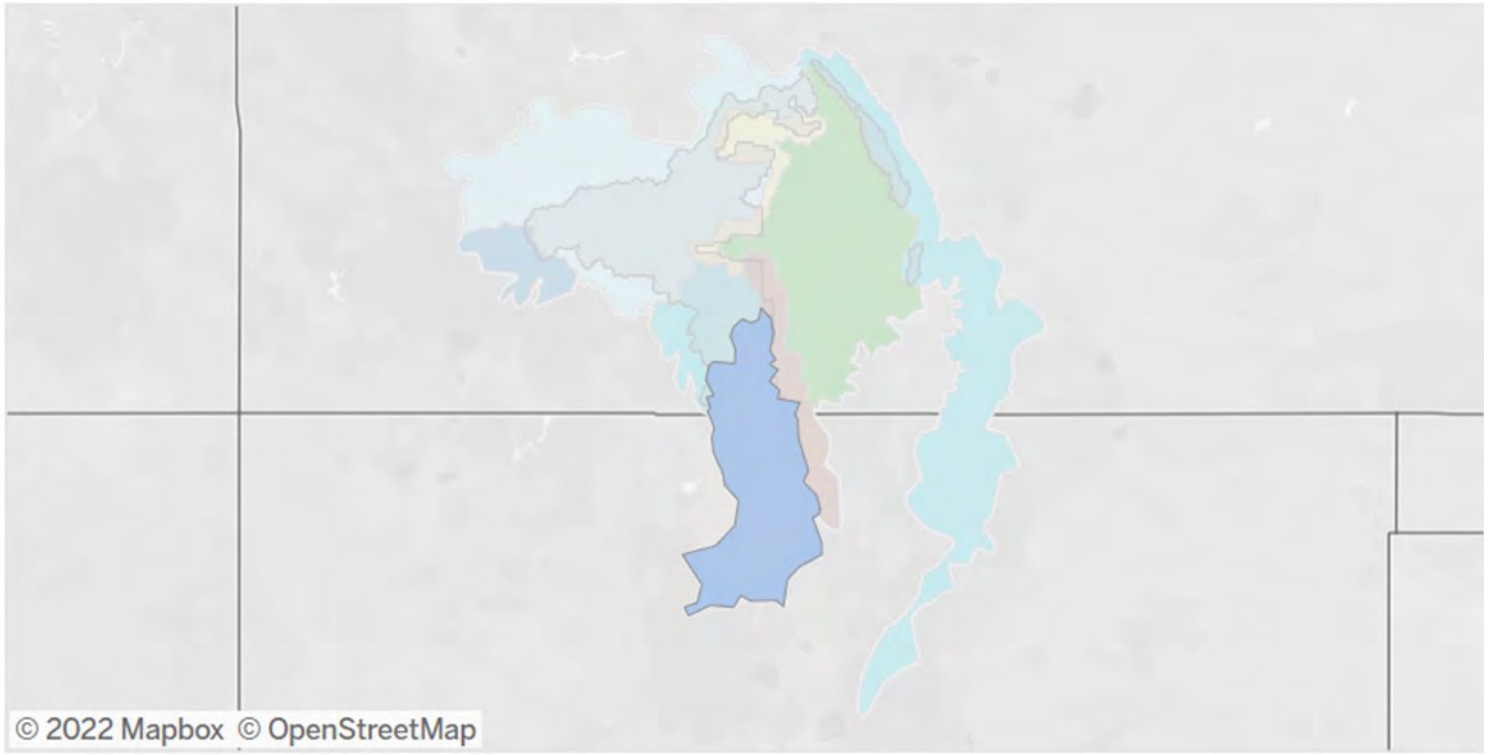
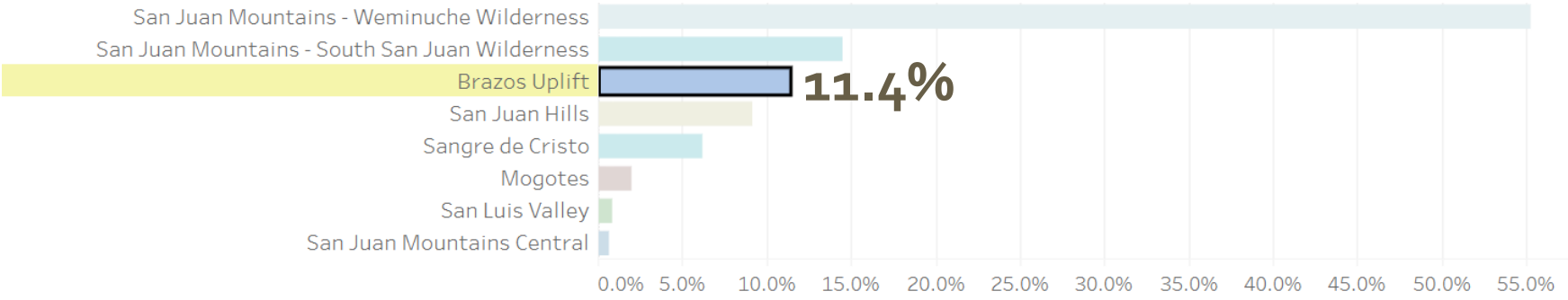
Brazos Uplift





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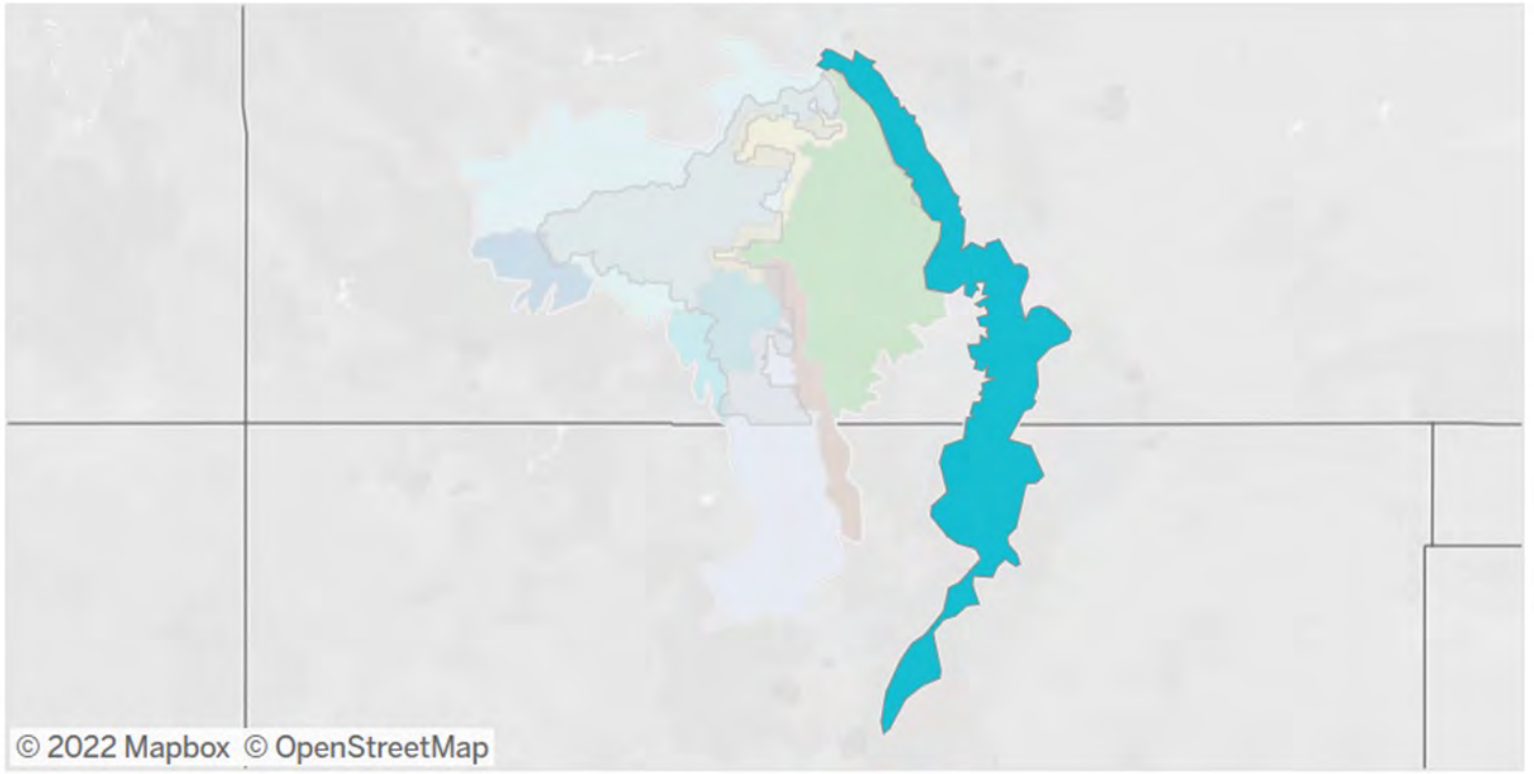
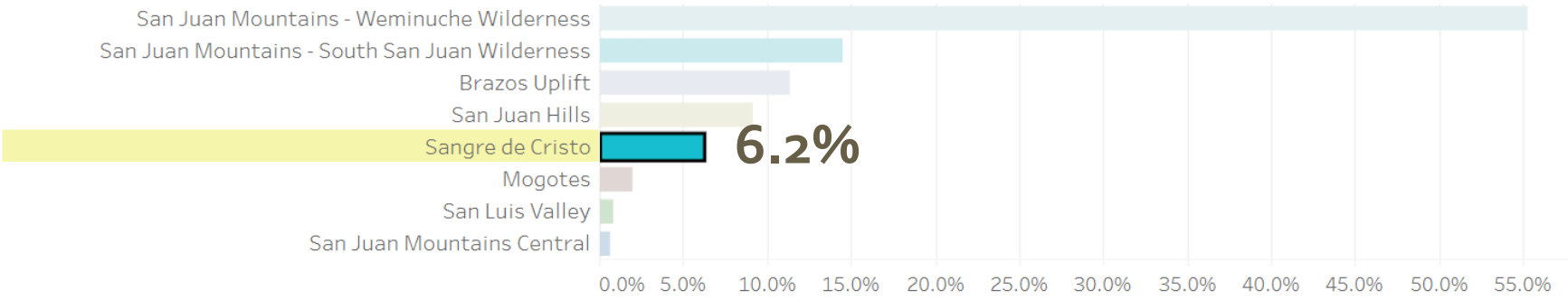
https://climate-by-forest.nemac.org/

Sangre de Cristo

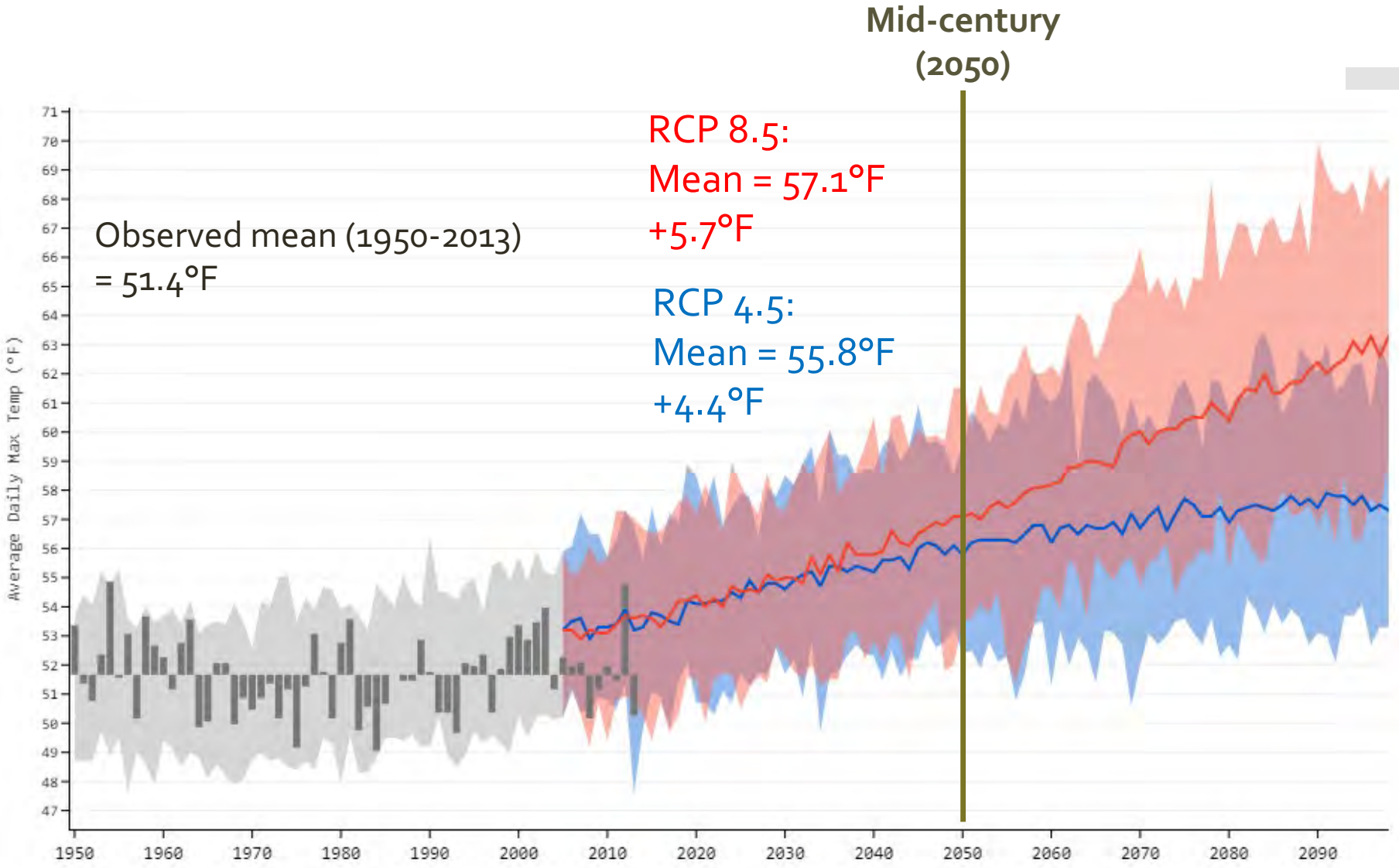




USDA United States Department of Agriculture
Southwest Climate Hub

https://climate-by-forest.nemac.org/

Projected Average Daily Maximum Temperature

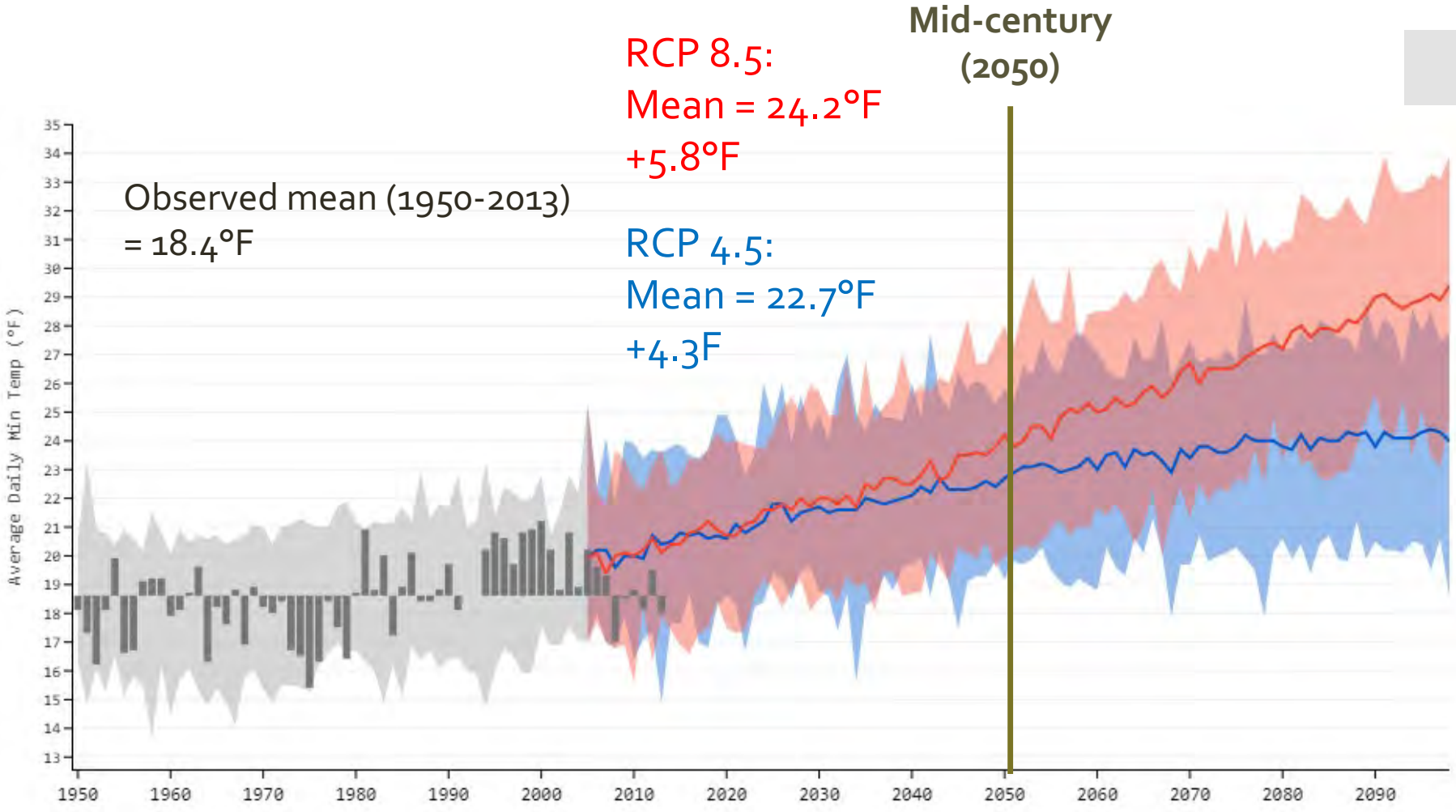


Projected Average Daily Max Temp (°F)
in the San Juan Mountains – Weminuche Wilderness Ecoregion

USDA United States Department of Agriculture
Southwest Climate Hub

https://climate-by-forest.nemac.org/

Projected Average Daily Minimum Temperature

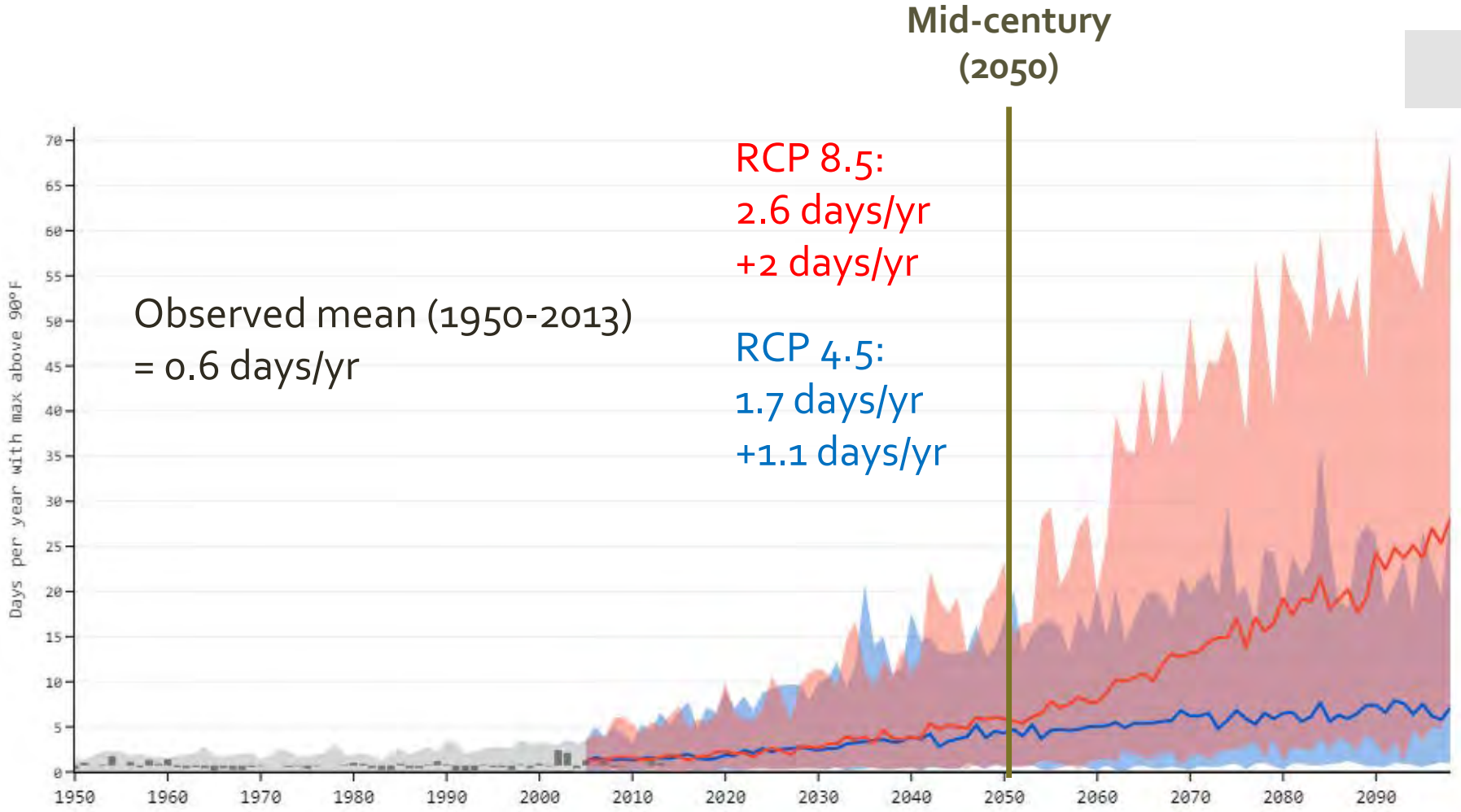


Projected Average Daily Min Temp (°F)
in the San Juan Mountains – Weminuche Wilderness Ecoregion

USDA United States Department of Agriculture
Southwest Climate Hub

https://climate-by-forest.nemac.org/

Projected Days per Year with Maximum Temperature Above 90° F (Heat Days)

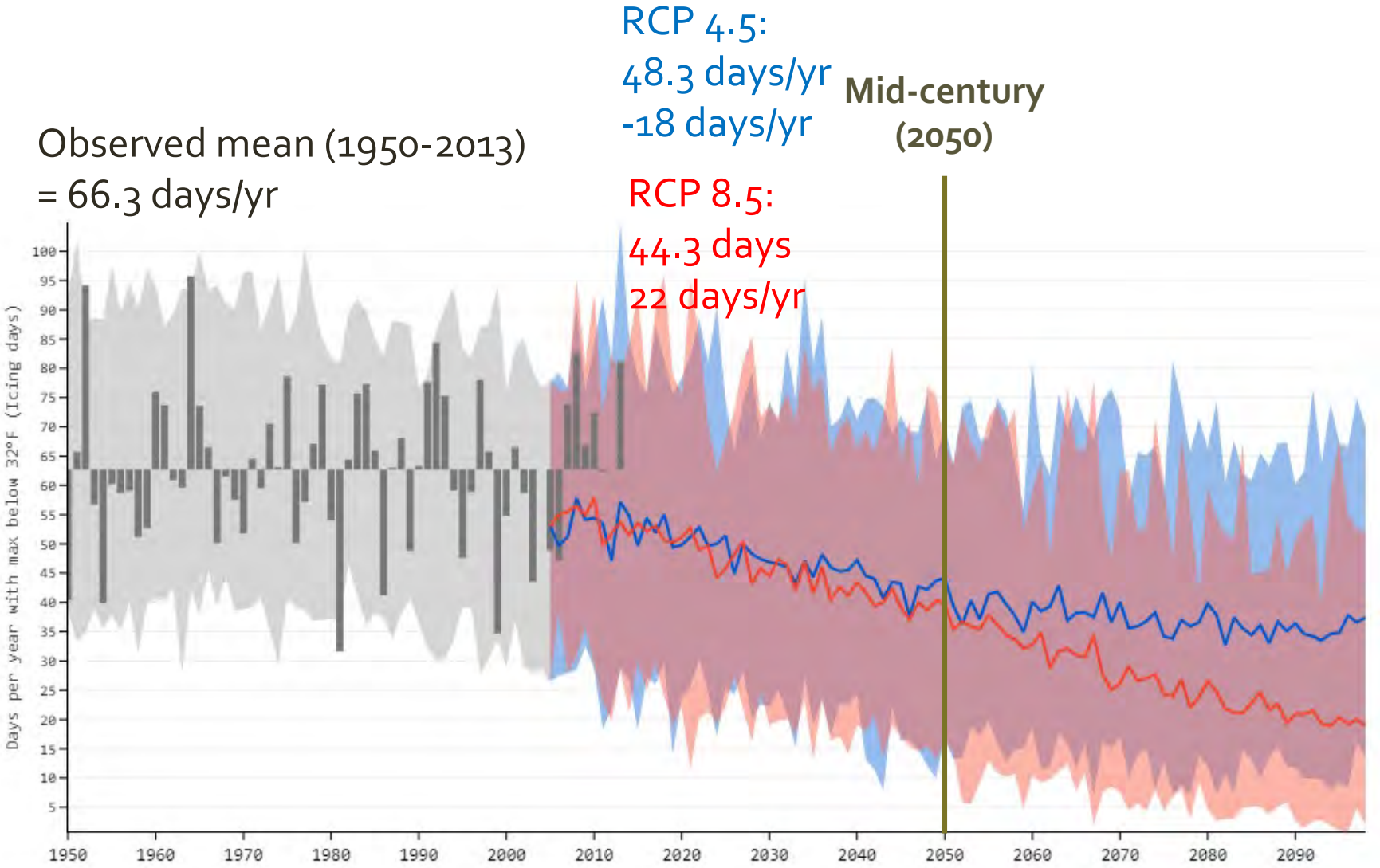


Projected Days Per Year with Max Above 90°F
in the San Juan Mountains – Weminuche Wilderness Ecoregion

USDA United States Department of Agriculture
Southwest Climate Hub

https://climate-by-forest.nemac.org/

Projected Days per Year with Maximum Temperature Below 32° F (Icing Days)

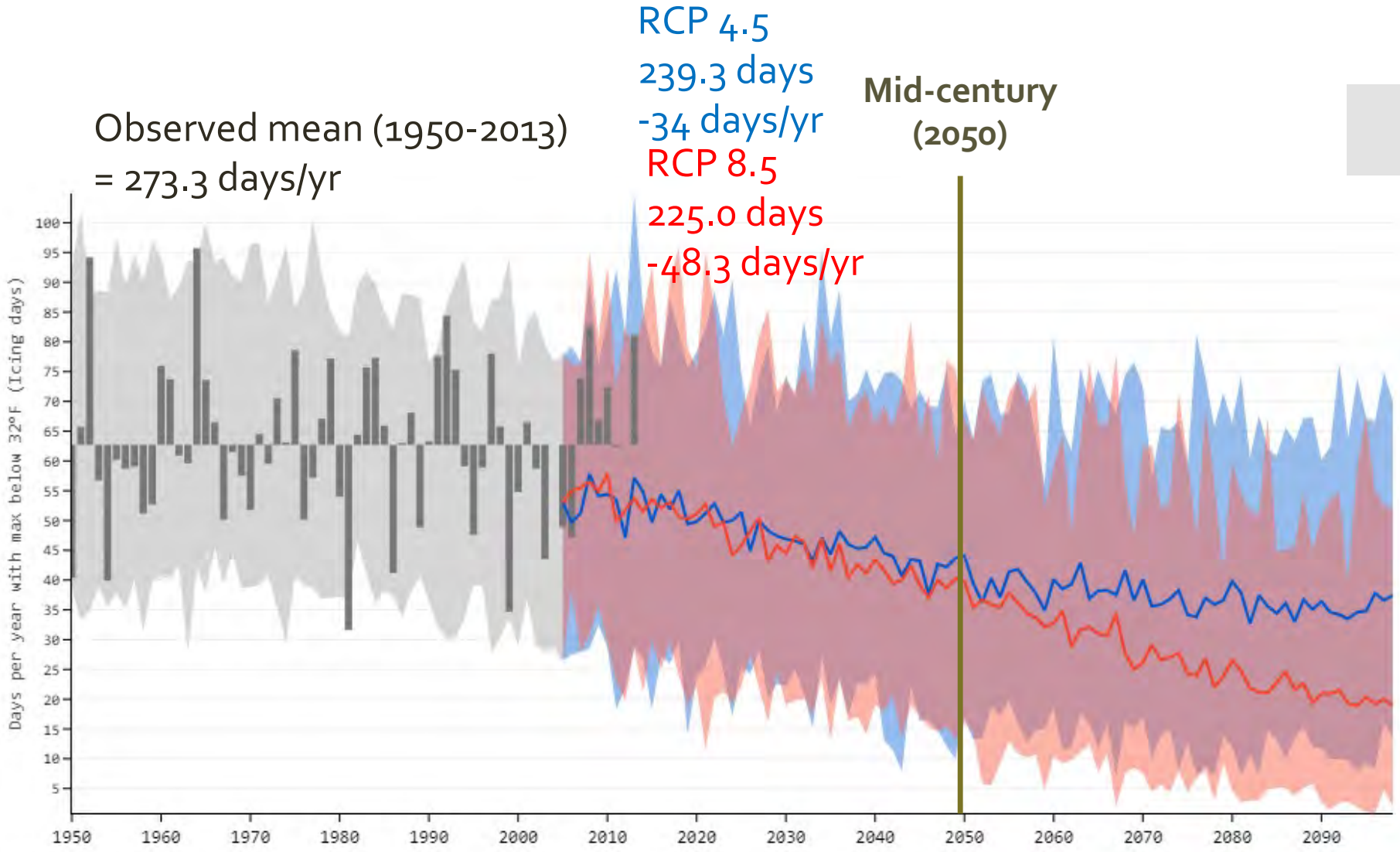


Projected Days Per Year with Max Below 32°F (Icing Days)
in the San Juan Mountains – Weminuche Wilderness Ecoregion

USDA United States Department of Agriculture
Southwest Climate Hub

https://climate-by-forest.nemac.org/

Projected Days per Year with Minimum Temperature Below 32° F (Frost Days)

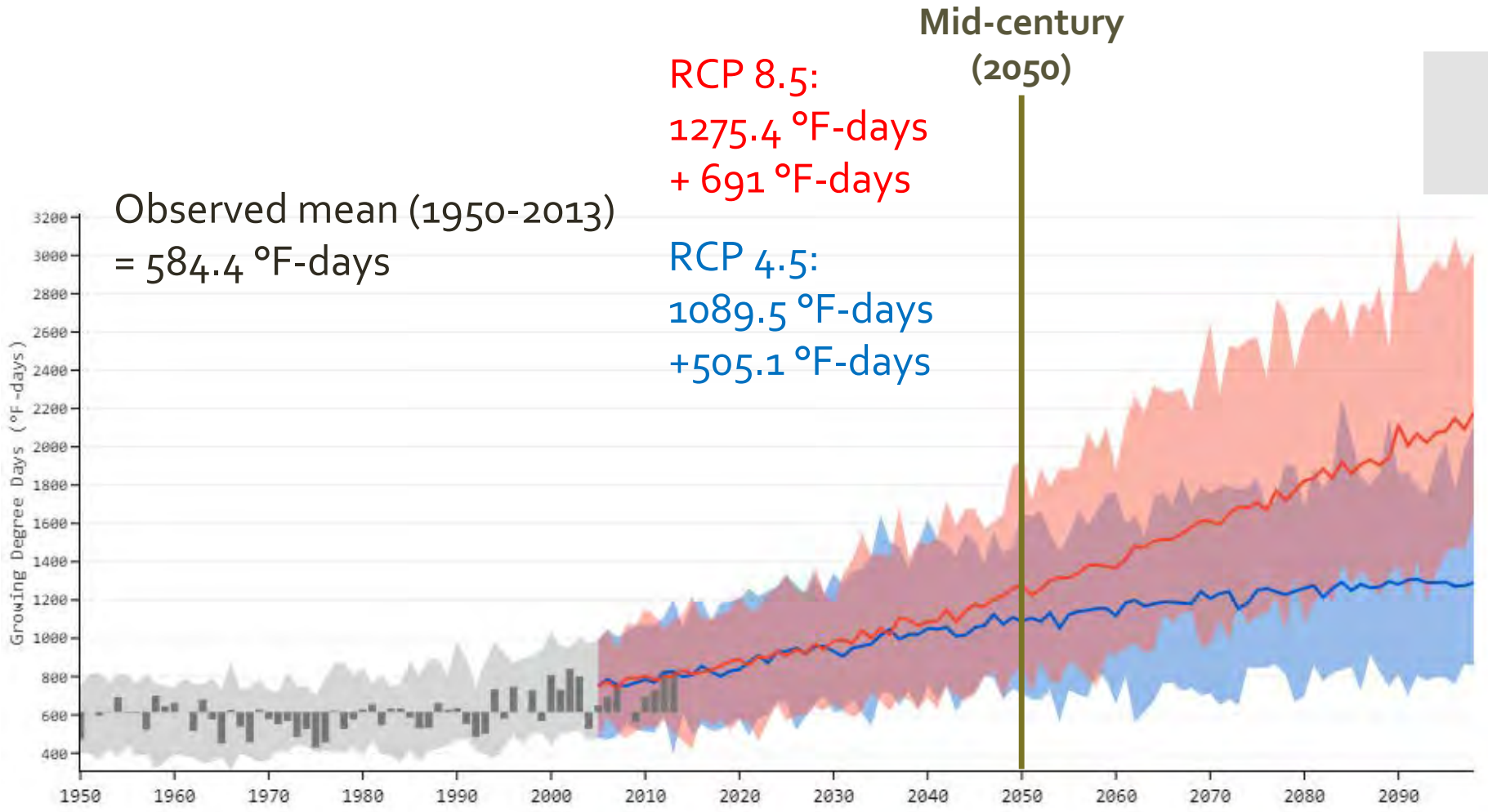


Projected Days Per Year with Min Below 32°F (Frost Days)
in the San Juan Mountains – Weminuche Wilderness Ecoregion

https://climate-by-forest.nemac.org/

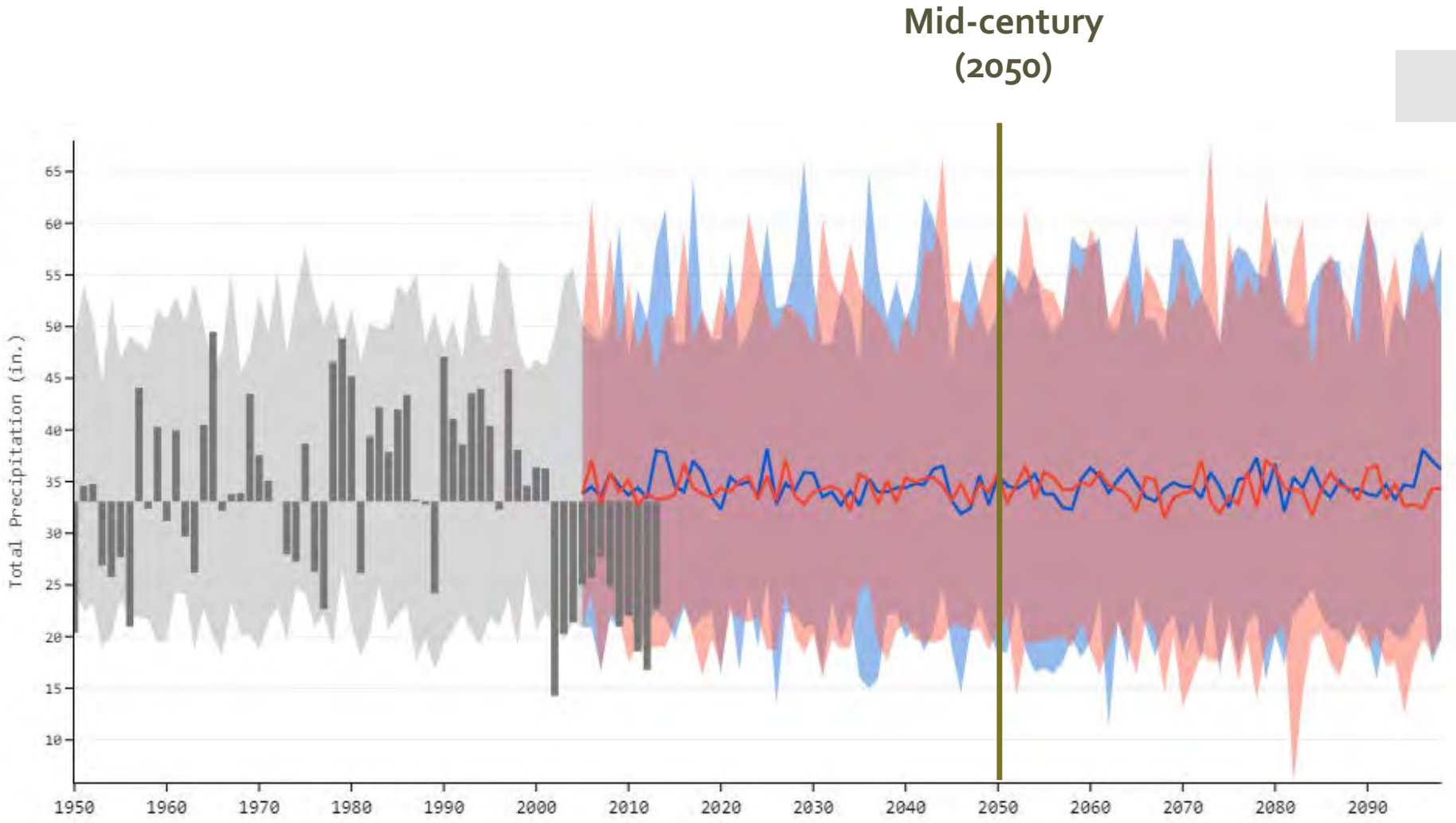
USDA United States Department of Agriculture
Southwest Climate Hub

Projected Growing Degree Days (GDD)



Projected Growing Degree Days
in the San Juan Mountains – Weminuche Wilderness Ecoregion

Projected Precipitation



Projected Total Precipitation
in the San Juan Mountains – Weminuche Wilderness Ecoregion

https://climate-by-forest.nemac.org/

Overview: Projected changes for the San Juan Mountains – Weminuche Wilderness Ecoregion

By the mid-21st century…

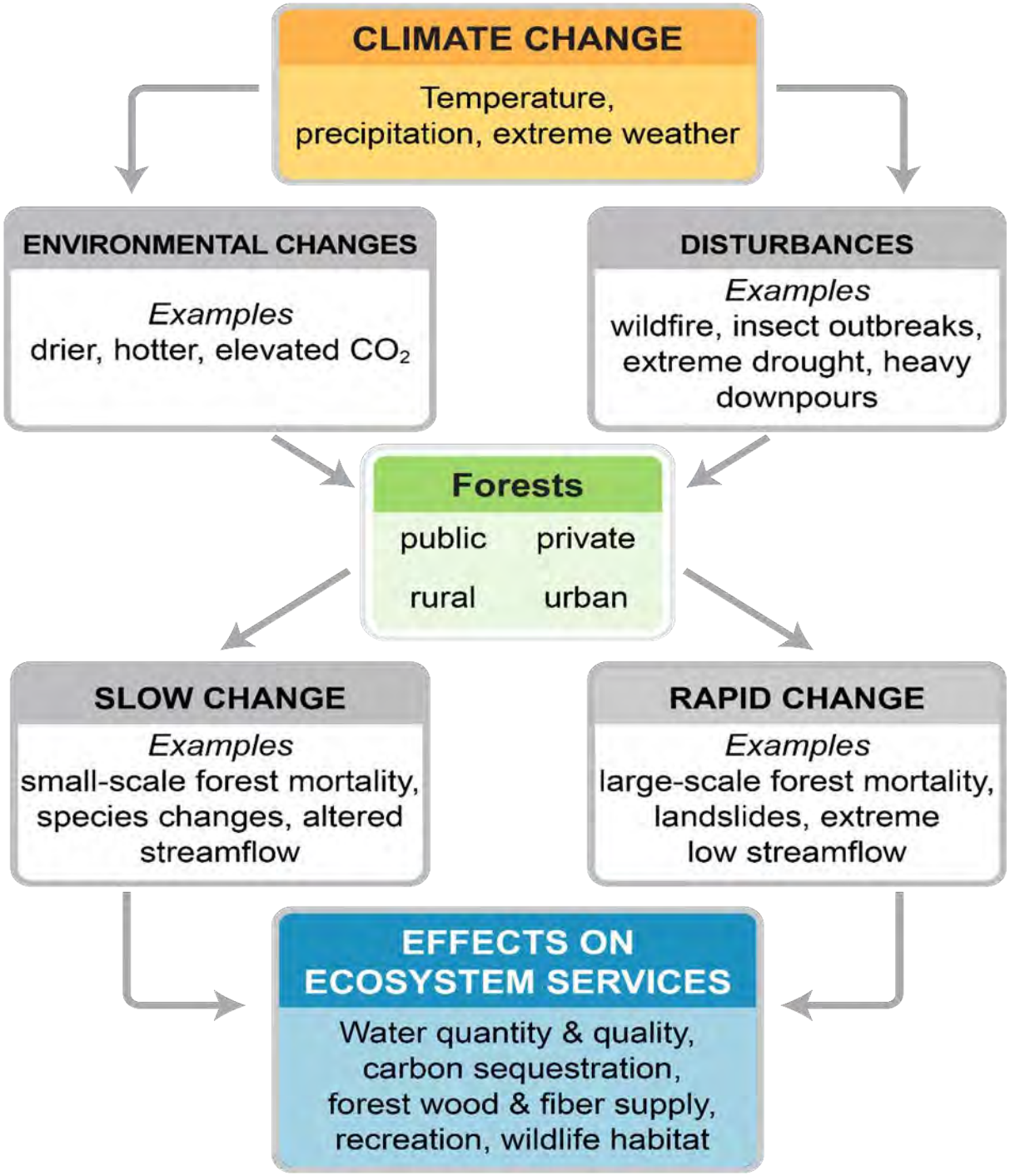
- **Daily Max Temp:** +4.4°F to +5.7°F
- **Daily Min Temp:** +4.3°F to +5.8°F
- **Heat Days** (max > 90°F): 1.1 days/yr to 2 days/yr
- **Icing Days** (max < 32°F): 18 days/yr to 22 days/yr
- **Frost Days** (min < 32°F): 34 days/yr to 48.3 days/yr
- **Growing Degree Days**: +505.1°F-days to +691°F-days
- **Precipitation** projections are highly variable with the likelihood of more extreme events occurring

By the end of the 21st century…

- **Daily Max Temp:** +6.1°F to +6.9°F
- **Daily Min Temp:** +3.5°F to +4.5°F
- **Heat Days** (max > 90°F): 13.3 days/yr to 19.3 days/yr
- **Icing Days** (max < 32°F): 24.8 days/yr to 44 days/yr
- **Frost Days** (min < 32°F): 42.6 days/yr to 80.6 days/yr
- **Growing Degree Days:** +513.1 °F-days to +675.7 °F-days
- **Precipitation** projections are highly variable with the likelihood of more extreme events occurring

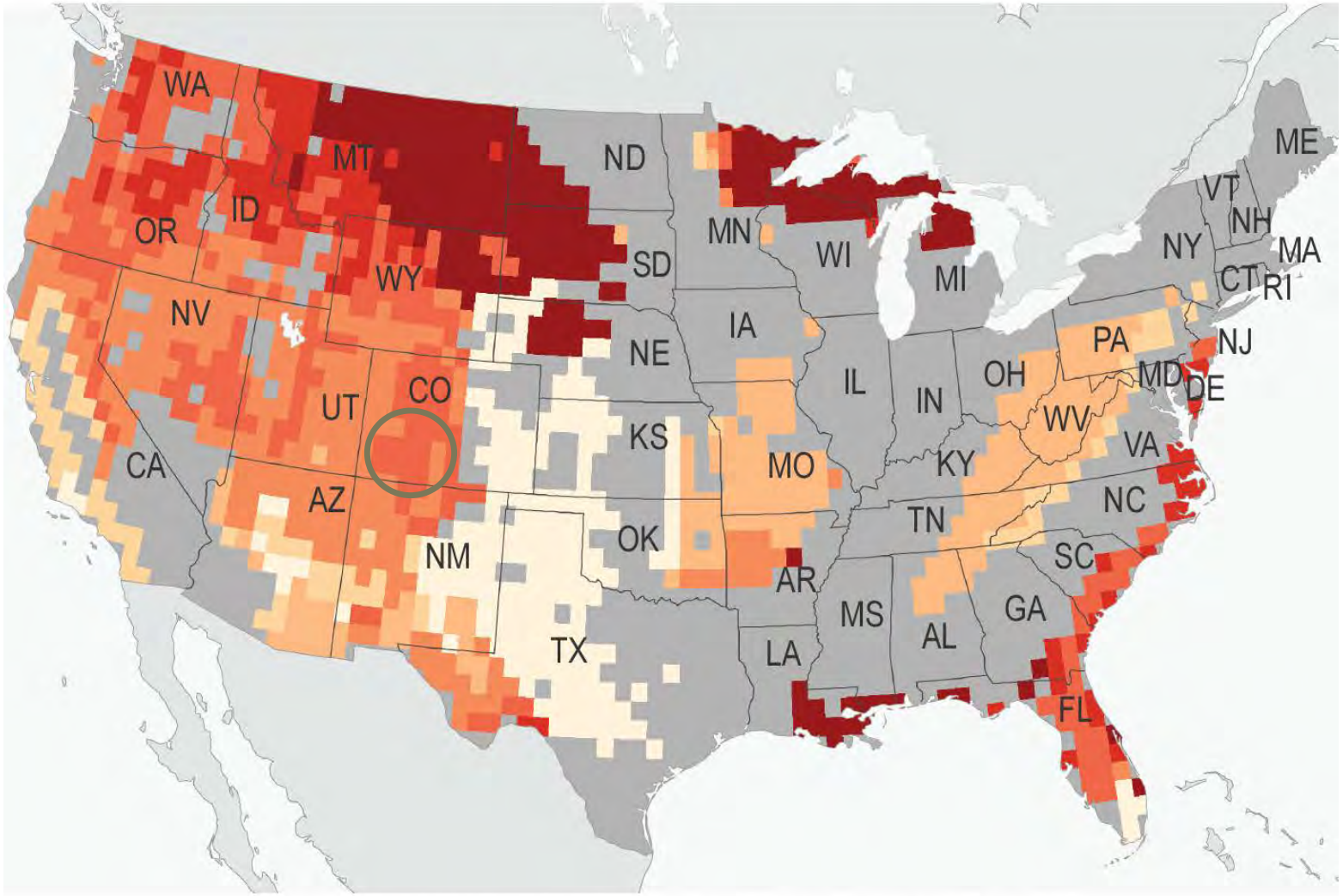
Forest Implications

How climate change will affect the forest



Fire

Projected Increase in Risk of Very Large Fires by Mid-Century



Increase in Weeks with Risk of Very Large Fires (%)

0 50 100 200 300 400 500 600

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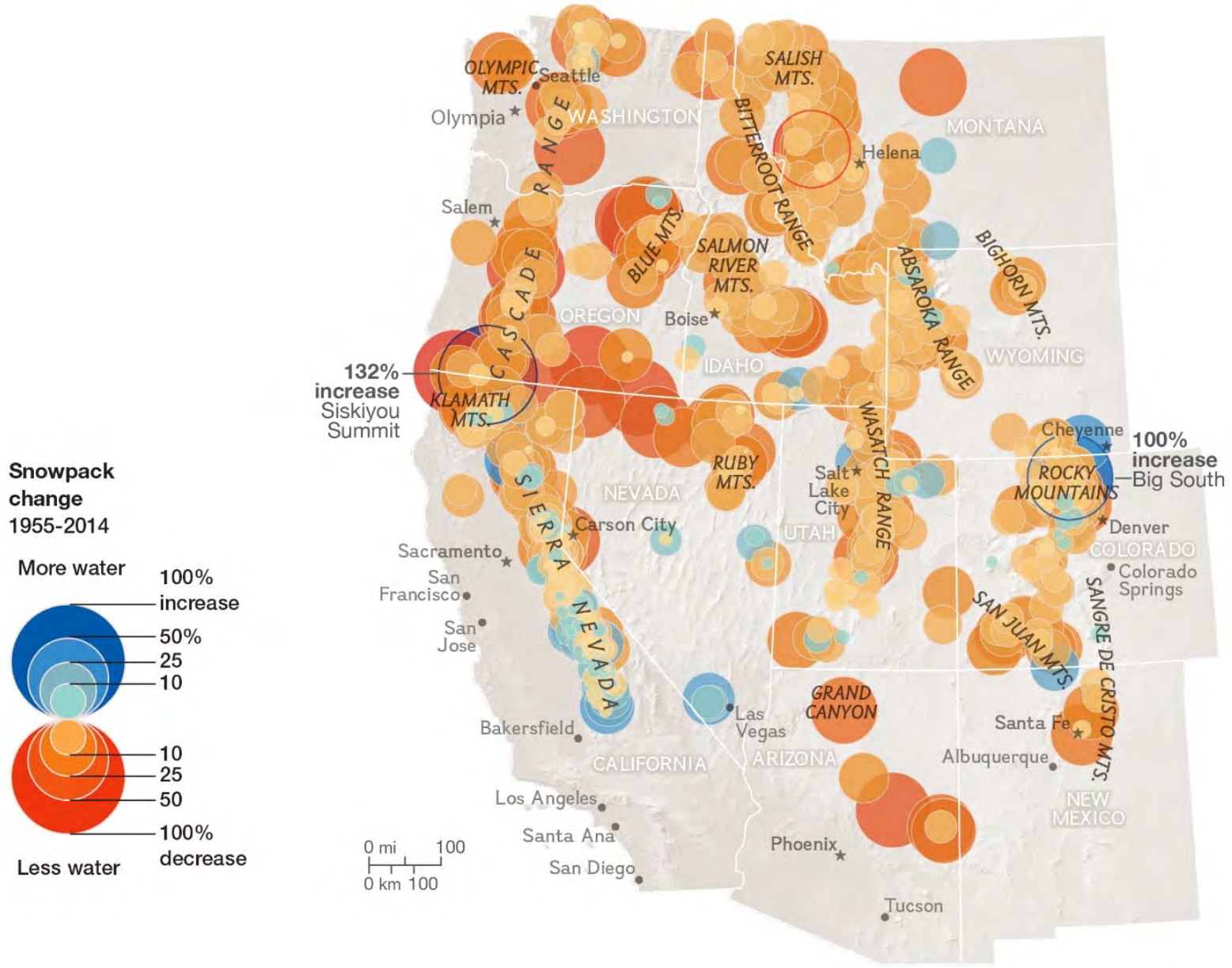
Southwest Climate Hub

Snowpack

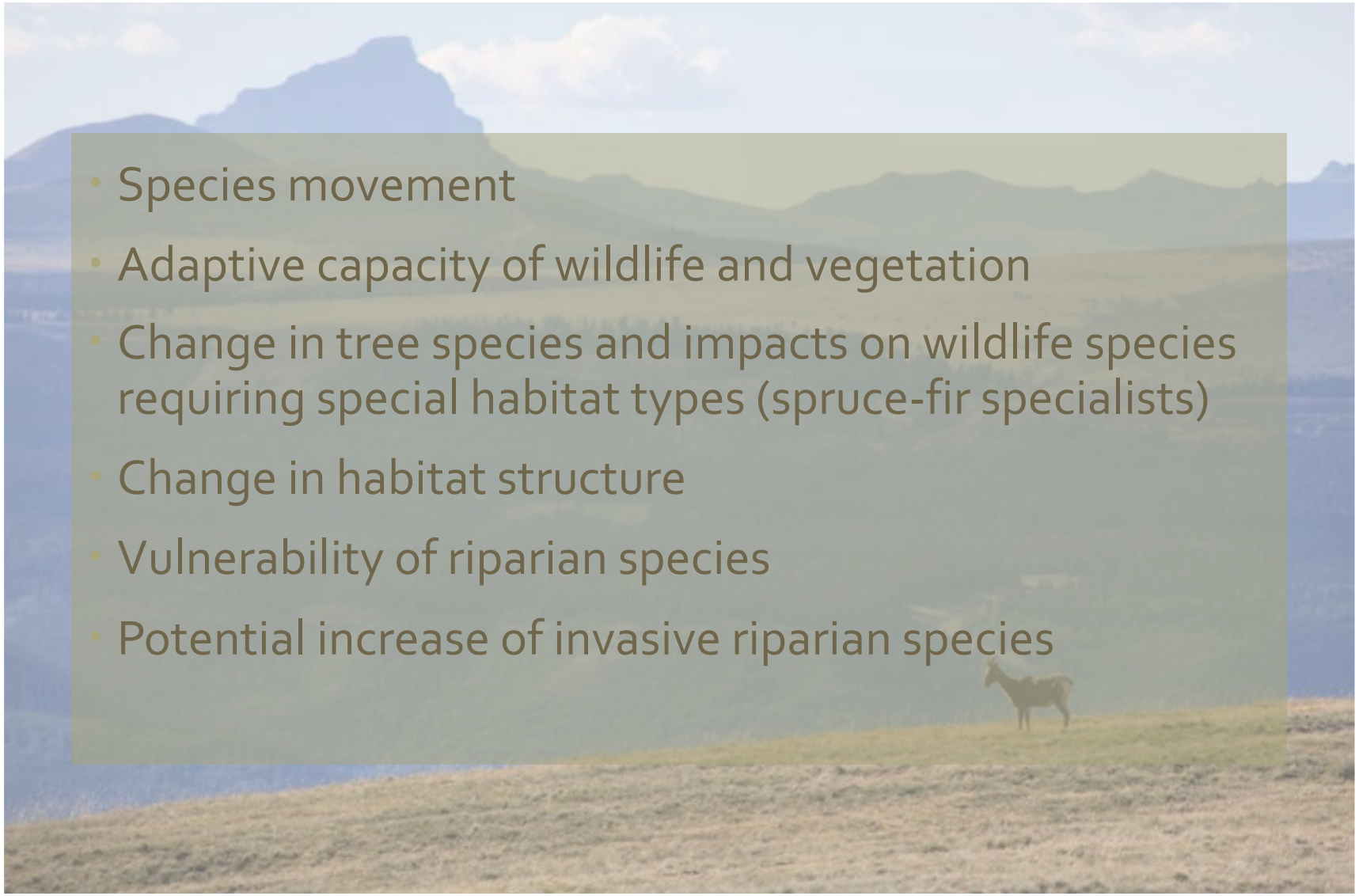


VIRGINIA W. MASON AND KELSEY NOWAKOWSKI, NGM STAFF. SOURCES: NATURAL RESOURCES CONSERVATION SERVICE; CALIFORNIA DEPARTMENT OF WATER RESOURCES; DARRIN SHARP AND PHILIP MOTE, OREGON STATE UNIVERSITY

Hydrology

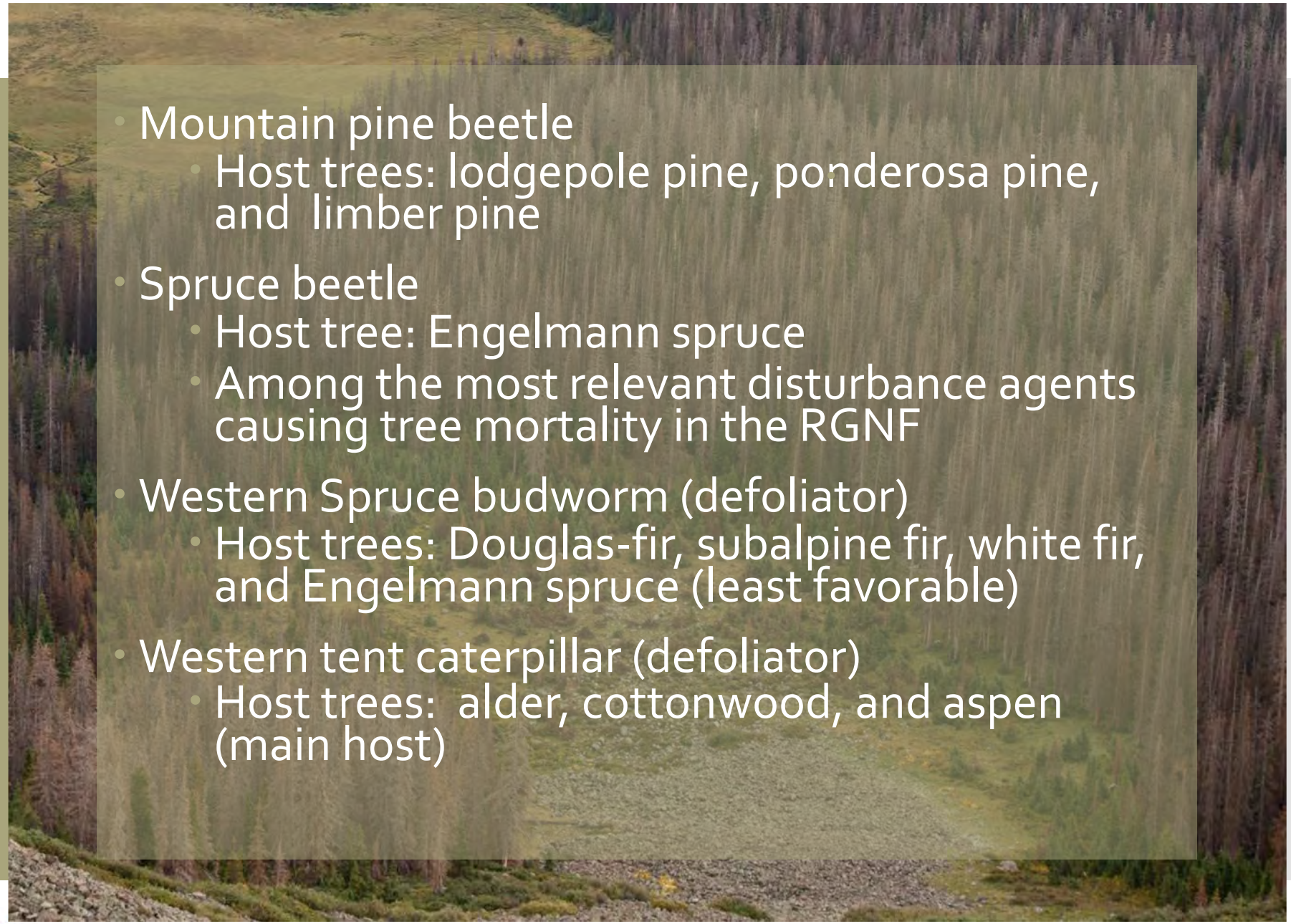
Declining snowpack, heavy rainfall, and summer droughts are increasing the risk of winter flooding, low summer streamflow, and reduced water quality

Wildlife



- Species movement
- Adaptive capacity of wildlife and vegetation
- Change in tree species and impacts on wildlife species requiring special habitat types (spruce-fir specialists)
- Change in habitat structure
- Vulnerability of riparian species
- Potential increase of invasive riparian species

Insects



- Mountain pine beetle
  - Host trees: lodgepole pine, ponderosa pine, and limber pine
- Spruce beetle
  - Host tree: Engelmann spruce
  - Among the most relevant disturbance agents causing tree mortality in the RGNF
- Western Spruce budworm (defoliator)
  - Host trees: Douglas-fir, subalpine fir, white fir, and Engelmann spruce (least favorable)
- Western tent caterpillar (defoliator)
  - Host trees: alder, cottonwood, and aspen (main host)

"Climate Change and Selected Forest Insect and Pathogens in the Rio Grande National Forest" (Negrón 2019)

Pathogens

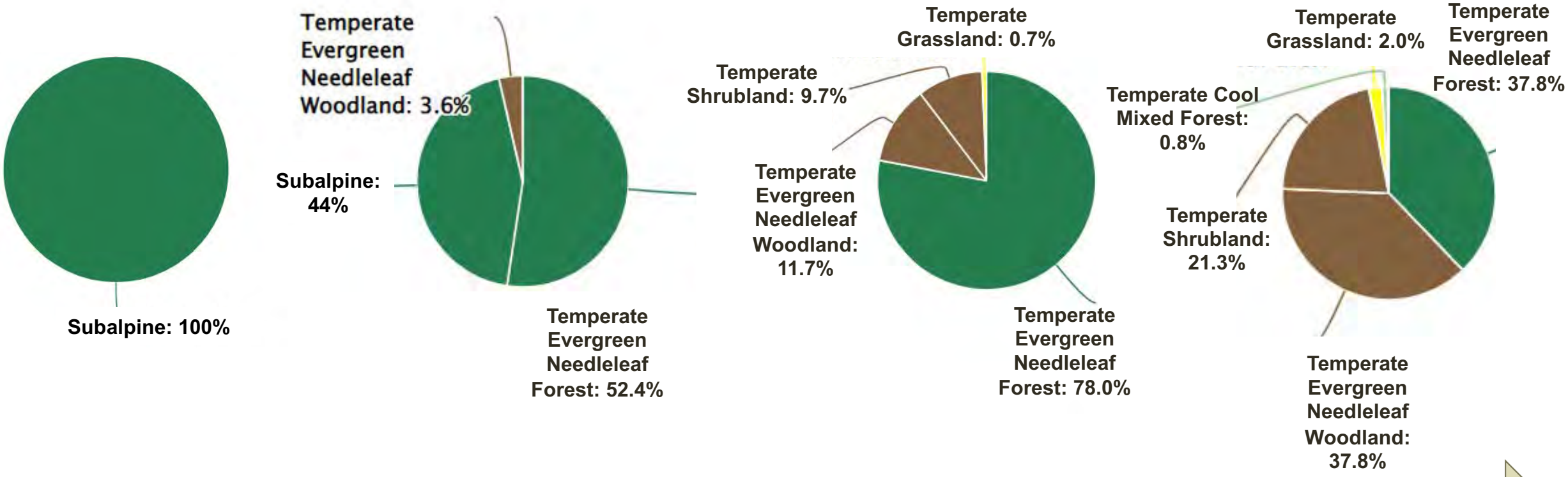
- Dwarf mistletoes
- Armillaria root disease
- White Pine Blister Rust
- Sudden Aspen Decline


White Pine Blister Rust (USFS)


Dwarf mistletoe (Colorado State Forest Service)

"Climate Change and Selected Forest Insect and Pathogens in the Rio Grande National Forest" (Negrón 2019)

Climate-Driven Shifts in Vegetation Cover



Shifts in modeled vegetation class under RCP 8.5,
with fire suppression

https://climatetoolbox.org/tool/Future-Vegetation

Thank you!

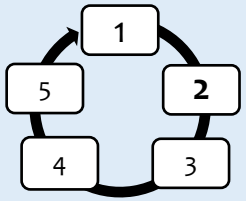
Lauren Kramer:
Lauren.Kramer@usda.gov

https://www.climatehubs.usda.gov/hubs/southwest

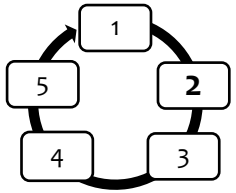
USDA Southwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

References

- The Climate Toolbox https://climatetoolbox.org/
- Climate by Forest https://climate-by-forest.nemac.org/
- Box folder “climate_change_workshop”



Step 2: How will climate change impacts affect your local area?



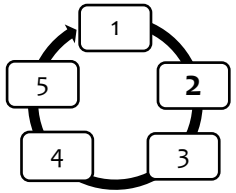
Step 2: ASSESS climate change impacts and vulnerabilities

Purpose:

- Consider how climate change may specifically affect the project area

Key Questions:

- How might the area be uniquely affected by climatic change and subsequent impacts?
- How might regional impacts be different in the project area?



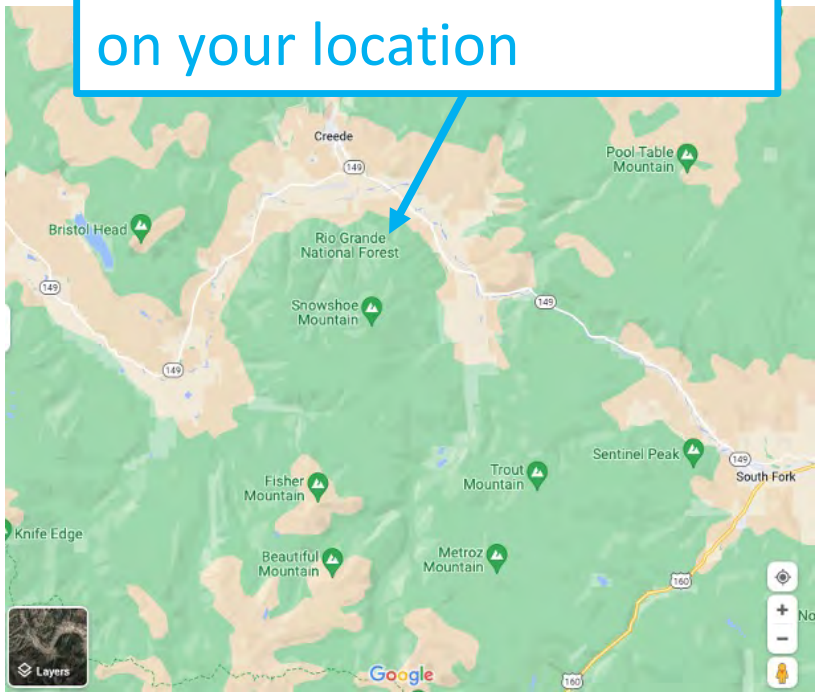
Step 2: ASSESS climate change impacts and vulnerabilities

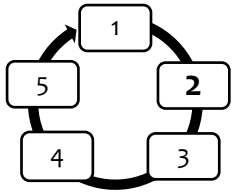
Regional Impacts:

- Warmer temperatures
- Longer growing season
- Less snow and shorter winters
- Altered seasonal precipitation and streamflows
- Increased summer moisture stress and drought
- More frequent heavy precipitation events
- Less suitable habitat for northern & alpine species
- More suitable habitat for southern species
- Increases in insect pests and forest pathogens
- Increases in non-native plants
- Potential changes in wildfire regimes

How will my site be uniquely affected???

List of impacts is based on your location





Step 2: ASSESS climate change impacts and vulnerabilities

Regional Climate Impacts
Based on regional info

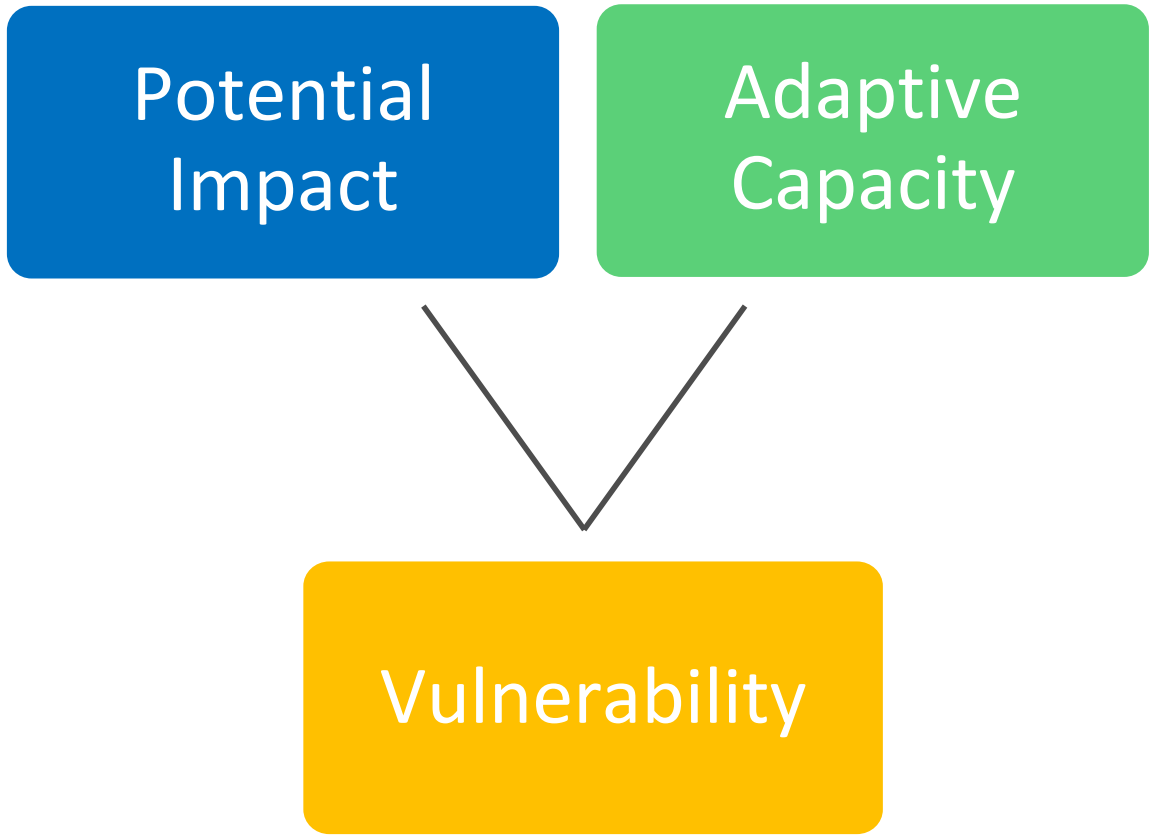
You will describe site-specific considerations
Based on your expertise

Mgmt. Unit/ Topic	Climate Change Impacts and Vulnerabilities	
	Regional From vulnerability assessments	For the Property or Project Area Based on your knowledge of the site
Colorado State Forest	Uncertain changing precipitation patterns	• Decreases in snow during winter months and less rain during spring/summer months may impact seedling regeneration and survival
	Longer growing seasons	• Spruce beetle populations emerging earlier in the spring

Vulnerability Components

Direct and indirect effects of climate change (sensitivity + exposure)

- Temperature
- Precipitation
- Stressors
- Species shifts

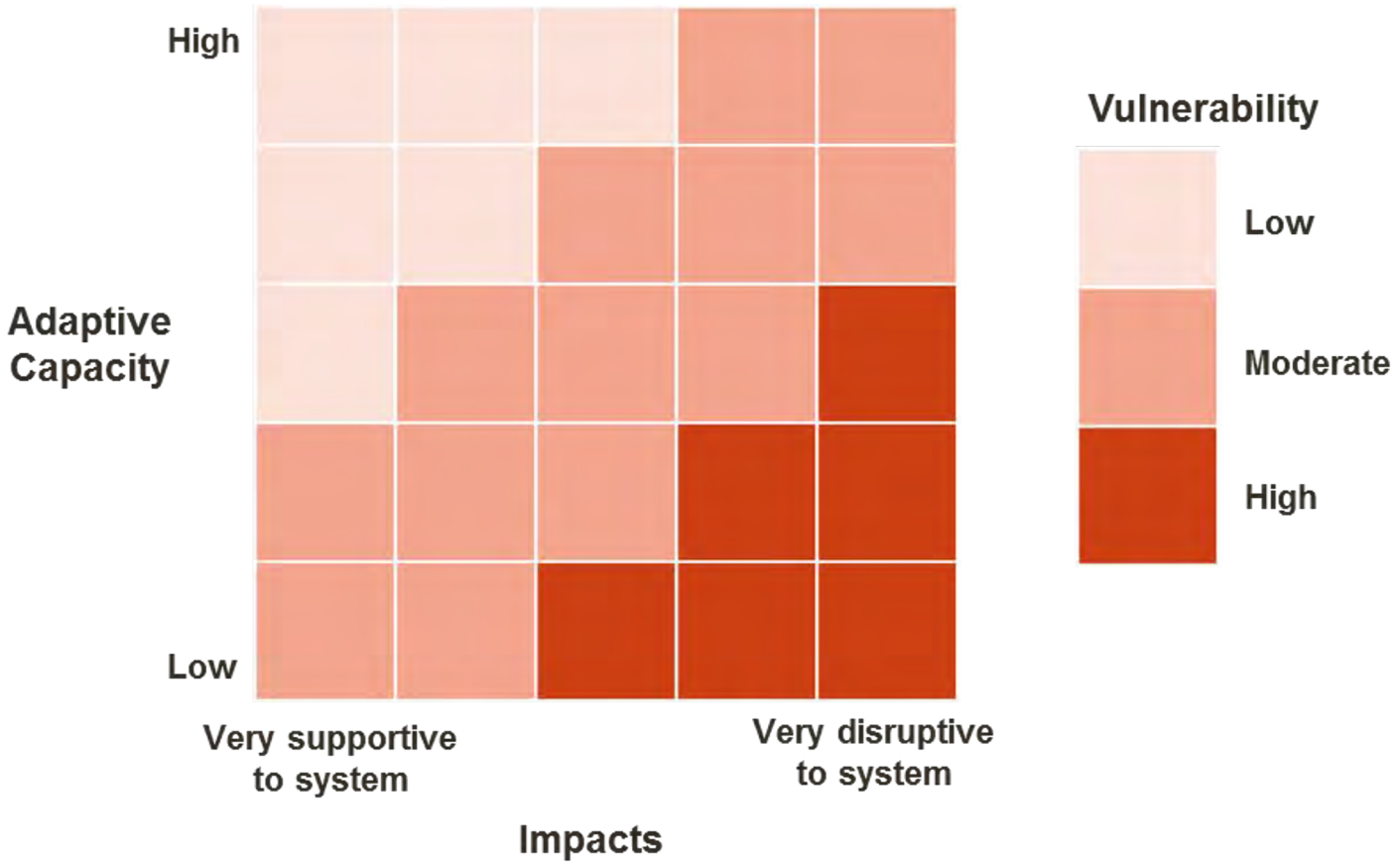


Ability of the system to cope with change

- High diversity
- Species tolerance or plasticity
- Multiple ways to respond to disturbance (e.g. upslope movement)

Vulnerability Determination

How would you rate the overall climate vulnerability of your project area?

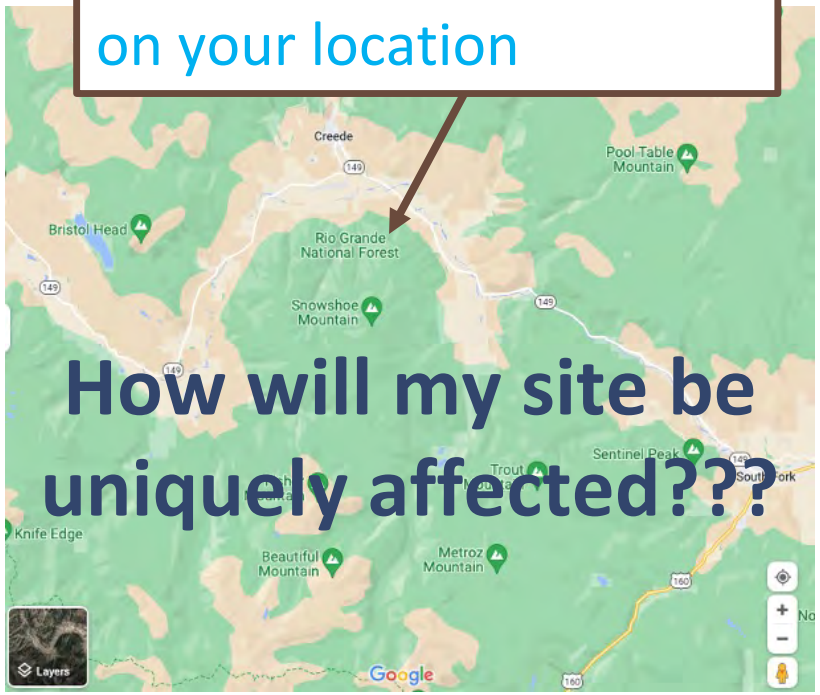


Work Time

- Read through impacts list
- Write down key impacts for your project area
- Write down local considerations that may make your area more less/vulnerable for each selected impact

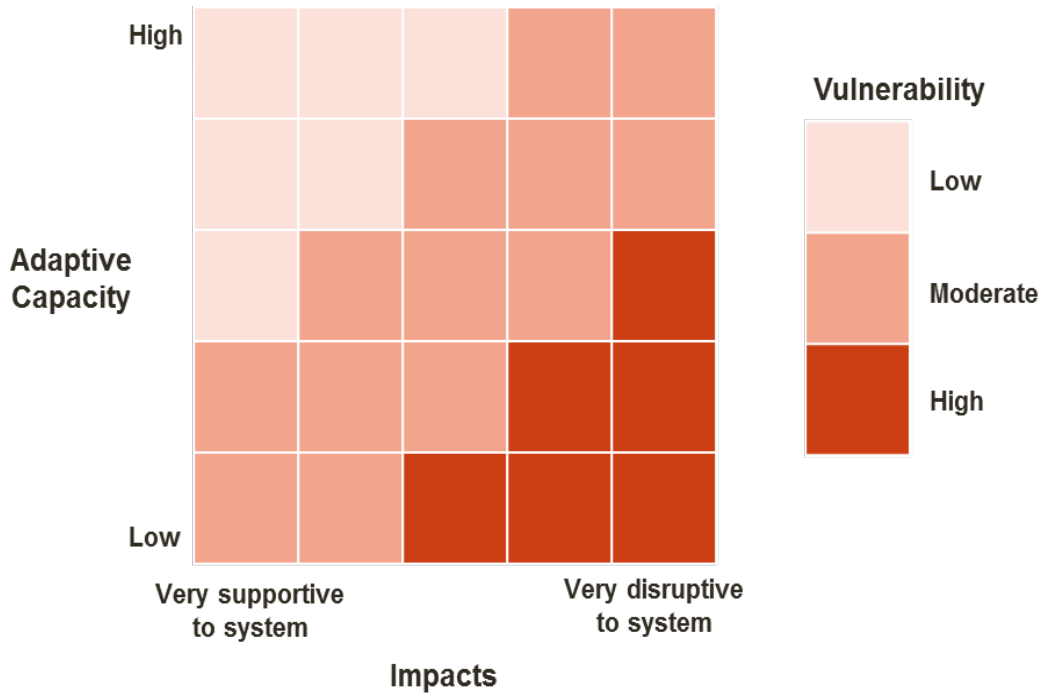
Regional Impacts:

List of impacts is based on your location

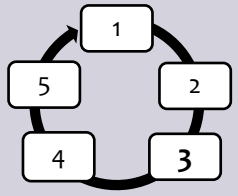


Impacts & Vulnerability Group Synthesis

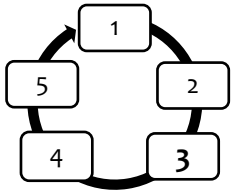
- Key impacts are listed on papers around the room
- Use dots to vote on which impacts are going to affect your project most (3 votes per person)
- Discuss your project's overall impacts and adaptive capacity and select a rating to place on the figure




Break



Step 3: What challenges or opportunities does climate change present?



Step 3: Evaluate management objectives given climate change

Purpose: Realistically assess the ability to meet goals and objectives under current management.

Key Questions:

- How might climate change challenge our ability to meet goals and objectives for the project?
- Are there climate-related opportunities?
- Do our objectives need to change?

Photo: https://www.fs.usda.gov/gmug

Climate Vulnerability vs. Challenges to Objectives

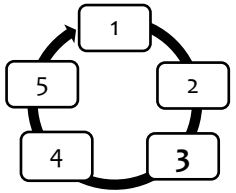
Step 2 is about the place:

- Detailing site characteristics that may present climate-related vulnerabilities

Step 3 is about your goals

- Describe how climate change may affect your ability to achieve the project goals and objectives

Similar but <u>different</u>!

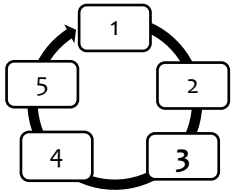


Step 3: Evaluate management objectives given climate change

Challenges to Meeting Management Objective with Climate Change: Things that will make it harder to achieve the management objective due to climate change.

Opportunities to Meeting Management Objective with Climate Change: Things that will make it easier to achieve the management objective due to climate change.

***Focus on challenges within control of your management (not global markets, policies, etc.)*



Step 3: Evaluate management objectives given climate change

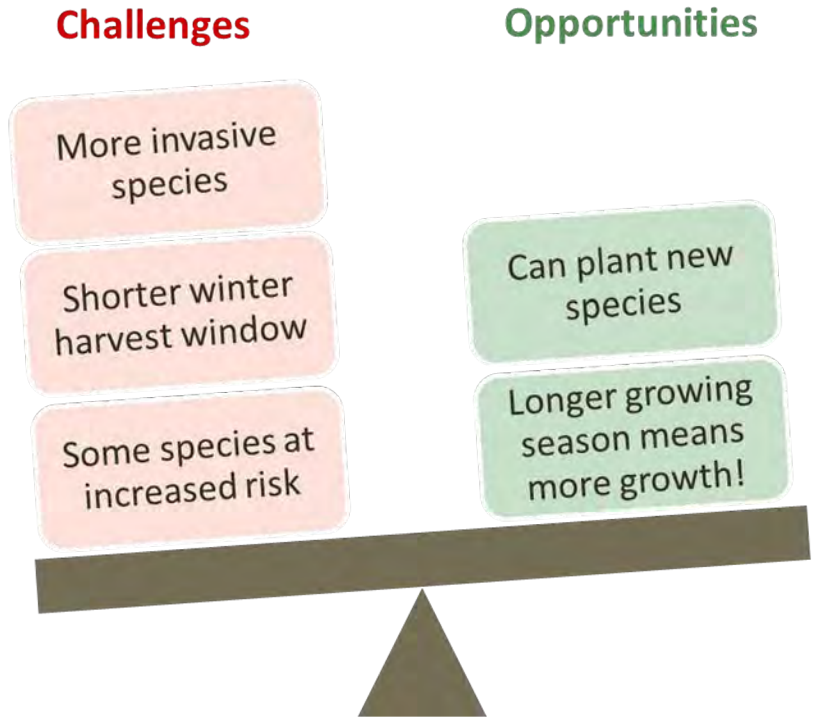
Feasibility – Can you meet your management objectives using current (business-as-usual) management actions?

High: We can do it! *Opportunities > Challenges*

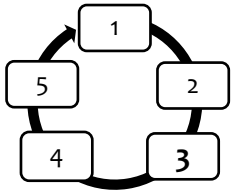
Moderate: Somewhere in the middle

Low: We'll need more resources or effort.

Challenges > Opportunities

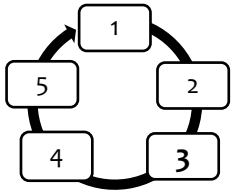


Other Considerations – Social, financial, or other factors that also affect your ability to meet objectives.

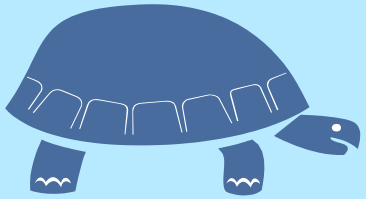


Step 3: Evaluate management objectives given climate change

Objective	Challenge from Climate Change	Opportunity from Climate Change	Feasibility	Other considerations
Create opportunities for carbon sequestration through large tree retention	Drought stressed trees have increased susceptibility to bark beetle attacks	Increased drought conditions hinder fungi growth and promote tougher leaves that are less palatable to pests Increased habitat range for Douglas-fir, aspen, and ponderosa pine (possible assisted migration)	Moderate	Higher elevation species have no where to migrate up to
Utilize low intensity understory prescribed fire as an initial treatment	Increasingly hot/dry conditions may limit the windows available to conduct Rx fire.	Fire promotes species diversity and resilient systems due to more diverse sets of genes in the ecosystem that react to fires differently	Low	Capacity and personnel availability to implement Rx fires are limited.

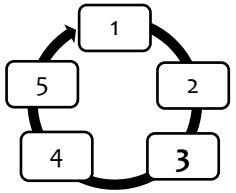


Step 3: Evaluate management objectives given climate change

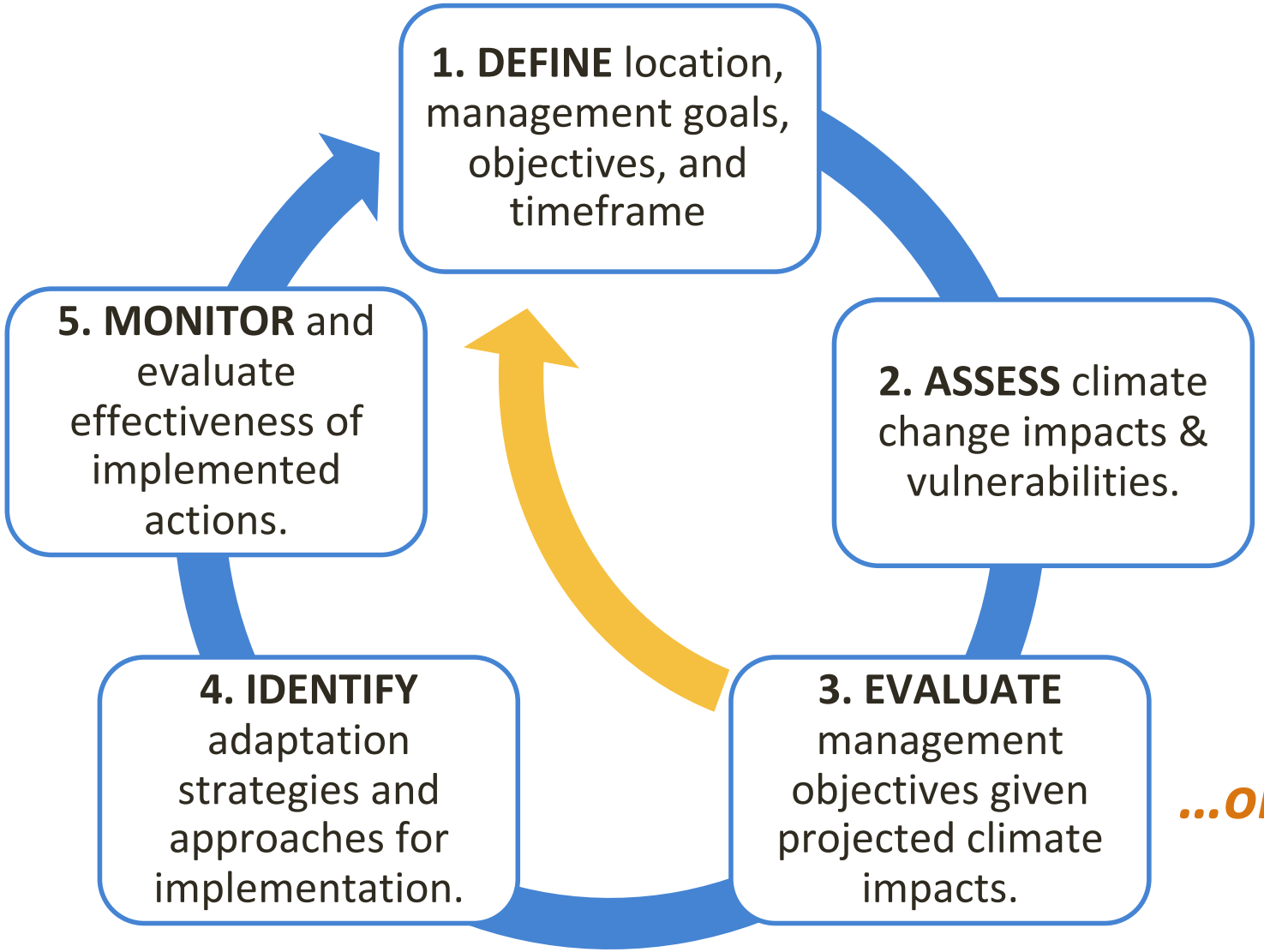


Slow down!

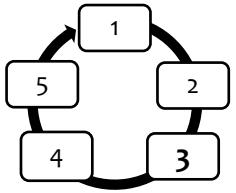
Are you going to continue with the management goals and objectives that you have identified?



Step 3: Evaluate management objectives given climate change



…or, RE-EVALUATE



Step 3: Evaluate management objectives given climate change

1. DEFINE location, management goals, objectives, and timeframe

2. ASSESS climate change impacts & vulnerabilities.

3. EVALUATE management objectives given projected climate impacts.

4. IDENTIFY adaptation strategies and approaches for implementation.

5. MONITOR and evaluate effectiveness of implemented actions.

Update Management Goals/Objectives in Step 3 if necessary

…or, RE-EVALUATE

In Breakout Groups:

Brainstorm:

- What are the climate-related challenges to achieving your objectives?
- What are the climate-related opportunities to achieving your objectives?
- [As time allows] Discuss feasibility of meeting objectives under ‘business as usual’ management.

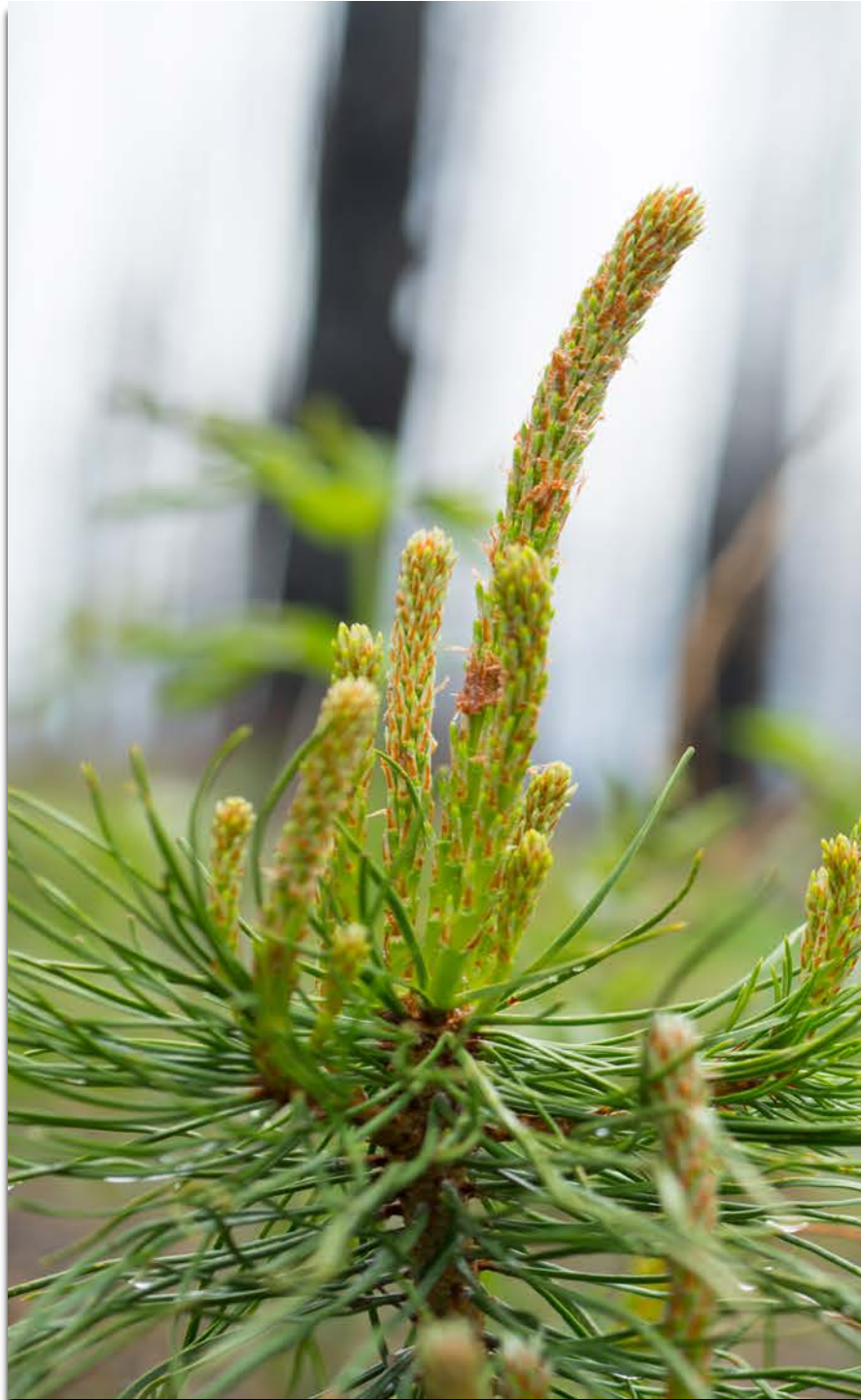
4:10 pm – Reconvene for discussion.

** Focus on climate-related challenges (not global markets, policies, etc.)*

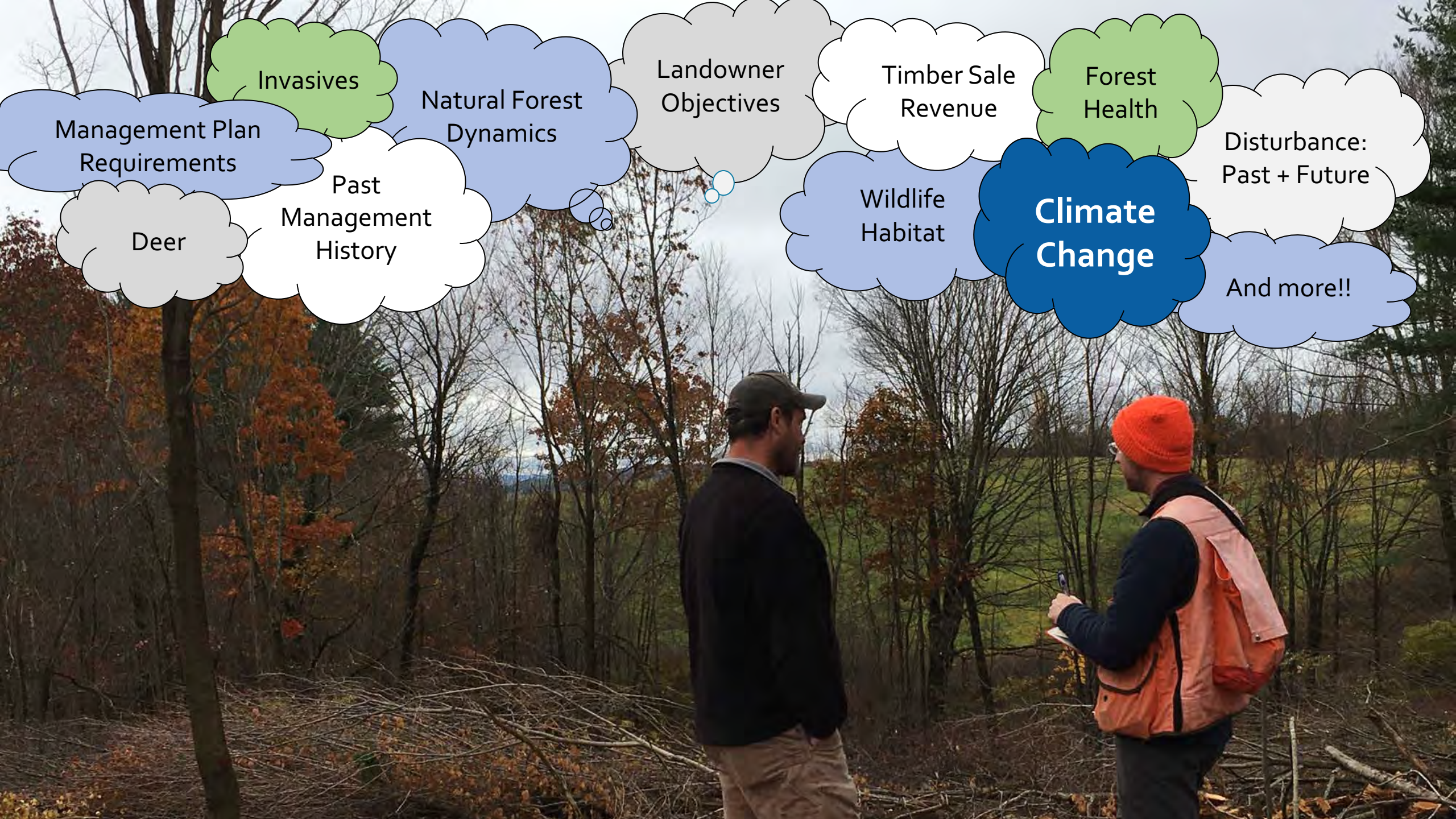
DISCUSSION

Write down:

- One key challenge (pink sticky)
- One key opportunity (green sticky)



Adapting to Climate Change


Invasives
Natural Forest Dynamics
Landowner Objectives
Timber Sale Revenue
Forest Health
Management Plan Requirements
Disturbance: Past + Future
Deer
Past Management History
Wildlife Habitat
Climate Change
And more!!

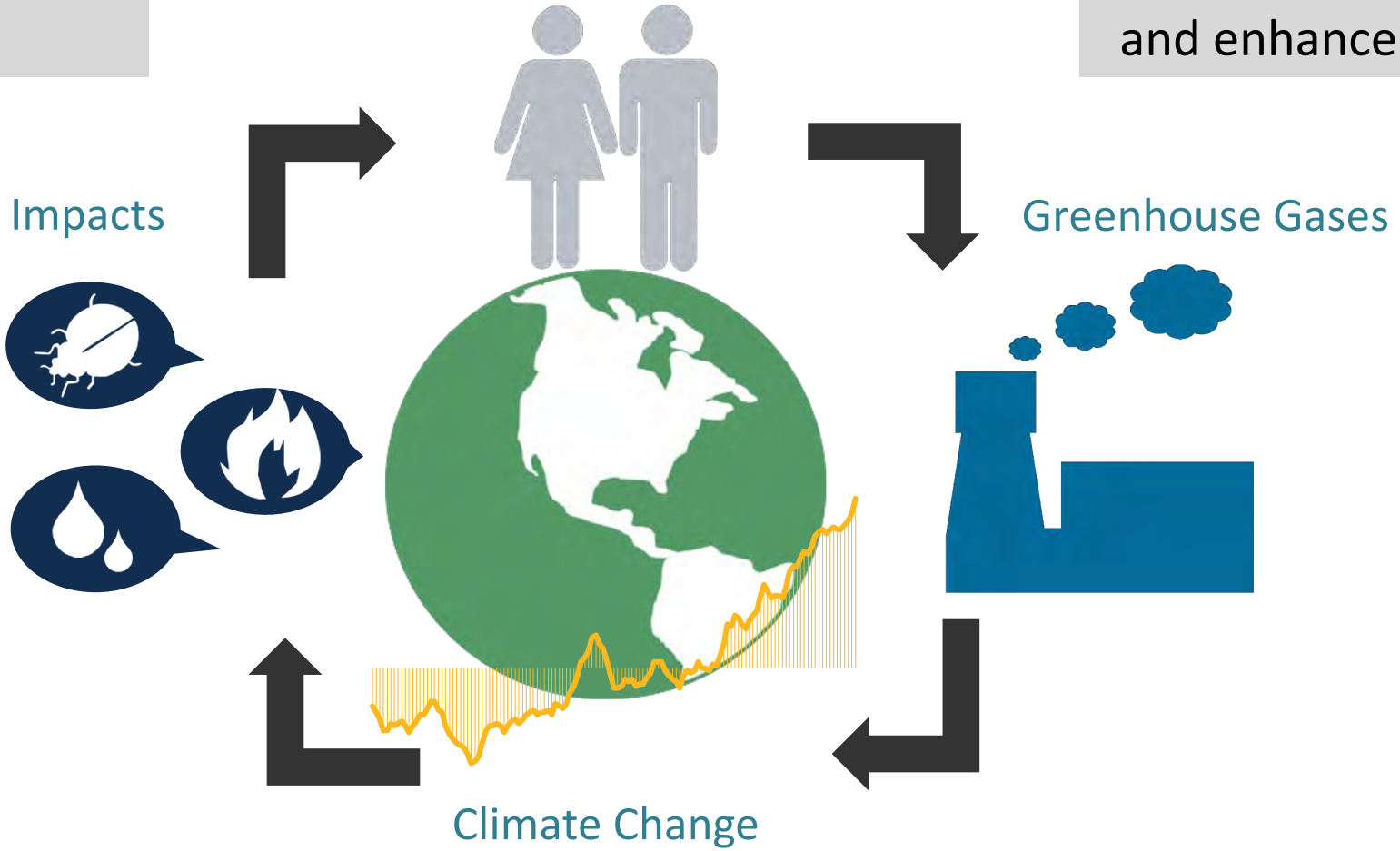
How can we respond to climate change?

Adaptation

Actions to reduce the vulnerability of systems to climate change effects.

Mitigation

Actions that reduce greenhouse gas emissions and enhance carbon sinks.

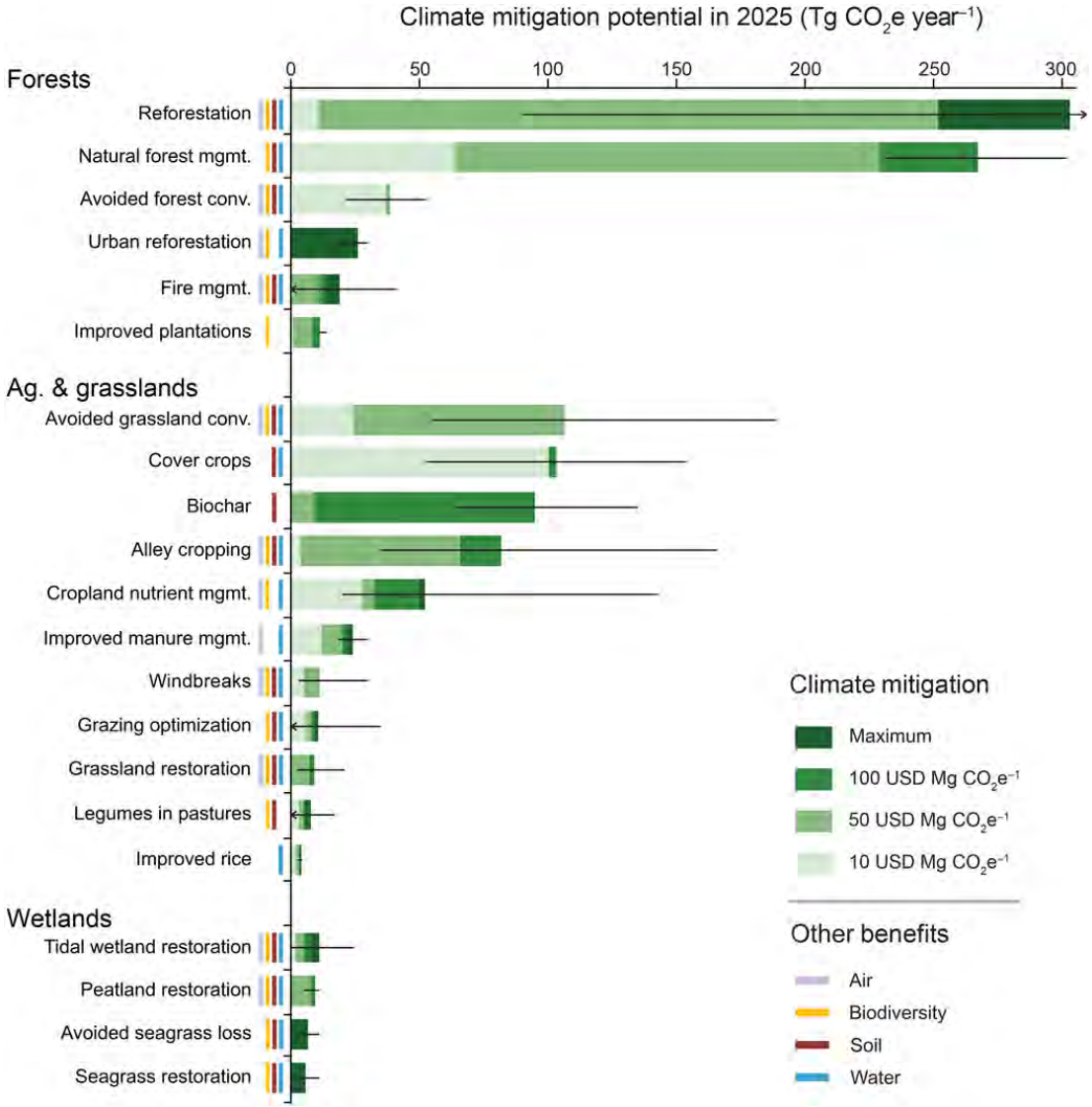


Mitigation – Efforts to reduce or prevent emissions of greenhouse gases (GHGs). – UN Environment Definition

https://www.un.org/en/sections/issues-depth/climate-change/

This can be done through new technologies, renewable energy, changing consumer behaviors, and changing management practices.

Climate mitigation potential of 21 Natural Climate Solutions in the United States



A changing climate puts those forests *and the carbon they sequester* at risk

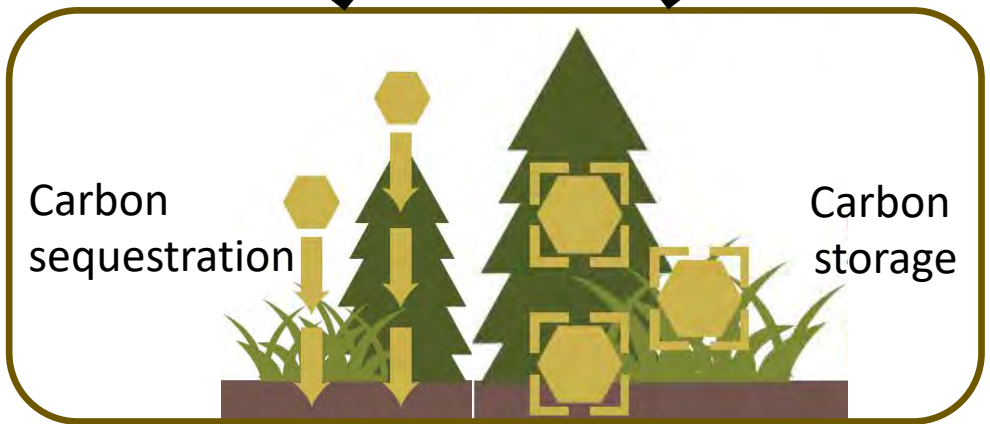
Joseph E. Fargione et al. Sci Adv 2018;4:eaat1869

ScienceAdvances
AAAS

Forest Management for Climate Adaptation & Carbon Mitigation

Avoid forest carbon losses
(adaptation)

Increase existing forest carbon
(mitigation)



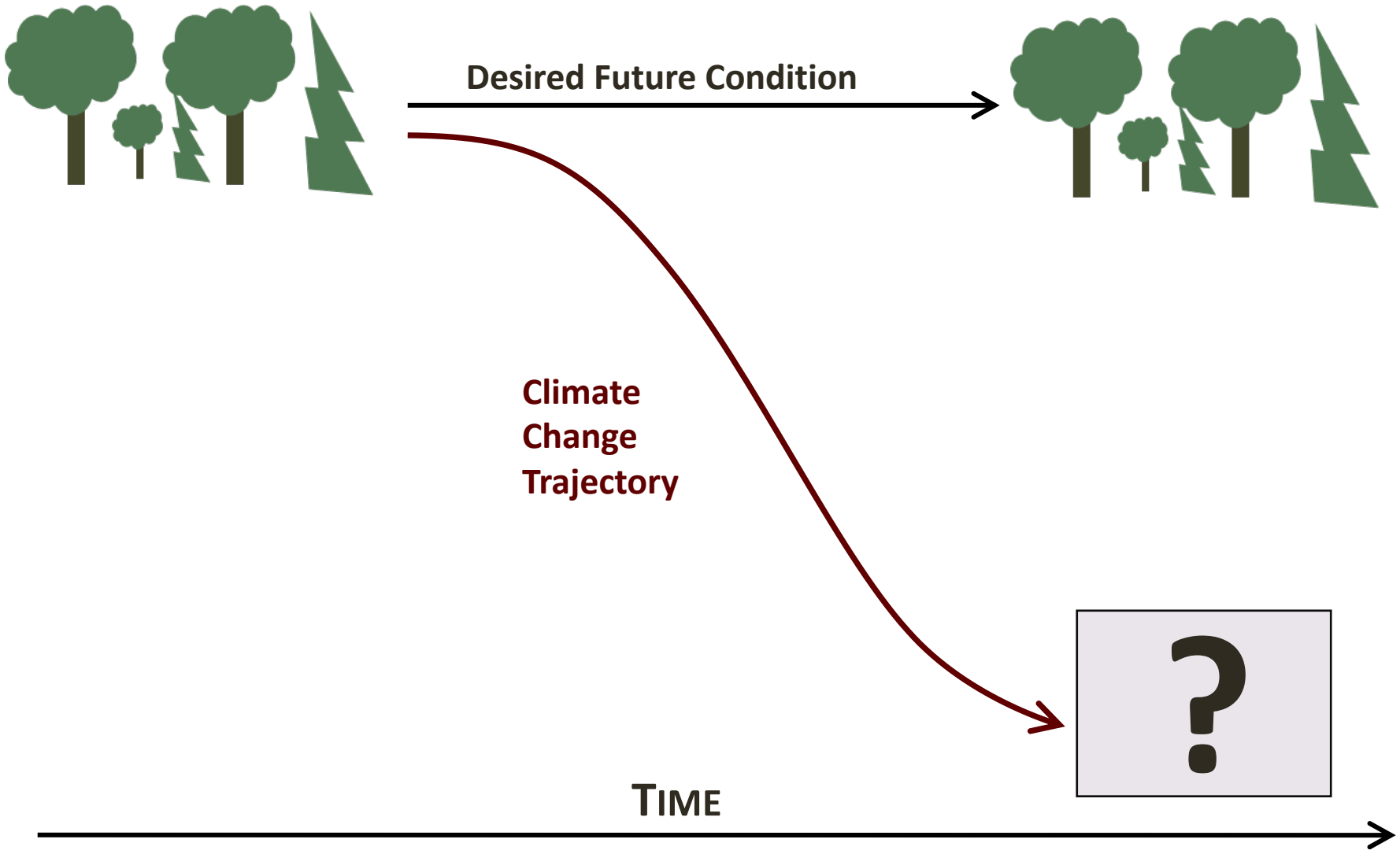
Adaptation - the adjustment of systems in response to climate change.

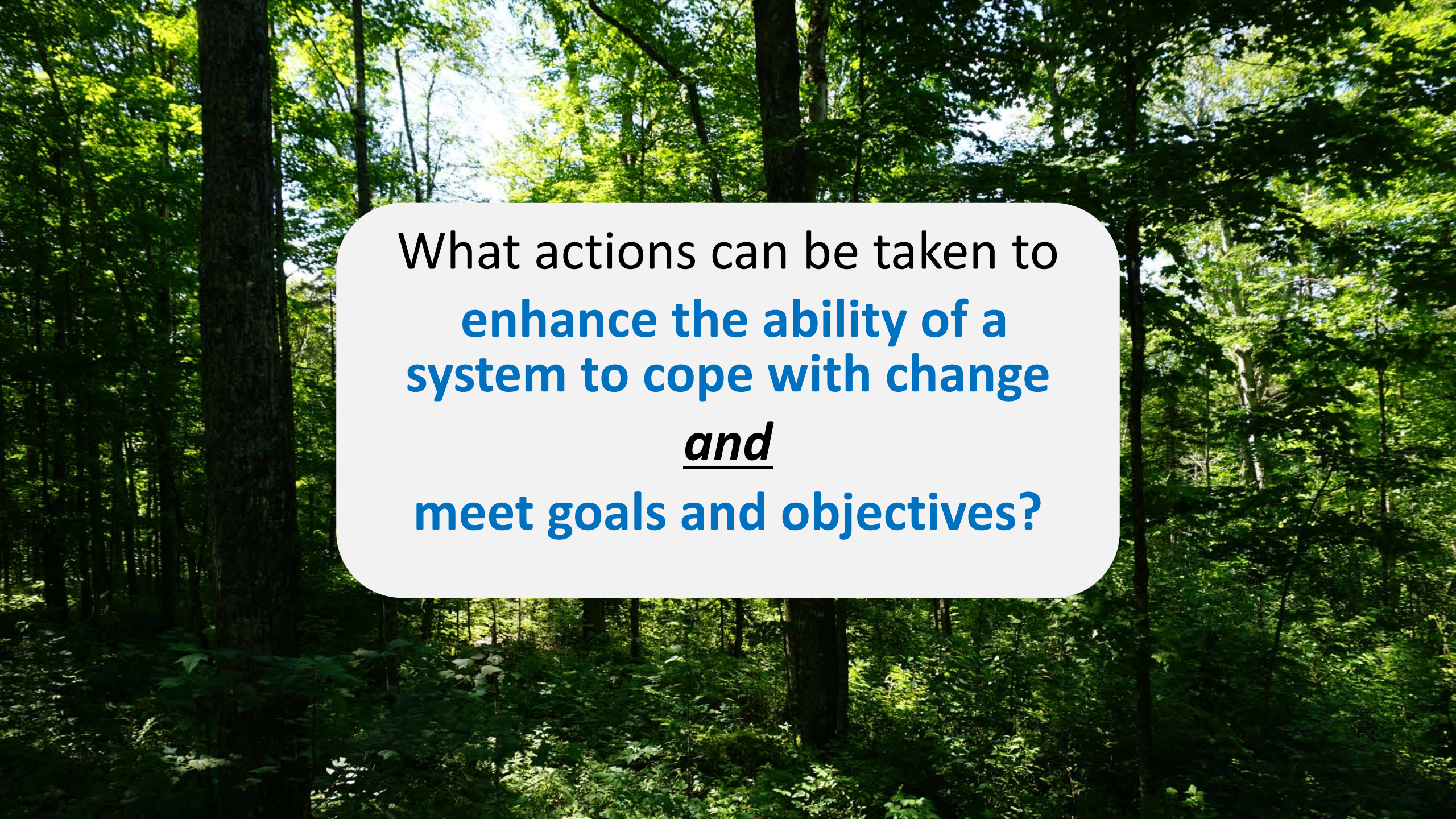



Ecosystem-based adaptation activities build on sustainable management, conservation, and restoration.

- What do you value?
- How much risk are you willing to tolerate?

Climate-Driven Changes



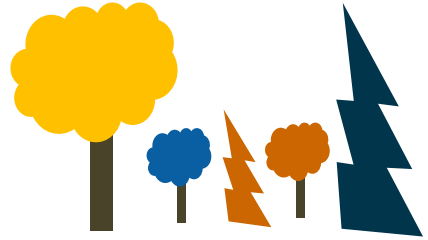

What actions can be taken to
enhance the ability of a system to cope with change
and
meet goals and objectives?

Adaptation Options

RESISTANCE

RESILIENCE

TRANSITION



Identify and implement actions that are

robust across a range of potential future conditions

Millar et al. 2007, Swanston et al. 2016, Nagel et al. 2017

Resistance

Improve the defenses of the system against anticipated changes or directly defending against disturbance in order to maintain relatively unchanged conditions.

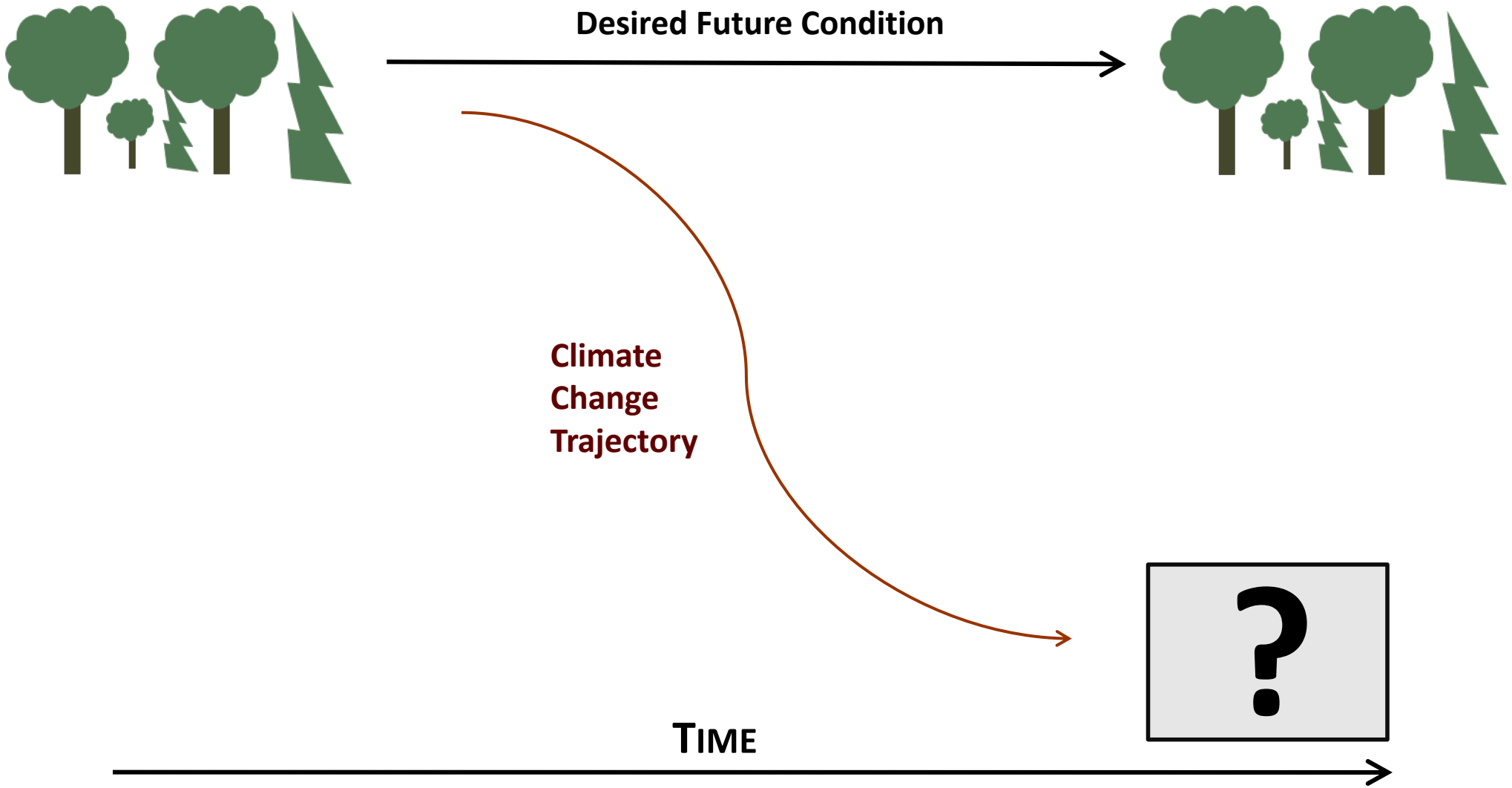
Road crossings that can withstand flood events (USFS, Monongahela NF)

Threatened Dwarf lake iris (FWS)

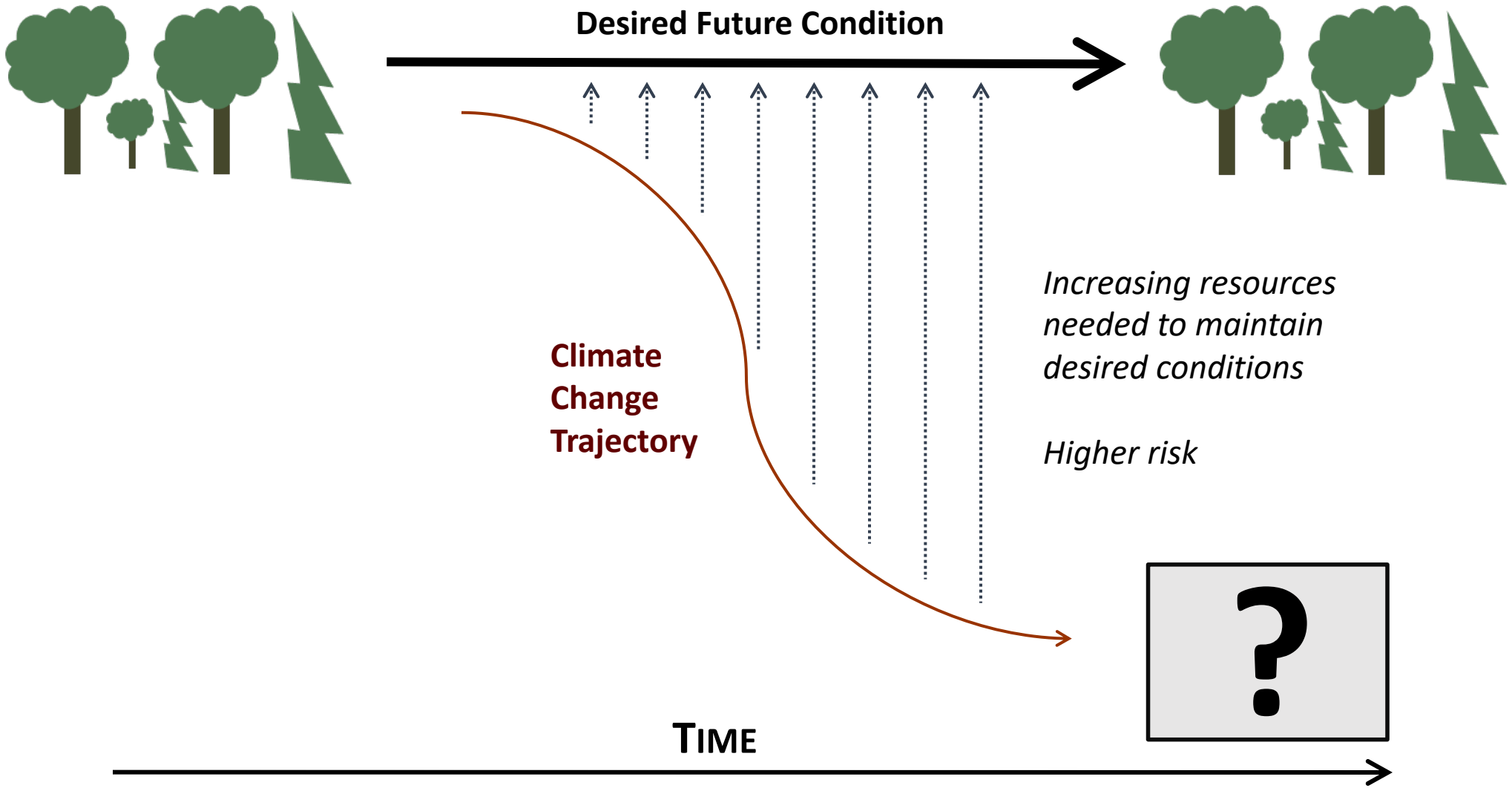
Invasive species management (USFS)

Millar et al. 2007, Swanston et al. 2016, Nagel et al. 2017

Resistance



Resistance


Desired Future Condition
Climate Change Trajectory
Increasing resources needed to maintain desired conditions
Higher risk
?
TIME

Resilience

Accommodate some degree of change or disruption, but be able to return to a similar condition after disturbance.

- Improve overall health & vigor
- Management of vegetation following disturbance

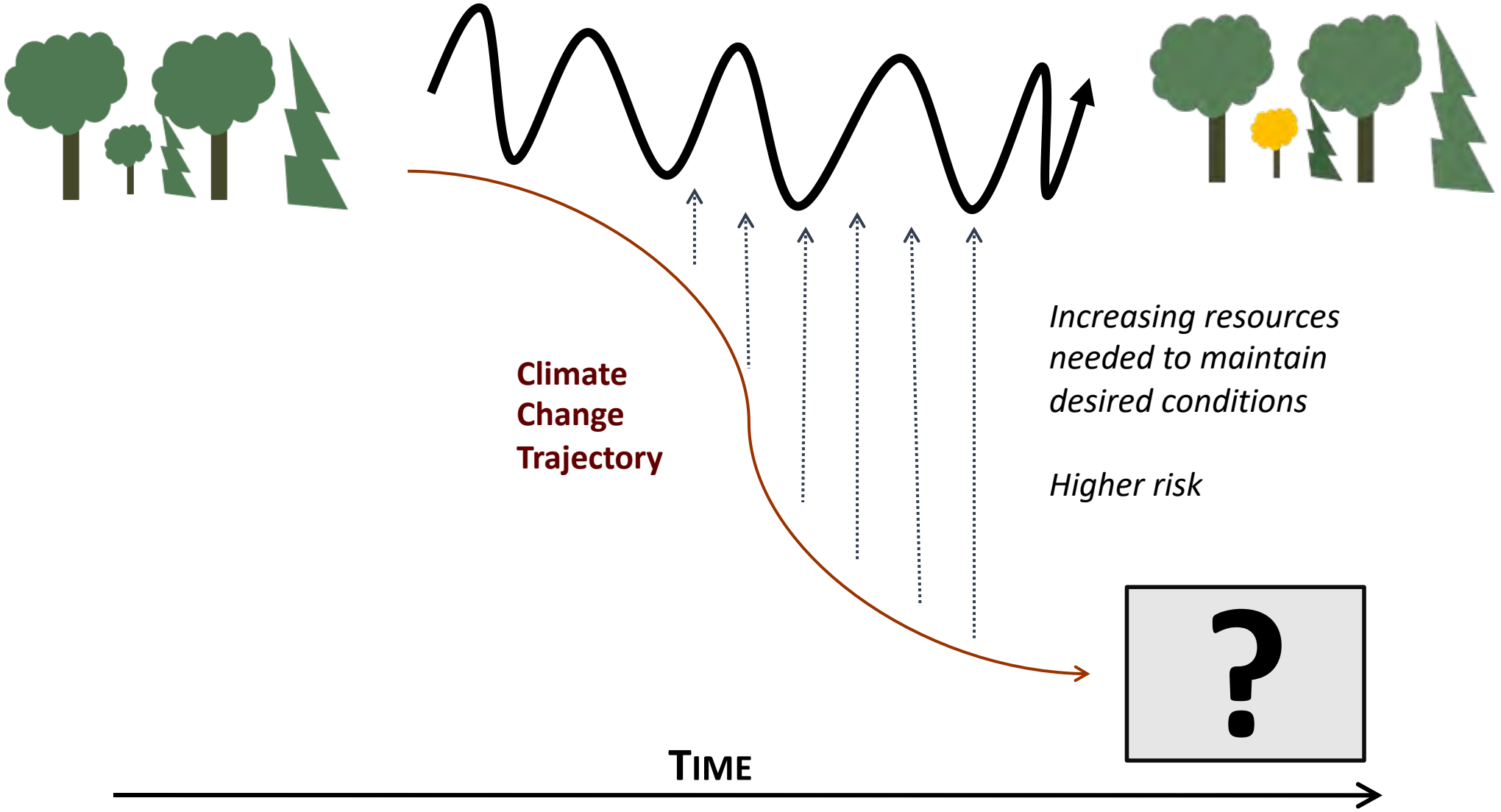
Prescribed burning to regenerate fire-adapted species

Reducing overstocked stands (Tahoe NF)

Increasing setbacks to allow for fluctuating water levels.

Holling 1973, Millar et al. 2007, Swanston et al. 2016
See also – Moser et al. 2019

Resilience

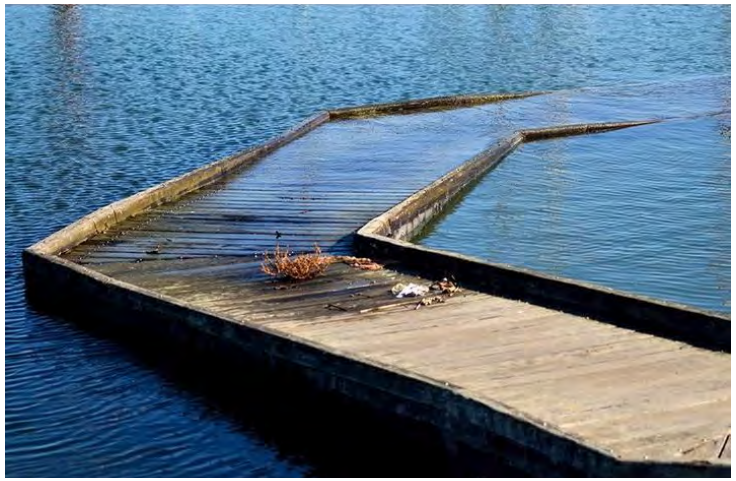

Climate
Change
Trajectory
Increasing resources
needed to maintain
desired conditions
Higher risk
?
TIME

Transition

Intentionally accommodate change and enable ecosystems to adaptively respond to changing and new conditions

- Foster well-adapted native species
- Relocate visitor and recreation infrastructure
- Accommodate new & altered hydrologic processes

Favoring native species that are expected to be adapted to future conditions.

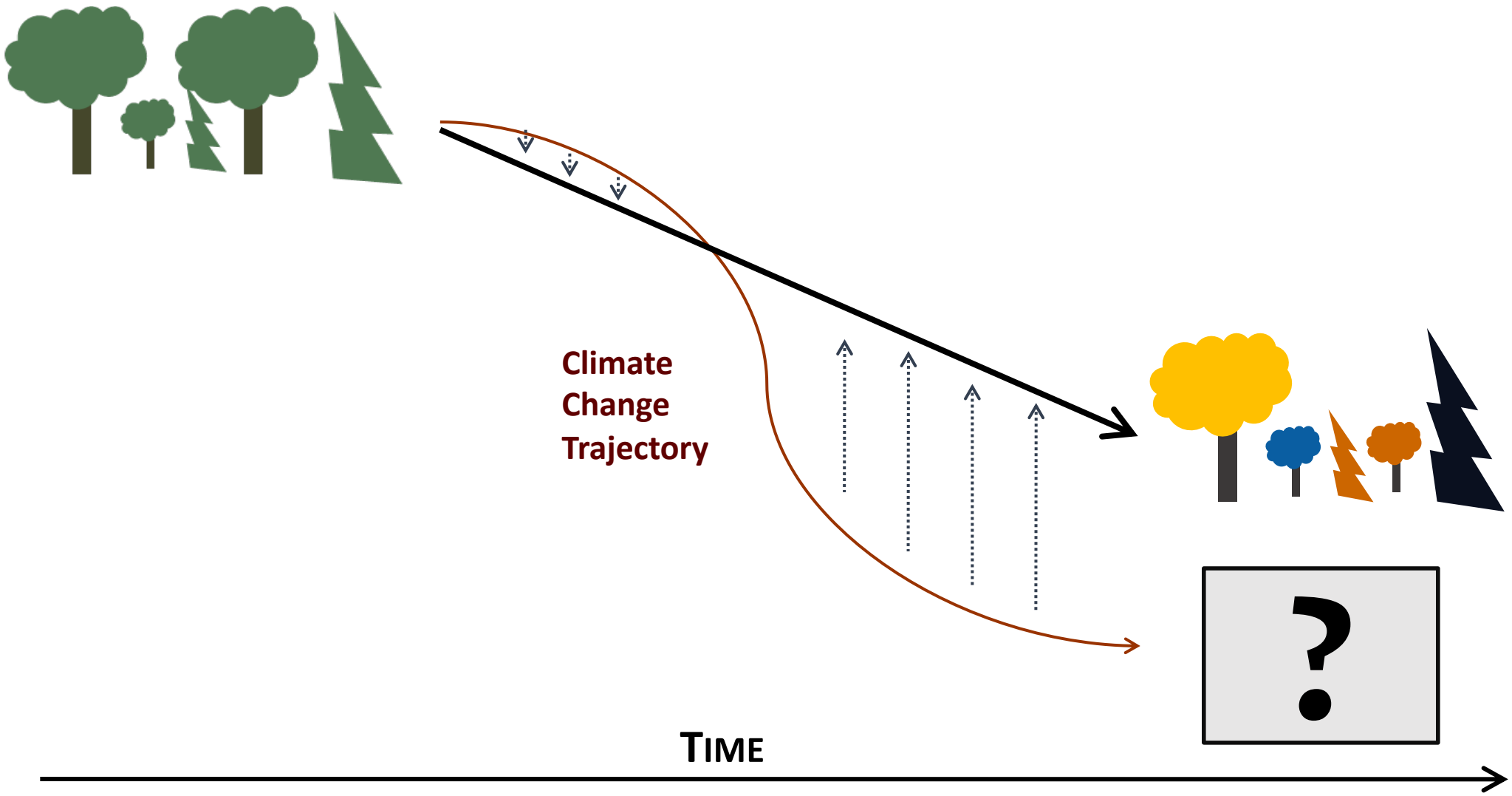


Relocate existing infrastructure to areas with less risk (P:Tom Hilton)

River & riparian area restoration in agricultural fields (P:Joann Kline)

Millar et al. 2007, Swanston et al. 2016, Nagel et al. 2017

Transition



Adaptation Options - Managing Risk

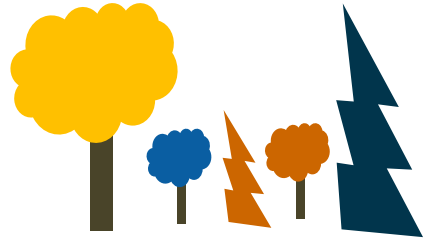
RESISTANCE

- Improve defenses of forest against change and disturbance
- Maintain relatively unchanged conditions

RESILIENCE

- Accommodate some degree of change
- Return to prior reference condition following disturbance

TRANSITION



- Intentionally facilitate change
- Enable ecosystem to respond to changing and new conditions

Reduce impacts/maintain current conditions

Forward-looking/promote change

Millar et al. 2007, Swanston et al. 2016, Nagel et al. 2017

Adaptation Concepts - RAD

Resist

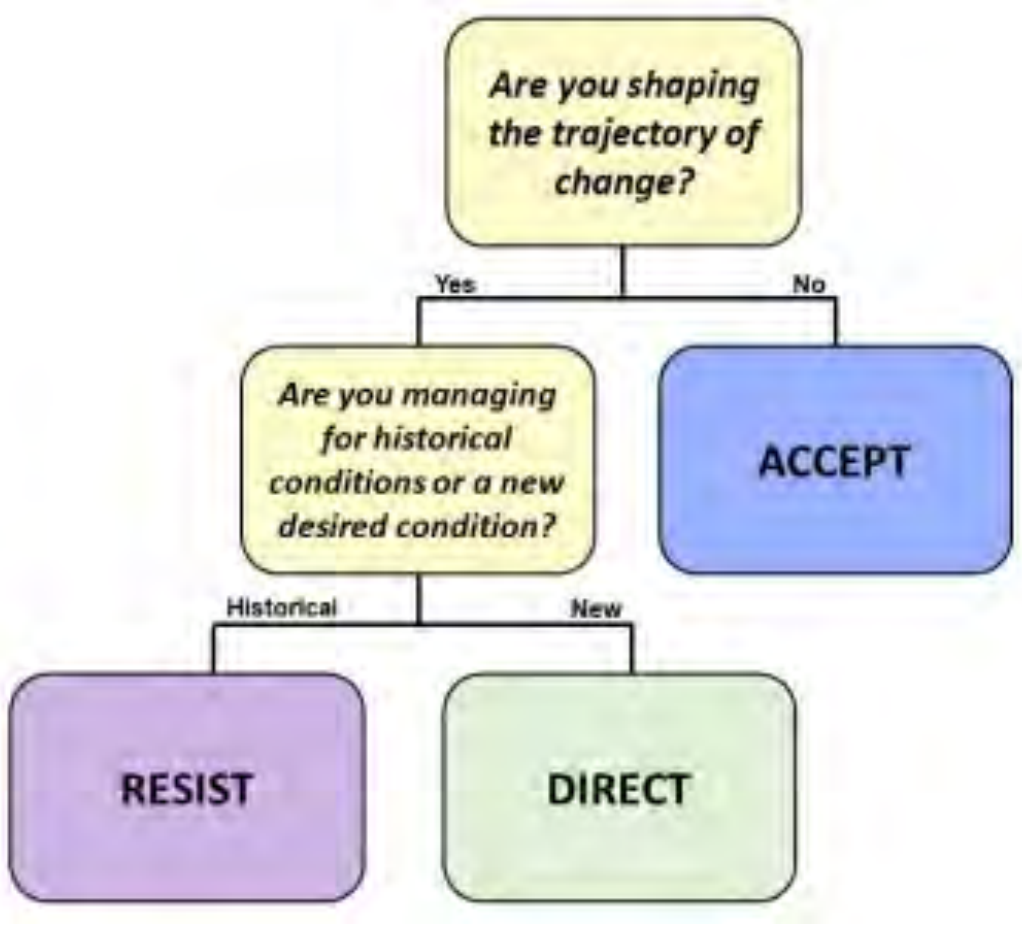
Maintain ecosystem processes, function, structure, or composition based upon **historical** or acceptable current conditions.

Accept

Allow ecosystem processes, function, structure, or composition to change, without intervening to alter their trajectory.

Direct

Actively shape ecosystem processes, function, structure, or composition towards **desired new conditions**.



Schuurman et al. 2020

The Bottom Line

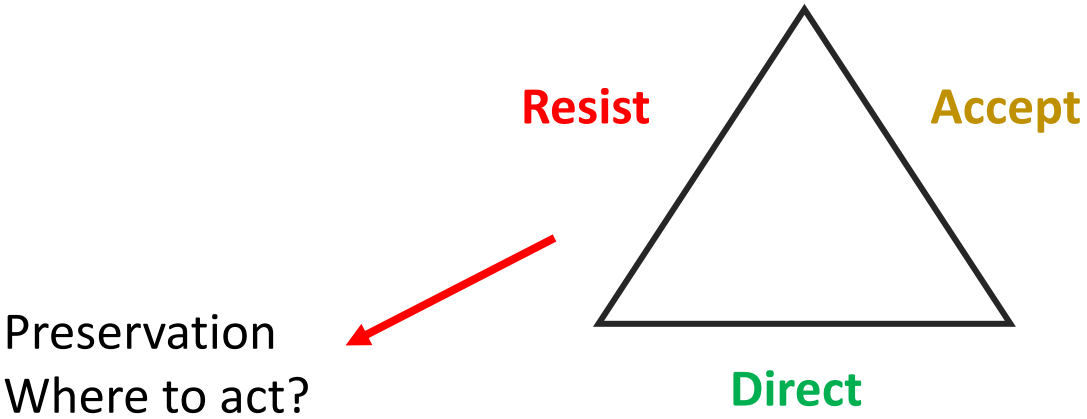
- Different conceptual frameworks may resonate with you depending on where you're coming from.

RESISTANCE

RESILIENCE

TRANSITION

- Active Management
- How to achieve goals?



- Preservation
- Where to act?

- All of these are meant to help you communicate what you're trying to do and be explicit about intent.

Intentionality

- Explicitly consider and address climate change
- Sure we might get lucky…
- Intentionally assessing risk and vulnerabilities **makes our plans more robust!**

Adaptation Menus of Strategies and Approaches

OPTION

STRATEGIES

APPROACHES

TACTICS

A “menu” of **possible actions** that allows you to decide what is ***most relevant for a particular location and set of conditions.***

Adaptation menus available at: www.forestadaptation.org/strategies

Translating broad **concepts** to specific **actions**

www.adaptationworkbook.org/niacs-strategies

Options:

- **Foundational adaptation concepts:**
- **R**esistance, **R**esilience, **T**ransition

Strategies:

- Broad adaptation responses that consider:
  - Regional ecological conditions
  - Overarching management goals

Approaches:

- More detailed responses that consider:
  - Site-level conditions
  - Site-level management objectives

Tactics:

- Prescriptive actions designed for:
  - Specific site conditions
  - Specific management objectives

Example: Fire Adaptation Menu

Option: Resistance (forestall change)

Example: Fire Adaptation Menu

Sustain fire as a fundamental ecological process

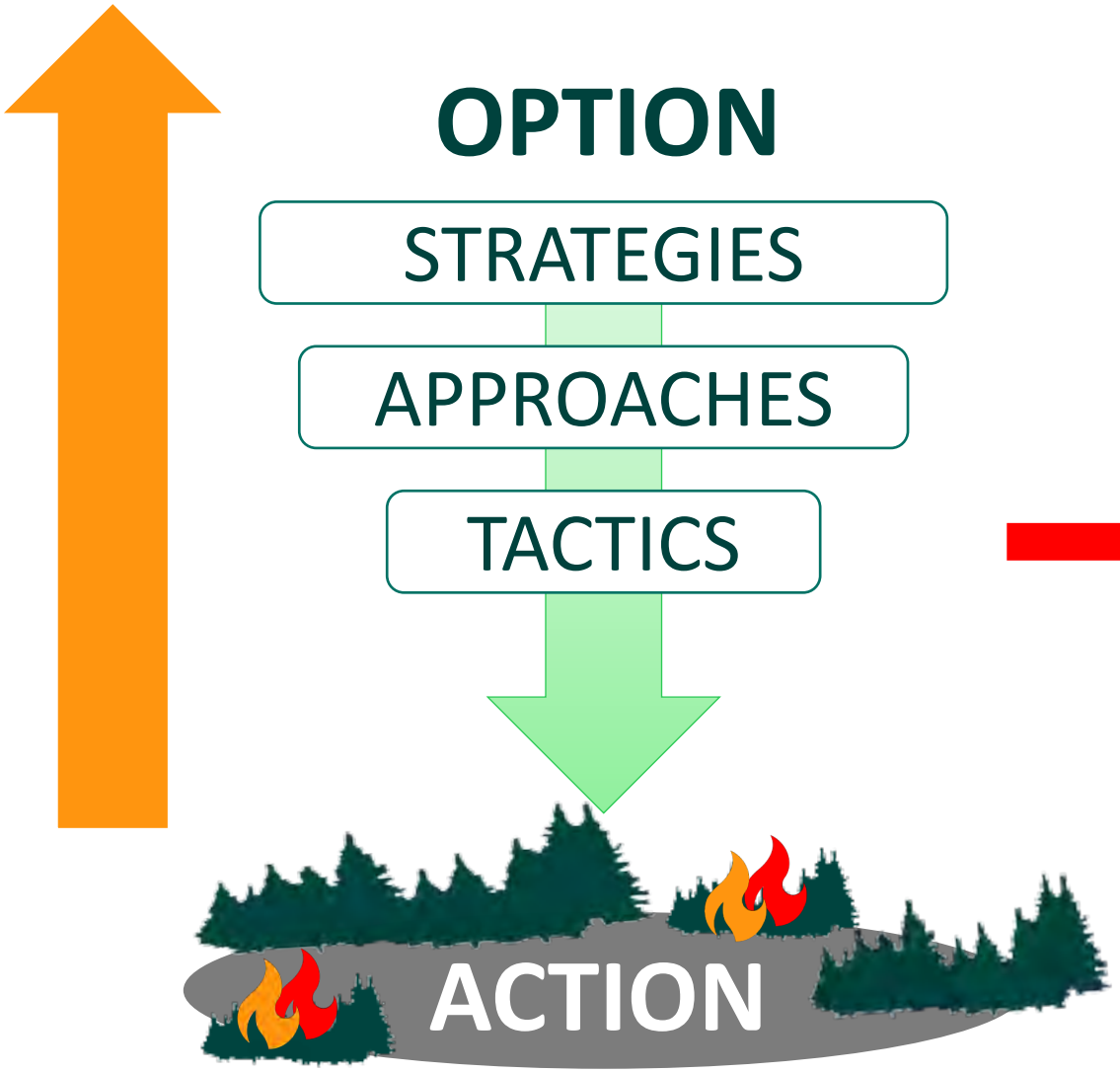
Example: Fire Adaptation Menu

Approach 1.1. Restore or maintain fire in fire-adapted ecosystems

Example: Fire Adaptation Menu

Tactic example: Use prescribed fire and mechanical treatments to manipulate structure and fuels (describe when, where and how)

Example: Fire Adaptation Menu



Tactic example: Consider using managed and/or prescribed fire to facilitate transition to new fire regimes (describe when, where and how)

Example: Fire Adaptation Menu

Approach 7.3. Consider using fire as a tool to align existing vegetation communities with changing climate regimes

Example: Fire Adaptation Menu

Strategy 7: Facilitate ecosystem adaptation to expected future fire and climate regimes

Example: Fire Adaptation Menu

OPTION

STRATEGIES

APPROACHES

TACTICS

Option: Transition (facilitate change)

Adaptation Menus of Strategies and Approaches

Published:

2012: **Forestry**

2016: **Urban Forestry**

2016: **Agriculture**

2019: **Forested Watersheds**

2019: **Recreation**

2019: **Non-Forested Wetlands**

2019: **Inland Glacial Lake Fisheries**

2020: **Tribal Perspectives**

2020: **Forest Carbon Management**

2021: **Wildlife Management**

2022: **Fire-Adapted Ecosystems**

2022: **Great Lakes Coastal Ecosystems**

Menu of Adaptation Strategies and Approaches

Developed for forests

Strategy 1: Sustain fundamental ecological functions.
1.1. Reduce impacts to soils and nutrient cycling.
1.2. Maintain or restore hydrology.
1.3. Maintain or restore riparian areas.
1.4. Reduce competition for moisture, nutrients, and light.
1.5. Restore or maintain fire in fire-adapted ecosystems.

Strategy 2: Reduce the impact of biological stressors.
2.1. Maintain or improve the ability of forests to resist pests and pathogens.
2.2. Prevent the introduction and establishment of invasive plant species and remove existing invasive species.
2.3. Manage herbivory to promote regeneration of desired species.

Strategy 3: Reduce the risk and long-term impacts of severe disturbances.
3.1. Alter forest structure or composition to reduce risk or severity of wildfire.
3.2. Establish fuelbreaks to slow the spread of catastrophic fire.
3.3. Alter forest structure to reduce severity or extent of wind and ice damage.
3.4. Promptly revegetate sites after disturbance.

Strategy 4: Maintain or create refugia.
4.1. Prioritize and maintain unique sites.
4.2. Prioritize and maintain sensitive or at-risk species or communities.
4.3. Establish artificial reserves for at-risk and displaced species.

Strategy 5: Maintain and enhance species and structural diversity.
5.1. Promote diverse age classes.
5.2. Maintain and restore diversity of native species.
5.3. Retain biological legacies.
5.4. Establish reserves to maintain ecosystem diversity.

Strategy 6: Increase ecosystem redundancy across the landscape.
6.1. Manage habitats over a range of sites and conditions.
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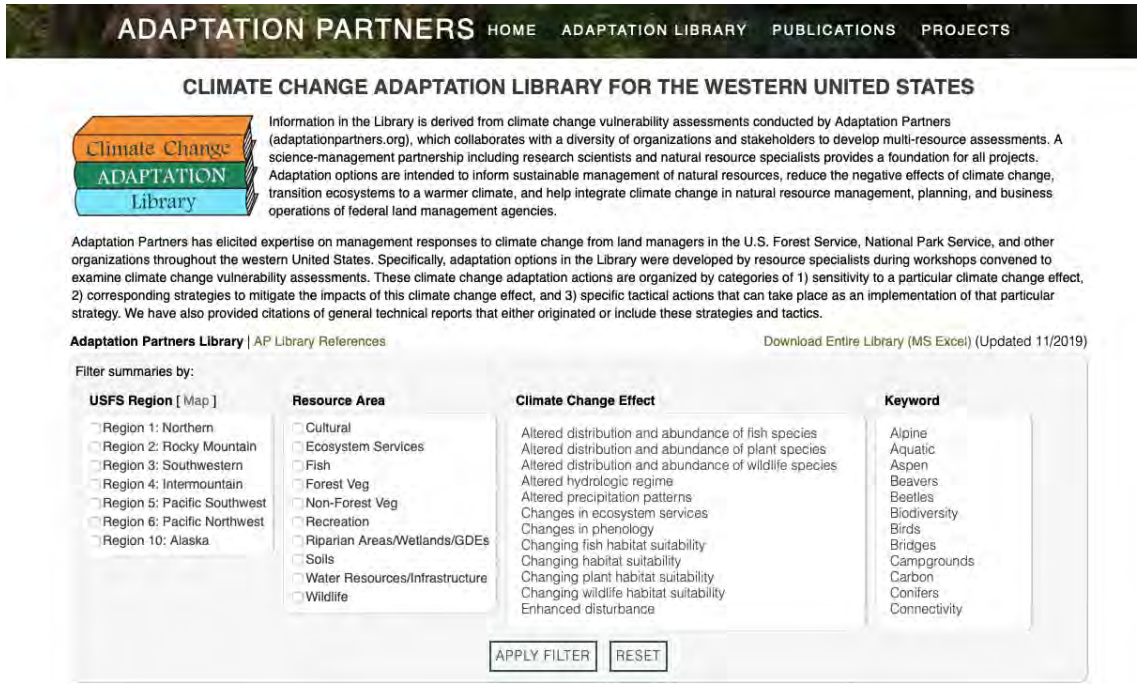
Strategy 10: Realign ecosystems after disturbance.
10.1 Promptly revegetate sites after disturbance.
10.2. Allow for areas of natural regeneration to test for future-adapted species.
10.3. Realign significantly disrupted ecosystems to meet expected future conditions.

NIACS

To be used in the Adaptation Workbook decision-support framework – Swanston et al, 2016. Forest Adaptation Resources: climate change tools and approaches for land managers, 2nd edition http://www.treesearch.fs.fed.us/pubs/52760 ***More information can be found at*** *www.forestadaptation.org/strategies*

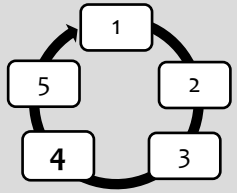
Adaptation menus available at: www.forestadaptation.org/strategies

Find Approaches for Your Project

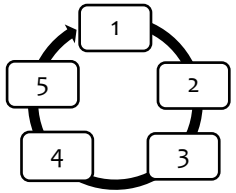


https://www.fs.usda.gov/ccrc/climate-projects/adaptation-approaches

http://adaptationpartners.org/library.php

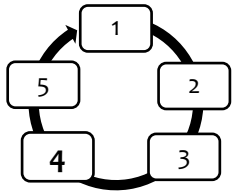


Step 4: What actions can help systems adapt to change?



Step 4: Identify and select adaptation approaches and tactics for implementation

- What actions can help cope with change and help meet the project goals and objectives?
- How will future planners know what you were trying to do?
- Consider a variety of actions, including:
  - **Things you already do** that are even more important because of climate change.
  - **Small tweaks or enhancements** that improve upon what you are already doing.
  - **Major changes**, or wild and crazy ideas, from the current way of doing things.



Step 4: Identify and select adaptation approaches and tactics for implementation

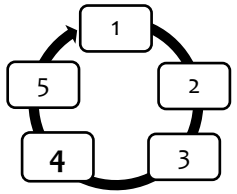
Approach – Select from the compendium, library, or menus. Pick any that seem to make sense and help address the challenges.

Tactic – Describe a specific action you can take.

These details should ideally answer the

what, where, and **how**

you will implement the actions.



Step 4: Identify and select adaptation approaches and tactics for implementation

Benefits – Describe why the tactic is good.

For example:

- addresses biggest or multiple challenges
- is cheap and easy
- has co-benefits
- is likely to succeed

Drawbacks and Barriers – Describe why it's not so good.

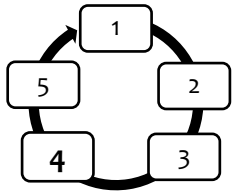
For example:

- it may have negative side effects,
- requires high cost or effort
- may not be successful
- has social, financial, or other barriers

Timeframe – Specify when you will implement the tactic.

For example:

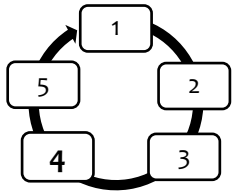
- Summer 2022
- Winter 2022-2023
- Within 3 years of…
- After…
- If… then…



Step 4: Identify and select adaptation approaches and tactics for implementation

Practicability – Is it both ***effective*** (will meet desired intent) and ***feasible*** (capable of being implemented)?

- **High:** Yes to both!
- **Moderate:** Yeah, but it will take some additional effort or planning…
- **Low:** No, the barriers/drawbacks seem too big or the benefits too small.



Step 4: Identify and select adaptation approaches and tactics for implementation

Recommend Tactic– Given all this, is this tactic likely to be helpful?

- *Also consider: trade-offs, urgency, likelihood of success, cost, and effort…*

Yes: look to integrate into plan, prescription, or other activities

No: not useful at this time

Step 4: Activity

Place dots next to the adaptation approaches you selected.

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DISCUSSION

- What are some examples of tactics you discussed in your groups?
- Overall, were the strategies you selected geared toward resisting climate change, transitioning to align with future conditions, or somewhere in between/a mix?
- Do the strategies you selected help reduce the biggest impacts you identified?
- Do the strategies you selected help enhance your adaptive capacity?
- Do your strategies address the challenges you identified, capitalize on opportunities, and help you meet your goals and objectives?

REGION 2 MONITORING RESOURCES

Reach out to your regional monitoring coordinator!

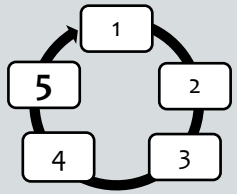
Alison Foster (Region 2 Inventory, Monitoring, and Roadless Rule Coordinator)
alison.foster@usda.gov

Lots of data already exists – let me help you find an existing data set that will work for you.

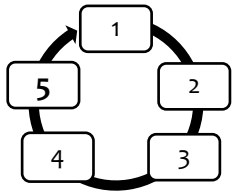
Other existing resources:

- **Region 1 Monitoring Page**
- **Site for Regional Inventory and Monitoring Coordinators (RIMC)**
- **Master List of Inventory and Monitoring Protocols (usda.gov)**

Coming soon: Region 2 Monitoring Sharepoint (or Team)



Step 5: MONITOR and evaluate effectiveness of implemented actions.



Step 5: MONITOR and evaluate effectiveness of implemented actions.

Purpose: Practice adaptive management

Key Questions:

- How will you know if your actions were effective?
- What can you learn to inform future management?
- Provide an example of something you could monitor to evaluate whether your project actions helped to both achieve your goals and increase your area's ability to adapt to changing conditions.


Photo: Scoprionweed, NPS, Kait Thomas

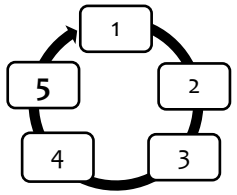
A Few Thoughts about Monitoring

- Learning about our actions is useful
- Our track record is not very good

A Few Thoughts about Monitoring

Be VERY CLEAR about your objectives! The questions you ask guide your monitoring approach:

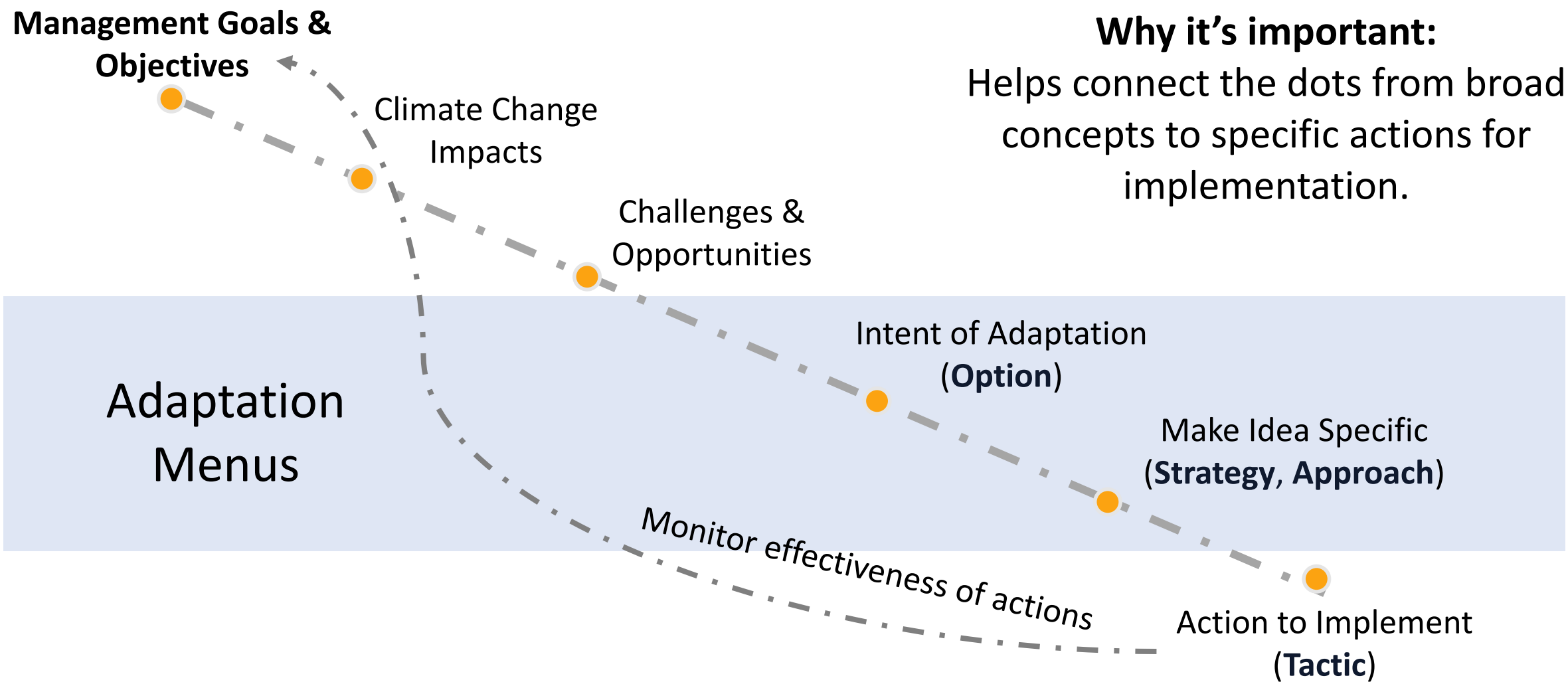
- **Scientific research** = Is this outcome statistically significant compared to a control? Could we expect similar results elsewhere?
- **Impact/response monitoring** = What changes are occurring?
- **Implementation monitoring** = Did we do the action?
- **Effectiveness monitoring** = Did our actions actually have the desired effect?



Step 5: MONITOR and evaluate effectiveness of implemented actions.

- **Adaptation Monitoring Variable** – What you will measure?
  - *Items that can tell you whether you have achieved your* ***management goals & objectives.***
- **Criteria for Evaluation** – a value or threshold that is meaningful for assessing effectiveness or informing future decisions
  - ***What is success?***
  - *What you're monitoring or measuring:* ***What are the units on your data?***
- **Monitoring Implementation**– How you will gather the information
  - *How, and when the monitoring will actually get done.*
  - ***Take advantage of existing monitoring when possible!***

Workbook + Menu



Why it's important:
Helps connect the dots from broad concepts to specific actions for implementation.

Monitoring Discussion

- Provide an example of something you could monitor to evaluate whether your project actions helped to both achieve your goals and increase your area's ability to adapt to changing conditions.
- What requests do you have for information on the Broadscale Monitoring Strategy (how the region support monitoring)?
- What is the monitoring connection with Climate Action Tracker?

Photos: https://cfri.colostate.edu/expertise/forest-science/

Time To Apply: Tell Your Adaptation Story

- 5 min or less!
- Goals/objectives
- Key climate change impacts
- Key adaptation strategies/approaches to meet your goals/objectives
- One idea on measuring effectiveness/monitoring

Be creative and expand your management toolbox!

https://www.recreation.gov/camping/gateways/1052

https://www.fs.fed.us/database/feis/animals/bird/acge/all.html

What is one action you'll take based on the ideas and resources that you've learned about through this training in your everyday work once you return to the office/field?

Thank you for your participation! We appreciate your feedback!

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