Rio Grande National Forest Adaptation Workshop
What to Expect & How to Prepare

October 25-27, 2022

Rio Grande Water Conservation District, 8805 Independence Way, Alamosa, CO 81101

Pre-Workshop Webinar

October 6, 2022

USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

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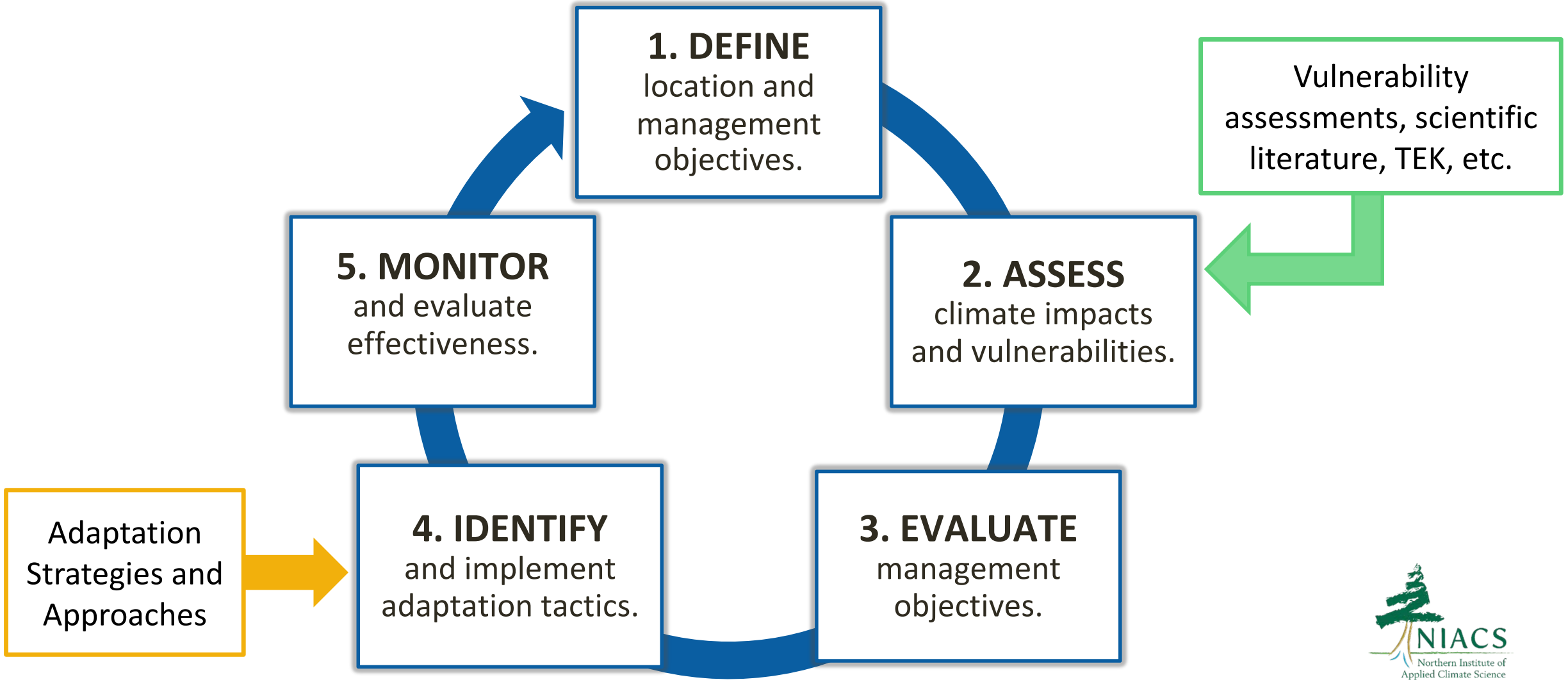
Workshop Planning Team

Webinar Agenda

- Introductions of Workshop Planning Team
- Welcome and Background
- USFS National Climate Adaptation Direction
- RGNF Adaptation Workshop Overview & Adaptation Workbook
- Presentation on Climate Change Vulnerability for South Central CO
  - Observed trends
  - Future projections
- What to Expect for Workshop Pre-work
- Questions/Discussion

Adaptation Workbook



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

National Direction: Climate Change Adaptation

Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad (Jan 2021)

- Directs every agency to create a climate action plan

USDA Action Plan for Climate Adaptation and Resilience (Oct 2021)

USFS Climate Adaptation Plan (July 2022)

- 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

Climate Action Tracker (CAT)

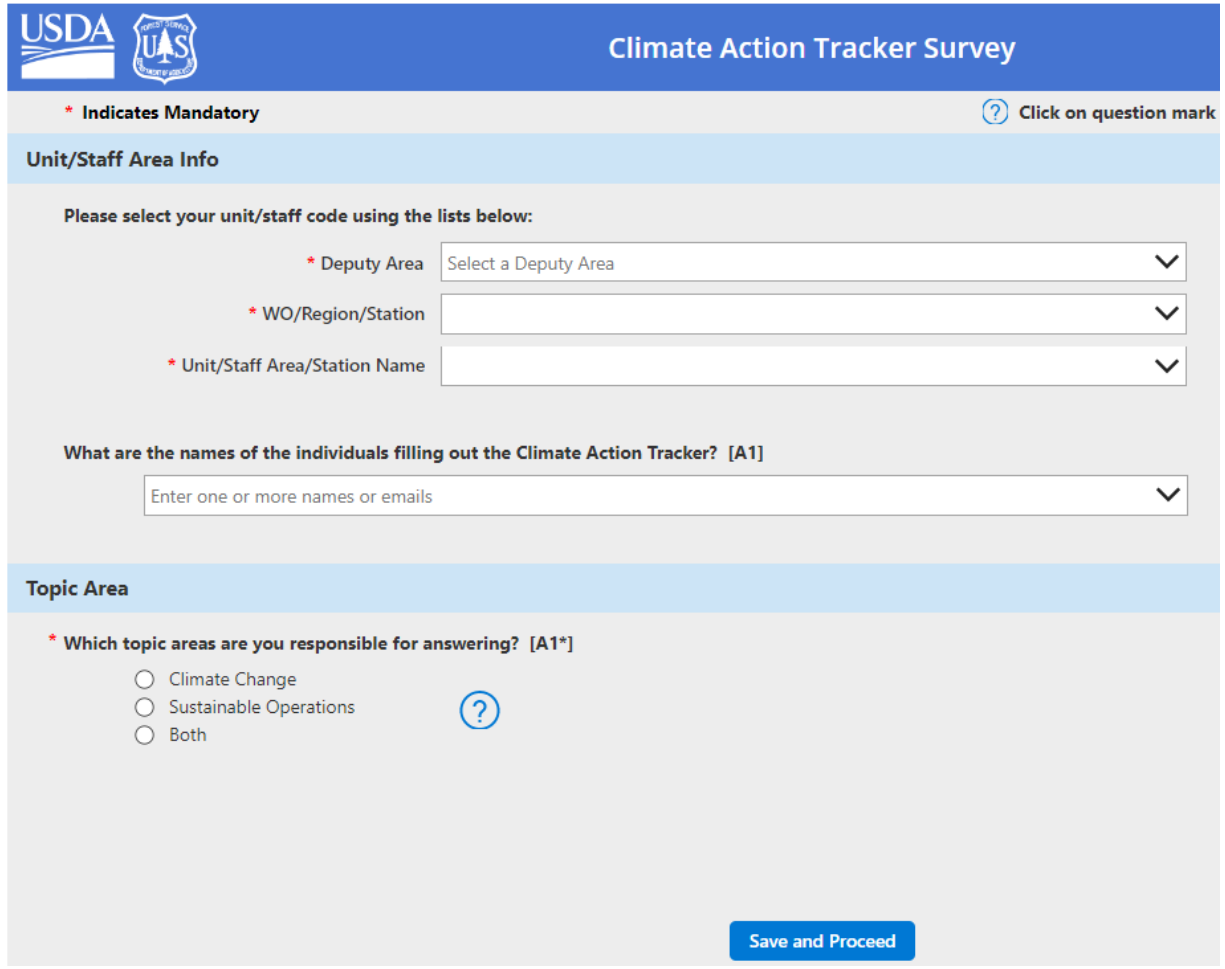
Mechanism for measuring and reporting progress towards Agency climate goals (replaces "Sustainability Scorecard")

WO Deadline: December 9, 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)

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.

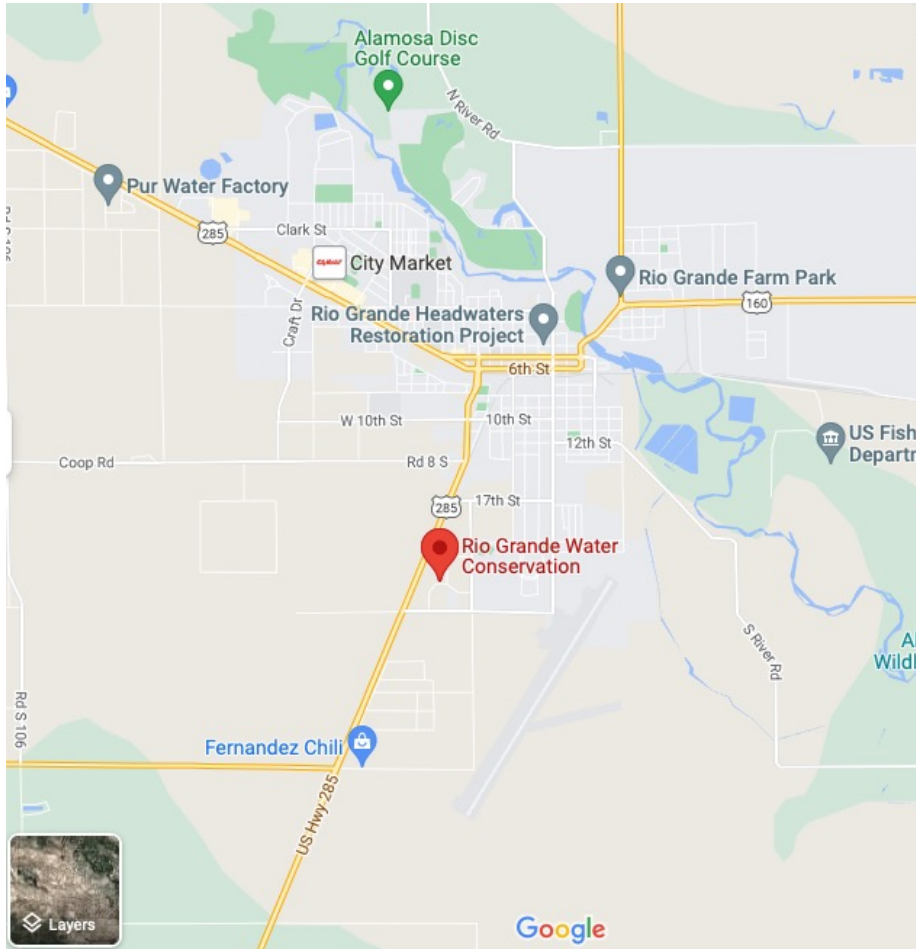
Workshop Details

In-Person Workshop:

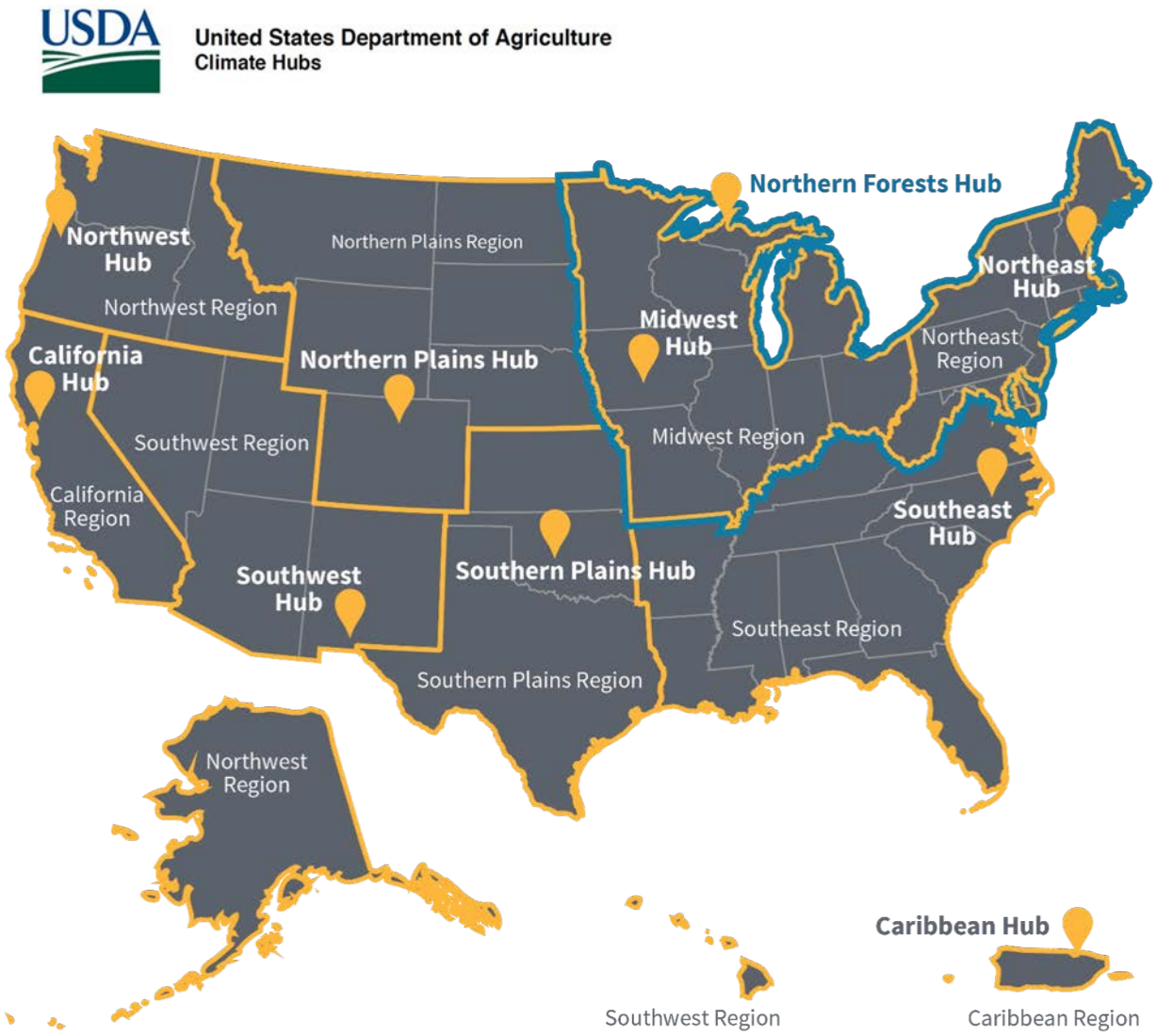
- Tuesday, October 25: 10 – 4:30 MT
- Wednesday, October 26: 8 – 4:30 MT
- Thursday, October 27: 8 – 3 MT (in-the field)
  - Bring a sack lunch!

LOCATION: Rio Grande Water Conservation District

- 8805 Independence Way, Alamosa, CO 81101



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

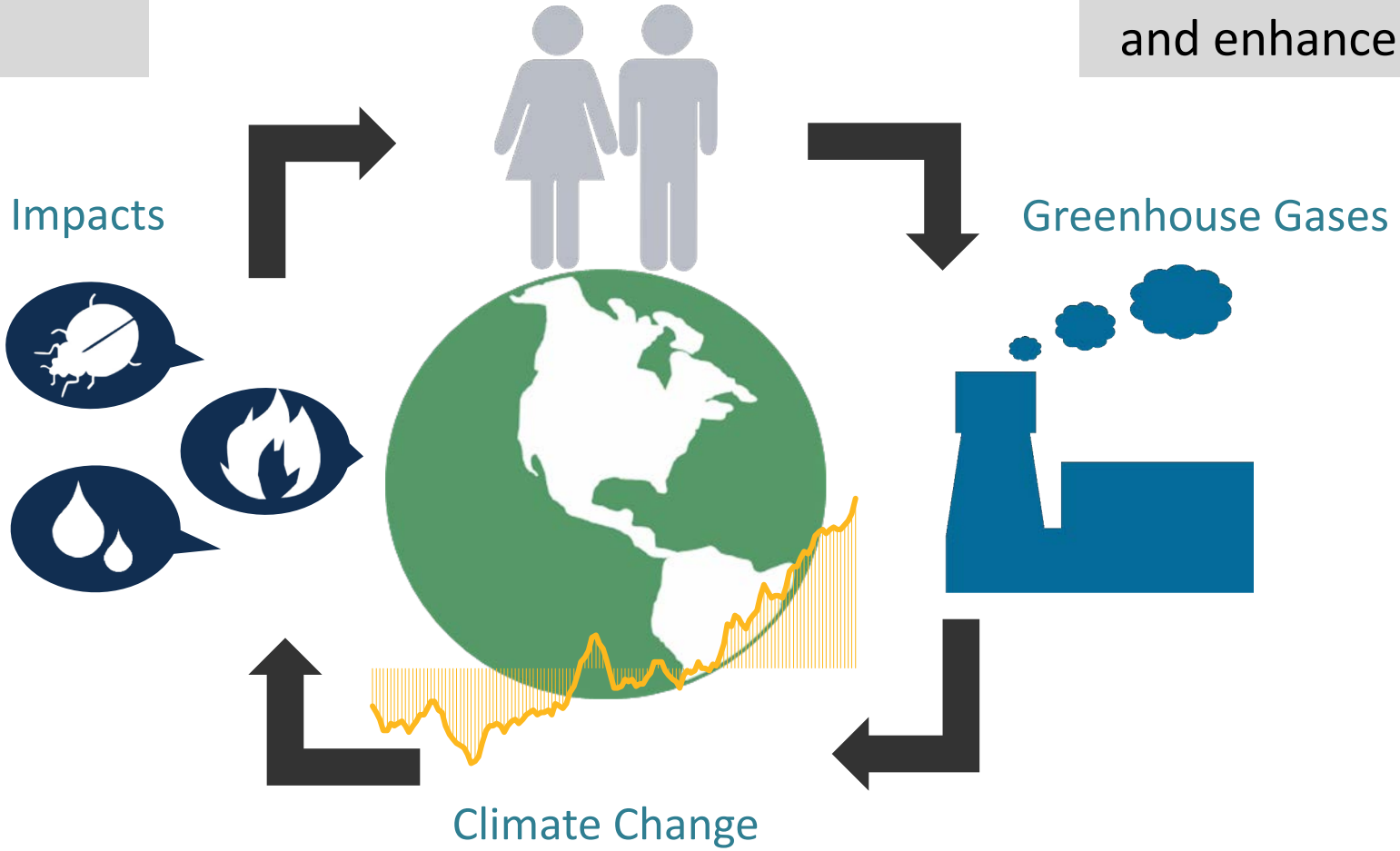
How can we respond to climate change?

Adaptation

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

Mitigation

Actions that reduce greenhouse gas emissions and enhance carbon sinks.

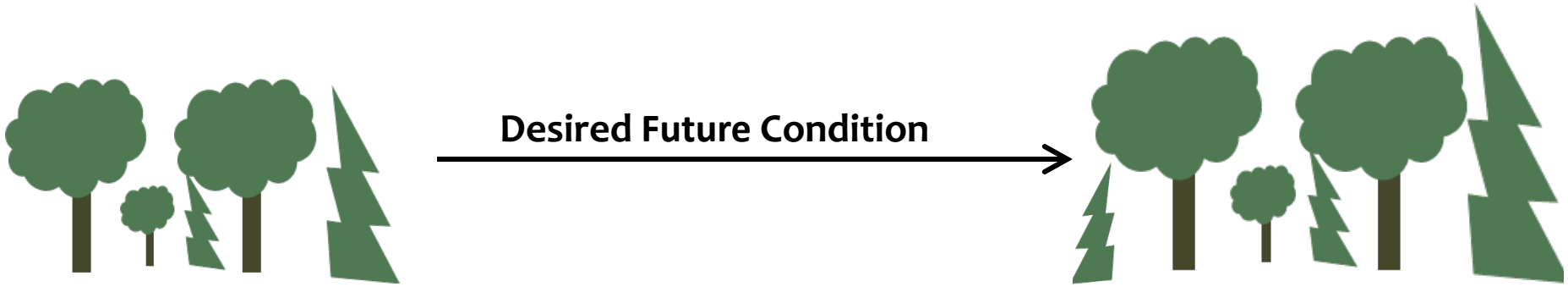


Adaptation - the adjustment of systems in response to climate change.

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

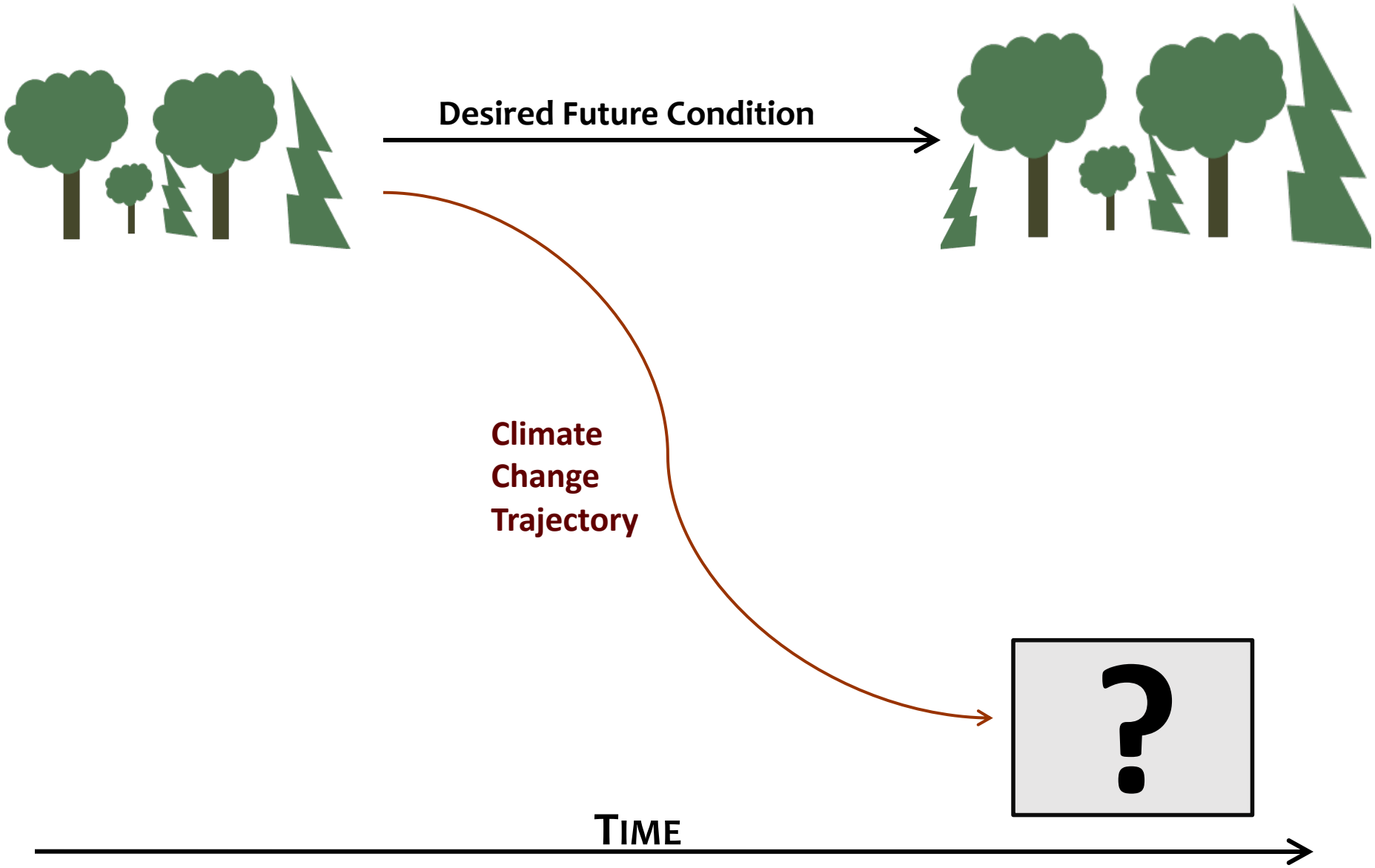
- What do you value?
- How much risk are you willing to tolerate?

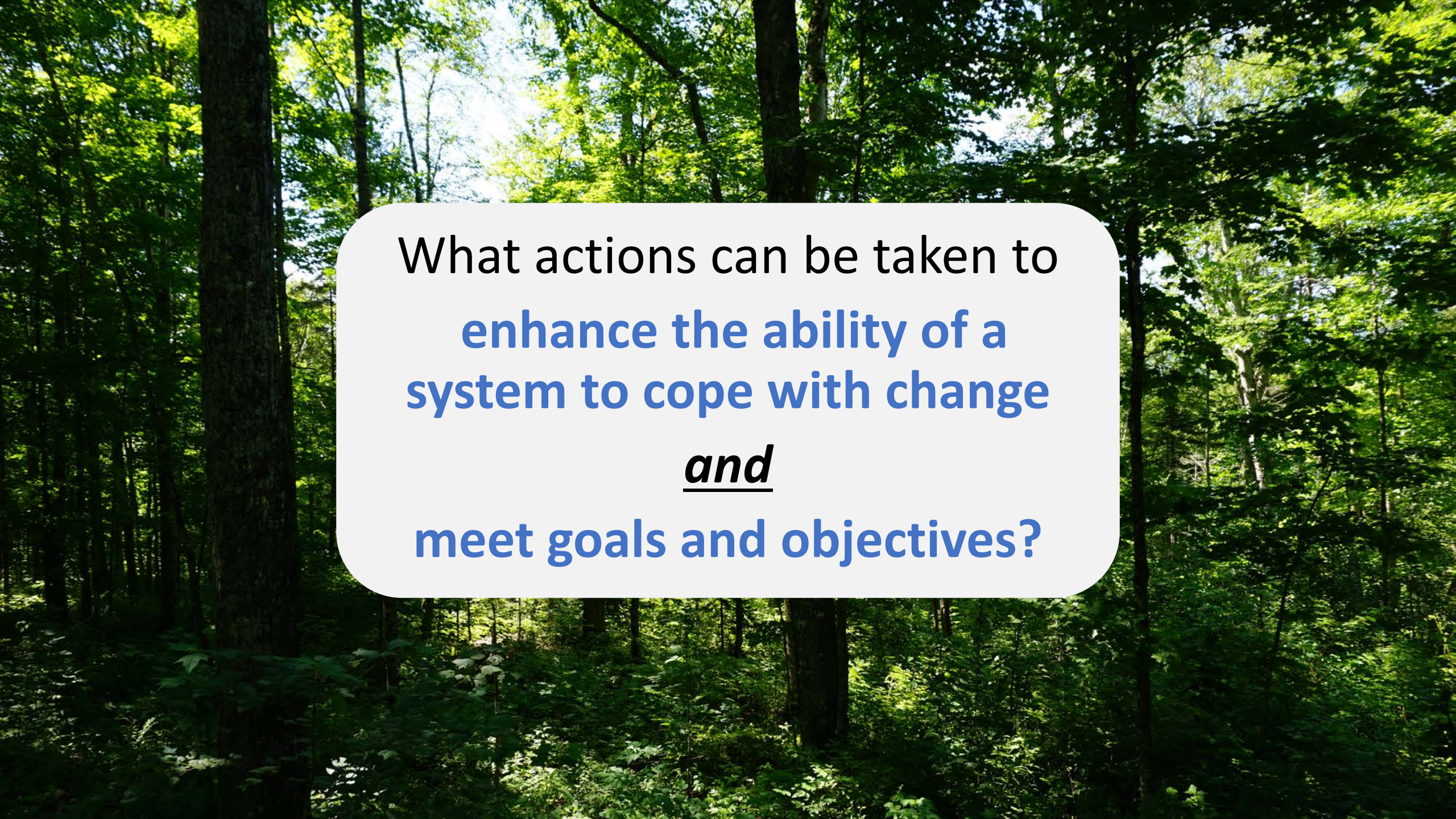
Climate-Driven Changes



TIME

Climate-Driven Changes




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

Identifying Adaptation Actions

Connecting Broad Ideas to Specific Actions

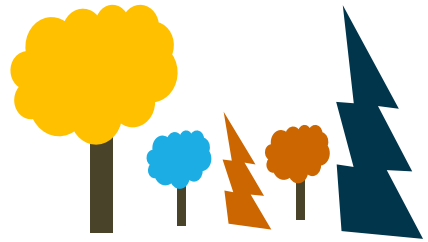
RESISTANCE

- Improve defenses of ecosystems 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 Planning

Responding to Climate Change - Adaptation Planning

If you want a single “answer” for how to respond to climate change, it’s

“It depends”

…ecosystem, objectives, climate pressure, risk tolerance, capacity…

Challenges to Implementation

Climate change is too big and too complex.

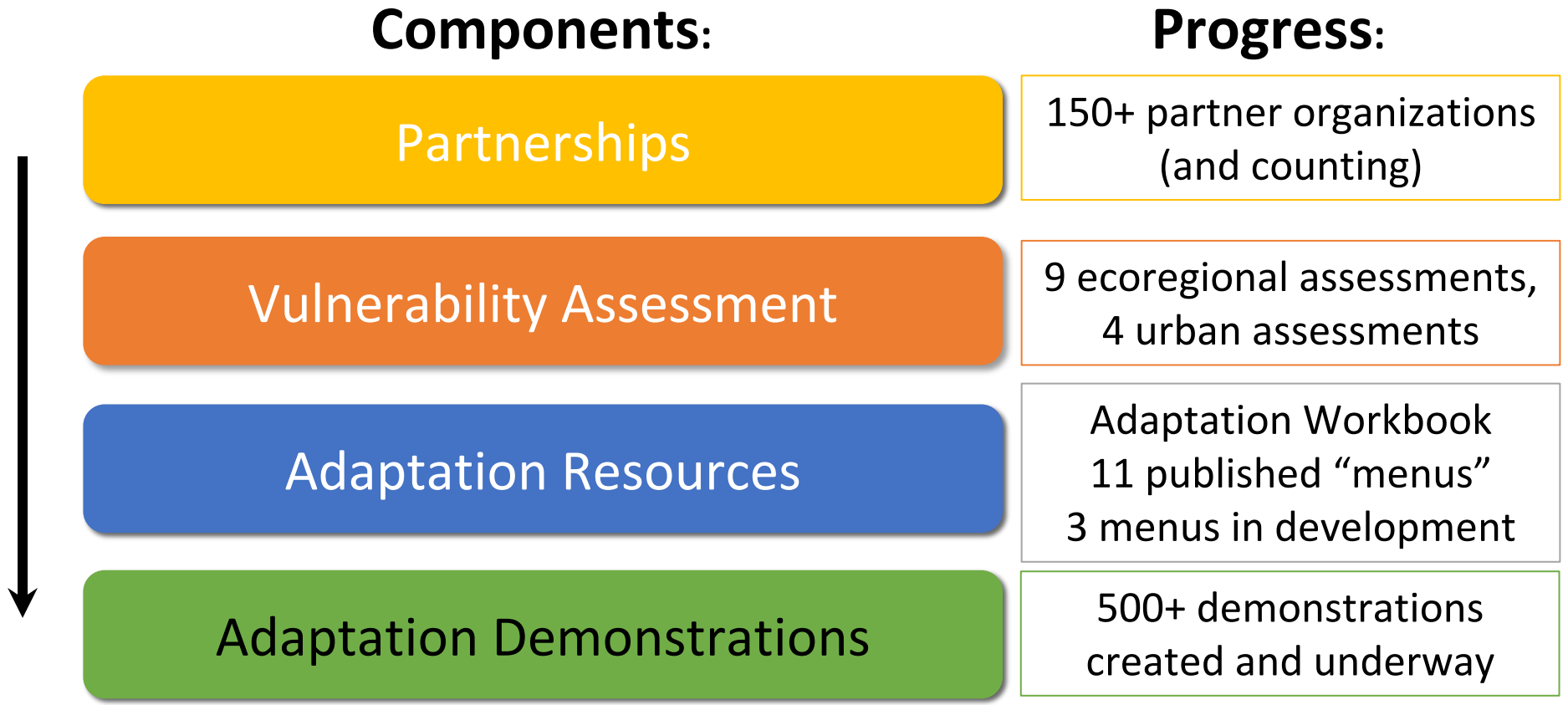
Climate information is not relevant enough.

One-size-fits-all answers are insufficient.

There are not enough real-world examples.

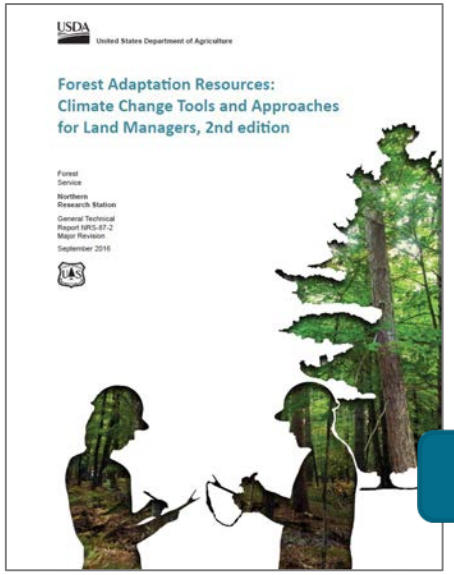
Climate Change Response Framework

A collaborative, cross-boundary approach among scientists, managers, and landowners to incorporate climate change considerations into natural resource management.



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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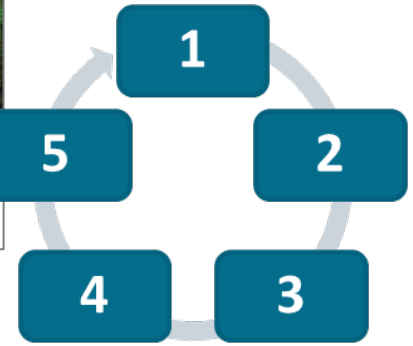
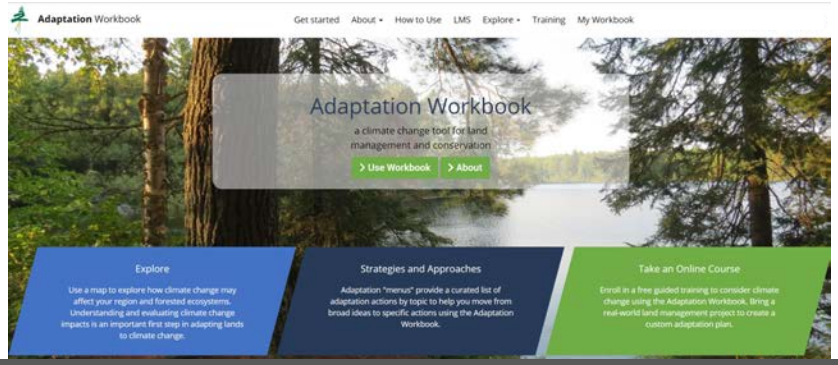


Swanston et al. 2016
(2nd edition)



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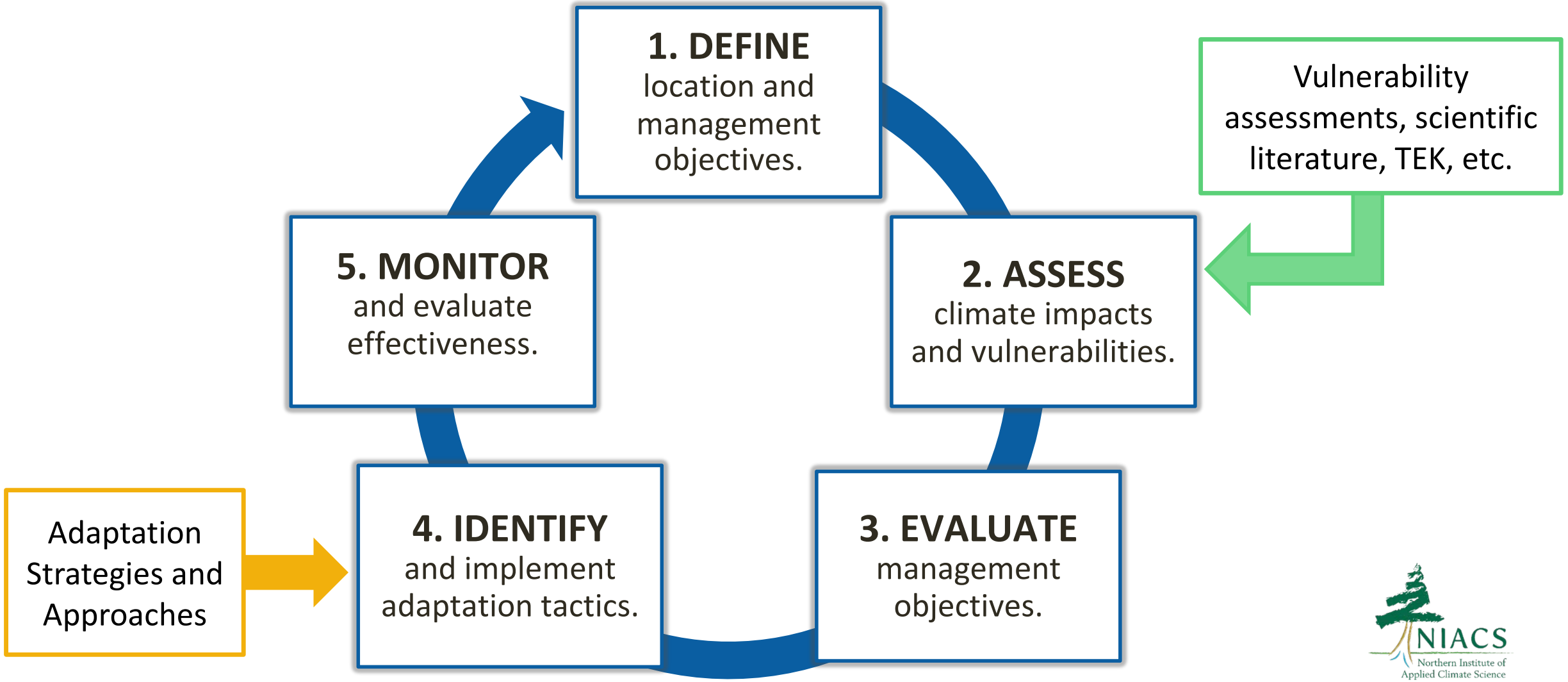
Adaptation Workbook



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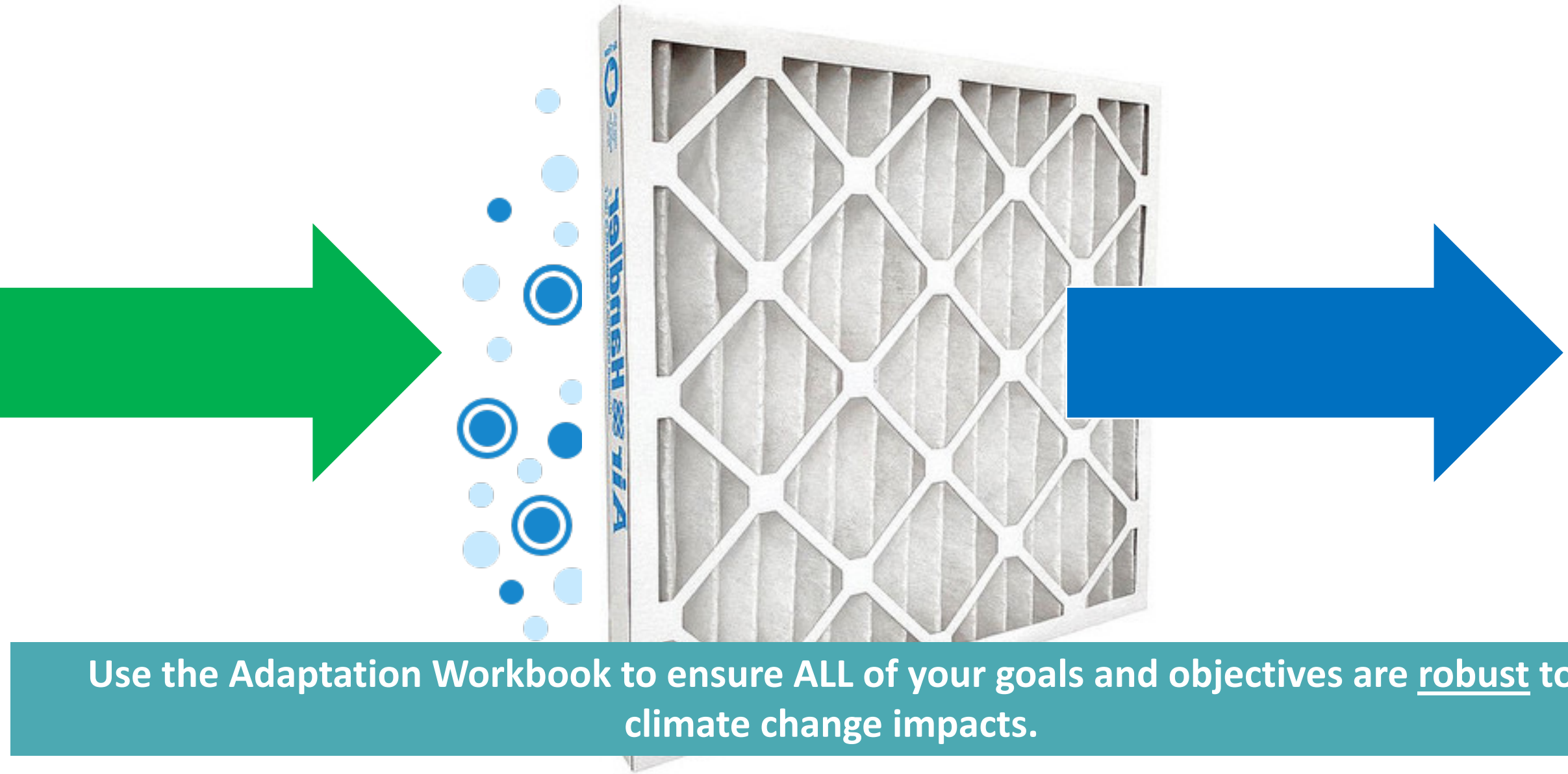
Adaptation Workbook = Climate Change Filter



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

Intentionality

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

Climate Change Vulnerability for South Central Colorado

Lauren Kramer

USDA Southwest Climate Hub, ARS

lauren.kramer@usda.gov

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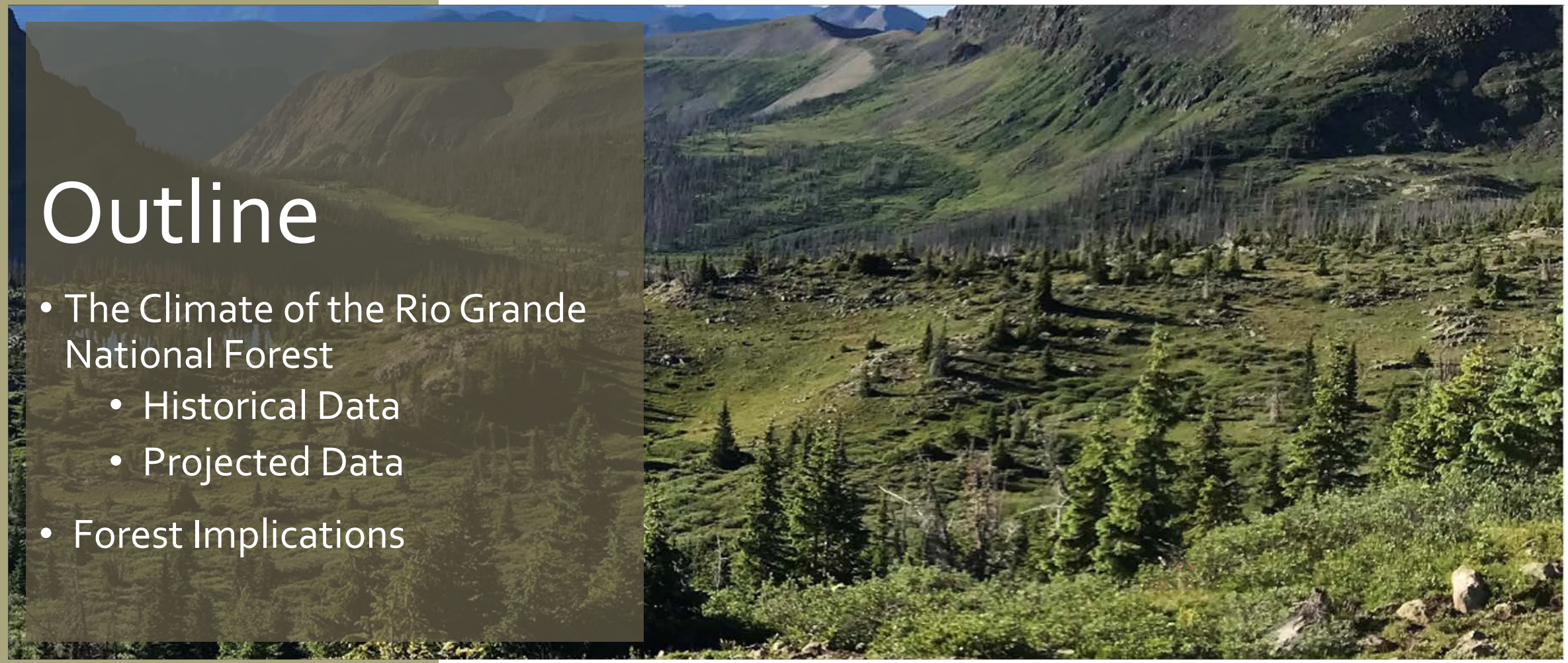
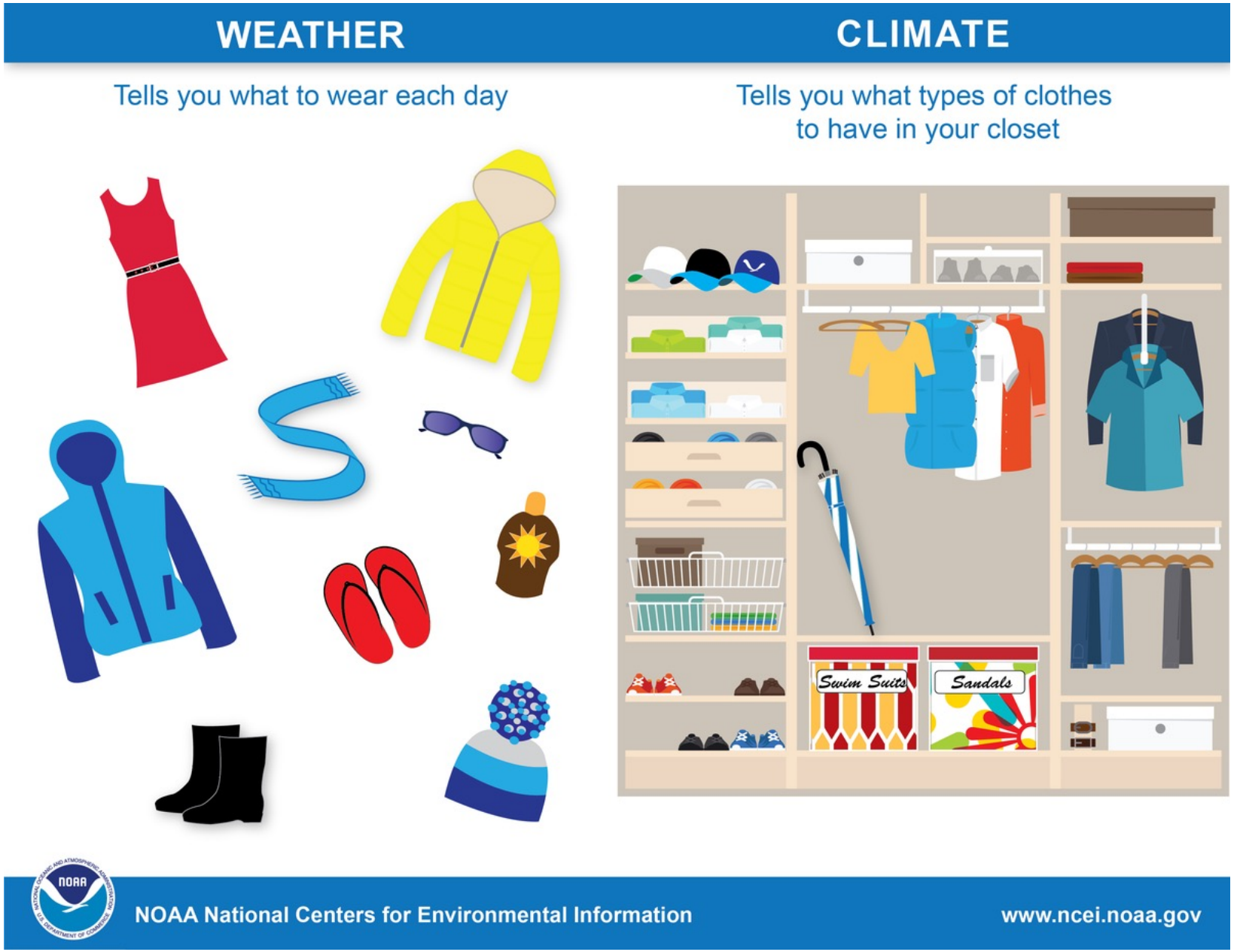
Outline

- The Climate of the Rio Grande National Forest
  - Historical Data
  - Projected Data
- Forest Implications



Climate is what you expect, and **weather** is what you get



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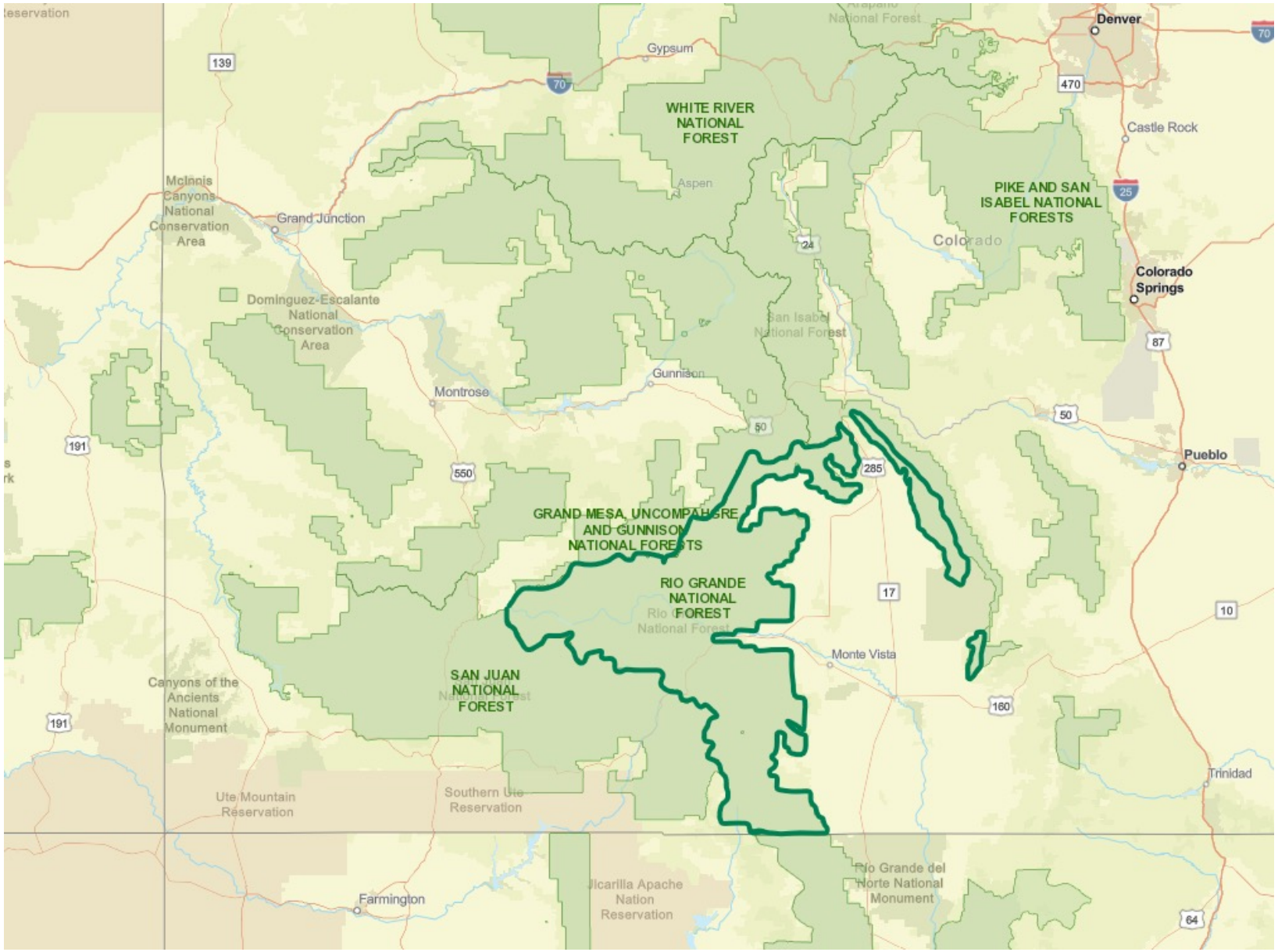
The Climate of the Rio Grande National Forest

Historical Data

Rio Grande National Forest Overview

- Elevation: 7,600-14,335 ft
- Area:
- 2,906 square miles



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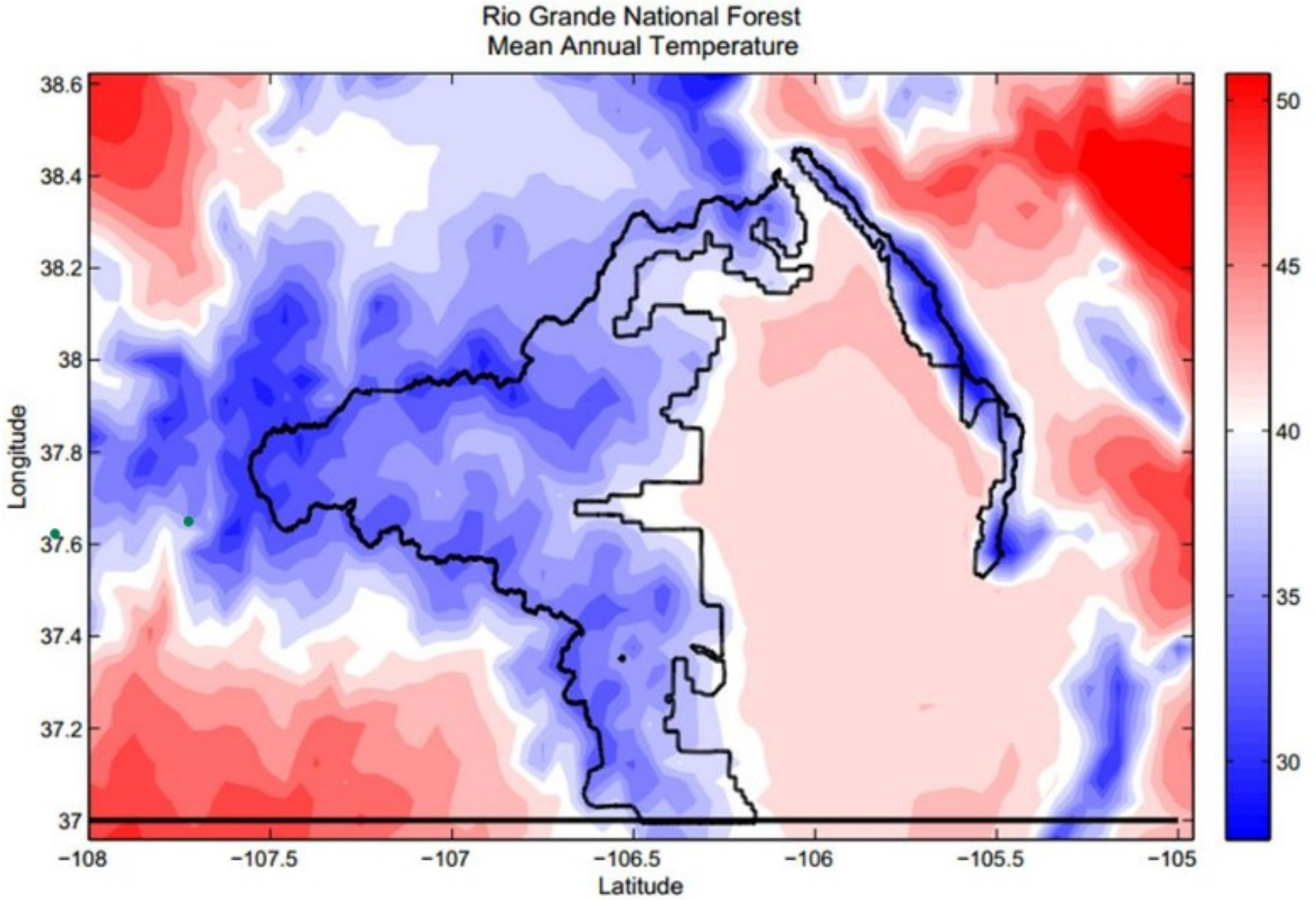
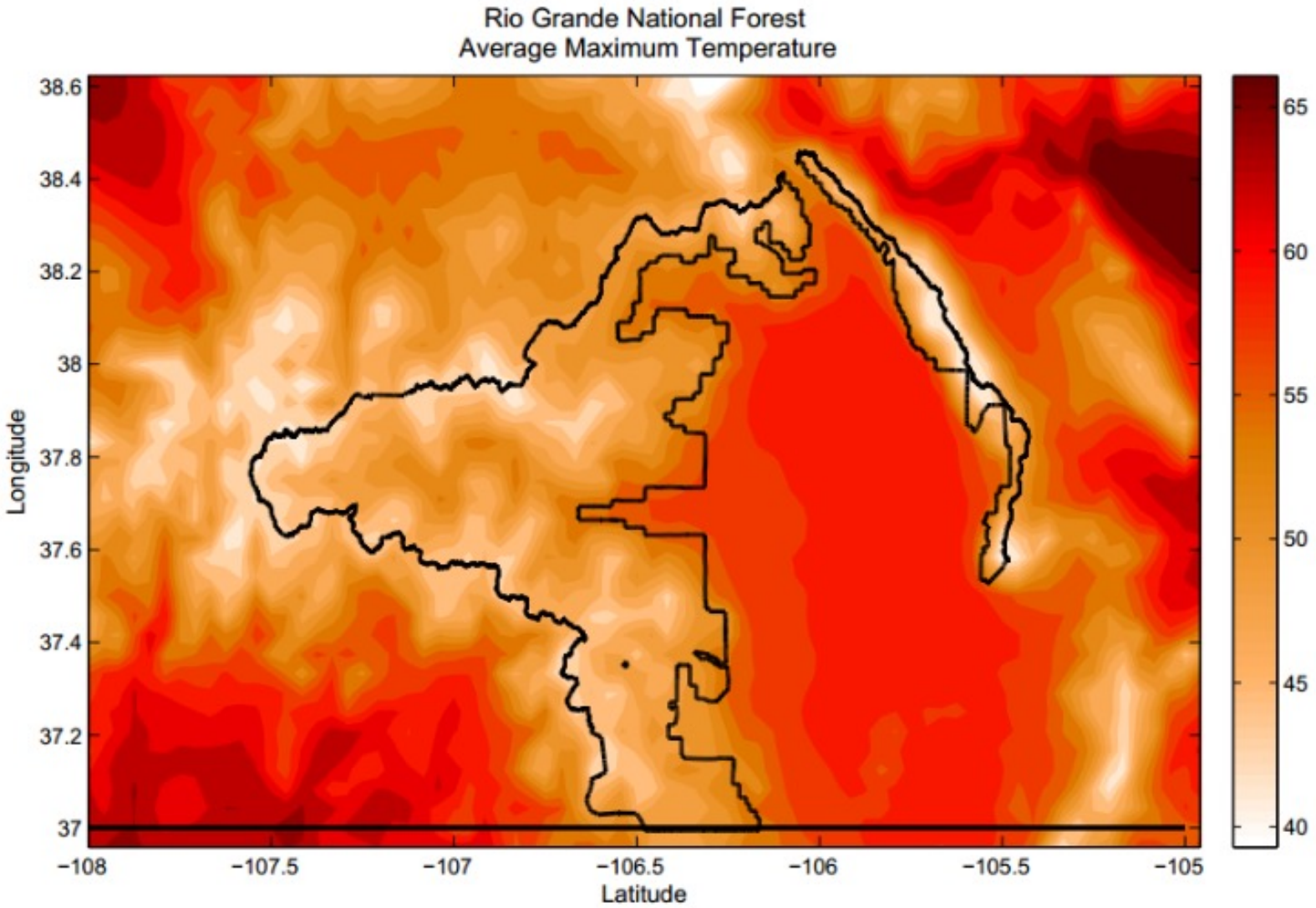
Mean Annual Temperature 28 °F - 40 °F



Annual average temperature for south-central Colorado on a latitude-longitude plane. Data are provided at a 4km resolution by the PRISM climate group at Oregon State for the 1981-2010 period of record

"Rio Grande National Forest Historic Climate Assessment" (2019)

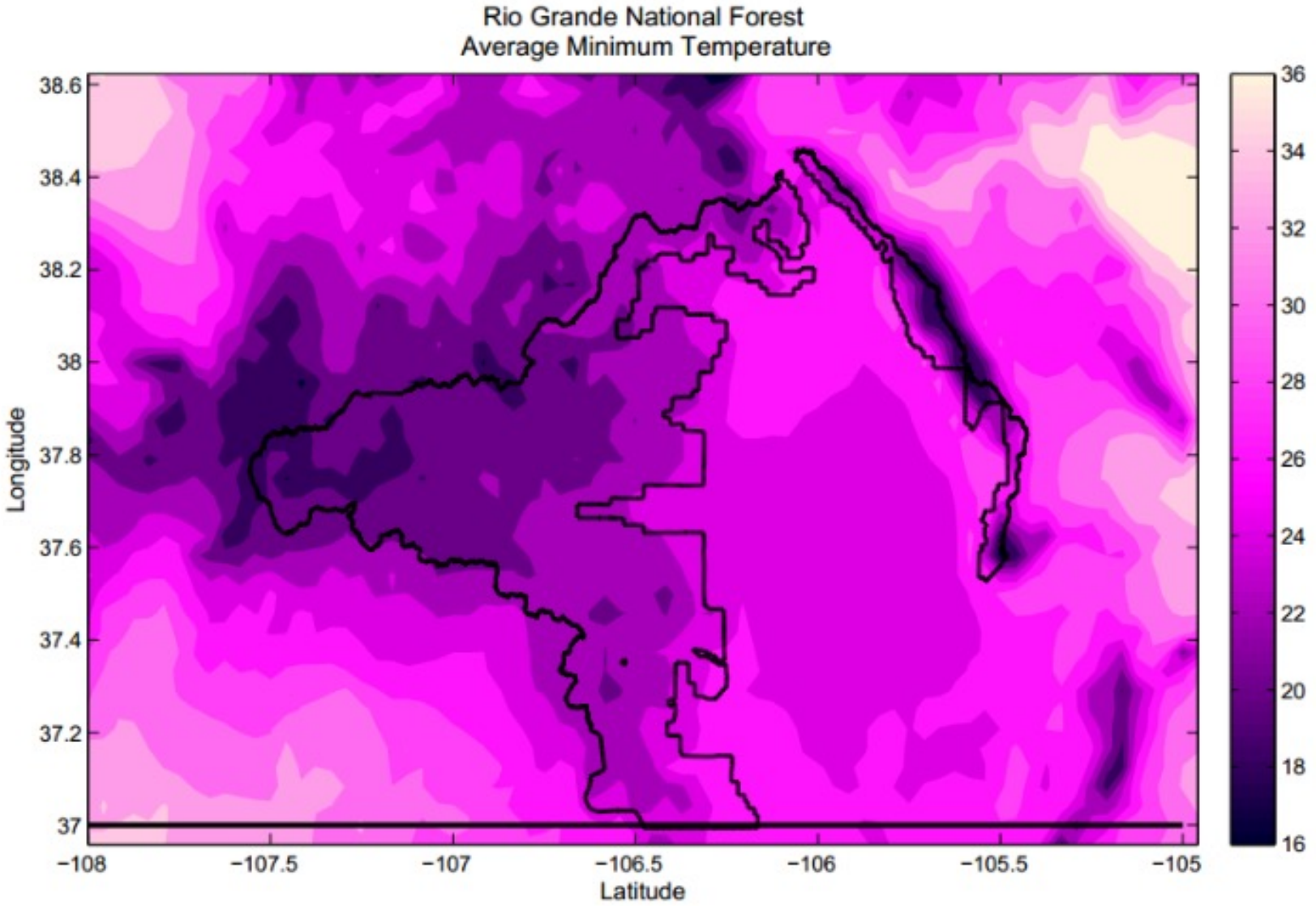
Average Maximum Temperature 40°F - 58 °F



The contour plot above depicts annual average maximum daily temperature for south-central Colorado on a latitude-longitude plane. Data are provided at 4km resolution by the PRISM climate group at Oregon State for the 1981-2010 period of record.

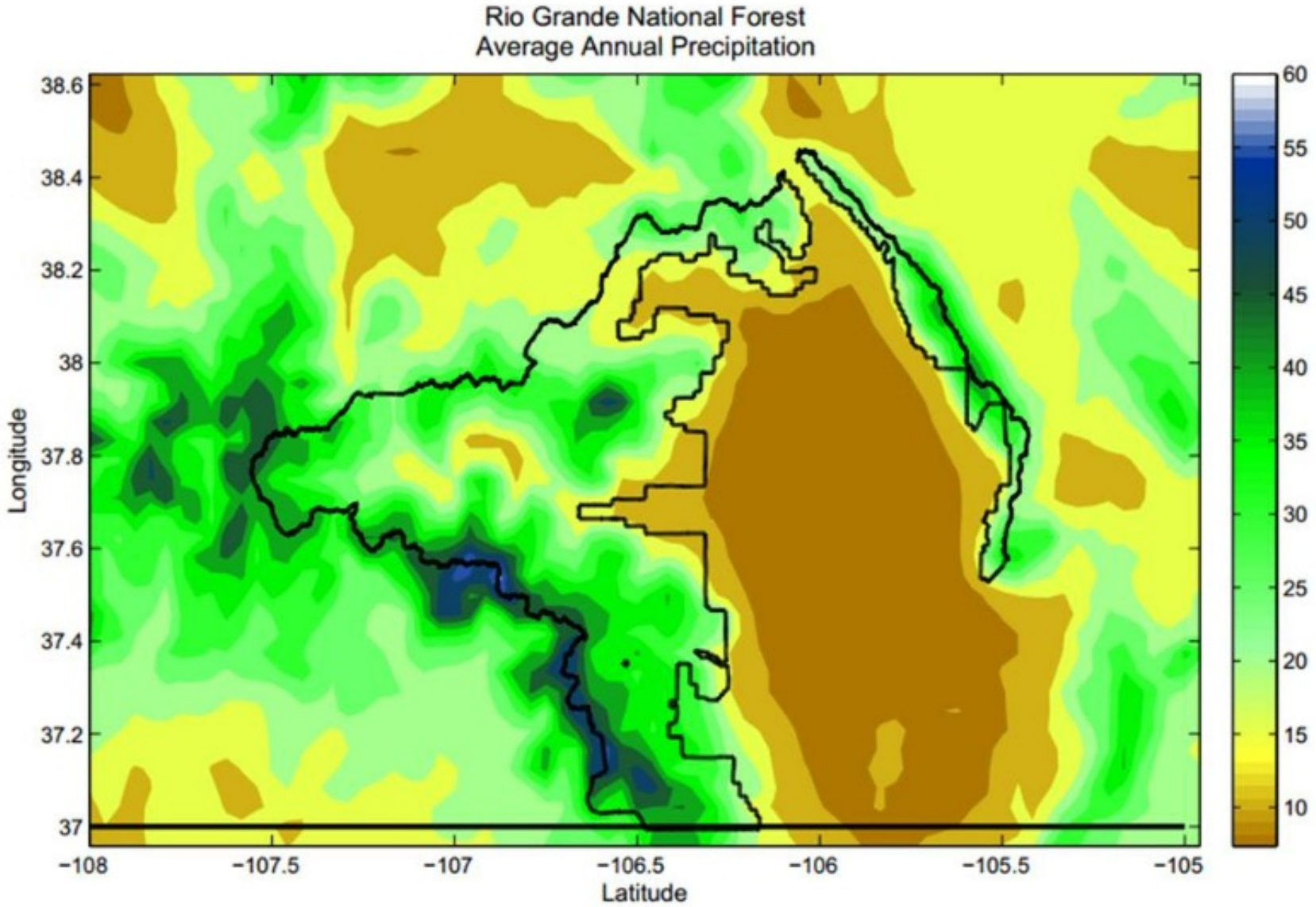
"Rio Grande National Forest Historic Climate Assessment" (2019)

Average Minimum Temperature 16°F - 30°F



The contour plot above depicts annual average daily minimum temperature for south-central Colorado on a latitude-longitude plane. Data are provided at 4km resolution by the PRISM climate group at Oregon State for the 1981-2010 period of record.

Average Annual Precipitation 12”- 55”



Amount of precipitation (in) expected annually for south-central Colorado. Data are provided at a 4km resolution by the PRISM climate group at Oregon State for the 1981-2010 period of record.

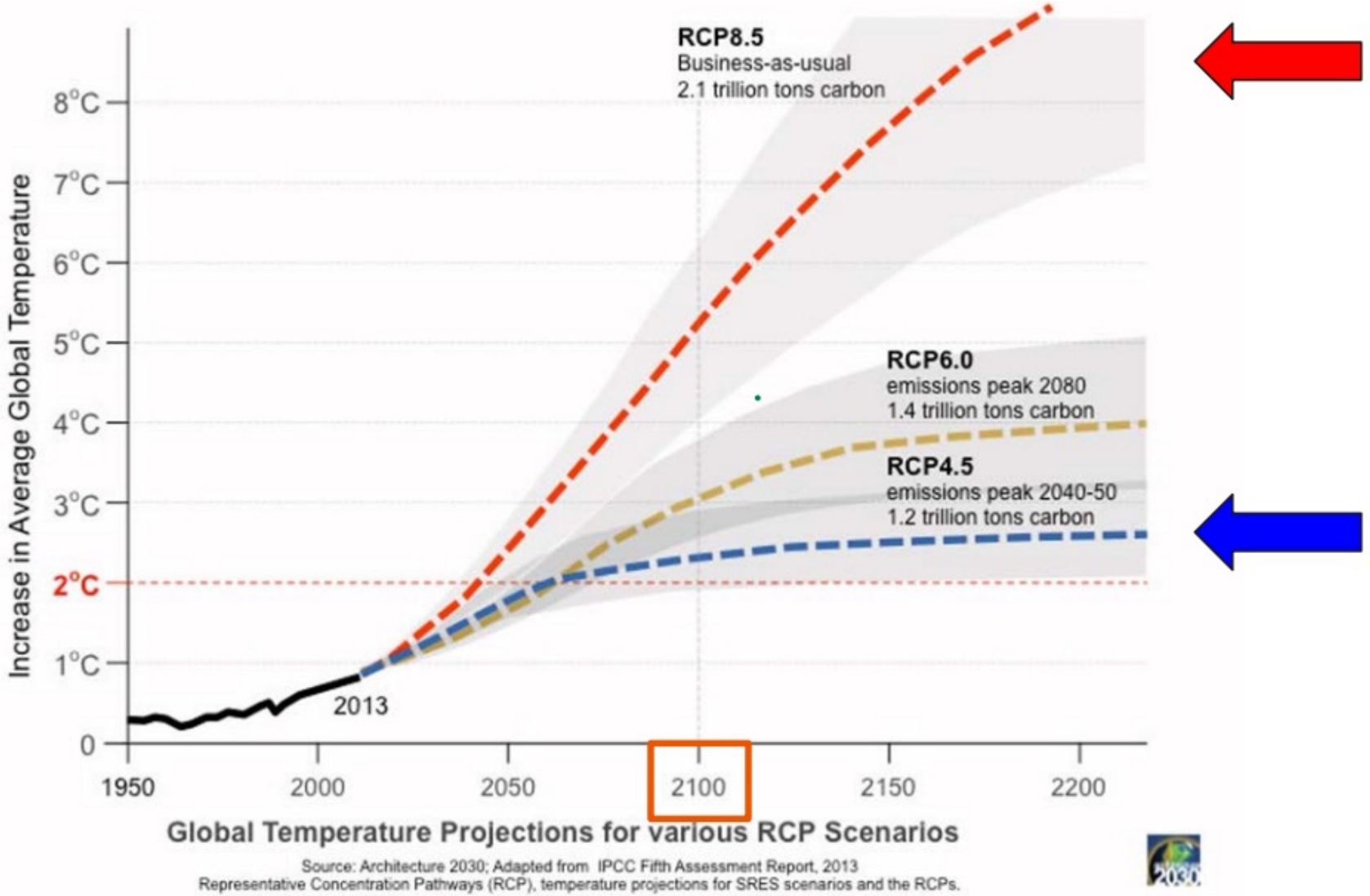
“Rio Grande National Forest Historic Climate Assessment” (2019)

The Climate of the Rio Grande National Forest

Future Projections

Future Projections

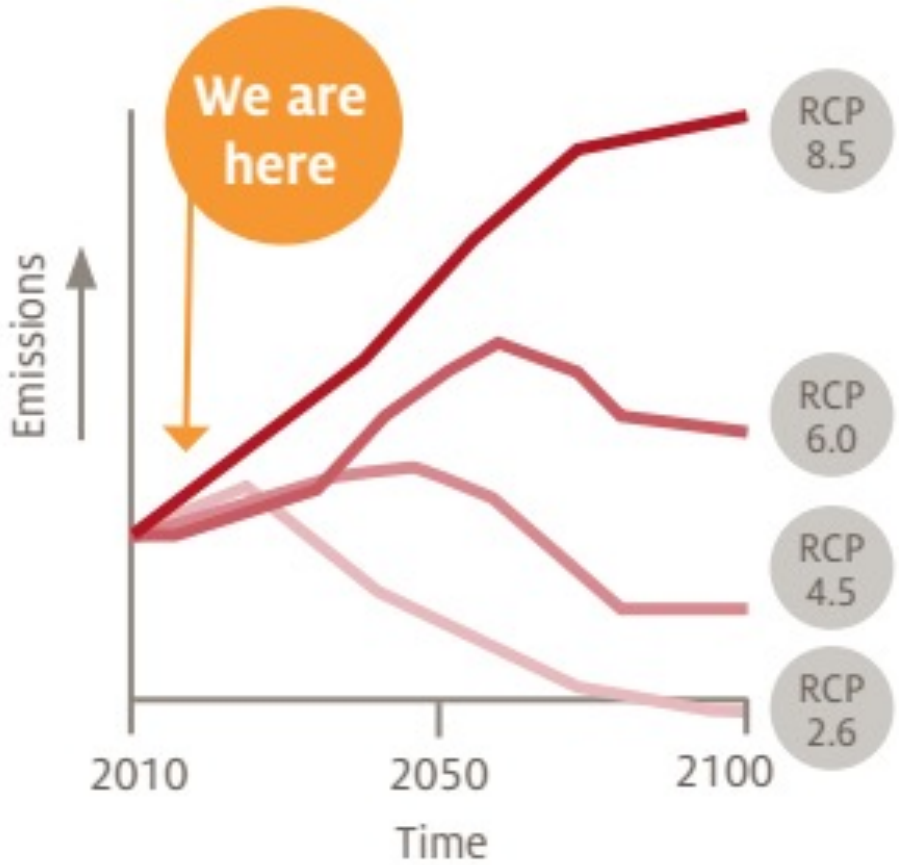
Future Emission Scenarios



IPCC Fifth Assessment Report (2013)

We can use the RCPs to plan for the future

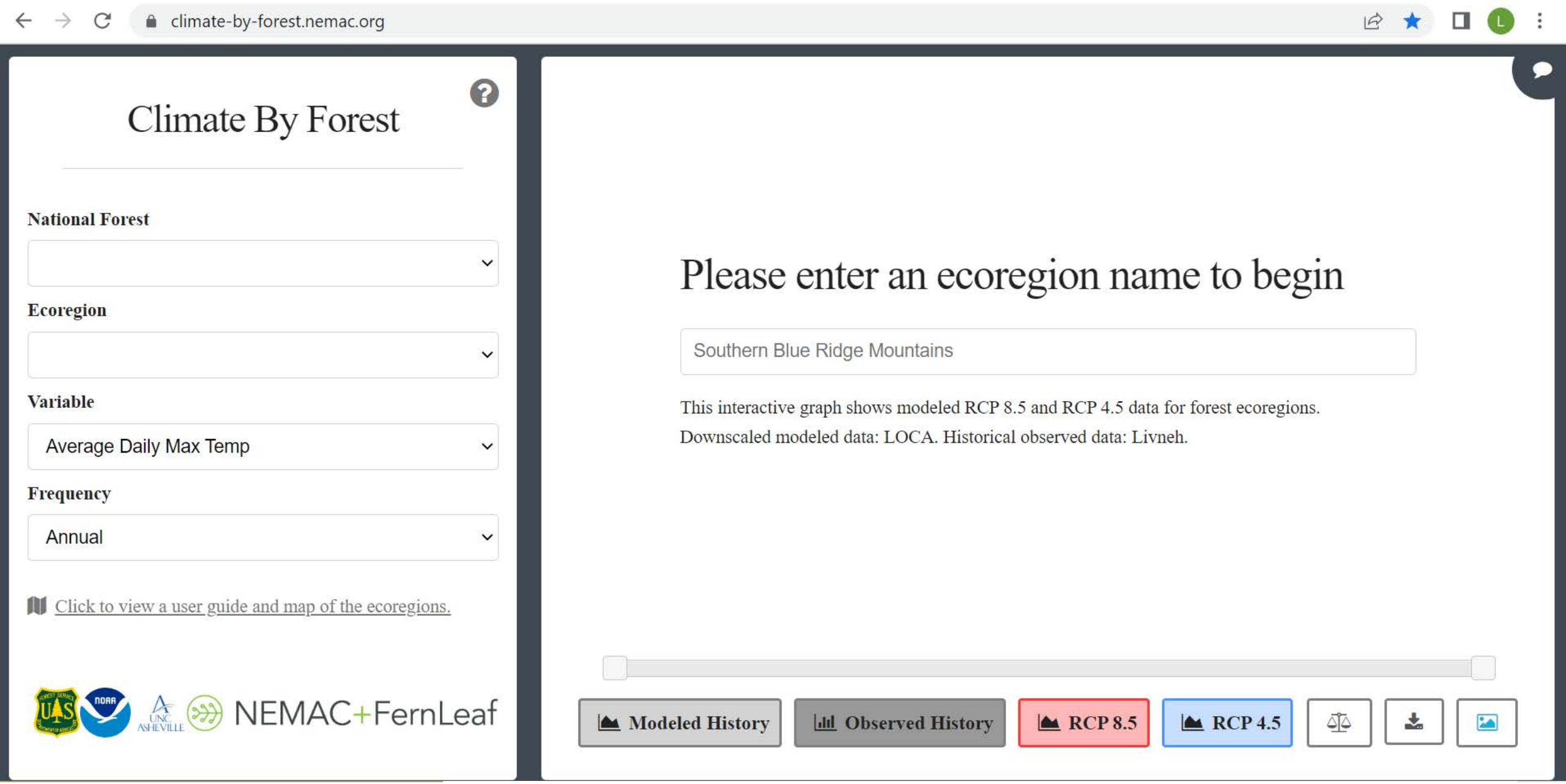
Scientists use the RCPs to model climate change and build scenarios about the impacts. You can use these scenarios to plan for the future.



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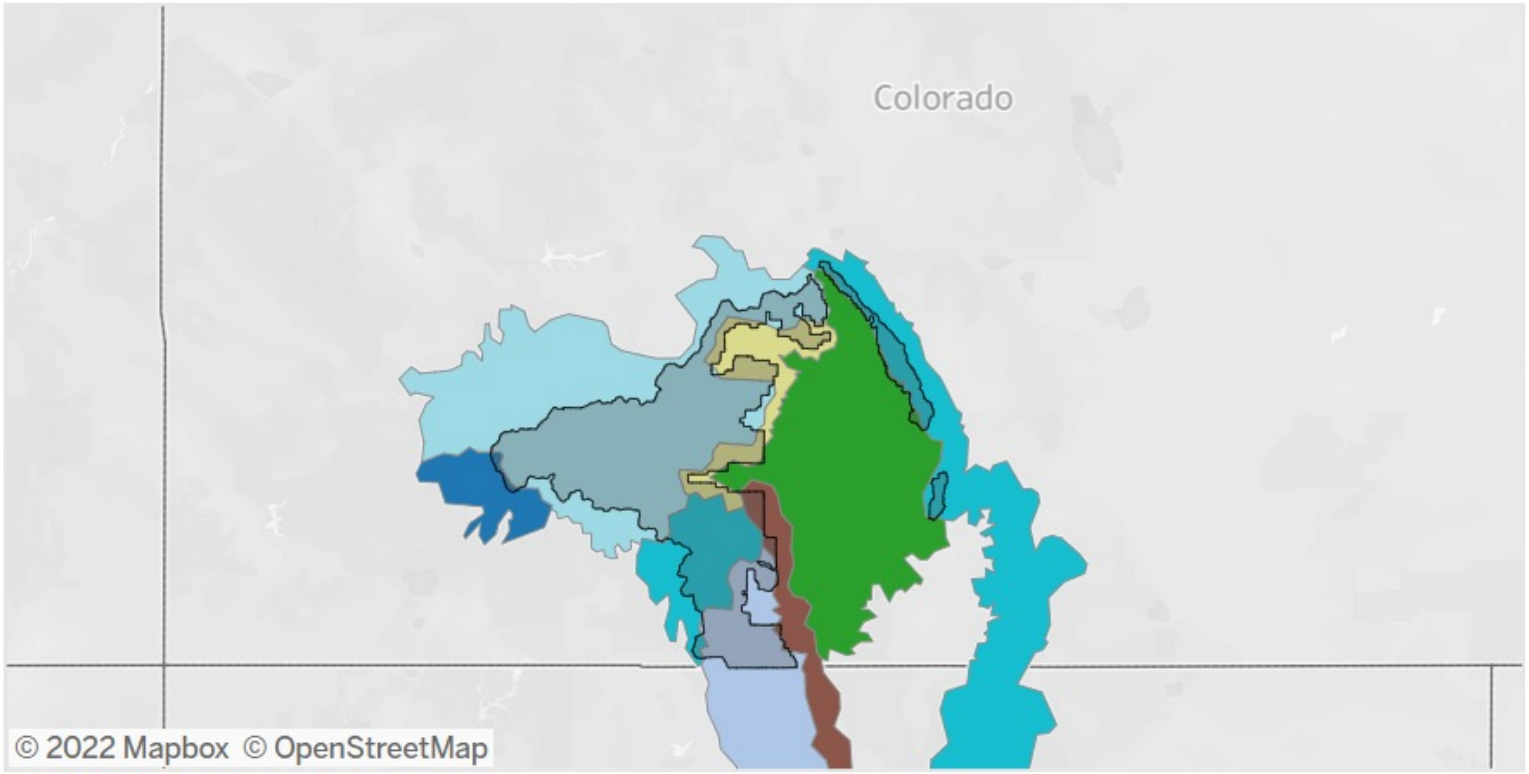
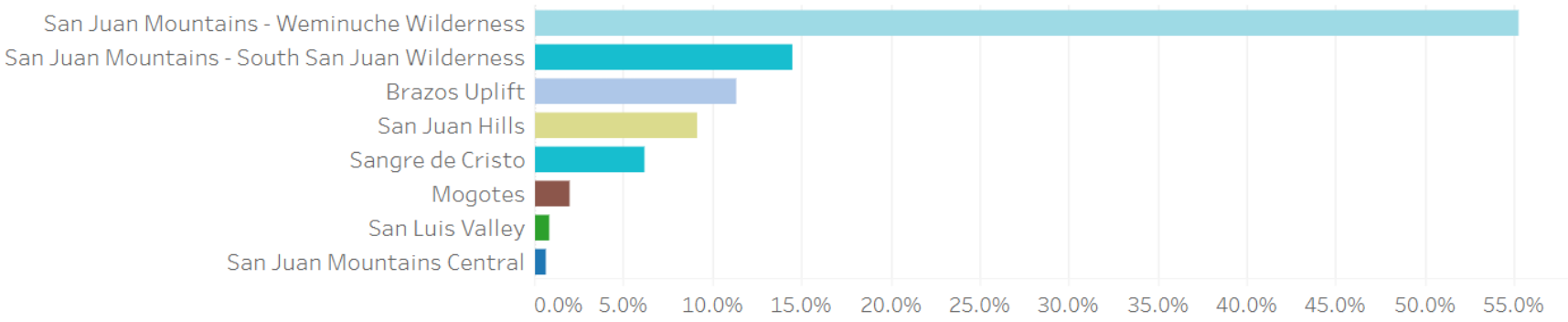
Climate By Forest
National Forest
Ecoregion
Variable
Average Daily Max Temp
Frequency
Annual
Click to view a user guide and map of the ecoregions.
NEMAC+FernLeaf
Please enter an ecoregion name to begin
Southern Blue Ridge Mountains
This interactive graph shows modeled RCP 8.5 and RCP 4.5 data for forest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

Rio Grande National Forest Ecoregions





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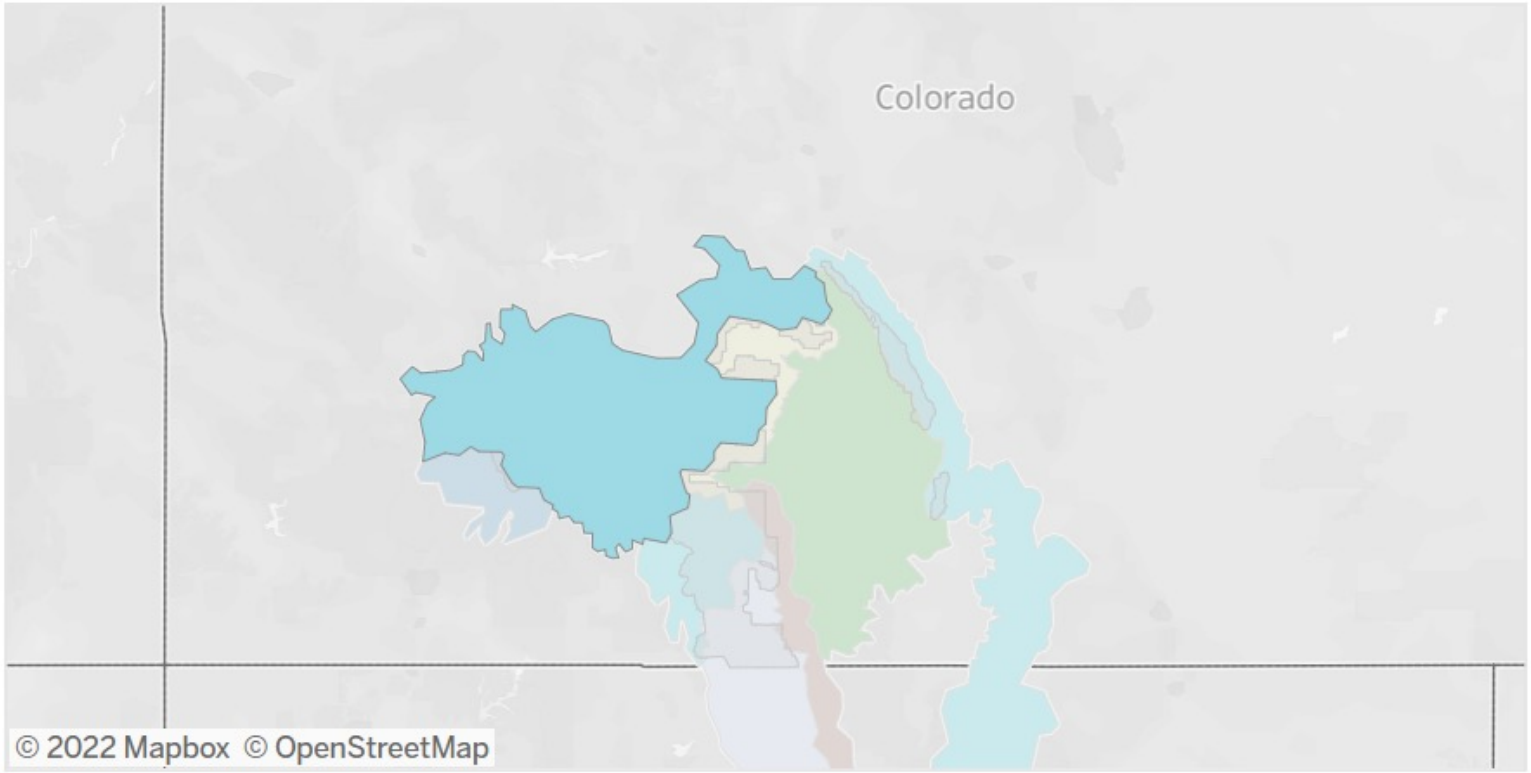
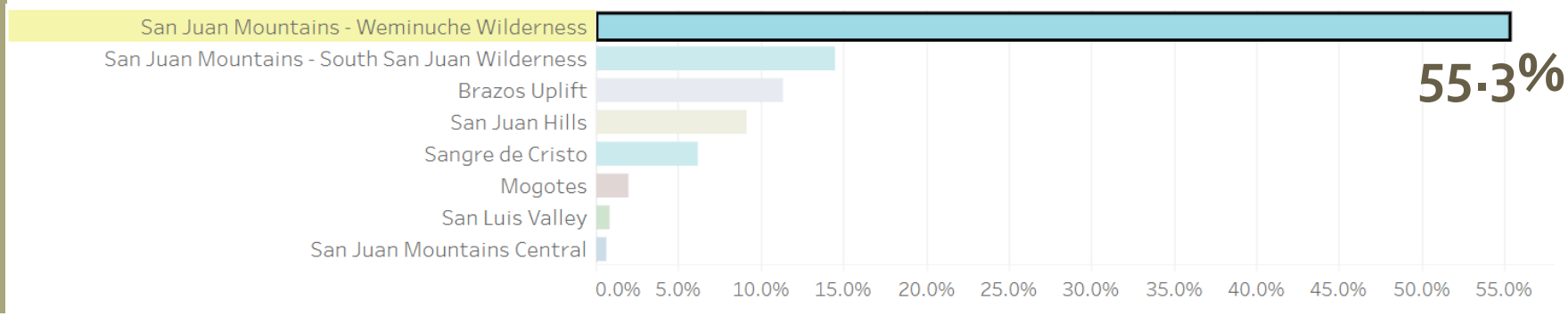
San Juan Mountains – Weminuche Wilderness





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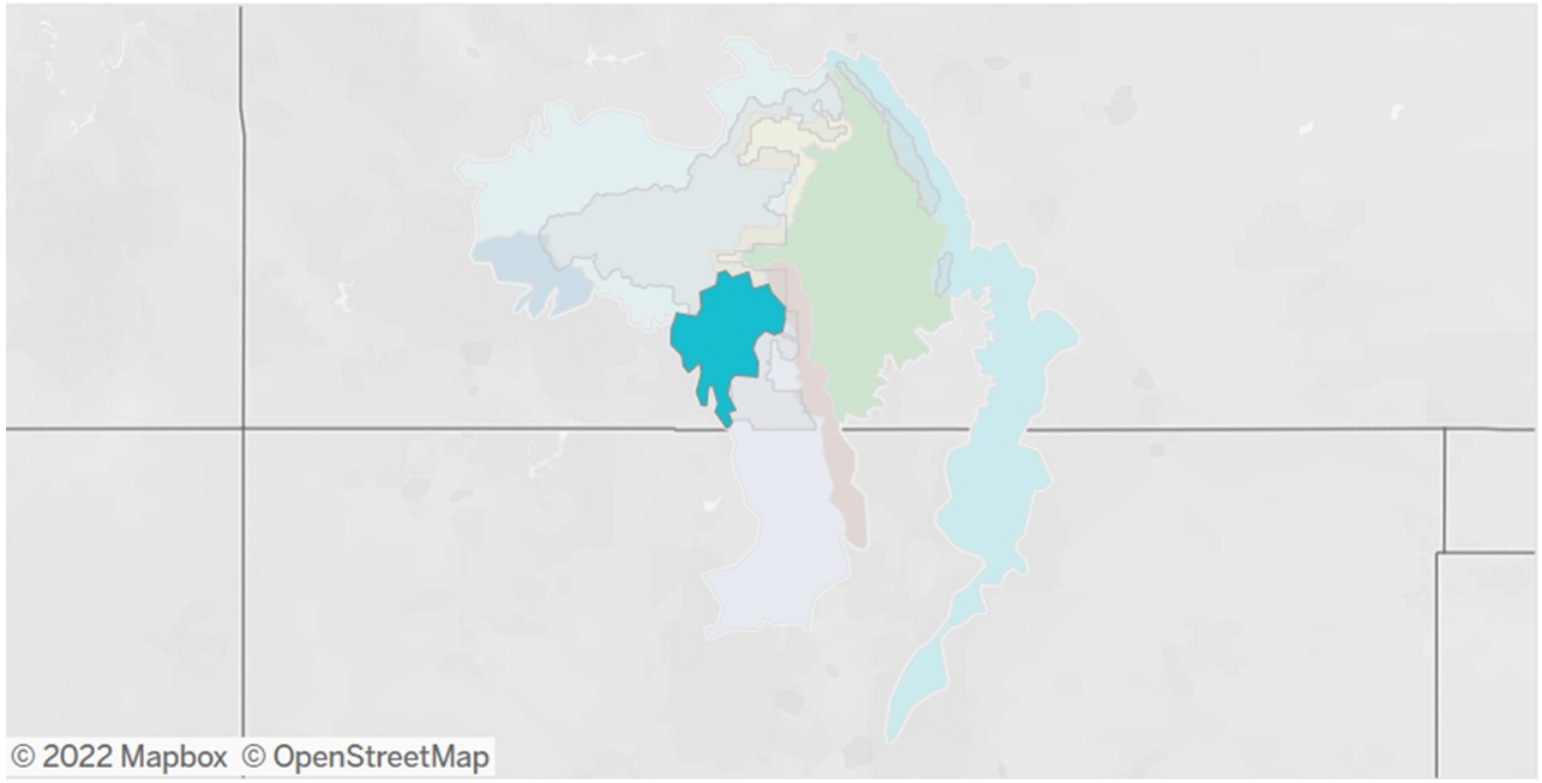
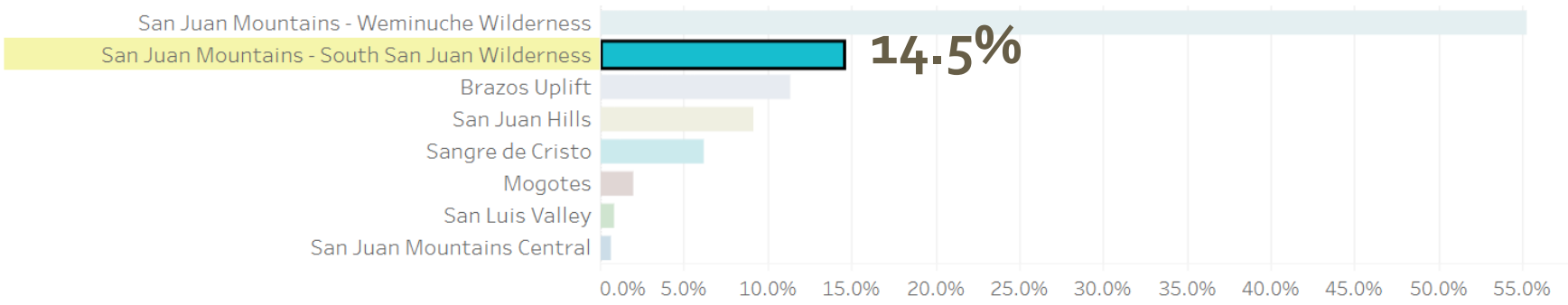
San Juan Mountains – South San Juan Wilderness





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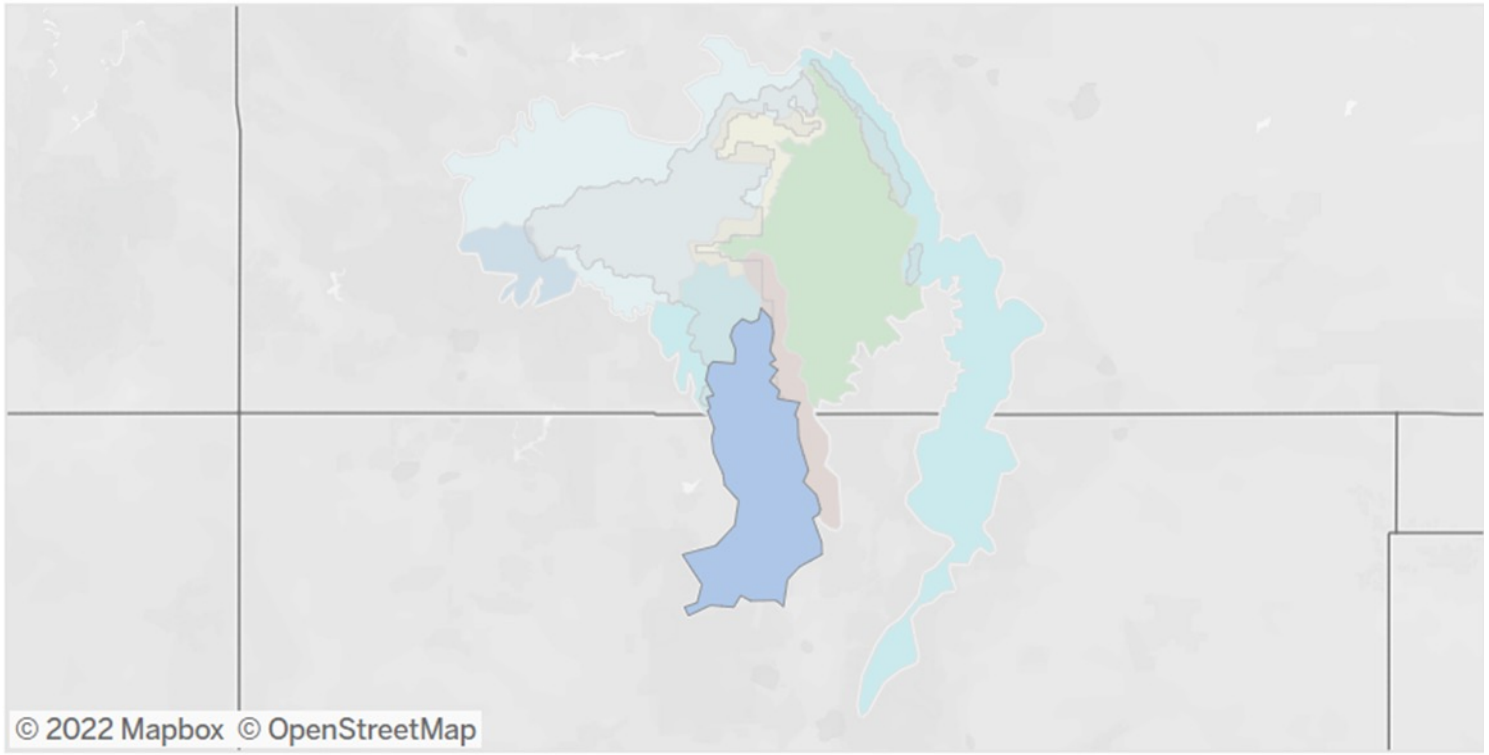
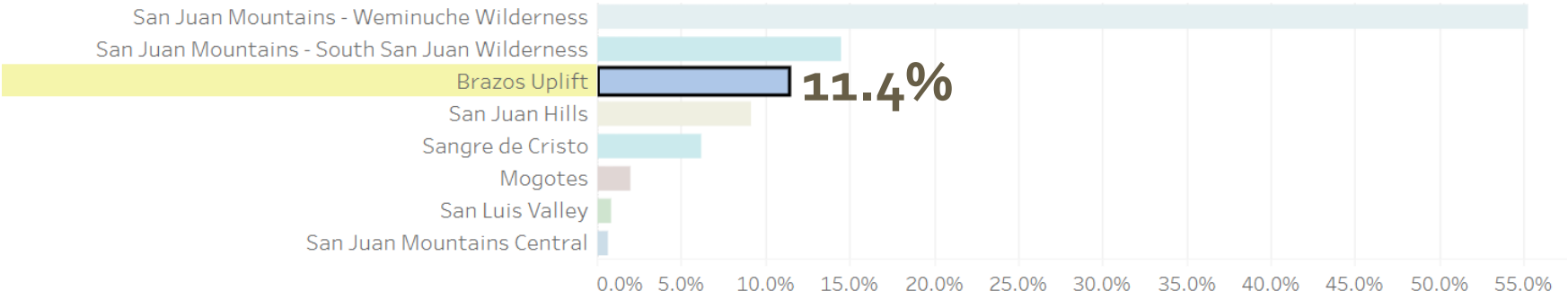
Brazos Uplift





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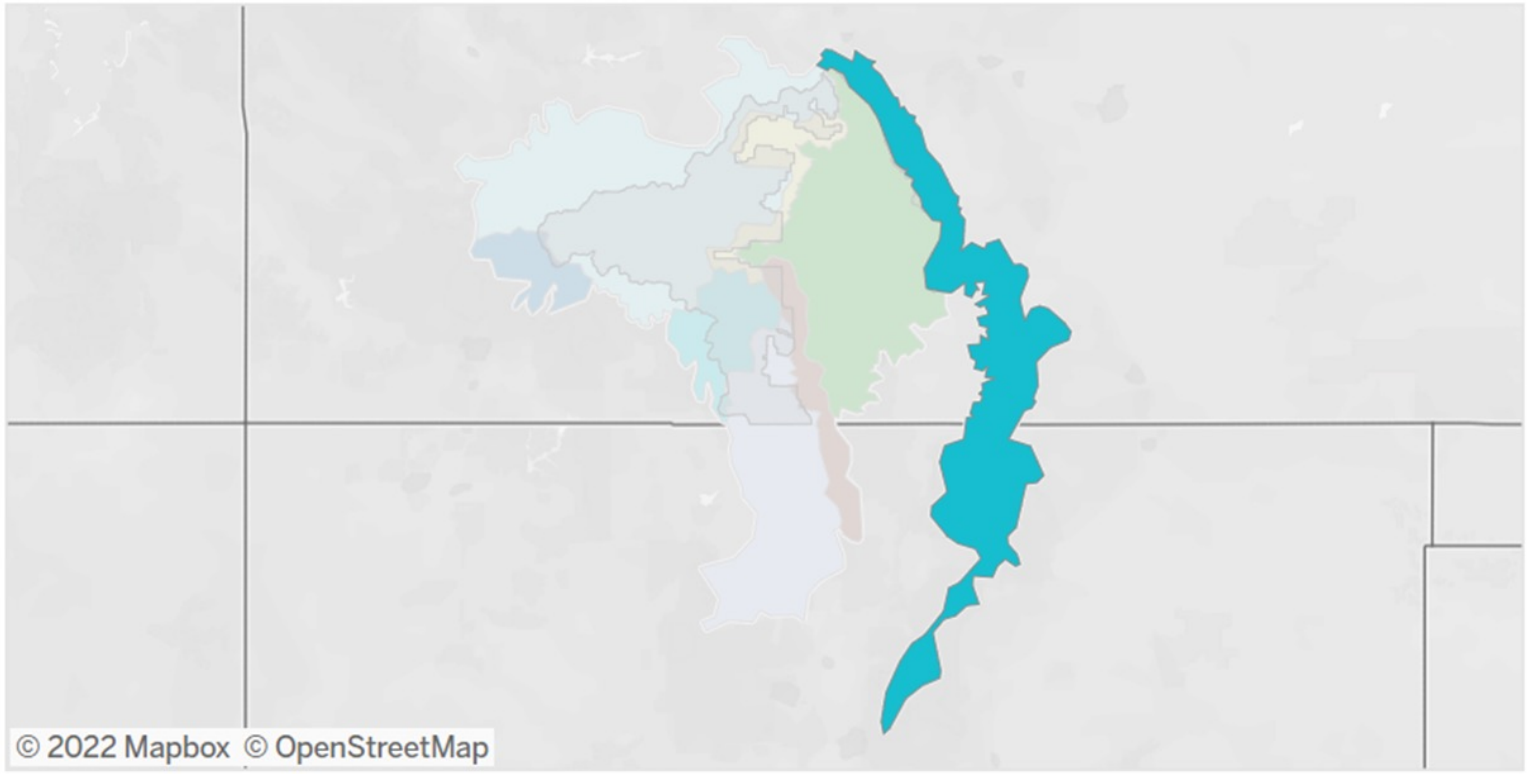
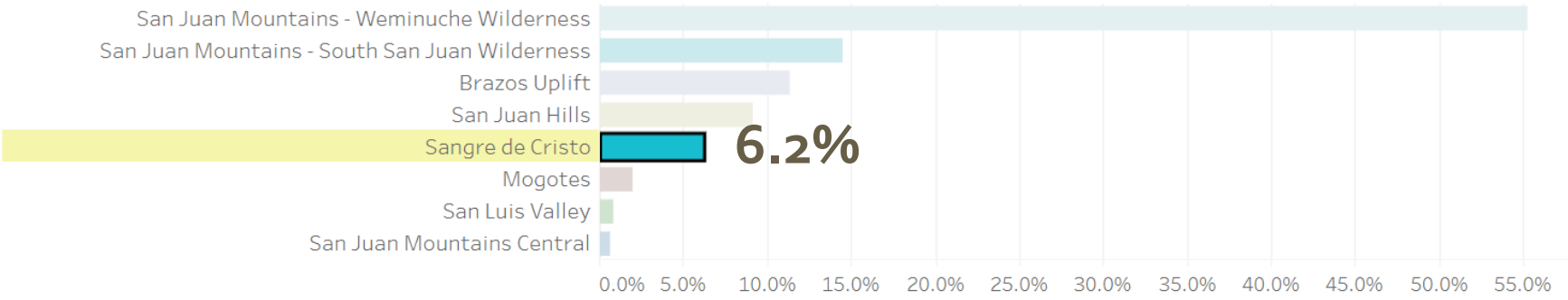
Sangre de Cristo





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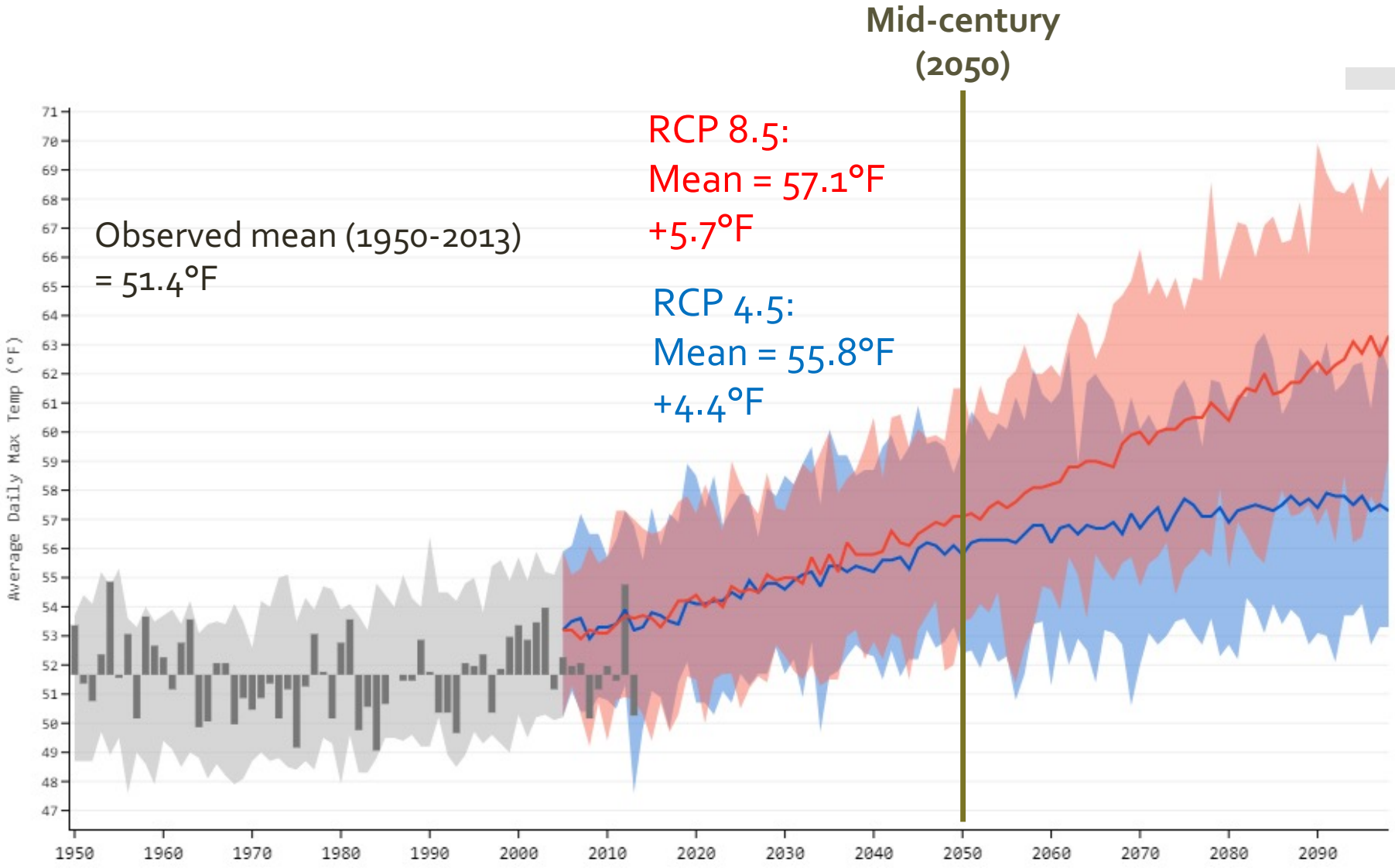
Projected Average Daily Maximum Temperature



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

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Projected Average Daily Maximum Temperature

Rio Grande National Forest Ecoregion	Observed (1950-2013)	Mid-century (2050)		End-of-century (2098)	
		RCP4.5	RCP8.5	RCP4.5	RCP8.5
	Mean Temp (°F)	Mean Temp (°F)	Mean Temp (°F)	Mean Temp (°F)	Mean Temp (°F)
Brazos Uplift	56.3	60.6	61.9	62.1	68.0
San Juan Mountains – South San Juan Wilderness	50.7	55.2	56.5	56.7	62.6
San Juan Mountains – Weminuche Wilderness	51.4	55.8	57.1	57.3	63.3
Sangre de Cristo	58.8	62.9	64.1	64.4	70.3

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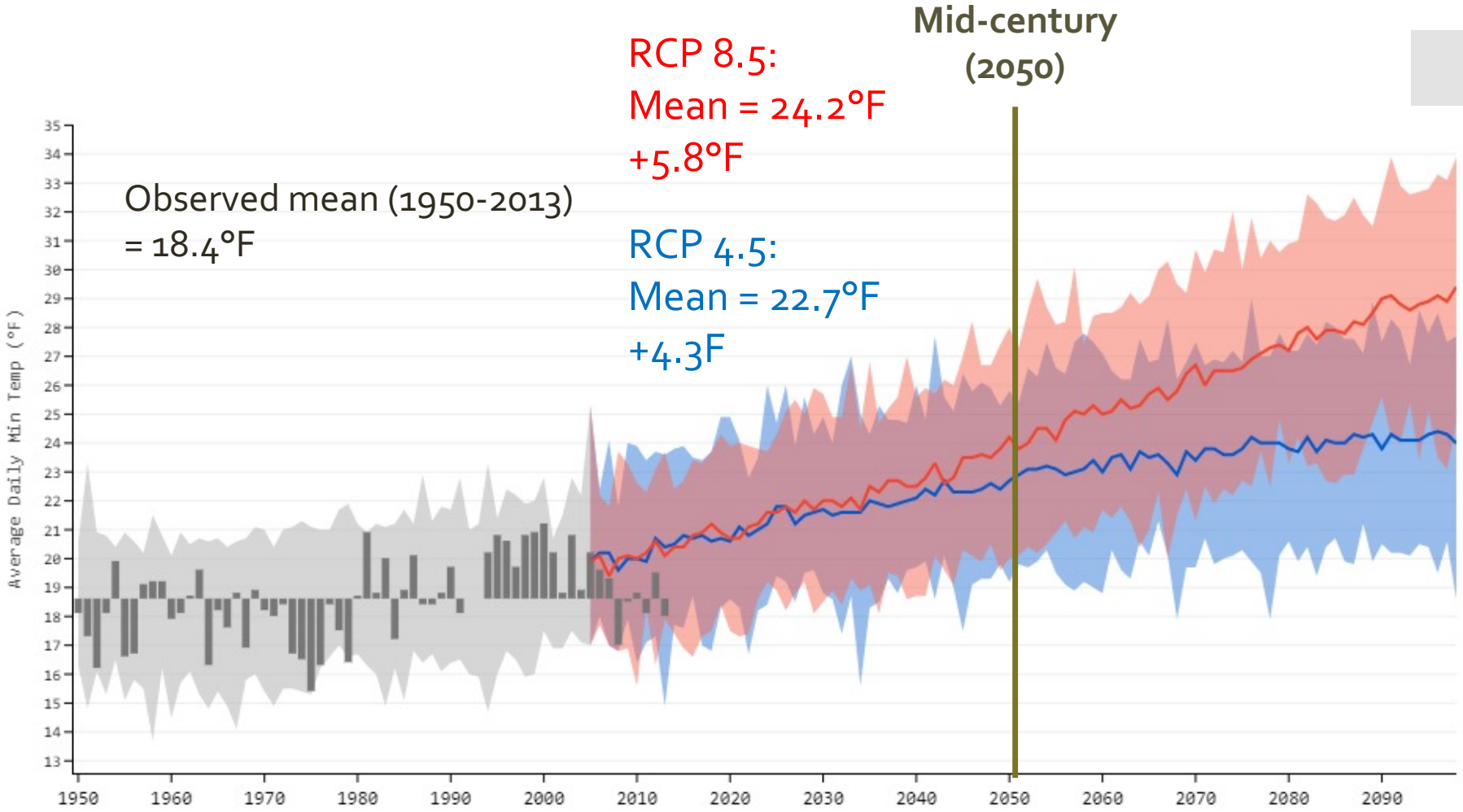
https://climate-by-forest.nemac.org/

Projected Average Daily Minimum Temperature



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

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Projected Average Daily Minimum Temperature

Rio Grande National Forest Ecoregion	Observed (1950-2013)	Mid-century (2050)		End-of-century (2098)	
	Mean Temp (°F)	RCP4.5 Mean Temp (°F)	RCP8.5 Mean Temp (°F)	RCP4.5 Mean Temp (°F)	RCP8.5 Mean Temp (°F)
Brazos Uplift	24.1	27.9	29.5	29.4	34.3
San Juan Mountains – South San Juan Wilderness	18.8	22.9	24.6	24.4	29.4
San Juan Mountains – Weminuche Wilderness	18.4	22.7	24.2	24.0	24.7
Sangre de Cristo	26.8	30.4	31.9	31.9	36.9

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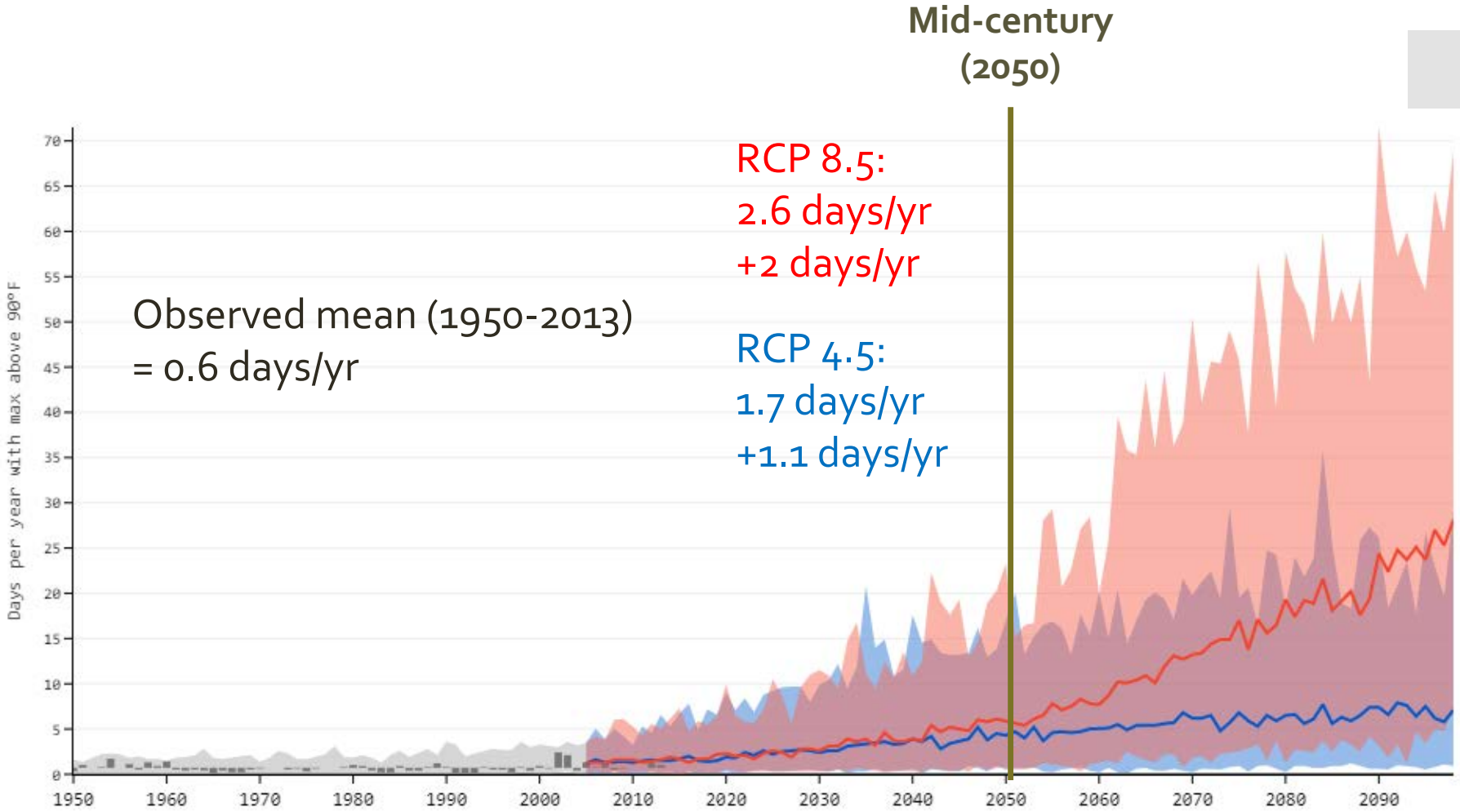
Projected Days per Year with Maximum Temperature Above 90° F (Heat Days)



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

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

Ecoregion	Observed (1950-2013)	Mid-Century (2050)		End-of-century (2098)	
	Days/Year	RCP4.5 Days/Year	RCP8.5 Days/Year	RCP4.5 Days/Year	RCP8.5 Days/Year
Brazos Uplift	2.1	12.6	16.9	18.6	52.5
San Juan Mountains – South San Juan Wilderness	0.1	1.7	2.6	3.1	17.4
San Juan Mountains – Weminuche Wilderness	0.6	4.3	5.9	7.1	28.1
Sangre de Cristo	3.5	16.0	21.1	23.4	62.6

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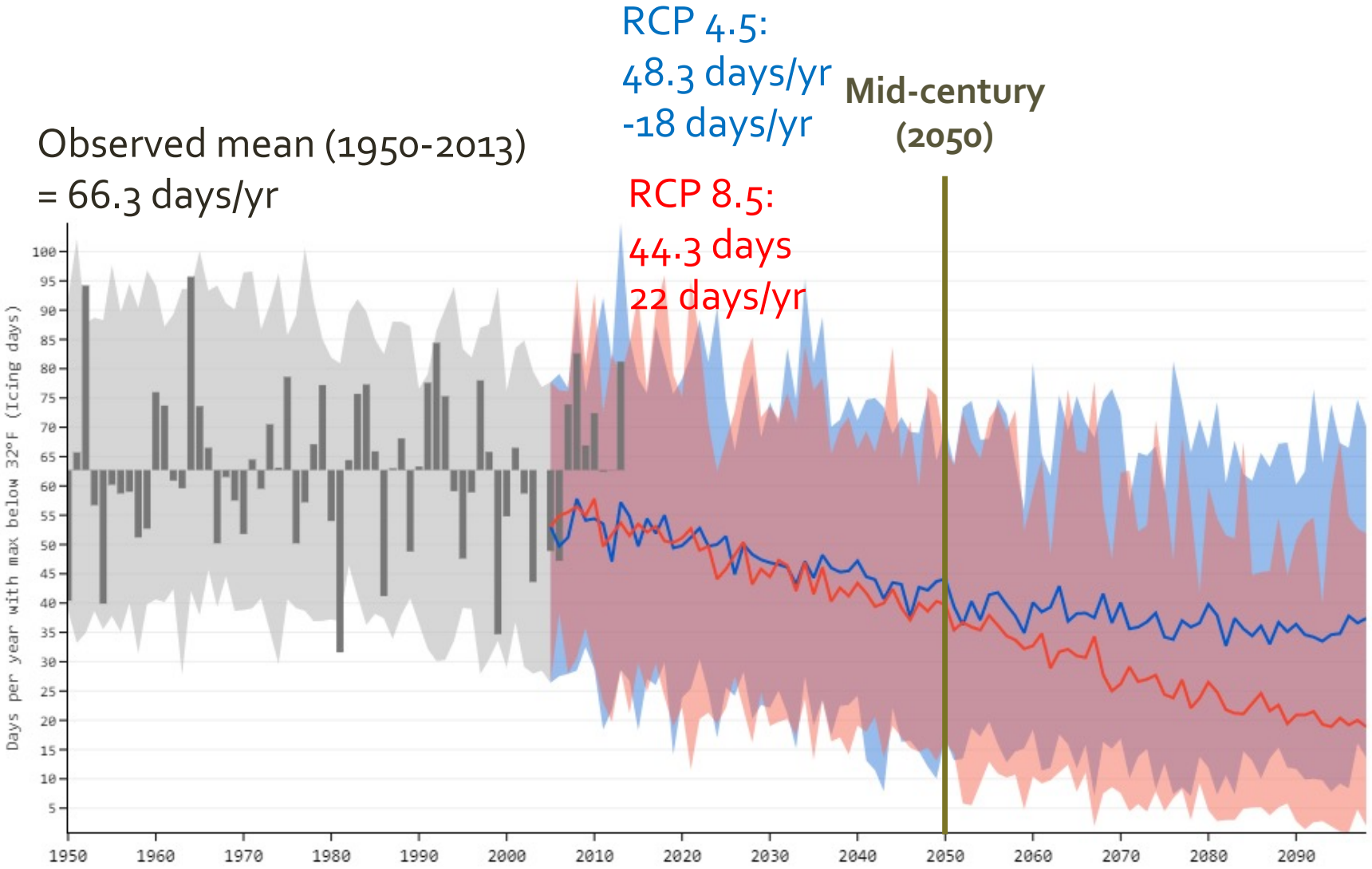
Projected Days per Year with Maximum Temperature Below 32° F (Icing Days)



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

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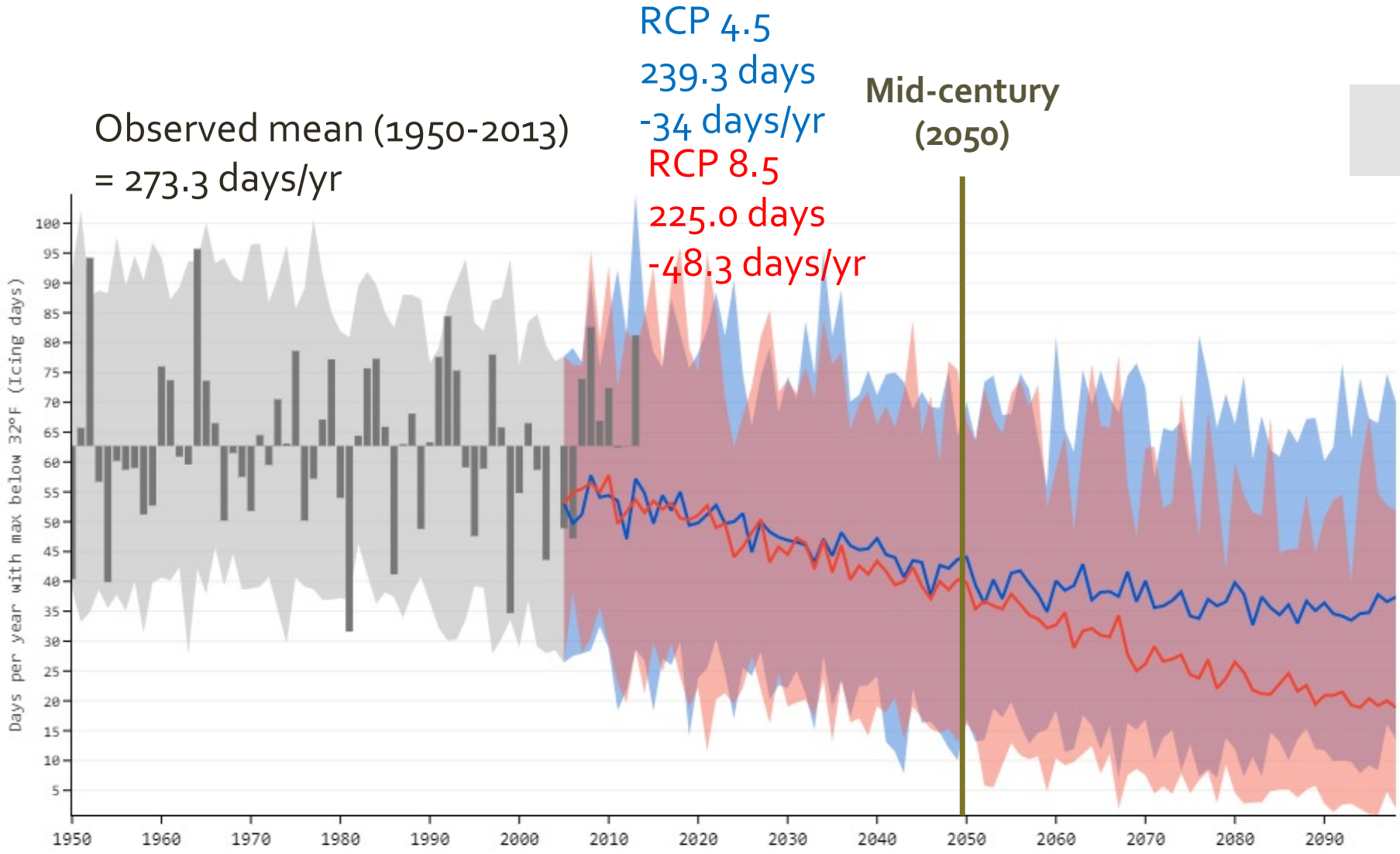
Projected Days per Year with Maximum Temperature Below 32° F (Icing Days)

Ecoregion	Observed (1950-2013)	Mid-Century (2050)		End-of-century (2098)	
	Days/Year	RCP4.5 Days/Year	RCP8.5 Days/Year	RCP4.5 Days/Year	RCP8.5 Days/Year
Brazos Uplift	37.2	25.0	22.0	20.3	9.5
San Juan Mountains – South San Juan Wilderness	63.2	44.1	39.8	37.4	18.9
San Juan Mountains – Weminuche Wilderness	66.3	48.3	44.3	41.4	22.3
Sangre de Cristo	26.2	18.6	16.4	14.5	6.8

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/

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

Ecoregion	Observed (2050-2013)	Mid-century (2050)		End-of-century (2098)	
	Days/Year	RCP4.5 Days/Year	RCP8.5 Days/Year	RCP4.5 Days/Year	RCP8.5 Days/Year
Brazos Uplift	235.6	208.3	193.5	198.4	164.5
San Juan Mountains – South San Juan Wilderness	272.8	239.6	224.3	230.3	194.4
San Juan Mountains – Weminuche Wilderness	273.3	239.3	225.0	230.7	192.7
Sangre de Cristo	214.1	188.8	175.7	179.7	145.5

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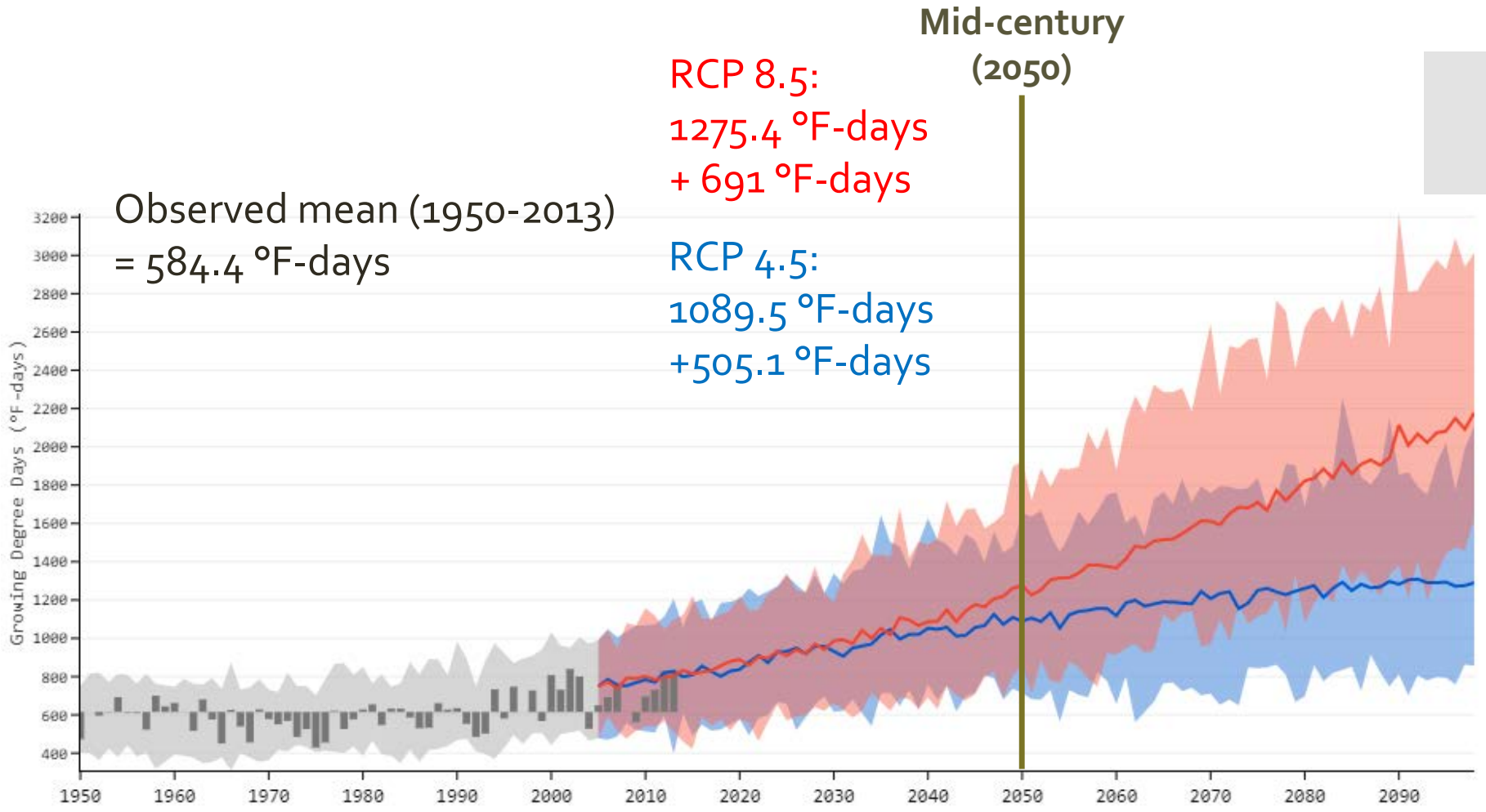
Projected Growing Degree Days (GDD)

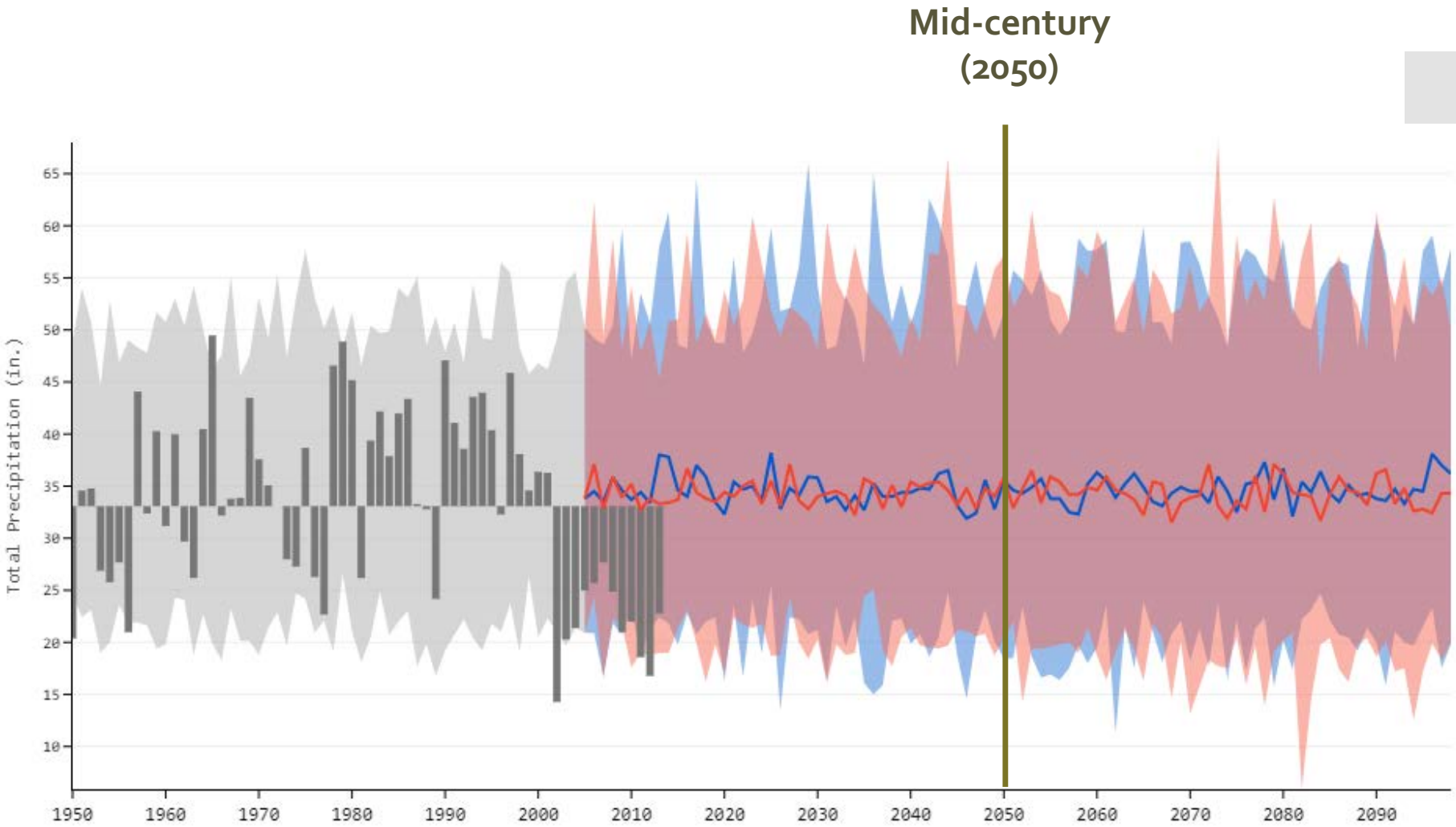


Projected Growing Degree Days
in the San Juan Mountains – Weminuche Wilderness Ecoregion

Projected Growing Degree Days (GDD)

	Observed (1950-2013)	Mid-century (2050)		End-of-century (2098)	
Ecoregion	Observed Days	RCP4.5 °F-days	RCP8.5 °F-days	RCP4.5 °F-days	RCP8.5 °F-days
Brazos Uplift	1088.4	1734.0	1984.7	1979.2	2999.5
San Juan Mountains – South San Juan Wilderness	450.5	932.4	1113.5	1130.8	1962.8
San Juan Mountains – Weminuche Wilderness	584.4	1089.5	1275.4	1290.1	2178.6
Sangre de Cristo	1374.8	2067.9	2327.4	2338.2	3454.2

Projected Precipitation



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

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

Projected Precipitation

Ecoregion	Observed (1950-2013)	Mid-century (2050)		End-of-century (2098)	
	Total Annual Precip (in.)	RCP4.5 Total Annual Precip (in.)	RCP8.5 Total Annual Precip (in.)	RCP4.5 Total Annual Precip (in.)	RCP8.5 Total Annual Precip (in.)
Brazos Uplift	22.3	22.5	22.9	22.6	21.3
San Juan Mountains – South San Juan Wilderness	34.7	35.5	35.8	36.2	34.3
San Juan Mountains – Weminuche Wilderness	24.1	24.7	24.5	25.1	24.0
Sangre de Cristo	17.4	17.4	18.0	17.1	16.3

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

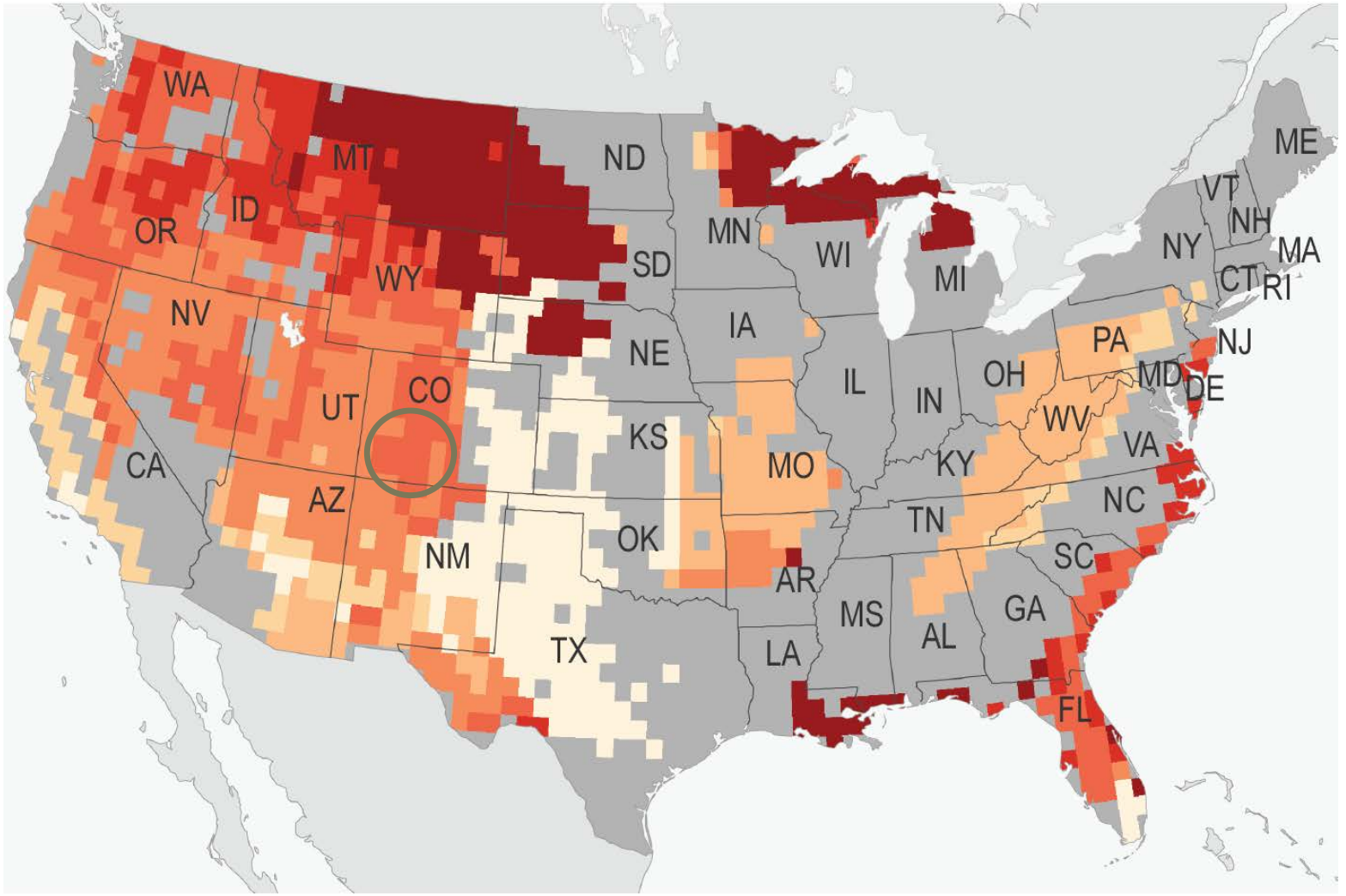
By the end of the 21st century…

- **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

Fire

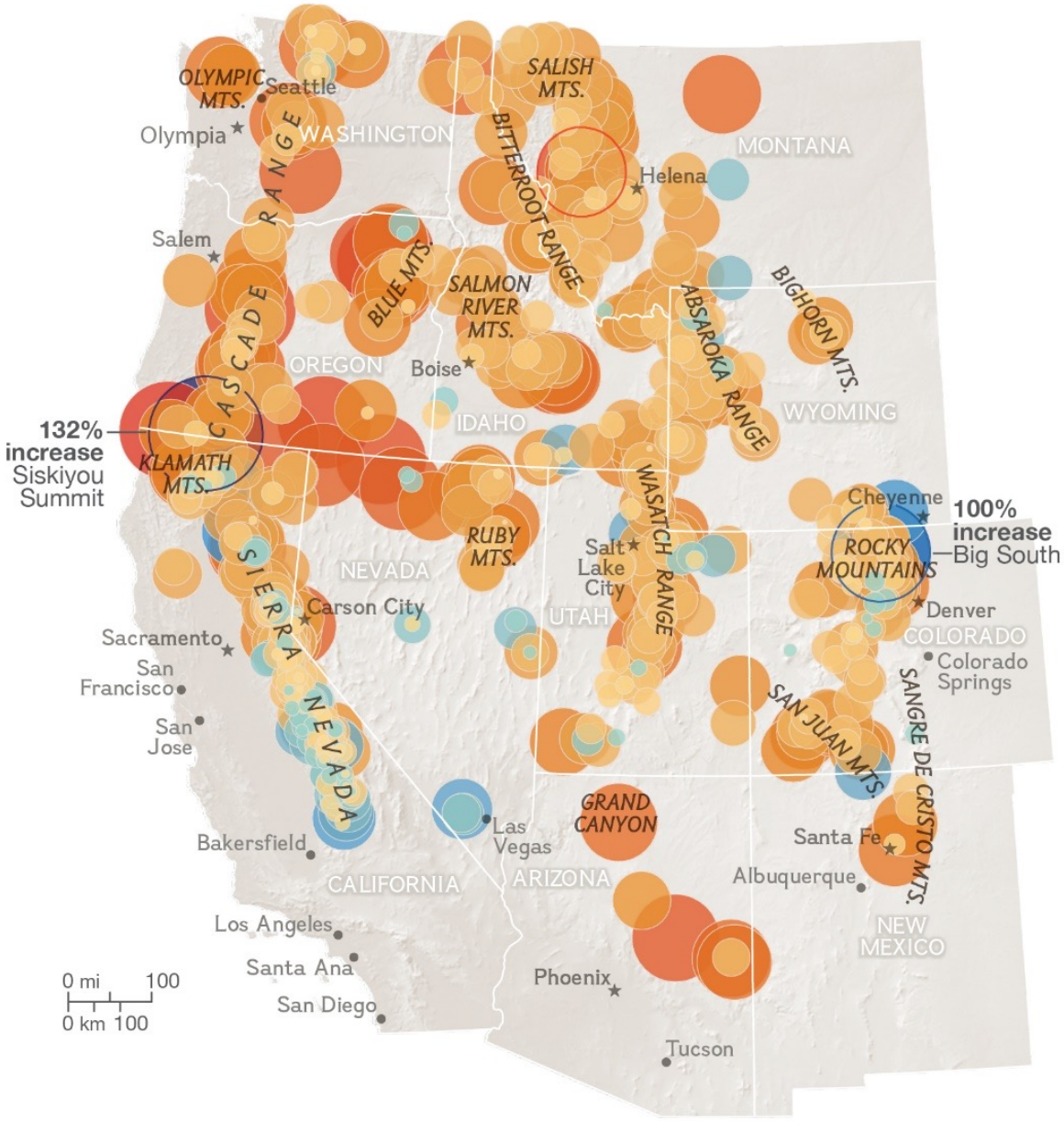
Projected Increase in Risk of Very Large Fires by Mid-Century



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

0 50 100 200 300 400 500 600

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

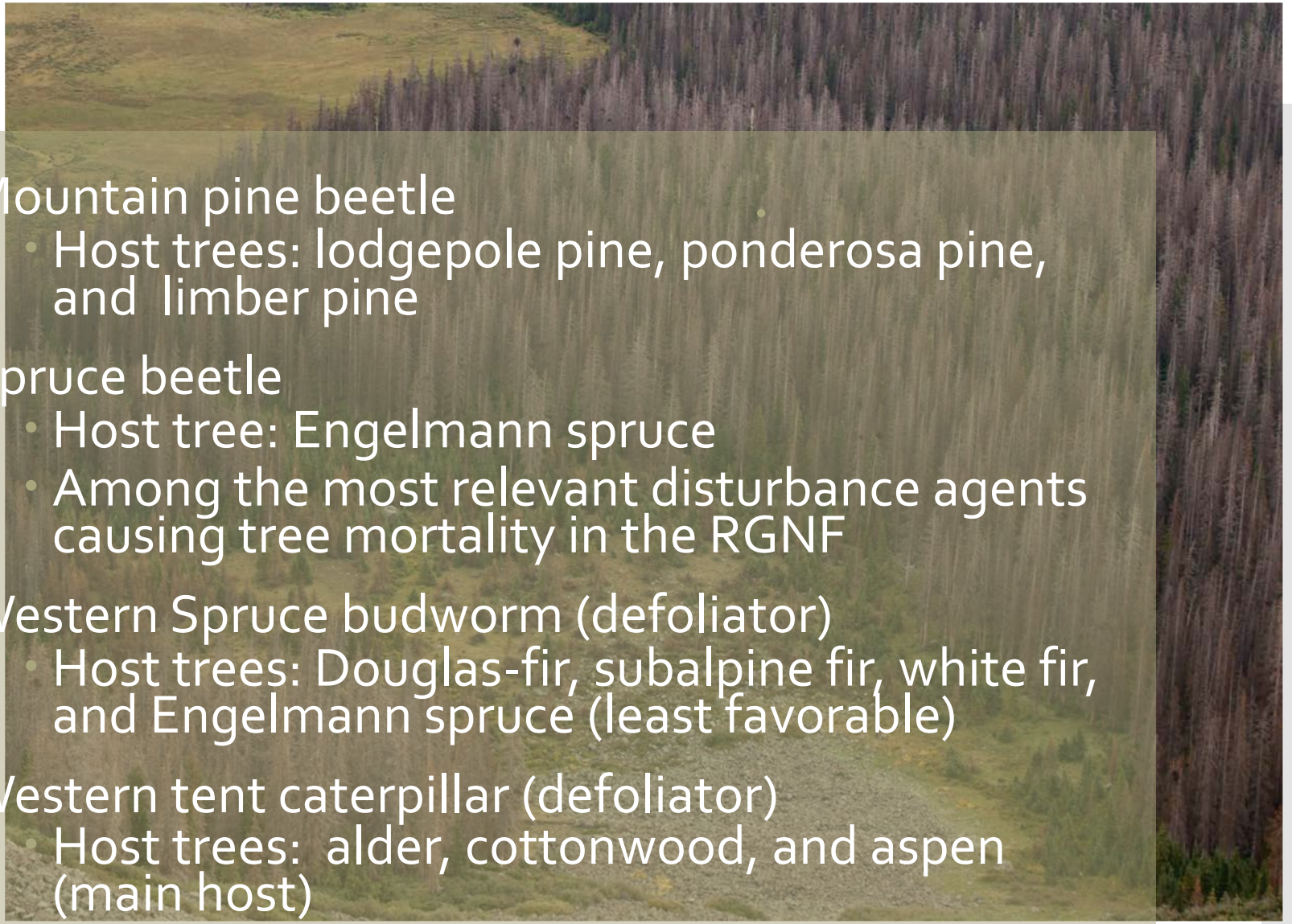
Hydrology

- 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

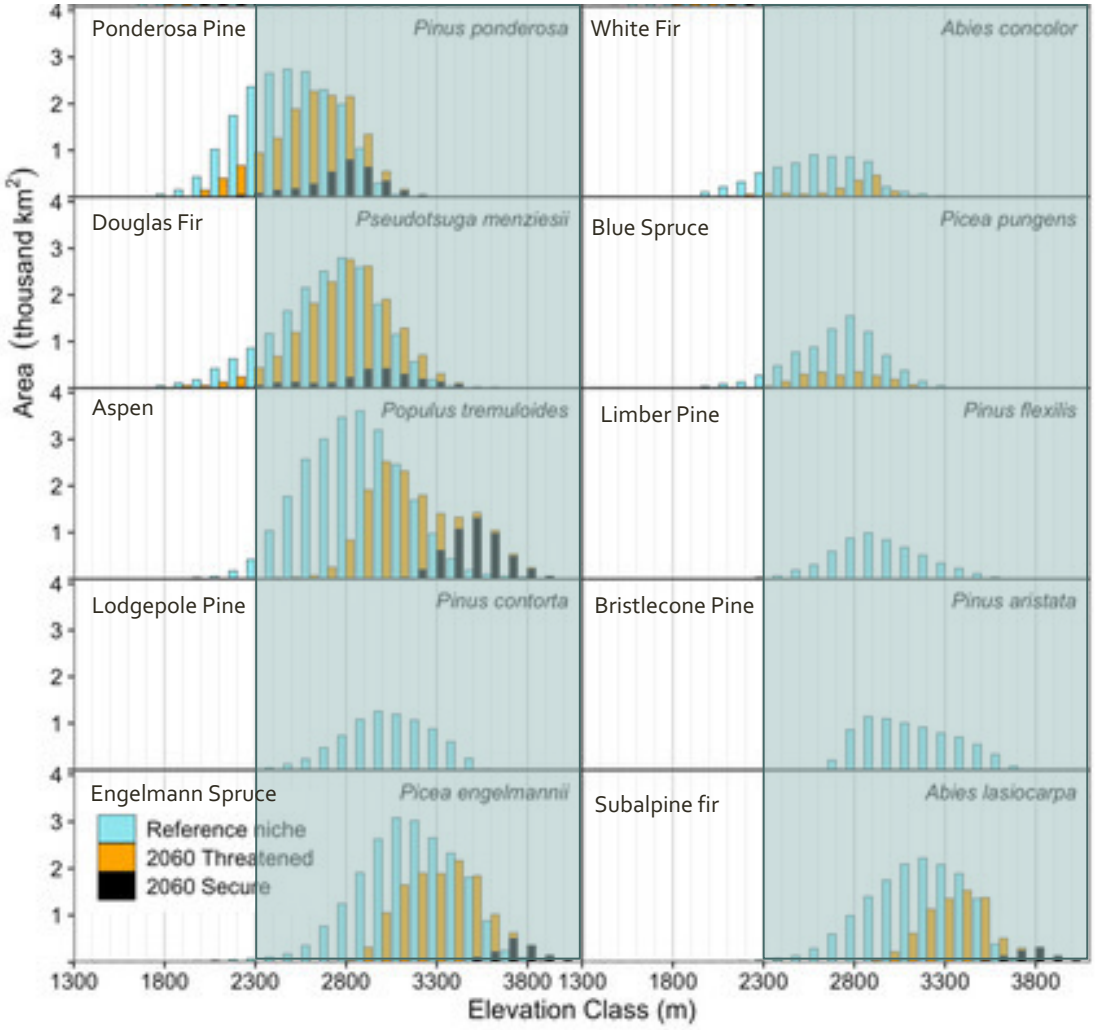
White Pine Blister Rust (USFS)

Dwarf mistletoe (Colorado State Forest Service)

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

Vegetation Class Niche Shifts

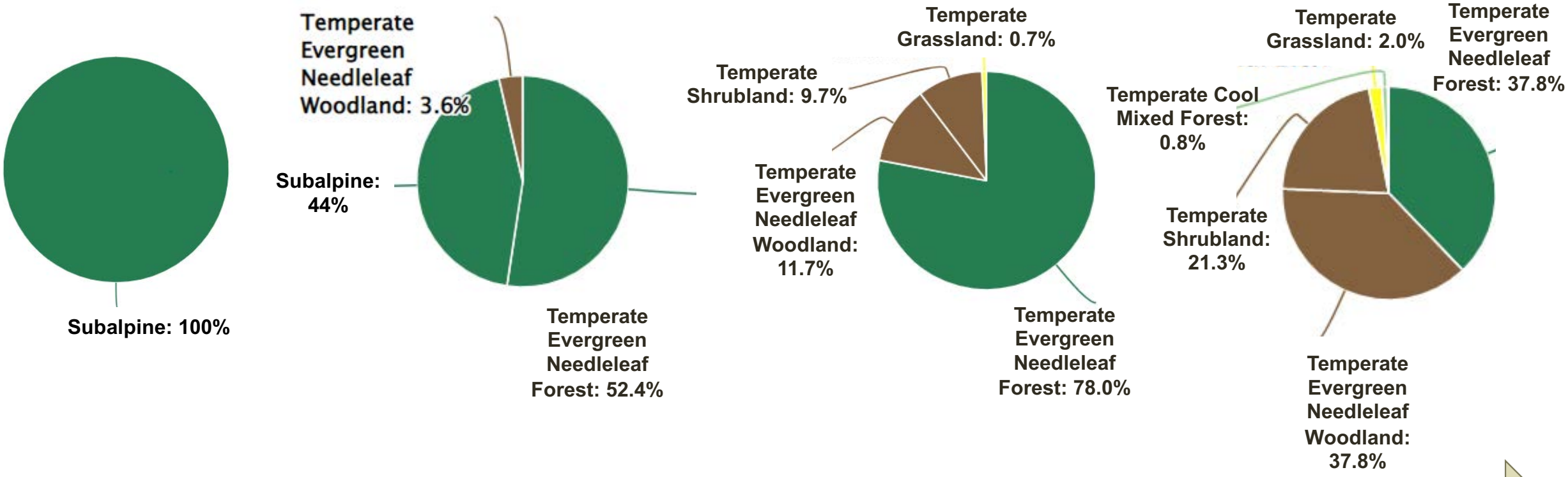
Climate Niche Models - 2060



- Blue shaded box represents RGNF elevational gradient (2316 – 4358 m or 7,600-14,335 ft)
- **Potential loss** of Limber pine, Bristlecone pine, and Lodgepole pine
- **Threatened:** Engelmann Spruce, Blue Spruce, White fir
- **Secure:** Ponderosa Pine, Douglas-fir, Aspen, and subalpine fir

Worrall, J.J.; Rehfeldt, G.E. Strategic Application of Topoclimatic Niche Models in Managing Forest Change. Forests 2021, 12, 1780. https://doi.org/10.3390/f12121780

Climate-Driven Shifts in Vegetation Cover



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

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

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Thank you!

Lauren Kramer:
Lauren.Kramer@usda.gov

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

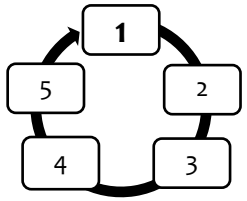
USDA Southwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

References

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

Pre-Work

- Complete Step 1 worksheet and supplemental questions for your district or program area and send to Judi, Lauren, or Courtney by **October 18.**
- This information will help us organize our discussions as we move through the Adaptation Workbook. Thank you for sharing!
- Workshop details: https://forestadaptation.org/learn/RGNF



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

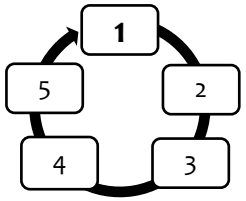
Key Questions:

- 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

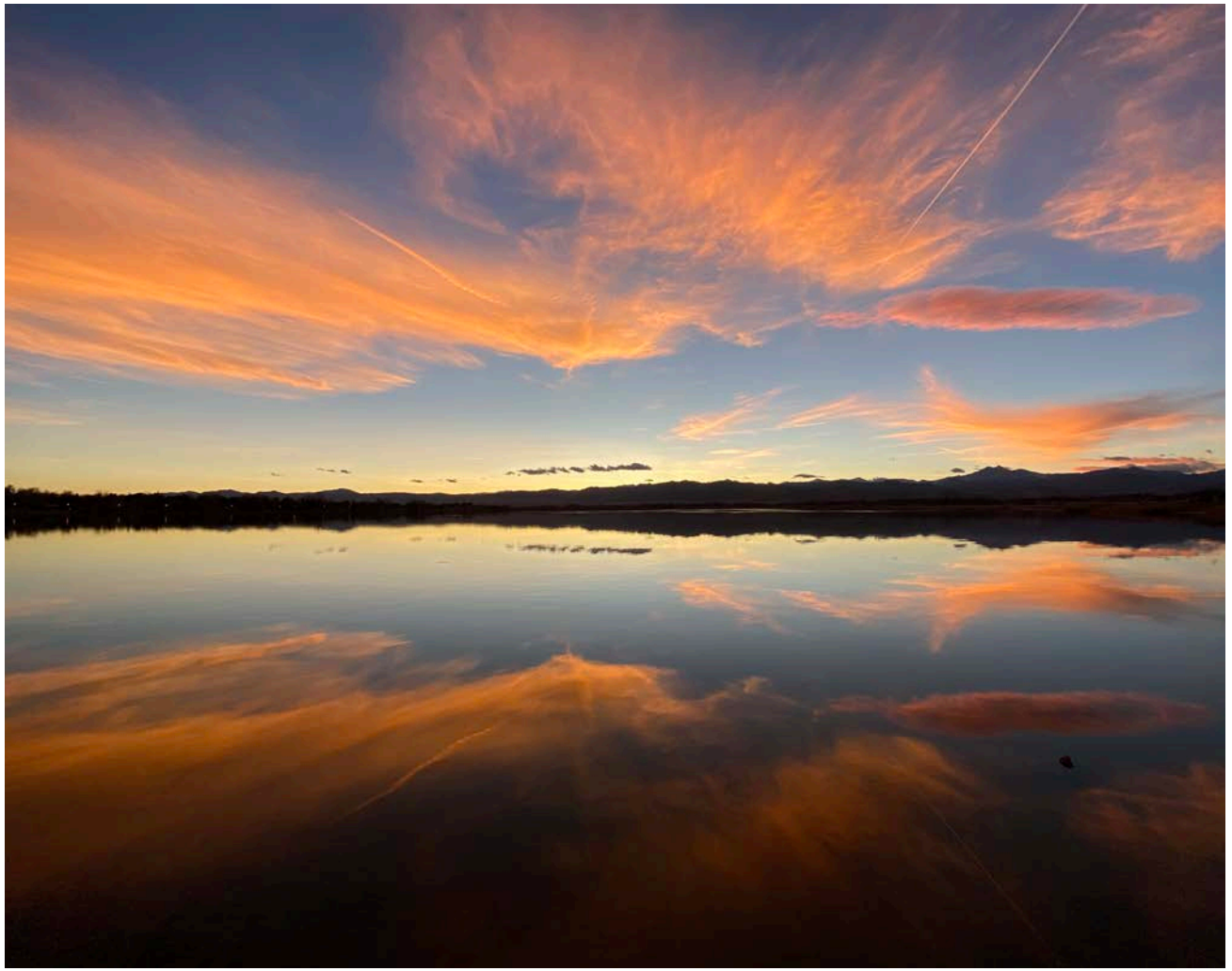


Step 1: Where are you working and what do you care about?

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

Questions/Discussion?
Thank you!



See you on Tuesday, October 25 at 10:00 a.m. at the Rio Grande Water Conservation District!

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