Climate Change Trends & Projections

FOR NATURAL LANDS PRESERVES

EcoAdapt™

Meeting the challenges of climate change

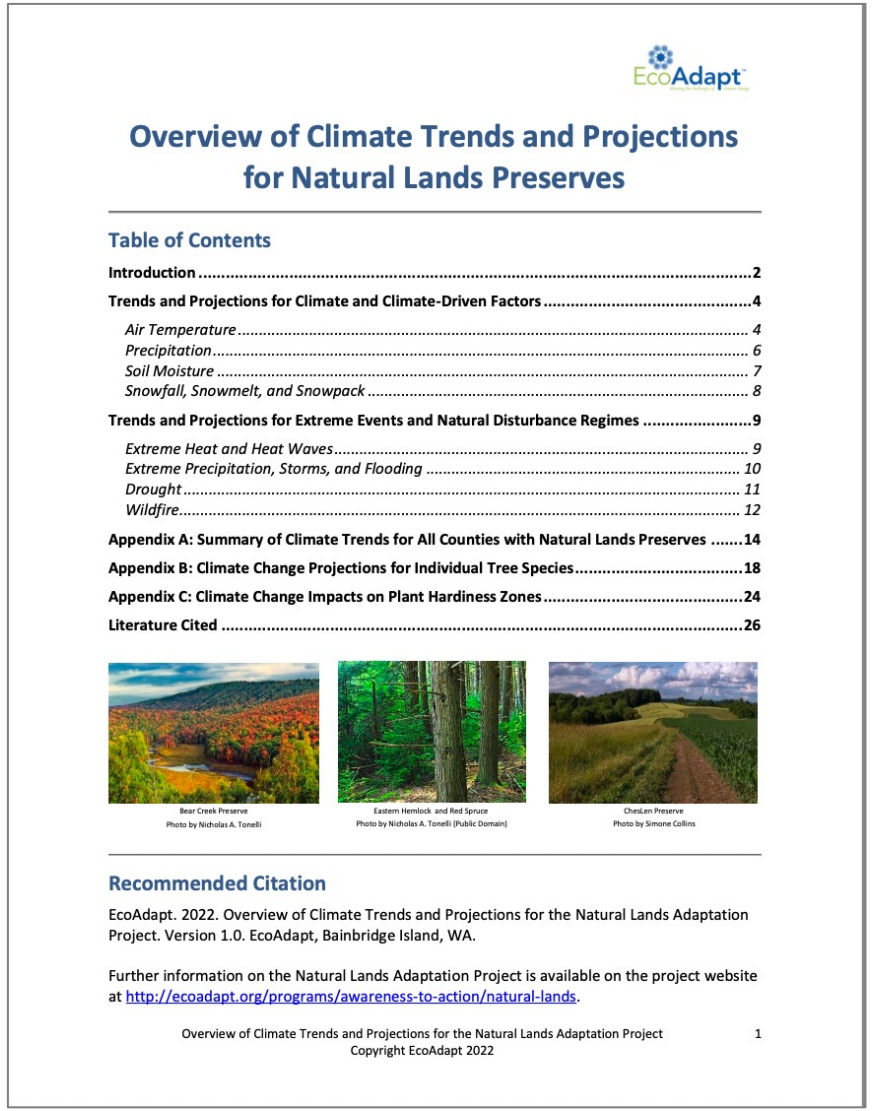
Introduction

Climate Projections

What future changes do scientists expect to occur?

Information drawn from multiple sources:

- PA 2021 Climate Impacts Assessment
- Climate Explorer (web-based tool)
- Other scientific literature (reports and peer-reviewed journal articles)



EcoAdapt

Overview of Climate Trends and Projections for Natural Lands Preserves

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Bear Creek Preserve
Photo by Nicholas A. Tonelli

Eastern Hemlock and Red Spruce
Photo by Nicholas A. Tonelli (Public Domain)

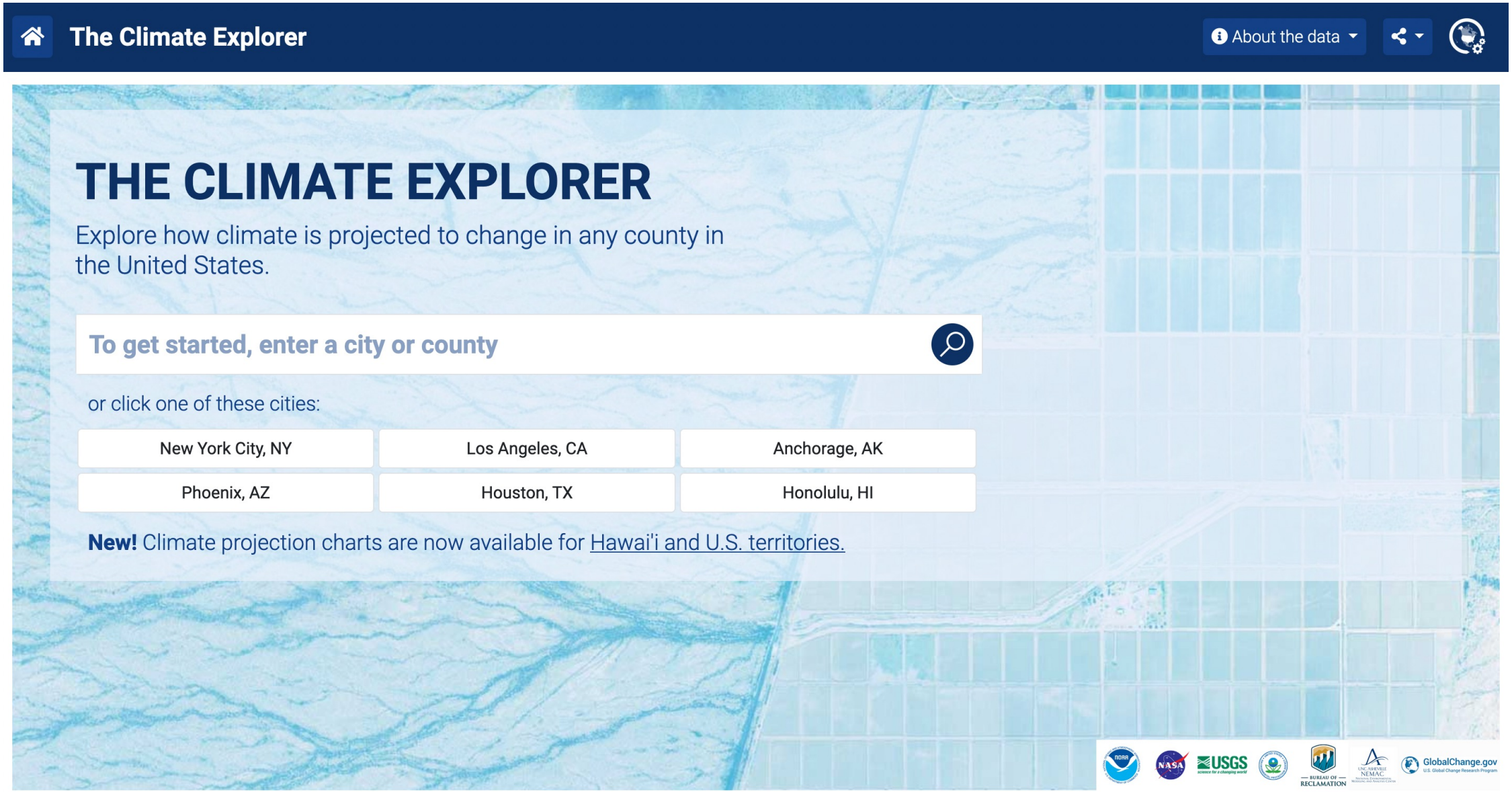
ChesLen Preserve
Photo by Simone Collins

Recommended Citation

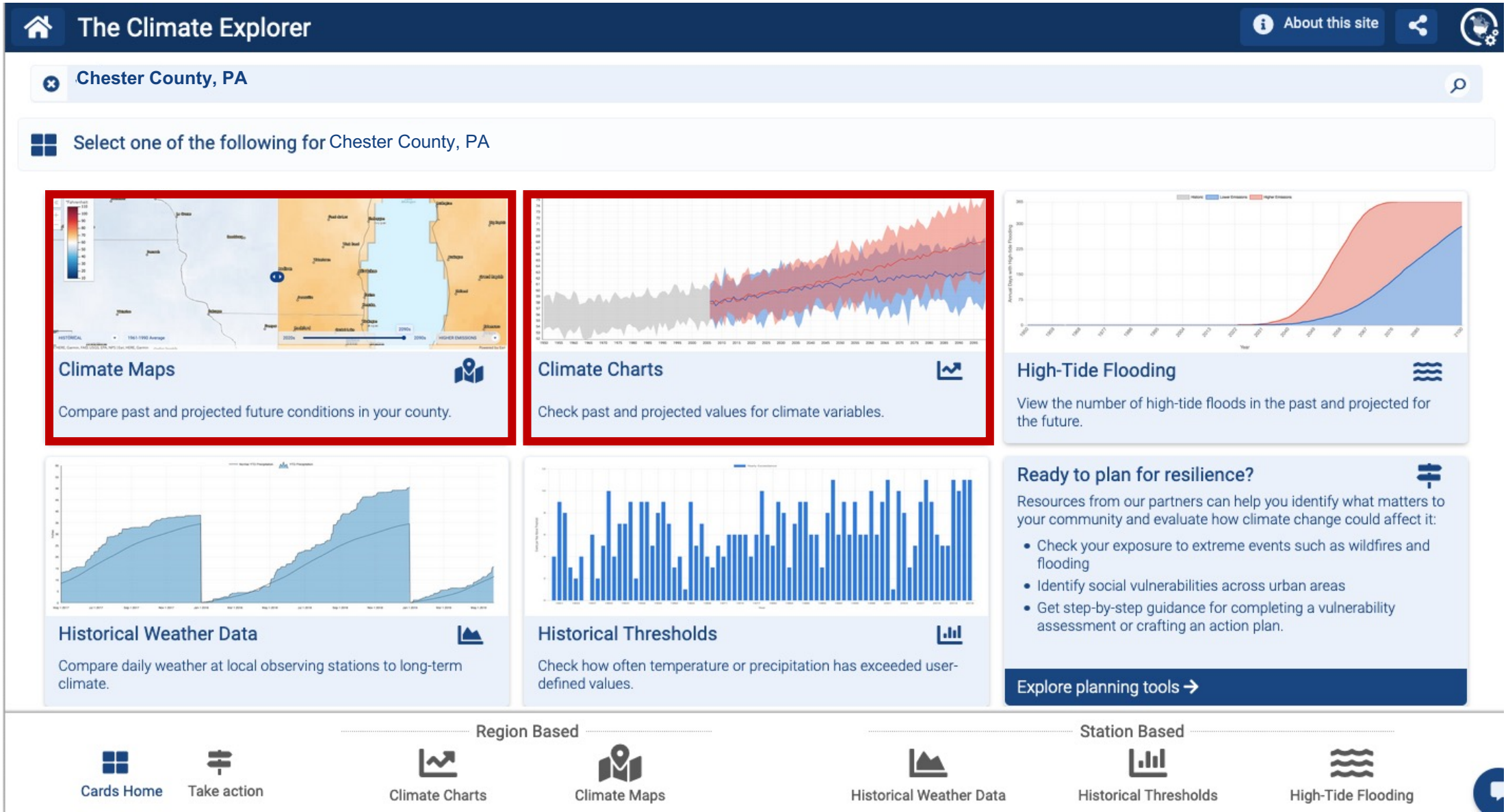
EcoAdapt. 2022. Overview of Climate Trends and Projections for the Natural Lands Adaptation Project. Version 1.0. EcoAdapt, Bainbridge Island, WA.

Further information on the Natural Lands Adaptation Project is available on the project website at http://ecoadapt.org/programs/awareness-to-action/natural-lands.

Climate Explorer



Climate Explorer



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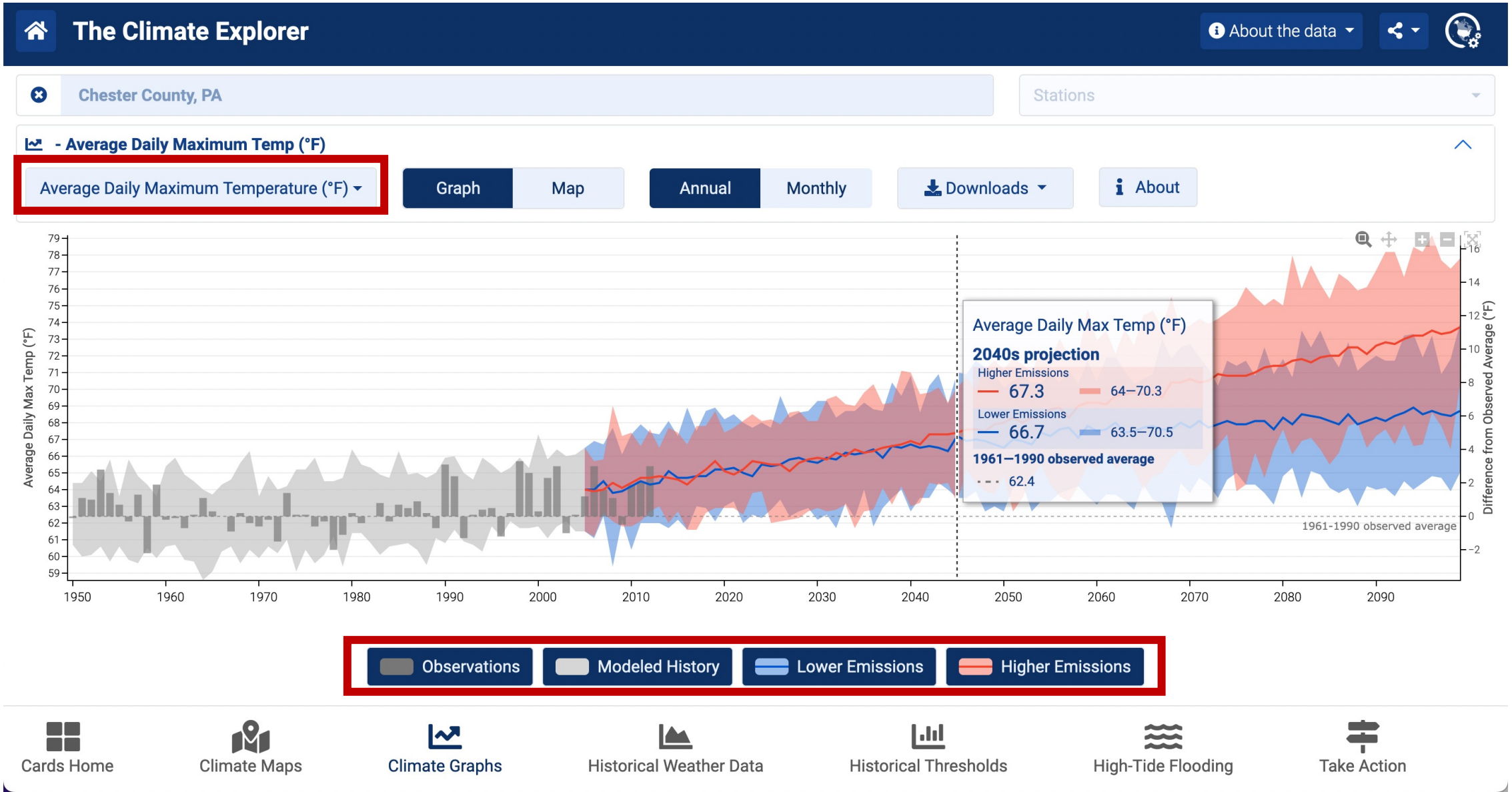
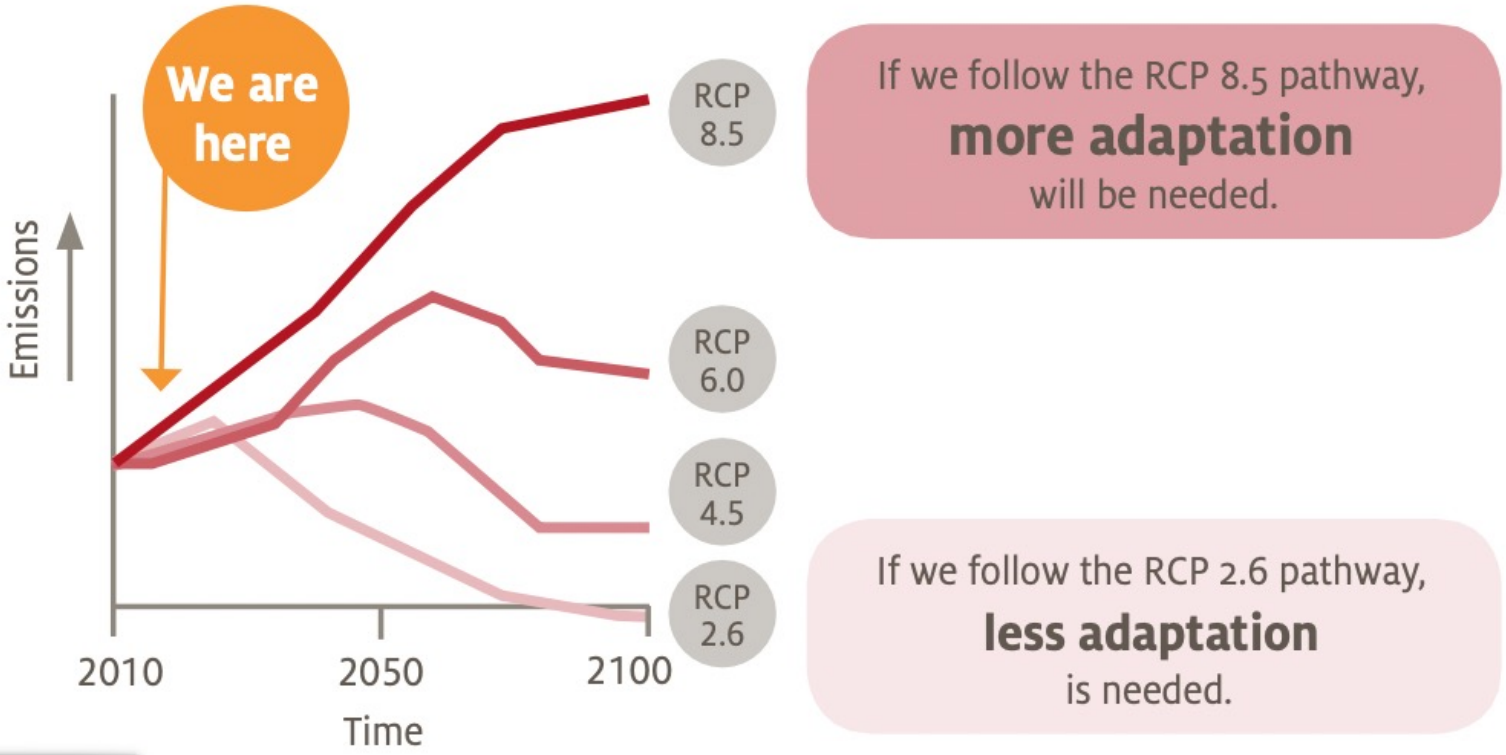


Climate Models and Emissions Scenarios

Emissions scenarios **are standardized descriptions of potential futures and the pathway leading to them**



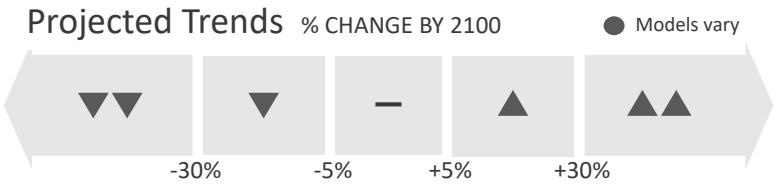
- **RCP 8.5:** High-emissions scenario ("business-as-usual")
- ~~**RCP 6.0**~~
- **RCP 4.5**
- ~~**RCP 2.6**~~

Not usually available

Source: What are the RCPs? (CoastAdapt)

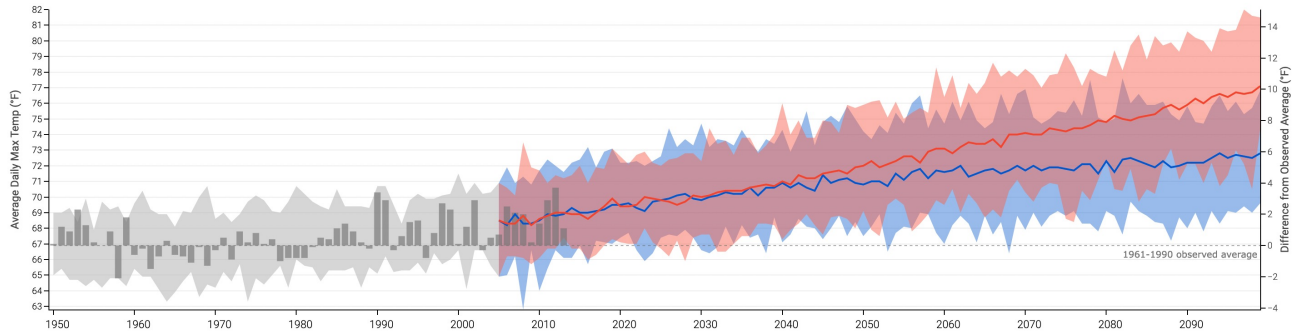
Important Considerations

- Trend direction
- Magnitude of change



- Shifts in timing and/or variability
- Scientific uncertainty

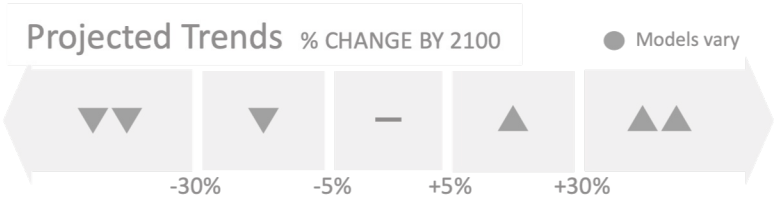
Maximum temperature



Total precipitation

Important Considerations

- Trend direction
- Magnitude of change



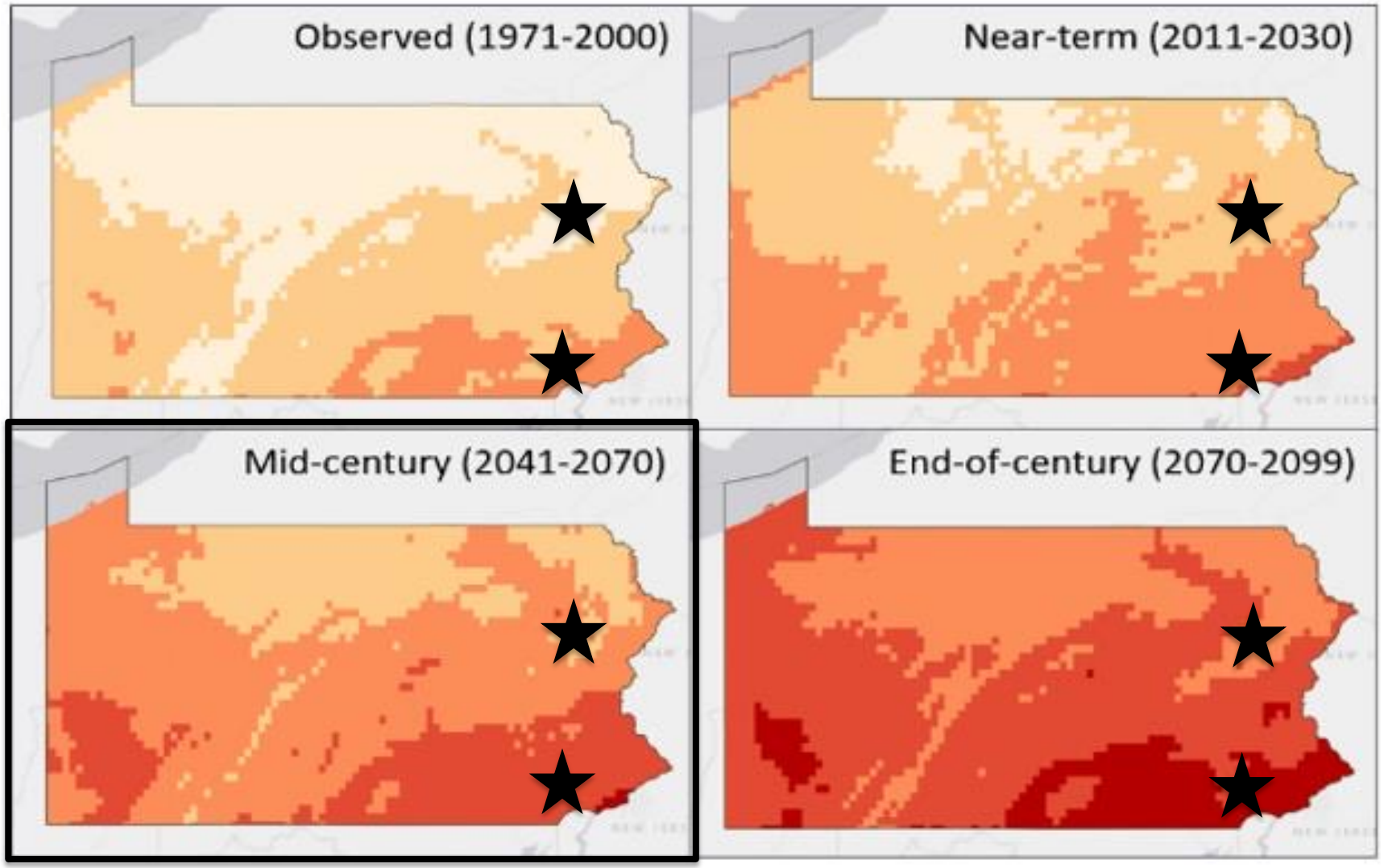
- Shifts in timing and/or variability
- Scientific uncertainty

Observed historical 1971–2000

Mid-Century 2041–2070

Late-Century 2081–2100

Air Temperature



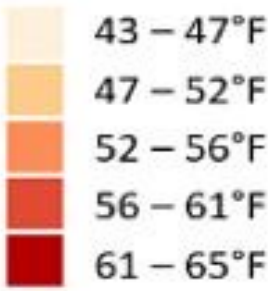
Compared to 1971-2000

By Mid-Century:

+5.9°F increase in annual temps in PA

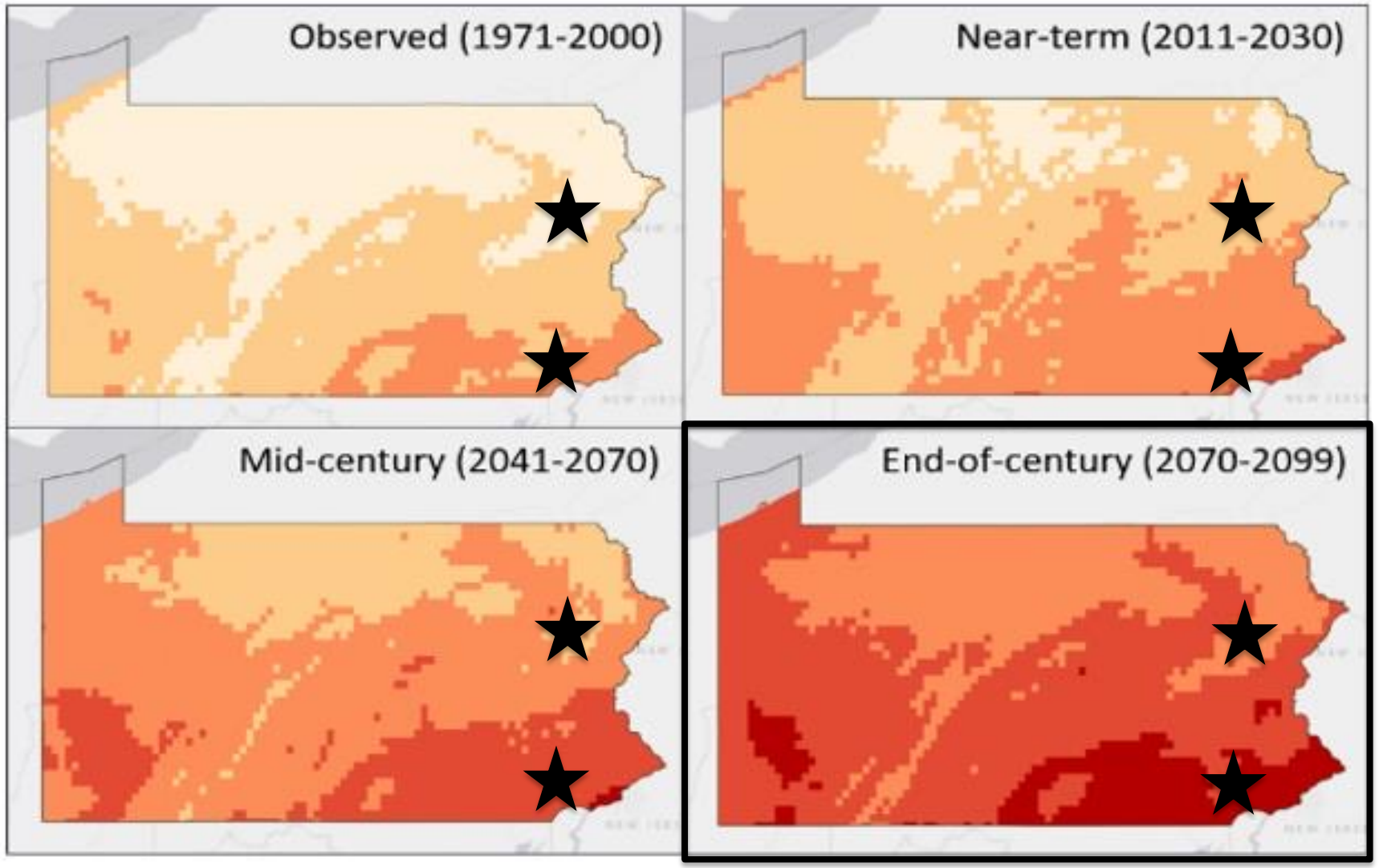
+5.7°F in Chester Co.

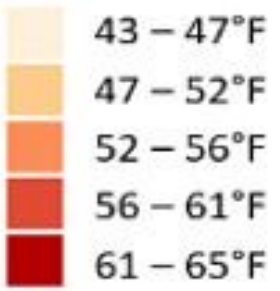
+6.1°F in Luzerne Co.



Source: ICF 2021

Air Temperature





Compared to 1971-2000

By Late-Century:

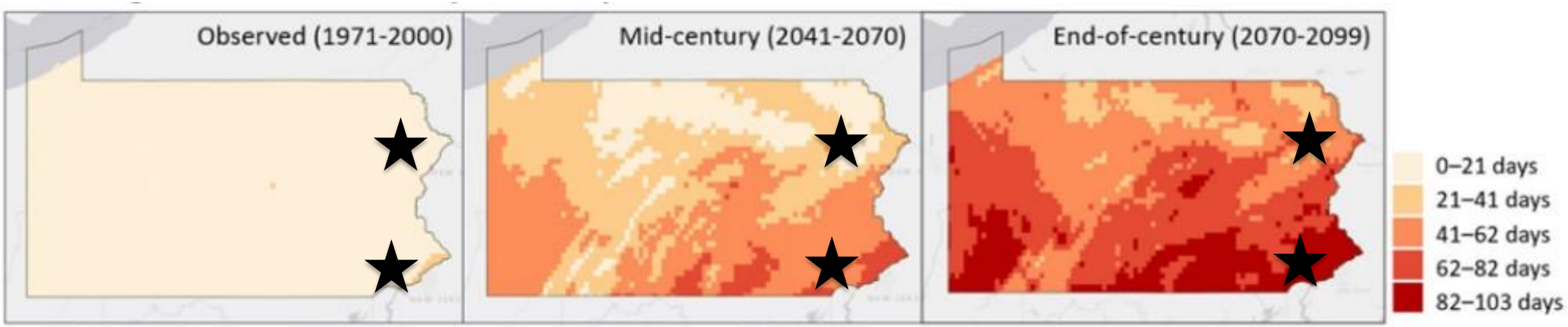
+9.3°F increase in annual temps in PA

+9.1°F in Chester Co.

+9.6°F in Luzerne Co.

Source: ICF 2021

Extreme Heat



5.1 days over 90°F

13.3 days in Chester Co.

2.3 days in Luzerne Co.

By Mid-Century:

+32 days per year (+625%) in PA

+32.1 days in Chester Co.

+19.1 days in Luzerne Co.

By Late-Century:

+60.4 days per year (+1,184%) in PA

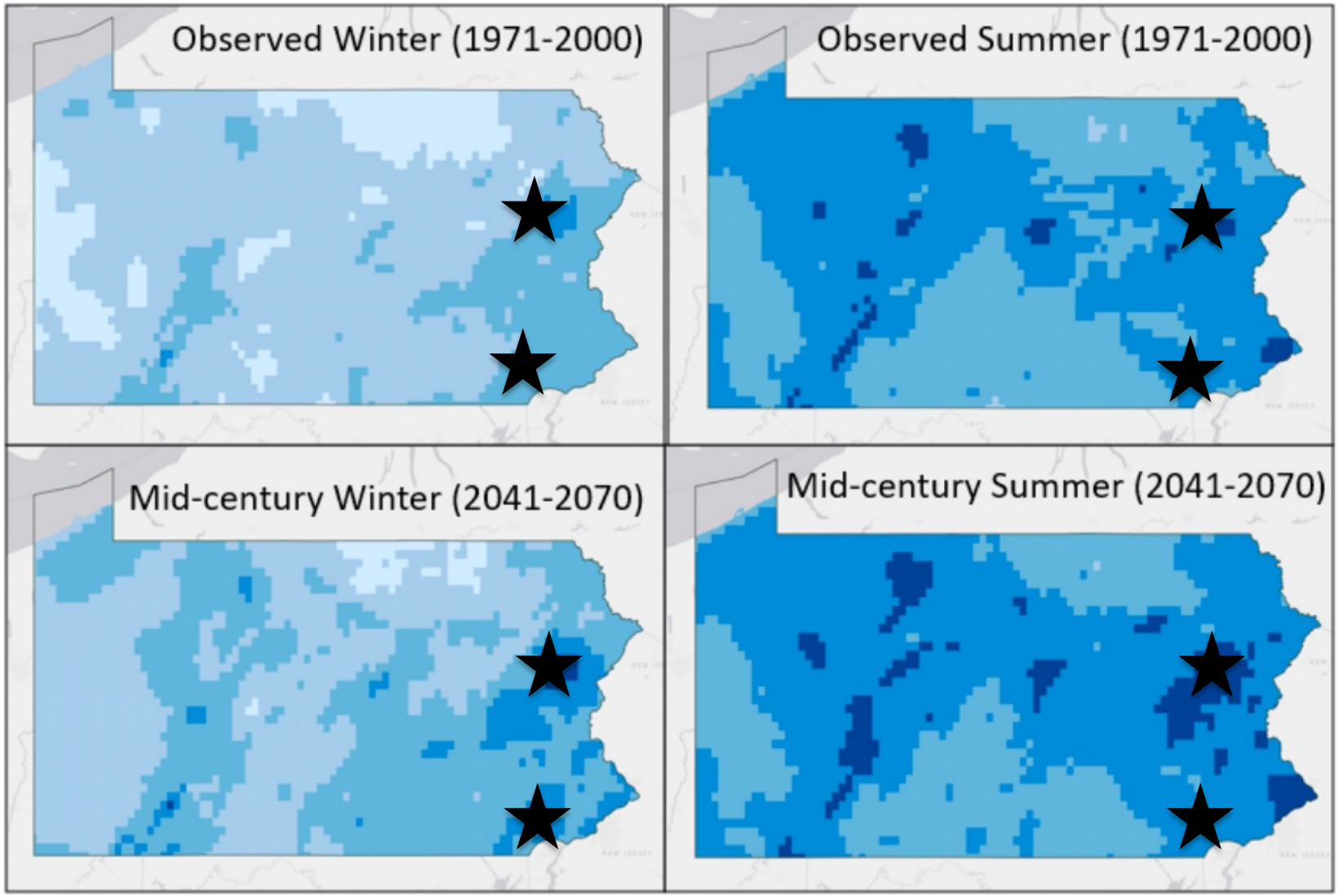
+78.3 days in Chester Co.

+60.7 days in Luzerne Co.

Source: ICF 2021, Climate Explorer

Precipitation

Seasonal Average Cumulative Precipitation



Compared to 1971-2000

By Mid-Century:

+8.4% increase in annual precip in PA

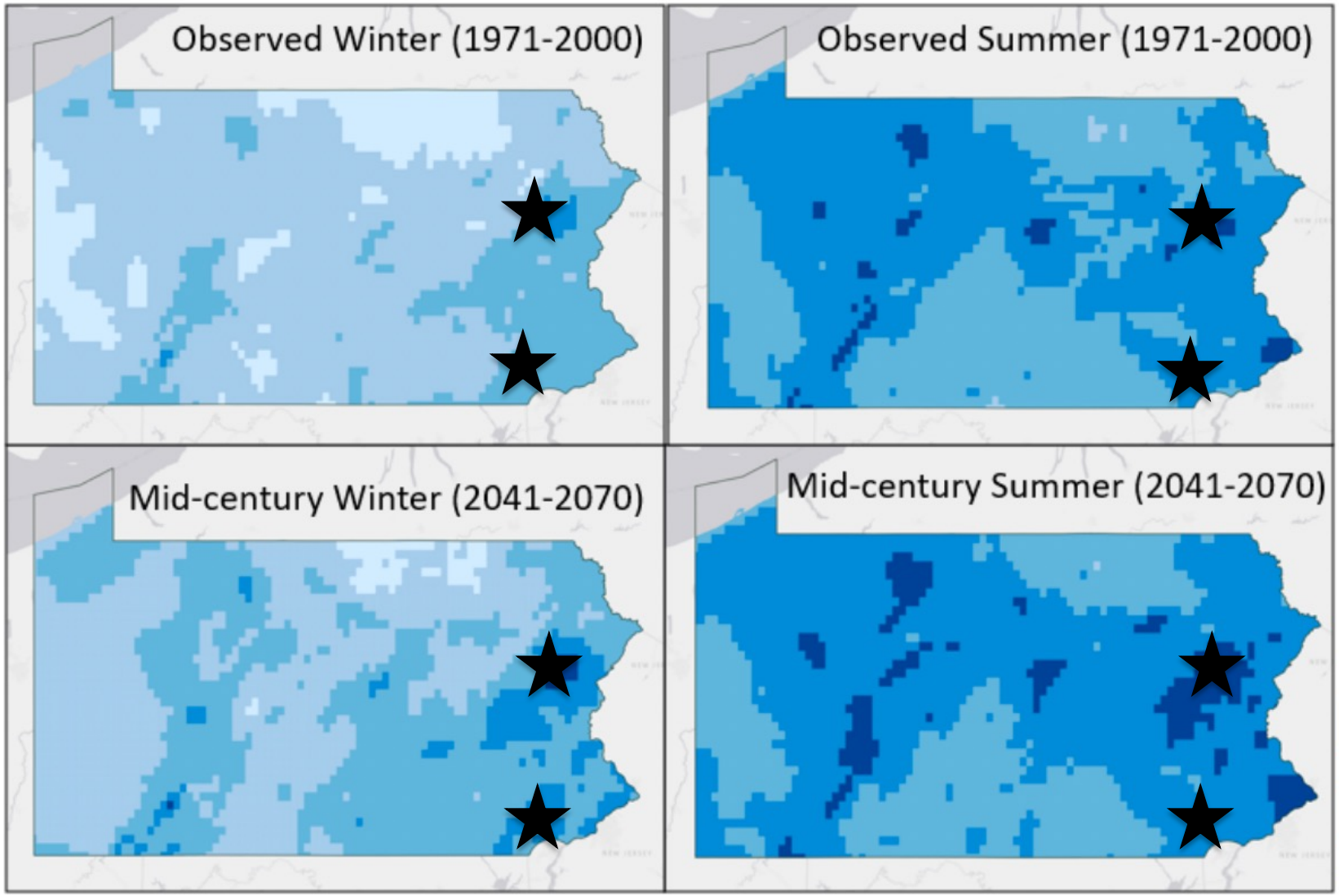
+4.8% in Chester Co.

+4.7% in Luzerne Co.

Source: ICF 2021, Climate Explorer

Precipitation

Seasonal Average Cumulative Precipitation



Compared to 1971-2000

By Late-Century:

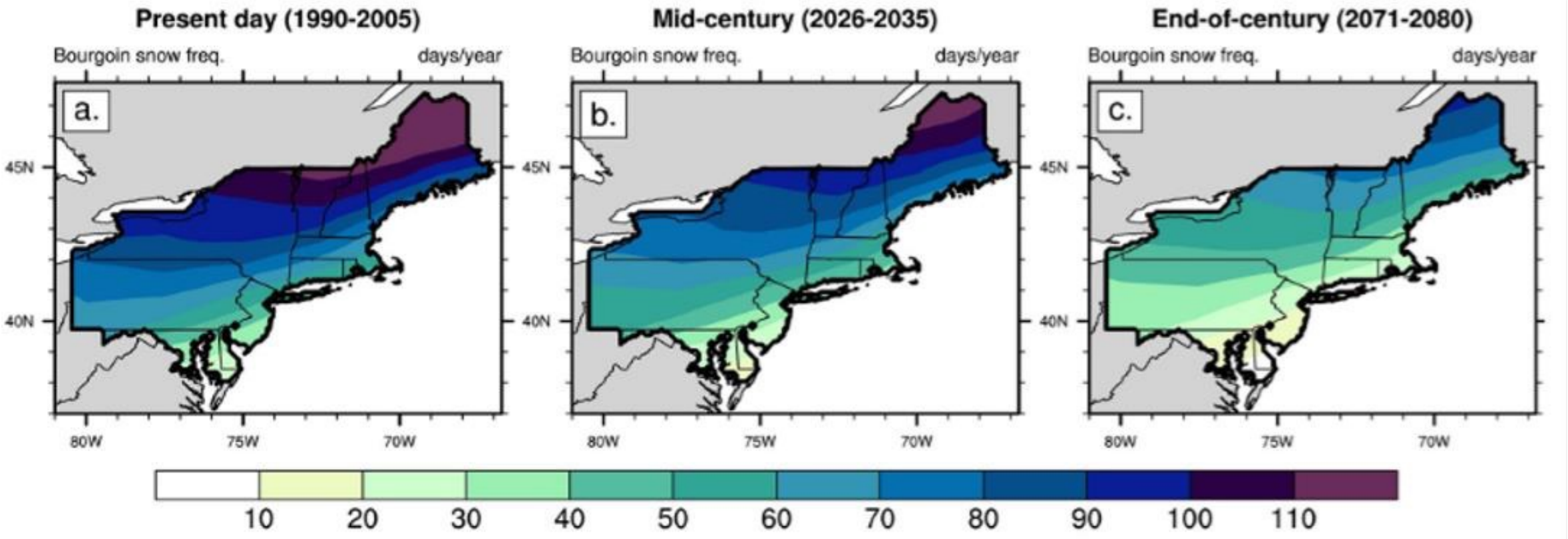
+11.5% increase in annual precip in PA

+12% in Chester Co.

+12% in Luzerne Co.

Source: ICF 2021, Climate Explorer

Snow



Across the Northeast, fewer days per year when snowfall occurs

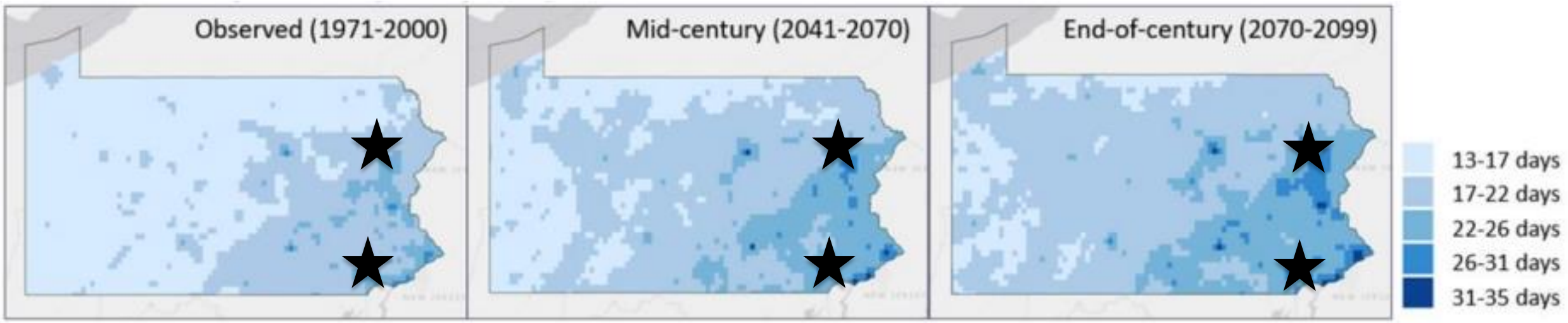
Source: ICF 2021

Snow

- 60-70% decline in snowfall by mid-century; 100% decline by late-century
- Decreased extent and duration of snow cover
- Increased proportion of winter precipitation falling as rain, contributing to earlier snowmelt

Source: ICF 2021, Alder & Hostetler 2013

Extreme Precipitation



2.5 days per year with extremely heavy rain (event that occurs less than 1% of the time)

1.2” average amount for these events

By Mid-Century:

+3.5 days/year (+42%) in PA

13% increase in average amount to 1.3”

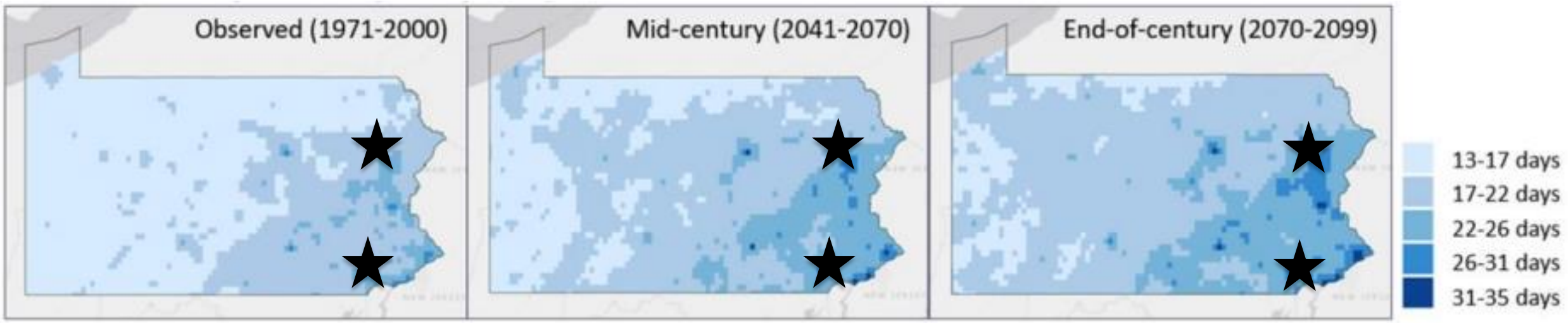
By Late-Century:

+4.2 days/year (+69%) in PA

20% increase in average amount to 1.4”

Source: ICF 2021

Extreme Precipitation



Days over 2” of rain:

0.8 days in Chester Co.

0.5 days in Luzerne Co.

By Mid-Century:

+0 days (+0%) in Chester Co.

+0.1 days (+20%) in Luzerne Co.

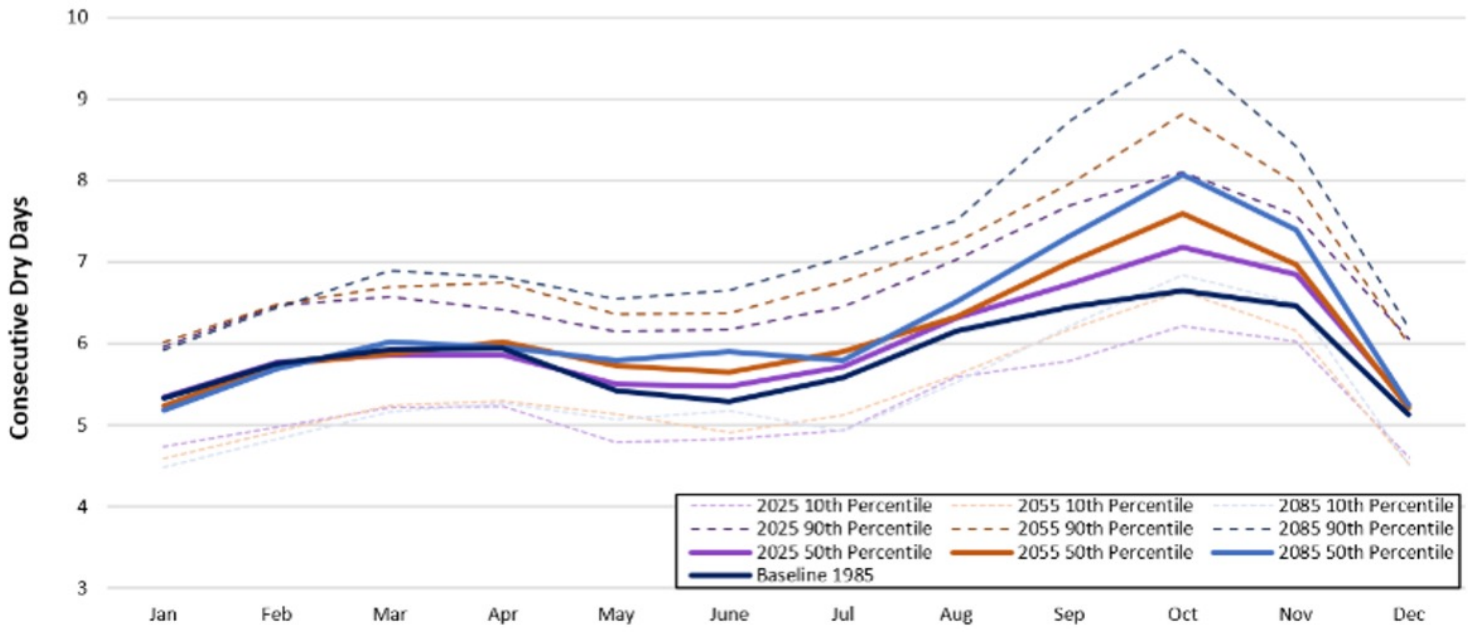
By Late-Century:

+0.4 days (+50%, to 1.2 days) in Chester Co.

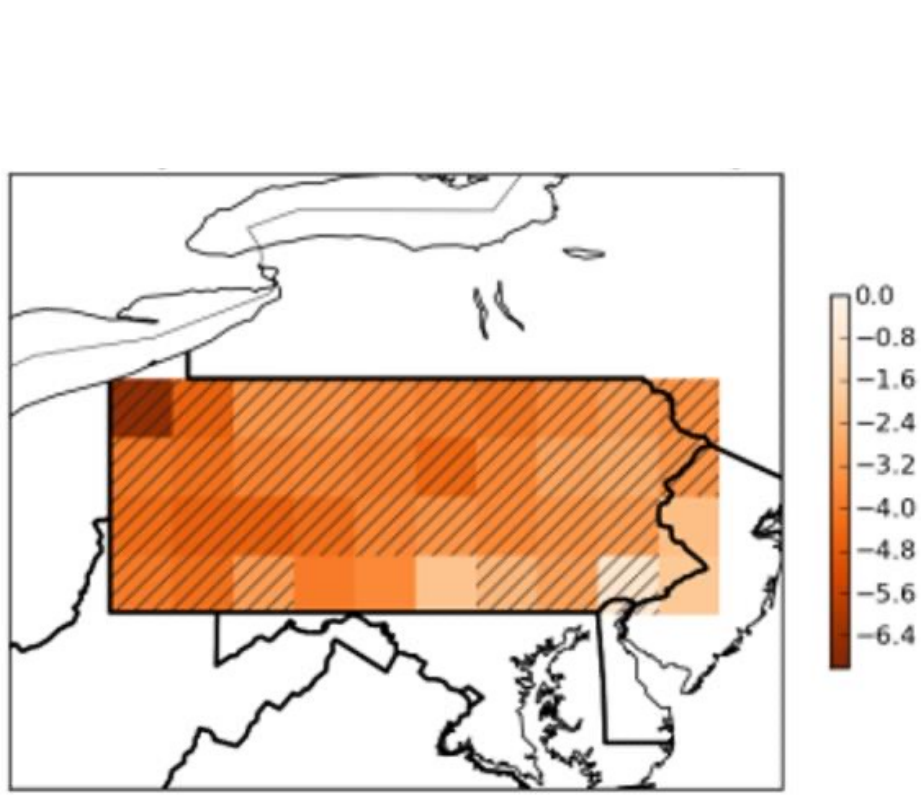
+0.4 days (+80%, to 0.9 days) in Luzerne Co.

Source: Climate Explorer

Drought



11% increase in consecutive dry days statewide by the end of the century

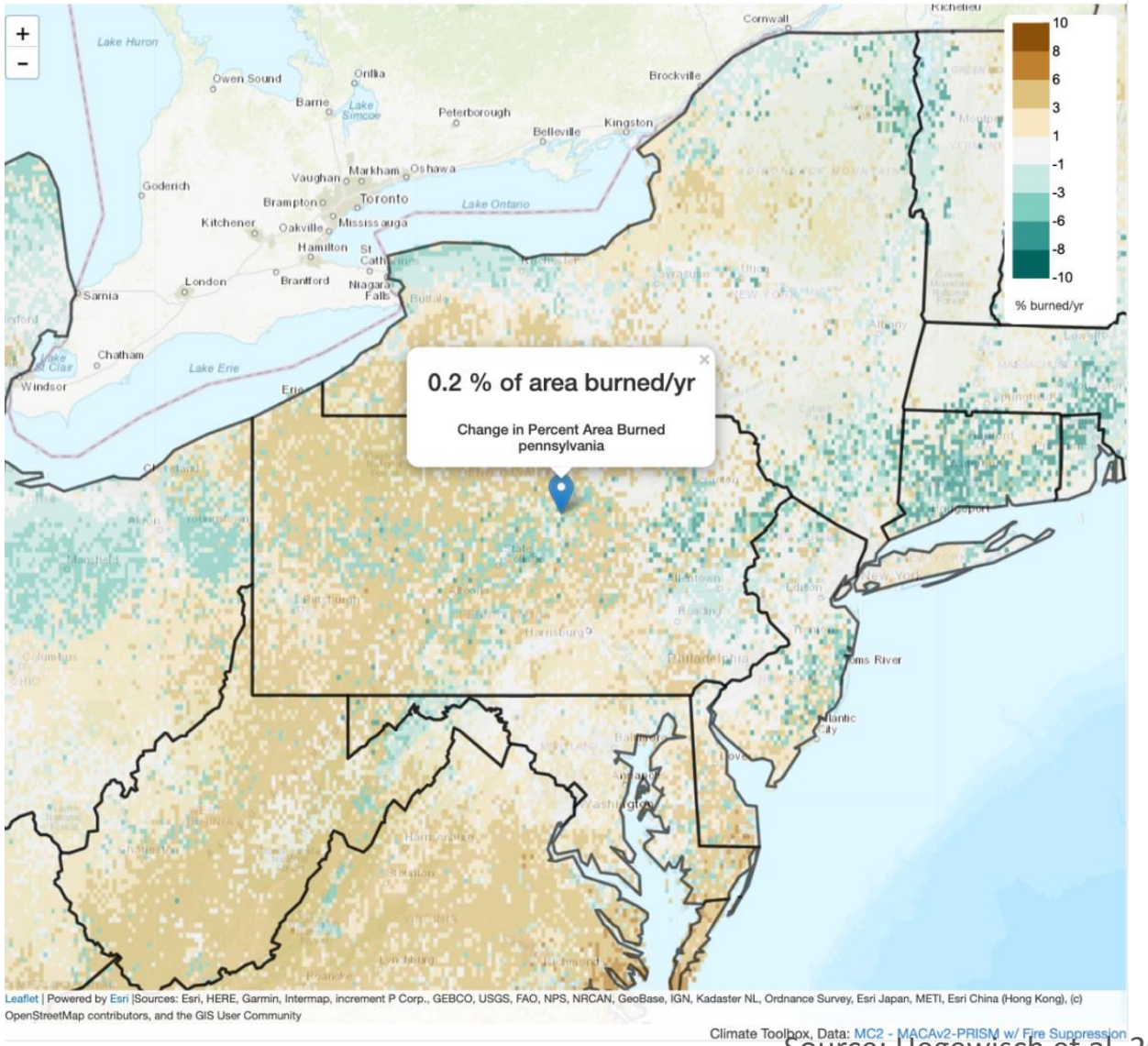


Decreased soil moisture

Source: ICF 2021

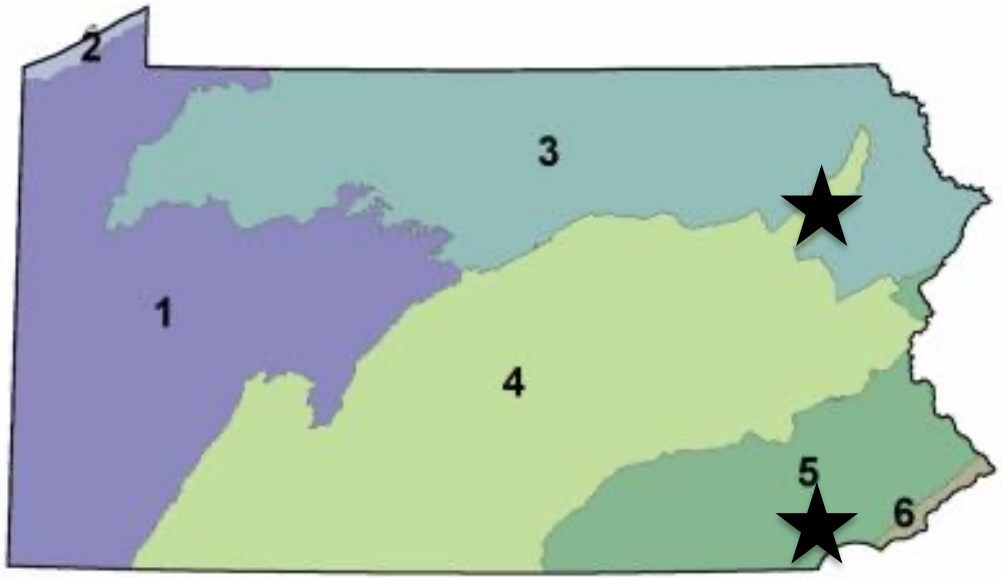
Wildfire

- 0.2% increase in the area of the state that burns each year (from historical average of 0.6% area)
- Greater risk in Chester County compared to many other areas of the state



Source: Hegewisch et al. 2022

Climate Change Projections for Tree Species



Physiographic Regions of Pennsylvania

- 1 - Western Allegheny Plateau
- 2 - Erie and Ontario Lake Plain
- 3 - Northern Allegheny Plateau
- 4 - Ridge and Valley
- 5 - Piedmont
- 6 - Coastal Plain

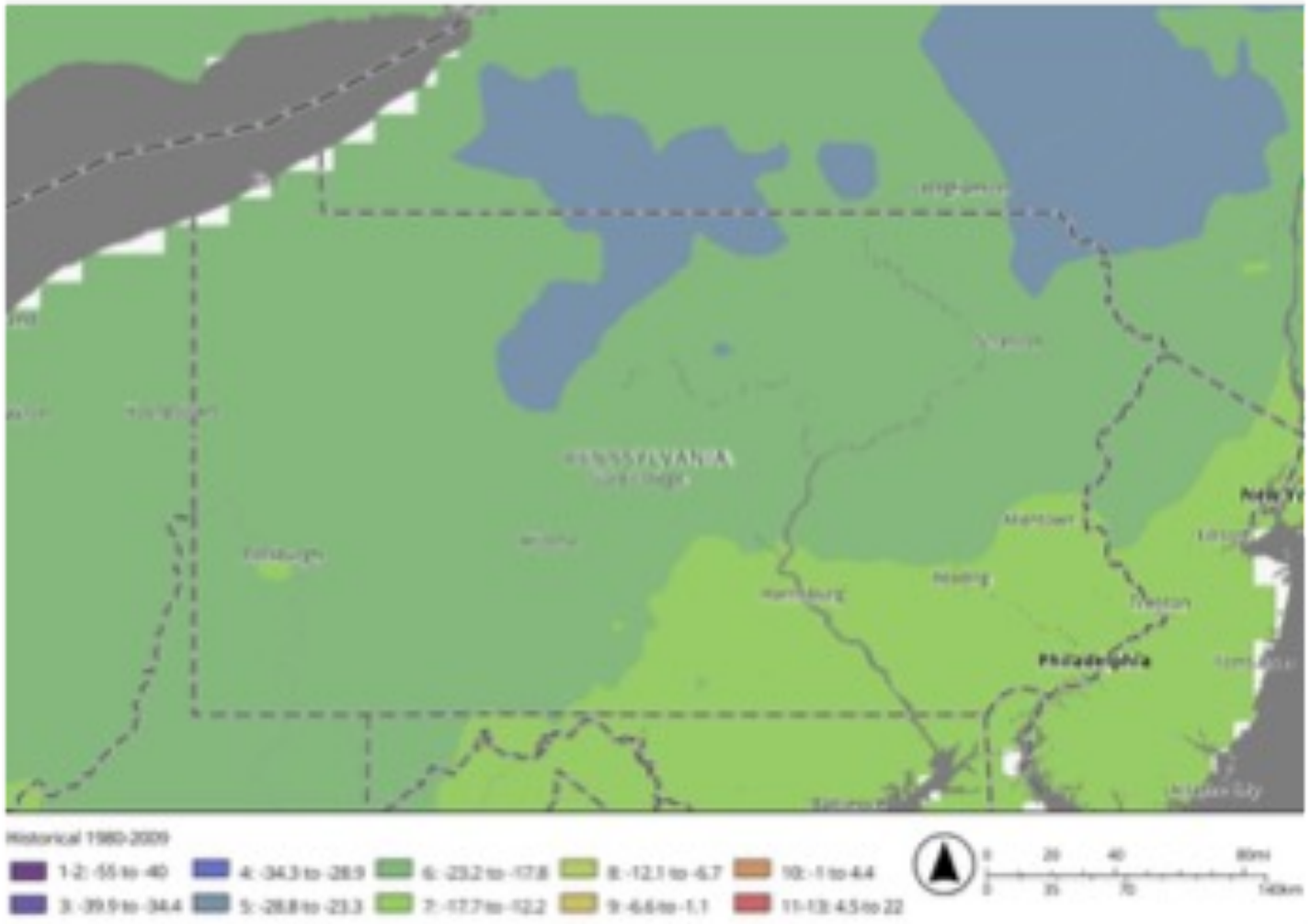
Subregion 5: Piedmont

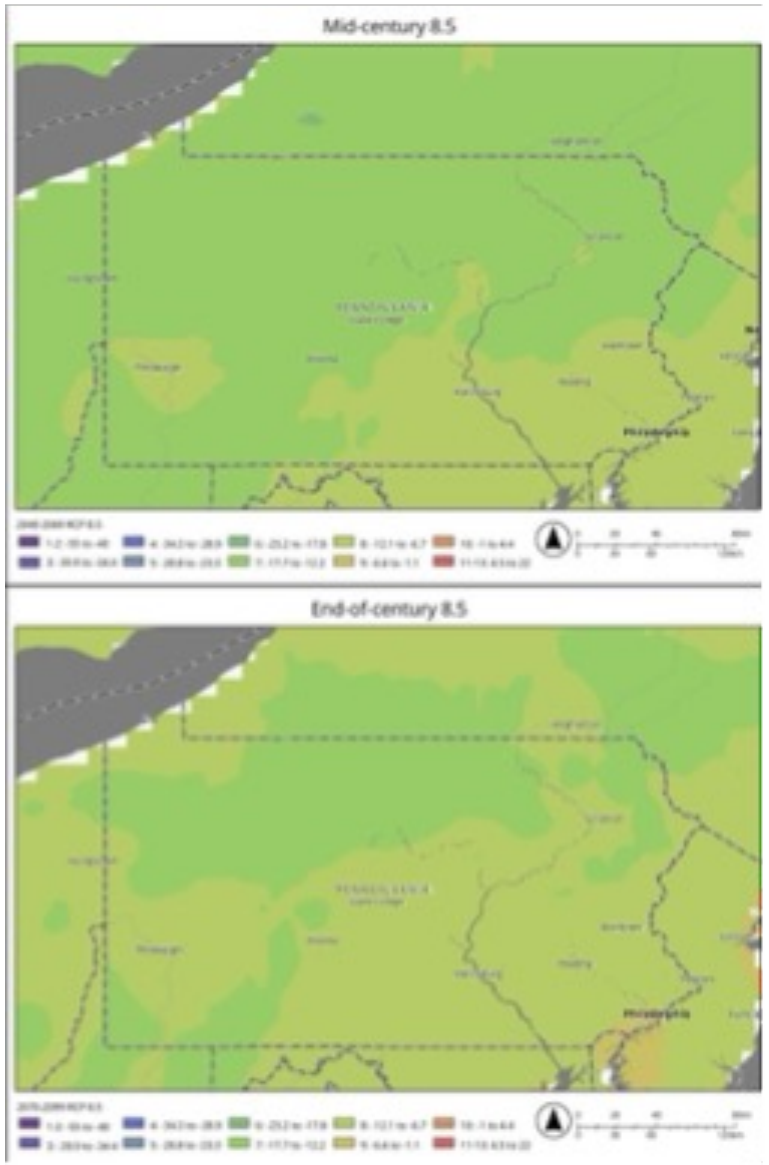
SPECIES	ADAPT	ABUN	LOW CLIMATE CHANGE (RCP 4.5) HABITAT CHANGE	LOW CLIMATE CHANGE (RCP 4.5) CAPABILITY	HIGH CLIMATE CHANGE (RCP 8.5) HABITAT CHANGE	HIGH CLIMATE CHANGE (RCP 8.5) CAPABILITY
American basswood	·	–	▲	△	▲	△
American beech	·	–	▲	△	▲	△
American elm	·	–	▲	○	▲	△
American hornbeam*	·	–	●	▽	▲	○
Bald cypress	·		★		★	
Bigtooth aspen	·	–	▼	▽	▼	▽
Bitternut hickory*	+	–	▲	△	▲	△
Black cherry	–	·	●	▽	▼	▽
Black locust*	·	·	●	○	▲	△
Black oak	·	·	▲	△	▲	△
Black walnut*	·	·	▼	▽	▼	▽
Black willow*	–	–	▼	▽	●	▽
Blackgum	+	·	▲	△	▲	△
Blackjack oak	+		★		★	
Boxelder*	+	·	●	△	▲	△
Cherrybark oak	·		★		★	
Chestnut oak	+	·	●	△	▼	○
Common persimmon*	+	–	●	○	▲	△
Eastern hemlock	–	–	▼	▽	▼	▽
Eastern redcedar	·	·	▲	△	▲	△
Eastern white pine	–	·	▼	▽	▼	▽
Flowering dogwood	·	–	▲	△	▲	△
Green ash*	·	·	●	○	▲	△
Hackberry	+	–	▼	▽	●	○
Jack pine	+	–	▼	▽	▼	▽
Loblolly pine	·	–	▲	△	▲	△
Mockernut hickory	+	·	▲	△	▲	△
Northern red oak	+	·	▲	△	●	△
Osage-orange	+	–	▼	▽	▼	▽

SPECIES	ADAPT	ABUN	LOW CLIMATE CHANGE (RCP 4.5) HABITAT CHANGE	LOW CLIMATE CHANGE (RCP 4.5) CAPABILITY	HIGH CLIMATE CHANGE (RCP 8.5) HABITAT CHANGE	HIGH CLIMATE CHANGE (RCP 8.5) CAPABILITY
Pignut hickory	·	·	▲	△	▲	△
Pin oak*	–	–	▲	▽	▲	▽
Pitch pine	·	–	▼	▽	▼	▽
Post oak	+		★		★	
Quaking aspen	·	–	▼	▽	▼	▽
Red maple	+	+	●	△	▼	△
Red mulberry*	·	–	▼	▽	▼	▽
Redbay*	+		★		★	
Sassafras*	·	·	▲	△	▲	△
Scarlet oak	·	·	▲	△	▲	△
Shagbark hickory	·	·	▲	△	●	○
Shortleaf pine	·		★		★	
Silver maple*	+	–	●	○	▲	△
Sugar maple	+	·	▲	△	▲	△
Swamp tupelo	–		★		★	
Swamp white oak*	·	–	▼	▽	▼	▽
Sweet birch	–	·	▼	▽	▼	▽
Sweetbay	·		★		★	
Sweetgum	·	·	▲	△	▲	△
Virginia pine	·	–	▲	△	▲	△
Water oak	·		★		★	
Water tupelo	–		★		★	
White ash	–	·	▼	▽	▼	▽
White oak	+	·	▲	△	▲	△
White spruce	·	–	▼	▽	▼	▽
Winged elm	·		★		★	
Yellow birch	·	–	●	▽	●	▽
Yellow-poplar	+	·	●	△	▼	○

Source: NIACS 2022

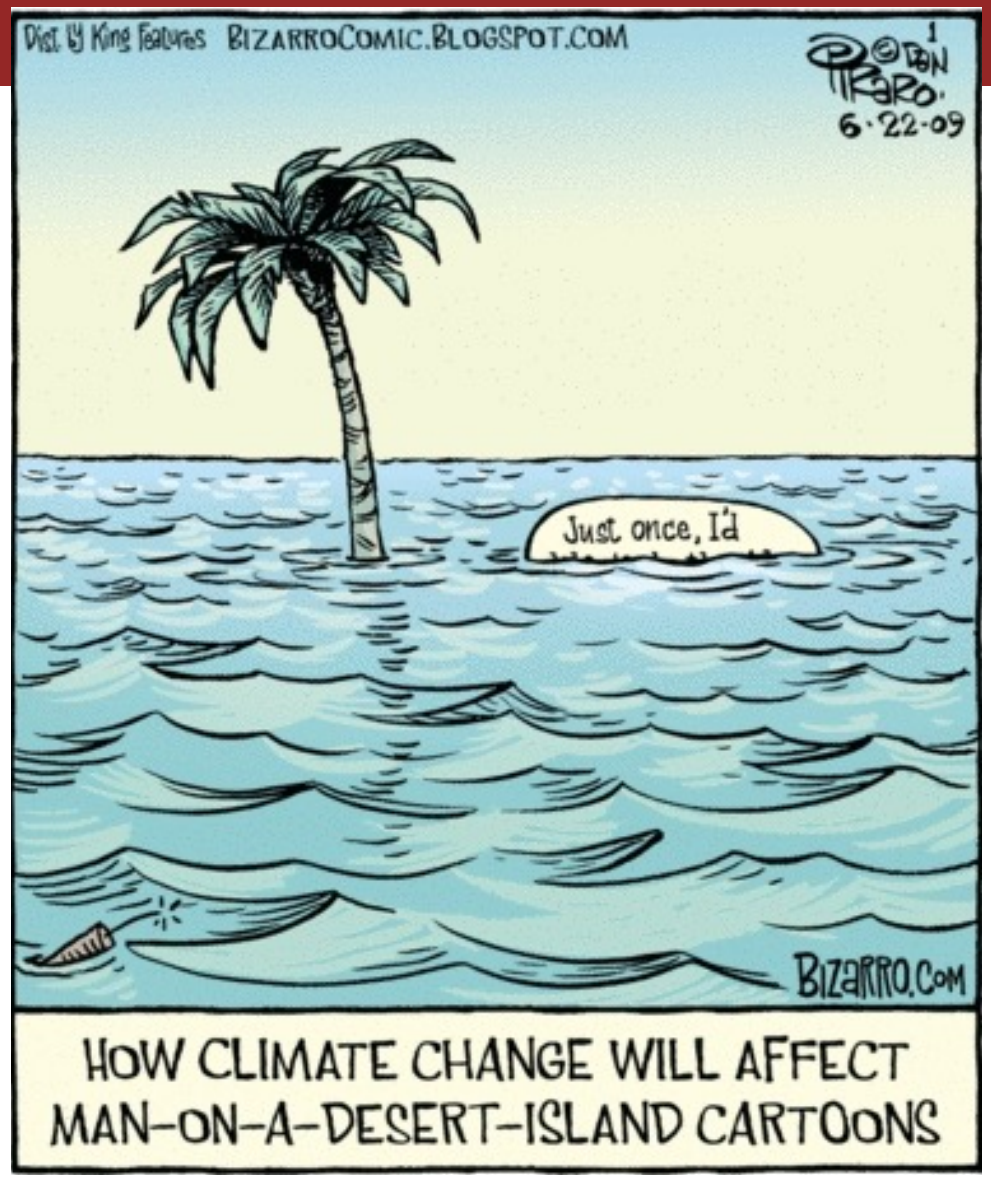
Plant Hardiness Zones





Source: Matthews et al. 2018

Questions?



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