Climate considerations: warming, precipitation, extremes

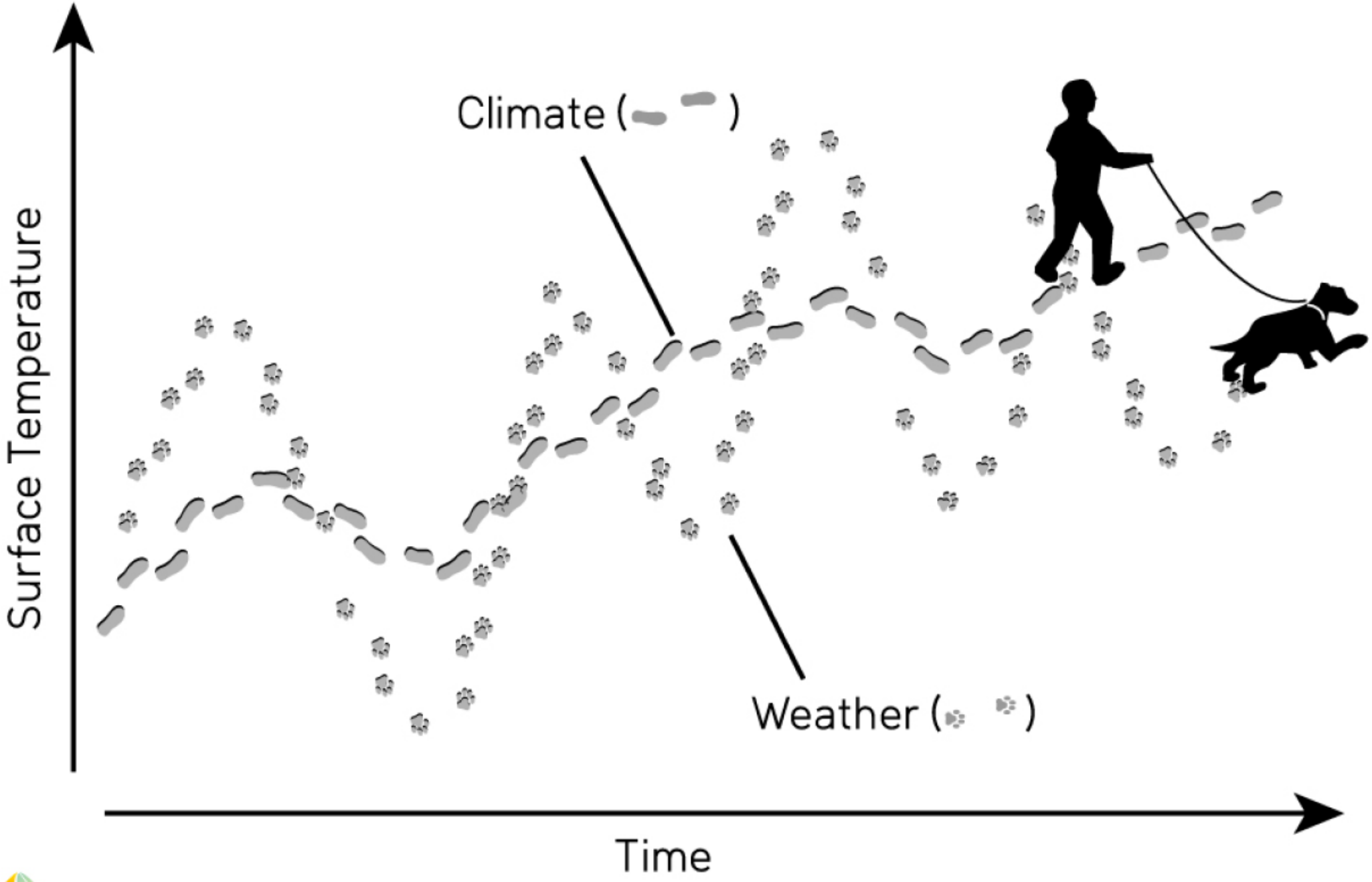
For the Hatfield Comprehensive Planning Committee

July 26, 2023

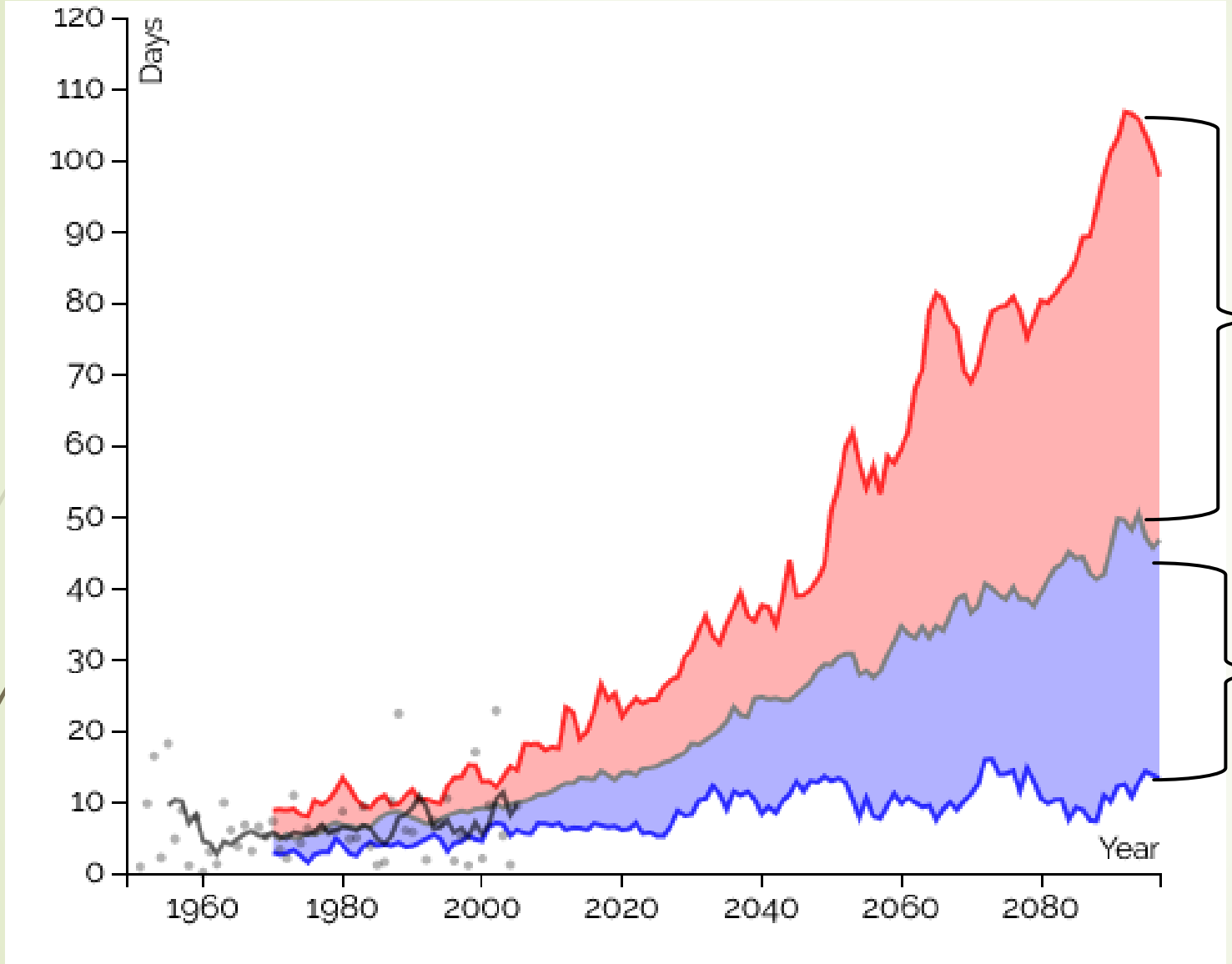
Patty Gambarini, Chief Environmental Planner

Pioneer Valley Planning Commission

- Projections and Trends
- Responses



skso.to/jg Redrawn from TeddyTVNorge, https://www.youtube.com/watch?v=e0vj-0imOLw From: Julie Brigham-Grette, College of Natural Sciences



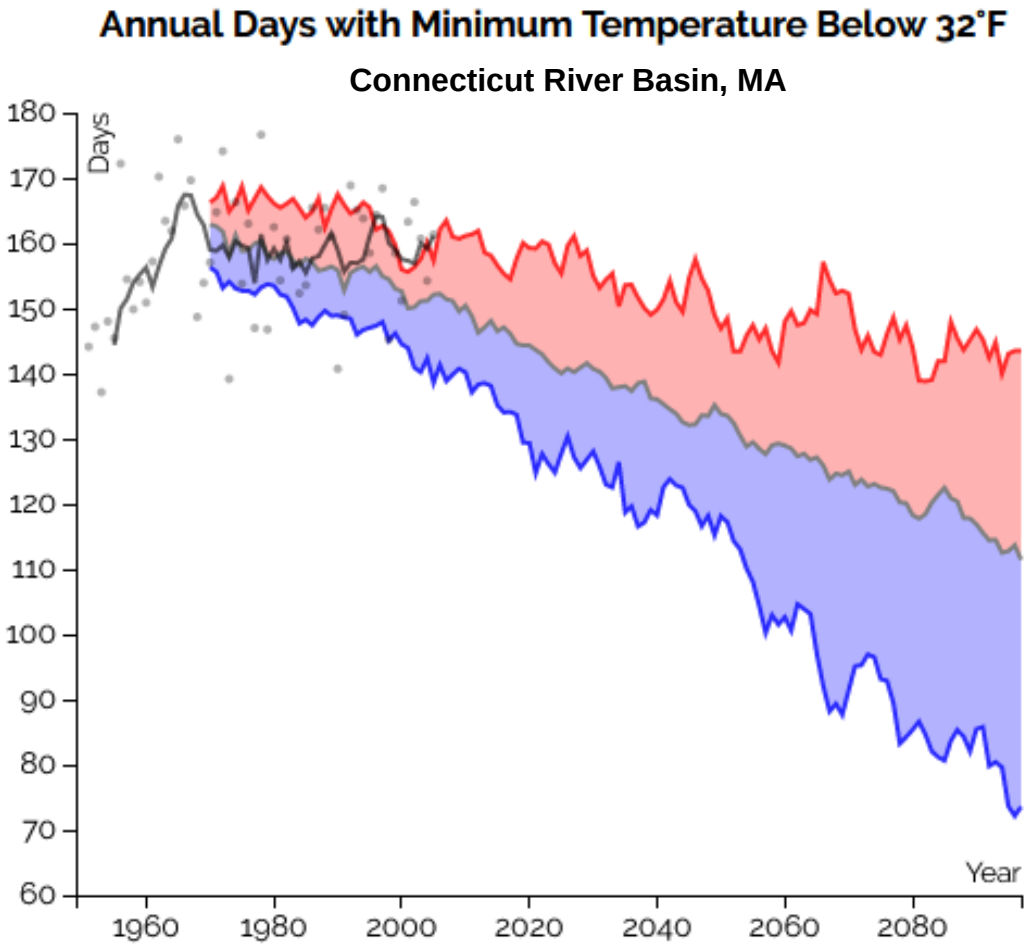
High emissions scenario,
RCP 8.5 – worst case

Lower emissions scenario,
RCP 4.5

More about Representative Concentration Pathway:
https://skepticalscience.com/rcp.php

www.resilientma.mass.gov
Northeast Climate Adaptation Science Center

Temperatures - Winter Warming



Download Data

Observed

days

5-yr Mean

Modeled days

Max

Median

Min

Changes from 1971-2000 for:

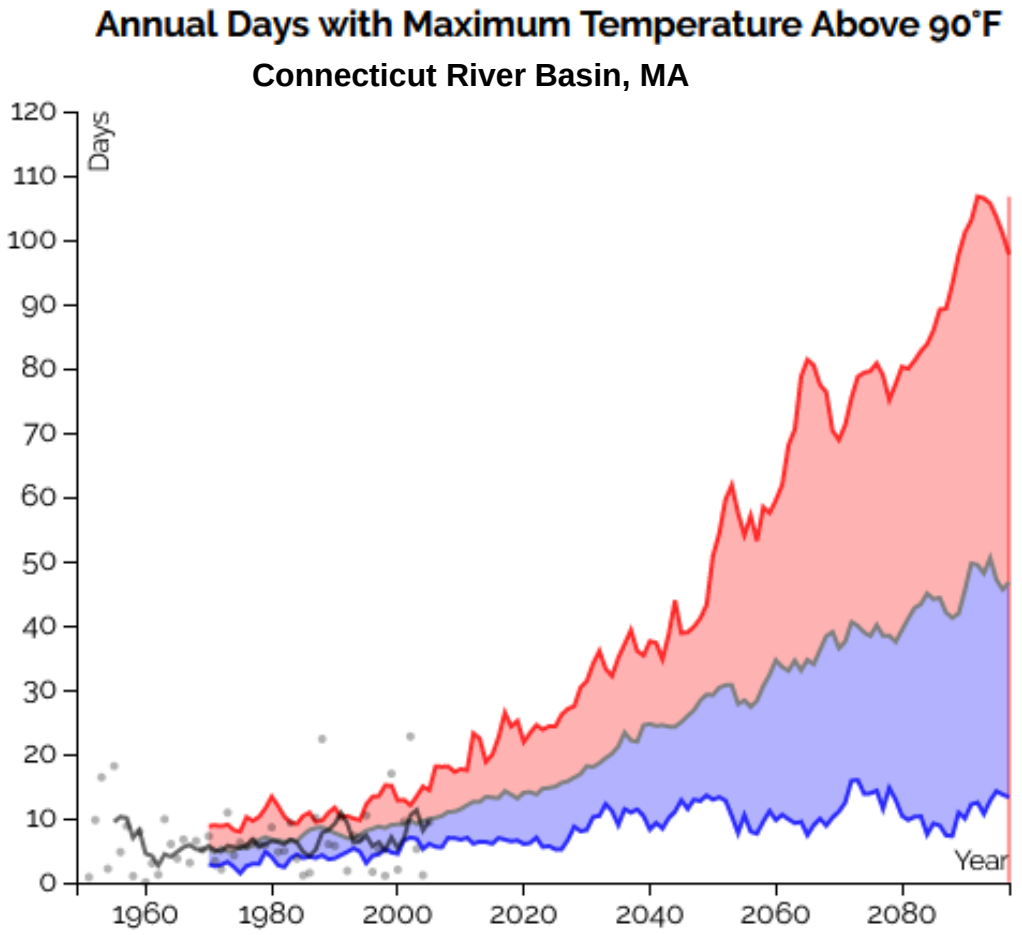
2020 - 2049	-22.49days
2040 - 2069	-31.41days
2060 - 2089	-38.18days
2080 - 2097	-43.02days

About the Source Data

Median values

NECASC Northeast Climate Adaptation Science Center

Temperatures - Summer Heat



Download Data

Observed

days

5-yr Mean

Modeled days 2095–2099

Max	97.74
Median	46.75
Min	13.3

Changes from 1971-2000 for:

2020 - 2049	14.89 days
2040 - 2069	24.05 days
2060 - 2089	32.93 days
2080 - 2097	38.90 days

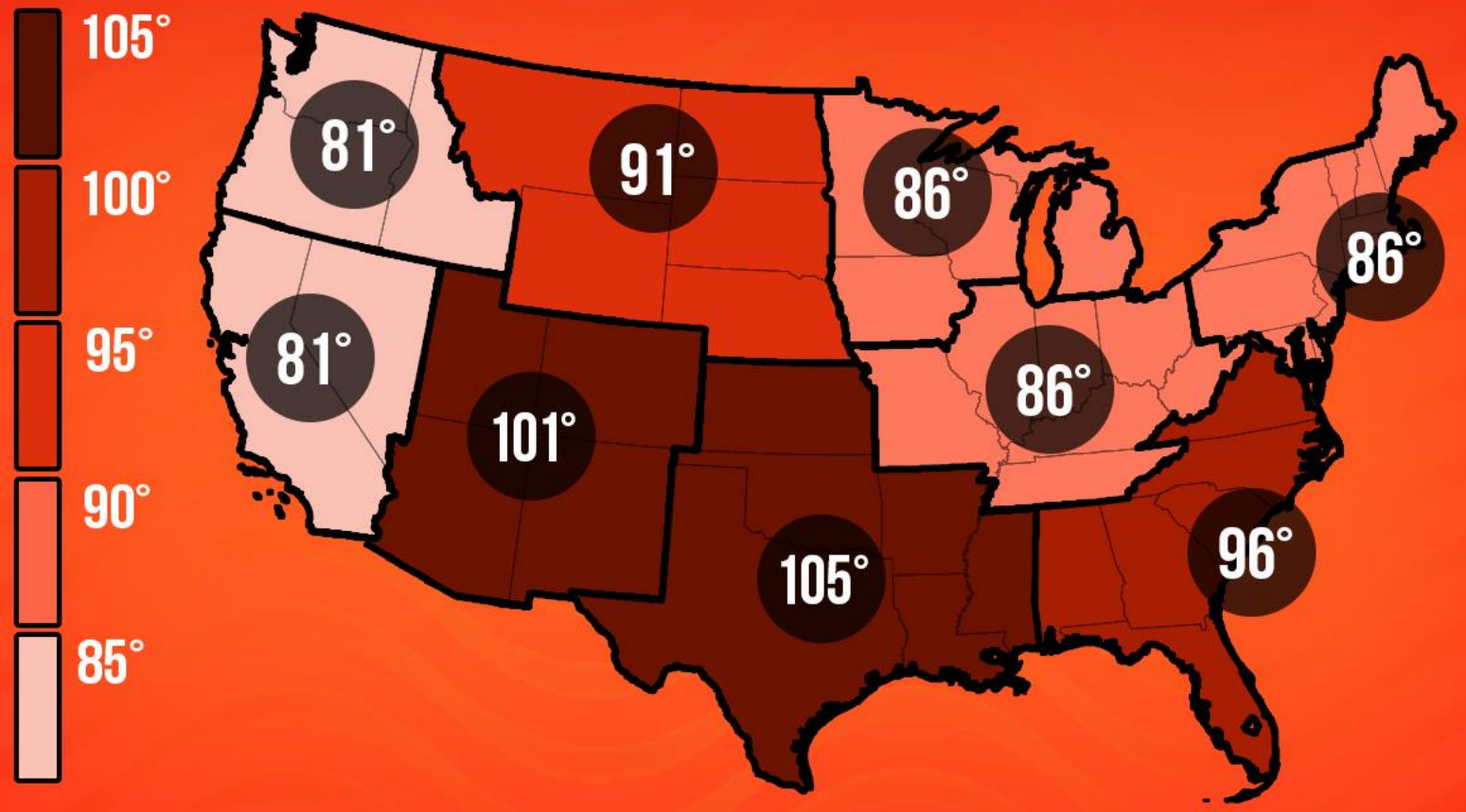
About the Source Data

Median values

NECASC Northeast Climate Adaptation Science Center

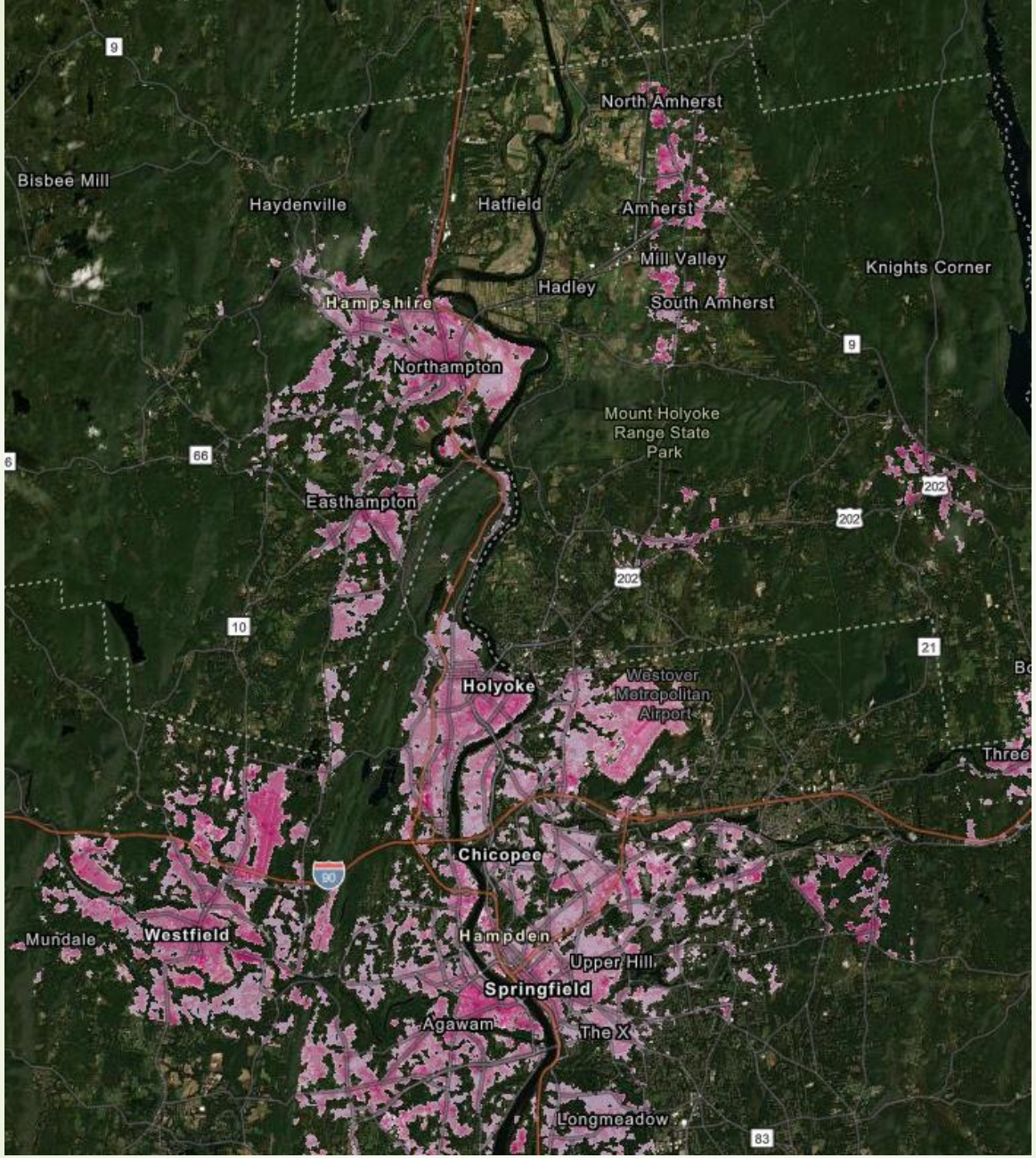
HEAT & HOSPITALIZATIONS

REGIONAL HEAT INDEX RANGE FOR PEAK HOSPITALIZATIONS



Source: Vaidyanathan, et. al (2019) DOI: 10.1073/pnas.1806393116

CLIMATE CENTRAL



Urban heat island severity (for U.S. cities, 2020)

Contiguous United States Cities Heat Severity 2020

Value

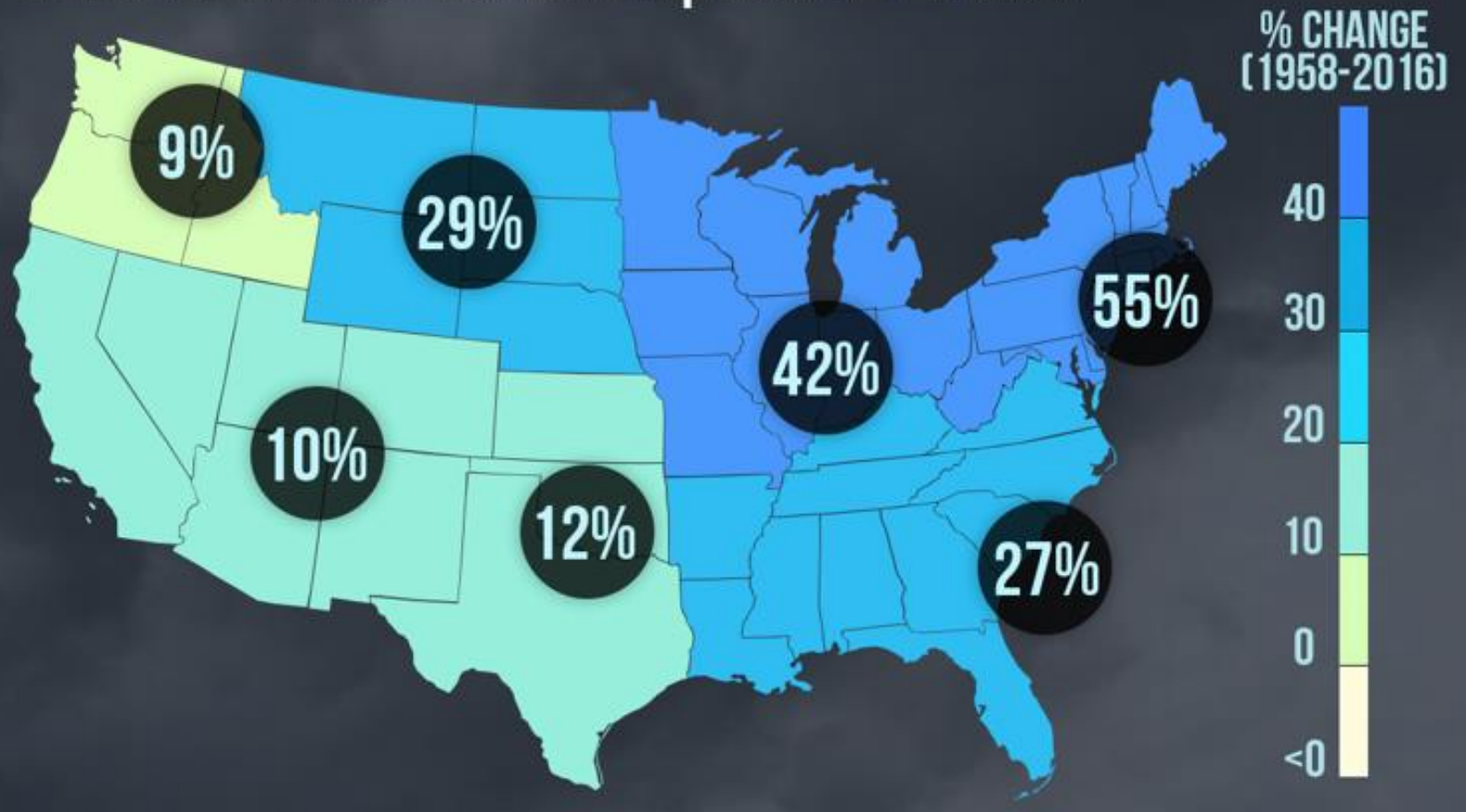
- Mild
- Mild to Moderate
- Moderate
- Moderate to High
- Severe

Source: Trust for Public Land

This 30-meter raster derived from Landsat 8 imagery band 10 (ground-level thermal sensor) from the summers of 2019 and 2020.

MORE DOWNPOURS

Increase in Heaviest Precipitation Events

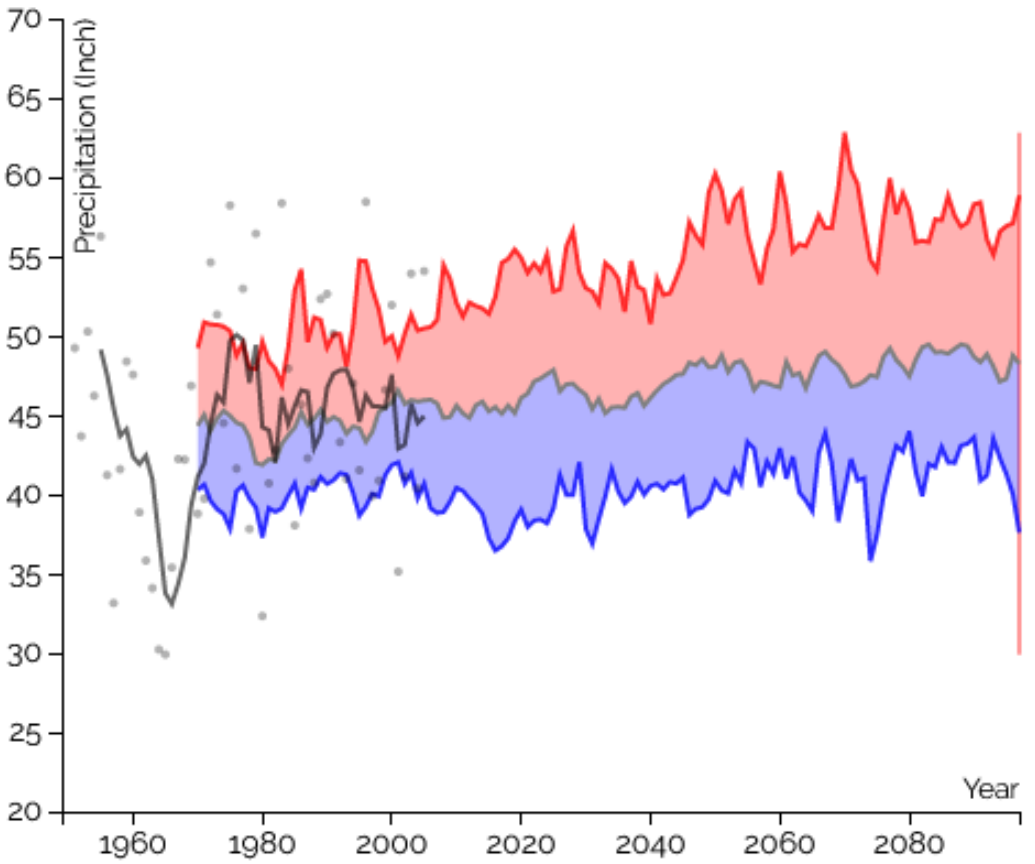


Heaviest events defined as top 1% of events
Source: USGCRP Climate Science Special Report 2017

CLIMATE CENTRAL

Precipitation

While median model does not show dramatic change in annual total precipitation, the higher emissions scenario does.



Download Data

Observed

	Inches
5-yr Mean	

Modeled Inches 2095–2099

Max	58.85
Median	48.24
Min	37.59

Changes from 1971-2000 for:

2020 - 2049	1.48°
2040 - 2069	2.66°
2060 - 2089	3.32°
2080 - 2097	3.71°

About the Source Data

NECASC Northeast Climate Adaptation Science Center

Extremes

2021 – Drought in early part of season; then 8” of rain between July 1 and July 14

Severe rains flood East Street in Belchertown, road collapses

By LUIS FIELDMAN
Staff Writer

Published: 7/18/2021 6:49:06 PM

Too much of a good thing: Area farmers cope with losses from wet summer

Town of Palmer
Yesterday at 7:41 AM ·

Significant storm damage to Rondeau Road last night for about ¼ mile. Also affects Hickory Lane, Walters Way, and Onley Road.

The road is now open to residents and emergency vehicles. Great thanks to the Public Works and P&H Excavation as well as Palmer Paving.

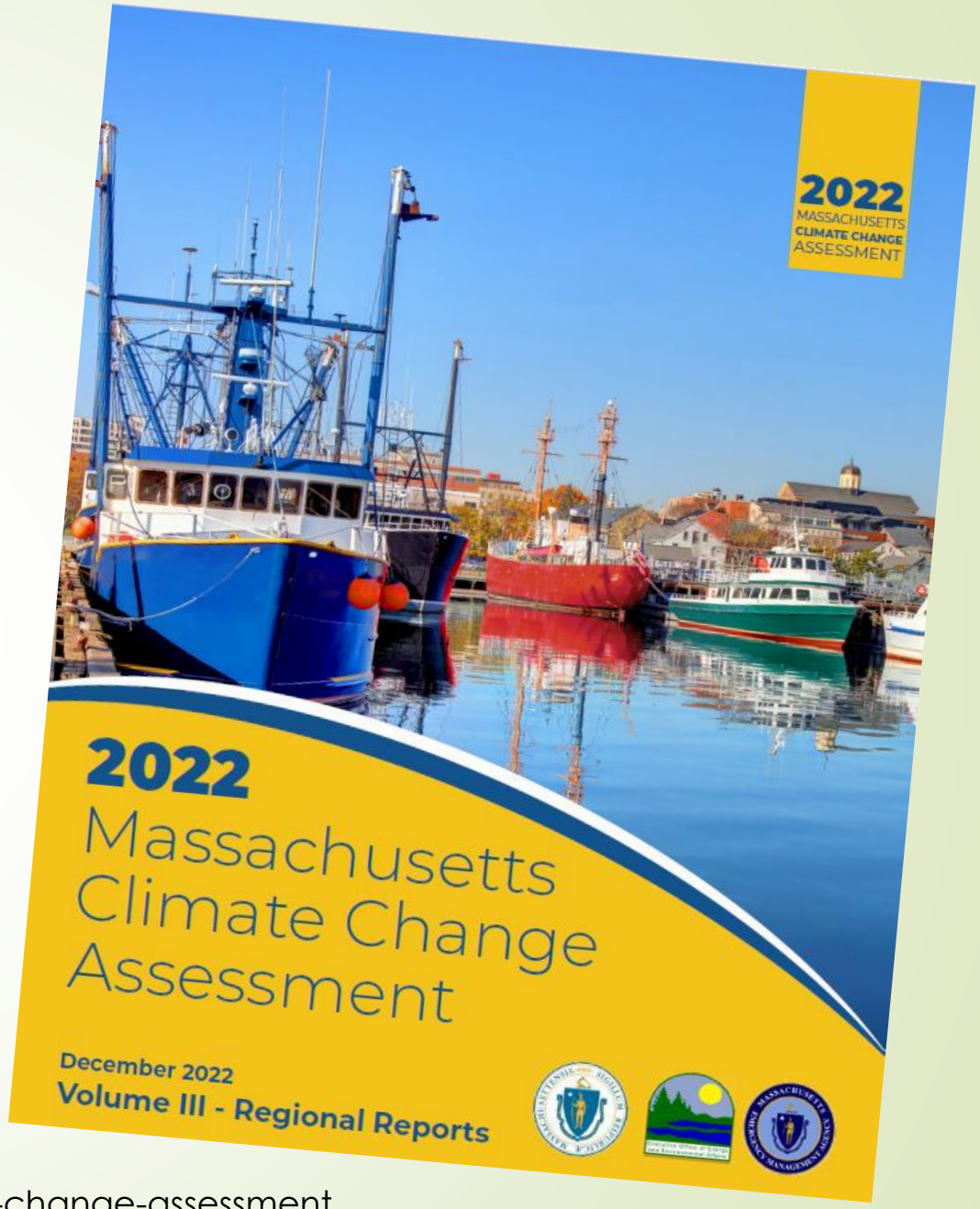
Hopefully, the rain stays away until we can design a more permanent repair with better drainage.

Source: Daily Hampshire Gazette, November 14, 2021

Highlights of Future Climate Projections

The most important climate hazards for the region include temperature extremes, changes in precipitation patterns, and consequent changes in the patterns of river flows, particularly in the Connecticut River and its network of tributaries. Each of these affects both the urban areas in the southern portion of the region and the agriculture and natural resources that characterize the northern, more rural areas. Some key findings of the climate change projections that may be important for this region over the 21st century include the following:

2030	2050	2070	2090
NEAR TERM	MID-CENTURY	MID-LATE CENTURY	END OF CENTURY
The summer mean temperature could increase by 3.6°F from the historical period (1950-2013), increasing urban heat stress and reducing local crop yields.	The 1 percent annual chance river flood could be three times more likely to occur, increasing Connecticut River and other area flood risk.	There could be 65 fewer days below freezing, increasing the chance of ticks overwintering and reducing winter recreation opportunities.	The historical 10 percent annual chance daily rainfall event (2.6 to 4 inches) could occur four times more frequently.



Source: https://www.mass.gov/info-details/massachusetts-climate-change-assessment

Most Urgent Impacts by Sector for the Greater Connecticut River Valley Region

Centered around the Connecticut River, this region includes rural towns and urban centers. Many of the most urgent climate impacts are already large concerns in the region (e.g., food security, agriculture, and housing). Below are the top two impacts per sector (three listed for tied scores). The bookmark icons identify unique regional priorities, meaning for each sector, impacts that are not a top three most urgent impact statewide but are a top two impact regionally.

Human

Reduction in Food Safety and Security due to production and supply chain issues, as well as spoilage during power outages.

Health Effects of Extreme Storms and Power Outages, including from injuries, food safety, and medical device failure.

Infrastructure

Damage to Inland Buildings from heavy rainfall and overwhelmed drainage systems.

Damage to Electric Transmission and Utility Distribution Infrastructure associated with heat stress and extreme events.

Natural Environment

Shifting Distribution of Native and Invasive Species as changing climate conditions favor certain species.

Freshwater Ecosystem Degradation due to warming waters, drought, and increased runoff.

Forest Health Degradation from warming temperatures, changing precipitation, extreme storms, and increasing pest occurrence.

Governance

Increase in Costs of Responding to Climate Migration, including planning for abrupt increases in local populations.

Reduction in State and Municipal Revenues, including a reduced property tax base due to inland flood risk.

Economy

Decrease in Agricultural Productivity as crop yields are impacted by precipitation patterns, extreme weather, pests, and other climate factors.

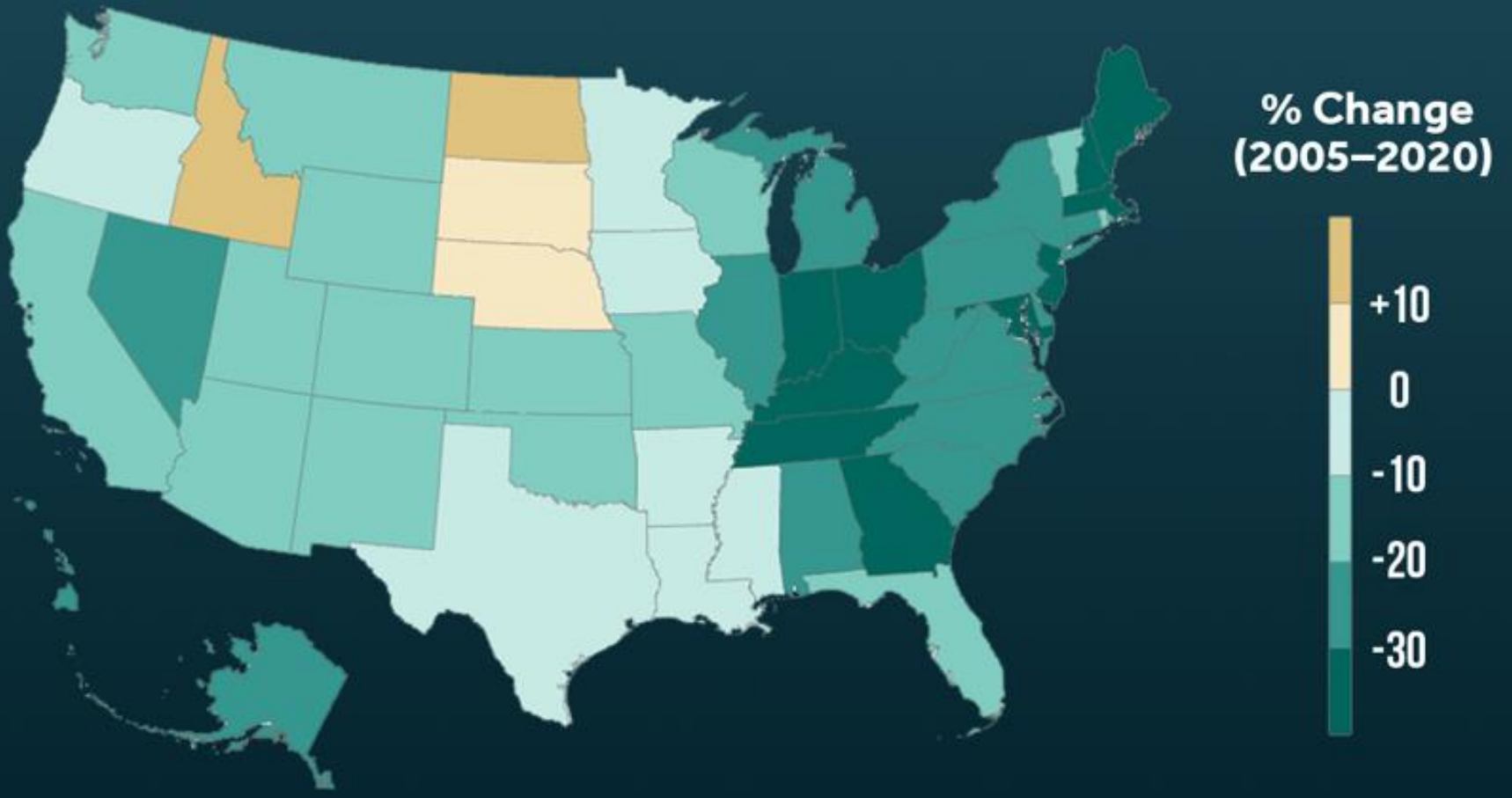
Reduction in the Availability of Affordably Priced Housing from direct damage (e.g., flooding) and the scarcity caused by increased demand.

Responses - Mitigation

- Reducing the amount of heat trapping emissions into the atmosphere to lessen severity of impacts

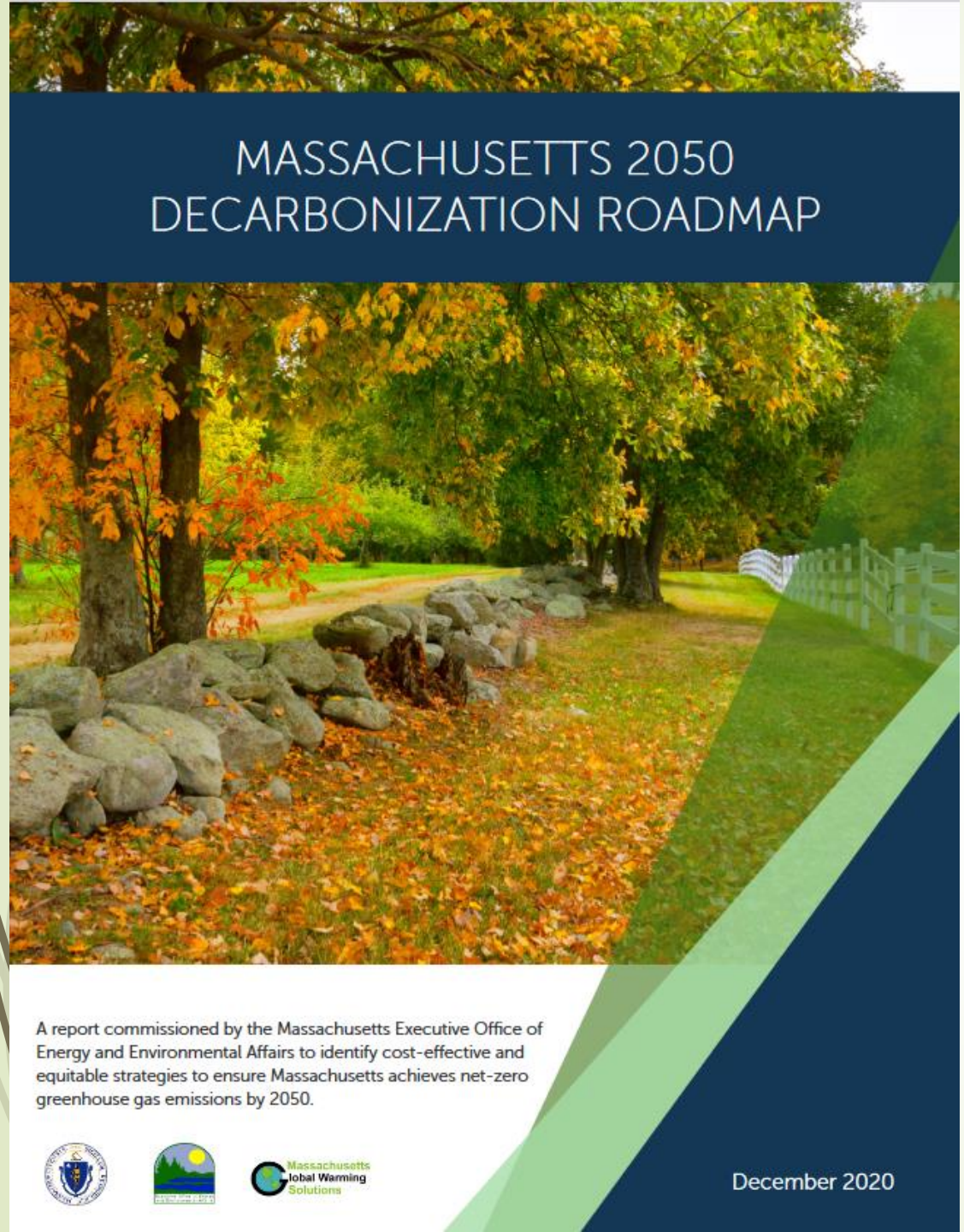
  - Reduce energy use
  - Reduce and eliminate sources of these emissions (burning of fossil fuels) with clean renewable sources
  - Protect and enhance the “sinks” that accumulate and store carbon (e.g., forests, wetlands, soils)

CHANGE IN HEAT-TRAPPING EMISSIONS



Percent change in total greenhouse gas emissions in each state (2005–2020).
Source: EPA (2021)

CLIMATE CENTRAL



Locally

- Green Community designation, including adoption of stretch code and continued work toward emission reduction goals
- Solar incentives, including solarize programs
- More rail trails, complete streets programs, and regional bike share “Valley Bike”
- PVTA and others electrifying vehicle fleets
- Carbon credits trade for forest protection (e.g., Holyoke, West Springfield, Westfield)

Responses - Adaptation

- Adjusting to today's actual or expected future climate changes
  - Reduce the risks from harmful effects
  - Make the most of any potential beneficial opportunities associated with climate change

Flood adaptation examples memo - outline

Increasing natural storage and moving out of harm's way

- Preserving and restoring lands that provide natural flood mitigation
- Moving out of harm's way
- Upgrading culverts and bridges so as to not impede flow/create backwater flooding
- Collaborating at a regional scale

Updating local land use regulations

- Floodplain management standards
- Stormwater management

Strategies can have multiple beneficial outcomes

Response to increased rainfall and summer heat can be complementary

→

Reduce and limit creation of new impervious cover (streets, parking lots, etc.) and use “green infrastructure” wherever possible

→

Help to create landscapes that can absorb rainfall and cool ambient air temperatures during hot weather

Narrower streets, more trees

9 houses; $ 40,400 to repave
~$4,500/house

14 houses; $ 24,200 to repave
~$1,700/house

Source: Horsley Witten Group, Inc.

Stormwater management that makes use of plants and soils

Climate-Smart Comprehensive Planning

- What are the most important opportunities for mitigation?
  - Reducing energy use
  - Reducing and eliminating sources of these emissions (burning of fossil fuels) with clean renewable sources
  - Protecting and enhancing the “sinks” that accumulate and store carbon (e.g., forests, wetlands, soils)
- What are the most critical adjustments needed to adapt to expected future climate changes?
  - Reducing the risks from harmful effects
  - Making the most of any potential beneficial opportunities associated with climate change

Thank you!

HATFIELD 2040

A Vision to Protect, Prepare, and Prosper