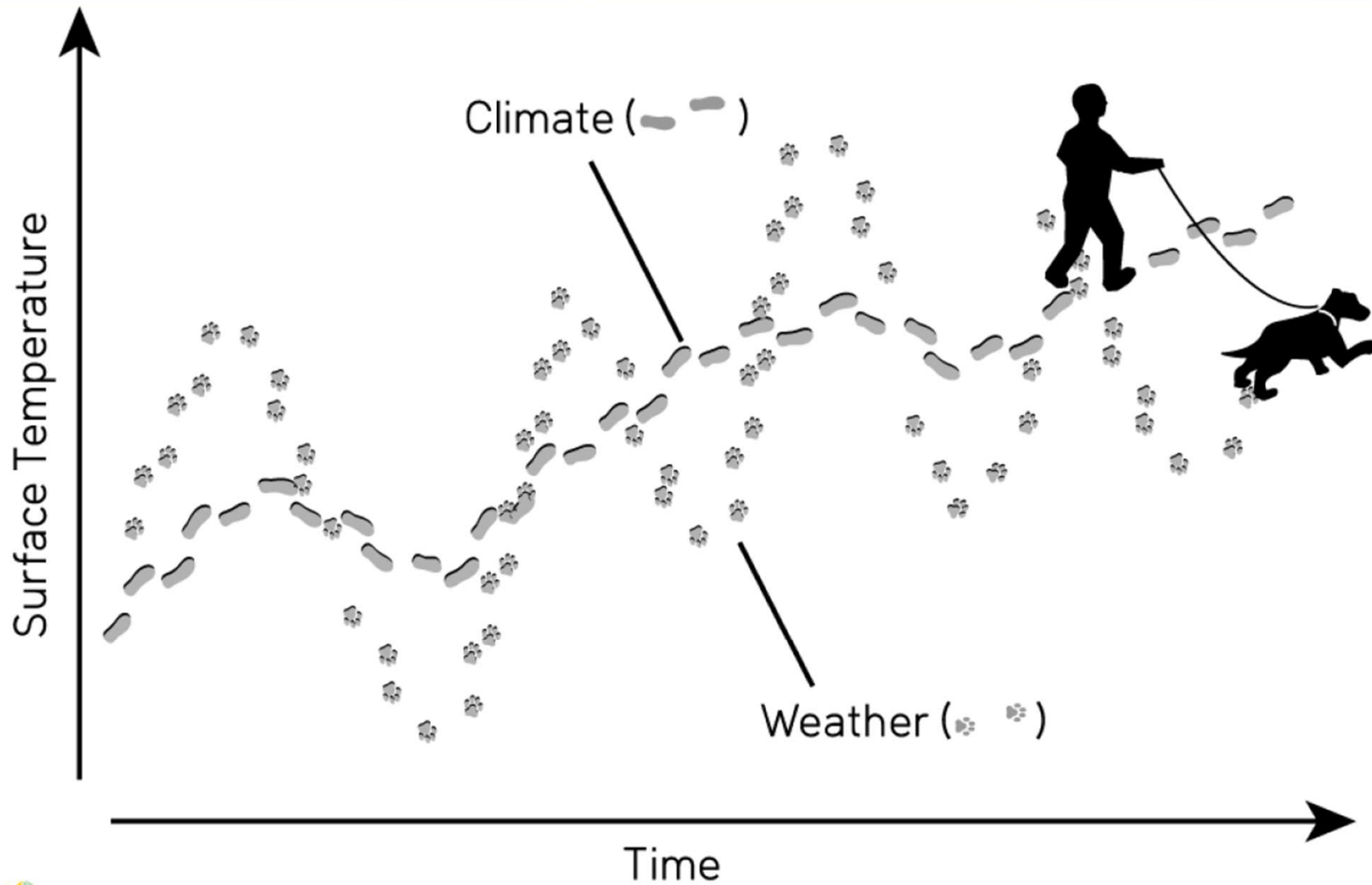


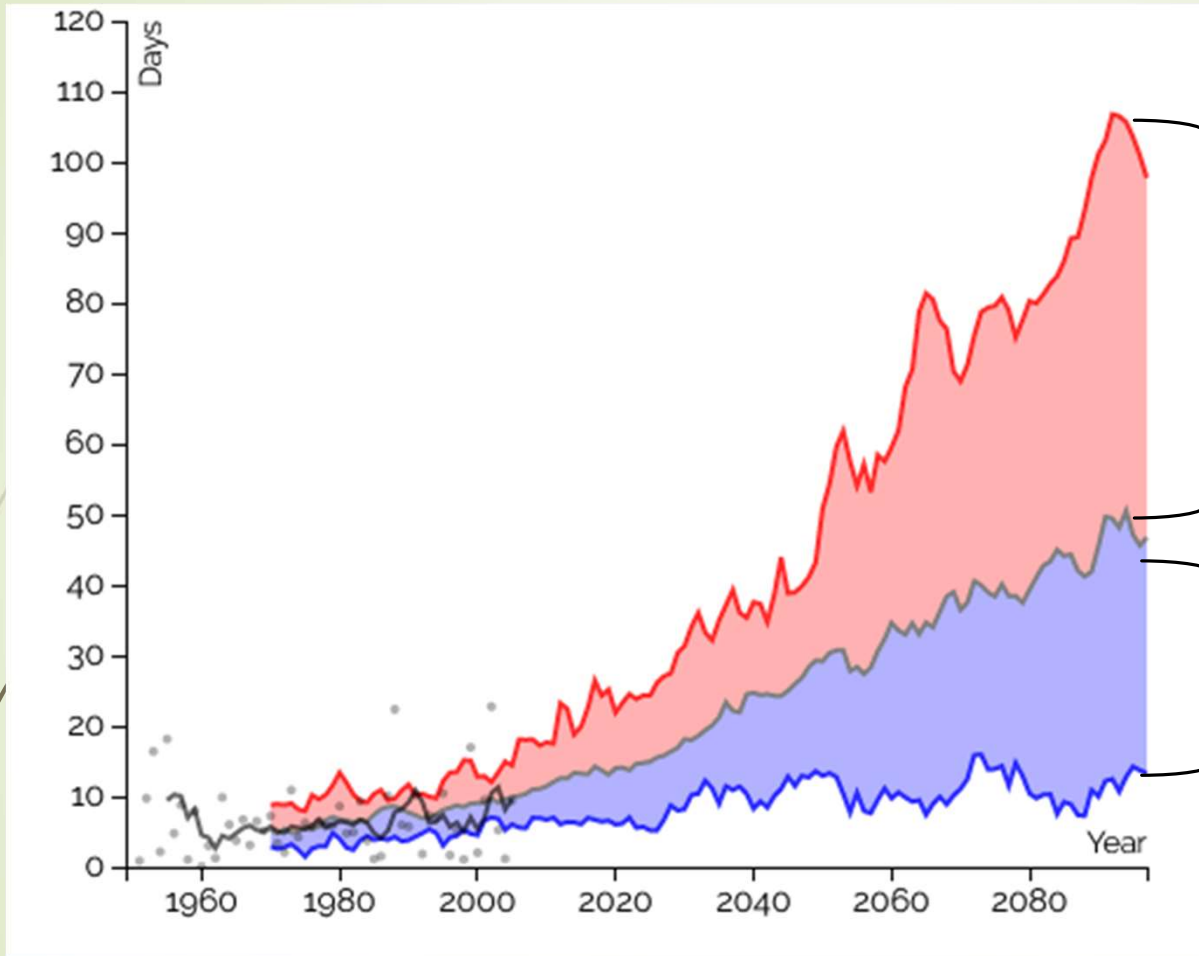
# **Climate considerations: warming, precipitation, extremes**

**For the Hatfield Comprehensive Planning Committee  
July 26, 2023**

**Patty Gambarini, Chief Environmental Planner  
Pioneer Valley Planning Commission**

- 
- Projections and Trends
  - Responses





High emissions scenario,  
RCP 8.5 – worst case

Lower emissions scenario,  
RCP 4.5

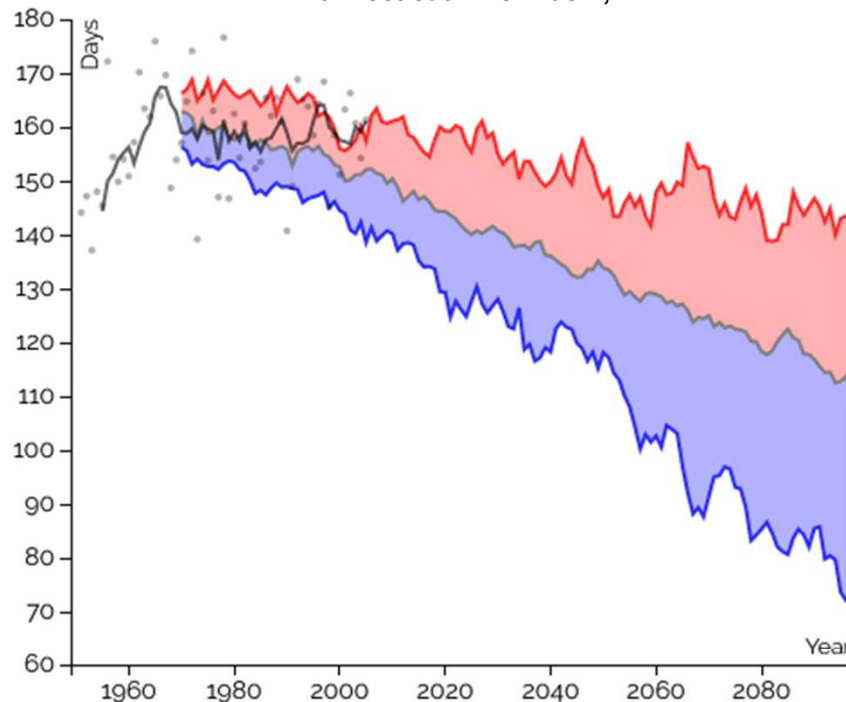
More about Representative  
Concentration Pathway:  
<https://skepticalscience.com/rcp.php>

[www.resilientma.mass.gov](http://www.resilientma.mass.gov)

Northeast Climate Adaptation Science Center

# Temperatures - Winter Warming

Annual Days with Minimum Temperature Below 32°F  
Connecticut River Basin, MA



[Download Data](#)

**Observed** days

5-yr Mean ✓

**Modeled days**

Max ✓

Median ✓

Min ✓

Changes from 1971-2000 for:

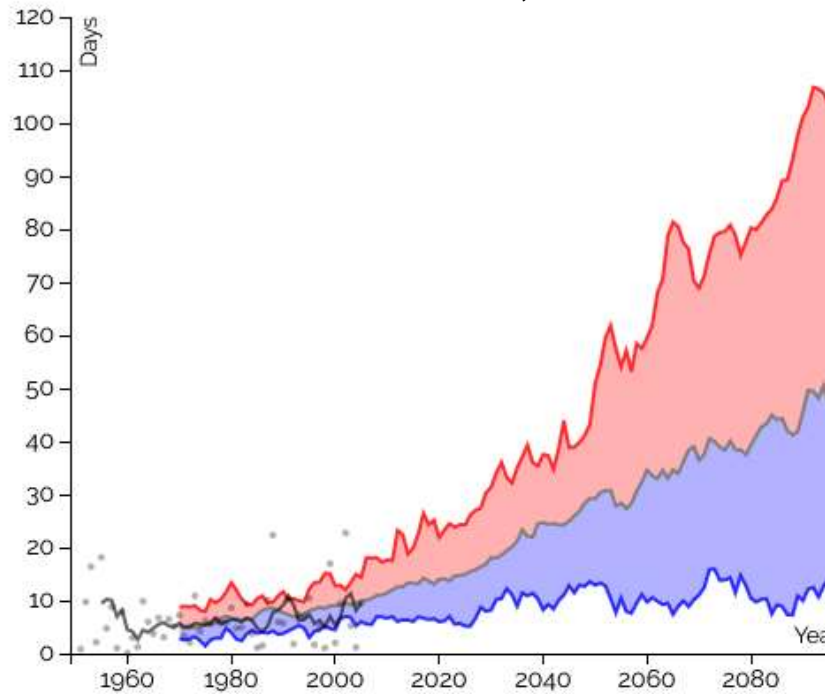
2020 - 2049	-22.49days
2040 - 2069	-31.41days
2060 - 2089	-38.18days
2080 - 2097	-43.02days

[About the Source Data](#)

Median values

# Temperatures - Summer Heat

Annual Days with Maximum Temperature Above 90°F  
Connecticut River Basin, MA



[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:

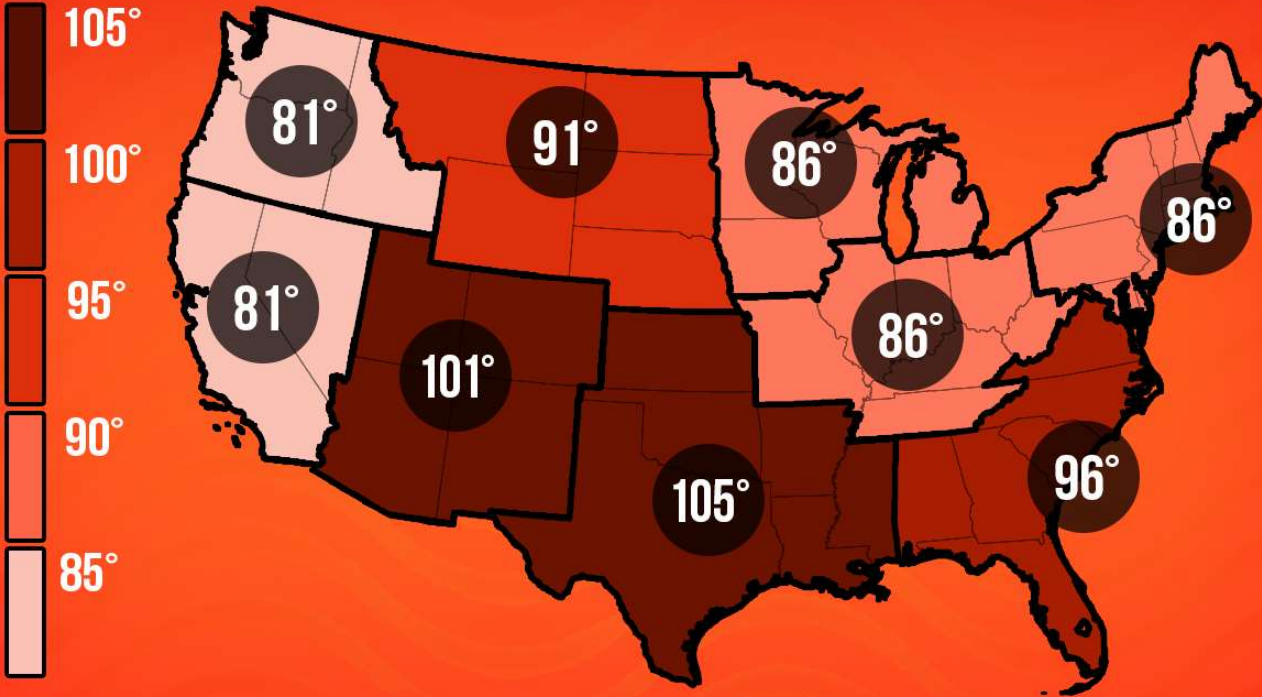
2020 -	14.89
2049	days
2040 -	24.05
2069	days
2060 -	32.93
2089	days
2080 -	38.90
2097	days

[About the Source  
Data](#)

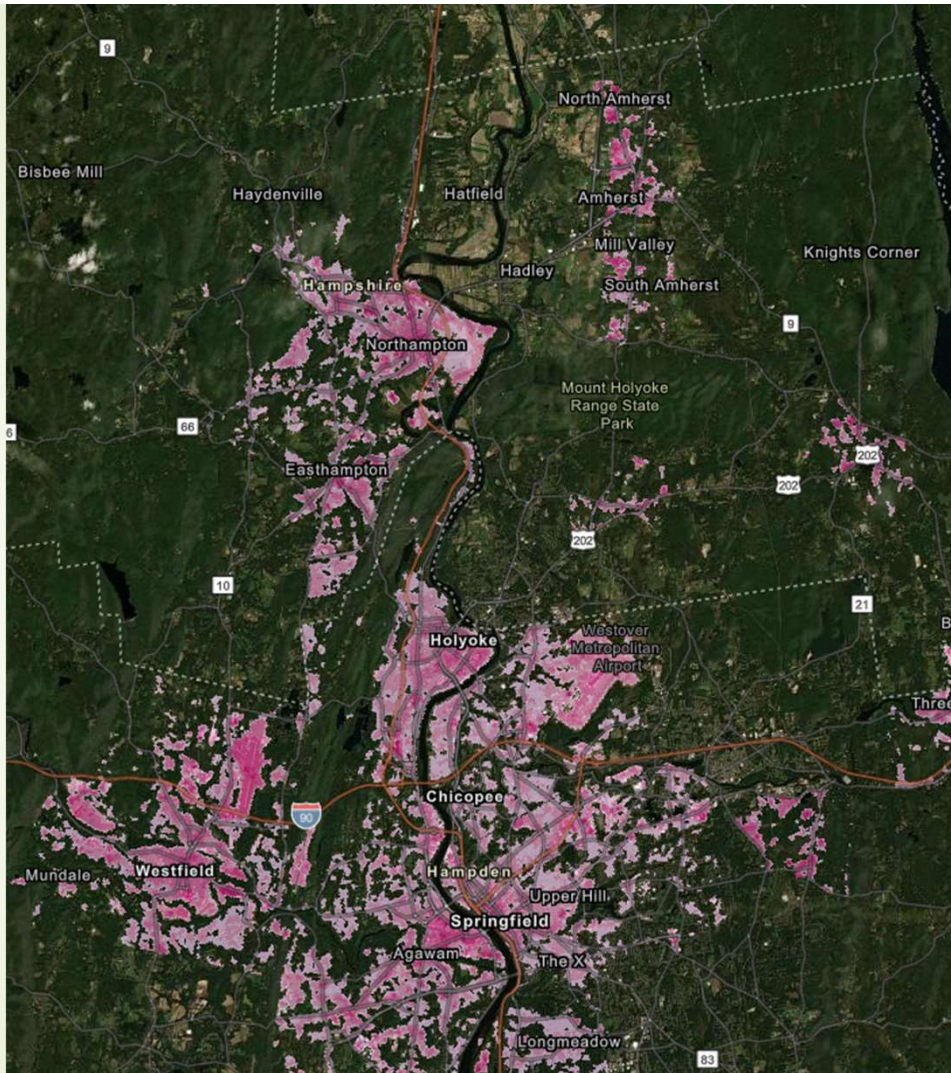
Median values

# HEAT & HOSPITALIZATIONS

REGIONAL HEAT INDEX RANGE FOR PEAK HOSPITALIZATIONS



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

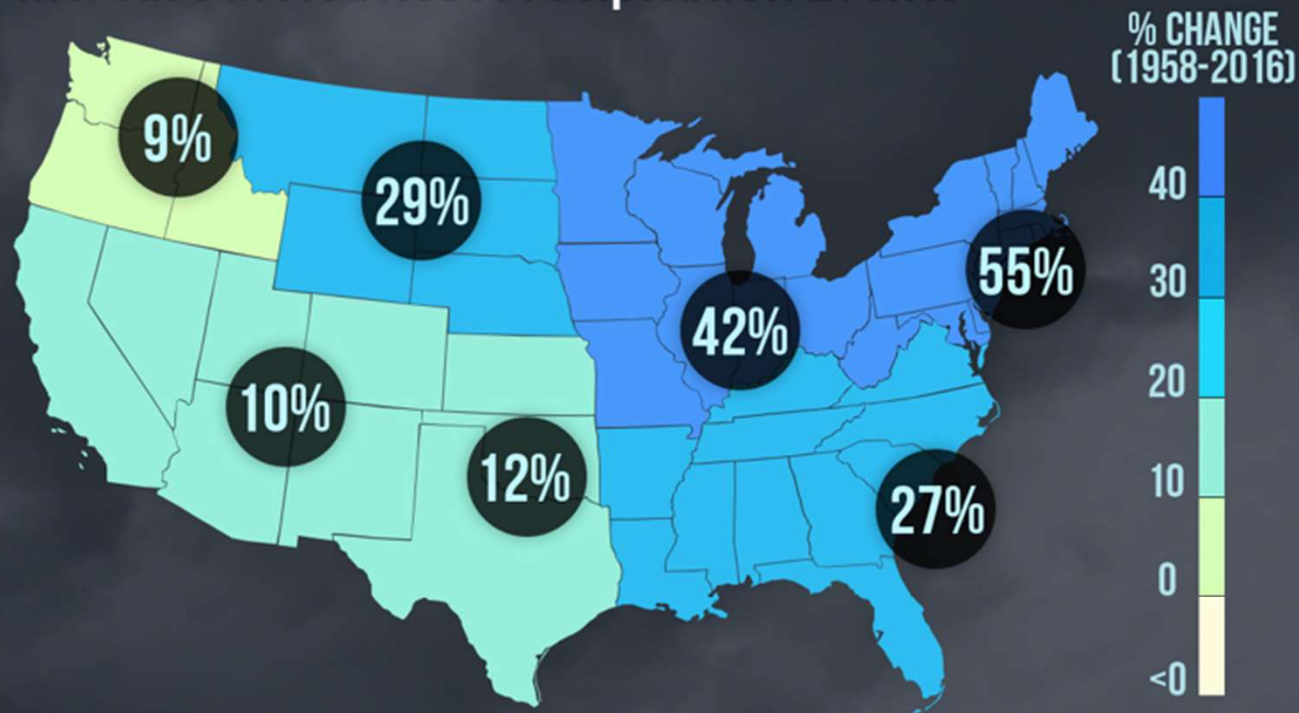


Source: Trust for Public Land  
 This 30-meter raster derived from Landsat 8 imagery band 10 (ground-level thermal sensor) from the summers of 2019 and 2020.



# MORE DOWNPOURS

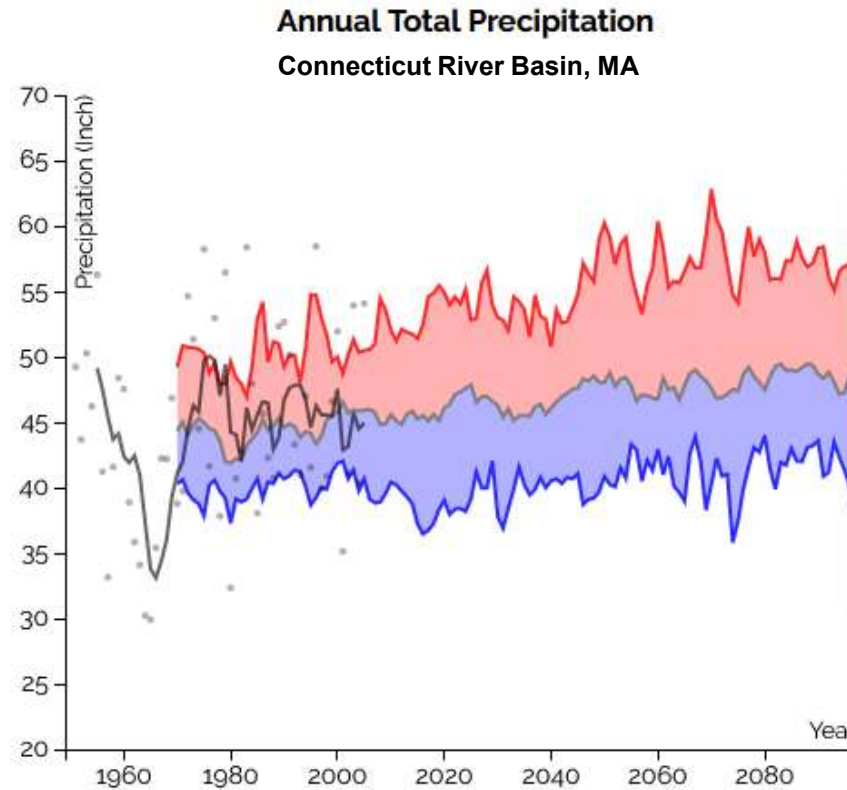
Increase in Heaviest Precipitation Events



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

# 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](#)

# 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



Source: Daily Hampshire Gazette, November 14, 2021



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.

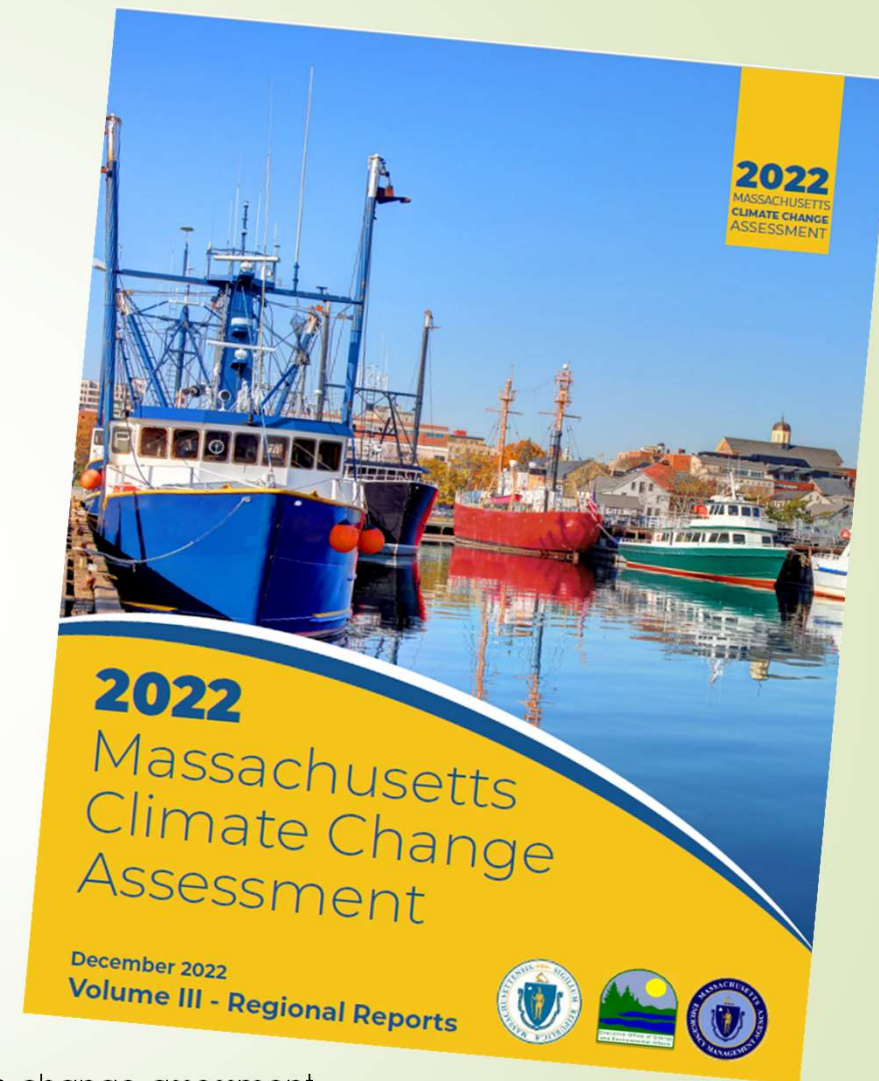
Hopefully, the rain stays away until we can design a more permanent repair with better drainage.

### 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 21<sup>st</sup> century include the following:

2030	2050	2070	2090
<b>NEAR TERM</b>	<b>MID-CENTURY</b>	<b>MID-LATE CENTURY</b>	<b>END OF CENTURY</b>
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



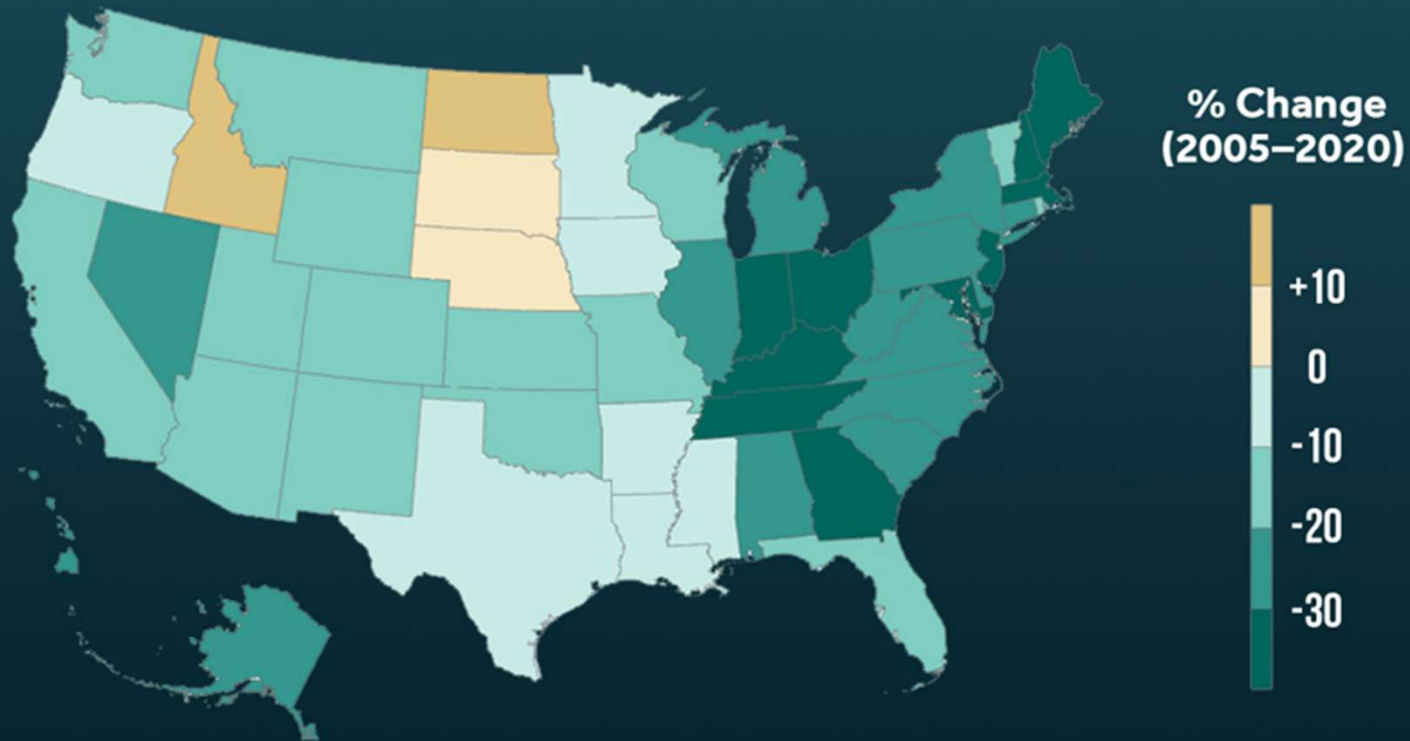
**Decrease in Agricultural Productivity** as crop yields are impacted by precipitation patterns, extreme weather, pests, and other climate factors.

**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)

# MASSACHUSETTS 2050 DECARBONIZATION ROADMAP



A report commissioned by the Massachusetts Executive Office of Energy and Environmental Affairs to identify cost-effective and equitable strategies to ensure Massachusetts achieves net-zero greenhouse gas emissions by 2050.



December 2020

## 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”
- PVRTA 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**

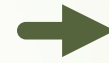
- Floodplain management standards
- Stormwater management

# 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*