

# Climate Resilience: Challenges and Opportunities in the Upper Valley

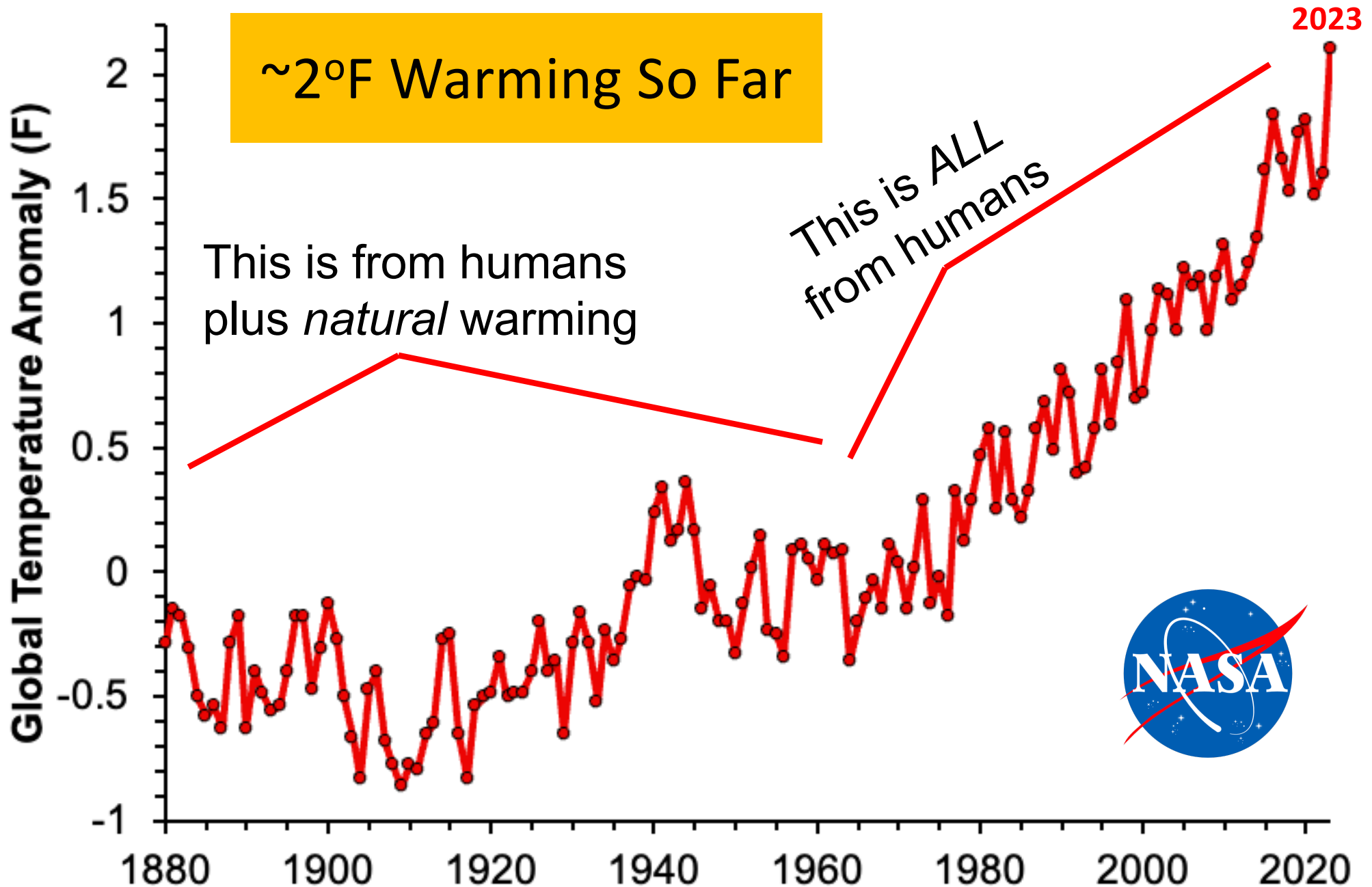


**Dr. Erich Osterberg**  
Dartmouth College Earth Sciences

# Take-Home Messages

- Many climate challenges are already affecting the Upper Valley
  - Extreme heat, rain & flooding, air pollution, tick-borne disease
- Climate impacts nearly every aspect of our communities, but not evenly (economy, health, infrastructure, housing, etc.)
- UVAW is strategically assessing UV needs related to climate resilience
- New opportunities – with funding – for partnerships between researchers and community orgs to increase local climate resilience

# Humans Are Now Causing 100+% of Global Warming





# Climate Impacts are Already Here

Stronger Hurricanes with More Rain



More Intense & Frequent Heatwaves & Drought



Stronger Extreme Downpours & Flooding



More Frequent Wildfires



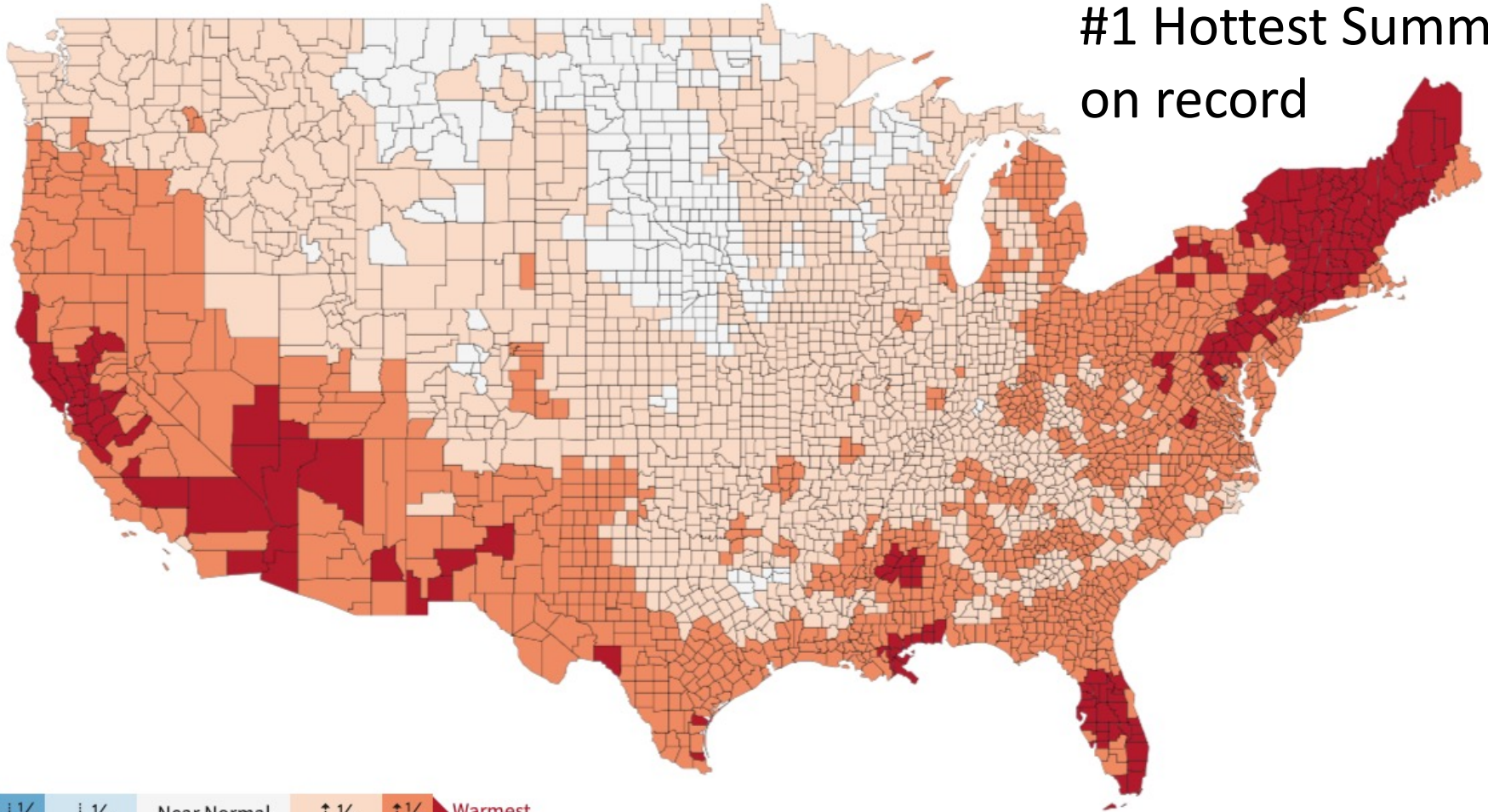


# 2024 May-July Temperature Rank

County Average Temperature Rank (130 years)

May - July 2024

#1 Hottest Summer  
on record



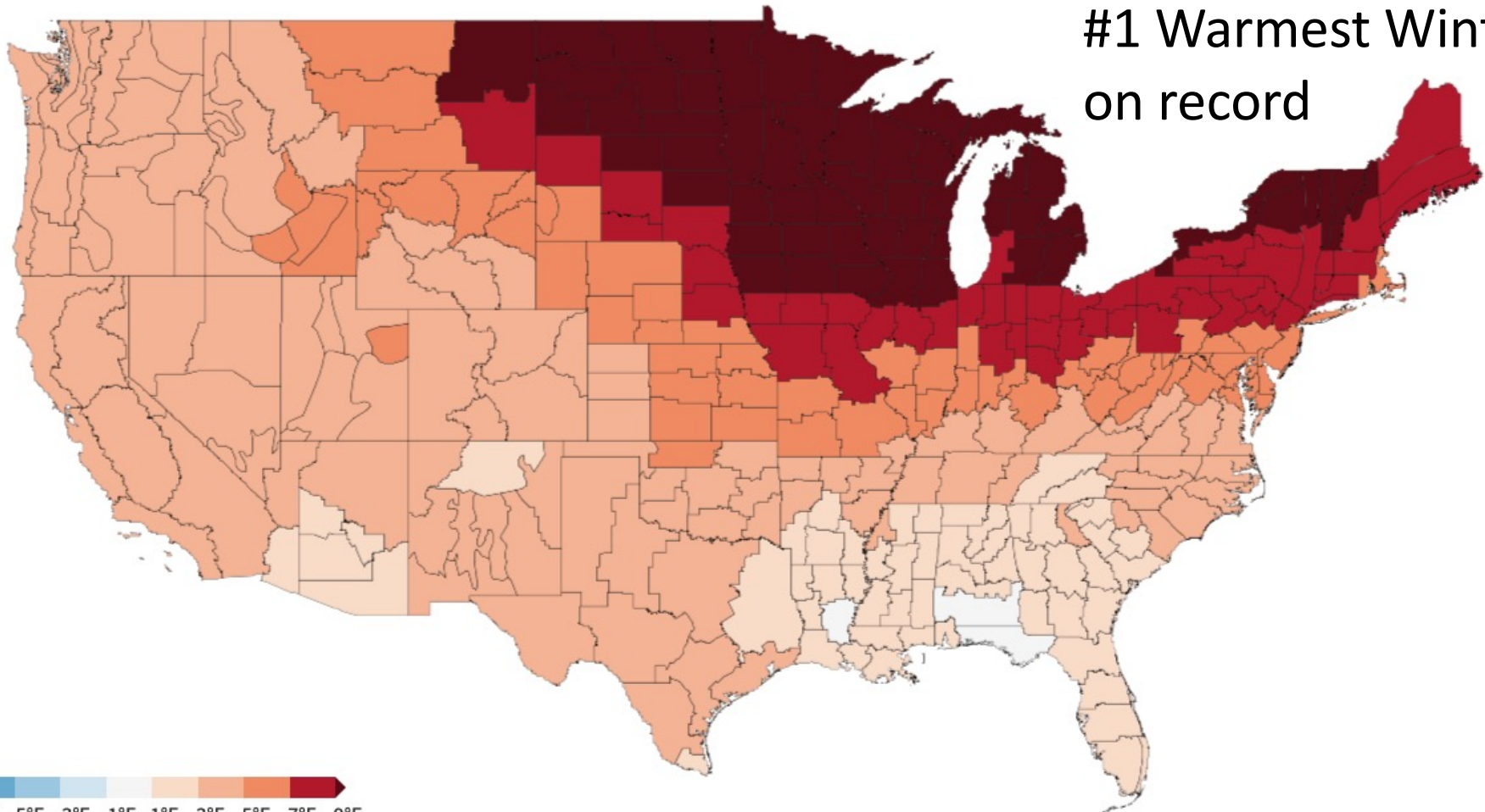
Coldest  $\downarrow 1/10$   $\downarrow 1/3$  Near Normal  $\uparrow 1/3$   $\uparrow 1/10$  Warmest

# 2023-2024 Winter Surface Temperature Anomaly

## Divisional Average Temperature Anomaly

December 2023 - February 2024

#1 Warmest Winter  
on record



-9°F -7°F -5°F -3°F -1°F 1°F 3°F 5°F 7°F 9°F

**Contiguous U.S.** (Hover over a Climate Division)

**Temp:** 37.60°F

**Anomaly:** 5.38°F

**Rank:** Warmest

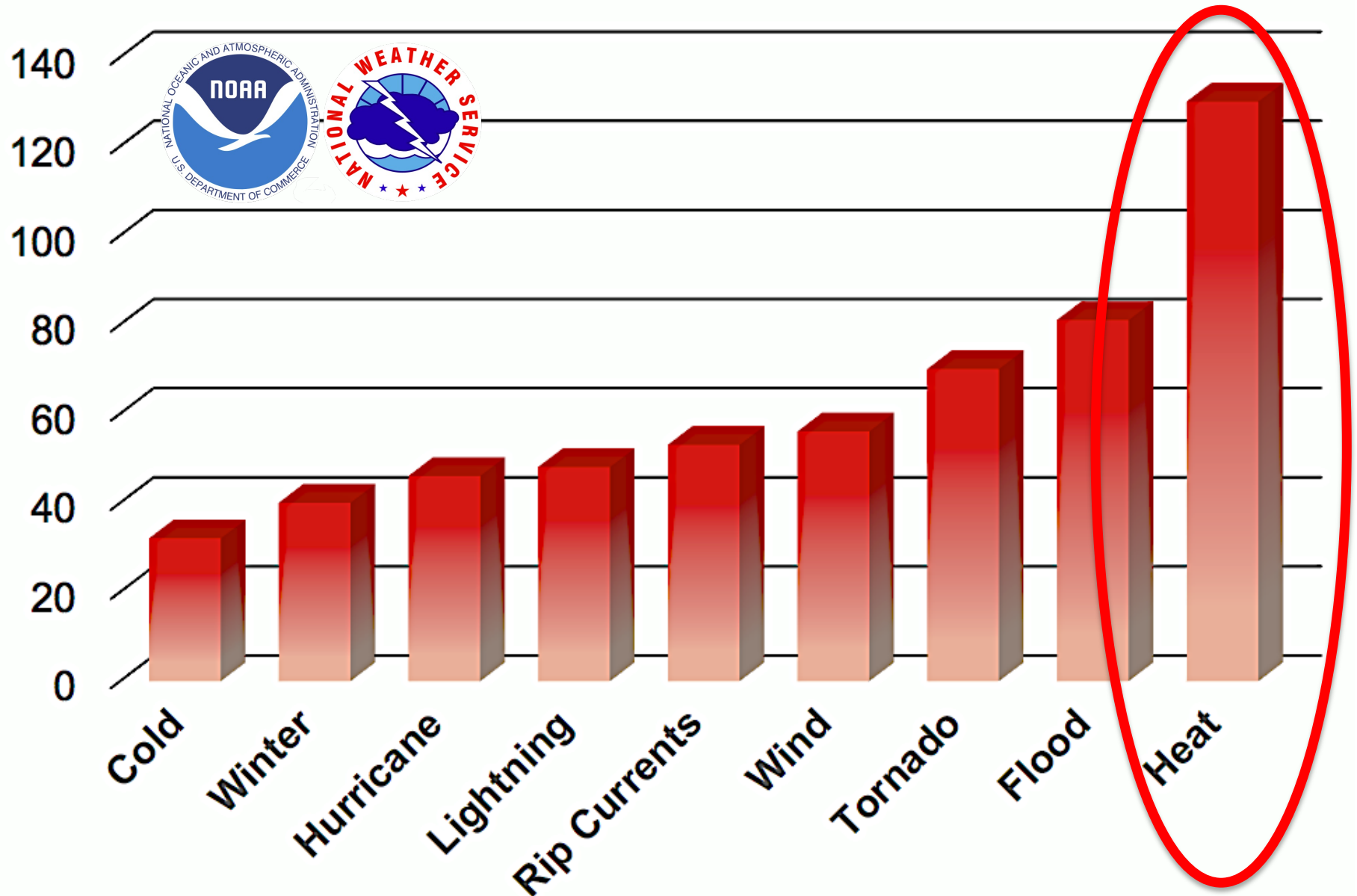
**Mean:** 32.23°F





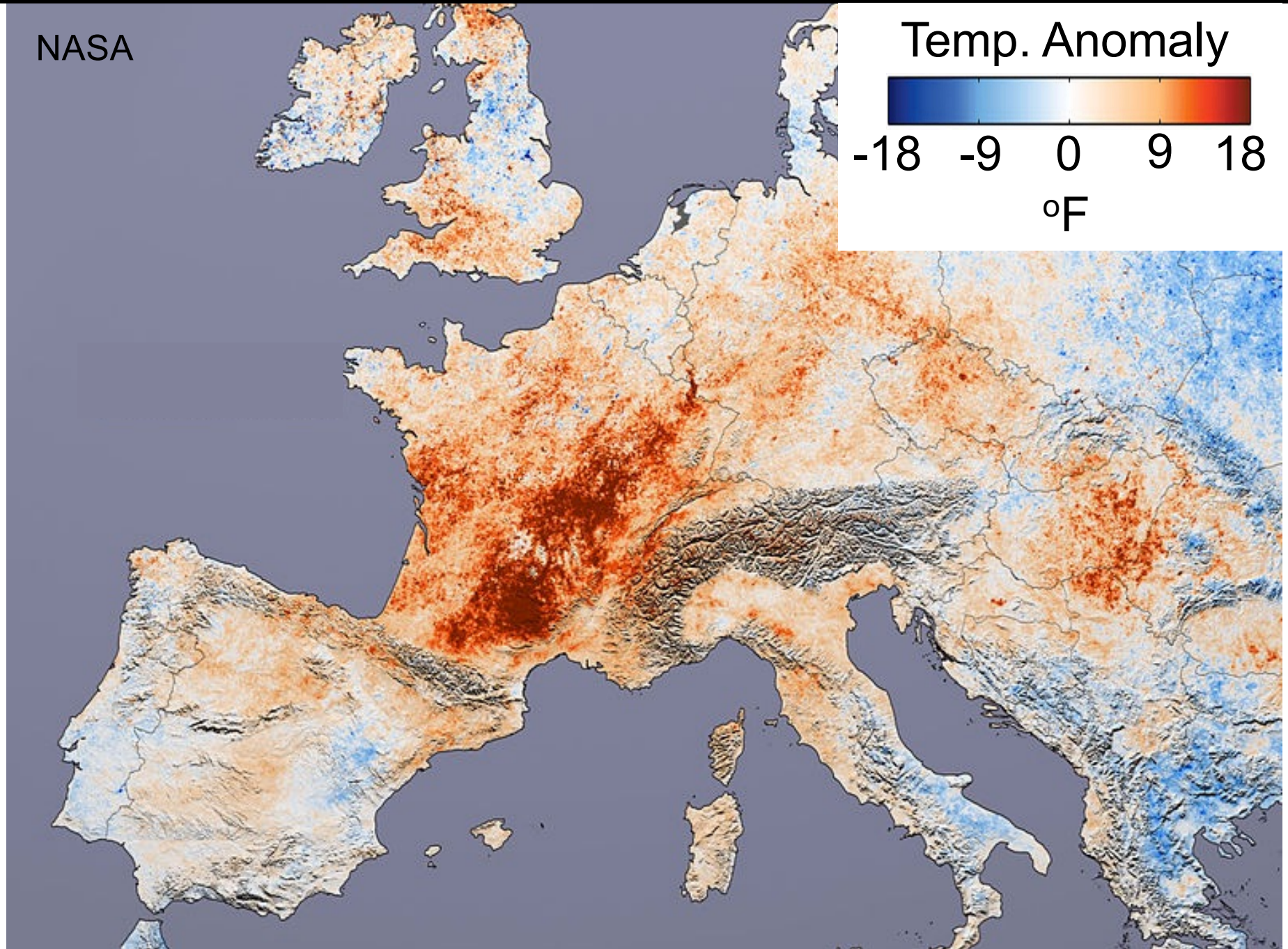
# Heat is *Already* #1 Cause of U.S. Weather Deaths

## U.S. Weather Fatalities (30-Year Average)



# 2003 European Heat Wave: 70,000+ Deaths

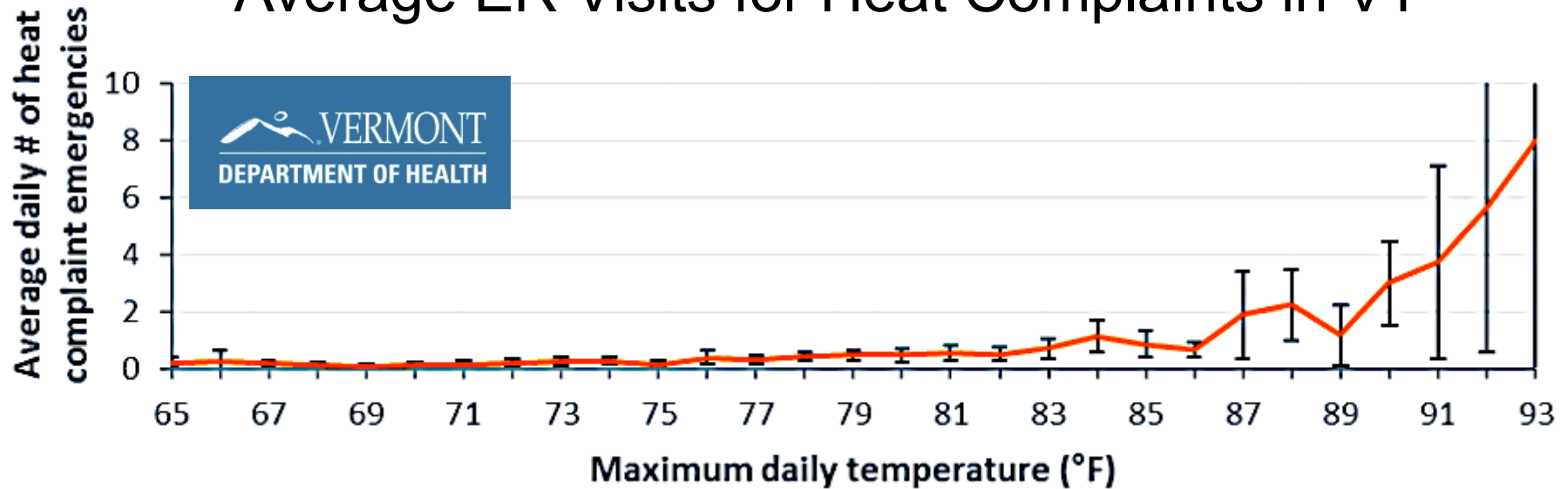
NASA



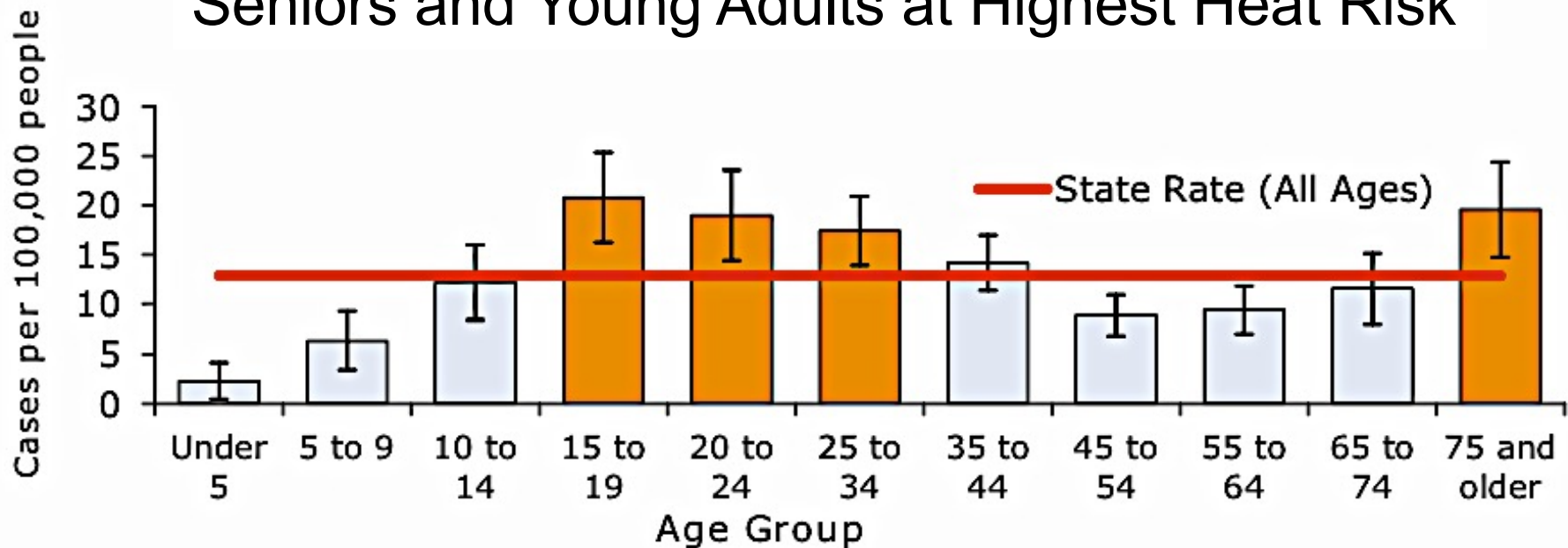


# ER Visits Increase Starting at 87°F

## Average ER Visits for Heat Complaints in VT



## Seniors and Young Adults at Highest Heat Risk



# New England Heatwave, July 2-15, 1911

Pennsylvania to Maine  
Estimated ~2000 deaths

5000+ People Slept in Boston Common  
(photo from Central Park, NY)

TOTAL DEATHS IN CITY FROM HEAT.	
Sunday .....	10
Monday .....	14
Tuesday .....	35
Wednesday .....	43
Thursday .....	66
Total .....	158

New York Tribune



New England Historical Society

## 1911 Record Temperatures:

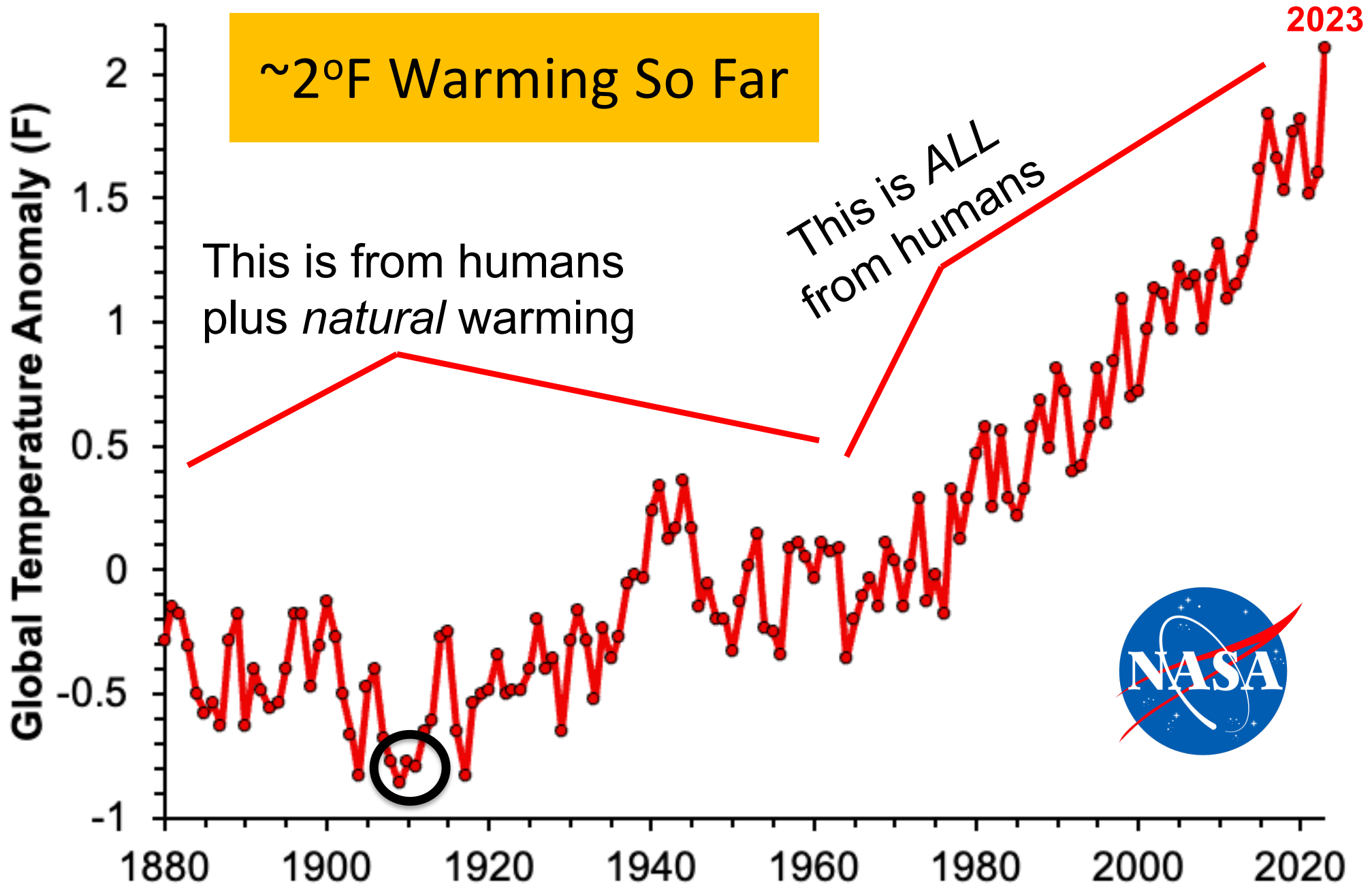
Boston: 104°F on July 4 (still stands as all-time high)

Nashua: 104°F on July 4 (still stands as all-time high)

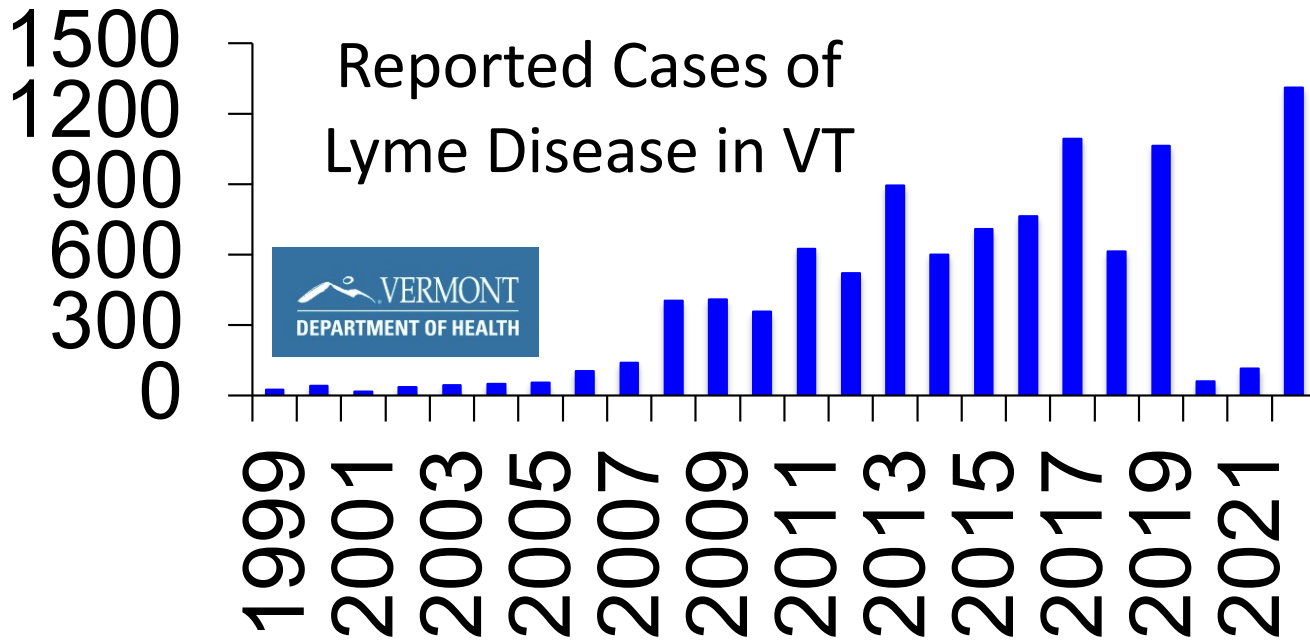
Hanover: 101°F on July 3 (#2 all time; 1911 had 3 >100°F days in a row)



# Humans Are Now Causing 100+% of Global Warming



# Tick-Borne Illnesses On the Rise



## Reported Cases of Lyme Disease

2001

2013

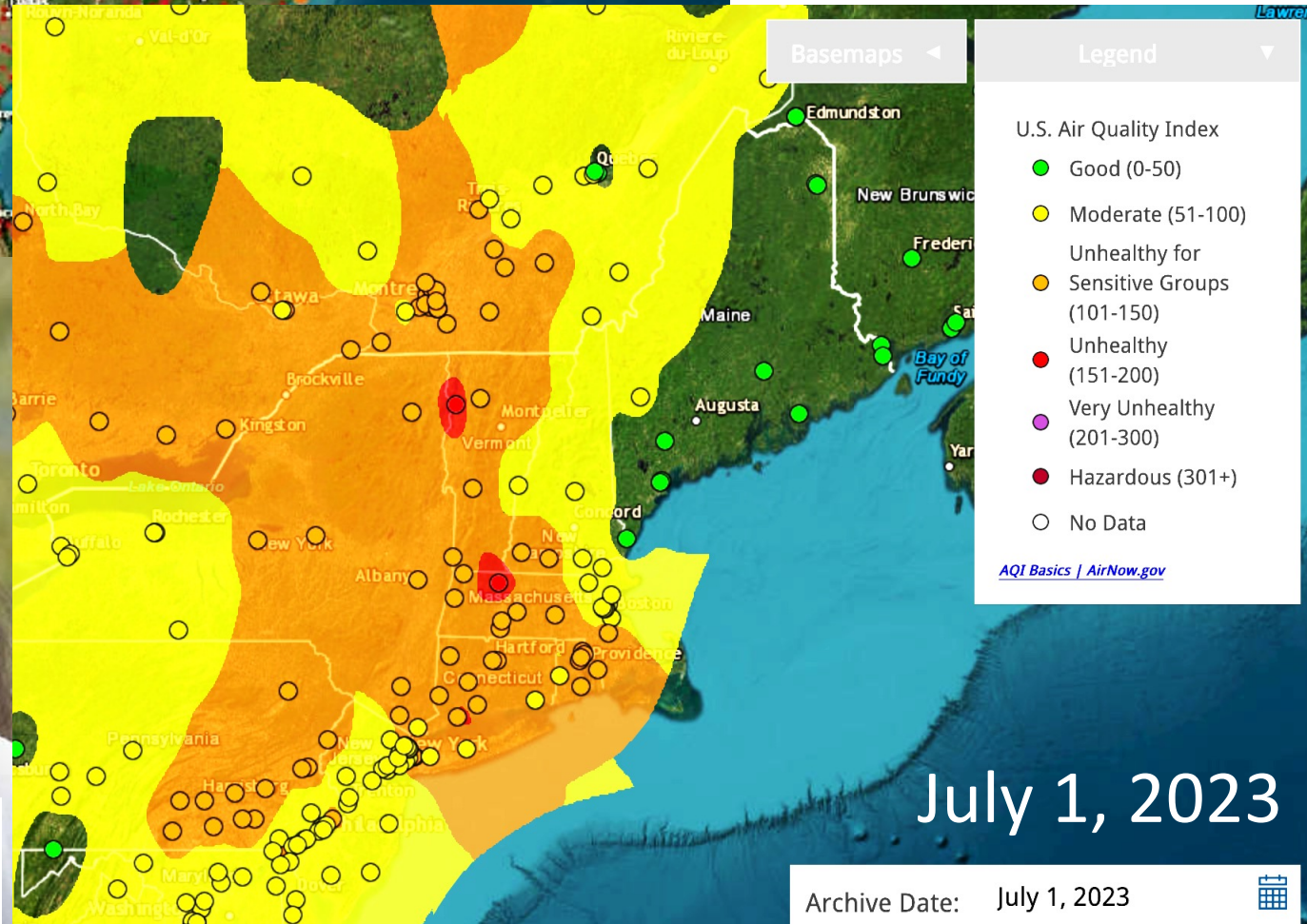
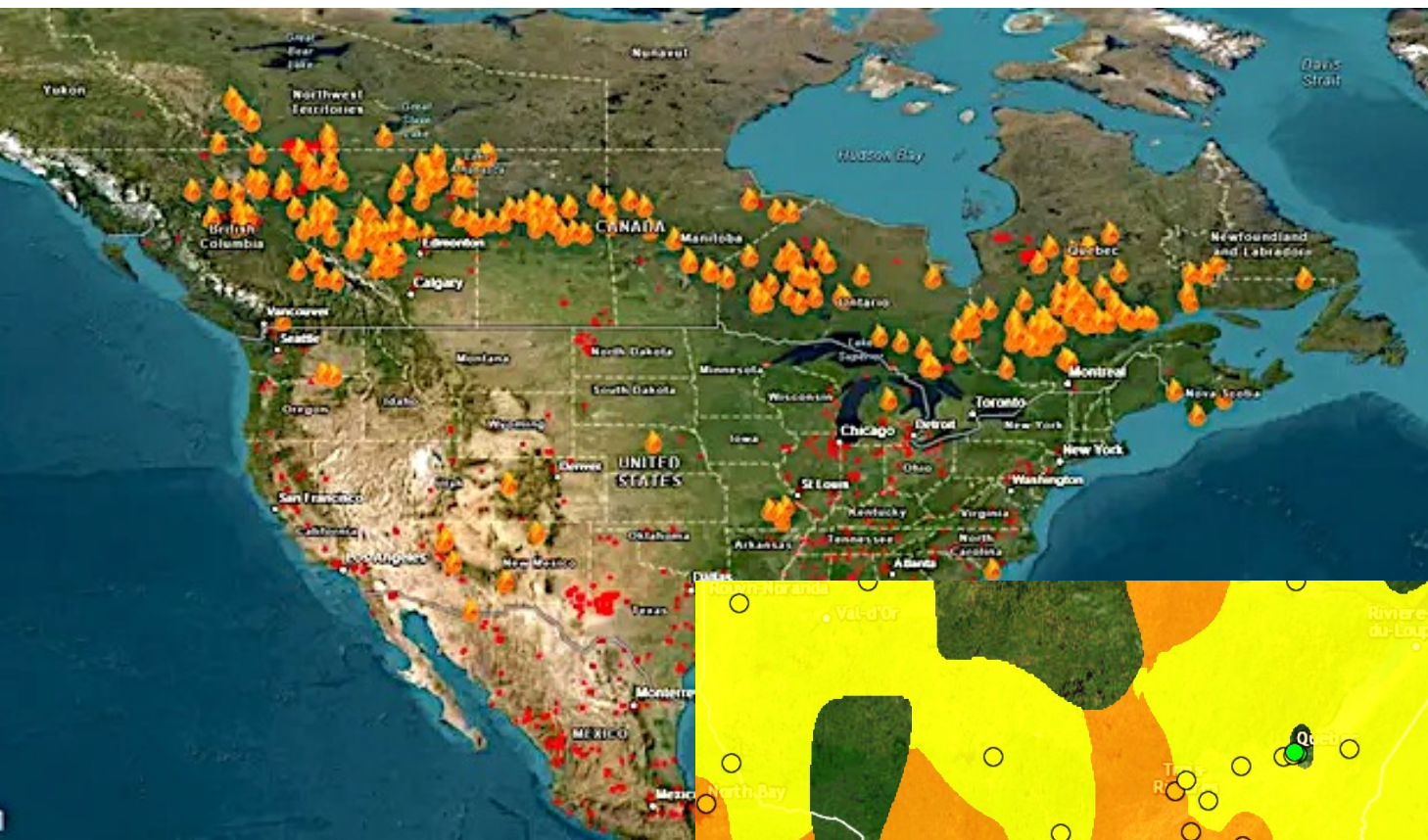
Prof. Winter, Dartmouth Geography Dept. research group



Centers for Disease Control and Prevention  
CDC 24/7: Saving Lives, Protecting People™



# Wildfire Smoke (July 2023)



10+ Million deaths per year from air pollution

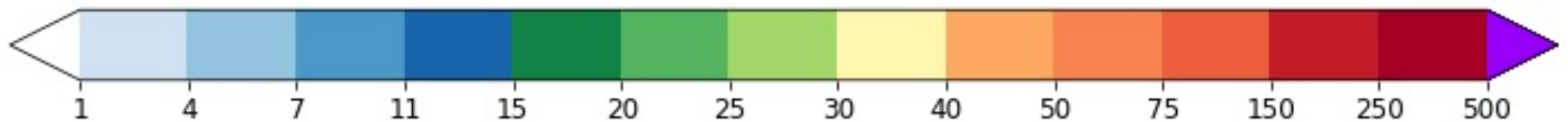
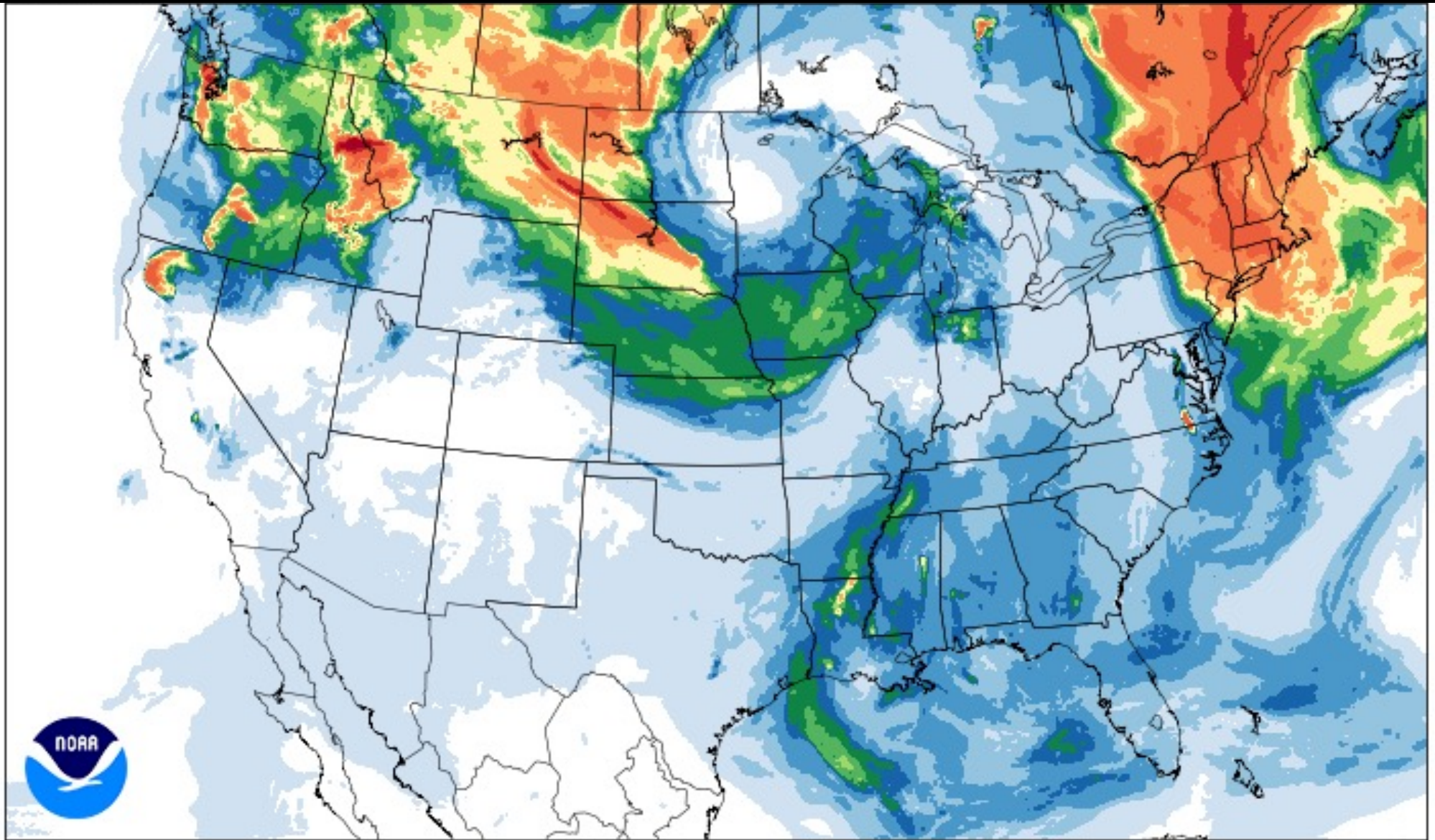
July 1, 2023

Archive Date: July 1, 2023





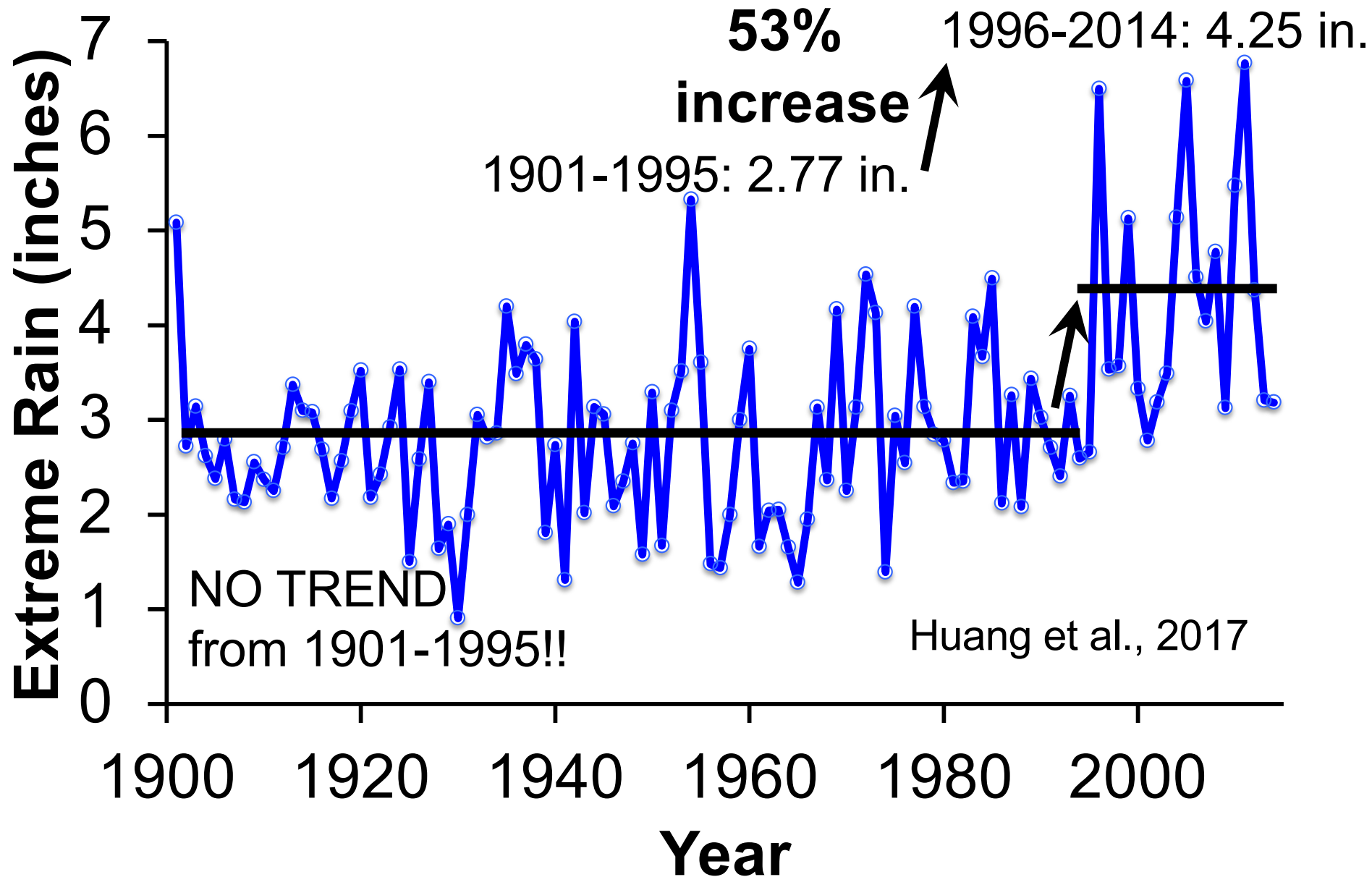
# Hazardous Wildfire Smoke *TODAY*







# Extreme Rain in the Northeast US JUMPED ~50% in 1996





# Hurricane Irene: August, 2011

Credit: CVPS

Rt. 4 near Rutland



Wilmington, VT



Quechee, VT



~50% of the jump since 1996 is from MORE Hurricanes due to warmer ocean waters (Huang et al., 2018)



# Hurricane Beryl Remnants: July 10, 2024

Credit: Reuters

Lyndonville, VT

200- to 500-year  
storm (NWS)



Credit: NWS Burlington

Barnet, VT





# July 2013 & 2017 & 2023 & 2024 Storms

3+” Rain for Each Event

Route 25A • Orford, N.H.  
July 1, 2017 • Courtesy Peter Bouchard



Montpelier, VT



Credit: Reuters

~40% of the jump  
since 1996 is from  
thunderstorms and  
Nor'Easters  
(Huang et al., 2018)



# July 30, 2024 Storm

7+” Rain

Lyndonville, VT

July 31



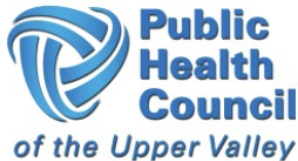
Credit: Associated Press/New York Times



# Upper Valley Adaptation Workgroup (UVAW)

Municipal Regional State Medical Academic Non-Profit Business

Building Climate Resilient Communities in the Upper Valley through Research, Information Sharing and Education



DARTMOUTH



# 15 Public Forums, Each with ~50-120 People





# Climate Change Leadership Academy (2CLA)



- Catalyzing grassroots climate action by training and supporting community leaders
- Sessions on climate science, mitigation, adaptation, climate migration, effective communication, & project management.
- Scaffolded support for individual or team community projects

# Service Learning through the Dartmouth Center for Social Impact

Partnered with Dartmouth students in 10 courses on UVAW projects since 2018:

- *SOC 11: Sociology Methods*: How to engage climate skeptics
- *ENVS 80: Science Policy & Diplomacy*: Film about flooding and culverts
- *ENG 53*: Children's Book on Climate Change
- *PBPL 51*: A proposal for the Climate Change Leadership Academy (2CLA)
- *PBPL 45*: Lyme Disease Prevention and Education
- *SINC*: Developing an inventory of UV climate groups
- *ENGS 15*: Climactor App
- *SPEE 20*: Logo and branding for UVAW
- *SINC*: Completing the Climactor App
- *ENGS 15*: Climate-Informed Pediatric Toolkit
- *ENVS 61*: Climate Migration Stakeholder Engagement



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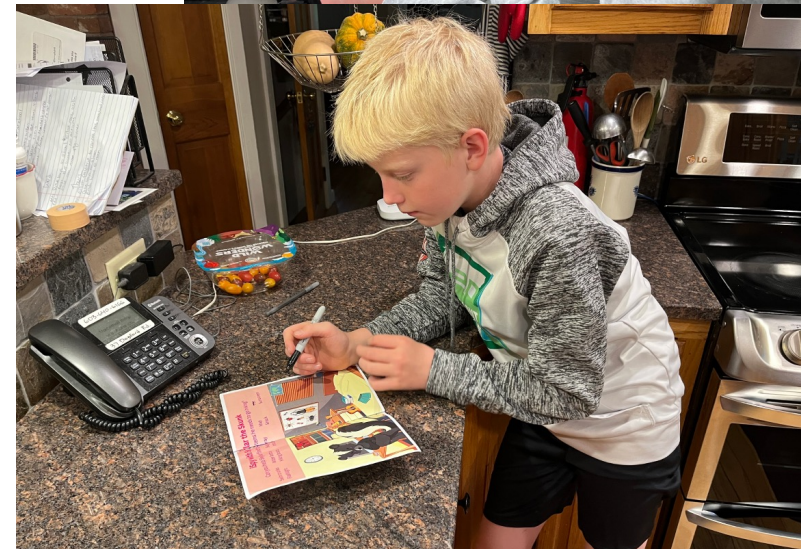
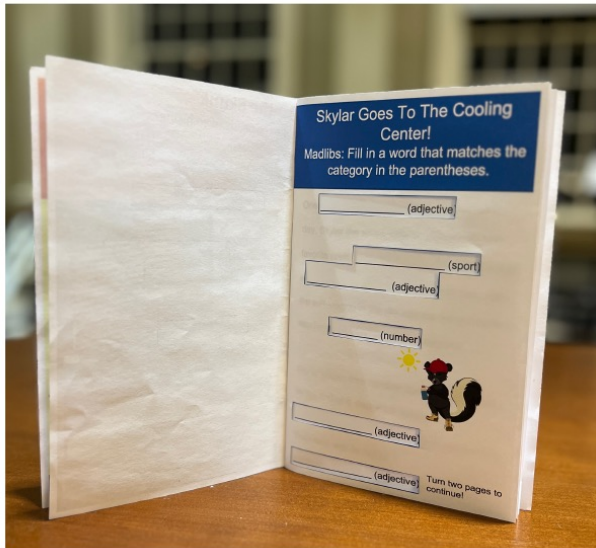
# A pediatrician's guide to climate change-informed primary care



Rebecca Pass Philipsborn, MD, MPA,<sup>a</sup> Julia Cowenhoven, MD,<sup>b</sup> Aparna Bole, MD,<sup>c</sup> Sophie J Balk, MD,<sup>d</sup> and Aaron Bernstein, MD, MPH<sup>e,\*</sup>

Madlib with cutouts to facilitate individual play

The character, Skylar the Skunk



**NH** HEALTHY CLIMATE



## A DHMC pilot program wants to make it easier for NH doctors to talk about climate change



*Jessica Blasko says she is always thinking about how to keep her children safe from the impacts of climate change. Amanda Pirani NHPR NHPR – Amanda Pirani*

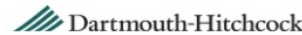
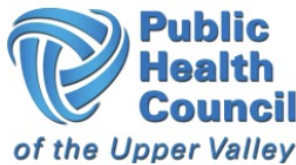


# Upper Valley Adaptation Workgroup (UVAW)

Municipal Regional State Medical Academic Non-Profit Business

## UVAW Strategic Questions:

- 1. What are the needs in the Upper Valley to increase climate resilience?*
- 2. How might UVAW help to meet those needs?*



DARTMOUTH



# Upper Valley Adaptation Workgroup (UVAW)

Municipal   Regional   State   Medical   Academic   Non-Profit   Business

## UVAW Strategic *Process*:

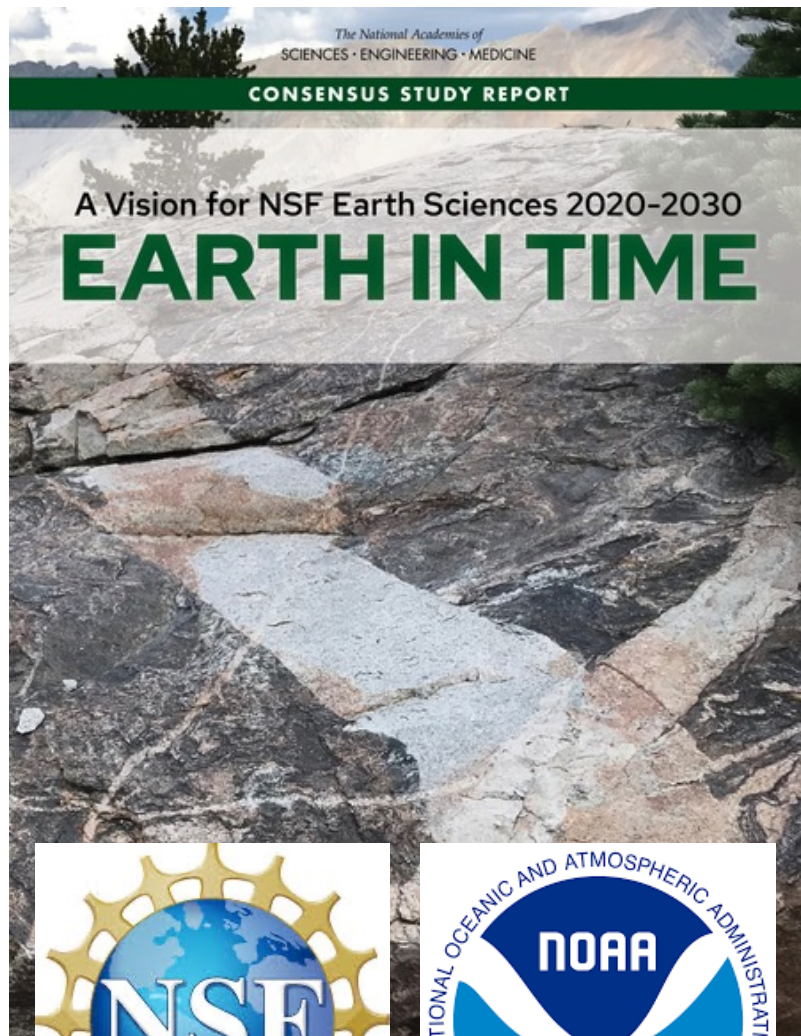
1. Develop a series of conceptual maps of UV orgs that contribute to climate resilience
2. Host a community meal in the fall to work collaboratively to improve the initial draft maps
3. Reflect on what we've learned and prioritize UVAW focus areas/activities for the future



# New Opportunities for Research-Community Partnerships



NATIONAL ACADEMY OF SCIENCES

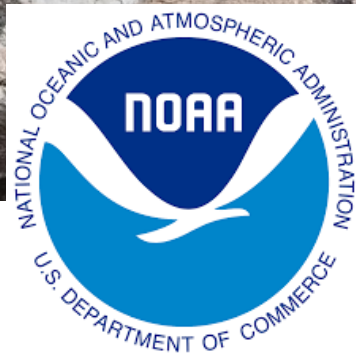


“Today’s Earth science landscape is vastly different from what it was only a decade ago”

“All-hands-on-deck moment”

“**Building relationships** that help local decision makers and researchers **collaborate** on **equitably** adapting to climate change “

“Meaningful collaboration among scientists and a broad swathe of stakeholders is essential”





**Climate Adaptation  
Partnerships**  
*Formerly RISA*

1-Year Planning Grant funded  
on climate migration (2023)

5 World Café Events  
>300 Participants

1. What do communities identify as priority concerns and opportunities with climate migration?
2. What regional governance gaps inhibit equitable migration, and how can we do better?





# Key Learnings from Community Conversations



1. Housing, housing, housing, and housing!!
  - Current 'housing crisis': affordability, accessibility, and quality all lacking
  - Low-income, BIPOC, renters most impacted
  - Climate in-migration would exasperate problems



2. Local government lacks capacity
  - Small towns are severely understaffed
  - Often volunteers
  - Insufficient funding





## New 5-Year Grant Proposal

“We envision an Upper Northeast where people work collaboratively across political, sectoral, and disciplinary boundaries to build and support affordable, climate-adapted, and decarbonized housing for all.”

1. Where is affordable housing vulnerable to flooding and heat?
2. Have past flood mitigation efforts increased housing resilience?
3. Where might housing expand to minimize carbon emissions and flooding risks?
4. How does zoning support or deter affordable housing that is resilient and affordable to all?



# New 2-Year Planning Grant *Funded* Focused on NH & VT Flood Erosion



## Project Goals:

1. Strengthen Community Partnerships
2. Co-develop research questions with flood-impacted communities
3. Identify effective strategies for sharing scientific info

Hinesburg, VT  
July 11, 2024

Credit: Emma Cotton



- *Where are the greatest flood erosion hazards?*
- *Which areas include vulnerable populations?*
- *How effective were post-Irene flood measures in 2023 and 2024?*

# Dartmouth to Invest \$500 Million in Decarbonization

April 22, 2024

The Dartmouth Climate Collaborative will reduce campus emissions 100% by 2050.

# Climate Futures Initiative Announces First Pilot Project

August 6, 2024

The service learning course will match students with climate resilience efforts.

- 2-term service-learning course at Dartmouth (Jan-June 2025)
- Students work collaboratively with community partners to plan and implement a small climate resilience project
- \$7-10k available to help implement the project
- Seeking potential community partners now!



# Climate Adaptation Saves Lives




Changes in community processes, practices, and structures can reduce potential damages and/or benefit from opportunities associated with climate change

## Heat waves: How France has cut death toll 90% since 2003

*The* CHRISTIAN SCIENCE  
**MONITOR**<sup>®</sup>  
Nov. 4, 2019



# Heat-related mortality in Europe during the summer of 2022

Joan Ballester <sup>1</sup>✉, Marcos Quijal-Zamorano <sup>1,2</sup>,  
Raúl Fernando Méndez Turrubiates<sup>1</sup>, Ferran Pegenaute <sup>1</sup>,

**Fig. 3: Regional temperature anomaly and heat-related mortality rate during the summer of 2022.**

