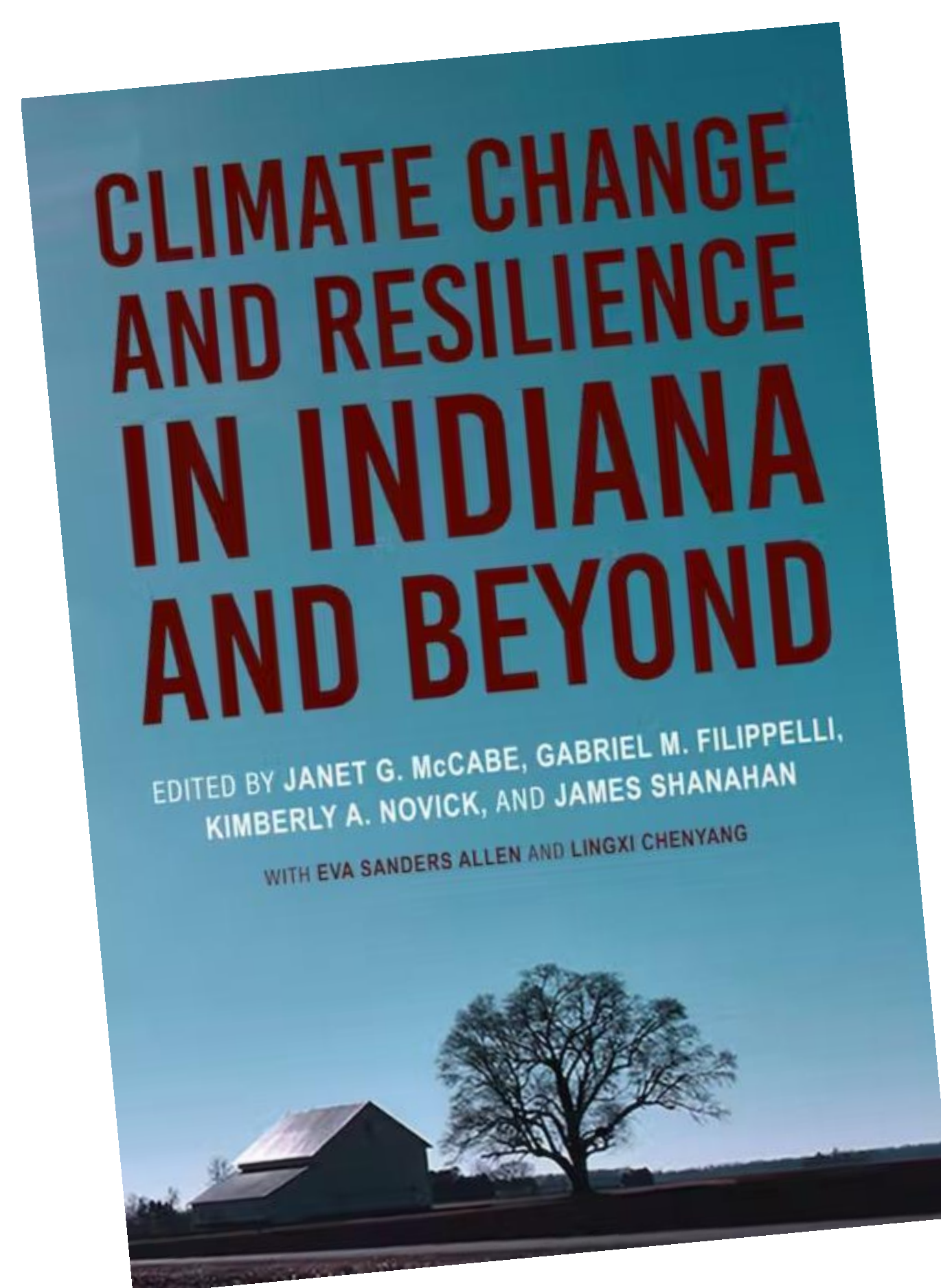




**CARMEL GREEN INITIATIVE**

# Sustainable Living seminars



**Dr. Gabe Filippelli**



INDIANA UNIVERSITY

**ENVIRONMENTAL RESILIENCE INSTITUTE**

Sept, 14, 2023  
Carmel Clay Public Library





**Dr. Gabriel Filippelli** is a Chancellor's Professor of **Earth Sciences** and Executive Director of the Indiana University **Environmental Resilience Institute**. Filippelli is a **biogeochemist** with broad training in climate change, exposure science, and environmental health. Filippelli has published broadly, including publications in ***Science, Nature and Geology*** as well as in specialty journals and in popular press. He is the Editor-in-Chief for the journal **GeoHealth**, a Fellow of the **International Association of Geochemistry**, a 2022 Fulbright Distinguished Chair, and former **National Academy of Sciences** Jefferson Science Fellow, where he served as a **Senior Science Advisor for the U.S. Department of State**.

Climate Change and Life, author 2022

<https://twitter.com/GabeFilippelli>



# The Climate Challenge

Eight hottest years on record (since 1880):

2016  
2020  
2019  
2021  
2018  
2022  
2017  
2015

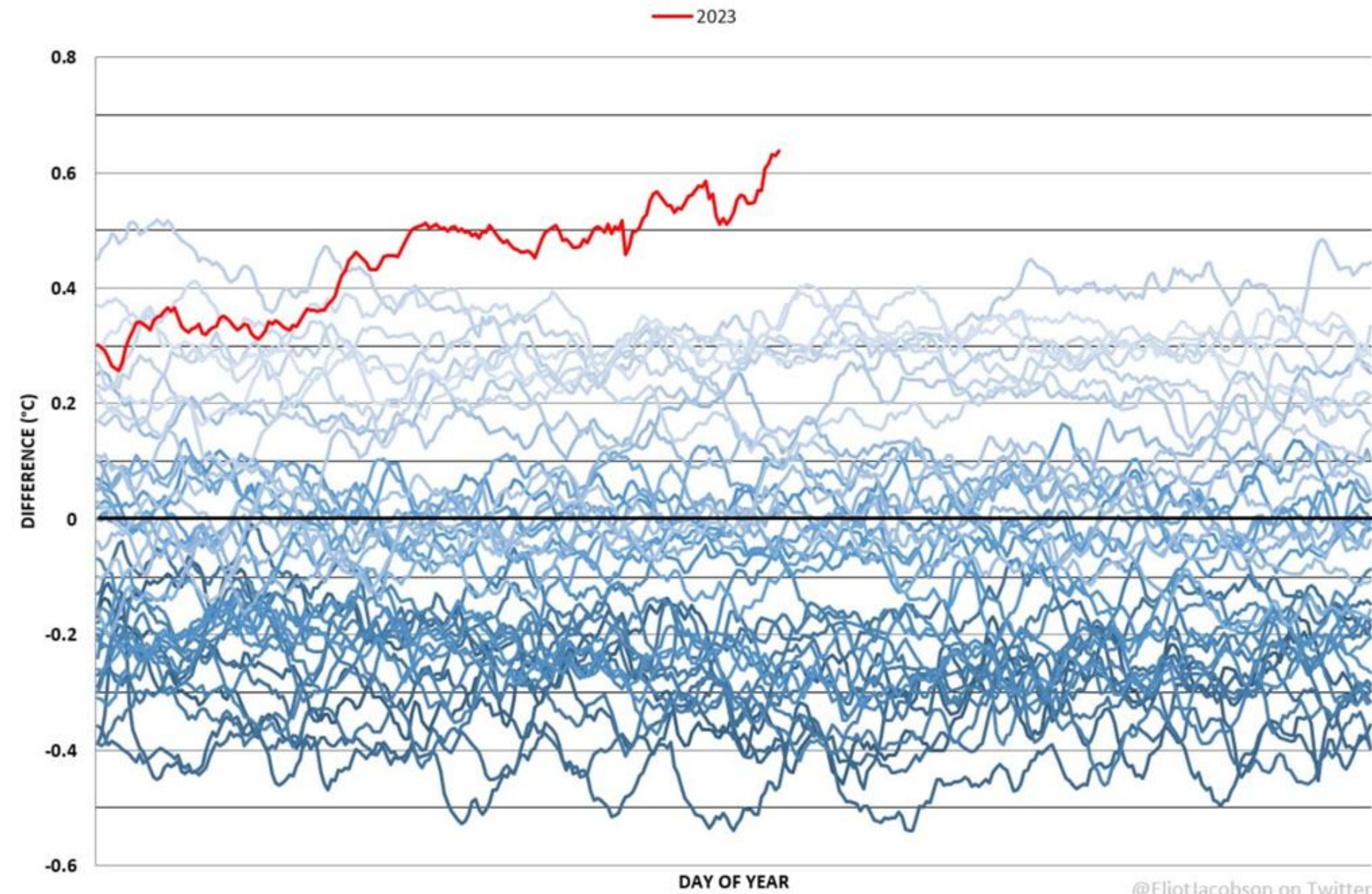




# 2023 is insane

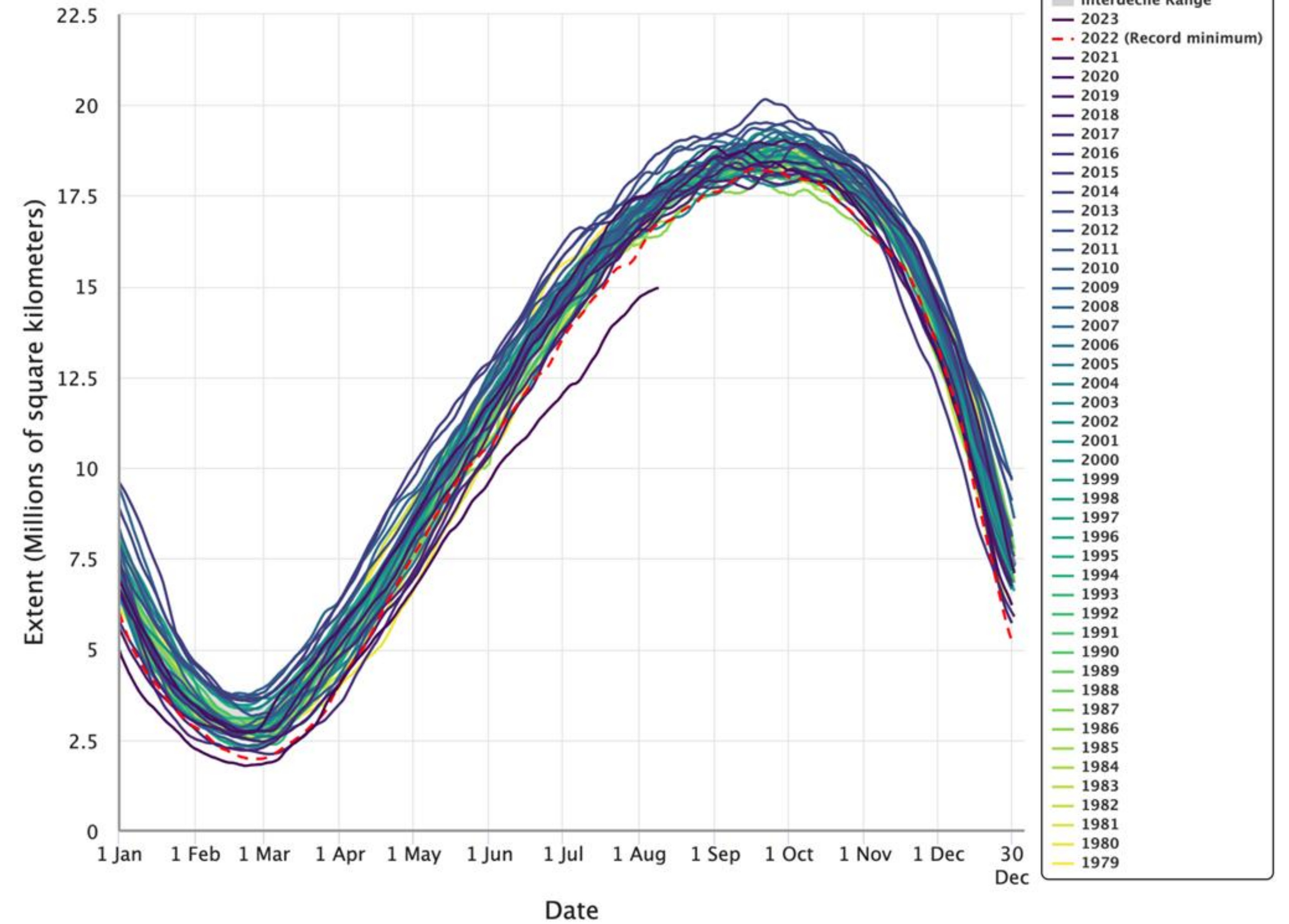
### Daily Global Sea Surface Temperature Anomaly (Difference from 1991-2020 Mean)

Data: [https://climateresearcher.org/clim/sst\\_daily/json/oiisst2.1\\_world2\\_sst\\_day.json](https://climateresearcher.org/clim/sst_daily/json/oiisst2.1_world2_sst_day.json)



### Antarctic Sea Ice Extent

(Area of ocean with at least 15% sea ice)





# The Climate Challenge



Eight hottest years on record (since 1880):

2016

2020

**Why is this happening to us???**  
**When will it stop???**  
**Is there hope or are we toast???**

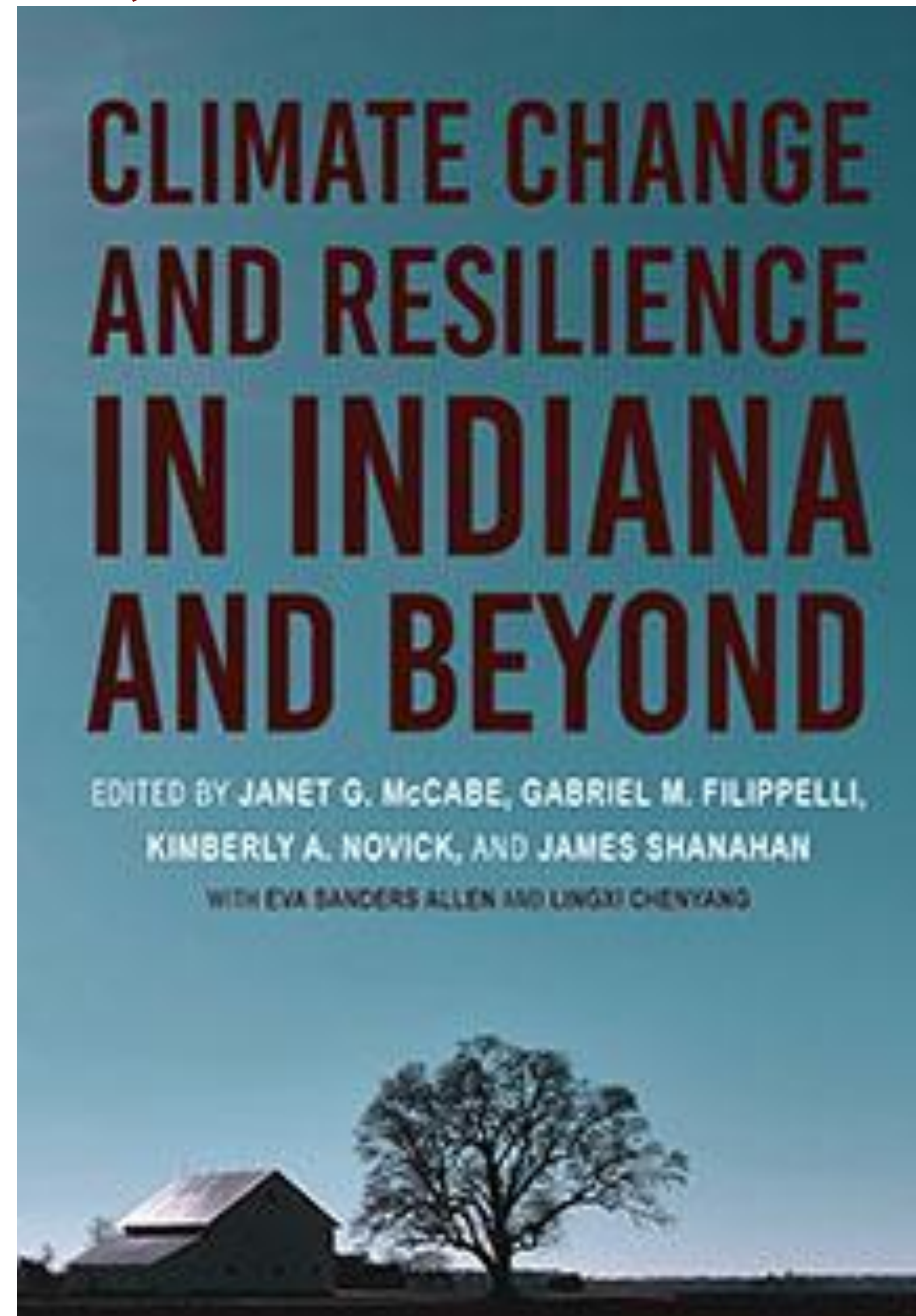


2015



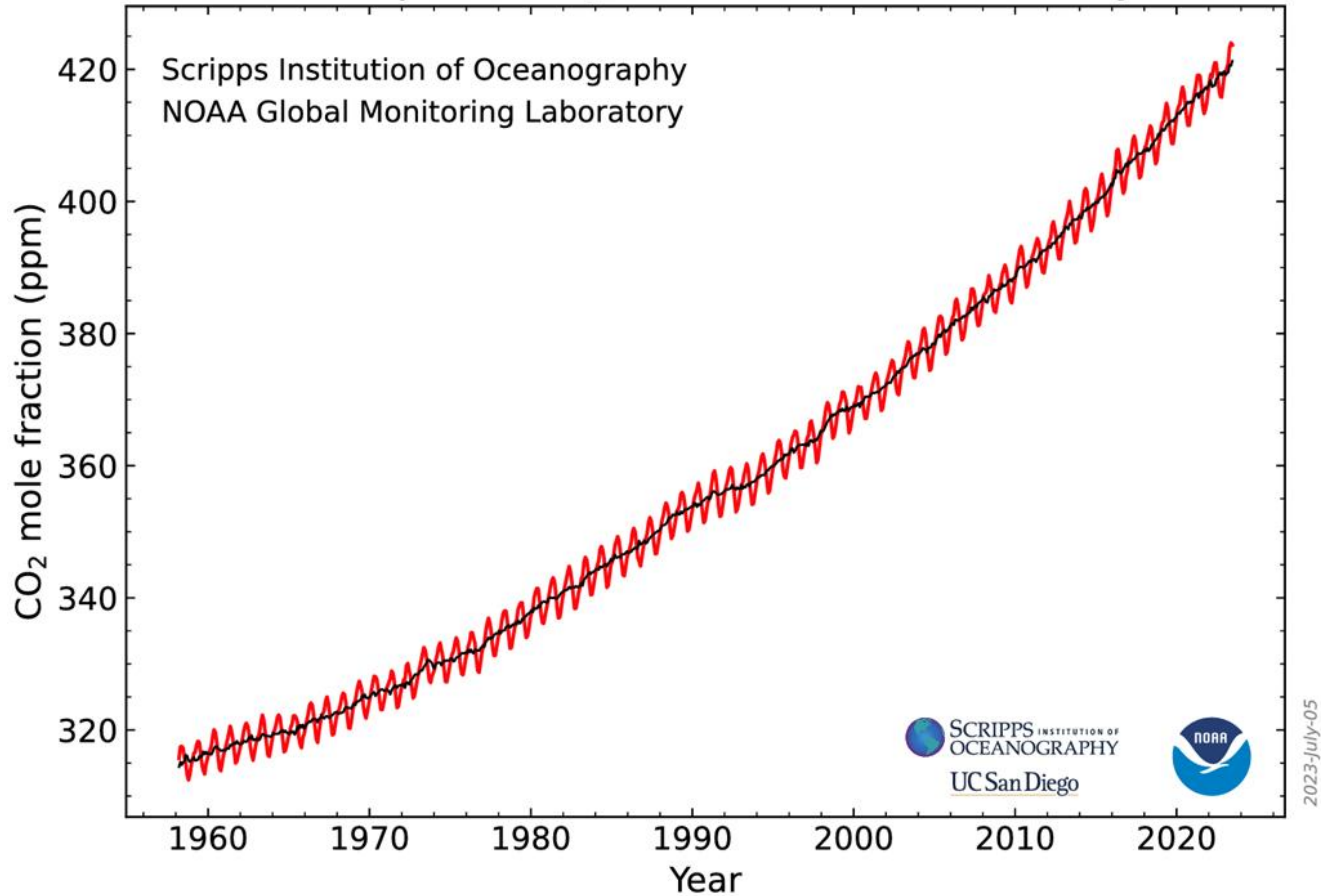


**There are climate solutions—some are easy,  
some are not, all should be pursued**



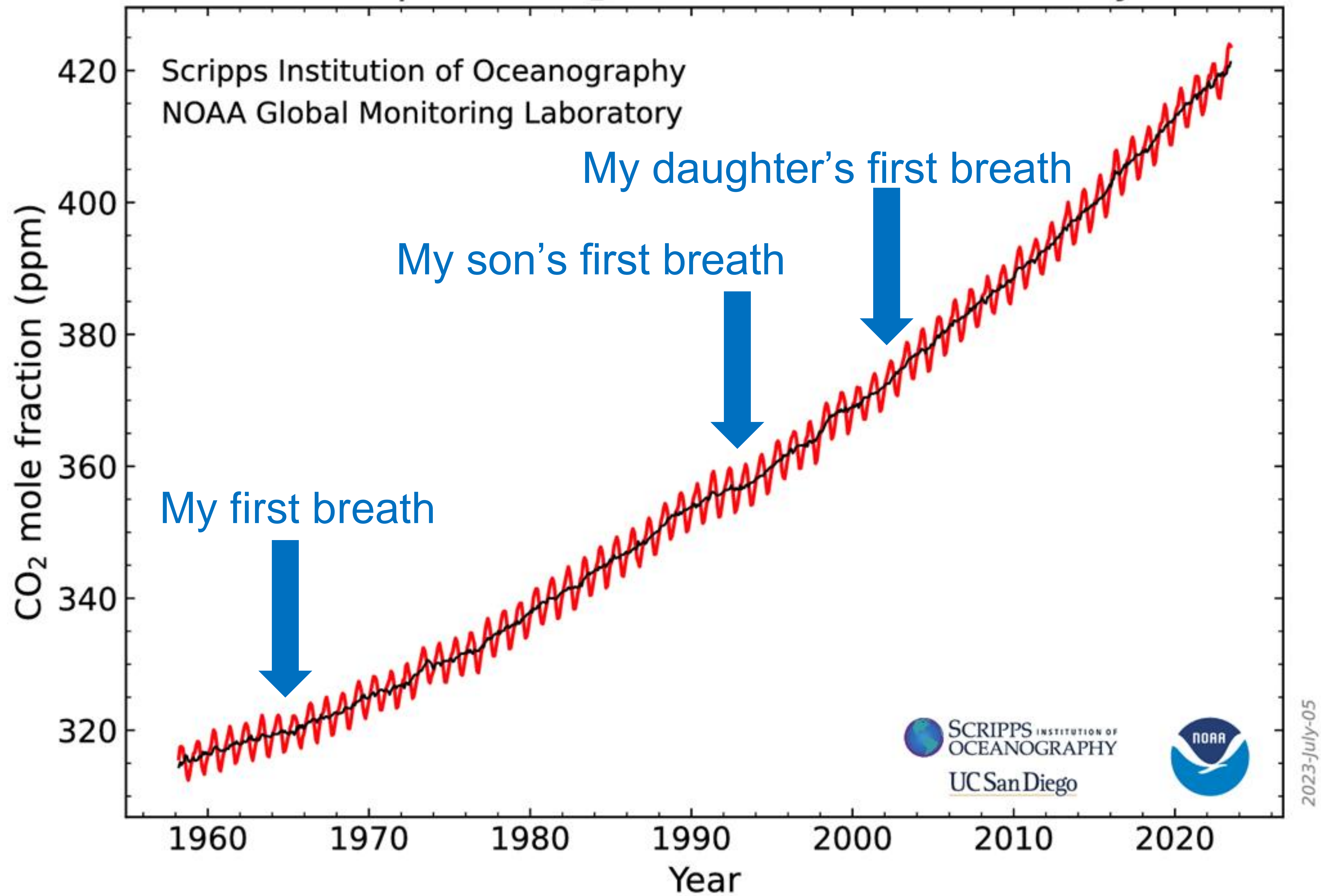


# Atmospheric CO<sub>2</sub> at Mauna Loa Observatory





# Atmospheric CO<sub>2</sub> at Mauna Loa Observatory





# You, me, the birds and the bees

PNAS

ARTICLES ▾

FRONT MATTER

AUTHORS ▾

TOPICS +



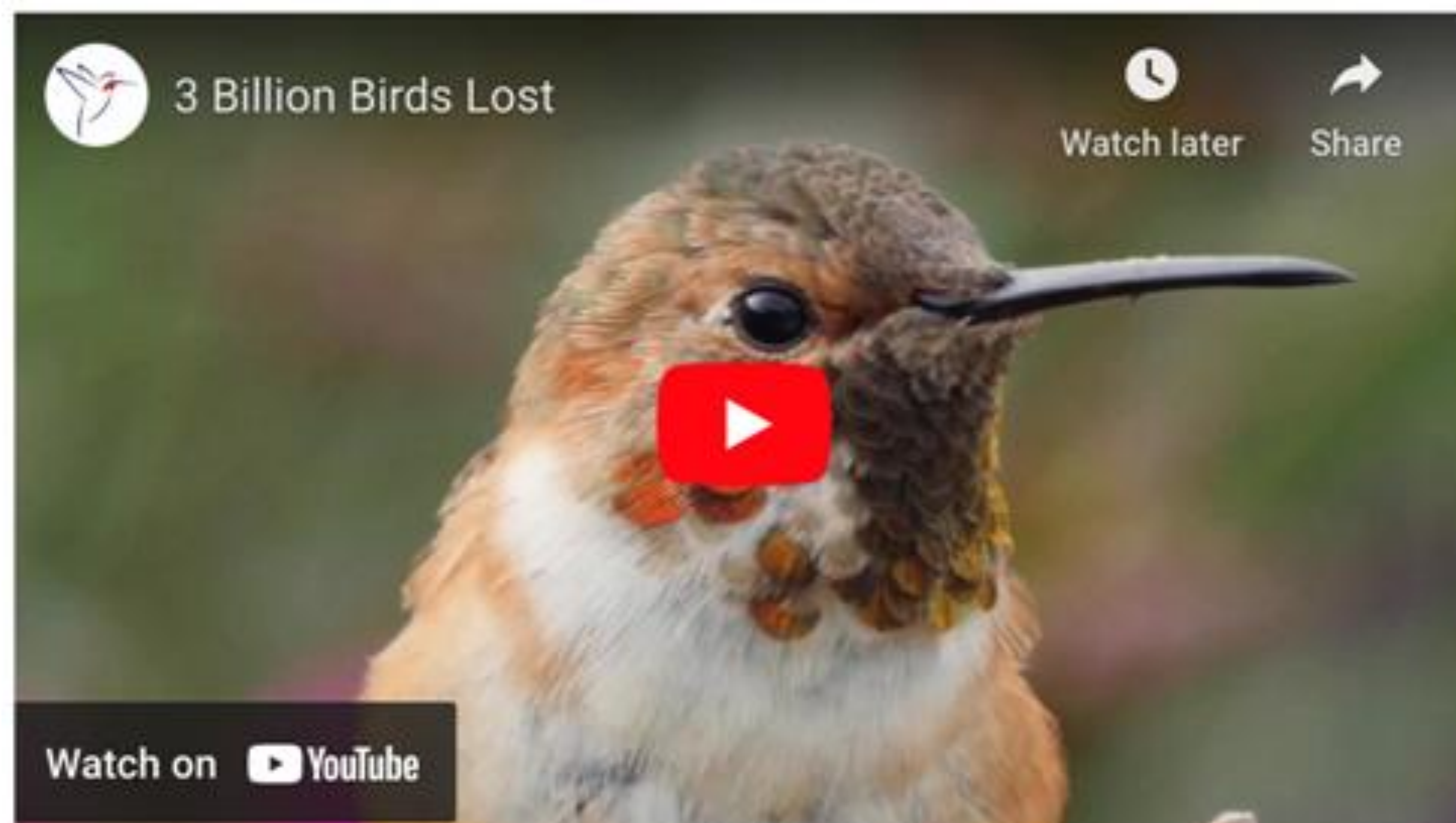
INTRODUCTION | BIOLOGICAL SCIENCES | ✓



## Insect decline in the Anthropocene: Death by a thousand cuts

David L. Wagner  , Eliza M. Grames , Matthew L. Forister , , and David Stopak [Authors Info & Affiliations](#)

January 11, 2021 | 118 (2) e2023989118 | <https://doi.org/10.1073/pnas.2023989118>



### Nearly 3 Billion Birds Gone Since 1970

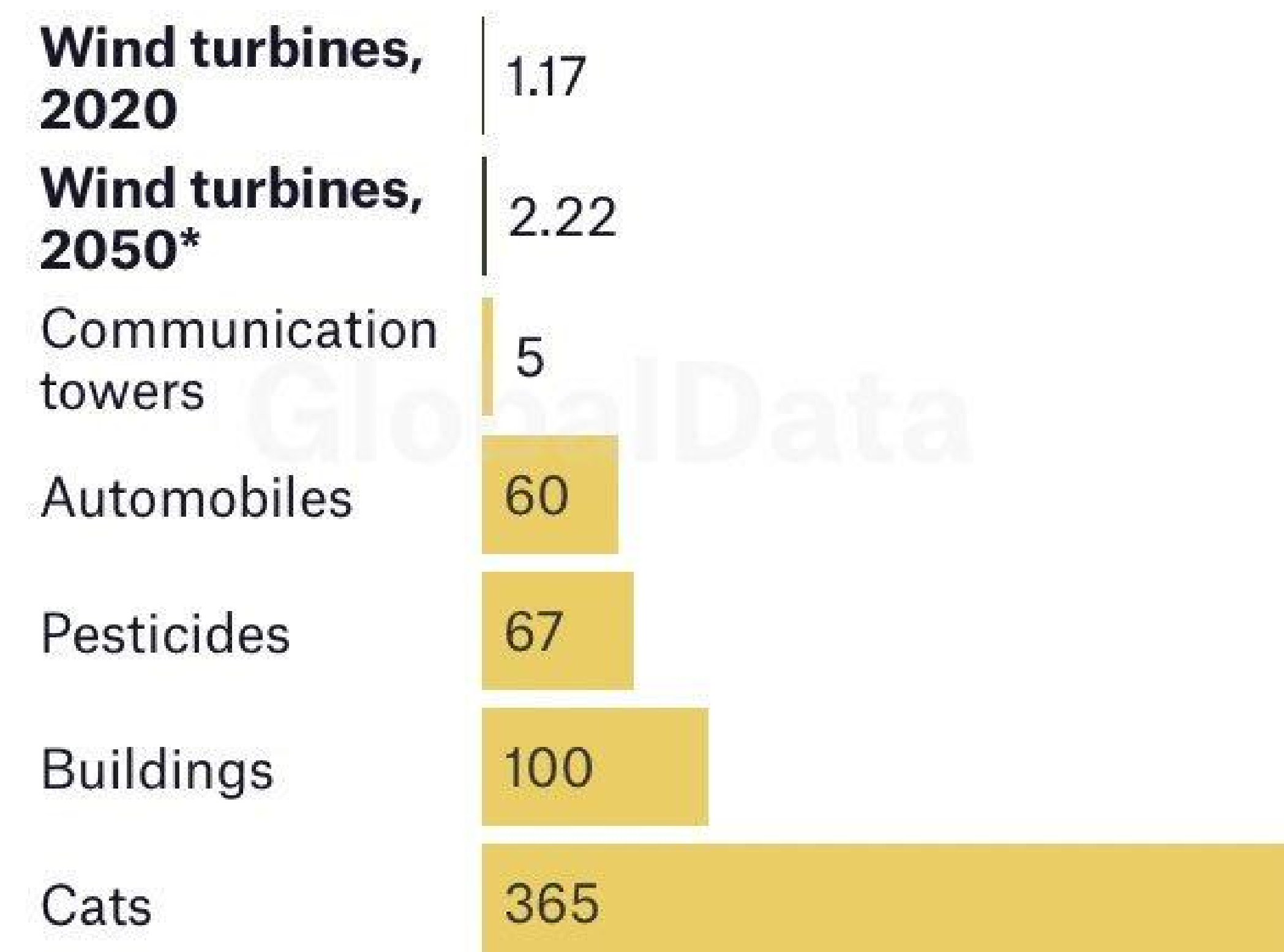
The first-ever comprehensive assessment of net population changes in the U.S. and Canada reveals across-the-board declines that scientists call “staggering.” All told, the North American bird population is down by 2.9 billion breeding adults, with devastating losses among birds in every biome. Forests alone have lost 1 billion birds. Grassland bird populations collectively have declined by 53%, or another 720 million birds.



# Don't believe what you read online...

## Wind turbines kill far fewer birds than other hazards

Estimated number of birds killed by hazards in the US each year (millions)



\*Based on EIA Annual Energy Outlook 2021

Source: A. Manville, US Fish and Wildlife Service / American Bird Conservancy / Cornell Lab of Ornithology / EIA

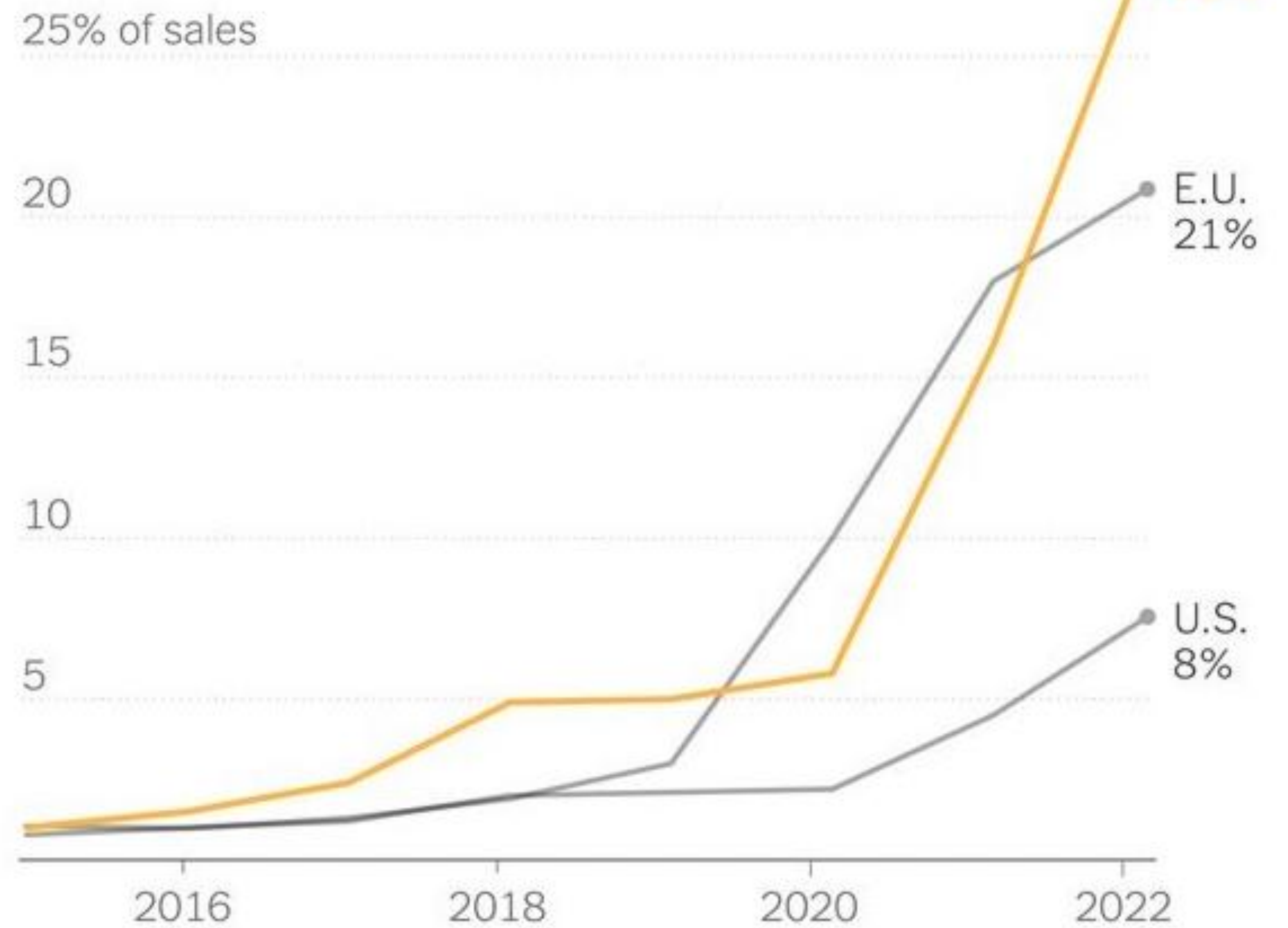




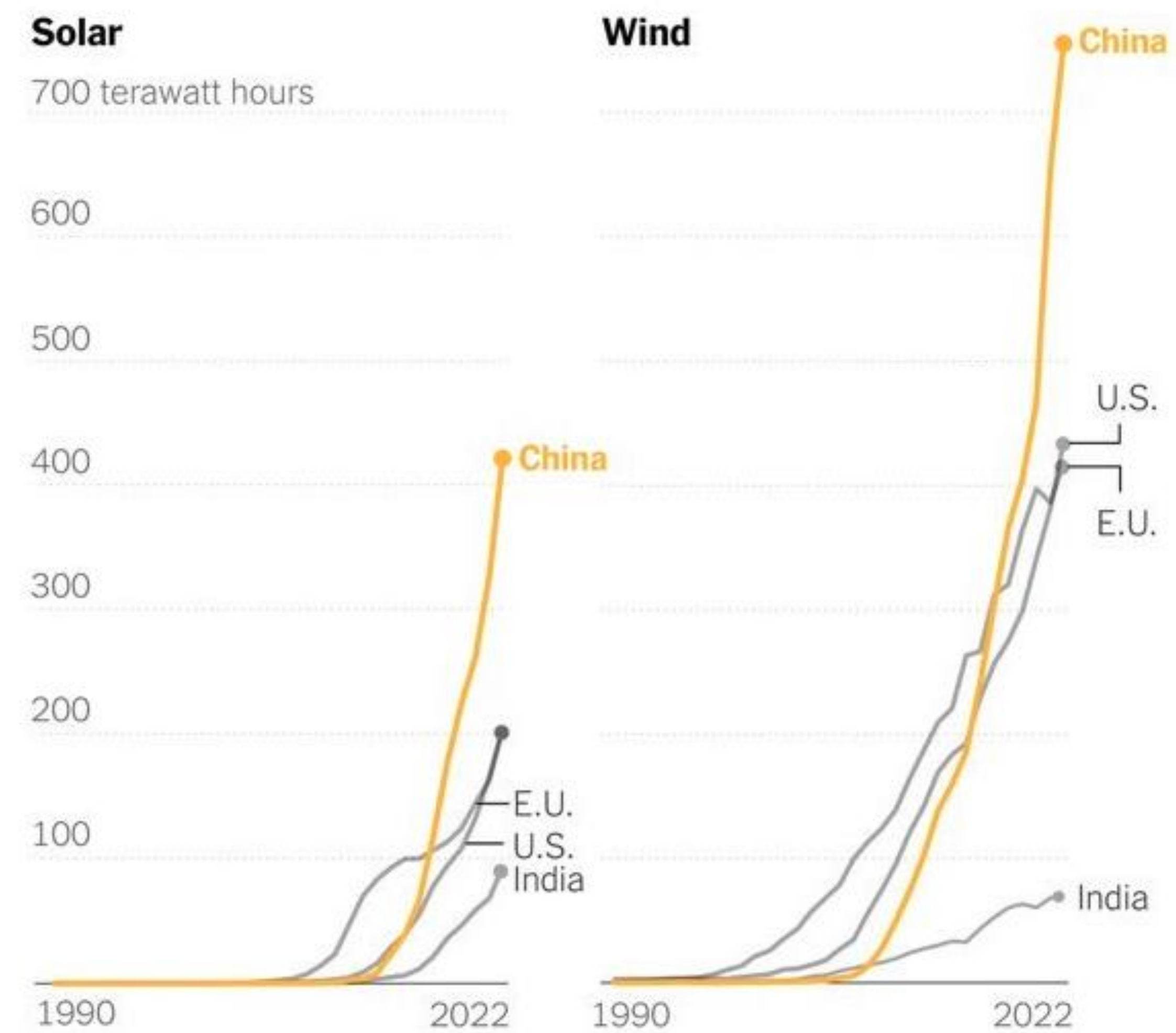
# Mitigation? Yes, certainly

Mitigation occurring rapidly, both in the US and globally

Share of electric car sales among all passenger vehicle sales



Electricity generated per year by solar and wind power





# Adaptation? Yes, sadly



		°F	°C
2030	summer	↑ 3-4	2
	winter	↑ 2	1
2095	summer	↑ 8-10	4-6
	winter	↑ 5-7	3-4

		% Increase/Decrease
2030	summer	↓ -15
	winter	---
2095	summer	↓ -10 to -15
	winter	↑ 5 to 10

		% Increase 24hour/Multiday precipitation events
2095	summer	---
	winter	---

TEMPERATURE CHANGE

PRECIPITATION CHANGE

EXTREME EVENTS

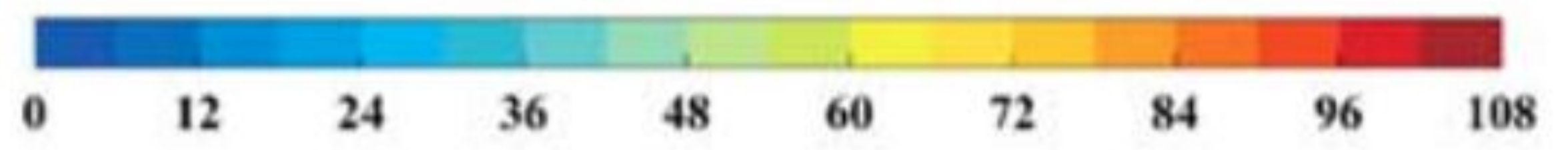
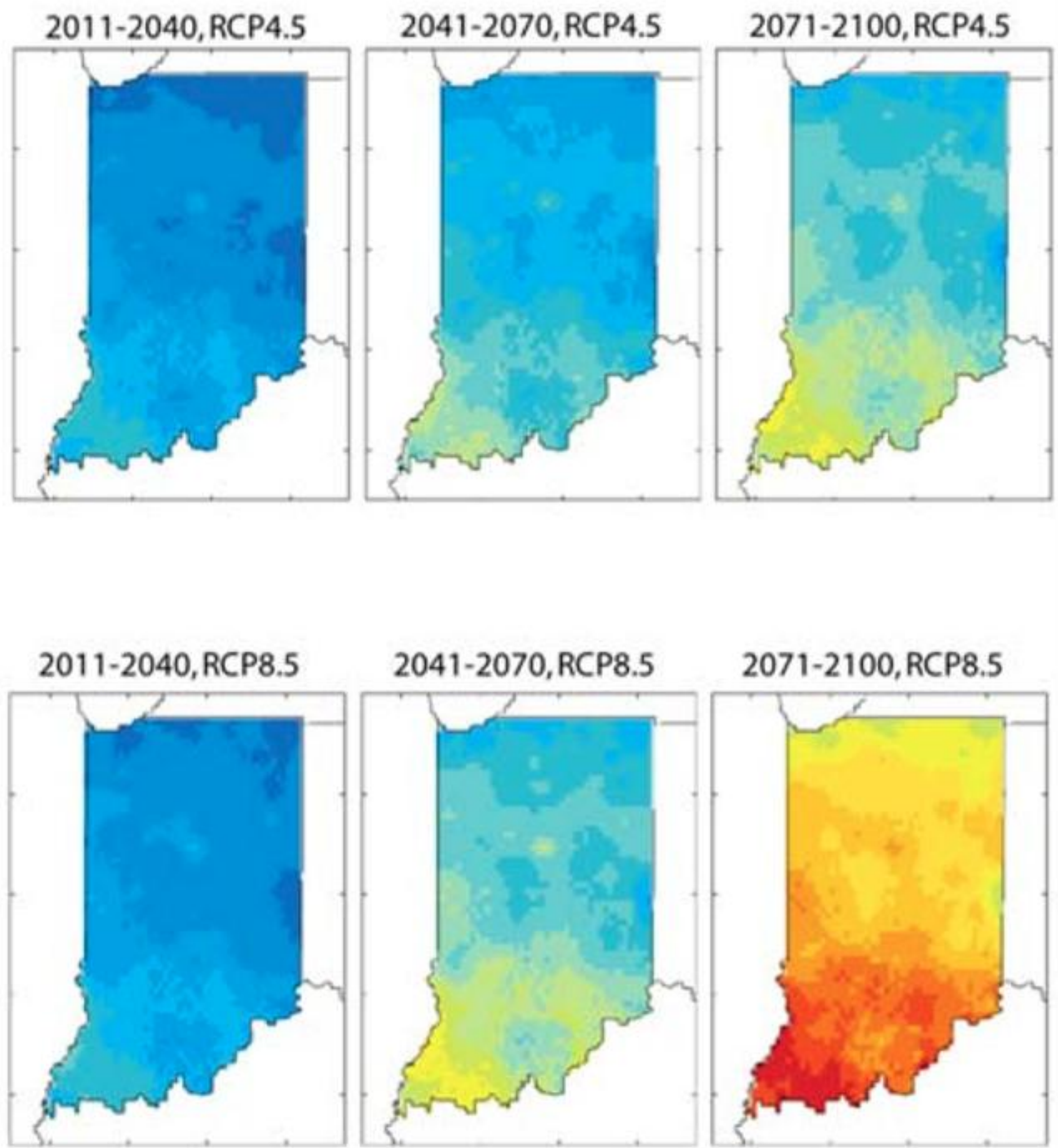




# Hotter

## Extreme Heat

Annual Number of Days with Maximum Temperature > 95°F



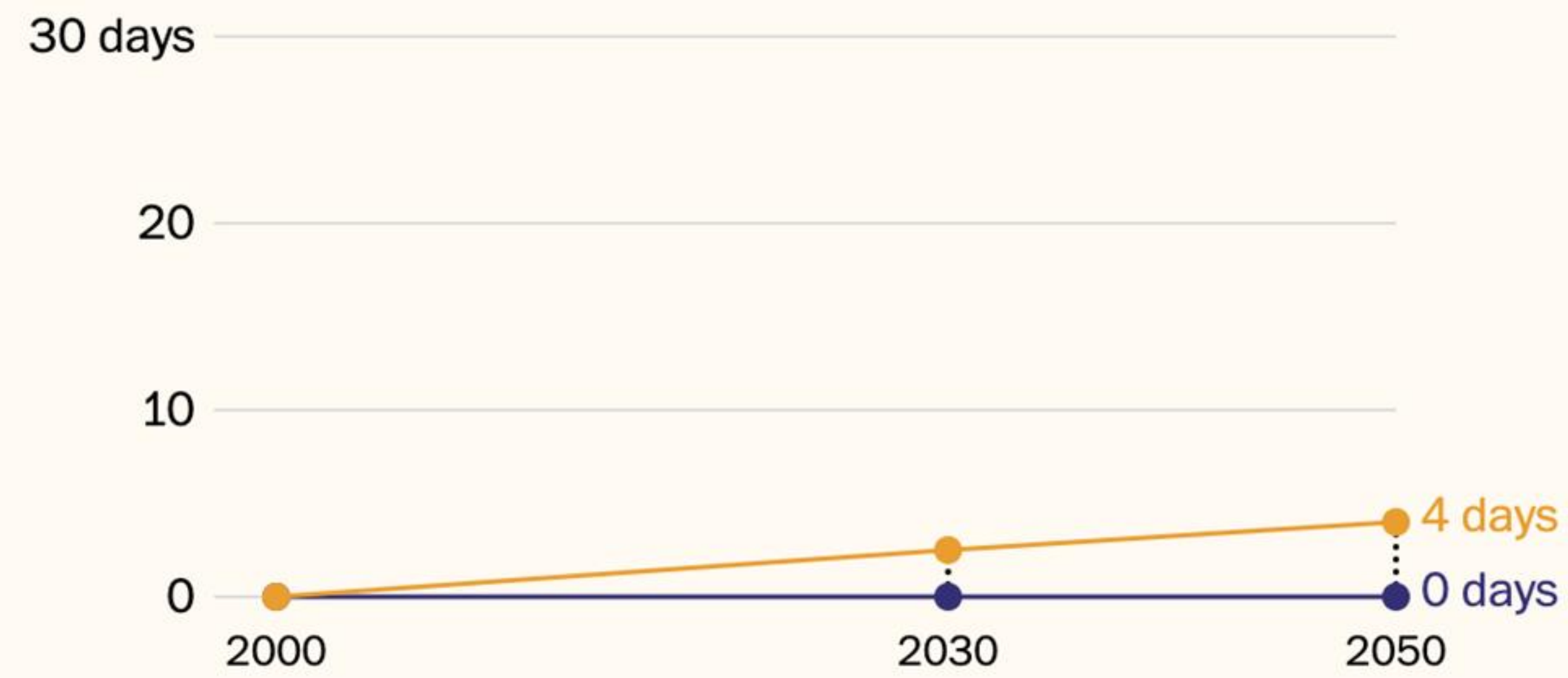
Adapted from Hamlet et al. (2019)  
Future periods are 30-year averages



# Hotter

## South Bend, Ind.

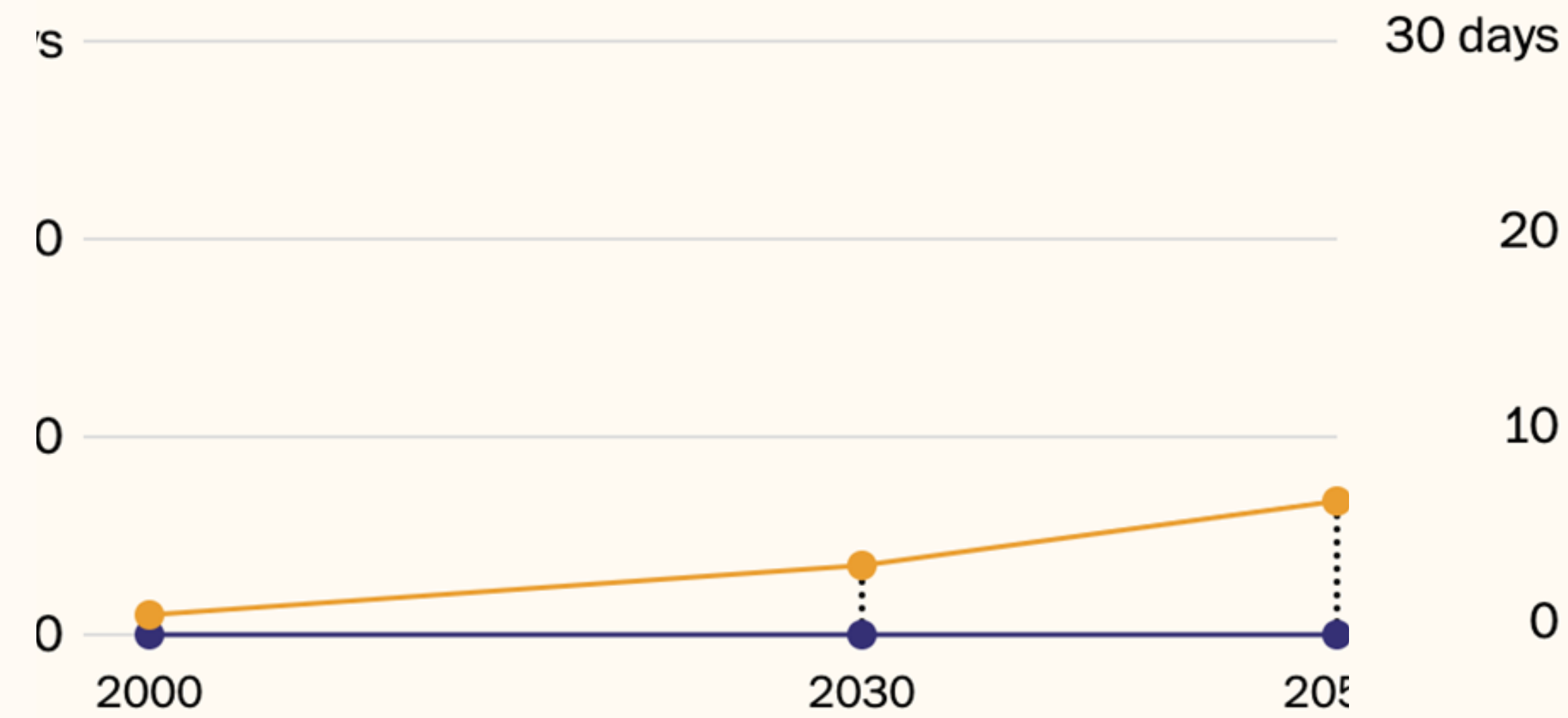
In 2050, your city will have 4 days with highly dangerous heat\* **in the sun** and no days with such heat **in the shade**.



\*Wet-bulb globe temperature above 89.6°F

## Indianapolis, Ind.

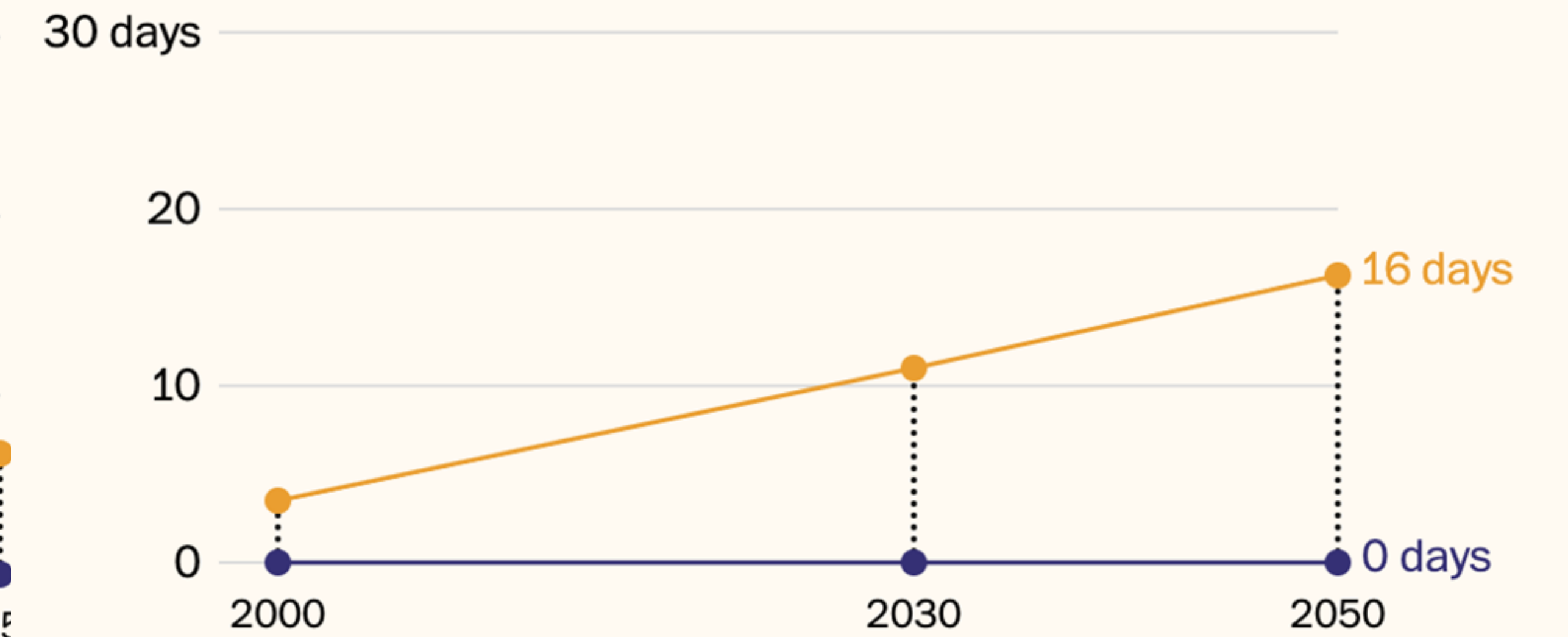
In 2050, your city will have 7 days with highly dangerous heat\* **in the sun** and no days with such heat **in the shade**.



\*Wet-bulb globe temperature above 89.6°F

## Evansville, Ind./Ky.

In 2050, your city will have 16 days with highly dangerous heat\* **in the sun** and no days with such heat **in the shade**.



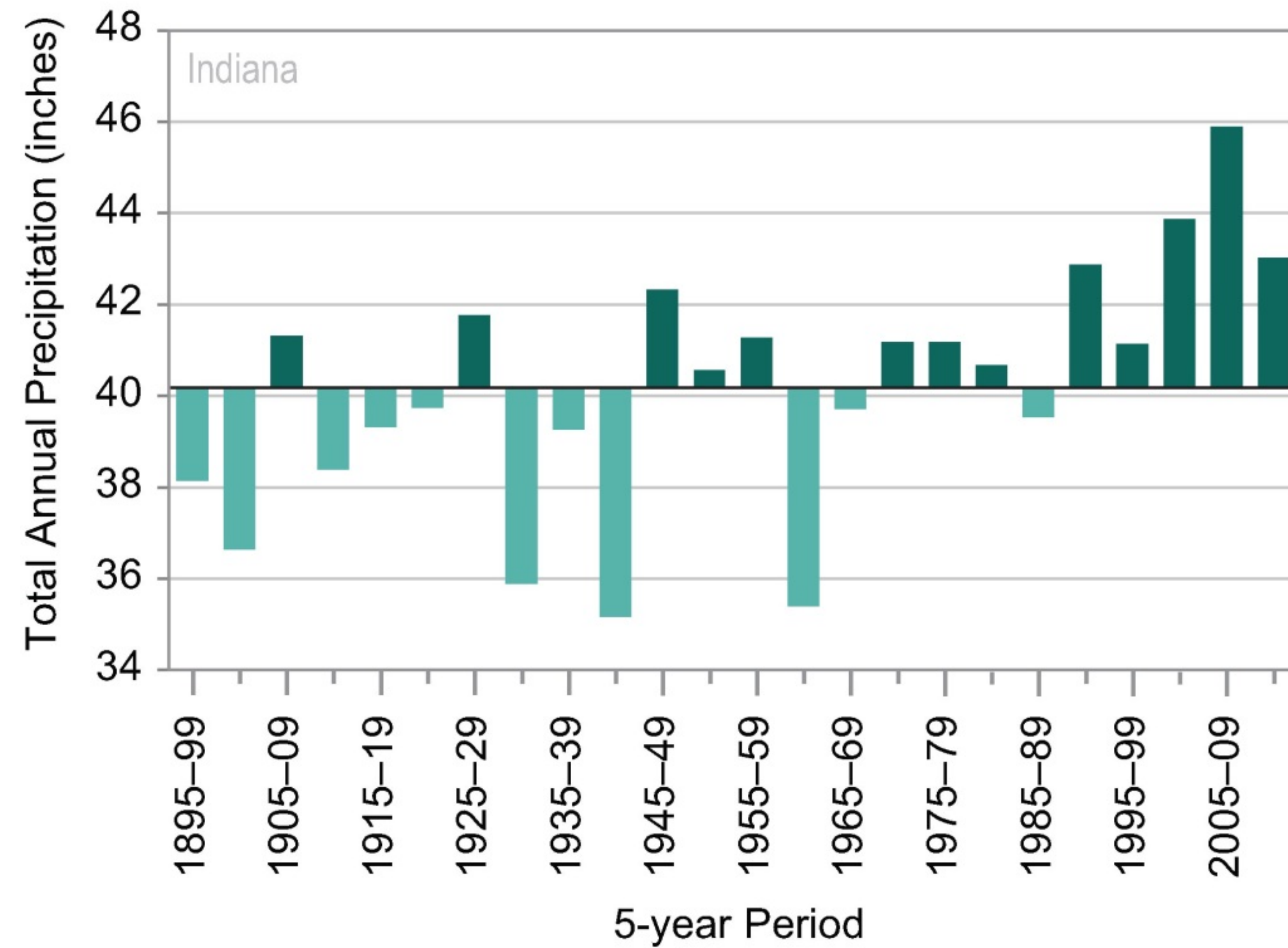
\*Wet-bulb globe temperature above 89.6°F



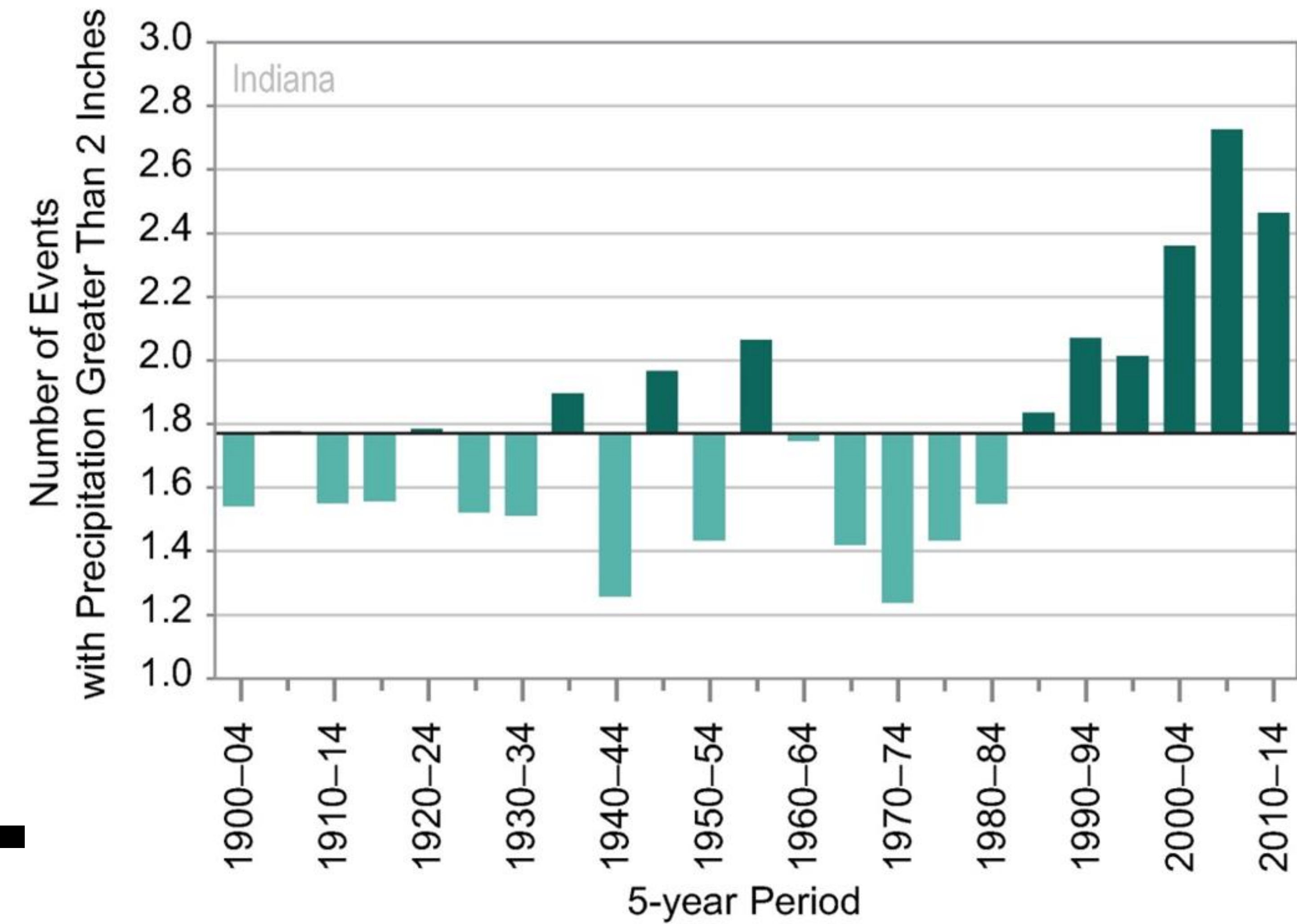
# Wetter



Observed Annual Precipitation



Observed Number of Extreme Precipitation Events



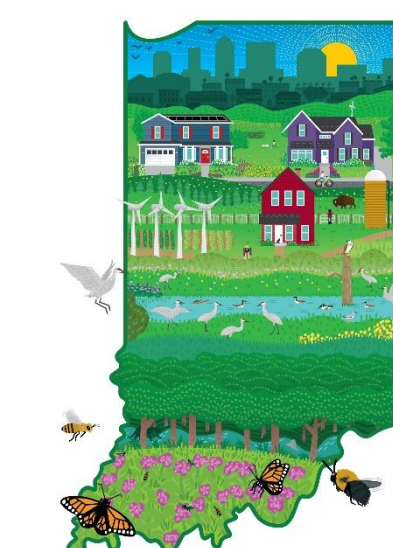
# INDIANA







INDIANA UNIVERSITY  
**ENVIRONMENTAL RESILIENCE  
INSTITUTE**





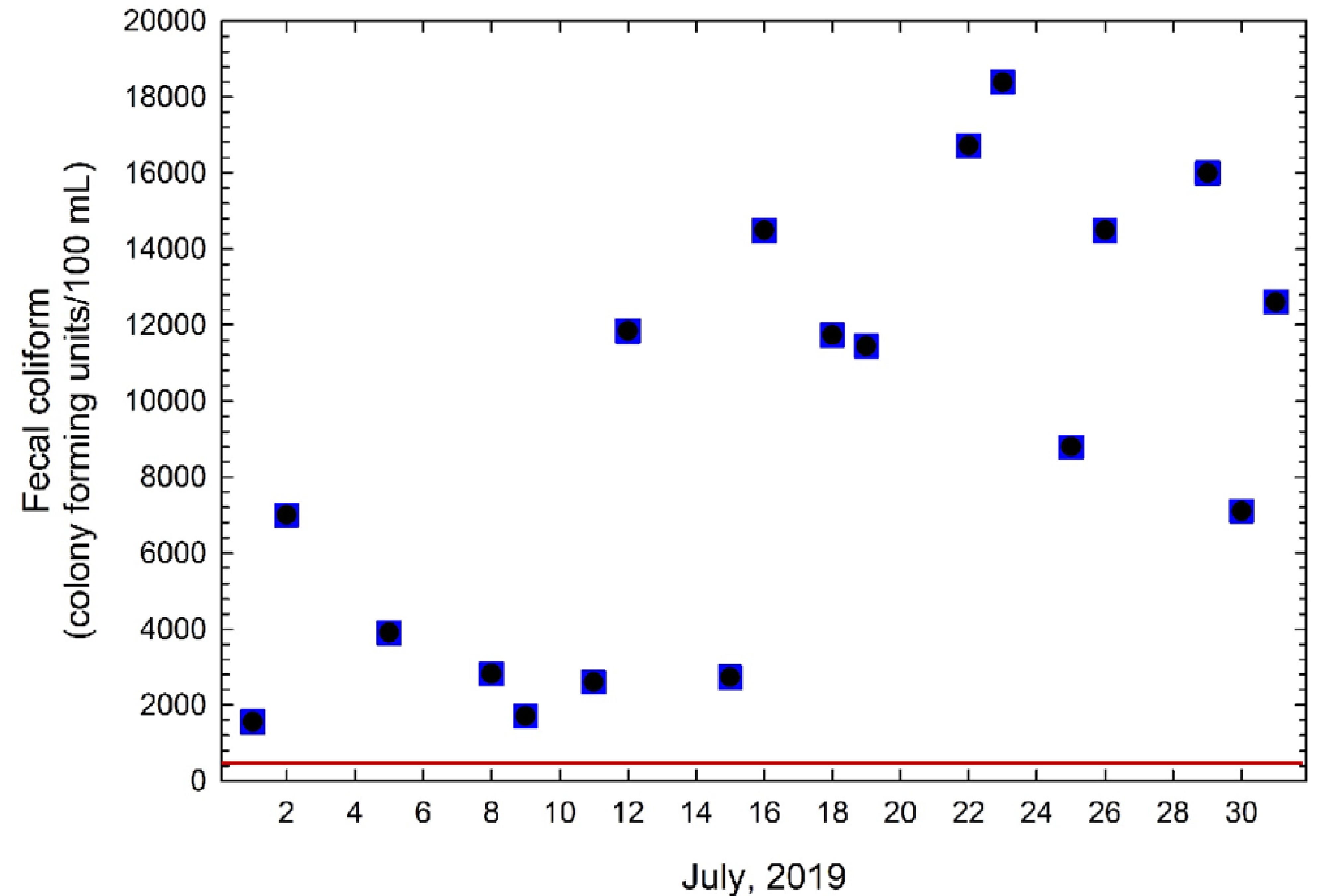
# Floods, climate change and water quality

Frequent flooding highlights importance of trees and native landscape buffers in riparian areas





# White River, partnership with IndyStar





# Environmental Resilience Institute

The mission of the Environmental Resilience Institute is to enhance resilience to environmental change in Indiana and the Midwest by accurately predicting impacts and effectively partnering with communities to implement feasible, equitable, and research-informed solutions.

“ In just a few short years, the Environmental Resilience Institute has proven invaluable to cities and towns. The data and educational resources being provided by the institute are critical new tools that local officials have never had before.”

Matt Greller, Accelerated Indiana Municipalities CEO





# McKinney Climate Fellows



201

STUDENT FELLOWSHIPS

64,000+

HOURS SERVED

70%

OF FELLOWS LIVE AND WORK IN INDIANA AFTER  
COMPLETING THE PROGRAM

40%

OF MCF ALUMNI WORK IN CLIMATE CAREERS IN THE  
MIDWEST



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# Hoosier Resilience Index



## Extreme Heat

### Average Number of Extreme Heat Events per Year

Porter County

Timeframe	High Heat Days <sup>i</sup>	High Heat Nights <sup>i</sup>	High Heat Days and Nights <sup>i</sup>	Total Days with Extreme Heat Events* <sup>i</sup>
Current <sup>i</sup>	8	7	7	23
2050s - Medium Emissions Scenario <sup>i</sup>	21	12	27	60
2050s - High Emissions Scenario <sup>i</sup>	24	13	37	73

[hri.eri.iu.edu/](http://hri.eri.iu.edu/)





# FutureWater


[ABOUT FUTUREWATER](#)

[RESEARCH PROJECTS](#)

[OUR TEAM](#)

[PUBLICATIONS + NEWS](#)

[TEACHING RESOURCES](#)



## FutureWater – modeling climate change impacts on Indiana's water resources

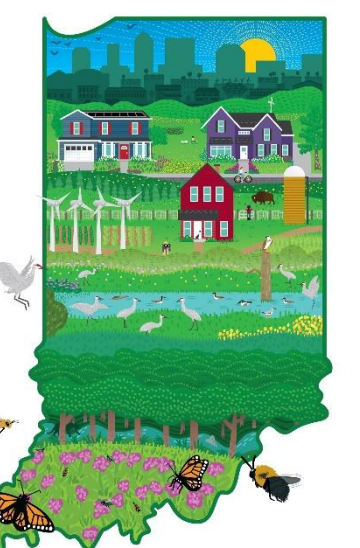
Part of the "Prepared for Environmental Change" Grand Challenge

[Explore Modeling Results](#)



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# Environmental Resilience Institute Toolkit

## Air Quality

- Indoor Air
- Outdoor Air

## Critical Infrastructure

- Buildings and Housing
- Communications
- Energy Generation, Procurement and Transmission
- Transportation Systems
- Waste and Wastewater

## Ecosystem Protection

- Estuaries
- Invasive Species and Pests
- Lakes, Rivers and Streams
- Maintaining Biodiversity
- Parks, Trees and Forests
- Urban Ecosystems
- Wetlands

## Energy

- Alternative and Renewable Energy Sources
- Distribution Mechanisms
- Energy Efficiency

## Equity and Justice

- Climate and Environment
- Energy
- Food
- Housing

## Food and Agriculture

- Food Distribution and Access
- Rural Agriculture
- Urban Gardens and Farms

## Policies and Planning

- Disaster Preparedness and Emergency Response
- Greenhouse Gas Inventories and Mitigation
- Resilience Planning
- Risk and Vulnerability Assessments
- State and Local Policies

## Public Health

- Air Quality
- Extreme Heat
- Mosquitoes, Ticks and Other Vectors
- Water Quality

## Solid Waste Management

- Contaminated Site Management
- Disaster Debris Management
- Waste Reduction and Recycling

## Transportation

- Alternative Fuels
- Multi-modal Transportation
- Walkable Communities

## Water Management

- Algal Blooms
- Drinking Water
- Drought
- Erosion and Sedimentation
- Flooding
- Green Infrastructure
- Saltwater Intrusion
- Sea-level Rise

## New Case Studies

Evansville's solar technician training program for low-income residents

NWI's voluntary air quality improvement program

Richmond's solar potential map

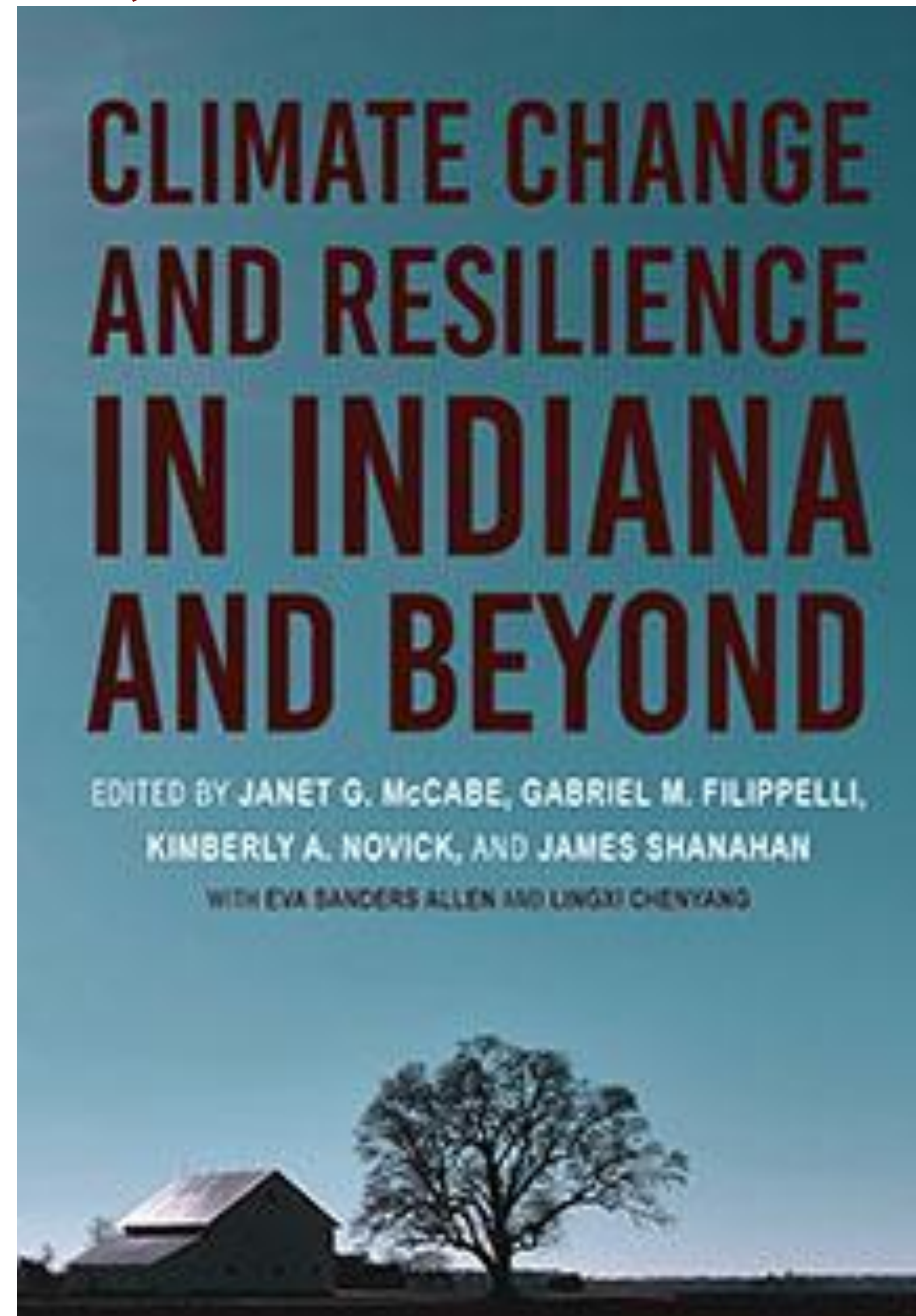
Plymouth's EV charging infrastructure

Lucas County, OH's nutrient source inventory

New Albany's walkable downtown



**There are climate solutions—some are easy,  
some are not, all should be pursued**





# Thank you!

**Gabriel Filippelli**  
Executive Director  
Environmental Resilience Institute

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