

Tackling climate change & building a sustainable future

The essential role of climate science & higher education

Jessica J. Hellmann
hellmann@umn.edu
@jessicahellmann

INSTITUTE ON THE
ENVIRONMENT
UNIVERSITY OF MINNESOTA
Driven to DiscoverSM





INSTITUTE ON THE
ENVIRONMENT

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM





daughter

husband

dog





1st UN
Biodiversity &
Climate
Conferences



1994

1st UN
Biodiversity &
Climate
Conferences

Kyoto
Protocol



1994



1997

1st UN
Biodiversity &
Climate
Conferences



1994

Kyoto
Protocol



1997

American
Clean
Energy &
Security Act



2009

1st UN
Biodiversity &
Climate
Conferences



1994

Kyoto
Protocol



1997

American
Clean
Energy &
Security Act



2009

Hurricane
Sandy



2012

1st UN
Biodiversity &
Climate
Conferences



1994

Kyoto
Protocol



1997

American
Clean
Energy &
Security Act



2009

Hurricane
Sandy



2012

Paris
Agreement



2015

1st UN
Biodiversity &
Climate
Conferences



1994

Kyoto
Protocol



1997

American
Clean
Energy &
Security Act



2009

Hurricane
Sandy



2012

Paris
Agreement



2015

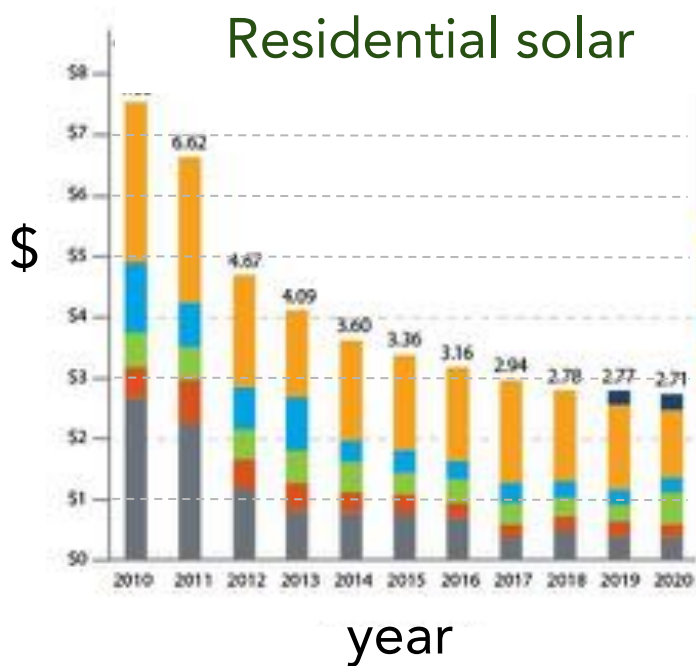
Infrastructure
& Inflation
Reduction
Acts



2022

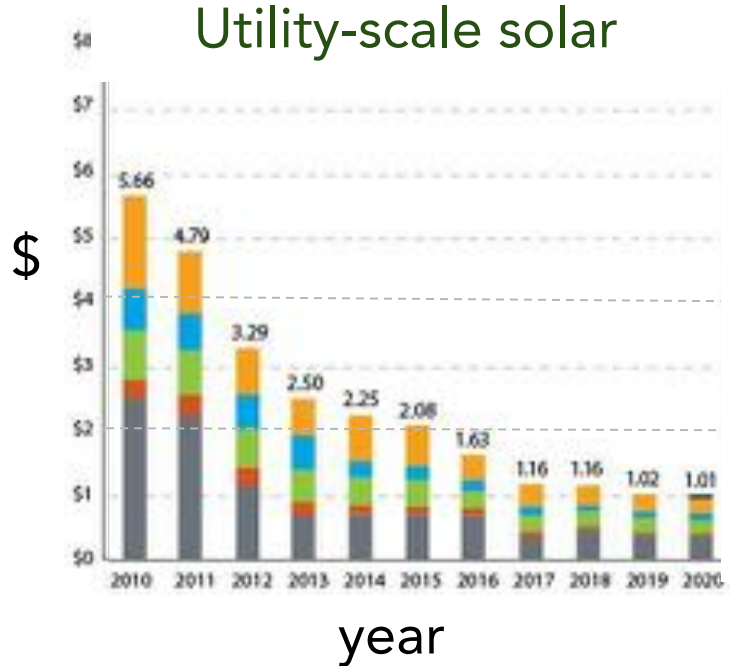
↓64%

Residential solar



↓82%

Utility-scale solar



colors = different types of costs

NREL 2021

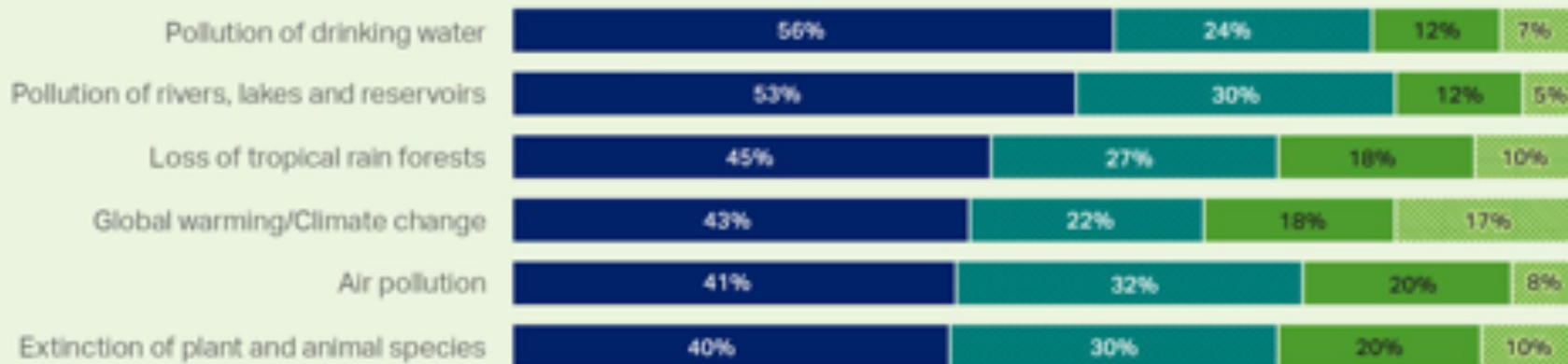
% of US adults...



Americans' Level of Worry About Environmental Problems

How much do you personally worry about each problem?

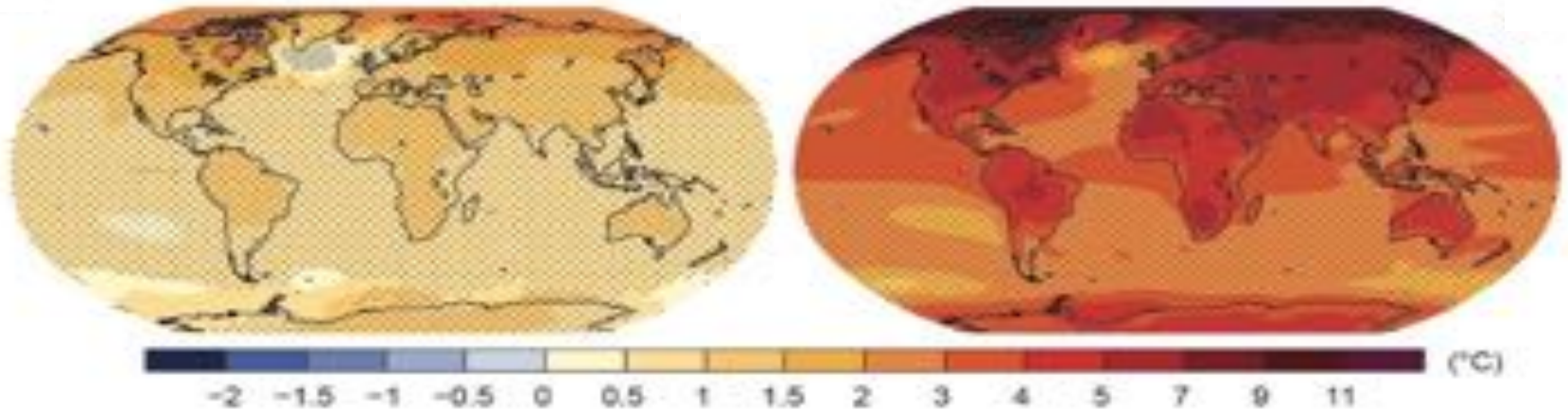
■ A great deal ■ A fair amount ■ Only a little ■ Not at all





Low emissions (Paris Agreement)

High emissions (business as usual)



GLOBAL

(Top 10 Emitters)

1. China
2. U.S.
3. India
4. Russia ← **Midwest**
5. Japan
6. Germany
7. Islamic Republic of Iran
8. South Korea
9. Saudi Arabia
10. Indonesia

U.S.

(Emissions by Region)



Updated November 2021

Sources: Union of Concerned Scientists (2020) Each Country's Share of CO2 Emissions Report

U.S. Energy Information Administration (2018) Energy-Related CO2 Emission Data, Table 1

Fresh  Energy



Better. Faster. Smarter.

More equitable and inclusive.

No more silos. More systems thinking.

expect change



the past is not a reliable reference

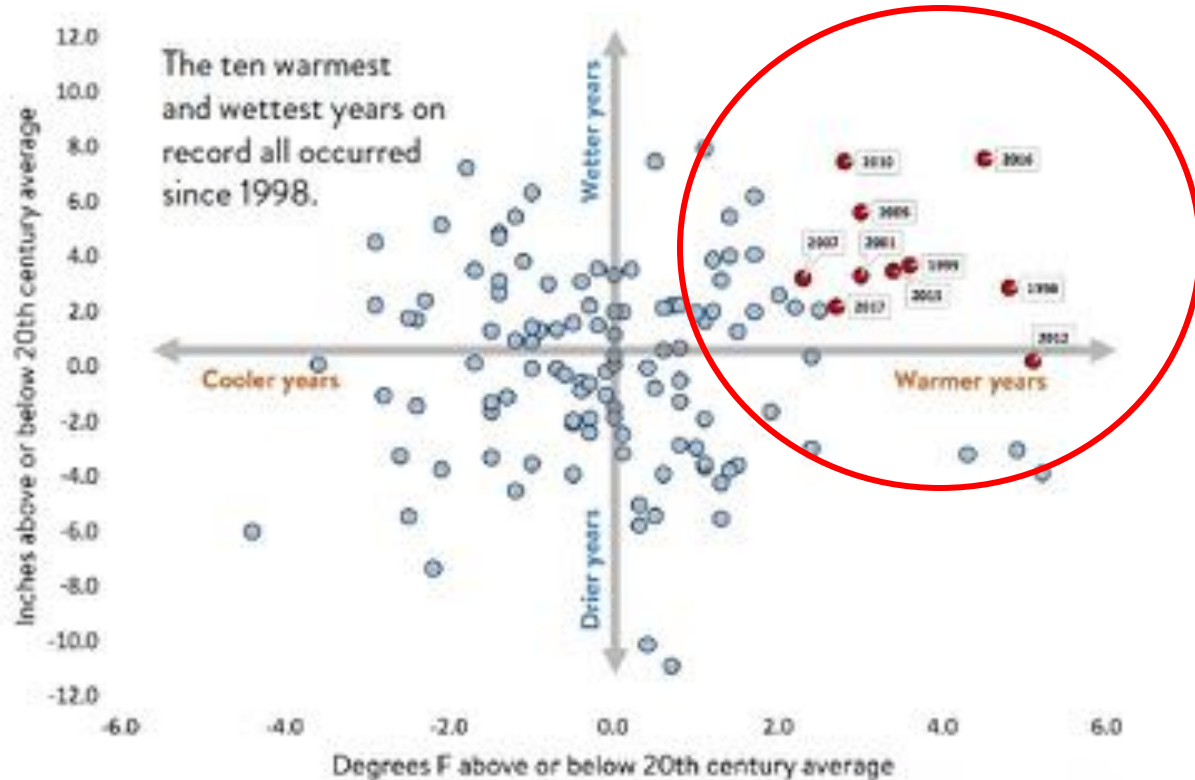


expect the unexpected



ecosystems particularly sensitive to climate

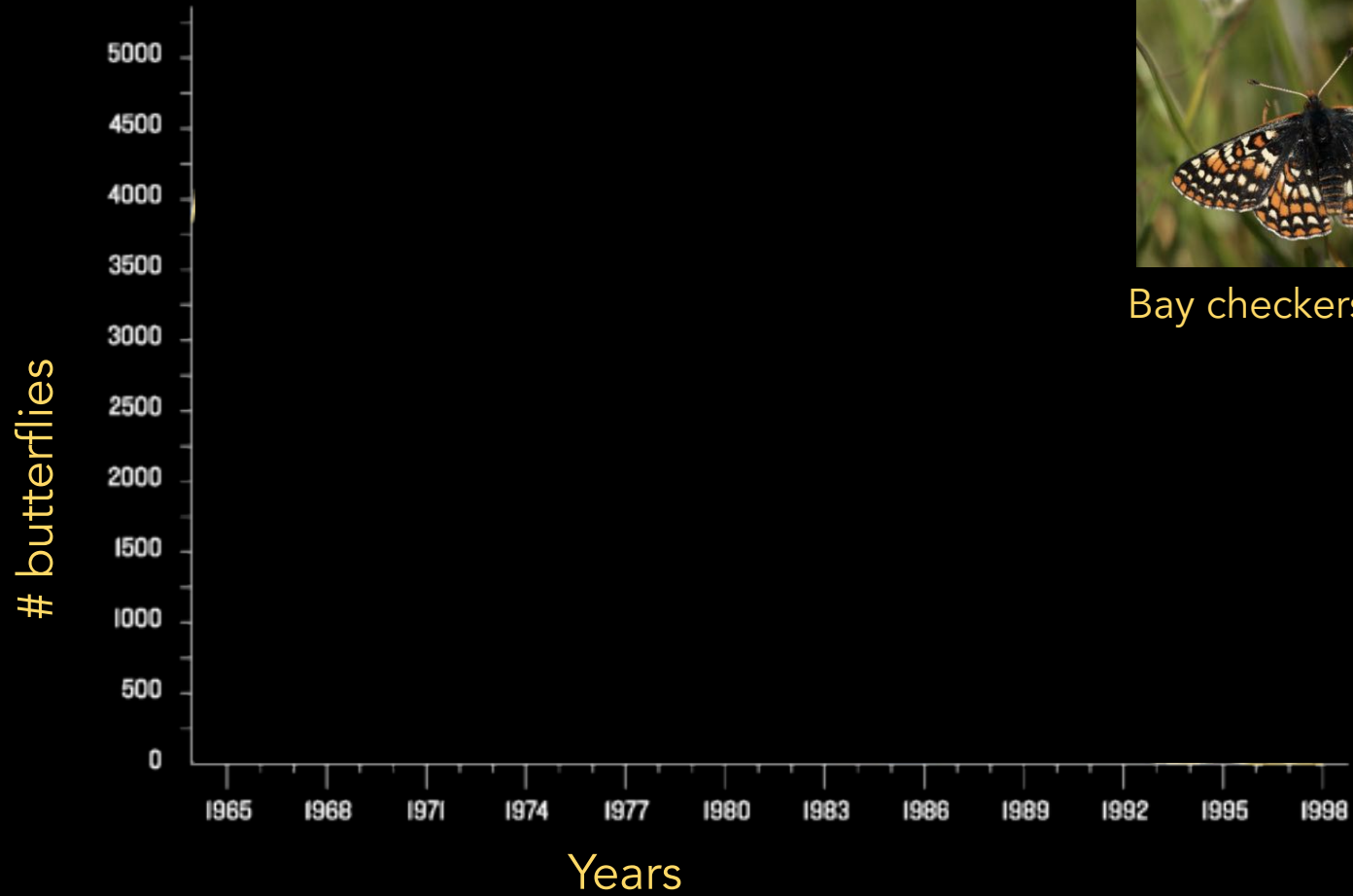
Minnesota = warmer. wetter.



Major issues in the Midwest region

- Urban heat
- Flooding: rural & urban
- Lake levels: shipping, property damage
- Warmer, shorter winters: rain not snow
- Ecological changes: pests & invasive, species & biomes shifts





Bay checkerspot butterfly



Lycaeides melissa san

Canada

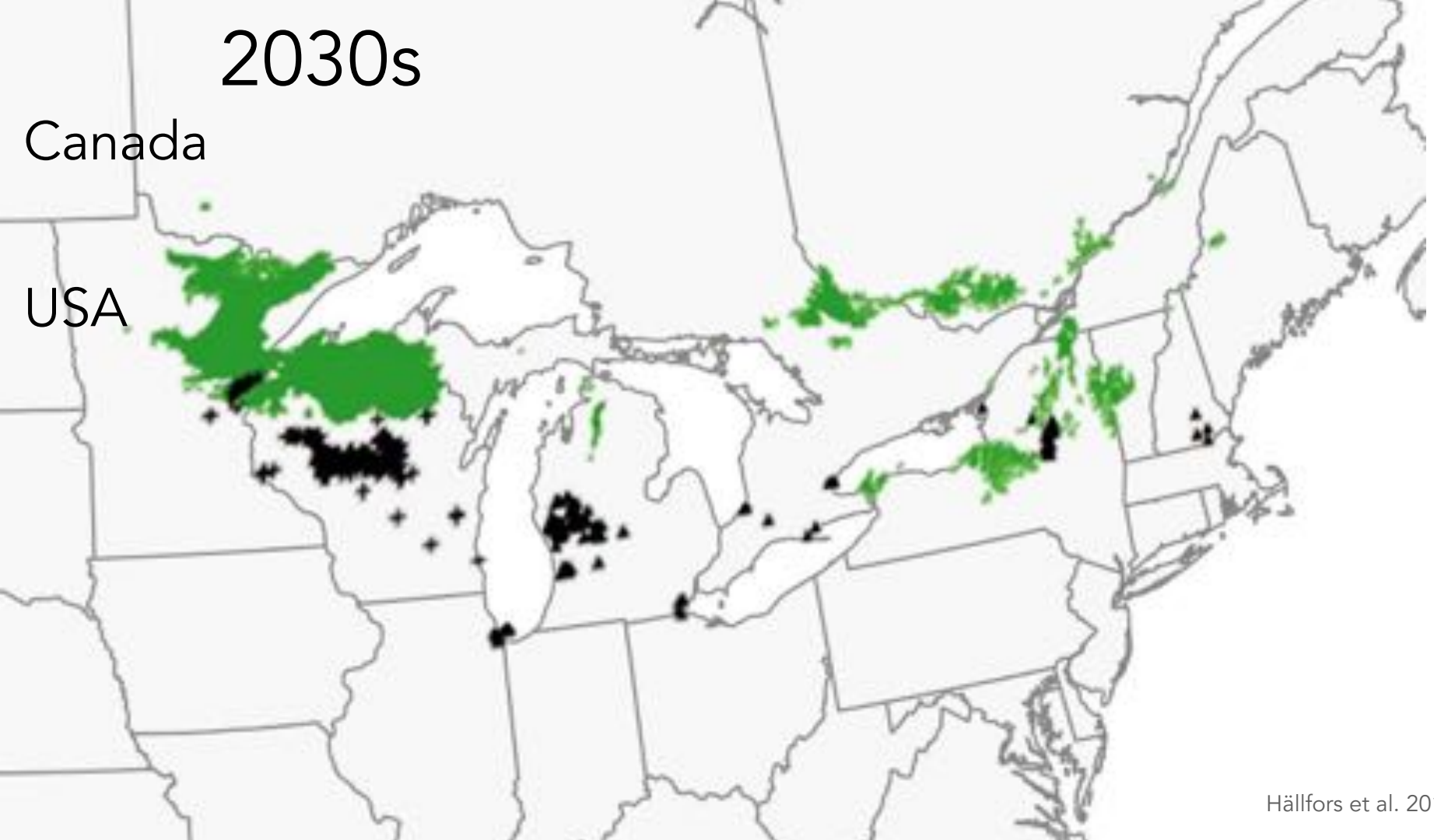
USA



2030s

Canada

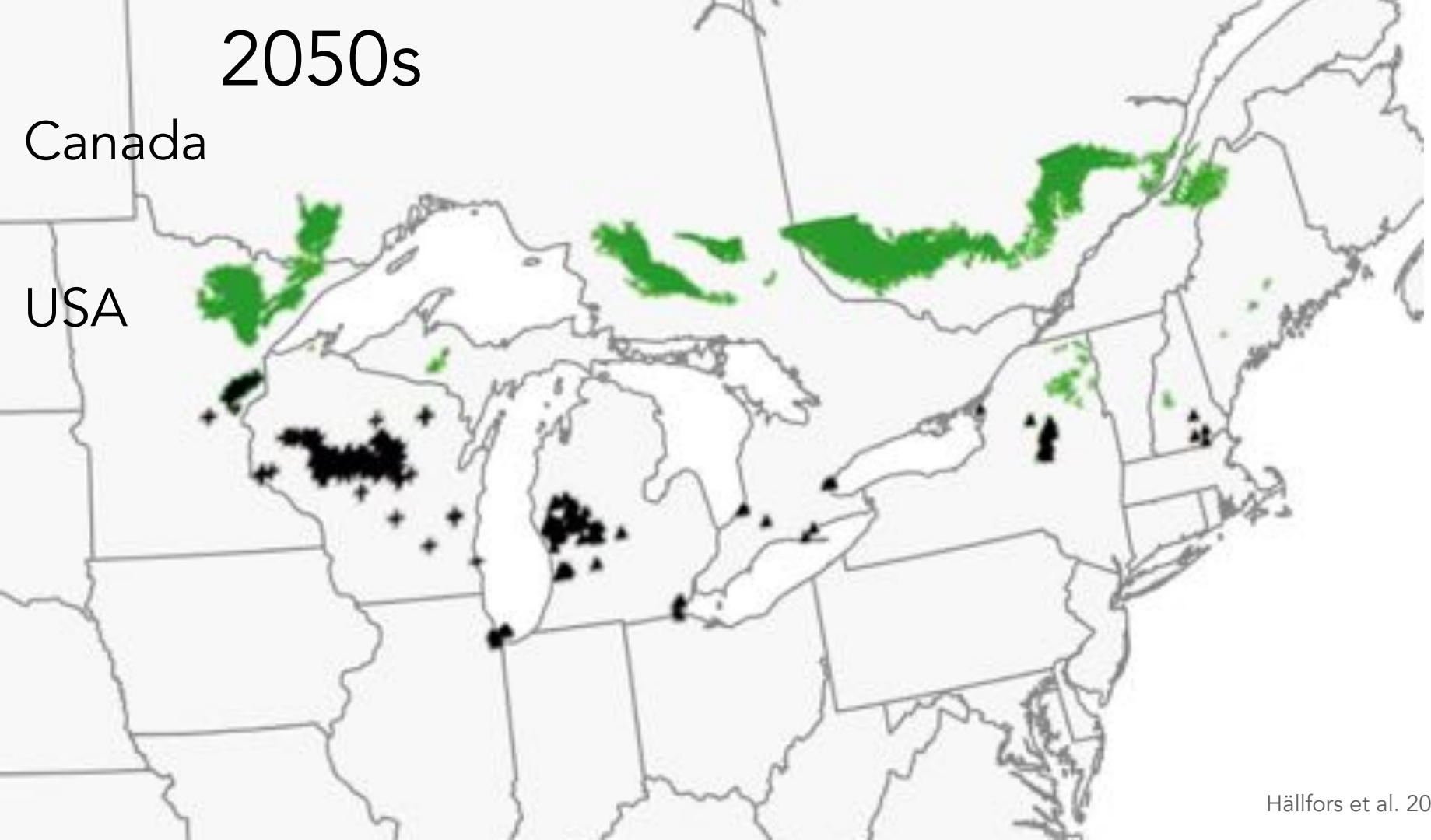
USA



2050s

Canada

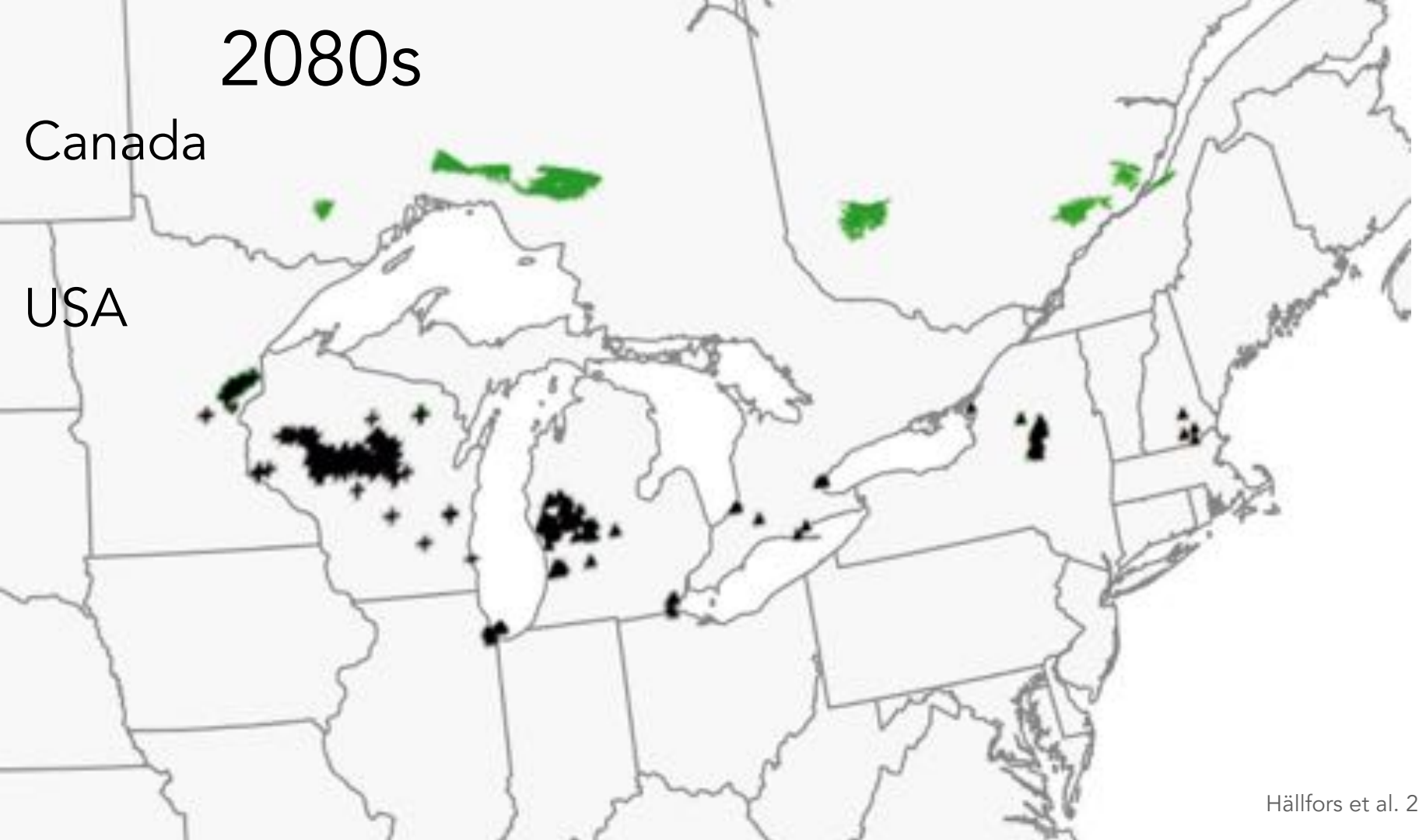
USA



2080s

Canada

USA



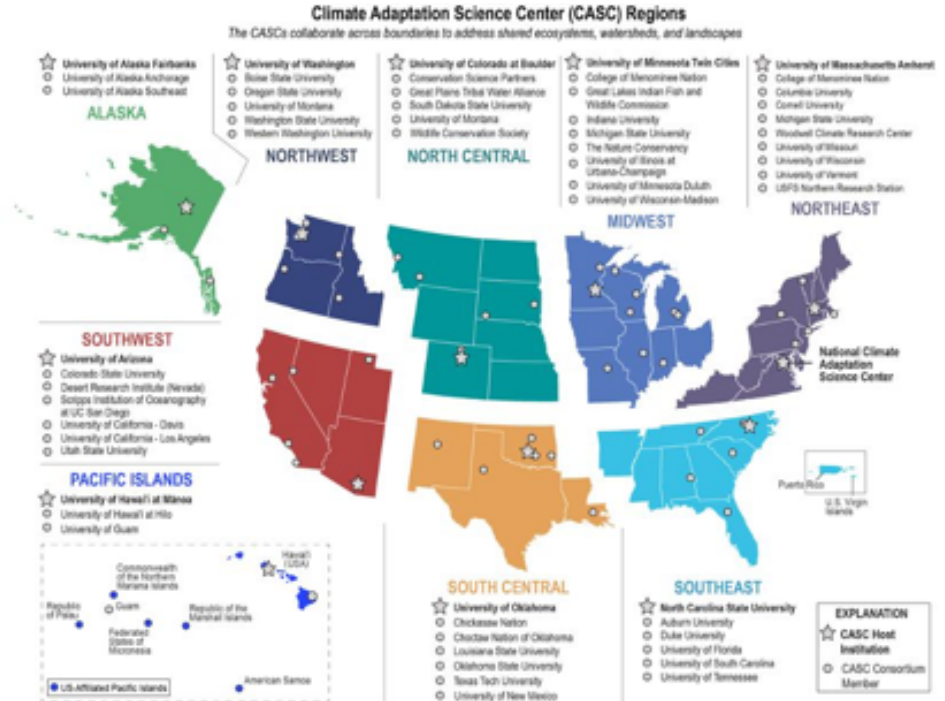
the past is not a reliable reference

expect the unexpected

ecosystems particularly sensitive to climate

Climate Adaptation Science Centers (CASC)

Delivering science to help fish, wildlife, water, land, and people adapt to a changing climate.



The Midwest CASC



COLLEGE OF
MENOMINEE NATION



MICHIGAN STATE
UNIVERSITY



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN



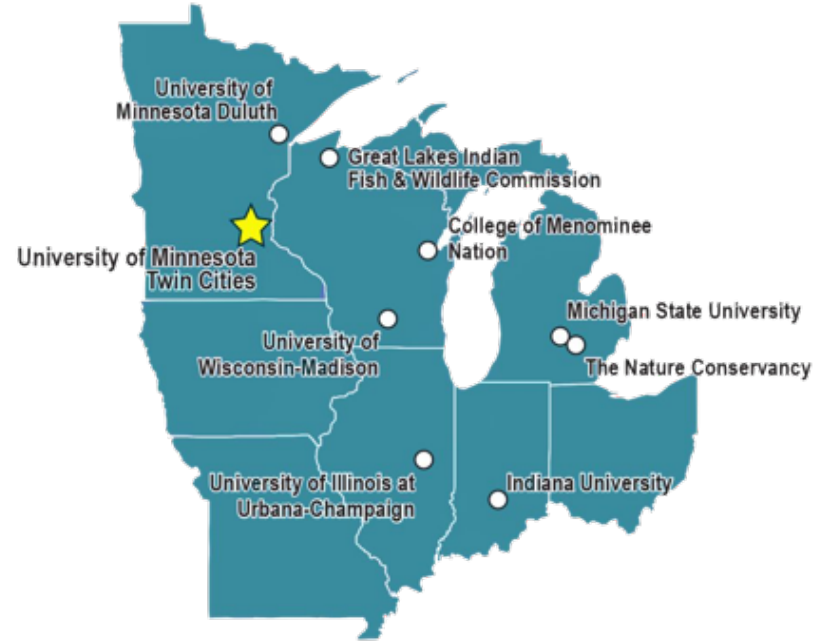
WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON



INDIANA UNIVERSITY



UNIVERSITY OF MINNESOTA



Floods & Droughts



Examples of science priorities:

Assess the population-level effects of extreme rainfall on at-risk aquatic and terrestrial species

Evaluate the potential of natural lands to moderate extreme rainfall and flooding

Identify and evaluate methods to reduce the effects of drought on fish and wildlife

Assess the effects of human adaptation on water availability for fish and wildlife

Novel Terrestrial Ecosystems



Examples of science priorities:

Advance climate knowledge for under-studied terrestrial species

Assess the potential for range shifts or local extirpation of focal species from Tribal lands

Evaluate the effects of climate-adapted agriculture on wildlife habitat

solutions exist







not all solutions are technological



but all have side effects



Sentinel 5P

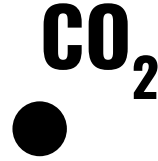
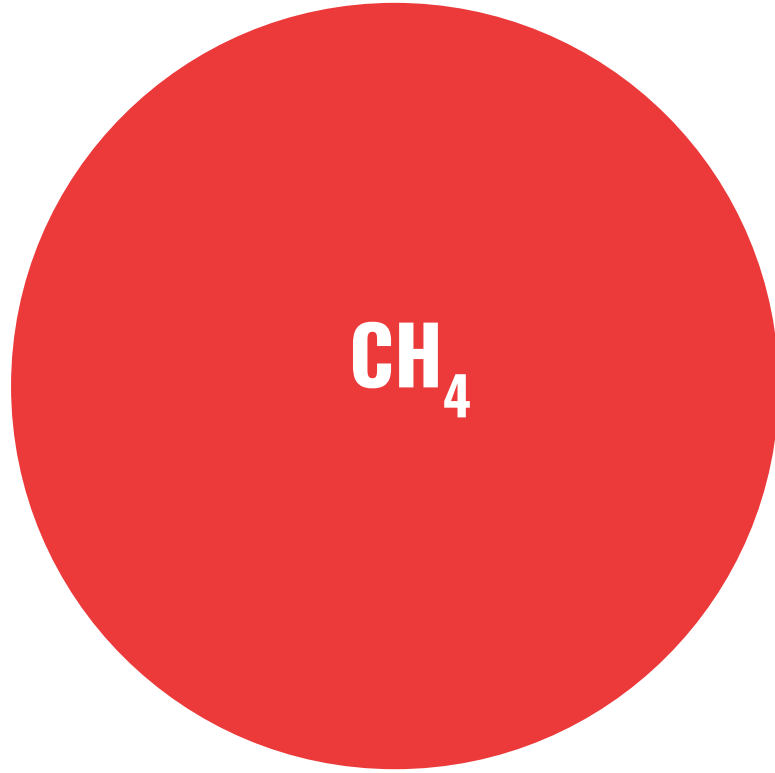


An aerial photograph of a rugged, mountainous landscape. The terrain is characterized by numerous ridges and valleys, with some areas appearing to be covered in dense vegetation or forest. In the upper central portion of the image, a vertical plume of gas is visible, highlighted in bright orange and red colors. A white line points from the text label to this plume. At the bottom of the image, there are several distinct, roughly rectangular areas with a grid-like or terraced pattern, likely agricultural fields or ranch land. One of these areas is labeled with text.

Methane plume

Porter Ranch

86x Global Warming Potential



“Very soon nobody is going to be able to hide from methane leakage.”

– Chevron CEO Mike Wirth, September 2019

MethaneScan[®]

1 x 5 km

1 km²

GEOFINANCIAL
ANALYTICS



Better. Faster. Smarter.

More equitable and inclusive.

No more silos. More systems thinking.

Mission

*Building a future where people and
planet prosper together*



Produce novel insights



Build activated leaders



Tell compelling stories

INSTITUTE ON THE
ENVIRONMENT

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM

Impact Goals

- Achieve carbon neutrality
- Define sustainable land use
- Ensure safe drinking water

In Minnesota, for the world...









INSTITUTE ON THE
ENVIRONMENT

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM

