

A Look at Projected Climate Change and Michigan's Future

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Run of show...

- Quick (!) look at recent global climate change, impacts and why it's so critical to keep global warming $<2^{\circ}\text{C}$
- The sharp edge of climate change – water security
- More on regional climate change losers in the US
- An opportunity for Michigan, but a challenge too
- Why I think we can do it if we all work together



The growing wildfire crisis is global – it's a climate crisis



What do all of these have in common?





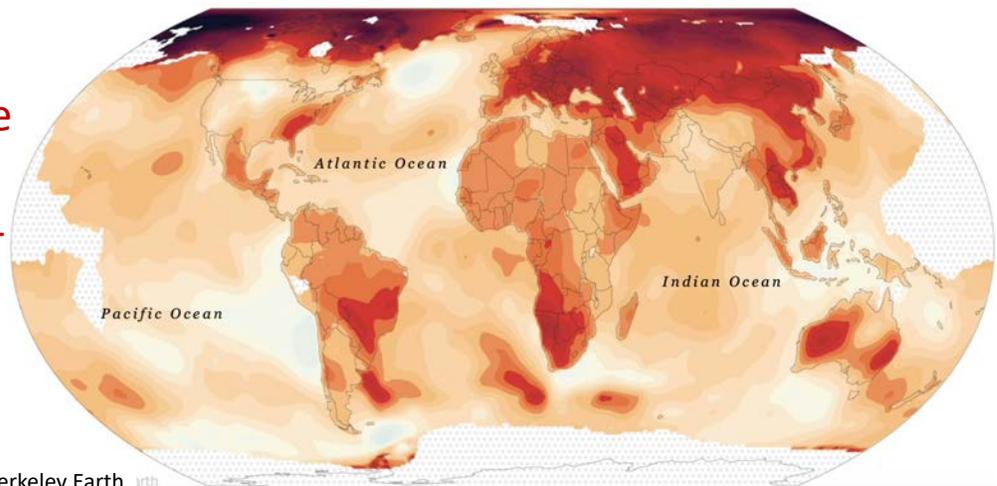
Warming is making all these natural disasters worse



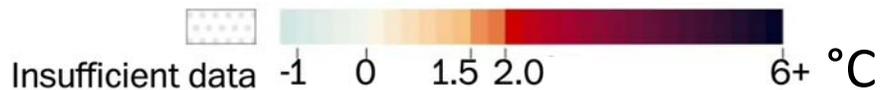
The globe is warming almost everywhere

2019 Average Annual Temperature Versus 1880-1899 Average

So far, the global average has warmed 1°C since pre-industrial times



Source: Berkeley Earth ¹17th



Political reality check

(we're not on track for a +2°C world)

Why is a 1.5 to 2°C warming limit so key?

Political reality check

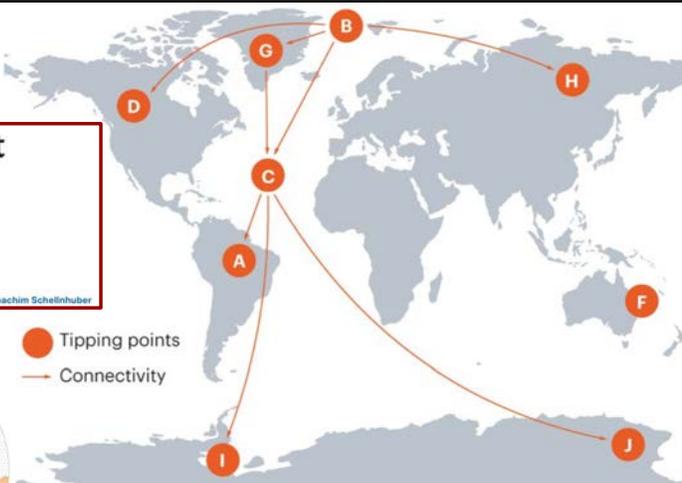
(we're not on track for a +2°C world)

Why is a 1.5 to 2°C warming limit so key?

Tipping points

(could preclude a +2-3°C world)

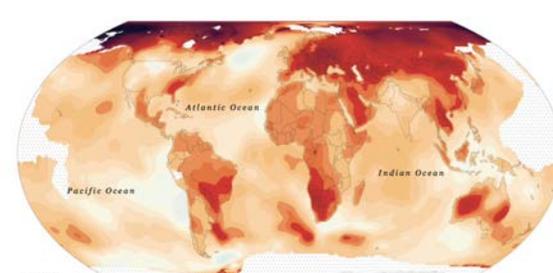
nature November 27, 2019



Climate tipping points – too risky to bet against

The growing threat of abrupt and irreversible climate changes must compel political and economic action on emissions.

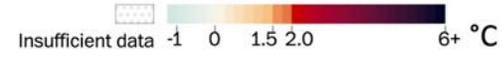
Timothy M. Lenton, Johan Rockström, Owen Gaffney, Stefan Rahmstorf, Katherine Richardson, Will Steffen & Hans Joachim Schellnhuber



● Tipping points

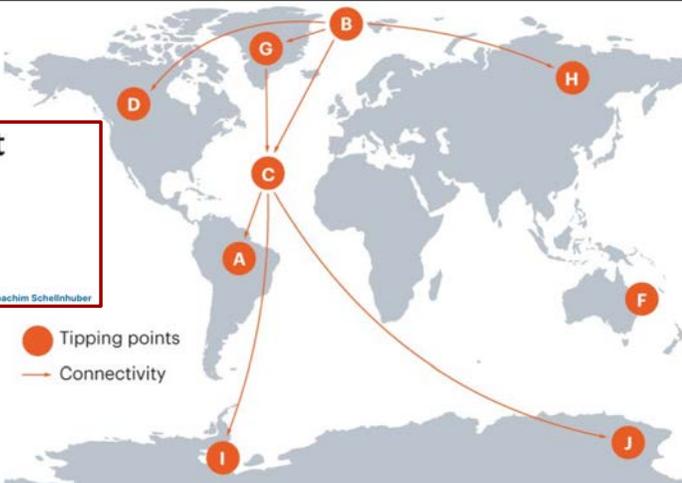
— Connectivity

Source: Berkeley Earth



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nature November 27, 2019



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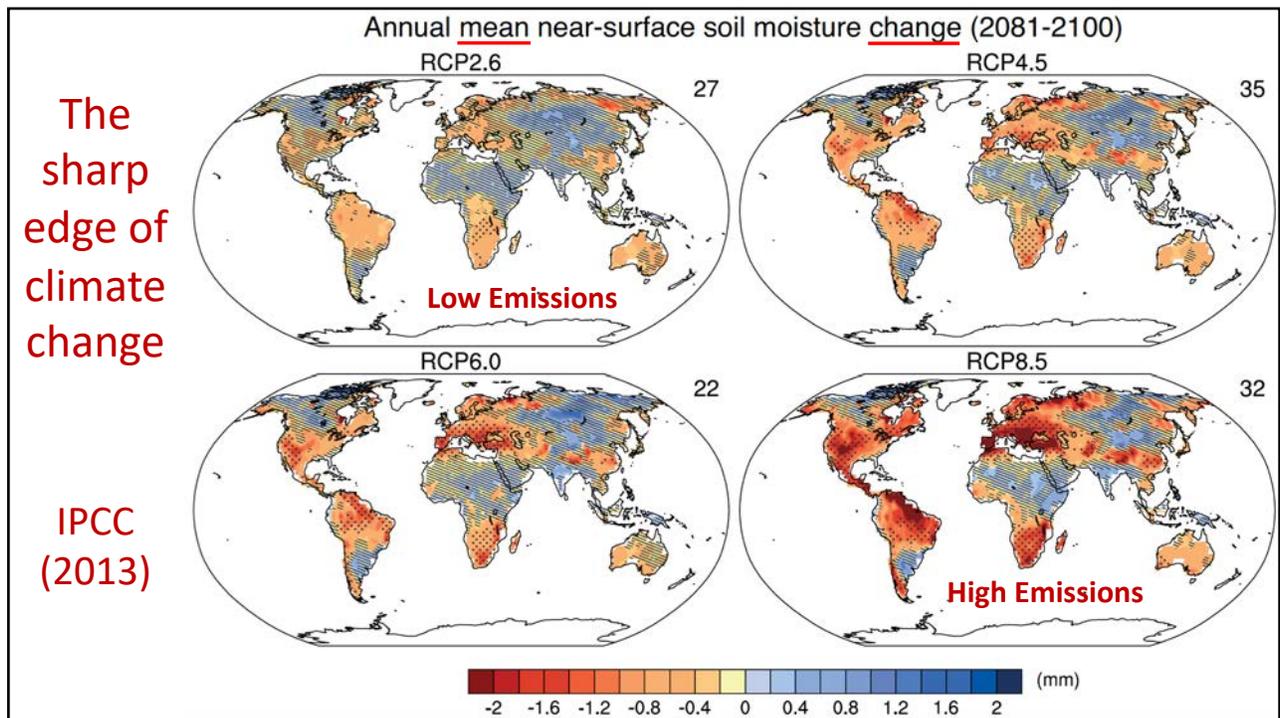
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● Tipping points

— Connectivity

<p>A. Amazon rainforest Frequent droughts</p> <p>B. Arctic sea ice Reduction in area</p> <p>C. Atlantic circulation In slowdown since 1950s</p>	<p>D. Boreal forest Fires and pests changing</p> <p>F. Coral reefs Large-scale die-offs</p> <p>G. Greenland ice sheet Ice loss accelerating</p>	<p>H. Permafrost Thawing</p> <p>I. West Antarctic ice sheet Ice loss accelerating</p> <p>J. Wilkes Basin, East Antarctica Ice loss accelerating</p>
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As predicted, southern Africa and Australia are experiencing unprecedented “hot drought”

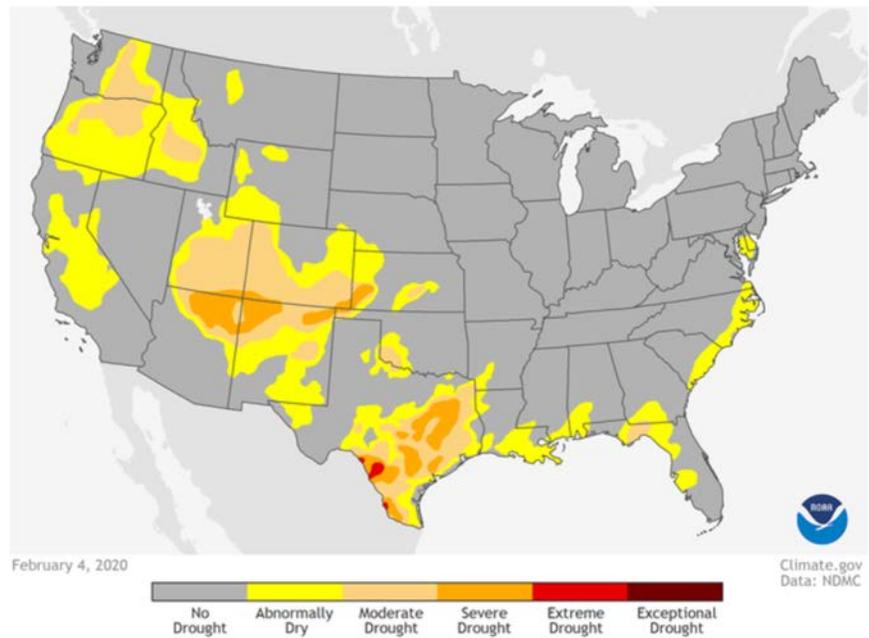
Farmers are committing suicide as drought in southern Africa reaches crisis levels

By Associated Press

November 21, 2019 | 1:56pm



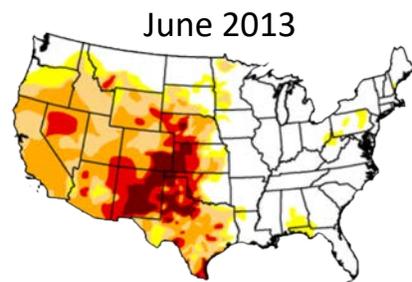
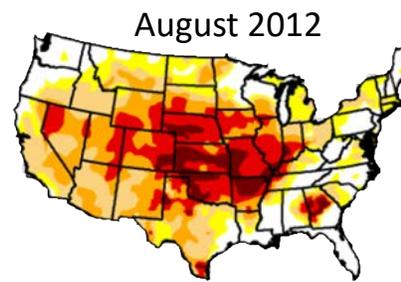
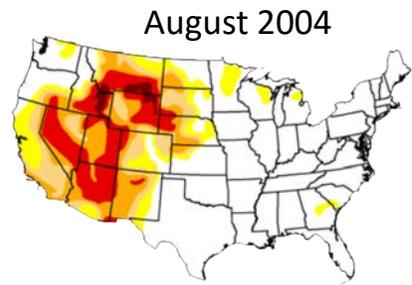
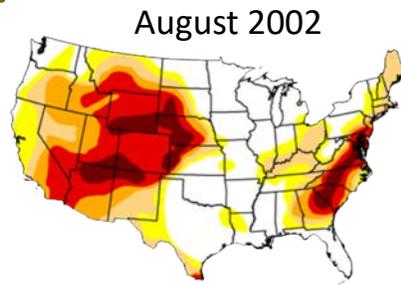
The *current* Southwest US drought in its 20th year, making it the first U.S. “megadrought” in recorded history



<https://www.climate.gov>

The SW drought 20 years and counting

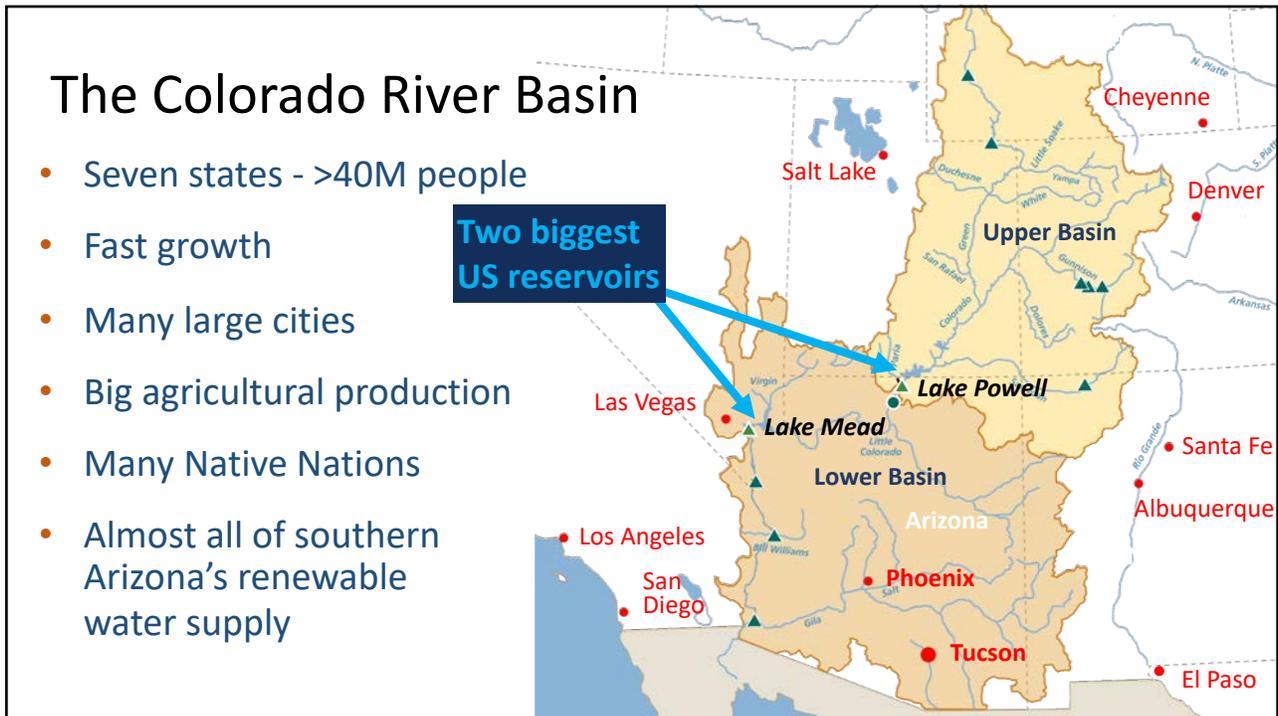
Still very real and
exacerbated by
record hot
temperatures



Dead trees in Kings Canyon National Park, California



2016





At water-starved Lake Mead and Lake Powell, 'the crisis is already real,' scientists say Arizona Republic, August 2018

Colorado River Managers See A Possible Future And It Doesn't Look Pretty

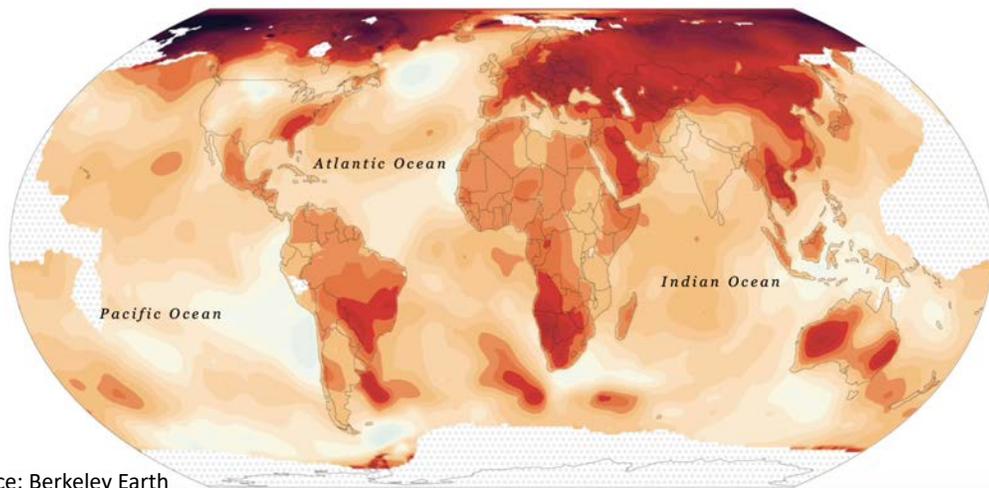
Friday, June 29, 2018
 Luke Runyon/KUNC

Congress Passes Colorado River Drought Contingency Plan

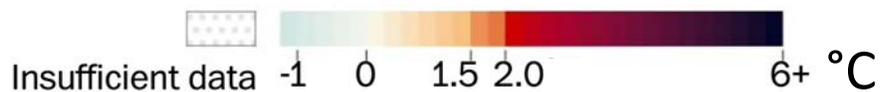
The bipartisan bill passed with no opposition following two years of negotiations.
 by Christopher Conover
 Arizona Public Media, April 8, 2019

Why are the only sustainable water supplies for the SW U.S. drying up?

The globe is warming almost everywhere
2019 Average Annual Temperature Versus 1880-1899 Average



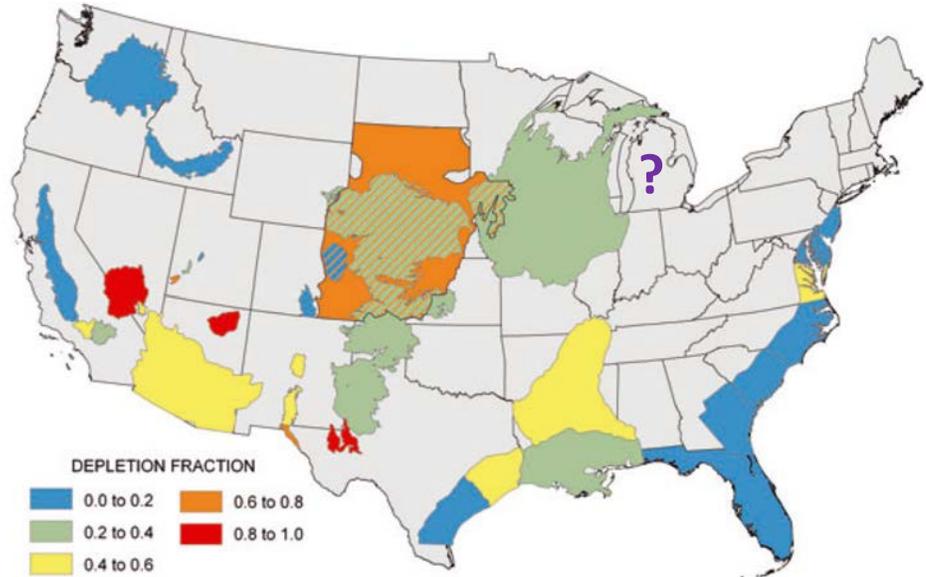
Source: Berkeley Earth



Insufficient data -1 0 1.5 2.0 6+ °C

Unsustainable Groundwater Depletion

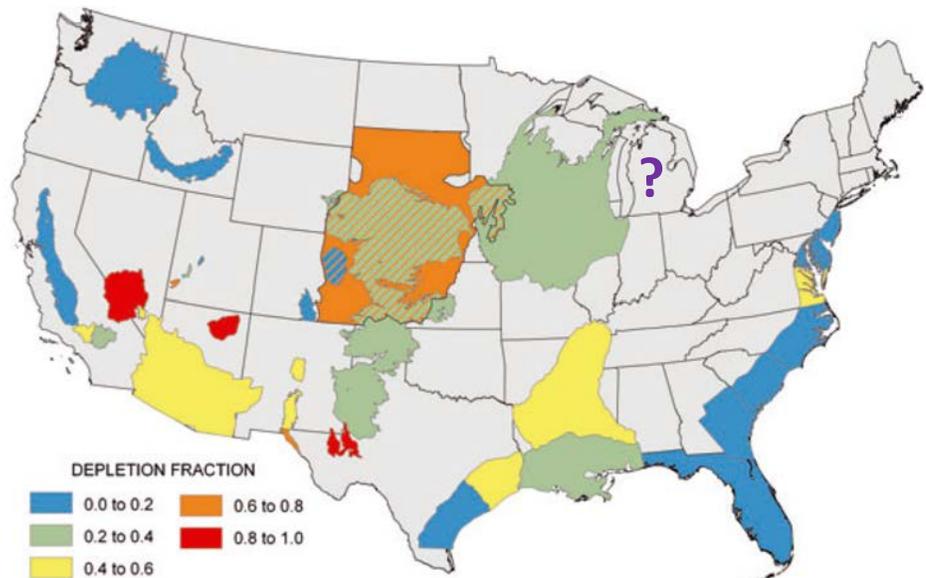
As aquifers dry up, where will the SW and High Plains get their water in the future?



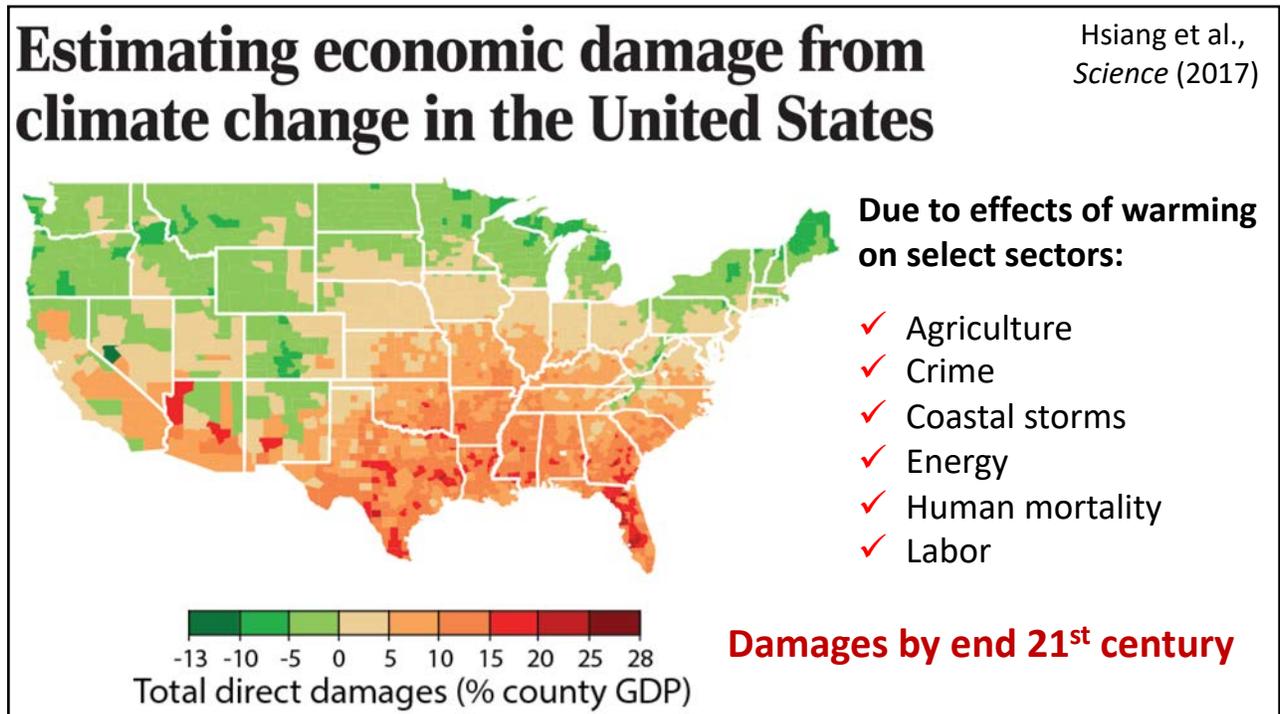
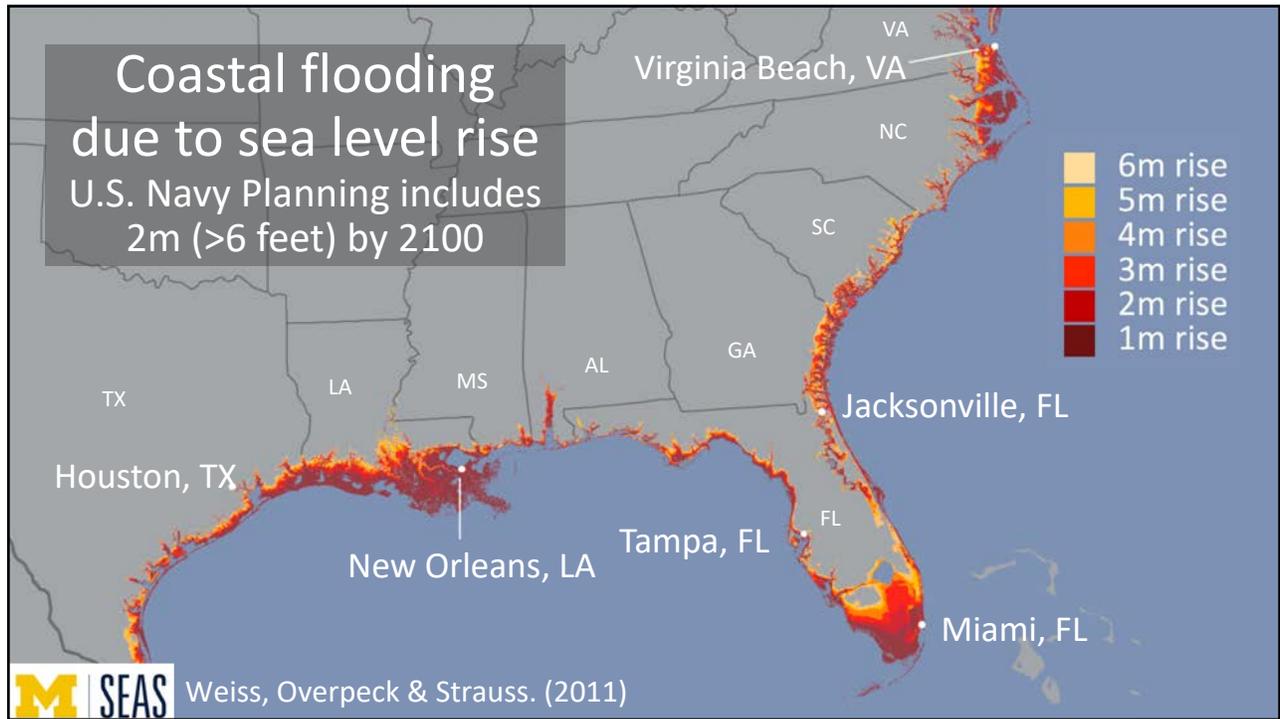
Konikow and Leake, 2014

Unsustainable Groundwater Depletion

How will the Great Lakes region manage its water in a growing era of national need?



Konikow and Leake, 2014





What you
gunna do?

San Francisco is losing residents because it's too expensive for nearly everyone

Marco della Cava USA TODAY

Published 8:54 a.m. ET Oct. 19, 2019 | Updated 1:47 p.m. ET Oct. 24, 2019

REAL ESTATE

Boston Has One of the Least Affordable Housing Markets in the Country

Boston May 29, 2019



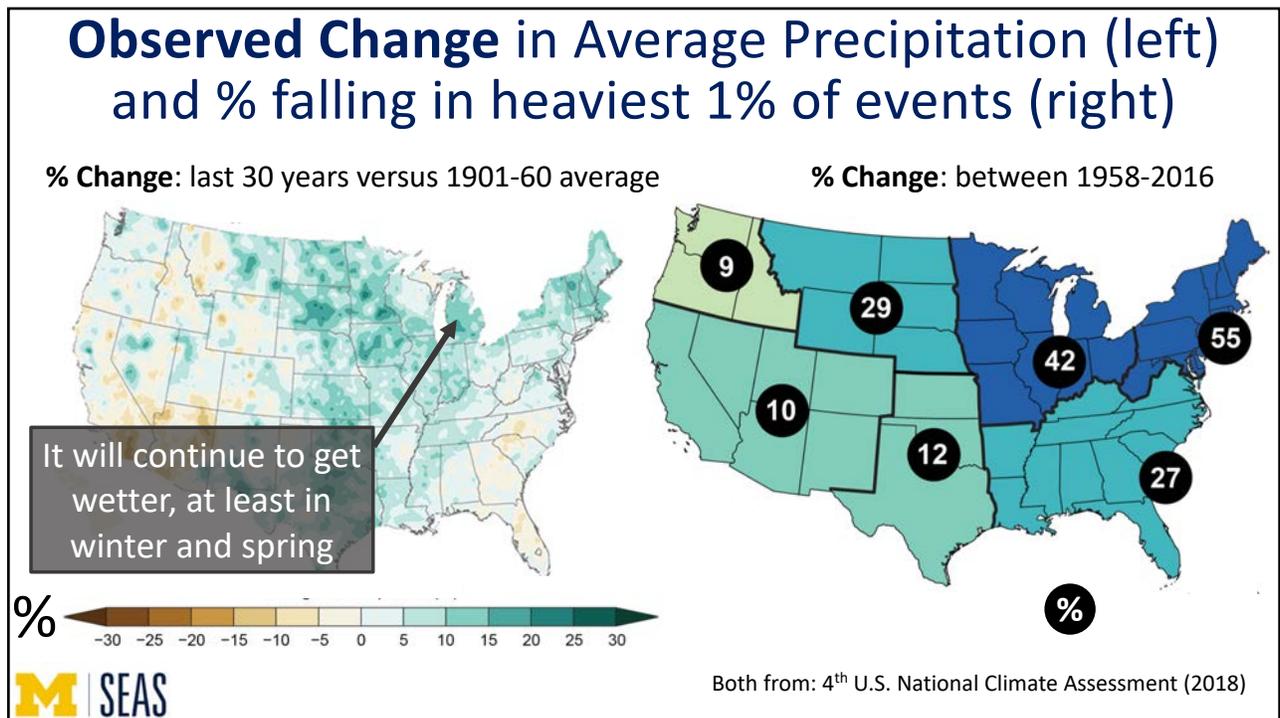
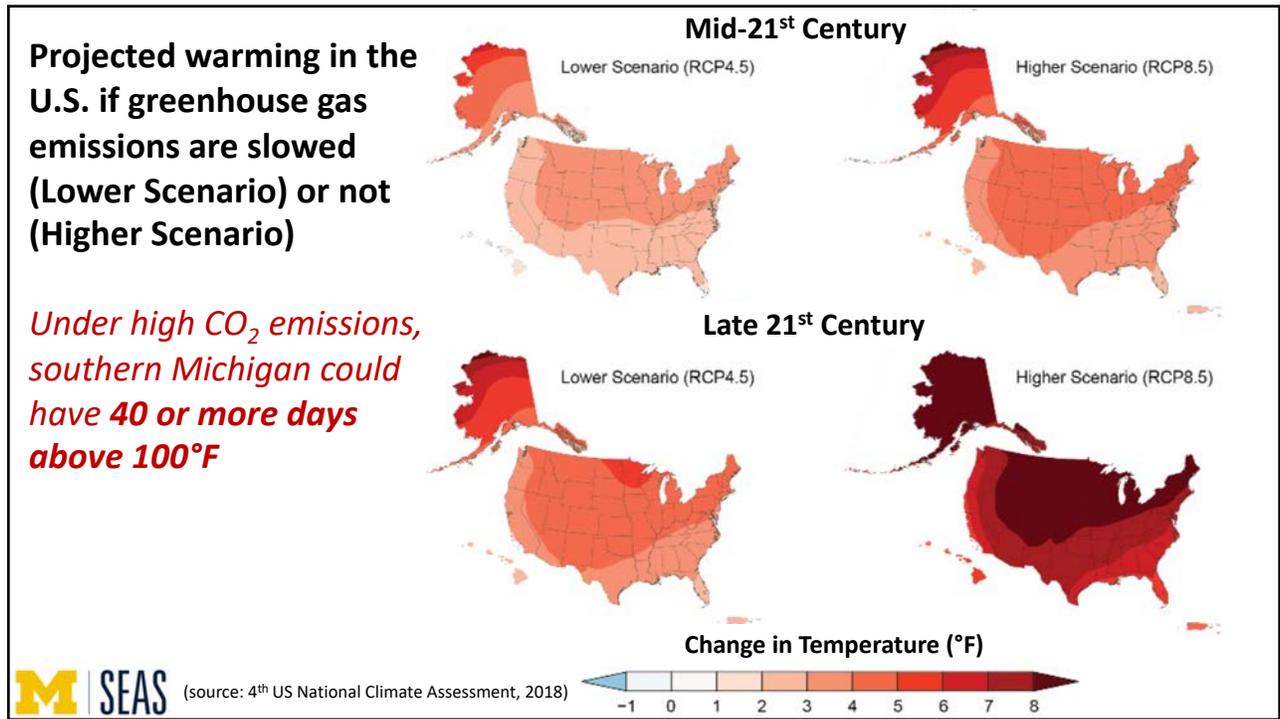
NYC's affordability crisis continues to deepen, report shows

June 20, 2019



There is also a **climate challenge** for Michigan





Critical point: Too much climate change endangers the Great Lakes and regional communities

- more frequent/severe runoff and flooding
- water infrastructure risk and...
- expansion of harmful algae blooms into *all* of the Great Lakes*



* Algae blooms also grow worse with warming



Critical point: Too much climate change endangers the Great Lakes farms, forests & aquatic systems

- longer/hotter heatwaves

+

- more frequent and severe drought

= { **water stressed agriculture, forests, small lakes, rivers and more**



Critical point: Too much climate change endangers the Great Lakes human health

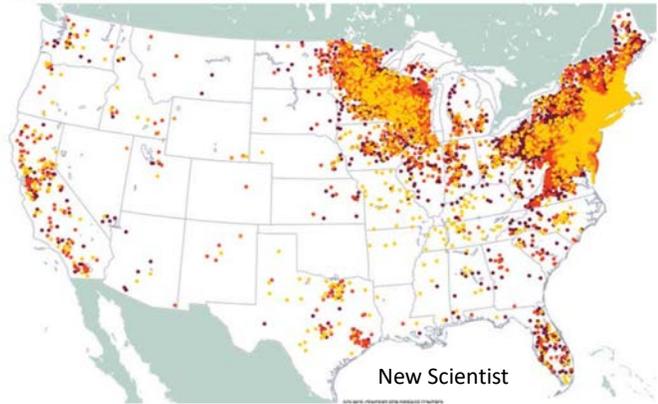
- longer/hotter heatwaves and...
- Increased infectious disease



Lyme on the march

Cases of Lyme disease have spread across the US as warmer winters encourage the ticks that carry it to move into new areas

● 2001 ● 2005 ● 2010 ● 2015



Lyme disease cases may rise 92 per cent in US due to climate change



HEALTH 8 February 2020

By Adam Vaughan

NewScientist





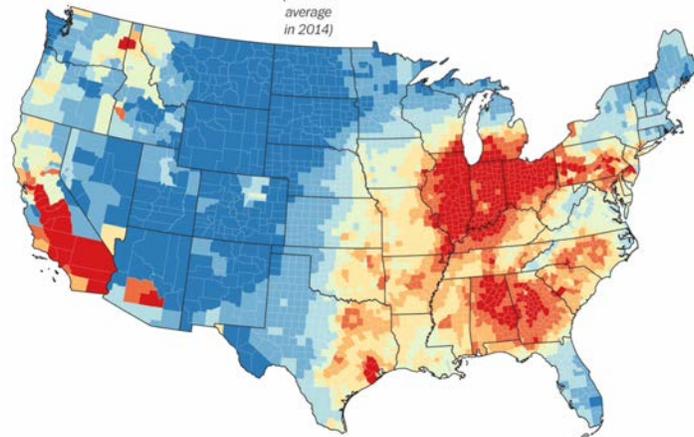
Air pollution is getting worse, and data show more people are dying

The Washington Post

October 23, 2019

The map of American air pollution

Daily average small particulate matter (PM2.5) concentration in 2014



Eroding air quality has been linked to 10,000 additional U.S. deaths in 2018 thanks to vehicles and the burning of natural gas



Source: Robert Wood Johnson Foundation County Health Rankings THE WASHINGTON POST



What does all this mean for Michigan & the Great Lakes?

- State/region could become a desired place to live & do business
- **But, if we don't embrace renewable energy, adaptation will be tough**
- **If we do embrace renewable energy, the state/region could win big**
- Fortunately, the cost of clean energy is falling fast and the entire planet is transitioning out of fossil fuels & more...



Clean energy is catching up to natural gas

The natural gas "bridge" to sustainability may be shorter than expected.

By David Roberts | @drvox | david@vox.com | Updated Aug 8, 2018, 11:56am EDT



Renewable Energy Will Be Consistently Cheaper Than Fossil Fuels By 2020, Report Claims

Forbes

Jan 13, 2018

Renewable Energy Costs Take Another Tumble, Making Fossil Fuels Look More Expensive Than Ever

Forbes

May 29, 2019

US adds 2.6 gigawatts of solar photovoltaics in third quarter, new figures show



PUBLISHED THU, DEC 12 2019 • 11:05 AM EST

“For 2019 as whole, forecasting year-over-year growth of 23% and expecting 13 GW of installations”



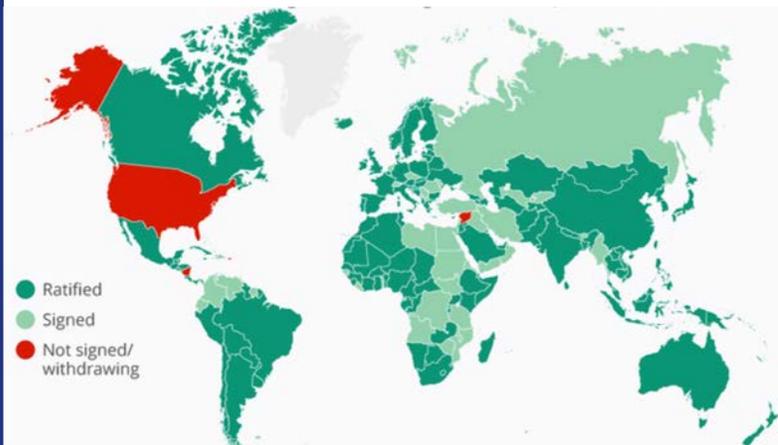
Who's transitioning to renewable energy?

To much more efficient energy use?

And to a more sustainable and just world?

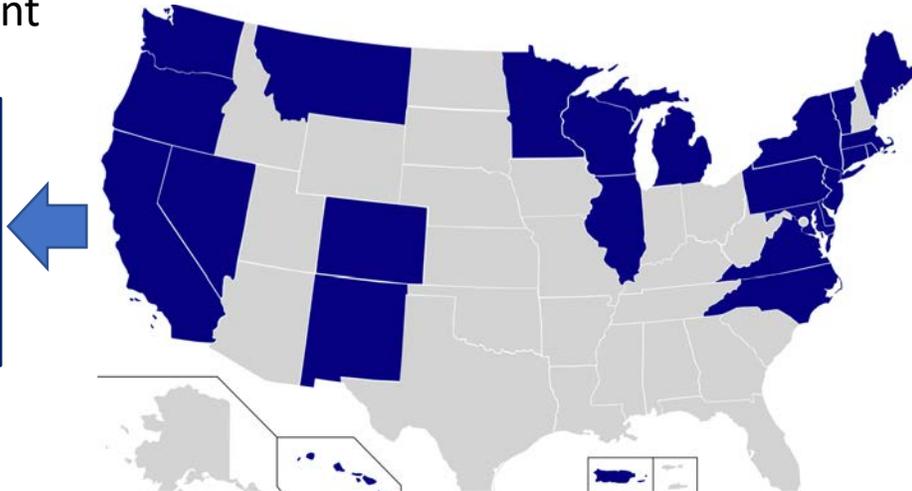
The entire planet!

The Paris Climate Agreement: who is in, and who is not



The U.S. Climate Alliance* – 24 states and Puerto Rico, all committed to greenhouse gas emissions reductions and the Paris Agreement

Latest update:
California has committed to zero emissions by 2045.



* >50% of the nation's population and >50% of the nation's GDP

WE ARE STILL IN

Together, we will remain actively engaged with the international community as part of the global effort to hold warming to well below 2°C and to accelerate the transition to a clean energy economy that will benefit our security, prosperity, and health.

BUSINESSES & INVESTORS	CITIES & COUNTIES	COLLEGES & UNIVERSITIES	CULTURAL INSTITUTIONS
2,234	287	353	68
HEALTH CARE ORGANIZATIONS	FAITH GROUPS	STATES	TRIBES
28	50	10	11

<https://www.wearestillin.com/signatories>



Including the University of Michigan – on trajectory to carbon neutral



What does all this mean for Michigan & the Great Lakes?

- **We all need to work together to get it done...**
- The UM, Ann Arbor, Grand Rapids, and more are planning paths to decarbonization and UM wants to partner with businesses, the state, other communities, non-profits, everyone... **to speed the transition to a robust economy that is *free of climate change, sustainable and just* – that attracts talent and 21st century enterprise**

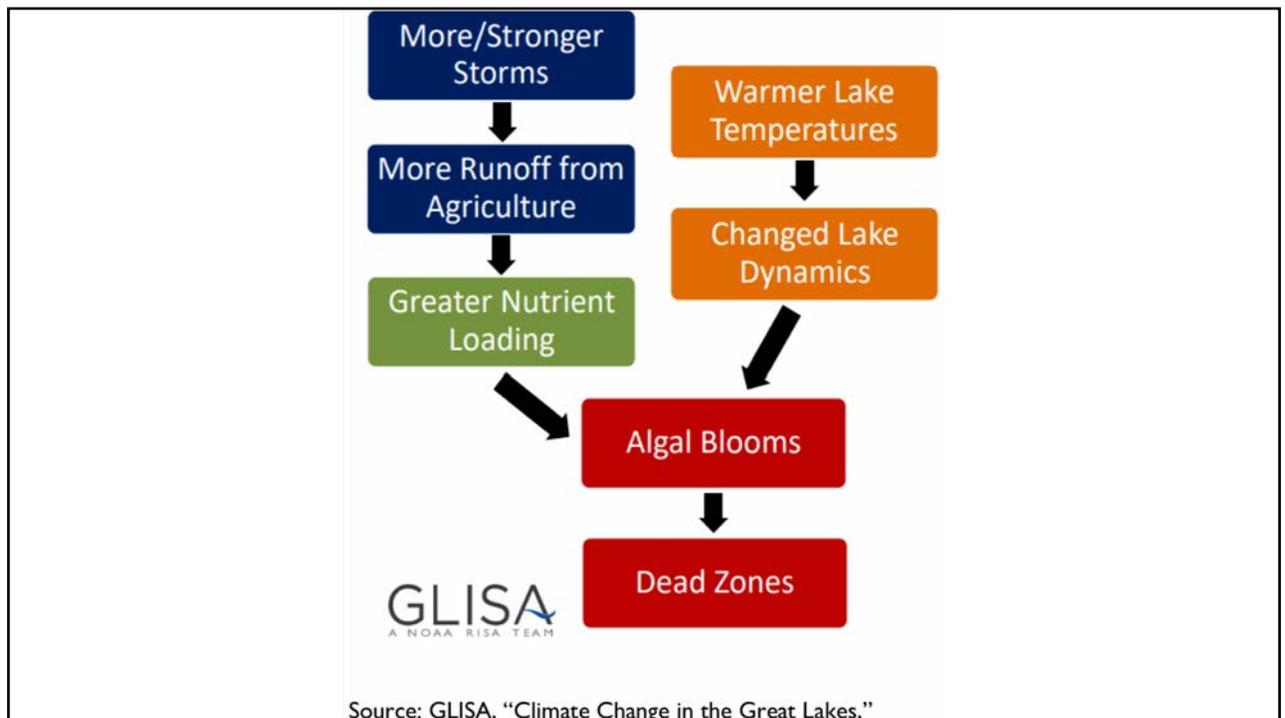
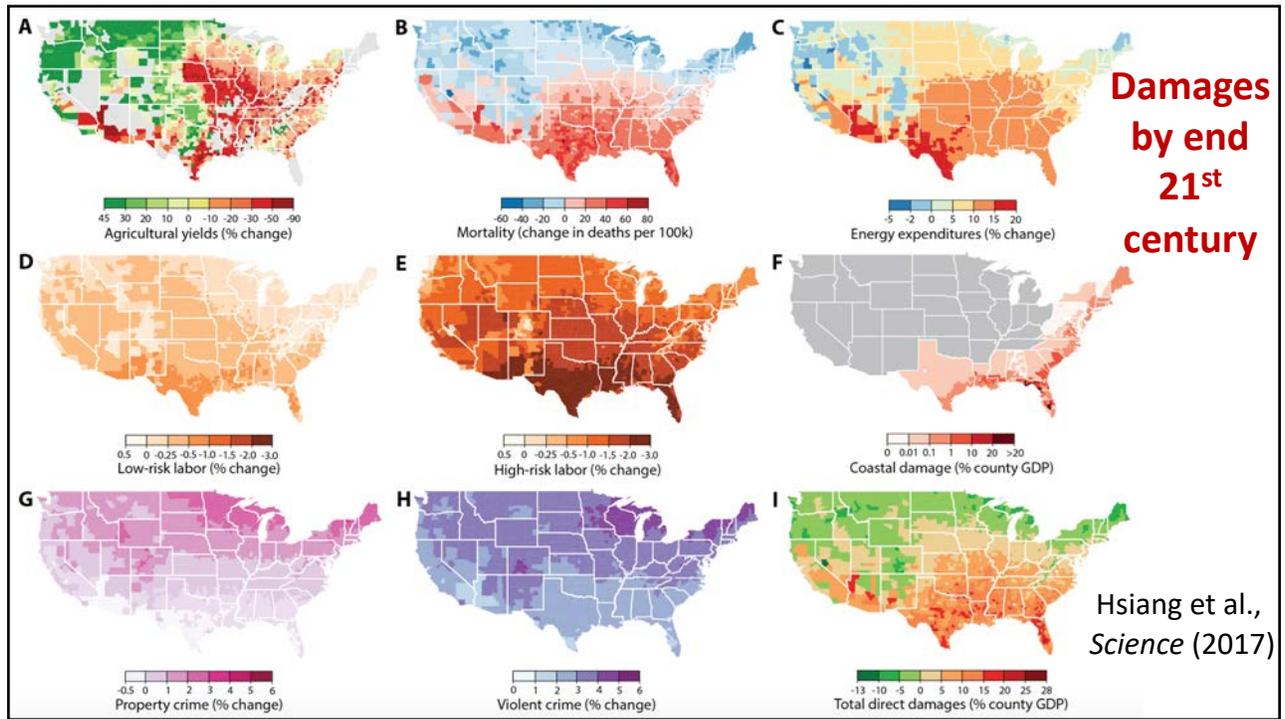


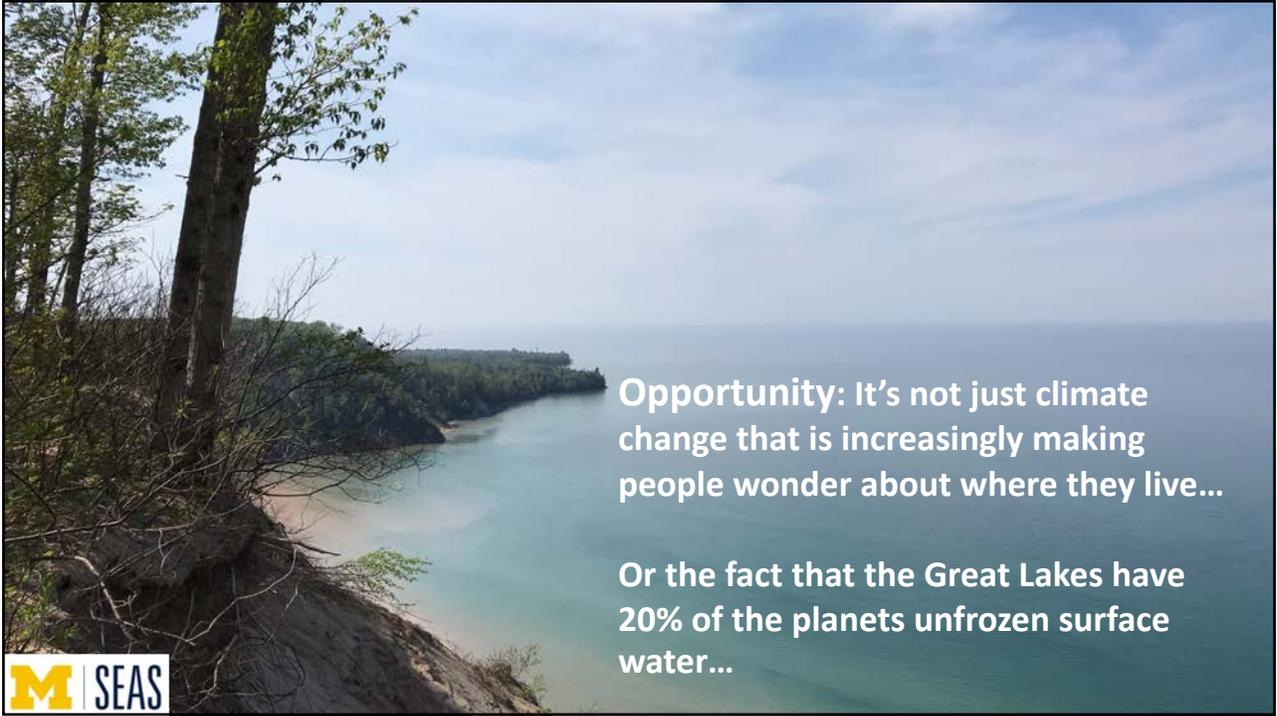
Questions?

Thanks!



 Twitter: @GreatLakesPeck





Opportunity: It's not just climate change that is increasingly making people wonder about where they live...

Or the fact that the Great Lakes have 20% of the planets unfrozen surface water...

