

Water, Weather, & Climate: Sowing hope in the Mountain State



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Joint Climate Workshop – Jackson's Mill

Outline of presentation

Water

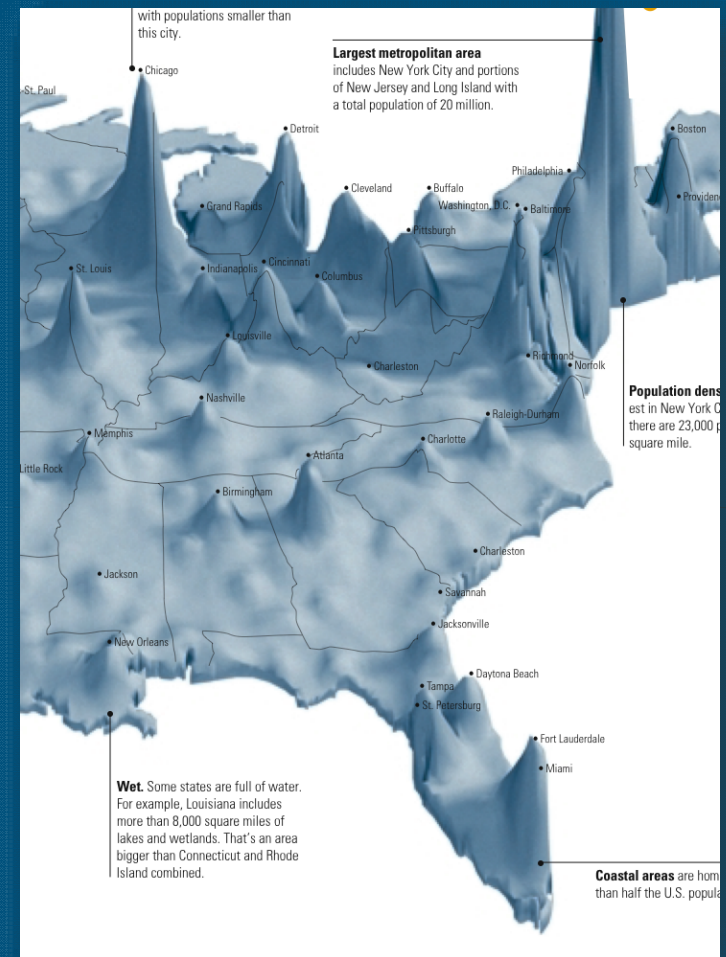
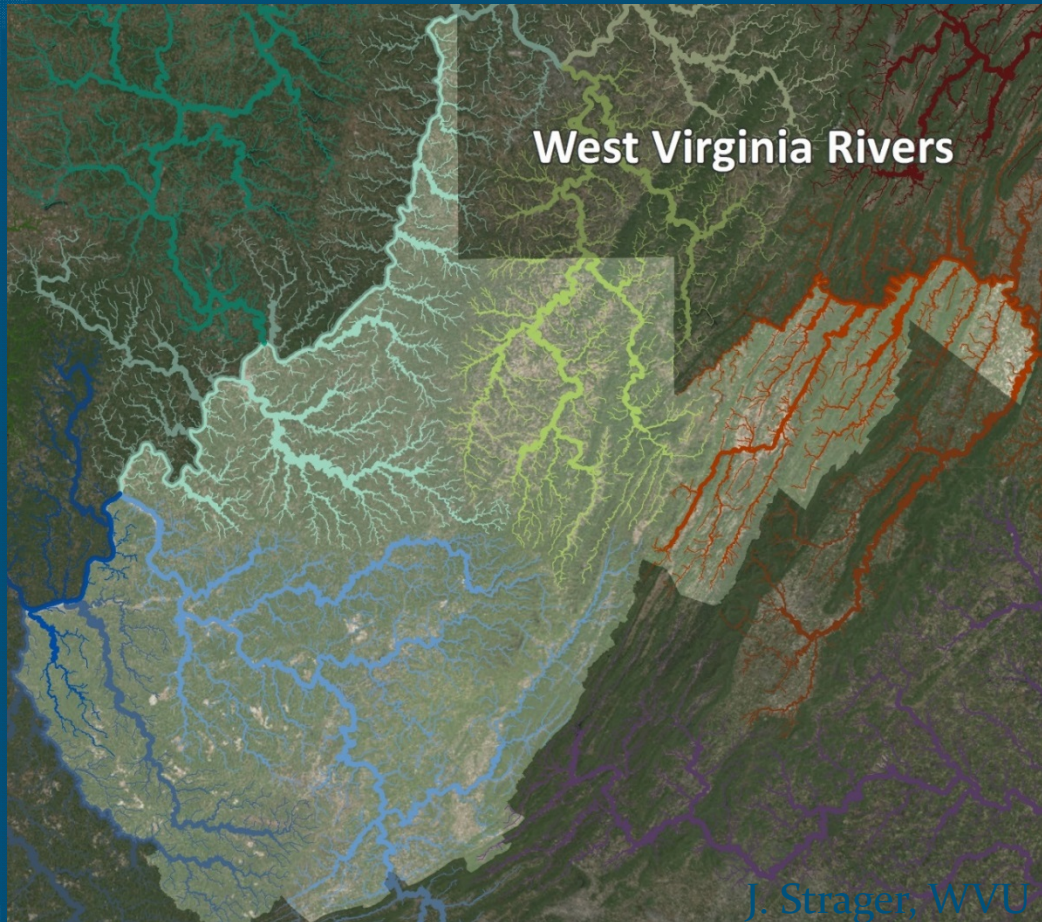
Climate

Change

Hope

WV has a lot of Water

- 54,825 miles of rivers
- Headwater state
- Precipitation – 50”/year
- Potomac – 1.2 billion gal/yr

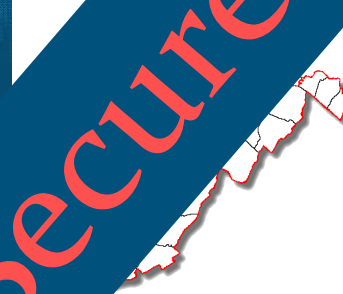


“Water Rich”

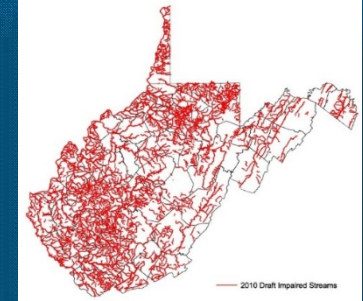
Viewed from Water Security

Acceptable level of water-related ecosystems...

- Floods
- Pollution
- Function



humans &



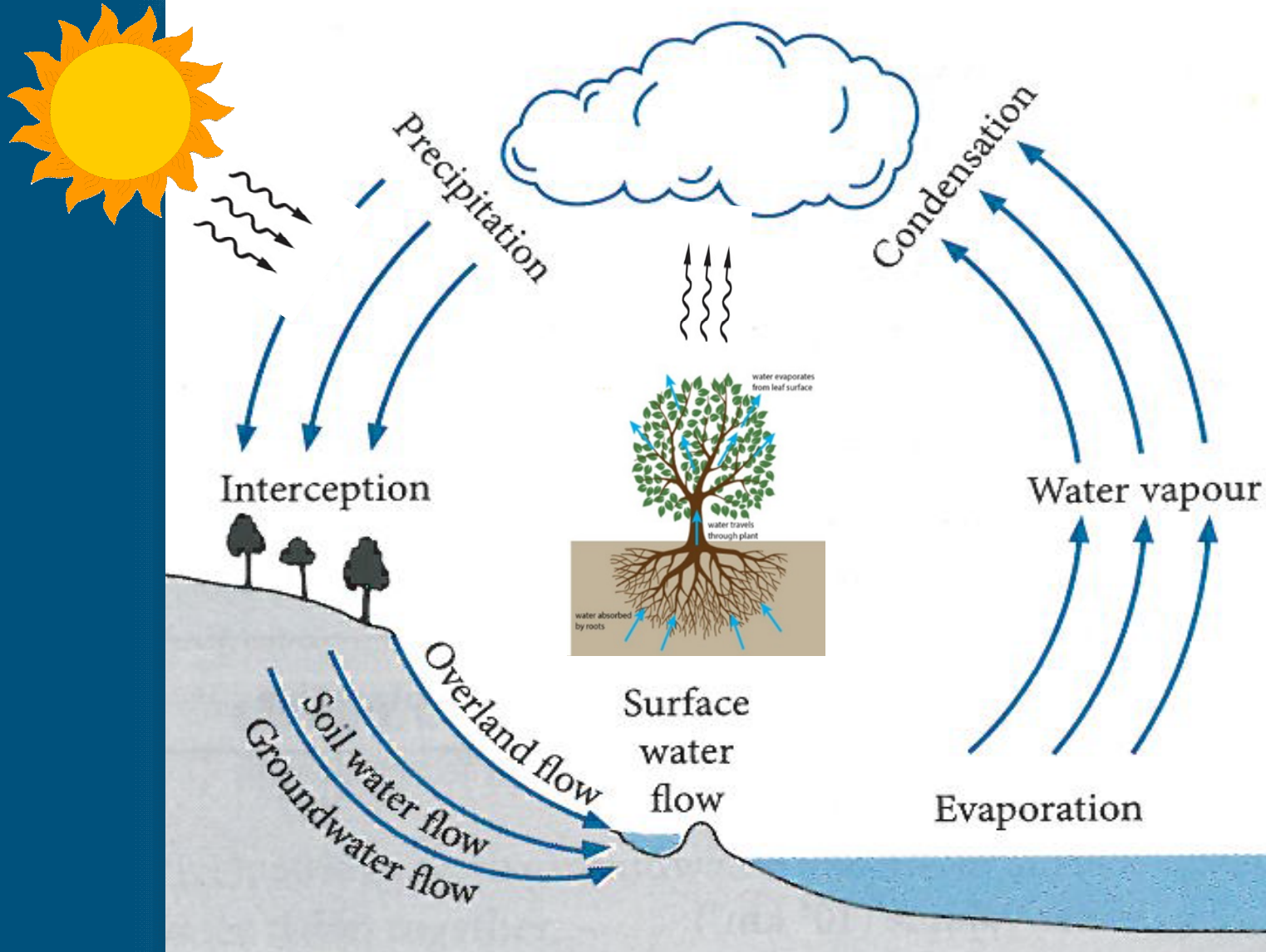
coupled with availability of sufficient water quantity & water quality

to support livelihoods, security, human health, & ecosystems (Bakker 2012)

- Breakdown of social system
- Chronic health
- Dearth of opportunity



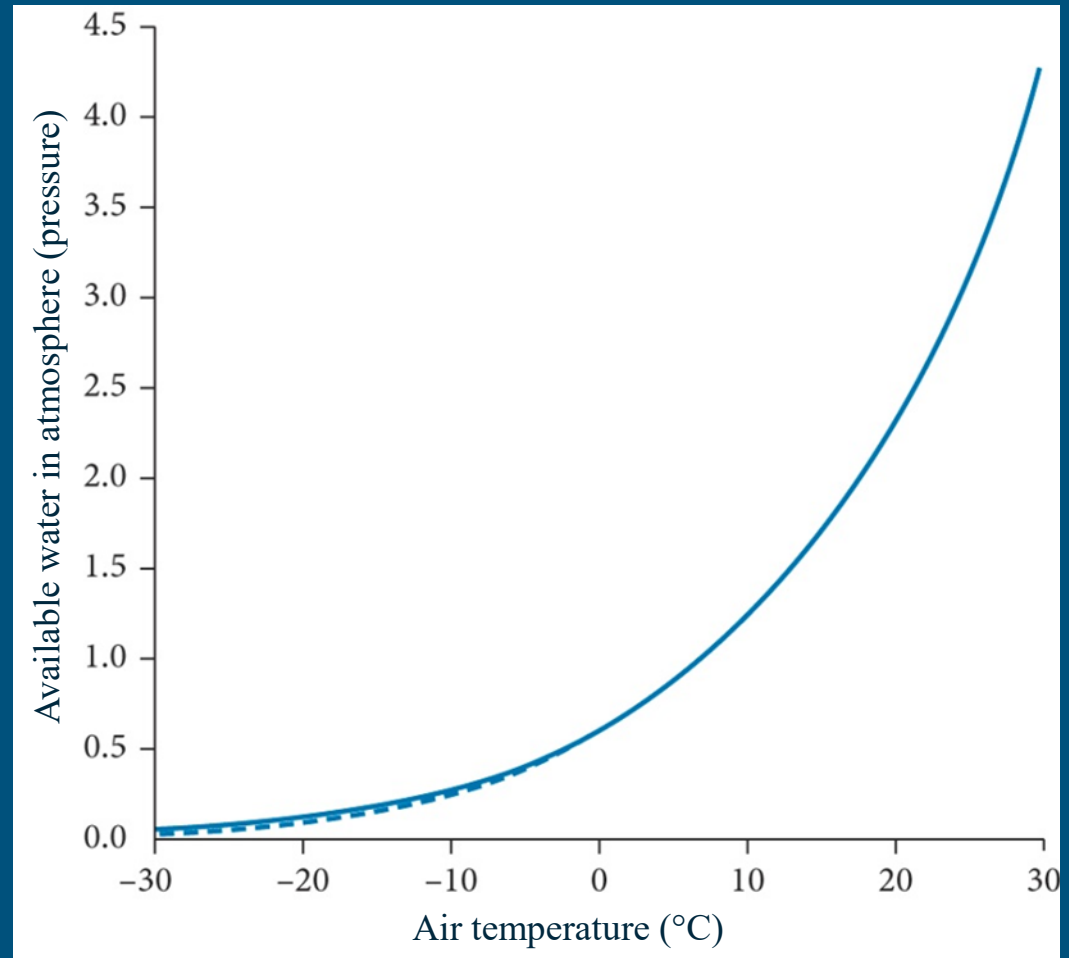
Climate controls water availability



Atmospheric water function of air temperature

Think, Pair, Share

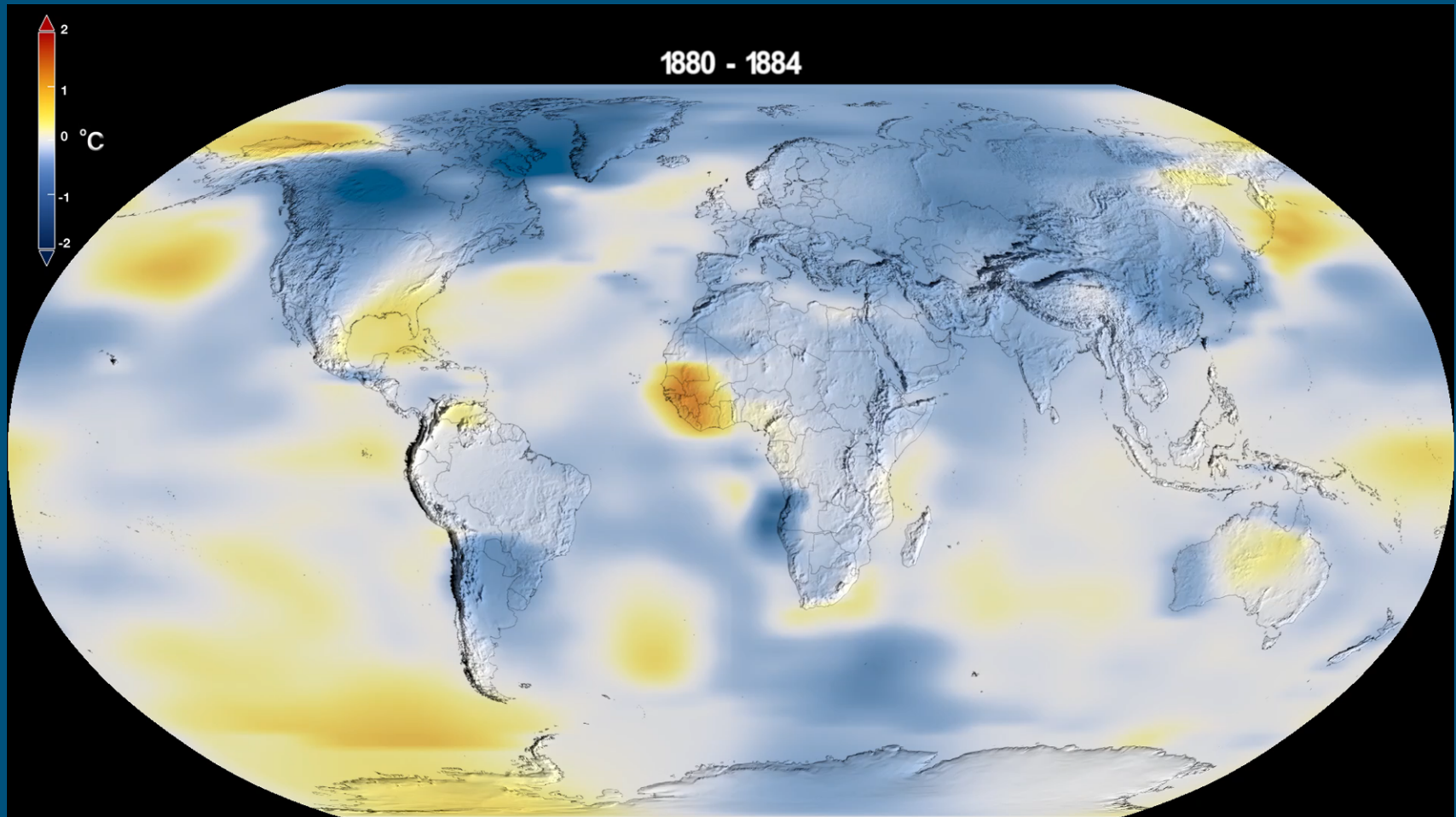
1. Describe each term;
2. As simply as possible, describe the relationship between terms
3. Discuss the implications of relationship



Learning activity

Climate change

~1.8°F increase in air temperature worldwide

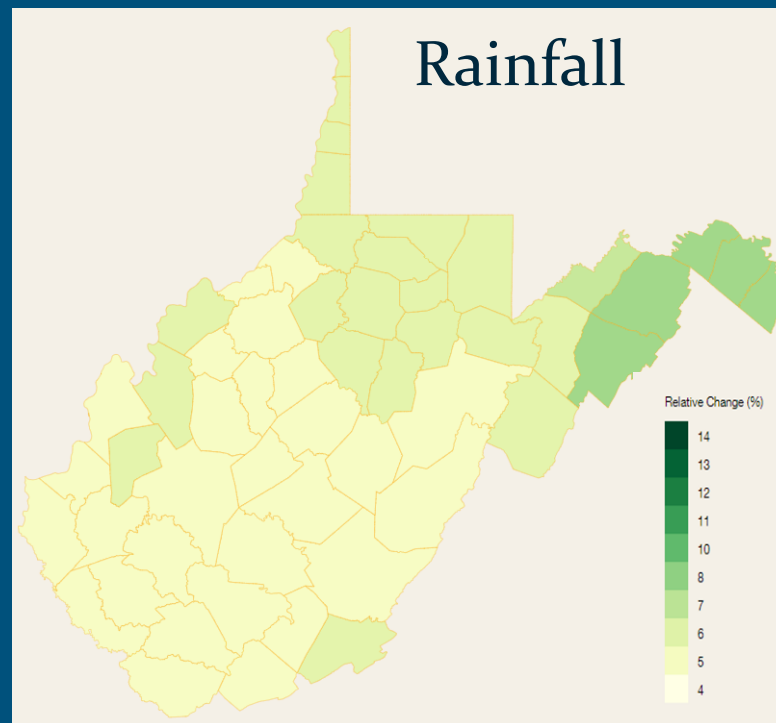
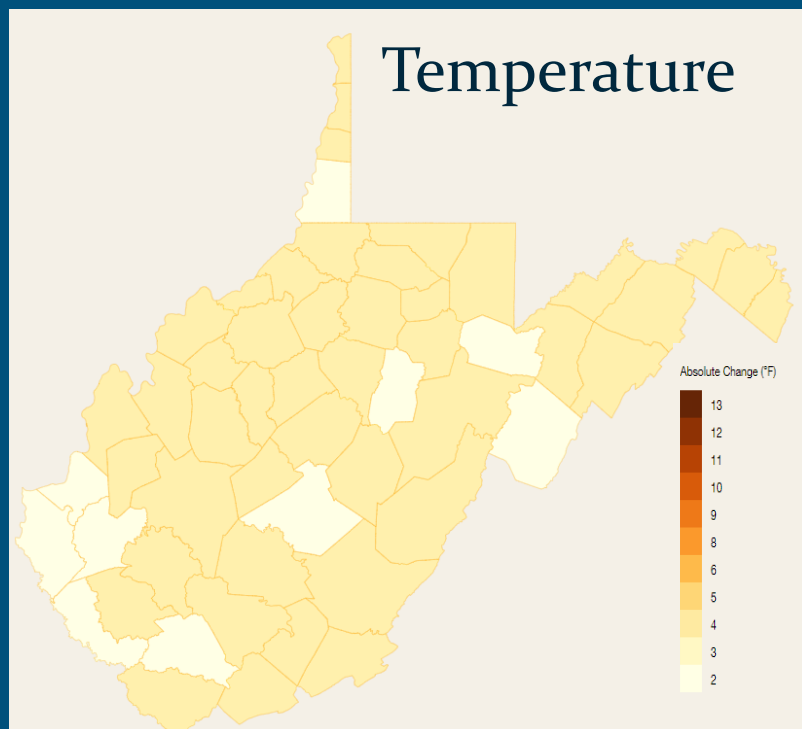


https://climate.nasa.gov/climate_resources/139/video-global-warming-from-1880-to-2021/

WV becoming warmer & wetter

Time Period	Min Temp	Max Temp	Precipitation
1950-2005 (~1° F increase)	41°F	64°F	47 in

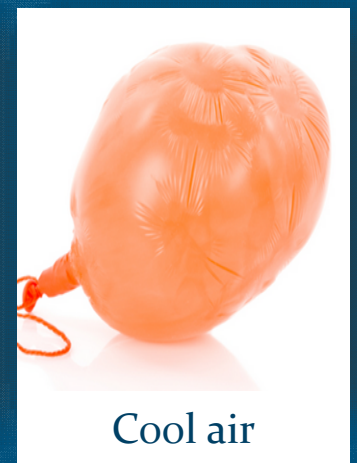
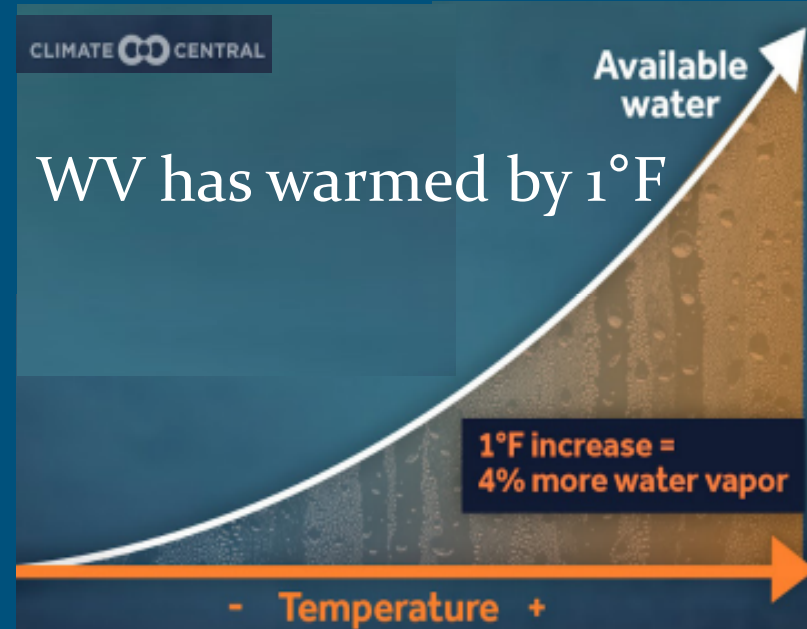
Current climate compared to 1980-2010



Why a small change in temperature matters

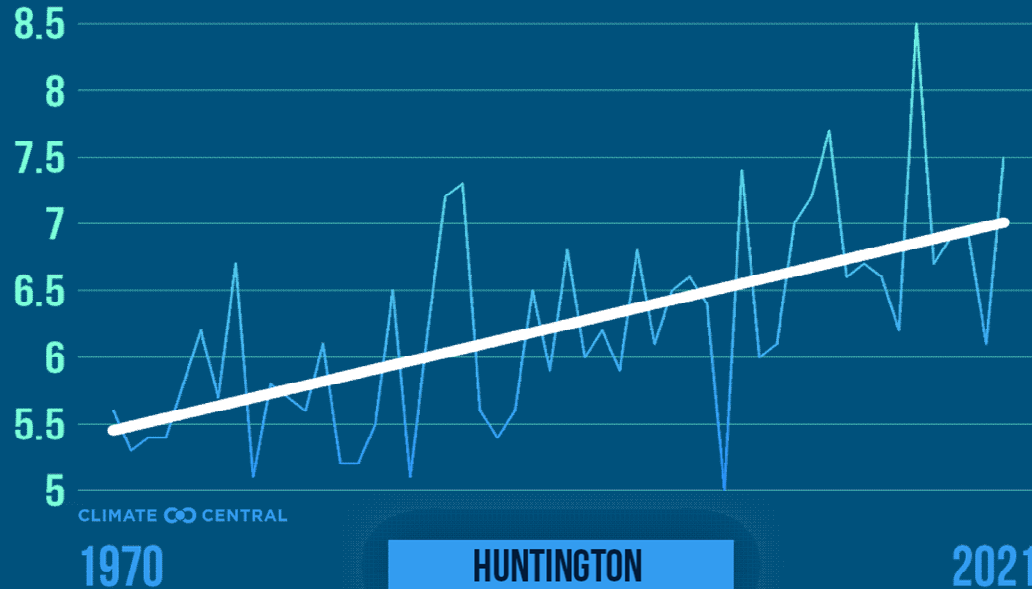
Warmer air holds more water

- Atmosphere expands (think balloon)
- Increases amount of water it can store
- Warmer temperatures increase evaporation from forests, soils, and water bodies
- Small increase in air temperature = disproportionately large increase in water vapor
- More frequent storms, extreme rainfall, and floods



Extreme rainfall is increasing

Annual average hourly rainfall (hundredths of inches)



- Hourly rainfall intensity increasing throughout US
- Huntington has 28% more hourly rainfall now than in 1970

May 2022



More extreme rainfall across WV

Aug 2021 Huntington



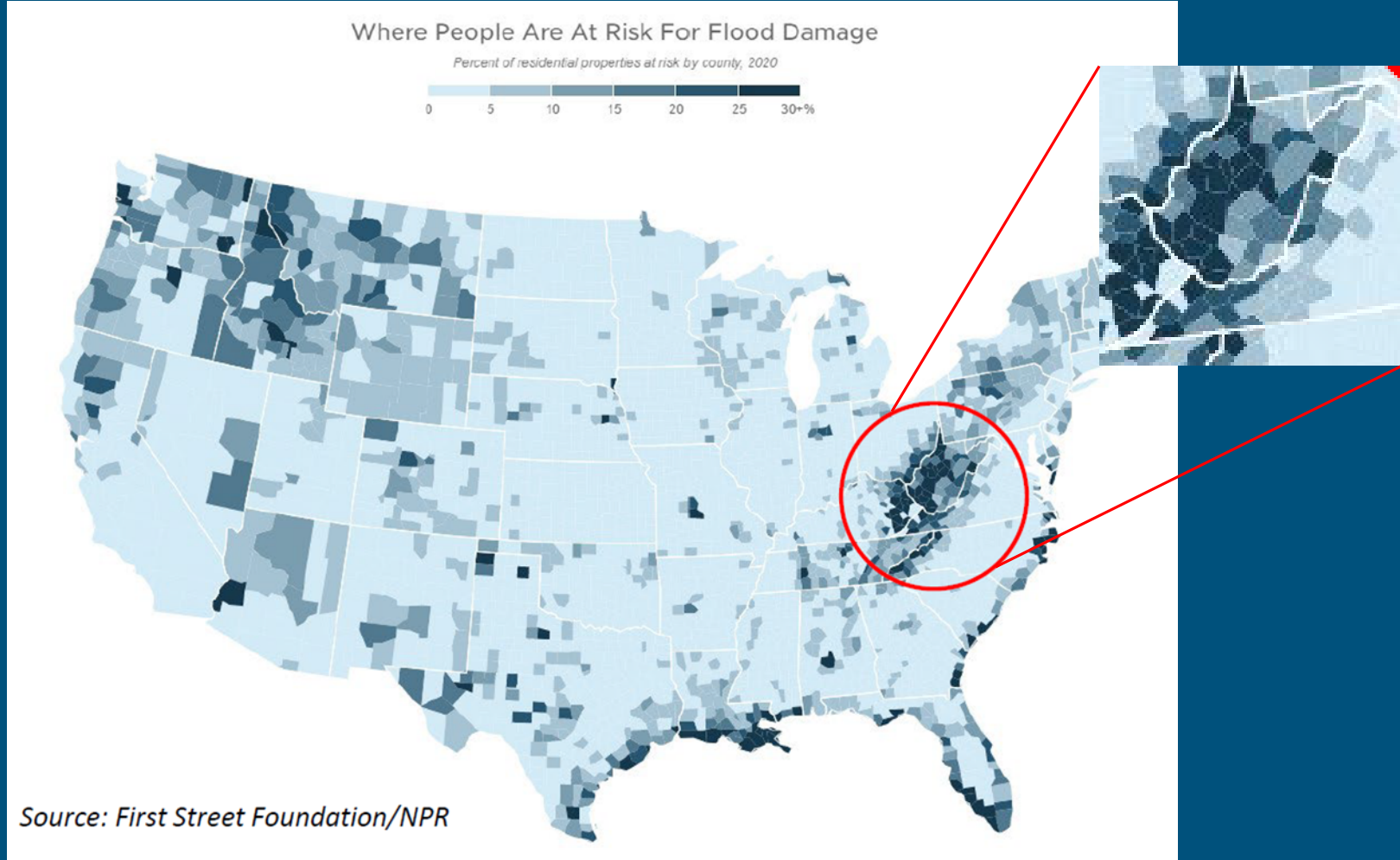
June 2021 Morgantown



July 2021
Morgantown



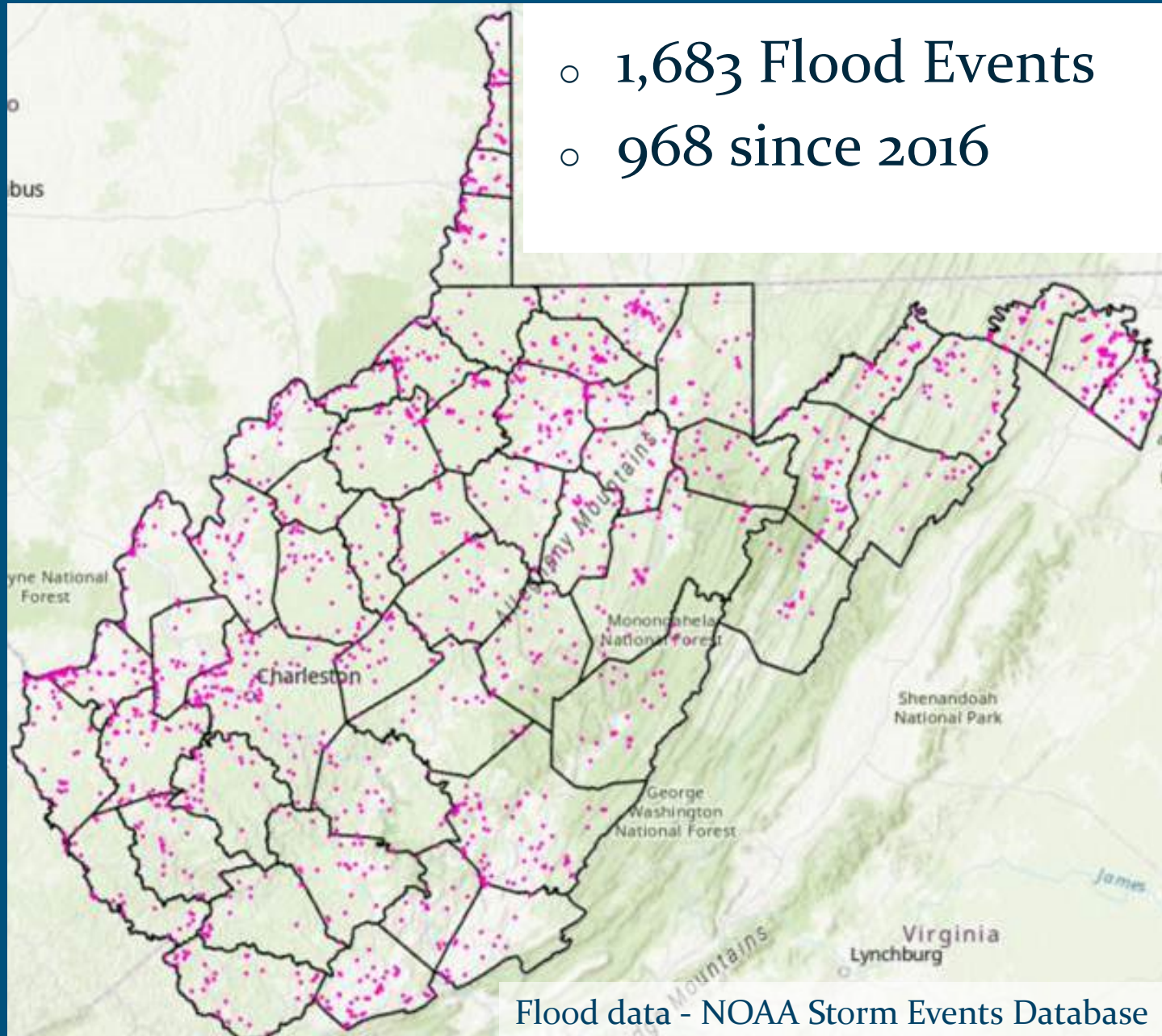
Current flood risk in West Virginia



Slide courtesy Mat Sanders, The PEW Charitable Trusts

Recent Flood History: 2007 – March 2022

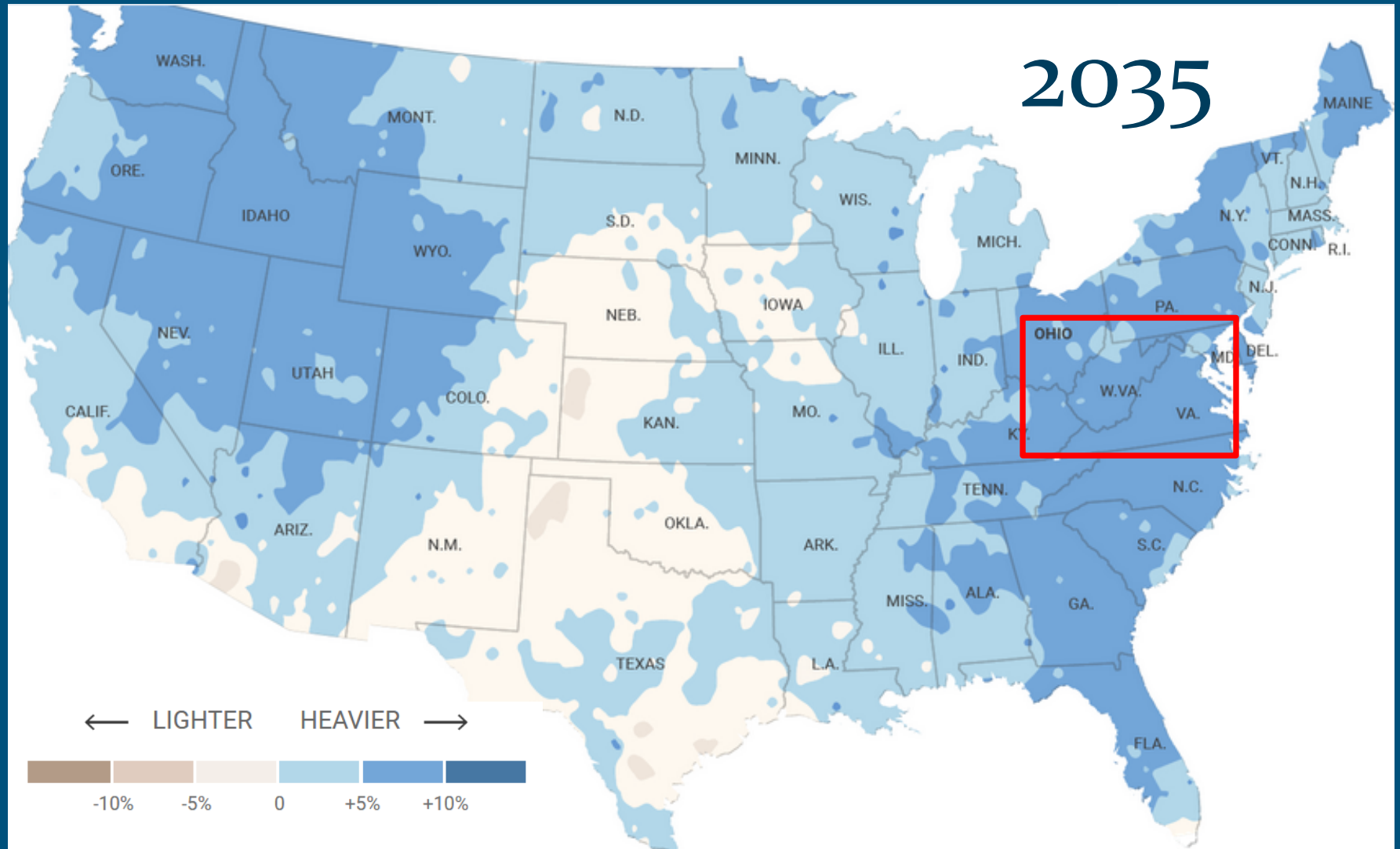
- 1,683 Flood Events
- 968 since 2016



Flood data - NOAA Storm Events Database

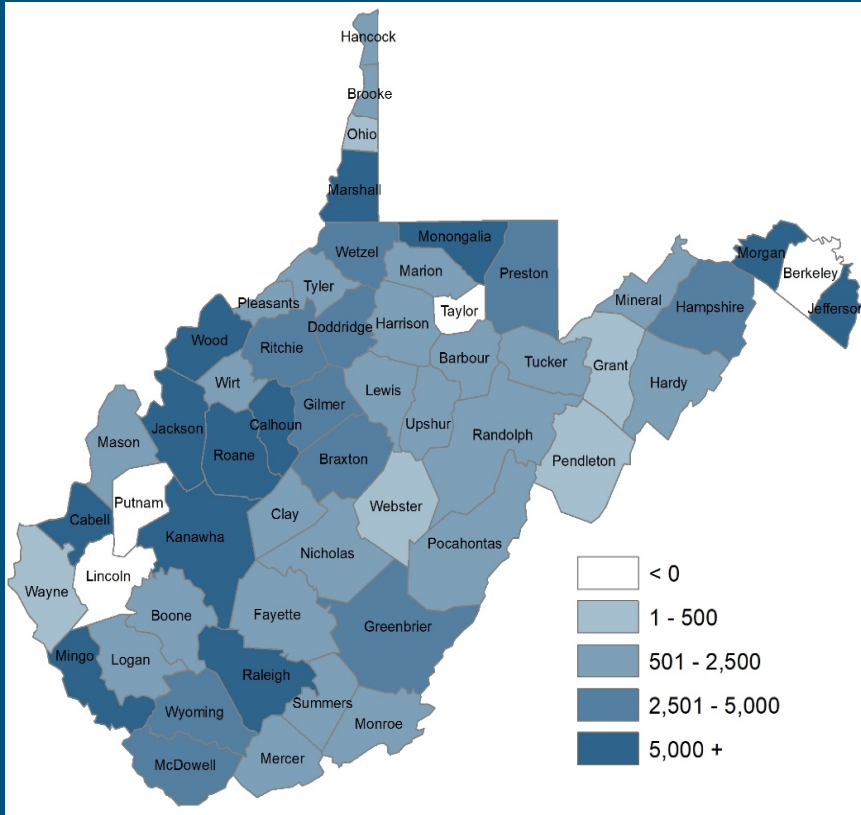
Future extreme rainfall

Change in extreme rain compared to 1980-2010 average

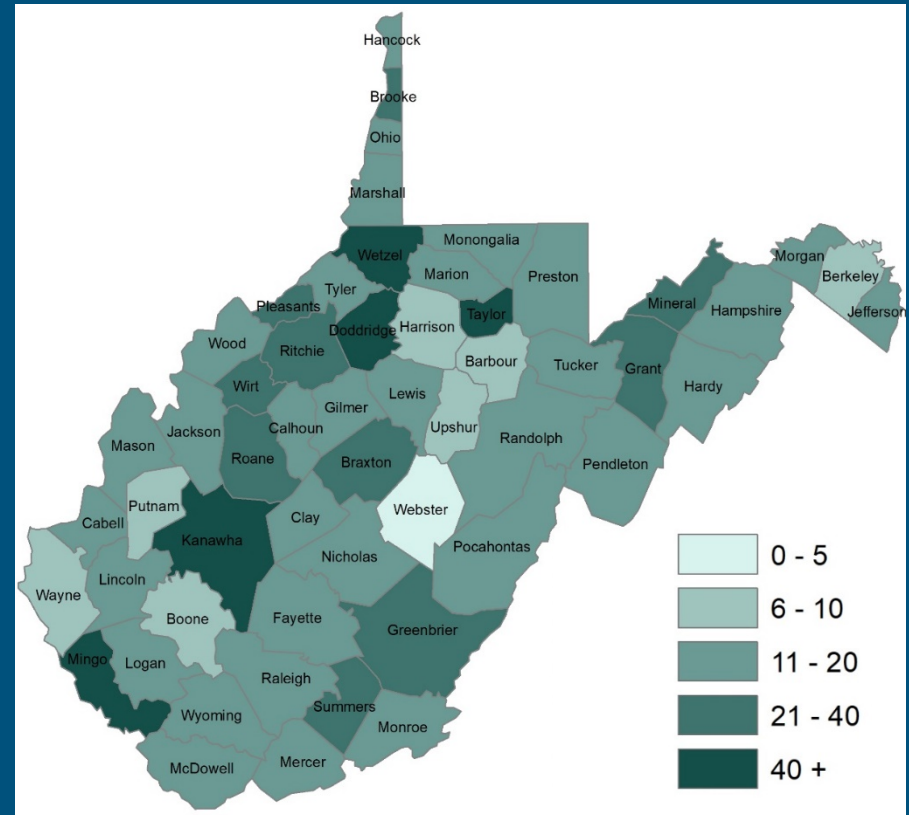


Flooding will only increase...

Number of properties at risk of
flooding by 2050



Percent change properties at risk of
flooding by 2050 compared to 2020



WV Properties at risk

57% fire stations

46% roads at risk

37% commercial

56% police stations

38% schools

<https://firststreet.org/flood-factor/>

“He started crying on me, it was happening so fast, and I, literally, I shook him,” Bentley recalled. “I said, ‘Son, listen. We’re fighting for our lives now — you’ve got to keep it together.’” Todd Bentley, Harless Creek, KY 2010



Adult perspectives on climate change



CNN asks West Virginia residents about climate change. See their responses

The Lead

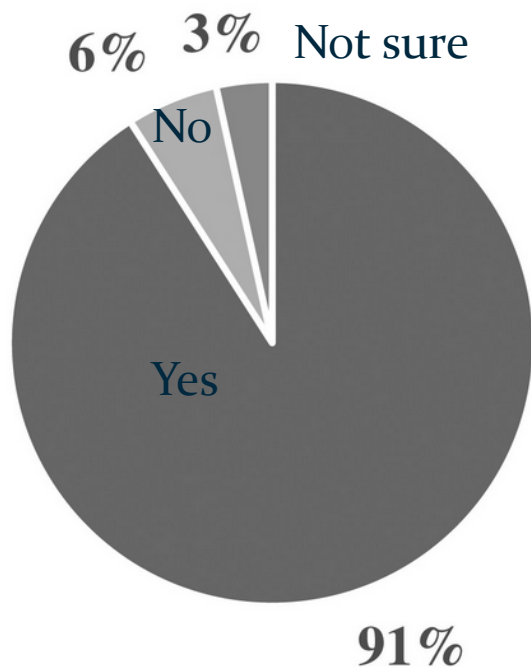
West Virginia continues to grapple with the effects of the climate crisis after the town of Clendenin was nearly wiped off the map in 2016 in what was dubbed the "thousand year flood." CNN's Rene Marsh reports as Sen. Joe Manchin (D-WV) continues to fight legislation aimed at combating severe weather.

<https://www.cnn.com/videos/politics/2021/10/19/west-virginia-climate-crisis-joe-manchin-marsh-dnt-lead-vpx.cnn>

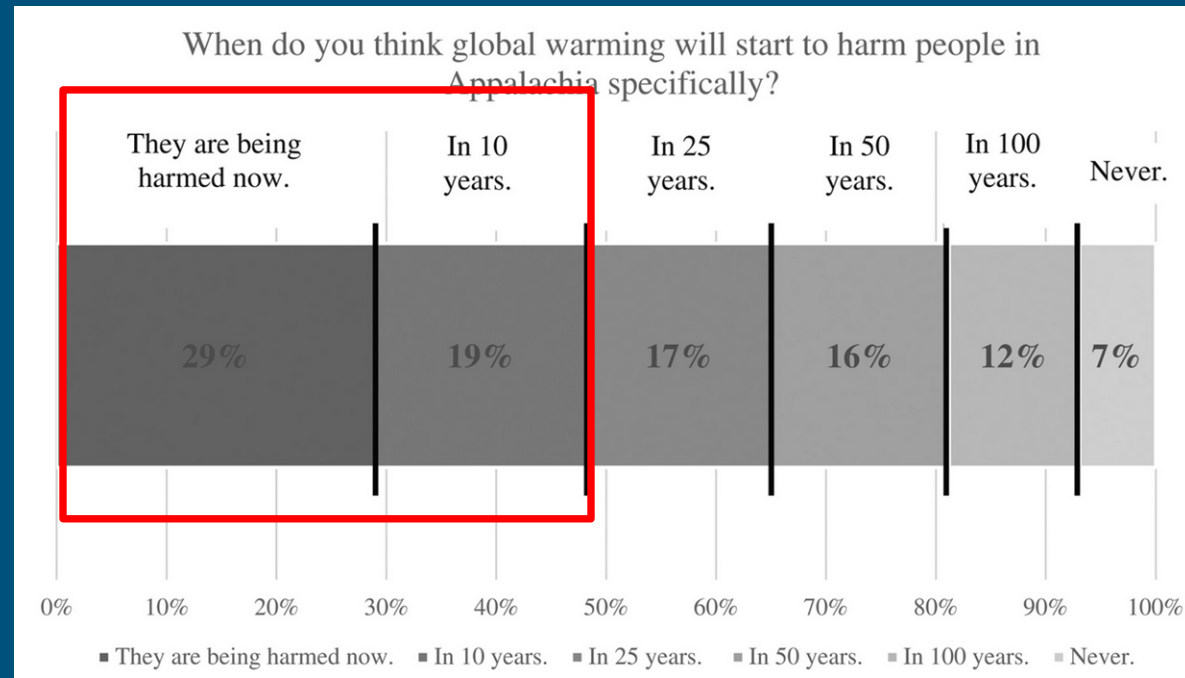
Young adult perspectives on climate change

Surveyed and interviewed Appalachian students

Do you think global warming is happening?



When do you think global warming will start to harm Appalachia?



Exploring Climate Change Perspectives. An Analysis of Undergraduate Students' Place-Based Attachment in Appalachia, USA, *Rural Sociology* 2022

“The **coal industry is putting food on his table** his entire life, and then you're going to go and take it away from him...” Focus Group 2, 2017

My main concern is my inability to have a future and to experience life as an independent adult... **what is my future going to look like?** How is society going to adjust to these massive changes and who is it going to affect the most?” Interview 20, 2020

“..I remember growing up always hearing in my house about that **climate change wasn't real...**” Interview 18, 2020

“...it's **really frustrating** because the more I learn about stuff, the more overwhelming it becomes. **I want to do my best to make a difference...**but it's frustrating knowing that the cause of all of this is out of my hands... there's nothing I can do to make a difference...” Interview 24, 2020

“I am **exhausted every day waking up** because I feel this overarching sense of dread... when I try to talk to my parents about it or other people, they just chose to not delve into the issues” Focus Group Participant 11, 2020

Climate Resilient Futures



The latest action comes after the **global strike on 15 March**, when more than 1 million young people globally demanded action to tackle the climate crisis. Photograph: Gary Calton/The Observer



Environmental activists rally during the Global Climate Strike in central London. (BEN STANSALL/AFP/Getty Images)



Youth organizers led a Climate Strike in Portland, Maine, in September 2019. Credit: AP Photo/Robert F. Bukaty

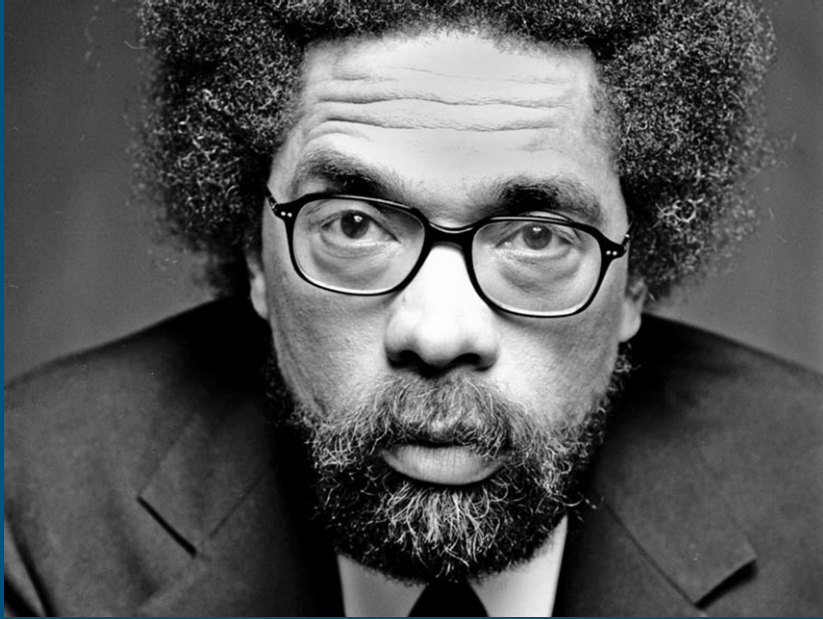
Climate change is overwhelming



Isaac Cordal

How do we move forward?

What is Hope?



-Dr. Cornel West

“Hope is about everybody trying to contribute to the push, the motion, the momentum, the movement for something bigger than them[selves]..”

“Hope and optimism are different. Optimism tends to be based on the notion that there's enough evidence out there to believe things are gonna be better...

Hope looks at the evidence and says, ‘It doesn't look good at all. Doesn't look good at all’.

[But we are] gonna go beyond the evidence to create new possibilities... that allow people to engage in heroic actions always against the odds, no guarantee whatsoever.”

Importance of Hope

Hope is imbued with a positive feeling about the future (Olaja, 2012).

Only when we are hopeful and when we believe we have a role to play, will we act.

Hope requires **agency**— the belief the *I* am the cause of *my own* thoughts and actions

Agency requires **self efficacy** – one's own beliefs that they...
have control over events that affect their lives
have purpose and can fulfill that purpose

Efficacy requires **confidence** – Requires foundational knowledge of how the world works

Teaching narratives that sow Hope

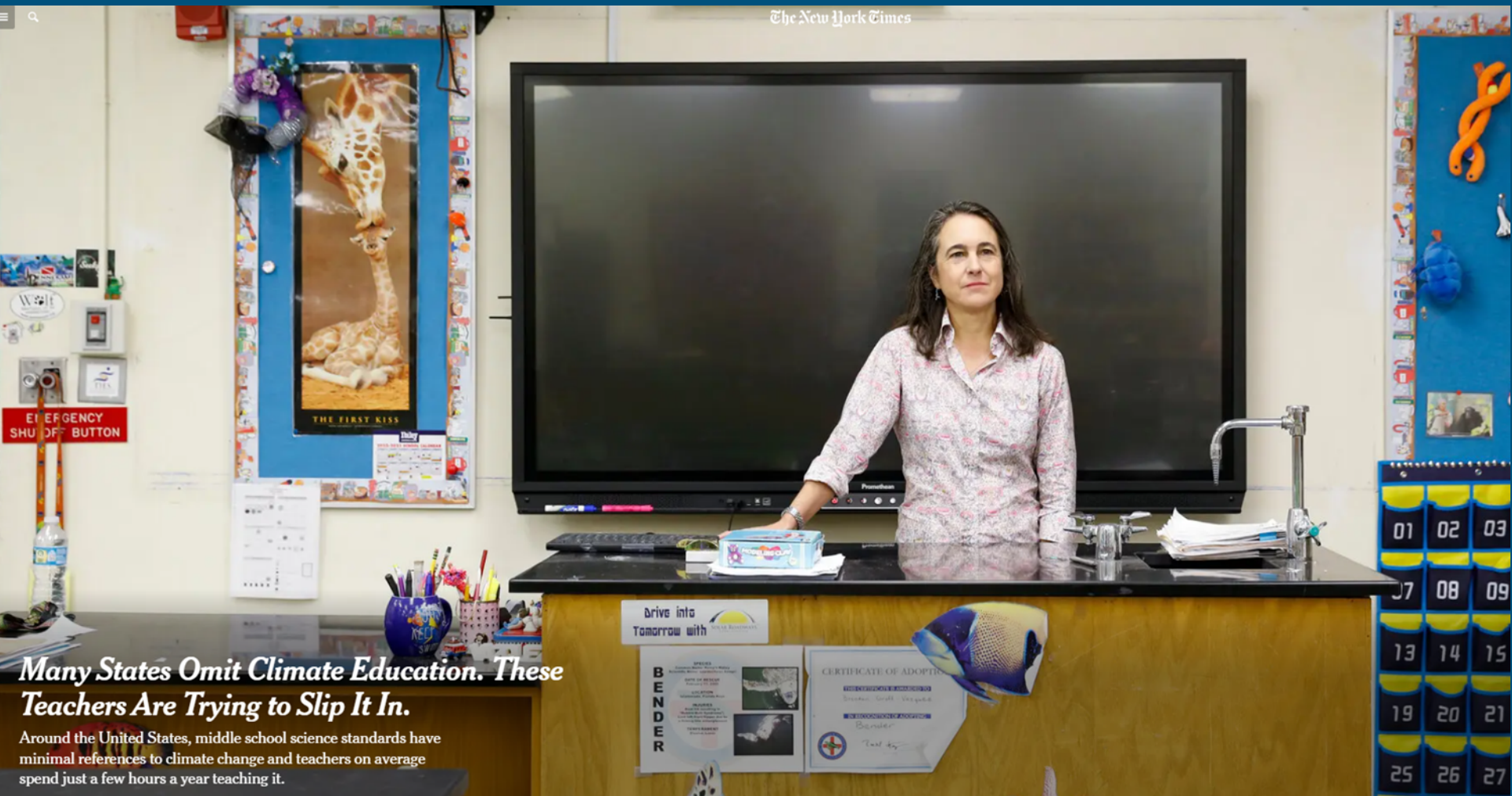
- Arc of Hope: Confidence – Efficacy – Agency
- Place-based learning
- Focus on solutions not debate
- Youth participation in research, planning, & decision making

Example learning activities

- WV ClimateLink/Project PACT
- West Virginia Forests
- Rebirth of the Cheat River

Many States Omit Climate Education. These Teachers Are Trying to Slip It In.

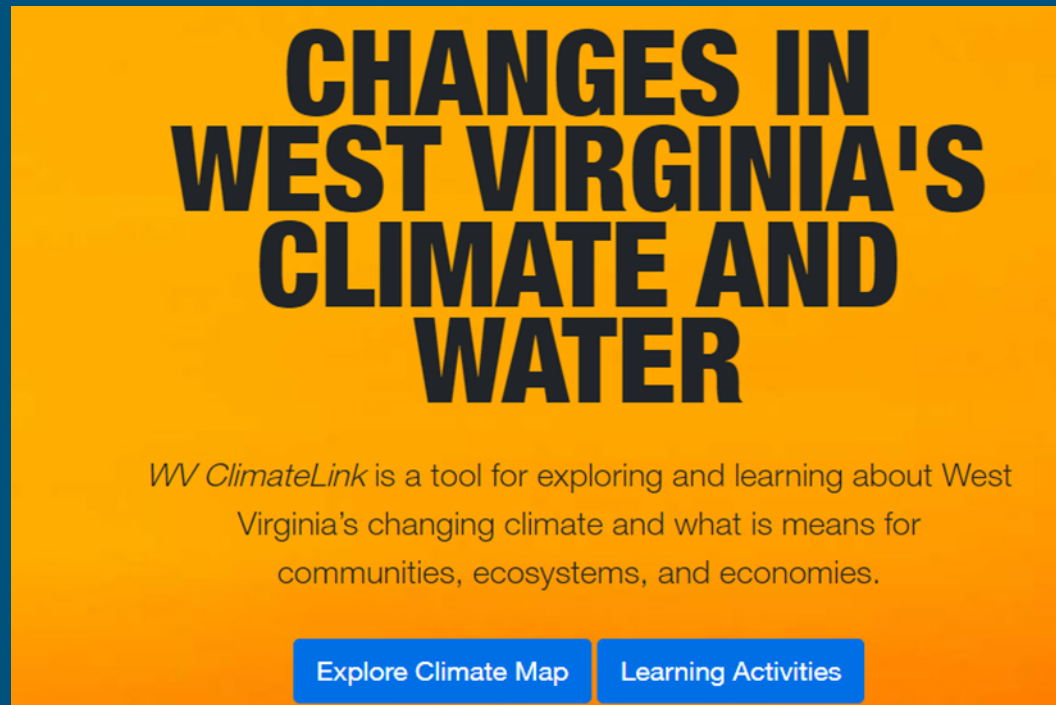
Around the United States, middle school science standards have minimal references to climate change and teachers on average spend just a few hours a year teaching it.



<https://www.nytimes.com/2022/11/01/climate/middle-school-education-climate-change.html>

Teaching narratives that sow Hope

- WV ClimateLink – <https://wvclimatelink.wvu.edu/>



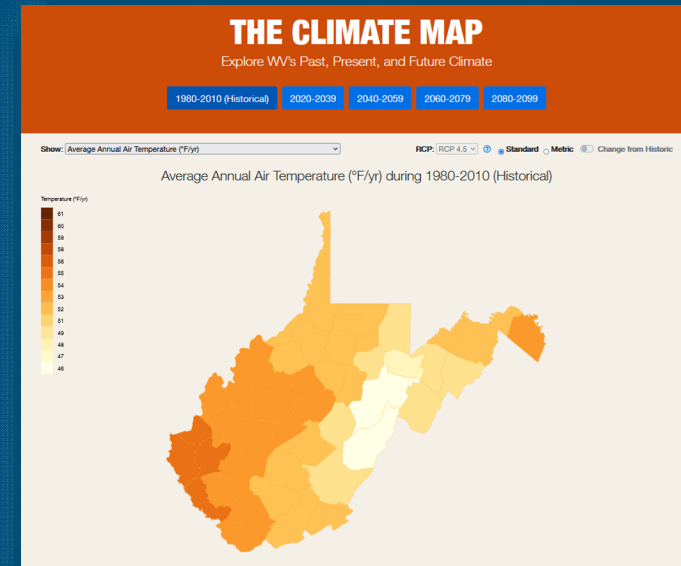
Climate – Ecology – Natural Resources –
Geography – Chemistry – History – Economy –
Resilience – Planning – Restoration – Civics

Preparing Agents of Change for Tomorrow (PACT)

Tier 1 – Climate & Resilience Literacy

WV ClimateLink

- On-line interactive atlas
- Data repository
- Learning Activities
 - Existence
 - Causes
 - Consequences
 - Stories of Resilience
 - Solution



Climate Change Activities

Learning activities for students, teachers, citizens, and decision makers

EXISTENCE



Explore data that demonstrates the existence of climate change.

[View Existence Activities](#)

CAUSES



Explore what is driving changes in global temperatures.

[View Causes Activities](#)

CONSEQUENCES



Explore what changes in climate mean for West Virginia and beyond.

[View Consequences Activities](#)

SOLUTIONS



Explore what can be done to help solve the climate crisis.

[View Solutions Activities](#)

Preparing Agents of Change for Tomorrow (PACT)

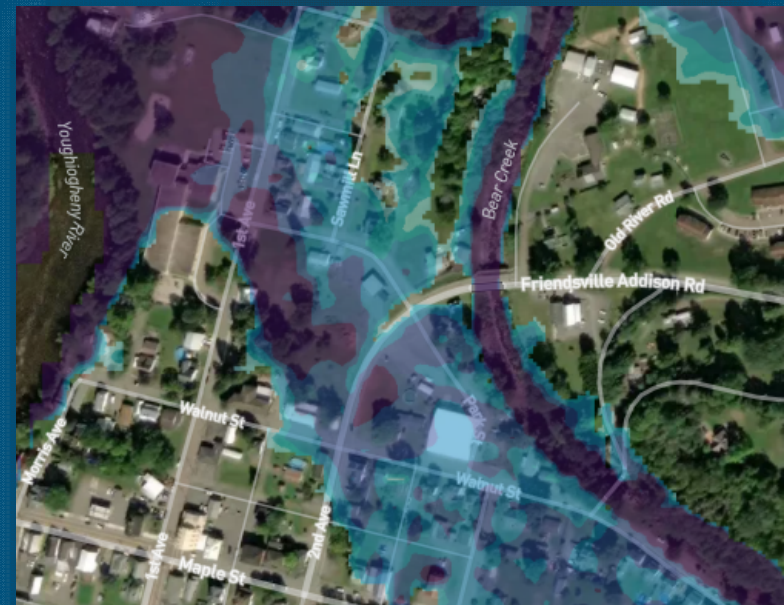
Tier 2 – Resilience Planning

Youth-led mapping

- Socioeconomic indicators
- Landscape features
- Critical infrastructure
- Hazards identification
- Disaster preparedness
- Community Resilience Planning

Youth-led plans

- Community workshop
- Submission to SRO



Preparing Agents of Change for Tomorrow (PACT)

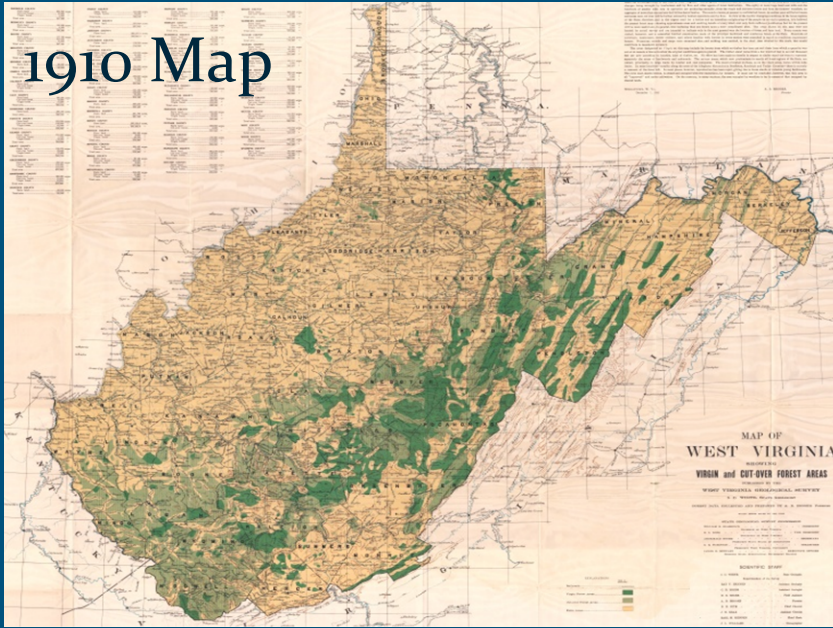
Tier 3 – Youth Resilience Leadership Summit

- Youth presentations to larger community of public, officials, scientists, decision makers
- Learn about vulnerability & resilience in other communities
- Share experiences and develop peer network of Youth Ambassadors
- Participate in workshops on climate, water management, adaptation, and resilience planning careers

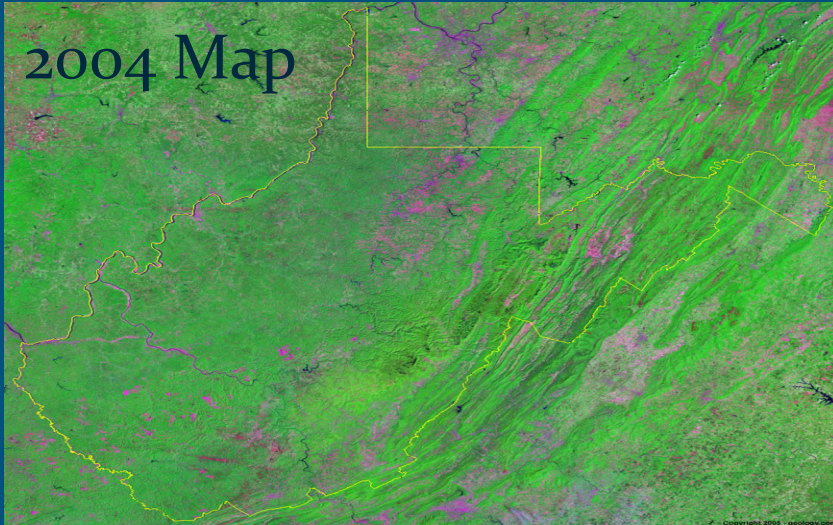
PACT curriculum –publicly bundled and distributed

West Virginia Forests

1910 Map



2004 Map



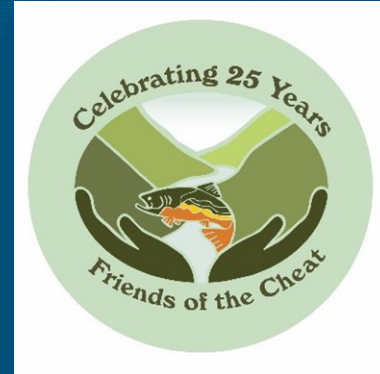
- Provides oxygen for 1.8 billion people and water for 10% US population
- Stores 56% of all above-ground carbon
- Provides freshwater & regulates flooding
- Mitigates 1.3 millions tons of pollution
- Generates \$25 billion in recreation spending

Rebirth of the Cheat River



- Acid mine drainage
- 10 most endangered rivers
- Catastrophic flooding
- Post-coal transition

Rebirth of the Cheat River



- Water quality
- Smallmouth, trout, muskie
- Hellbender
- Economic development
- Albright Dam removal



MOUNTAINEER TRAIL NETWORK

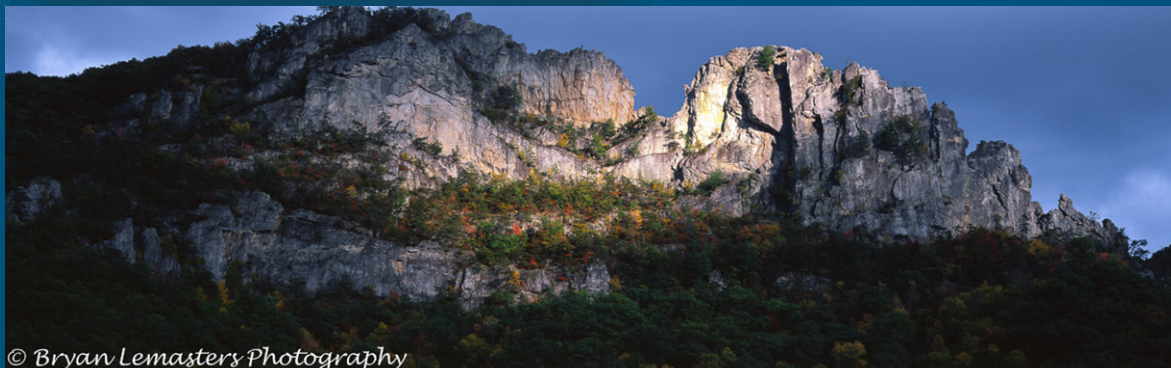
PRESTON COUNTY
MASTER TRAIL PLAN



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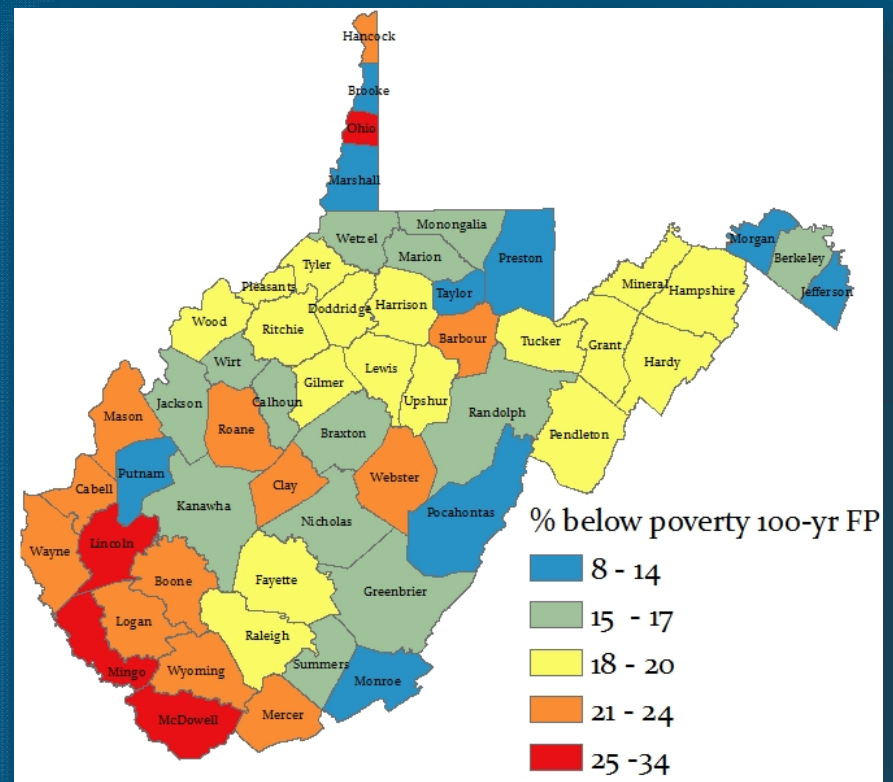
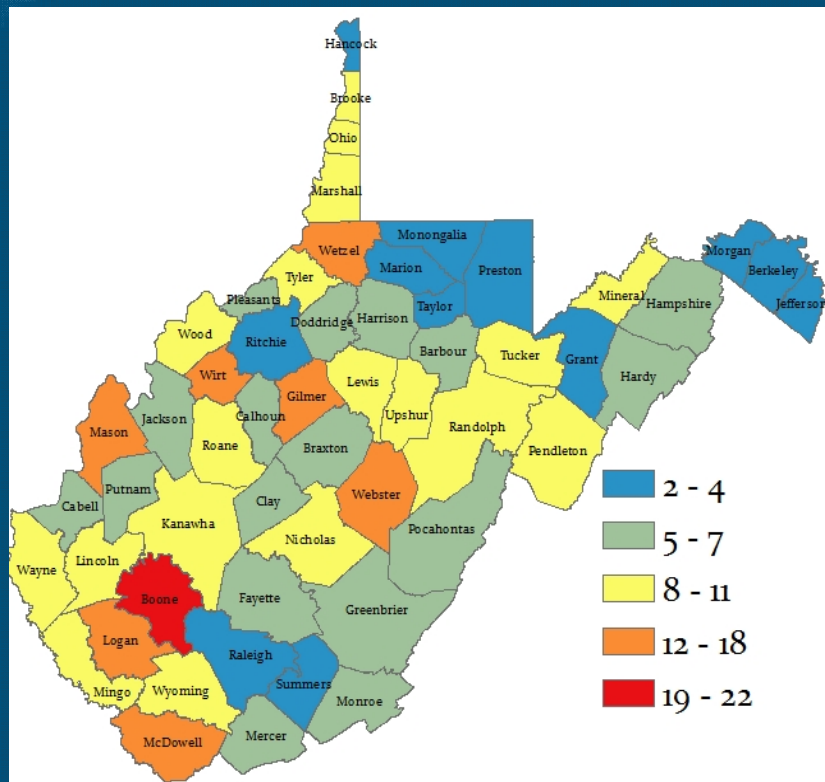
Supplementary Slides

High Vulnerability

- 7% Population in flood zone
- 11% Housing in flood zone
- 14% Renter occupied units in flood zone
- 19% Poverty rate in flood zone

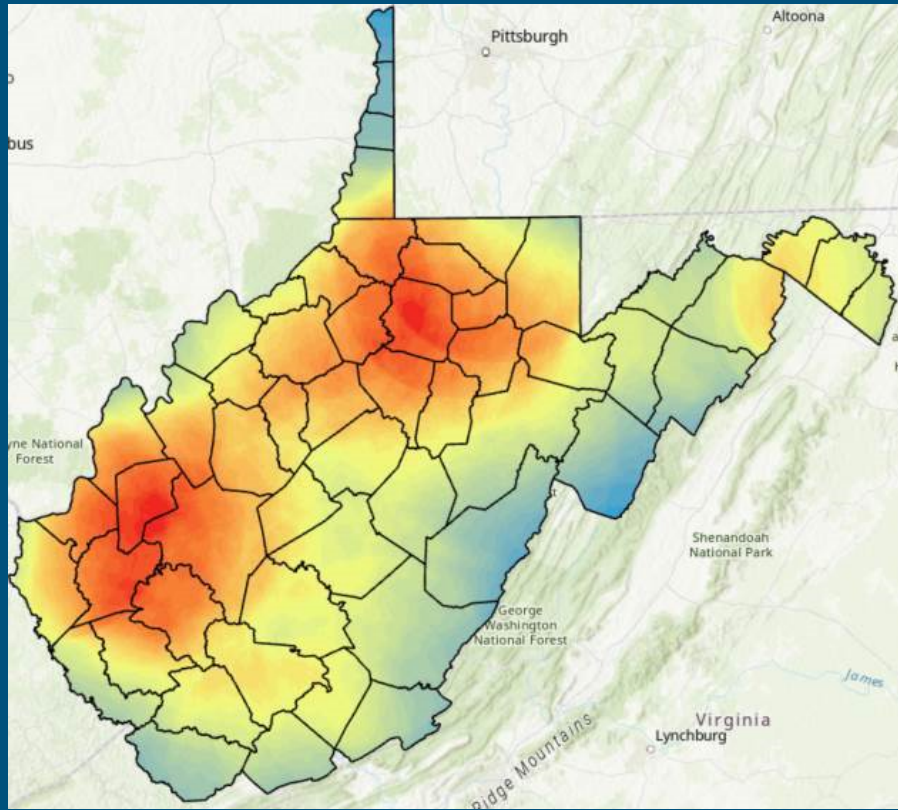
% population living in 1% floodplain

% population below poverty line in 1% floodplain

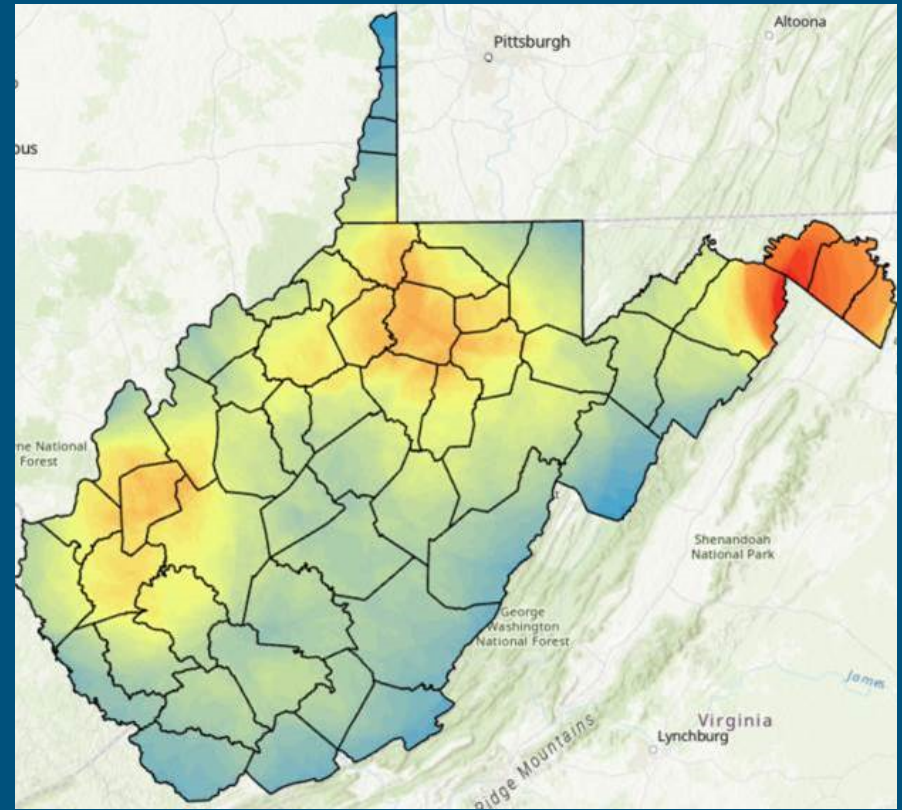


Flooding Hotspots

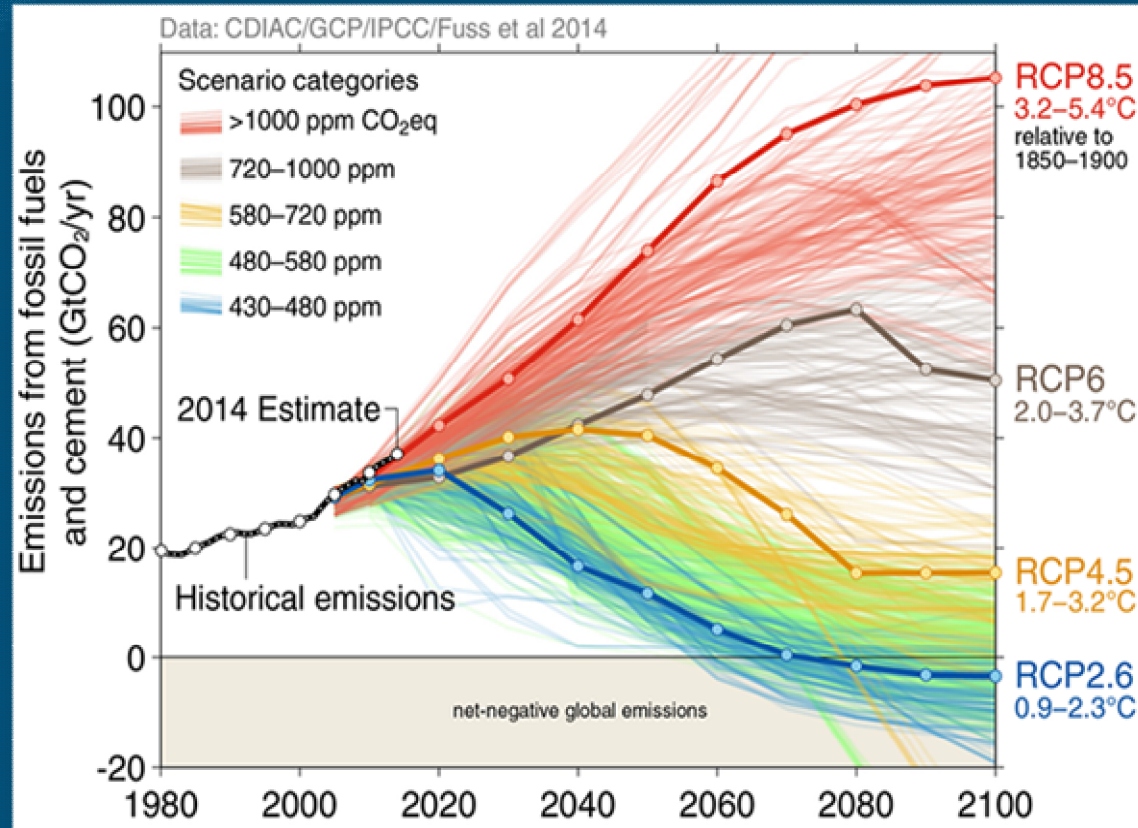
Flash Floods



Riverine Floods



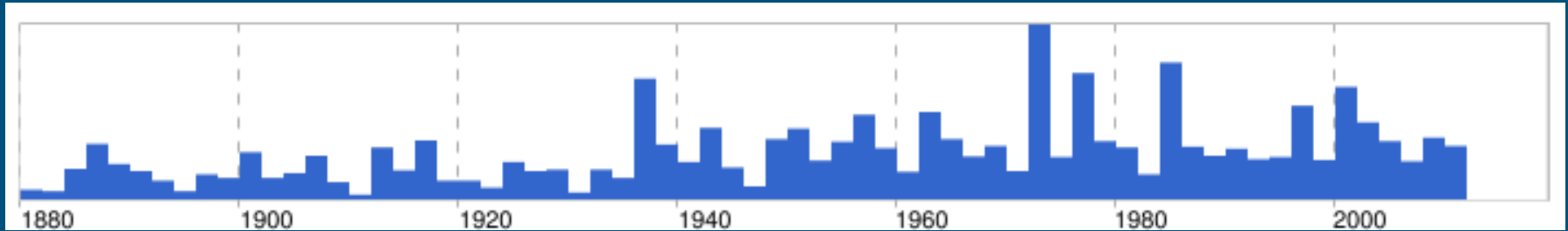
There is no crystal ball... but there is science



Envelope for decision making

Scenario	CO ₂ Equivalent	Temp change
Current	419 ppm	1.8 °F
Future - CO ₂ rises	1,370 ppm	5-10 °F
Future - Co ₂ stabilizes	650 ppm	2-4 °F

Number of floods in WV



Parkersburg- 1884



West Union - 1939



Gilbert - 2009



November 1985



Mullens - 2001



Huntington - 2022



WSAZ

Summary of floods: 2007 – March 2022

	Total	Riverine	Flash
No. Events	1,683	851	832
Deaths	34	12	22
Property Damage	\$54,605,260	\$19,418,060	\$35,187,200

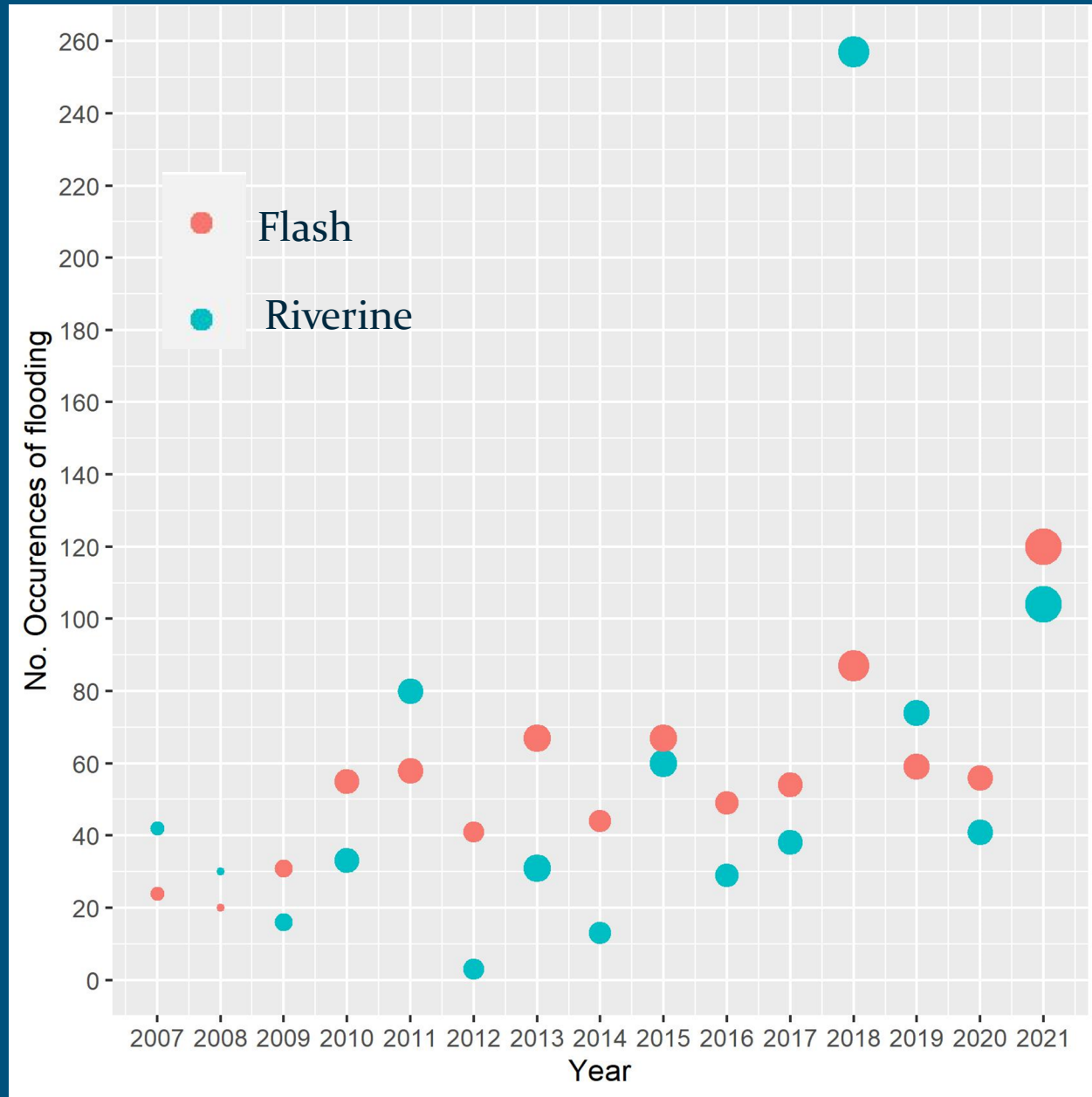
Flash floods are WV's
greatest hazard

49% of all floods

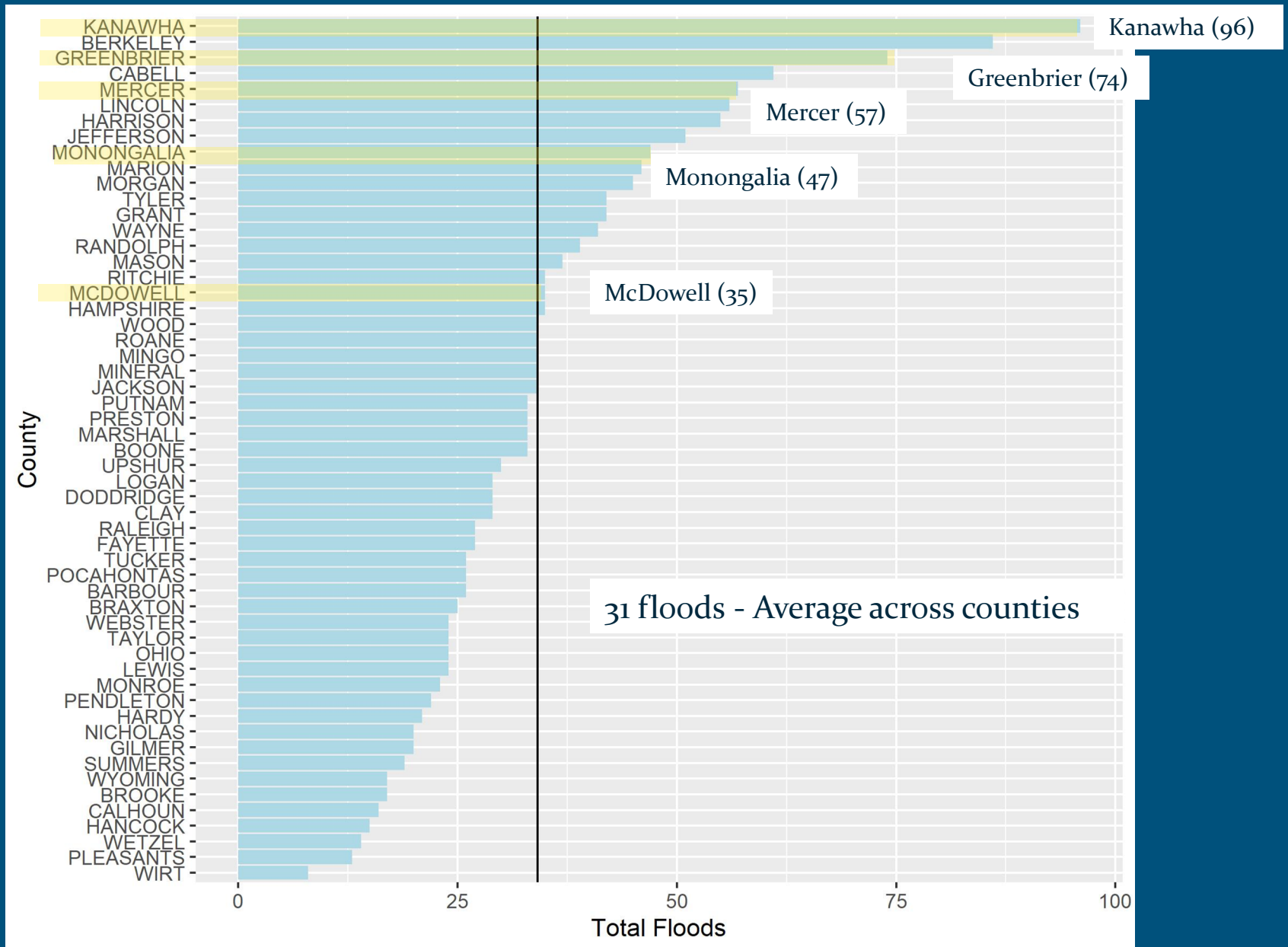
65% of fatalities

65% of property damage

Flooding in WV is on the rise



Every WV county experiences flooding



Why WV floods

- High rainfall
- Heavy rainfall exceeds soil infiltration

