



WEST VIRGINIA
RIVERS

Risks and resiliencies for Town Run water security

Nathaniel “Than” Hitt, PhD
WV Rivers Coalition

10 October 2024

are now in the Town Run Watershed

Your Watershed



As you walk along the stream, you are now in the Town Run Watershed. This watershed is one of the 100 watersheds in the County of York. It is a small watershed, but it is an important one. The Town Run Watershed is a small watershed, but it is an important one. The Town Run Watershed is a small watershed, but it is an important one.

Water flowing to the south in the Town Run watershed originates from the surrounding area. The water flows into the stream, and then into the Town Run watershed. The water flows into the stream, and then into the Town Run watershed. The water flows into the stream, and then into the Town Run watershed.

For more information, visit www.townrunwatershed.com or call 905-477-1234.

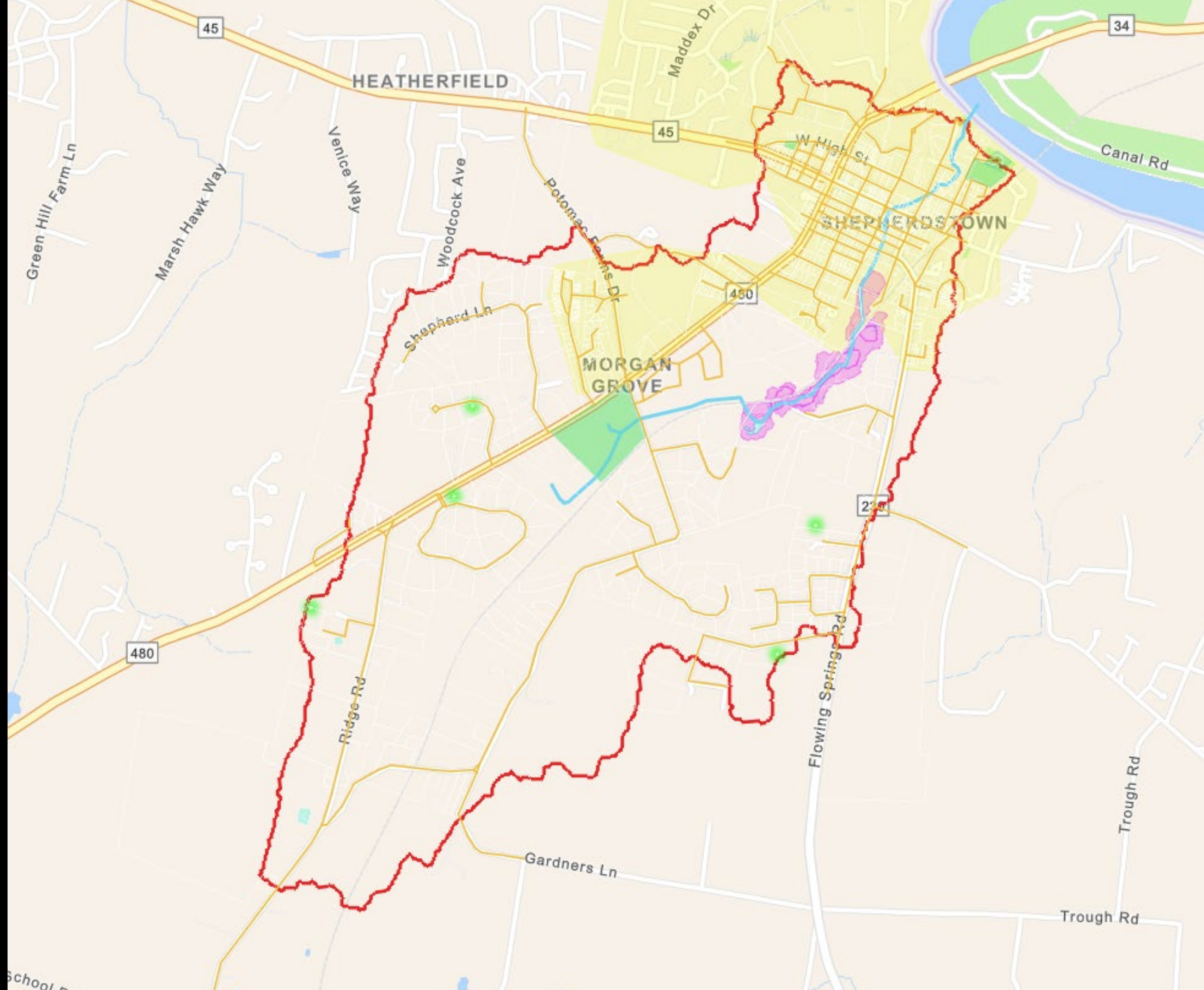
Stream restoration in progress



Town Run Watershed

Providing clean water and
habitat for all.







Water for...

Drinking

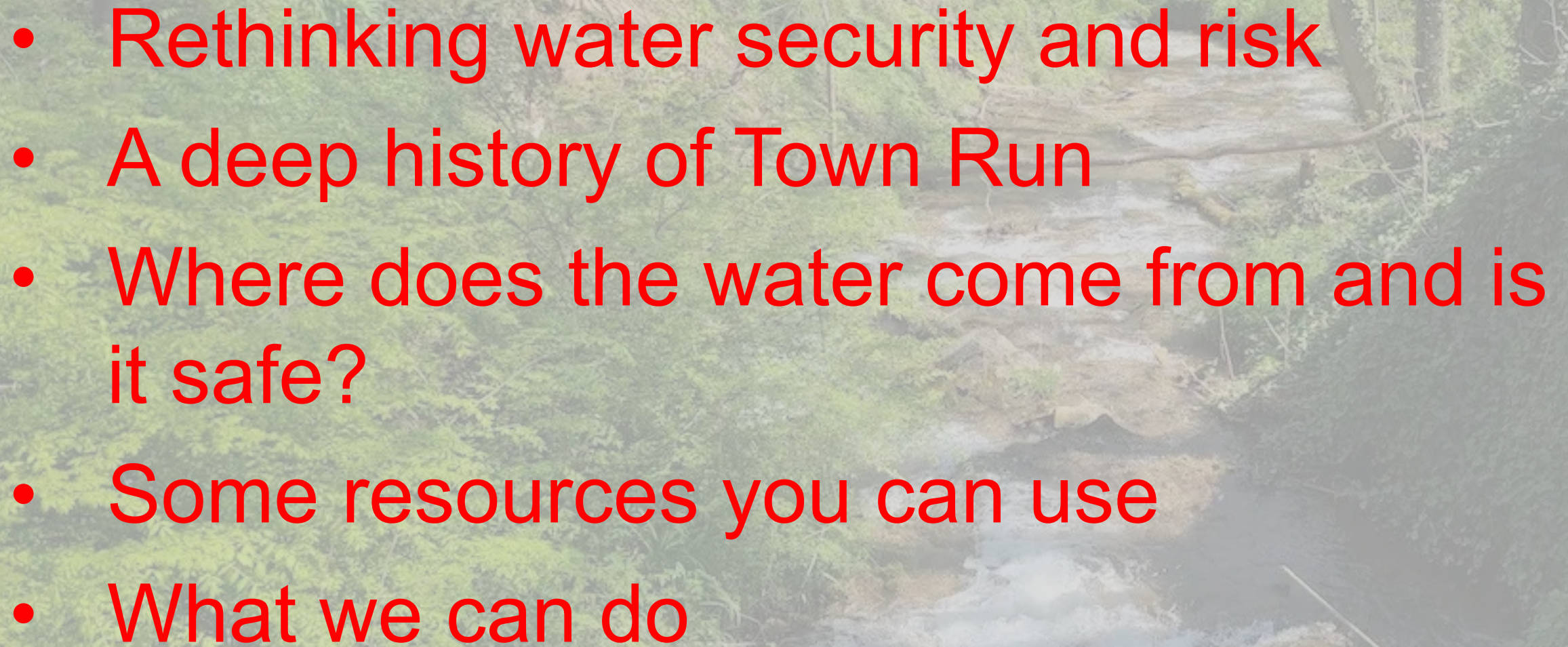
Industry

Irrigation

Recreation

Sanitation



- 
- Rethinking water security and risk
 - A deep history of Town Run
 - Where does the water come from and is it safe?
 - Some resources you can use
 - What we can do

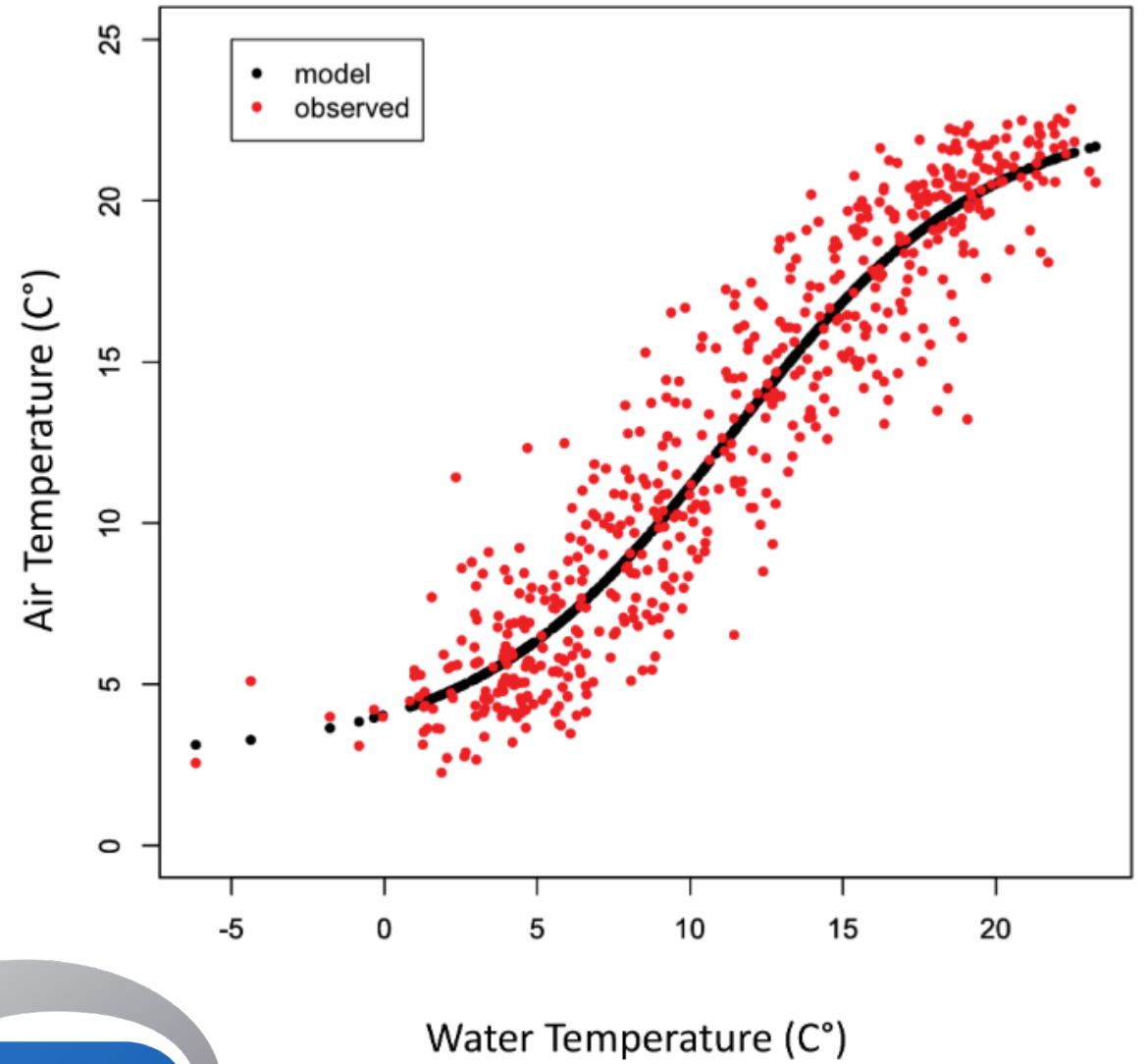


THE COLLEGE OF
WOOSTER

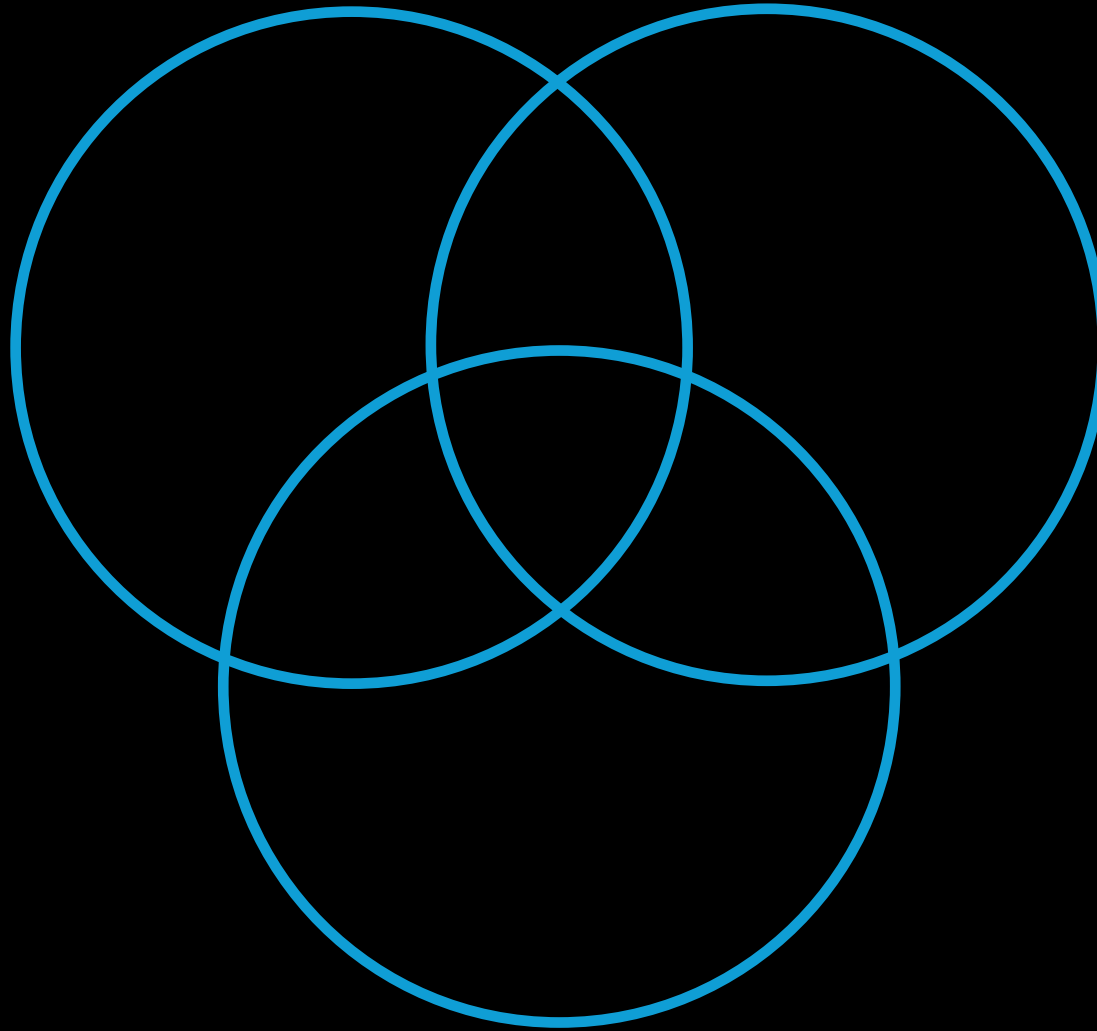


WEST VIRGINIA
RIVERS





Public lands

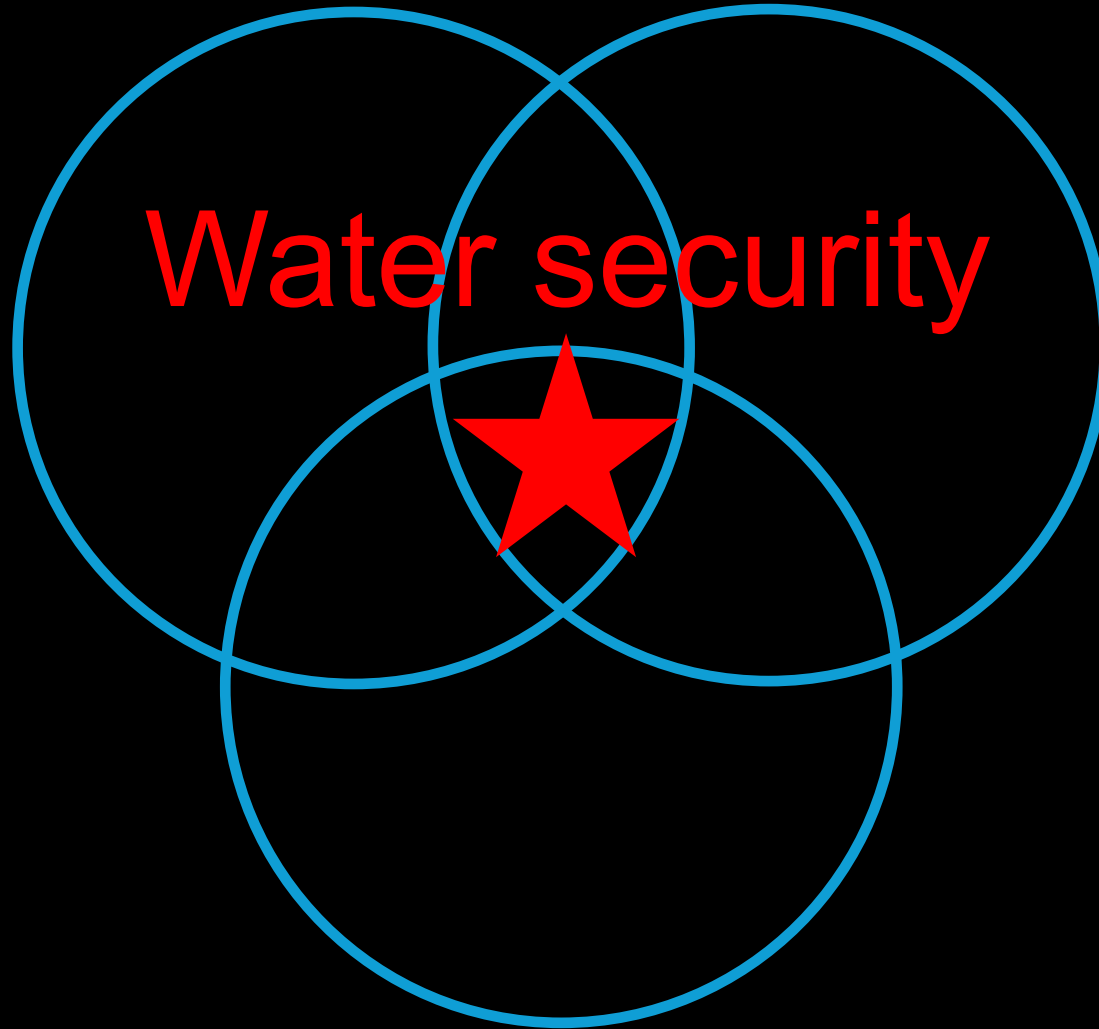


Public health

Wildlife



Public lands



Water security

Public health

Wildlife



Water quality and quantity

=

Water security



Clean water for all

=

Water security



Ecosystems are infrastructure

=

Water security





Hurricane Milton



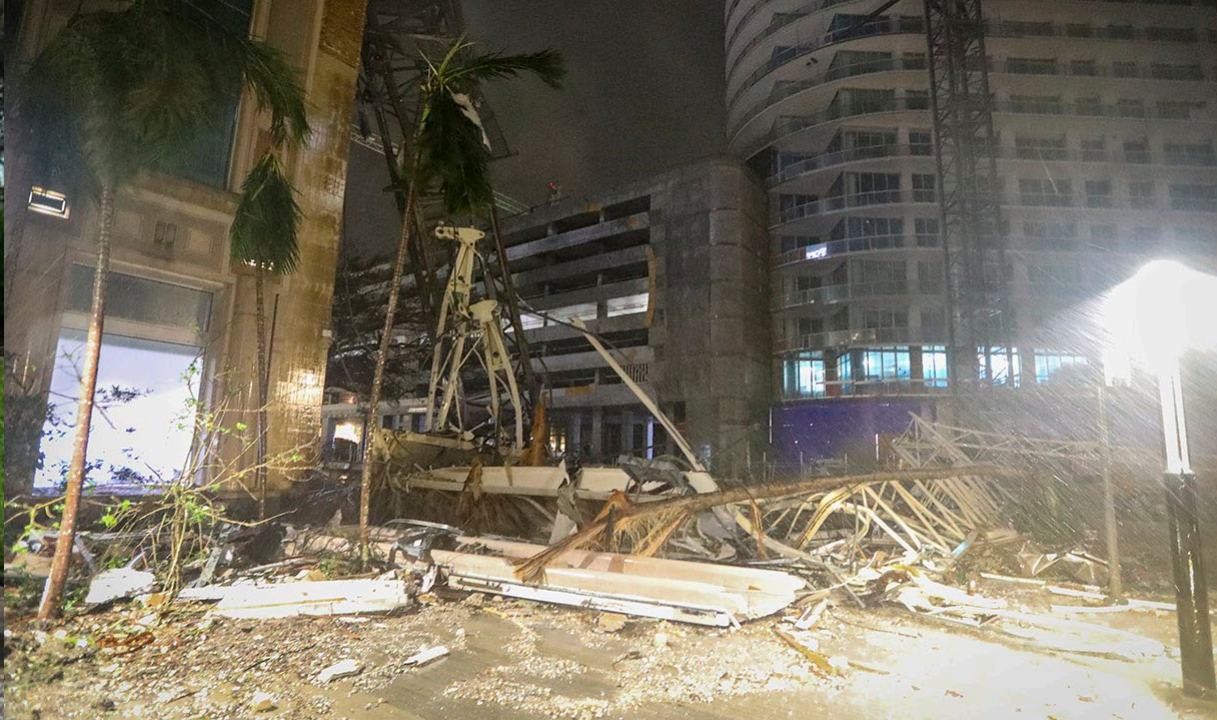
Hurricane Milton

Tampa Bay braces for what could be strongest storm in a century

Hurricane Milton's current track threatens to strike one of the most vulnerable and populated stretches of U.S. coastline.

🔊 9 min 🔗 📌 🗒 5737





Hurricane Milton



Hurricane Helene



Hurricane Helene



Hurricane Helene

CLIMATE

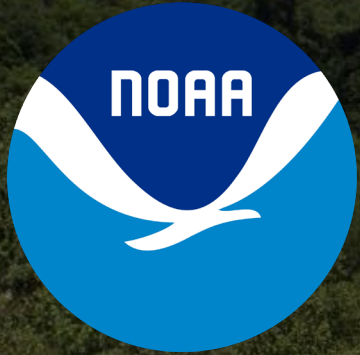
Climate change boosted Helene's deadly rain and wind and scientists say same is likely for Milton

AP



NOAA NATIONAL CENTERS
FOR ENVIRONMENTAL INFORMATION

STATE CLIMATE SUMMARIES 2022



WEST VIRGINIA

Key Messages

Narrative

Downloads

<https://statesummaries.ncics.org/chapter/wv>

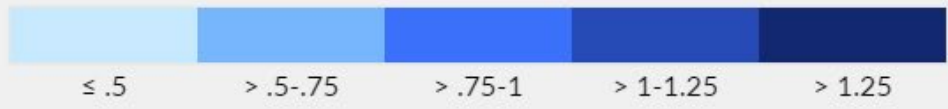


Key findings for WV:

- **Air temperatures** have increased by 1°F since 1895
- Total annual **precipitation** has increased since 1895
- The intensity of **extreme weather events** has increased and is expected to further increase

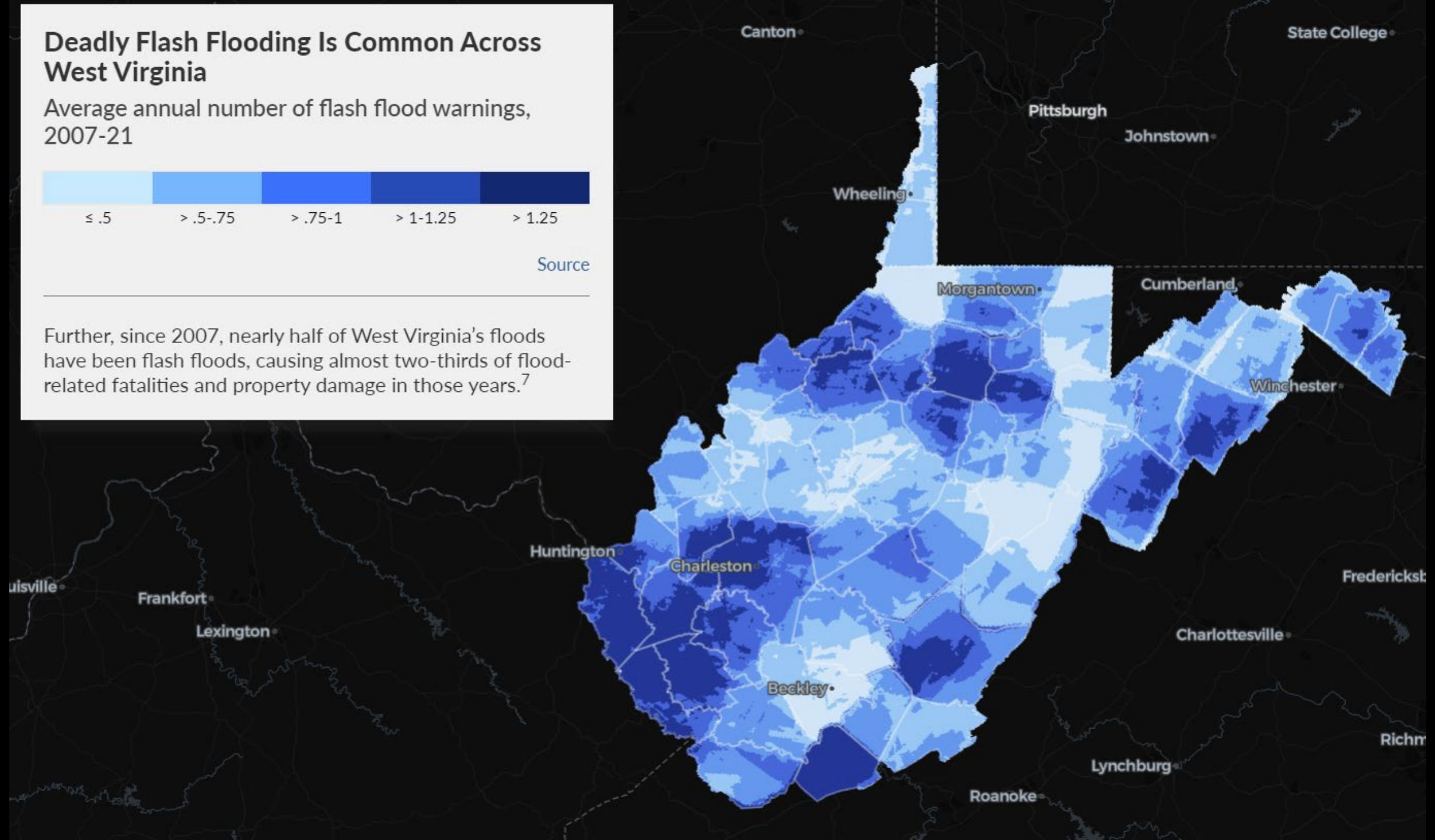
Deadly Flash Flooding Is Common Across West Virginia

Average annual number of flash flood warnings, 2007-21



Source

Further, since 2007, nearly half of West Virginia's floods have been flash floods, causing almost two-thirds of flood-related fatalities and property damage in those years.⁷





Valley fills increase flood risk



Impervious surfaces increase flood risk

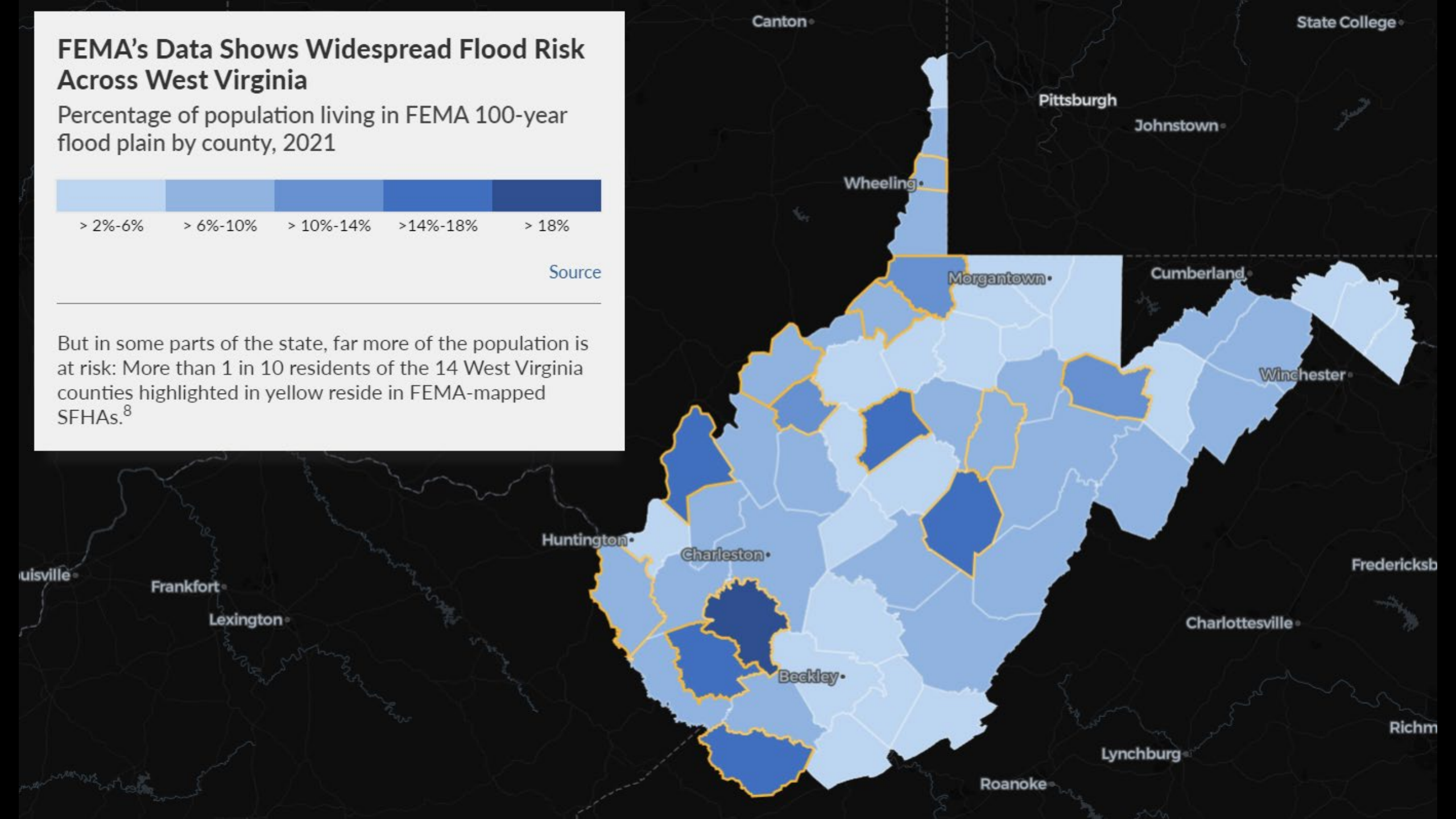
FEMA's Data Shows Widespread Flood Risk Across West Virginia

Percentage of population living in FEMA 100-year flood plain by county, 2021



Source

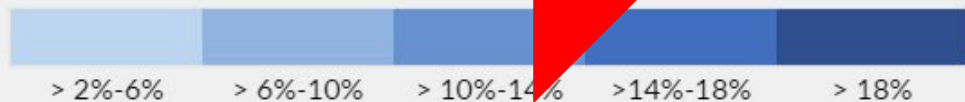
But in some parts of the state, far more of the population is at risk: More than 1 in 10 residents of the 14 West Virginia counties highlighted in yellow reside in FEMA-mapped SFHAs.⁸



FEMA's Data Shows Widespread Flood Risk

Underestimates risk
in most cases

100-year



Source

But in some parts of the state, far more of the population is at risk: More than 1 in 10 residents of the 14 West Virginia counties highlighted in yellow reside in FEMA-mapped SFHAs.⁸

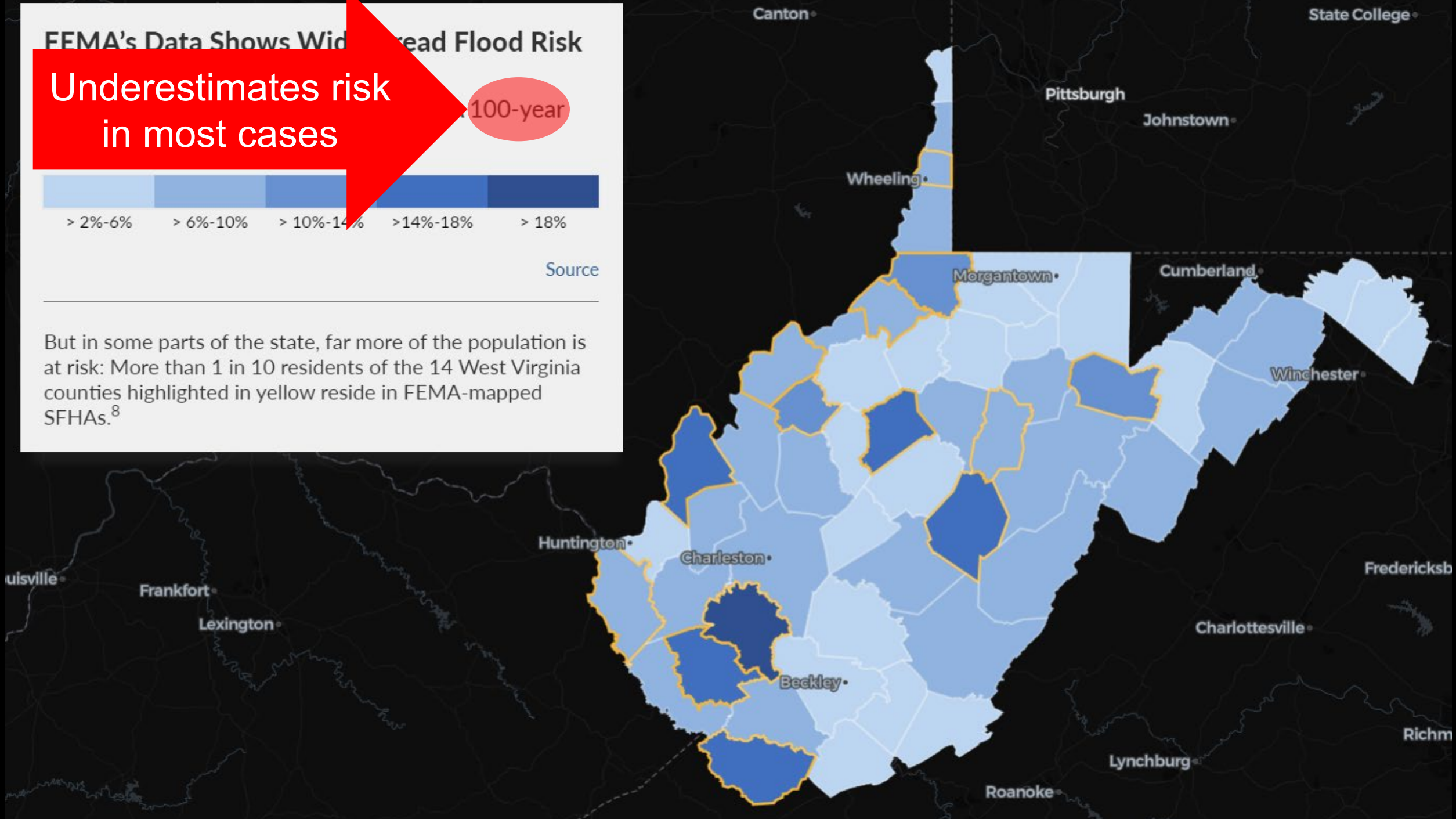




Photo: Joe Brocato, WV MnetroNews

Charleston WV, 4 April 2024



Photo: Cara Radford

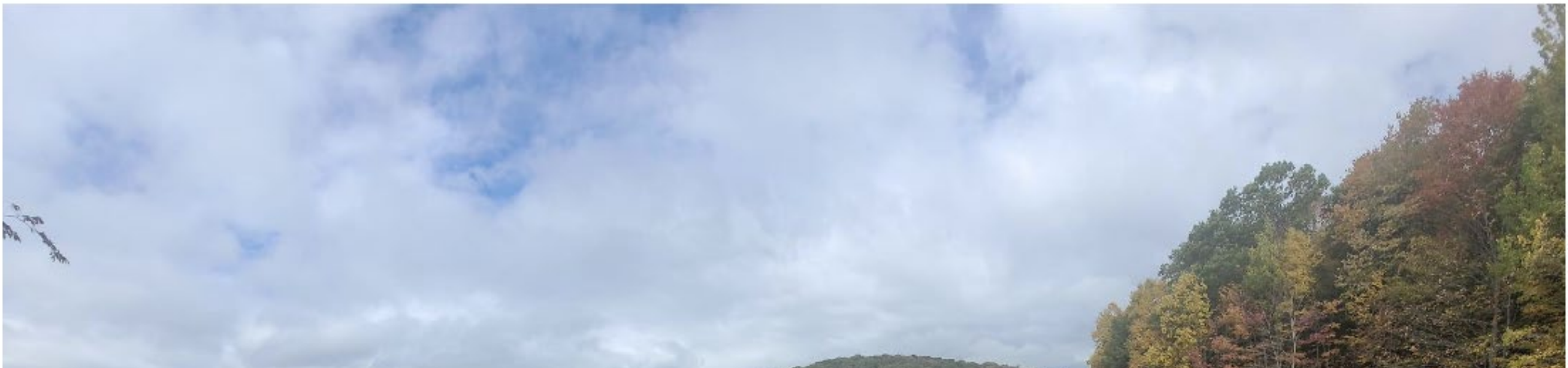
Blackwater Falls, 16 September 2024

ENVIRONMENT & ENERGY

Richwood residents have about a week's supply of water due to drastic drought, emergency declared

Residents are under a water conservation ban as they hope predicted rainfall refills their river water source. 'I can't imagine what it's going to be like if we do lose all of our water,' said Ashley Kenney, a Richwood resident.

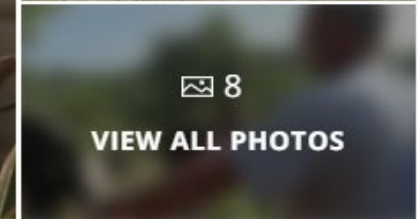
BY: AMELIA FERRELL KNISELY - SEPTEMBER 19, 2024 6:00 AM



Farmers and ranchers grappling with worst drought in 25 years

by DANIEL BURBANK | Sat, August 24th 2024 at 9:26 PM

Updated Mon, August 26th 2024 at 4:01 PM



Dead, dried out grass in Roane County (WCHS).



TOPICS: [DROUGHT](#) [FARMERS](#) [RANCHERS](#) [WEST VIRGINIA](#) [MASON COUNTY](#) [CROPS](#) [SOYBEANS](#) [USDA](#)

ROANE COUNTY, W.Va. (WCHS) — West Virginia farmers and ranchers are facing one of the worst droughts in 25 years.








U.S. Drought Monitor

[Current](#)[Maps](#)[Data](#)[Summary](#)[About](#)[Conditions & Outlooks](#)[Ag in Drought](#)[En Español](#)[NADM](#)

Map released: Thurs. September 19, 2024

Data valid: September 17, 2024 at 8 a.m. EDT

Intensity

-  None
-  D0 (Abnormally Dry)
-  D1 (Moderate Drought)
-  D2 (Severe Drought)
-  D3 (Extreme Drought)
-  D4 (Exceptional Drought)
-  No Data

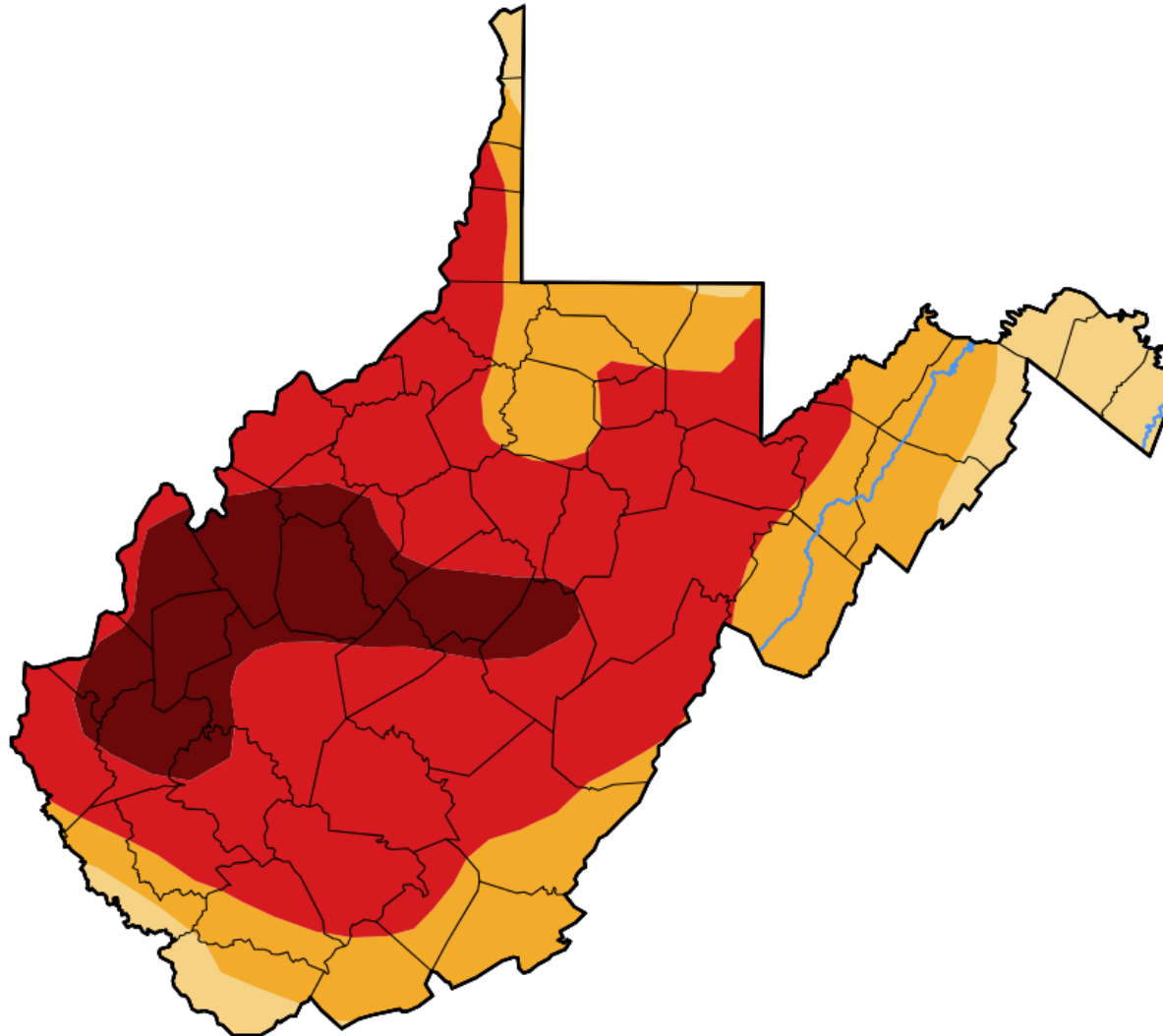
Authors

United States and Puerto Rico Author(s):

[Brad Rippey](#), U.S. Department of Agriculture

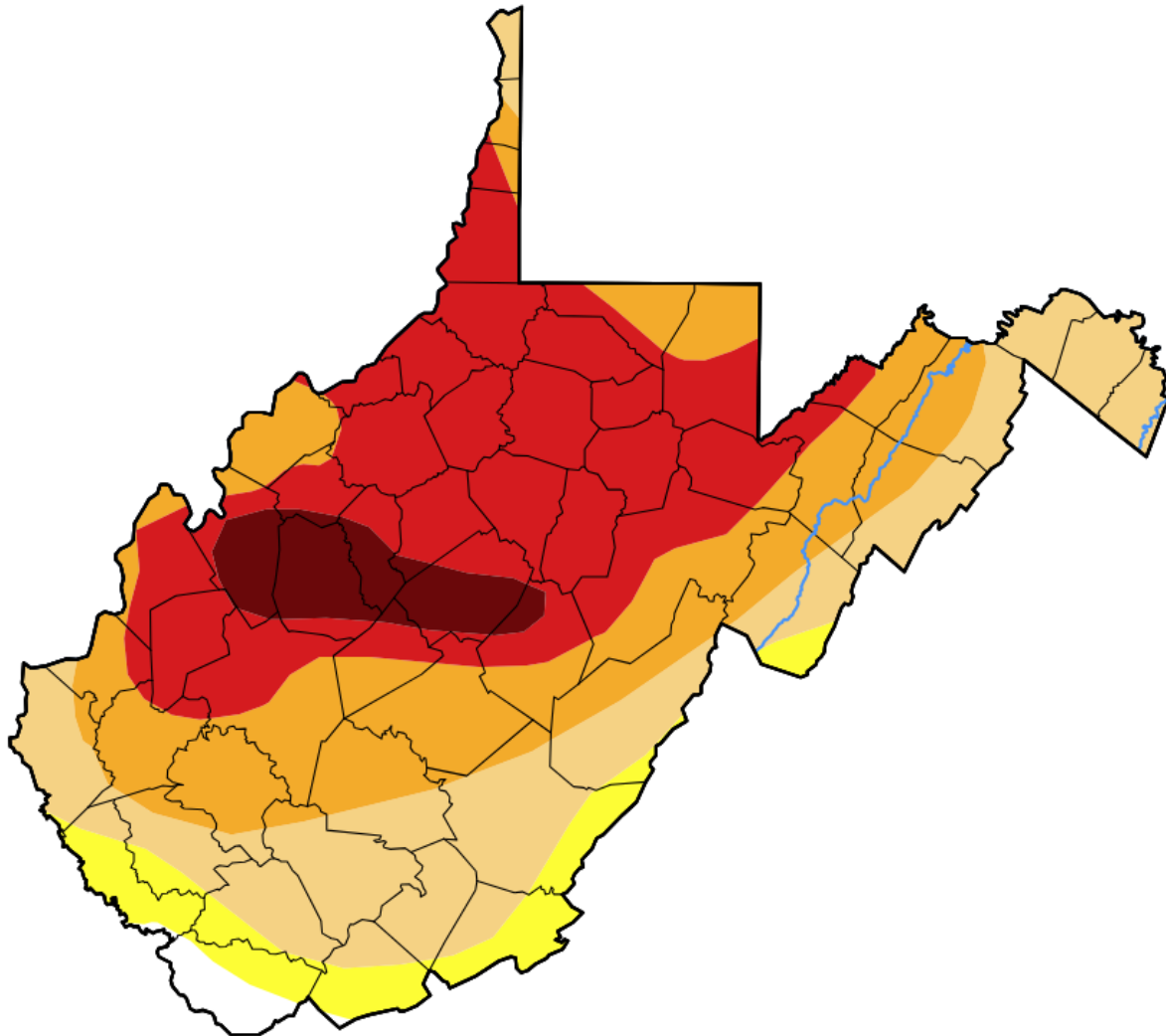
Pacific Islands and Virgin Islands Author(s):

[Rocky Bilotta](#), NOAA/NCEI



Before Helene

U.S. Drought Monitor

[Current](#)[Maps](#)[Data](#)[Summary](#)[About](#)[Conditions & Outlooks](#)[Ag in Drought](#)[En Español](#)[NADM](#)

Map released: Thurs. October 3, 2024

Data valid: October 1, 2024 at 8 a.m. EDT

Intensity

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

Authors

United States and Puerto Rico Author(s):

[Richard Tinker](#), NOAA/NWS/NCEP/CPC

Pacific Islands and Virgin Islands Author(s):

[Denise Gutzmer](#), National Drought Mitigation Center

After Helene

ENVIRONMENT & ENERGY

Despite rainfall from Hurricane Helene, West Virginia's drought continues

Drought state of emergency left off call for special legislative session

BY: LORI KERSEY - OCTOBER 4, 2024 6:00 AM





**are now in the
Town Run
Watershed**

Your Watershed

Water flowing to the sea in the form of rain and snowmelt is called runoff. It flows over the ground and into streams, rivers, and lakes. The area of land that drains into a particular body of water is called a watershed. The Town Run Watershed is the area of land that drains into the Town Run Stream, which flows into the Chesapeake Bay.

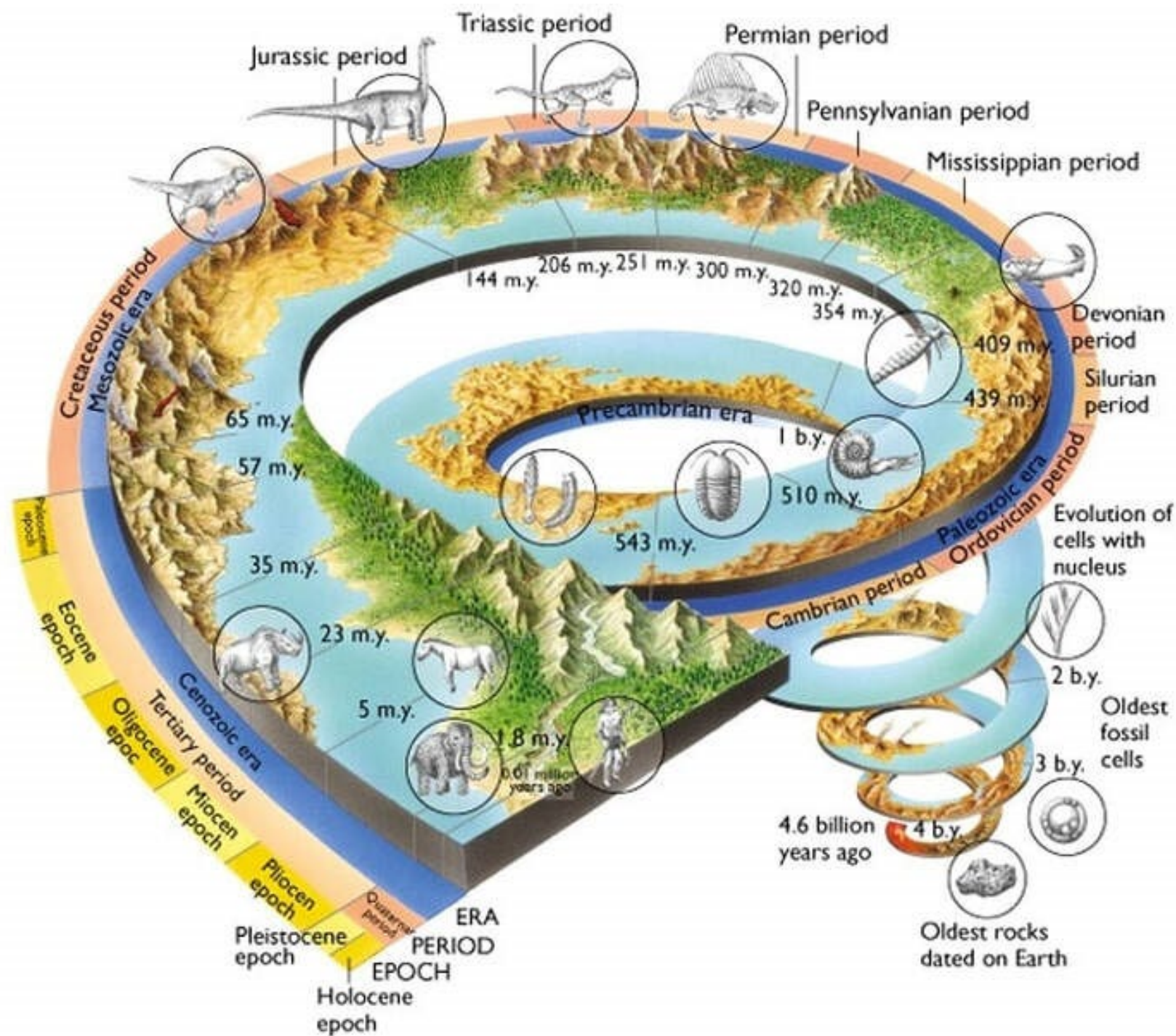
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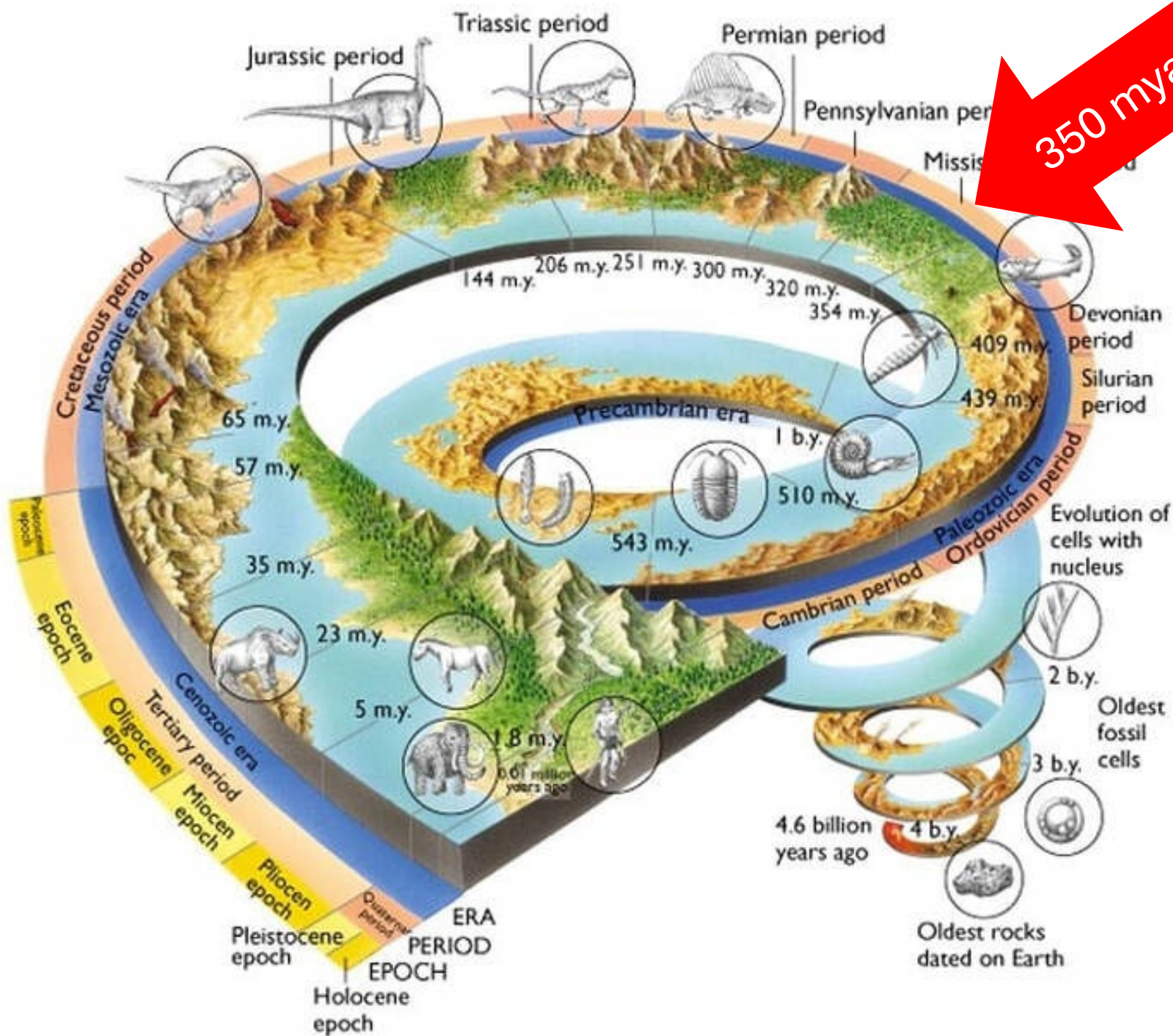
**Stream restoration
in progress**

 **Town Run
Watershed**

Providing clean water and
habitat for all.



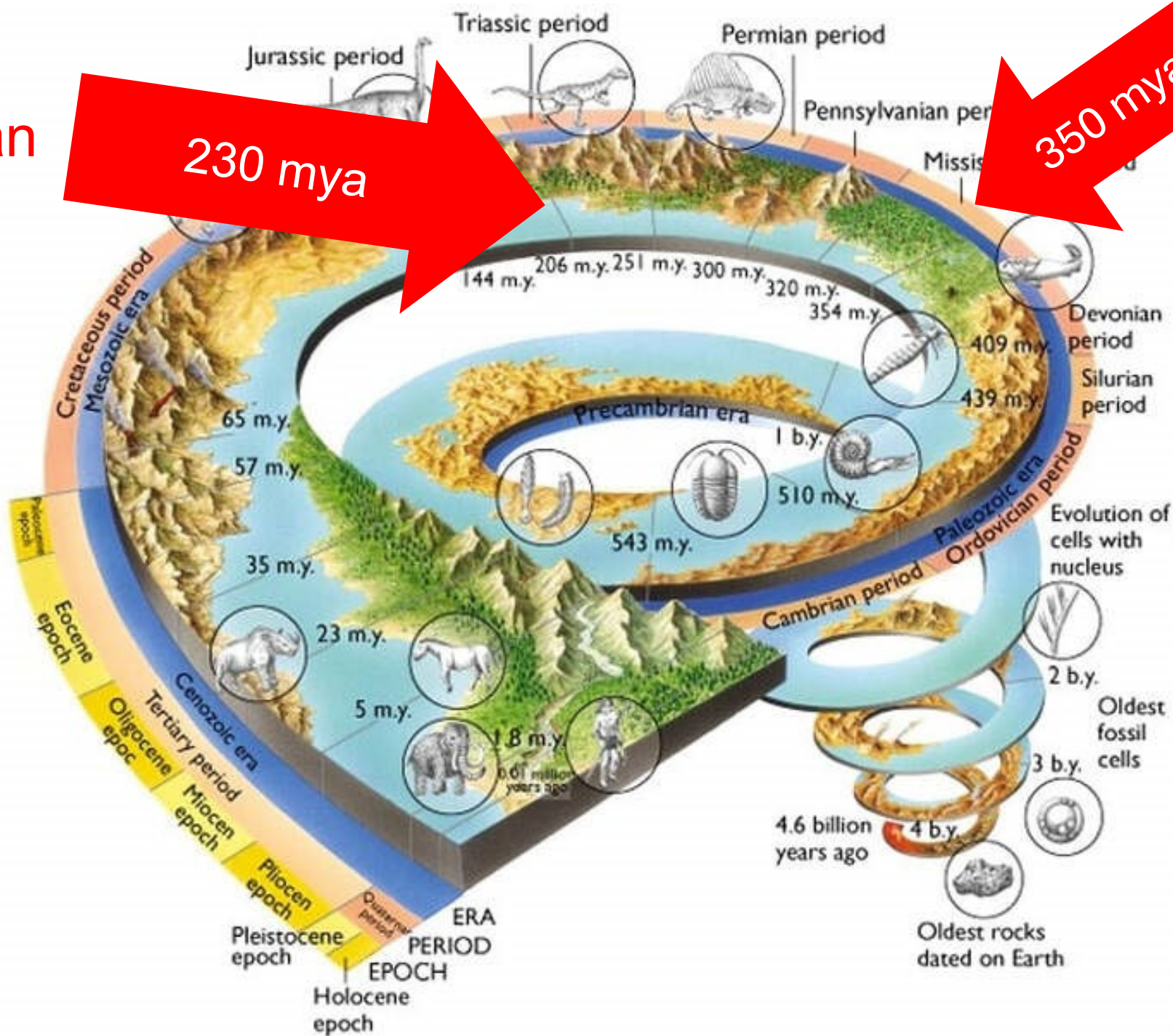




350 mya

Limestone and dolostone deposition

Ancestral Appalachian mountains formed

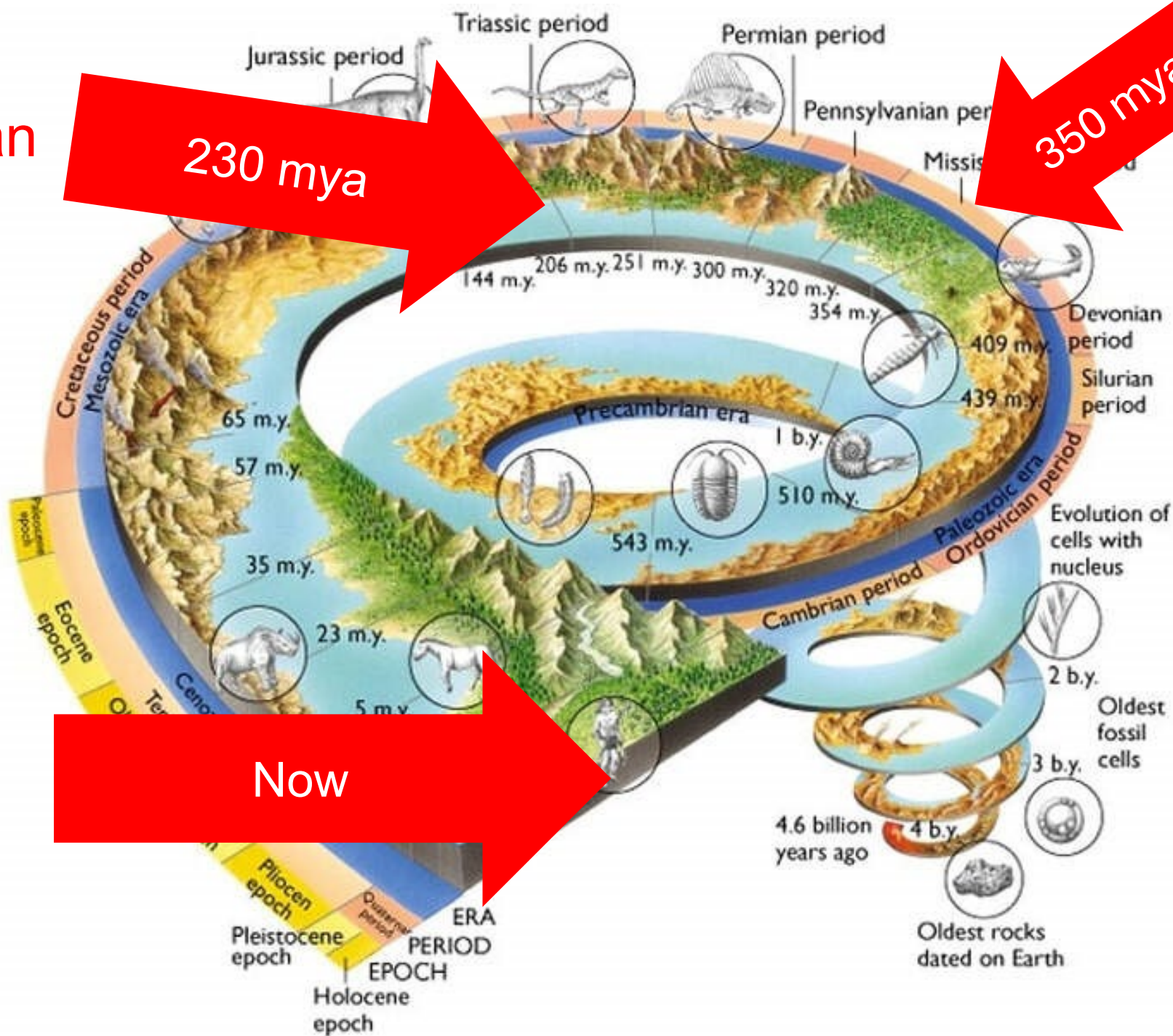


230 mya

350 mya

Limestone and dolostone deposition

Ancestral Appalachian mountains formed



230 mya

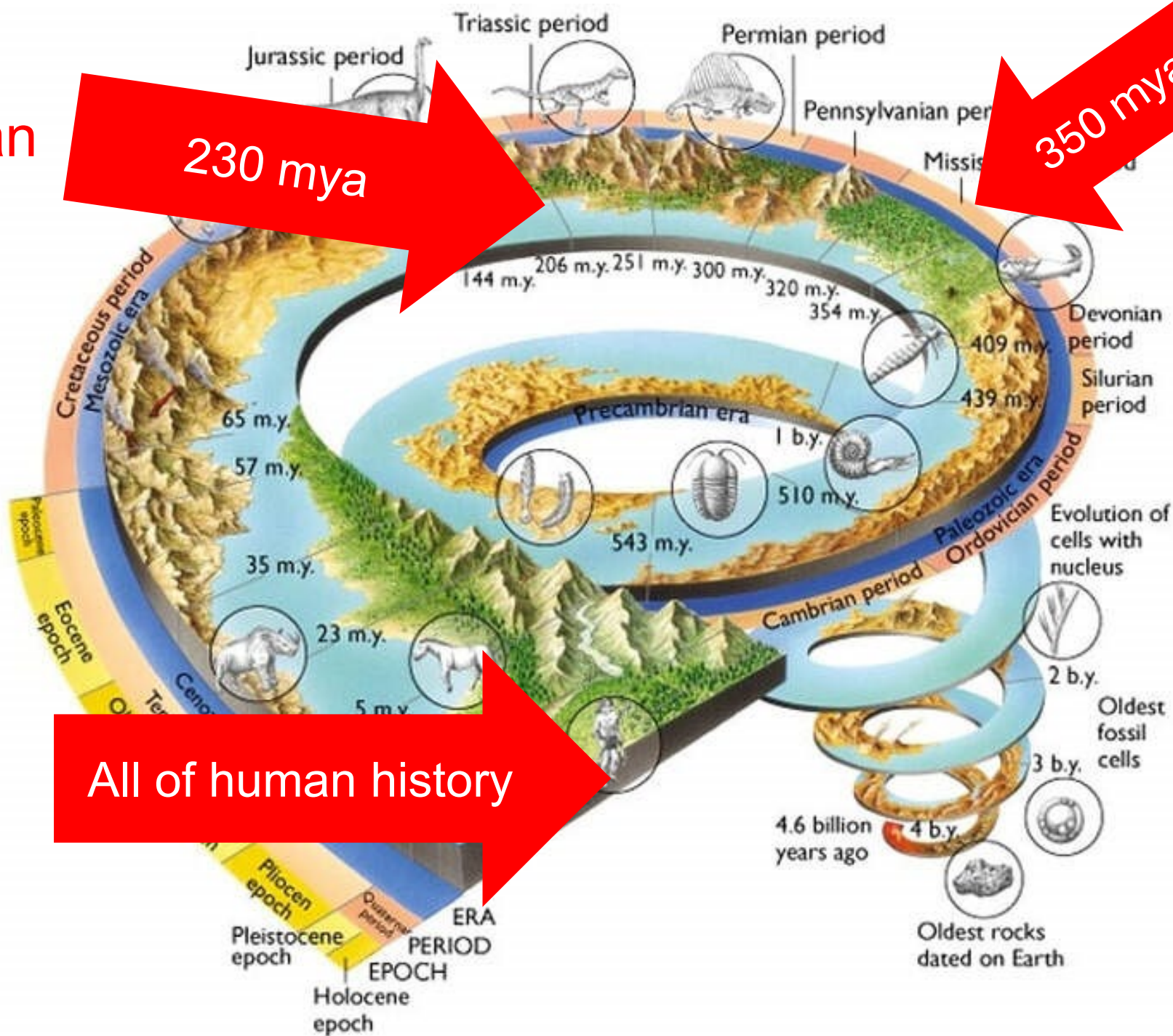
350 mya

Limestone and dolostone deposition

Now

ERA
PERIOD
EPOCH

Ancestral Appalachian mountains formed



230 mya

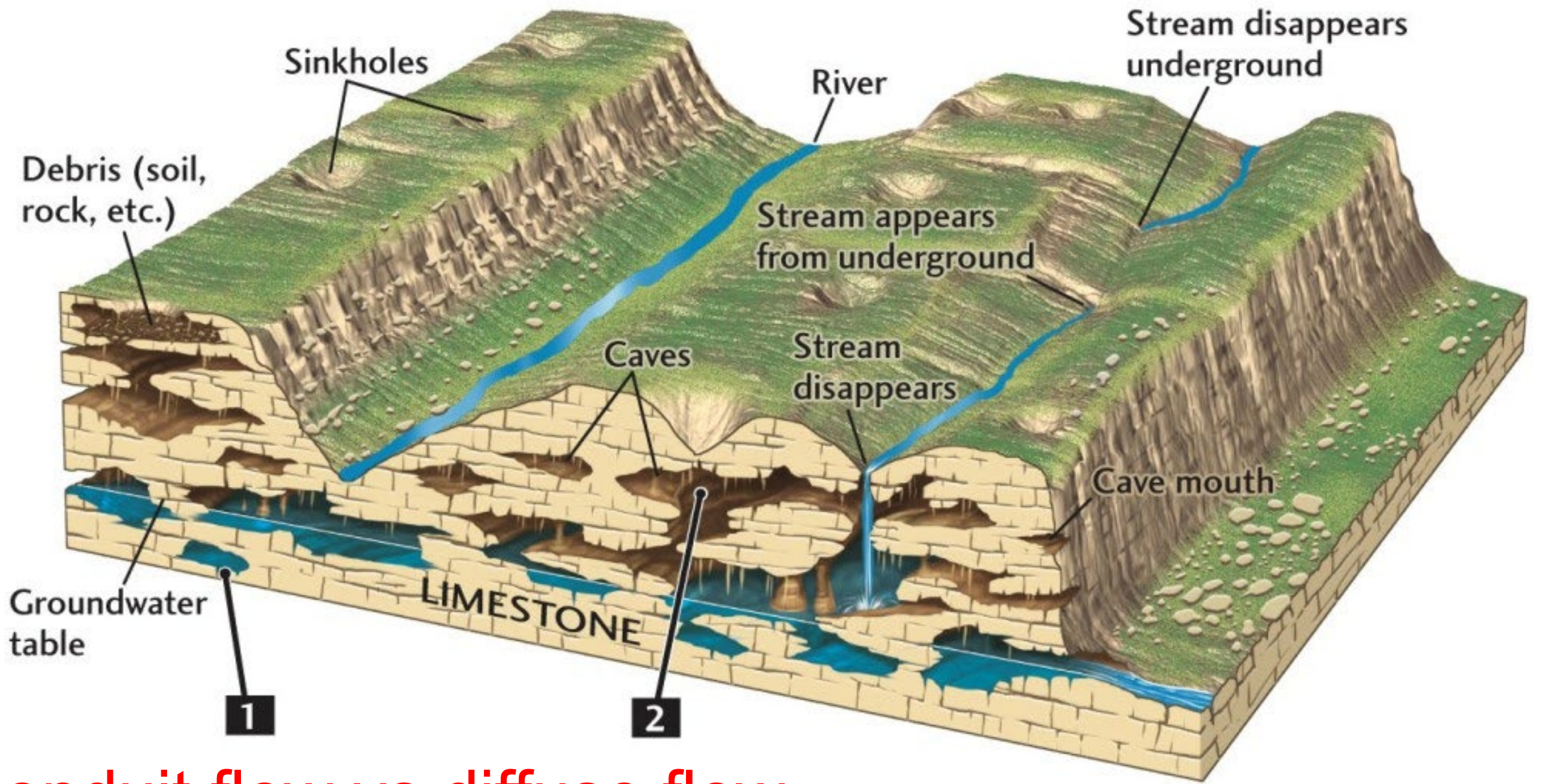
350 mya

Limestone and dolostone deposition

All of human history

ERA
PERIOD
EPOCH
Pleistocene epoch
Pliocene epoch
Quaternary period
Holocene epoch

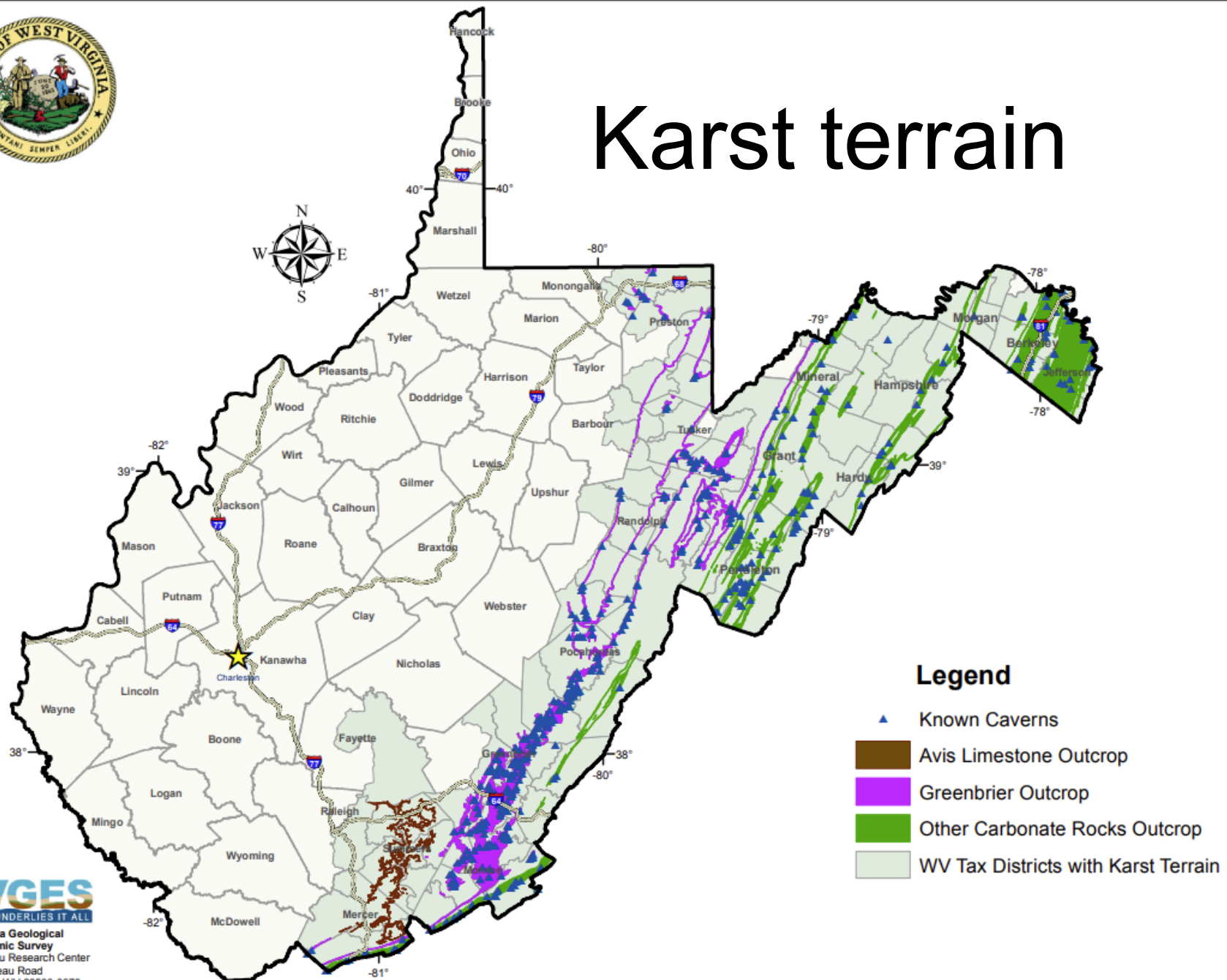




Conduit flow vs diffuse flow



Karst terrain



Legend

- ▲ Known Caverns
- Avis Limestone Outcrop
- Greenbrier Outcrop
- Other Carbonate Rocks Outcrop
- WV Tax Districts with Karst Terrain

WVGES
GEOLOGY UNDERLIES IT ALL

West Virginia Geological
and Economic Survey
Mont Chateau Research Center
1 Mont Chateau Road
Morgantown, WV 26508-8079
Phone: (304) 594-2331
Web: www.wvgs.wvnet.edu

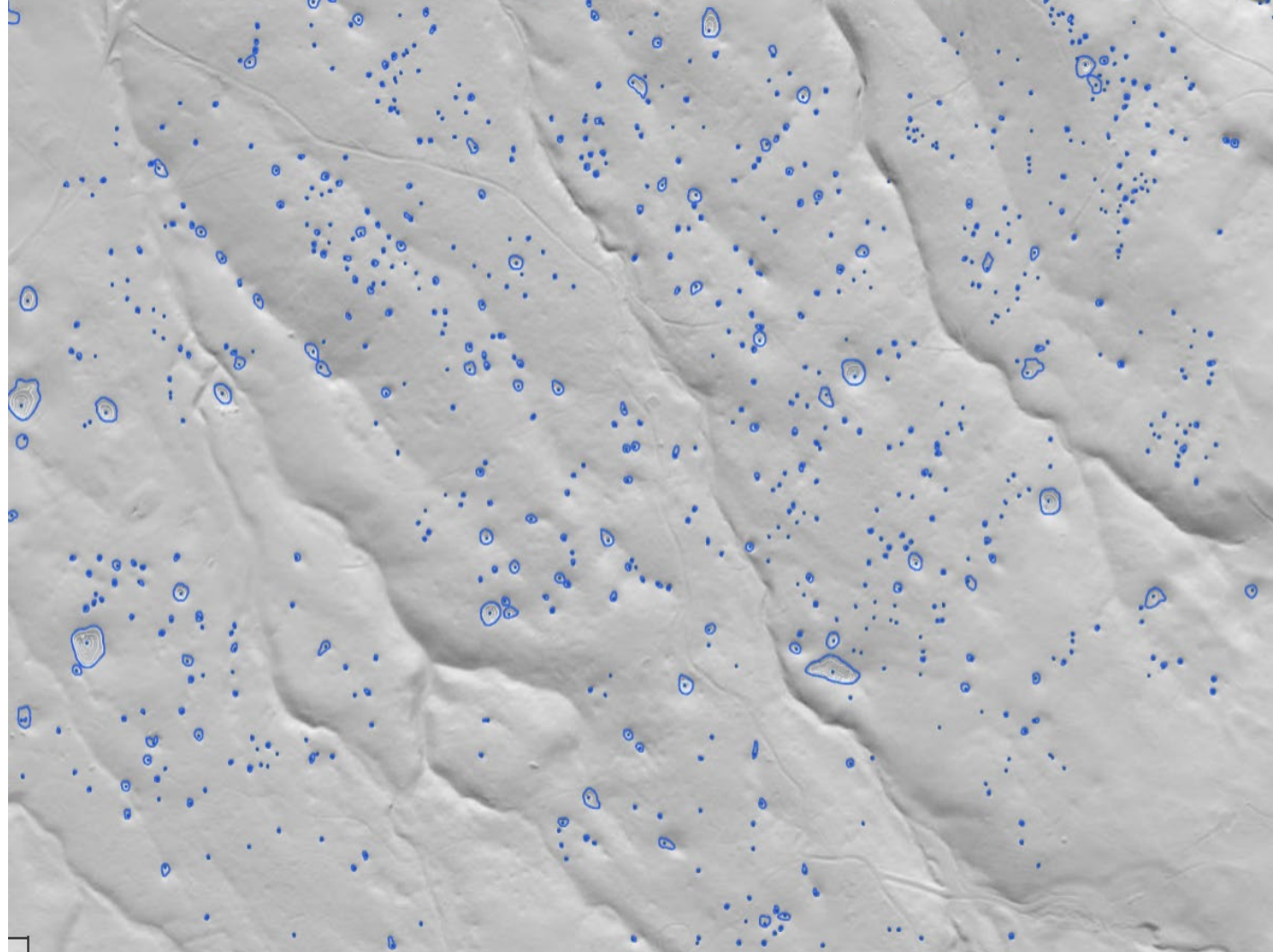
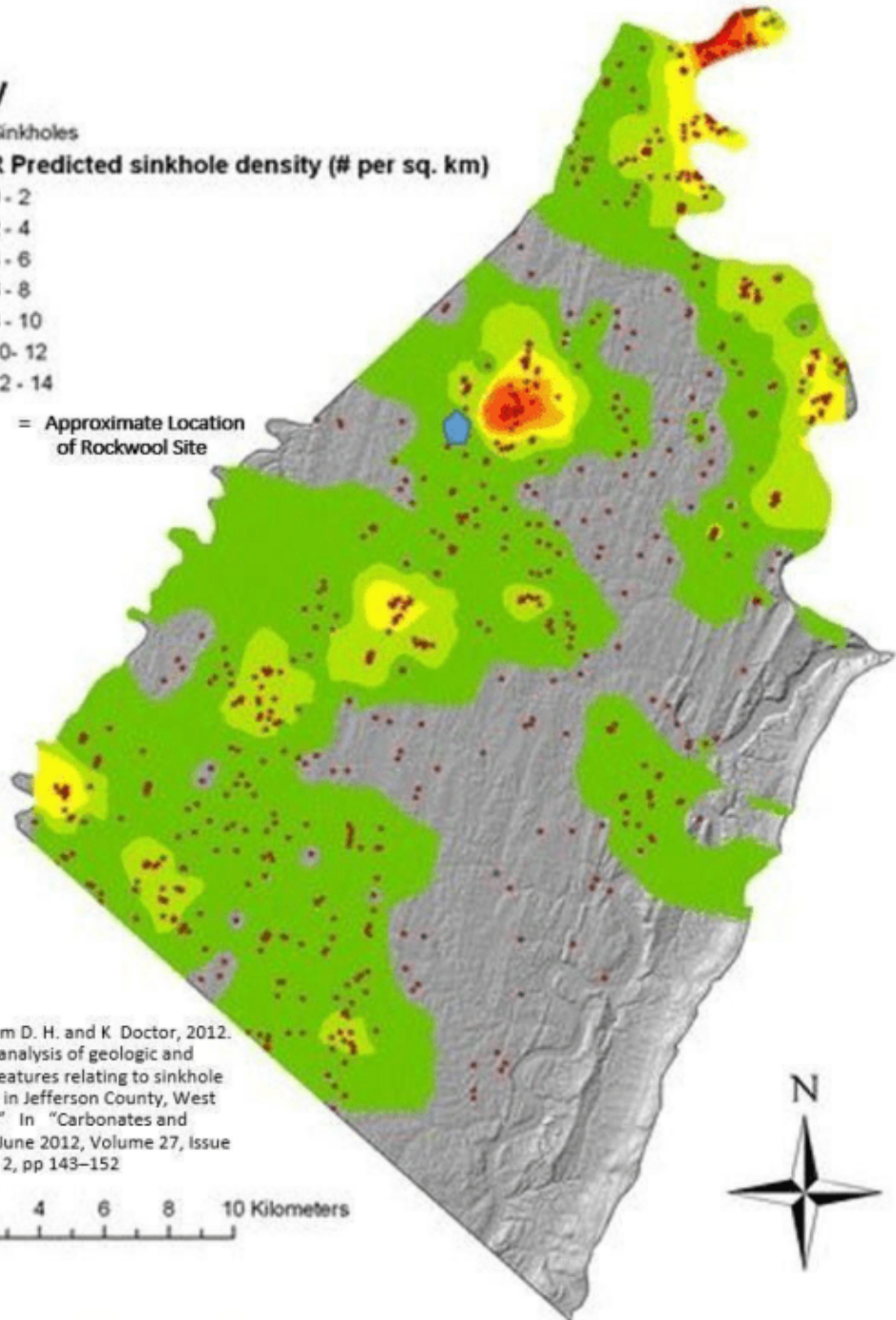
Key

• Sinkholes

GWR Predicted sinkhole density (# per sq. km)



⬢ = Approximate Location of Rockwool Site



Karst feature explorer

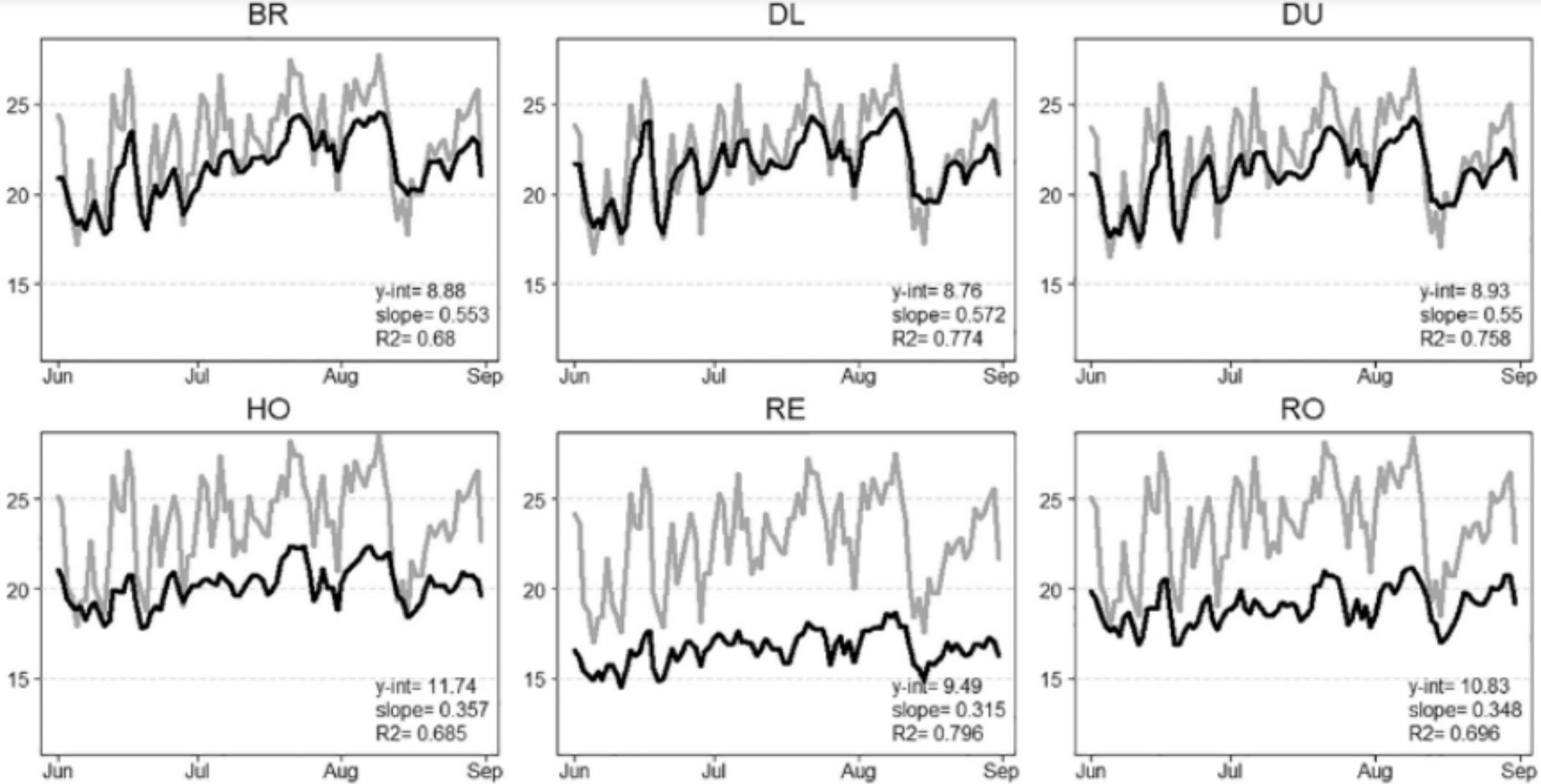
<https://tagis.dep.wv.gov/home/>

Base map from D. H. and K. Doctor, 2012. "Spatial analysis of geologic and hydrologic features relating to sinkhole occurrence in Jefferson County, West Virginia" In "Carbonates and Evaporites," June 2012, Volume 27, Issue 2, pp 143-152

Karst presents resiliencies and risks for water security

Karst presents resiliencies...

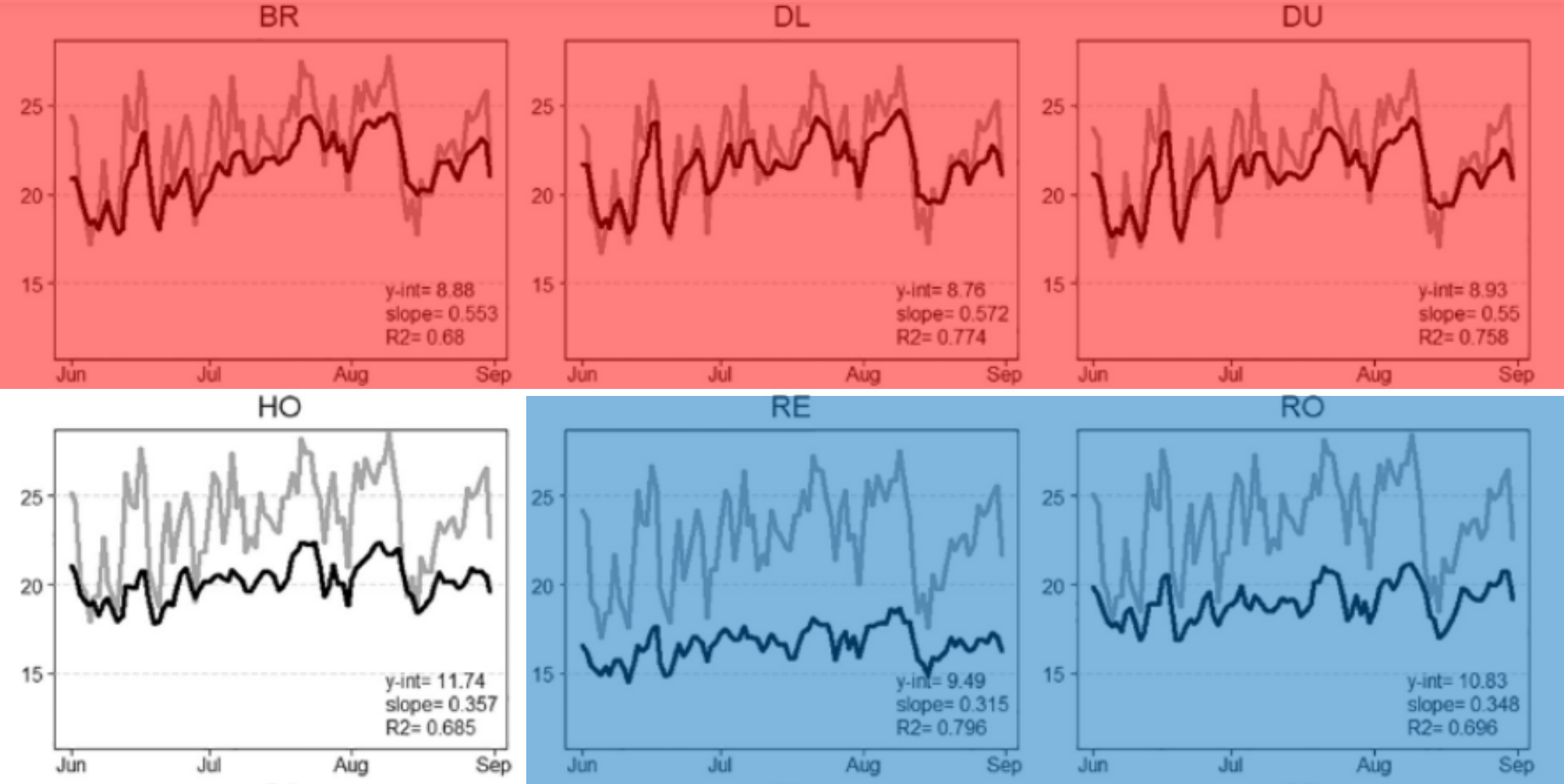
Temperature (deg C)



Air
Water

Karst presents resiliencies...

Temperature (deg C)



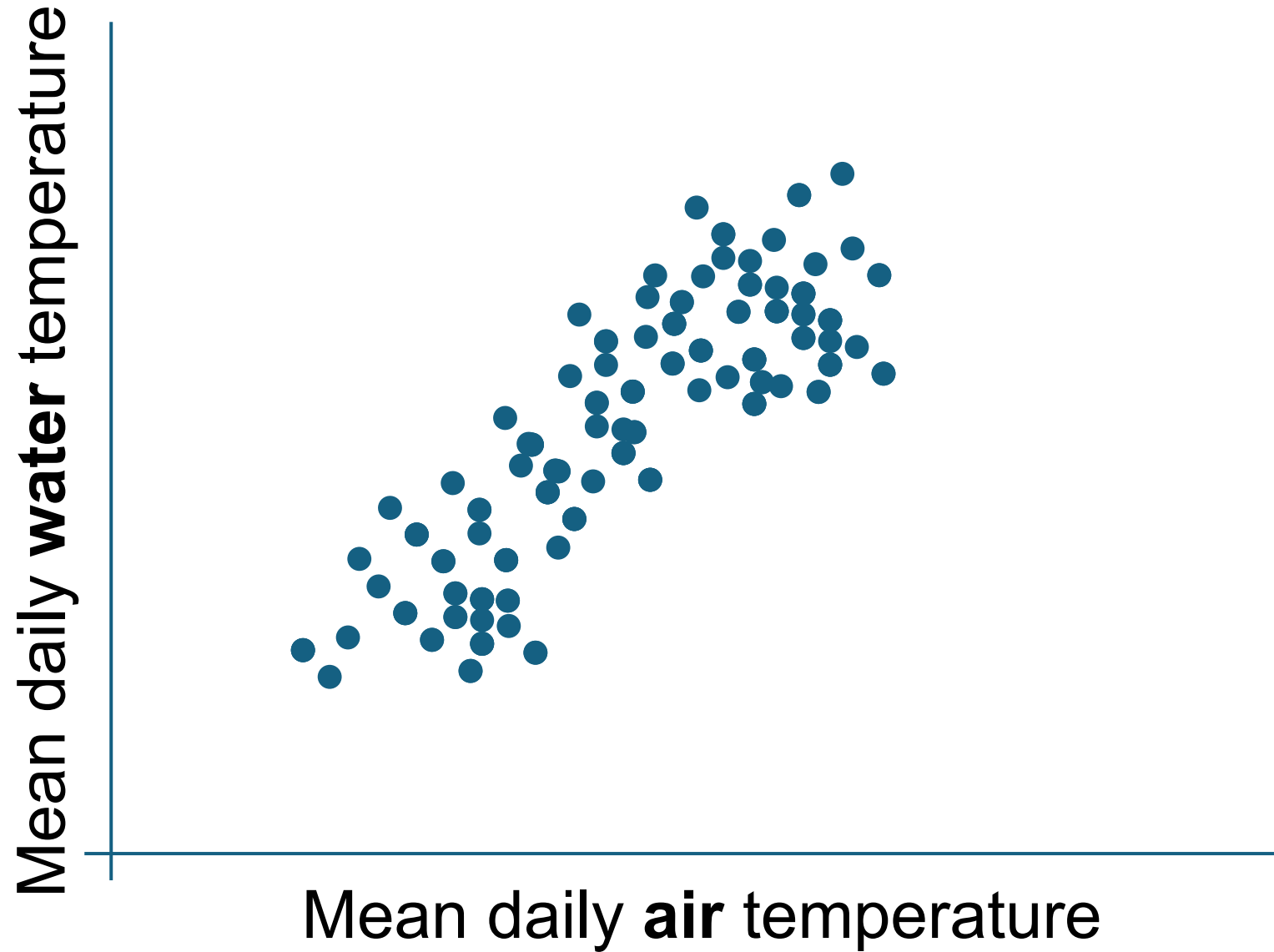
Karst
absent

Air

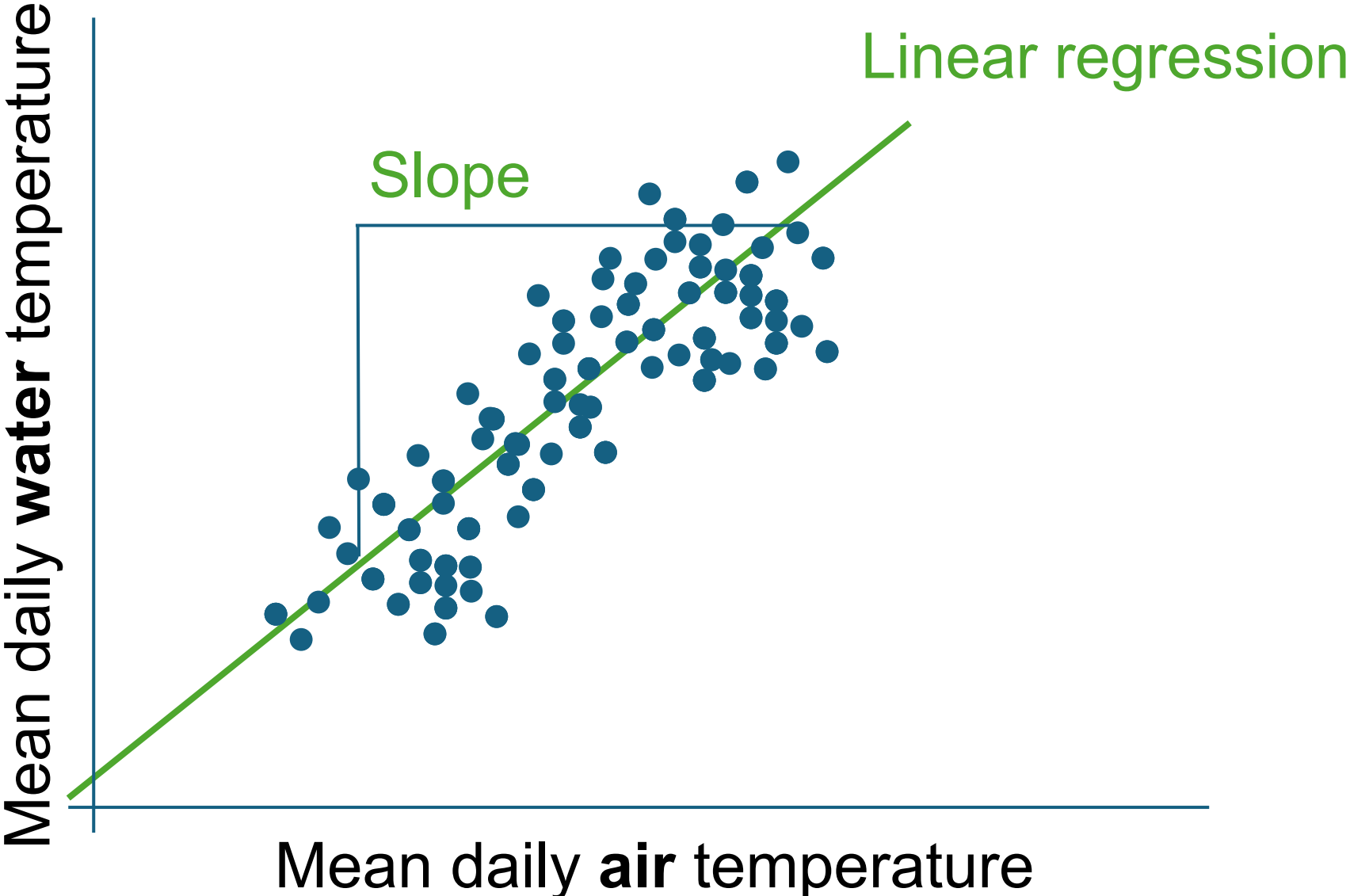
Water

Karst
present

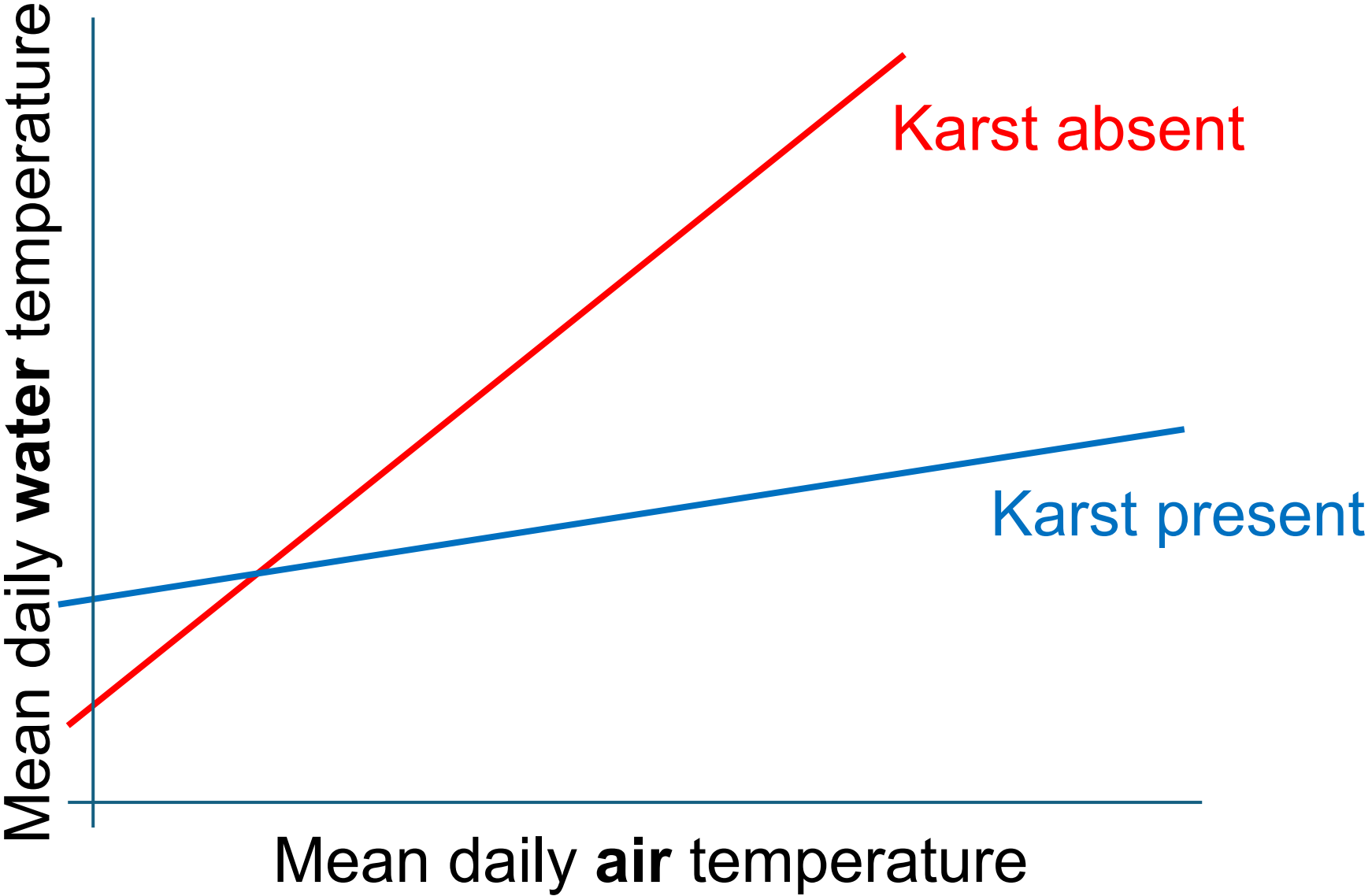
Karst presents resiliencies...



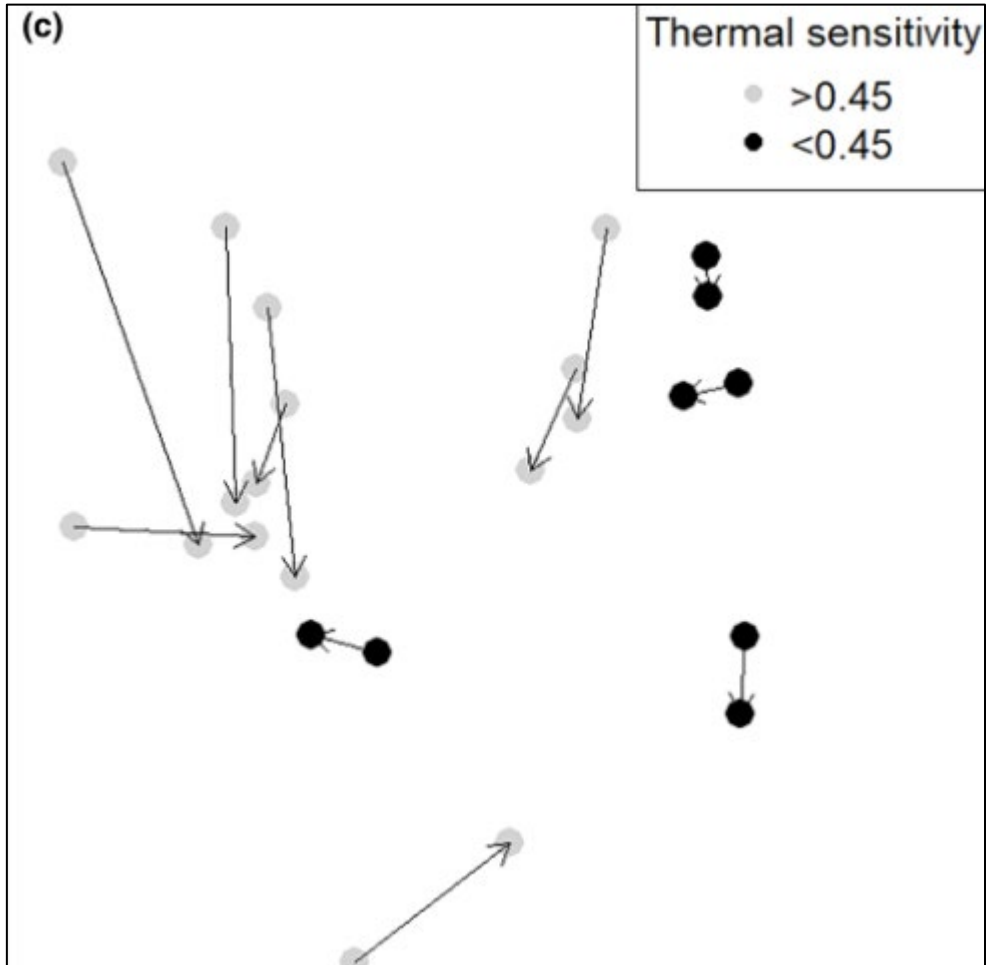
Karst presents resiliencies...



Karst presents resiliencies...



Karst presents resiliencies...



Fish communities are more stable over time in the presence of karst

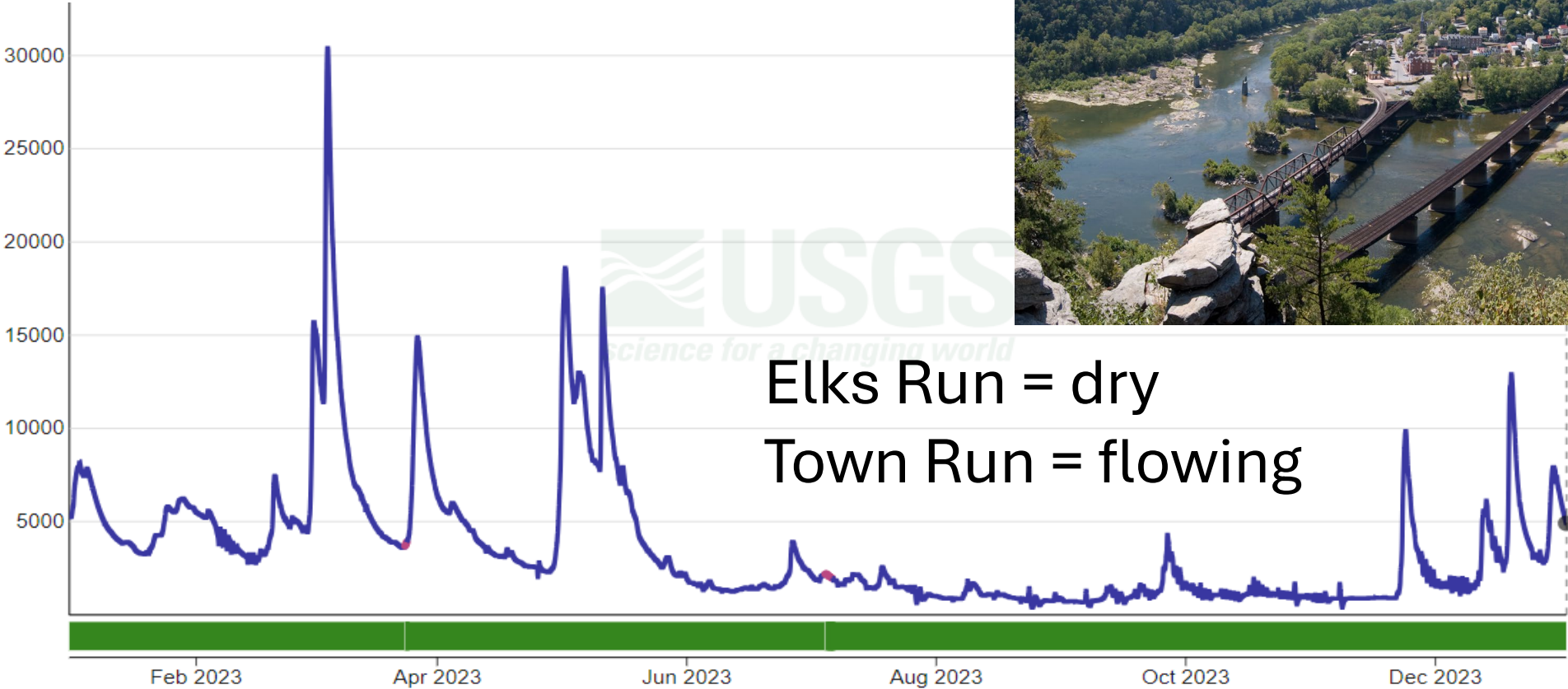
Karst absent
Karst present



Karst presents resiliencies...

...but not all karst is the same: a case study from the 2023 drought

Potomac River flow (cfs)



Elks Run = dry
Town Run = flowing

But Town Run has flooded before (and has gone dry)...



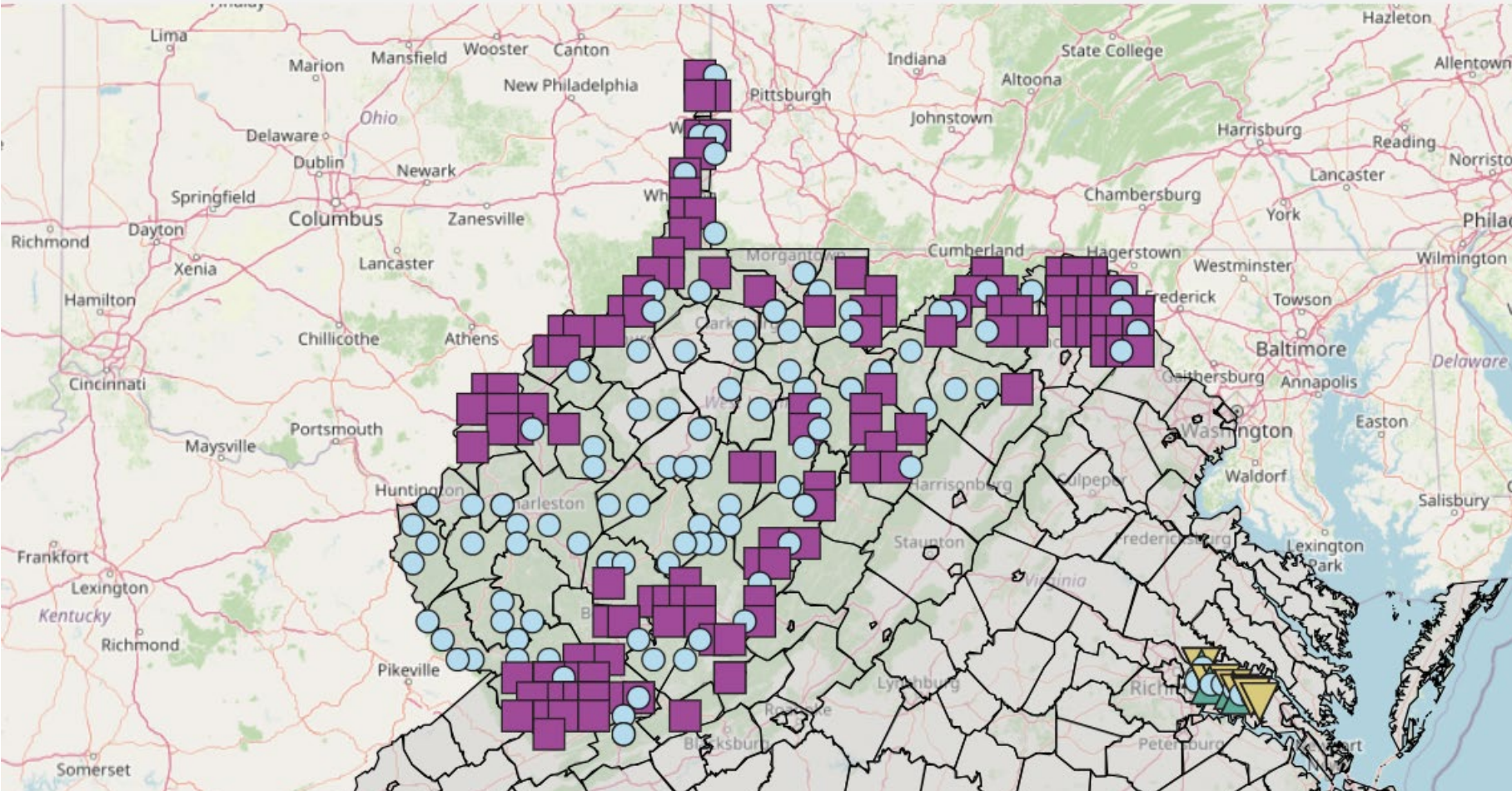
The Falling Spring Flood of 1934. The entire lower section of town was flooded from a cloud-burst in 1934.



Karst presents risks...



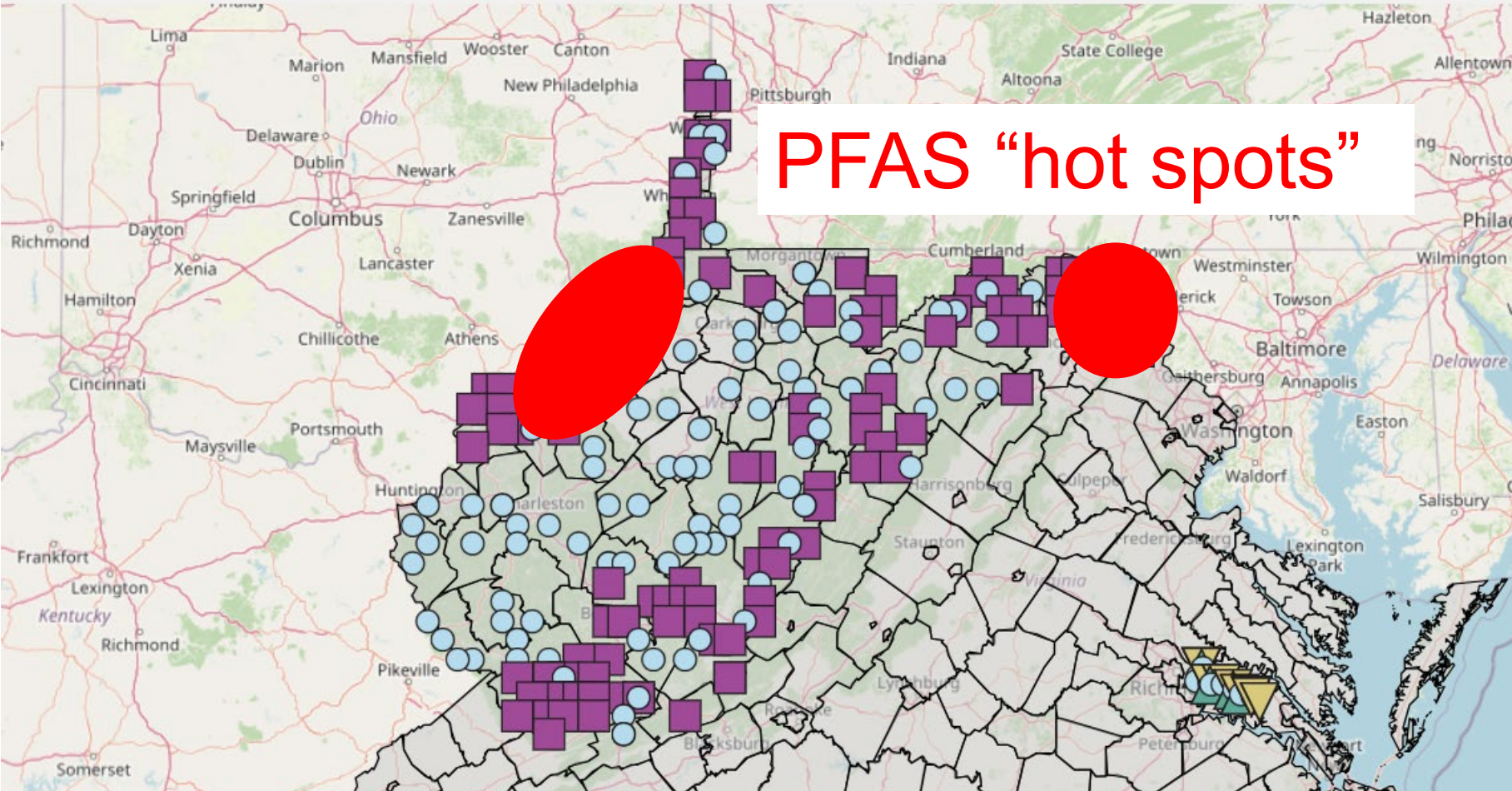
Virginia and West Virginia PFAS Sampling Locations



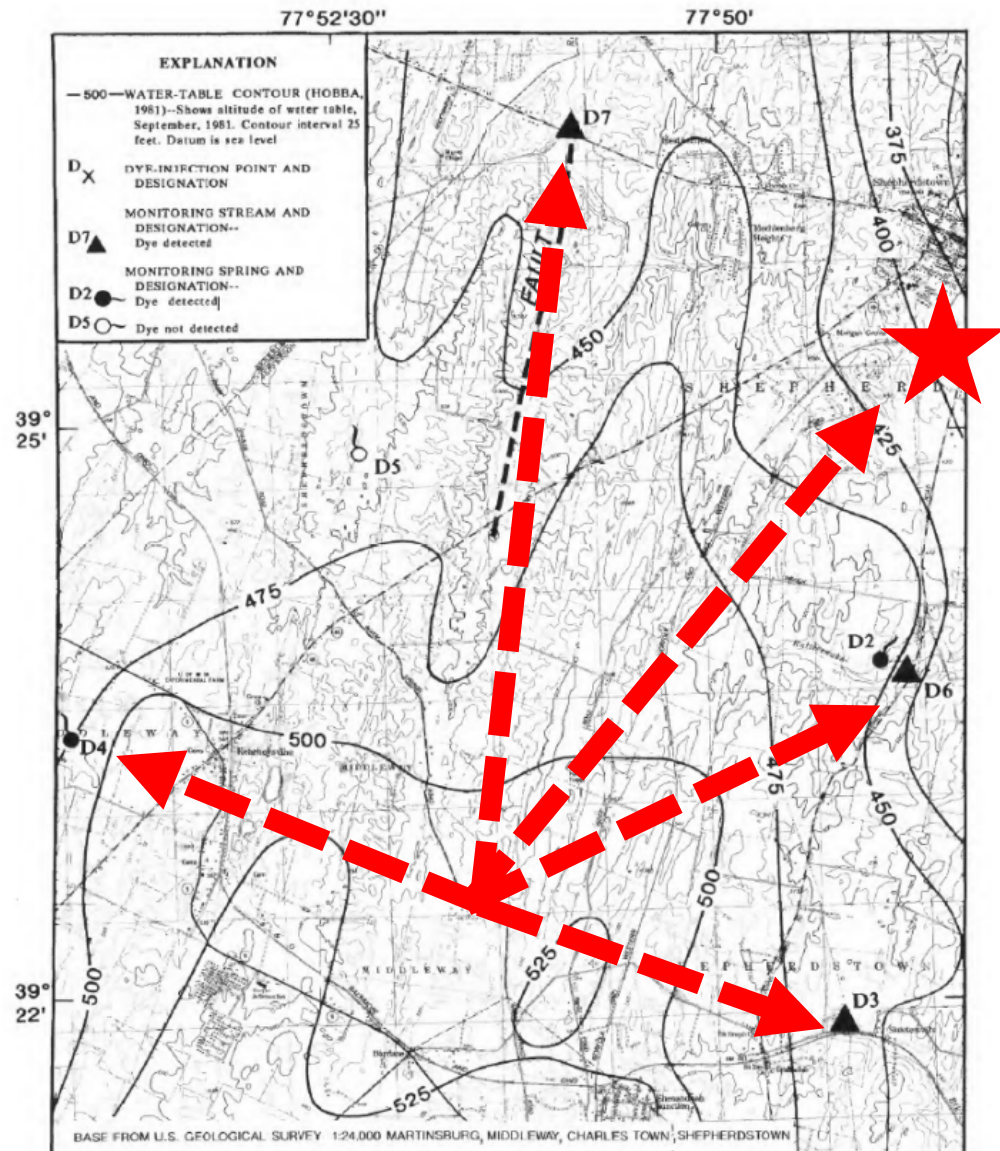
Karst presents risks...



Virginia and West Virginia PFAS Sampling Locations



Where does Town Run water come from?

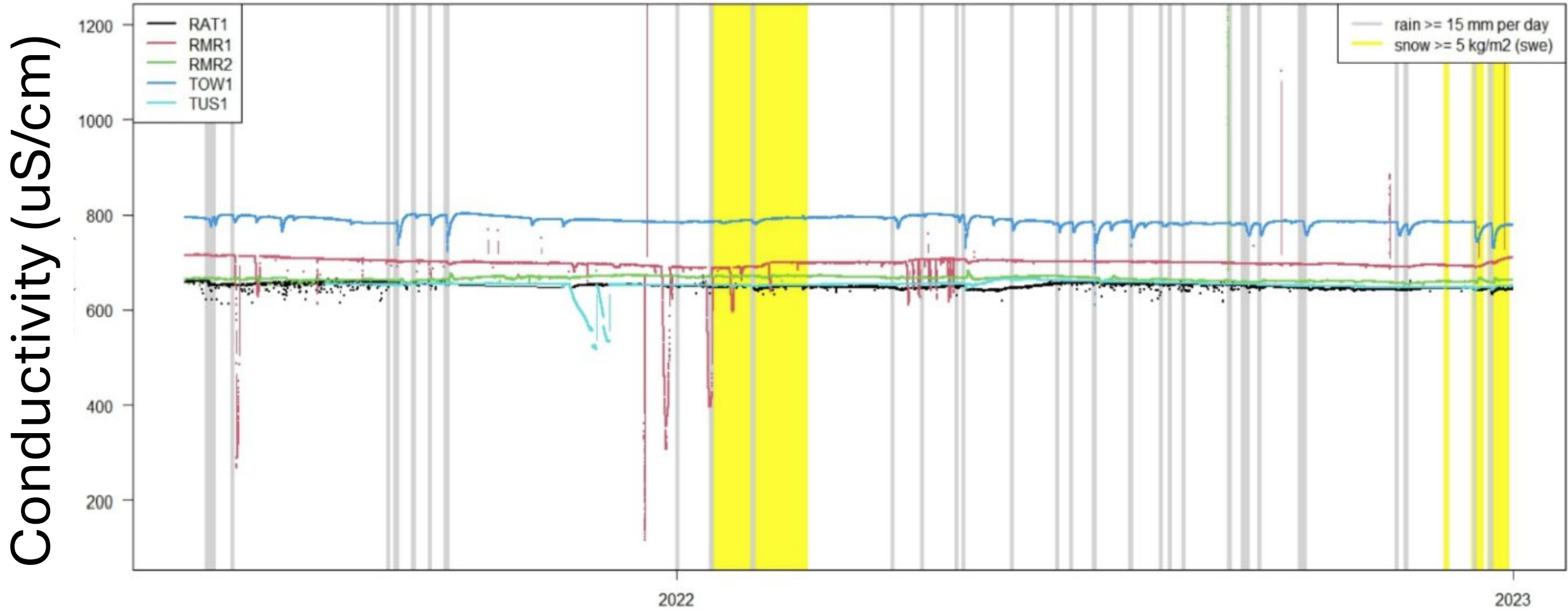


Kozar et al. (1991)

Dye tracing study

Shenandoah Junction to Shepherdstown

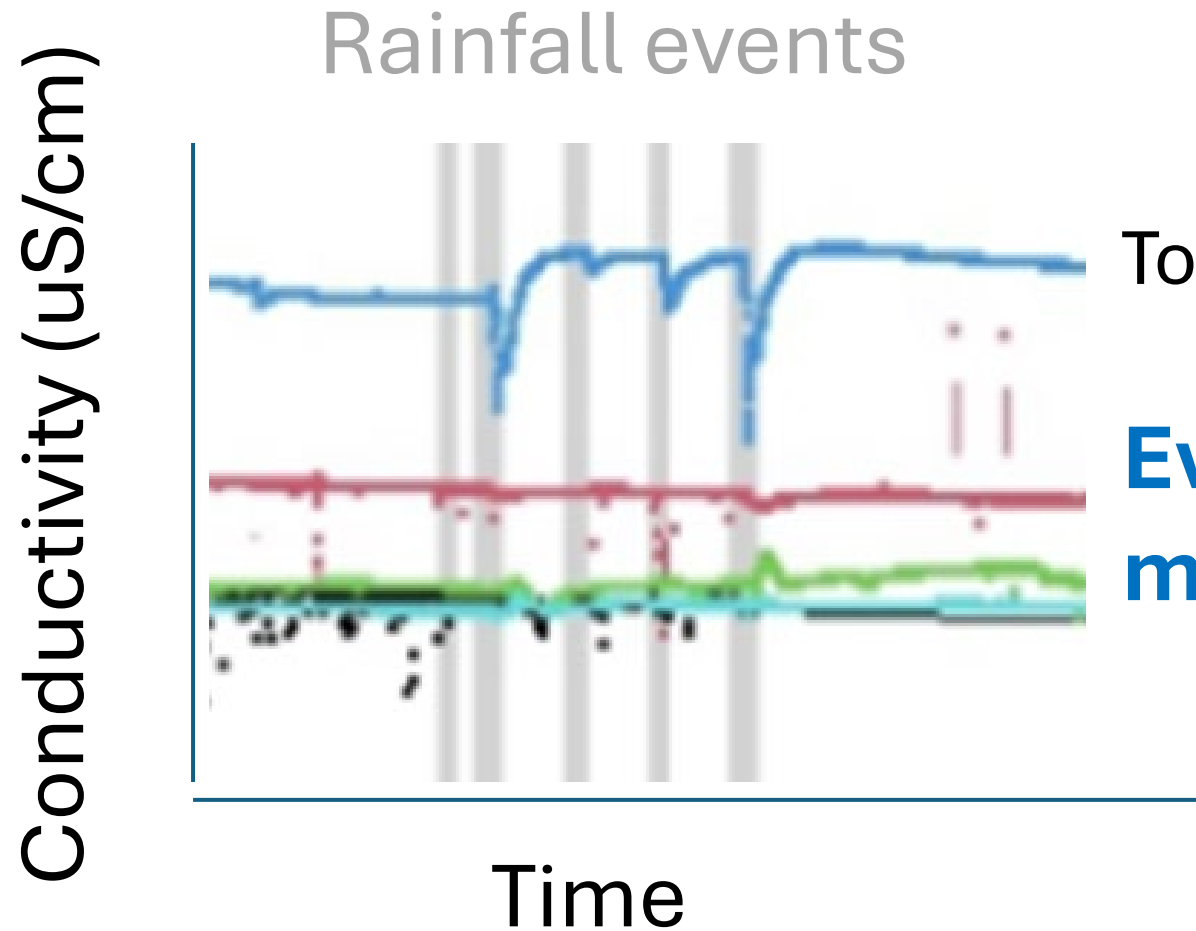
Where does Town Run water come from?



Where does Town Run water come from?



Where does Town Run water come from?

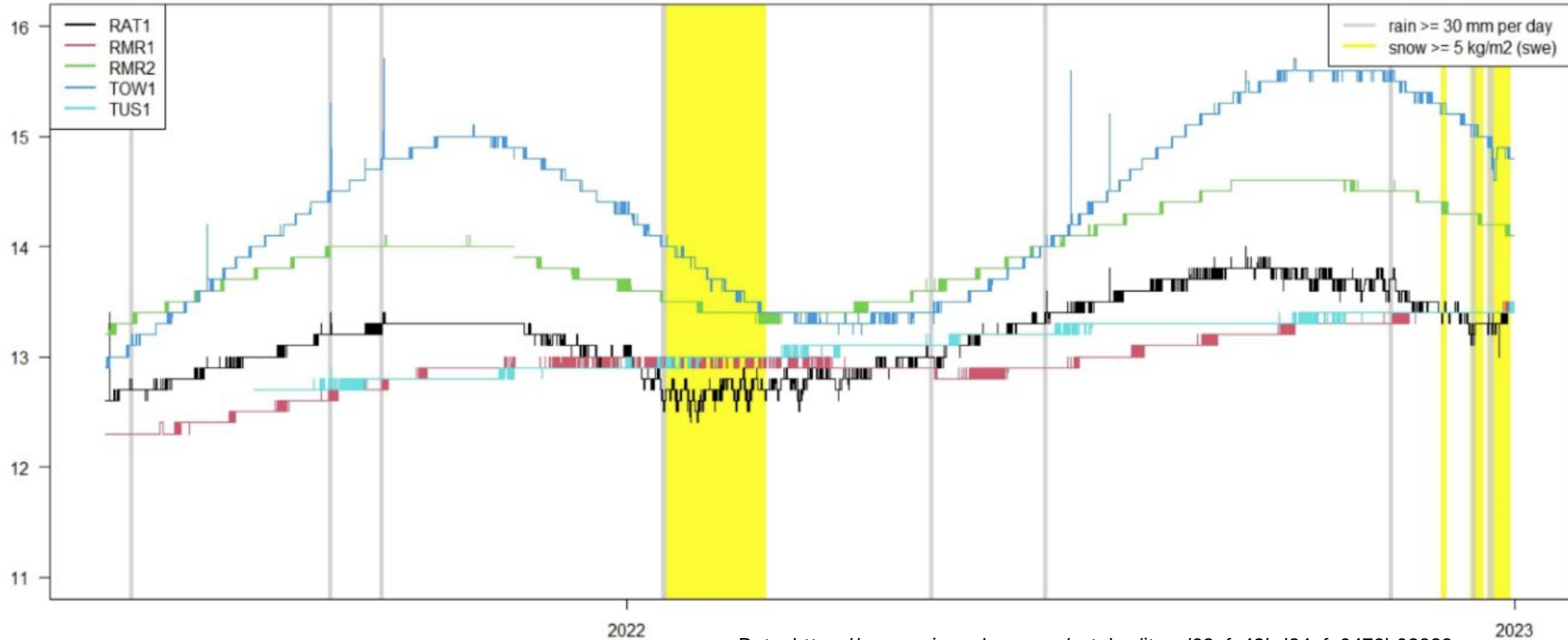


Town Run spring at Morgan's Grove:

**Evidence for runoff x GW
mixing via dilution signals**

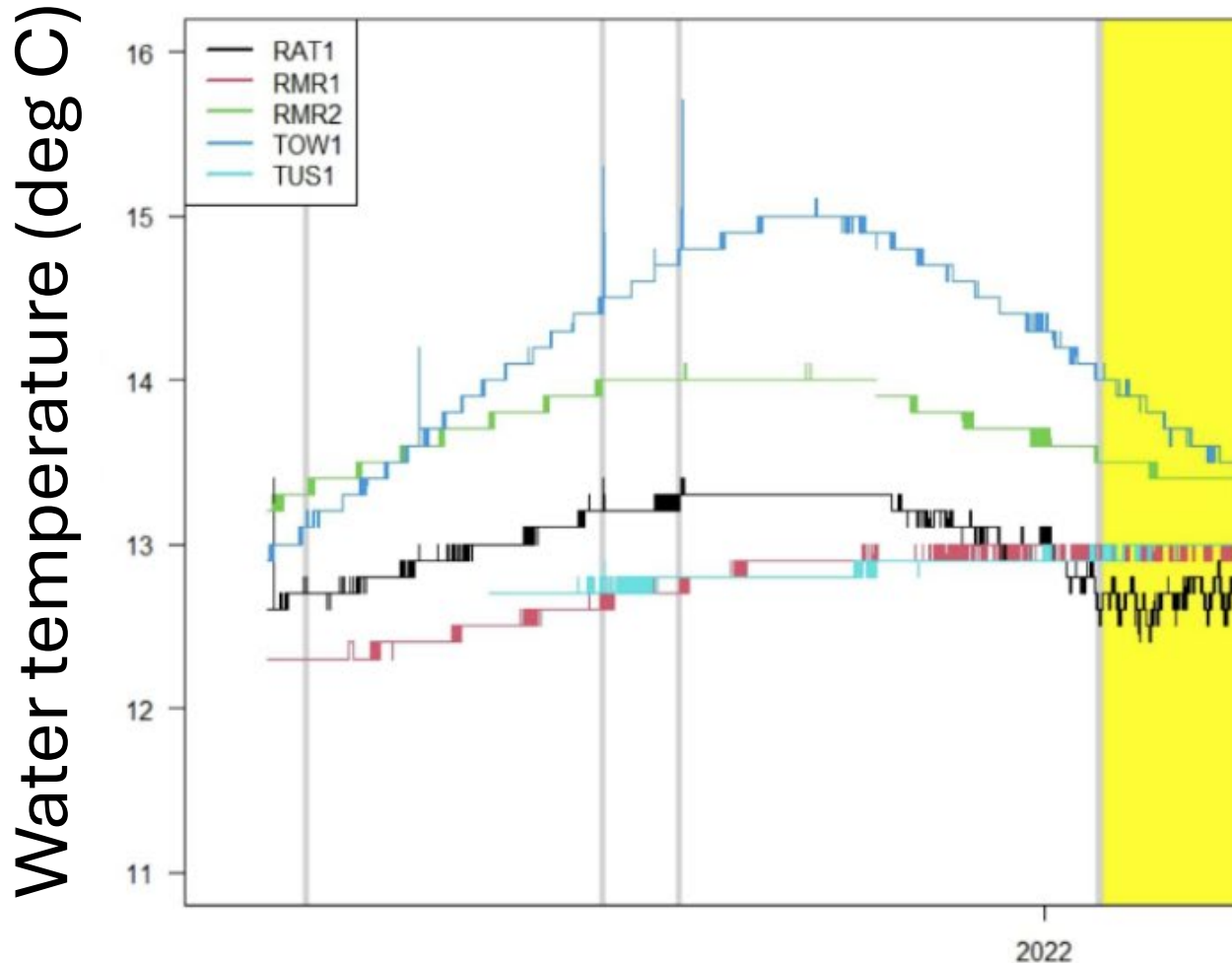
Where does Town Run water come from?

Water temperature (deg C)



Data: <https://www.sciencebase.gov/catalog/item/63efa42bd34efa0476b03829>

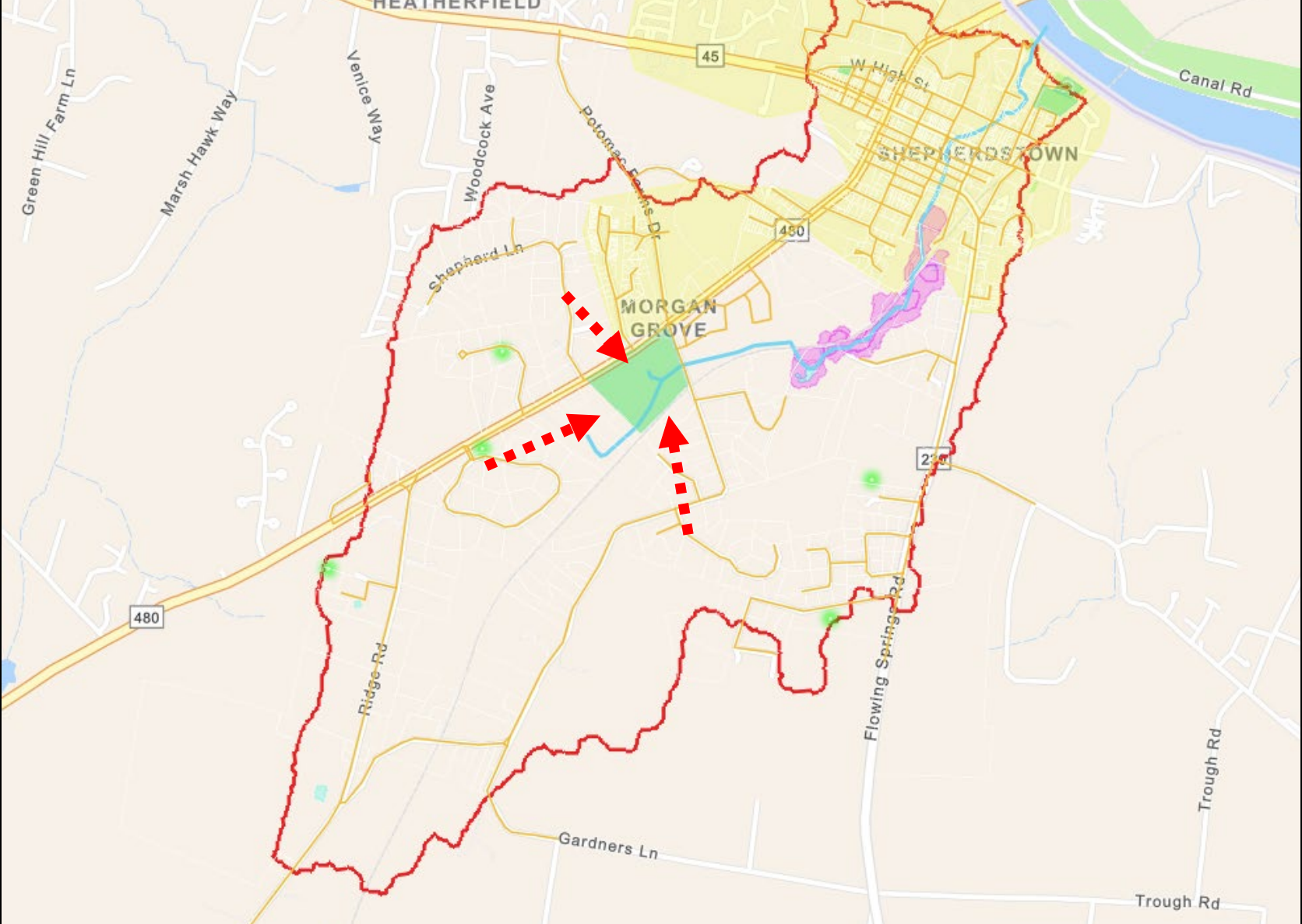
Where does Town Run water come from?



Town Run spring: more annual variation

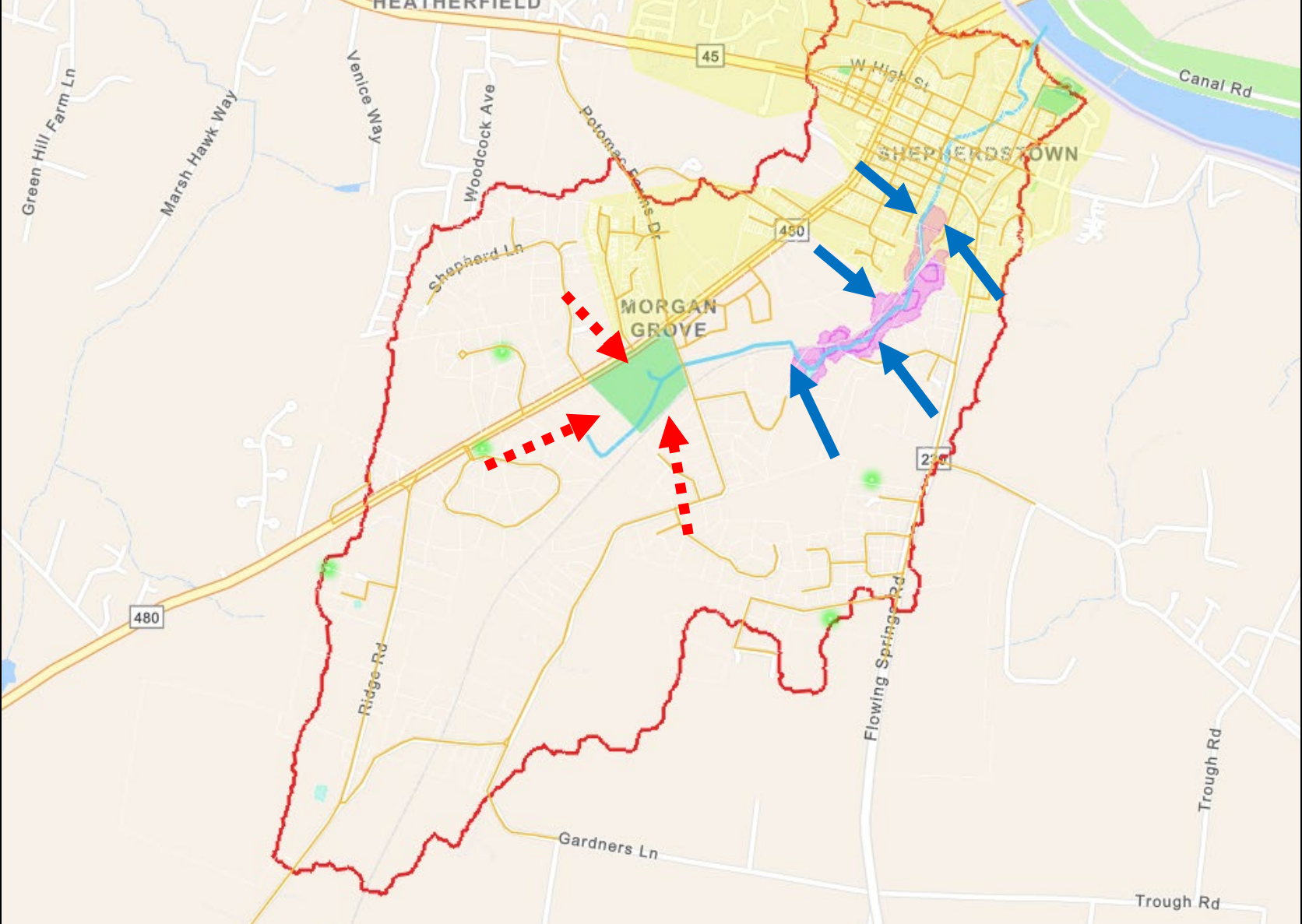
Other springs in the region: less annual variation

Where does Town Run water come from?



← Local GW mixing

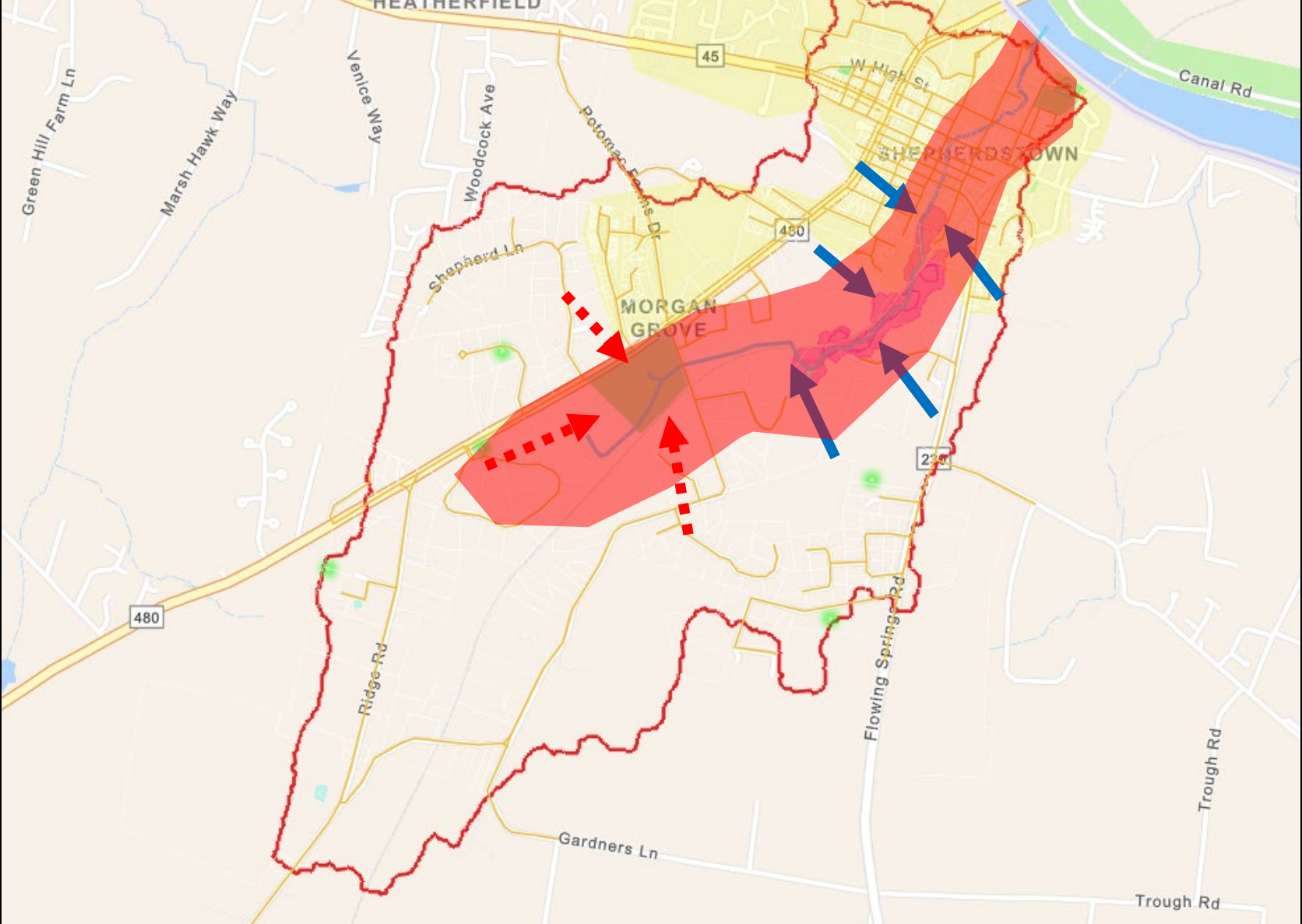
Where does Town Run water come from?



← Local GW mixing

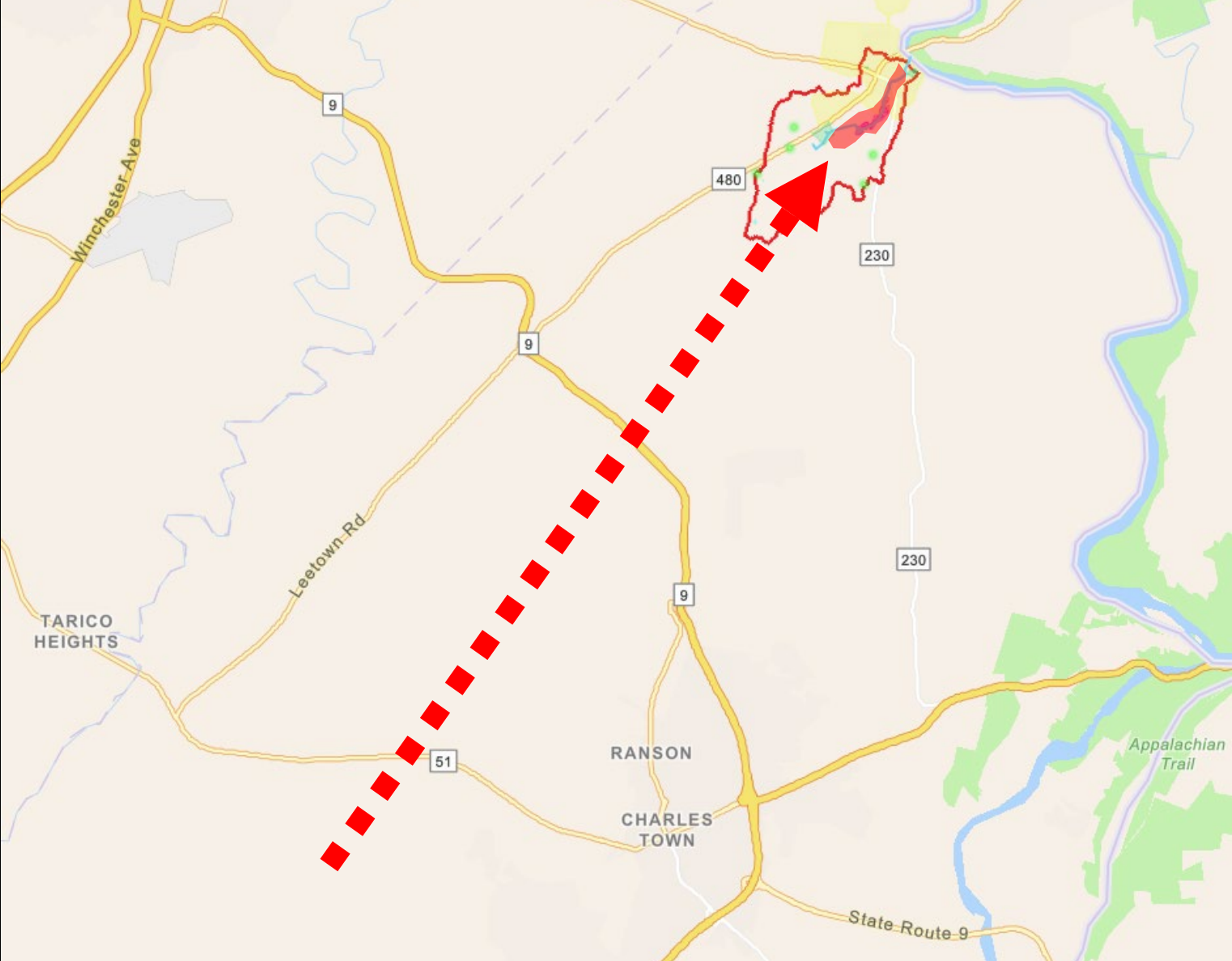
← Runoff

Where does Town Run water come from?



- ← Local GW mixing
- ← Runoff
- Designated zone of critical concern

Where does Town Run water come from?



← Regional GW flow path

■ Designated zone of critical concern

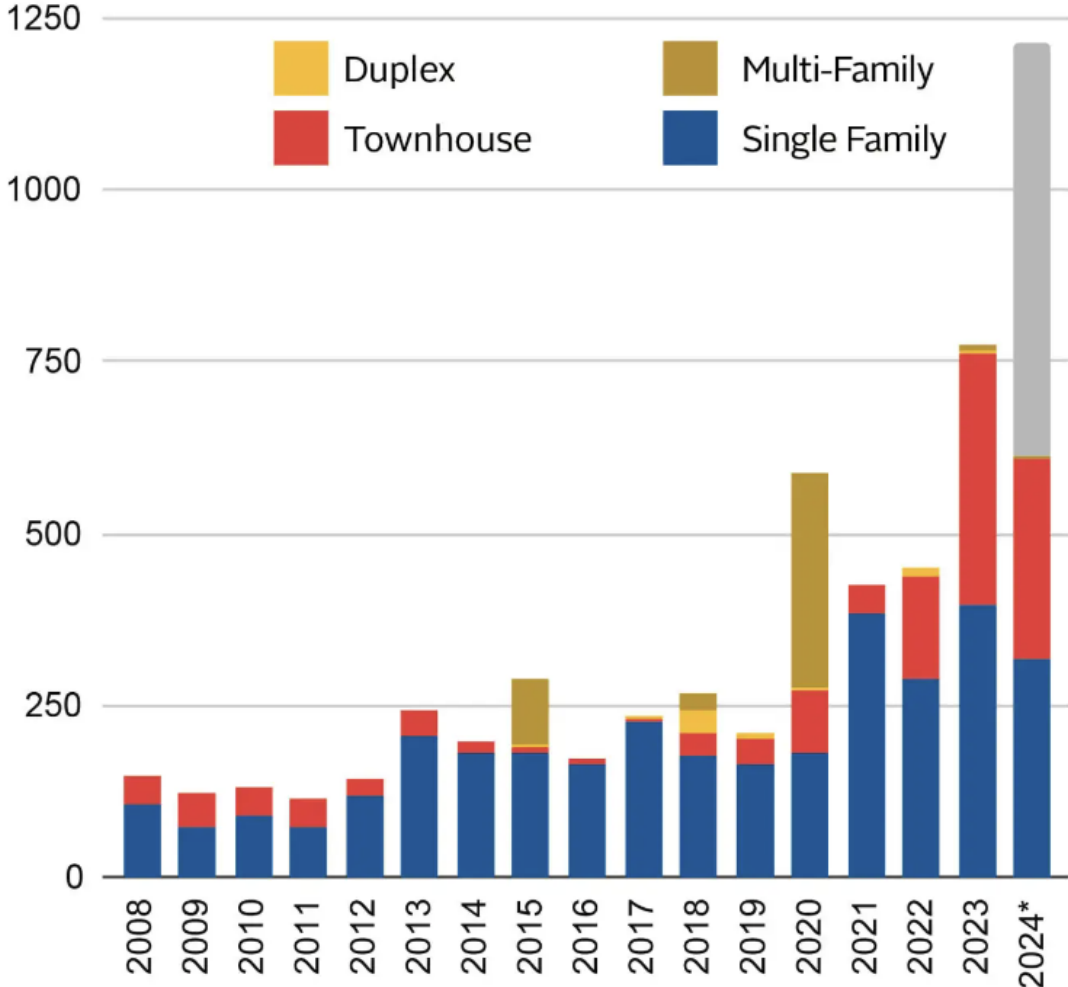
Risks = contaminant sources across the landscape



Risks = increased water demand across the landscape



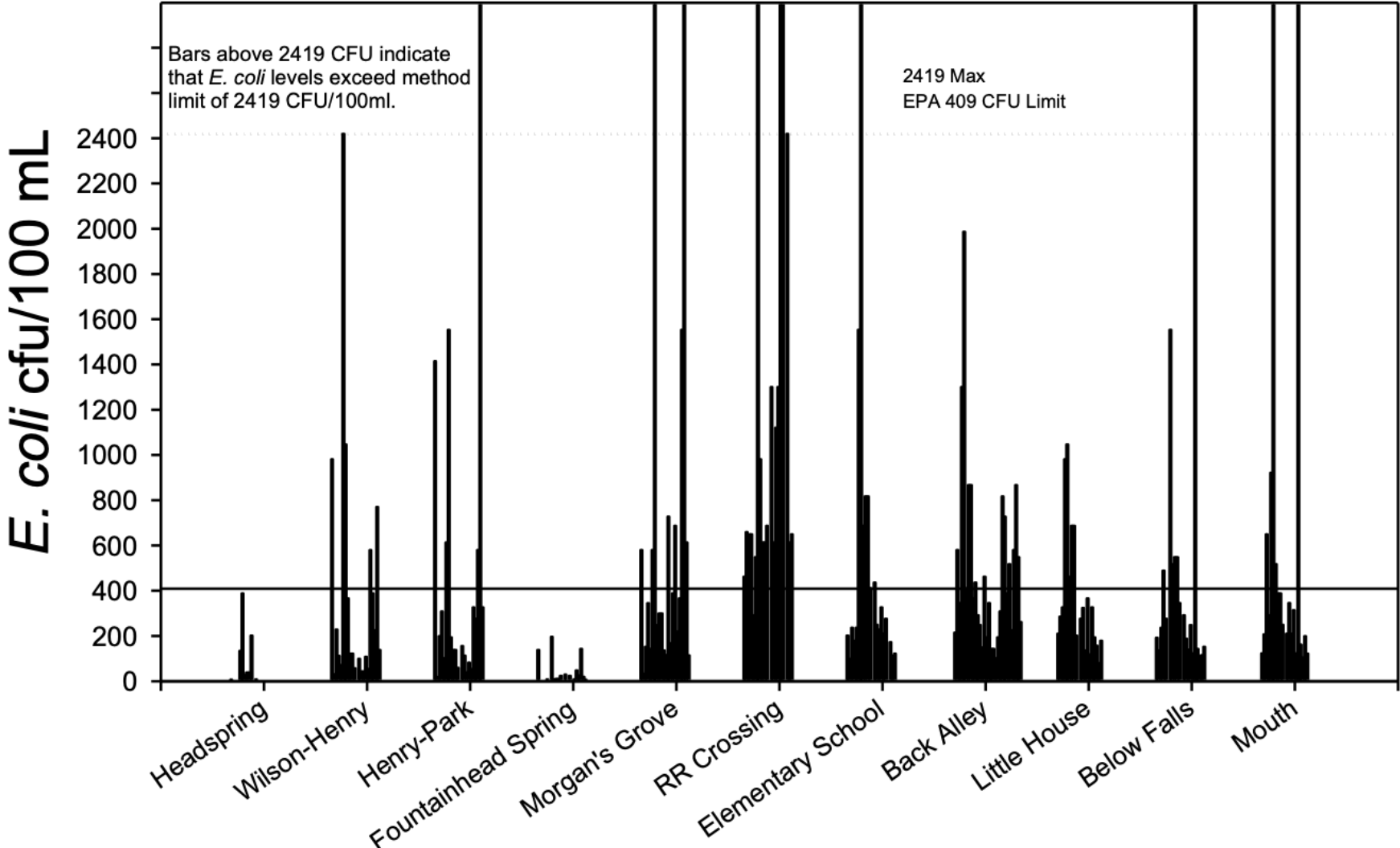
NEW HOUSING PERMITS IN JEFFERSON COUNTY



*2024 data are for Jan - Jun (6 months). Gray bar indicates projection for full year.



Risks = bacterial contamination

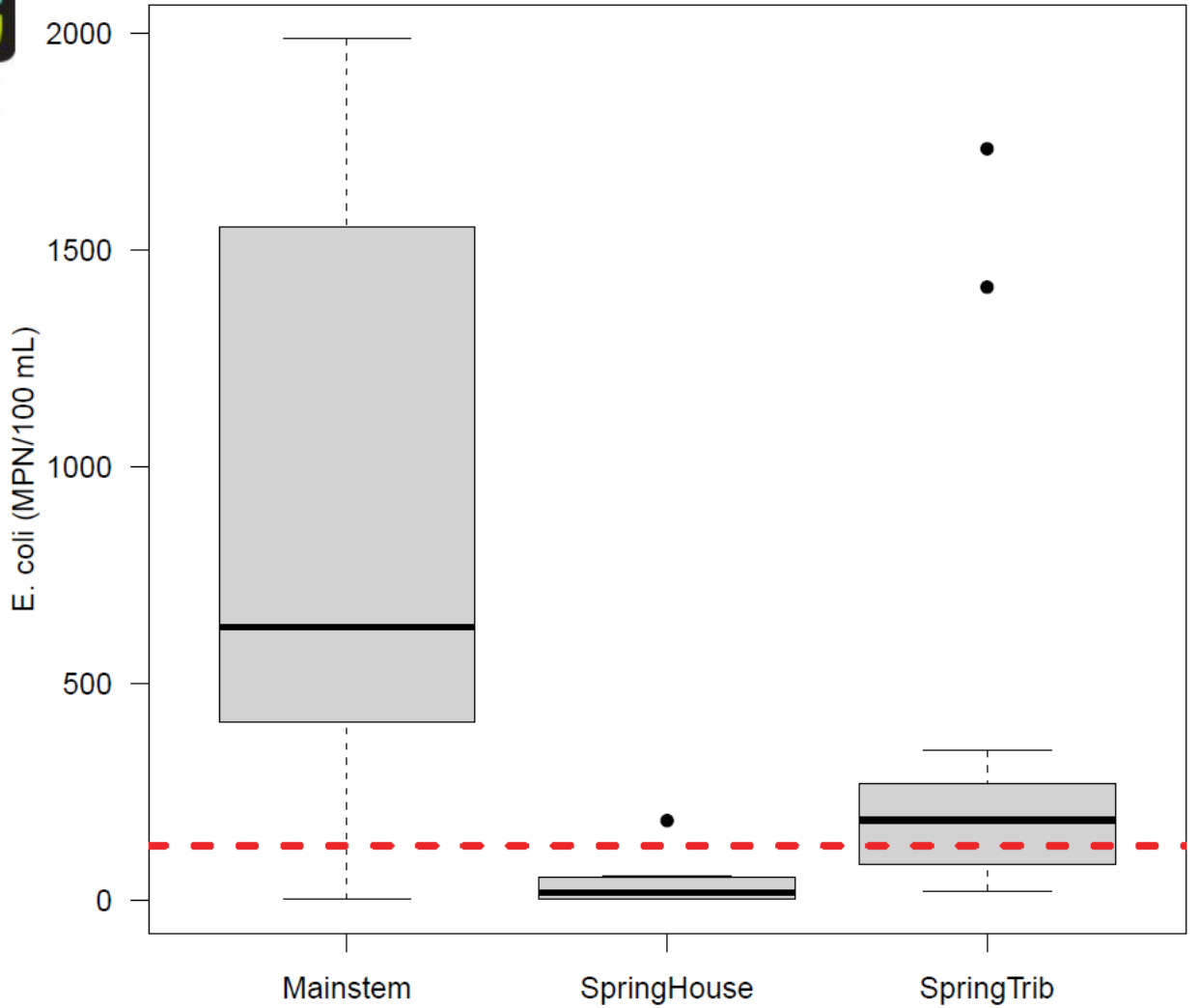


2005-
2006
data

Risks = bacterial contamination



Town Run 2024 E. coli survey



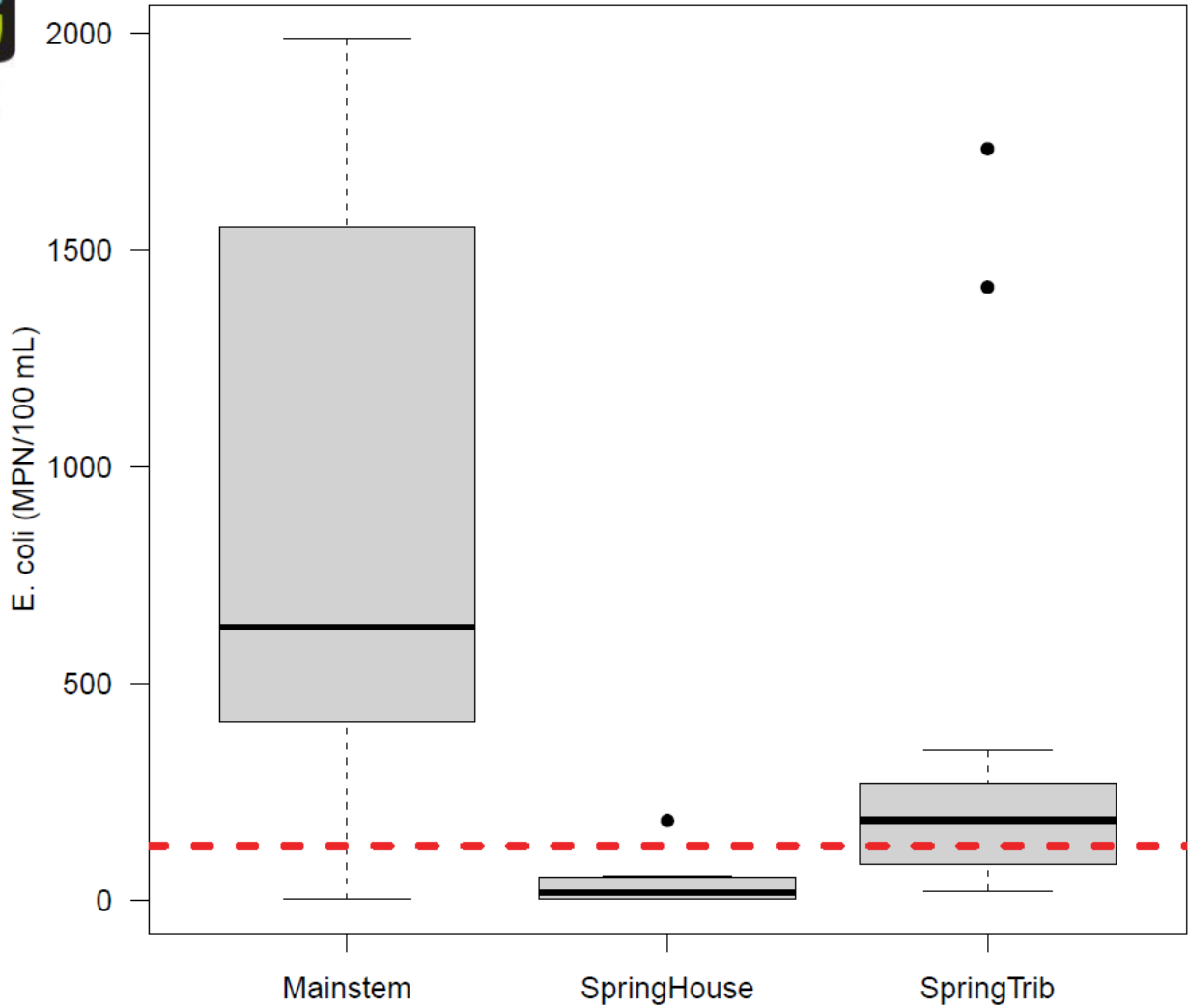
WVDEP benchmark for recreational contact



Risks = bacterial contamination



Town Run 2024 E. coli survey



- Potential sources:
- Broken septic systems
 - Biosolid applications
 - Pets
 - Livestock

WVDEP benchmark for recreational contact

...source tracking study underway

Some resources and what we can do

Septic maintenance and repair



FREE Homeowner Septic Class

The Town Run Watershed Association invites Shepherdstown and Jefferson County residents and homeowners to attend a Free Homeowner Septic Class on Saturday, October 5th, from 1:30 PM to 3:00 PM, at the Shepherdstown Public Library, 145 Higbee Lane, Shepherdstown.



Stream monitoring

Drought Monitor

<https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?WV>

Flash drought predictions

<https://www.cpc.ncep.noaa.gov/products/predictions/threats/threats.php>

USGS river gage network

<https://waterdata.usgs.gov/wv/nwis/rt>

USGS Groundwater Levels

<https://rconnect.usgs.gov/vawv-groundwater/>



WV Stream Watch App



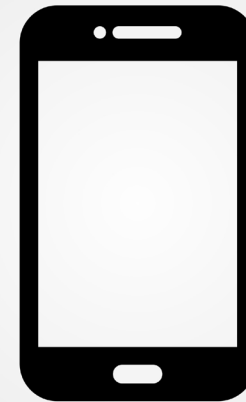
Photo documentation of stream conditions via crowdsourcing

Drought, sediment, fish kills, pollution discharge

Free, simple, and mobile

Builds social networks

Includes DEP reporting option



WV Stream Watch App



WV Stream Watch App



WV Stream Survey Portal



[+ Add Data](#)

224 Members

9487 Observations

628 Locations

106925 Measurements

2 Liked

MEMBER BASED

PUBLIC

[Home](#) [Data](#) [Resources](#) [Forum](#) [Analyses](#) [Results](#) [Edit Project](#) [Datasheets](#) [Members](#) [Integrations](#)

Welcome to Trout Unlimited WV-VA Water Quality Monitoring Project

Monitor the impact of development activities on the statewide water resources

Goals

The West Virginia and Virginia Water Quality Monitoring Project was created for Trout Unlimited volunteers to monitor the impact of development on the state's water resources and report any issues to the appropriate authority.

Tasks

The West Virginia and Virginia Water Quality Monitoring Project was created for Trout Unlimited volunteers to monitor the impact of development on the state's water resources and report any issues to the appropriate authority.

Project Owner



Nathaniel H

[Contact Manager](#)

Project Dataset

[Download Dataset](#)



WEST VIRGINIA
RIVERS

Choose clean water coalition

Choose Clean Water Coalition



The [Choose Clean Water Coalition](#) is an alliance of organizations across the Bay states (West Virginia, Pennsylvania, Delaware, Maryland, New York and Virginia) that work together to advocate for clean rivers and streams in all communities in the Chesapeake Bay region.

WV Rivers is the state lead in West Virginia. We organize and support collective advocacy efforts for West Virginia coalition members. You can find members of the Choose Clean Water Coalition [here](#).

We invite watershed groups and community organizations to learn about and advocate on policies that affect the Chesapeake Bay and its headwaters and tributaries in West Virginia.

If you are an organization working in the Chesapeake Bay region and is interested in incorporating clean water advocacy in your work, [contact us to become a member](#).



WEST VIRGINIA
RIVERS

Safe Water Conservation Collaborative



Home

Who we are ▾

Trees ▾

What we do ▾

Events Calendar

Learn more ·

Safe Water Conservation Collaborative



Tom Gleason - a Safe Water Conservation Collabor...

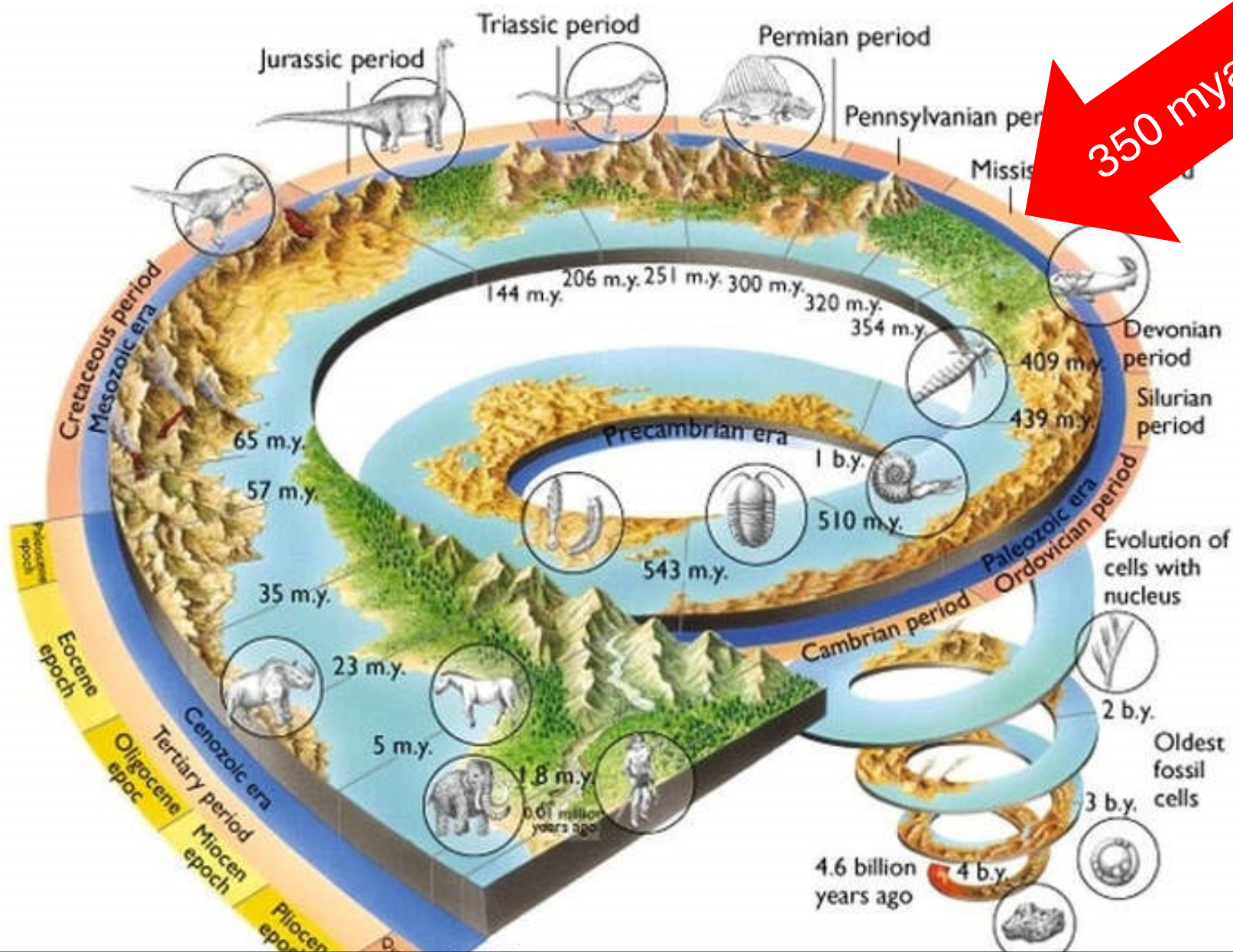
Share

Local landowners like you have protected their land & legacy with conservation easements.

See what Tom Gleason has to say about conserving their "special place" along Back Creek.

You can also:

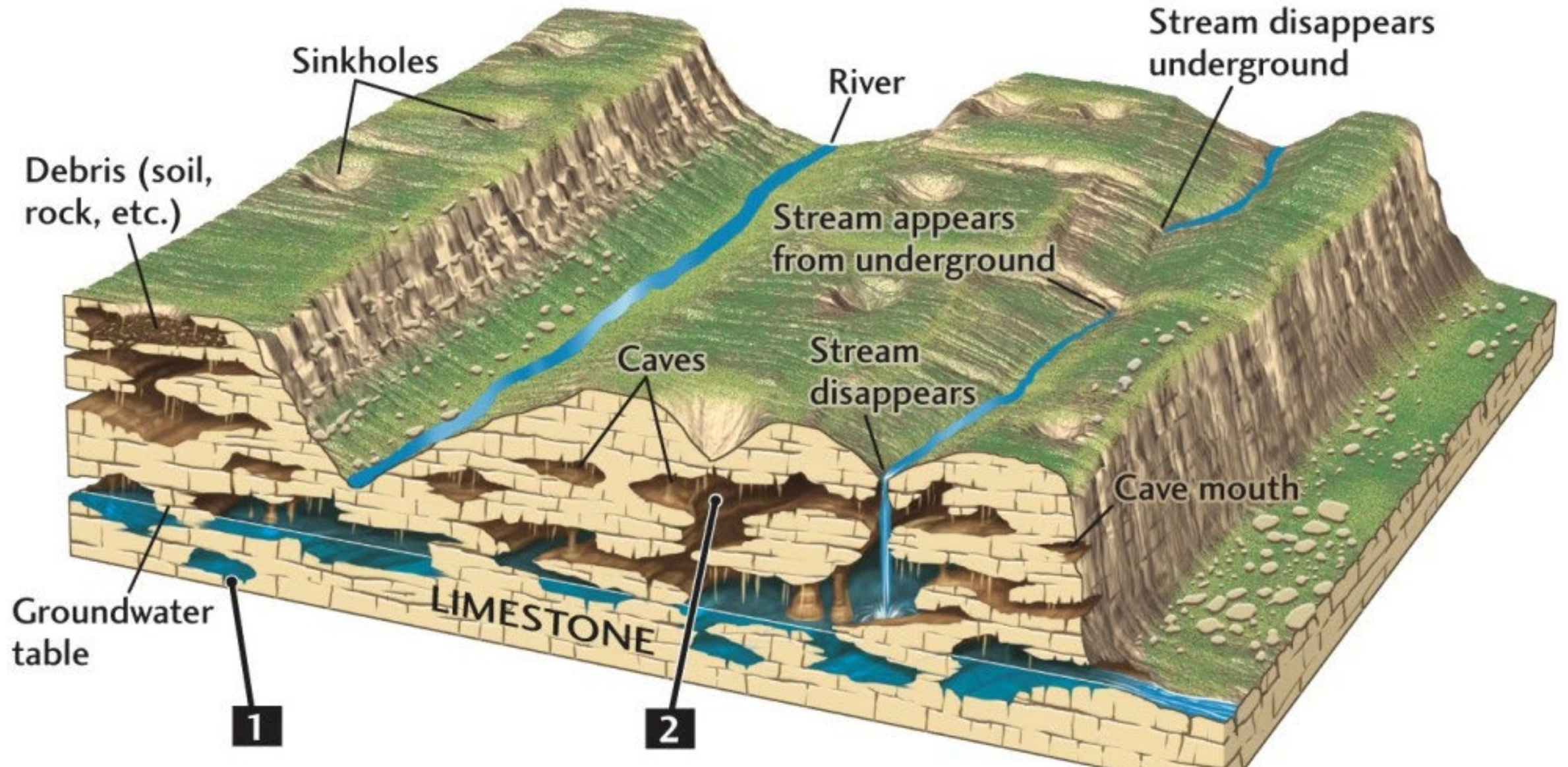
- [Watch more landowner stories](#)



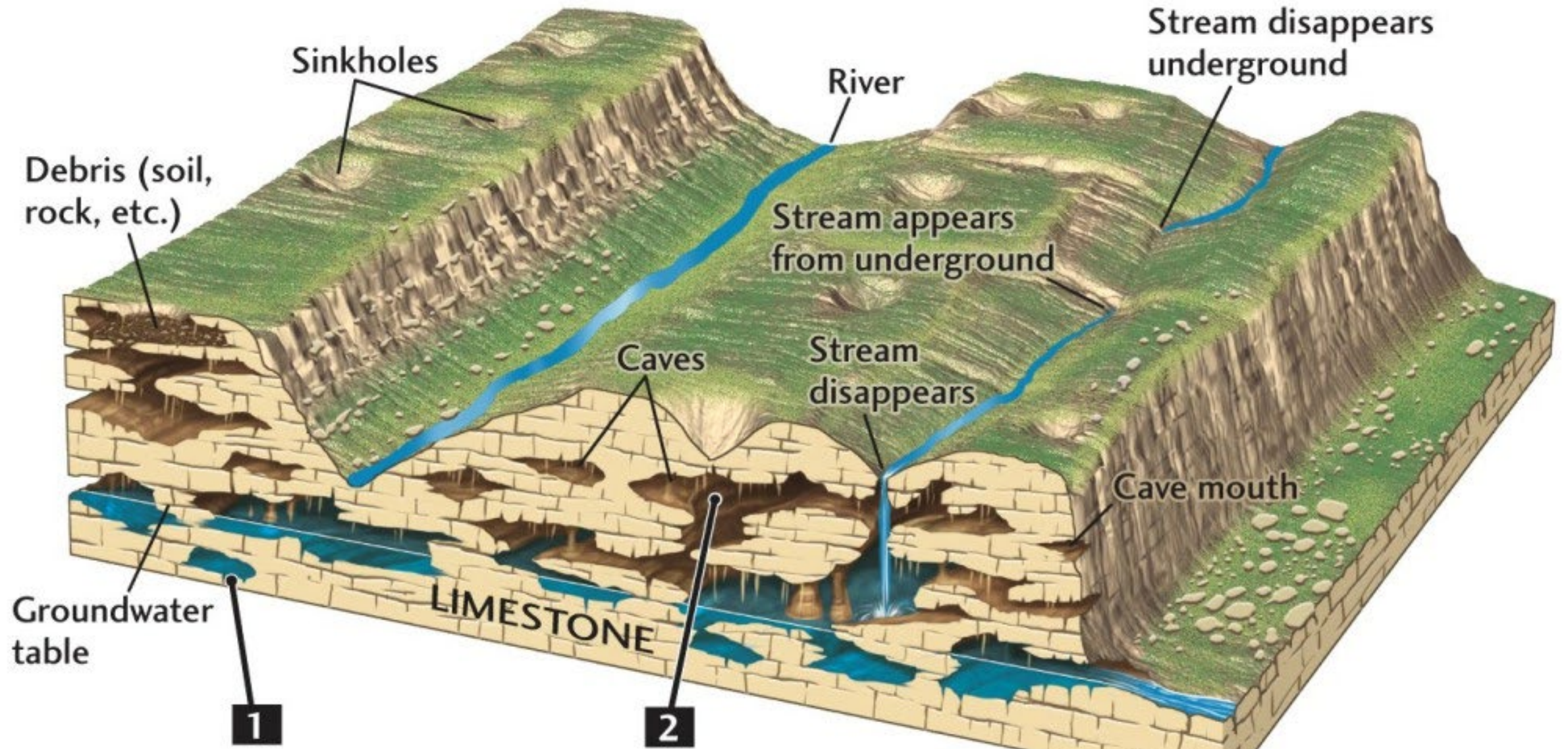
Limestone and dolostone deposition

Deep history affects current risks and resiliencies

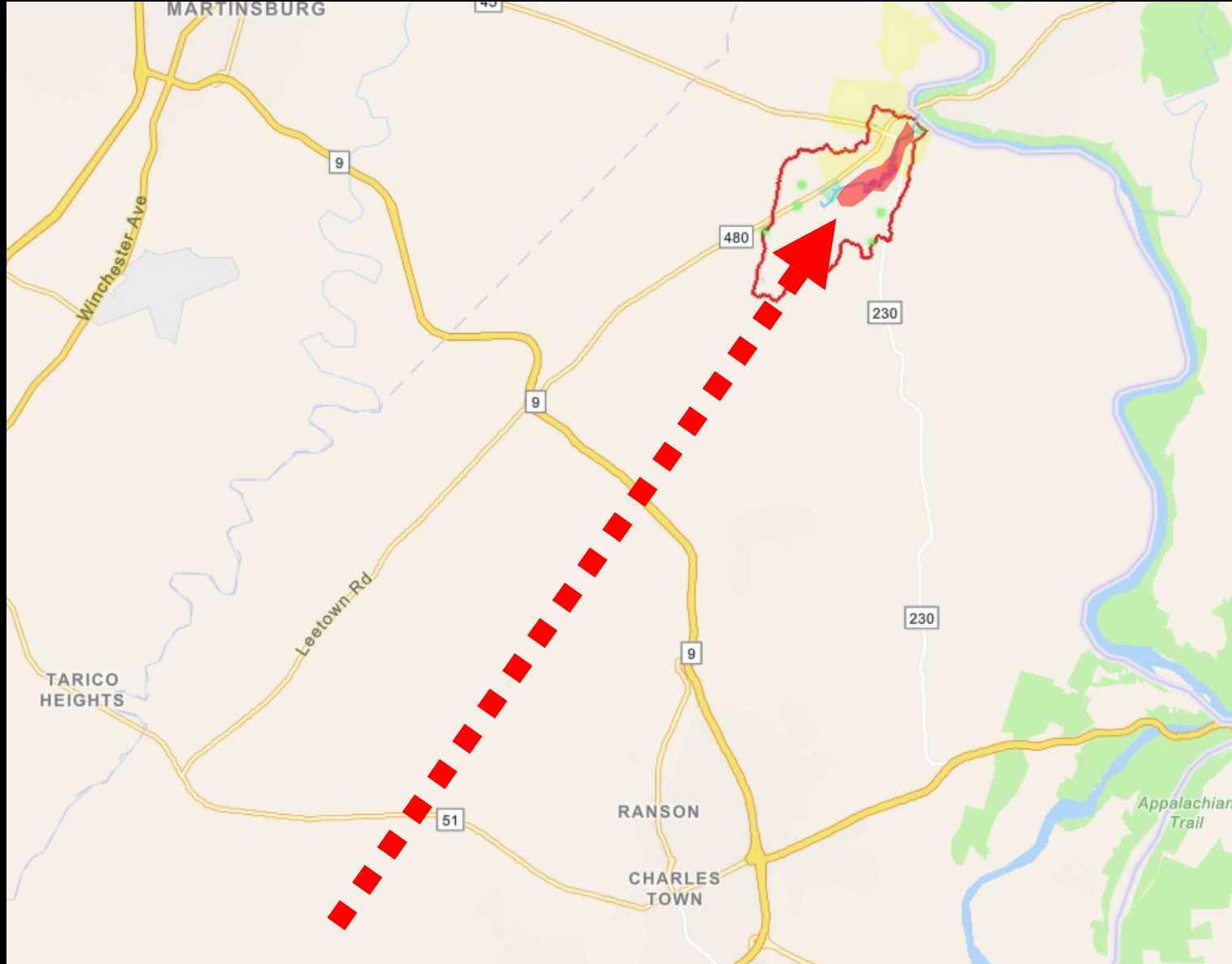
Karst terrain = we're all drinking from the same cup



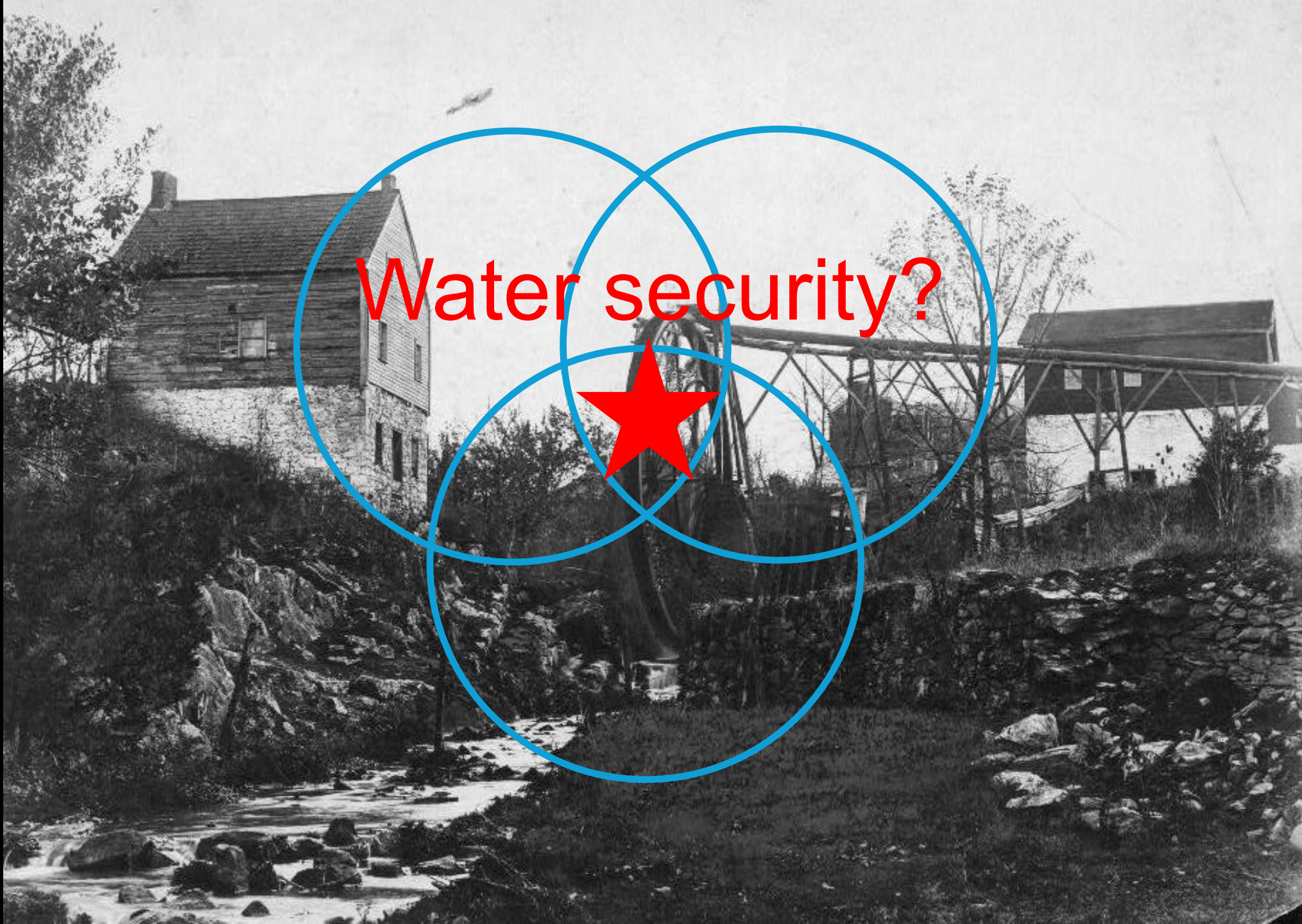
Karst terrain = resiliency and risk



Karst terrain = county planning affects Shepherdstown







Water security?



WEST VIRGINIA
RIVERS