Aquatic Organism Passage in PA

Benjamin D. Lorson, Fish Passage Coordinator
Division of Habitat Management, PA Fish and Boat Commission

The mission of the Fish & Boat Commission is to protect, conserve and enhance the Commonwealth's aquatic resources and provide fishing and boating opportunities.

PA Fish and Boat Commission

- The mission of the Fish and Boat Commission is to protect, conserve and enhance the Commonwealth's aquatic resources, and provide fishing and boating opportunities.
- Bureau of Fisheries
  - Division of Fisheries Management
  - Division of Environmental Services
  - Division of Habitat Management

Aquatic Organism Passage in PA

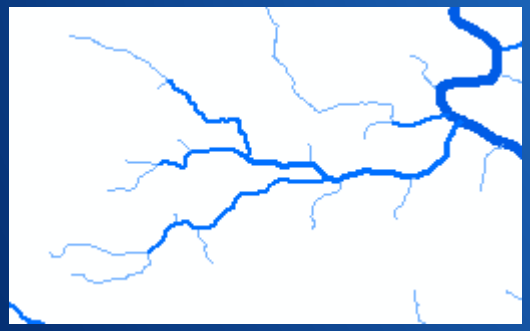
- Why do we care about fish passage
- How fragmented are our waterways
- What is happening in PA to connect our waterways
- How is aquatic connectivity related to resiliency

Resiliency (Merriam-Webster)

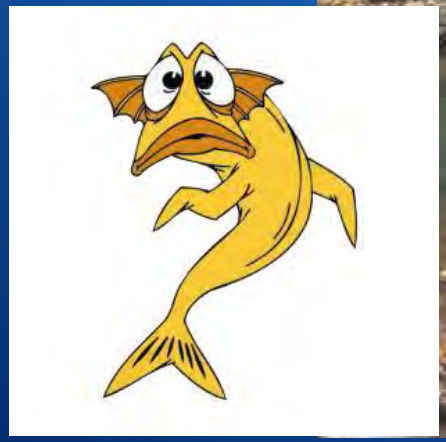
1. The ability of something to return to its original size and shape after being compressed or deformed
2. **An ability to recover from or adjust easily to adversity or change**

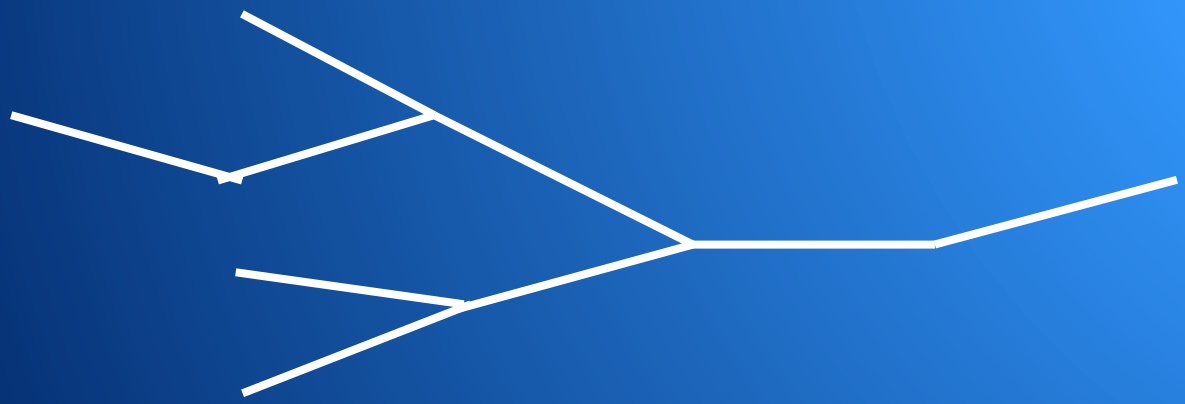
Why is fish passage important??

- Fish live in a linear world

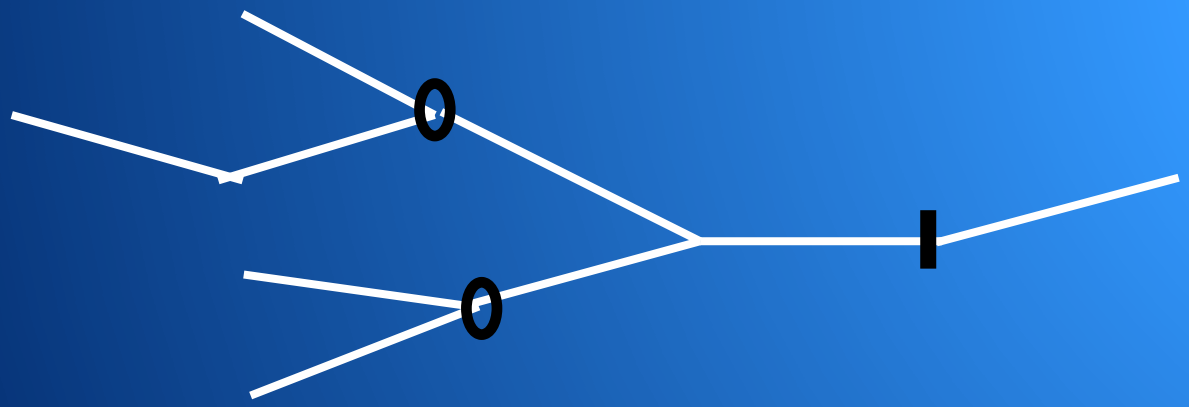


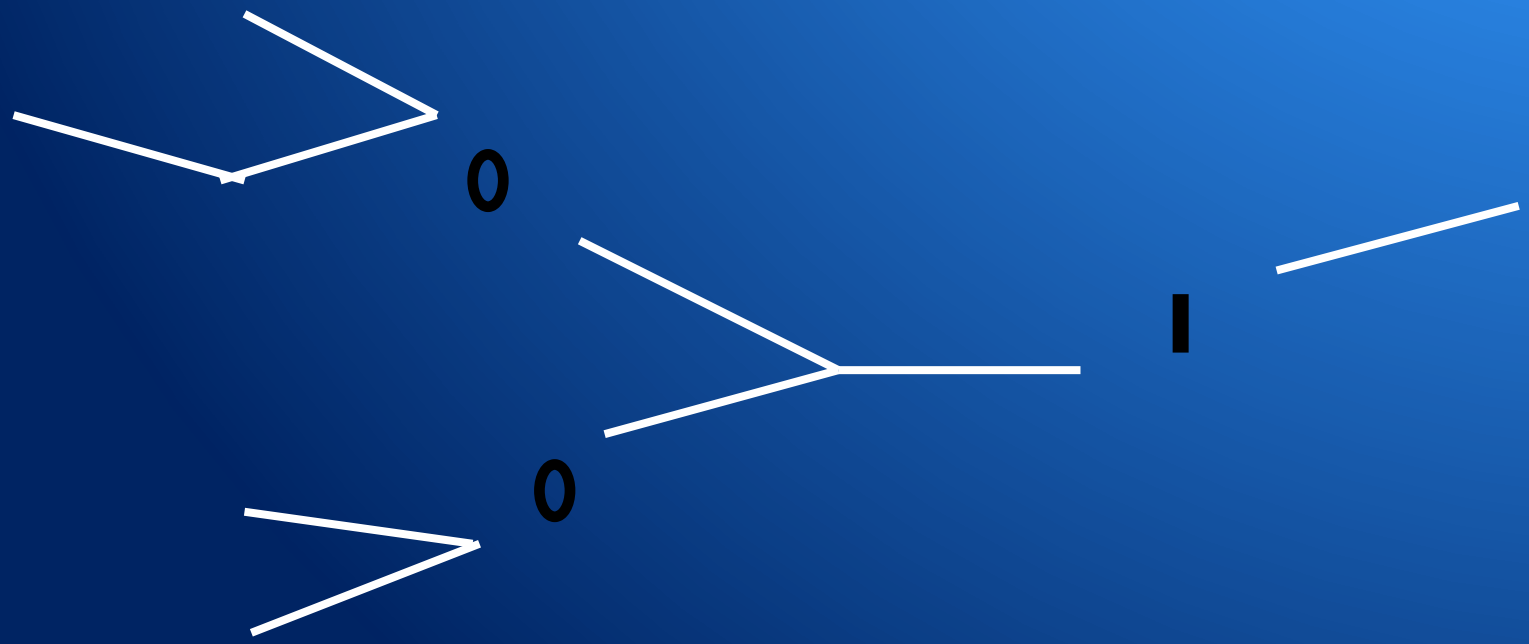
- Inability to deviate from aquatic corridor





- Fish move to satisfy various life history needs:
  - Spawning
  - Seasonal habitat – winter vs. summer, floods, droughts
  - Escape competitive or predatory pressure
  - WQ issues – temp, pH, DO, pollution event

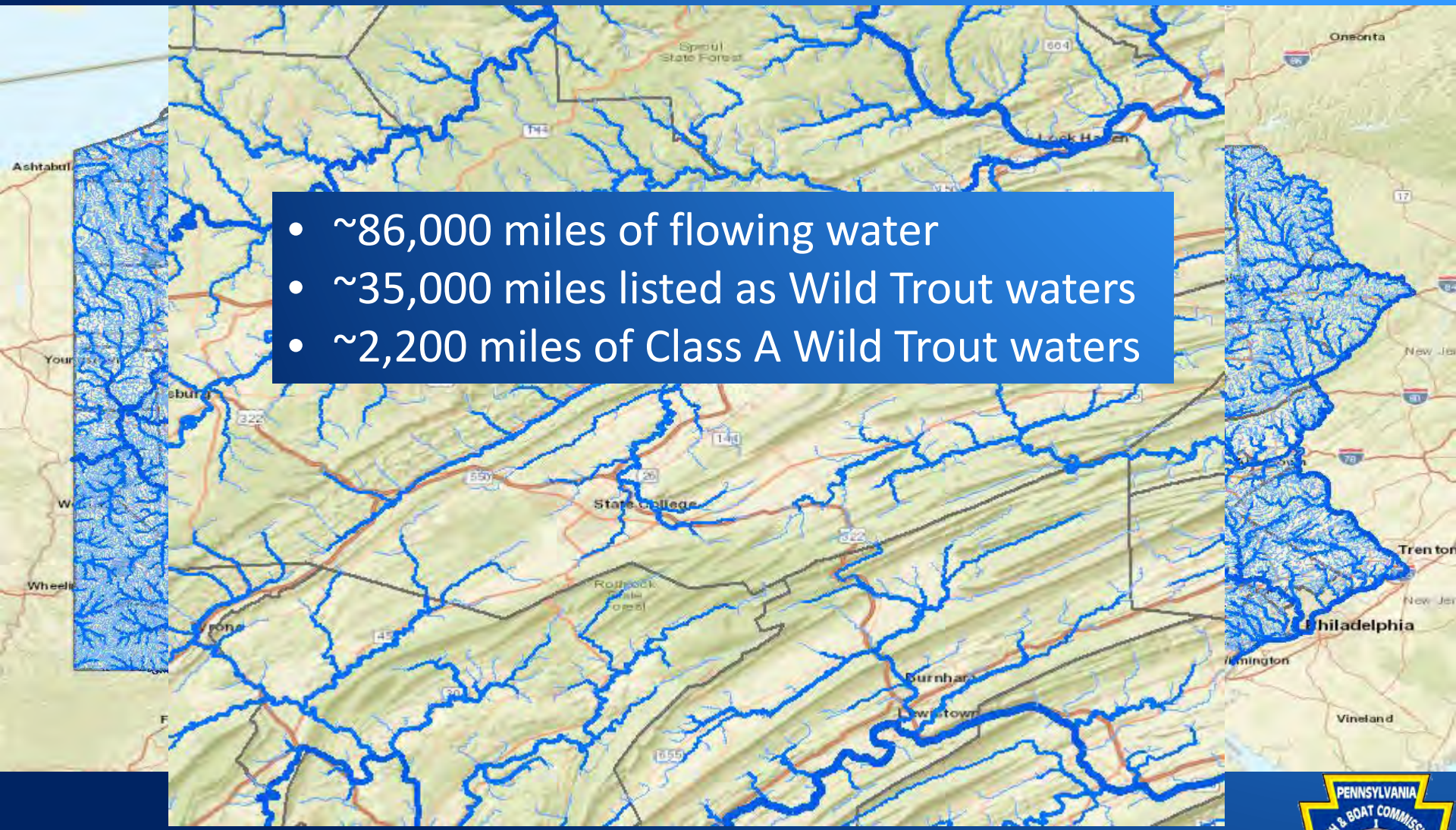

O
O
I


O
O
I

- Fragmentation → Compartmentalization
  - fish seek best available habitat rather than optimal habitat
  - Can lead to a lack of genetic diversity

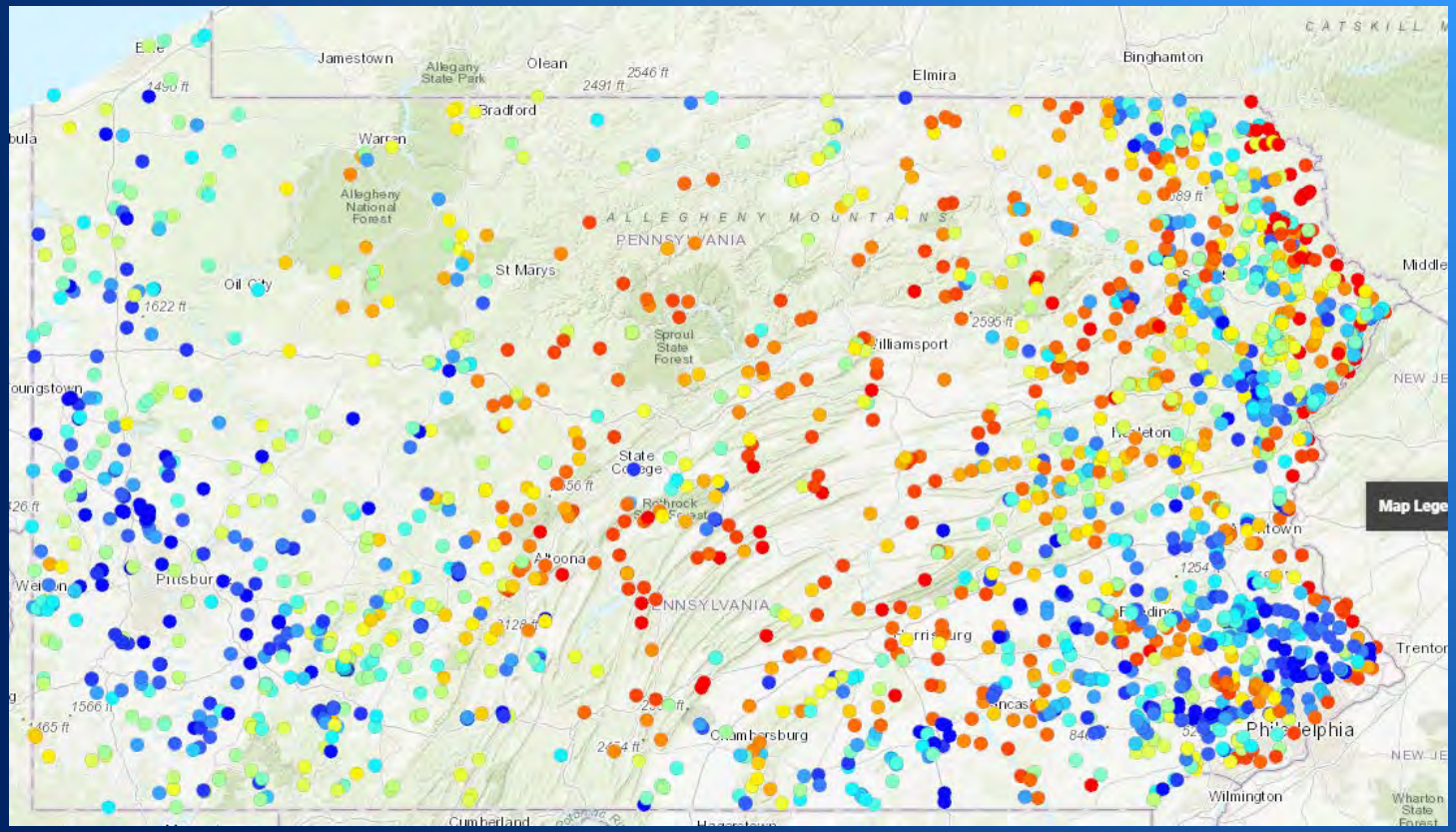
- **Connectivity → Resiliency**
  - Maintain genetic diversity, occupy best habitat, move to deal with stressors, dispersal

PA stream network

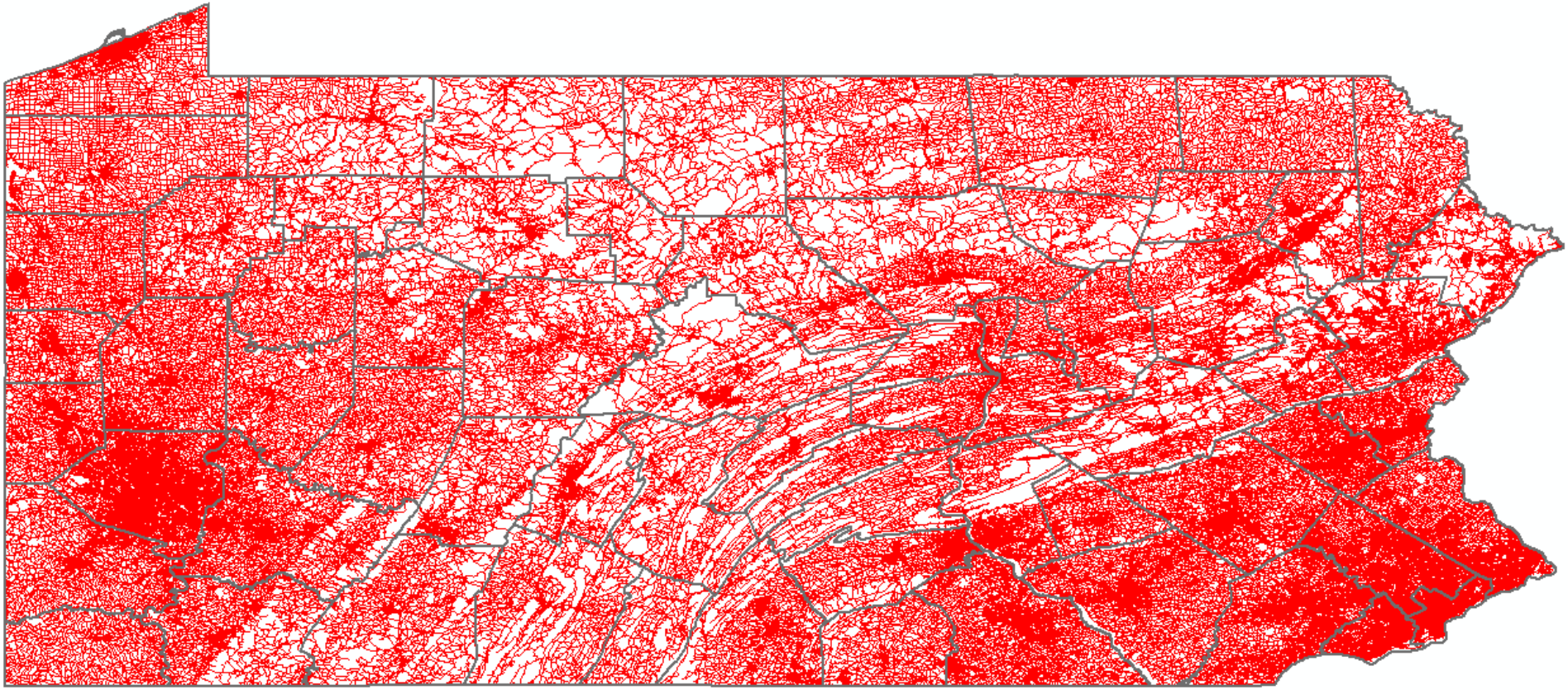


- ~86,000 miles of flowing water
- ~35,000 miles listed as Wild Trout waters
- ~2,200 miles of Class A Wild Trout waters

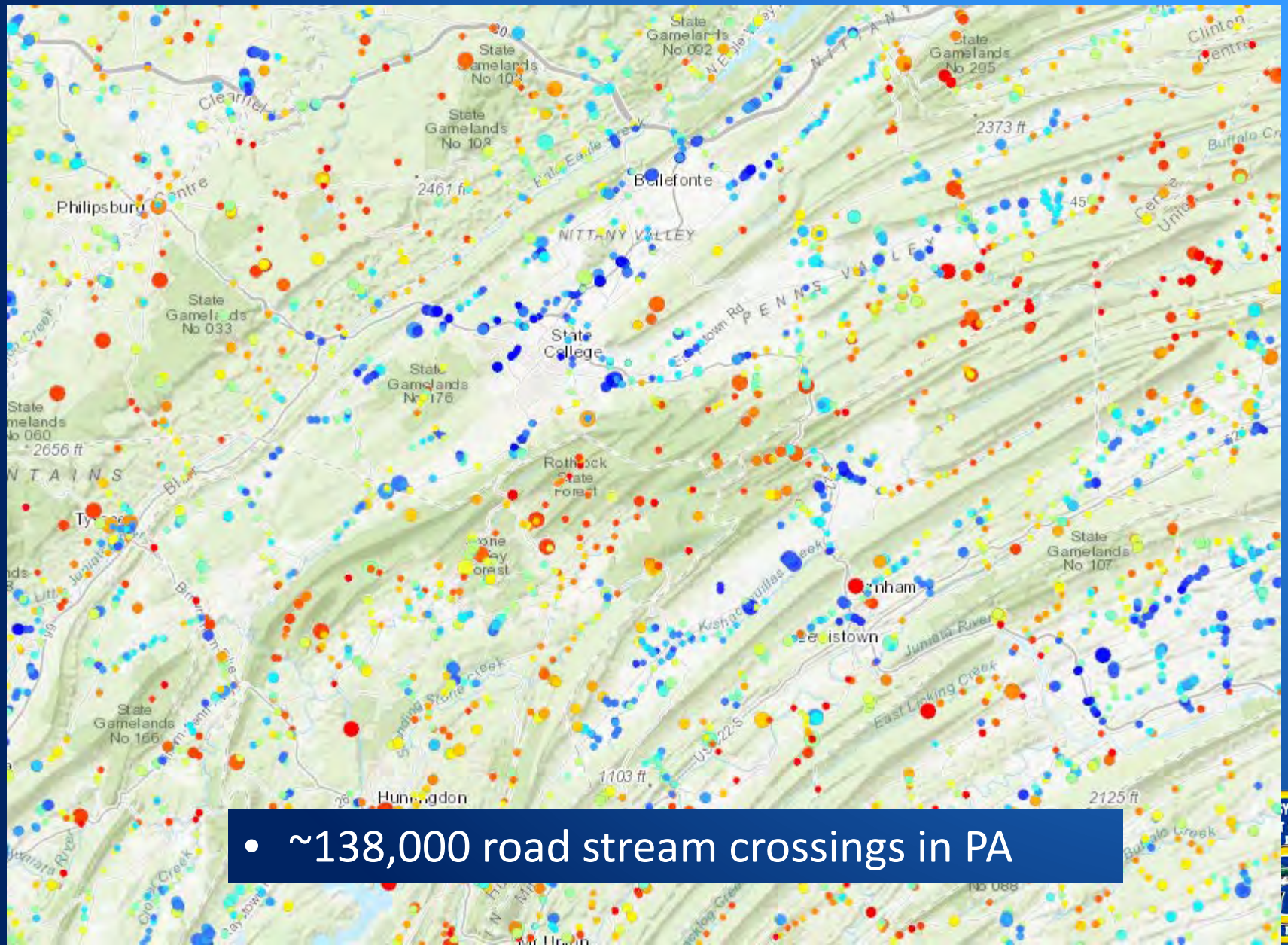
Dams


Jamestown
Allegany State Park
Olean
Elmira
Binghamton
Bradford
Warren
Allegheny National Forest
ALLEGHENY MOUNTAINS
PENNSYLVANIA
St Marys
Oil City
Sproul State Forest
State College
Altoona
Chambersburg
Philadelphia
Wilmington
Cumberland
Trenton
Map Lege

PA Road Network



Dams and road/stream crossings



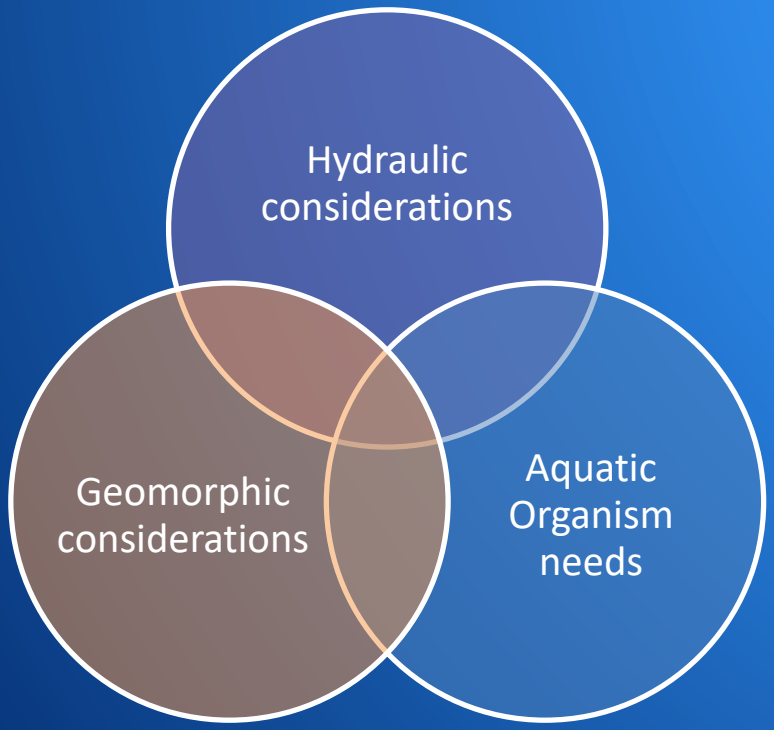
- ~138,000 road stream crossings in PA

Road owners vs. “-ologists”

- Road owners – get people, equipment, vehicles over the stream
- “-ologists” – get the stream and aquatic organisms under the road

Fish movement needs

- Jump height
- Swim speed
- Water depth = propulsion
- Seasonality/duration of conditions
- Energetic costs



- **Match geomorphic conditions within a structure to what is naturally present upstream and downstream**

Road owners <u>and</u> "-ologists"

- Road owners – get people, equipment, vehicles over the stream
- "-ologists" – get the stream and aquatic organisms under the road

- **Fishhead argument: by accommodating aquatic organism passage under the road you will achieve/surpass the road owners' needs – *increased lifespan and reduced maintenance of the structure*.**

How is PFBC involved in AOP

- Maximizing linear nature of our flowing systems
  - Permit review
  - Project facilitation
  - Sharing data to help guide decision making
  - Various technical and policy committees

Partnerships are critical

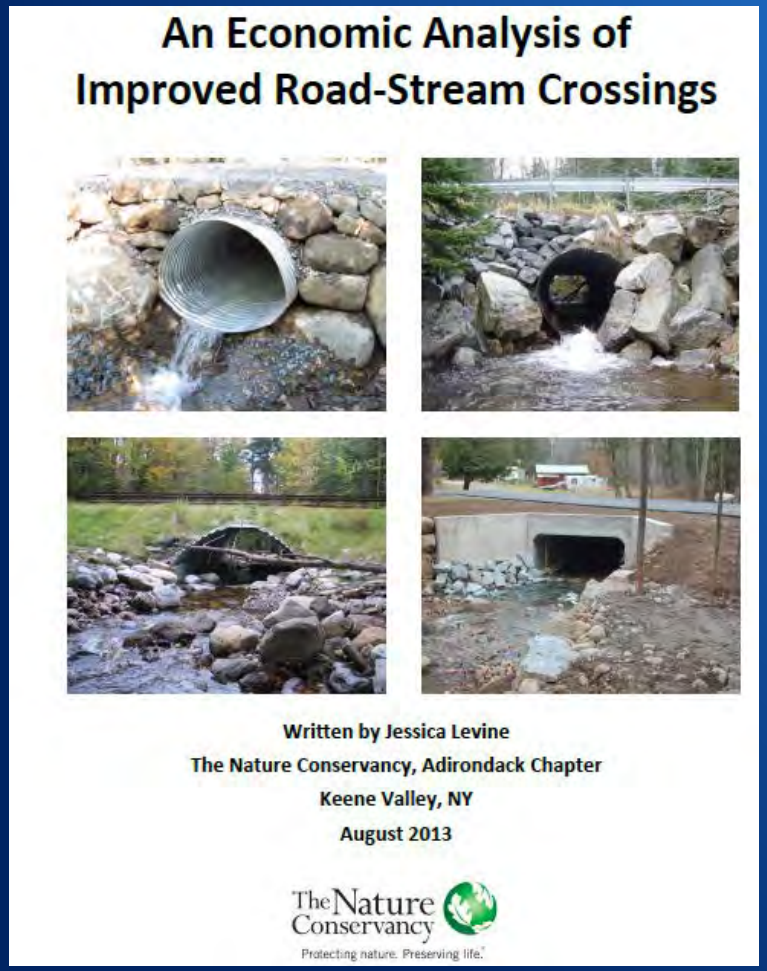
PA Aquatic Connectivity Team

- Encourage Collaboration
- Maximize efficiency in tackling AOP issues
- Minimize redundancy

North Atlantic Aquatic Connectivity Collaborative - NAACC

- Formed in 2015 to look at AOP from VA to ME
- Unified culvert inventory and assessment methodology
- Certification for observers and coordinators
- Publicly accessible culvert assessment database

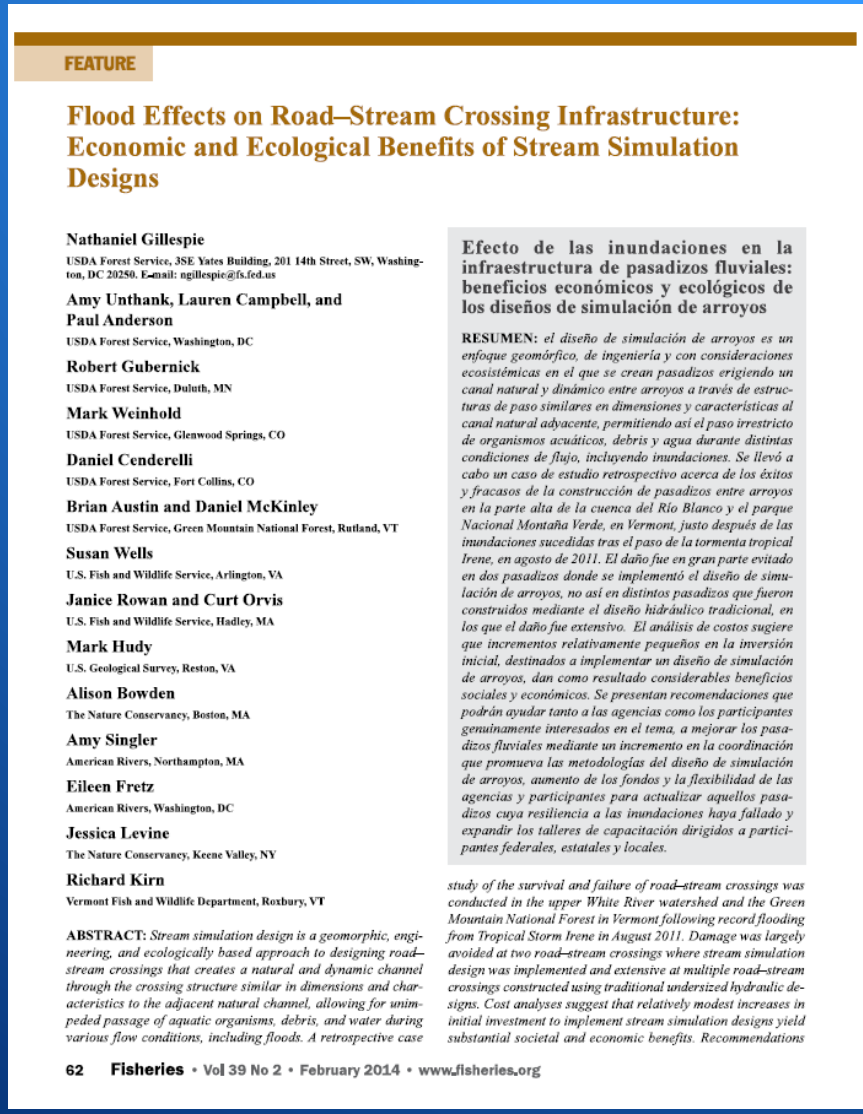
Resilient infrastructure and aquatic populations



- increased up front costs for larger structures
  - = increased structure longevity
  - = lower maintenance costs
  - long term cost implications

https://www.cwicny.org/files/Road-Stream%20Crossing%20Economic%20Analysis.pdf

Resilient infrastructure and aquatic populations



FEATURE

Flood Effects on Road–Stream Crossing Infrastructure: Economic and Ecological Benefits of Stream Simulation Designs

Nathaniel Gillespie
USDA Forest Service, 3SE Yates Building, 201 14th Street, SW, Washington, DC 20250. E-mail: ngillespie@fs.fed.us

Amy Unthank, Lauren Campbell, and Paul Anderson
USDA Forest Service, Washington, DC

Robert Gubernick
USDA Forest Service, Duluth, MN

Mark Weinhold
USDA Forest Service, Glenwood Springs, CO

Daniel Cenderelli
USDA Forest Service, Fort Collins, CO

Brian Austin and Daniel McKinley
USDA Forest Service, Green Mountain National Forest, Rutland, VT

Susan Wells
U.S. Fish and Wildlife Service, Arlington, VA

Janice Rowan and Curt Orvis
U.S. Fish and Wildlife Service, Hadley, MA

Mark Hudy
U.S. Geological Survey, Reston, VA

Alison Bowden
The Nature Conservancy, Boston, MA

Amy Singler
American Rivers, Northampton, MA

Eileen Fretz
American Rivers, Washington, DC

Jessica Levine
The Nature Conservancy, Keene Valley, NY

Richard Kirn
Vermont Fish and Wildlife Department, Roxbury, VT

ABSTRACT: *Stream simulation design is a geomorphic, engineering, and ecologically based approach to designing road–stream crossings that creates a natural and dynamic channel through the crossing structure similar in dimensions and characteristics to the adjacent natural channel, allowing for unimpeded passage of aquatic organisms, debris, and water during various flow conditions, including floods. A retrospective case study of the survival and failure of road–stream crossings was conducted in the upper White River watershed and the Green Mountain National Forest in Vermont following record flooding from Tropical Storm Irene in August 2011. Damage was largely avoided at two road–stream crossings where stream simulation design was implemented and extensive at multiple road–stream crossings constructed using traditional undersized hydraulic designs. Cost analyses suggest that relatively modest increases in initial investment to implement stream simulation designs yield substantial societal and economic benefits. Recommendations*

Efecto de las inundaciones en la infraestructura de pasadizos fluviales: beneficios económicos y ecológicos de los diseños de simulación de arroyos

RESUMEN: *el diseño de simulación de arroyos es un enfoque geomórfico, de ingeniería y con consideraciones ecosistémicas en el que se crean pasadizos erigiendo un canal natural y dinámico entre arroyos a través de estructuras de paso similares en dimensiones y características al canal natural adyacente, permitiendo así el paso irrestricto de organismos acuáticos, debris y agua durante distintas condiciones de flujo, incluyendo inundaciones. Se llevó a cabo un caso de estudio retrospectivo acerca de los éxitos y fracasos de la construcción de pasadizos entre arroyos en la parte alta de la cuenca del Río Blanco y el parque Nacional Montaña Verde, en Vermont, justo después de las inundaciones sucedidas tras el paso de la tormenta tropical Irene, en agosto de 2011. El daño fue en gran parte evitado en dos pasadizos donde se implementó el diseño de simulación de arroyos, no así en distintos pasadizos que fueron construidos mediante el diseño hidráulico tradicional, en los que el daño fue extensivo. El análisis de costos sugiere que incrementos relativamente pequeños en la inversión inicial, destinados a implementar un diseño de simulación de arroyos, dan como resultado considerables beneficios sociales y económicos. Se presentan recomendaciones que podrán ayudar tanto a las agencias como los participantes genuinamente interesados en el tema, a mejorar los pasadizos fluviales mediante un incremento en la coordinación que promueva las metodologías del diseño de simulación de arroyos, aumento de los fondos y la flexibilidad de las agencias y participantes para actualizar aquellos pasadizos cuya resiliencia a las inundaciones haya fallado y expandir los talleres de capacitación dirigidos a participantes federales, estatales y locales.*

https://fisheries.org/docs/wp/AFS-Fisheries-Magazine-February-2014.pdf

Resiliency in a changing environment

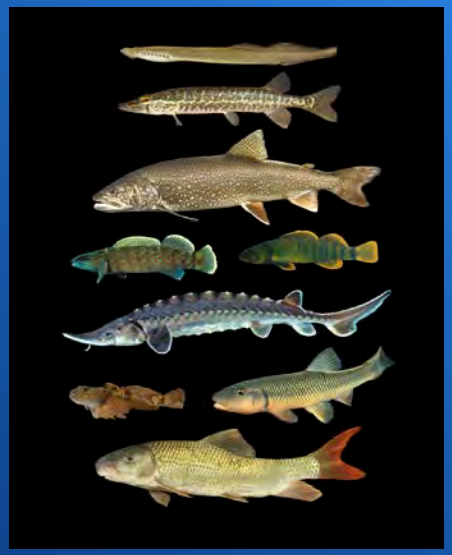
- Aquatic organisms live in a linear world
- highly fragmented aquatic systems
- Various stressors enhance the need to maintain/enhance connectivity

- Improving connectivity builds resilience for our aquatic populations and road infrastructure networks!

Questions?

(Hold until the end)

- belorson@pa.gov
- 814-359-5106



What can you do to help?

- Get involved!
  - Let someone know about a problem culvert
  - Create awareness about the importance of AOP

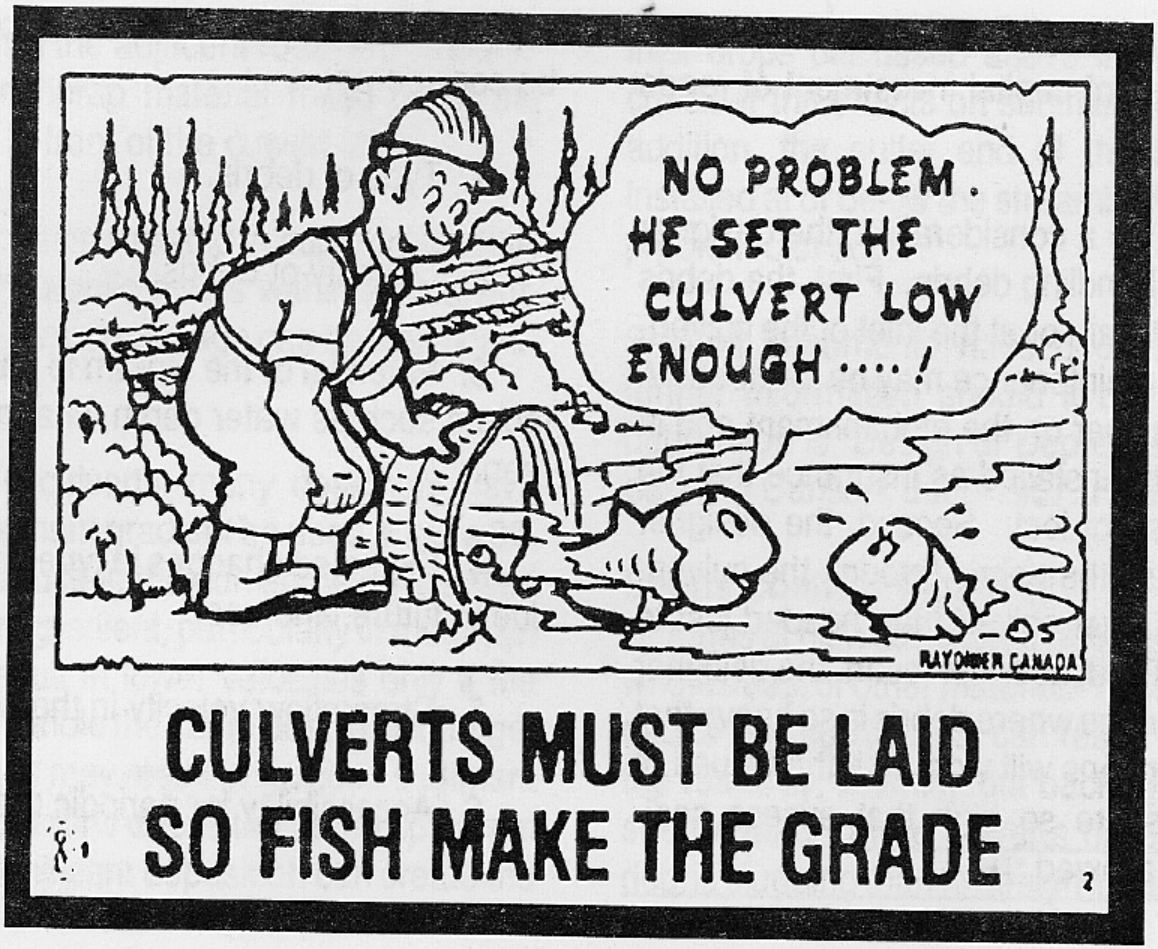


Figure 33.

Slide courtesy of Mark Hudy, USFS