



# OPPORTUNITIES AND CHALLENGES OF WORKING AT THE TIDAL / NON-TIDAL INTERFACE

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8 / 1 / 2022

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# CONTEXT

What is the tidal interface?

- Terrestrial-aquatic interfaces (TAIs) are where fully terrestrial ecosystems transition to those that are fully aquatic—the largely coastal areas of the planet that some scientists say go from “boots to boats.”

Why is it important?

- These terrestrial-aquatic zones are relatively small in size, but they have monumental consequences for Earth systems. They capture, store, transform, and release carbon, nitrogen, water, energy, and other entities that influence feedback loops with aquatic environments, land ecosystems, the atmosphere, and climate.

Source: Pacific Northwest National Laboratory  
<https://www.pnnl.gov/terrestrial-aquatics>

# CONTEXT

## Why is it important? (continued)

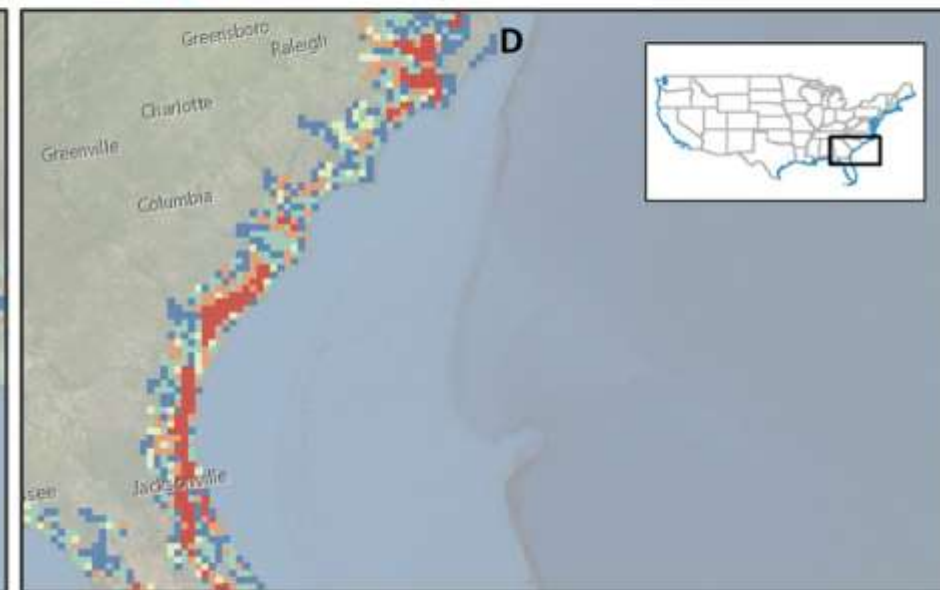
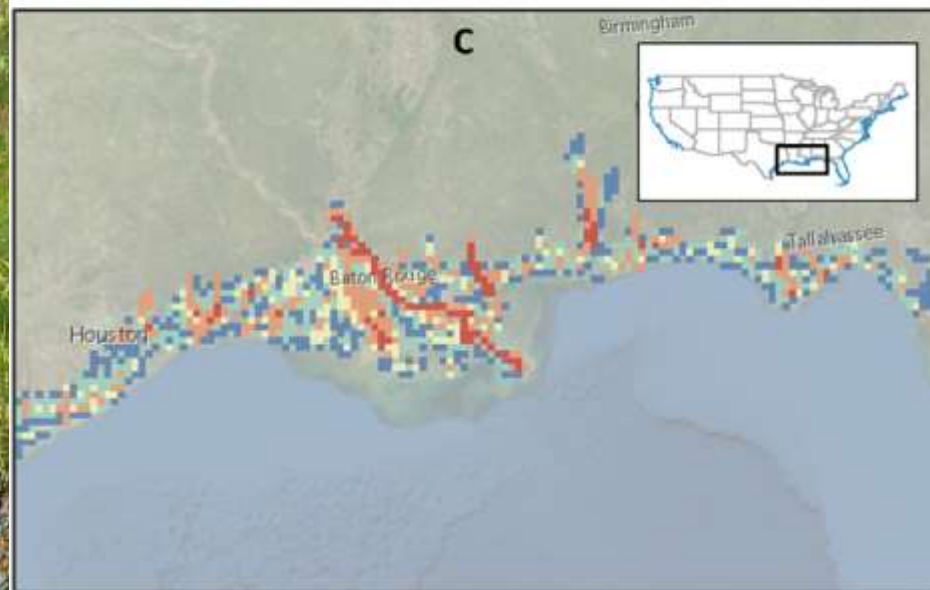
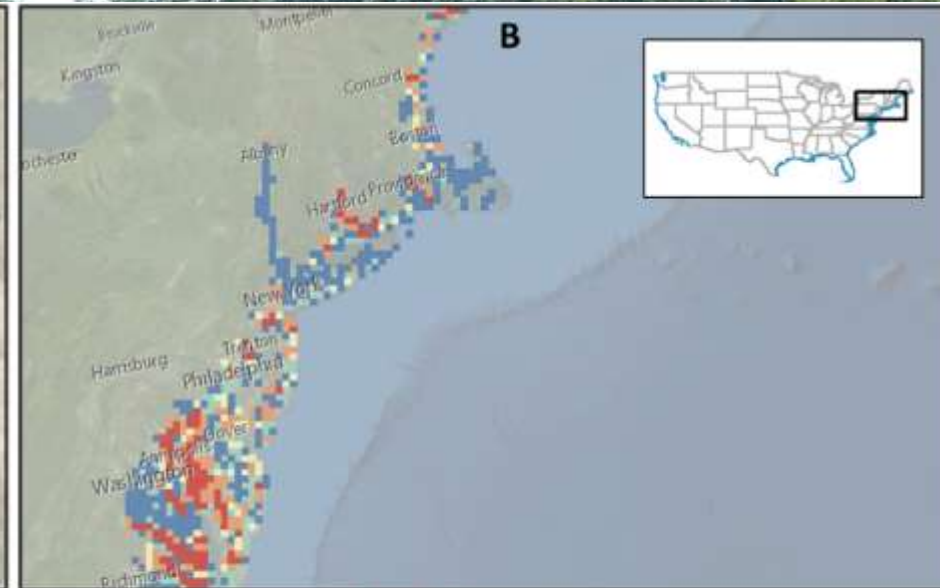
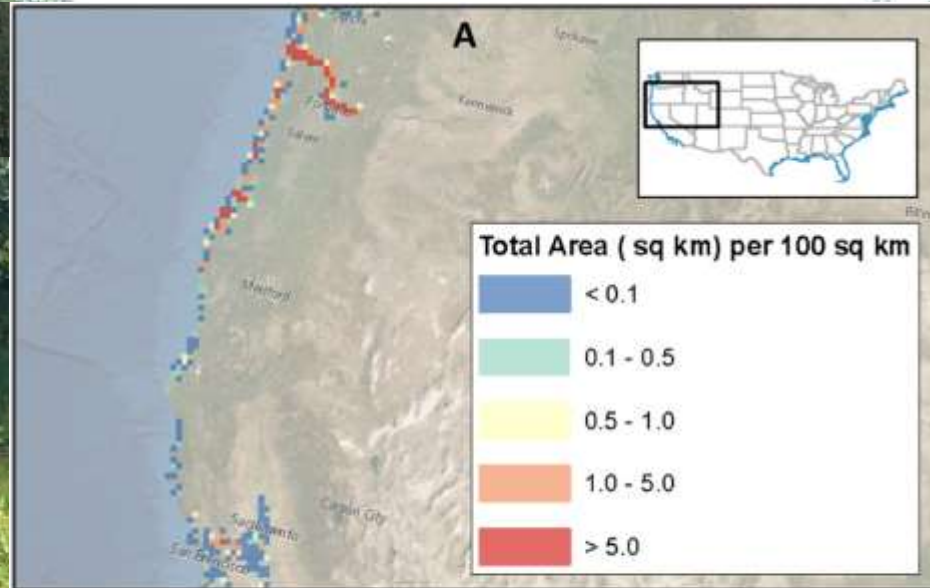
- Tidal streams are ecological and economic hotspots – their full spatial distribution has not been documented
- Small streams dominate the interface with terrestrial ecosystems - dynamic yet poorly understood biogeochemical processes
- Ecosystems associated with small tidal streams are 30% more productive than adjacent ecosystems
- Tidal terrestrial-aquatic interfaces are dominated by small coastal watersheds – not large river deltas
- Small watersheds are highly and disproportionately vulnerable to sea-level rise

Source: Jerry Tagestad, Nicholas D. Ward, David Butman, James Stegen, Small streams dominate US tidal reaches and will be disproportionately impacted by sea-level rise, *Science of The Total Environment*, Volume 753, 2021, 141944, ISSN 0048-9697,

<https://doi.org/10.1016/j.scitotenv.2020.141944>.  
(<https://www.sciencedirect.com/science/article/pii/S0048969720354735>)

# CONTEXT

What is the spatial distribution?



Source: Jerry Tagestad, Nicholas D. Ward, David Butman, James Stegen, Small streams dominate US tidal reaches and will be disproportionately impacted by sea-level rise, *Science of The Total Environment*, Volume 753, 2021, 141944, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2020.141944>. (<https://www.sciencedirect.com/science/article/pii/S0048969720354735>)

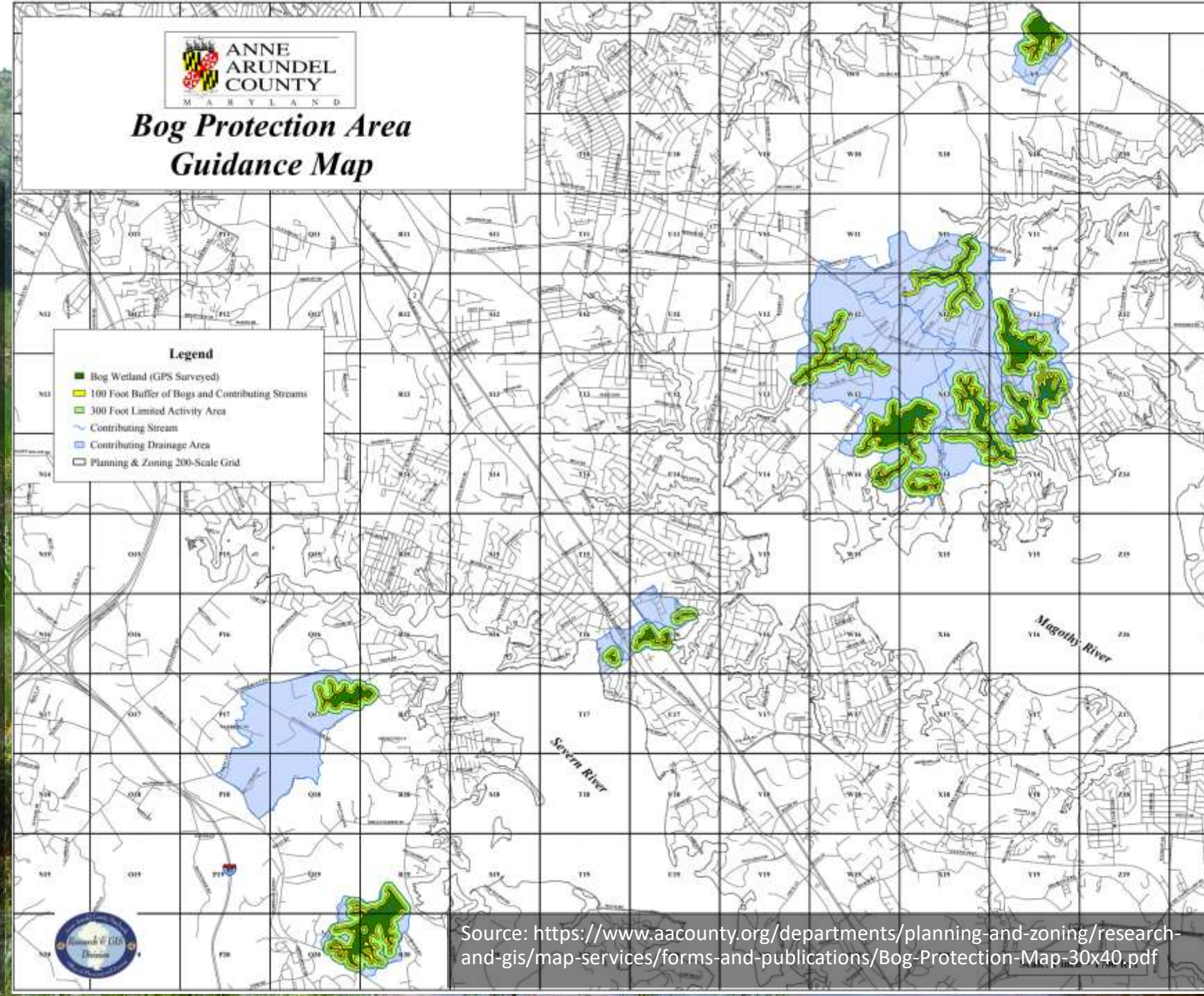
# CONTEXT

What ecosystems can be found within TAI's?

- Salt Marshes
- Mangrove Forests
- Bogs / Peatlands
- Floodplains

Source: U.S. DOE. 2017. Research Priorities to Incorporate Terrestrial-Aquatic Interfaces in Earth System Models:

Workshop Report, DOE/SC-0187, U.S. Department of Energy Office of Science. [tes.science.energy.gov](https://science.energy.gov).



Source: <https://www.aacounty.org/departments/planning-and-zoning/research-and-gis/map-services/forms-and-publications/Bog-Protection-Map-30x40.pdf>

# CHALLENGES

## DESIGN / ENGINEERING

Where are the stable tie out points?

- Mean sea level? Mean low tide? What about blow out tides?

What is the design storm event?

- 100 year storm – but from land or sea?
- How do hurricanes fit into those scenarios?

How can the design be resilient into the future?

- What are the effects of climate change on both Relative Sea Level Rise (RSLR) and altered precipitation totals?

# CHALLENGES

## PERMITTING

Whose jurisdiction is it anyway?

- USACE regulates both tidal and non-tidal Waters of the US, but has different regional/national permits for each.
- Maryland Department of the Environment (MDE) has separate tidal and non-tidal reviewers, and different review processes for each.

Where do you draw the line between tidal & non-tidal wetlands?

- Especially in tidal fresh water, where does a wetland transition from tidal to non-tidal?



# CHALLENGES

## CONSTRUCTION

Erosion & sediment control – work in dry or in wet?

- Work in the dry requires large coffer dams and extensive pumping both for incoming flow from watershed and backwater from tides.
- Work in the wet requires special attention and care to use only coarse materials to limit turbidity, and work schedule may be dependent on tidal cycles.
- Ultimately, both approaches have merits and site specific conditions should be considered when deciding.

# OPPORTUNITIES

## RESTORE IMPORTANT ECOSYSTEMS, FUNCTIONS, AND SERVICES

- Anadromous fish passage (Alewife sp.)
- Invasive species control (*Phragmites australis*)
- Restore RTE species (Atlantic White Cedar, Pitcher Plants, Submerged Aquatic Vegetation / Underwater Grasses)
- Increase fisheries productivity (Blue crab - *Callinectes sapidus*)
- Efficient nutrient pollutant removal rates – Chesapeake Bay TMDL

## INCREASE RESILIENCY TO CLIMATE CHANGE

- Coastal ecosystems reduce flooding and erosion

## SLOW CLIMATE CHANGE

- High rates of carbon sequestration (Blue carbon)

# BISHOPSVILLE DAM RETROFIT – EXISTING CONDITIONS



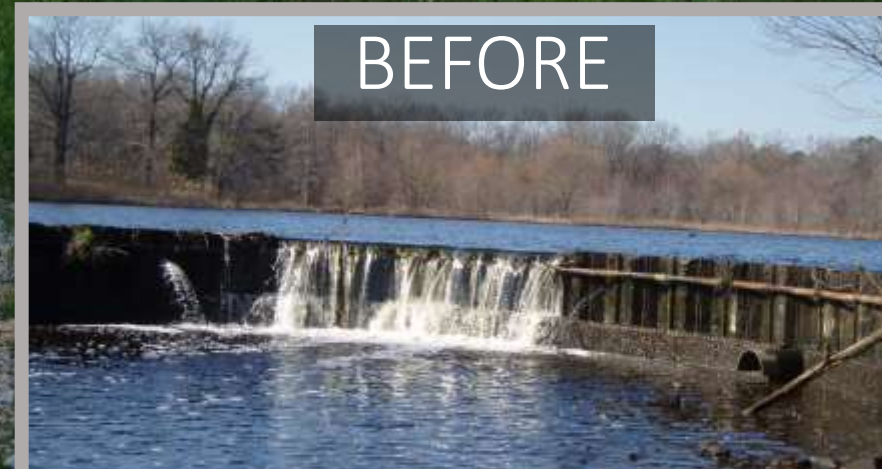
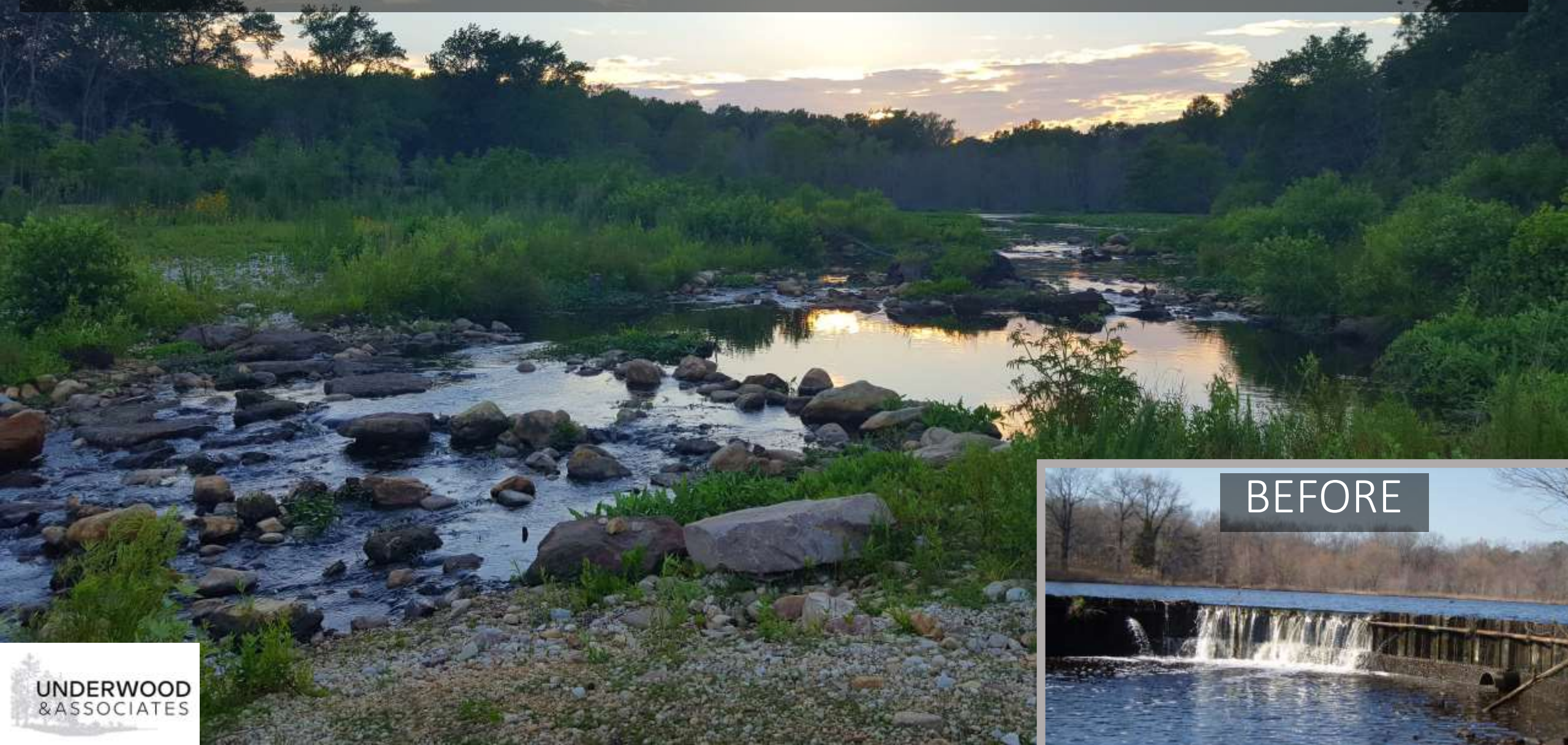
# BISHOPSVILLE DAM RETROFIT – AS-BUILT CONDITIONS



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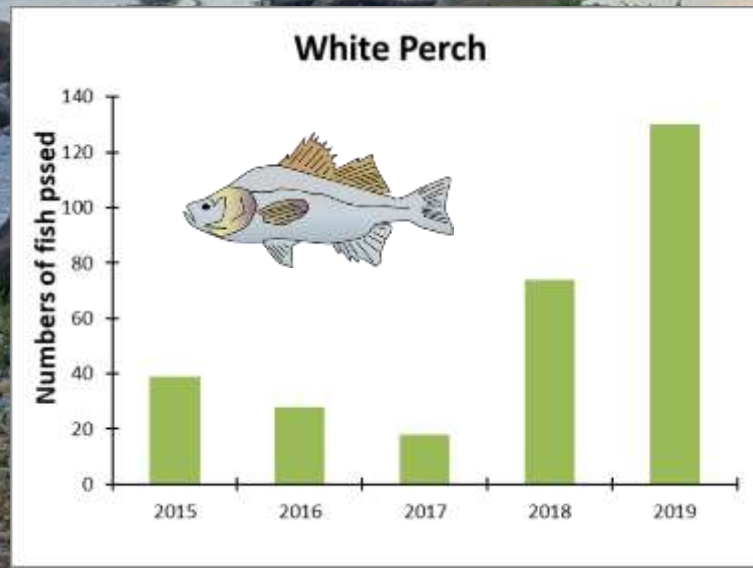
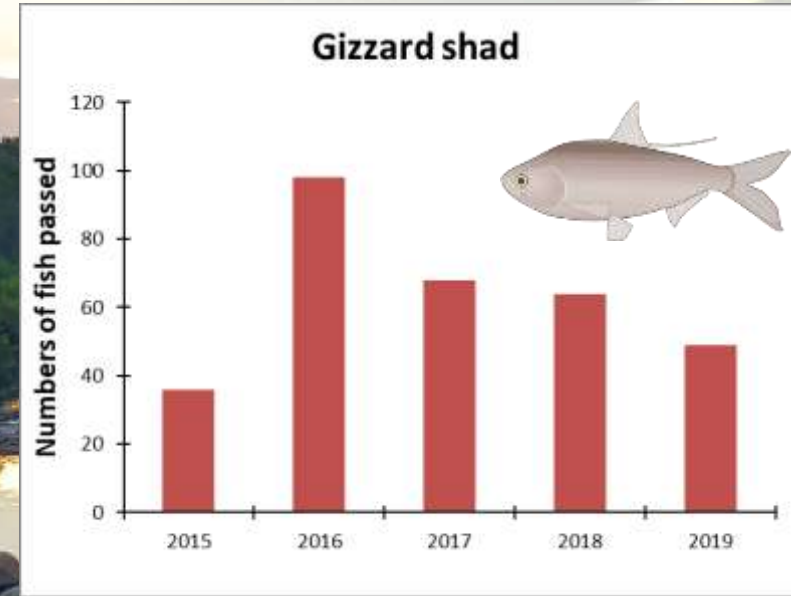
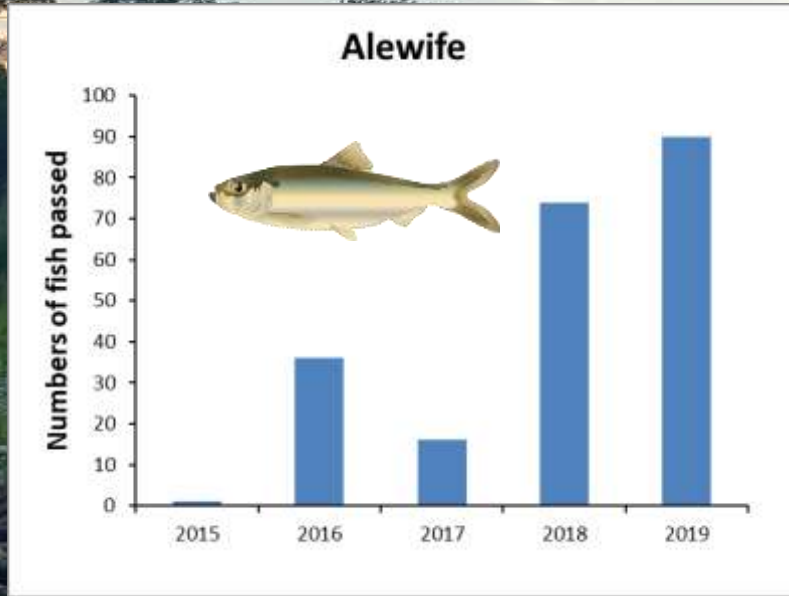


# BISHOPSVILLE DAM RETROFIT – AS-BUILT CONDITIONS



BEFORE

# BISHOPSVILLE DAM RETROFIT – MONITORING RESULTS



# CATTAIL CREEK – EXISTING CONDITIONS





# CATTAIL CREEK – EXISTING CONDITIONS



# CATTAIL CREEK – EXISTING CONDITIONS



# CATTAIL CREEK – AS-BUILT CONDITIONS



# CATTAIL CREEK – AS-BUILT CONDITIONS



# CATTAIL CREEK – AS-BUILT CONDITIONS



# CATTAIL CREEK – AS-BUILT CONDITIONS



# QUESTIONS?

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CONTACT ME AT [KEITH.BINSTED@ECOSYSTEMRESTORATION.COM](mailto:KEITH.BINSTED@ECOSYSTEMRESTORATION.COM)

