

This presentation does not represent official Maryland DNR policy, rather our continued efforts and focus on understanding the science and how to best apply it to our mission



The Influence of Chesapeake Bay Restoration Projects Implemented in Streams

STAC stream restoration workshop March 21, 2023

Scott Stranko and Bob Hilderbrand (presenters)

Sara Weglein, Greg Golden, Tony Redman, Tony Prochaska, Margaret Palmer, Allyson Bartell, Mary Genovese



Chesapeake Bay



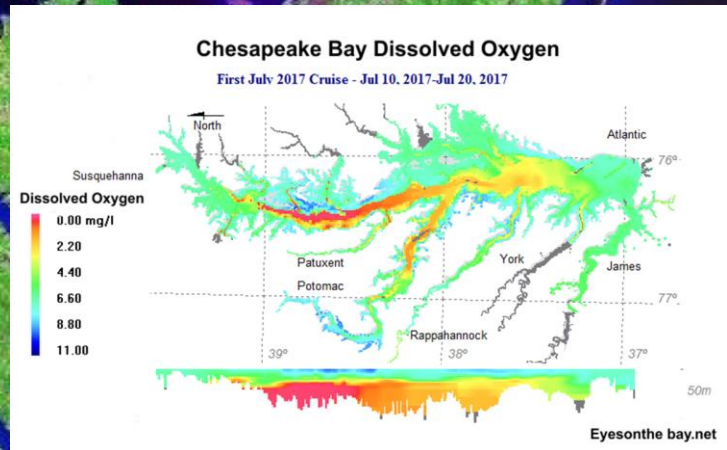
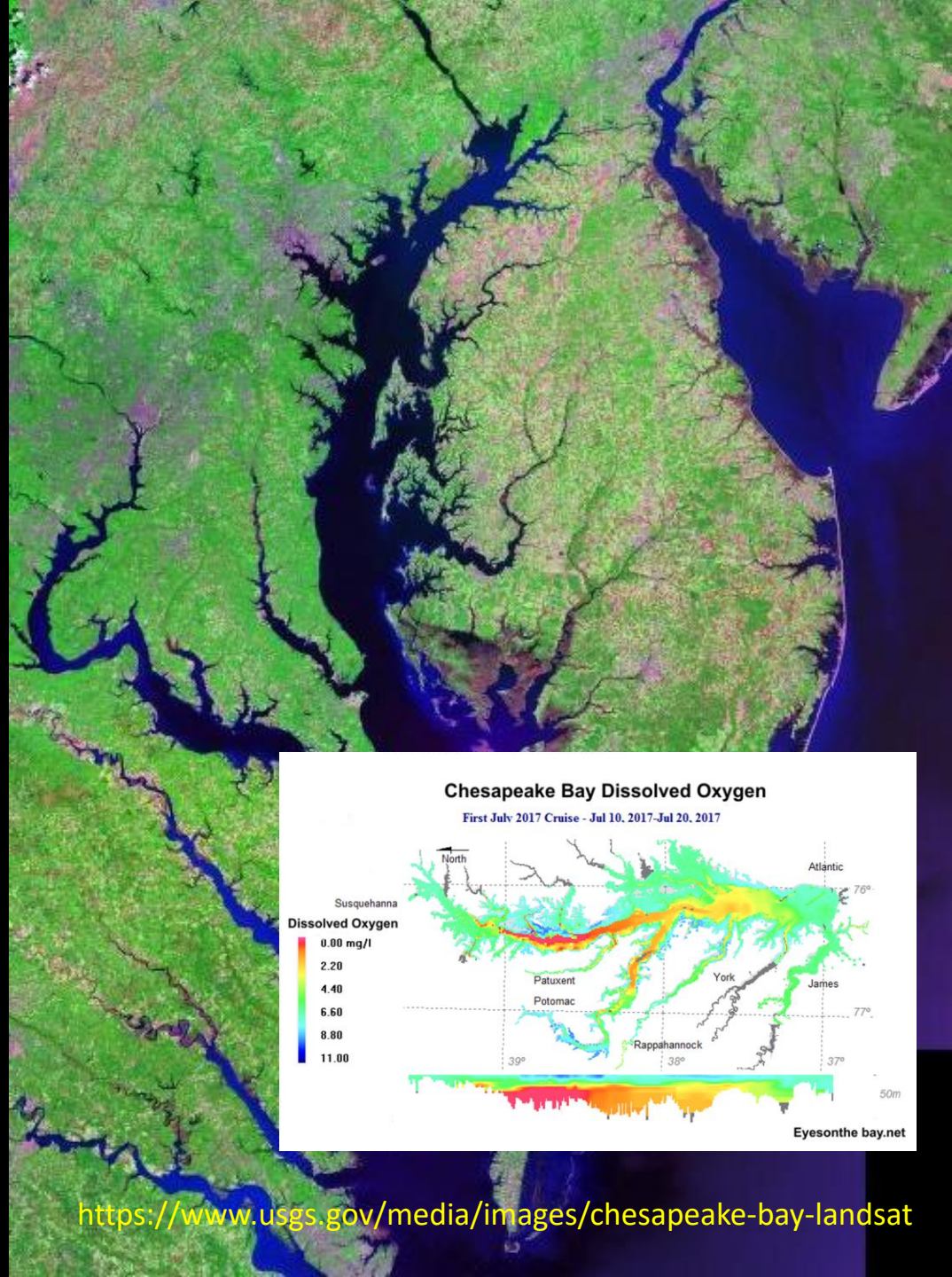
dnr.maryland.gov/fisheries/Pages/fish-facts.aspx?fishname=Striped+Bass



dnr.maryland.gov/fisheries/Pages/Fish-Facts.aspx?fishname=Shellfish%20-%20Blue%20Crab



dnr.maryland.gov/fisheries/Pages/Fish-Facts.aspx?fishname=Shellfish%20-%20Eastern%20Oyster



<https://www.usgs.gov/media/images/chesapeake-bay-landsat>

Streams are Different Than They were Historically



MBSS



<https://dnr.maryland.gov/streams/pages/musselrelocation.aspx>



Greg Pond



Natural Streams and the Legacy of Water-Powered Mills

Robert C. Walter and Dorothy J. Merritts

Science **319**, 299 (2008);

DOI: 10.1126/science.1151716



Mark Tegges



MBSS

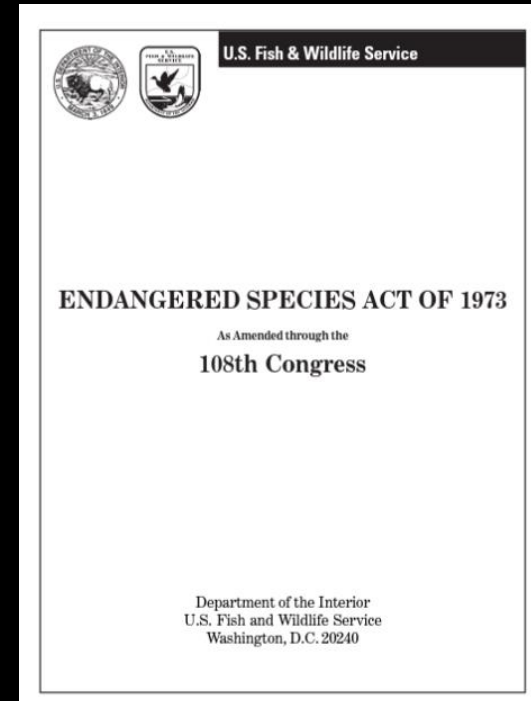
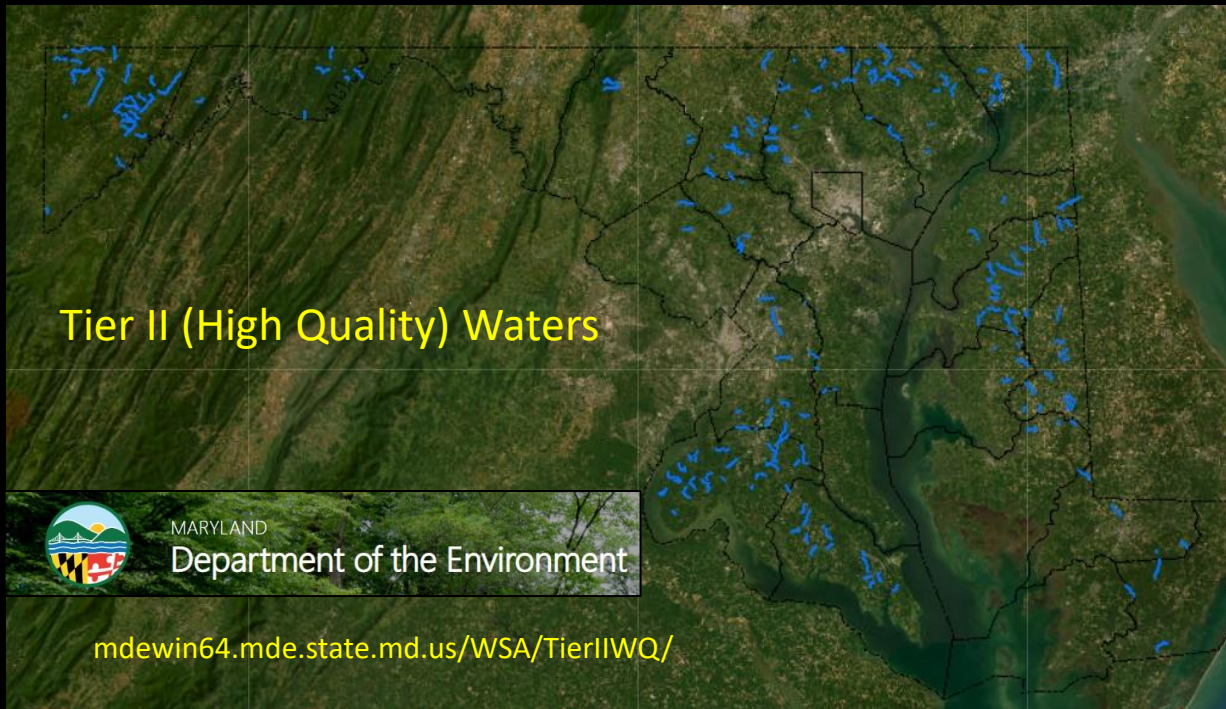
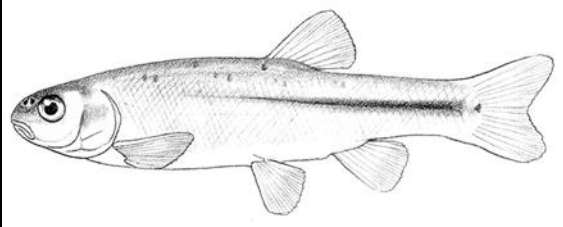


<https://dnr.maryland.gov/fisheries/Pages/fish-facts.aspx?fishname=American+Eel>

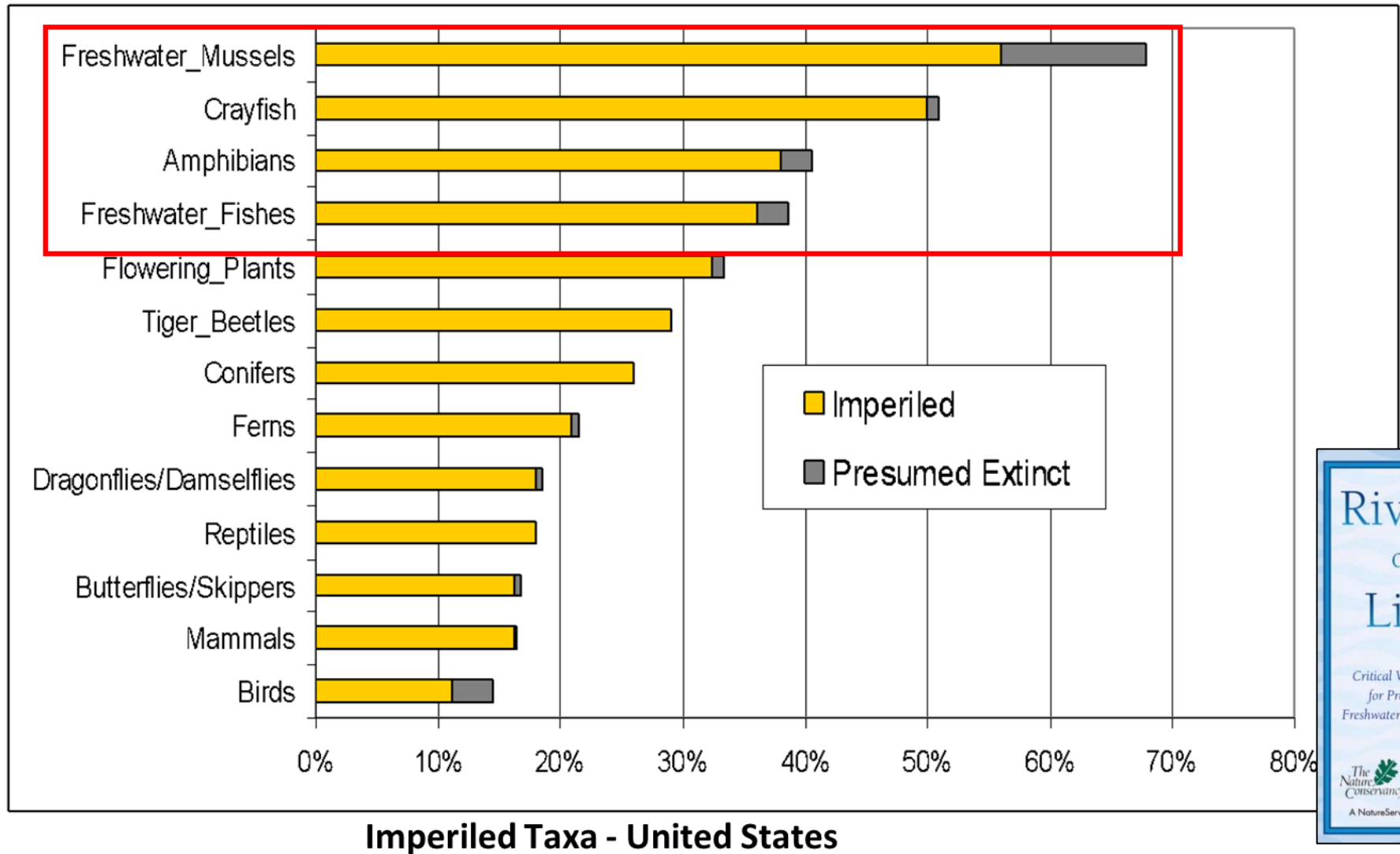


Wayne Davis

Stream Health - Biological Standards: Maryland Example



Relatively large % of species that live in freshwater streams are imperiled



Many Streams are in Poor Condition



mde.maryland.gov/programs/land/mining/pages/acidminedrainage/section_amds.aspx

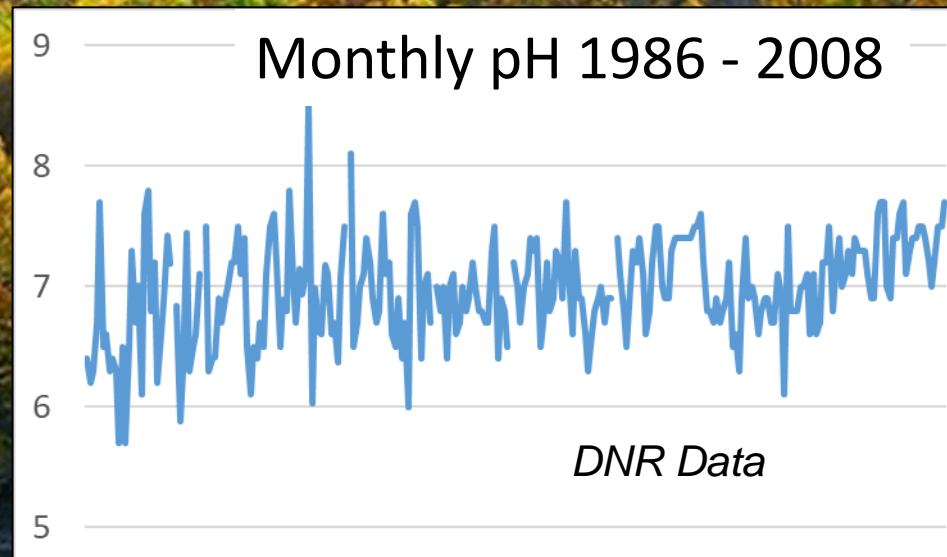
Must Understand Important Limiting Factors



Current Biology and pH Data from the Youghiogheny River



After decades of
historical mine
drainage



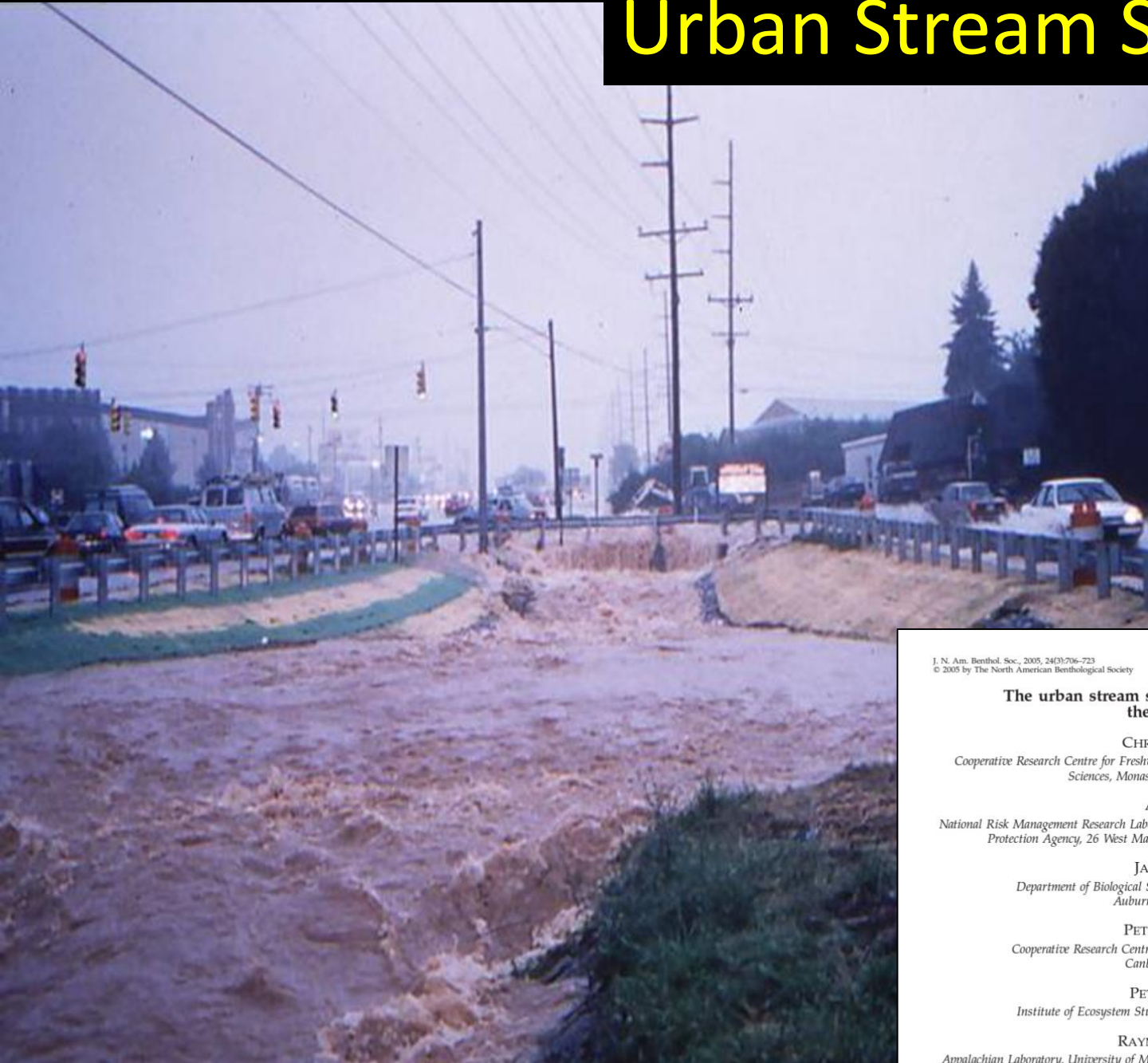
2013 Biology Scores = Fair

Fish 3.3

Benthic Macroinvertebrate 3.5

(Range = 1-5; Good, Fair, Poor)

Urban Stream Syndrome



J. N. Am. Benthol. Soc., 2005, 24(3):706-723
© 2005 by The North American Benthological Society

The urban stream syndrome: current knowledge and the search for a cure

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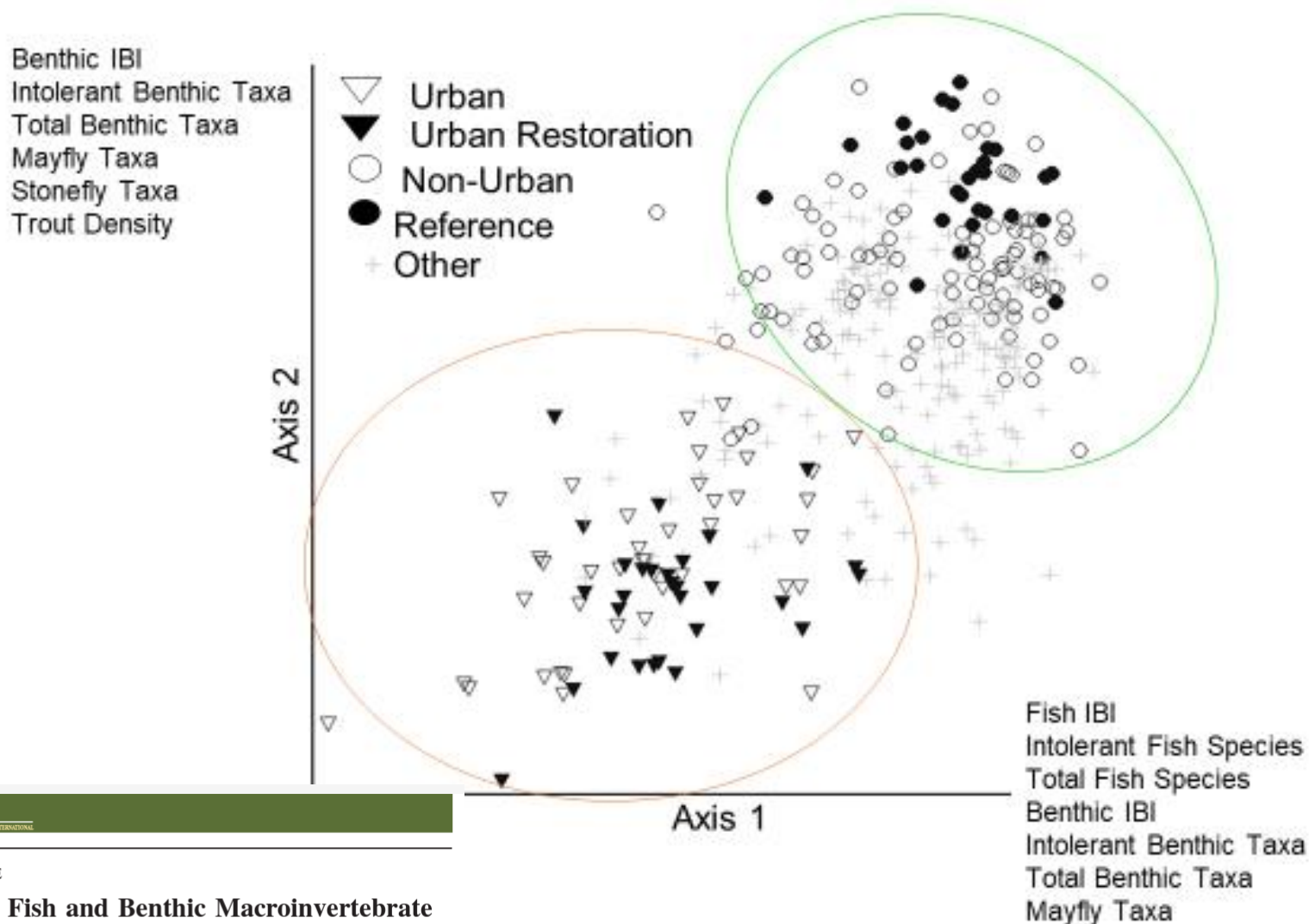
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Biological Condition of Urban Restoration Streams

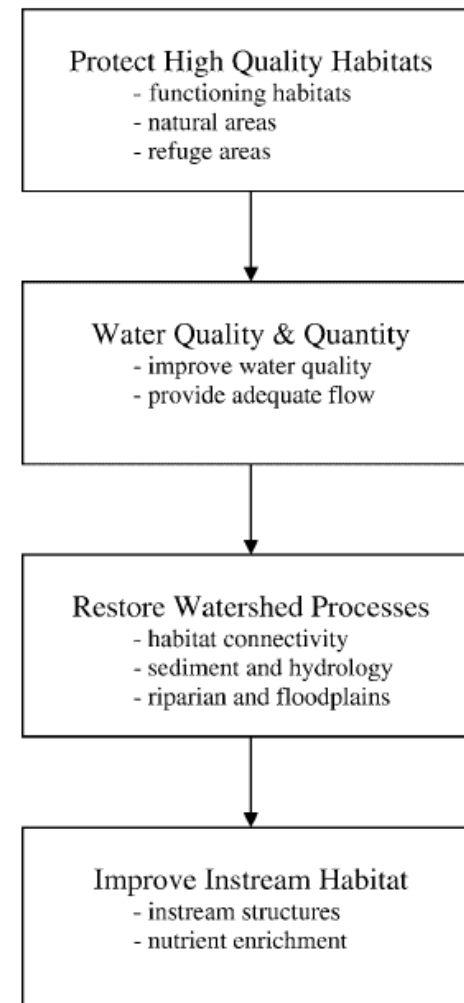


Global Review of the Physical and Biological Effectiveness of Stream Habitat Rehabilitation Techniques

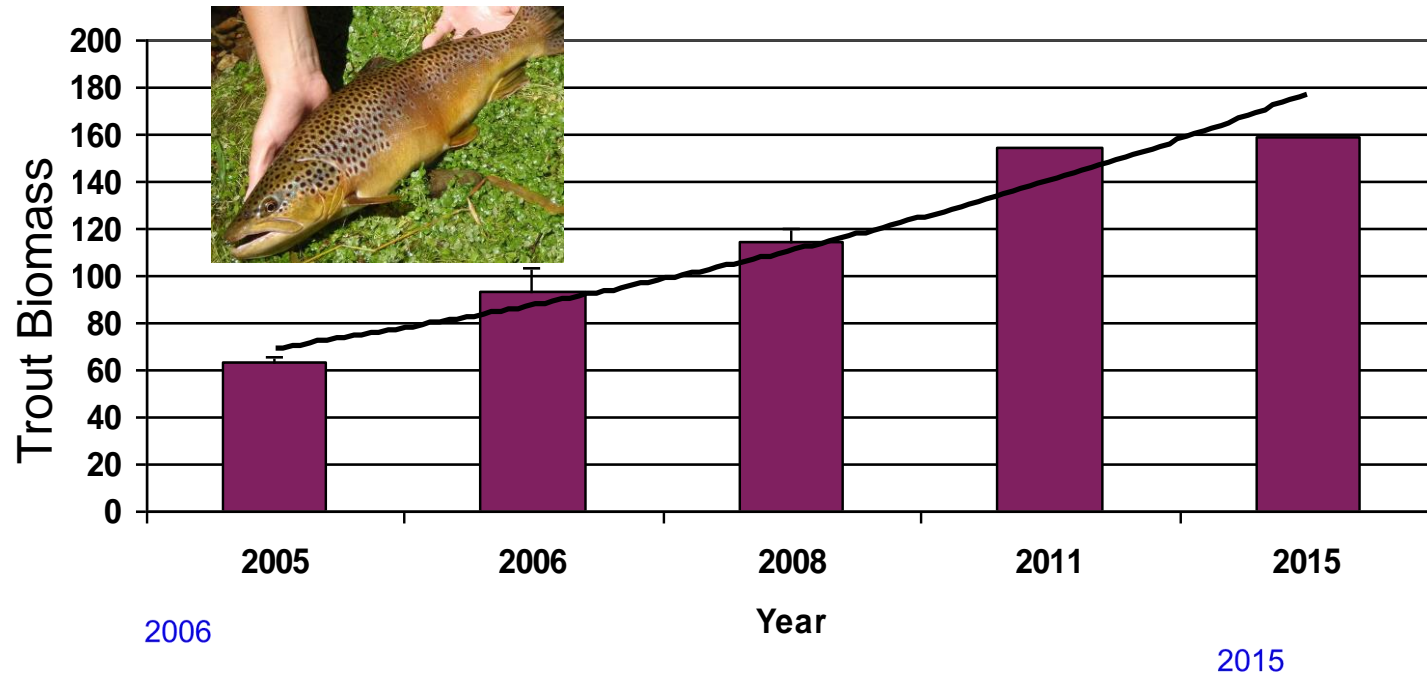
PHIL RONI,* KARRIE HANSON, AND TIM BEECHIE

“Avoidance of the common causes of project failure requires a clear process for using watershed assessments to identify and prioritize projects.”

“broader watershed processes must be considered when planning projects”



Upper Beaver Creek Watershed



Black Rock Creek



What about Chesapeake Bay restoration?

There are many approaches and techniques being implemented to reduce nutrients and sediment to Chesapeake Bay.



<https://www.epa.gov/restoration-chesapeake-bay>

To Help Chesapeake Bay - Slow Stream Water



- Less erosion
- Sediment deposition here, instead of downstream
- More microbial processing of nutrients

The slower and more spread out the water, the better

Slower Water Can Make Certain Water Quality and Stream Biota Worse



- Sediment deposition
- lower oxygen
- higher temperature
- Poor biology

September 2011

EVALUATING RIVER RESTORATION

Ecological Applications, 21(6), 2011, pp. 1989–2006
© 2011 by the Ecological Society of America

Assessing stream restoration effectiveness at reducing nitrogen export to downstream waters

SOLANGE FILOSO^{1,3} AND MARGARET A. PALMER^{1,2}

“in order to compensate for the increasing pace of anthropogenic N inputs and the concomitant loss in the capacity of N processing in the drainage areastreams may need to be increasingly manipulated or highly engineered to manage high N loads, at the expense of losing some of the fundamental functions associated with stream ecosystems if it is acceptable to convert them to dramatically different ecological systems (i.e., more like created wetlands than restored streams). “

Risks to sensitive species and water quality

- Working in stream channels can put high-quality resources, water quality, and sensitive stream species at risk – where they occur
- Risk may result from construction and/or slowing water – at a minimum



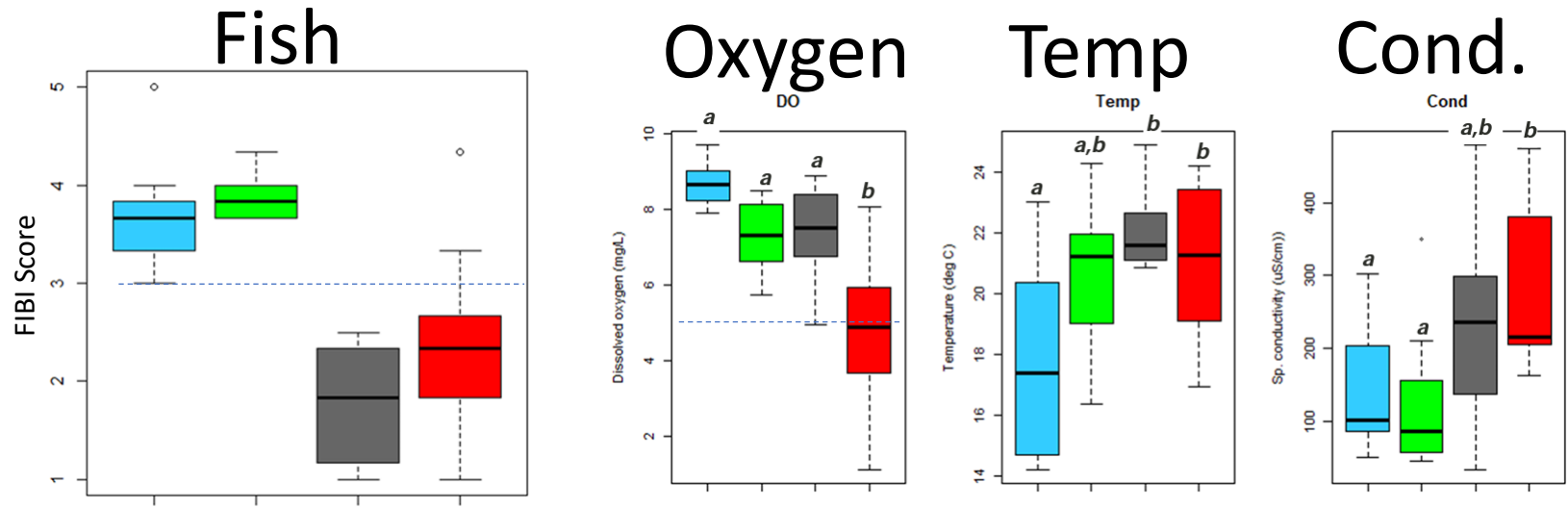
Beaver-Impounded and Naturally Slow Streams



- Good Biology Score
- High Quality (Tier II) Water
- High Biodiversity

Can these habitats be replicated?

Natural low-gradient wetland streams better for fish, oxygen, and conductivity



High-quality Single Stream



High-quality Stream Wetland



Low-quality Single Stream



RSC

 **TETRA TECH**

 **University of Maryland**
CENTER FOR ENVIRONMENTAL SCIENCE
CHESAPEAKE BIOLOGICAL LABORATORY

Vertebrate Community Trajectory in Regenerative Stream Conveyances

Mark Southerland, Bob Murphy, and Nancy Roth
Tetra Tech
Ryan Woodland and Solange Filoso
UMCES-CBL

Natural Beaver Dams



Can have:

- Low Oxygen
- High Temperature
- Trap Sediment

Bledzki et al. 2011

Burchsted et al. 2016

Johnson-Bice et al. 2018

Due to human influence, there are more sediment and nutrients entering streams to cause these conditions - now than historically. Temperatures are warmer too.

Can you guess the biological condition of these streams?



Can you guess the biological condition of these streams?



Eroded Streams Not Necessarily Biologically Degraded

-Can Have Sensitive Resources

This stream had 12th
highest eroded area
and severity rating
(1,778 streams
surveyed)



Fish IBI = Good
Benthic IBI = Good
Tier II (High-Quality) Water



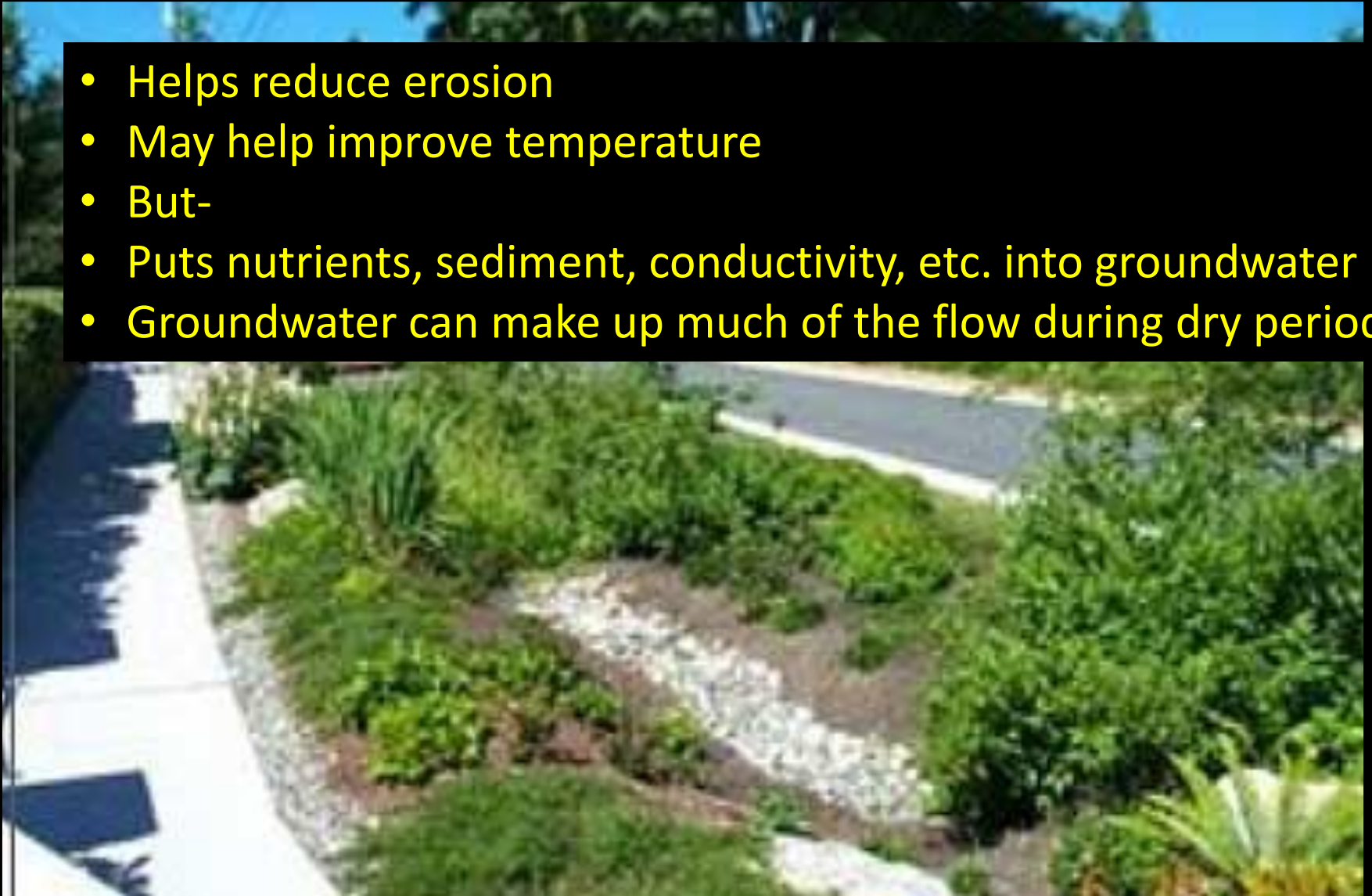
Brook trout stream
MBSS Sentinel (Reference) stream

Reducing erosion benefits the stream!

Is it possible to reduce erosion without risking sensitive
resources – where they occur?

Upland Projects and Infiltration

- Helps reduce erosion
- May help improve temperature
- But-
- Puts nutrients, sediment, conductivity, etc. into groundwater
- Groundwater can make up much of the flow during dry periods



Summary/ Conclusions

- There is no one-size-fits-all approach to stream restoration - It is important to know the goals, limiting factors, and risks
- Certain types of projects in streams to achieve nutrient reduction goals can harm streams/violate water quality and biological standards
- While some eroded streams have poor biology, some have sensitive resources that could be at risk

Nutrient and sediment reduction is beneficial and should continue, where and in ways that are appropriate

- Can nutrients and/or sediment effectively be addressed without risks to sensitive resources – where they occur?
- Improvements to stream biology are constrained by watershed and water quality conditions
- Depending on watershed and water quality conditions, stream biology can be improved
- Depending on the project type and location, stream biology or water quality can become worse

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