THE CASE FOR WETLANDS:

HISTORICAL LOSSES, ECOSYSTEM SERVICES, PROTECTION AND RESTORATION - *AND SOME PERSONAL STORIES*

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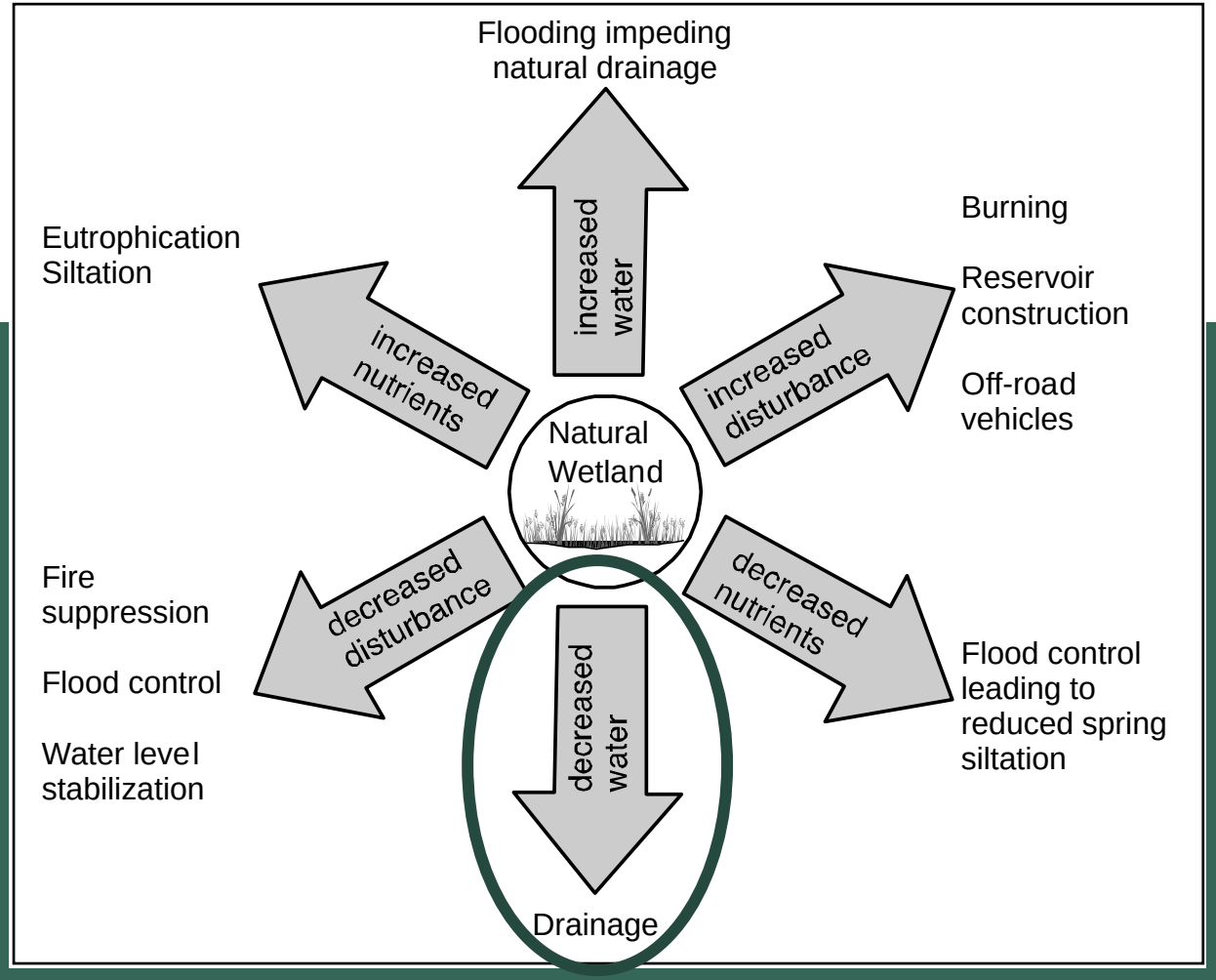
WETLANDS LOSS & REPURCUSSIONS

HISTORICAL TREATMENT OF WETLANDS & THE PROBLEMS THAT HAVE RESULTED


DC
SWAMP
THING

MODEL OF HUMAN - INDUCED IMPACTS ON WETLANDS

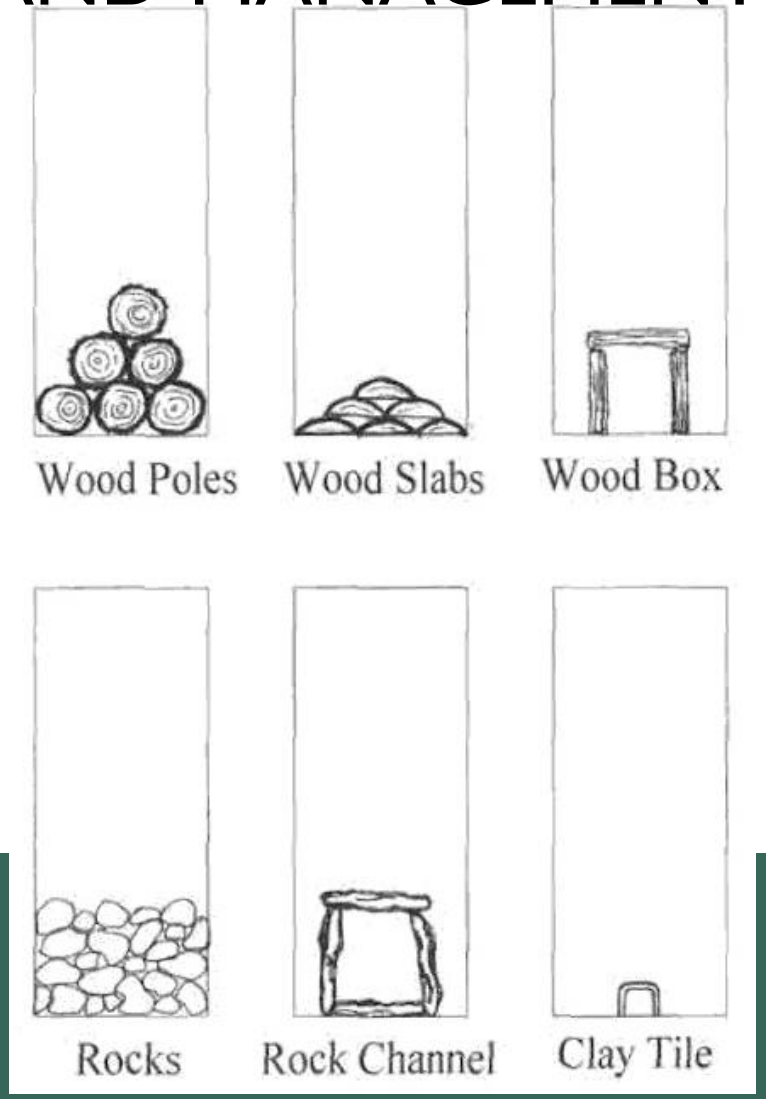
INCLUDING EFFECTS ON WATER LEVEL, NUTRIENT STATUS, AND NATURAL DISTURBANCE



By either increasing or decreasing any one of these factors, wetlands can be altered.

AN EARLY HISTORY OF WETLAND MANAGEMENT

Old drainage ditches, Wadden Sea, Germany



AGRICULTURAL DRAINAGE

WHAT MAKES A WETLAND?

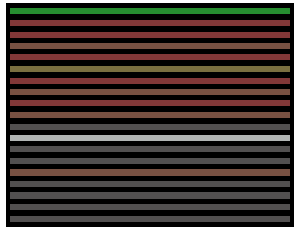
3 Parameters:

Hydrophytic vegetation

- Obligate wetland (OBL)
- Facultative (FACW, FAC)

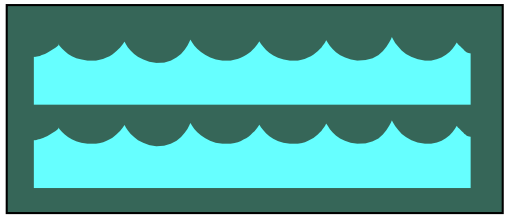
Hydric soils

- Low chroma
- Mottles (redoximorphic features)



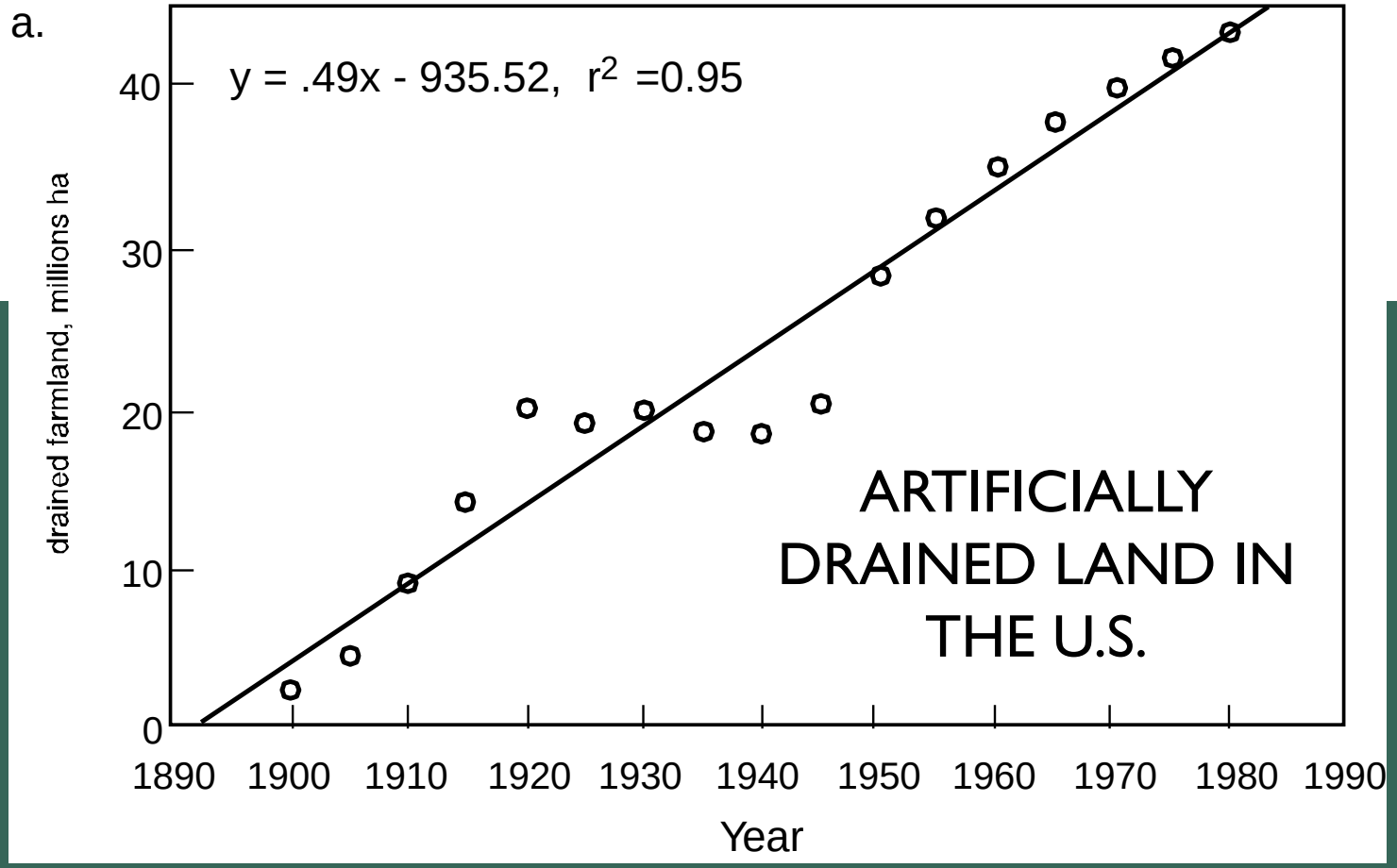
Wetland hydrology

- Inundation
- Saturation
- Other indicators



WHAT UNMAKES A WETLAND?

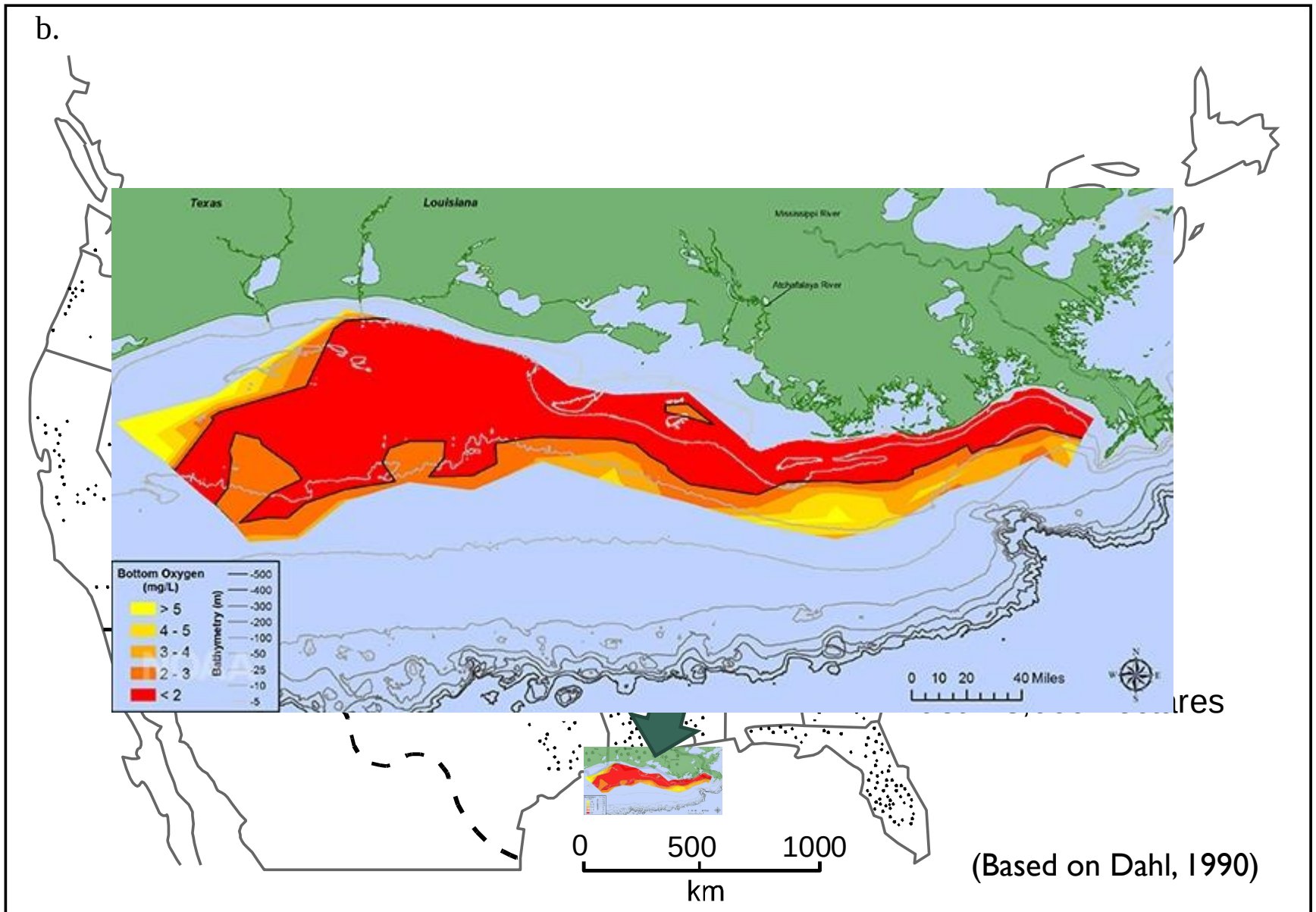
Wetland Conversion



After Gosselink and Maltby, 1990, based on data from Office of Technology Assessment, 1984)

Wetland Conversion

Each dot represents 8,000 ha (20,000 acres) and total area drained is 43,5000,000 ha.



WETLAND LOSSES IN THE WORLD

Location	% Loss
NORTH AMERICA	
United States (not including Alaska)	53
Canada	
Atlantic tidal and salt marshes	65
lower Great Lakes-St. Lawrence River	71
Prairie potholes and sloughs	71
Pacific coastal estuarine wetlands	80

(continued on next slide)

WETLAND LOSSES IN THE WORLD (cont'd)

Location	% Loss
AUSTRALASIA	
Australia	>50
Swan Coastal Plain	75
Coastal New South Wales	75
Victoria	33
River Murray Basin	35
New Zealand	90
Philippine mangrove swamps	67
China	60
EUROPE	>90 (est)

Source: Mitsch, 1998

GREAT LAKES REGION WETLAND LOSSES

- The national decline in wetlands from the 1780's to the 1980's is dramatic. Losses in particular regions of the country are even more startling. **For example, the mid-western farm belt states of Illinois, Indiana, Iowa, Michigan, Minnesota. Ohio, and Wisconsin account for over 36 million acres of wetland lost since the country was settled.** This amounts to roughly one third of all wetlands lost in the history of our Nation.

Estimated losses by state/province

- Illinois – 90%
- Indiana – 85%
- Michigan – 50%
- Minnesota – 50%
- New York – 60%
- Ohio – >90%
- Pennsylvania – 60%
- Wisconsin – 50%
- Ontario – 68%
- Quebec – 50%

Wetland Conversion

WaterNews

Toledo Issues Emergency ‘Do Not Drink Water’ Warning to Residents

August 2, 2014 / in Cities, Great Lakes, Infrastructure, North America, Pollution, Water News / by Codi Kozacek

Algae toxins poison Lake Erie; 400,000 people without water.

Photo by Scott Strazzante / Circle of Blue

Efforts by the City of Toledo and other “point source” dischargers of phosphorus have not been enough to stop toxic algal blooms in Lake Erie. The city warned residents not to drink their water Saturday due to algal toxins. *Click image to enlarge.*

PROBLEMS CAUSED OR EXACERBATED BY WETLAND LOSS

- Degraded water quality
- Increased frequency and severity of flooding
- Increased erosion and risk of bank failure
- Lower water tables and reduced base flows in streams
- Loss of habitat
- Reduced biological diversity
- Diminished recreational opportunities
- Reduced carbon sequestration (and carbon releases)

UNDERSTANDING THE IMPORTANCE OF WETLANDS

CHANGING ATTITUDES

The importance of wetlands is being increasingly recognized

- Declining waterfowl populations drove the early wetland protection efforts
- A No Net Loss goal was adopted in the U.S.
- Additional benefits of wetlands were identified as "Ecosystem services"
- Concerns over increasing frequency and severity of Harmful Algal Blooms, devastating flood losses, and other environmental challenges are now catalyzing restoration efforts

ECOSYSTEM SERVICES (MILLENNIUM ECOSYSTEM ASSESSMENT, 2005)

Scale is low •, medium ●, to high: ⬤; not known = ?; blank cells indicate that the service is not considered applicable to the wetland type. The information in the table represents expert opinion for a global average pattern for wetlands; there will be local and regional differences in relative magnitudes.

Services	Comments and Examples	Permanent and Temporary Rivers and Streams	Permanent Lakes, Reservoirs	Seasonal Lakes, Marshes, and Swamps, Including Floodplains	Forested Wetlands, Marshes, and Swamps, Including Floodplains	Alpine and Tundra Wetlands	Springs and Oases	Geothermal Wetlands	Underground Wetlands, Including Caves and Groundwater Systems
Inland Wetlands									
Provisioning									
Food	production of fish, wild game, fruits, grains, and so on	●	●	●	●	•	•		
Fresh water	storage and retention of water; provision of water for irrigation and for drinking	●	●	●	•	•	•		●
Fiber and fuel	production of timber, fuelwood, peat, fodder, aggregates	●	●	•	⬤	●	•		
Biochemical products	extraction of materials from biota	•	•	?	?	?	?	?	?
Genetic materials	medicine; genes for resistance to plant pathogens, ornamental species, and so on	•	•	?	•	?	?	?	?
Regulating									
Climate regulation	regulation of greenhouse gases, temperature, precipitation, and other climatic processes; chemical composition of the atmosphere	•	●	•	●	•		•	•
Hydrological regimes	groundwater recharge and discharge; storage of water for agriculture or industry	●	●	●	●	•	•		•
Pollution control and detoxification	retention, recovery, and removal of excess nutrients and pollutants	●	●	•	●	•	•		●
Erosion protection	retention of soils and prevention of structural change (such as coastal erosion, bank slumping, and so on)	●	•	•	●	?	•		•
Natural hazards	flood control; storm protection	●	●	⬤	●	●	•		•
Cultural									
Spiritual and inspirational	personal feelings and well-being; religious significance	●	●	●	●	•	●	•	•
Recreational	opportunities for tourism and recreational activities	●	●	●	•	•	•	•	•
Aesthetic	appreciation of natural features	●	●	•	●	•	•	•	•

ECOSYSTEM SERVICES OF WETLANDS

Level of Services provided by Forested Wetlands, Marshes, Swamps (including Floodplains):

Service	Level
Provisioning services (food, fiber, etc.)	low to high
Climate regulation	high
Groundwater recharge	medium
Water quality improvement	medium
Erosion protection	medium
Flood protection	medium
Cultural services	medium

WETLANDS ARE ALWAYS WORKING FOR US! *

**Whether we realize it or not!*

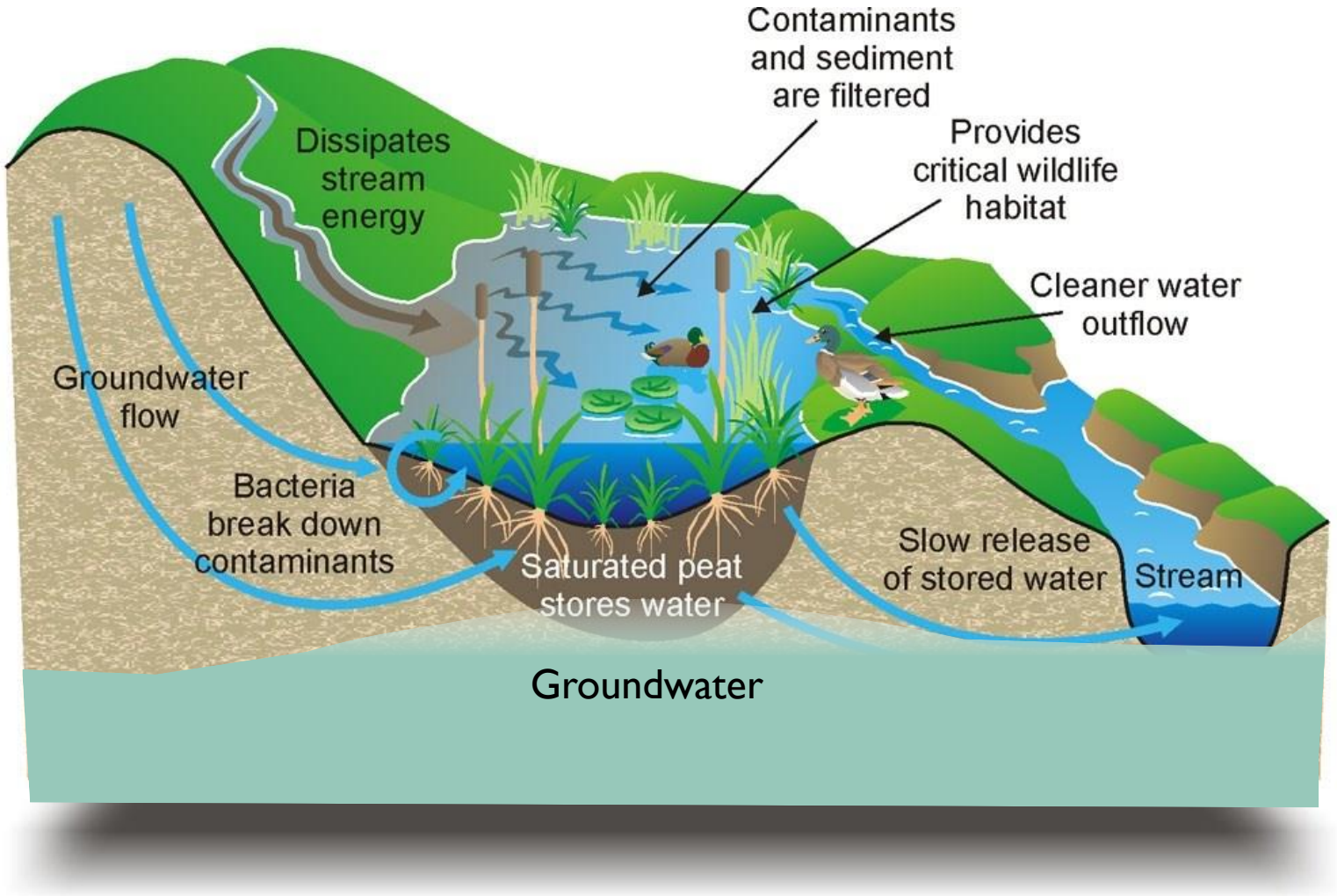
PROVISIONING SERVICES

- Pelts from fur-bearing mammals (trapping)
- Waterfowl (hunting)
- Fish & shellfish
- Fiber
- Peat
- Timber

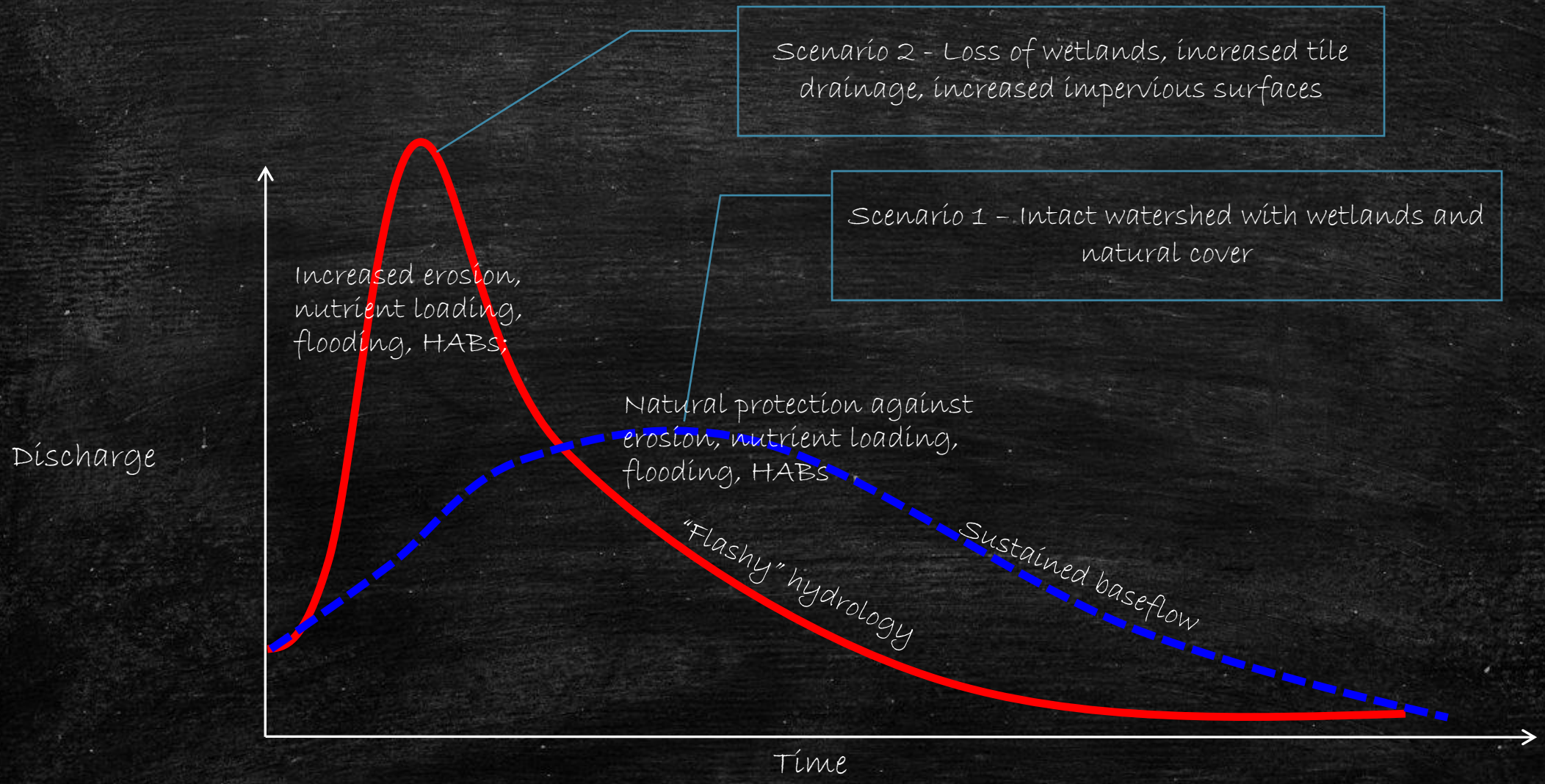
-wild-

REGULATING SERVICES
GROUNDWATER RECHARGE

- Wetlands store water above and below ground
- Water gradually infiltrates through soil recharging groundwater
- Groundwater, in turn, sustains baseflow conditions in receiving streams
- Aquifer recharge is vital to anyone who gets their water from a well



It's All Connected!

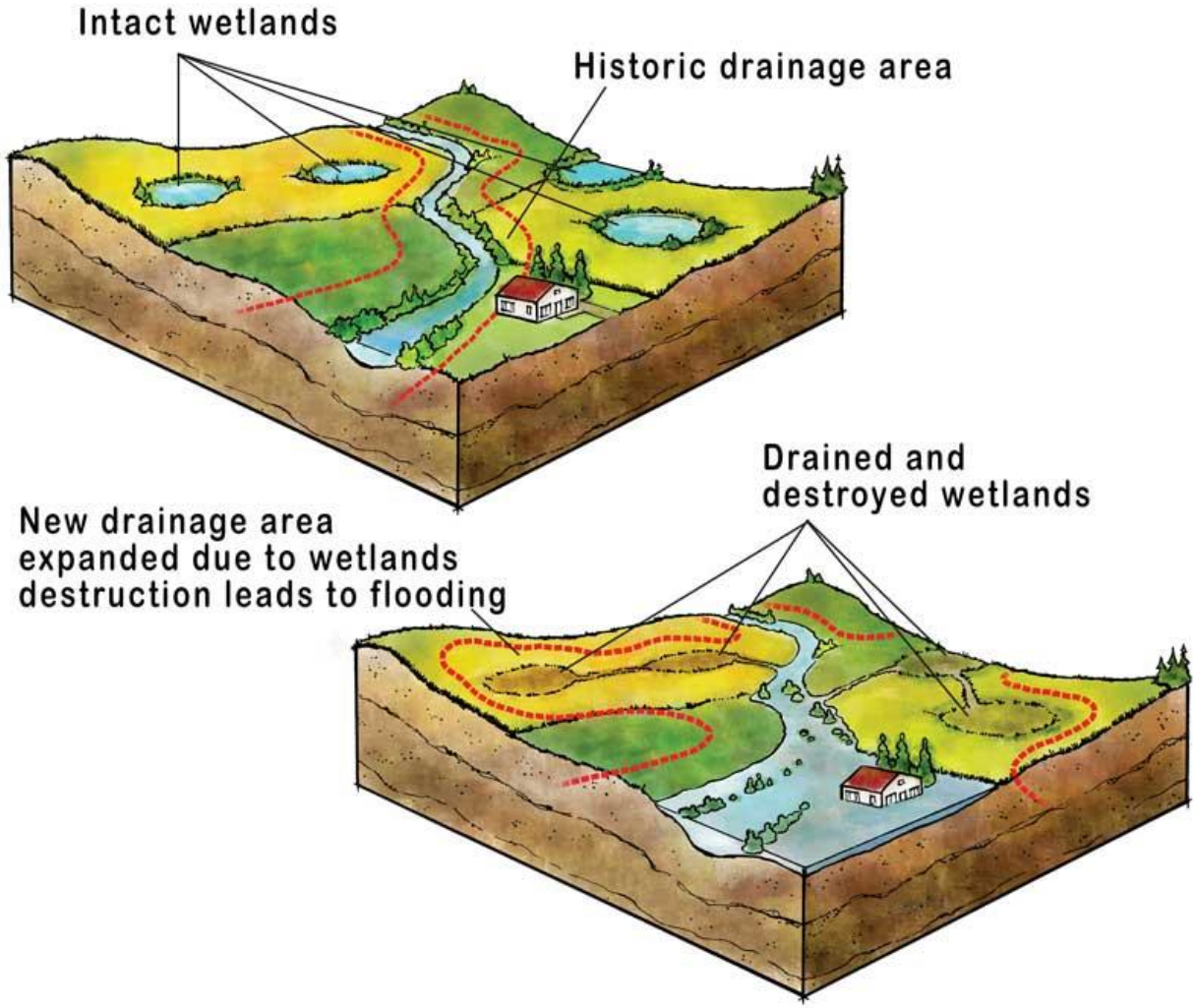


REGULATING SERVICES
EROSION CONTROL

- Floodplains, riparian wetlands accommodate expanding water surface
- Wetlands delay the delivery of water downstream
- The temporary water storage reduces energy, bed pressure and downcutting that can lead to erosion and bank failure
- Wetlands and floodplains remove sediment

REGULATING SERVICES
FLOOD CONTROL / PROTECTION

- Wetlands provide natural detention areas in the landscape
- Restoring the 4 million acres (about half) of former wetlands would store 40 million acre-feet of water
- More than enough to prevent the Mississippi River Flood of 1993
- The economic benefit from converting cropland in the floodplain to wetland flood storage would be $500 million per year!



REGULATING SERVICES
WATER QUALITY IMPROVEMENT

- Wetlands absorb nutrients
  - Phosphorus (~75%)
  - Nitrogen (~50%)
- Can reduce frequency and severity of Hazardous Algal Blooms (HABs)
- Many other toxins are sequestered

CLIMATE REGULATION

- Wetlands are among the most productive systems in the world
- Photosynthesis captures CO_2 from the atmosphere, stores it in biomass
- Slow decomposition in anaerobic environment allows carbon accumulation in soil
- Marshes and swamps hold carbon for millennia
- Can emit methane (CH_4)

HABITAT AND BIODIVERSITY

- Wetlands compare with tropical rain forests and coral reefs in species richness
- ~50% of Threatened and Endangered Species rely on wetlands at some point in their life cycle
- The biological diversity of wetlands make them extremely valuable and attractive for passive and active **recreation** and **education**, too (=Cultural Services)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PRESERVATION OF BIODIVERSITY

Associated with wetlands are:

- 20% of T&E mammals;
- 28% of T&E plants;
- 38% of T&E insects
- 48% of T&E fish;
- 63% of T&E reptiles;
- 66% of T&E mussels;
- 68% of T&E birds; and
- 75% of T&E amphibians

CULTURAL SERVICES

- Aesthetics
- Cultural history
- Education
- Relaxation & Recreation
- Sense of place
- Sense of wonder
- Source of inspiration
- Spirituality
- Subsistence use (provisioning)

EXPANDING & IMPROVING OUR WETLAND RESOURCES

WETLAND PRESERVATION & PROTECTION

THE FIRST & BEST OPTION

MITIGATION HIERARCHY

The U.S. Army Corps of Engineers (Corps) and EPA issued a 1990 Mitigation Memorandum of Agreement. According to this MOA, these mitigation types are generally applied sequentially, in the following order:

- **Avoidance** means avoiding impacts to water resources (wetlands and streams) to the maximum extent possible, while still achieving the purpose of the project. This amounts to **protection and preservation**.
- **Minimization** means managing the severity of a project's impact on water resources at the selected site. This is achieved through good design and risk avoidance measures.
- **Mitigation (=Compensatory Mitigation)** means mitigating an aquatic resource impact by replacing or providing substitute aquatic resources for impacts that remain after avoidance and minimization measures have been applied, and is achieved through appropriate and practicable restoration, establishment, enhancement, and/or preservation of aquatic resource functions and services.

RESTORATION

THE GOLD STANDARD IN MITIGATING WETLAND LOSS

RESTORATION

Key Characteristics:

- Placed in location where a wetland once existed (preferred by agencies)
- Soils are hydric, or nearly so, and may still contain a viable seed bank
- Landscape (topographically) appropriate
- Earthwork required may be minimal (e.g., tile disruption, low berm, etc.)


Classic Drainage Example
East of Hoover Reservoir - Galena, OH
Google earth
Image U.S. Geological Survey

GENERATION RESTORATION

A RESTORATION PROJECT EXAMPLE

HIGHLIGHTING PERSONAL STORIES OF THE CULTURAL SERVICES WETLANDS PROVIDE IN ABUNDANCE!

PROJECT EXAMPLE

EXTREME MARSH MAKEOVER

BACKGROUND

- Land was farmed in the 1950s
- City of Westerville acquired the site for a park in the 1970s
- Hydric soils were buried with sediment and a dense stand of invasive cattail (*Typha x. glauca*) established
- When the City decided to raze the community pool and re-develop the park, the planners wanted to incorporate the wetland as a central feature
- A Section 319 grant (water quality grant) was awarded by Ohio EPA ($131,328)
- Construction in 2012, planting completed in 2013


2014
E Walnut St
S Spring Rd
Chelsea Ln
Luke Ct
Thirlwall Ct
Knebworth Ct
Apache Cir
Google earth
© 2016 Google
500 ft
N

PUBLIC EDUCATION

WESTERVILLE
Parks and Recreation
www.westerville.org

What to Expect:

Construction of a Wetland

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Reynoldsburg City School District, Summit Road Campus, Reynoldsburg, Ohio.

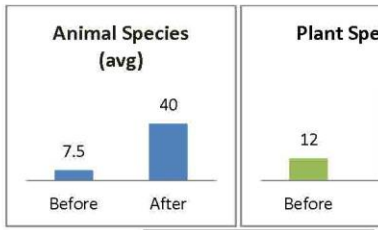
Miami Valley Hospital Wetland Mitigation, New Carlisle, Ohio.

Boyer Nature Preserve, Vernal Pool Creation, Westerville, Ohio.

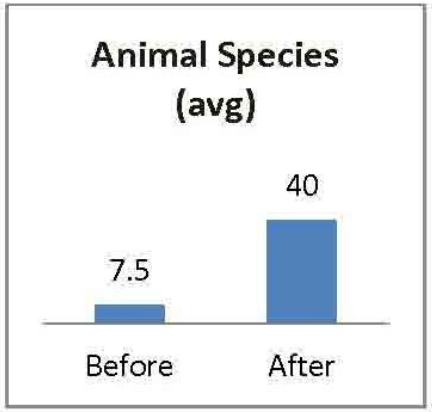
Wetland

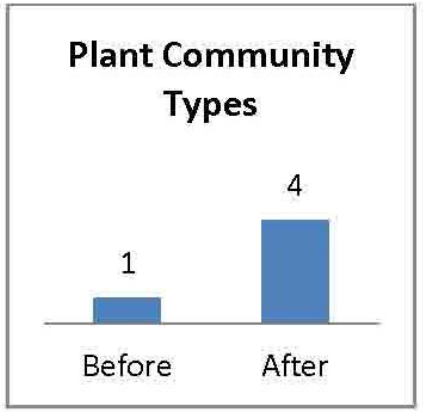
Before
Number of taxa (animals): 5-10*
Number of taxa (plant): 12
Plant community types: 1 • Shallow emergent marsh
Flow length: 720'
Residence time: 2-3 days
Water depth range: 0-1'
Acreage: 1.9

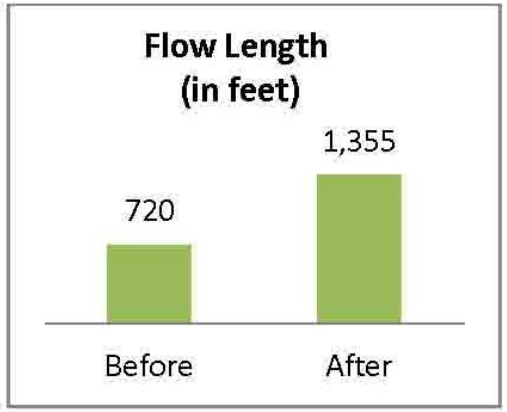
*estimate based on observations made du
**Water will be too deep to sustain a vege

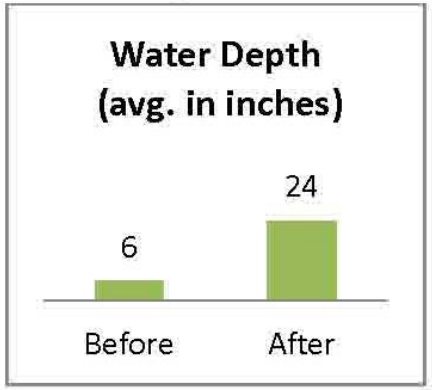


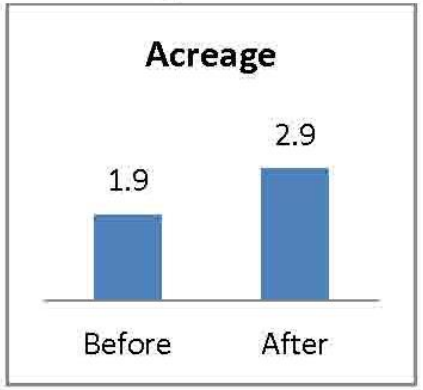
Anticipated Benefits

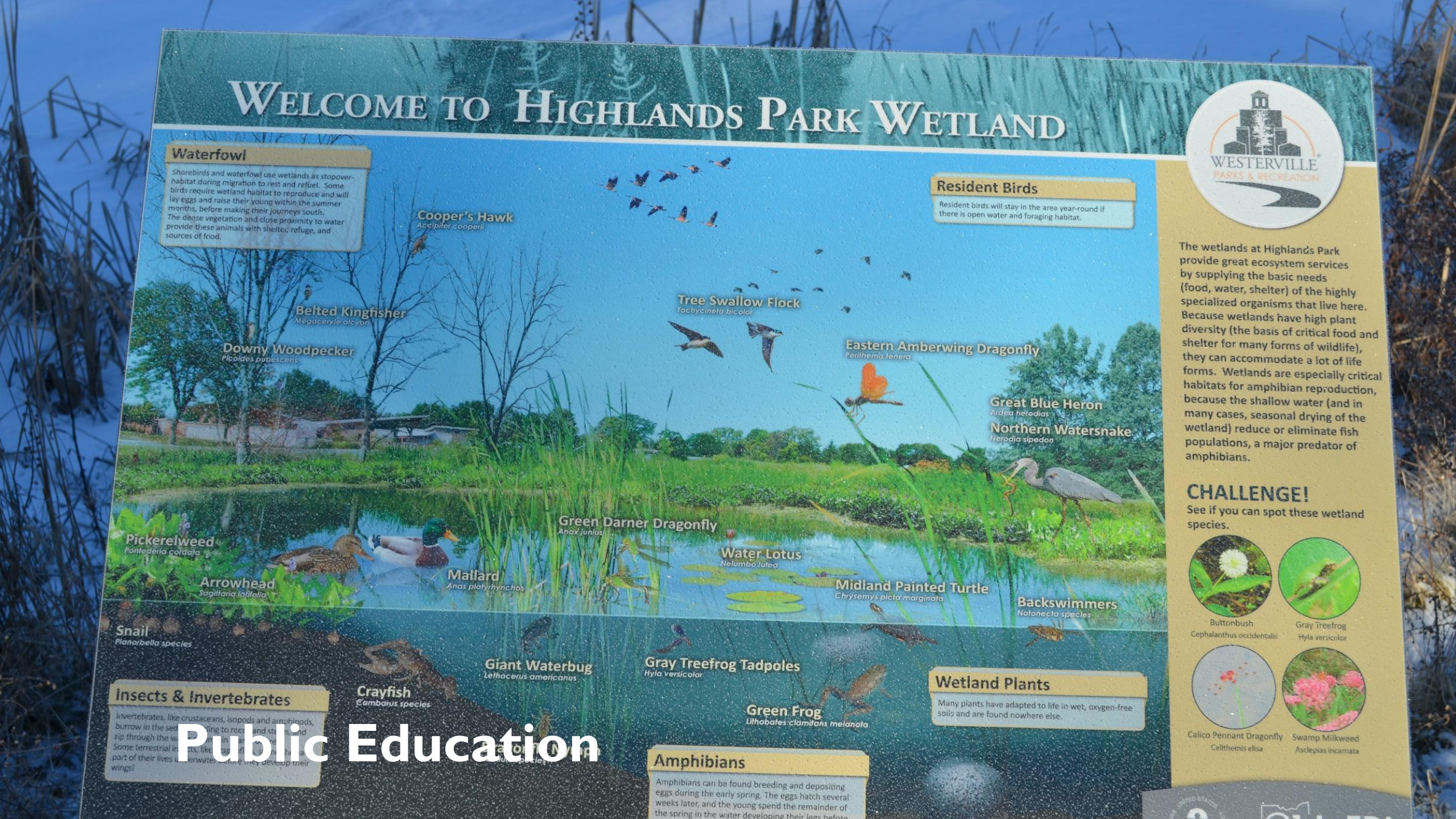












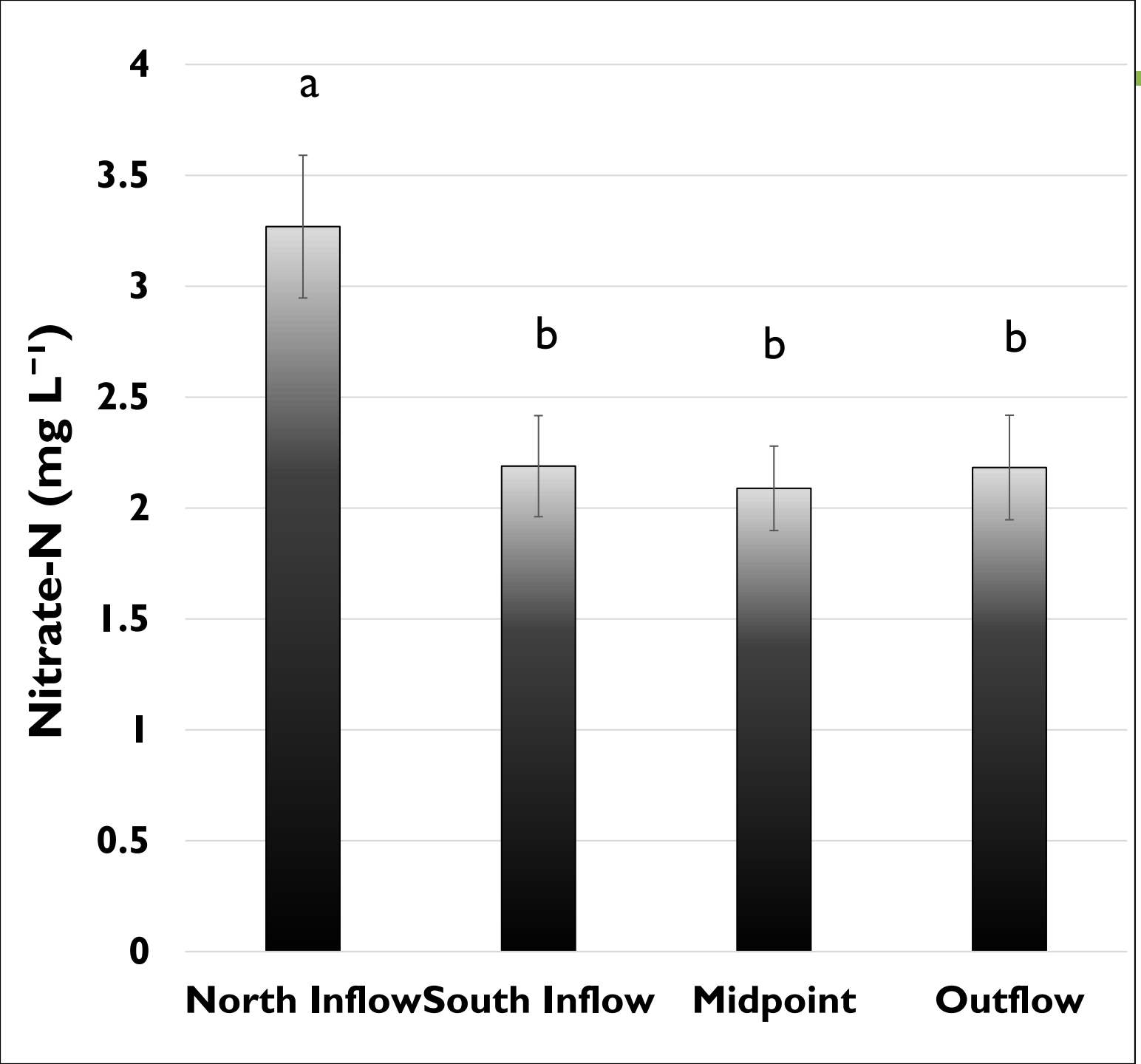
Public Education

WESTERVILLE WETLAND WORKSHOP

AMPHIBIAN DIVERSITY

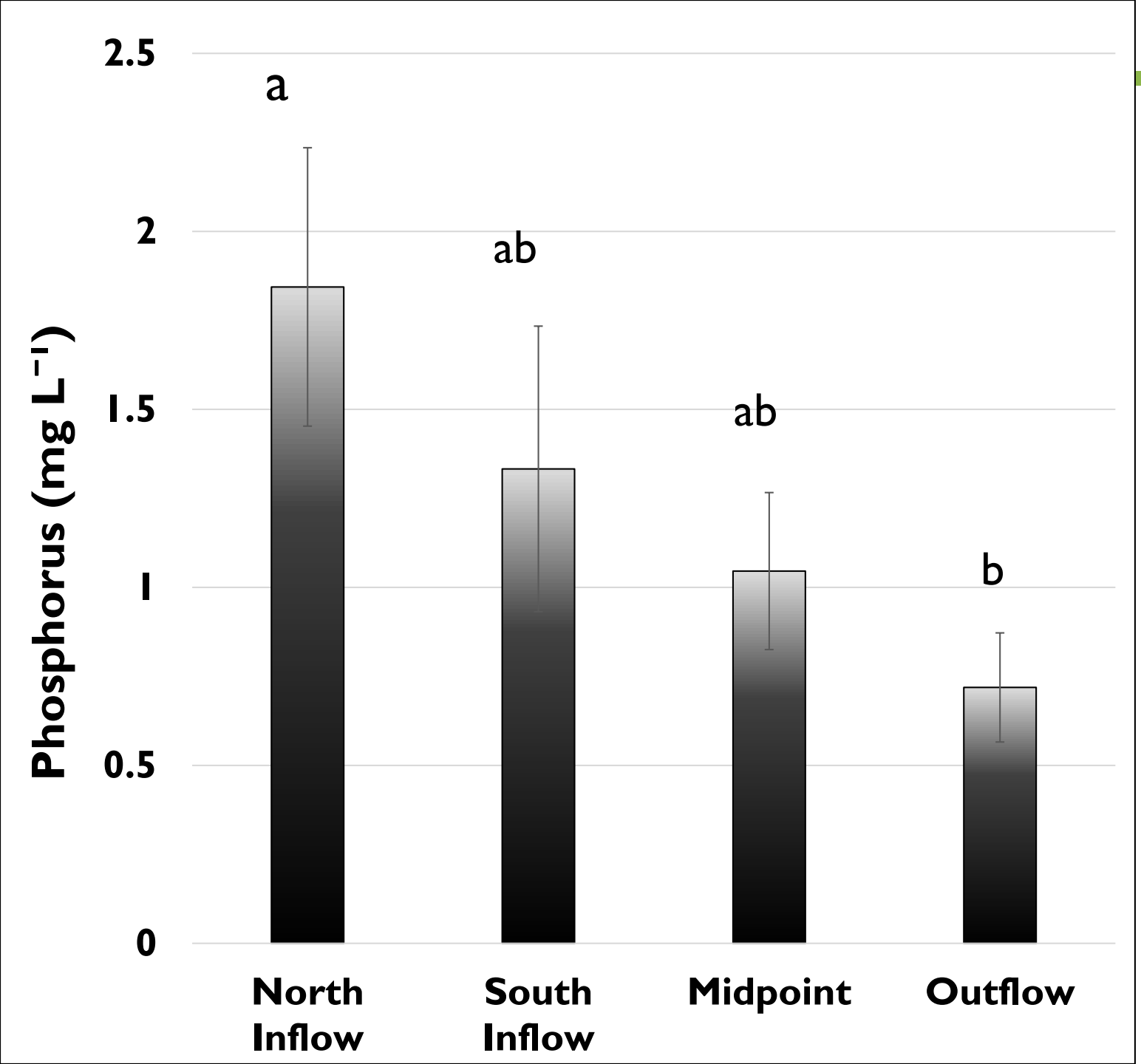
- American Toad
- Fowler's Toad
- Spring Peeper
- Gray Tree Frog
- N. Leopard Frog
- Green Frog
- American Bullfrog

FROG FRIDAYS!



WATER QUALITY IMPROVEMENT – 2015 RESULTS

Column plot of nitrate-N concentration measured at each sampling point as measured using a Yellow Springs Instruments nitrate-N probe. Letters denote statistically different post-hoc subgroups from the Tukey's analysis ($\alpha = 0.05$).



WATER QUALITY IMPROVEMENT – 2015 RESULTS

Column plot of phosphorus concentration measured at each sampling point using the vanadomolybdate method. Letters denote statistically different post-hoc subgroups from the Tukey's analysis ($\alpha = 0.05$).

Bringing Wetlands to Your Community – *and Vice Versa!*

Mark Dilley, Chief Scientist

Mary Skapof, Permitting Specialist & Environmental Educator

MAD SCIENTIST ASSOCIATES LLC

Specialists in Ecological & Wetland Consulting • **M**aking **A** **D**ifference–Through Science, Service and Education

A Birding & Photography Success Story

Birding

Bald eagle spotted above Highlands Park

Red-winged blackbird chicks found at Highlands Park

Photography

Sunset at Highlands Park

(Photo by Mark Dilley)


Photographer Bill
Baird

Artistic Inspiration

Painting

Painting Club at
Highlands Park

Painting

Painting purchased by MAD Scientist Associates, LLC

Untitled

Kevin Buckland
2015

A Public Education Program Grows by Leaps & Bounds

Frog Fridays

Westerville, OH

WESTERVILLE

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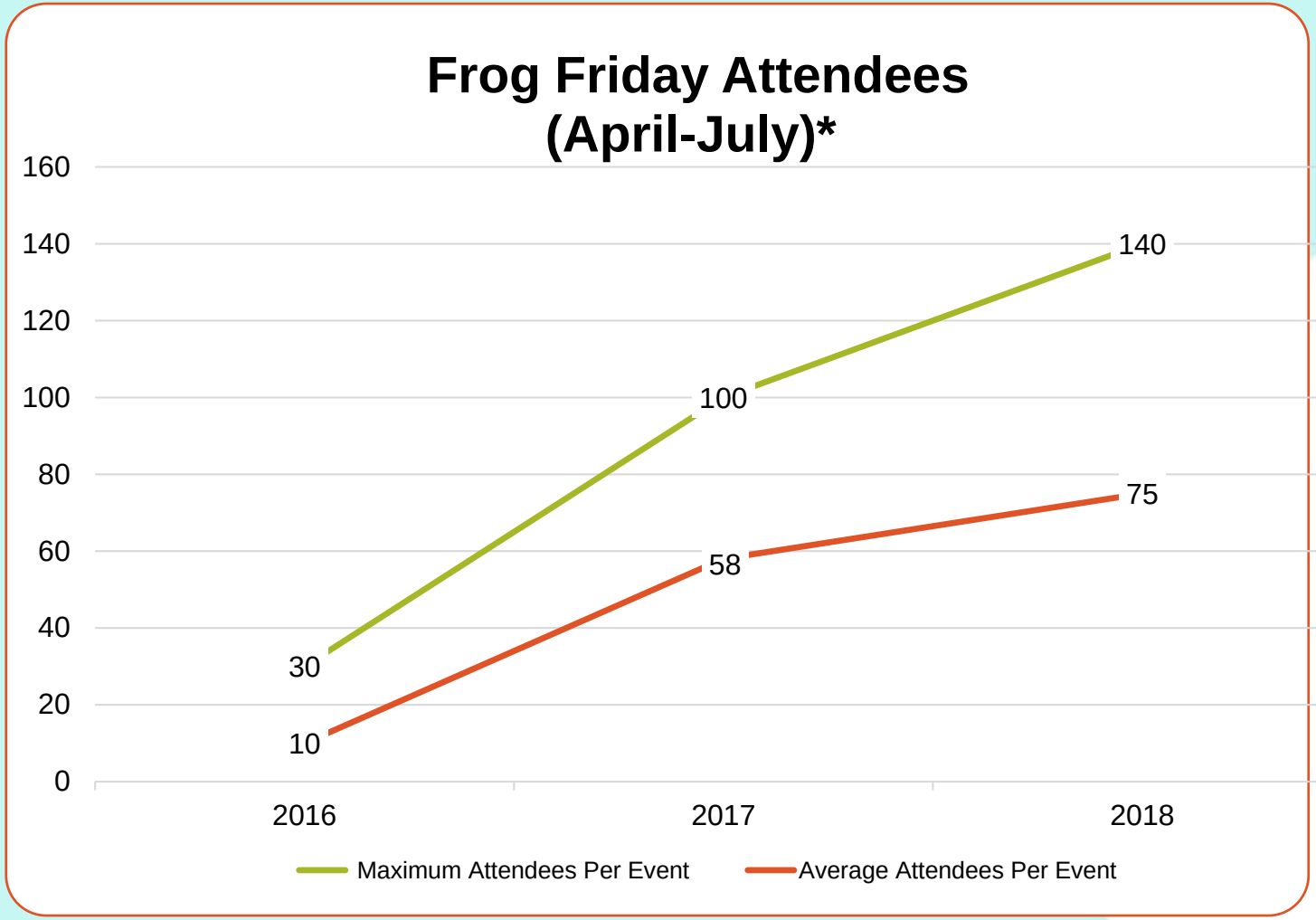
Frog Fridays

Westerville, OH



Frog Fridays

Overall Attendance Increase over 3 Years

*Note: MAD hosted 3 events in 2016 and increased programming to 6 events in 2017 and 2018.

In 2019, we attracted crowds exceeding 200 for several events! (then Covid…[sigh])

Frog Fridays

Westerville, OH

WESTERVILLE

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Wetlands Work Wonders!

Questions?

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