

Will Hydrologically Restored Mississippi River Wetlands Promote Critical Biogeochemical Function?

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Introduction

- Wetland Functions
 - Floodwater protection
 - Storm Protection
 - Water quality improvement
 - Habitat
 - Carbon reservoirs
 - Economic gains
 - Recreation

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 - **Floodwater protection**
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Floodwater Protection



- 1 Acre of wetlands can store three-acre feet of water

- ~1,000,000 Gallons of water



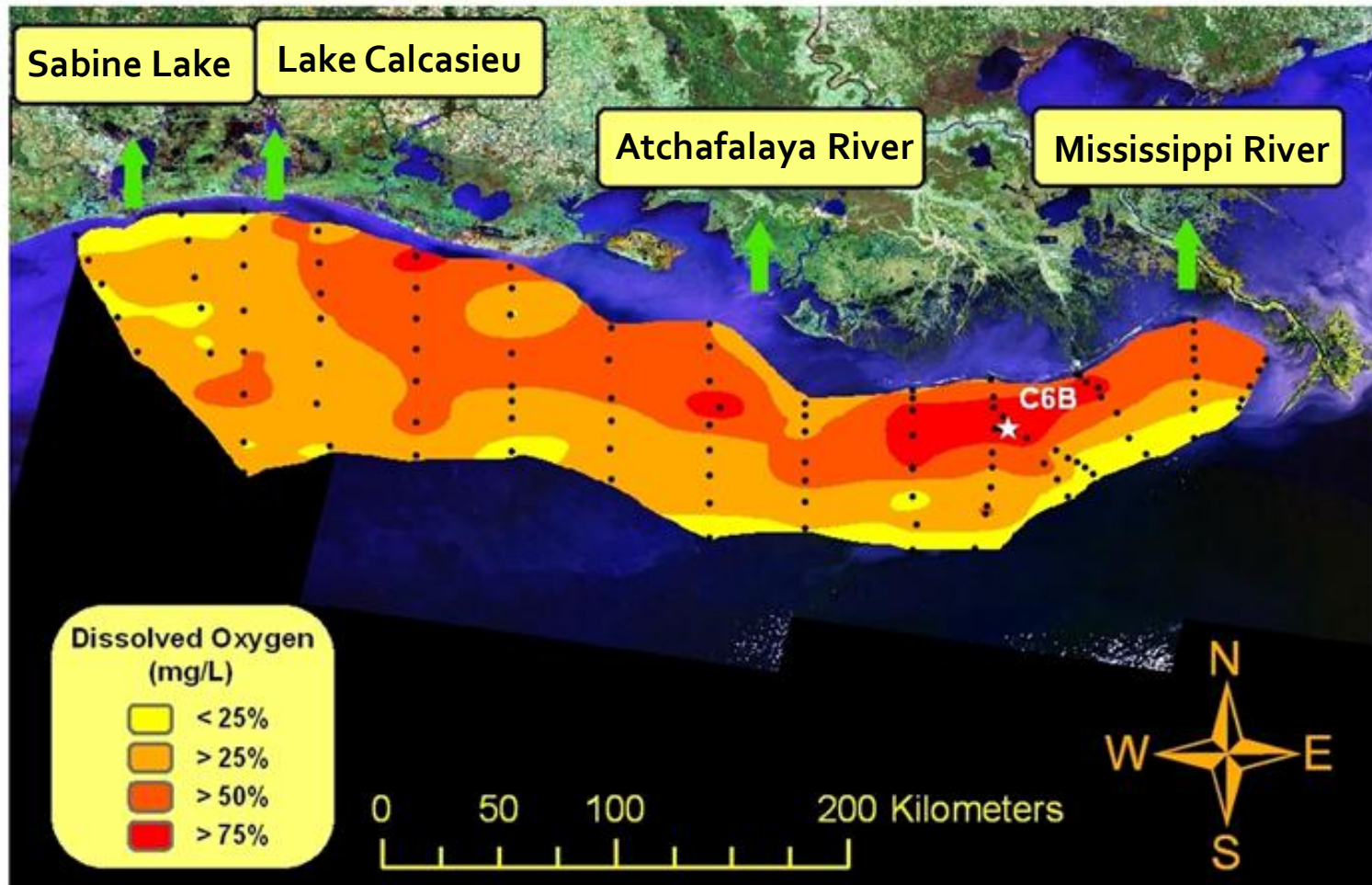
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Hypoxia



Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

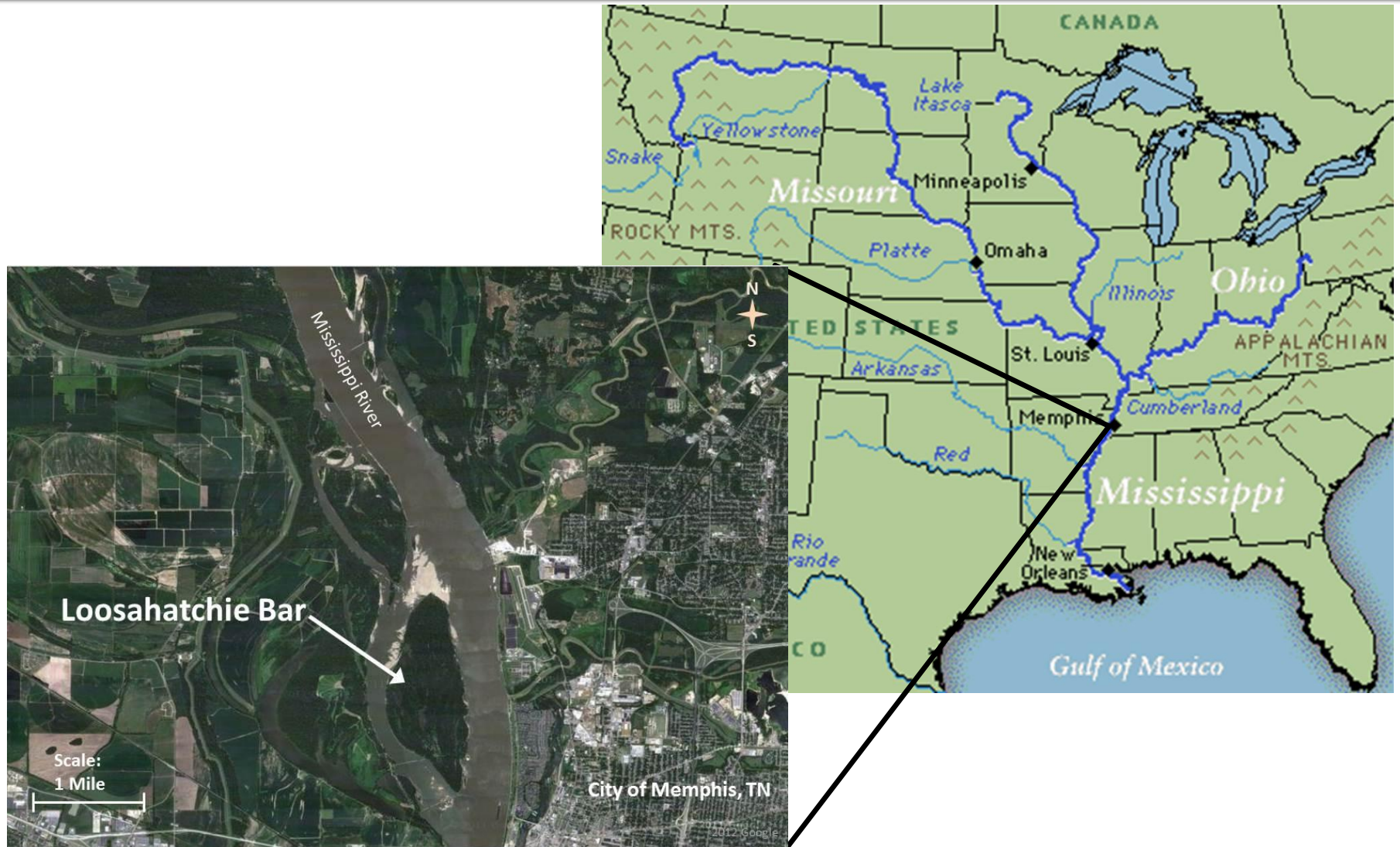
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Wetland Restoration Projects

- Cost: \$3,500 – \$80,000 per acre
- Today ~250,000 acres have or are currently being restored
- Agricultural land → Wetland
 - Through reintroduction of water

Loosahatchie Bar Restoration Project

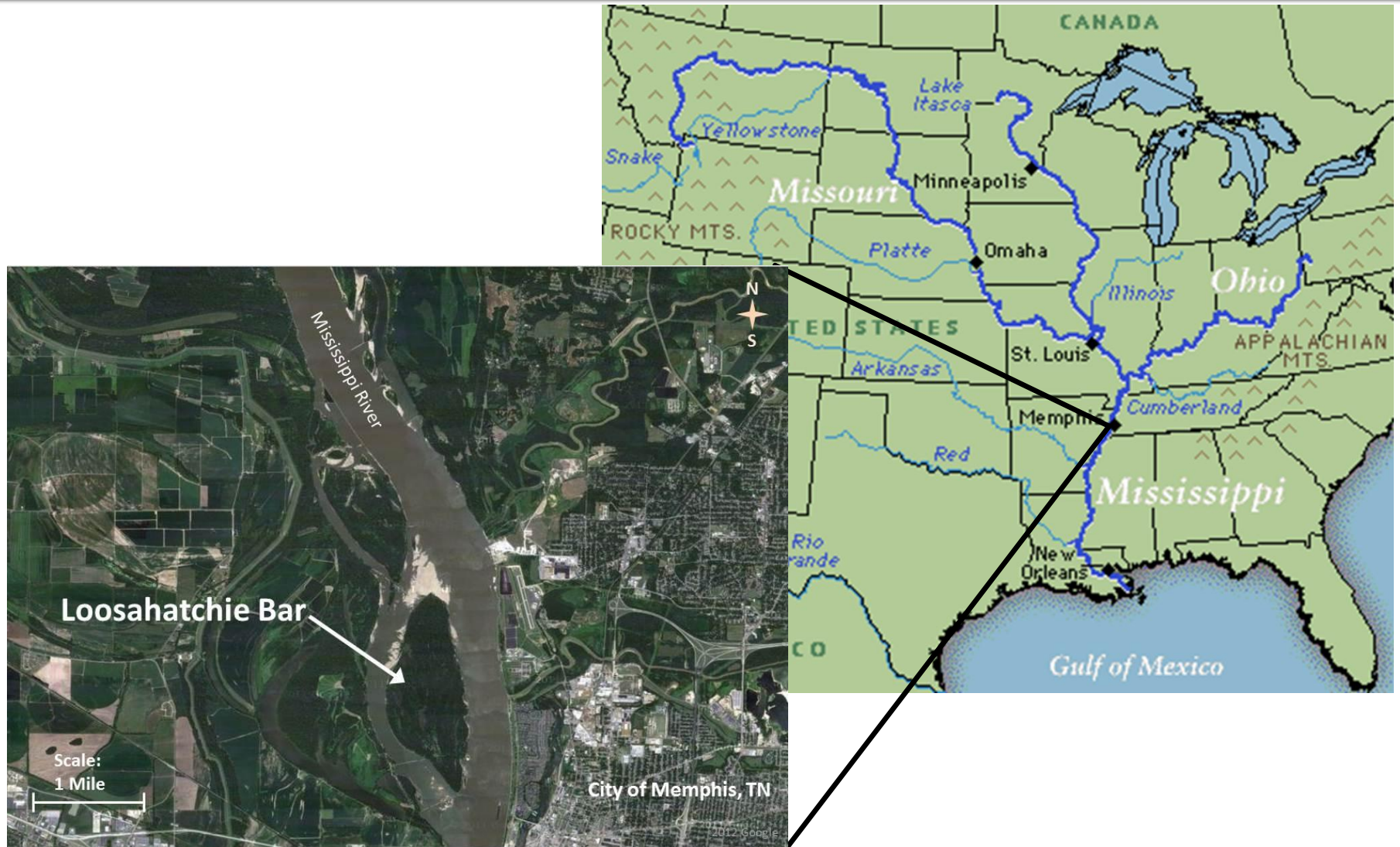


Loosahatchie Bar Restoration Project

- Stone dikes were added in the 1960's
 - Re-routed Mississippi River water away from the Loosahatchie Bar
- Notches were made within the stone dikes
 - Reconnected river water to Loosahatchie Bar



Loosahatchie Bar Restoration Project

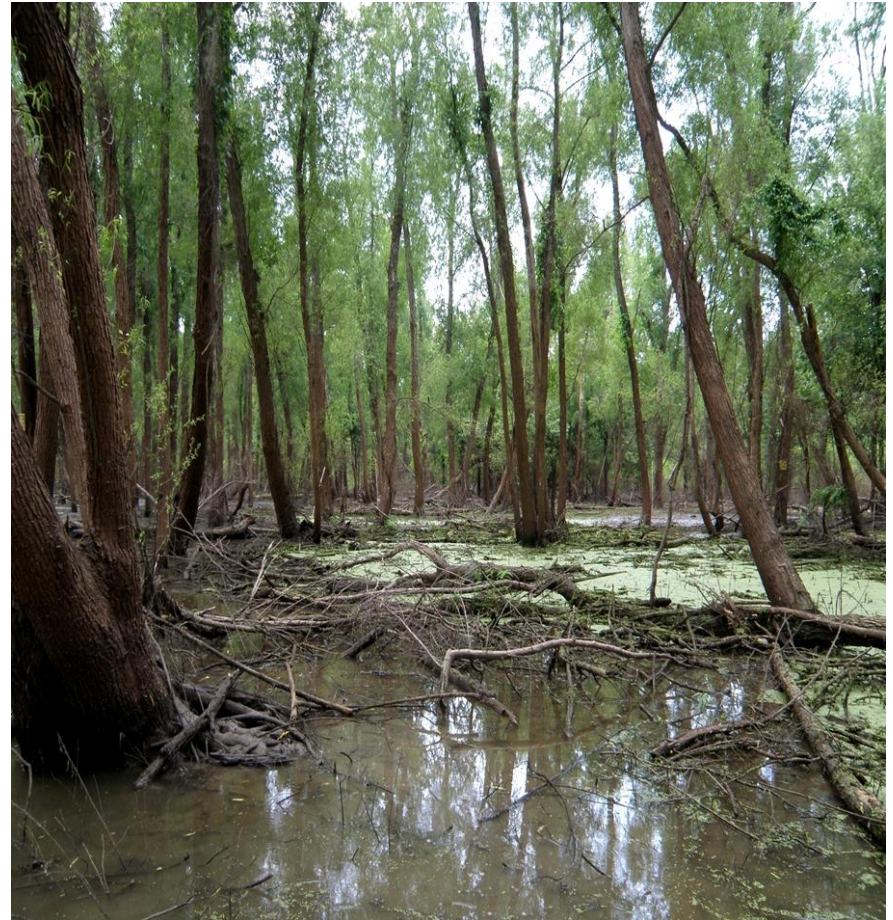


Wetland Restoration

Restored

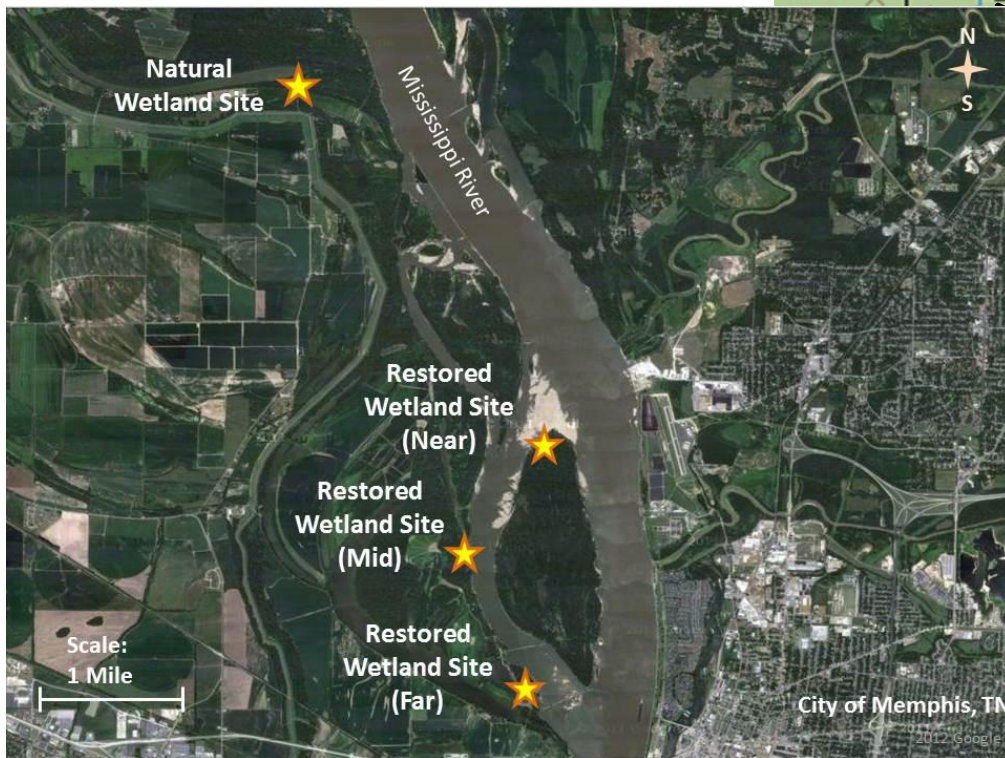


Natural



Study Area

- 4 Total Sites



- 1 Natural Wetland Site
- 3 Restored Wetland Sites

Methods

- Soils were collected by 10 cm deep cores
- Homogenized
- Analyzed for 8 soil properties
- Repeated 4 times throughout 1 year seasonally



Soil Properties

- Compared soil properties

Soil Characteristics

- Bulk Density
- Total Carbon
- Total Nitrogen
- Total Phosphorus

Microbial Characteristics

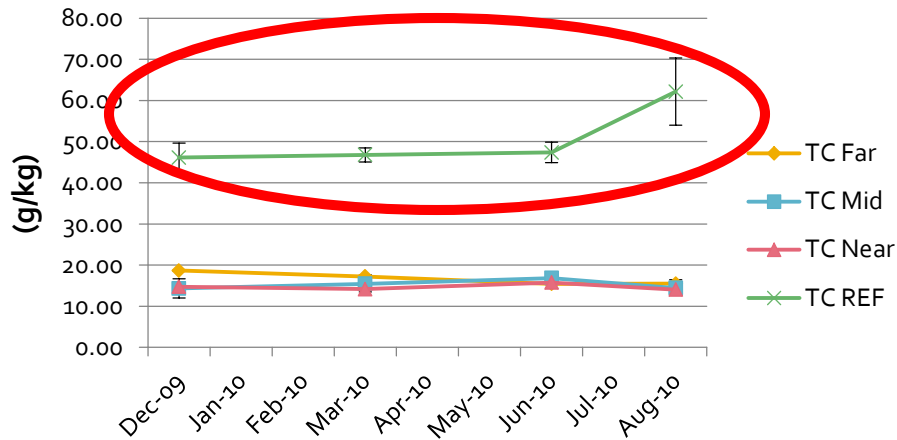
- Microbial Biomass Carbon
- Microbial Biomass Nitrogen
- Potentially Mineralizable Nitrogen
- Potential Denitrification

Results

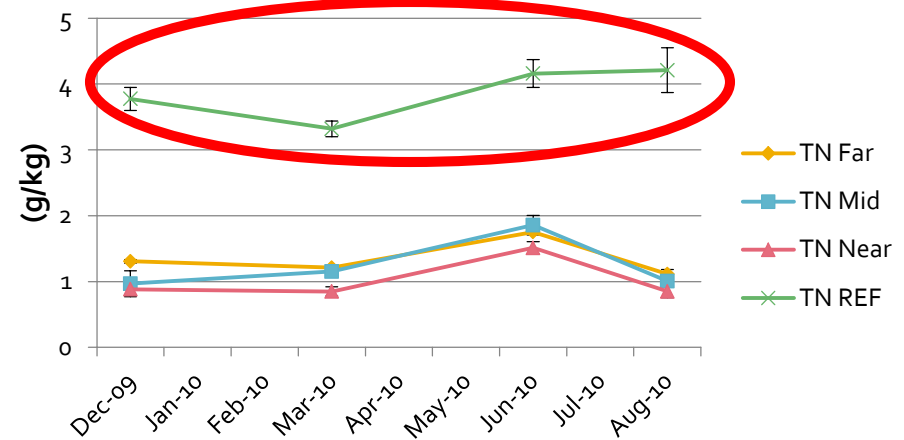
- 1.) Variation among restored and natural sites
 - Soil Characteristics
 - Microbial Characteristics
- 2.) Spatial Variation
- 3.) Restoration Progress

Variation Among Soil Characteristics

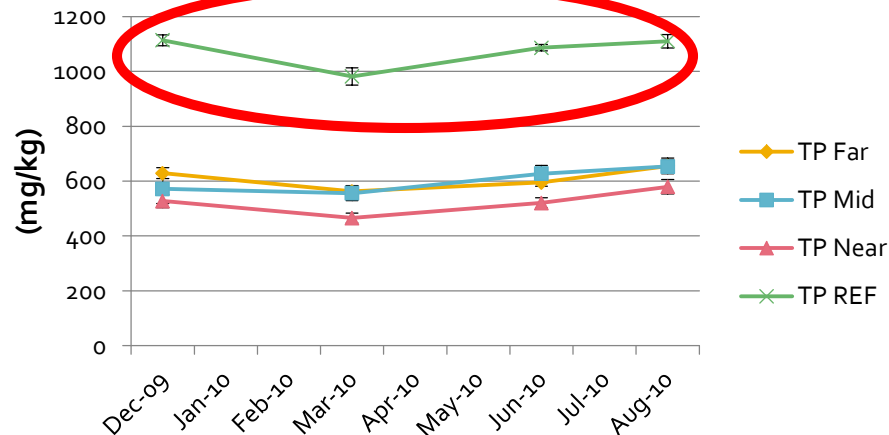
Total Carbon Versus Time



Total Nitrogen Versus Time

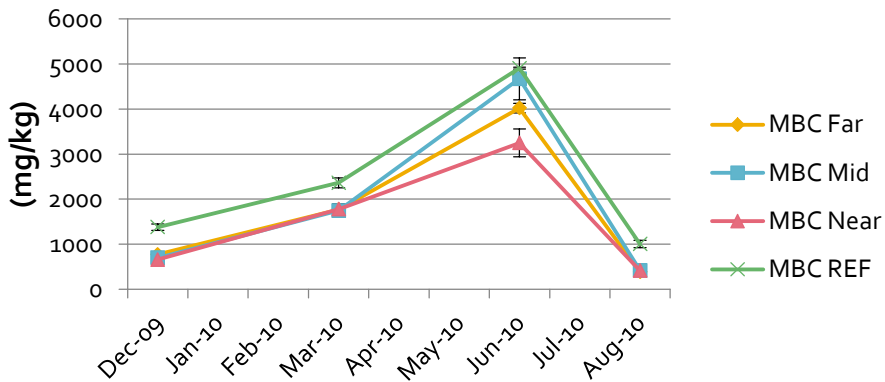


Total Phosphorus Versus Time

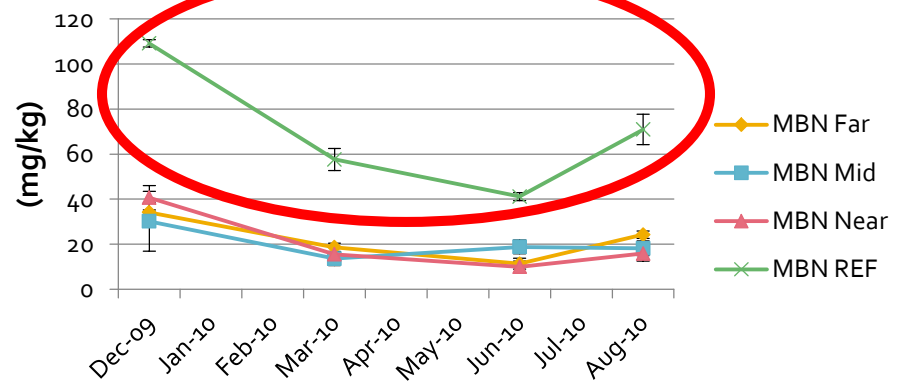


Variation Among Microbial Characteristics

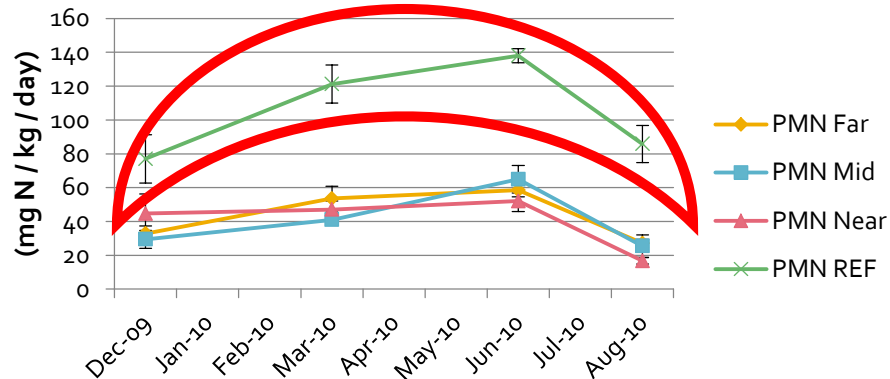
Microbial Biomass Carbon Versus Time



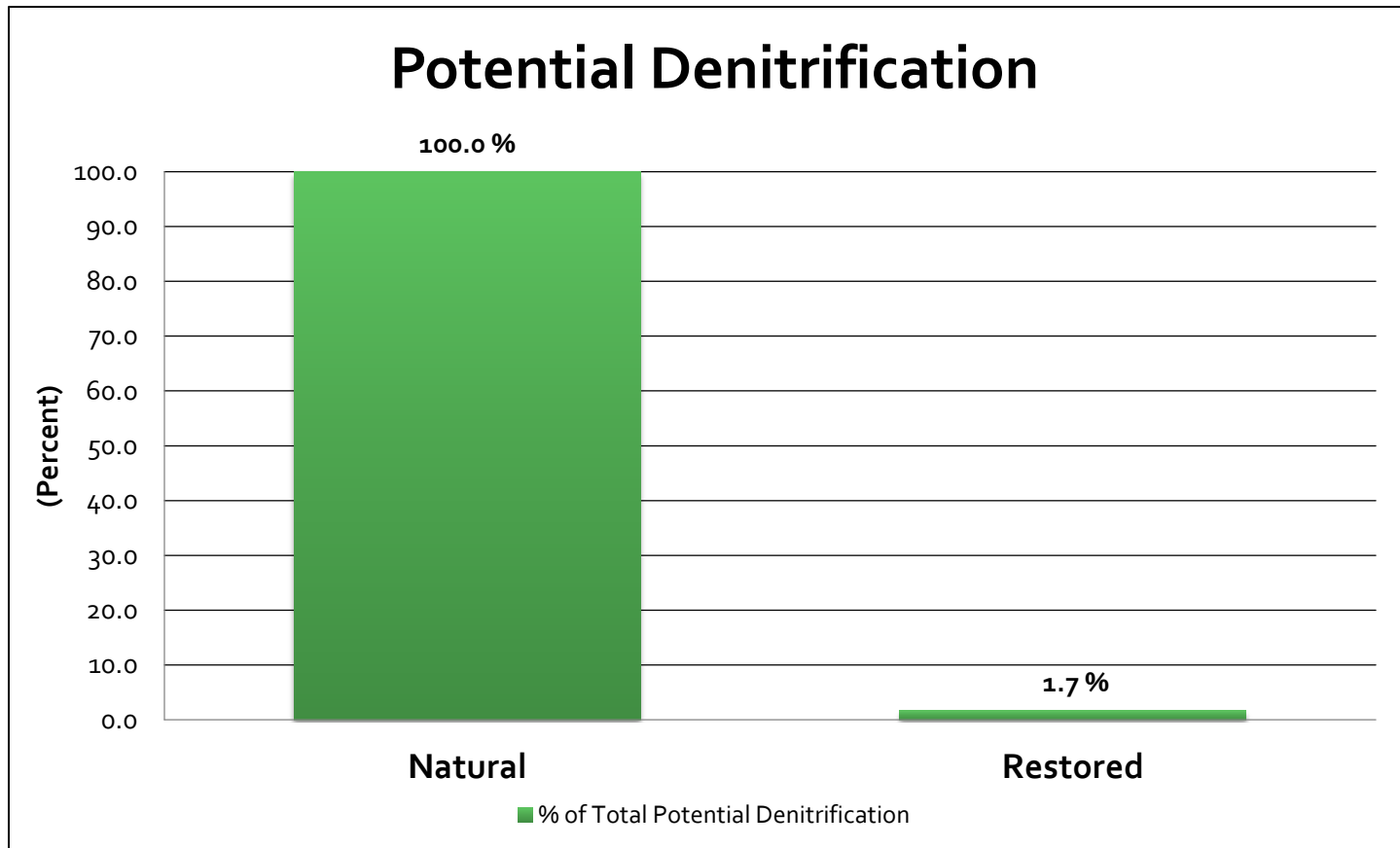
Microbial Biomass Nitrogen Versus Time



Potentially Mineralizable Nitrogen Versus Time

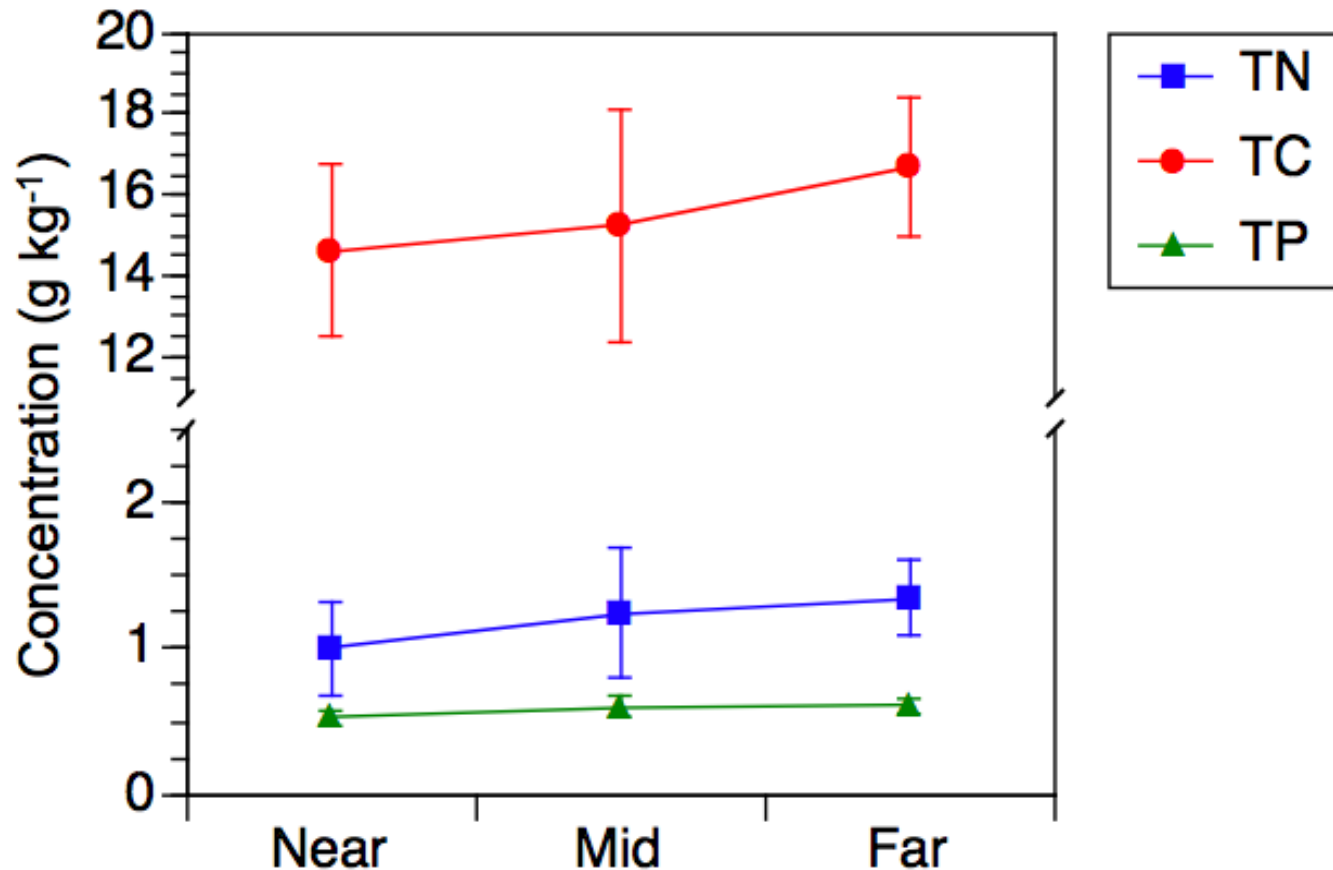


Variation Among Microbial Characteristics Continued



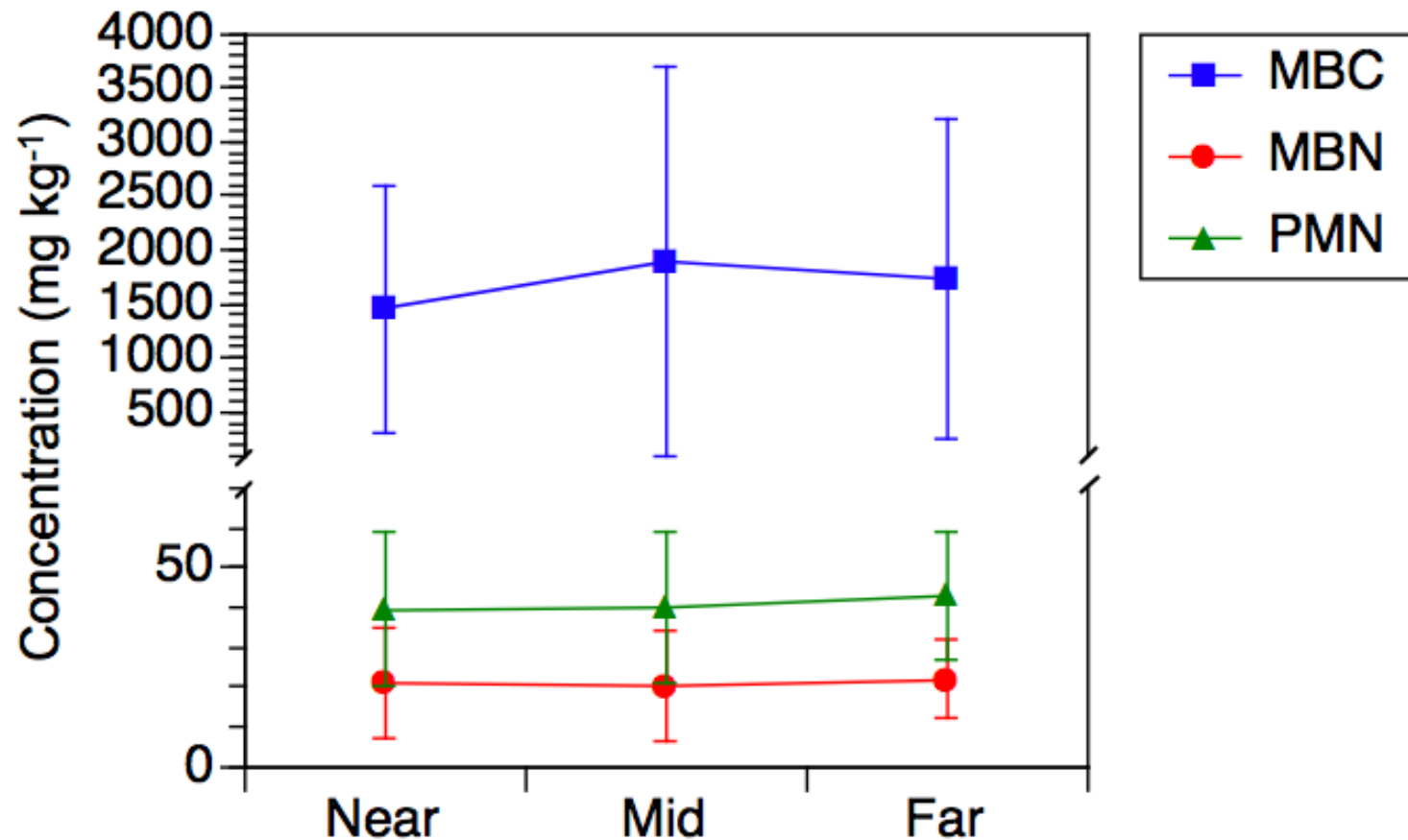
Variation Among Restored Sites

Variation of Soil Characteristics Among Restored Sites



Variation Among Restored Sites

Variation of Microbial Properties Among Restored Sites



Restoration Progress

Soil Characteristic	Restored	Natural	Percent Restoration
Bulk Density (g cm ⁻³)	0.81 ± 0.11*	0.52 ± 0.11*	63%
Total Nitrogen (g kg ⁻¹)	1.15 ± 0.37*	3.87 ± 0.54*	30%
Total Carbon (g kg ⁻¹)	15.3 ± 2.35*	50.6 ± 10.6*	30%
Total Phosphorus (mg kg ⁻¹)	566 ± 73.1*	1073 ± 68.5*	53%
Microbial Biomass Carbon (g kg ⁻¹)	1.63 ± 1.40	2.41 ± 1.59	68%
Microbial Biomass Nitrogen (mg kg ⁻¹)	21.1 ± 12.8*	69.7 ± 27.2*	30%
Potentially Mineralizable Nitrogen (mg kg ⁻¹)	40.6 ± 18.2*	106 ± 32.0*	38%
Potential Denitrification (mg N ₂ O-N kg ⁻¹ day ⁻¹)	7.94 ± 7.44*	549 ± 60.6*	2%

Measured soil and microbial properties results ± standard deviation.

* denotes significant difference between columns (P<0.01).

Conclusion

- Wetlands provide many important functions including biogeochemical nutrient cycling
- Restored wetlands may take significant time to reach biogeochemical function similar to natural wetlands
- May never reach natural wetland levels

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