Revisiting historic dredged material habitat improvement sites informs the future of beneficial use initiatives

Western Dredging Association
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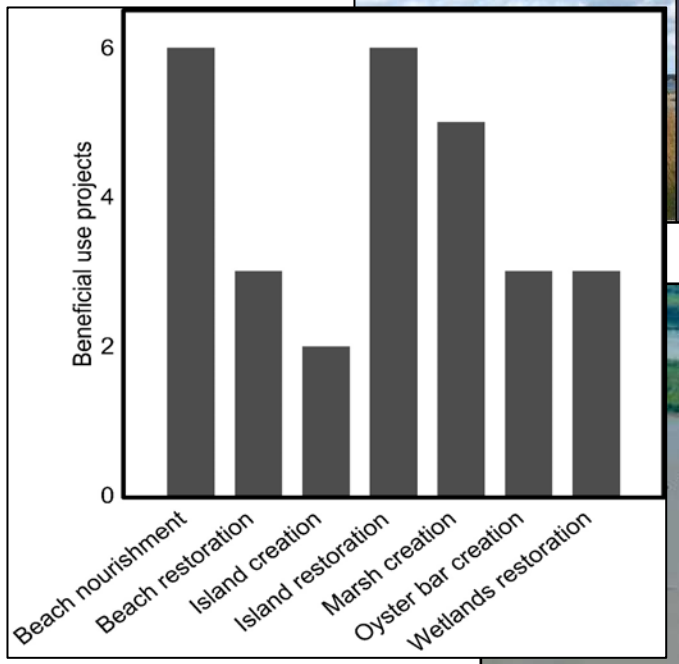
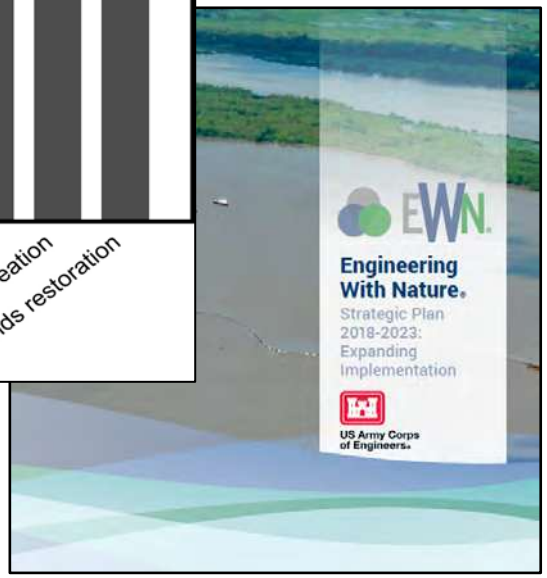
DOER

DOTS

Beneficial use of dredged material

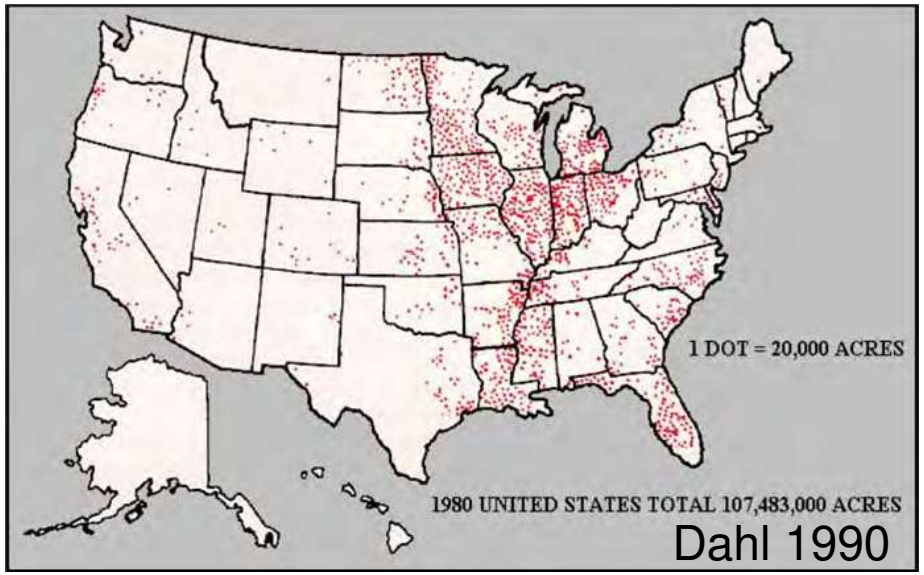
- Over 1,300 beneficial use projects documented to date in the US
- Range of project objectives/benefits (Berkowitz and Szimanski 2020)
- EWN® initiative to deliver navigation and cost-effective dredged material management while improving environmental outcomes (Bridges et al 2014)



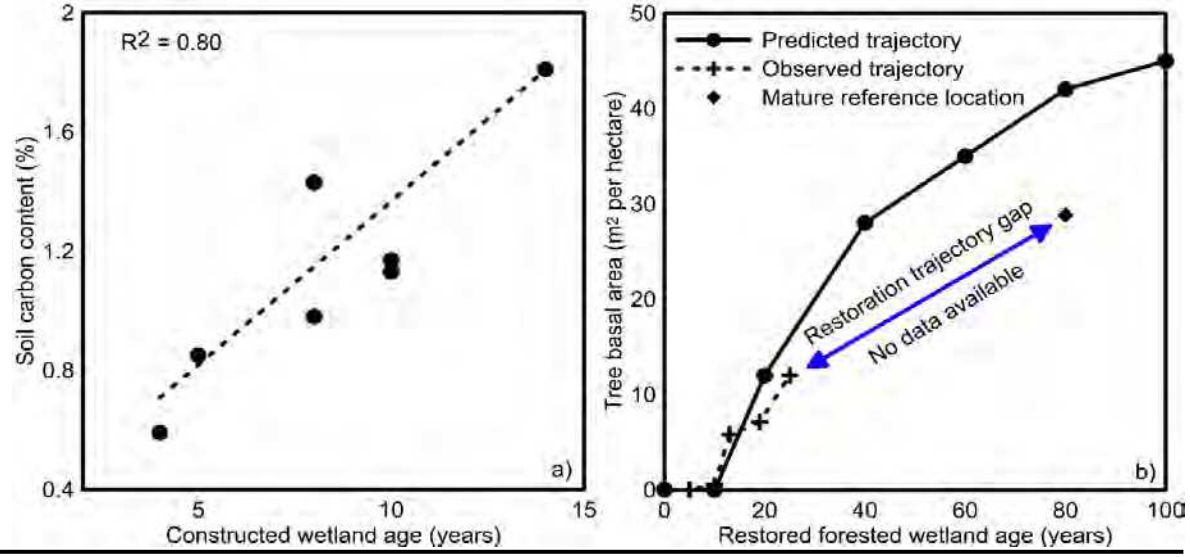


We live in an altered wetland landscape

- **Altered conditions dominate wetlands in the US and internationally**
  - **Unaltered reference conditions often unknown (Otte et al 2021)**
- **Alteration changes wetland functional magnitude compared to undisturbed areas (Novitski et al 1996)**
- **Long-term functional trajectory of altered wetlands remains unknown (Berkowitz et al. 2017; Berkowitz 2018)**
- **Alteration creates opportunities for BU**

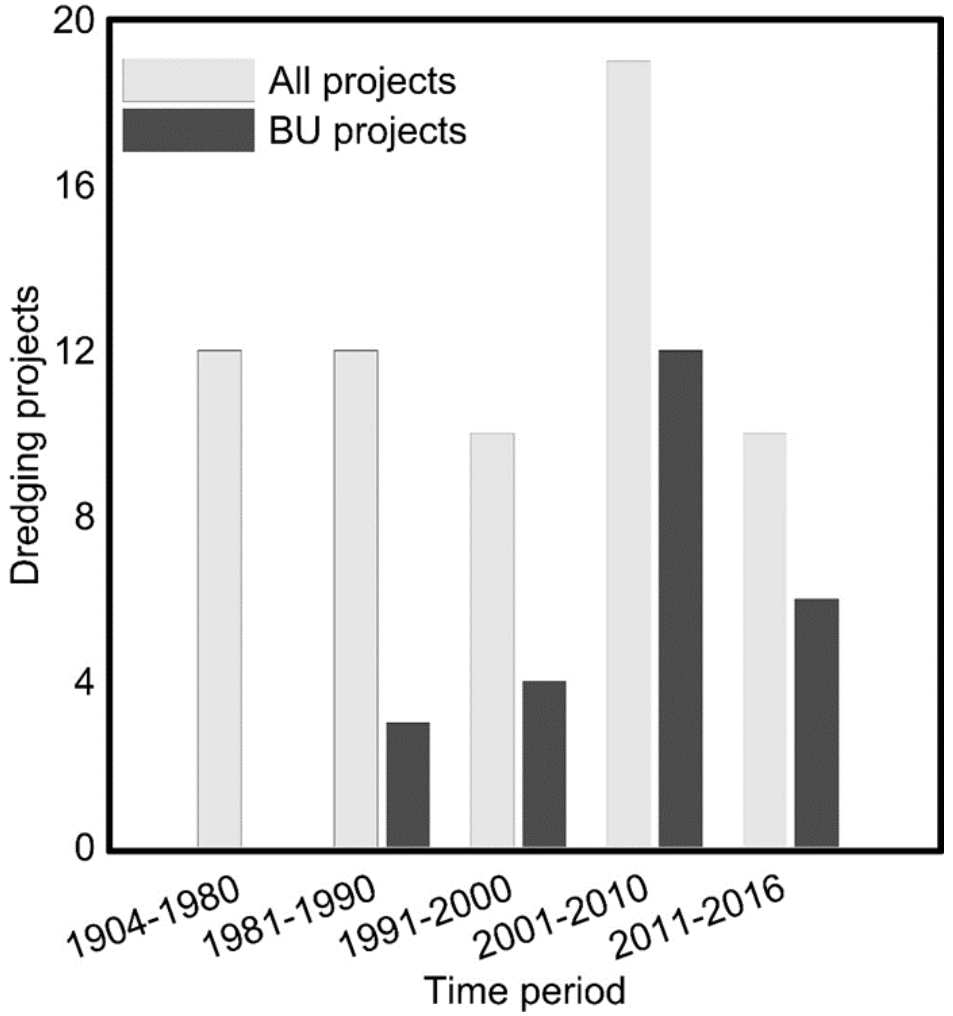


Dahl 1990



Evolution of beneficial use activities

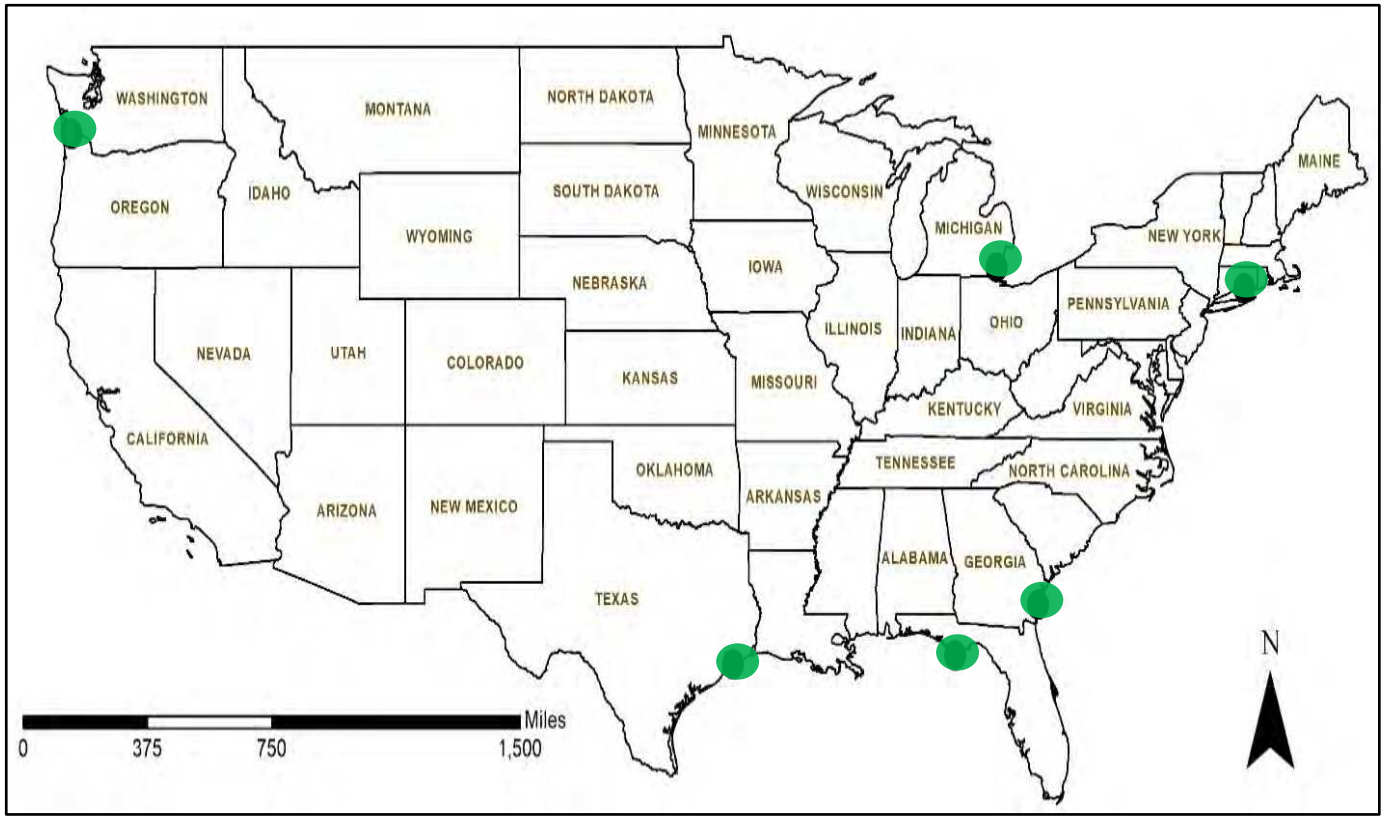
- Historic attitude → dredged "spoil"; placement in wetlands
- Expanding beneficial use of dredged materials over time
- Early assessments of habitat improvement using dredged materials (1970s)
- Long term trajectory of restored features remains unknown
- Revisited six historic wetland restoration sites after >40 yrs to evaluate project outcomes



Berkowitz and Szimanski (2020)

Objectives and approach

- Assess long-term benefits of wetlands restored or created using dredged material
- Six wetland sites across the US
- Wide range of geographic and geomorphic diversity in study sites

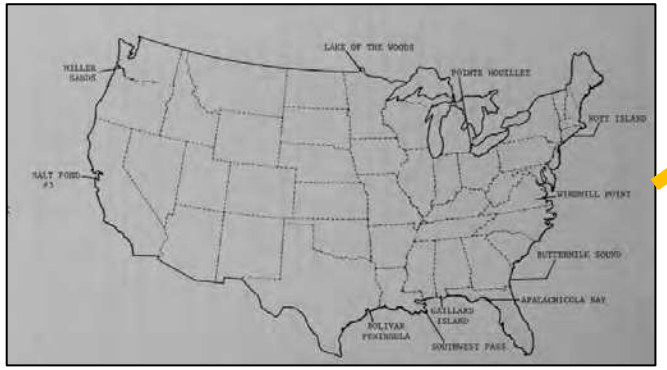


Objectives and approach

Projects constructed using dredged materials (1974-1978)

These represent some of the oldest wetland restoration sites in the US for which monitoring data is available

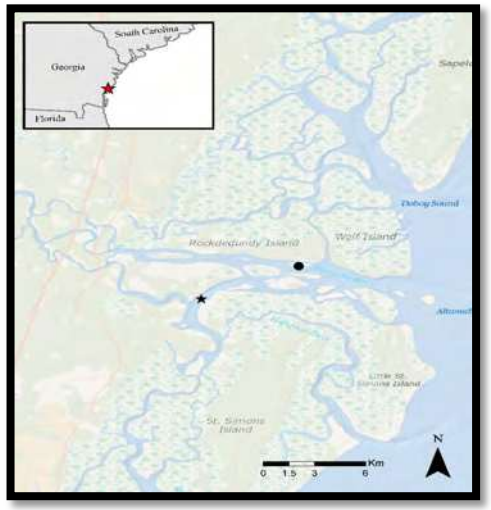
We re-created the previous study to evaluate conditions at each location after >40 years

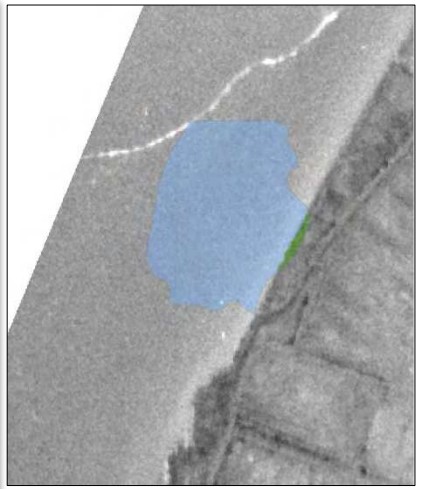


There was no Google Earth in 1978!

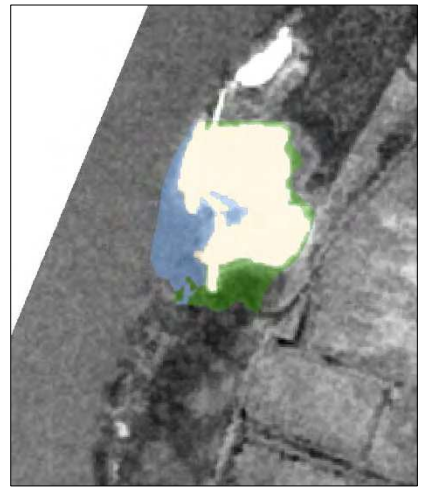
Example: Buttermilk Sound, GA

- 3 ha sandy dredge island built in 1974, adjacent to the ICWW
- Originally a high, unvegetated sand mound
- Site was graded to intertidal elevation, planted, and fertilized
- Monitored through the early 1980s, then in 2019
- Currently displays a diverse array of habitats, ecological functions, and engineering benefits

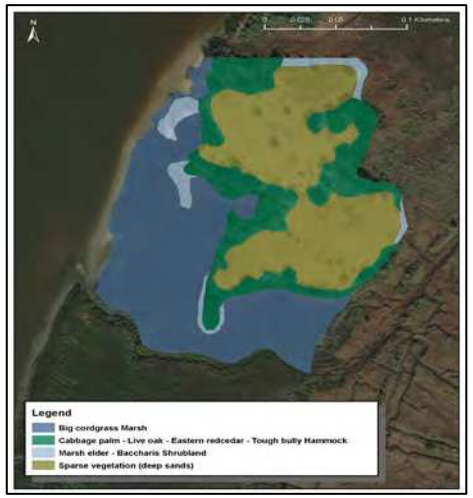




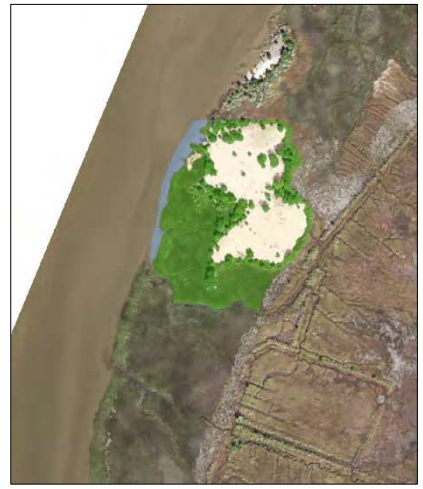
1956



1993



2010



2019

40 years of wetland functional and engineering benefits

General findings:

- Project sites persisted without hard structures or intervention
- Continue to provide a range of wetland functions & engineering benefits after 4 decades

Avian communities:

- Habitat for a diversity of avian communities
- Numerous Species of Conservation Concern utilize these locations

(Berkowitz et al, In Press)

Soils:

- Bulk density decreased
- Salinity decreased
- Organic matter increased
- Nutrient availability increased
- Hydric soil indicators now present in all sites

Vegetation communities:

- Species richness increased over time
- Planting helped vegetation establishment and soil stabilization
- Planting had limited effect on current species composition
- Elevation/salinity determined ecological endpoints

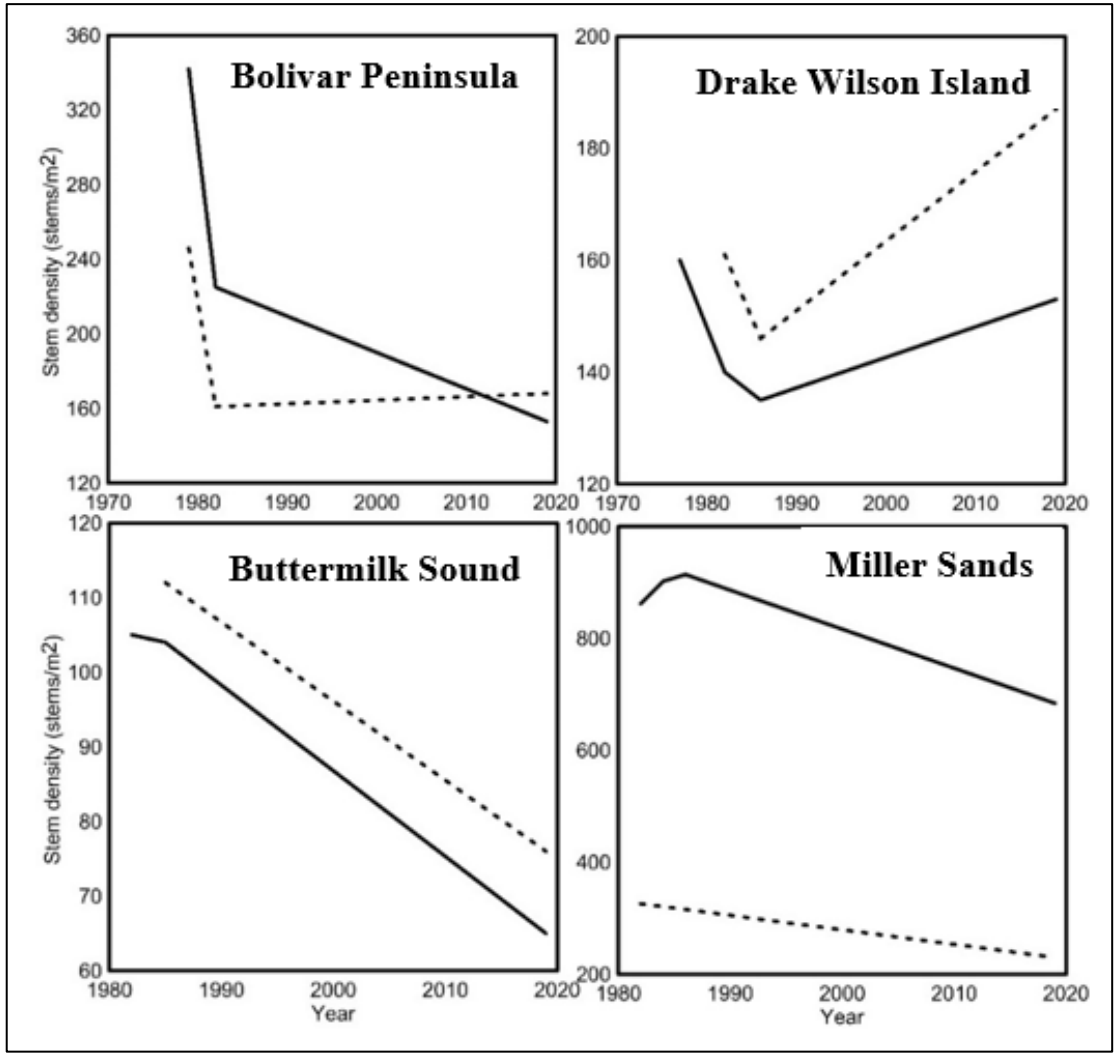
40 years of wetland functional and engineering benefits

- Restored sites became more similar to the reference areas over time
- Remain on unique trajectories compared with unaltered natural wetlands
- More diverse vegetation and avian communities than reference areas due to elevation gradients and a wider range of substrate characteristics

	Vegetation community assemblages (count)		Dominant species richness in target community types (count)			
Location	Beneficial use (BU) site	Reference location	Habitat type	BU (2019)	Historic	Reference (2019)
Bolivar Peninsula, TX	10	1	Low marsh	4	2	2
Drake Wilson Island, FL	6	8	Low marsh	2	2	2
Buttermilk Sound, GA	4	2	Marsh	3	4	3
Nott Island, CT	10	4	Meadow	16	5	NA
Pointe Mouillee, MI	7	NA	Marsh	7	4	NA
Miller Sands, OR	7	1	Marsh	18	17	15

40 years of wetland functional and engineering benefits

- **Similar response to ecological perturbation as unaltered wetlands, despite differences in magnitude**

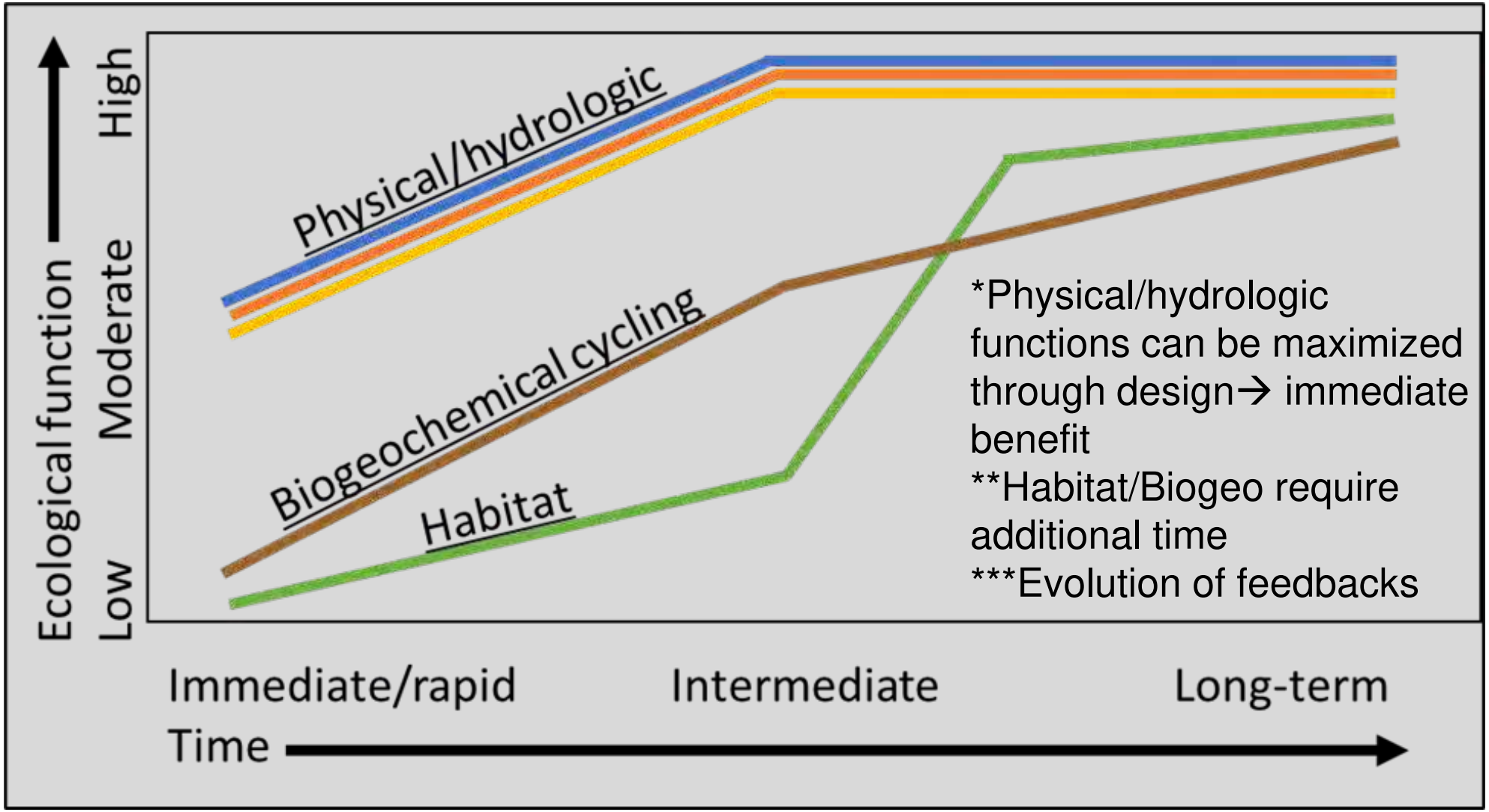


What we know about long-term BU outcomes:

- Projects differ from natural wetlands initially
- Provide habitat for a variety of species
- Provide better habitat for some avian species prior to the establishment of robust vegetation
- Show increasing similarity with natural areas over time when natural designs are mimicked
- Fail to develop soil characteristics (e.g., C accumulation) equivalent to natural wetlands
- Opportunities to improve site conditions through management
  - Selective species removal; sediment deposition

What we know about long-term BU outcomes:

-Functional responses differ across physical, habitat, & biogeochemical drivers



What we still don't know about long-term BU outcomes:

- **Long-term trajectories require additional research → geomorphology, vegetation, fauna, soils**
- **Project life-cycle analysis and associated cost-benefit analysis**
- **Need better linkages between ecological functions and engineering benefits***
- **These unknowns limit our capacity to promote additional beneficial use projects that increase wetland functions at landscape scales**

40 years of wetland functional and engineering benefits

Conclusions:

1) The target habitats have persisted for >40 years

2) Wetland conditions continue to improve, but have not (and may not) reach reference conditions

3) Despite this, the projects provide valuable functions and benefits although the magnitude of some outcomes differ from reference conditions

Recommendations:

4) We *should* use natural processes to create sustainable wetlands

5) We *should* focus on maximizing the available functions and benefits

6) We *should not* focus on mimicking natural conditions to determine success/failure

Connect for questions and discussion:

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