Wetland Types: Succession and Hydrology

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Hydrology Determines Wetland Types

In General:

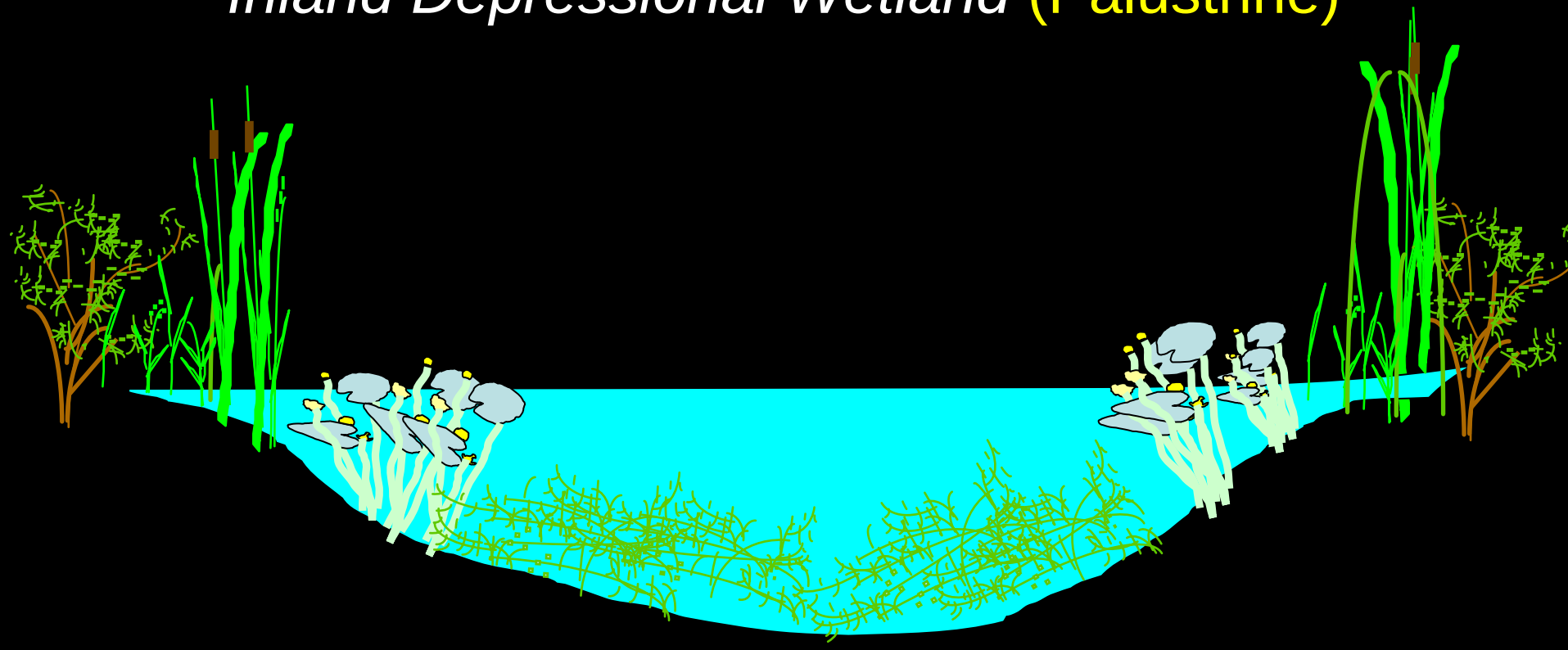
- Precipitation Dominated Wetlands
  - Bogs
  - Vernal Pools
  - Wet Meadows
- Ground Water Dominated Wetlands
  - Fens
  - Forested Swamps
- Surface Water Dominated Wetlands
  - Riparian Forested Wetlands (floodplain)
  - Marshes
  - Great Lakes Coastal Wetlands

Succession: Wetland Types

- Pond, Marsh, Wet Meadow, Shrub Swamp, Forested Swamp.
  - Not necessarily distinct ‘wetland types’, instead
  - A ‘continuum’
  - Pond → Marsh → Wet Meadow → Shrub Swamp → Forested Swamp → Upland
- Aquatic Ecosystems “Age”→ Die
  - Become Upland
  - Anthropogenic disturbance = Increased Rate
- Groundwater follows topography
  - As Wetlands fill, new Wetlands form in ‘new low spot’

Natural Wetland Succession

Inland Depressional Wetland (Palustrine)



Deep Water = Aquatic Bed and Floating Leaf Plants
most competitive

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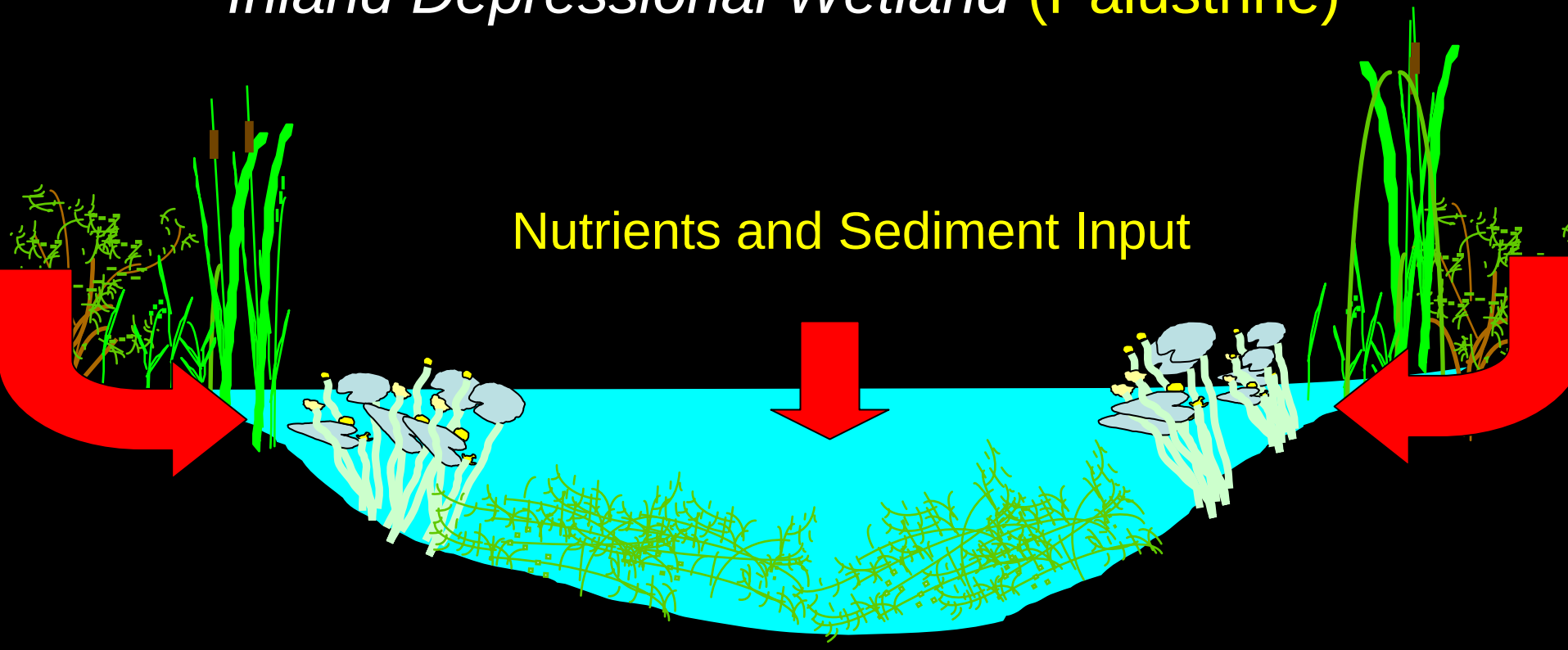

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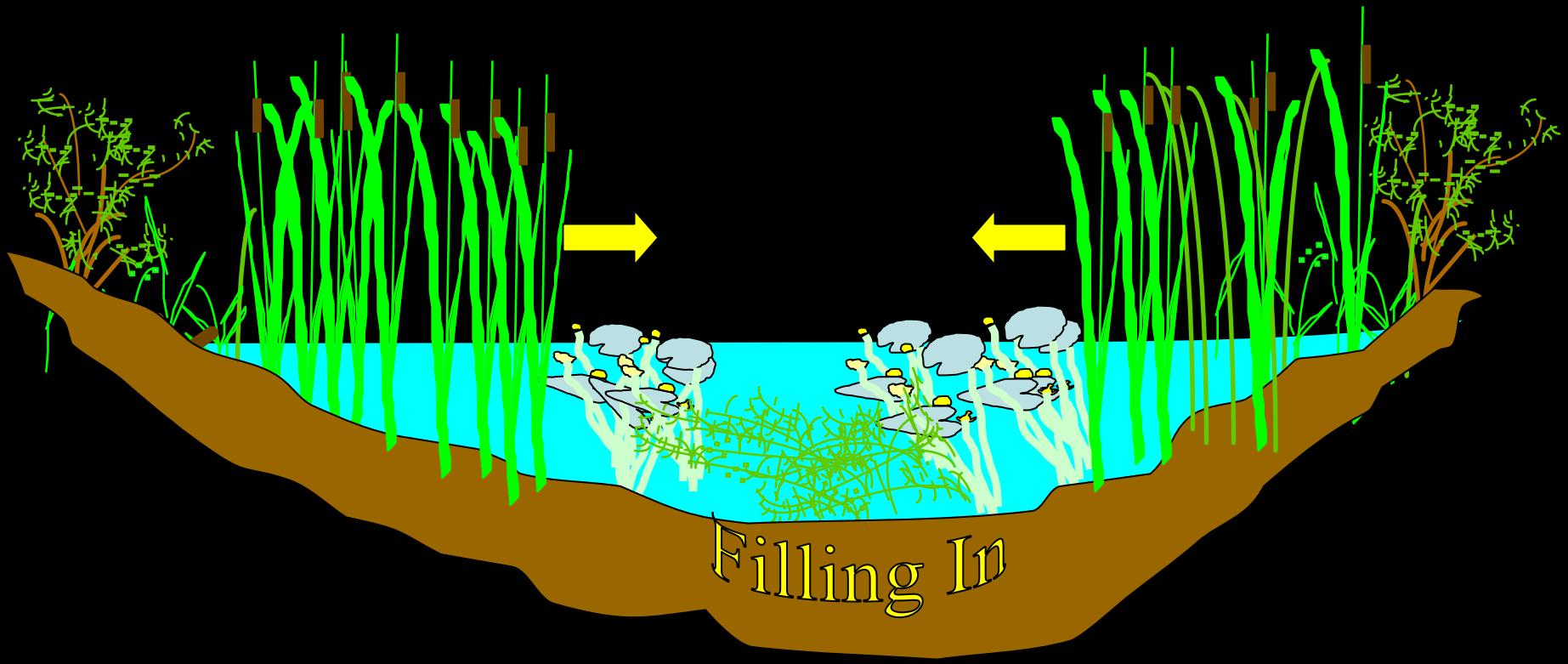

Intermediate Depth = Emergent Vegetation
becomes more competitive

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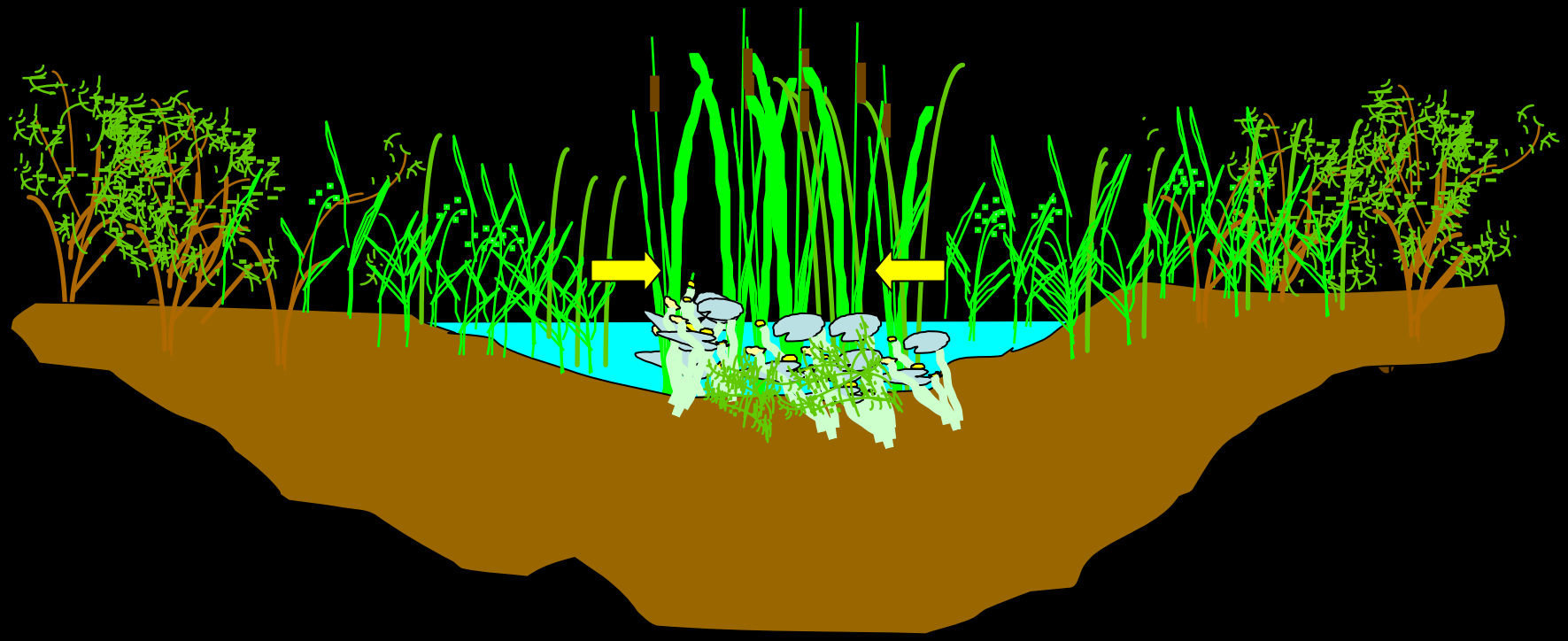
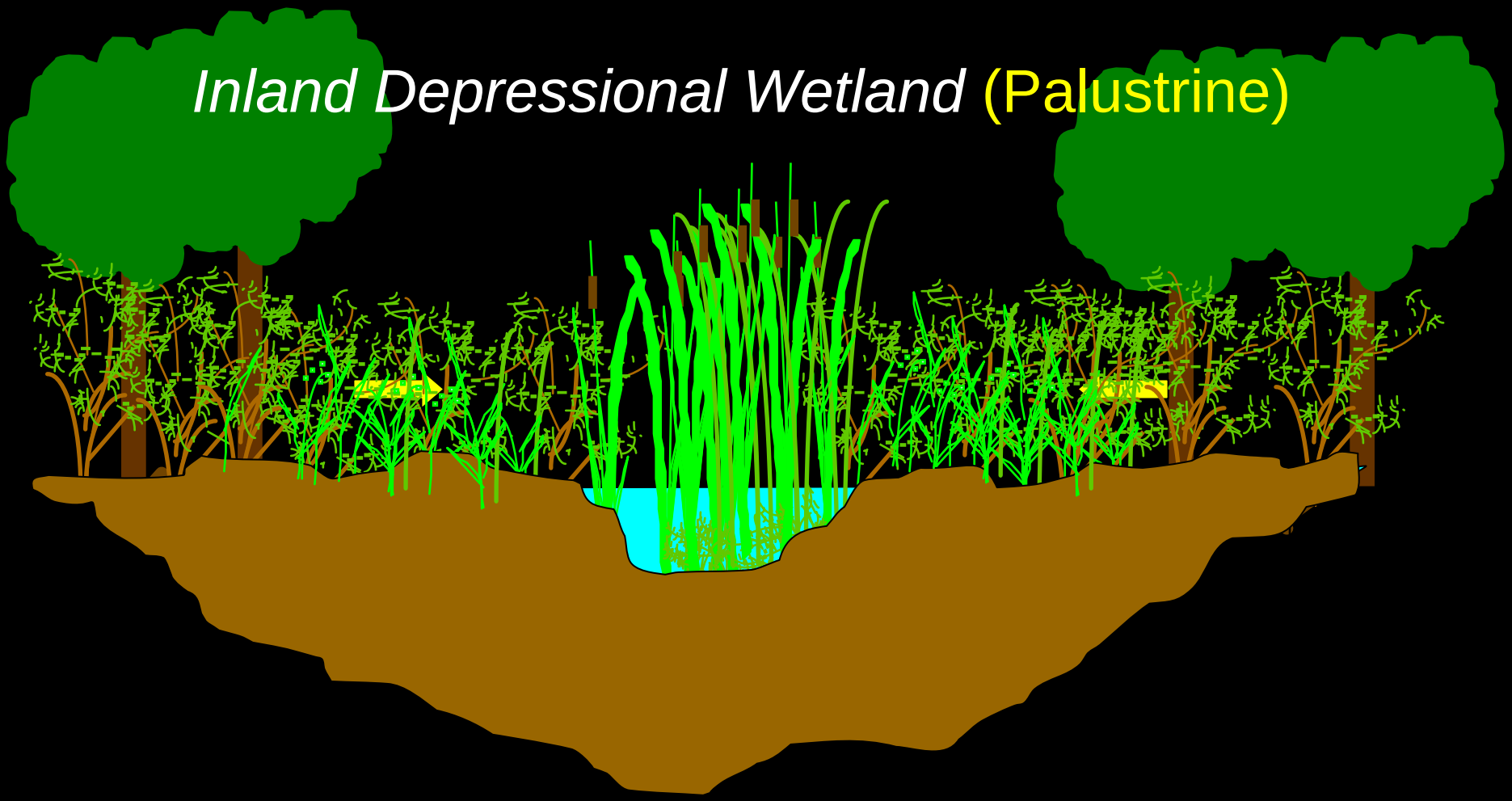
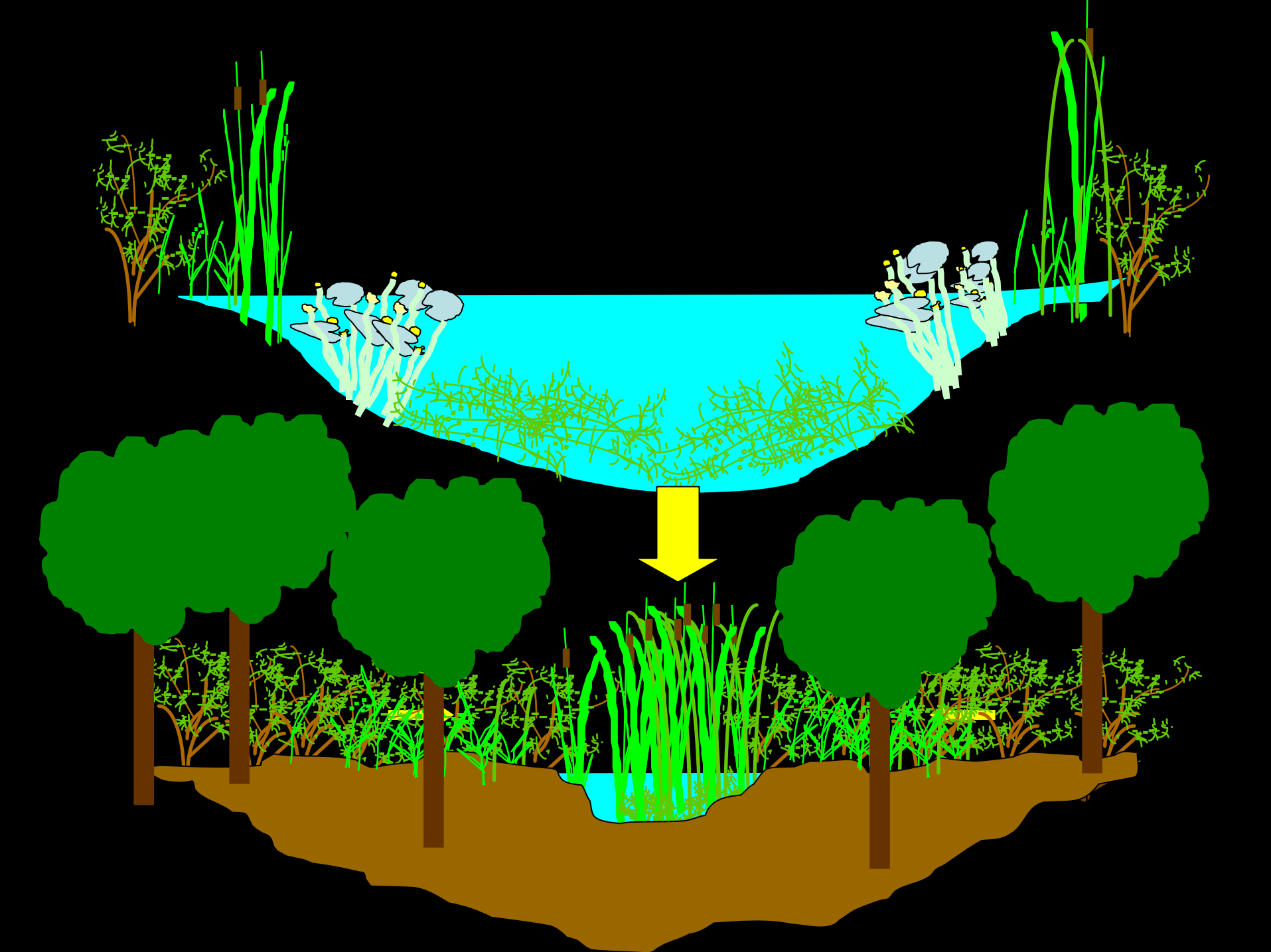


Shallow = Grasses and Sedges,
become more competitive

Natural Wetland Succession



Shallow = Grasses, Sedges, and Shrubs
become more competitive



Decrease in the Duration of Deep-Water Inundation

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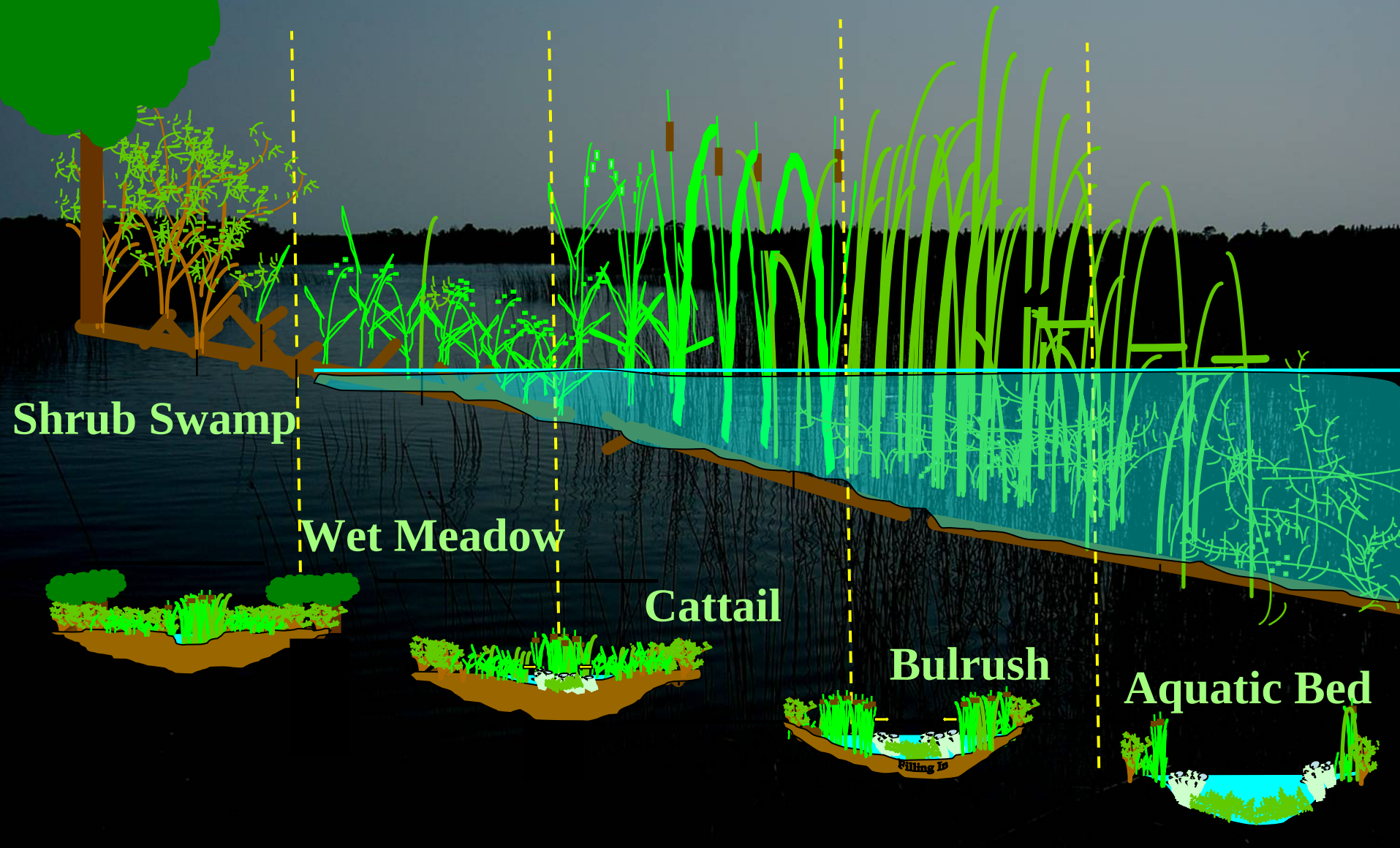
Zonation in *Coastal Wetlands*
Spatial Equivalent of Succession in Time



Precipitation Dominated Wetlands

Precipitation Dominated Wetlands

- ‘Wettest’ of the 3 Examples
  - Peat holds precipitation
  - Mat separates shrubs and trees from the saturated peat.
- MUST be isolated from Groundwater Alkalinity
  - Or would no longer be a bog

Precipitation Dominated Wetlands (…and surface & groundwater)

- Dominated by Grasses and sedges
- Periodic inundation with water
- Poorly drained soils
  - Holds water too long for shrubs
  - Not long enough for emergent vegetation.
  - Greatest species richness

- Duration of inundation can be very short.

- Poorly drained soils
  - Capture spring run-off
  - Very important for amphibians and waterfowl.

Precipitation Dominated Wetlands

Groundwater Dominated Wetlands

Groundwater Dominated Wetlands

- Peat forming groundwater fed wetland.
  - Cool annual temperatures
  - Short growing season
- Activities that make these dryer = peat decomposition.
  - Drain peat
  - Anaerobic peat → aerobic
  - Facultative anaerobes → O_2
- Major community composition shift
- In light of climate change, runaway effect in C cycling.

- ‘Driest’ wetland type.
  - Most susceptible to development.
- Not easily mitigated
- Flooding > ~ 70 days or 1/3 growing season kills woody plants
- Change in hydrology = major impact
  - Divert water in = Marsh
  - Divert water away = Upland

Groundwater Dominated Wetlands

Surface Water Dominated Wetlands

Riparian Forested Wetlands (floodplain)

Marsh

Great Lakes Coastal

Surface Water Dominated Wetlands

Riparian Forested Wetlands (floodplain)

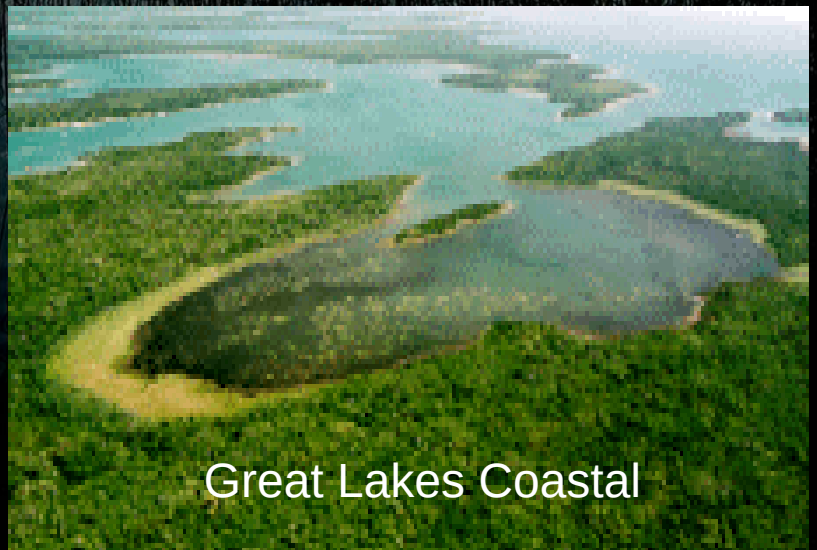
- Surface water important in winter/spring.
  - Groundwater often important remaining year.
    - River at potentiometric surface
- Often converted to agriculture or developed.
  - Both increase occurrence and magnitude of floods downstream.

- ‘Wettest’ wetland types.
  - Flooded most of the growing season.
- Emergent aquatic vegetation dominate
  - Aerenchyma
    - Adaptation to anaerobic soils
- Vegetation ‘prefers’ dryer areas, but:
  - Easily outcompeted by terrestrial
    - Depend on dry periods for regeneration from seed bank.

Surface Water Dominated Wetlands

- Continuum from surface water lake ward to groundwater inland
  - Distinct chemical/physical gradient
- Areas often developed:
  - Wet meadow zone
  - Shrub and Forested Swamp zone
- ‘Last line of defense’ – Pollutants entering Great Lakes
- Key in supporting our $7.5 billion annual fishery
- Have already lost >50%

Surface Water Dominated Wetlands



Open Embayments

Barrier-Beaches

Protected Embayments

Drowned River Mouths

Photo from Minc and Albert (2000) and taken by Ted Cline (1996)

Wetland Functions

(Bardecki et al. 1989; Adamus et al. 1987; Richardson 1995

1. Groundwater recharge
2. Groundwater discharge
3. Flood flow alteration
4. Sediment stabilization
5. Sediment/toxicant retention
6. Nutrient removal/transformation
7. Carbon transformation
8. Production export
9. Wildlife diversity/abundance
10. Wildlife breeding
11. Wildlife migration
12. Wildlife wintering

Value of Wetland Ecosystem Services

- Canadian Coastal Wetlands (Krantzberg and de Boer, 2008)
  - Calculated value of wetlands for:
    - nutrient cycling, flood control, climate control, soil productivity, forest health, genetic repository, pollination, natural pest control
  - $69 billion per year for Canada alone.

- West MI Inland Wetland (Sterrett-Isely et al. (In Review))
  - Calculated value of wetlands for:
    - aesthetic, recreation, fish and wildlife habitat, nutrient cycling, waste assimilation, erosion control, and water supply services
  - $1,300 per acre per year

- 90% of all Great Lakes fishes use coastal wetlands for some portion of their life history ($7.5 billion annually)
- 50% wetlands in lower 48 states have been destroyed (More than 50% in MI)
- Only 3.5% of U.S. land area is wetland (Mitsch and Gosselink 1993).
  - More than 33% threatened & endangered species are wetland obligates
  - More than 50% (Additional 20%) use or inhabit some time in their life.

Questions?