Establishing Aquatic Plants in Reservoirs: why and how

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Ecological Impacts

- Light transmission
- Water temperature, flow, and chemistry
- Substrate changes
- Oxygen production and consumption
- Carbon flux (both organic and inorganic)
- Nutrient flow & decomposition
  - Barko 1993, Carpenter and Lodge 1996

Why We Establish Plants?

- **Aquatic vegetation is beneficial to fish communities**
  - "Grass = Bass"
  - influence ecosystem functions

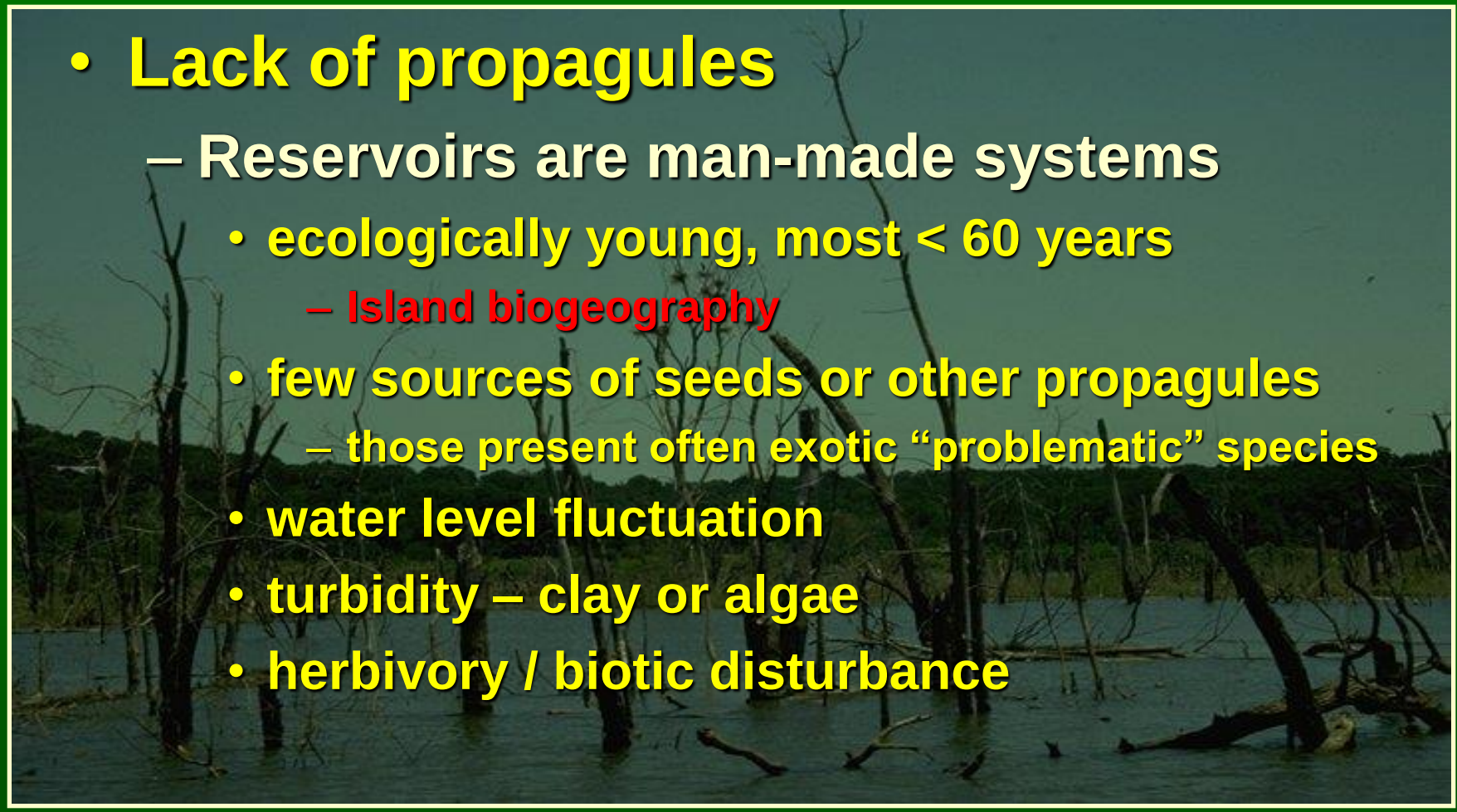
- **No existing vegetation**
  - Provide sustainable habitat for fish and other aquatic wildlife
  - Improve water quality
  - Reduce erosion

- **Limited existing vegetation**
  - Improve habitat & diversity
  - Improve esthetics

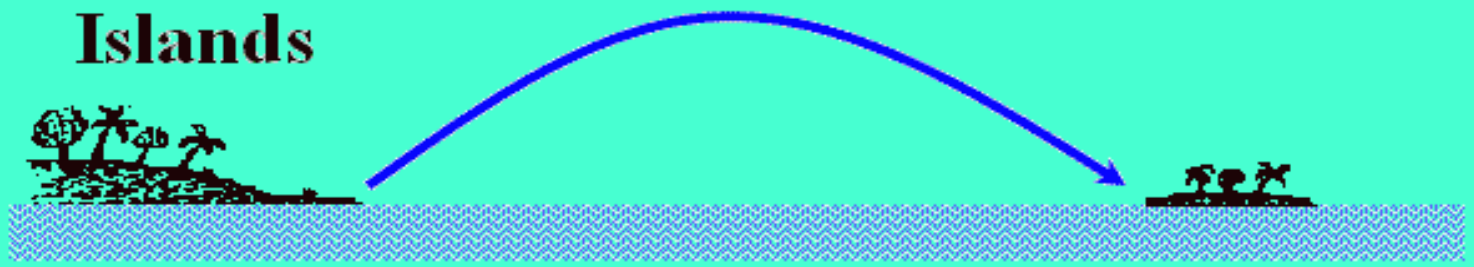
- **Excessive vegetation (exotic)**
  - Planting after control to replace lost habitat
  - Fills empty niche to reduce re-infestation

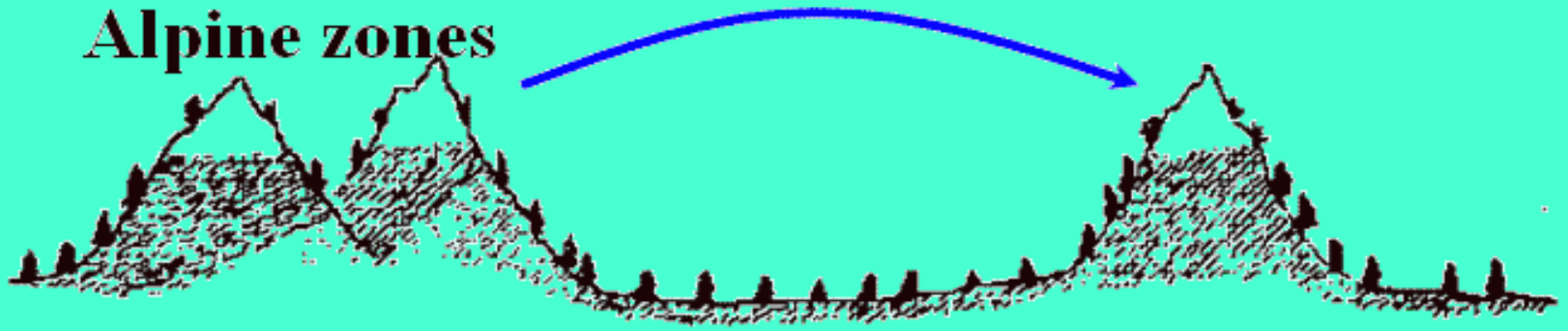
Dense hydrilla and Eurasian watermilfoil canopies harm fish

Obstacles to Natural Establishment

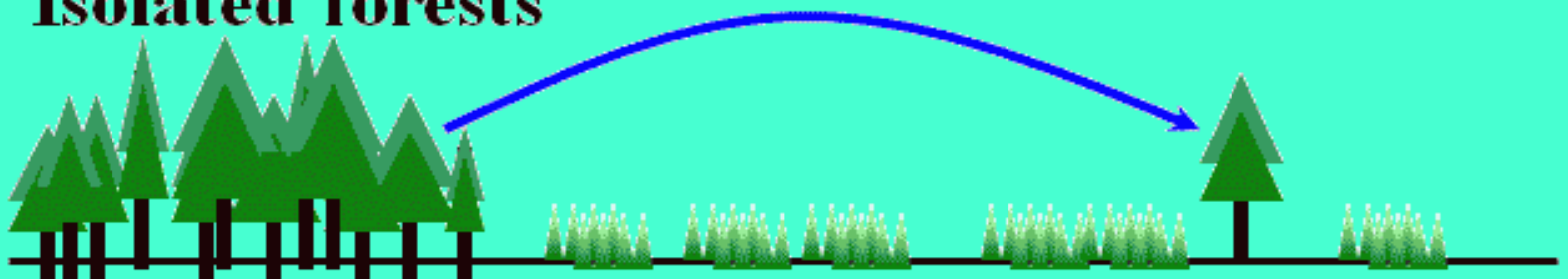


- **Lack of propagules**
  - **– Reservoirs are man-made systems**
    - **ecologically young, most < 60 years**
      - **– Island biogeography**
    - **few sources of seeds or other propagules**
      - **– those present often exotic “problematic” species**
    - **water level fluctuation**
    - **turbidity – clay or algae**
    - **herbivory / biotic disturbance**

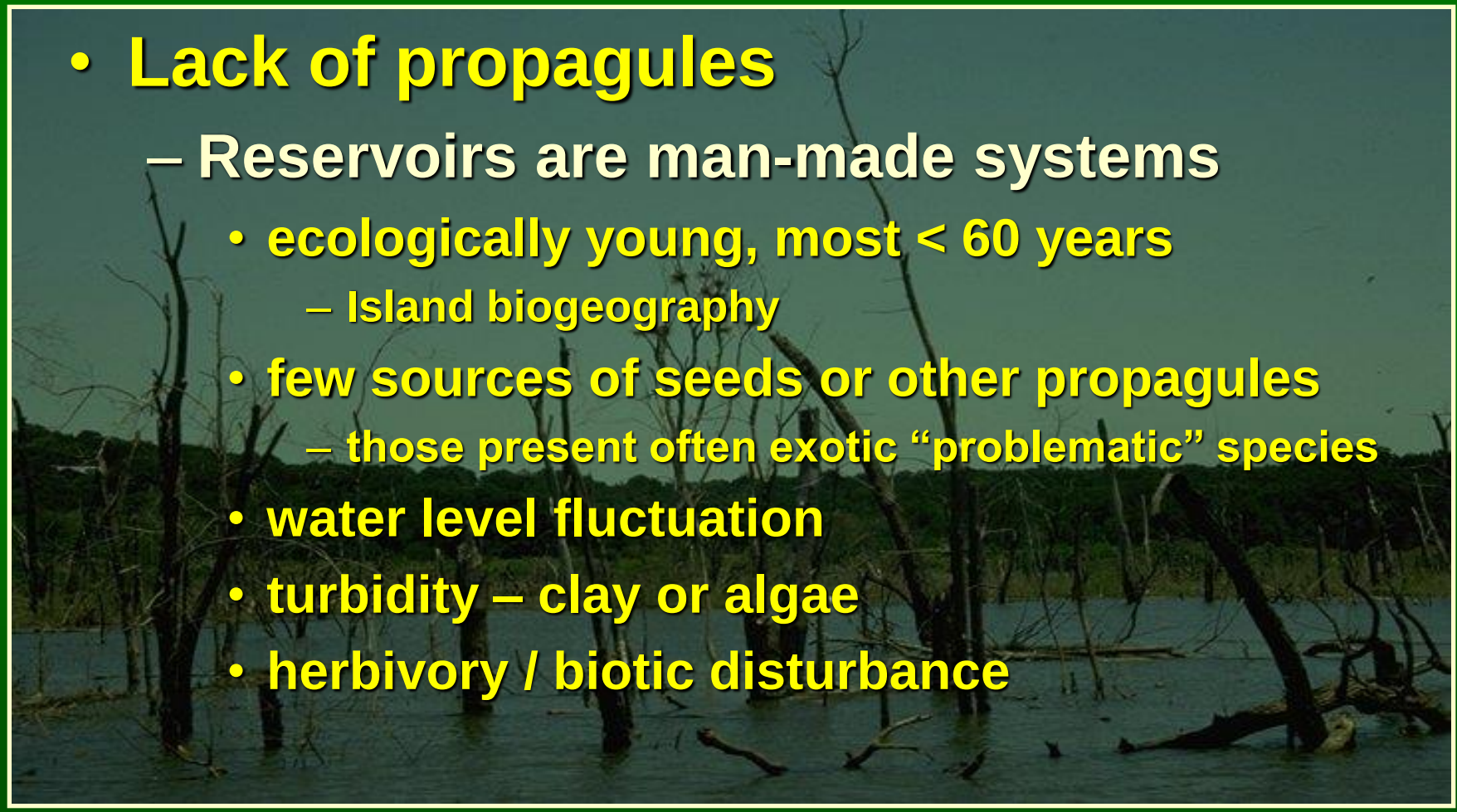

Islands


Alpine zones


Ponds


Isolated forests

Obstacles to Natural Establishment



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Overcoming Obstacles

- **Lack of propagules**
  - introduce seed / shoot fragments
- **Water level fluctuations**
  - mature transplants, depth
- **Turbidity / light limitation**
  - mature transplants, depth
- **Herbivory / biotic disturbance**
  - protective exclosures

Considerations

- Approach
- Species Selection
- Propagule Acquisition
- Site Selection
- Planting Technique's
- Herbivory Management
- Monitoring and Maintenance

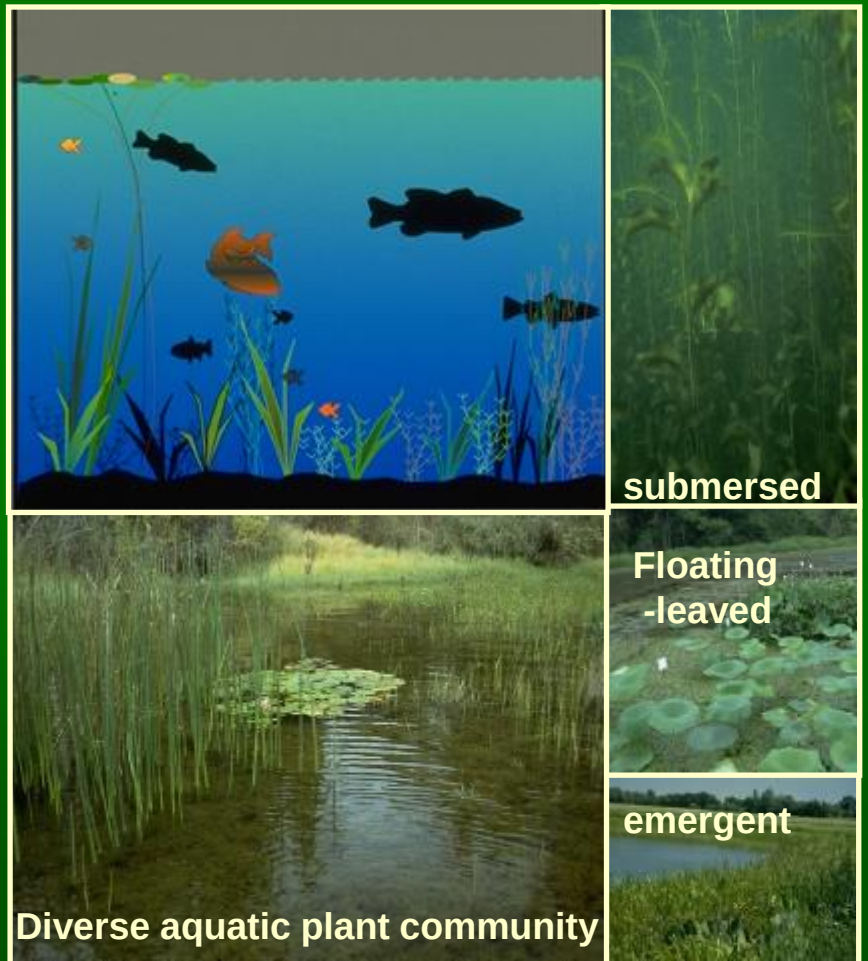
Water lilies and wild celery established in grass carp infested Lake Conroe, Texas

Approach:
founder colonies

In a nutshell…

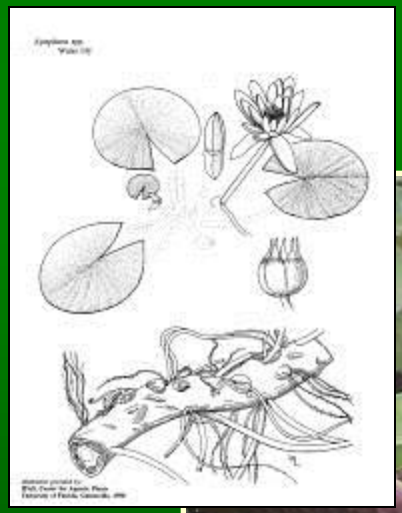
Species Selection:

A diversity of species and growth forms to maximize habitat diversity and resilience. Native aquatic plants including submersed, floating-leaved, emergent species.

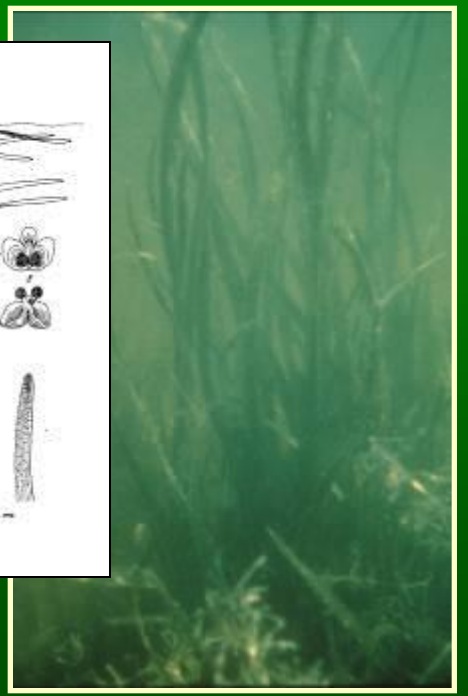


Species Selection:
growth forms

Emergent



Floating-leaved



Submersed

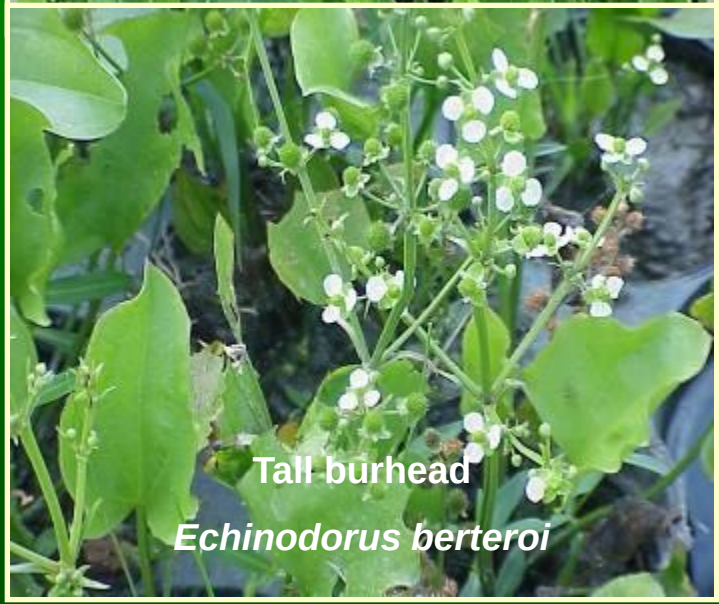
Emergent Species

Smartweed

Polygonum spp.

- Shoreline (moist soil) to 2 ft deep, depending on species
- Anchored to sediments, emergent leaves
- Structure/habitat fish & invertebrates
- Food for wildlife
- Deter invasive species (occupy niche)
- Improve water quality, control erosion

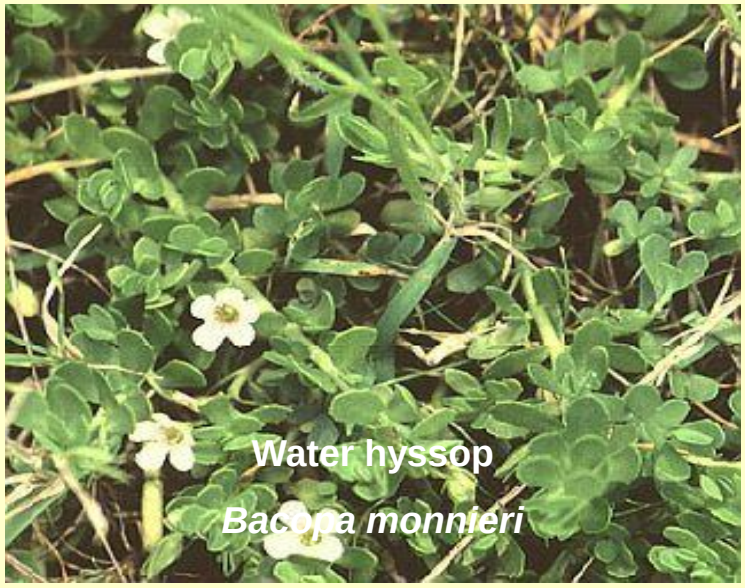
Emergent Choices



Emergent Choices

Squarestem spikerush

Eleocharis quadrangulata



Water hyssop

Bacopa monnieri

Slender spikerush

Eleocharis acicularis

Maidencane

Panicum hematomum

Emergent Choices

Floating-leaved Species

American lotus

Nelumbo lutea

- 1 to 6 ft deep
- Anchored to sediments, floating leaves
- Structure/habitat fish & invertebrates
- Food for wildlife
- Deter invasive species (occupy niche)
- Improve water quality, control erosion

Floating-leaved Choices


White water-lily

Nymphaea odorata


Watershield

Brasenia schreberi


Spatterdock

Nuphar luteum


American lotus

Nelumbo lutea

Submersed Species

Wild celery

Vallisneria americana

- 1 to 10 ft deep
- Anchored to sediments, leaves & stems submersed &/or at the water surface
- Structure/habitat fish & invertebrates
- Food for wildlife
- Deter invasive species (occupy niche)
- Improve water quality, erosion control

Submersed Choices

American pondweed

Potomogeton nodosus

Illinois pondweed

Potomogeton illinoensis

Sago pondweed

Potamogeton pectinatus

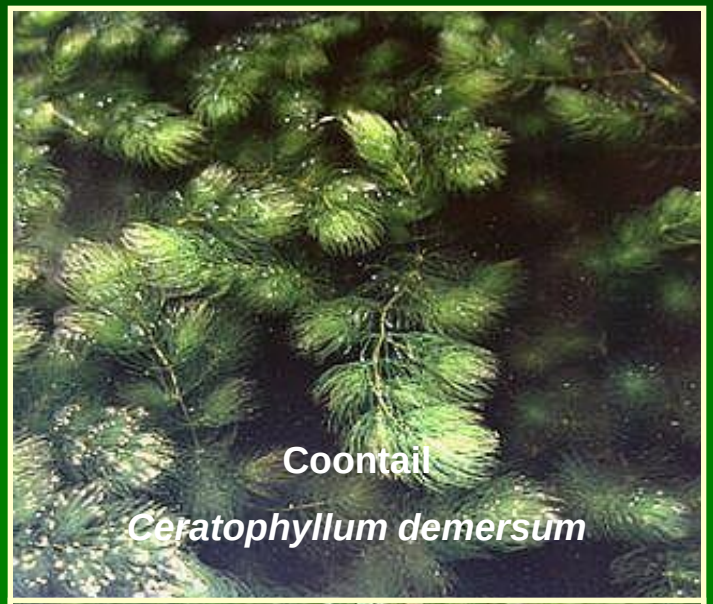
Wild celery

Vallisnaria americana

Submersed Choices

Water stargrass

Heteranthera dubia



Coontail

Ceratophyllum demersum

Southern naiad

Najas guadalupensis

Muskgrass

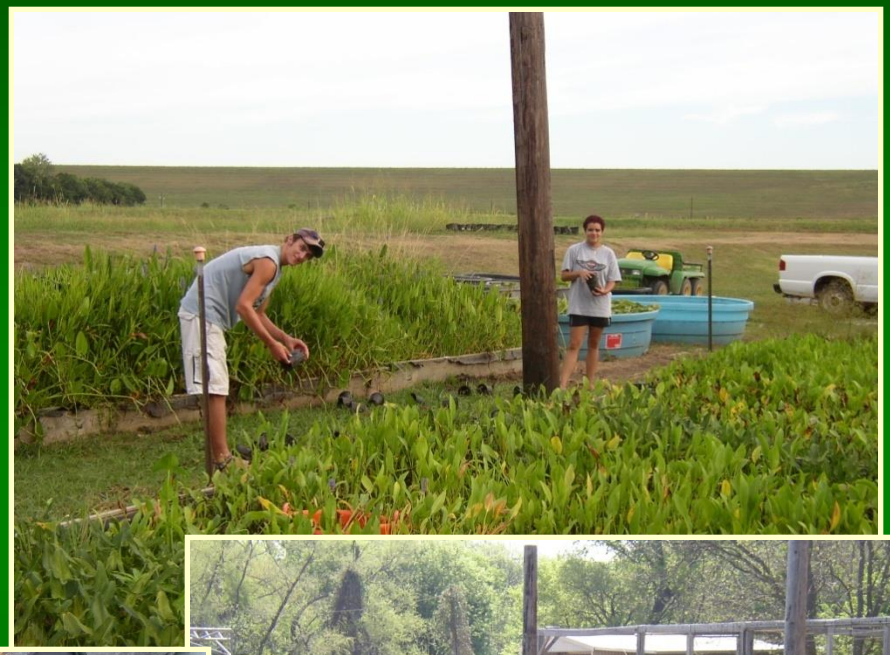
Chara vulgaris

Propagule Acquisition:

- Limited commercial sources for proper ecotype
  - Hard to find local suppliers
  - Water garden shops
  - Joe Snow (Dallas area) 940-390-7053
- Avoid using bare root transplants, especially from other systems and most especially from other regions – use local ecotype
  - Contamination with exotics, etc.
  - Weaker propagules may not survive harsh conditions
  - Slower to recover from transplant shock
- Grow your own
  - Upfront costs are reasonable
  - Requires time commitment
  - Saves money

Propagule Acquisition:

Where to get them……..?



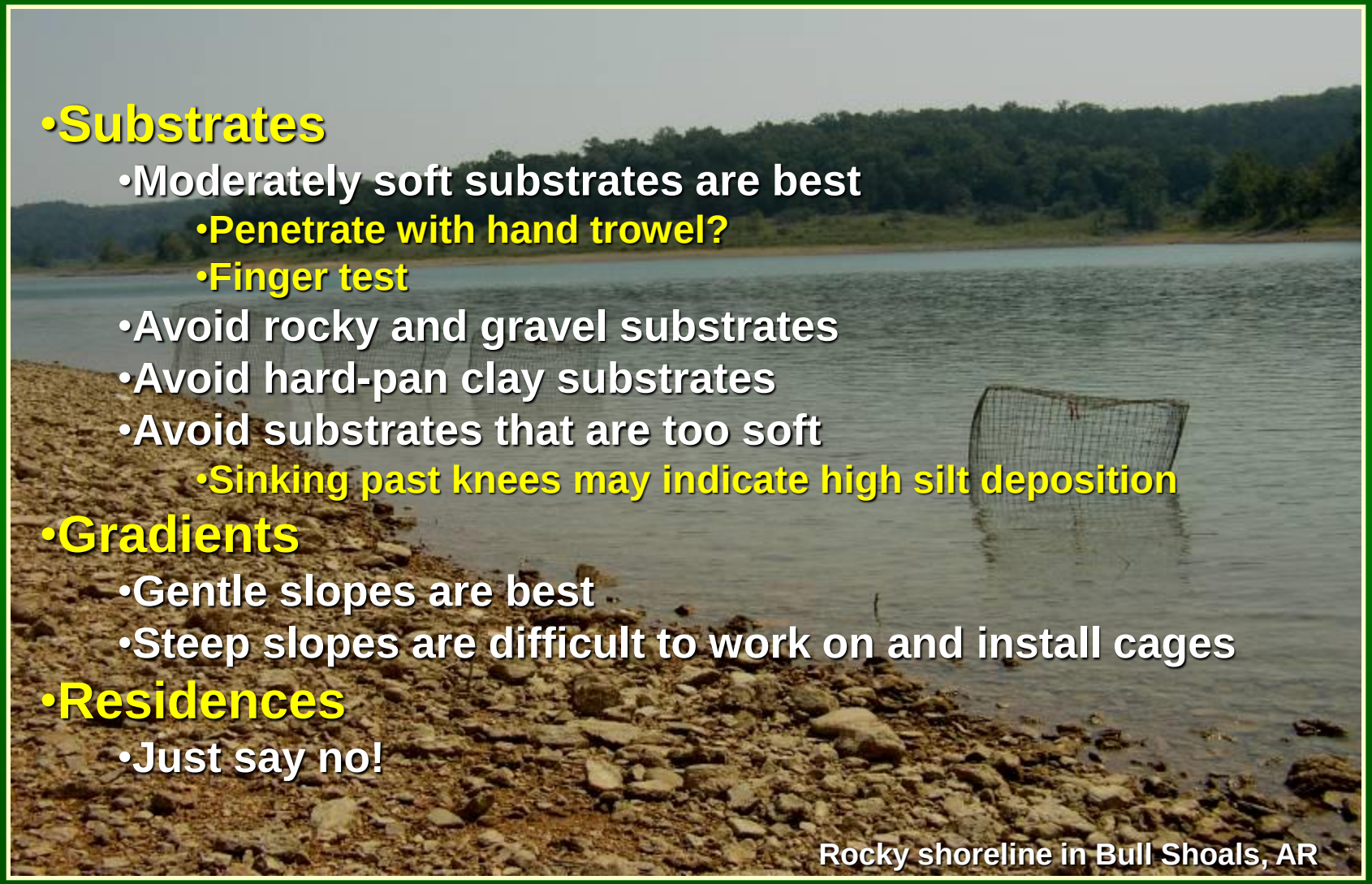
Propagule Acquisition:

Where to get them ……cheaply?

Build it, they will grow!

Site Selection:
location

- **Substrates**
  - Moderately soft substrates are best
    - Penetrate with hand trowel?
    - Finger test
  - Avoid rocky and gravel substrates
  - Avoid hard-pan clay substrates
  - Avoid substrates that are too soft
    - Sinking past knees may indicate high silt deposition
- **Gradients**
  - Gentle slopes are best
  - Steep slopes are difficult to work on and install cages
- **Residences**
  - Just say no!



Rocky shoreline in Bull Shoals, AR

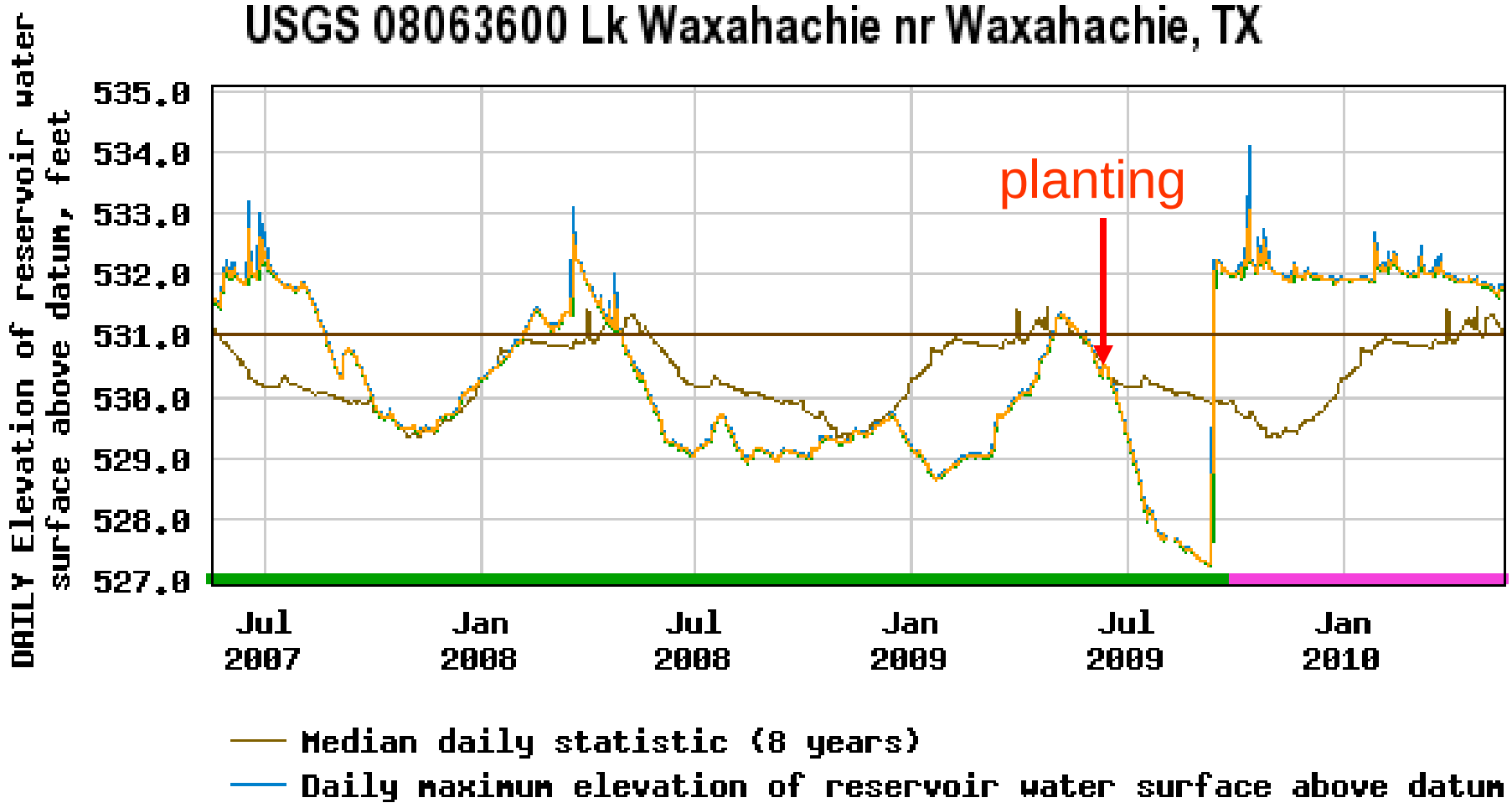
Site Selection:
planting depth

- **Emergent**
  - Establish best from moist soil to 2 ft deep
  - Most "drown" in water 3 ft and greater

- **Floating-leaved**
  - Establish best between 1 ft and 3 ft deep
  - Once established grow to 6 ft deep

- **Submersed**
  - Establish best between 1 and 4 feet deep
  - Once established can grow to 10 ft or greater
  - Turbidity is critical for both depths

Site Selection:
fluctuation



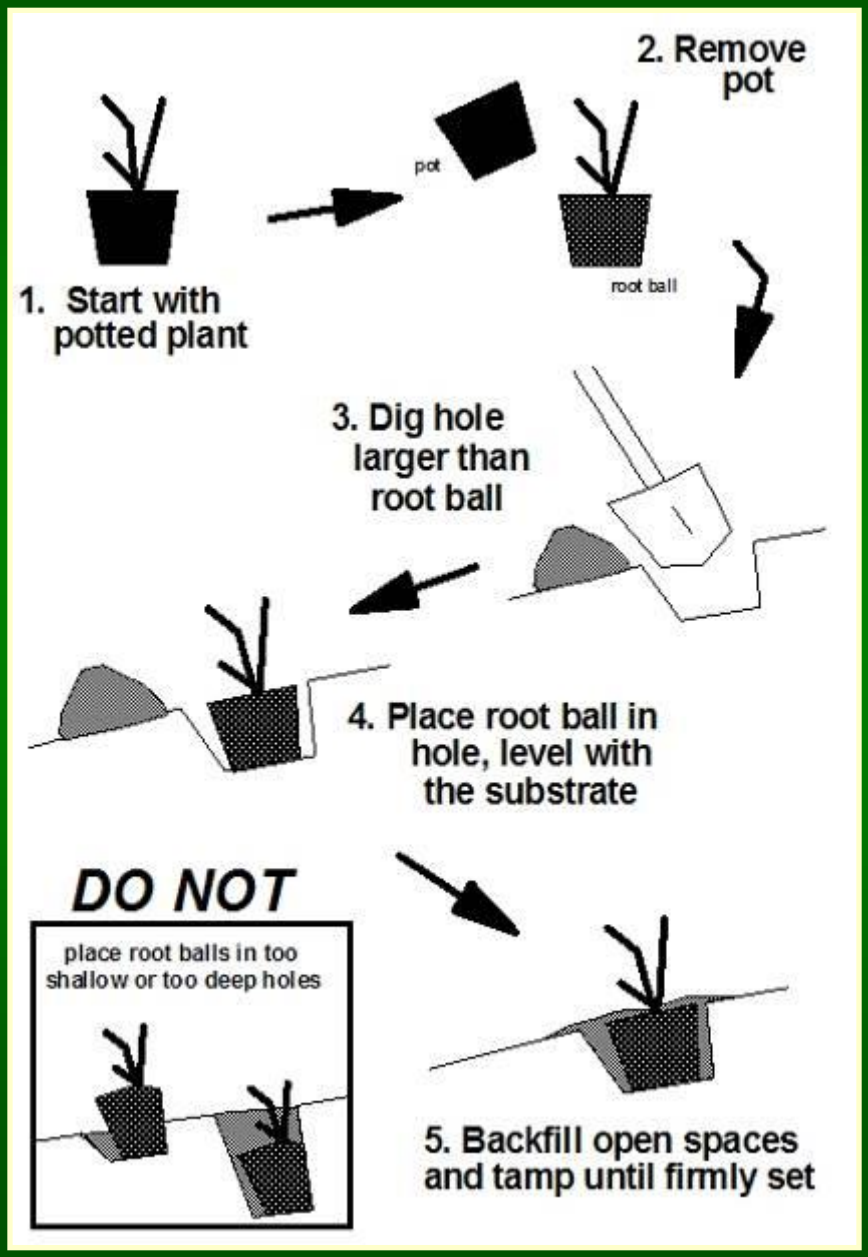
Site Selection:
fluctuation

Dry exclosure in Lake Waxahachie, TX

Planting Technique's:

Transportation

- Covered containers
- Avoid desiccation, esp. submersed species
- Avoid excess heat, damage to plants



Planting Technique's:

Remove plant from pot

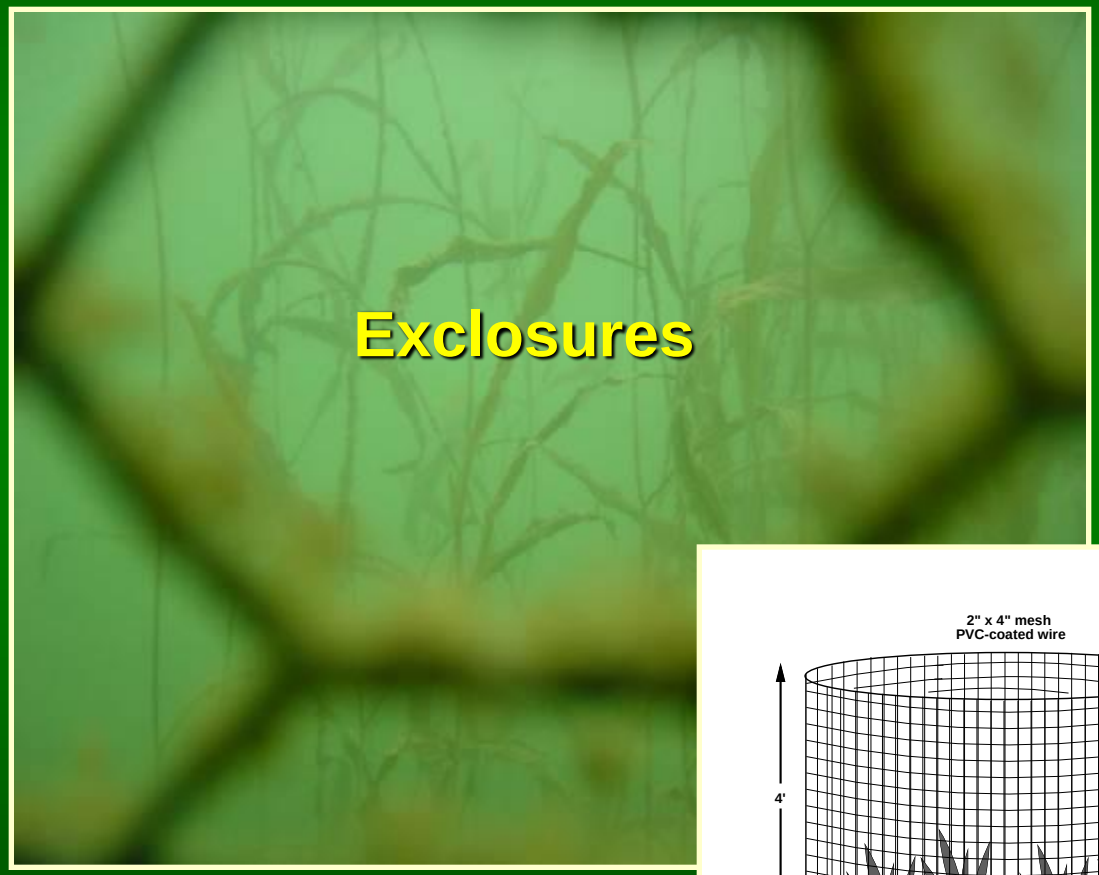
Dig hole, place (green side up), backfill

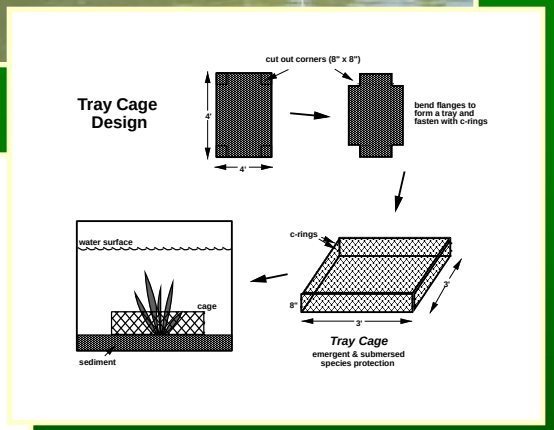
Place exclosure

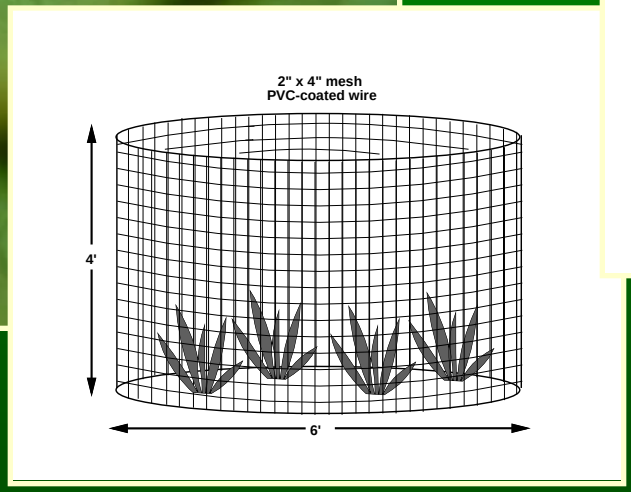
Managing Herbivory:
what's out there?

Fish (carp, etc.)
Turtles (basking species)
Waterfowl (ducks and geese)
Aquatic mammals (nutria, etc.)
Terrestrial mammals (deer, etc.)
Invertebrates (crayfish, insects, snails, etc.)

Managing Herbivory:
Initial protection







Managing Herbivory:
in reservoir exclosures

Hoop cages

Cove & Shoreline fences

Pens

Tray cages

Ring cages

New Approaches:

Mobile Nursery

Mobile Nursery:

battery array & pump

Mobile Nursery:
reliable production

Mobile Nursery:
continuous distribution

Monitoring and Maintenance:

You might think you are done after planting…but

- **Monitoring**
  - **Evaluate plantings**
  - **May take additional plantings**
  - **Replace if necessary**
- **Maintenance**
  - **Repair damaged or lost cages**
  - **Vandalism**

GPS “monitoring”

In Summary

Choose your plants wisely

- species, planting depth, function, aesthetics, robust propagules

Choose your site wisely

- water elevation, substrate, wave action, homes

Install your plants wisely

- too deep, smother your plant
- too shallow, desiccation
- protect with exclosures
- monitor/maintain


Thanks!!