Wetland Restoration Using Native Plants

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Restoration: Conserving Diversity

Species of Concern inhabiting rich fen wetlands

- Plant populations may require vegetation management to ensure that habitat conditions remain favorable to the persistence of species in question

Managed vs. Unmanaged Wetlands

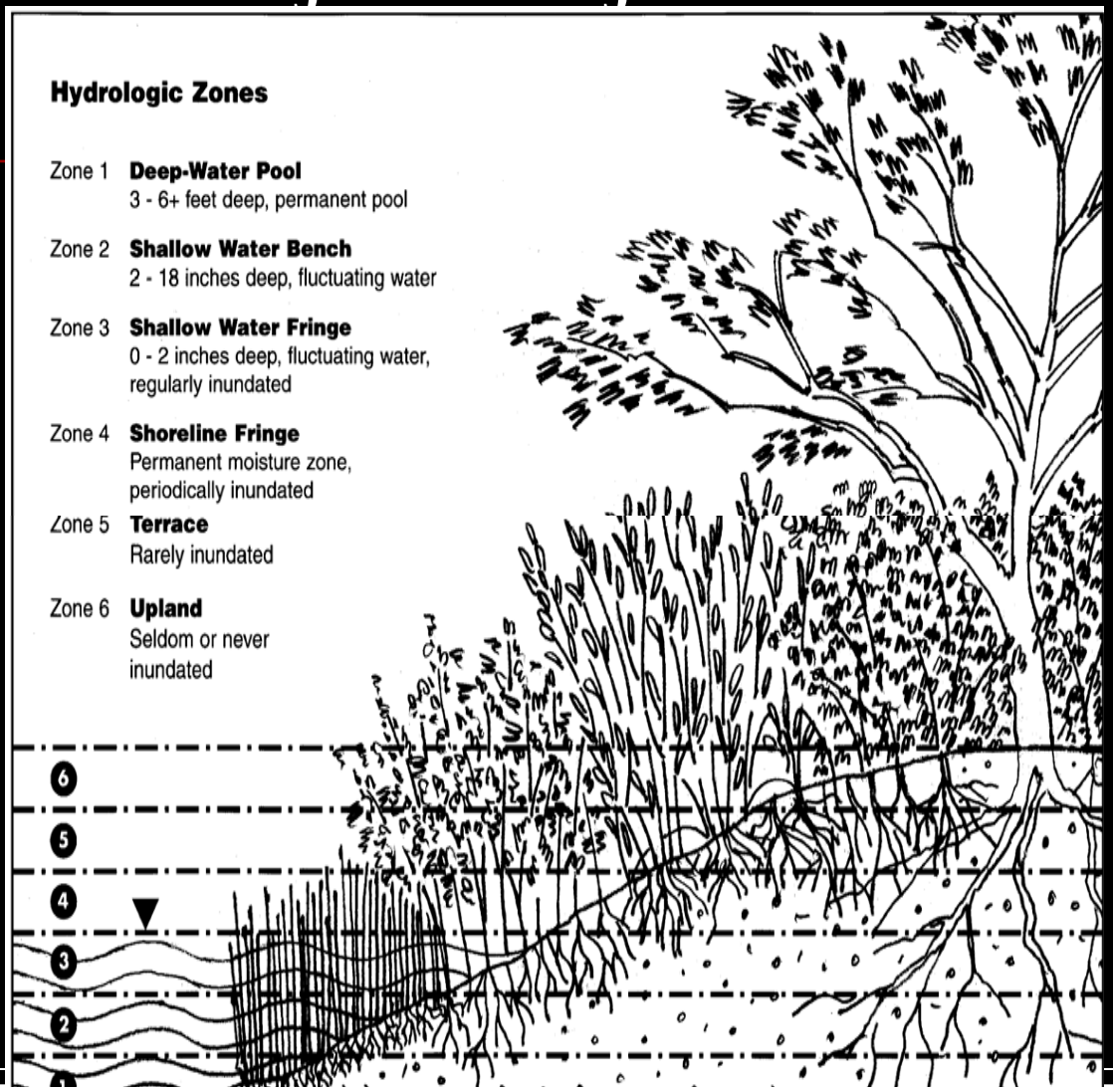
Challenges

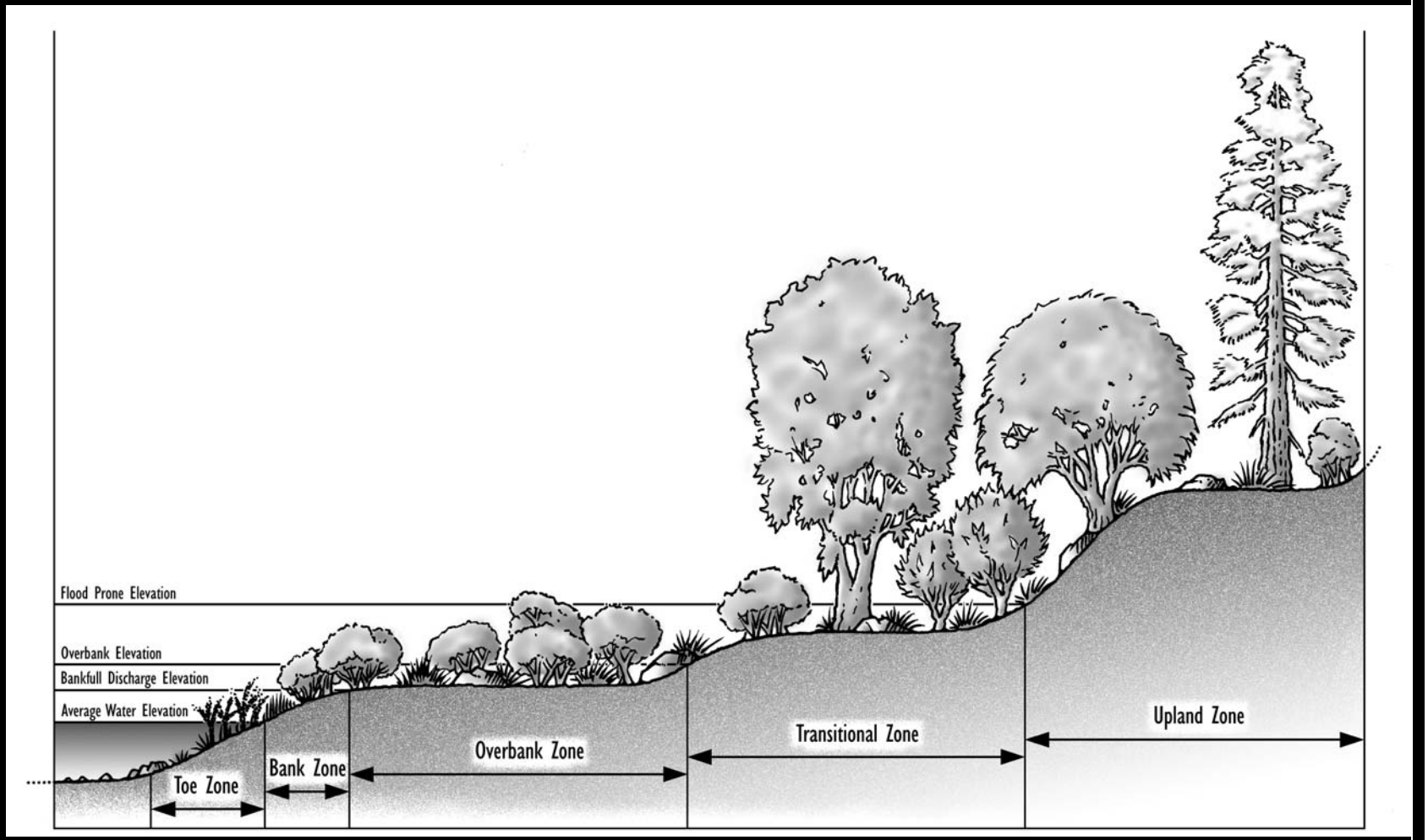
Successful Restoration Requires

- Phase 1: Define Project Objectives
- Phase 2: Assess Site Conditions
- Phase 3: Strategy Development
- Phase 4: Native Plant Material Preparation and Implementation
- Phase 5: Post Restoration Management & Monitoring

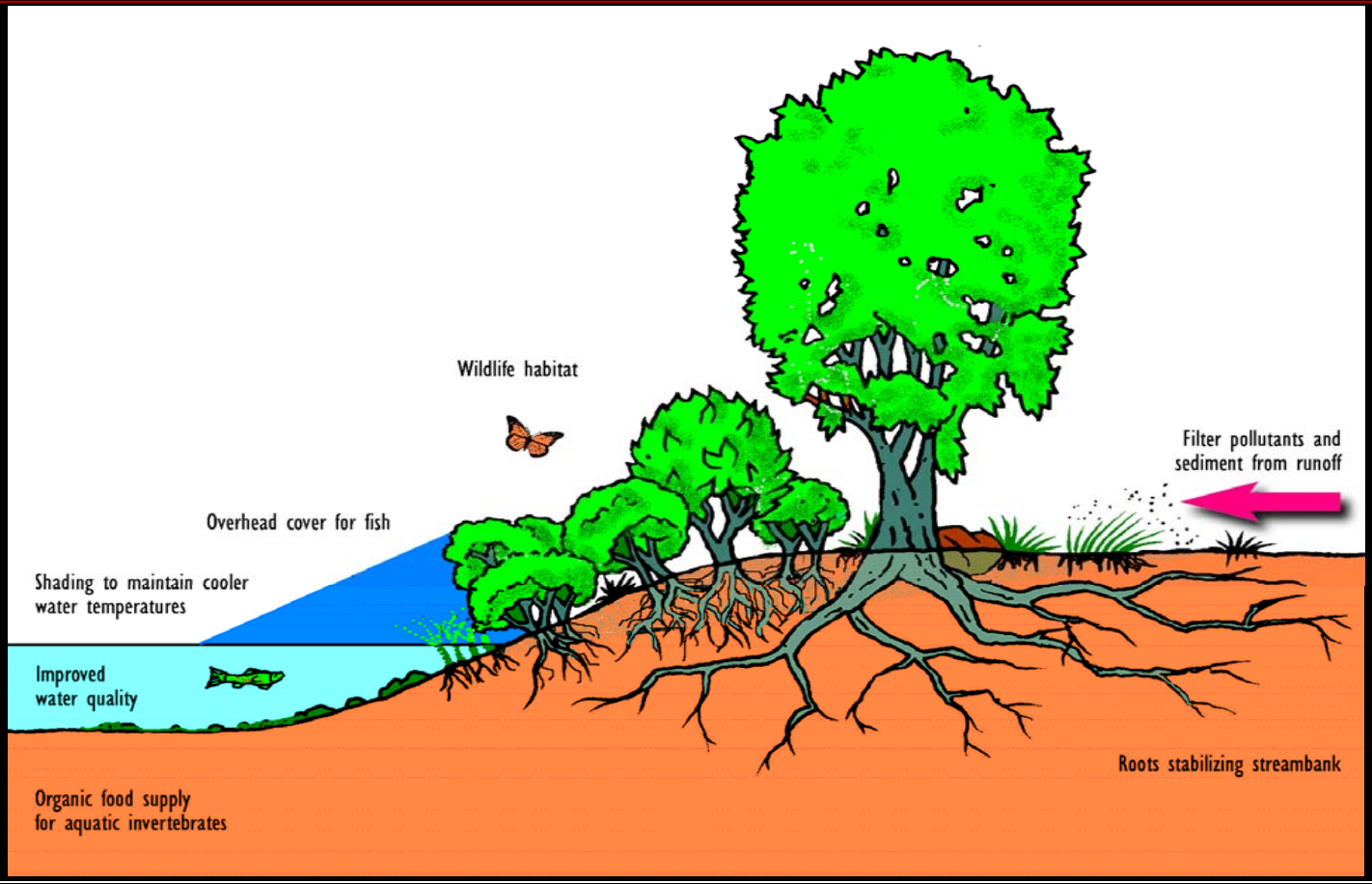
Phase 1: Define Project Objectives

- Define restoration areas (units) based on site conditions (hydrology, soils, slope, etc)
- Select reference sites
- Define goals and desired future conditions




Flood Prone Elevation
Overbank Elevation
Bankfull Discharge Elevation
Average Water Elevation
Toe Zone
Bank Zone
Overbank Zone
Transitional Zone
Upland Zone

1. Define necessary vegetation structure/function for objectives



1. Select Reference Sites

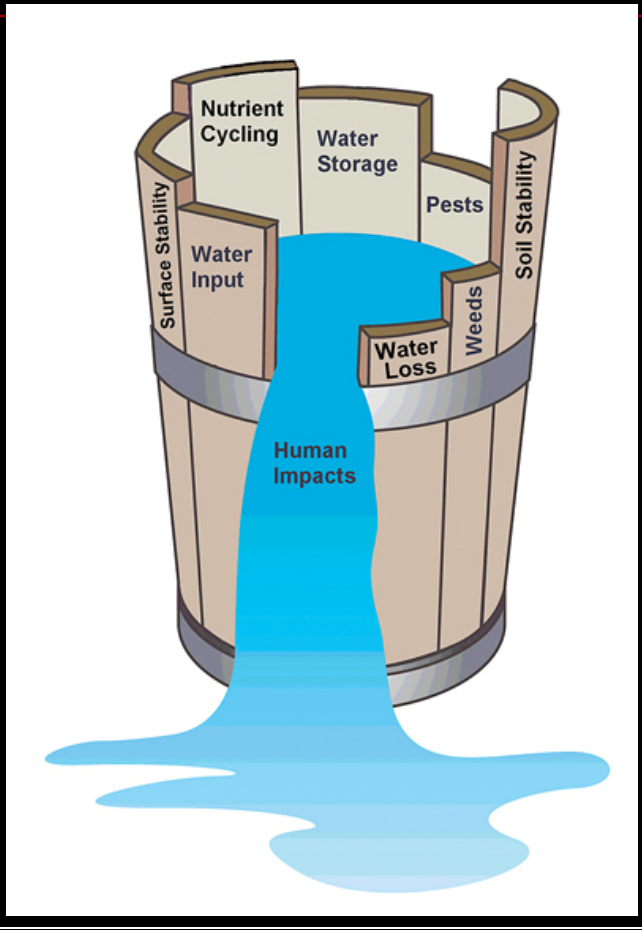
- Reference sites similar to each restoration area (unit) of project site
- Provides baseline ecological information and vegetation inventory
- Analyze vegetation, define communities and successional processes

Phase 2: Assess Site Conditions

- Identify Limiting Factors on restoration site (Biotic and Abiotic factors)
- Consider specific strategies targeted at limiting factors
- Analyze existing site vegetation (potential for maximizing natural regeneration/recovery per species)
- Determine species to be used

2. Identify Limiting Factors

- Restoration success can only be held to the level of the most limiting factor



2. Develop strategies/ stock types targeted at limiting factors

- All key players should be involved in site evaluation (project planner, ecologist, nursery manager, engineers, planters, weed managers, wildlife ecologist, livestock managers

Hopi Reservation, Arizona

2. Species Characteristics

- Ecological/Successional Role
- Hydrology Zone
- Rate of Growth and Spread
- Type of Root System
- Reproductive Strategy
- Physionomic Characteristics (mature size and canopy cover at maturity)
- Ease of reestablishment, propagation

Phase 3:Strategy Development

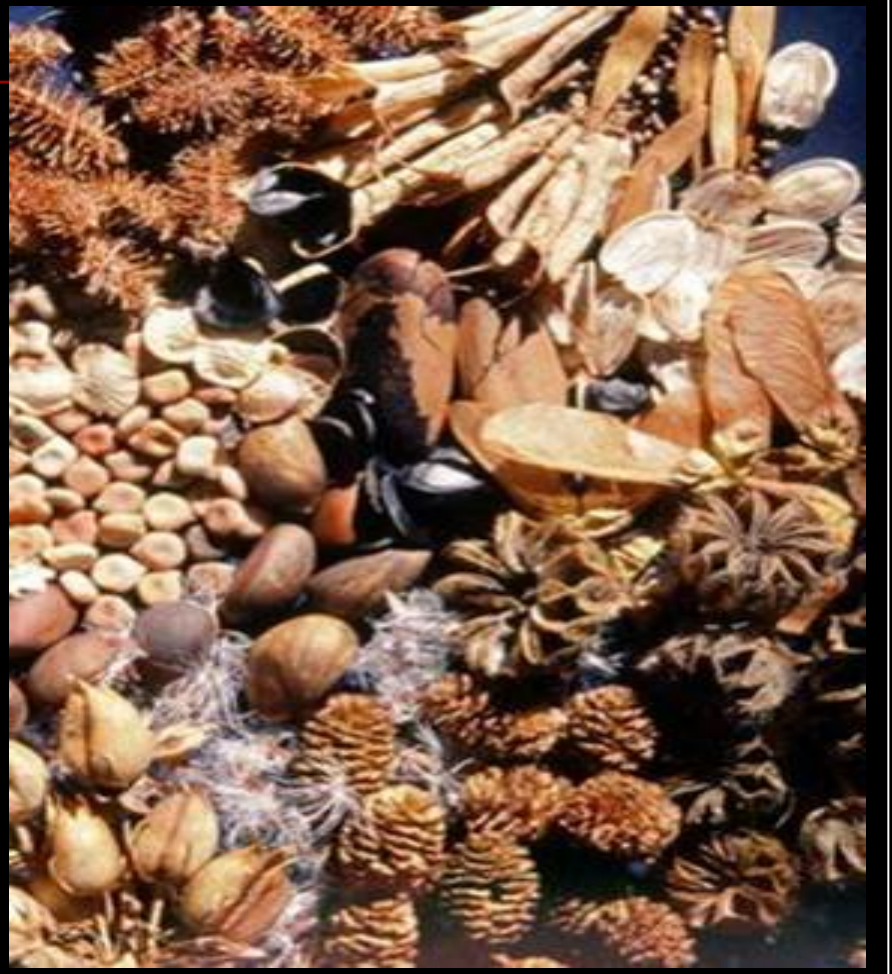
- Determine planting densities of species used based on known or predicted survival rates
- Determine tools, techniques, outplanting window, cost effectiveness to ensure high survival rates

3. Advanced Planning for Stock Types

Native Plant Material Quality is fitness for purpose!

3. Genetic Adaptability: Seeds and Seedlings

- Seed Collection and propagation procedures must conserve sufficient genetic diversity to buffer environmental changes to maximize adaptive potential to current and future environmental change.

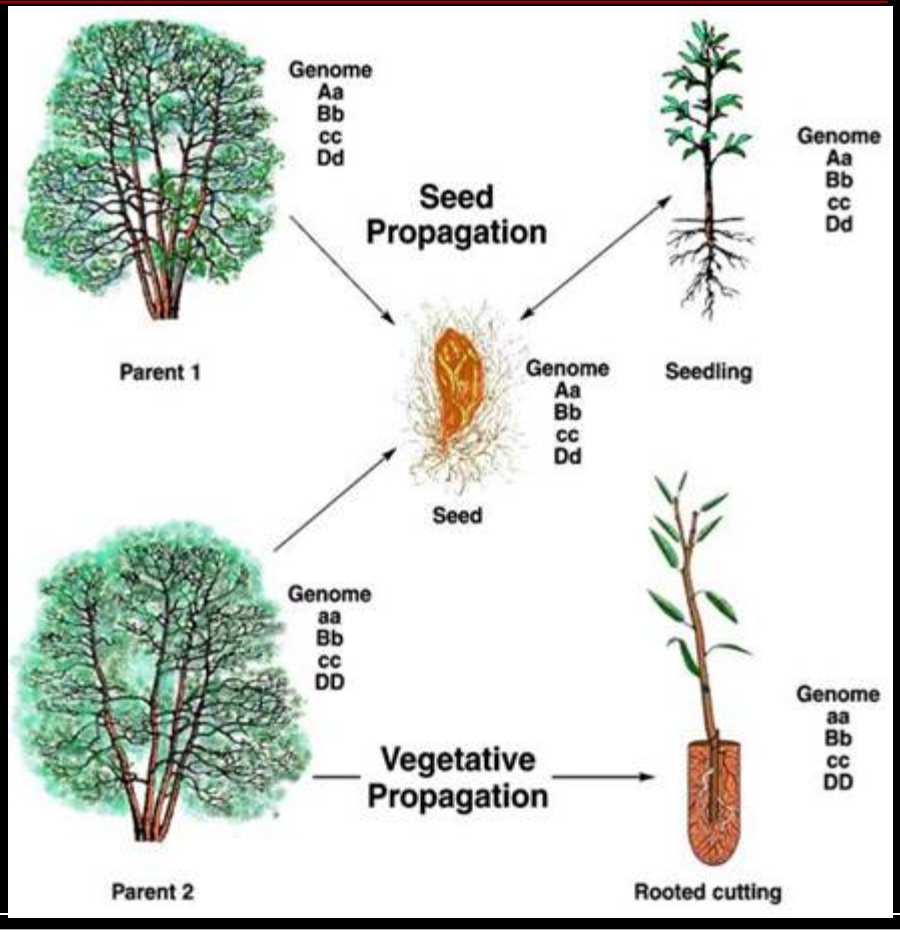


3. Genetic Adaptability: Seed Collection

- 10% captures 90 percent of genetic variation
- Know reproductive strategy of species
- Ensure seeds are c quality and fully mature at time of collection

3. Genetic Adaptability: Cuttings

- Cuttings are genetically identical to donor plant
- Important to select material from healthy stock



Populus and *Salix* used for cuttings

Case study: Hopi Riparian Restoration Project

- Determined all individuals of *Salix lutea* in canyon were one gender and genetically identical

3. Direct Seeding: Grasses/Forbs

- Planning direct seeding according to site hydrology during establishment period is important to be successful.
- Important to understand specific germination/stratification requirements of the seeded species
- Seeding rates, sowing depth, timing vary depending on seed size, species used, application methods, seed quality

3. Direct Seeding: Grasses/Forbs

- Grasses are normally located in hydrologic zones 4, 5, and 6 (are direct seeded-periodic inundation, fringe, upland transition zone).
- Colonizer species are often found in hydrologic zones 2 and 3 (planted as plugs-permanent shallow water).

3. Direct Seeding: Key: Wetland Genera

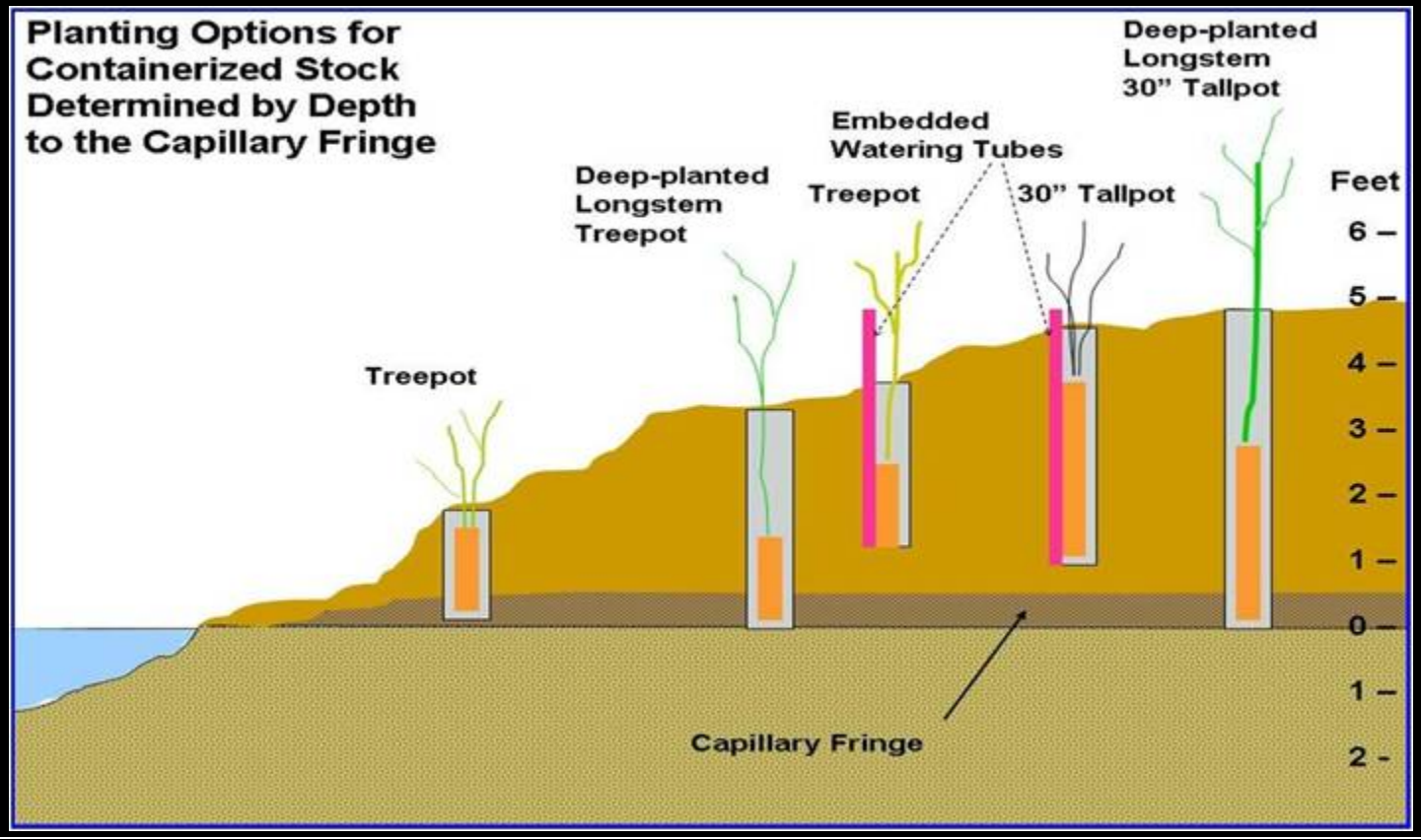
- *Schoenoplectus*, *Scirpus*, *Eleocharis*, *Carex*, *Juncus*) do not readily establish from direct seeding.

- Require 4 conditions for germination
- 1) stratification (cold period to overcome dormancy),
- 2) heat,
- 3) water
- 4) light during germination.

3. Direct Seeding vs. Using Seedling Nursery Plugs

- Better to use nursery stock to ensure rapid site establishment and spread.

3. Woody container stock type sizes depend on species, water table depth, limiting factors of site



3. Visit Nursery and Discuss Advantages/Disadvantages of Select Stock Types based on outplanting conditions

- Nursery managers must also develop crop production schedules to meet specific planting dates, select best containers for each species

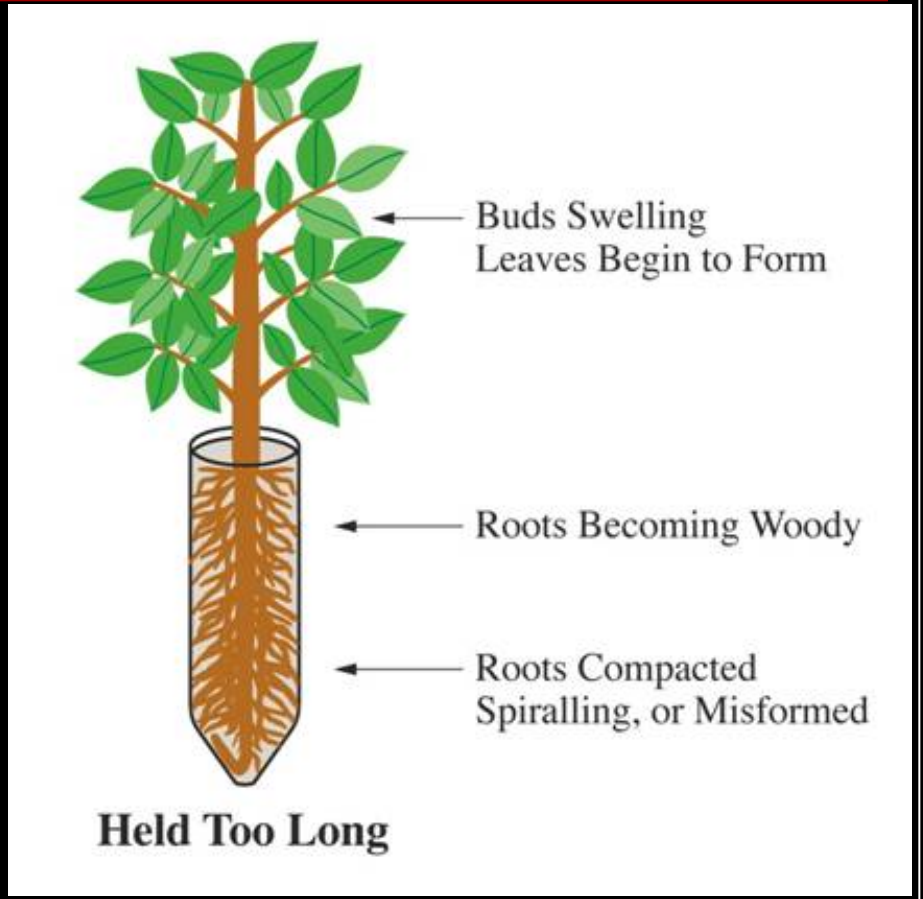
Phase 4: Native Plant Material Preparation and Implementation

- Wetland herbaceous species must develop tissues necessary to withstand inundation during growth and development at the nursery

- Seedling Quality: critical that seedlings are hardened and conditioned to withstand conditions at outplanting site.
- Must ensure crop is ready for planting on specific date

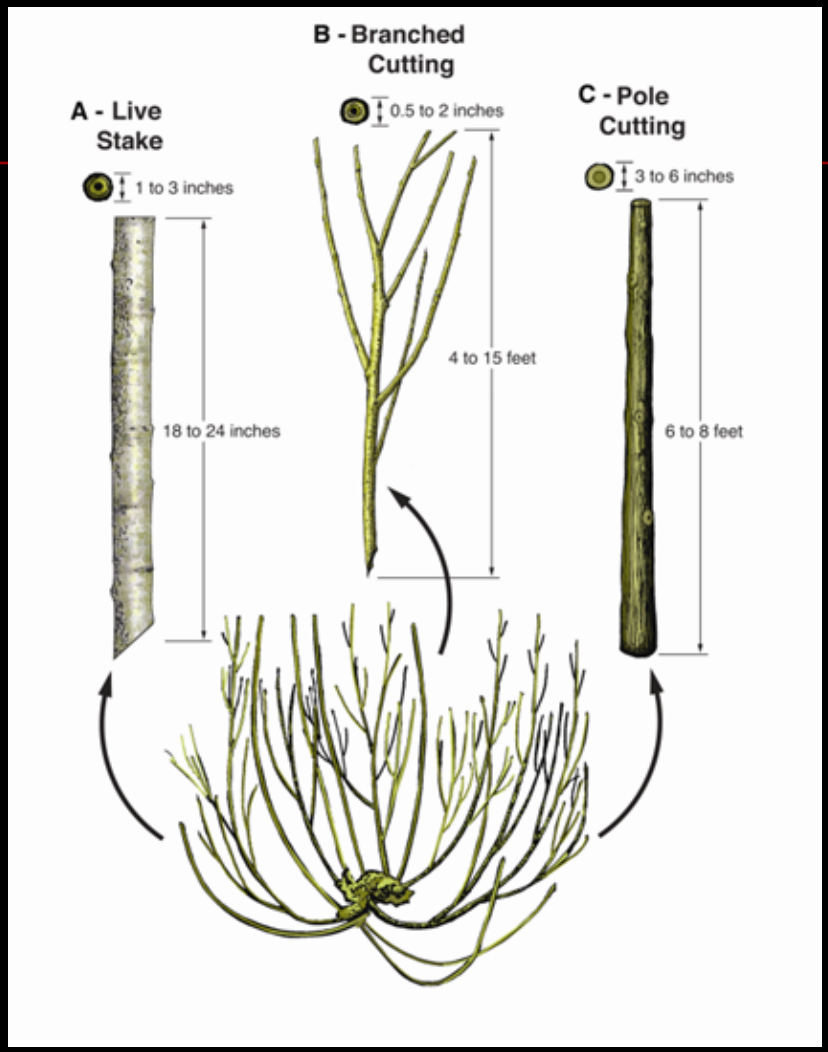
Problems with Hold-over stock

- Decreasing seedling quality
- Imbalance root to shoot ratio
- Problems with windthrow/breakage
- Spiralling roots
- Increasing costs, materials and labor



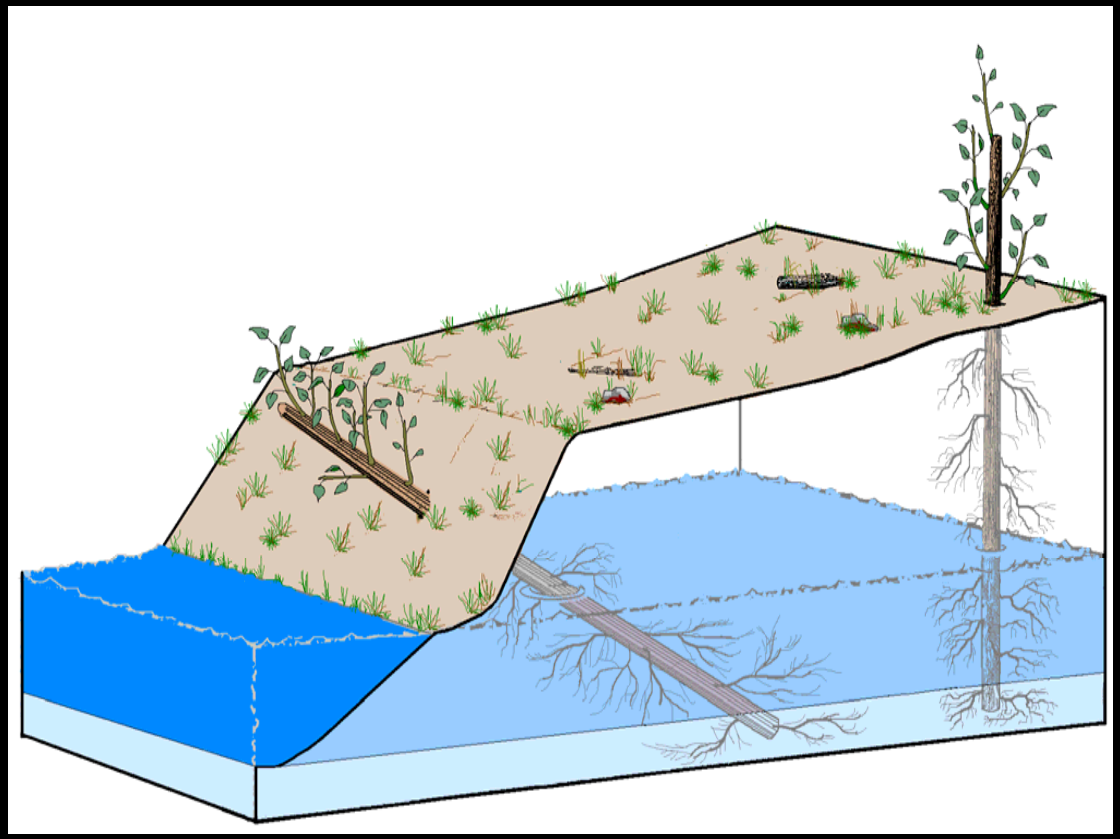
4. Types of Cuttings

- Dormant Material
- Live Stakes
- Branched Cuttings
- Pole Cuttings



4. Stock Types of Plant Materials Needed: Pole Cuttings

Because of their planting depth, they resist flood erosion yet access the water table through the season



Survival Rate Studies

Cottonwood and Willow Pole Plantings

- 50 to 90 percent
- Sample size of more than 10,000 during a 20-year period

Shrub Pole Plantings (species other than willow)

- 10 to 40 percent
- Sample size of more than 4,000 during a 10-year period

Tallpot and Treepot Longstem Deep Plantings

- 70 to 90 percent
- Sample size of more than 6,000 during a 4-year period

4. Growth Form/ Mature Canopy

More shade produced with tall and/or wide canopy species.

Stem flexibility is important for species at the waterline to mid-bank on streams with high velocities, debris loads, and ice flows

Species with deep or rhizomatous root systems might be better suited to streams with severe ice flows

4. Cutting length is determined by depth to the mid-summer water table and erosive force of stream at the planting site

- 6-8 inches of cutting are in the mid-summer water table
- 3-4 buds are above the ground
- No less than 1/2 the total length is in the ground
- If long periods of inundation exceeding 30 days, cuttings must be long enough to extend 6-12 inches above the expected high water level
- If weeds are present, cutting must extend above herbaceous growth in summer to receive adequate light and below the weed root mass to minimize competition.

4. Quality of Material and Handling

4. Temporary Site Storage During Planting for Cuttings

- Poles, Whips, Bundles and Live stakes must be kept fully hydrated and in dormant condition prior to planting.
- If using species other than willow or cottonwood, need to soak ends in 1,000 ppm IBA for 5 minutes

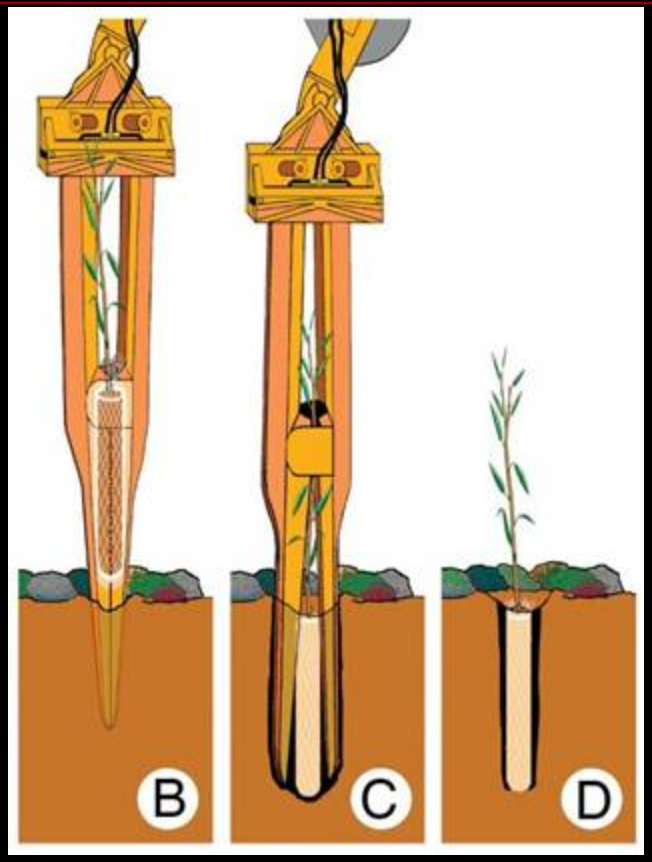
4. Outplanting Tools and Techniques

- The Right Tool For conditions on the restoration site
- Stock Type Sizes
- Training and Experience of the Crew (volunteers?)
- Planting Technique-Outplanting Quality Monitoring

4. Useful Planting Equipment in assessable sites

Water Jet Stinger

Stinger



4.Outplanting Wetland Seedling Plugs

- Ensure quality control during outplanting
- Budget for outplanting labor, tools
- Timing, methods are important
- Spacing density and patterns depend on species, desired cover, limiting factors of site

4.Outplanting Seedling Plugs

- Stock may be outplanted successfully provided sufficient water is available to allow for continued growth, root establishment and development prior to winter freezing.
- Following outplanting, continued maintenance and management is required to ensure a successful project and depends on the particular environmental conditions and location of the restoration site.

Phase 5: Post Restoration Management & Monitoring

- Revisit project objectives
- Develop monitoring protocol
- Evaluate data and apply corrective measures
- Share results/lessons learned

At conclusion of second growing season constructed wetland, Oregon

Pyramid Pauite Tribe Wetland restoration project

Site preparation prior to planting March

At conclusion of second growing season

Targee Creek, Idaho

Planting dormant willow poles

At conclusion of second growing season

Hopi Reservation, Keams Canyon

3 years following tamarix eradication

Hopi Reservation, Keams Canyon

Questions/Comments

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