Living Shorelines

Plant Materials Applications

Presented by Chris Miller
Manager/Plant Materials Specialist
USDA-NRCS
Cape May Plant Materials Center

United States Department of Agriculture

NRCS Natural Resources Conservation Service

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Properly evaluating site conditions

* Adequate sand supply?
* Shoreline orientation/shape?
* Fetch distance/wave height?
* boat wake?
* naturally occurring vegetation?
* salinity concentration?
* adjacent structural measures?

Site Constraints

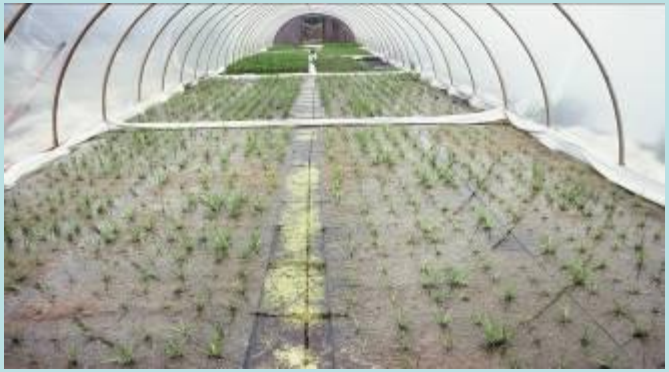
*3-4 mile fetch

*N to E orientation

*Straight shoreline

*heavy boat traffic

*lack of littoral sand



Tidal Species Selection

- Based on salt tolerance and elevation
- Zonation/Hydrology most critical
- Most species require 6-8 hours of direct sunlight during growing season (north facing may be more problematic)

Planting Guidelines

Plant in as dry a condition as possible. Plant on incoming tide.

Plant low marsh with Spartina alterniflora on one-two foot centers

Plant from mean tide to mean high tide.

Use Osmocote slow release fertilizer 18-6-12

In high salt concentrations, plants need to be slowly acclimated to site salinity

Planting-Lessons Learned

- Planting time is about reducing risk
- Optimal planting window: April-June for most herbaceous plants. (exception-beachgrass)
- Fall for larger trees and shrubs i.e. plant salvage, large container.

Herbaceous salt tolerance

- **Spartina alterniflora (MLT-MHW); 5-30 ppt**
- **Spartina patens (MHW-ULW);5-30 ppt**
- **Distichlis spicata (MHW-ULW); 10-30 ppt**
- **Spartina pectinata (MHW-ULW; 0-5 ppt**
- **Spartina cynosuroides (MHW-ULW); 0-10 ppt**
- **Scirpus americanus (MHW-ULW); 0-15 ppt**
- **Juncus gerardii (above MHW); 0-30 ppt**
- **Panicum virgatum (above ULW); 0-25 ppt**
- **Panicum amarulum (above ULW); 0-25 ppt**

Spartina alterniflora/patens

‘Avalon’ Saltmeadow Cordgrass

Distichlis spicata

Giant Cordgrass (*Spartina cynosuroides*)

Freshwater Cordgrass (*Spartina pectinata*)

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-Long Island population

American Three-Square (*Scirpus americanus*)


High Tide Germplasm switchgrass

Native Warm Season Grasses

- Switchgrass plug root development within 3 months.
- Tolerate periods of drought well.
- Deep root system allows for soil/bank reinforcement


‘Atlantic’ coastal panicgrass
(Panicum amarulum)
9 24 98

Coastal Little Bluestem

‘Cape’ american beachgrass
(*Ammophila breviligulata*)

Seaside Goldenrod

Jamaica Bay-Seeding Trials in cooperation with ACOE-New York

Plant Propagation

7.5” deep plugs produced.
Cost was $1.00/plug.

Quart pots produced at
$ 5.00/container

Plugs-$29,040/ac.

Qt. Pots- $145,000/ac.

Plug Planting-Season 1 vs Season 2

Low Energy Site

Seeding vs Vegetative Planting

- Advantages of plugs
  - -quick stabilization under high energy. Used quart sized pots in highest energy shoreline fringe
  - -Resistant to waterfowl “plucking” if planted by end of June-early July.

Seeding vs Vegetative Planting

- Advantages of Seeding
  - -reduced planting costs, more mechanized
  - -Cover more area less time
  - -Seed is cheaper than plugs.

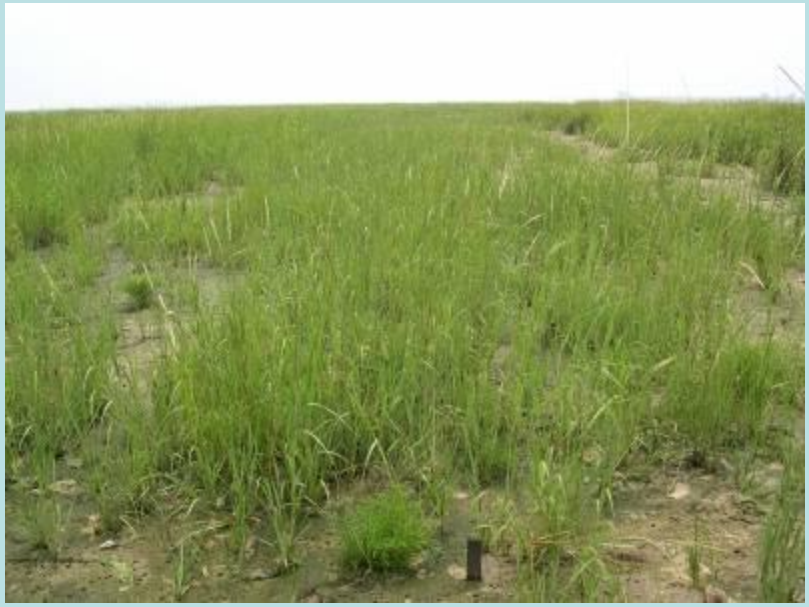
Low Energy Site Conditions

- Highest elevation of the daily tidal inundation
- 70 foot wide vegetated buffer in front the planting.

Low Energy Site-Seeding

Sept. 07

July 08



High Energy site conditions

- 25 foot planted buffer of quart pots - Spartina alterniflora.
- Planting in Median tidal range elevation.

High Energy Site

High Energy Site Seeding

September 07

July 08

Seed Study Conclusions

- Seeding is a viable option in lower energy environments, particularly in coarse-textured dredge materials.
- In higher energy sites, seed at higher elevation and plant buffer of at least 50 foot of vegetative material.
- High quality seed properly stored and handled is necessary.
- Seedings in high organic soils may have different results.

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Direct seeding for tidal marsh restoration

Jamaica Bay-Yellow Bar

Integrated Approach for Slope Stabilization

- The integrated approach incorporates soil bioengineering techniques using a combination of woody and herbaceous plant materials in various forms

Factors affecting bluff stabilization

- Surface Water - creates rill/gully erosion
- Ground Water - creates slumping and slope instability
- Bay Water – wave energy creates toe erosion

Traditional Approach-Turfgrass seeding

- Not the best approach for long term sustainability of the site.

Coastal Bluff Stabilization
Full sun/Drought tolerant Species

- Bayberry (*Morella pensylvanica*)
- Dwarf sumac (*Rhus copallina*)
- Sand cherry (*Prunus depressa*)
- Sweetfern (*Comptonia peregrina*)
- Indigobush (*Amorpha fruticosa*)
- Groundsel (*Baccharis halimifolia*)
- American beachgrass (*Ammophila breveligulata*)
- Coastal panicgrass (*Panicum amarulum*)
- Switchgrass (*Panicum virgatum*)
- Saltmeadow cordgrass (*Spartina patens*)
- Coastal little bluestem (*Schizachyrium scoparium var. littorale*)

Soil Bioengineering

- **Soil Bioengineering**: The practice of utilizing plant materials alone in such a way as to perform a structural function of stabilization
- **Biotechnical Stabilization**: Utilizing a combination of plants, geotextile fabrics, and/or structural measures for stabilization.

Woody Plant Functions
Soil Bioengineering Systems

- Root reinforcement - root tensile strength mechanically reinforces soil.
- Soil moisture depletion - remove excess soil water through evapotranspiration.
- Buttressing and Arching - anchored & embedded stems/roots counteract downslope shear forces.
- Flexible stems deflect erosive energy

Vegetative Considerations

Planting Techniques

- Seeding vs vegetative material
- Woody/Herbaceous
- Plant types
  - plugs
  - Dormant unrooted
  - Bare root
  - Containerized
- Caution with invasive plants
  - Lonicera
  - Polygonum
  - Crownvetch

Willow Whips

- 3/8” to 5/8” in diameter
- 4-8 ft. in length
- Cut when dormant
- Nursery grown; same diameter/branching pattern

Pussy Willow

Silky willow

‘Ruby’ redosier dogwood (*Cornus serecia*)

Developed because of it’s prolific layering ability.

Soil Bioengineering Species Limited rooting ability

- Buttonbush (*Cephalanthus occidentalis*)
- Elderberry (*Sambucus canadensis*)*
- Ninebark (*Physocarpus opulifolia*)*
- Arrowwood, Blackhaw (*Viburnum spp*.)*

- Groundsel (*Baccharis halimifolia*)
- High Tide bush (*Iva frutescens*)
- Indigobush (*Amorpha fruticosa*)

- * indicates shade tolerance

Groundsel Bush

Indigobush (*Amorpha fruticosa*)

Soil Bioengineering Species Bare root/Containerized

- Alder species (*Alnus spp*.)*
- Red/Black chokeberry (*Aronia spp*.)*
- Gray dogwood (*Cornus racemosa*)*
- Sweet pepperbush (*Clethra alnifolia*)*
- Winterberry holly (*Ilex verticillata*)*
- Spicebush (*Lindera benzoin*)*
- Witch-hazel (*Hamamelis virginiana*)*
- Highbush blueberry (*Vaccinium corymbosum)**

- Bayberry (*Morella pensylvanica*)
- Dwarf sumac (*Rhus copallina*)
- Sweetfern (*Comptonia peregina*)


Bayberry

BEACH PLUM: This long-lived native species thrives in environments with salt, apparent drought and frequent disturbances, where their neighbors are often short lived.

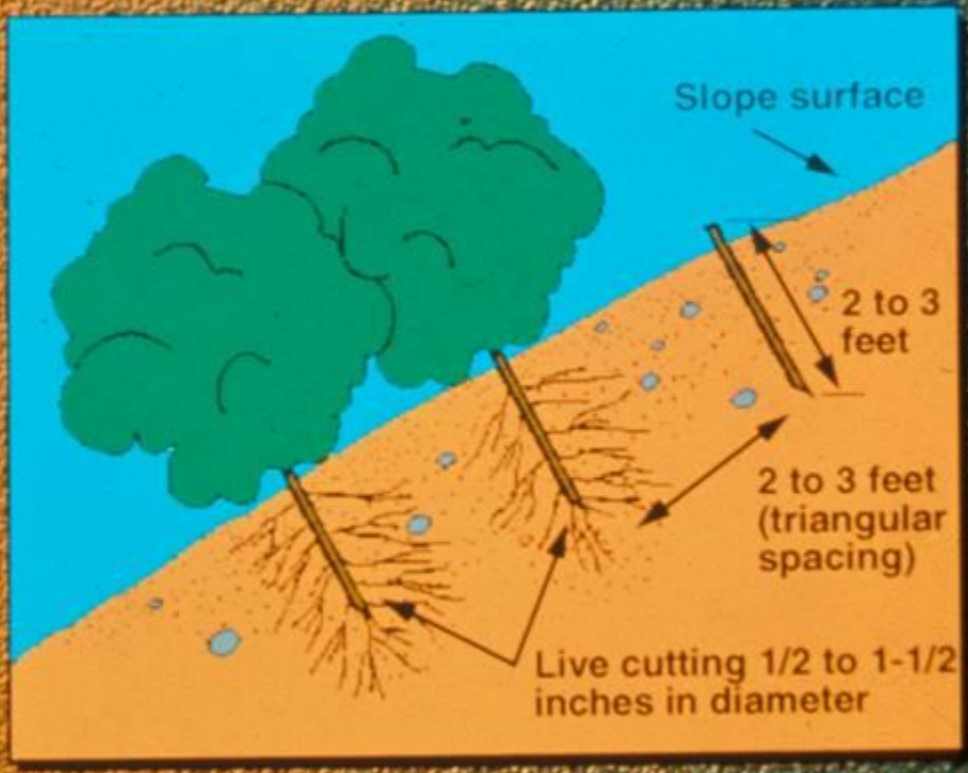
Dwarf Sumac
(*Rhus copallina*)

Sweetfern
(Comptonia peregrina)

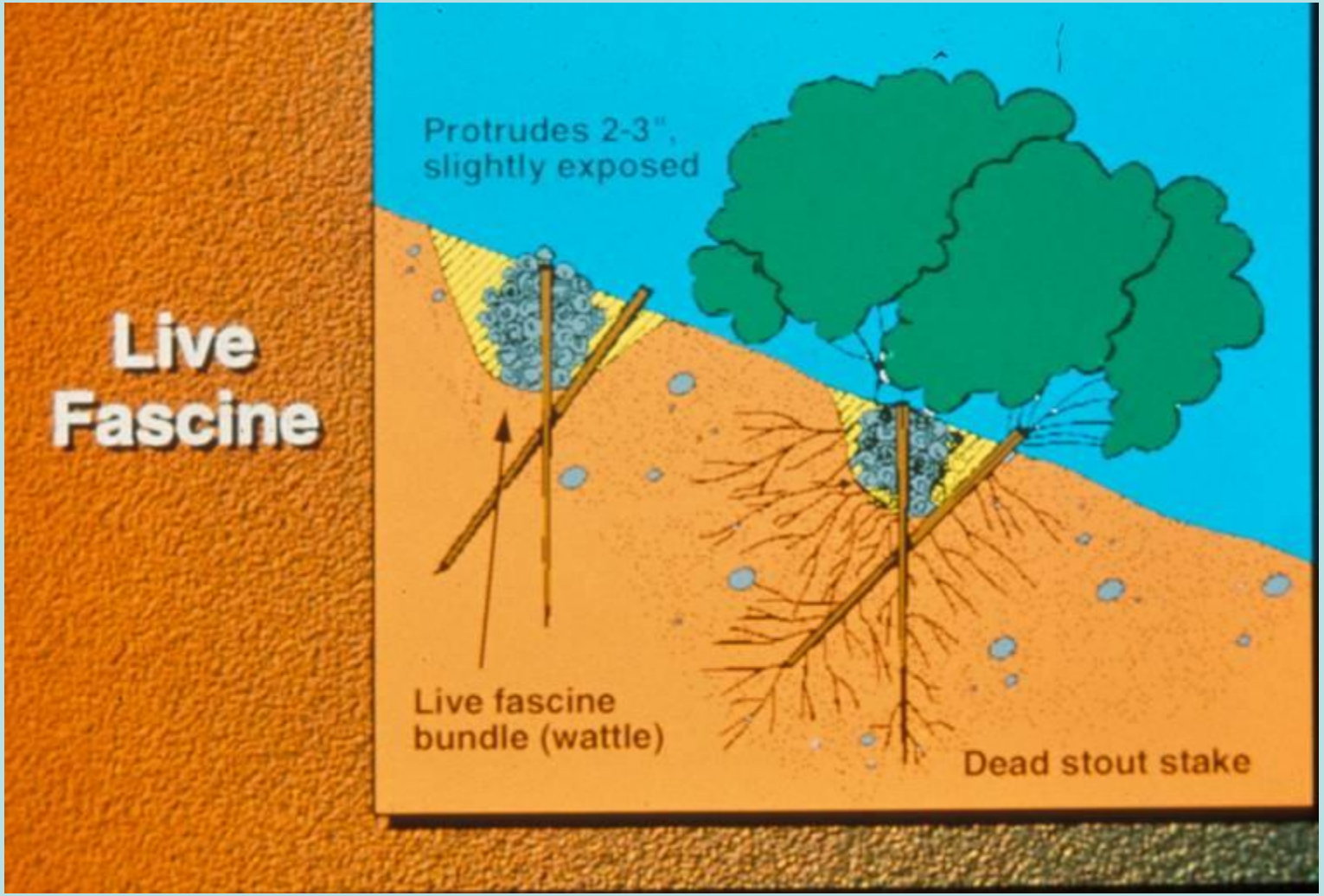
Soil Bioengineering

- Utilizes vegetation to provide some structural support to the slope.
- Examples
  - Fascines
  - Brushmattressing
  - Live Staking

Live Stake Installation



A “living” live stake


Live Fascine
Protrudes 2-3", slightly exposed
Live fascine bundle (wattle)
Dead stout stake

Other Plant Forms

- Unrooted cuttings
- Bare Root
- Tubelings
- Container

Unrooted Cuttings

- 1/4”-3/8” diameter
- 8”-12” length
- Perform better in moist soils
- May be planted through erosion control fabric

Rooted (bare root) plants

- field dug, bare root
- 3/8” at root collar
- Root gel (Terrasorb) increases survival in higher, drier bank zones
- May be planted though erosion control fabric

Tubelings

Containerized Plants

Plant Materials Costs

Plant Form	Approximate Cost
Unrooted cuttings	$0.45-$0.75
Live stakes (1-3 ft.)	$1.00-$1.50
Willow whips (4’-8’)	$1.00-$3.00
Tubelings	$1.25-$1.75
Bare root (1-0)	$1.00-$2.00
Container (1-2 gal)	$ 3.00-$12.00

General Bluff Planting Alternatives

- Establish good herbaceous cover then incorporate containerized, bare root, or dormant unrooted shrubs, but no trees
- Plant a few scattered “mother” plants of well adapted shrub species and allow for natural succession due to seed dispersal
- Use the “Vegetative Barriers” approach to slope protection. Plant beachgrass, saltmeadow cordgrass, and/or coastal panicgrass on a tight (6”-8”) spacing within a row. Plant 2-3 rows one foot apart
- Soil bioengineering techniques may be used where water may be piping out of the slope.

Herbaceous Plantings of beachgrass/saltmeadow cordgrass

Internet Resources

- USDA-NRCS Plant Materials Program-Atlantic Coastal Restoration: http://plant-materials.nrcs.usda.gov/technical/atlantic_restoration.html
- Cape May Plant Materials Center: http://plant-materials.nrcs.usda.gov/njpmc/index.html
- Dune Restoration FAQ: http://gcuonline.georgian.edu/wootton_l/restoration.htm

The Time is Now to Act!