Living Shorelines

Using an Integrated Planting Approach

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Cape May Plant Materials Center
Properly evaluating site conditions

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

Vegetative Treatment Potential

- Fetch
- Shape
- Orientation
- Boat Traffic
  - Width
  - Slope
  - Vegetation
  - Soil Conditions
Vegetated Treatment Potential

<table>
<thead>
<tr>
<th>FETCH</th>
<th>&lt; 0.5 mi</th>
<th>0.5 – 1.4</th>
<th>1.5 – 3.4</th>
<th>3.5 – 4.9</th>
<th>&gt; 5.0</th>
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<tbody>
<tr>
<td></td>
<td>8</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>SHAPE</th>
<th>Coves</th>
<th>Irregular Shoreline</th>
<th>Headland or straight</th>
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<tbody>
<tr>
<td></td>
<td>8</td>
<td>3</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>ORIENT</th>
<th>0.5 mi fetch</th>
<th>W to N</th>
<th>S to W</th>
<th>S to E</th>
<th>N to E</th>
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<tbody>
<tr>
<td></td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>BOAT TRAFFIC</th>
<th>None</th>
<th>1 – 10 per wk</th>
<th>10</th>
<th>1 – 10</th>
<th>&gt; 10</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>@ .5 mi</td>
<td>0.5 mi</td>
<td>100 yds</td>
<td>100 yds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>Total</th>
<th>VTP</th>
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<tr>
<td>23</td>
<td>26</td>
</tr>
<tr>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
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<td>13</td>
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</tr>
<tr>
<td>0</td>
<td>13</td>
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## VTP, cont’d

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<tr>
<th></th>
<th>&gt; 10 ft</th>
<th>7 - 10</th>
<th>3 - 6</th>
<th>&lt; 3</th>
<th>Subtotal</th>
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<tbody>
<tr>
<td><strong>BEACH WIDTH</strong></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>PLANT WIDTH</strong></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>NG</td>
</tr>
<tr>
<td><strong>BEACH SLOPE</strong></td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>BEACH VEG</strong></td>
<td>Veg below toe of slope</td>
<td>3</td>
<td>No veg below toe</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>SAND DEPTH</strong></td>
<td>&gt; 10 in</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
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<th>VTP</th>
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<td>24</td>
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<tr>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
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<table>
<thead>
<tr>
<th></th>
<th>TOTAL</th>
</tr>
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<tbody>
<tr>
<td>33</td>
<td>Good</td>
</tr>
<tr>
<td>24</td>
<td>Fair</td>
</tr>
<tr>
<td>16</td>
<td>Poor</td>
</tr>
<tr>
<td>0</td>
<td>Do not plant</td>
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</table>
Site Constraints
* 3-4 mile fetch
* N to E orientation
* Straight shoreline
* heavy boat traffic
* lack of littoral sand

After Installation

One year later
Planting Guidelines

Plant in as dry a condition as possible

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

Plant from mean tide to mean high tide.

Use Osmocote slow release fertilizer 18-6-12

Acclimate plants to site salinity

Set up monitoring before planting
Misuse of erosion control products. Not designed to function as a wave break.

Not all coir fiber logs are created equal. Once netting is damaged, the log is compromised.
Chesapeake Bay Bluffs
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

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

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

WATER DIVERTED AWAY FROM SLOPE
OVER HANGING LIP REMOVED
WELL VEGETATED SLOPE
WELL VEGETATED TOE
NORMAL HIGH TIDE
‘Cape’ american beachgrass
(Ammophila breviligulata)
‘Avalon’ Saltmeadow Cordgrass
Native Warm Season Grasses

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

- **Natural Habitat:** Dry to wet, sterile and acid, sandy soil. Upper edges of salt marshes and stream banks.

- **Description:** A moderately tall (3-6 ft.) perennial, warm season bunchgrass which produces a large amount of leaf biomass. A distinguishing characteristic is the fine fringe of hairs present in the leaf axils. The large, spreading inflorescence casts a purple tinge when flowering. Flowers and seed are borne singly at the ends of the flowering branches. This plant is a prolific seed producer. These smooth, shiny seeds mature from September-October.

- **Uses:** erosion control, forage, wildlife, ornamental
High Tide Germplasm switchgrass
‘Atlantic’ coastal panicgrass (Panicum amarulum)
Freshwater Cordgrass
(Spartina pectinata)

Cape May Plant Center
-Long Island population
Giant Cordgrass
(*Spartina cynosuroides*)

Chesapeake Bay population
Eastern gamagrass
(Tripsacum dactyloides)
Coastal Little Bluestem
Seaside Goldenrod
BEACH PLUM: This long-lived native species thrives in environments with salt, apparent drought and frequent disturbances, where their neighbors are often short lived.
Beach Plum fruit
Soil Bioengineering Species
Limited rooting ability

- Buttonbush (*Cephalanthus occidentalis*)
- Elderberry (*Sambucus canadensis*)*
- Ninebark (*Physocarpus opulifolia*)*
- Arrowwood, Blackhaw (*Viburnum spp.*)*
- Groundsel (*Baccharis halimifolia*)
- Indigobush (*Amorpha fruticosa*)

* indicates shade tolerance
Indigobush

(*Amorpha fruticosa*)
Groundsel Bush
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 peregrina*)
Dwarf Sumac
(Rhus copallina)
Sweetfern
(Comptonia peregrina)
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.
Vegetative Considerations

Planting Techniques

- Seeding vs vegetative material
- Plant types
  - Dormant unrooted
  - Bare root
  - Containerized

Native or naturalized materials?
- Caution with invasive plants
  - Polygonum
  - Crownvetch
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
### Soil Bioengineering Systems

#### “Keystone Species”

<table>
<thead>
<tr>
<th>Species</th>
<th>Rooting Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrub willows (<em>Salix spp.</em>)</td>
<td>70%-100%</td>
</tr>
<tr>
<td>Shrub dogwoods (<em>Cornus spp.</em>)</td>
<td>30%-70%</td>
</tr>
</tbody>
</table>
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
Prairie Willow
‘Ruby’ redosier dogwood
(Cornus serecia)

Developed because of it’s prolific layering ability.
Soil Bioengineering

• Utilizes vegetation to provide some structural support to the slope.

• Examples
  – Fascines
  – Brushmattressing
  – Live Staking
Live Stake Installation

Slope surface

2 to 3 feet

2 to 3 feet (triangular spacing)

Live cutting 1/2 to 1-1/2 inches in diameter
A “living” live stake
Live Fascine

Protrudes 2-3", slightly exposed

Live fascine bundle (wattle)

Dead stout stake
Installation of brushmattress

After one growing season
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

<table>
<thead>
<tr>
<th>Plant Form</th>
<th>Approximate Cost</th>
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<tbody>
<tr>
<td>Unrooted cuttings</td>
<td>$0.45-$0.75</td>
</tr>
<tr>
<td>Live stakes (1-3 ft.)</td>
<td>$1.00-$1.50</td>
</tr>
<tr>
<td>Willow whips (4’-8’)</td>
<td>$1.00-$3.00</td>
</tr>
<tr>
<td>Tubelings</td>
<td>$1.25-$1.75</td>
</tr>
<tr>
<td>Bare root (1-0)</td>
<td>$1.00-$2.00</td>
</tr>
<tr>
<td>Container (1 gal)</td>
<td>$3.00-$12.00</td>
</tr>
</tbody>
</table>
Planting Trial
Red Point-Cecil County
Red Point-Cecil County
Dormant Shrub Willow Planting
Herbaceous Plantings of beachgrass/saltmeadow cordgrass
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.
Is Time Running Out?