Living Shorelines

Using an Integrated Planting Approach

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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?

SHORELINE STABILIZATION

Vegetative Treatment Potential

- Fetch
- Shape
- Orientation
- Boat Traffic
  - Width
  - Slope
  - Vegetation
  - Soil Conditions

Vegetated Treatment Potential

FETCH	< 0.5 mi **8**	0.5 – 1.4 **7**	1.5 – 3.4 **4**	3.5 – 4.9 **2**	> 5.0 **0**	
SHAPE	Coves **8**	Irregular Shoreline **3**		Headland or straight **0**		
ORIENT	0.5 mi fetch **5**	W to N **3**	S to W **2**	S to E **1**	N to E **0**	
BOAT TRAFFIC	None **5**	1 – 10 per wk @ .5 mi **3**	10 0.5 mi **2**	1 – 10 100 yds **1**	> 10 100 yds **0**	
					TOTAL	

Total		VTP
23	26	Excellent
20	22	Very Good
16	19	Good
13	15	Fair
0	13	Poor

VTP, cont'd

				Subtotal	
BEACH WIDTH	> 10 ft **3**	7 - 10 **2**	3 - 6 **1**	< 3 **0**	
PLANT WIDTH	> 20 ft **3**	15 - 20 **2**	14 - 10 **1**	< 10 ft **NG**	
BEACH SLOPE	< 8 % **6**	8 – 14 **3**	15 – 20 **1**	> 20 % **0**	
BEACH VEG	Veg below toe of slope **3**		No veg below toe **0**		
SAND DEPTH	> 10 in **3**	3 – 10 **2**		< 3 in **0**	
				TOTAL	

Total		VTP
33	40	Good
24	32	Fair
16	23	Poor
0	16	Do not plant

Site Constraints

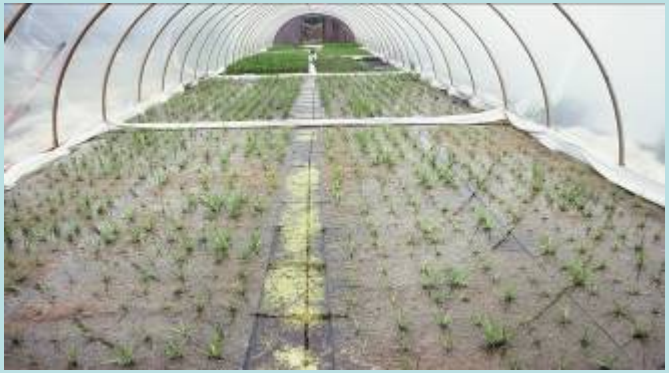
*3-4 mile fetch

*N to E orientation

*Straight shoreline

*heavy boat traffic

*lack of littoral sand



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.

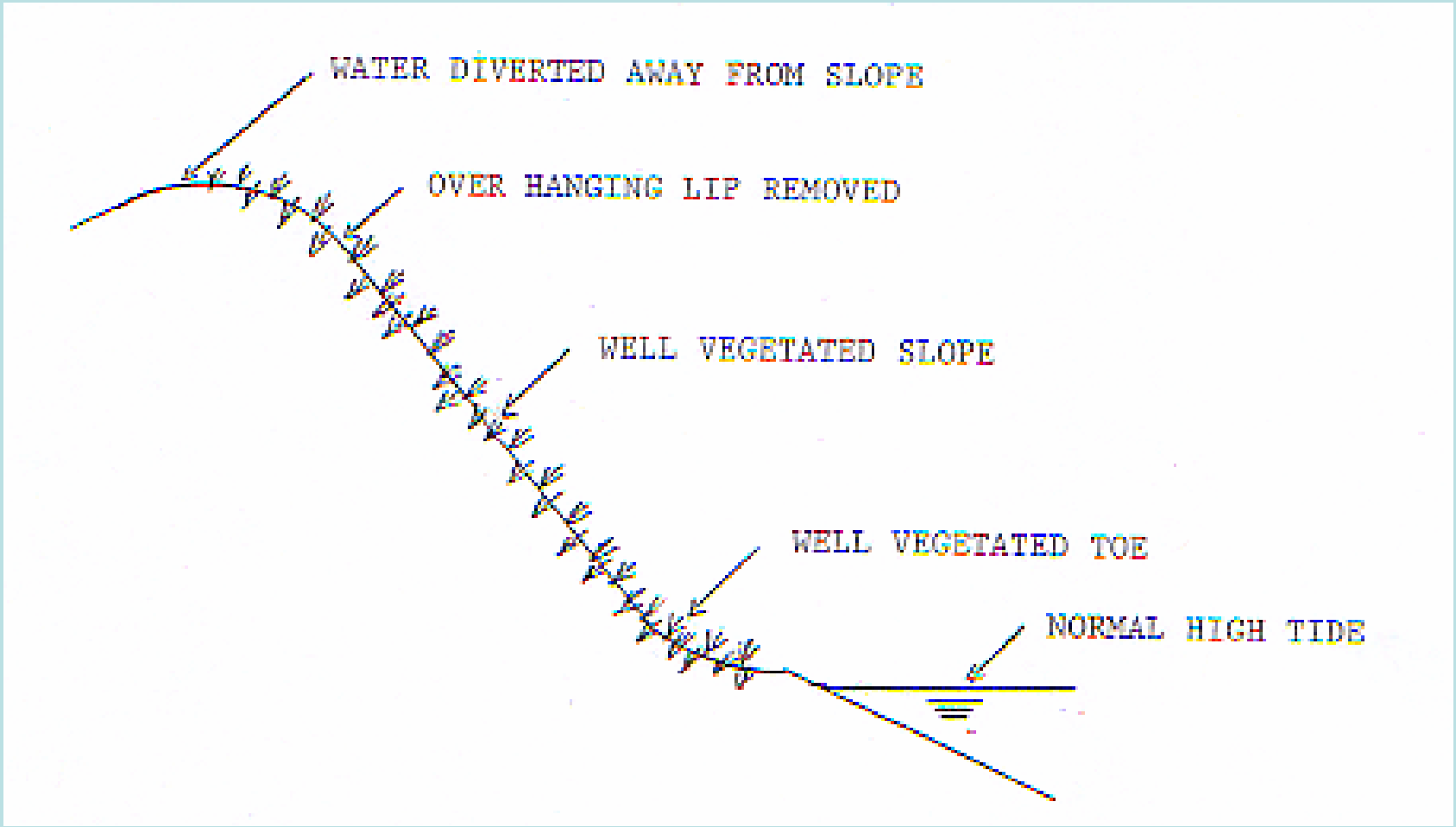
Integrated Approach

- 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



‘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*)

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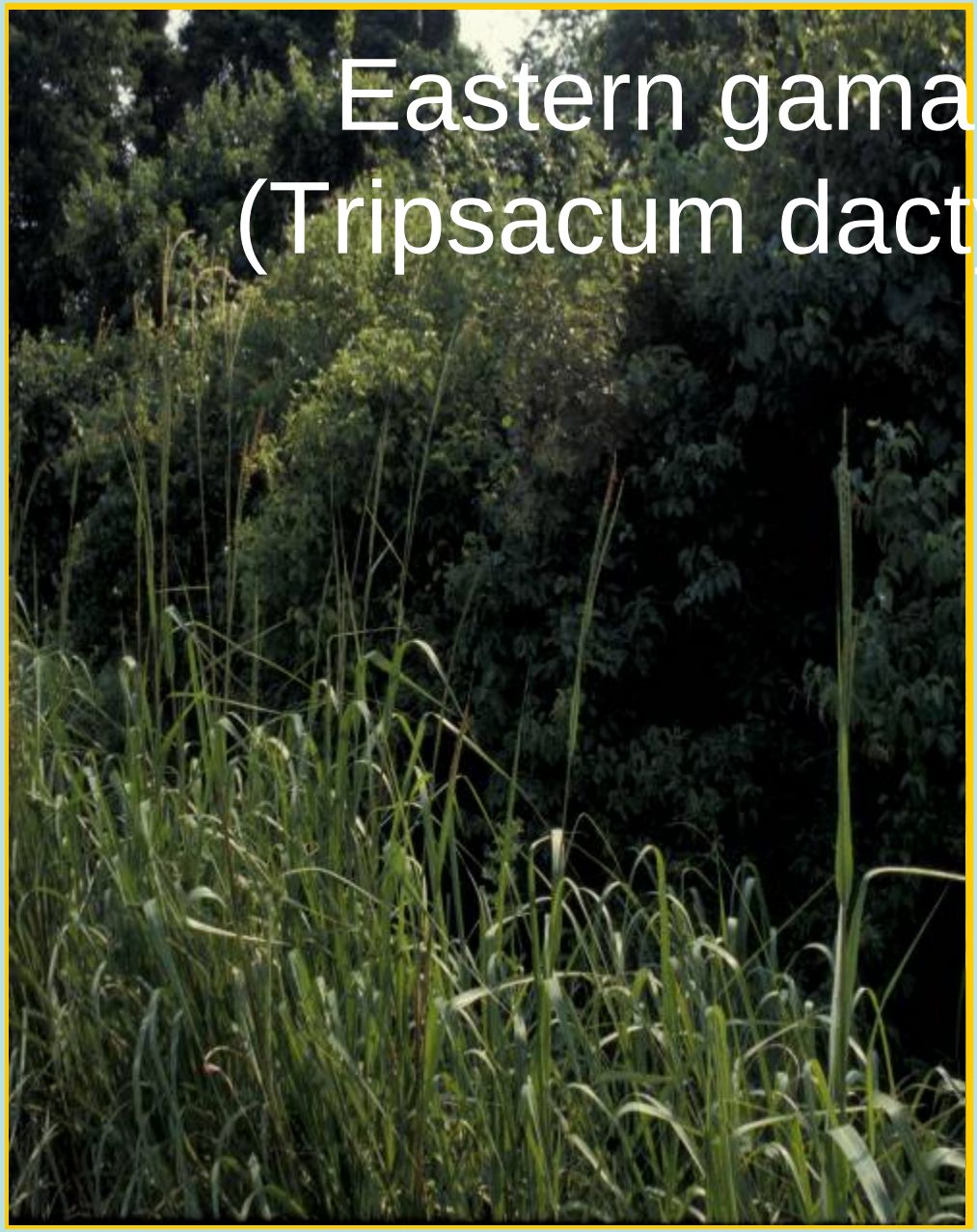
-Long Island population

Giant Cordgrass (*Spartina cynosuroides*)

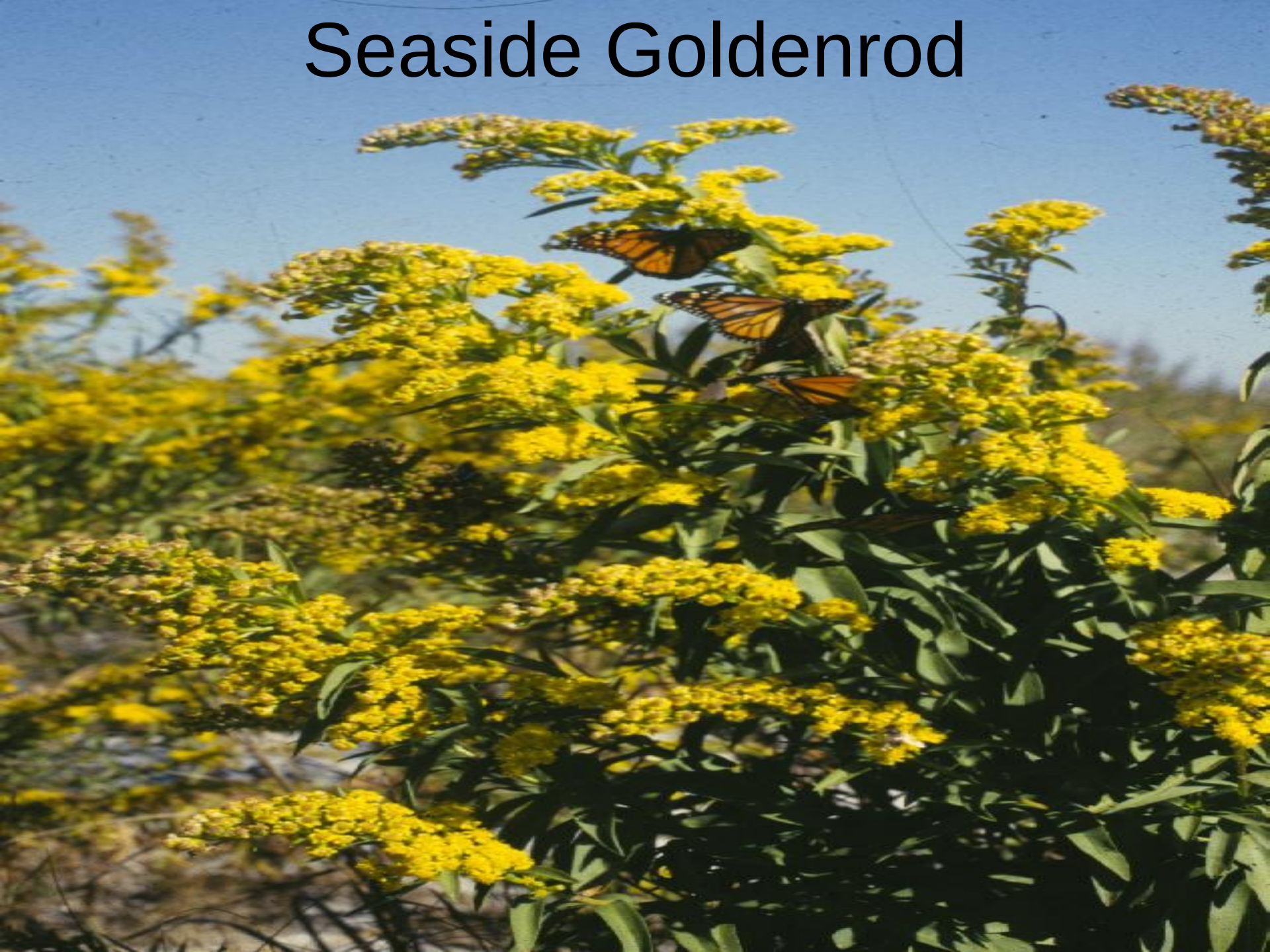
Chesapeake Bay population

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 peregina*)


Bayberry

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"

Species	Rooting Success
Shrub willows (*Salix spp*.)	70%-100%
Shrub dogwoods (*Cornus spp*.)	30%-70%

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

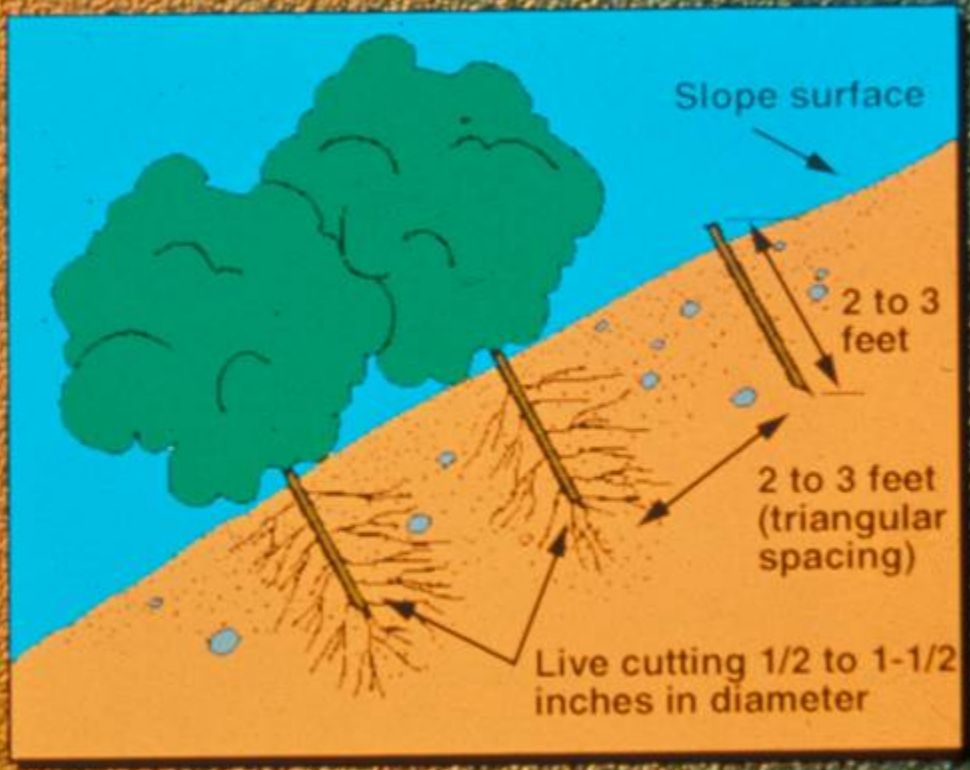
‘Ruby’ redosier dogwood (*Cornus serecia*)

Developed because of it’s prolific layering ability.

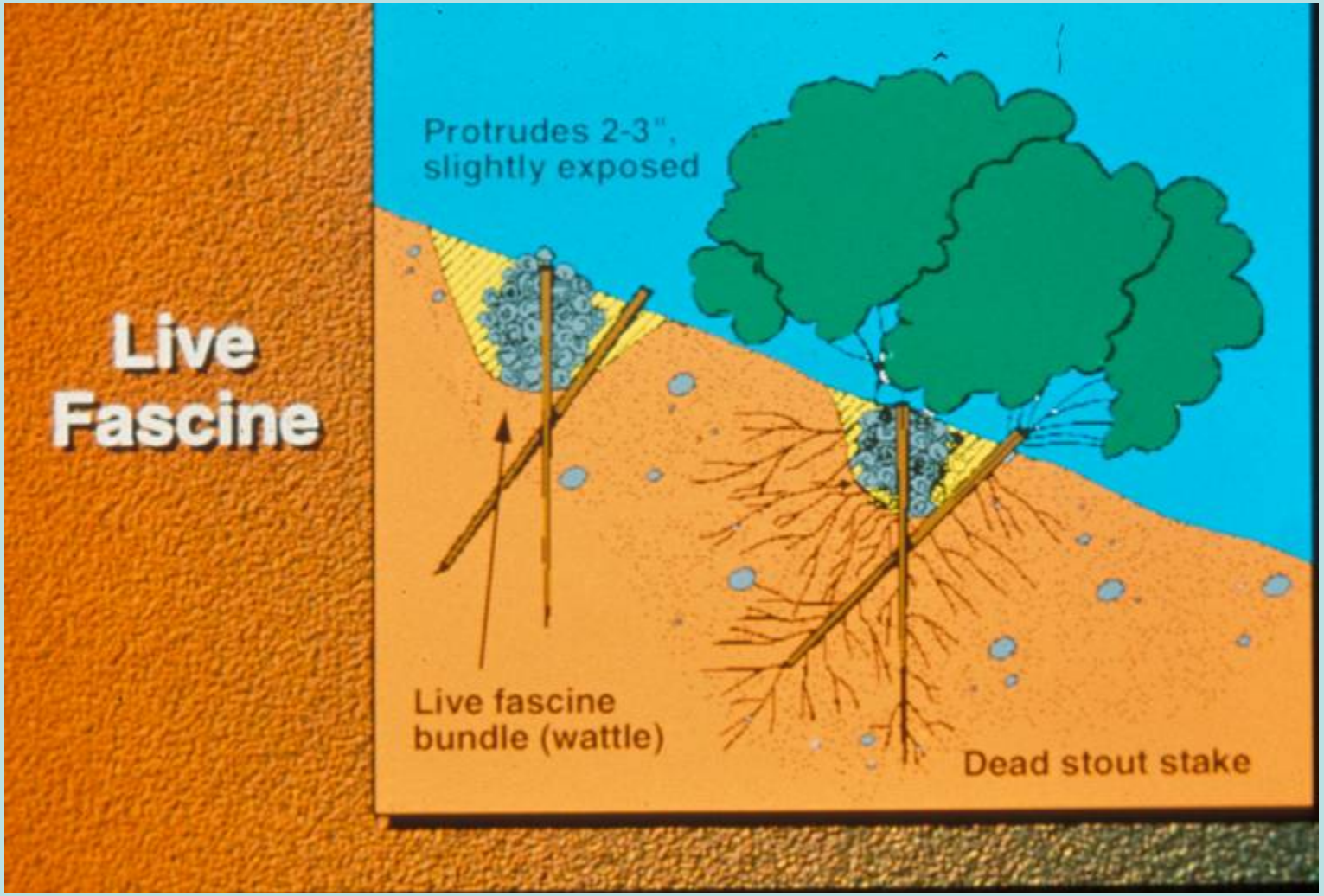
Soil Bioengineering

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

Live Stake Installation



A “living” live stake


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

Brushmattress Installation

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

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 gal)	$ 3.00-$12.00

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?