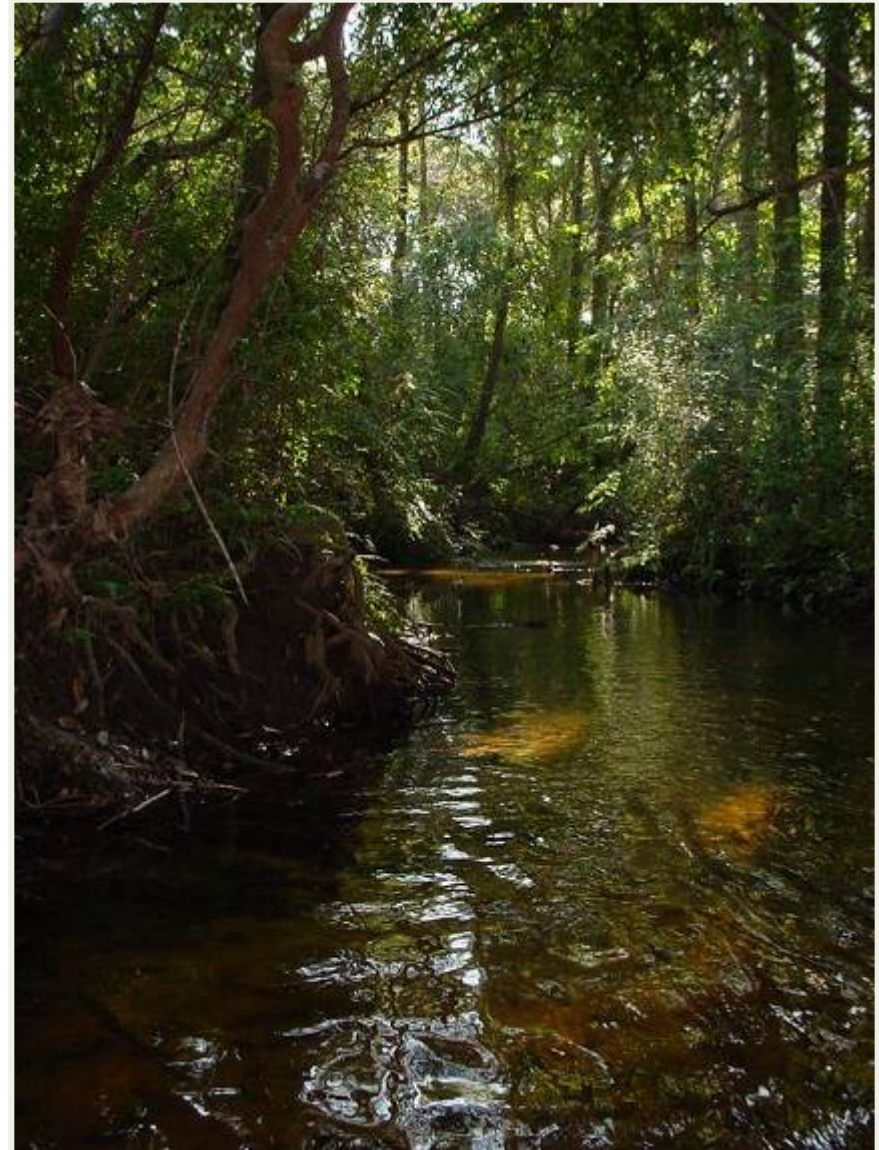


Vegetation for Stream Restoration

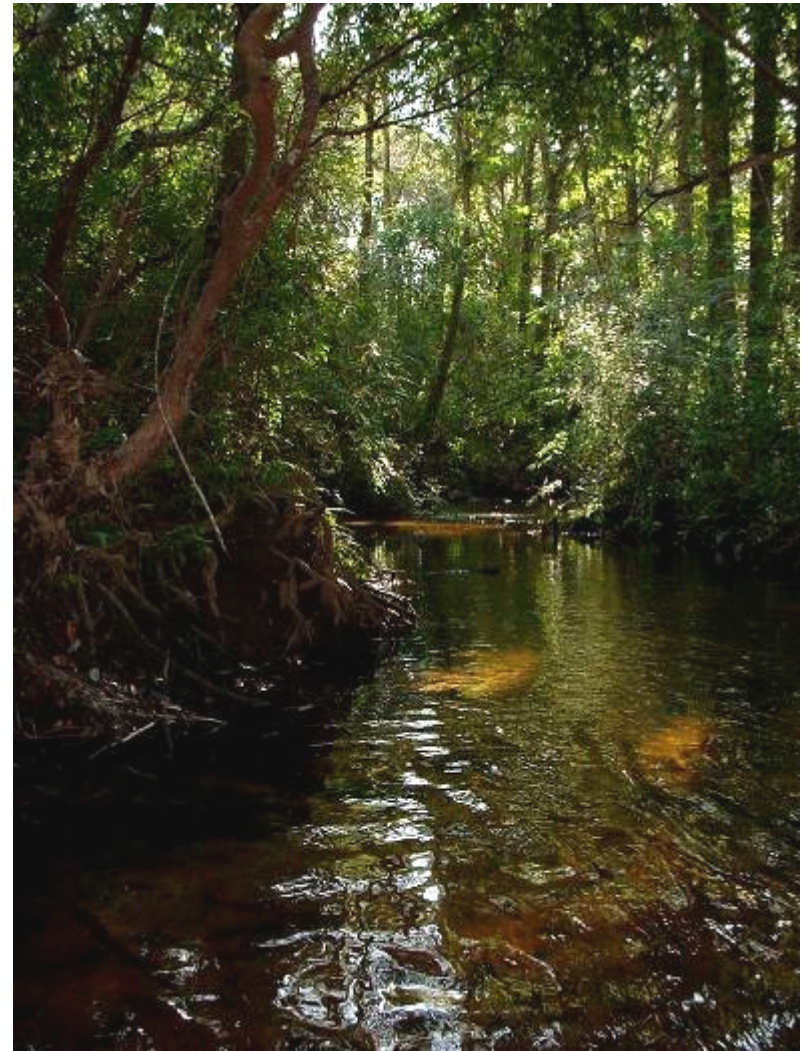


Riparian vegetation influences in-stream life

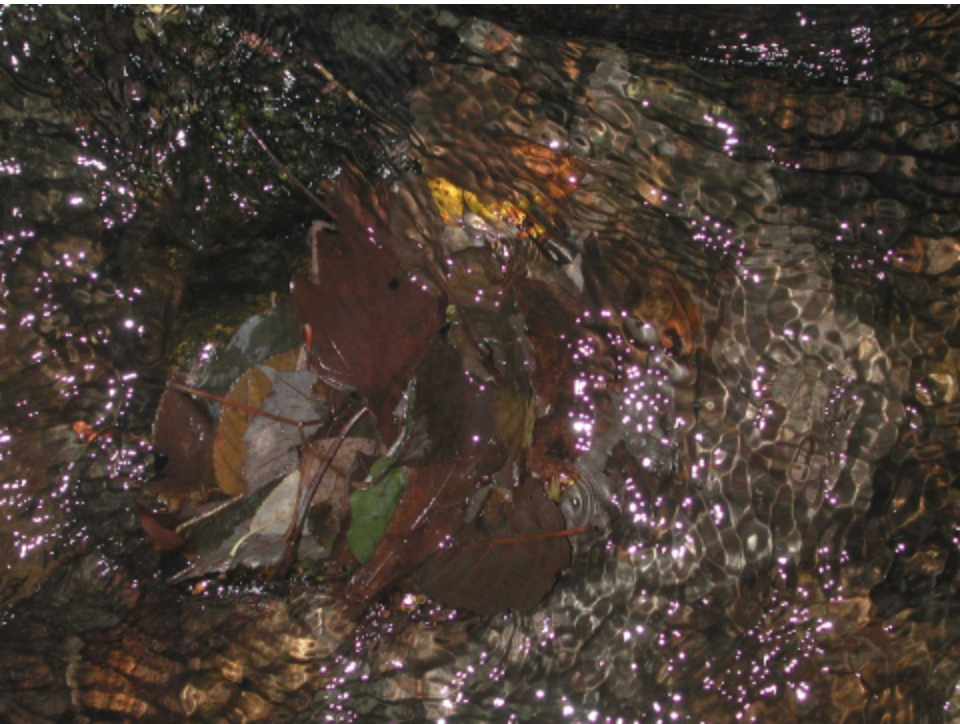
- Shading
- Temperature
- Food sources for aquatic animals
- Woody debris
- Bank stability
- Filtering nutrients and sediments



Shading-Temperature



Food sources for aquatic animals



Woody debris



Bank stability



Filtering nutrients and sediments

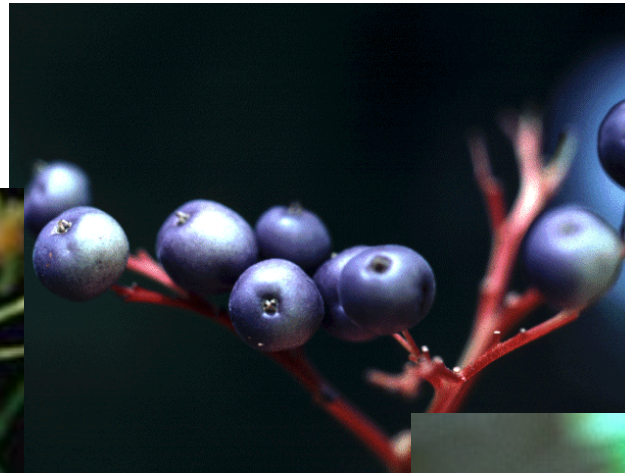


Plants reduce flooding – and drought

- Slow rain
- Absorb rain
- Store rain
- Link to aquifers



Plants provide terrestrial and aerial wildlife habitat



The right plants can even improve human habitat



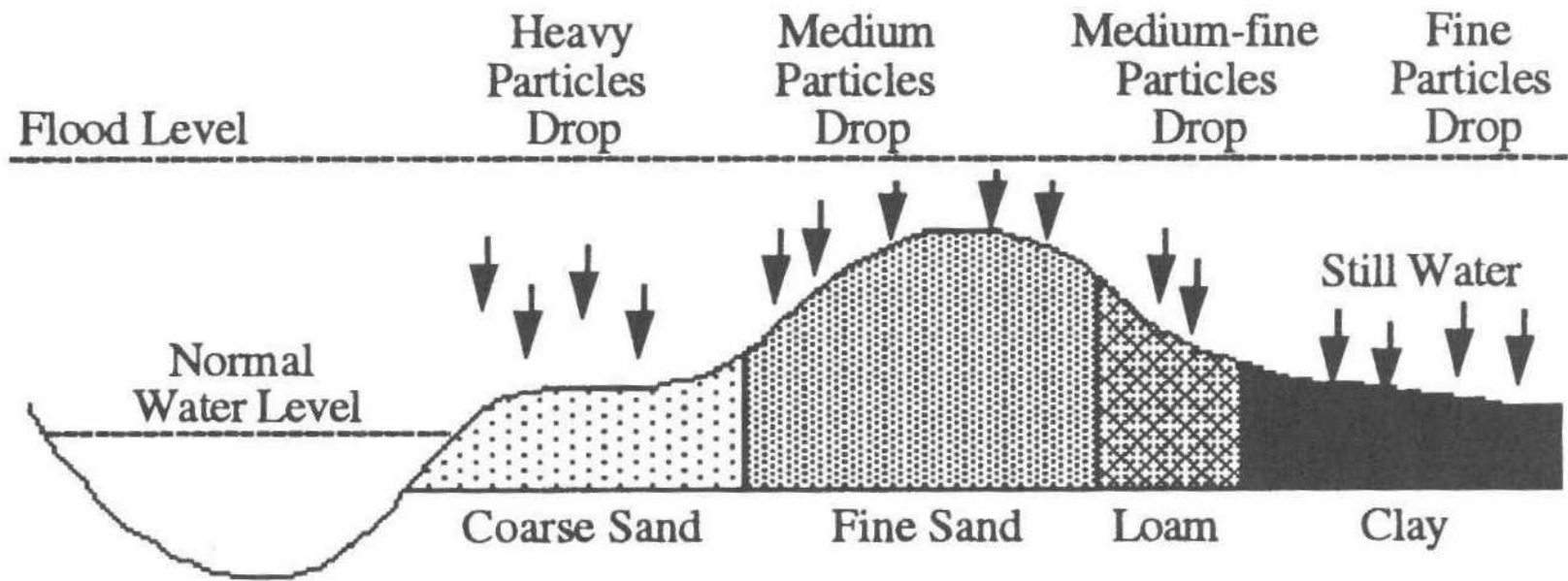
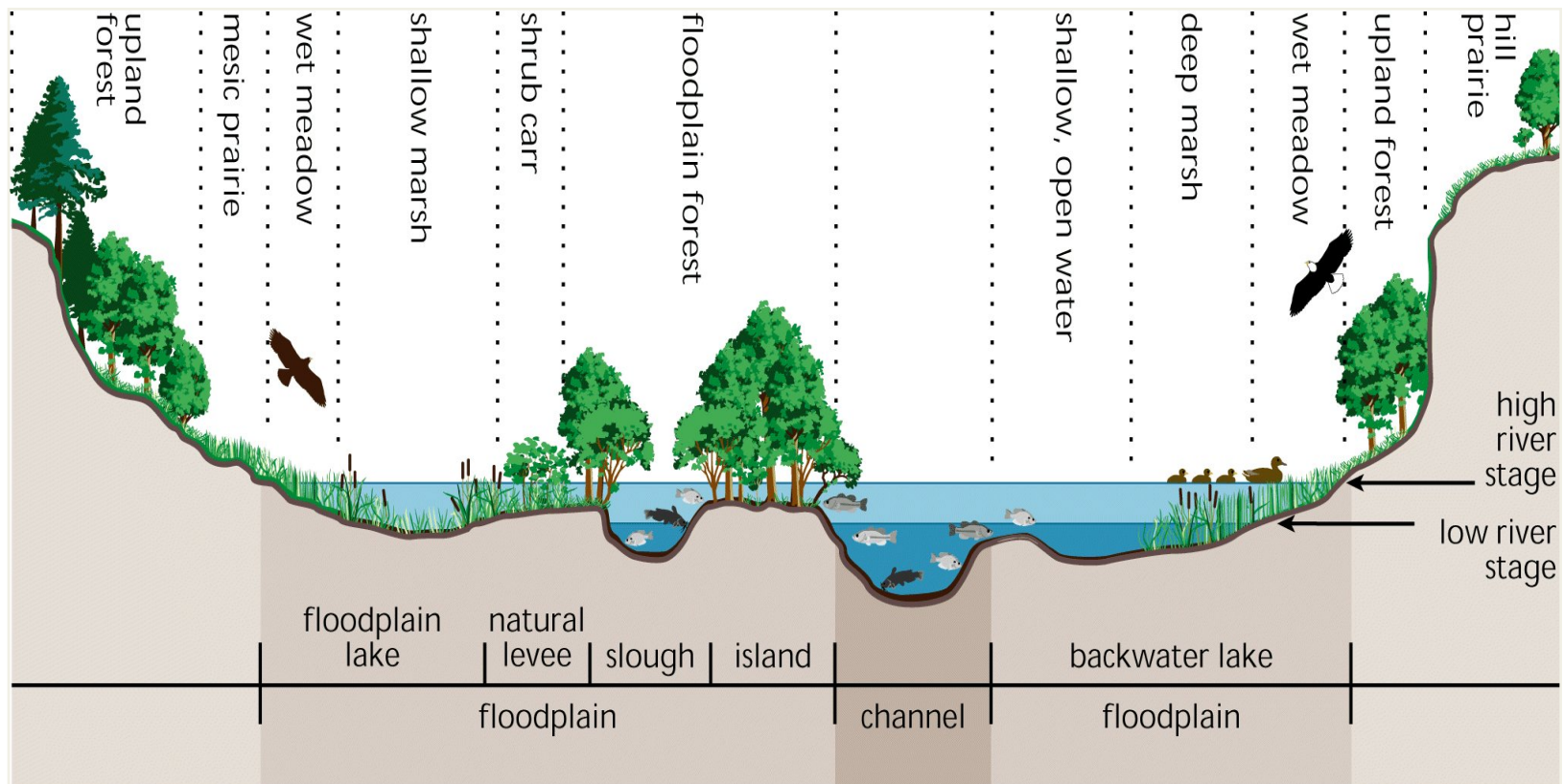


FIGURE 13.3 Depositional patterns in minor floodplains and the relationship to topographic features of the floodplain.



Variety of natural systems created with the deposition of sediment onto the floodplain

Initial Assessment

- Plant inventory,
 - exotics, transplants, protected
- Soil characterization
- Wetland delineation
- Threatened & endangered species
- Other project constraints?



Planning for pre-construction

- Extent of disturbance
- Vegetation assessment
- Conserving and stockpiling topsoil
- Species selection
- Invasive removal



Planning

Extent of restoration disturbance?



Planning

- Transplants
 - Marking and excavation
 - Storage during construction
- Topsoil
 - Storage during construction
- Seeding



Other constraints

- Power lines
 - Identify easement
 - Confirm species with power company
 - Place signs to prevent removal of vegetation
- Landowner vision
 - Park-like vs. Hairy Nature



Planning

- Invasive, exotic removal



Invasive, Exotic Plants

- Thrive in disturbed conditions
- Low habitat value
- May not be providing erosion control

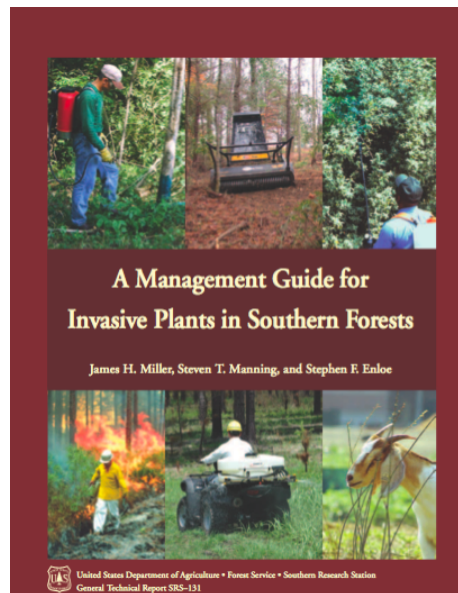


Invasive, Exotic Management

- ✓ Mechanical
- ✓ Chemical
- ✓ Physical



Invasive, Exotic Management



AGRONOMY AND SOILS SERIES
TIMELY INFORMATION
Agriculture & Natural Resources

Control Options for Chinese Privet



Chinese privet (*Ligustrum sinense*) is a serious problem for many homeowners, farmers, foresters, and land managers in Alabama. Many control efforts are done incorrectly or are short lived if follow up is not performed. This sheet provides the technical specs on treatment options. For detailed information on specific herbicide treatment techniques consult the Timely Information Series on herbicide techniques available at: <http://www.aces.edu/timelyinfo/#Agronomy>.

Hand pulling or weed wrenching: Privet seedlings and young stems can often be hand pulled, especially in moist bottomland hardwood soils. However, privet spreads by creeping roots and the stems from root sprouts can rarely be pulled up. Grasp small privet stems by the base and pull upward. If they do not easily come up, hand pulling cannot be done. Weed wrenching is another hand method that works on single stemmed privet less than two to three inches in diameter. Because privet has a shallow fibrous root system that often holds large chunks of soil, hand pulling is not recommended along stream banks or other areas where erosion may be of concern.

Mowing or cutting: Because privet will rapidly resprout from the stump and roots, mowing or cutting alone do not provide satisfactory control. Mowing may also result in a large flush of new seedlings along with the resprouts.

Brush grinders: Brush grinding is another mechanical option that has shown considerable promise. Brush grinders can grind all sizes of privet and often leave a thick mulch layer that may reduce privet seedling germination. Brush grinders do not remove the root system so expect some resprouting to occur. However, there is some evidence that brush grinding destroys the root collar of many privet stems and may reduce stump resprouting.

Foliar herbicide treatment: Privet control with most pasture herbicides is variable when sprayed on the foliage. For many applications, glyphosate is the most effective treatment. Here are the specifics: Use a glyphosate product with a minimum of 41% active ingredient. DO NOT use glyphosate formulations that are "Ready to Use" (RTU) because they do not contain enough glyphosate to be effective. Make sure the glyphosate product you choose has a good surfactant or add a non-ionic surfactant (NIS) at 0.5% v/v. Mix a 3:5 % solution (4.6 fluid ounces per gallon) of the glyphosate product with water and NIS (0.5 fluid ounces per gallon) if needed. Coverage of the



ALABAMA A&M AND AUBURN UNIVERSITIES, AND TULANE UNIVERSITY, COUNTY GOVERNING BODIES AND USDA COOPERATING
The Alabama Cooperative Extension System offers educational programs, materials, and equal opportunity employment
to all people without regard to race, color, national origin, religion, sex, age, veteran status, or disability.

US Forest Service - A management guide for invasive plants in southern forests

www.treesearch.fs.fed.us/pubs/36915

•AL Cooperative Extension System – Timely Information Articles

www.aces.edu/anr/crops/haypastweedcontrol.php

Vegetation and Stream Restoration

Seeding

Transplants

Live stakes

Bareroot plants

Container plants



Seeding

- Temporary seeding
- Permanent seeding
- Mulch



Prepare the Site

- Apply topsoil where necessary
- Use soil samples to determine pH, fertilizer needs
- Loosen soil



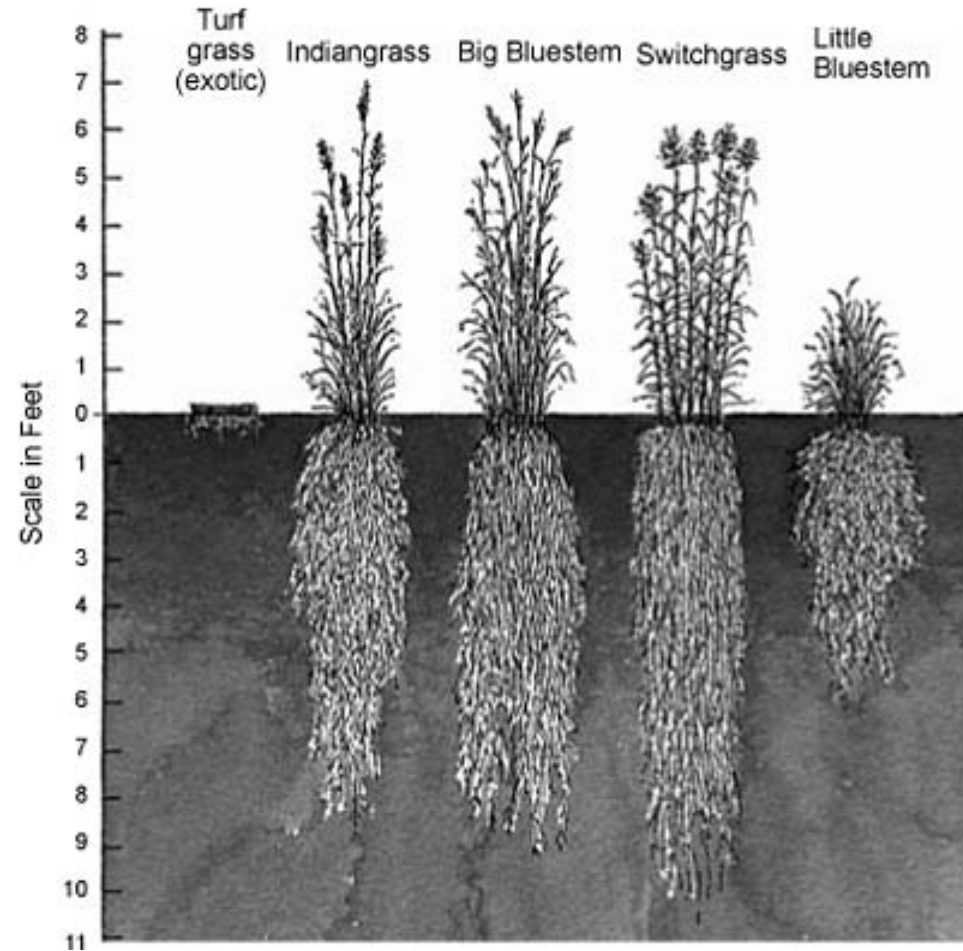
Temporary seeding

Common name	Scientific Name	Rate per Acre	Optimal Planting Dates		
			Mountains	Piedmont	Coastal Plain
Rye grain	<i>Secale cereale</i>	30 lbs	Aug. 15-May 15	Aug. 15-May 1	Aug. 15-Apr. 15
Wheat	<i>Triticum aestivum</i>	30 lbs	Aug. 15-May 15	Aug. 15-May 1	Aug. 15-Apr. 15
German millet	<i>Setaria italica</i>	10 lbs	May 15-Aug. 15	May 1-Aug. 15	Apr. 15-Aug. 15
Browntop millet	<i>Urochloa ramosa</i>	10 lbs	May 15-Aug. 15	May 1-Aug. 15	Apr. 15-Aug. 15



Permanent Seed mix

- Wetland
- Cool season grasses
- Warm season grasses



Permanent Seed Mix

- Switchgrass, *Panicum virgatum*
- Indiangrass, *Sorghastrum nutans*
- Deertongue, *Dichanthelium clandestinum*
- Partridge Pea, *Chamaecrista fasciculata*
- Soft rush, *Juncus* spp
- Sedges, *Carex* spp.

Consider different mixtures for different areas (moist vs. upland)



Application

- Broadcast
 - seed on soil surface
 - hand spreaders or by hand
 - ground raked or harrowed before seeding



Application

- Mulch increases successful seed germination:
 - provides physical substrate for the seeds so they are not blown or washed off site
 - provides physical protection for the seeds from extremes in temperature, light, and moisture
 - retains moisture
 - reduces soil erosion
 - Wheat straw, 2 tons / acre
 - 75% cover



Application

- Erosion Control Matting
 - Spread seeds before placing matting
 - Cover with mulch
 - Stake matting into place along streambank



Permanent Seed Calculations

- 12-15 pounds per acre, pure live seed, broadcast



Trees and shrubs

- Bare root, container, transplants, live stakes
- Number planted may depend on requirements (mitigation), project goals, aesthetics, etc.

Type	Spacing	# per 1,000 sq ft
Shrubs (<10 ft)	3-6 ft	25 – 110
Shrubs & Trees (10 – 15 ft)	6-8 ft	15 – 25
Trees (> 25 ft)	8-15 ft	4 - 15



Transplants

- Take advantage of native vegetation on site with the equipment you have on site
- Get as large a rootball as you can (2' – 3' of soil)
- Plant as soon as possible ... may create a waiting area for plants

Transplants

- Look for small shrubs & trees up to 3 inches in diameter
- Sycamore, Alder, Elderberry, and Spice Bush all respond well as transplants
- Plant at bankfull elevation or above
- Start in critical areas along meander bends or near in-stream structures



Transplants

- Wetland plants transplant well – *Carex*, *Juncus*
- Collect marsh vegetation from nearby area (don't ransack it)
- Keep transplants moist and plant as soon as possible



Live Stakes

- A dormant hardwood stick, pushed into wet/moist soil
- Best planted in dormant season
- Not likely to be washed away
- 0.5 – 2” in diameter, 2’ – 3’ long
- Keep moist, soak in water for 24 hours



Live Stakes

- Install 2 to 4 feet apart using triangular spacing
- Drive stakes into the ground using a rubber hammer – may have to use leader (rebar)
- At least 2 buds should remain above ground
- Green side up ... cut bottom at an angle



Live Stake Species

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

Salix sericea, Silky Willow

Physocarpus opulifolius, Ninebark

Platanus occidentalis, Sycamore

Sambucus canadensis, Elderberry

Itea virginica, Virginia sweetspire



Bioengineering

- Brush mattress



C. amomum
S
9 month



Itea
S
9month



12-3-11

S. nigra
9 mg

S

12-3-11

S. sericea

9 mg

S

Bare Root Seedlings

- Bare root seedlings dug and stored without soil around their roots
- Missing >90% of root hairs - plant's water absorbing structures
- Keep plants moist and cool



Bare Root Seedlings

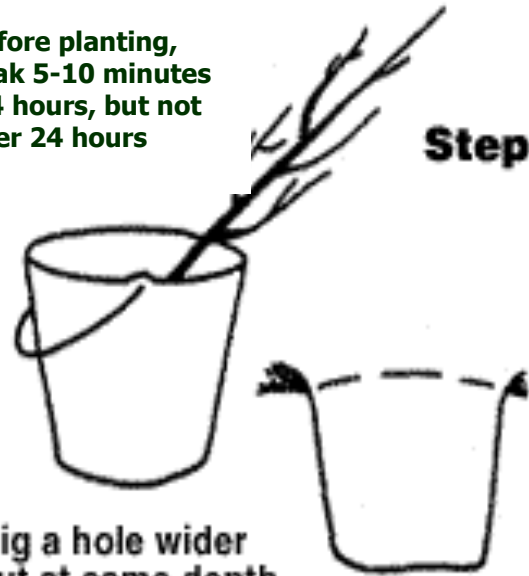
- Ideal to plant when vegetation is dormant, winter or early spring
- Benefits –
 - less expensive,
 - don't need much expertise to plant (green side up),
 - may be more diverse nursery selection
- Drawbacks –
 - may experience higher mortality than container plants,
 - purchase 10 – 15% more than needed, plant additional plants in holding area



Planting Bare Roots

1. Carefully remove loose packing material (peat moss, sawdust).
2. Soak roots
3. Trim away moldy, poor condition roots
4. Dig a hole deep and wide
5. Cover roots with soil and press down firmly. Root collars of seedlings should be slightly below soil surface
6. Make sure all roots - especially those under the crown - are in contact with soil.

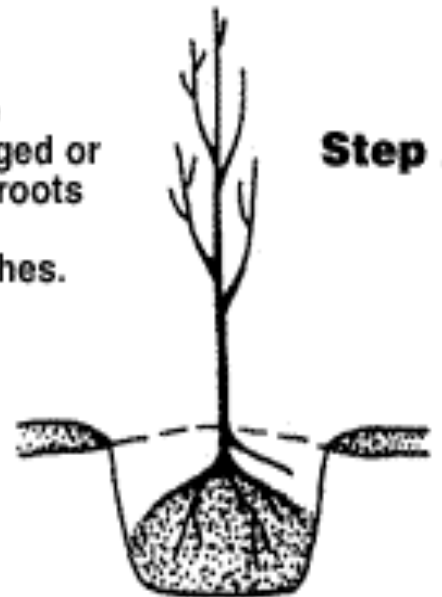
Before planting, soak 5-10 minutes - 4 hours, but not over 24 hours



Step 1

Dig a hole wider but at same depth as root length

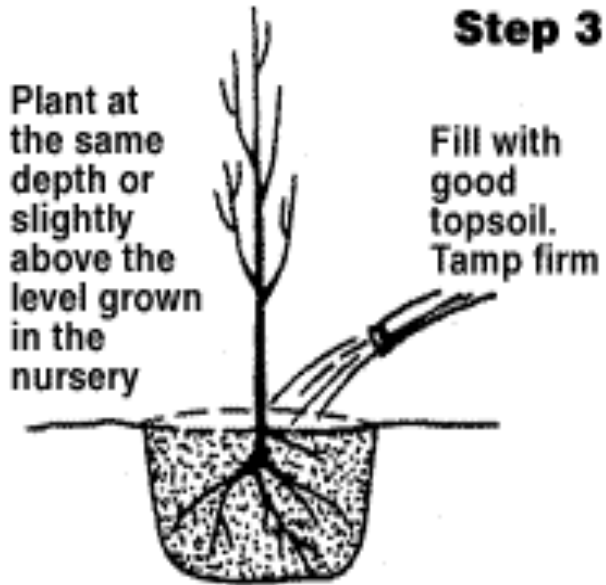
Prune damaged or weak roots and branches.



Step 2

Set on firm mound of good topsoil, spread roots.

Step 3

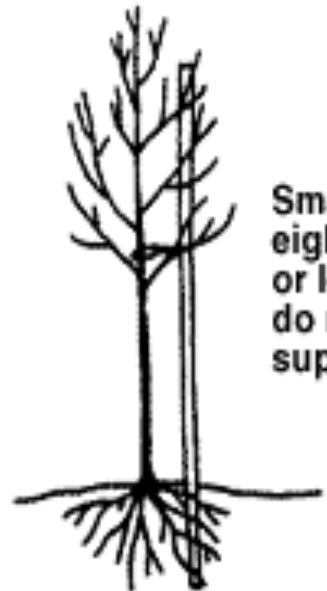


Plant at the same depth or slightly above the level grown in the nursery

Fill with good topsoil. Tamp firm

Fill basin with water. Add topsoil to reshape basin.

Step 4



Small trees, eight feet tall or less, usually do not need support.

Support larger trees if necessary for one growing season only.

Container Plants



Container Plants

- Benefits:
 - well established root system,
 - may have higher survivorship than bare root,
 - can be planted just about any season
 - Instant tree or shrub
- Drawbacks:
 - expensive,
 - requires more labor in planting



Plant Selection

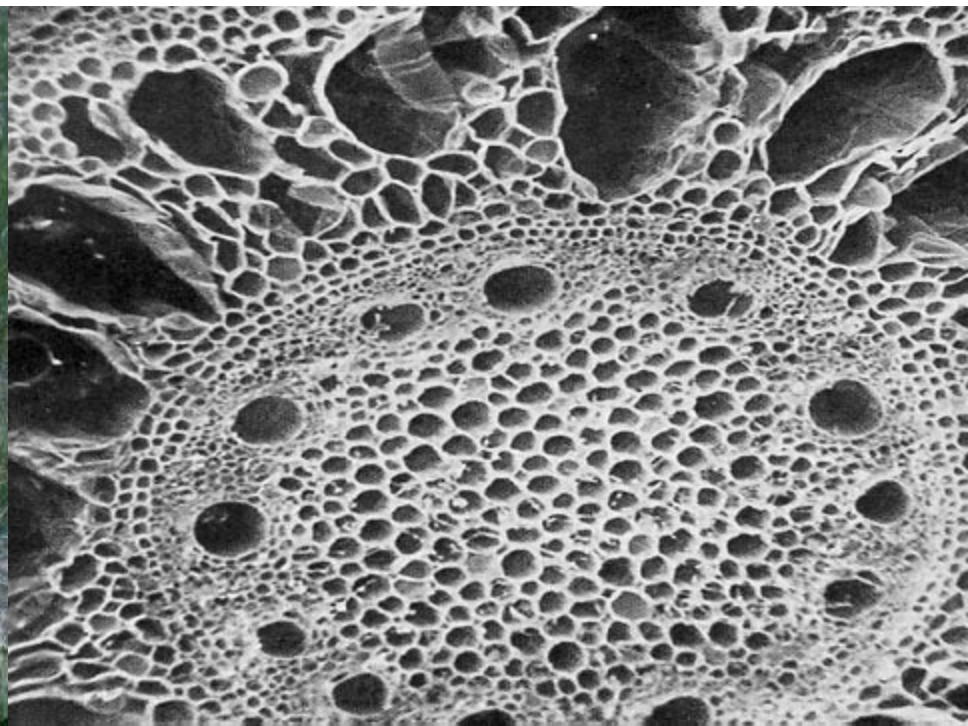
- Native Plants
- Water Tolerance
- Light Tolerance
- Compatible with Soils
- Wildlife Value
- Aesthetics

What are the goals?



Water Tolerance

- Hydrophytes – water loving plants
- Have physiological and morphological traits that promote survival in flooded soil conditions
- Important to match plants with appropriate zone of inundation (don't want to drown them)



Wetland Indicator Status

Code	Wetland Type	Comment
OBL	Obligate Wetland	Occurs almost always (estimated probability 99%) under natural conditions in wetlands.
FACW	Facultative Wetland	Usually occurs in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
FACU	Facultative Upland	Usually occurs in non-wetlands (estimated probability 67%-99%), but occasionally found on wetlands (estimated probability 1%-33%).
UPL	Obligate Upland	Occurs almost always (estimated probability 99%) under natural conditions in non-wetlands

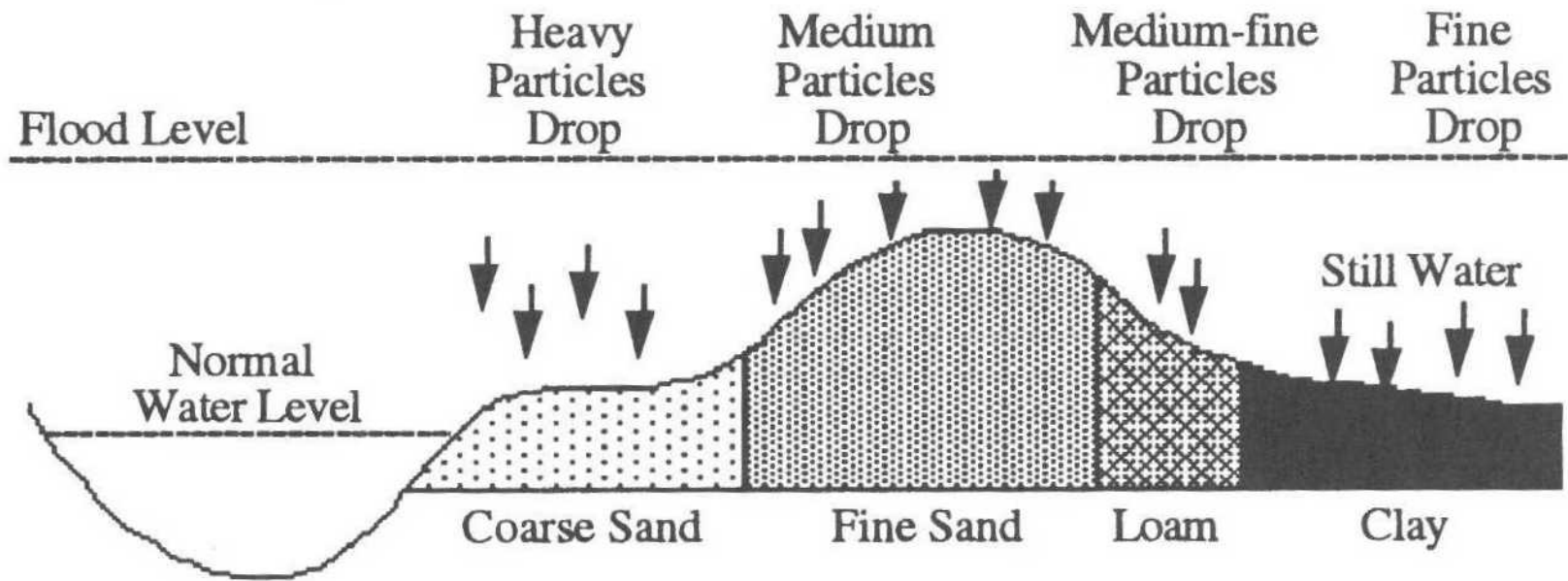


FIGURE 13.3 Depositional patterns in minor floodplains and the relationship to topographic features of the floodplain.

Outside Edge of Buffer

Zone 4 FAC, FACU

Zone 5 OBL

WB

Zone 3 FACW, FAC

Zone 1 OBL

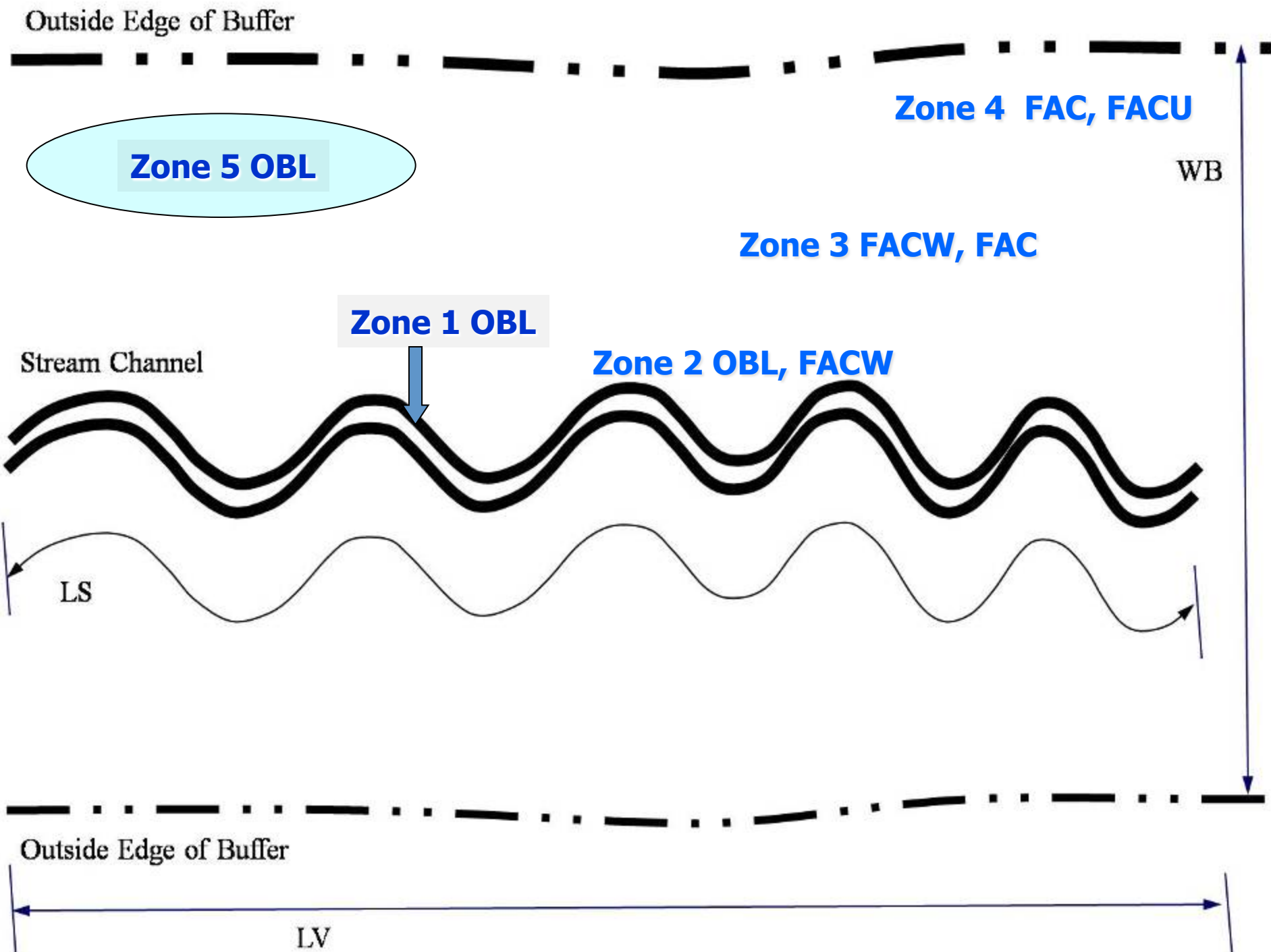
Stream Channel

Zone 2 OBL, FACW

LS

Outside Edge of Buffer


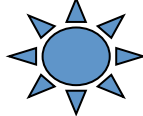

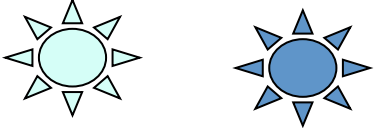



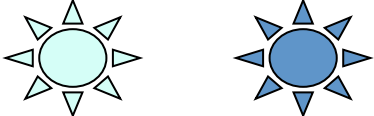

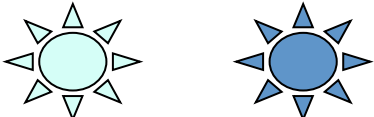


LV



Light Tolerance

- Plants will at first be exposed to high levels of sunlight (if large shade trees are absent)
- Consider ability of plant to withstand full sun conditions – select plants that won't get 'burned up'
- Take advantage of shade trees present to diversify planted species for future potential seed bank



Plant Name	Water Tolerance	Light Tolerance
<i>Acer rubrum</i> , Red Maple		
<i>Iris versicolor</i> , Blue Flag Iris		
<i>Juncus effusus</i> , Soft Rush		
<i>Cercis canadensis</i> , Redbud	dry soils - 	
<i>Magnolia virginiana</i> , Sweetbay magnolia		
<i>Ilex vomitoria</i> , Yaupon Holly	dry soils - 	

Regional Considerations

- Mountains, Piedmont, Blackbelt, Coast
- Many native plants in Alabama will fair well across the state ...
- Be aware of plants that will only thrive in certain regions
 - Blackbelt prairie alkaline clay soils
 - Coastal sandy soils



Vegetation Examples

Depends on your region ...

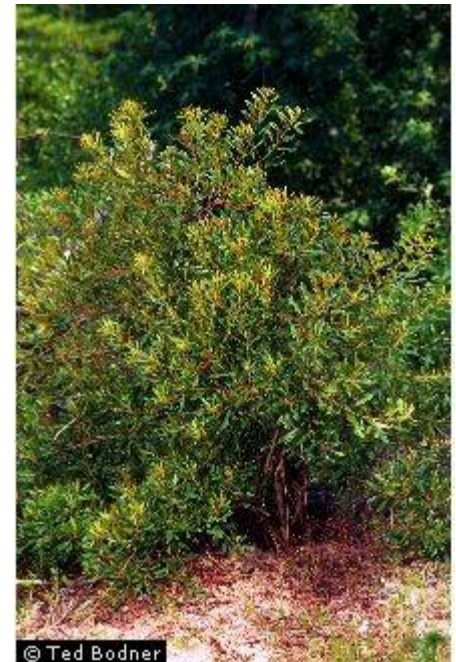
- Trees – River Birch, Cypress, Black Gum, Sycamore, Black Willow, Silky Dogwood, Sweet Bay Magnolia



Vegetation Examples

Depends on your region ...

- Shrubs / Small Trees – Tag Alder, Common Paw Paw, Spicebush, Yellow Root, Buttonbush, Wax Myrtle, Itea, Viburnum



Vegetation Examples

Depends on your region ...

- Herbaceous – Jack in the pulpit, Cardinal flower, Switchgrass, Woolgrass, Blue Flag Iris



Locating Plants

- Purchase from reputable nurseries
- Best to get local stock - greater wildlife benefit and better adapted to local climatic conditions
- May have to work with several nurseries to get the plant diversity you wish
- Some nurseries prefer wholesale only, so make arrangements with local nurseries for purchase & delivery
- **Plan early or be flexible**



Variety	Liner	1G	FullG	2G	3G	4G	5G	7G	10G	15G	20G	25G
Azaleas		🍷	🍷	🍷	🍷		🍷	🍷	🍷	🍷		
Boxwood		🍷										
Camellias, japonicas												
Camellias, sasanqua types			🍷		🍷			🍷				
Carnivorous	🍷	🍷		🍷			🍷					
Crape Myrtles								🍷		🍷		
Cypress			🍷		🍷			🍷				
Daylilies		🍷										
Ferns - Hardy & Tender		🍷		🍷			🍷	🍷				
Ferns - Allies (Selaginellas & Horsetails)		🍷										
Grasses	🍷	🍷	🍷		🍷			🍷				
Groundcovers	🍷	🍷										
Hollies		🍷	🍷	🍷	🍷			🍷	🍷	🍷		🍷
Hydrangeas												
Loropetalums					🍷							
Nandinas		🍷			🍷							
Ornamentals		🍷	🍷	🍷	🍷			🍷	🍷	🍷		
Pines						🍷		🍷		🍷		
Rhododendrons (Native Azaleas)			🍷		🍷			🍷				

Check around and see which planting type best suits your budget:

- bare root
- plugs
- container



Stream Restoration Sites

- Stream construction sites = harsh conditions
- Soil
 - Compacted
 - Little or no organic matter
 - Full sunlight (↓ soil moisture)
 - Water supply?



How can we improve vegetation establishment for stream restoration?

- Consider a mixture of larger trees and shrubs
 - 1 - 3 gallon container plants
 - Initial purchase price is higher, but they work
- Fertilize planting hole
- Match water and sun tolerance
- Minimize compaction



Vegetation Attributes

Incorporate trees, shrubs, grasses and forbs to protect waterways and diversify habitat

Benefit	Grass	Shrub	Tree
Stabilize Bank Erosion	Low / Medium	Medium / High	High
Filter Sediment & Nutrients (bound) Soluble Nutrients, Pesticides, Microbes	High Medium	Low / Medium Low	High Medium
Aquatic Habitat	Low	Medium	High
Wildlife Habitat (forest wildlife)	Low	Medium	High
Flood Protection	Low	Medium	High



Considering Your Vegetation



Plant Protection



Maintenance

Visit site often ...

- ✓ Replace dead plants
- ✓ Remove invasive, nonnative plants
- ✓ Browsing (or weed-whackers)
- ✓ Communication – please stop mowing our plants
- ✓ Planning thought - Has money been budgeted for vegetation maintenance?



Vegetation Resources

- TVA Native Plant Selector

<http://www.tva.gov/river/landandshore/stabilization/plantsearch.htm>

- USDA Plant Database

<http://plants.usda.gov/>

- National Native Plant Nursery Selector

http://www.plantnative.org/national_nursery_dir_main.htm

