Riparian Vegetation Community Assemblages:
Achieving Specific Functions While Maintaining Natural Systems

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Presentation Outline

- Introduction—a botanical and restoration ecology perspective (Reference Sites)
- Designing by function while emphasizing vegetation
- Important functions and plants that can be used to restore or enhance each function
- Specifications important to the design

A Botanical and Restoration Ecology Perspective

When considering riparian/stream restorations, it is very easy to get lost in the minutiae of stream channel characterization and bank morphology and to forget about the importance of the landscape and the vegetation lining the banks. The ecological characteristics and distribution of plant communities in a watershed influence the movement of water, sediments, nutrients, and wildlife.

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A Botanical and Restoration Ecology Perspective

Since vegetation provides some component of most riparian functions, it is very important to understand the regionally appropriate native vegetation from both individual-species and community perspectives and to select plants that provide the function-specific attributes.

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How do we Determine What is Regionally Native and Appropriate?

Examine a “Reference Site”

The Concept of a Reference Site

- Reference sites are areas in the landscape you are trying to duplicate or at the very least emulate.
- A good riparian reference site will be in “equilibrium.”
- The equilibrium is between the water contribution in the basin, the soil type, and the vegetation community – each changing with the other, each in flux, but in a way that affords the fish and wildlife the ability to adapt.

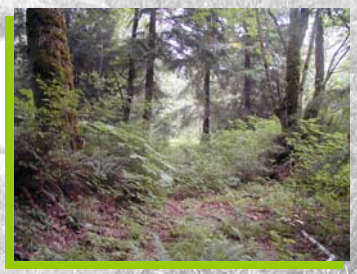
The Importance of Reference Sites

- The highest level of functional performance is NOT associated with degree of alteration.
- The highest level of performance is set by individual function. There is no universal riparian condition that has the highest performance for all functions.
- Reference sites should therefore be selected to target the function/s that will be emphasized in the project site.

Reference Site Characterization

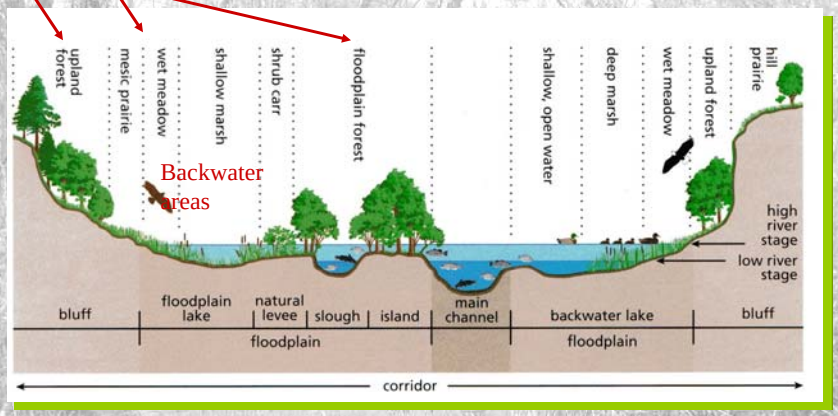
Example: Emphasize the shade function.

The reference site in this example includes a large overhanging vegetation component that can be replicated by using the same species in the same distribution and same amounts of cover. Such as: a multi-canopy community with both conifers and hardwood trees, and with a shrub understory. The associated Stream is stable and affords good Habitat.



Cross Section of a River Corridor

Transitions



Vegetation is the stabilizing force, giving character,supplying habitat

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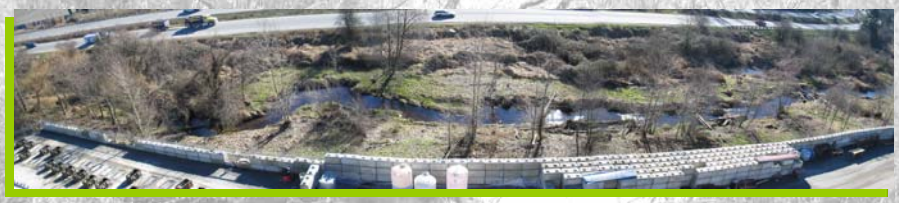
Cross Section of a River Corridor



Each riparian corridor is unique and segments vary in vegetative character across the landscape

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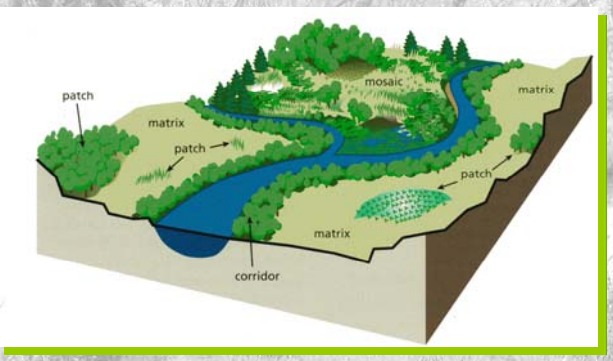
Spatial Structure of Riverine Systems



Riparian vegetation is a mosaic of many vegetative community types in the landscape.

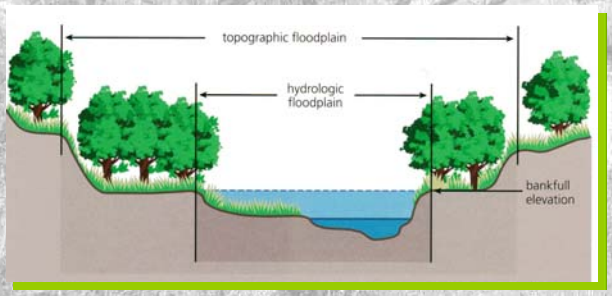
More variety = more function

Important Riparian Functions

- Flood storage
- Shading for reduction of stream temperatures
- Filtration for removing sediments and toxicants
- Nutrient cycling
- Structure (vegetation) for habitat
- Food web support
- Large woody debris production
- Habitat support
- Erosion protection

Flood storage

The floodplain provides temporary storage space for floodwaters and sediment produced by the watershed. This function is not provided by the vegetation, but can be enhanced by the vegetation by limiting the amount of emergent and willow plant material in the hydrologic floodplain.



The vegetation can also function to decrease storage through entrapment of sediments. To limit this function, limit vegetation types that filter.

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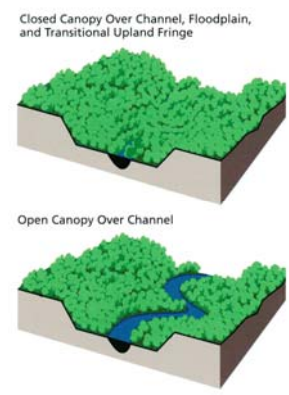
Shade



- Shading is a necessary attribute for the temperature reduction function. Important in first- to third-order streams where thermal stability is important.
- Shade provision capacity differs by species, by plant age, and across the growing season.

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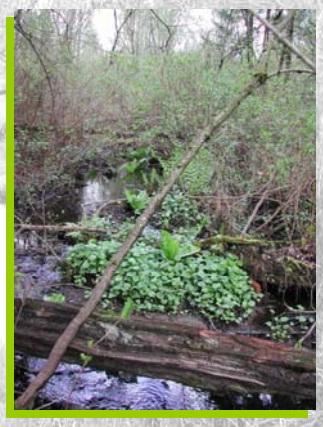
Shade

- Providing shade during the winter requires evergreen foliage.
- Good species for providing shade are those that produce abundant and/or broadleaf overhanging foliage.
- Proximity to the stream, creek, or river is also important.
- In wet-riparian conditions it is also important that plants tolerate at least periodic inundation or soil saturation.



Species "Good" for Shading

Broadleaf/ Abundant Foliage

- Bigleaf maple
- Blackcottonwood
- Quaking aspen
- Red alder
- Oregon ash
- Willow (any)
- Beaked hazelnut
- Spirea, pacific ninebark, salmonberry, rose

……..and (UGH) blackberry

Conifers (winter shading)

- Western red cedar
- Sitka spruce
- Douglas fir
- Western hemlock

Dense Emergent Plants

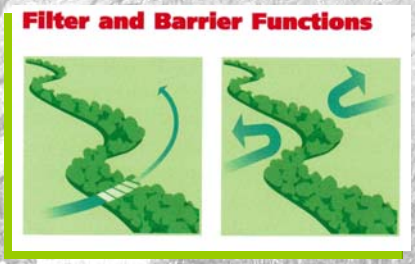
- Grasses, sedges and rushes

Filtration and Barrier Functions

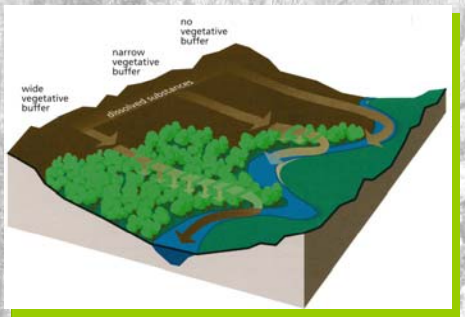
Riparian vegetation can act to physically separate the stream from a water source, or it can filter the water.

Which is it?

It depends, edge shape and vegetation type are important.



The Importance of Buffers in Water Quality



- The width of the vegetated buffer on riparian systems influences filter and barrier functions: **physical filtration, root absorption, soil adsorption (OM and clay)**

Filtration for Removing Sediments and Toxicants

- Thin-stemmed emergent vegetation (e.g., grasses, sedges, rushes, and some herbs) excel at filtration and nutrient/toxicant uptake.

Emergent Species and Filtration

Good for Filtration

Dense stands of:

- Small-fruited bulrush
- Any sedge, grass, or rush
- Burreed
- Spikerush
- Knotweeds (polygonums)
- Water-parsley

Good for nutrient/ toxicant uptake

(Fast growing plants and high biomass producers)

- Cattail
- Veronicas
- Aquatic grasses,sedges
- Duckweed, pondweed, water purslane,water-ferns

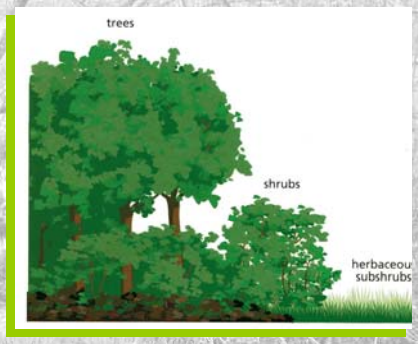
and …many (ugh)weeds (reed canarygrass, purple loosestrife, Japanese and giant knotweed, !

Nutrient/Toxicant Uptake - the double-edged sword

- Be aware that any fast-growing aquatic that takes up nutrients and toxicants will also remove oxygen from the water column. **THIS IS BAD FOR FISH**
- The biomass produced that is sequestering the nutrients and toxicants **NEEDS TO BE EXPORTED FROM THE SYSTEM BEFORE FALL** senescence or it will simply release it all once the plant dies and breaks down.

Structure (Vegetation) for Habitat

- Canopy layers—the number and characteristics of each layer can be crucial to supplying the correct habitat.



Structure (Vegetation) for Habitat

- Edge and interior habitat is also important.
- The vegetation communities can be highly variable - especially in the transition and floodplain zones.

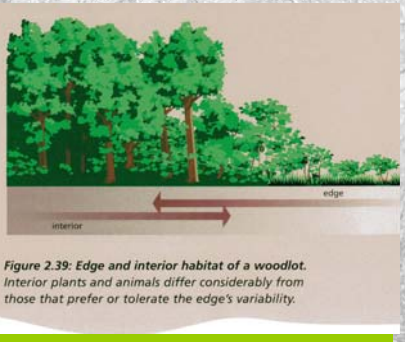


Figure 2.39: Edge and interior habitat of a woodlot. Interior plants and animals differ considerably from those that prefer or tolerate the edge's variability.

Trees and Shrubs for Structure

Conifers
- Upland—hemlock, Douglas fir
- Wetland—Western red cedar, Sitka spruce

Deciduous
- Upland—bigleaf maple
- Wetland—Western red cedar, Sitka spruce

Shrubs
- Upland—Vine maple, hazelnut, salal, Indian plum, thimbleberry, red and blue elderberry. snowberry, red huckleberry
- Wetland—twinberry, crab apple, devil's club, Pacific ninebark, ribes, roses, salmonberry, spirea, willows

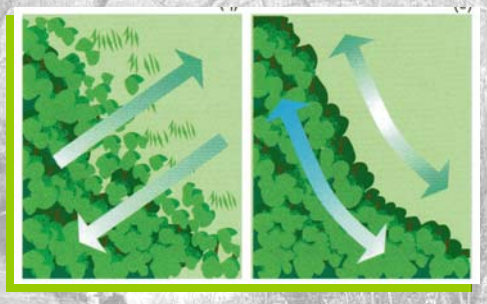
Plantings Along a Stream Corridor

Plantings should take into consideration the location in the watershed - you would have different strategies in the:

- Headwaters (emphasize LWD and OM production for export)
- Transition zone (emphasize stabilizing vegetation, usually the most variable vegetation communities)
- Downstream deposition zone (low-gradient, sediment tolerant plantings, highly productive because of nutrients)

Habitat Support

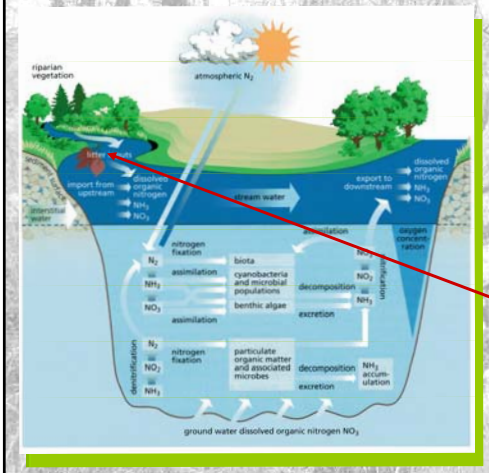
Edge effects can be HUGE in either attracting wildlife or providing a barrier to passage



Edges vs. Interiors

- Interior habitats are generally more stable while edges are exposed to highly variable environments.
- Edges filter the interior from disturbance.
- There is no “good or bad”, both are necessary for overall habitat to be provided.

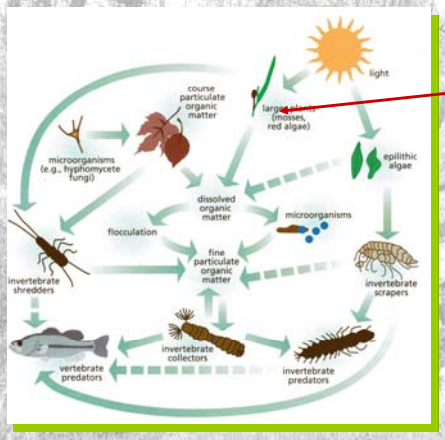
Nutrient Cycling



Nutrient cycling across a stream corridor

The cycle is complicated but can be replicated. Typically, we target a portion of the cycle, e.g. biomass production, in our design (through planting) and then the rest of the cycle “tags along.”

Food Web Support



- Plants provide the material to begin the cycle.
- Deciduous species are the key here.

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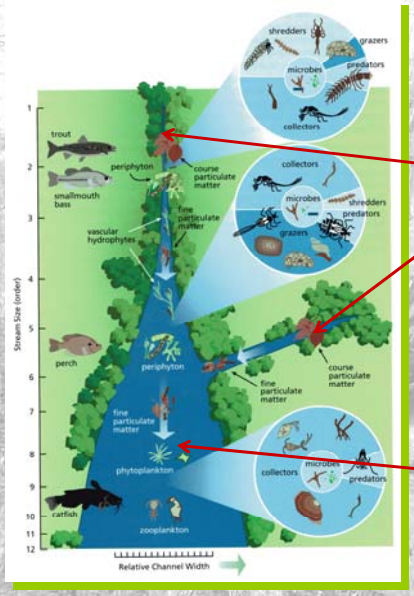
Food Web Support



- Backwater channels are the important areas for biomass production and organic matter deposition and export.
- Larger order streams depend on the OM exported.

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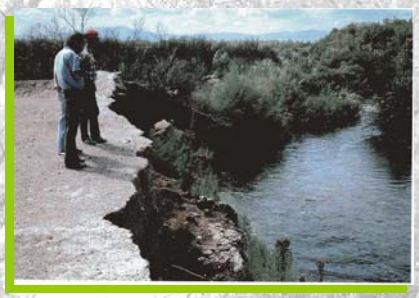
Large Woody Debris Production

Trees of any kind planted right next to the bank, especially in the headwater portion of the stream corridor. This is a very important element of the food web too!

Erosion Protection

The ability of plants to stabilize the banks of a creek, stream, or river cannot be overstated.

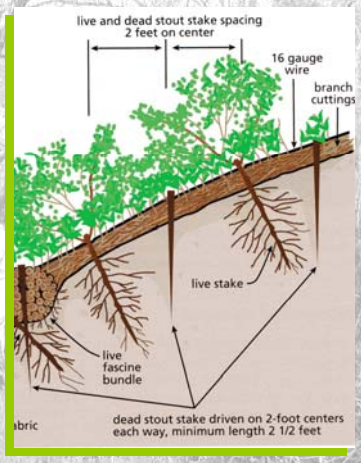


Bioengineering techniques are under utilized!

Erosion Protection

Planting stakes of rapidly growing and rapidly rooting species can stabilize a creek bank in just a few months.

Good species for this include **willows, dogwood, spirea, roses, and cottonwood.**



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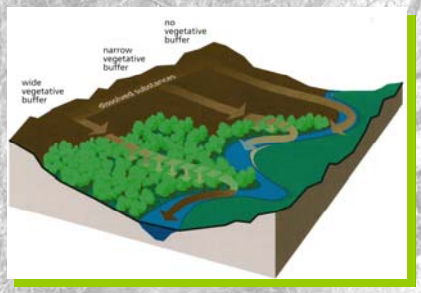
Buffers and Erosion Protection



- The wider the buffer, the more shielded a river, stream, or creek is from high-velocity surface water flows.
- Densely-growing, thickly rooted vegetation is better at affording protection.

"Good" Species for Erosion Protection

Shrubs

- Willows- any species
- Redstem dogwood
- Western crabapple
- Spirea
- Black twinberry
- Pacific ninebark
- Rose-Nootka & peafruit
- Salmonberry

Herbs

Any dense stands of grasses or sedges:

- Water sedge, bearded sedge, slough sedge, beaked sedge
- Spikerushes
- Bulrushes
- Mannagrass, bentgrass, foxtails, reedgrass, and (ugh) reed canarygrass

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Some Notes on Specifications

Designs should also include specifications for important details such as:

- Plant materials
- Planting techniques
- Planting distribution and patterns
- Installation timing
- Substrate testing and necessary soil amendments
- Antidessicant amendments for
- Antiherbivory netting and chemicals

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Thanks to the Following Publication for Providing Graphics:

Federal Interagency Stream Restoration Working Group. 1998. *Stream Corridor Restoration. Principles, Processes, and Practices.*