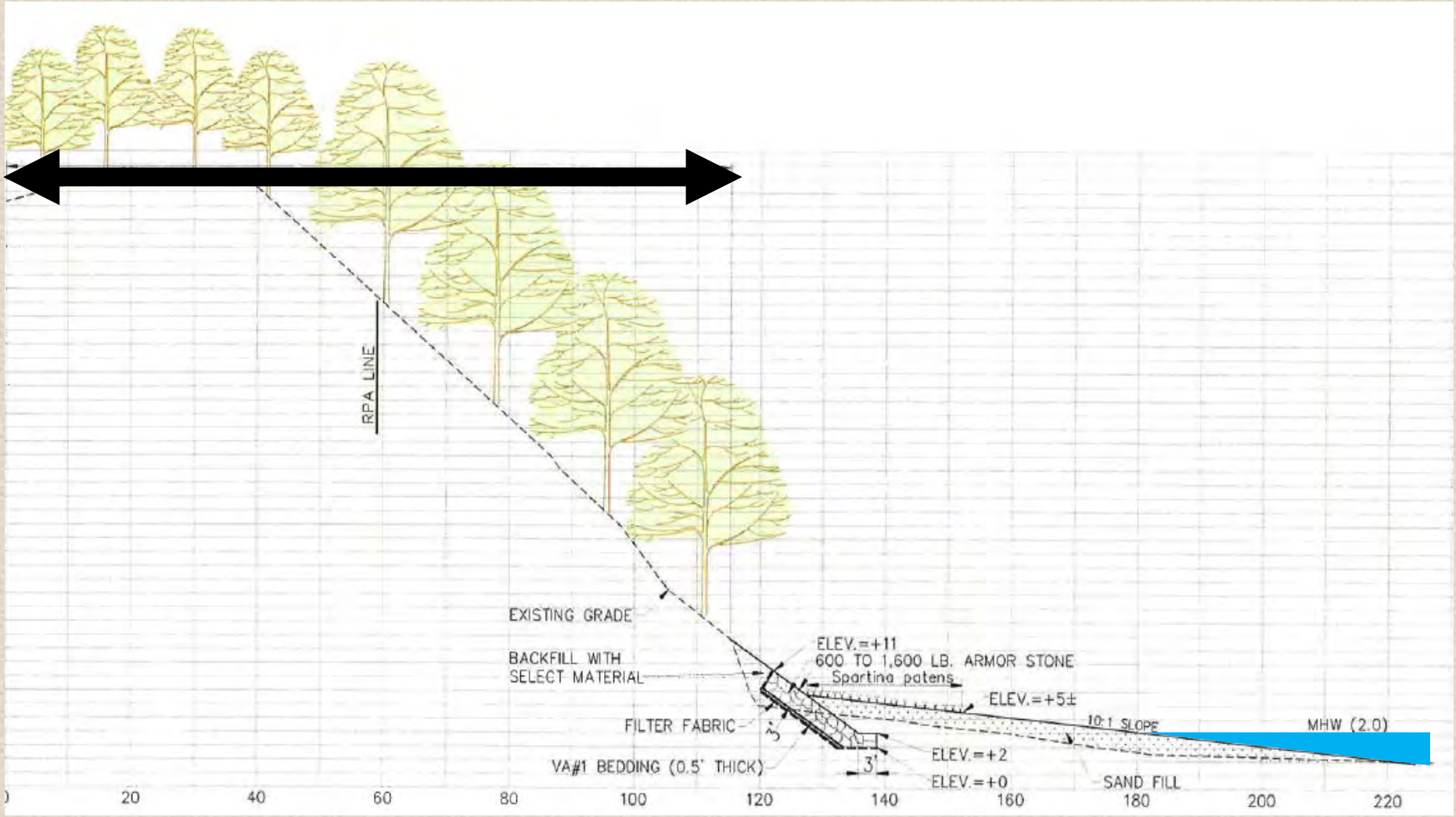
Above the Rock:

Native Landscaping in the Riparian Buffer

Doug DeBerry

Riparian Buffer Zone



Functional

Degraded

What is "Functional"?

- **Ecosystem function**: The physical, chemical, and biological processes or attributes that contribute to the self-maintenance of an ecosystem (e.g., nutrient cycling, biodiversity, habitat, primary productivity)

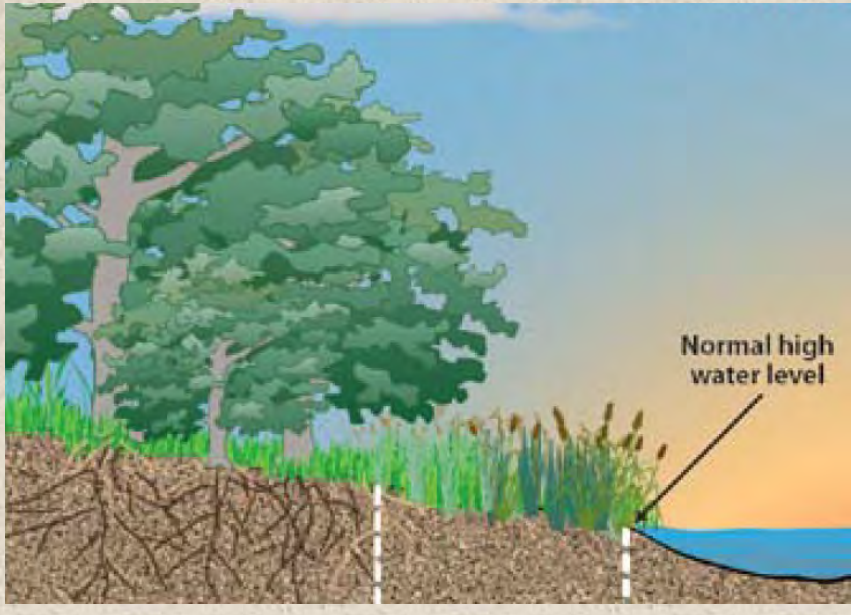
- Ecosystem structure: The 3-dimensional aspect of an ecosystem that gives it shape and physical character (e.g., vegetation type/height, shoreline complexity)

Functions of Riparian Buffers

- Erosion reduction
- Sediment and pollution filtration
- Water temperature moderation
- Habitat provision for wildlife
- Water storage and flood reduction ("flood-flow desynchronization")

Erosion Reduction

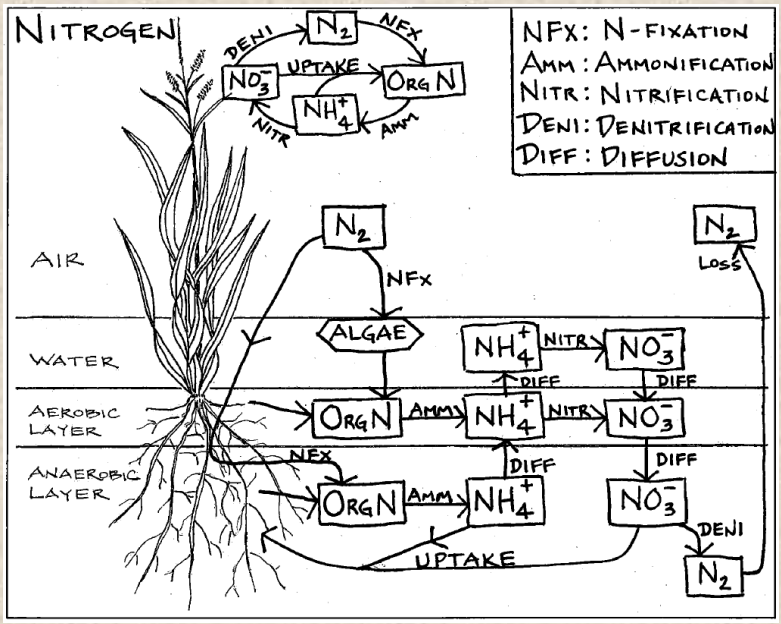
- Conserve topsoil
- Plant roots strengthen the bank and adj slope by binding topsoil to more stable substrata
- Increases soil cohesiveness and adds a tensile strength that can resist shear stresses



- Intercepts rainfall and physically slows/disrupts upland runoff – reduces energy at shoreline interface

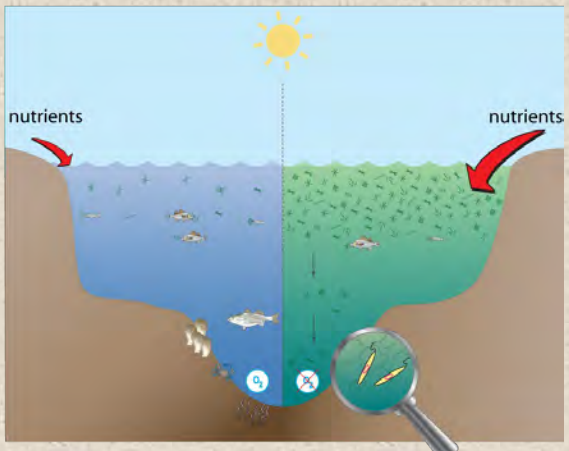
Sediment/Pollution Filtration

- Vegetation = physical barrier to sediment-laden stormwater – traps sediments and immobilizes pollutants/nutrients bound to soil particles (e.g., phosphorus)
- Plants remove nutrients and other pollutants by direct uptake – soil organic matter increases bacterial respiration which removes nutrients



Water Temperature Moderation

- Shading and thermal absorption capacities of vegetation increase thermal buffering in adjacent water bodies
- Important for shallow near-shore areas prone to algae growth

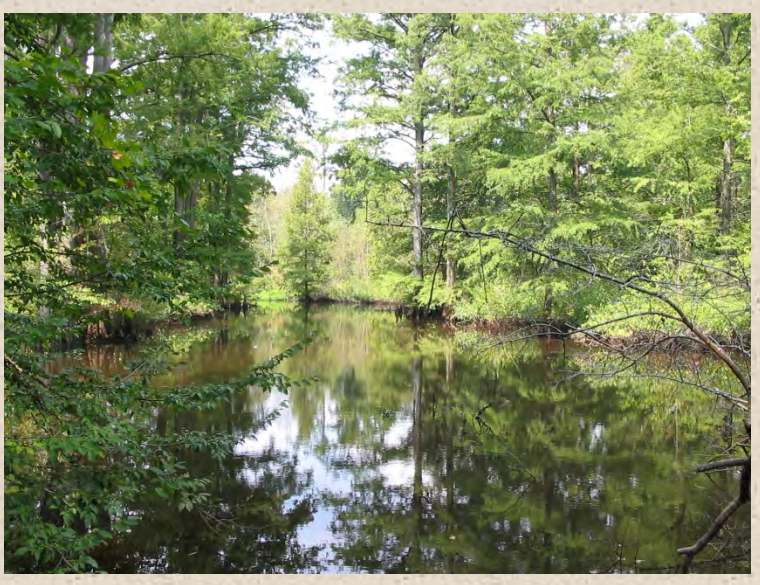


Wildlife Habitat

- Structure for animal nesting, refuge, and roosting/ resting, and core habitat for shoreline ecotone species (e.g., shorebirds and amphibians)
- Forage for terrestrial fauna
- Structure and food for aquatic fauna (e.g., large woody debris and biofilms on plant residues)
- Important link between producers and consumers
- Migration corridors

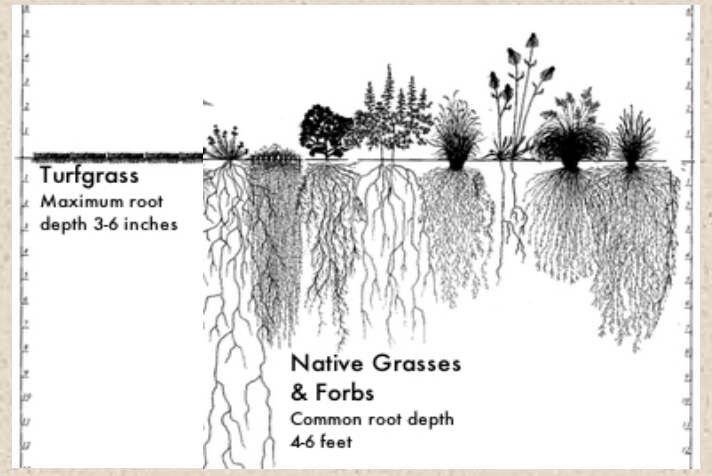
Water Storage and Flood Reduction

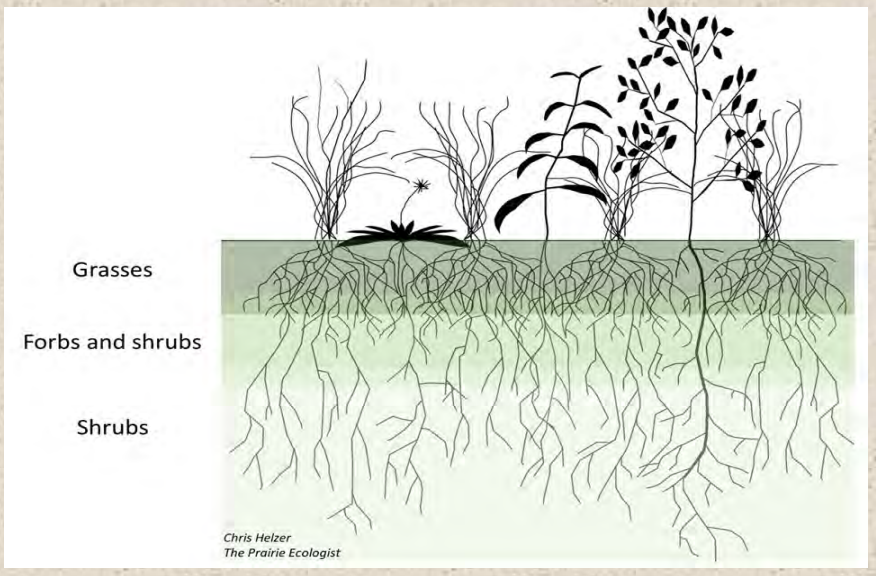
- Absorb rainfall, which recharges groundwater and slows timing of stormwater release
- Reduce energy of floodwaters during storm surges and spreads flow out over time (“flood-flow desynchronization”)



Forest or Turfgrass?

- Forests provide substantially more ecosystem functions in riparian zones vs. turfgrass



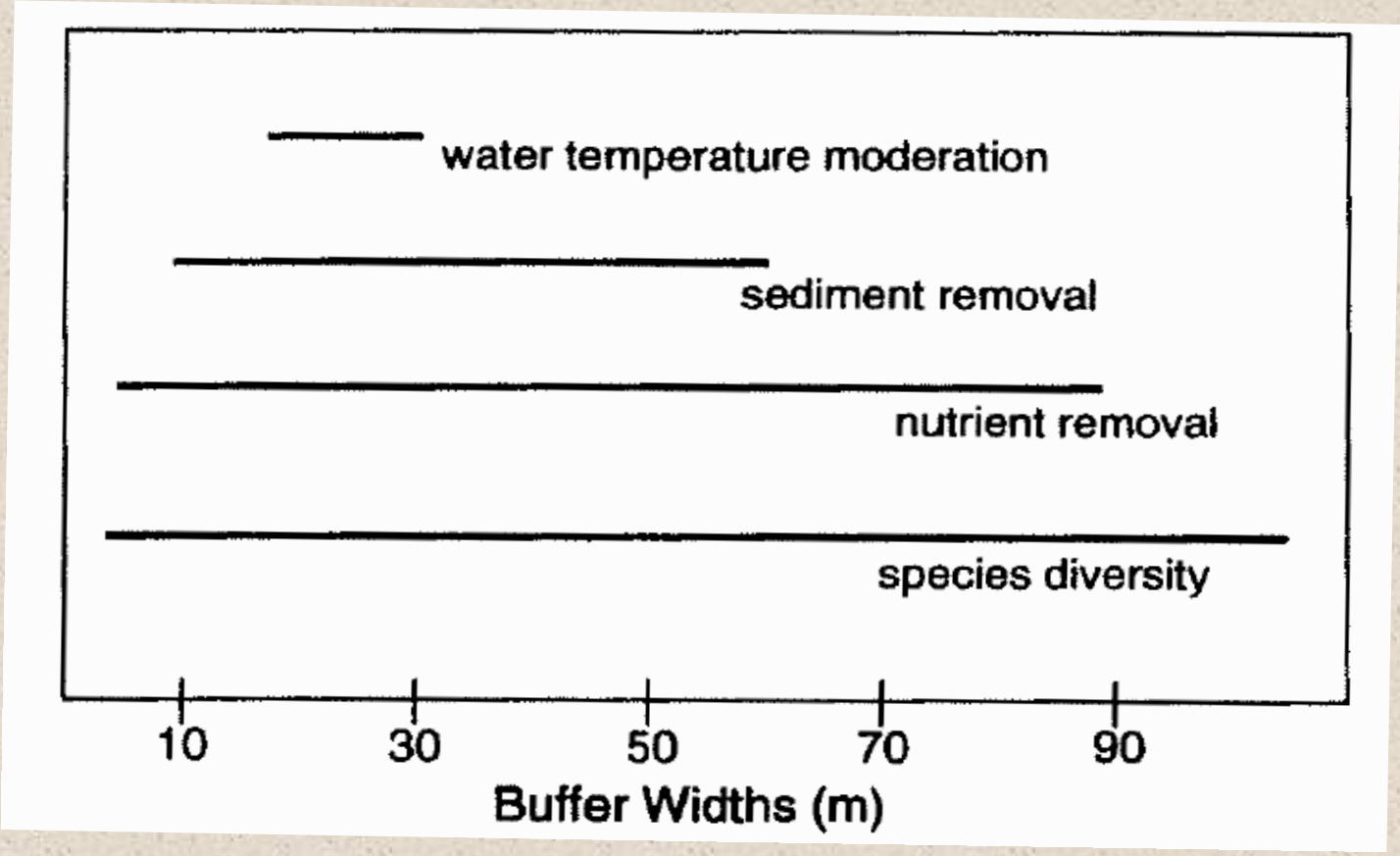


Turfgrass Buffer

Turfgrass Buffer

Forested Buffer

How Wide?

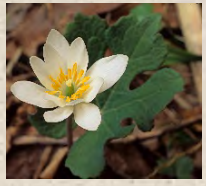


(Feet: 33 99 165 230 295)

From Castelle et al. 1994

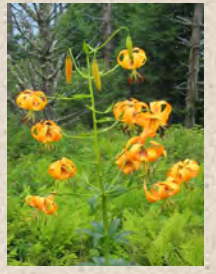
Resource Factor	Min. Buffer Width	Citation	Region/Comments
General recommendation for stream and wetland protection	**15m** (~50ft)	Castelle et al. (1994)	PacNW region (WA) but review is comprehensive
Recommended for resource protection	**~15m** (50ft)	Shisler et al. (1987)	New Jersey. Study conducted on wetlands in Coastal Plain. Recommendation considers development intensity.
Aquatic resource functions after tree harvest (clearing/logging)	**15m** (~50ft) **20m** (66ft)	Lee et al. (2004)	U.S. and Canada, but Mid-Atlantic well-represented. Buffer widths reported as means for intermittent (15m) and perennial (20m) streams
Sediment retention	**9m** (30ft)	Wenger (1999)	Georgia, but review based primarily on vegetative filter strip studies in Midwest agricultural settings.
Nutrient removal	**19m** (62ft)	Peterjohn and Correll (1984)	Maryland. Suggested buffer width results in greater than 80% removal efficiency for both nitrogen and phosphorus.
Plant species diversity	**10-30m** (33-98ft)	Spackman and Hughes (1995)	Vermont. Results varied, but range is reported as minimum width necessary to capture >90% of plant species within the corridor.
Bird diversity	**75-175m** (246-574ft)	Spackman and Hughes (1995)	Vermont. Results varied, but range is reported as minimum width necessary to capture >90% of bird species within the corridor.
Mammal diversity	**10m** (33ft)	Spackman and Hughes (1995)	Vermont. Width based on portion of buffer where most mammals were observed traveling.
Nesting habitat for forest interior birds	**100m** (328ft)	Keller et al. (1993)	Maryland and Delaware
Reptile and amphibian habitat	**142m** (466ft)	Semlitsch and Bodie (2003)	Nationwide, but summarizing multiple studies from Mid-Atlantic states

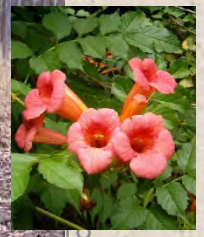
Why Native?



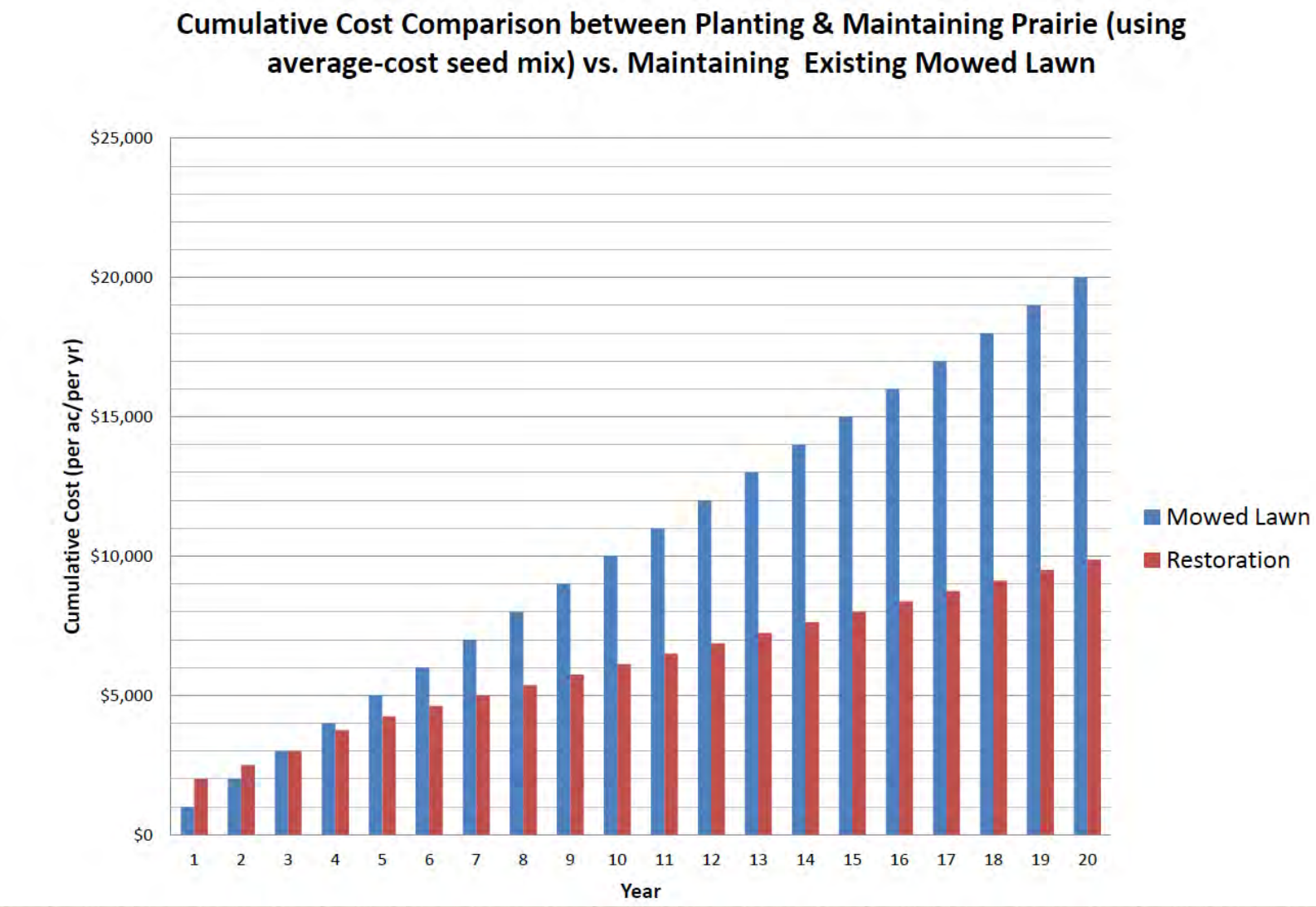
Native species:

- Are hardy and well adapted to local environmental conditions
- Maintain and improve soil fertility
- Reduce erosion and runoff
- Provide habitat for native wildlife
- Increase pollinator services for surrounding agricultural lands
- Contribute to the overall health of natural communities
- Require less fertilizer and pesticide
- Help sequester more carbon than turfgrass
- Contribute to the maintenance of biodiversity on the landscape





What About the Cost?



Integrated Vegetation Management (IVM)

EPA Definition:

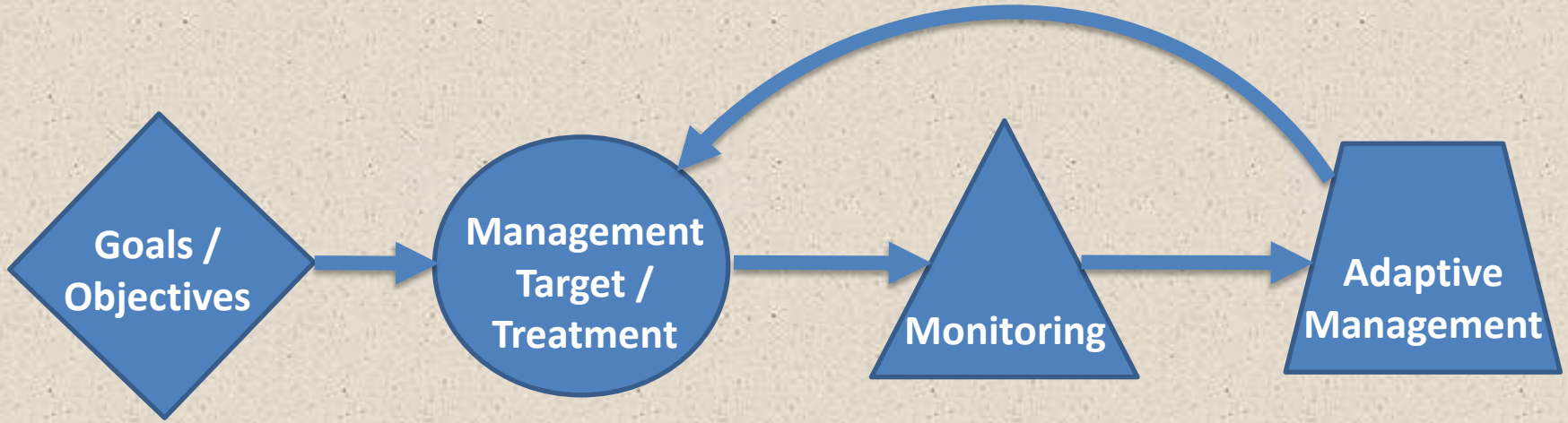
"**…the practice of promoting desirable, stable, low-growing plant communities that will resist invasion…through the use of appropriate, environmentally-sound, and cost-effective control methods.**"

(https://www.epa.gov/pesp/integrated-vegetation-management-fact-sheet)

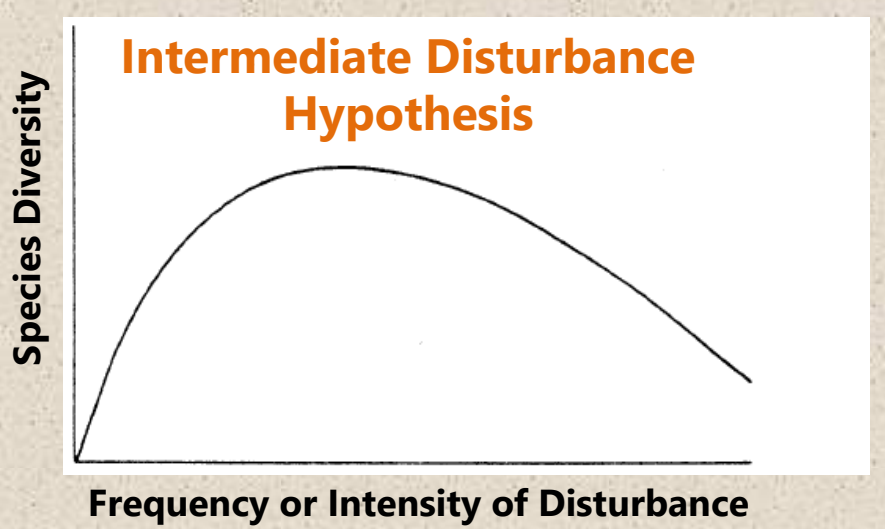
Techniques:

- **Chemical**
- **Biological**
- **Cultural**
- **Mechanical**
- **Manual**

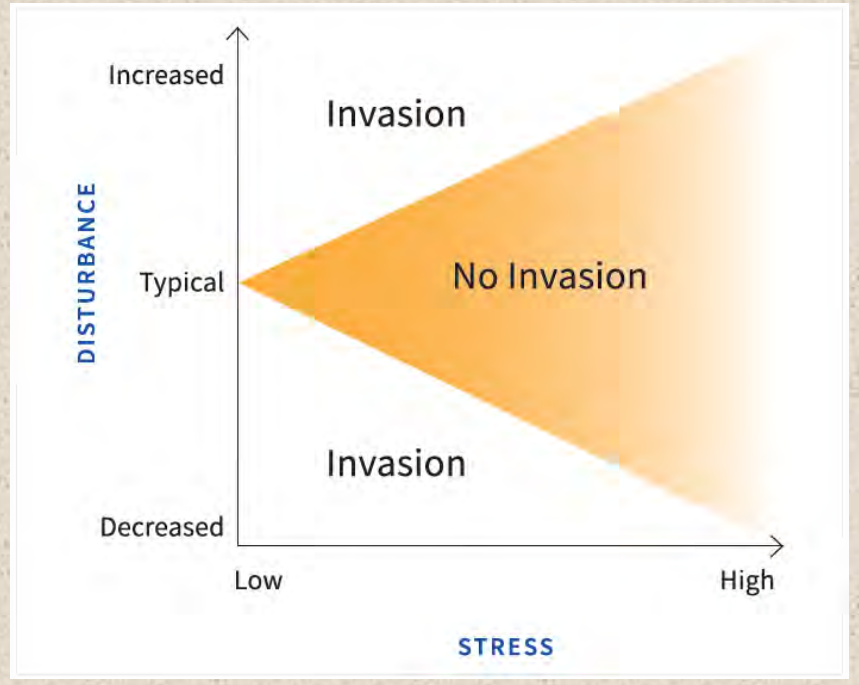
IVM is "…a treatment that minimizes its own use in the long run…" (Nowak and Ballard. 2005. J. Arboric. 31:28-37)



IVM and Invasion Ecology



Based on: Connell 1978. Science 199:1302-1310.



Based on: Alpert et al. 2000. Perspect. Plant Ecol. Evol. Syst. 3:52-66.

Relative intensity of STRESS →

Relative intensity of DISTURBANCE ↓

	Low	High
Low	Competitive strategy (**C**)	Stress-tolerant strategy (**S**)
High	Ruderal strategy (**R**)	No viable strategy (X)

Based on: Grime 1977. American Naturalist 111:1169-1194.

IVM maximizes the potential for native species richness by exploiting the stress-disturbance dynamic

Two Years After Restoration…

* Relative cover of native species 92.6%

Scientific Name	Common Name	Family	N/I*	PLOTS																		Relative Cover by Species
				1-1	1-2	1-3	2-1	2-2	2-3	3-1	3-2	3-3	4-1	5-1	5-2	5-3	6-1	6-2	6-3	7-1	7-2	8-1	9-1	9-2	
Sorghastrum nutans (L.) Nash	**Indian Grass, Yellow Indian Grass**	**Poaceae**	**N**	0.5	63	85	3	85	38	63	15	0.5	38	38	15	63	98	15	63	0.5	85	85			35.15%
Symphyotrichum pilosum (Willd.) Nesom var. pilosum	Frost Aster, White Old-field Aster, Awl Aster	Asteraceae	N		38	0.5			85				3		63	38	3	63	63		15				15.30%
Panicum virgatum L.	Switchgrass	Poaceae	N		38	3	85				63			38					15						9.96%
Eragrostis spectabilis (Pursh) Steud.	Purple Lovegrass, Tumblegrass	Poaceae	N	0.5				15		85	3	15		63											7.47%
Chamaecrista fasciculata (Michx.) Greene var. fasciculata	**Common Partridge-pea**	**Fabaceae**	**N**	3	15	0.5			15				63		0.5	38			3						5.68%
Eupatorium serotinum Michx.	Late Thoroughwort	Asteraceae	N	15	3				15						63					38					5.52%
Cynodon dactylon (L.) Pers. var. dactylon	Bermuda Grass	Poaceae	I																	85					3.50%
Conyza canadensis (L.) Cronq. var. canadensis	Horseweed, Common Horseweed	Asteraceae	N	63																		15			3.21%
Lespedeza cuneata (Dum.-Cours.) G. Don	Sericea Lespedeza, Chinese Lespedeza	Fabaceae	I		3	3	3	0.5	0.5	3	3	15	15	0.5	3	3		15	3						2.90%
Rudbeckia hirta L.	**Black-eyed Susan**	**Asteraceae**	**N**	3	3			3	3	15	15	3	15									0.5			2.49%
Ulmus rubra Muhl.	Slippery Elm, Red Elm	Ulmaceae	N	38	3	3	3				3	3	0.5		3	3					0.5				2.47%
Andropogon gerardii Vitman	**Big Bluestem, Turkeyfoot**	**Poaceae**	**N**		15		15			15				3						3					2.10%
Strophostyles helvola (L.) Ell.	Beach Bean, Trailing Wild Bean, Amberique Bean	Fabaceae	N																	15					0.62%
Ampelopsis brevipedunculata (Maxim.) Trautv.	Porcelain-berry, Amur Peppervine	Vitaceae	I																	15					0.62%
Asclepias syriaca L.	**Common Milkweed**	**Apocynaceae**	**N**								15														0.62%
Ulmus alata Michx.	Winged Elm	Ulmaceae	N	15																					0.62%
Oxalis dillenii Jacquin	Southern Yellow Wood-sorrel	Oxalidaceae	N				0.5								0.5	3		0.5							0.19%
Desmodium glabellum (Michx.) DC.	Dillenius' Tick-trefoil	Fabaceae	N				0.5						3												0.14%
Schizachyrium scoparium (Michx.) Nash var. scoparium	**Little Bluestem**	**Poaceae**	**N**																			3			0.12%
Cynanchum laeve (Michx.) Pers.	Honeyvine, Sandvine	Apocynaceae	N																	3					0.12%
Persicaria pensylvanica (L.) M. Gomez	Pennsylvania Smartweed, Pinkweed	Polygonaceae	N																	3					0.12%
Andropogon virginicus L. var. virginicus	**Broomsedge, Broomstraw, Sedge Grass, Sage Grass**	**Poaceae**	**I**																	3					0.12%
Kummerowia striata (Thunb.) Schindl.	Japanese-clover	Fabaceae	I																		3				0.12%
Solanum carolinense L. var. carolinense	Horse-nettle, Carolina Horse-nettle	Solanaceae	N															3							0.12%
Setaria faberi Herrm.	Nodding Bristlegrass, Japanese Bristlegrass	Poaceae	I												3										0.12%
Bouteloua curtipendula (Michx.) Torr. var. curtipendula	**Side-oats Grama**	**Poaceae**	**N**									3													0.12%
Dichanthelium clandestinum (L.) Gould	**Deer-Tongue Grass**	**Poaceae**	**N**								3														0.12%
Ambrosia artemisiifolia L.	Common Ragweed	Asteraceae	N					3																	0.12%
Elymus virginicus L. var. virginicus	**Virginia Wild Rye**	**Poaceae**	**N**					3																	0.12%
Acalypha rhomboidea Raf.	Common Three-seeded Mercury, Common Copperleaf	Euphorbiaceae	N		0.5											0.5									0.04%
Echinochloa muricata (Beauv.) Fern. var. muricata	Rough Barnyard Grass	Poaceae	N											0.5											0.02%
Morus alba L.	White Mulberry	Moraceae	I				0.5																		0.02%
			Total Cover By Plot:	138	182	95	111	110	157	181	120	39.5	138	143	151	149	101	96.5	147	166	104	104			
			Bare Ground:																						

* N = Native; I = Introduced
Planted Species in Bold Type
Invasive Species in Red Type

More Info on Natives?

- Chesapeake Bay Foundation (https://www.cbf.org/join-us/more-things-you-can-do/in-your-yard/native-plants.html)
- Maryland Extension (https://extension.umd.edu/resource/recommended-native-plants-Maryland)
- USFWS (https://www.fws.gov/chesapeakebay/pdf/NativePlantsforWildlifeHabitatandConservationLandscaping.pdf)
- Chesapeake Bay Native Plant Center (https://www.nativeplantcenter.net/)
- Maryland Plant Atlas (https://www.marylandplantatlas.org/index.php)
- Digital Atlas of Virginia Flora (http://vaplantatlas.org/index.php?do=start)
- VA DCR (https://www.dcr.virginia.gov/natural-heritage/nativeplants)
- Maryland Native Plant Society (https://mdflora.org/)
- Virginia Native Plant Society (https://vnps.org/)
- *Flora of Virginia* App (https://floraofvirginia.org/flora-app/)

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