

Native Vegetation Investments Pay Conservation Dividends

Presented by Jef Hodges
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Why are we interested in native vegetation?



- Key strategy - increasing adoption of native vegetation.
- NBCI leading Natives First.

Today's Webinar:



- Review root system facts.
- Native vegetation roles in ecosystem services.
- Look at some economic comparisons.

References used throughout this presentation are in the handout.

Native vegetation's roots are the foundation of their benefits



<https://www.jimrichardsonphotography.com>

Rooting depth of select grasses

Grass species	Depth	Grass species	Depth
Switchgrass	8 - 11 ft.	Big Bluestem	5 - 7 ft.
Indiangrass	5 - 5.5 ft.	Little Bluestem	4.5 - 5.5 ft.
Sideoats Grama	4 ft.	Buffalograss	4 - 6 ft.
Western Wheatgrass	6 - 8 ft.	Junegrass	1.5 - 2 ft.

Weaver, 1954

Rooting depth of select forbs

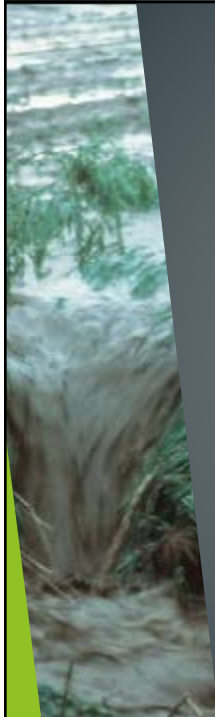
Forb species	Depth	Forb species	Depth
Stiff Sunflower <i>Helianthus laetiflorus</i>	7 ft.	Stiff Goldenrod <i>Solidago rigida</i>	5 ft.
Smooth Goldenrod <i>Solidago missouriensis</i>	5 - 7 ft.	Compassplant <i>Silphium laciniatum</i>	9 - 14 ft.
Dotted Gayfeather <i>Liatis punctata</i>	7 - 16 ft.	Pale Purple CF <i>Echinacea pallida</i>	6 - 8 ft.
Prairie Clovers <i>Dalea sp.</i>	5.5 - 6 ft.	Lead Plant <i>Amorpha canescens</i>	12 - 16.5 ft.

Weaver, 1954



Up to 70% total plant biomass is below ground.

- In upper 12 inches
 - Big bluestem 5.4 tons/acre
 - Little bluestem 4.4 tons/acre
(Weaver, 1954)
- As much as a third of root biomass dies and is replaced annually.



Soil conservation

- Rainfall interception
 - Native vegetation: from 47 to 87% interception depending on intensity and season. (Clark, 1940)
 - Holds from 50 to 97%. (Weaver, 1954)
 - Function of leaf surface area



Soil conservation - Filter strips

- Reduced flow velocity
 - Stiff stemmed, resistant to hydraulic pressure. (Grimshaw and Helfer, 1995)
 - Stem resistance dissipates energy, encourages ponding - infiltration.
- Effective longer
 - Not easily covered with sediment. (Dabney et al. 1993)

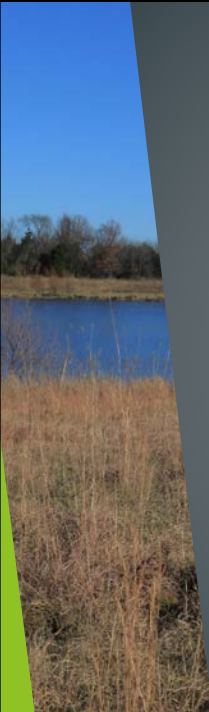


Soil conservation - Soil holding capacity

- Deep fibrous root systems:
 - Hold soil
 - Prevent slope failure.



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Water quality - Sediment

Sediment reduction

- 95% (Schulte et al., 2017, Lee et al., 2003)

Sediment removal - Lee et al., 1999

Compared 6 m and 3 m wide buffers of switchgrass to brome, timothy, tall fescue mixture.

- Removed 5.5 and 11.3% more sediment.*

STRIPS project, Iowa State University
(<https://www.nrem.iastate.edu/research/STRIPS/>)

Water quality - Nutrient

Schulte et al., (2017)

- 77% less N & P in surface water

Lee et al., (1999)

Compared 6 m and 3 m wide buffers of switchgrass to brome, timothy, tall fescue mixture.

- Removed 24.5 and 5.5% more total N
- Removed 11.7 and 12.3% more total P

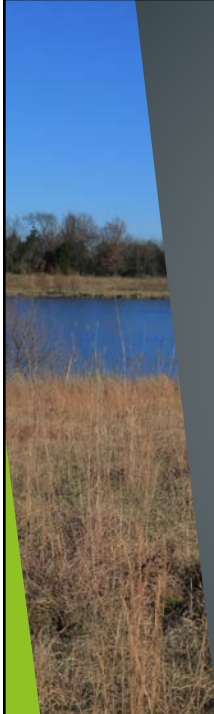
Water quality - Nutrient

Lee et al., 2003

Compared 23 ft. wide switchgrass to 53.5 ft. wide SW/woody buffers.

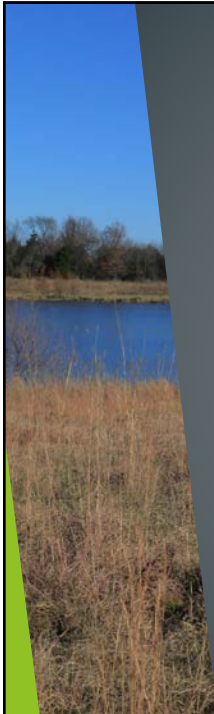
Percent reduction in nutrient concentration

Buffer type	Width	TN	NO ₃ -N	TP	PO ₄ -P
Switchgrass	23 ft.	80%	62%	78%	58%
SW/woody	53.5 ft.	94%	85%	91%	80%



Water quality - Pesticides

- Neonicotinoids (Hladik et al., 2017)
 - 68% lower concentration in groundwater
 - 96% lower concentration in soil @ footslope
 - 37 to 100% less in surface runoff



Water quality - Pesticides

- Common agricultural herbicides
 - Atrazine
 - Alachlor (Lasso, Lariat)
 - Metolachlor (Dual, Bicep)
 - Pendimethalin (Prowl)

Belden et al. (2004)

- Atrazine and alachlor degraded rapidly
- Metolachlor and pendimethalin were significantly reduced.



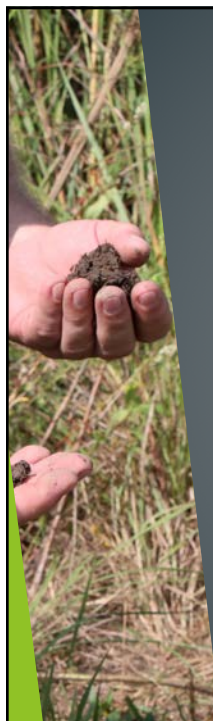
Water quality - Summary

- Native filter strips/buffers:
 - Remove more sediment,
 - Remove more nutrients,
 - Are functional longer, and
 - Require less width.



Air Quality

- Native vegetation sequesters more carbon.
 - Nichols et al. (2009) arbuscular mycorrhizal fungi and glomalin enhance carbon sequestration.
 - Greater amounts of glomalin under native vegetation. (Nichols and Millar, 2013)
 - Glomalin reduces decomposition of unstable organic carbon compounds. (USDA-ARS, 2008)




Soil Health

- Glomalin supports soil aggregation. (USDA-ARS, 2008)
- Prairie vegetation strips increase soil organic carbon and total nitrogen in soil. (Perez-Suarez, 2014)
- Prairie grasses able to phytoremediate PAH in the soil. (Aprill & Sims, 1990, Cofield et al. 2007)
- Soils under native vegetation have high soil organic matter. (Weaver, 1954)



Forage

- Increased summer forage production
- Summer weight gains (Keyser et al. 2011a, KSU.1981, Mitchell & Anderson. 2008, Burns & Fisher. 1999)
- Reduced acres needed for hay production. (Keyser et al. 2011b)
- Avoid endophyte infected tall fescue.
- Drought tolerant.



Biomass

- Doesn't compete with food crops.
- No annual cultivation/planting cycle.
- Out yield many biomass crops. (Hopkins et al. 1995, McLaughlin et al. 1999)
- Native vegetation sequesters carbon.



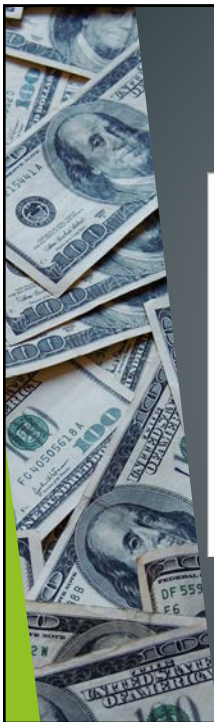
Wildlife

- Native grasses and forbs provide cover.
- Seeds, leaves and plant parts provide food.
- Native vegetation provides material/structure for nesting/bedding.



Economics - Ecosystem Services

- Value of ecosystem services - lack of research quantifying the value of ecosystem services.
 - Buffers and vegetative filter strips ≈ \$2.5 billion dollars. (Helmert et al., 2006)



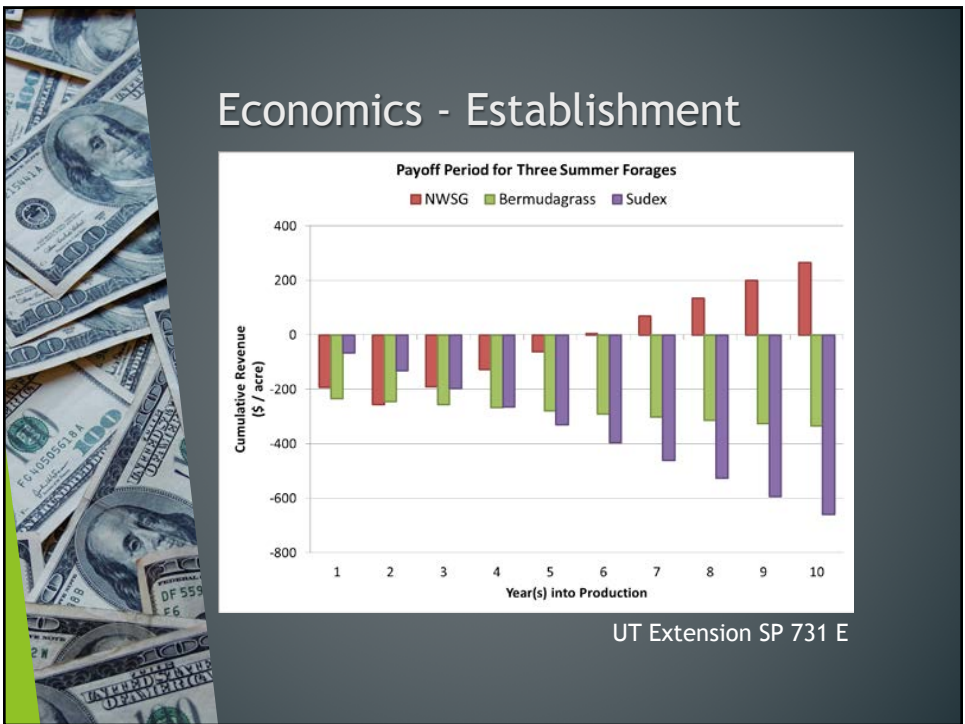
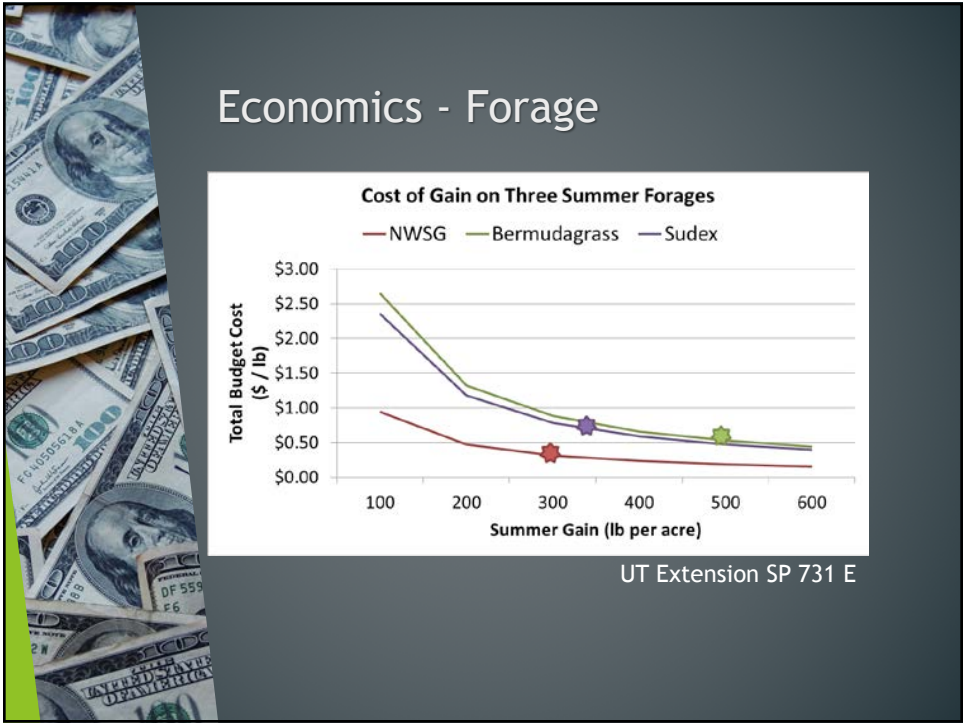
Economics - Forage


Production Costs for Four Common Mid-South Hay Crops



Hay Crop	Hay Yield (tons / acre)	Total Budget Cost (\$ / ton)
NWSG	4.0	~65
Bermudagrass	6.0	~80
Sudex	3.5	~90
Tall Fescue	2.5	~125

UT Extension SP 731 E





Economics - Establishment

Material	Rec. seeding rate	Unit cost	Cost range	N fert.	End-cost range
Estancia Tall Fescue	20 - 25 lbs./acre	\$3.50 bulk pound	\$70 - \$87.50	\$21.00*	\$91 - \$108.50
Big bluestem	8 - 10 lbs./acre	\$8.00 PLS pound	\$64 - \$80	\$0	\$64 - \$80
Indiangrass	8 - 10 lbs./acre	\$14.50 PLS pound	\$116 - \$145	\$0	\$116 - \$145
Switchgrass	4 - 8 lbs./acre	\$10 PLS pound	\$40 - \$80	\$0	\$40 - \$80

*50 units of N @ .42/unit. (Recommendation of U of K Extension publication; N cost based on call to local supplier.)



In Summary - Multiple Benefits

- Soil Conservation
 - Slow water flow
 - Hold soil
- Water Quality
 - Remove sediment, nutrients, pesticides, PAH
- Air Quality
 - Sequester carbon
- Soil Health
 - Build soil
- Economical Forage & Biomass
- Wildlife Habitat

Native Vegetation Investments Pay Conservation Dividends

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