To Fence or Not to Fence (Out a Stream): Planning Considerations and Design Options for Prescribed Grazing Systems and Functional Riparian Buffers

Presenter(s):

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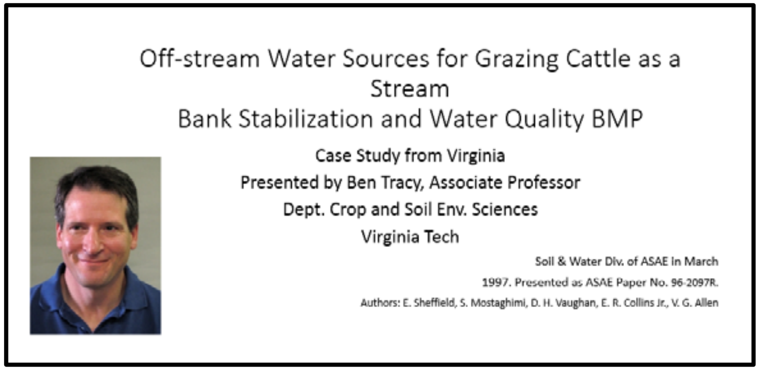

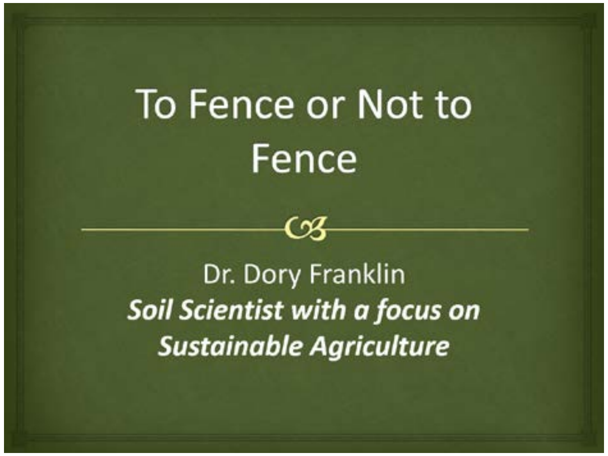


Brian Pillsbury, NRCS Grazing Lands Specialist,
Madison, WI

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Grazing Streamside Pastures – The Wisconsin Experience

September 2017 | Brian Pillsbury, State Grazing Lands Specialist

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Resource Concerns – Surface Water Quality

Solution?

Livestock Exclusion

Fencing

Buffer Strips

While these practices may work, what are the costs of the fence and buffer strip, (removing land from production)? What are the social impacts of limiting recreational access to the stream because of thick brush and heavy vegetation? Is managed grazing an alternative?

Study of Best Management Practices for Riparian Areas

University of Wisconsin Agricultural Ecosystems Research Project, 1997-1999

Comparison of Riparian Land Practices

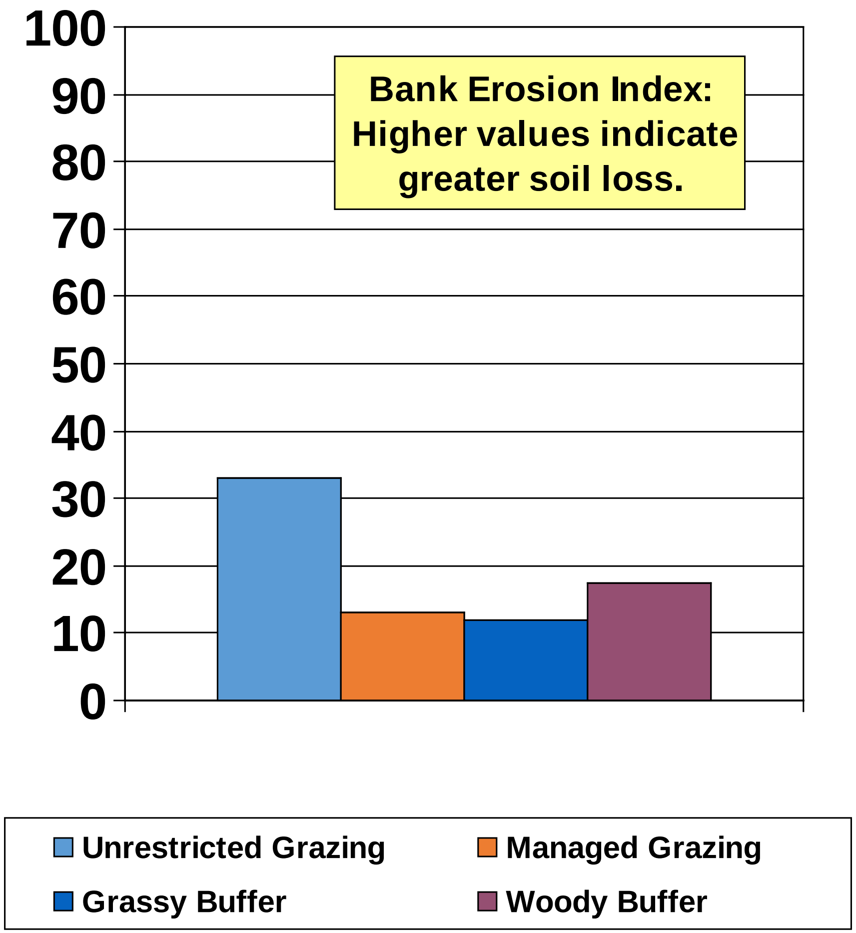
Grassy Buffers

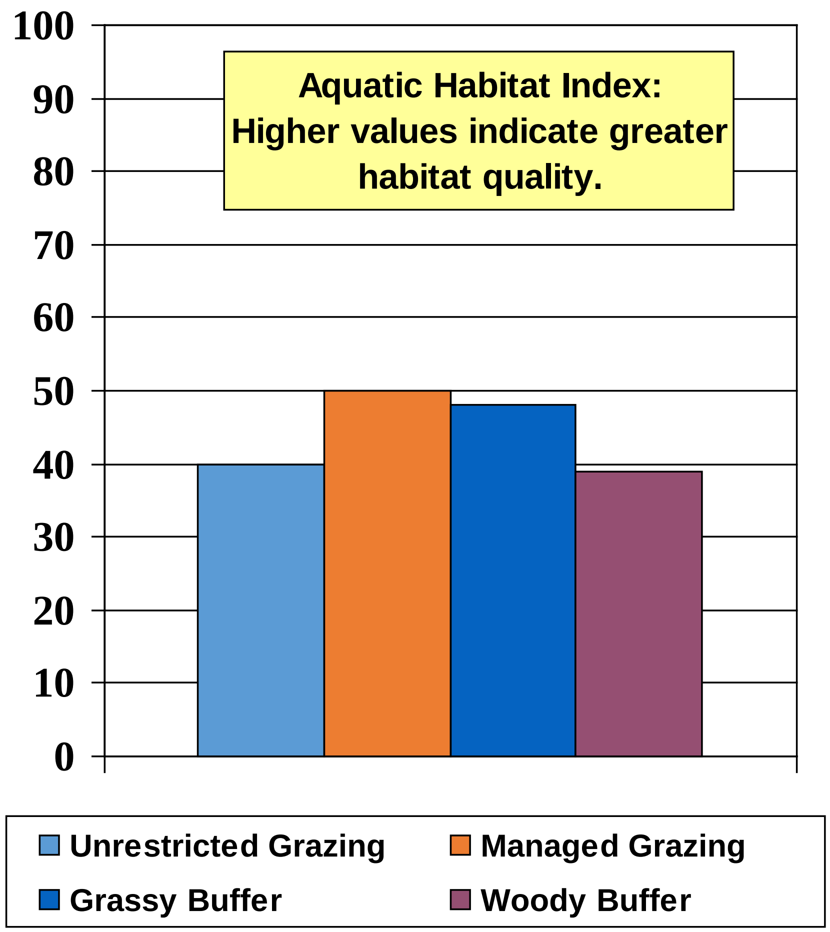
Managed (Rotational) Grazing

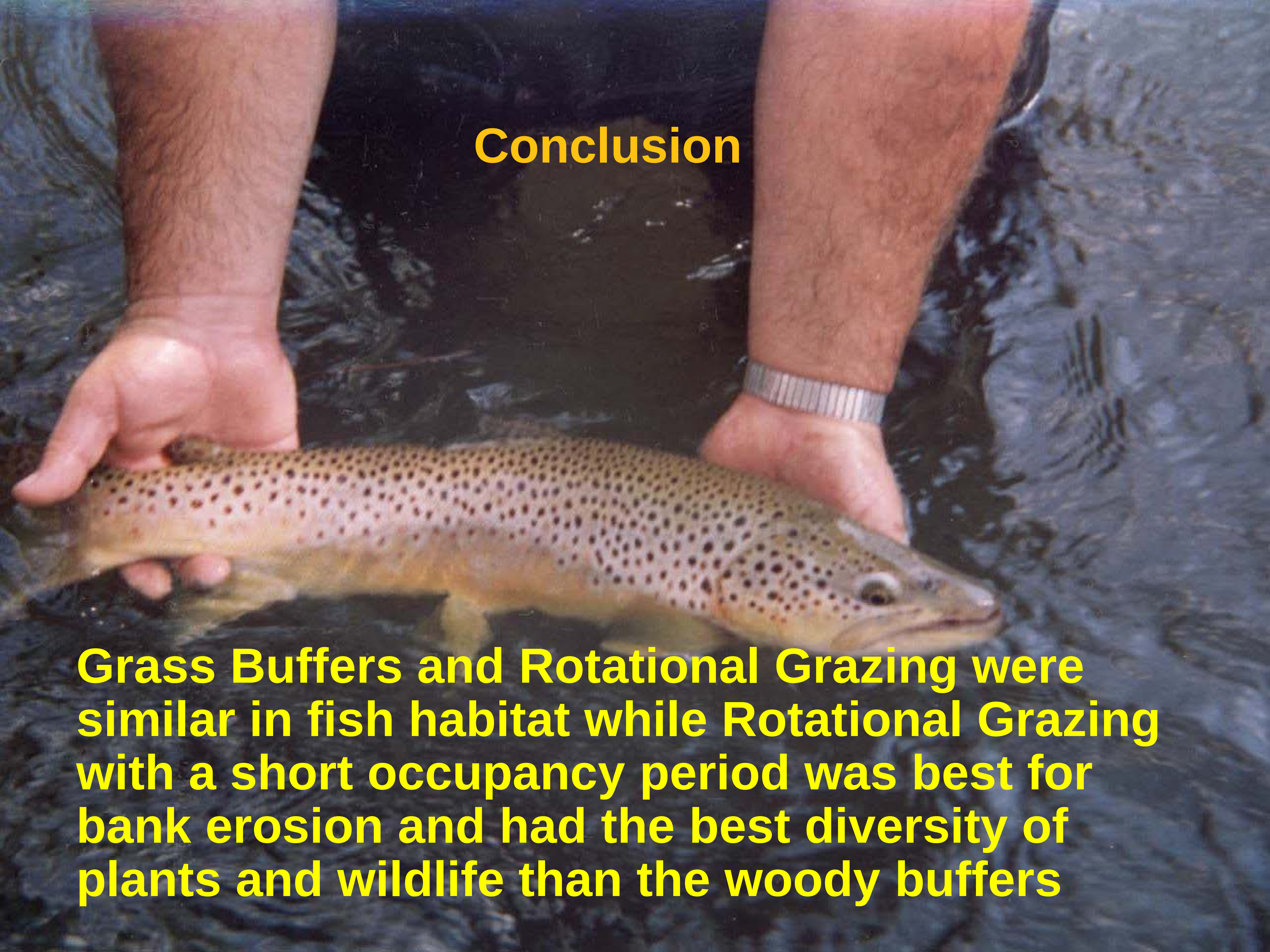
Unrestricted Cattle Access

Woody Buffers

Effects on Bank Erosion and Aquatic Habitat







Conclusion

Grass Buffers and Rotational Grazing were similar in fish habitat while Rotational Grazing with a short occupancy period was best for bank erosion and had the best diversity of plants and wildlife than the woody buffers

Basic Management Principles

Overgrazing Can Lead to Bank Erosion, Siltation and Widening of a Stream

Leave a Minimum of 4-6 Inches of Stubble Height in the Riparian Pasture After Grazing.

Manage Livestock Activity

Divide Pasture into Temporary Paddocks

During Grazing Season, Graze Pastures Multiple Times for 12 Hours to 1 Day for Dairy Cows and 3-4 Days for Beef and Sheep.

For Example, a 3-Day Occupancy

New Paddock is in Lower Center of Picture

For Example, a 1-Day Occupancy

New Paddock is in Lower Center of Picture

Provide Livestock Stream Crossings

One Crossing at Stream Grade, (Not a Culvert or Bridge) per Paddock or One Crossing Per 500 Feet in a Large Riparian Pasture

Stream Crossings Should be Stable

Specifications

Use Proper Size Rock Large Enough to Stay in the Bottom of Stream and Small Enough to Protect the Livestock Hooves

Height of the Rock Should be 2 Inches Below the Stream Bottom to Allow for Sedimentation

Restrict Grazing During Extreme Conditions

During Early Spring or Very Wet Periods

When the Pasture or Small Bare Areas have been Seeded to New Forages.

Once the Stubble Height is Below 3-4 Inches

Livestock Do Not Damage Banks With Adequate Stream Crossings

Plant Diversity Makes Good Aquatic Habitat

Stream is Narrow and Deep with Riffles and Pools for Spawning


Stream Banks
Grazed Separately
from the Rest of the
Pasture


Thank You!
USDA is an equal opportunity provider, employer, and lender.

Off-stream Water Sources for Grazing Cattle as a Stream Bank Stabilization and Water Quality BMP

Case Study from Virginia

Presented by Ben Tracy, Associate Professor

Dept. Crop and Soil Env. Sciences

Virginia Tech

Soil & Water Div. of ASAE in March

1997. Presented as ASAE Paper No. 96-2097R.

Authors: E. Sheffield, S. Mostaghimi, D. H. Vaughan, E. R. Collins Jr., V. G. Allen

Objectives

- The overall goal of this study was to evaluate the feasibility of using water troughs as a Best Management Practice (BMP) to reduce the losses of soil, nutrients, and bacteria from pasture lands.

Two study sites in SW Virginia

- three tall fescue dominated pastures

Methods

- Pre BMP (seven months)
  - Cattle had access to only one stream in the observed pasture as their source of water.
- Post BMP
  - After the first seven months, water troughs were installed in the pastures and cattle had continued access to streams

Measured:

- Site characteristics
- Cattle behavior (observations)
- Soil erosion (using semi-permanent stakes)
- Water quality in 6 locations

(total suspended solids (**TSS**), nitrate-nitrogen (**NO3-N**), ammonium (**NH4-N**), total nitrogen (**TN**), sediment-bound nitrogen (**SBN**), ortho-phosphorus (**PO4**), total phosphorus (**TP**), sedimentbound phosphorus (**SBP**), fecal coliform (**FC**), fecal streptococci (**FS**), and total coliform (**TC**)

Results

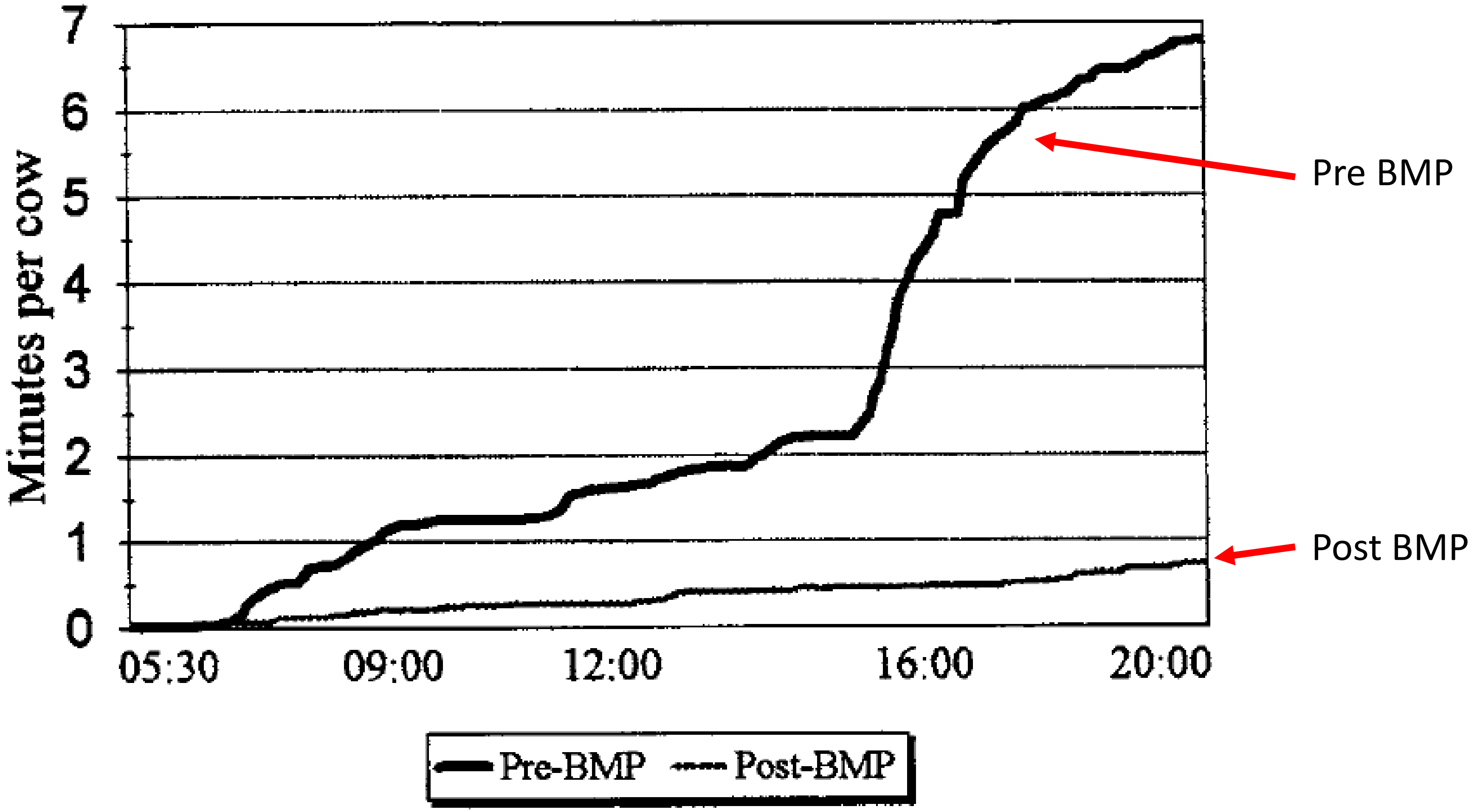


Figure 4–Cumulative time per cow spent in the stream drinking for an average cow-day.

Table 1. Comparison of length of time spent by each cow drinking from the stream and being in the stream area

Date	Farm	Cumulative Time per Cow Drinking from the Stream	Cumulative Time per Cow Being in the Stream Area
Pre-BMP*			
11-22-94	South Bender	6.20	13.33
12-03-94	River Ridge	6.62	12.71
1-10-95	North Bender	7.35	12.02
Mean		**6.72**	**12.69**
Post-BMP†			
6-29-95	River Ridge	0.62	3.55
8-22-95	South Bender	1.31	12.33
9-26-95	River Ridge	0.24	2.80
Mean		**0.72**	**6.19**
% Reduction in Mean		**89.4**	**51.2**

* Without water trough.
† With water trough.
NOTE: All values expressed in minutes.

Stream Bank Soil Erosion

Table 3. Results of stream cross-sectional surveys on the River Ridge Farm

	Pre-BMP	Post-BMP	D[1]*
P -value			0.006†
Mean	0.66	0.15	0.51
Std. dev.	0.96	0.17	0.96
% reduction		**77.2**	

* D[1] = Difference between pre- and post BMP values.

† Significant at 0.05 level.

NOTE: Means and standard deviations area expressed in terms of meters of stream bank loss (erosion) due to sloughing.

Table 4. Flow-weighted concentrations and loadings of water quality nutrients for the stream outlet (QRR-5) on the River Ridge Farm

	Flow-weighted Concentration (mg/L)			Loading (kg/cm rain)		
Parameter	Pre-BMP	Post-BMP	% Change	Pre-BMP	Post-BMP	% Change
Total Suspended Solids (TSS)	132.35	14.28	–89.21	292.84	11.06	–96.22*†
Total Nitrogen (TN)	1.340	1.237	–7.72	3.02	1.34	–55.63*
Ammonium (NH_4)	0.321	0.090	–72.06	0.52	0.12	–76.92*
Nitrate (NO_3)	0.167	0.229	37.05	0.31	0.35	12.90
Sediment Bound Nitrogen (SBN)	0.472	0.468	–0.66	1.05	0.55	–47.62
Total Phosphorus (TP)	0.203	0.072	–64.56	3.25	0.08	–97.54*
Ortho-phosphates (PO_4)	0.004	0.007	98.47	0.04	0.01	–75.00
Sediment Bound Phosphorus (SBP)	0.120	0.068	–42.87	0.93	0.07	–92.47*

* Significant difference between means at $\alpha = 0.05$ level.

† A negative value (–) indicates a reduction due to the installation of the BMP.


Concentrations of fecal coliform and fecal streptococci were reduced by an average of 51% and 77%, respectively post BMP

Conclusions and Shortcomings of the Study

- Conclusions
  - Installation of water troughs greatly reduced stream use by cattle in summer
  - Reduction in stream use lead to significant improvements in water quality indices and soil erosion protection
- Shortcomings:
  - Measurements only taken in the summer
  - Study short time frame of about 14 months (longer-term data needed)
  - Did not control for shade (or at least did not mention it)

Value of flash/mob grazing riparian areas?


Thanks!

To Fence or Not to Fence

Dr. Dory Franklin

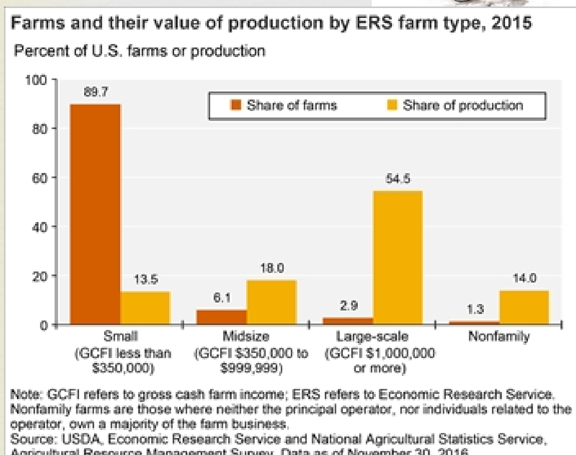
Soil Scientist with a focus on Sustainable Agriculture

Considerations:

- The Southesastern USA, experiences repeated droughts multiple times each decade and chronically experiences periods where evapotranspiration exceeds rainfall (Endale et al., 2011).
- The pattern of **very wet** and **very dry** periods is predicted to be exacerbated in the next 25 to 50 year (IPCC 2012).

RATIONALE:
Nutrient Efficiency for Sustained Productivity and Environmental Health

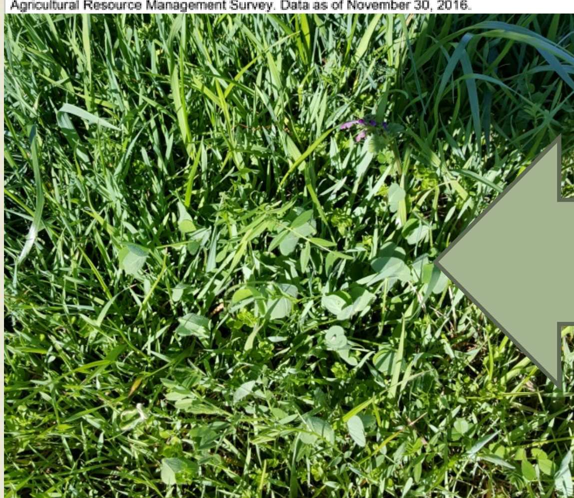
We cannot afford to lose nutrients



Nutrients must be in the soil to increase plant productivity

The more water moving into soil the more nutrients it can carry with it

If nutrients **are in vulnerable areas they will be lost and not utilized**



Why do we fence?

- To contain something of value

- To protect something of value (water)
- To better managed

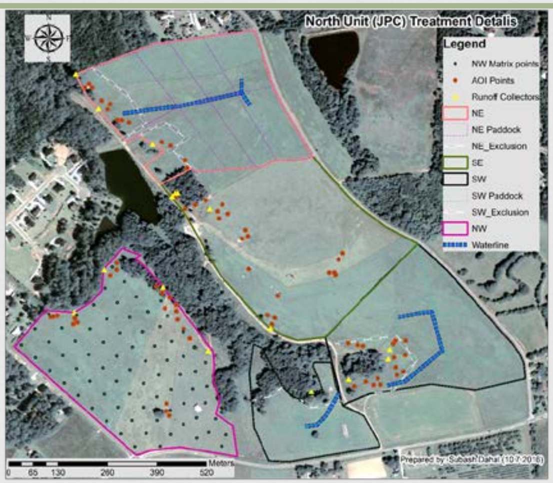


Fig : North Unit of J. Phil Campbell Sr.. Conservation Research and Education Center, University of Georgia,

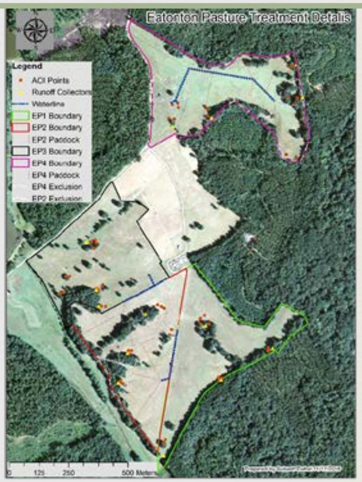


Fig : Animal Sciences and Dairy Cattle Beef Cattle Farm in Eatonton, GA

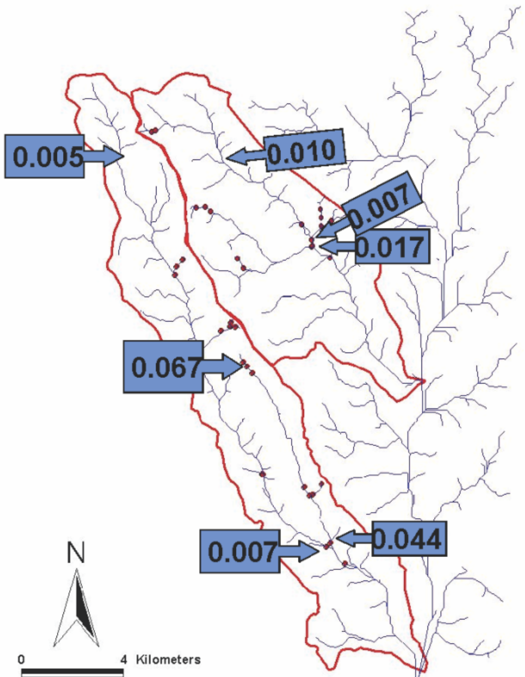
Grasslands Farm scale background:

- Surface water provides 90% of the public water supply in the Southern Piedmont,
- Pastures occupy 1.8 million ha (11% of the total area).
- Achieving well managed pastures with dense grass cover is important to provide consistent stream baseflows through groundwater inputs generated by good infiltration and storage of soil water (Schoonover et al., 2006).

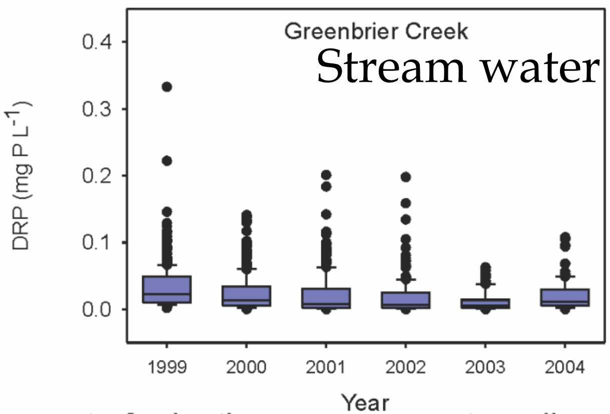
Working On-farm with Producers 1998 to Present

- Together we tested three crop/forage systems to determine which improved revenues, water quality, and quality of life

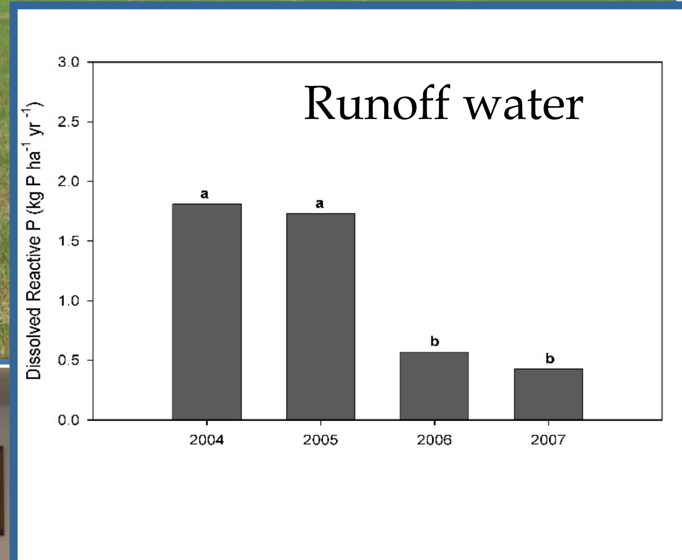
- Streams flowing out of Hay fields had lower nitrate concentrations



Blue boxes identify average dissolved P concentrations in base flow for 2004 and 2005

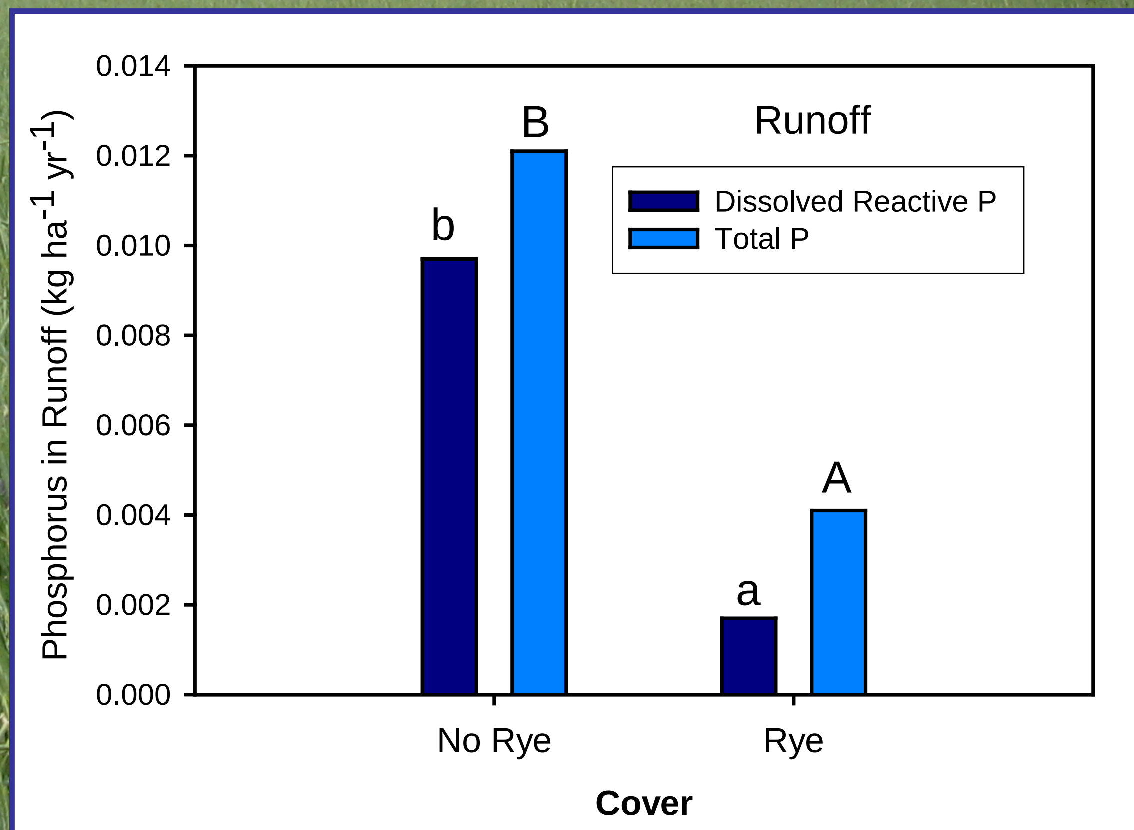


Impact of adaptive management on dissolved reactive phosphorus in the Greenbrier Creek

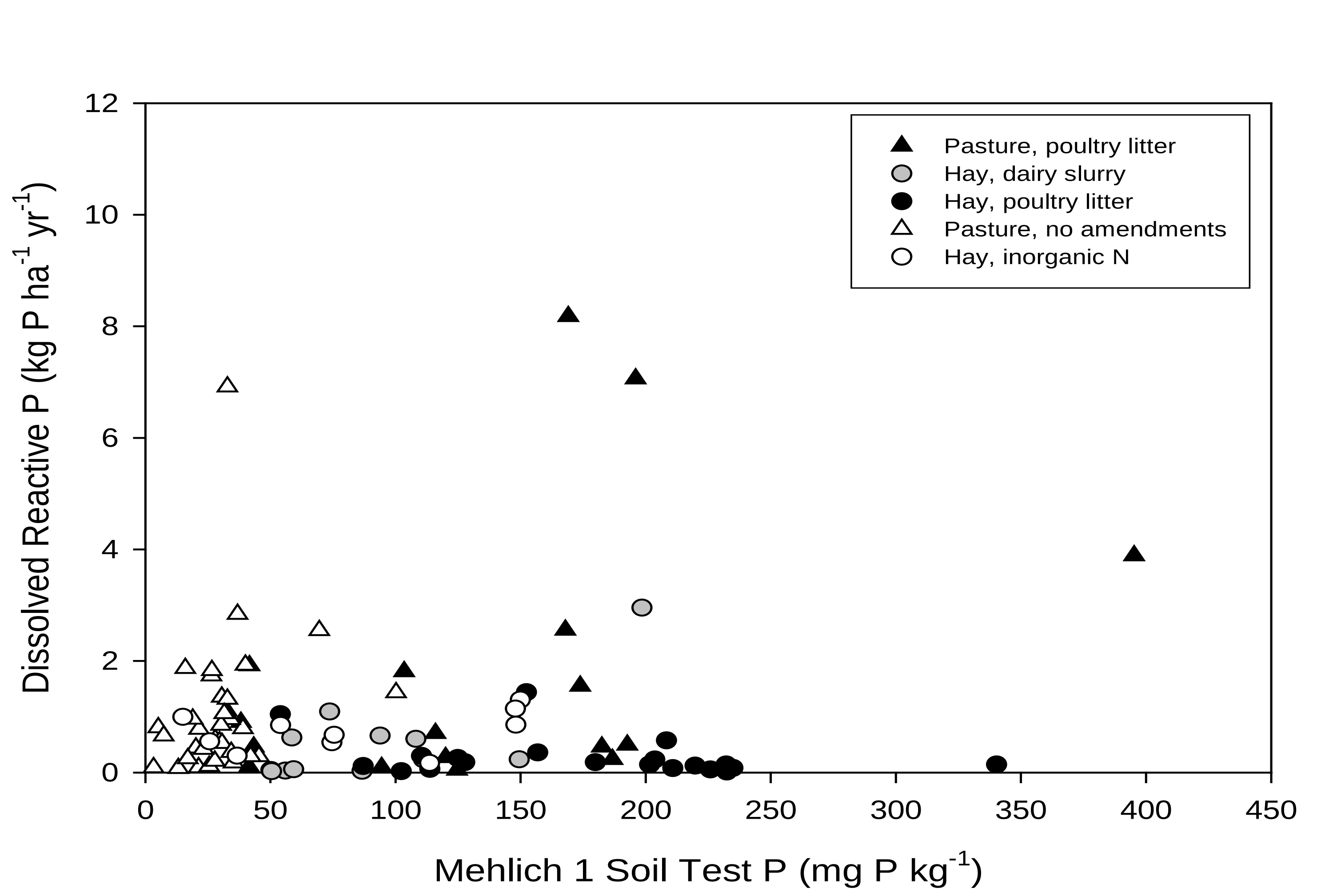


Grazinglands for Clean Water

- Effectiveness of rye cover

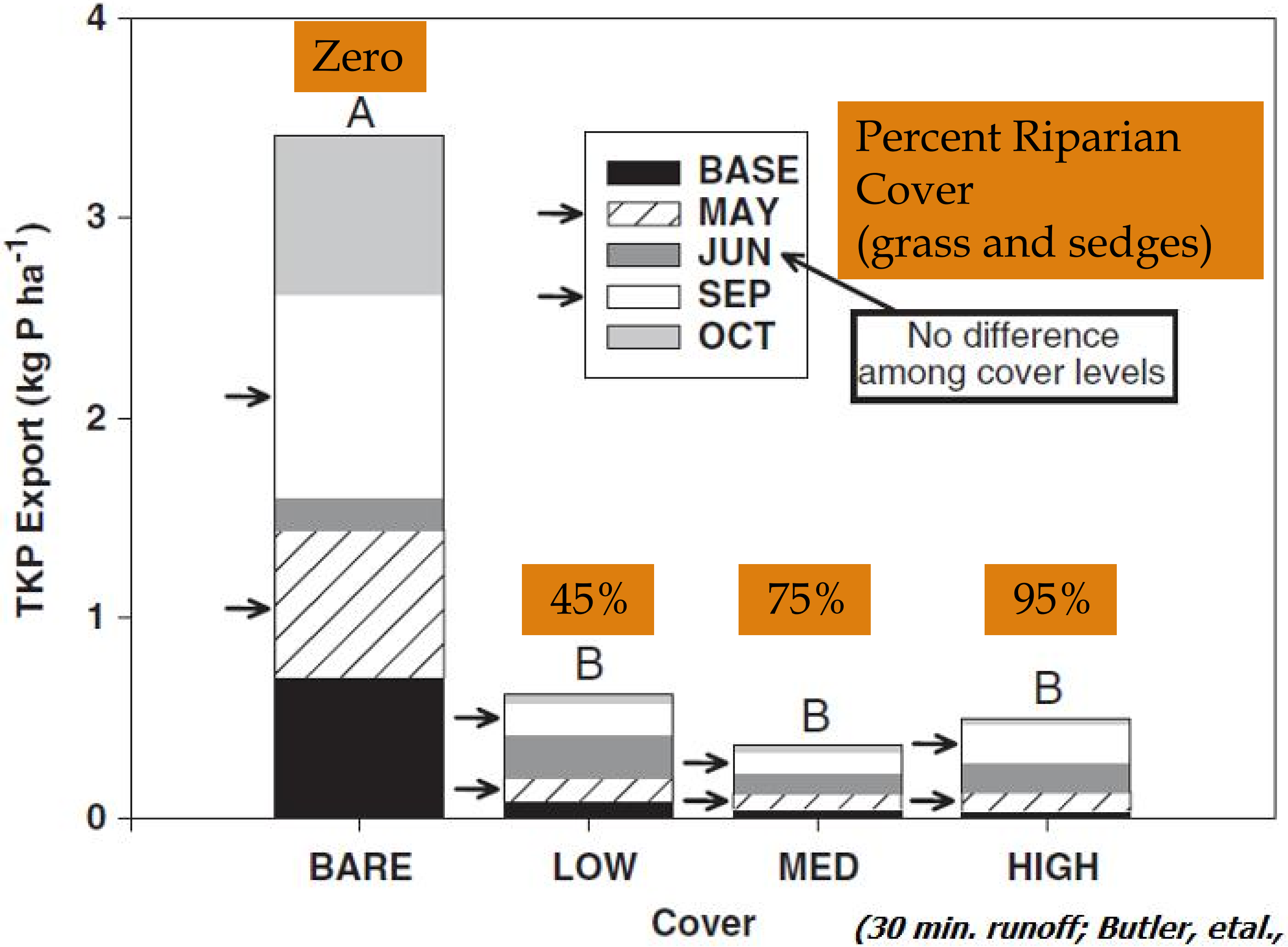


Phosphorus in runoff as a function of soil test P and grazing management



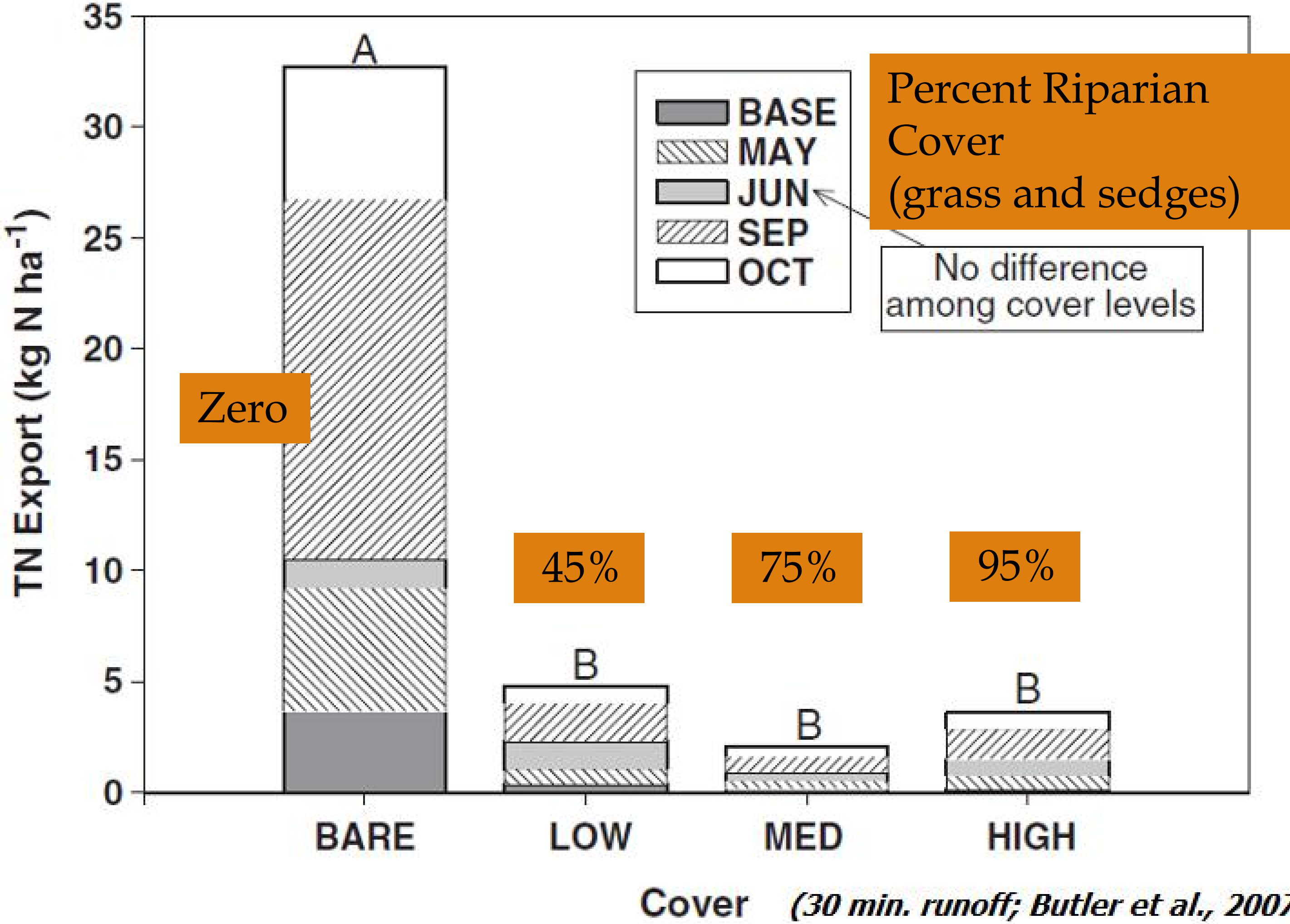
Butler et al., 2010

TOTAL P EXPORT



(30 min. runoff; Butler, etal., 2006)

TOTAL N EXPORT



(30 min. runoff; Butler et al., 2007)

SEDIMENT EXPORT

Site		Cover			
Slope	Soil	Bare	Low	Medium	High
		TSS export, kg ha^{-1}			
10% slope	Appling sandy loam	215a†	10.5a	5.88a	4.68a
20% slope	Wedowee sandy loam	562b	30.0b	7.11a	8.73a

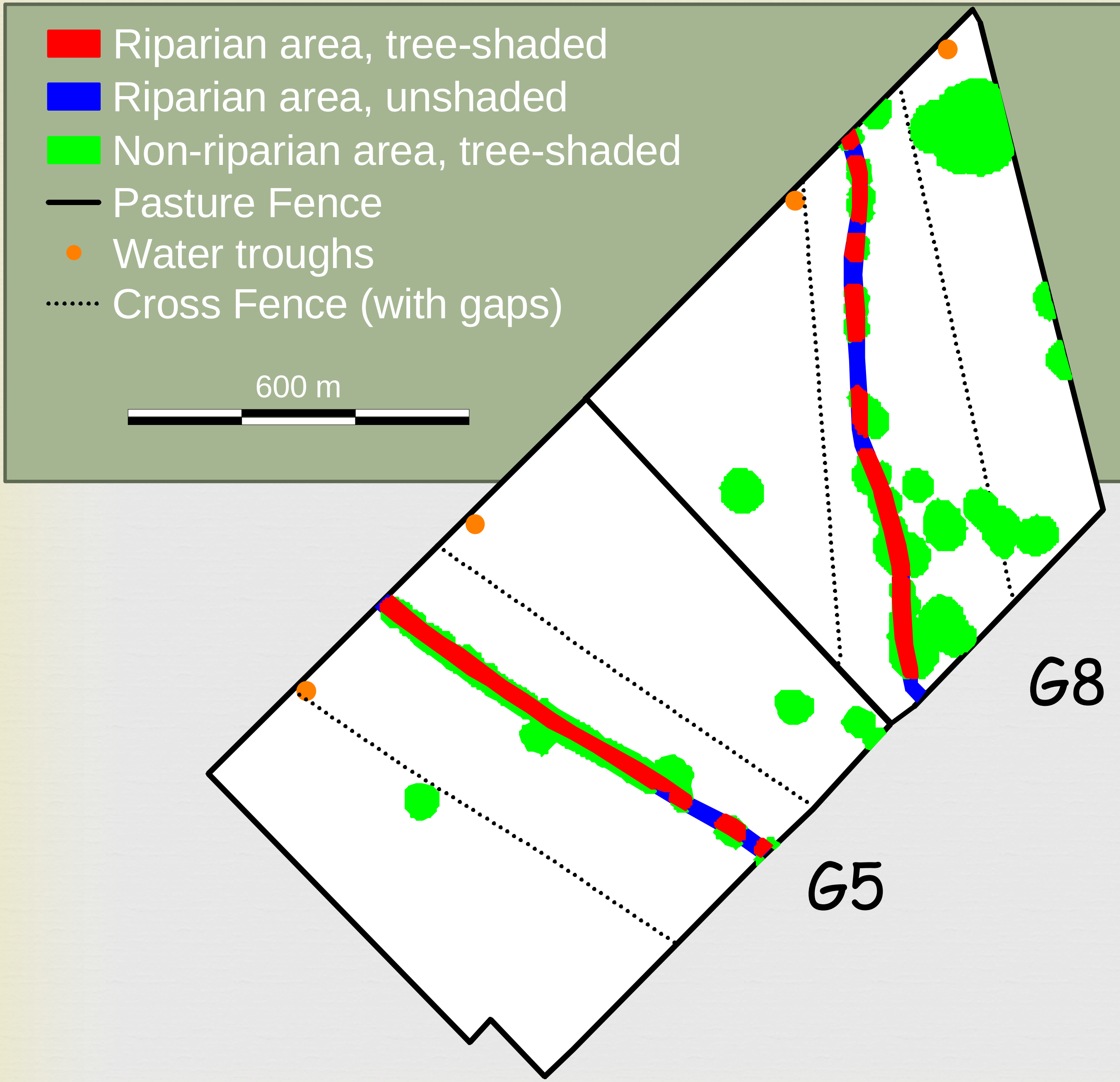
† Means within columns followed by the same letter are not significantly different ($P > 0.05$).

(Rain event average, 30 min. runoff; Butler et al., 2006)

Note: Riparian Cover (grass and sedges) was cut to 8 cm height prior to simulated rainfall events

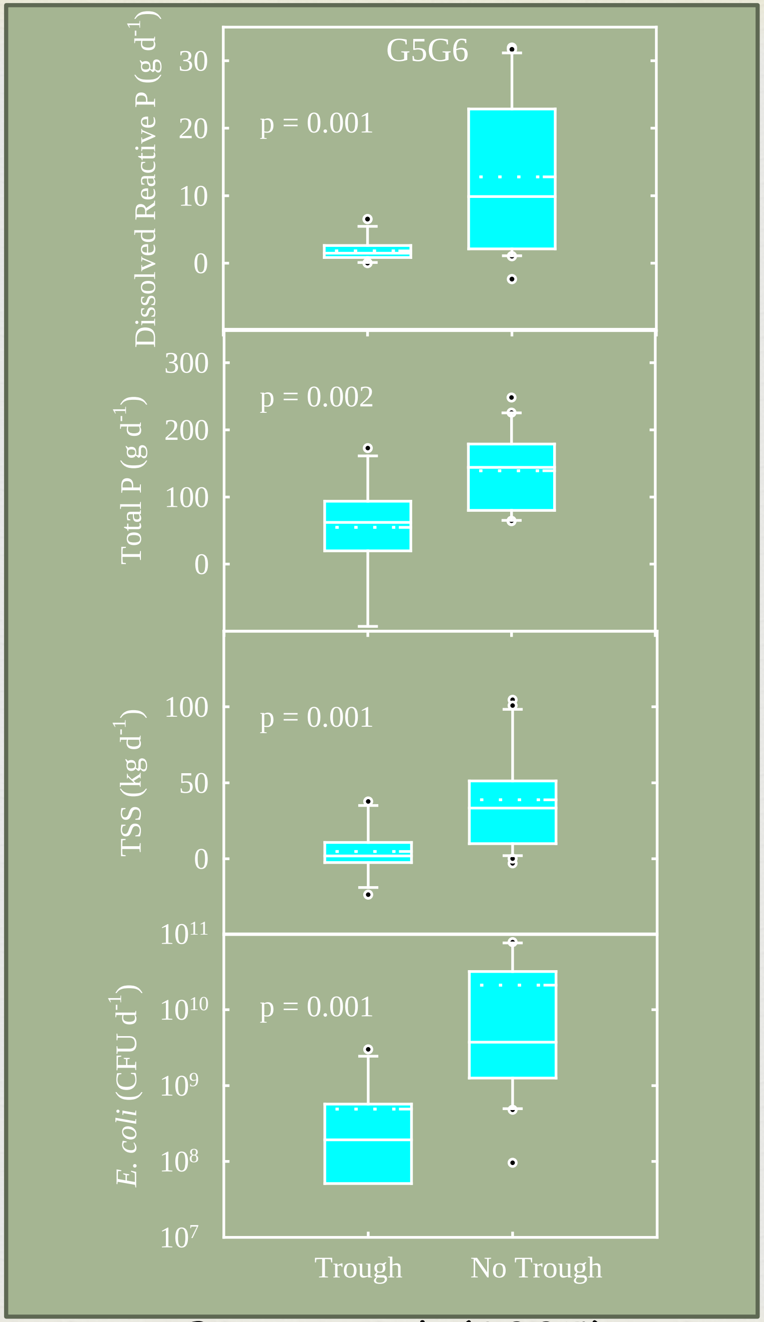
How else might we better manage nutrient and cattle if fenced out streams are not effective at retaining nutrients?

Using GPS Collars on Cow calf pairs

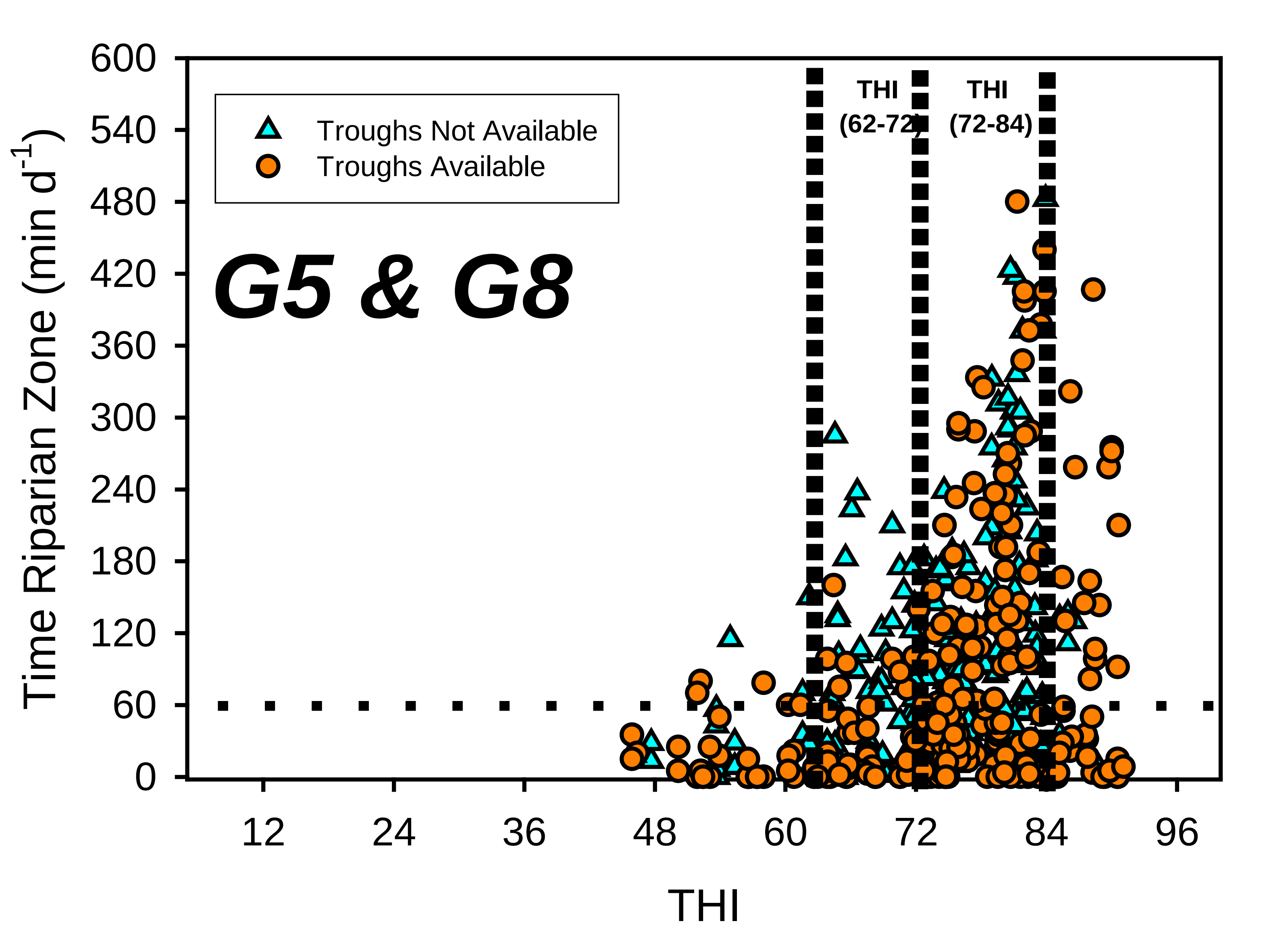


Animal Management

- water troughs in fields with unfenced streams kept nutrients in field
- Shade away from stream appeared to reduce time spent by cattle in stream

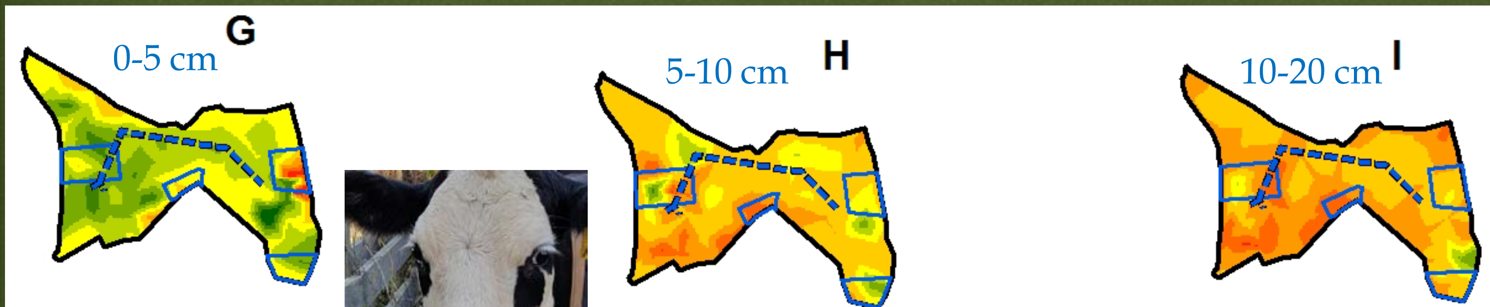


Byers et al. (2005)



Franklin et al. (2009)

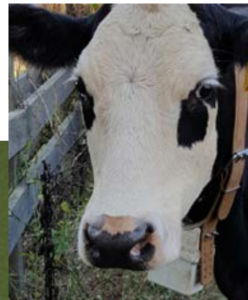
Permanganate Carbon

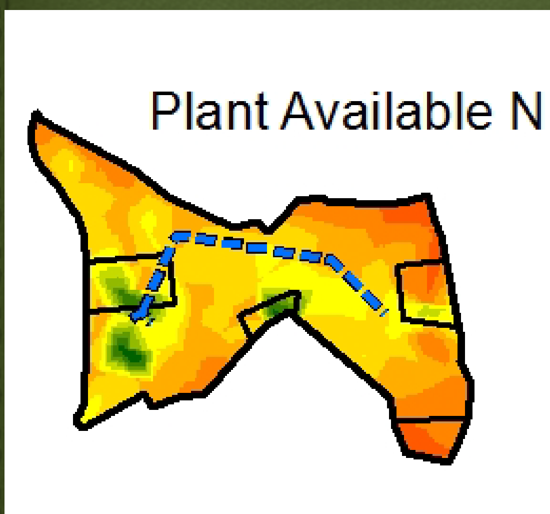


POXC (mg/kg)

- 20 - 200
- 200 - 400
- 400 - 600
- 600 - 800
- 800 - 1,000
- 1,000 - 1,200
- 1,200 - 1,400
- 1,400 - 1,600
- 1,600 or More
- Waterline
- Exclusions

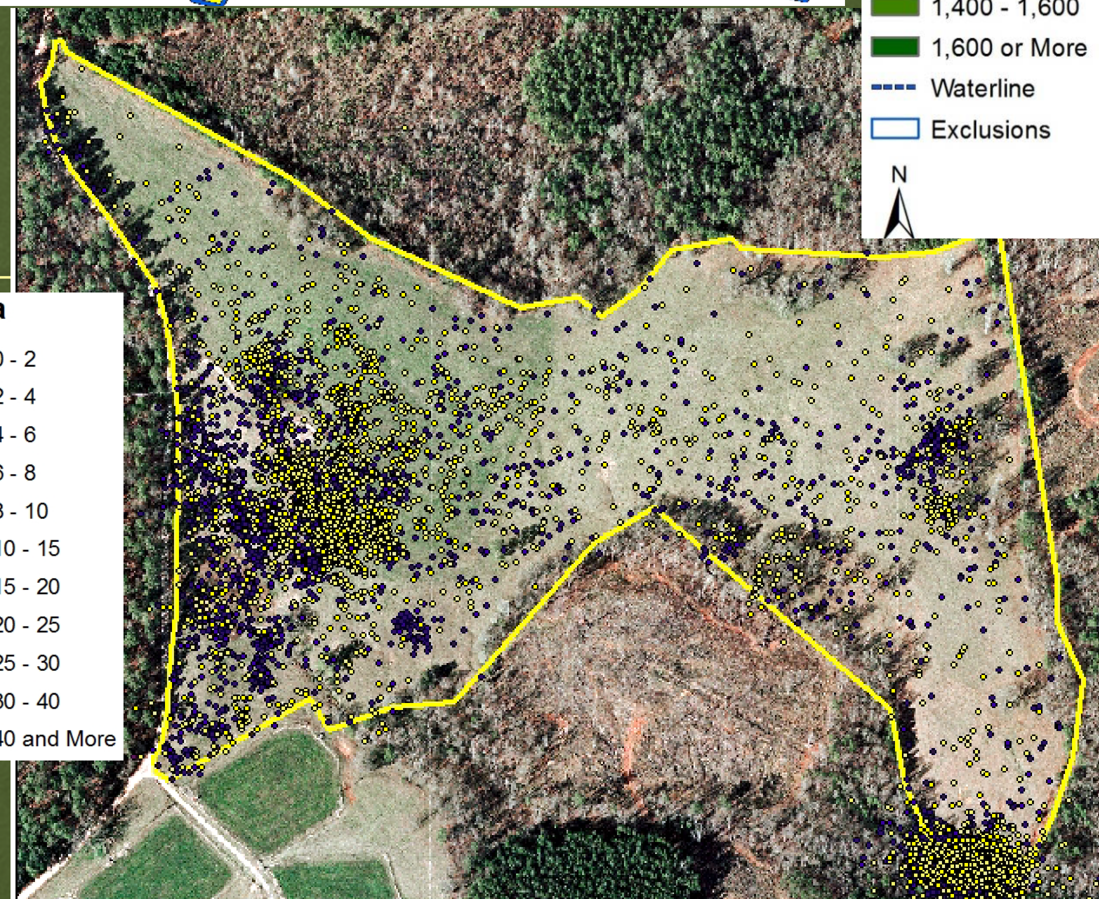
N





kg/ha

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 40
- 40 and More



Study Sites:

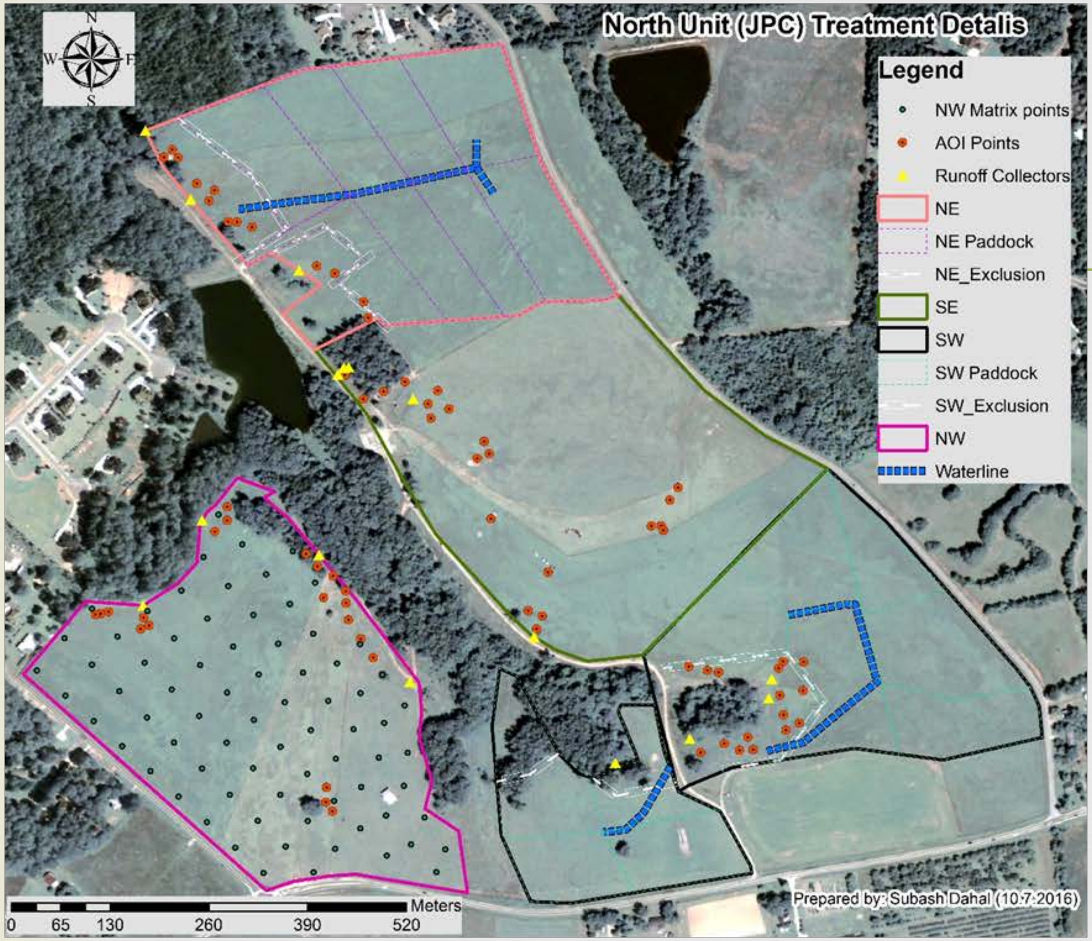


Figure 1A: North Unit of J. Phil Campbell Sr.. Conservation Research and Education Center, University of Georgia. Note, SR = Strategic-Rotational and C= Conventional.

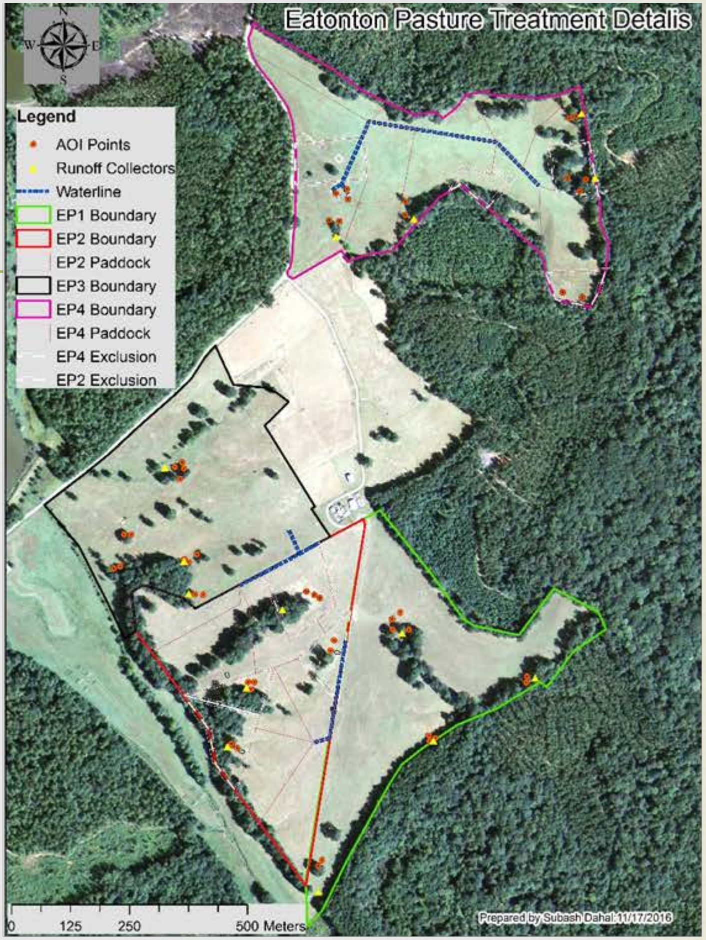
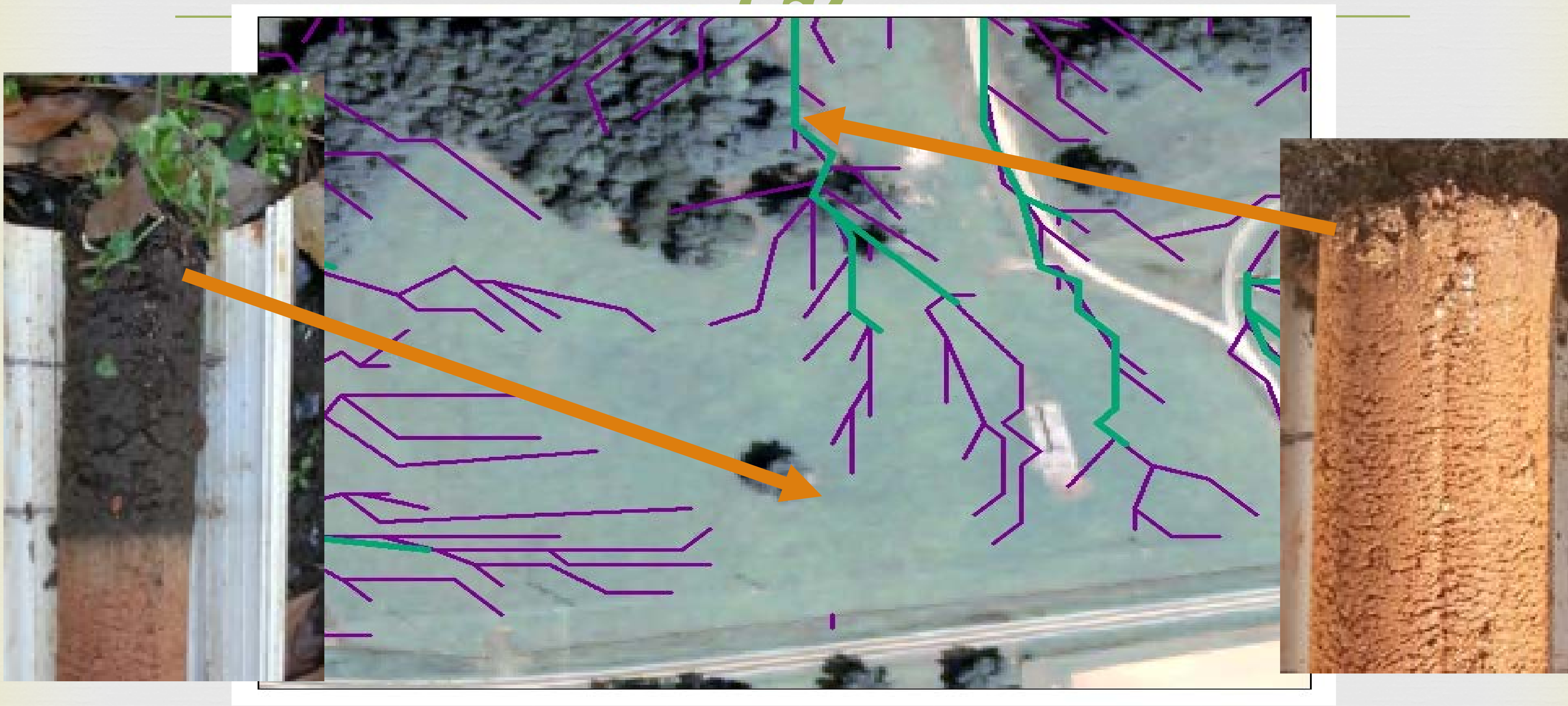


Figure 1B : Animal Sciences and Dairy Cattle Beef Cattle Farm in Eatonton, GA

What areas are vulnerable?



UGA

To Fence or not to Fence?
When do we need to fence?

Which grazing system retains and recycles water and nutrients?

Will fencing protect streams or contain nutrients where they are needed?

We need to capture the nutrients in the soil?

Thoughts, Comments or Questions

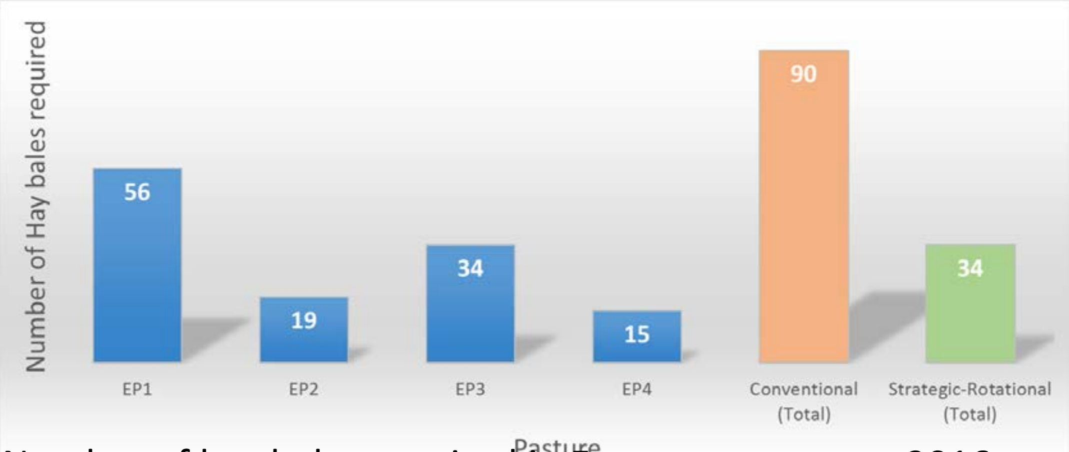
Thank you for this opportunity to discuss fencing practices

Strategic placement of fencing most Sustainable

- **Hypothesis: the use of strategic-rotation grazing will capture more rainfall and conserve water by dispersing and recycling nutrients at minimal cost and time to the farmer rather than concentrating and/or allowing excessive runoff and off-site movement of nutrients.**







Number of hay bales required in Eatonton pastures, 2016

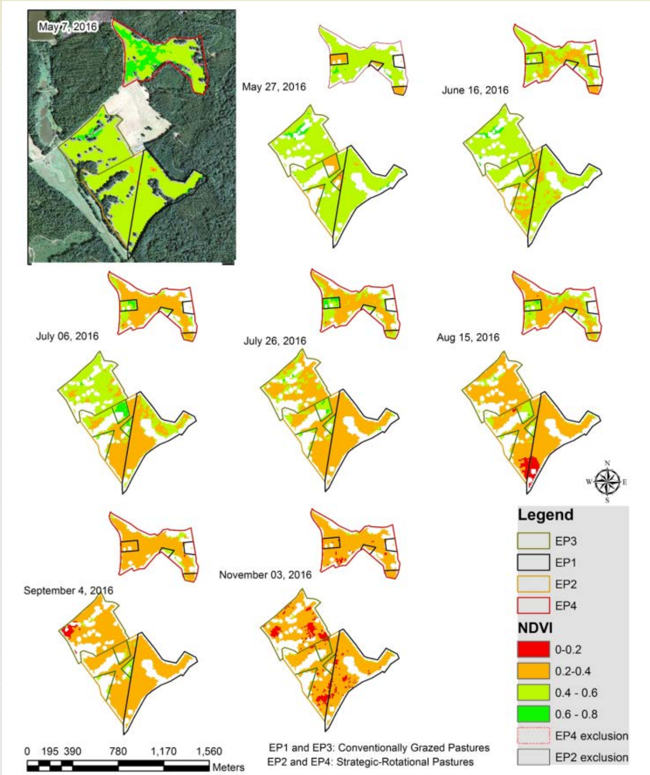
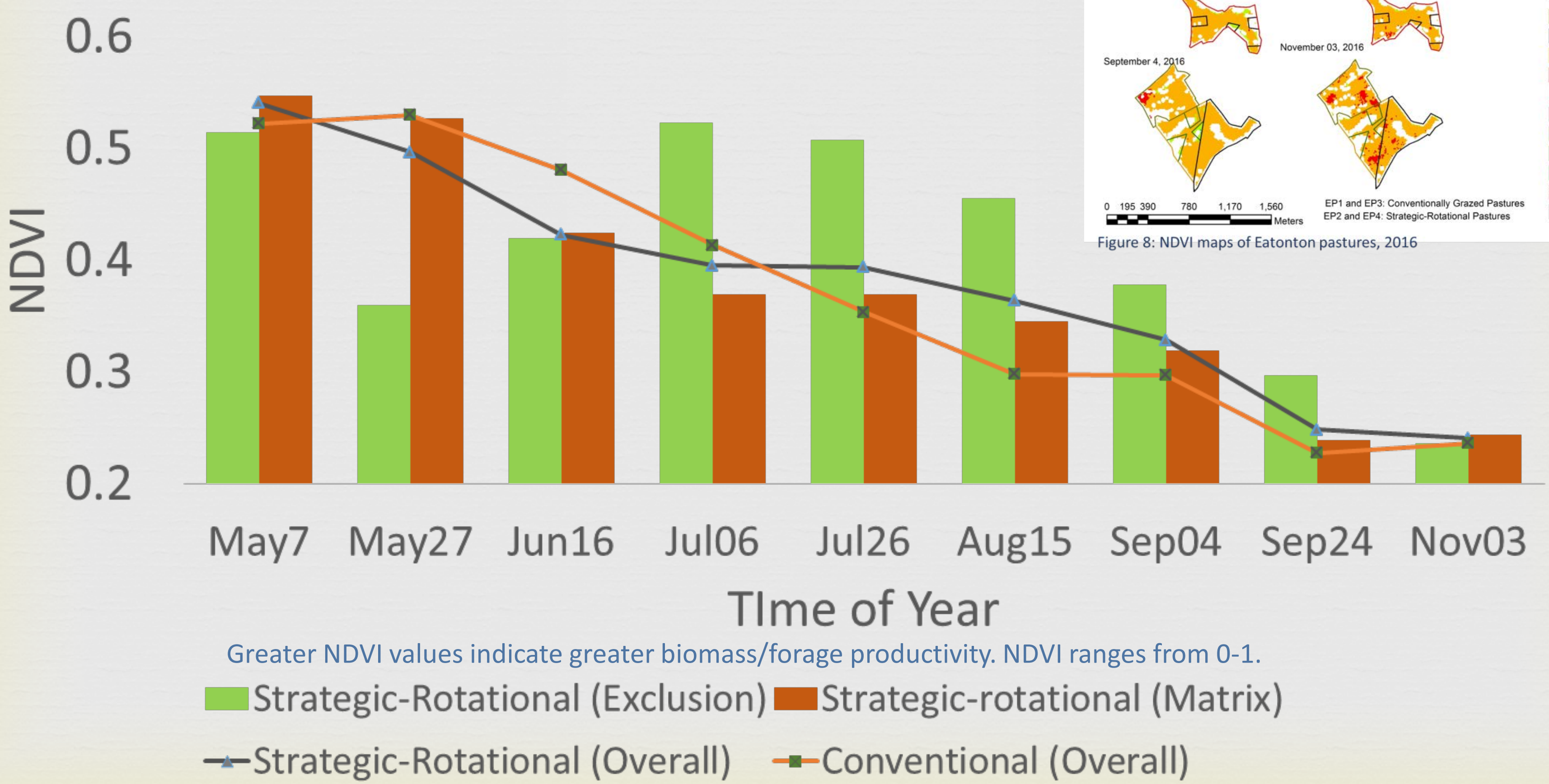


Figure 8: NDVI maps of Eatonton pastures, 2016



Greater NDVI values indicate greater biomass/forage productivity. NDVI ranges from 0-1.

Summary

Research to build soil health and soil biodiversity appears to be retaining and providing water, C, N, and P for plant productivity. However, this research is but an infant and much more research needs to be done to ensure that these nutrients and water are being utilized for plant productivity.