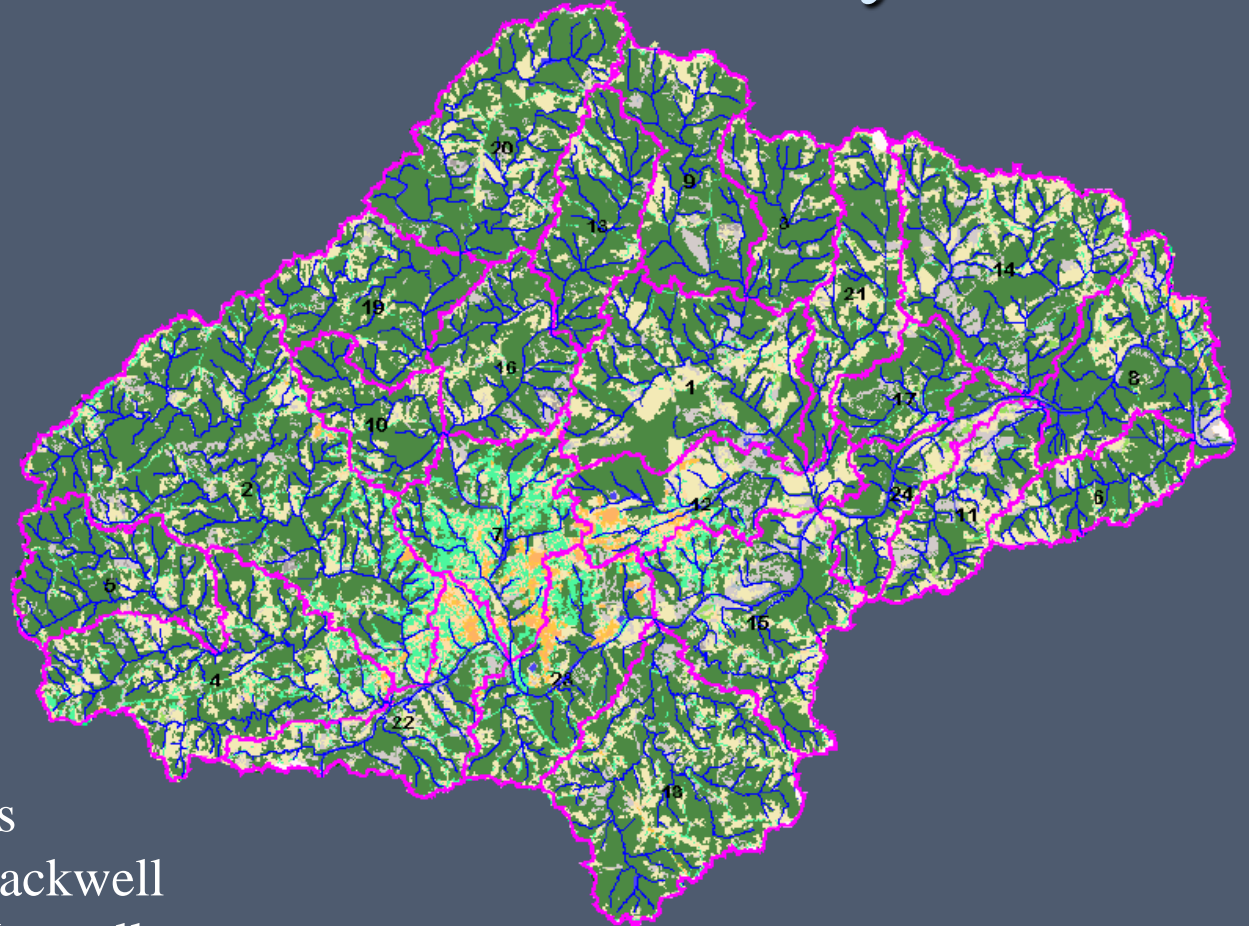


Eden Area Watershed Study



Kris Bass

Jaime Blackwell

Bryan Maxwell

Gene Squires

Background

Piedmont Triad Regional Council Eden Area Watershed Assessment

- Detailed data on watershed background, potential water quality issues, data, policy, and anything else you can think of!
- Key Findings:
 - Pollutants of highest concern: Sediment and Bacteria (fecal coliform)
 - Unique landscape setting, geology and soils.
 - No “smoking gun” for water quality issues
 - Distributed issues likely linked to land stewardship, education, limited resources, and enforcement.
 - Watershed policy is progressive and developing!
 - Lots and lots of opportunities out there!

NCSU/Water Quality Group

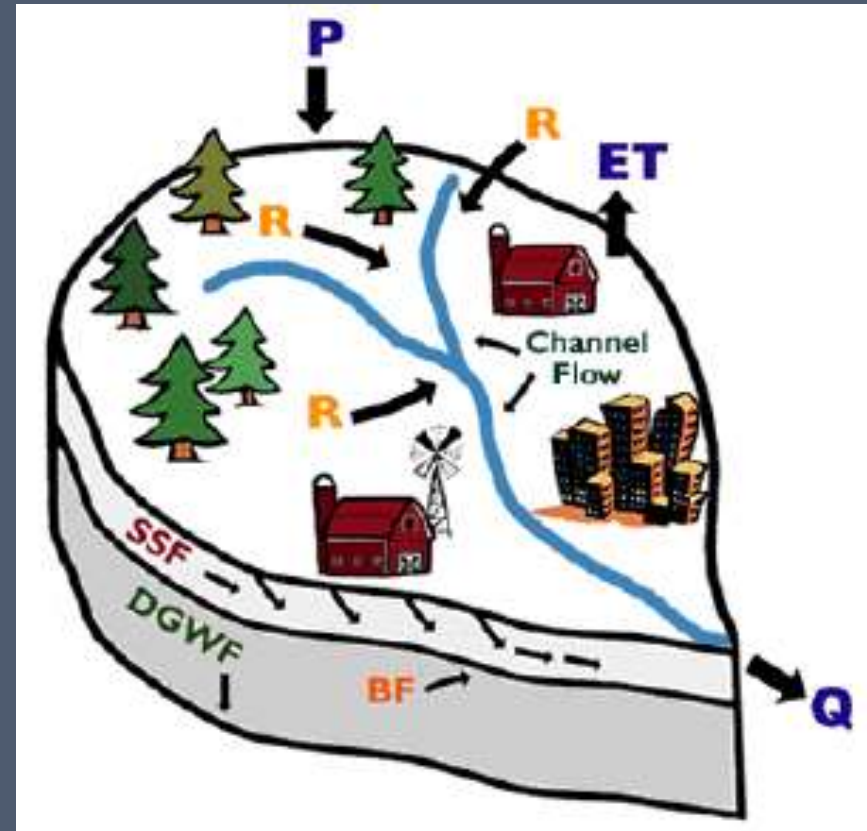
Eden Area Watershed Modeling

- Size of this watershed and distributed nature of issues makes prioritizing projects/opportunities a daunting task!
- Modeling:
 - Provides a thorough (mathematical) way of identifying potential water quality problems and sources.
 - Puts numbers on the spatial contribution of various sources towards flow and water quality loadings.
 - Combines an enormous array of factors that we cannot keep up with any other way!
 - Allows us to examine the potential effects of BMP implementations and to target practices for maximum value.

Mapshed – GWLF - Predict

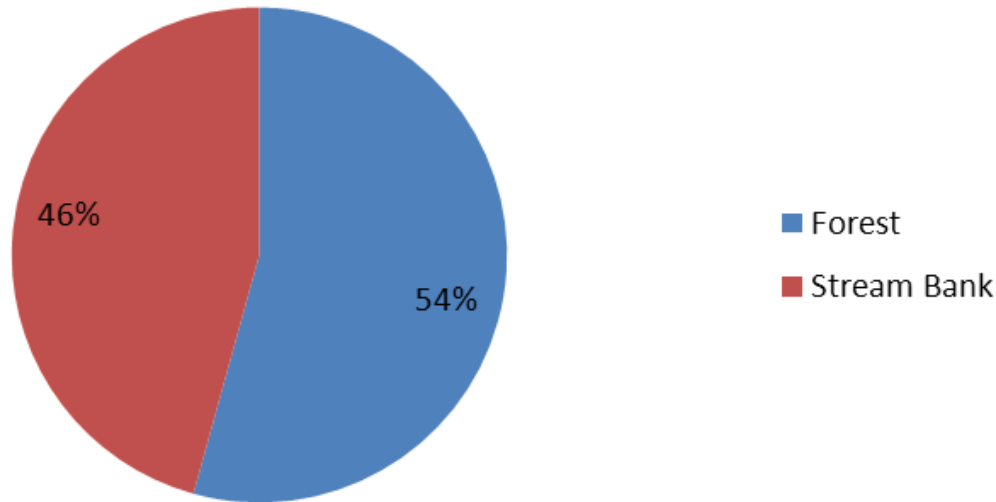
Penn State

- Generalized Watershed Loading Function
- Land Use
- Elevation
- Soils
- Subwatersheds
- Stream network
- Weather (22 yrs)
- Daily water balance
- Monthly loadings
- Sediment, Nutrients, and Bacteria
- Predict
 - Analyzing effect of potential BMPs
 - Initial cost estimates



All Forest Simulation

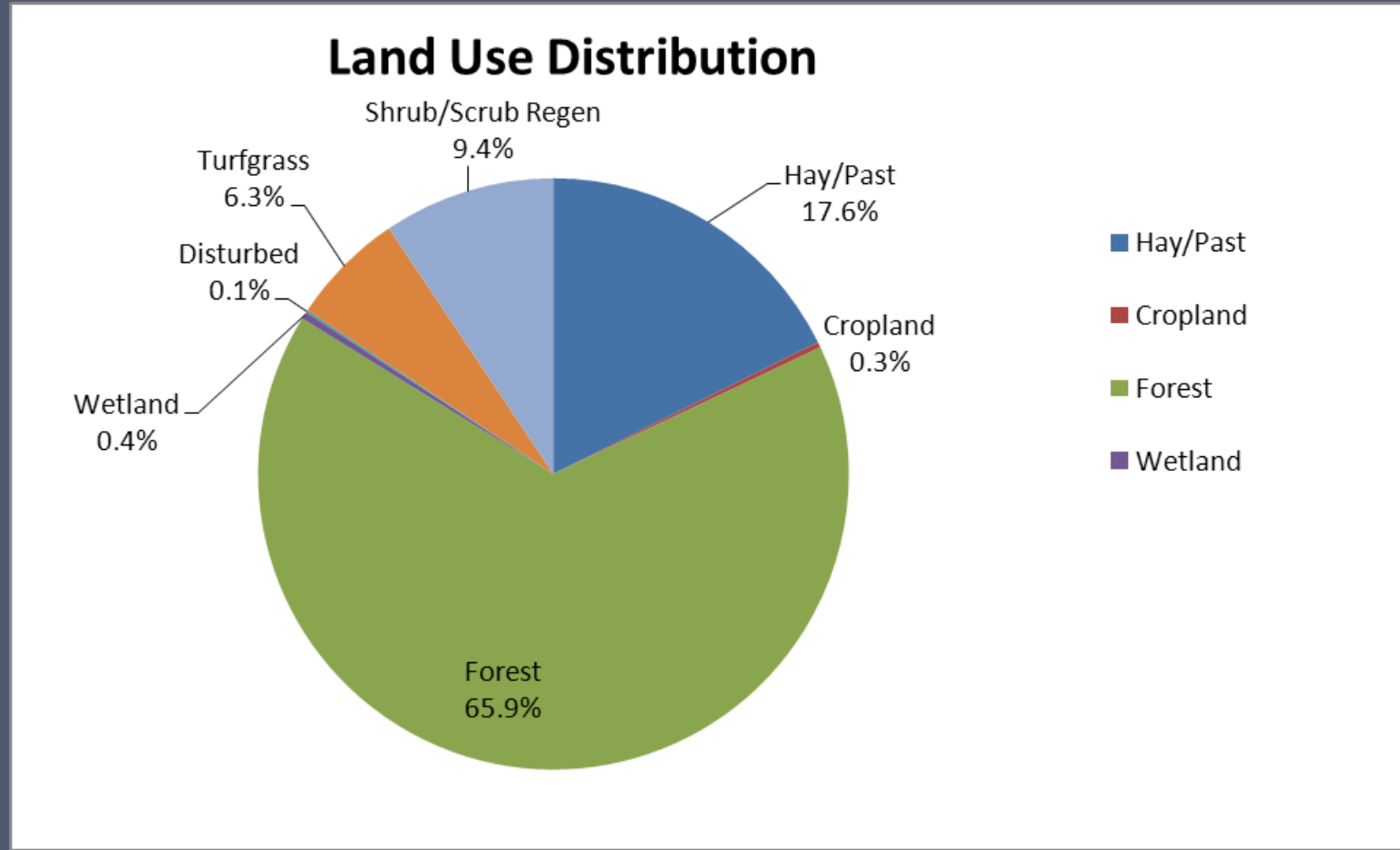
All Forest Sediment Sources

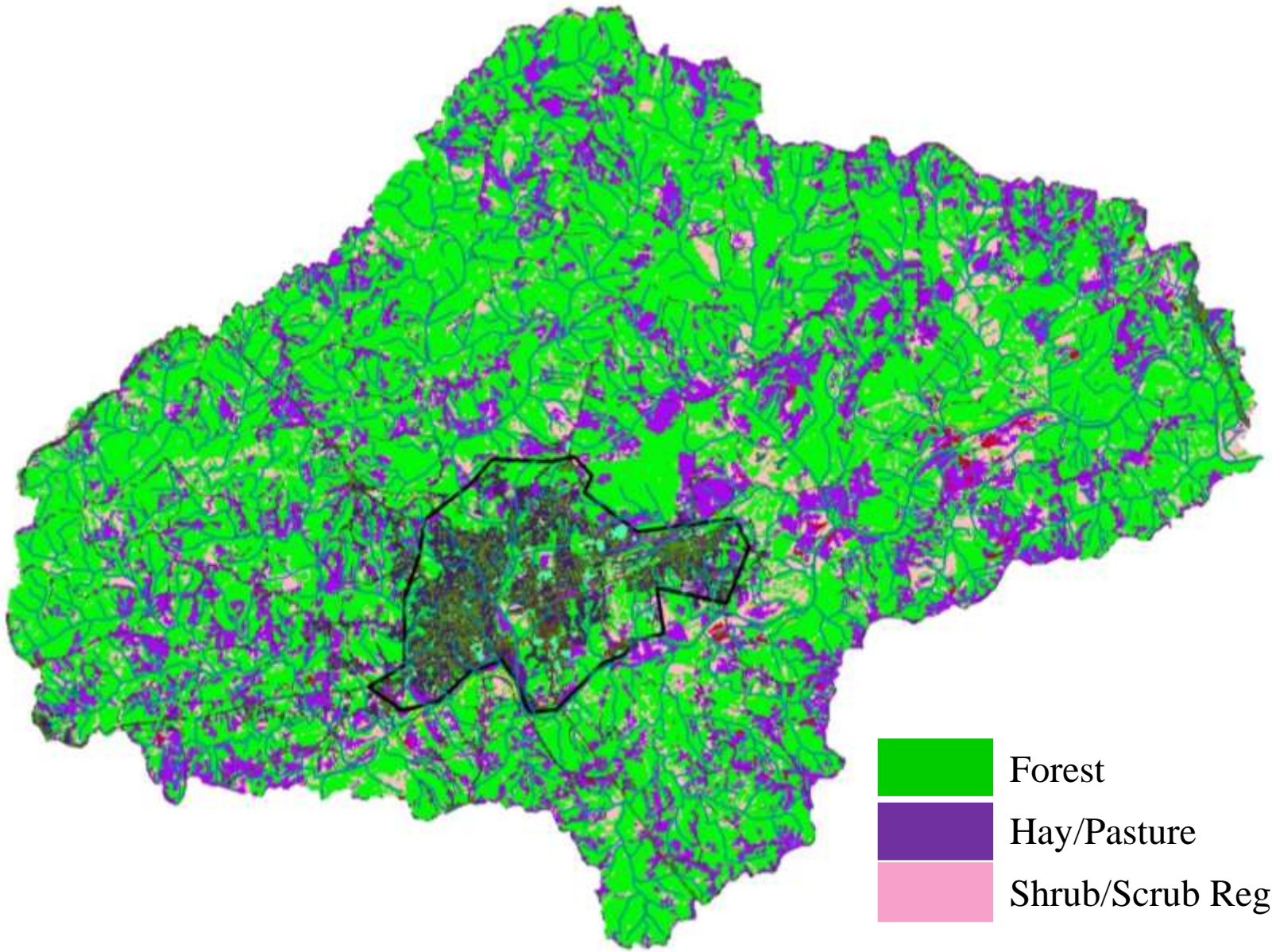


- This watershed is an evolving landscape!
- Terrain, soils, and geology lead to conditions that generate sediment load from the land and the streams...

Existing Conditions Simulation

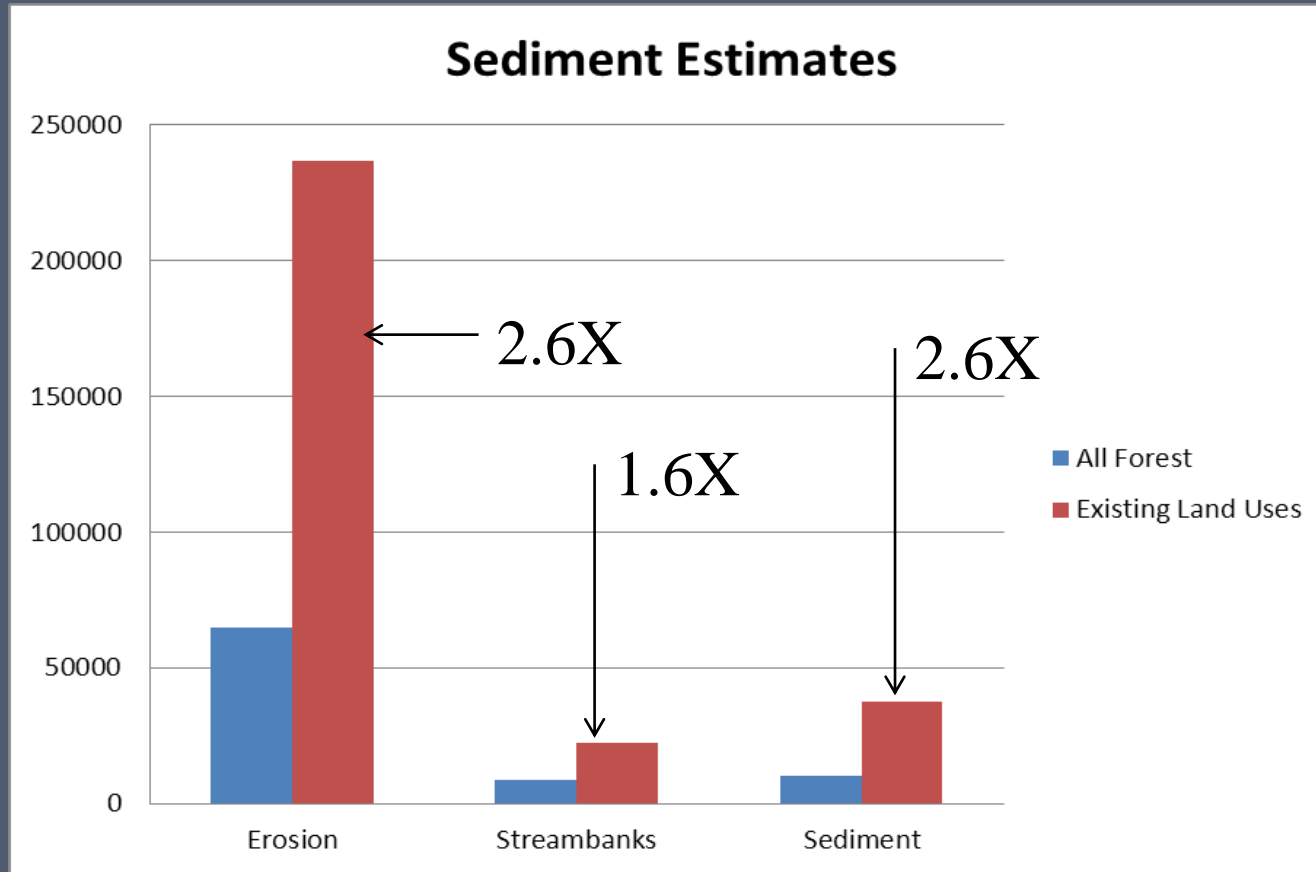
Watershed Land Uses





- Forest
- Hay/Pasture
- Shrub/Scrub Regen

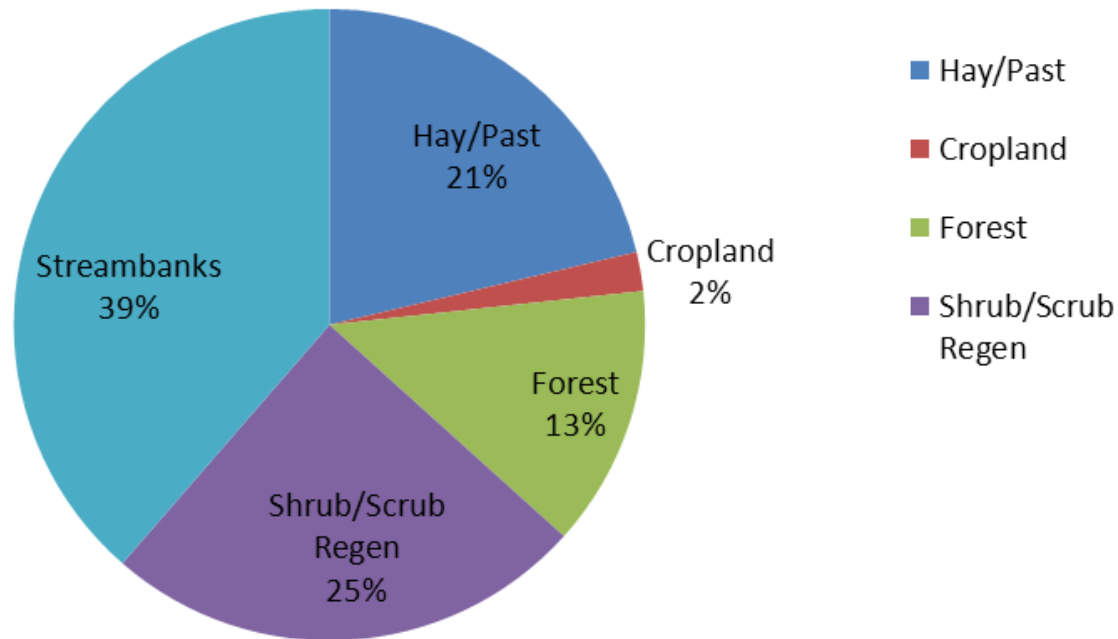
Existing Conditions Simulation



- Yes, there is a lot more sediment now....
- But the results are much more complex than this.
- (A Virginia study showed impaired watershed >10X increases)

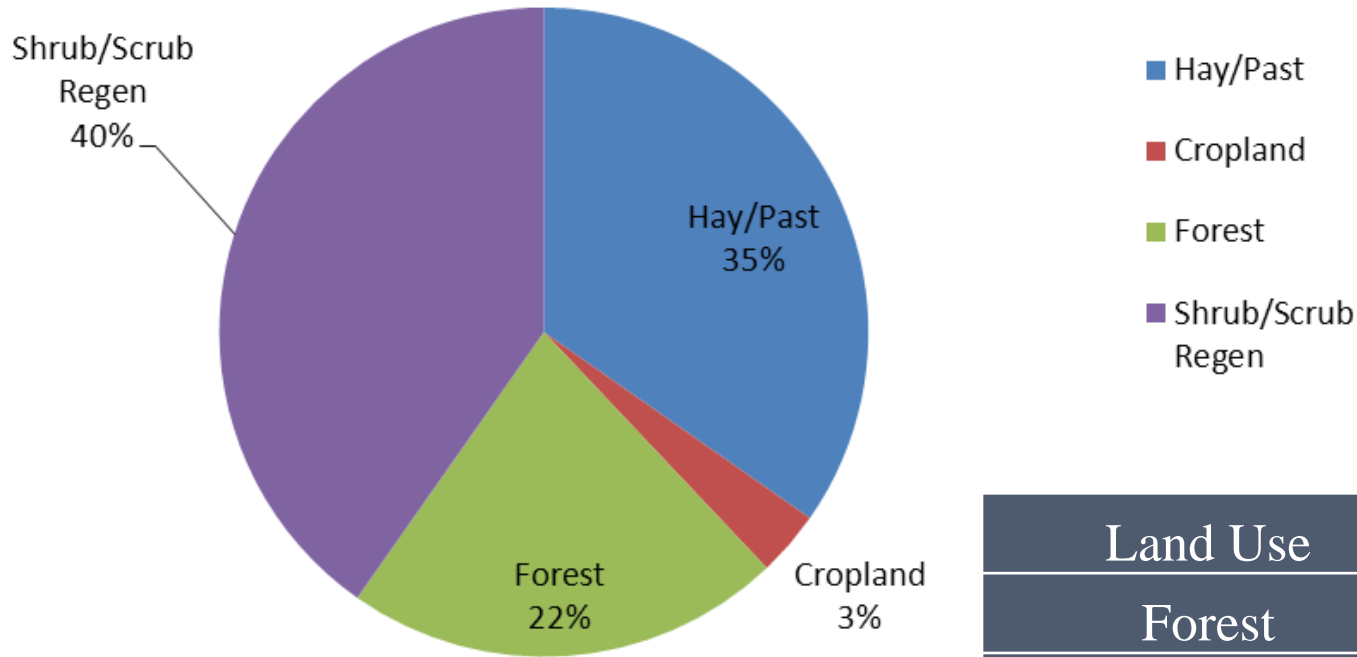
Sediment Sources

Sediment Sources - Primary contributors



- > double the load of sediment
- Erosion rate increase > streambank loss increase
- Low % of development indicates sensitivity...

Erosion Sources - Primary contributors



Land Use	Sed (tons/acre)
Forest	0.09
Hay/Past	0.51
Shrub/Scrub Regen	1.11
Cropland	2.78
Overall	0.40

- Overall load is not super high
- Logging: 10% land - 40% erosion.
- Streambanks – volume and land use.

Making Comparisons

Land Use	Sed (tons/acre)
Forest	0.09
Hay/Past	0.51
Shrub/Scrub Regen	1.11
Cropland	2.78
Overall	0.40

Land Use	Sediment Yield (tons/acre/year)
Undisturbed Forest	trace - .32
Careful Clearcut	.06 - .17
Careless Clearcut	1.35
Mechanical Site Prep	5.60 - 6.36
Cultivated Field	.42 - 7.50
Careless Agriculture	7.80 - 43.06
Active Construction	48.40 - 218.91

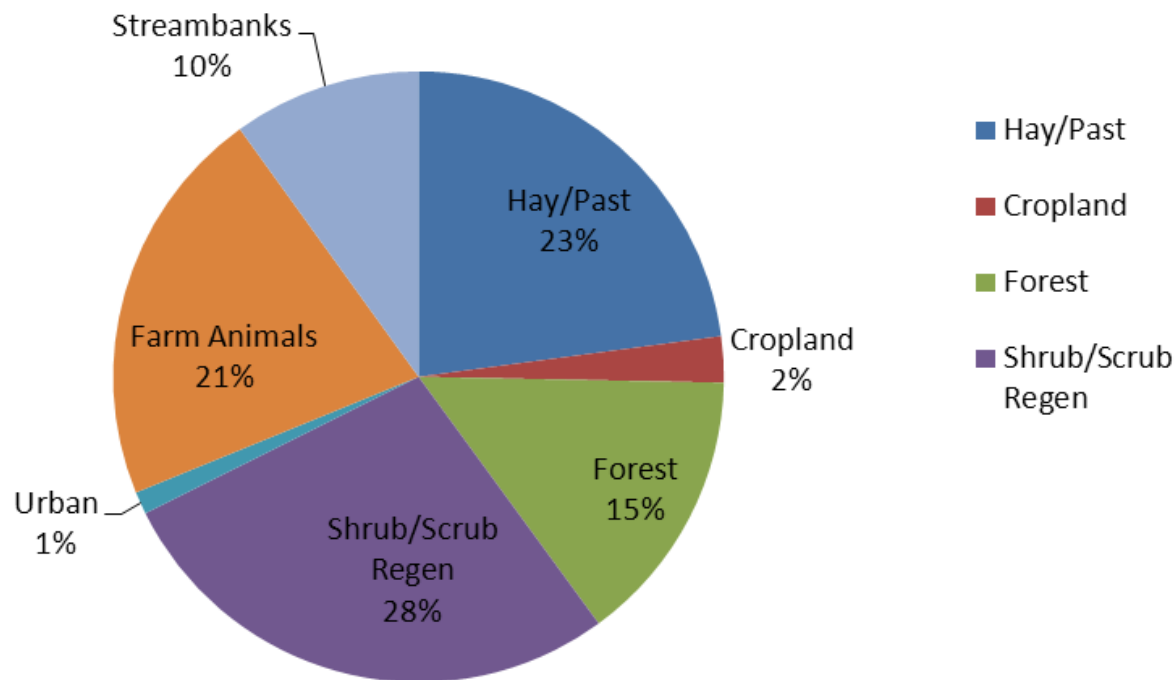
Yes!

Nooo!

Yoho, N.S. 1980. *Forest management and sediment production in the south – A Review*. Southern Journal of Applied Forestry. 4(1):27-36.

Nutrient Sources

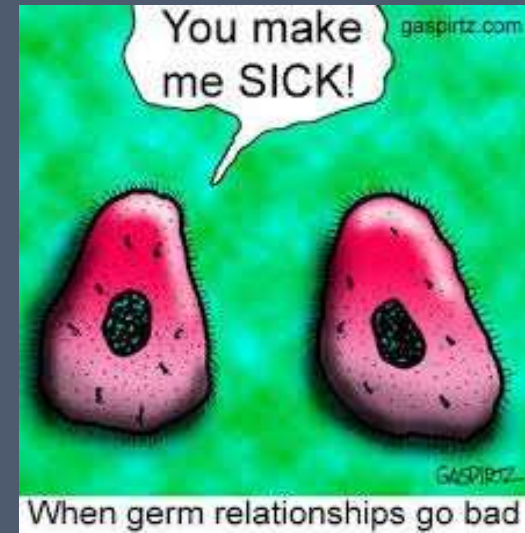
Nitrogen Sources - Primary contributors



- Nutrient loads are 1.7-2.5x as high as all forest
- Pastures, animals, and logging sites.

Bacteria

- Bacteria predictions are very high.
- Predictions of bacteria loading are challenging, but results are in the range of monitoring data.
- > 90% of predicted bacteria loads are generated by farm animals.
- In this case, almost entirely grazing cattle on relatively unmanaged pastures.
- Rest is generated by wildlife and pet waste/urban areas.
- No septic or wastewater was included in the analysis...



What does this all mean?

Simple take aways

- This watershed is still largely undeveloped.
- The terrain, soils, and underlying geology make this watershed very sensitive to changes in land use.

The Bad News

1. There are serious increases and problems with sediment and bacteria in this watershed.
2. The most sensitive things going on are logging and animal operations.

The Good News

1. These things are not yet at levels that cannot be improved.
2. There are a lot of opportunities out there to make improvements!

Where do we start?

Sediment targeting

1. By far #1 is logging sites (and management afterwards)
2. Pastures (particularly combined with animal operations)
3. Streambank stabilization

Bacteria

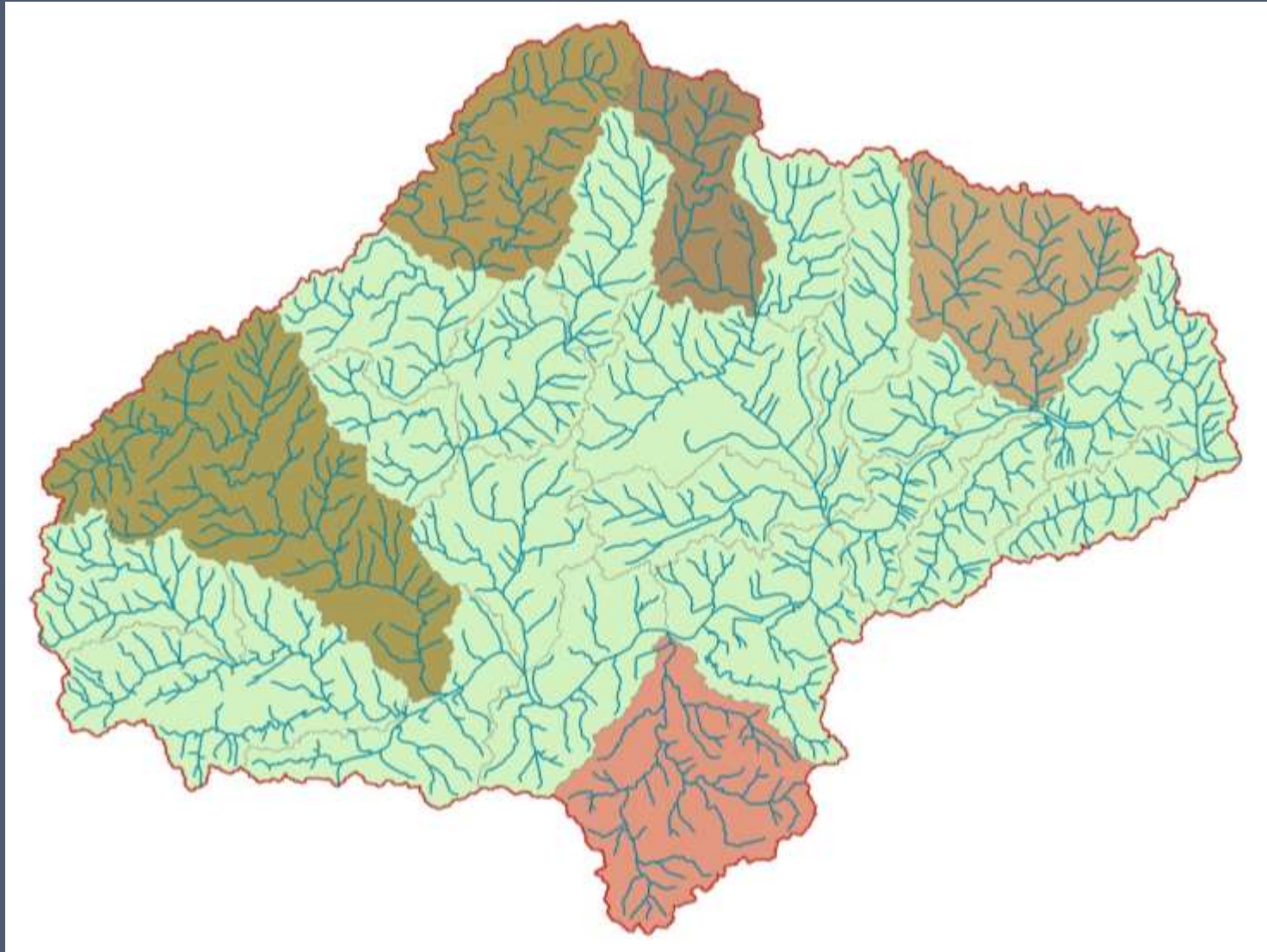
1. Animal operations (grazing cattle)

Urban

1. Urban areas are not even on the radar at a watershed scale.
2. Most drains to Smith or Dan.
3. A small area in the headwaters of Dry Creek may be worth targeting.

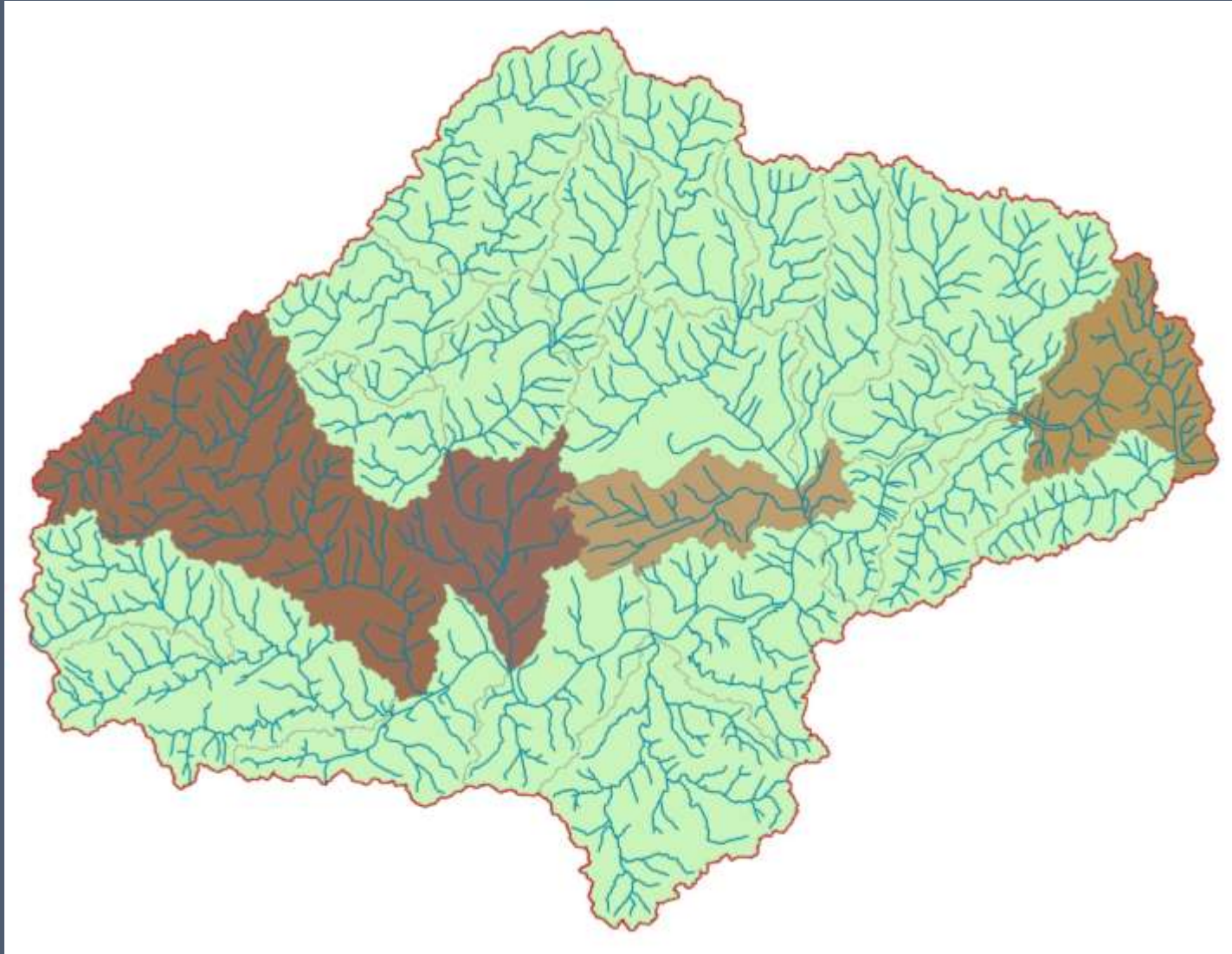
- Which watershed have the greatest exposure to these sources?
- What projects have the most potential in these areas?

Top Sediment Watersheds



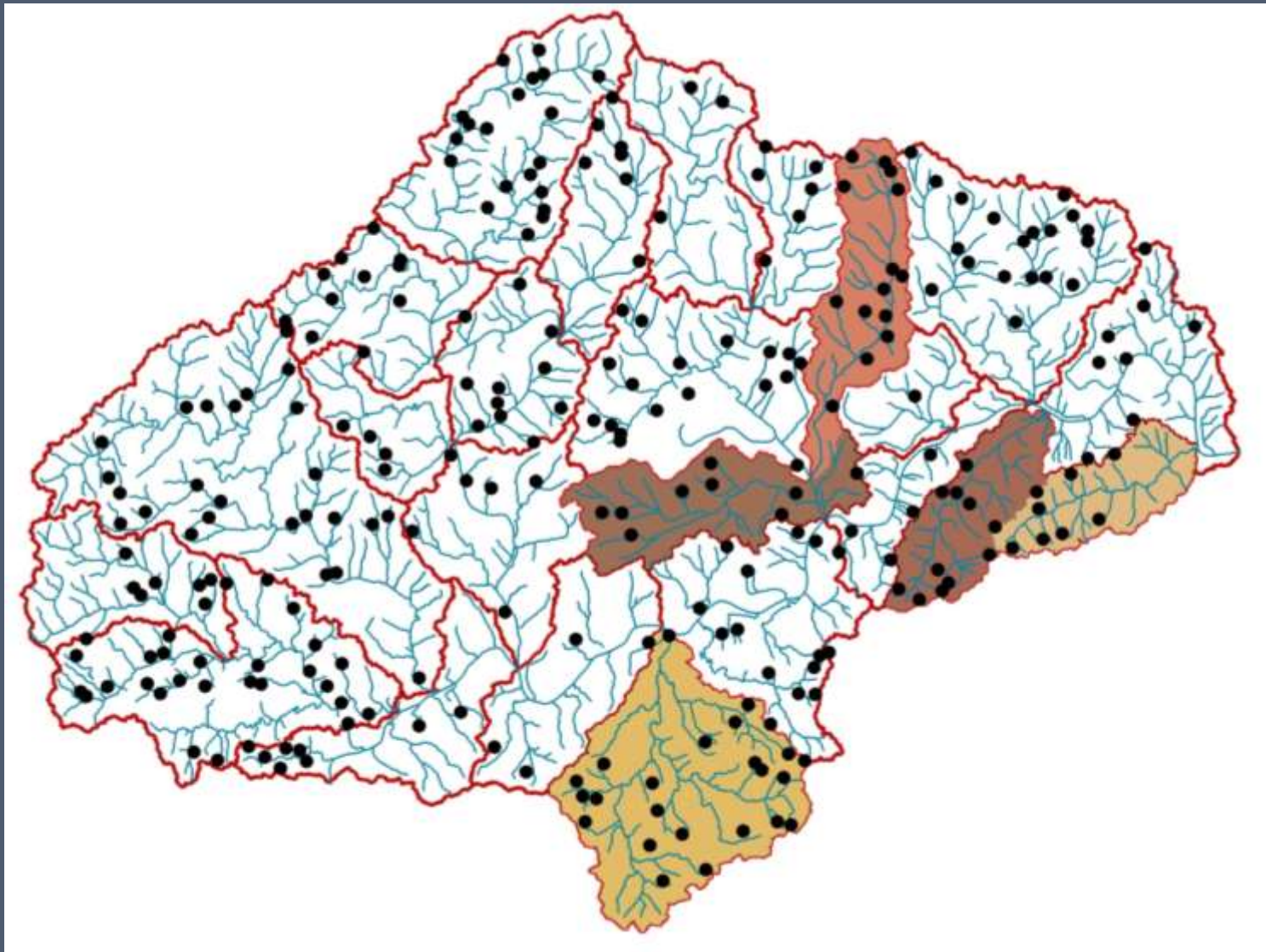
Target these watersheds for BMPs that reduce erosion!

Top Streambank Contributors



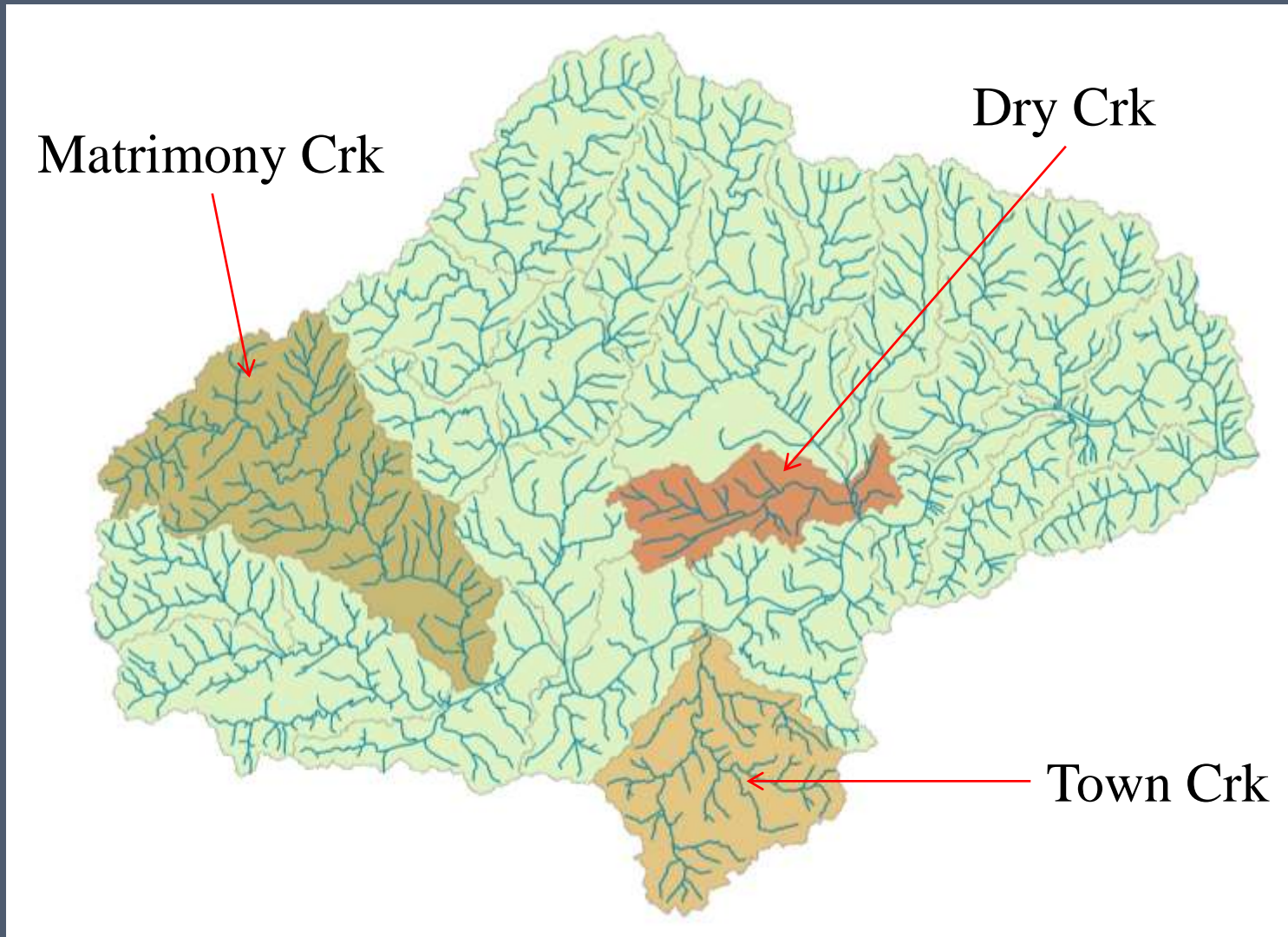
Target these watersheds for streambank stabilization!

Top Bacteria Contributors



Target these watersheds for Animal Operation BMPs!

NC Priority Watersheds



Identifying BMPs

- Focus on BMP types that can be identified using remote sensing. GIS
- Focus on BMPs that target sediment and/or bacteria
 - Logging sites
 - Cattle exclusion/fencing
 - Riparian buffers
 - Stream restoration
 - Wetland restoration
 - Stormwater BMPs
 - Pond protection sites
- Develop GIS procedure for identifying sites.
- Check results, calibrate procedures in small areas.
- Apply broadly at watershed scale.

BMP Results

Practice	# sites found	Area/Length
Logging management practices	20-30	>10 acres each
Cattle exclusion/fencing	> 300	30 miles
Stream restoration or buffers	> 300	30+ miles
Wetland restoration	74	2,000 acres
Farm ponds	186 (>.75 ac) total > 400	~300 acres
Stormwater BMPs	100	Varies

Field level analysis generated over 1,000 sites on 35%....
...Size thresholds...

Modeling Potential Benefits

- PRedICT
- Is a tool built into Mapshed and GWLF
- Predicts the load reductions associated with watershed scale BMPs.
- Provides initial cost estimates.

- Apply to targeted priority subwatersheds
- Implement range of BMPs to examine potential benefits and costs.

Matrimony Creek

- Kitchen Sink
 - Implement every BMP in every place that we can find.
 - Cost: \$2.5-3M
 - Benefit: 8-10% reduction in sediment and nutrient loads
 - This is a lot of reduction! But probably not enough to get where you want to go.
- Take Home:
 - BMPS are not gonna do it.
 - We have to change the standard of practice and the culture of land management in this area.



More Benefits Modeling

- Bacteria Reductions
 - Fencing and buffers is highly effective
 - Relatively low cost compared to other BMP types.
- > 50% reduction achieved with full implementation of fencing and buffers.
- (w/alternative water supplies)
- Improved management for added value...



Subwatershed	Sediment reduction	Estimated Cost	Bacteria reduction	Estimated Cost
Matrimony Creek	8%	\$2.75M	> 50%	\$270,000
Town Creek	10%	\$2M	> 50%	\$61,000
Dry Creek	12%	\$1.7M	> 50%	\$125,000

Recommendations!

1. Management Actions
 1. Focus Areas
 2. Policy directives
 3. Planning improvements
2. Implementation Priorities
 1. Target Watersheds
 2. Priority Practices
3. Other Ideas
 1. Organizational ideas
 2. Strategies



Management Actions

General

- Continue developing policy and strategies for watershed protection.
- A lot of the rules and planning currently in place are not as effective as they could be (ie: erosion control, animal operations).
- Develop/plan sources of funding for enforcement and inspectors!
 - Pittsboro...

Discussion/Ideas

- This watershed is very sensitive to development pressures.
- Use the PTRC to help!
- and other watersheds as examples!

Management Actions

Forestry Operations

- Improve the standard of practice for forestry operations.
- Existing rules and expectations for sustainable practices.
- Education on sensitivity of watershed to logging.
- Enforcement!

Discussion/Ideas

- Increased emphasis on sustainable forestry.
- County Extension, Soil and Water, DFR.
- Notification/permitting process.
- Incentivize protection/preservation.
- Empowered Inspector!



Ditch/ephemeral channel

No buffer

No erosion control

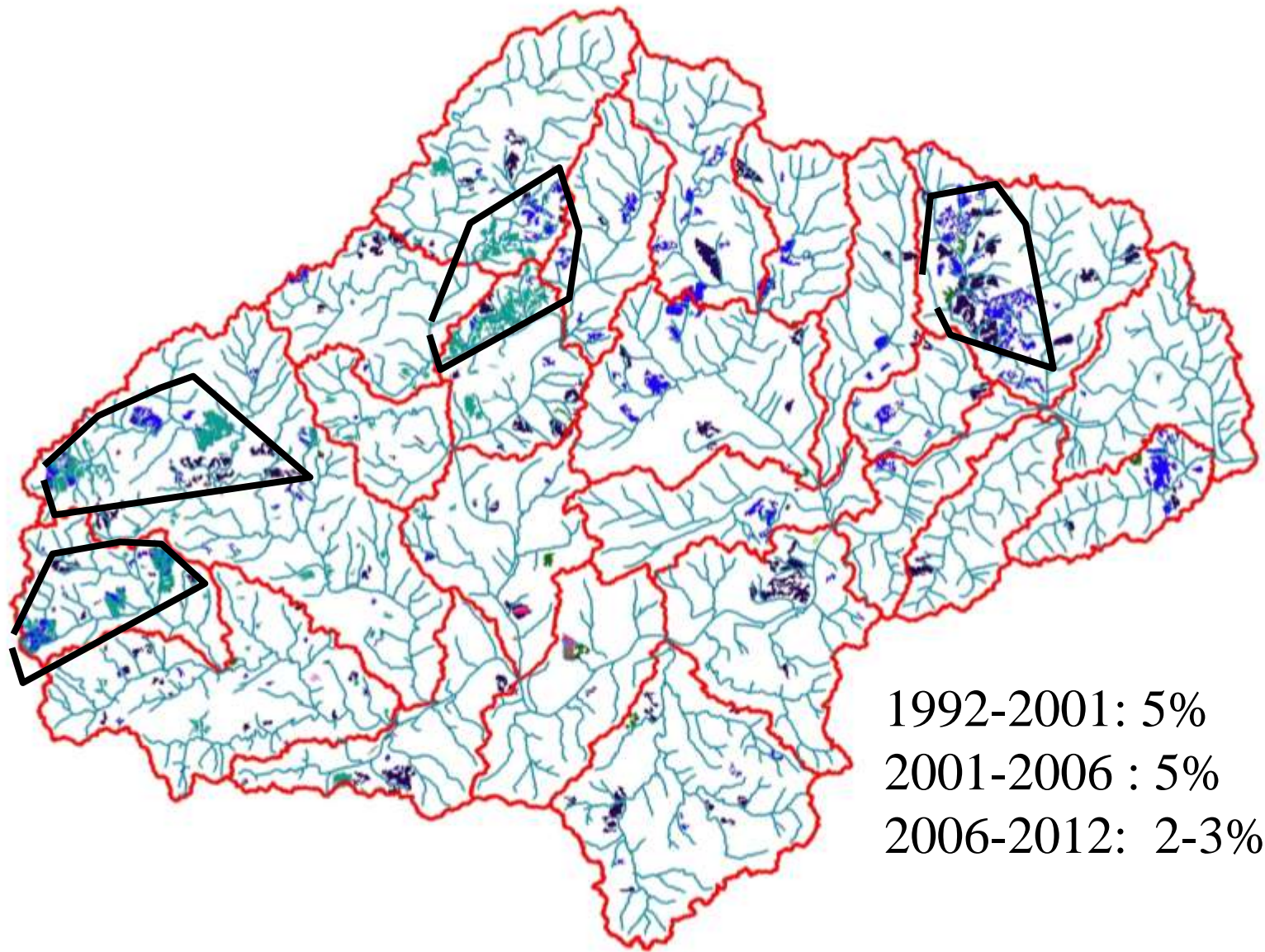
Short circuit

Google earth



Google earth

Logging/clearing estimates 1992-2012



1992-2001: 5%
2001-2006 : 5%
2006-2012: 2-3%

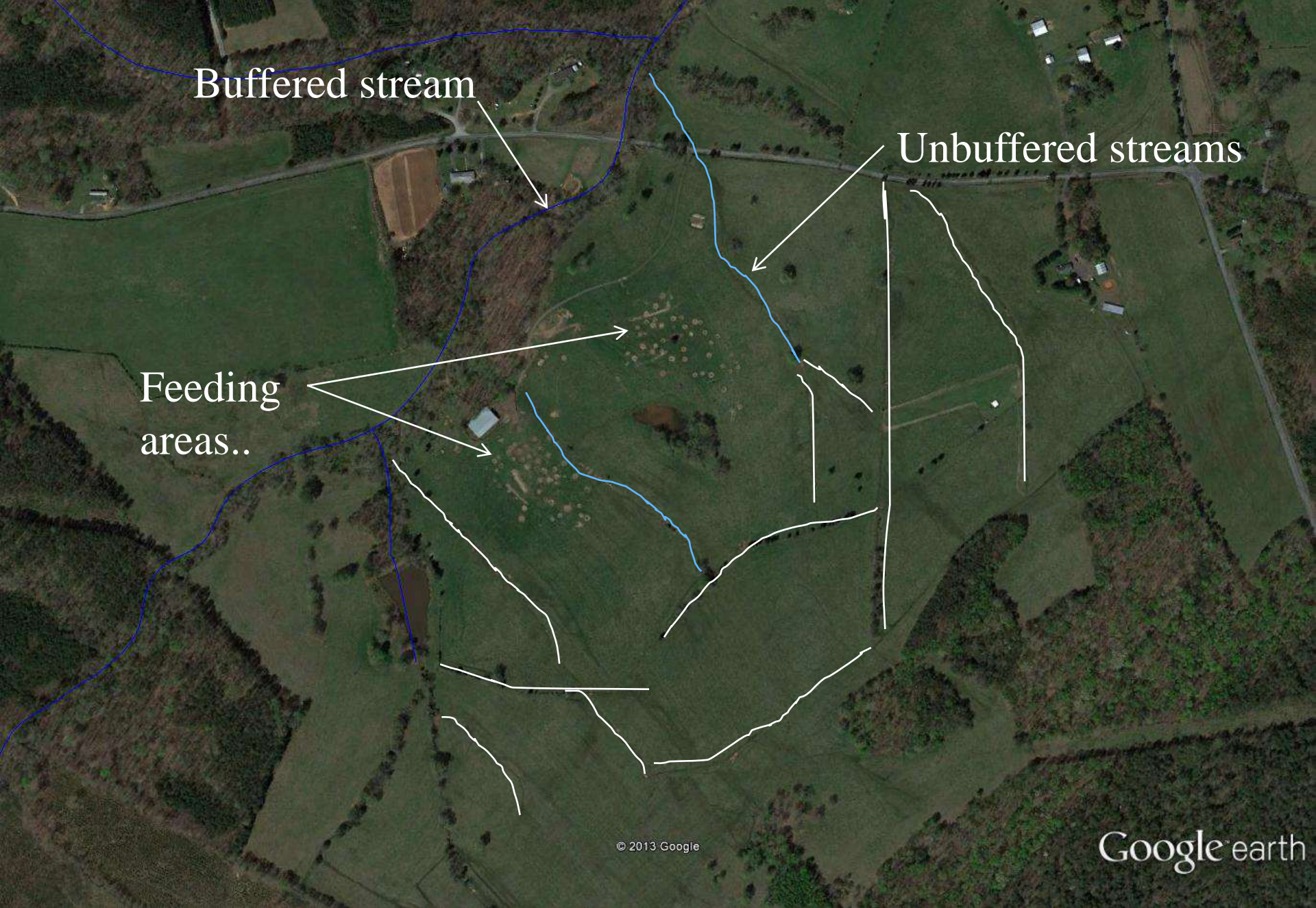
Management Actions

Animal Operations

- Improve the standard of practice for animal operations.
- Almost every site is exempt from existing rules.
- Every program we have is voluntary/cost-share.
- Perennial buffers are ineffective when short circuits exist.
- Enforcement!

Ideas

- Increased emphasis on BMPs for feedlots and pastures.
- County Extension, Soil and Water, NRCS
- Fencing and buffers
- Local or County Inspector?



Buffered stream

Unbuffered streams

Feeding areas..

© 2013 Google

Google earth

Short circuits...

NC STATE UNIVERSITY

Virginia TMDLs (Banister, Sandy, Polecate Creek)

Table 3. TMDL load reductions specified during TMDL development.

Impairment	Straight Pipes & Failed Septic Systems	Required Load Reductions (%)					
		Urban	Livestock Direct Deposit	Pasture	Cropland	Wildlife Direct Deposit	Forest
Banister River	100	92	100	92	92	35	0
Sandy Creek	100	85	100	85	85	40	0
Polecat Creek	100	74	100	74	74	40	0

64% forest (you have 66%)

28% hay/pasture... (10% more than you...)

Study indicates massive needs:

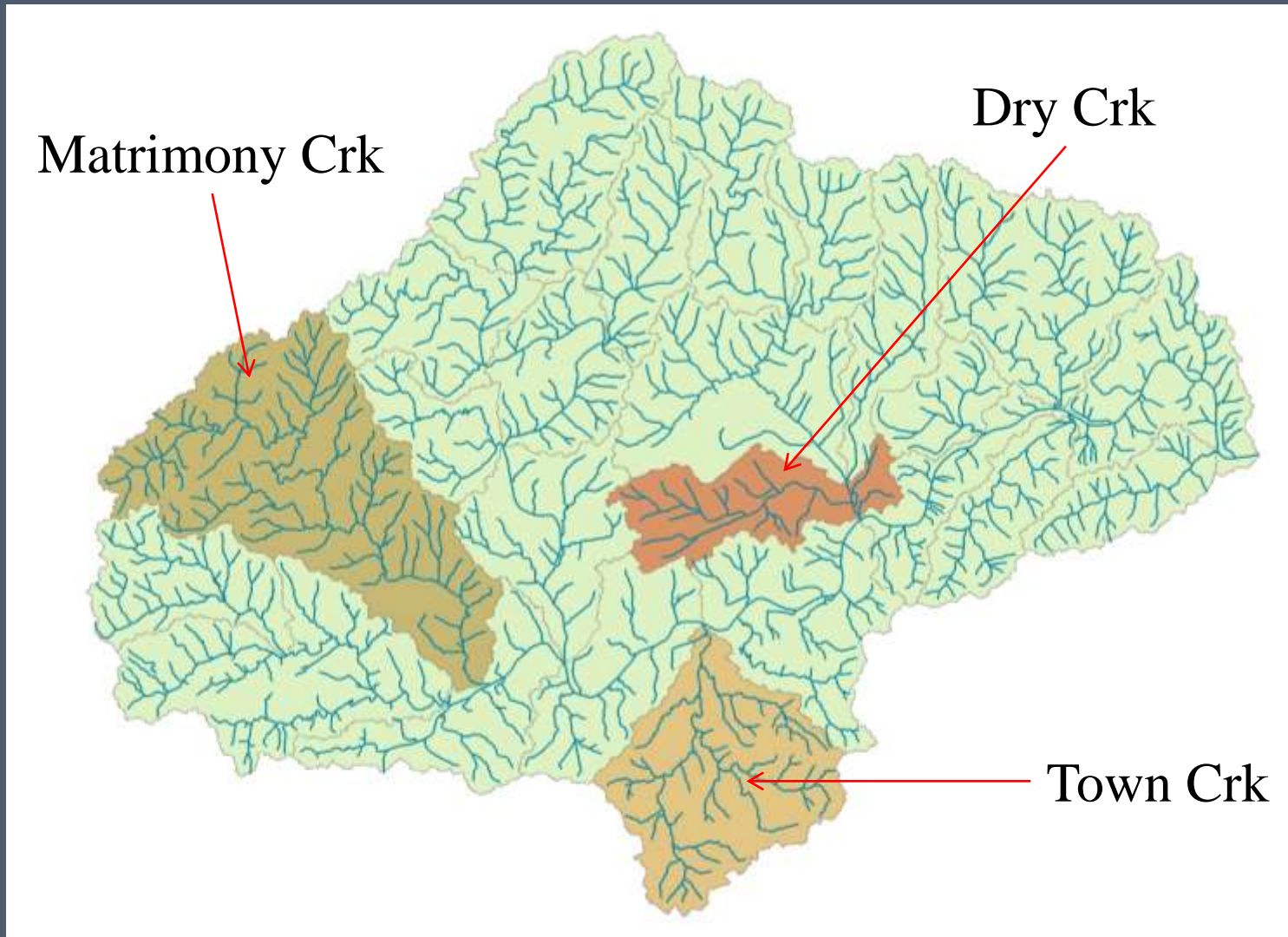
120 miles of fencing

50,000 acres of improved pasture management and BMPs

\$10-20M over 10 yrs.

Not enough to meet reduction goals....

NC Priority Watersheds



BMP Implementation

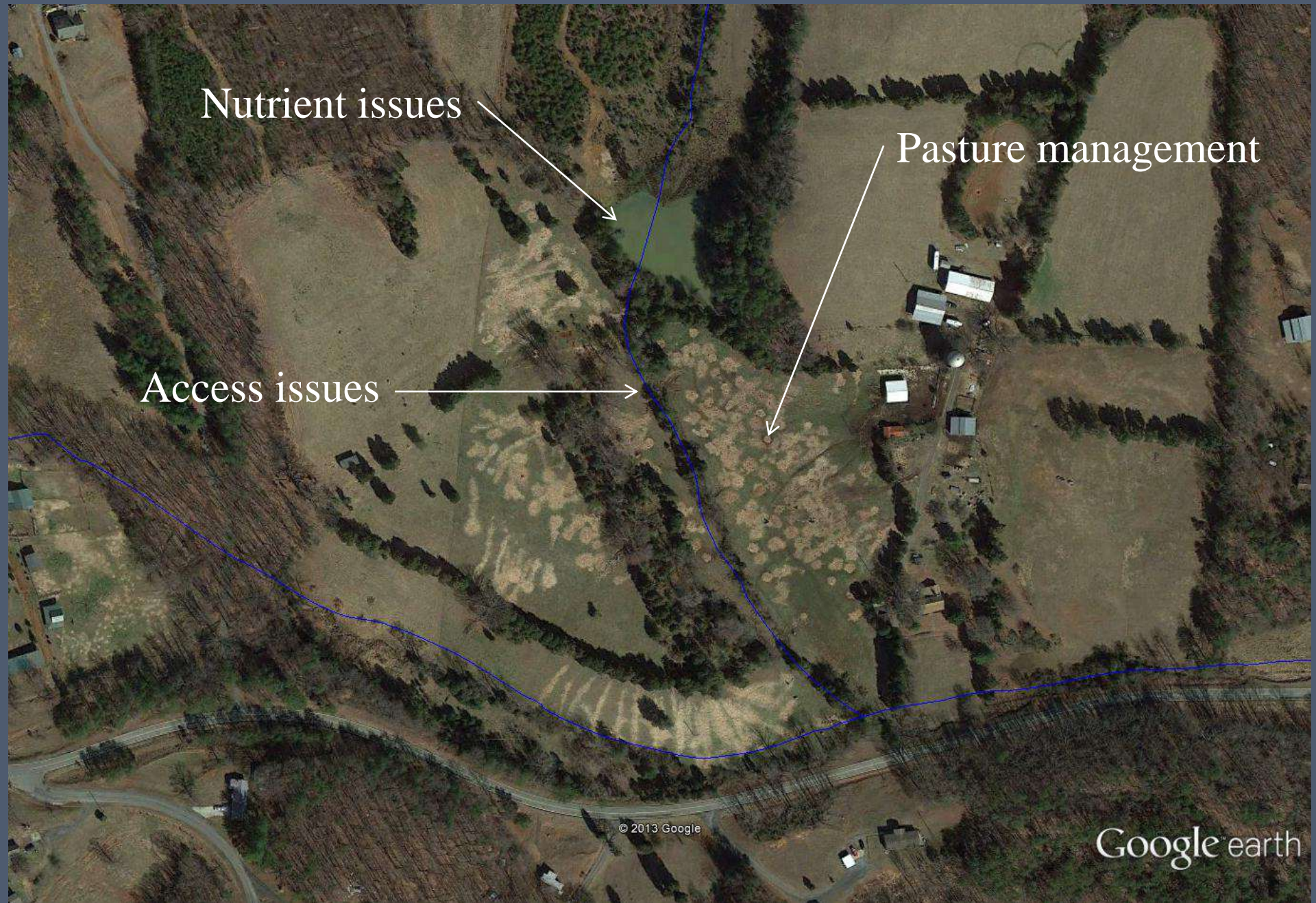
Priority Practices for Matrimony Creek

- **Cattle Exclusion/Fencing.**
- Combine with buffer establishment.
- Combined with improved pasture management.
 - Alternative water systems
 - Winter feeding strategies
 - Rotational grazing
- Preservation Sites

Nutrient issues

Pasture management

Access issues



© 2013 Google

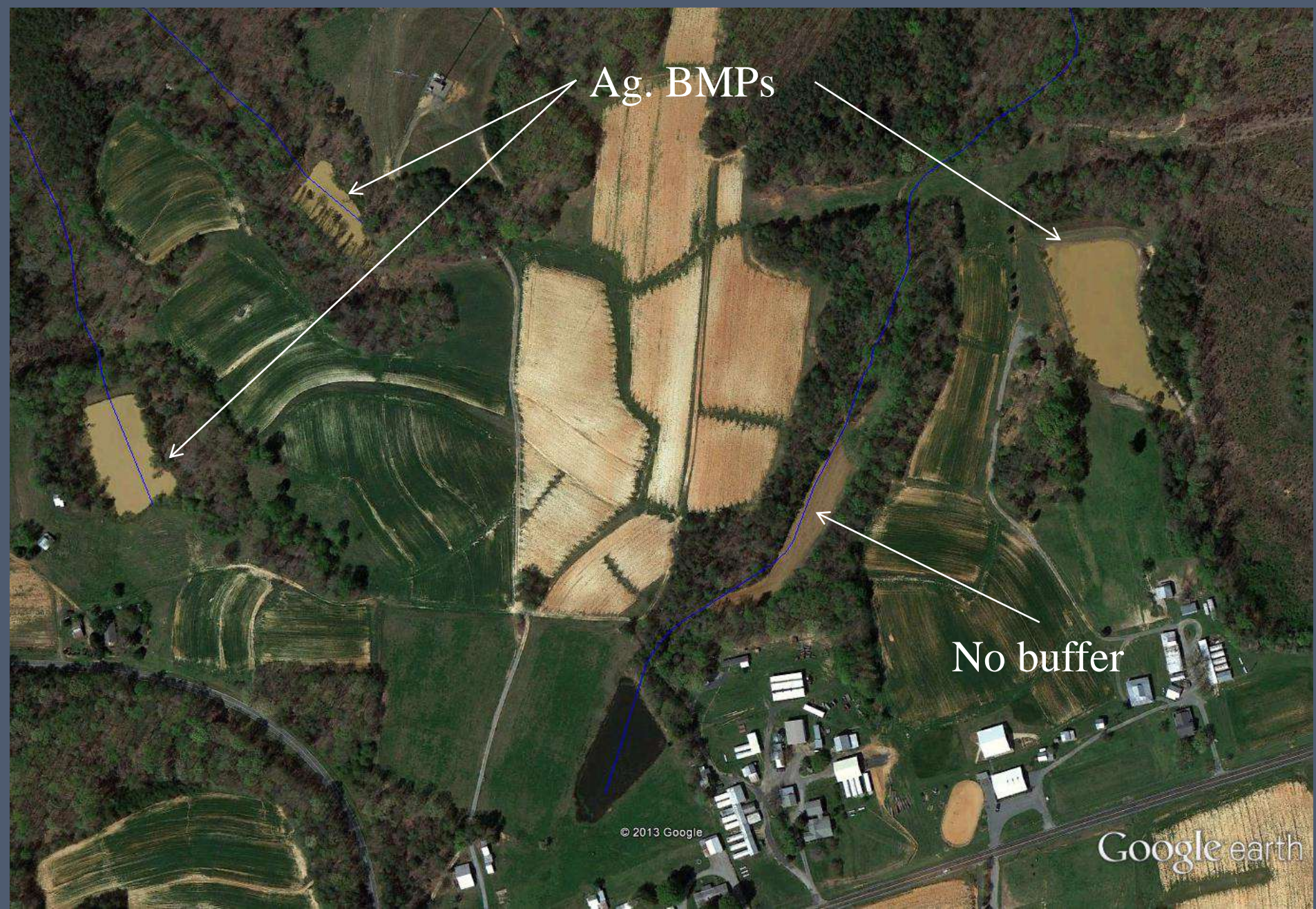
Google earth

BMP Implementation

Priority Practices for Town Creek

Town Creek

- Cattle exclusion fencing
 - **Agricultural BMPs**
 - Combined with improved pasture management
- Preservation Sites



Ag. BMPs

No buffer

© 2013 Google

Google earth

BMP Implementation

Priority Practices for Dry Creek

- Fencing and buffers.
- **Stream Restoration**
- **Stormwater BMPs**



*Field study in Dry Creek



Ag. BMPs

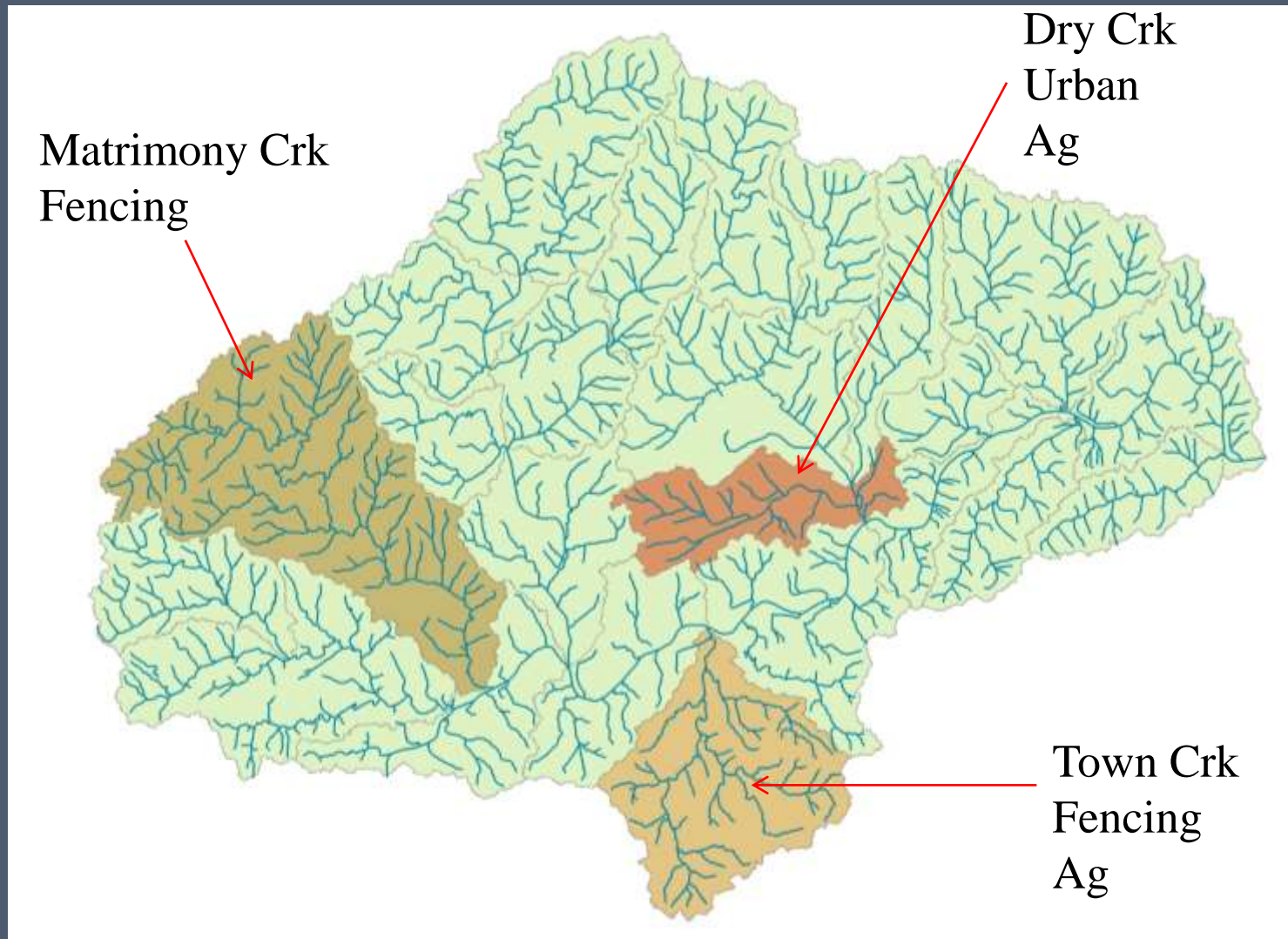
Stormwater BMPs

Meadow Summit

© 2013 Google

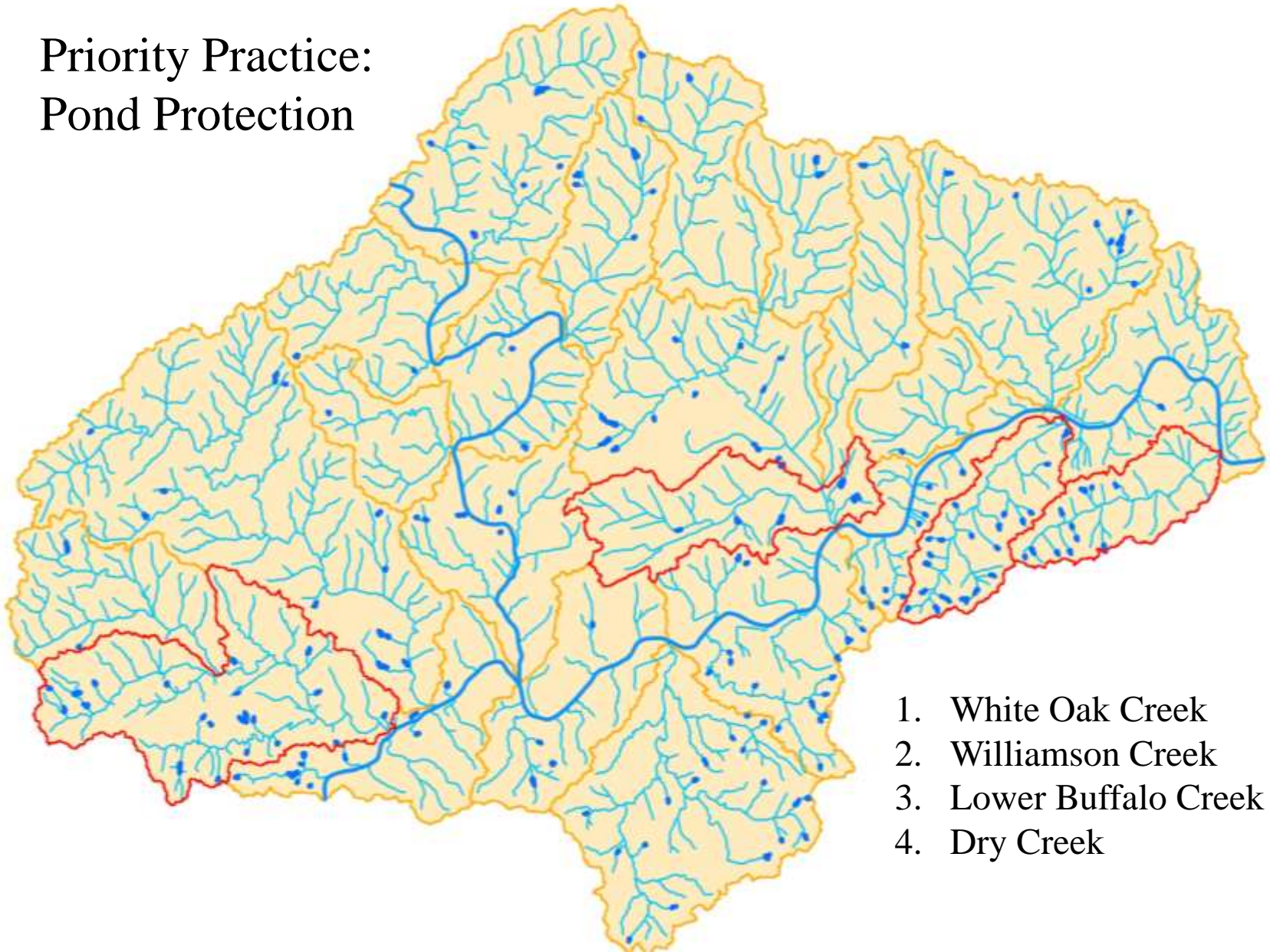
Google earth

NC Priority Watersheds



Pond Protection

Priority Practice:
Pond Protection



1. White Oak Creek
2. Williamson Creek
3. Lower Buffalo Creek
4. Dry Creek

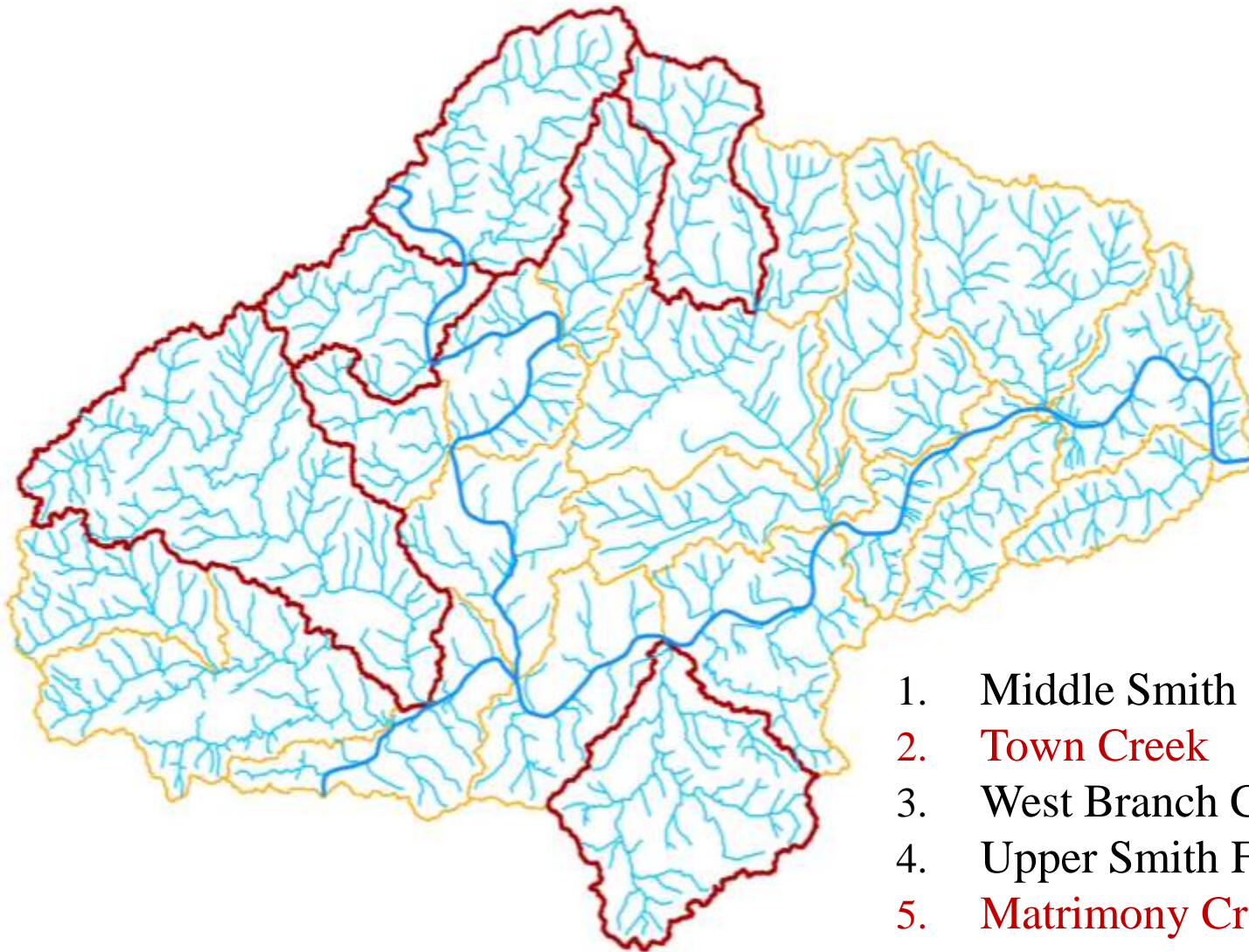
BMP Implementation

Priority Practice: Preservation

- Watershed Scale
- Separate Analysis
- Ranked by their sensitivity to land use changes to sediment yield...
- Priority Watersheds include:
 1. Middle Smith – Turkeycock Creek
 2. **Town Creek**
 3. West Branch Cascade
 4. Upper Smith Fall Creek
 5. **Matrimony Creek**

* Note: 4 out of 5 are top sediment contributors

Priority Preservation Watersheds



1. Middle Smith Creek
2. **Town Creek**
3. West Branch Cascade
4. Upper Smith Fall Creek
5. **Matrimony Creek**

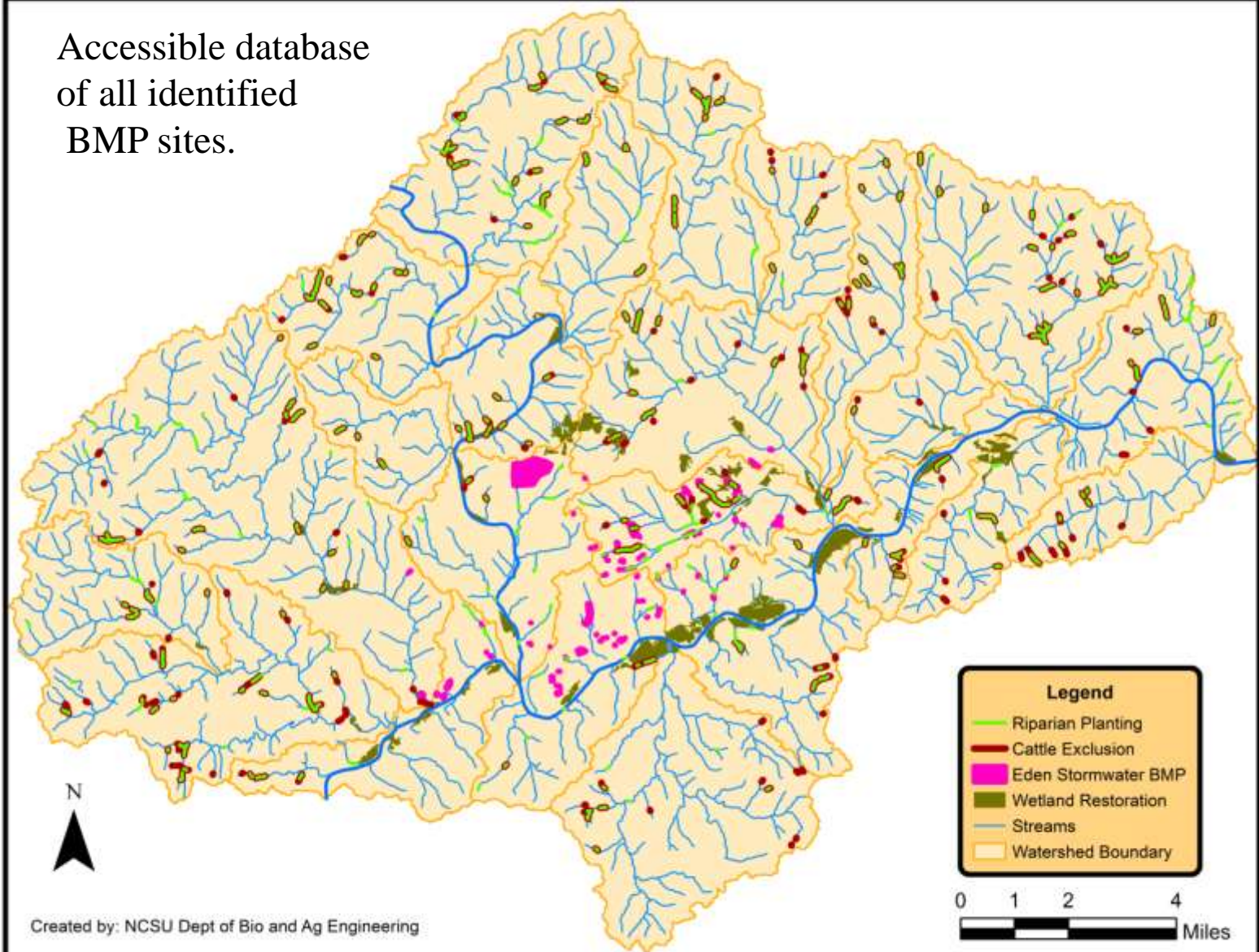
Bringing it all together...

- Compile feedback and additional ideas/needs.
- Final report and maps of priority areas...
- Final BMP map and database...
- Target efforts.
- Maximize usability.
- Provide ability to look more closely as needed.



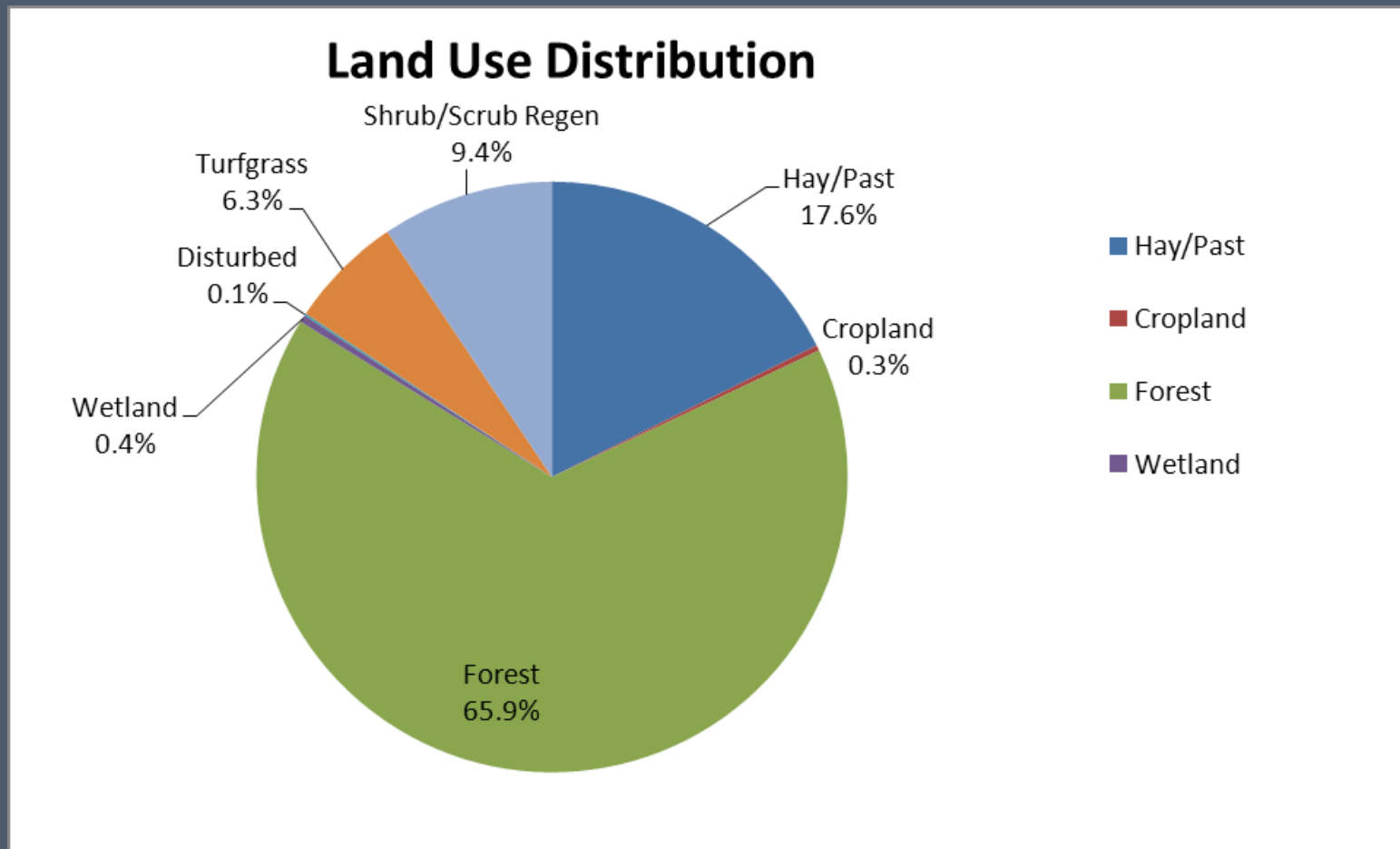
BMP Database

Accessible database
of all identified
BMP sites.



Created by: NCSU Dept of Bio and Ag Engineering

Watershed Land Uses



Eden vs Upper Neuse

225 sq mi

770 sq mi

66% Forest		61% Forest
12% Ag/Lumber	→	16% Ag
17% Hay/Pasture	→	17% Developed
??% Protected		12% Protected

- Promote sustainable forestry practices and enforcement.
- Participate in planning to keep forests!
- Develop policy and incentivize protected land however possible.
- Protect against impacts of future urban development.

Eden vs Banister vs Upper Neuse

225 sq mi

66% Forest



12% Ag/Lumber

17% Hay/Pasture

??% Protected

184 sq mi

64% Forest

8% Urban/Ag

28% Pasture

??% Protected

770 sq mi

61% Forest

16% Ag

17% Developed

12% Protected



- Promote sustainable forestry practices and enforcement.
- Participate in planning to keep forests!
- Develop policy and incentivize protected land however possible.
- Protect against impacts of future urban development.

Closing Thoughts

- Take ownership of your watershed!
- Do not rely on the state or regional office for policy and enforcement.
- Pareto Principle
- 80/20 rule
- In this case, 30% of the land is attributed to 75% of sediment problems.
- 10-20% of the land is attributed to 90%+ of bacteria.
- Start by revisiting policies
- Use your non-profits and government agencies.
- Incentivize BMPs and implement wherever possible!



Other Ideas/ Questions?

– kris_bass@ncsu.edu
– 919.515.8245

- What are we missing?
- How can we make this the most accessible and usable for the group?

