

# Hydrology and Water Quality Impacts of Loblolly Pine (*Pinus taeda*) and Switchgrass (*Panicum virgatum*) Intercropped Systems in Upland Southeastern Forested Watersheds.

Erin Bennett<sup>1</sup>, François Birgand<sup>1</sup>, George Chescheir<sup>1</sup>,  
Elizabeth Allen<sup>1</sup>, & Timothy Appelboom<sup>1</sup>

<sup>1</sup>. Biological and Agricultural Engineering, North  
Carolina State University

ASABE 2013 Annual  
International Meeting  
July 23, 2013

## Background

- ▶ Increased energy demand [1]
- ▶ Biofuels as alternative energy sources
  - Replace fossil fuels [1]
  - Reduce dependency on foreign oil [1]
  - Self-sustaining [1]
  - The Energy Independence and Security Act of 2007 [2]
    - Ethanol
    - Advanced biofuels – switchgrass and soybeans



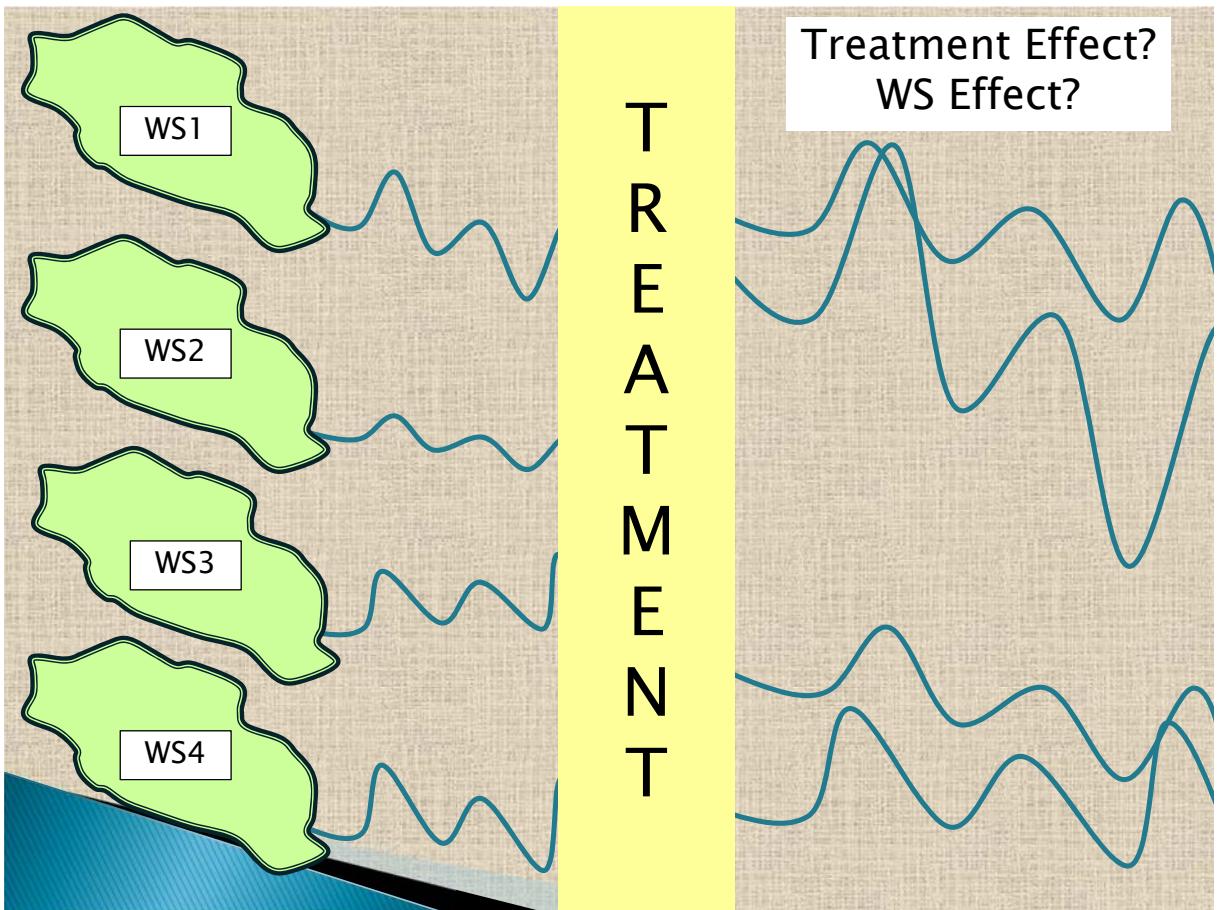
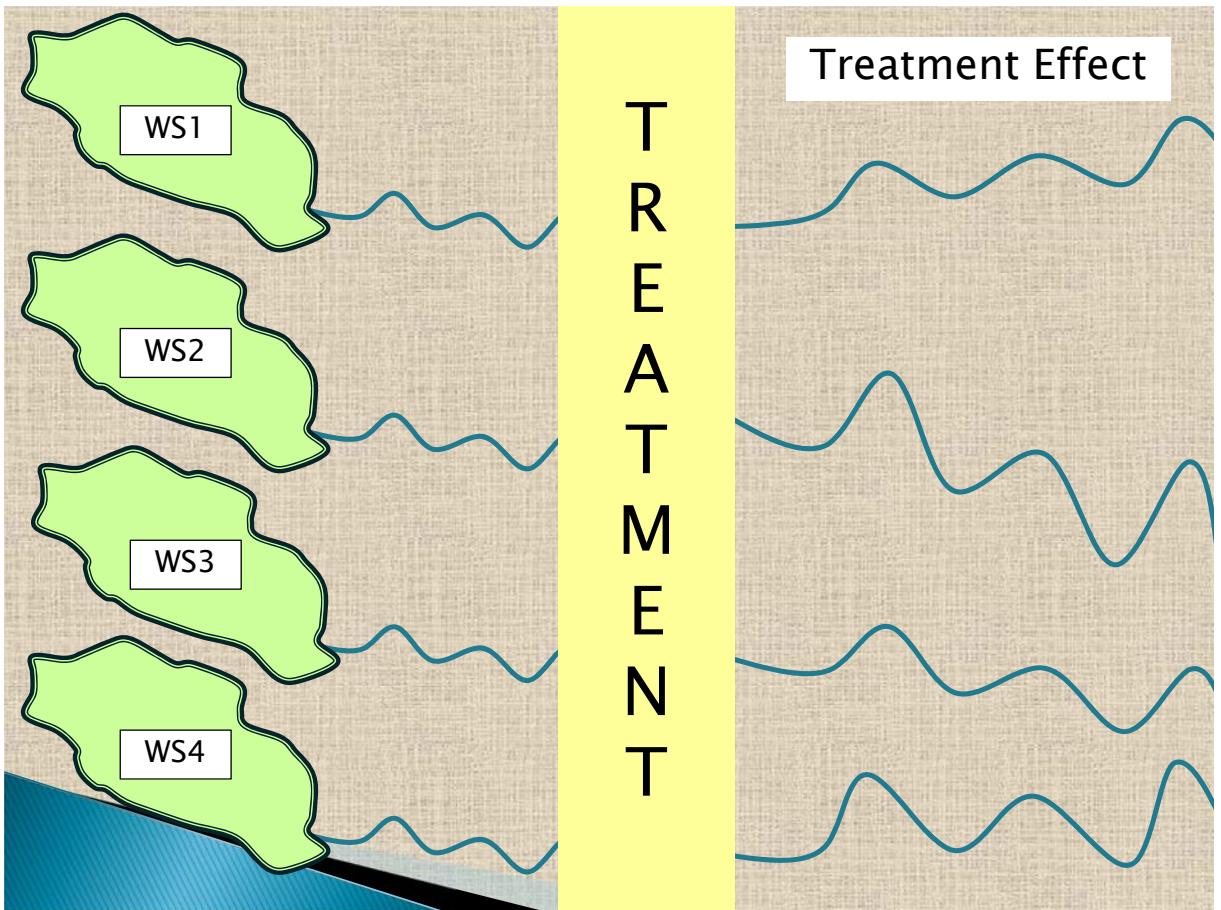
# What is Biomass Intercropping?

- ▶ Competition with food crops [3]
- ▶ Not taking away potential agricultural land [3]
- ▶ Too much shade after 10 years [4]



## Potential Problems

Crop Management	Potential Effects
Bare ground during establishment	Increase soil erosion and increase the amount of runoff from the site [5]
Fertilization	Potential nutrient leakage and increased nutrient loading [6]
Equipment traffic	Soil compaction and reduce infiltration which may increase the runoff from the site [4]



# Project

- ▶ Catchlight Energy, LLC – joint venture between Weyerhaeuser Company and Chevron Corporation and by the Department of Energy
- ▶ Environmental Sustainability
  - Look at environmental effects of cellulosic biofuel growth in a forest setting
  - Hydrology, water quality, soil productivity, carbon, and wildlife research projects



# Project

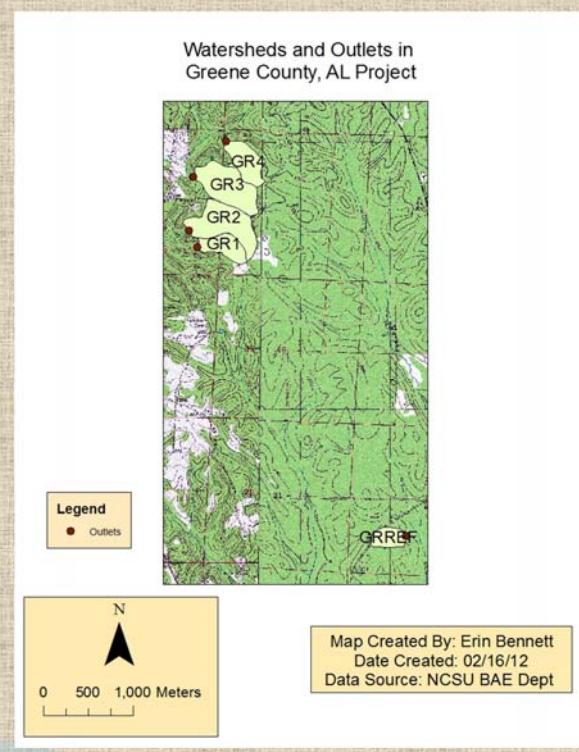
- ▶ 3 field regions: NC, MS, and AL
- ▶ 4 to 5 watersheds each having differing land cover treatments
  - Watersheds range from 20 to 40 ha



# Site

- ▶ Greene County, AL
- ▶ 5 watersheds and 5 different land cover treatments
- ▶ Initially (March 2010–March 2012) the first four watersheds were young pine stands with undergrowth and the fifth watershed is a 18 year reference pine stand (GRREF)
- ▶ In March 2012 the treatments were implemented:

GR1	Pine w/ undergrowth
GR2	Thinned pine w/ switchgrass intercropped
GR3	Age 0 pine w/ switchgrass intercropped
GR4	Switchgrass only
GRREF	Reference stand



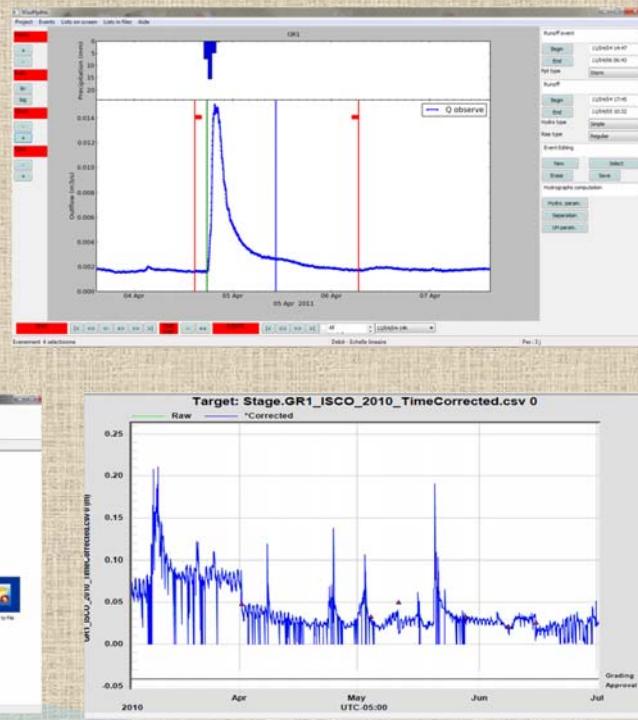
## Data Collection

- ▶ Wooden Flumes
- ▶ Velocity (2 min)
- ▶ Stage (2 min)
- ▶ Weather (15 min)
- ▶ Flow Proportional Composite Sampling
  - $\text{NO}_3^-$ ,  $\text{NH}_4^+$ , TKN, TSS, TP, DOC, and DIC

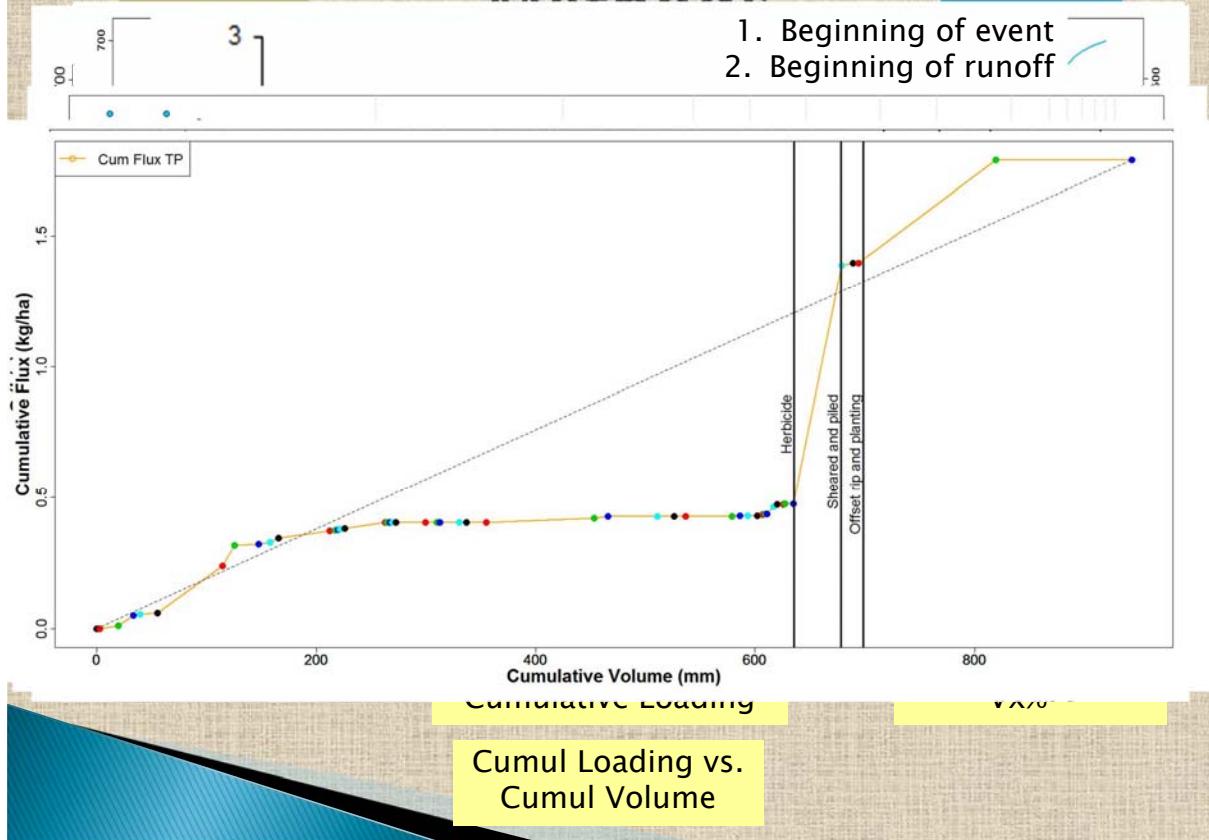


# Software

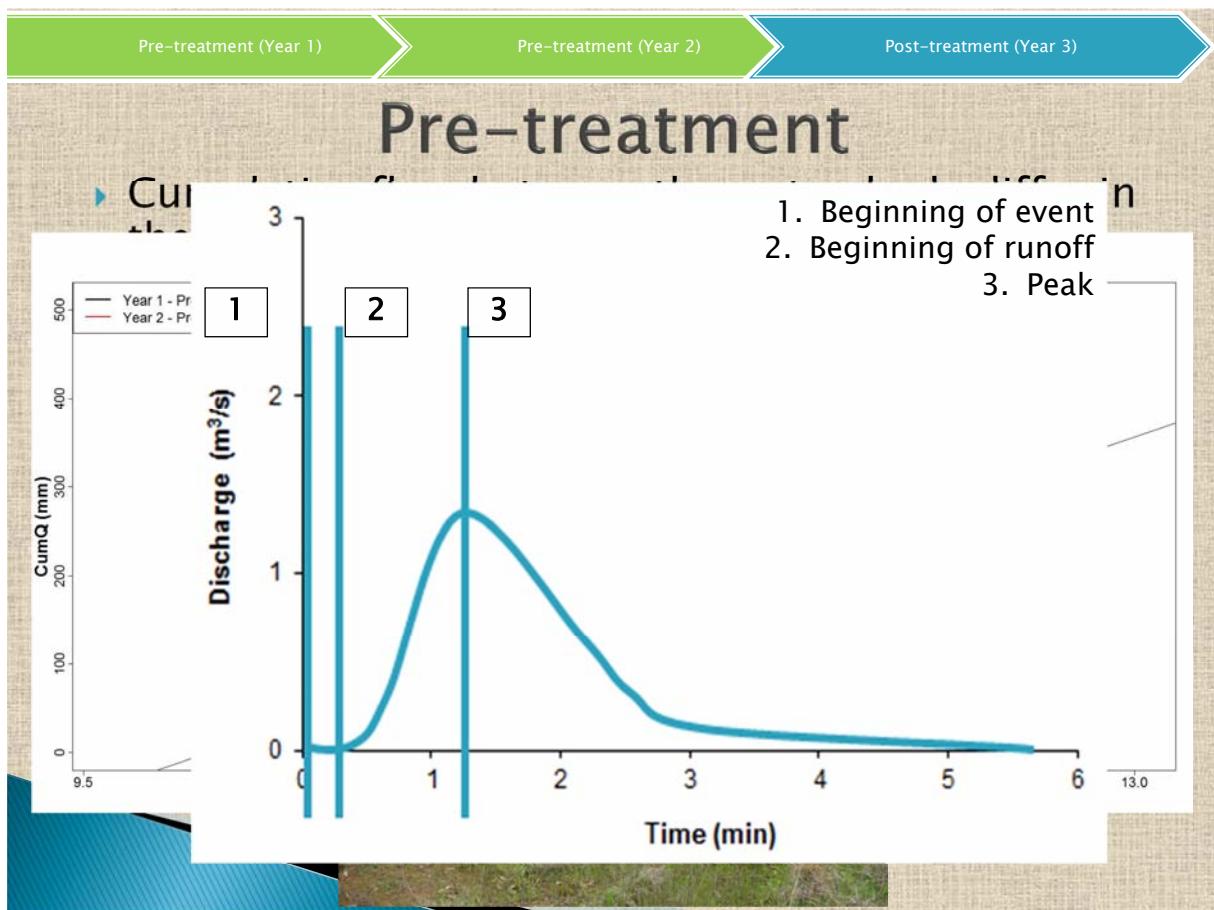
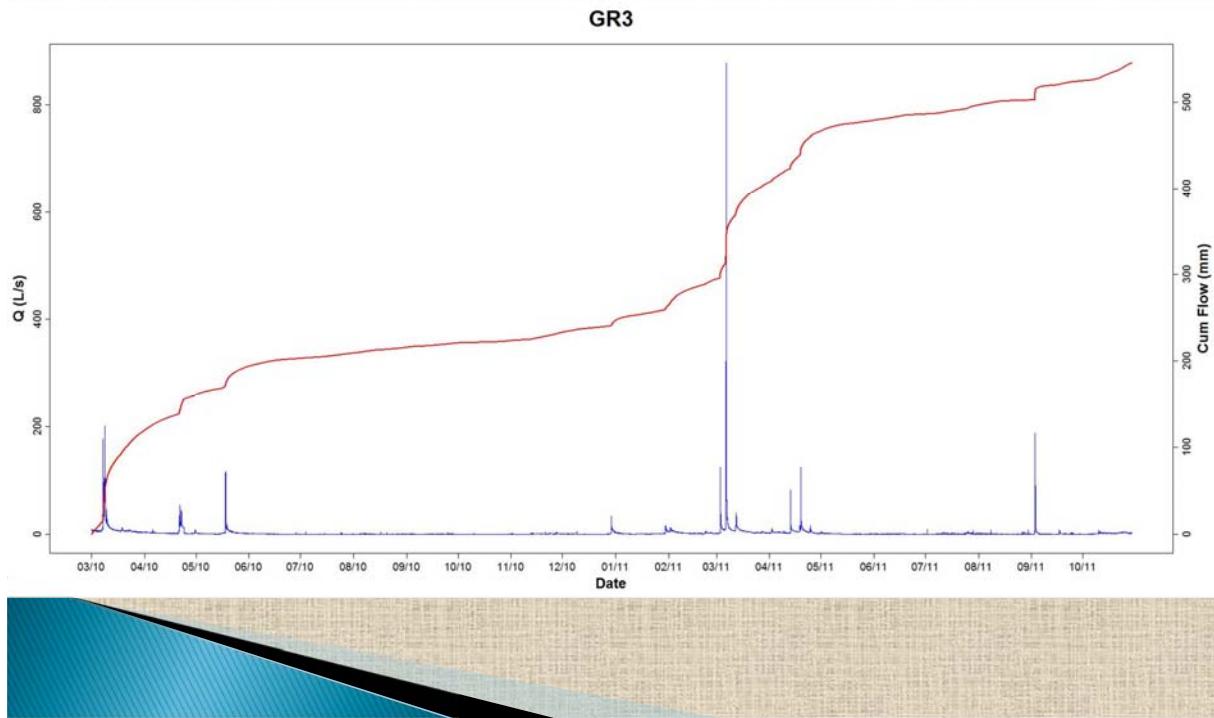
- ▶ AQUARIUS software [11]
- ▶ R Statistical Software
- ▶ VisuHydro [12]
- ▶ Excel
- ▶ SAS



## Methods

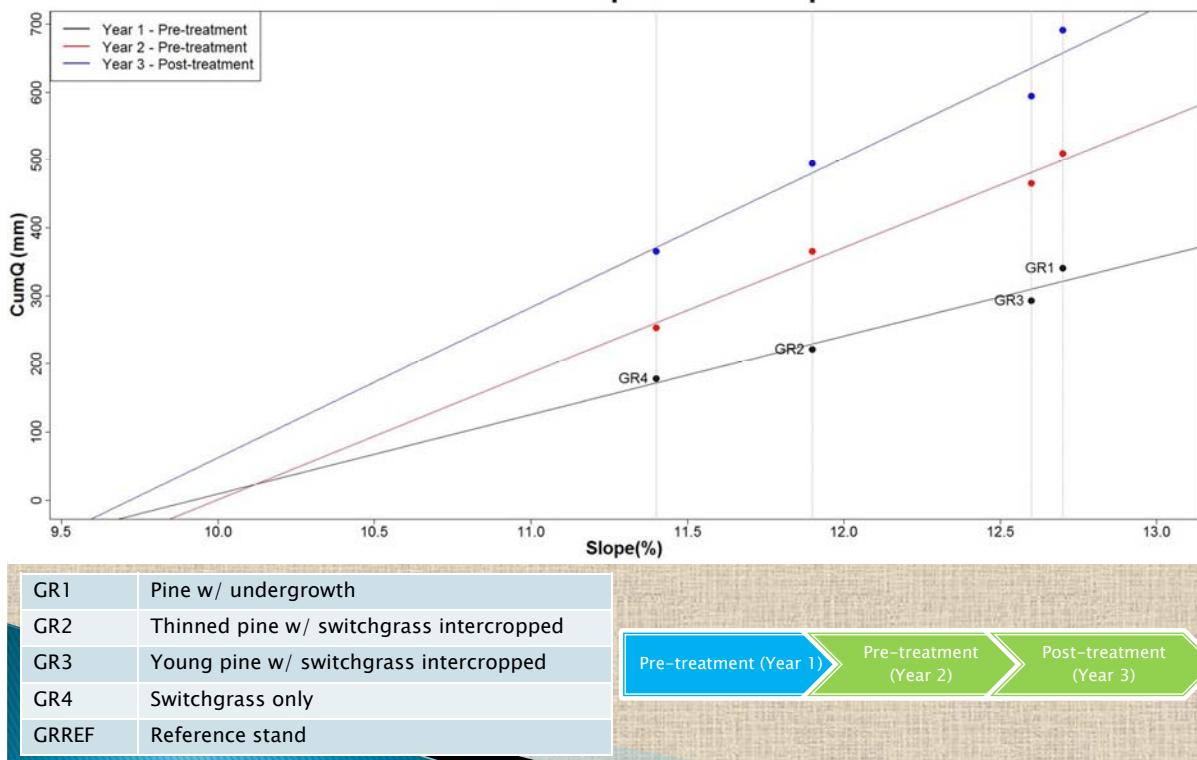


# Correcting Hydrology Data

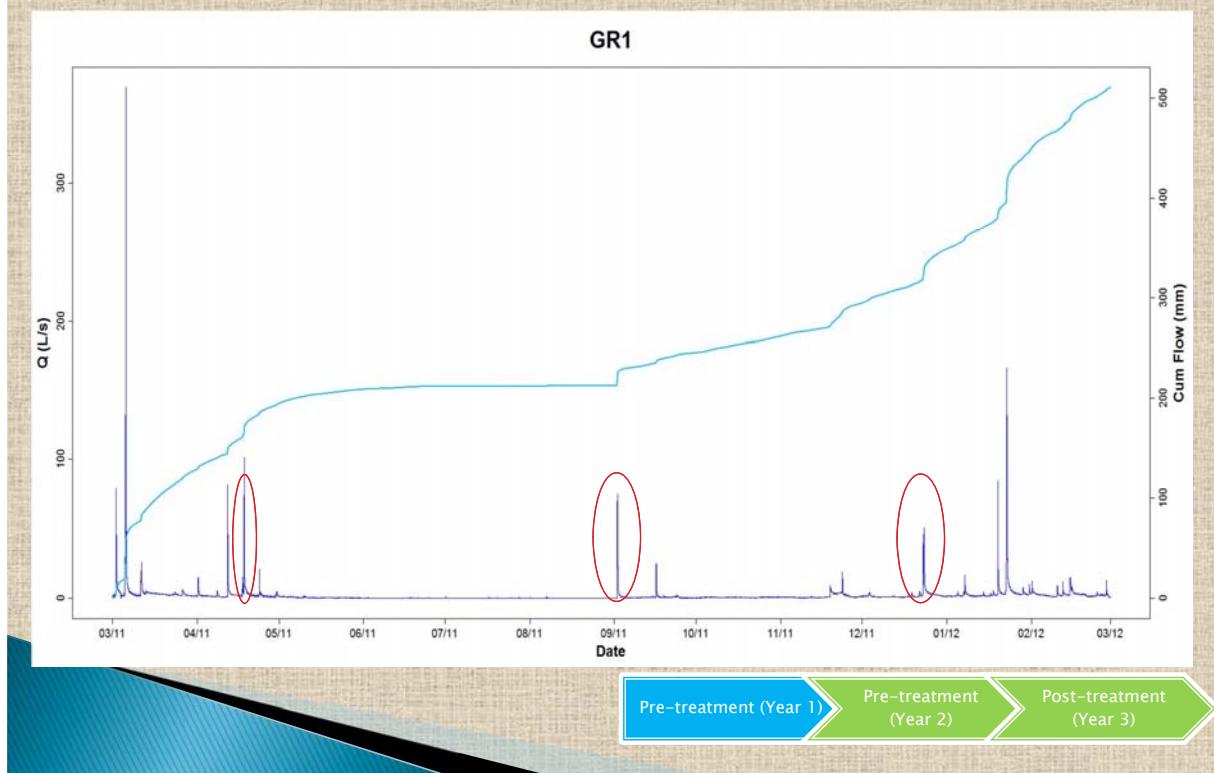


## Results – Hydrology – Pre vs. Post-treatment

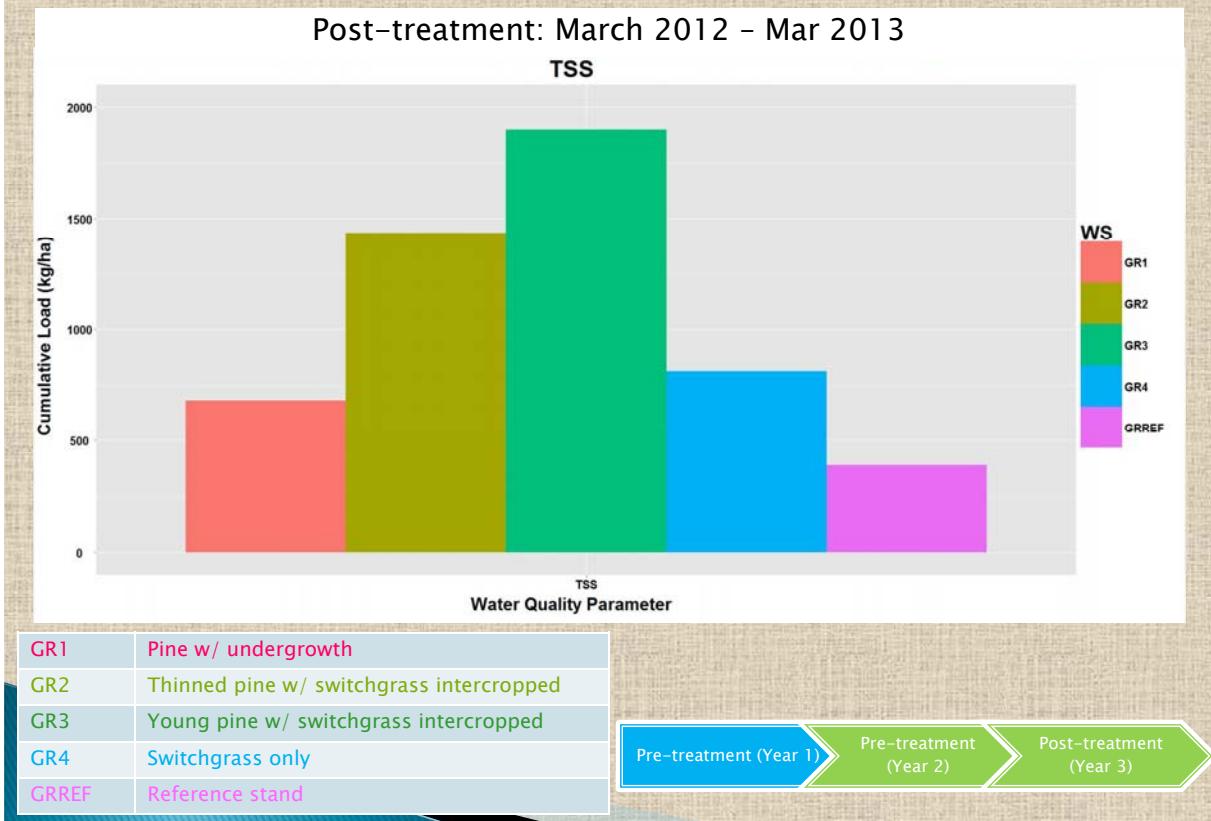
CumQ vs. Slope Relationship



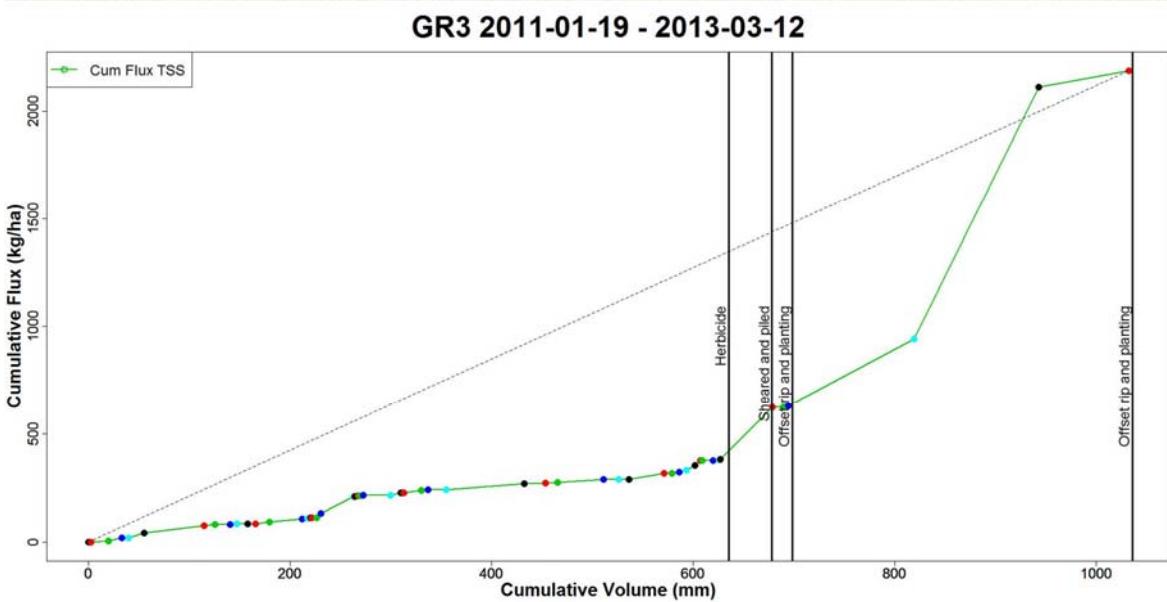
## Flashiness: Pre vs. Post-treatment



## Results – Water Quality – Pre vs. Post-treatment



## Results – Water Quality – Pre vs. Post-treatment



GR1	Pine w/ undergrowth
GR2	Thinned pine w/ switchgrass intercropped
GR3	Young pine w/ switchgrass intercropped
GR4	Switchgrass only
GRREF	Reference stand

Pre-treatment (Year 1)
Pre-treatment (Year 2)
Post-treatment (Year 3)

# Conclusions – Hydrology and WQ

- ▶ No treatment effect for the watersheds.
- ▶ The more precipitation and larger the watershed slope the more flow out of the watersheds.
- ▶ There was a WQ loading increase and the hierarchy changed between pre and post-treatment.
- ▶ There were changes in the temporal dynamics of exports as a function of volume due to management practices.

## References

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- [11] AQUARIUS, Aquatic Informatics, Vancouver, British Columbia, Canada.
- [12] VisuHydro. Robert Lagacé, Université Laval, Québec, Canada.

# Acknowledgements

- ▶ Dr. François Birgand
- ▶ Dr. Chip Chescheir
- ▶ Dr. Mohamed Youssef
- ▶ Dr. Sankar Arumugam
- ▶ Beth Allen
- ▶ Dr. Tim Appelboom
- ▶ Dr. Robert Lagacé
- ▶ Dr. Jami Nettles
- ▶ Blake Davis
- ▶ Dr. Devendra Amayta
- ▶ Dr. Herbert Ssegane
- ▶ Dr. Jason Osborne
- ▶ Dr. Wayne Skaggs



## Any Questions?

