

# ReNeWS Brown Bag Lunch

Swimming upstream, flowing downstream,  
Where does your science fit in?

---

CHRISTY PERRIN, WATER RESOURCES RESEARCH INSTITUTE

GLORIA PUTNAM, NC SEA GRANT

SUSAN WHITE, WATER RESOURCES RESEARCH INSTITUTE/ NC SEA GRANT

JOHN FEAR, WATER RESOURCES RESEARCH INSTITUTE/ NC SEA GRANT

# Our goal of this session

---

- Provide example of applied multi-disciplinary watershed research
- Spur ideas on how to:
  - increase collaboration/leveraging resources to
  - aid local watershed efforts and
  - provide academic research opportunities
- Spur your thinking on how your research may relate to local watershed efforts
- Introduce the NC Watershed Stewardship Network as an avenue to make academic/community connections

# The watershed approach to water resource management

---

## **Is hydrologically defined**

- geographically focused
- includes all stressors (air and water)

## **Involves all stakeholders**

- includes public (federal, state, local) and private sector
- is community based
- includes a coordinating framework

## **Strategically addresses priority water resource goals (e.g. water quality, habitat)**

- integrates multiple programs (regulatory and voluntary)
- based on sound science
- aided by strategic watershed plans
- uses adaptive management

Courtesy of US EPA



# Research & citizen engagement in watershed approach: Black Creek

3.3 mi<sup>2</sup>

Urban/suburban

- single & multifamily
- Commercial
- parkland
- Schools

Crabtree Creek-Neuse River

33% impervious

Portion of Cary Town Hall Campus drains to headwaters

# Snapshots from the watershed



# Black Creek 303(d) listed

Not meeting intended uses:

- supporting biological life
- secondary recreational contact



# Background



Black Creek Watershed Association –  
2006- now

Funding: 3 EPA grants, CWMTF

Watershed assessment & planning

Urban watershed restoration

Monitoring impacts



# Current Partners

---

- NC State University
  - Water Resources Research Institute
  - Dept. Biological and Agricultural Engineering
- Town of Cary
- Clemson University
- Homeowners associations & neighborhoods
- Lake Crabtree County Park, Wake County
- NC Division of Water Resources
- Wake County Extension
- Schools, businesses, churches



# Strong community engagement/citizen science throughout planning and implementation

---



# EPA approved Watershed plan 2009

---

Watershed assessment determined causes and sources of impairment

Goals, objectives, strategies for improvement



Former graduate student, Dr. Shelby Guill- Laird, working in the stream

# Determining causes and sources of impairment: Field assessments (2007-2008)

NCSU College of Natural Resources

---

Benthic Macro-invertebrates

Physical water parameters

Organic contaminants

Channel condition

Nutrients

Bacteria

Main stem flow

Dr. Stacey Nelson measures tributary channel height

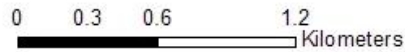


# Monitoring Sites










Shelby Gull Laird  
6/25/2007

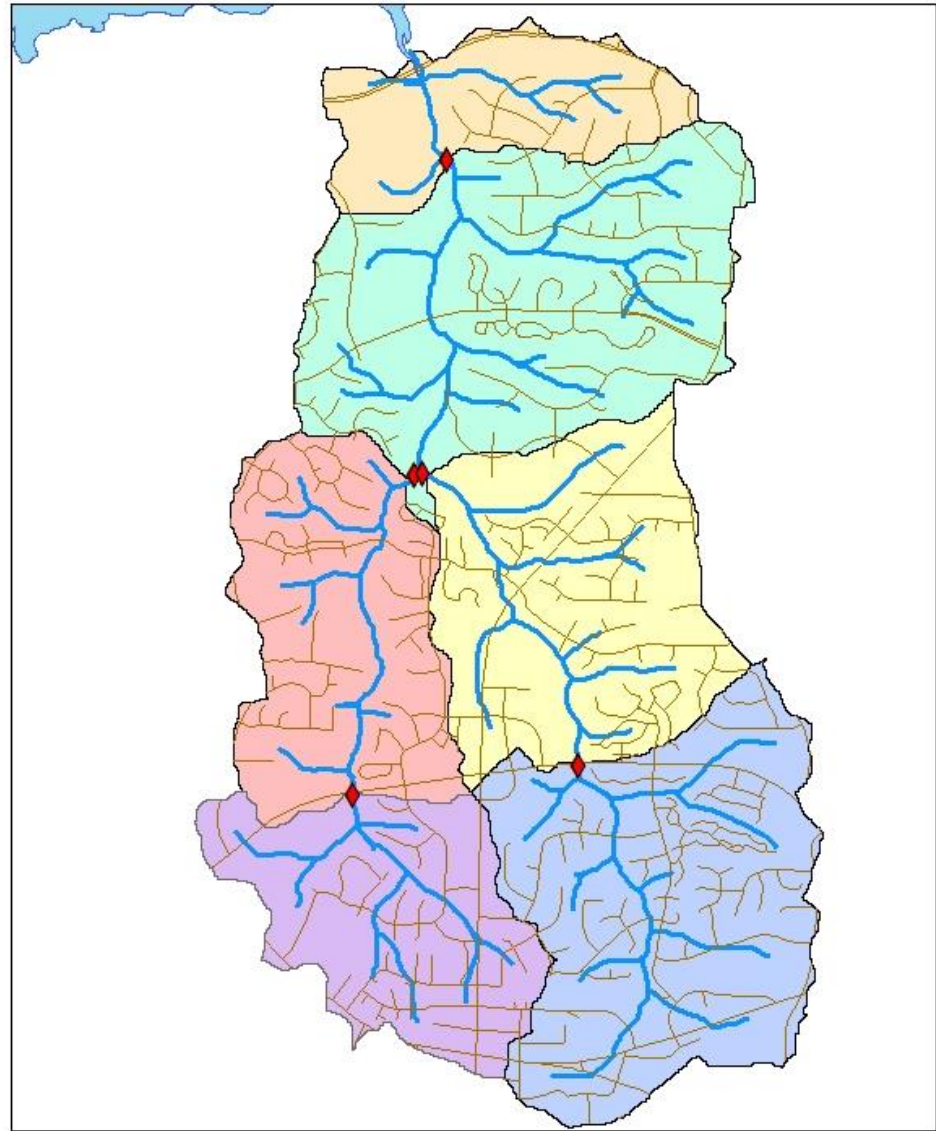


1:26,500



## Legend

-  Black Creek Watershed
-  Monitoring Sites
-  Stream Gauge Watershed
-  East Fork 2
-  West Fork 2
-  East Fork 1
-  West Fork 1
-  Streets
-  Crabtree Lake



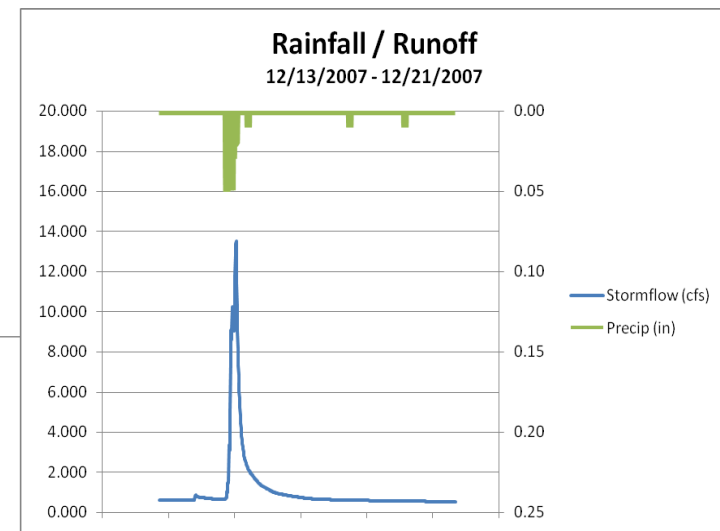
# Geodatabase developed (2009)

---

- Stream mapping with GPS -locations
- Land use land cover
- Soils
- Topography
- Town of Cary's stormwater infrastructure
- Hydrologic modeling with TR-55
- Online using GoogleEarth [www.ncsu.edu/WECO/blackcreek](http://www.ncsu.edu/WECO/blackcreek)

# Assessment Results

- Channel condition: average
- Macro-invertebrate counts- high flow blowing out leaf packs
- Very flashy- high volume & velocity flows
- DEET/phthalates found (sewer leak?)
- High fecal coliform counts
- Ammonia, turbidity in stormflows



# Restoration: reducing runoff through retrofits

---



**West Cary Middle School Before ...**



Raingarden/bioretention replaced raised turf area





West Cary Middle School before...



Raingardens provide pretty learning area in place of ugly swampy turf area



Residential campaign kick-off event



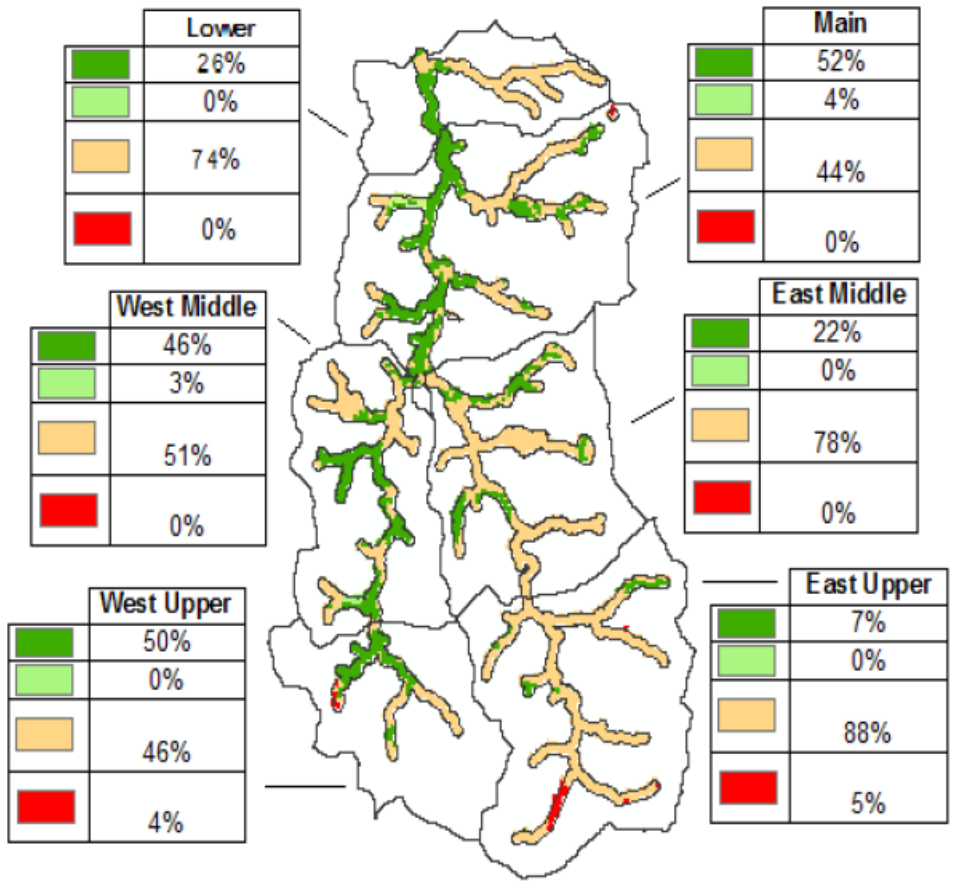
Northwoods Elementary School- BEFORE



Northwoods Elementary School- AFTER

# Using GIS for Prioritization in Subwatershed Restoration

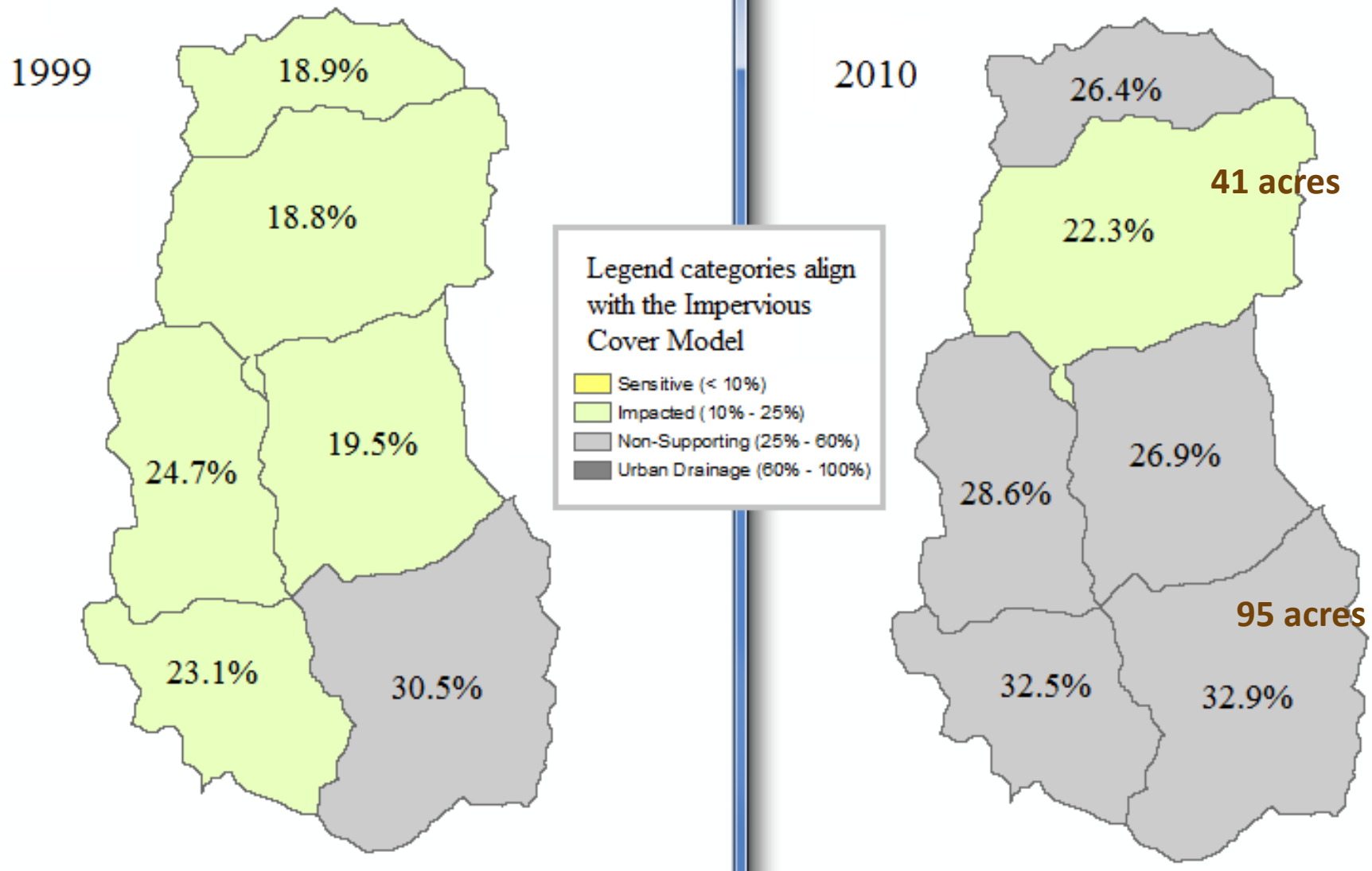
(Elena Horvath, Penn State)



100 ft Riparian Buffer analysis

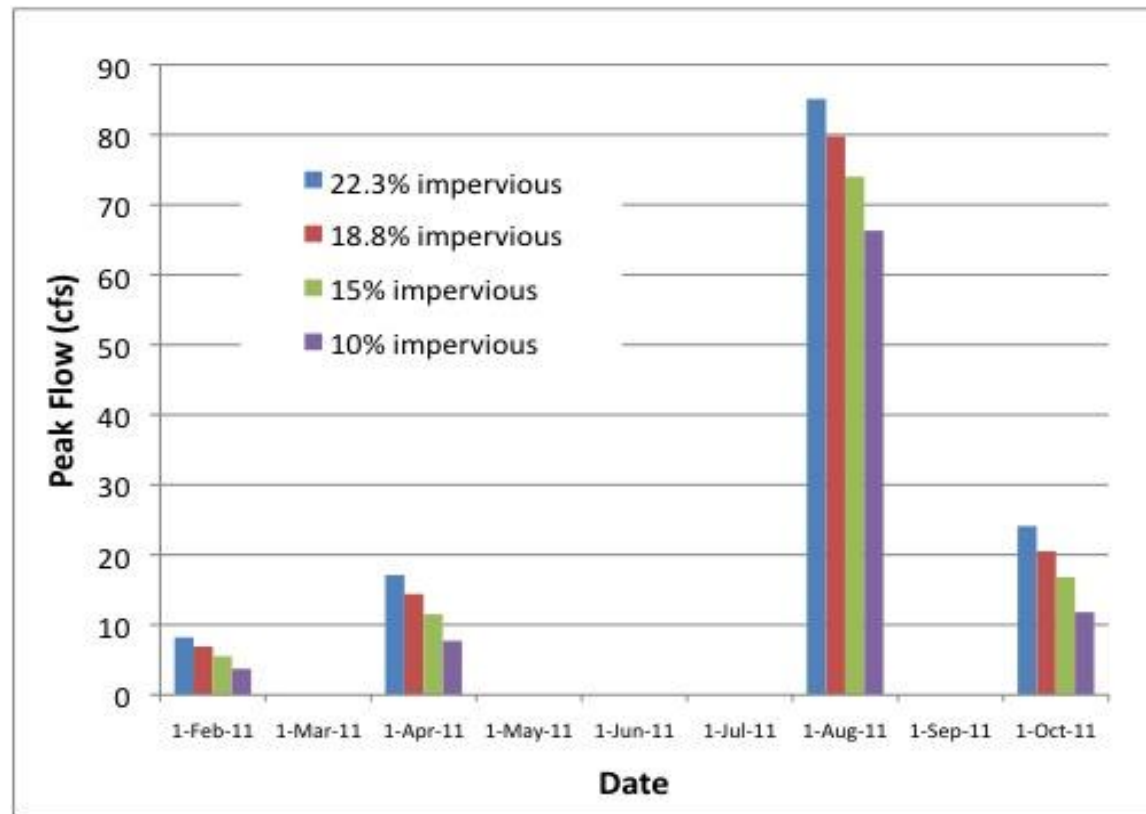
|   |   |
|---|---|
| 0 (Forest/Woody Wetlands)                   | 0 (Forest/Woody Wetlands)                   |
| 5 (Grassland/Herbaceous)                    | 5 (Grassland/Herbaceous)                    |
| 10 (Open Space / Low Intensity Development) | 10 (Open Space / Low Intensity Development) |
| 15 (Medium / High Intensity Development)    | 15 (Medium / High Intensity Development)    |

# New Impervious Disconnection Targets to reach 11% effective impervious cover (252 acres)



# Hydrology monitoring & modeling (Dan Hitchcock, Clemson University)

- Mainstem stream flow monitoring 2010-2015
- 3 subwatersheds monitored for stream flow
- Arc GIS Arc Hydro modeling
- HEC-HMS modeling to simulate impervious disconnection in subwatershed





# Residents' Willingness to Pay to Improve an impaired watershed

(Laura Taylor, Sanja Lutzeyer, NCSU Dept ARE)

---

## Purpose:

Understand knowledge and attitudes about:

- Black Creek and its environmental condition
- Willingness to install private BMPs
- Willingness to pay stormwater utility fee to improve Black Creek environmental condition



# Residents' Willingness to Pay to Improve an impaired watershed

---

## Results:

|                          | <i>Environmental Improvements</i> |                               |                                |
|--------------------------|-----------------------------------|-------------------------------|--------------------------------|
| <i>Restoration Level</i> | <i>Total WTP</i>                  | <i>Monthly WTP (10 years)</i> | <i>% of Average Water Bill</i> |
| Current → Partial        | \$427                             | \$3.56                        | 4.5%                           |
| Current → Full           | \$557                             | \$4.64                        | 5.9%                           |
| Partial → Full           | \$130                             | \$1.09                        | 1.4%                           |

# Bioretention retrofit performance

(Dr. Bill Hunt, Jonathan Page, Jeffrey Johnson; NCSU Dept. BAE)

---

- Monitoring 3 bioretention retrofits to increase internal water storage
- May result in improved water quality leaving bioretention, increased infiltration



# Research contributions to the understanding and restoration of Black Creek

---

## **Assessment:**

Dr. Jim Gregory, NCSU Department of Forestry & Environmental Resources

Dr. Stacey Nelson, NCSU DFER

Dave Penrose, NCSU BAE

Dr. Shelby Gull- Laird, NCSU DFER

Terri Litzenberger, NCSU DFER

Diane Norris, NCSU DFER

Elizabeth Nichols, NCSU DFER

Molly Puente, NCSU Dept. Entomology

## **Additional and/or ongoing:**

Dr. Dan Hitchcock, Clemson

Dr. Bill Hunt, Jon Page, Jeffrey Johnson, NCSU Dept. BAE

Dr. Laura Taylor, NCSU Dept. ARE

Dr. Sanja Lutzeyer, NCSU Dept. ARE

Elena Horvath, Penn State

## **Additional assistance:**

Ann Spafford, NCSU Dept. Horticulture

Kris Bass Engineering

Dragonfly, Inc.

# Research contributions to the understanding and restoration of Black Creek

| Topic of research  | Date of research | College/Dept                             |
|--|------------------|--|
| Aquatic biology (macro-benthic inverts)                            | 2007-2008        | NCSU College of Natural Resources        |
| Water Quality (physical, nutrient, bacteria, organic contaminants) | 2007-2008        | NCSU College of Natural resources        |
| Geospatial analysis  | 2007-2009; 2012  | College of Natural Resources, Penn State |
| Hydrology monitoring and watershed modeling                        | 2010- 2015       | Clemson University                       |
| Economics/willingness to pay                                       | 2011-2012        | NCSU Dept. ARE                           |
| Bioretention function  | 2013-2015        | NCSU Dept. BAE                           |

# Discussion Questions

---

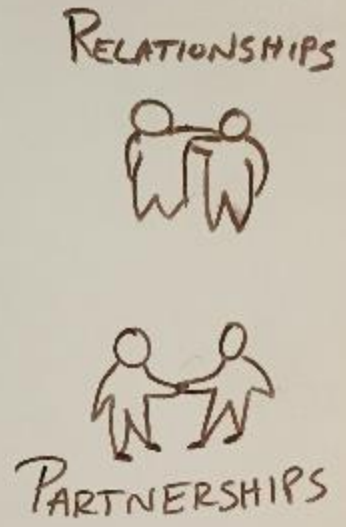
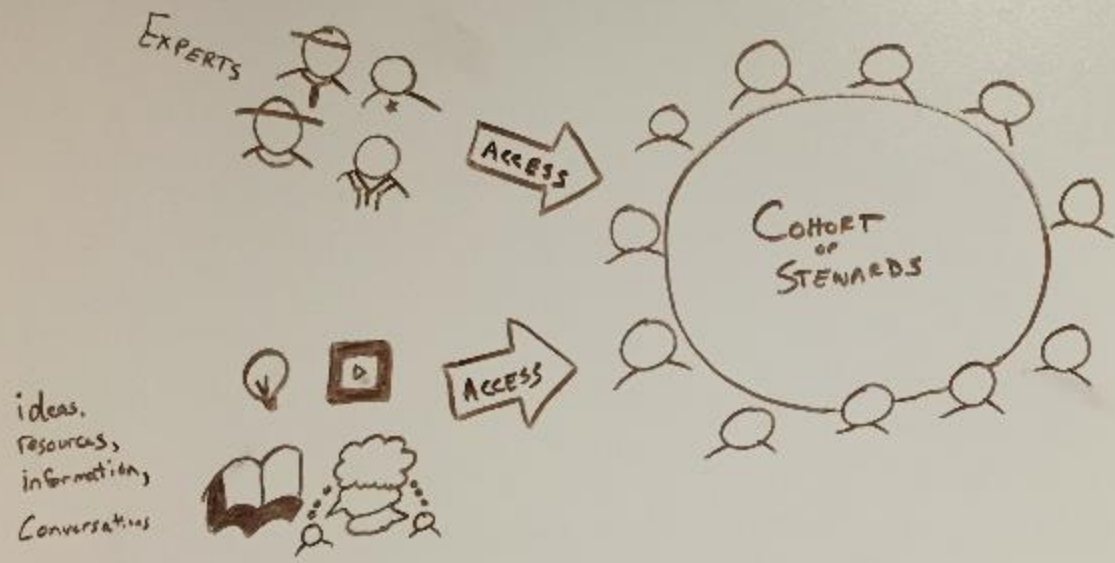
1. What are your reactions to the concept of research conducted within a watershed approach?
2. What opportunities do you see for integrating research from different disciplines to improve the effectiveness of local watershed management?
3. How can we leverage the research to achieve the most benefits from it?



**Our mission is to empower more effective watershed stewardship because water is critical to economic, environmental, and community health.**



Identify, include, link and serve watershed stakeholders in North Carolina







# Our Goals

---

- More people leading and working on watershed projects.
- People begin and sustain local watershed efforts in all areas across NC, including areas without watershed management due to lack of resources.
- Local watershed efforts are sustained by diverse and balanced sources of funds and resources.
- Stewards collaborate broadly for greater success protecting waters.
- People make decisions that protect water resources while improving community health and economic development.



# How do we work?

---

- Provide online tools to connect people and share resources
- Foster partnerships among public, private and nonprofit watershed stakeholders
- Maximize skills of a diverse network of watershed professionals and volunteers through training and networking
- Assist stakeholders to leverage limited resources to more efficiently improve watershed health
- Communicate on the ground watershed efforts and program successes



# Steering Committee

- 
- Kevin Boyer, City of Raleigh
  - Shari Bryant, NC Wildlife Resources Commission
  - Caitlin Burke, Conservation Trust for North Carolina
  - Paul Clark, Use Restoration Watershed Program, NCDWR
  - Bill Crowell, Abermarle Pamlico National Estuary Partnership
  - Nancy Daly, NC Ecosystem Enhancement Program
  - Michele Drostin, UNC Institute for the Environment
  - Joy Fields, Piedmont Triad Regional Council
  - Greg Godard, Upper Coastal Plain COG
  - Wendi Hartup, NC Cooperative Extension
  - Joey Hester, NCD&CS Division of Soil & Water Conservation
  - **Betty Huskins, NC Regional Councils**
  - George Matthis, River Guardian Foundation
  - Holly Miller, Town of Wake Forest
  - Christy Perrin, Water Resources Research Institute
  - Gloria Putnam, NC Sea Grant
  - Eric Romaniszyn, Haywood Waterways Association
  - Rebecca Sadosky, NC Drinking Water Protection Program, NCDWR
  - Mike Schlegel, Triangle J Council of Governments
  - Cy Stober, Piedmont Triad Regional Council
  - Ron Townley, Upper Coastal Plain COG
  - Jason Wager, Centralina COG
  - Nicole Wilkinson, Water Resources Research Institute
  - Melanie Williams, Basin Planning Branch, NCDWR
  - Mitch Woodward, NC Cooperative Extension



# Rolling out in 2015

Online interactive tools

Regional watershed planning workshops

Online success studies

Membership opportunities

Sponsorship opportunities

NC conference in 2016???





# Join Us!

---

Christy Perrin

Water Resources Research Institute

[christy\\_perrin@ncsu.edu](mailto:christy_perrin@ncsu.edu)

919- 513-1152

Michele Drostin

UNC Institute for the Environment

[michele.drostin@unc.edu](mailto:michele.drostin@unc.edu)

919-966-9802

[www.ncwatershednetwork.org](http://www.ncwatershednetwork.org)

 @NCWSN

# Discussion Questions

---

1. What research are you doing that is related to local watershed management?
2. What would you need to become prepared to engage with local watershed efforts?