Center for Nutrient Solutions

Center for Nutrient Solutions (CNS):
An Innovative Approach to Exploring Nutrient Pollution Solution Scenarios

Center for Nutrient Solutions

- One of 4 centers funded by EPA-STAR Program for "Innovative and Sustainable Water Research Incorporating Systems View of Nutrient Management"
- These centers employ:
    - Novel science to achieve sustainable and cost effective outcomes
    - Demonstration projects of innovative technologies and approaches
    - Community involvement in nutrient management

Solving Nutrient Pollution: The Old Paradigm

- Focus on "the BMP Fix"
  - enterprise level "tactics:"
    - Discharge limits for point sources
    - BMPs for nonpoint sources

Solving Nutrient Pollution: The Old Paradigm

- Inadequate attention to "systems" level challenges

  – Landscape scale mass balance, nitrogen cascade

  – Watershed management

  – Timing, location, selection of BMPs

Surplus P (kg ha^{-1})

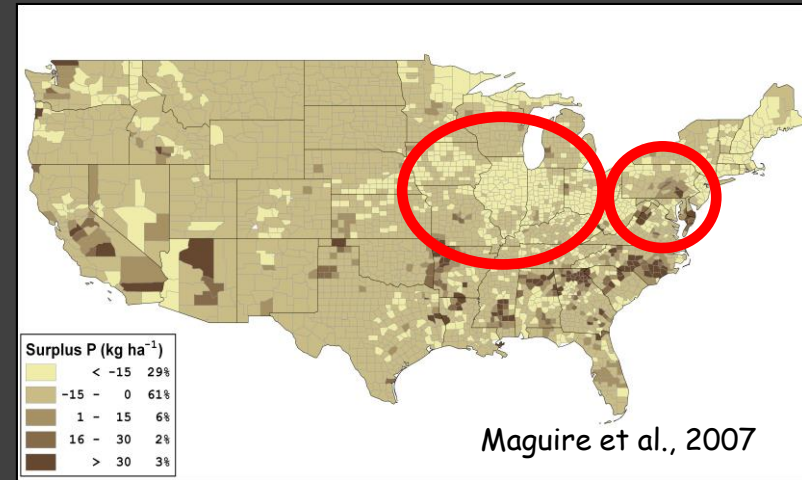|		
	< −15	29%
	−15 − 0	61%
	1 − 15	6%
	16 − 30	2%
	> 30	3%

Maguire et al., 2007

Image compliments of Doug Beegle

Solving Nutrient Pollution: The Old Paradigm

- Inadequate attention to people, economics, institutions, etc…

  - What works within profitable farming systems?

  - What kinds of incentives to facilitate adoption and change?

Some Key CNS Definitions: "Tactics" and "Strategies"

- *Tactics*: Address <u>enterprise level challenges</u>
  - Management practices on farms or at facilities (WWTPs, stormwater)
  - At a *site specific scale*

- *Strategies*: Address <u>system level challenges</u>
  - Deal with structure of our food production system
  - Consider relationship to other nutrient sources (i.e., air deposition)
 - At a *watershed or landscape sale*

Project Themes

- "…highly integrated process … to identify optimal locations for nutrient interventions, both *tactics* and *strategies*, within watersheds."

- "…authentic engagement of stakeholders is an integral part of our process to find solutions through *shared discovery*."

- "…challenge each other to find ways for agricultural industries, urban economies, and ecosystem services to *coexist sustainably*."

Center for Nutrient Solutions

Expected Outcomes

- Improved tools for nutrient management at multiple scales for multiple objectives

- Lessons for Chesapeake Bay nutrient management

- Stakeholder engagement processes for community-based solutions

Center for Nutrient Solutions
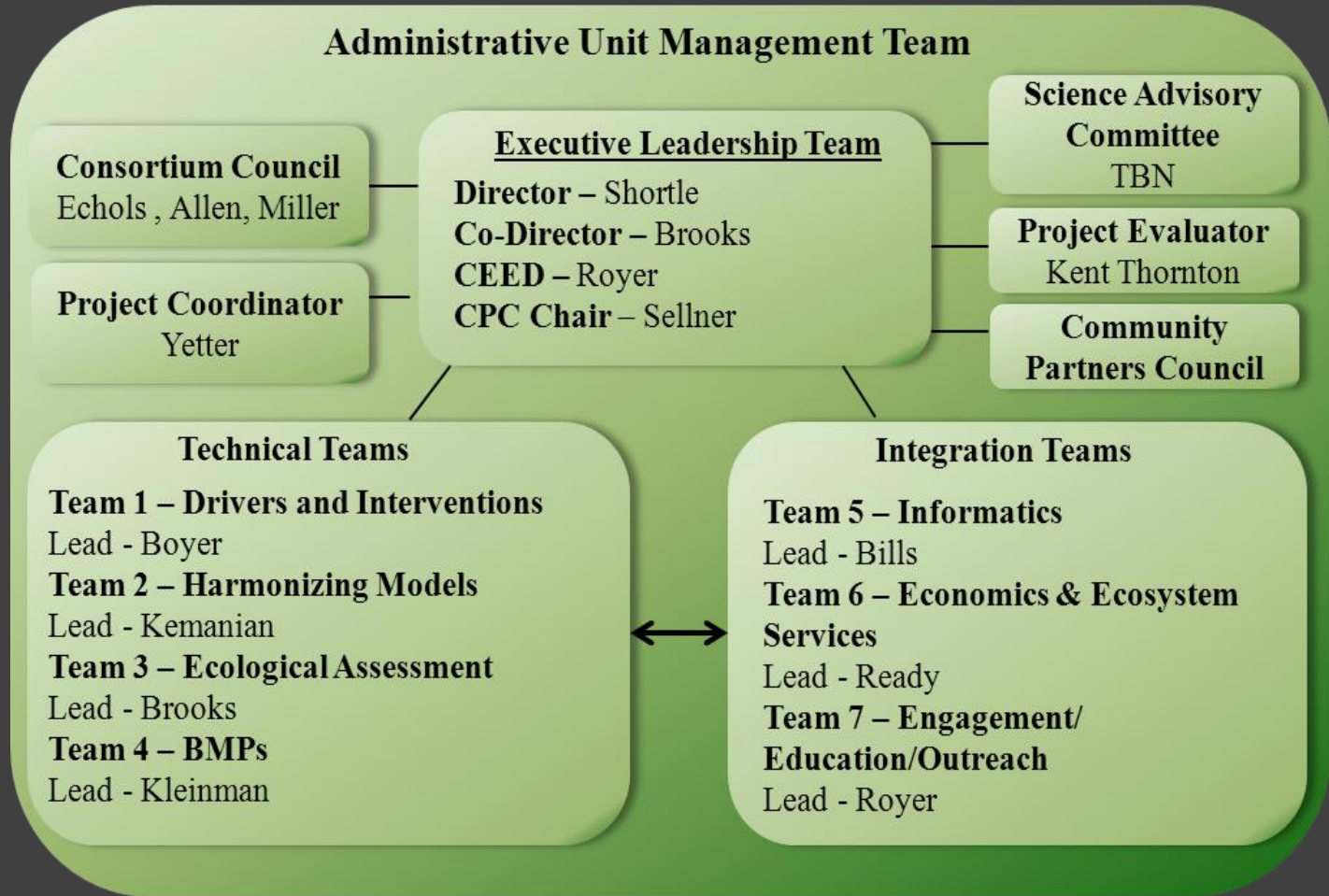
Project Components (Teams)

Technical Teams

- Drivers and Interventions (Team 1)
  - Landscape scale nutrient flows, N cascade, balances
- Harmonizing Models (Team 2)
  - Model inter-comparisons (PIHM, SWAT, CEAP etc)
- Ecological Assessment (Team 3)
  - Ecological condition responses, model validation
- BMPs (Team 4)
  - Optimum ag BMP selection and placement
- Economics and Ecosystem Services (Team 6)
  - Implementation costs, ecosystem service valuation

Project Components (Teams)

Integration Teams

- Environmental informatics (Team 5)
  - Internal data management and flow, online tools development

- Engagement and outreach (Team 7)
 - Shared discovery, stakeholder engagement at multiple scales

Center for Nutrient Solutions

Community Partners Council

|	
Kevin Sellner, Chesapeake Research Consortium	Jennifer Reed Harry, PennAg Industries
Al Todd and Donna Morelli, Alliance for C. Bay	Joanne Throwe, UMD Envt'l Finance Center
Marel King, Chesapeake Bay Commission	Dana York, Green Earth Connection LLC
Dan Dostie, USDA NRCS	Chris Thompson, Lancaster CCD
Lamonte Garber, Stroud Water Research Center	Katie Ombalski, ClearWater Conservancy
Andy Zemba, PA DEP	Karl Brown, PA State Conservation Commission
Kristen Saacke Blunk, Headwaters LLC	Bill Neilson, PA Farm Bureau
Harry Campbell, Chesapeake Bay Foundation	Robert Ensor, Howard Co. (MD) Soil Cons. District

Phase 1 Study Locations
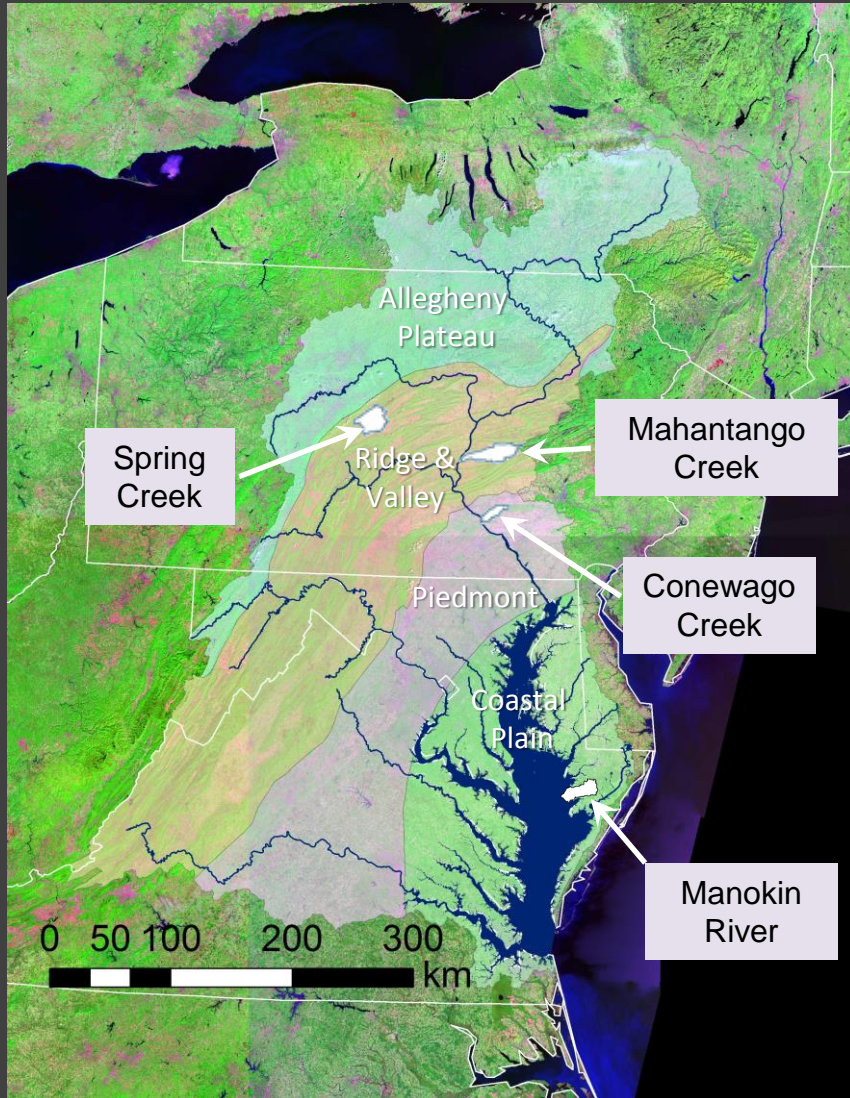
Spring Creek Watershed
Rock Springs, PA

Mahantango Creek Watershed
Klingerstown, PA

Conewago Creek Watershed
Elizabethtown, PA
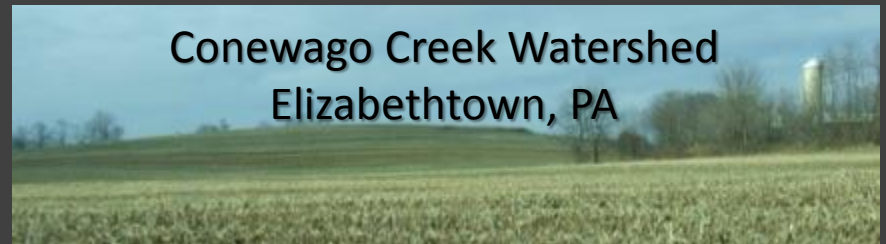
Manokin River Watershed
Princess Anne, MD

Center for Nutrient Solutions

Watershed "Shared Discovery" Scenario Approach

- Test multiple solutions ("scenarios")
  - Choose candidate solutions (scenarios combining tactics and strategies)
  - Model expected outcomes (pollution reductions, water quality change, ecosystem services, costs, benefits)
- Review and revise with stakeholders

Center for Nutrient Solutions

Scenario Drivers

- Baseline land use and management data

- Chesapeake Bay TMDL WIPs

- Cost effective portfolios

- Local water quality and other goals
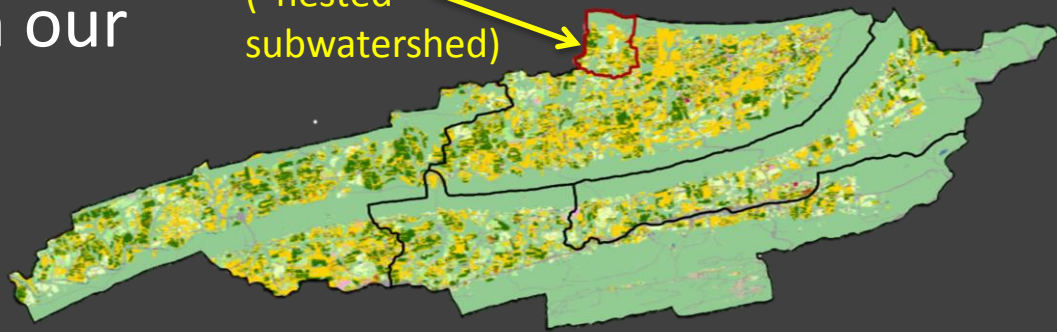
- Transformative experiments

The CNS "Shared Discovery" Approach: Evaluating Solution Scenarios

Center for Nutrient Solutions

"Shared Discovery" Helps Shape and Reshape Project Work Flow

- Multi-scale approaches will be explored through nested subwatersheds within our four test watersheds

Mahantango Creek Watershed

WE-38 ("nested" subwatershed)

Happenings

- All-Hand Research Team Meetings
  - Project Launch (Dec 4-5, 2013)
  - 2nd All Hands (May 6-7, 2014)
  - 3rd All Hands (Sept 17-18, 2014)
- Community Partners Council Meetings
  - CPC Launch (Jan 31, 2014)
  - CPC Scenario "Training" (Aug 21, 2014)
  - All Hands (Sept 17-18, 2014)

Happenings (cont.)

- Watershed Tours
  - Mahantango (Nov 20, 2013)
  - Spring Creek (June 5, 2014)
  - Manokin (Sept 16, 2014)
  - Conewago (Oct 20, 2014)
- Workshops and Boot Camps
  - SWAT Boot camp (Mar 24, 2014)
  - Scenarios Workshop (June 4, 2014)
  - SWR Boot camp (June 5, 2014)
  - Nutrient Balance Workshop (Aug 13, 2014)
  - Modeling Workshop (Nov 12, 2014)

Happenings (cont.)

- Science for Solutions Seminar/Webinar Series
  - Launched October 2014
  - Webinars archived on CNS website (www.cns.psu.edu)
- Watershed Stakeholder Meetings
  - Manokin (Mar 26, 2015)
  - Conewago (Mar 31, 2015)

Center for Nutrient Solutions

Coming Events

- Science for Solutions: Next Seminar
  - Bill Ball, Johns Hopkins University and new CRC Director (May 14, 2015, 12:15 to 1:15)

- Watershed Stakeholder Meetings
  - Spring and Mahantango TBD

- All Hands Meeting
  - May 13-14, 2015

- Community Partners Council Meeting
  - May 28, 2015

Center for Nutrient Solutions

Questions?

Matt Royer
Director, Agriculture and Environment Center

Penn State University

College of Agricultural Sciences

111 Ferguson Building

University Park PA 16802

(814) 863-8756

mroyer@psu.edu