Center for Integrated Multi-scale Nutrient Pollution Solutions (aka CNS)

FACs

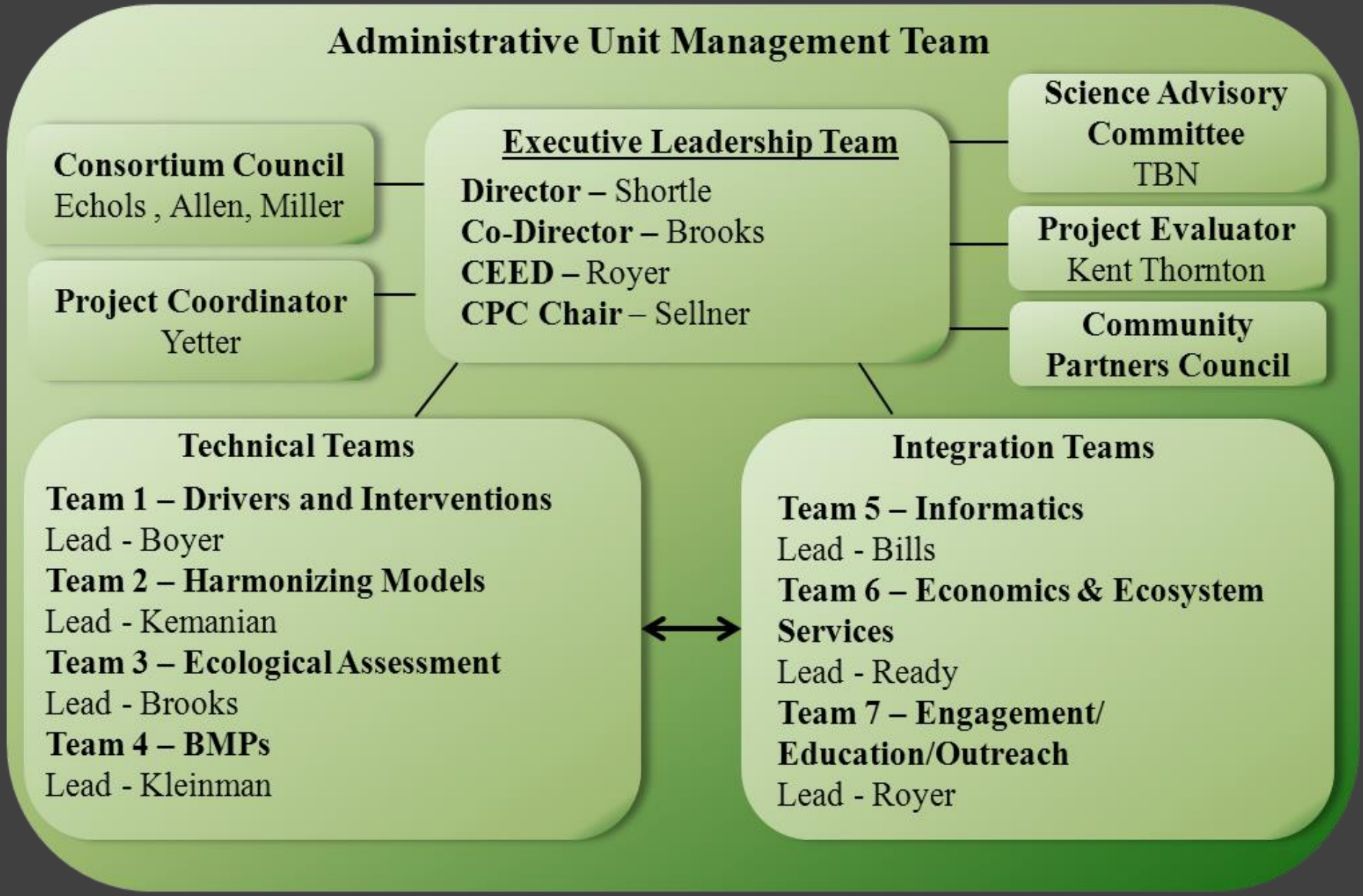
- One of 4 recently funded centers under the EPA-STAR program for "National Centers for Innovative and Sustainable Water Research, Incorporating a Systems View of Nutrient Management"
  - Novel science to achieve sustainable and cost effective health and environmental outcomes
  - Demonstration projects to support efficacy of water management systems with and beyond current technology and information at appropriate scales
  - Community involvement in the design, acceptance, and implementation of nutrient management systems
- Others at Colorado State University, University of South Florida (USF), and Water Environment Research Foundation

FACs

- Partners
  - Funded (including subcontracts): PSU, UMES, VTES, CRC, FTN
  - "Unfunded": USDA-ARS, CBP (Gary Shenk) Community Partners

Community Partners Council

- Kevin Sellner, Chesapeake Research Consortium (Chair)
- Jennifer Reed Harry, Penn Ag Industries (Co-Chair)
- Marel Raub, Chesapeake Bay Commission
- Dan Dostie, USDA NRCS
- Lamonte Garber, Stroud Water Research Center
- Harry Campbell, Chesapeake Bay Foundation
- Andrew Zemba, PA DEP
- Don McNutt, Lancaster County (PA) Conservation District
- Kristen Saacke Blunk, Spring Creek Watershed Association
- Al Todd, Alliance for the Chesapeake Bay
- Joanne Throwe, UMD Environmental Finance Center
- Dana York, Green Earth Connection LLC
- Robert Ensor, Howard County (MD) Soil Conservation District
- Karl Brown, PA State Conservation Commission
- Bill Neilson, PA Farm Bureau


Administrative Unit Management Team
Consortium Council
Echols , Allen, Miller
Project Coordinator
Yetter
Executive Leadership Team
Director – Shortle
Co-Director – Brooks
CEED – Royer
CPC Chair – Sellner
Science Advisory Committee
TBN
Project Evaluator
Kent Thornton
Community Partners Council
Technical Teams
Team 1 – Drivers and Interventions
Lead - Boyer
Team 2 – Harmonizing Models
Lead - Kemanian
Team 3 – Ecological Assessment
Lead - Brooks
Team 4 – BMPs
Lead - Kleinman
Integration Teams
Team 5 – Informatics
Lead - Bills
Team 6 – Economics & Ecosystem Services
Lead - Ready
Team 7 – Engagement/ Education/Outreach
Lead - Royer

Solving Nutrient Pollution
Old Paradigm

- Focused on enterprise level "tactics" (discharge limits for point sources, BMPs for nonpoint sources – the "BMP Fix")
- Inadequate attention to "systems" level challenges
  - Landscape scale mass balance/nitrogen cascade
  - Watershed based management
  - All nutrient sources
  - Tradeoffs between sources
  - Timing, location, selection among tactics (e.g. BMP) types
- And to people, economics, institutions, etc… e.g.,
  - What works within profitable farming systems?
  - What kinds of informal or formal incentives will best result in needed BMP adoption (tactics) or structural change (agricultural systems)?

CNS 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."

Components

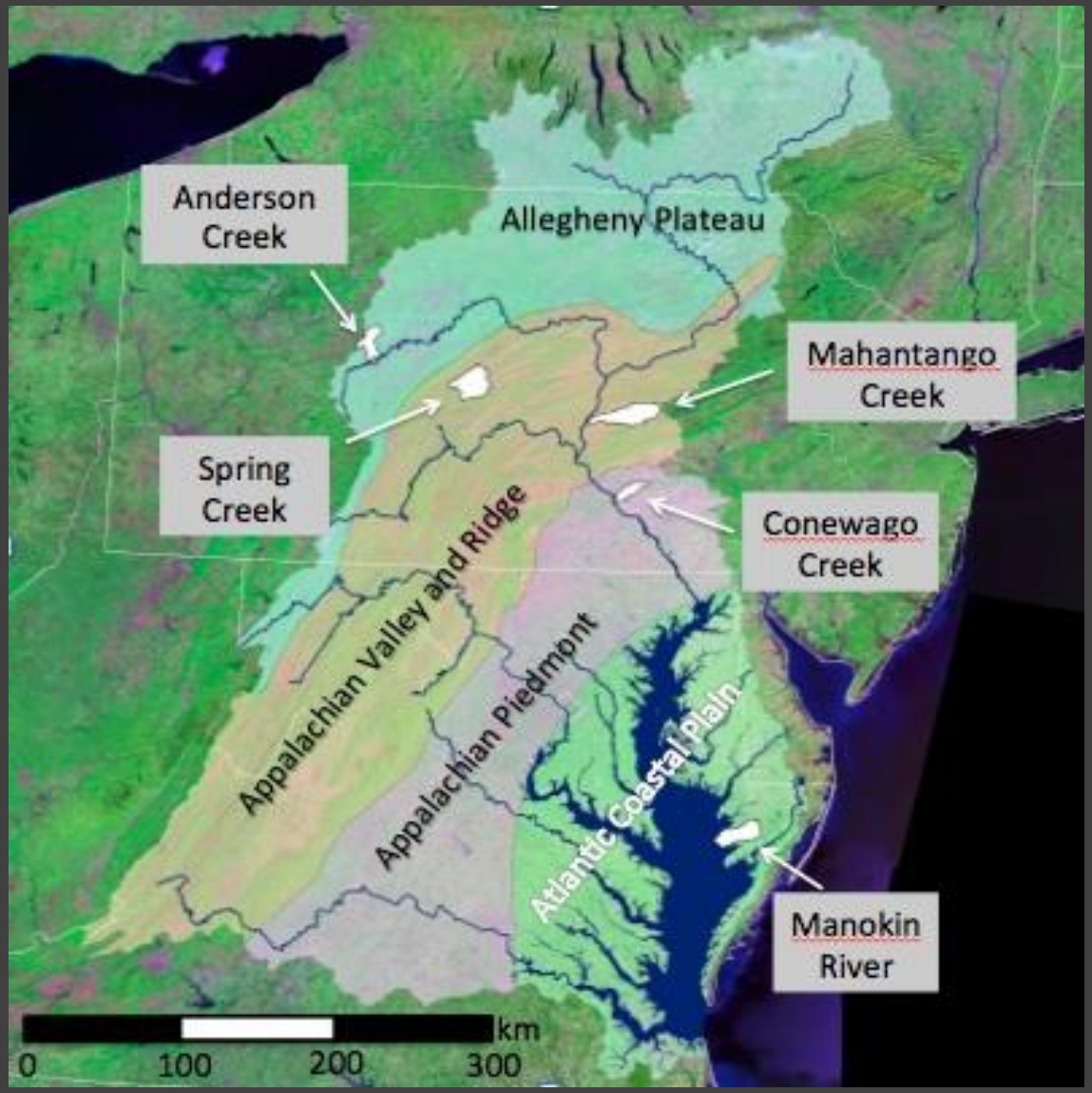
- Technical Teams
  - Drivers and interventions (Boyer, Beegle, Bishop, Shortle)
    - Landscape scale nutrient flows, nitrogen cascade, mass balances
  - Agricultural BMPs (Kleinman et. al. (ARS), Beegle, Karsten Arthur (UMES), Easton(VTES))
  - Harmonizing models (Kemanian, Duffy)
    - Nitrogen in PIHM
    - Model inter-comparisons (PIHM, SWAT, CEAP etc.)
  - Ecological Assessment (Brooks, Yetter et. al.)
    - Model outcome validation
    - Ecological condition responses

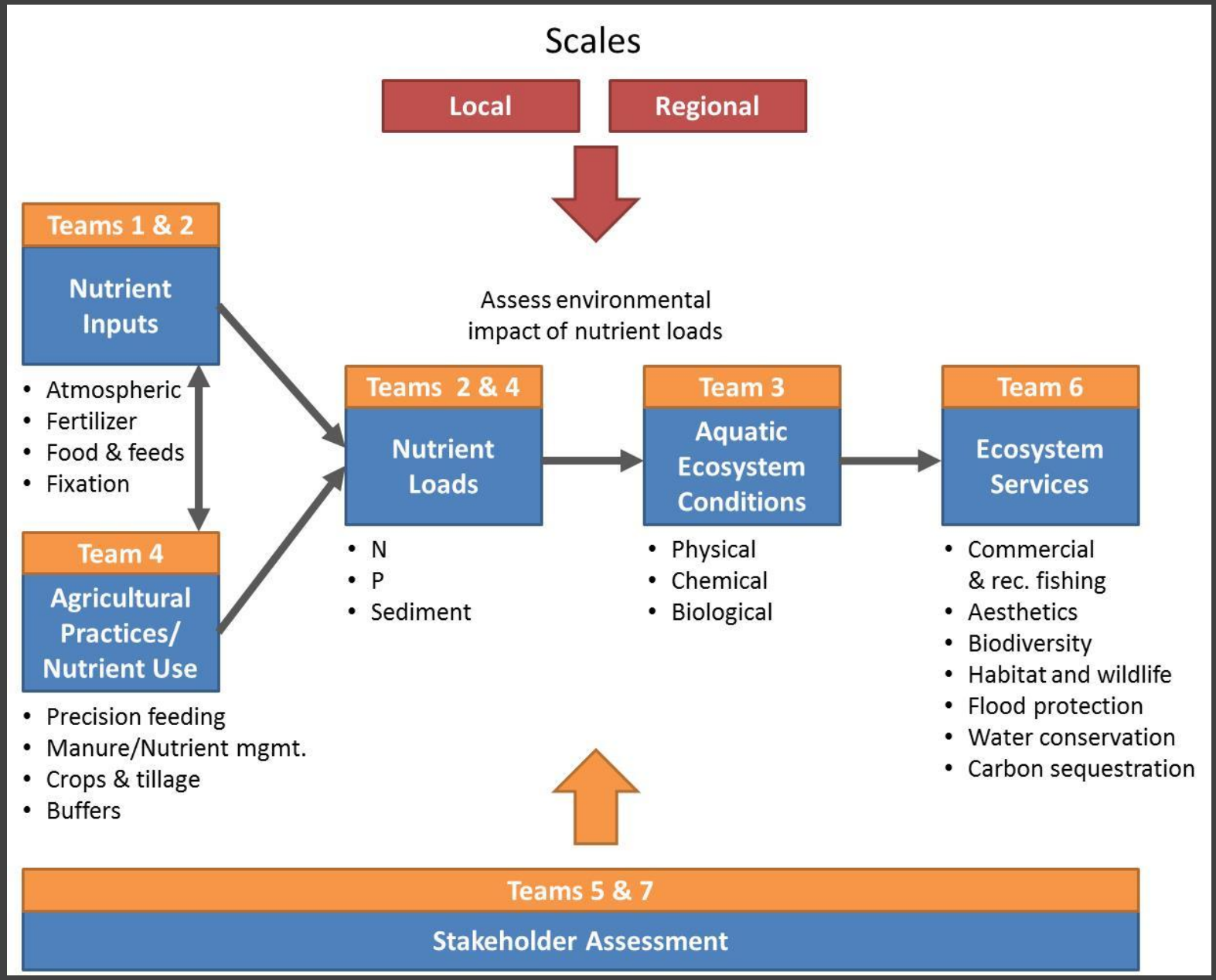
Components

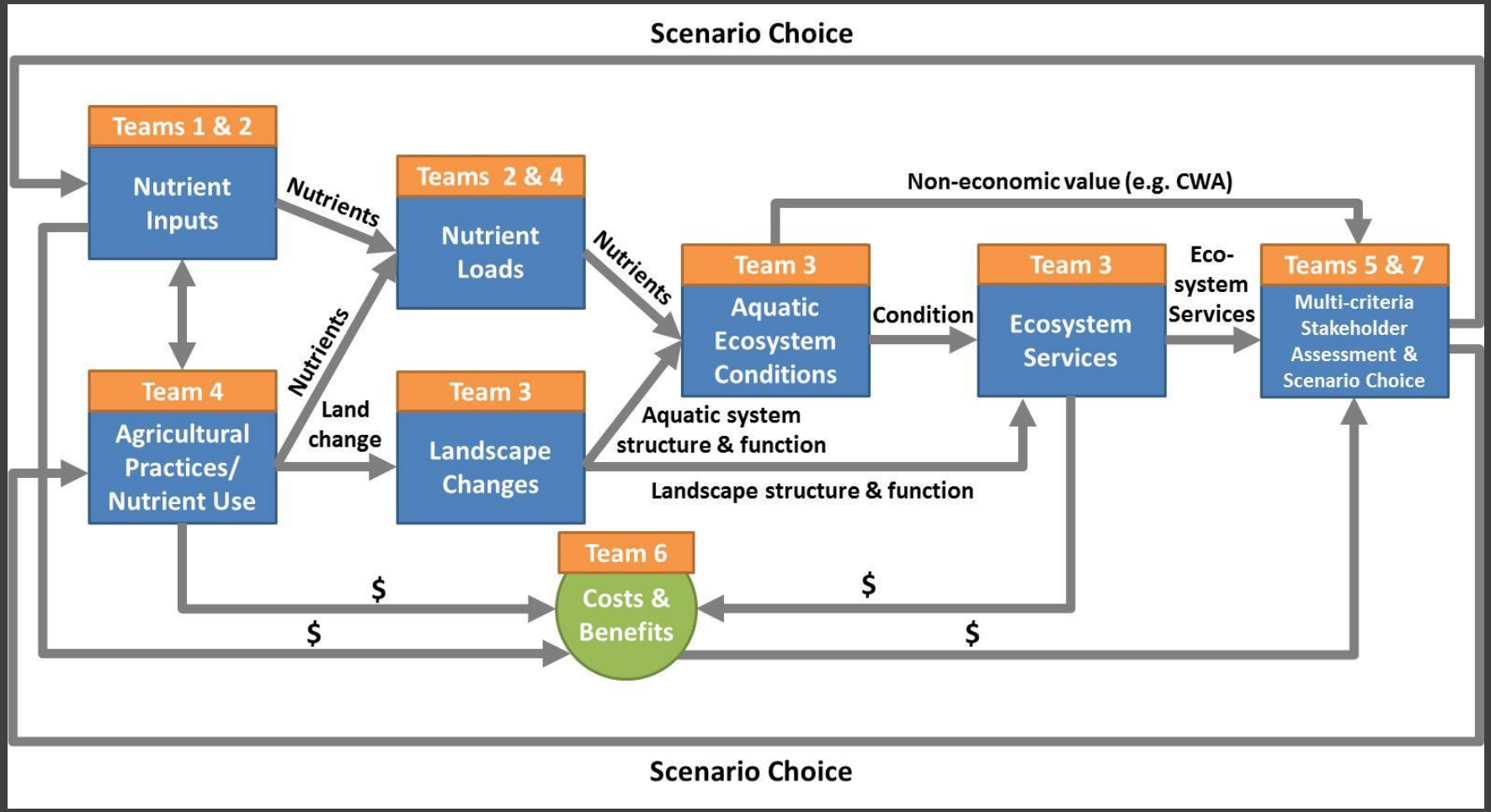
- Integration teams
  - Environmental Informatics (Bills, Miller, Bishop)
    - Internal data service
    - Online tools development
  - Economics and ecosystem services (Ready, Shortle)
    - Costs and benefits at multiple scales
  - Engagement and outreach (Royer, Sellner)
    - Shared discovery
    - Multiple scales

Study Locations

- Conewago Creek (PA)
- Mahantango Creek (PA)
- Manokin River (MD)
- Spring Creek (PA)


Anderson Creek
Allegheny Plateau
Mahantango Creek
Spring Creek
Conewago Creek
Appalachian Valley and Ridge
Appalachian Piedmont
Atlantic Coastal Plain
Manokin River
km
0
100
200
300


Scales
Local
Regional
Teams 1 & 2
Nutrient Inputs
• Atmospheric
• Fertilizer
• Food & feeds
• Fixation
Team 4
Agricultural Practices/ Nutrient Use
• Precision feeding
• Manure/Nutrient mgmt.
• Crops & tillage
• Buffers
Assess environmental impact of nutrient loads
Teams 2 & 4
Nutrient Loads
• N
• P
• Sediment
Team 3
Aquatic Ecosystem Conditions
• Physical
• Chemical
• Biological
Team 6
Ecosystem Services
• Commercial & rec. fishing
• Aesthetics
• Biodiversity
• Habitat and wildlife
• Flood protection
• Water conservation
• Carbon sequestration
Teams 5 & 7
Stakeholder Assessment


Scenario Choice
Teams 1 & 2
Nutrient Inputs
Nutrients
Teams 2 & 4
Nutrient Loads
Nutrients
Team 3
Aquatic Ecosystem Conditions
Non-economic value (e.g. CWA)
Condition
Team 3
Ecosystem Services
Eco-system Services
Teams 5 & 7
Multi-criteria Stakeholder Assessment & Scenario Choice
Team 4
Agricultural Practices/ Nutrient Use
Nutrients
Land change
Team 3
Landscape Changes
Aquatic system structure & function
Landscape structure & function
Team 6
Costs & Benefits
$
$
$
$
Scenario Choice

Expected Outcomes

- Nutrient pollution control science
  - Improved BMP selection and targeting
  - BMP fix vs. system level strategies
  - Ecosystem services at multiple scales
- Nutrient pollution control tools for decision makers
- Stakeholder engagement processes