Climate Change, Shifting Land Use, and Urbanization: Challenges for Water Quality and Quantity

NSF Water, Sustainability and Climate Program

P.I.s:
Chris Kucharik, Agronomy and SAGE, Lead PI
Steve Carpenter, Limnology
Corinna Gries, Limnology
Steve Loheide, Civil & Environmental Engineering
Adena Rissman, Forest & Wildlife Ecology
Monica Turner, Zoology

Investigating the relationships between society and the environment in ecosystem management, conservation, and sustainable use

Prof. Adena Rissman
Human Dimensions of Ecosystem Management
UW-Madison
Plan for Today

1) Introduction to the NSF Water, Sustainability, and Climate Program and Scenario Planning
2) Conceptual Modeling
3) Discussion

Prof. Adena Rissman
Elizabeth Katt-Reinders, Research Specialist
Bob Small, PhD Candidate, Environment & Resources

How will ecosystem services related to freshwater vary and how can they be sustained as climate, land use, cover and management, the built environment and human demands change?

Crops, Freshwater flows, Fish & Wildlife, Recreation etc.

Natural Capital
- Soil
- Hydrology
- Vegetation
- Habitat
- Biotic Interactions etc.

Human Use and Management
- Institutions, incentives, regulations
- Markets
- Operators
- Equipment etc.

Changes in Land Cover, Ecosystem heterogeneity, Water infiltration & runoff,
- Carbon storage, Nutrient flows, Soil fertility, Biota, etc.

Ecosystem Services: Food & Fiber Production, Freshwater, Flood Regulation,
- Nutrient Regulation, Carbon Sequestration, Recreation, Aesthetics, etc.
Study System and Approach:

Yahara Watershed, including Madison and the 5 lakes

Integrative scenarios of watershed development 2010-2060

Analyses of water and land use governance in the region

Scenarios of land cover and management practices, and climate scenarios

Water, C, N, P flows using Agro-IBIS and THMB based on new field data

Water and P flows to lakes, water quality implications

Information Management

Education and Outreach

New Data, Scenarios and Modeling

Institutions, Behavior & Perceptions

Integrated Scenarios

Quantitative Models & Analyses

BioPhysical Field Studies
Outreach and Education:


K-12 in collaboration with SYLTER

Interactive scenarios process, including Scenarios Advisory Group, public meetings, surveys, etc.

Wisconsin Public Television “In Wisconsin”, ~ 5 segments focused on sustainability of the Yahara Watershed

New 2-semester interdisciplinary team-taught graduate seminar on Integrated Watershed Assessment, focusing on the Yahara as a practical example

Staffing:

6 P.I.s

2 Research specialists: one to coordinate biophysical data and modeling, one to coordinate scenarios

2 Postdocs: one for biophysical modeling, one for governance analysis

5 graduate students: (1) Urban heat island analysis, (2) ecohydrology, (3) lake water quality modeling, (4) adaptive governance, (5) spatial modeling
**Timetable:**

The process of hiring staff is underway

First field season 2011

Initiation of scenario process (meetings, interviews, surveys) summer 2011

http://wsc.limnology.wisc.edu

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**Example of a Conceptual Model**

Arrows mean one item increases or decreases another
+3 means high increase, -3 means high decrease

- Police Presence
- Good Weather
- Bad Weather
- Personal Driving Speed
- Distance to Destination
- Amount of Freeway Congestion
- Car Accidents
- Amt Current Construction
- Rush Hour
- Highway Infrastructure
How will ecosystem services related to freshwater vary and how can they be sustained as climate, land use, cover and management, the Built environment and human demands change?

* How do different patterns of land use, land cover, land management, and water resource engineering practices affect the resilience and sensitivity of freshwater ecosystem services under a changing climate?

* How can regional governance systems for water and land use be made more resilient and adaptive to meet diverse human needs?

* In what ways are regional human-environment systems resilient and in what ways are they vulnerable to potential changes in climate and freshwaters?