Experimental Manipulation of Entire Watersheds through BMPs: Nutrient Fluxes, Fate and Transport and Biotic Responses

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Cooperative State Research, Education and Extension Service: Nutrient Science for Improved Watershed Management
Figure 1. Percentage of land within the Conesus Lake watershed in agriculture.

Legend:
- Subwatersheds
- Town Boundaries
- Land Use in Agriculture
  - >70%
  - 40 to 70%
  - <40%
Sub-watersheds heavily in Agriculture

High Losses NO₃, SRP, TKN, TP Soil, Na

Baseline (g/ha/d)  Event (g/ha/d)
During each of the last three years we have mapped the position of milfoil beds (I.e. > 75% milfoil) in Conesus Lake (beds are shown in green for the central part of the lake) using GPS technology. Excessive growth of filamentous algae on or around milfoil beds is related to near loss of nutrients from watersheds heavily used for agriculture. The surface area measurements we obtain by GPS are multiplied by biomass quadrat measures to estimate the standing crops of milfoil at each site.

Area near stream mouths dominated by algae species Zygnema and Spirogyra which grow on Eurasian milfoil
The loading of total and soluble reactive phosphorus were good predictor of the standing crop of milfoil beds in areas near the mouths of streams.
INCUBATION CHAMBER RESULTS:

Stream Loading Contributes to Increased Algae Biomass.

Applied Nested ANOVA:

% Growth Stream Sites vs % Growth of Lake Sites

- Greywood
- Sand Point
- Cottonwood
- Densmore
- Wilkins
- Wilkins
- Hanna's
- Wilkins
- N. McMillan

Lake Sites
Stream Sites
Pre- BMPs Results

Greater loss of nutrients and soils from agricultural watersheds – especially during hydrometeorologic events

Elevated levels of NO$_3$, SRP, TP, TKN and soil in streams

Macrophyte beds in lake associated with watersheds in agriculture – stream mouths

Macrophyte biomass highly correlated with phosphorus loading

Algae biomass at stream mouths stimulated by water from watershed
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Goals

1. To demonstrate, through the experimental watershed approach, that implementation of BMPs in agricultural dominated watersheds will preserve soil and reduce nutrient loss from a series of sub-watersheds.

2. To evaluate the impact of instituted BMPs by considering the impacts on the downstream lake community on the watershed scale.

3. To evaluate the fate and transport of nutrients over space and time.
Collaborative approach of local agencies, farming community and academics
Gully Erosion - Loss of 133 tons per year
Dairy Knoll Farms, 700 cows, 2200 acres, Manure Issue

Southwest Creeks Subwatershed

Peter Kanouse of the Livingston County Soil and Water Conservation District. P has been the liaison between the research scientists and the agricultural community making these BMP’s a reality. Meyer Farm, Southwest Creek waters
50 tons of soil from Gully Erosion, Installation of Gully Plugs, surface inlets and underground outlets on the McClellan Farm.
AEM Planning (All Exp. Watersheds)

*Total farm planning
*Nutrient Reduction
*Runoff reduction
*Silage
*Strip cropping

SRP = 210 mg SRP/L
TKN = 1000mg N/L
Pre- and Post- BMP monitoring of stream sites (continuous flow and chemistry)
Monitoring Post- Best Management Plans

**SUNY Brockport**
- Joe Makarewicz – Organization, Nutrient and hydrologic data
- Ted Lewis - Web, Field and Laboratory work
- Mark Noll - GIS
- Jim Zollweg - Watershed Models

**SUNY Geneseo**
- Sid Bosch - Macropytes and metaphyton
- Bob Simon - Bacterial abundance - coliforms, BST

**Rochester Institute of Technology**
- Tony Vodacek - Stream mouth modeling and imagery

**Cornell Cooperative Extension**
- Nate Herendeen – AEM, Soil analysis, soil nutrient assessment, outreach

**Livingston County SWCD**
- Pete Kanouse - Construction, liason

**Livingston County Planning**
- David Woods - Liaison
Demonstrate to the Finger Lakes farming community, the utility and effectiveness of the implemented BMPs allowing regional policy makers and managers to develop optimal strategies for improving land usage in watersheds while significantly improving water quality and decreasing abundance of nuisance plant species in downstream ecosystems.

The collaborative approach provides a mechanism for the farming community to be proactive in watershed issues through education, implementation of BMPs, and by its traditional stewardship of the land it farms and is a logical step in the implementation of the Conesus Lake Watershed Management Plan.
Runoff and Soil Moisture Modeling with SMR

- SMR – The Soil Moisture Routing Model
- Product of Zollweg’s Thesis
- GIS is the Ideal Environmental Modeling Platform
- Spatially-distributed, Physically-based