Establishing a Soil Chemical Baseline for the Catskills

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Response of Acidified Soils and Associated Surface Waters to Reduced Atmospheric Acid Inputs and Calcium Mitigation Strategies

- New Project – April 2010
  - How is soil chemical change linked to stream and lake responses to acidic deposition?
  - Are existing soil chemical data sufficient to adequately track future soil change?
  - Have applications of Ca to soils been effective in increasing the long-term base status of forest soils and drainage waters?
  - Which Ca mitigation strategies hold the most promise for accelerating the chemical recovery of soils and surface waters in the Adirondacks?
Climatic data
- Solar radiation
- Precipitation
- Temperature

PnET
- Water balance
- Photosynthesis
- Living biomass
- Litterfall

Net Mineralization

BGC
- Aqueous reactions
- Surface reactions
  - Cation exchange
  - Adsorption
  - Humic binding
  - Aluminum dissolution/precipitation

Shallow water flow
Deep water flow
BGC – Surface water
Aqueous reactions
Weathering
Response of Acidified Soils and Associated Surface Waters to Reduced Atmospheric Acid Inputs and Calcium Mitigation Strategies

- Forest Comp/History
- Climate Data/Scenarios
- Soil Chemical Data
- Calcium Mitigation?
- Biogeochemical Model (Pnet-BGC)
- Outputs/Forecasts

Stream Chemistry
Response of Acidified Soils and Associated Surface Waters to Reduced Atmospheric Acid Inputs and Calcium Mitigation Strategies

- Forest Comp/History
- Climate Data/Scenarios
- Soil Chemical Data
- Calcium Mitigation?
- Stream Chemistry
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- Outputs/Forecasts

Calibration and Validation processes are involved in the model calibration and validation steps.
Response of Acidified Soils and Associated Surface Waters to Reduced Atmospheric Acid Inputs and Calcium Mitigation Strategies

- Long-Term Monitoring/Reporting
- Forest Comp/History
- Climate Data/Scenarios
- Soil Chemical Data
- Calcium Mitigation?
- Biogeochemical Model (Pnet-BGC)
- Outputs/Forecasts

Stream Chemistry

Calibration

Validation
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- Proposed Field and Laboratory Work
  - Chemical analysis of mineral soil samples collected at 130 sites in NE USA in 2001-02, comparison with 1984 data.
  - Monthly sampling and analysis of 12 (or more) Catskills stream sites selected from sites in Lovett et al. (2000) study.
  - Bi-monthly sampling and analysis of inlet streams to six Adirondack lakes.
  - Soil sampling and analysis from experimentally manipulated sites in the Adirondacks.
  - Soil sampling and analysis from 25 Catskills watersheds to establish a soil monitoring baseline for future studies
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Catskills Study Watersheds
Goals of Soil Sampling

1. Establish a baseline for future monitoring.
2. Provide data for biogeochemical modeling.
   - ≈ 50 pits  [25 watersheds x 2 pits]
     - Sample sites that actually have soil (!)
     - Sample range of forest types
     - State land – low probability of land-use change
In each watershed:
- One site near stream sampling location.
- One site at elevation approximately half-way between stream sampling site and watershed crest.

Site Locations
Methods

- Quantitative soil pits
  - Direct measurement of soil mass (kg m\(^{-2}\))
  - Calculate soil chemical pools
  - Oi+Oe, Oa
  - Mineral soil by depth increment: 0-5 cm, 5-10, 10-20, 20-C
Analysis and Storage

• Analytes:
  ▪ Total C, N (Combustion/GC)
  ▪ Soil pH
  ▪ Exchangeable Al, Ca, Mg, K, Na (NH₄Cl extraction)
  ▪ Exchangeable Acidity (KCl extraction)
  ▪ Cation Exchange Capacity

• Archiving Options?
Stream Sulfate Concentrations
Stream Calcium Concentrations