Catskill Environmental Monitoring & Research Conference
NOVEMBER 17 AND 18, BELLEAYRE
Abstracts

DAY 1: NOVEMBER 17 (WEDNESDAY)

SESSION 1: FOREST ECOLOGY AND MANAGEMENT

Global Problems, Local Impacts: Research on the Effects of Air Pollution, Climate Change, and Introduced Pests on Catskill Mountain Forests. **Gary M. Lovett, Mary A. Arthur, and Kathleen C. Weathers. Contact: Gary M. Lovett, Senior Scientist, Cary Institute of Ecosystem Studies, email:lovettg@caryinstitute.org**

This presentation will give a brief overview of our research in the Catskill forests over the last 20+ years, and a discussion of future research that we plan over the next 5-10 years. The topics to be addressed include (1) the effects of atmospheric pollutant deposition, particularly nitrogen, on the functioning of the forests; (2) the role of individual tree species in mediating those effects; (3) how introduced forest pests and diseases such as the beech bark disease and the hemlock woolly adelgid are changing tree species composition and the functioning of the forest, and (4) how climate change may interact with air pollution and introduced pests to determine the nature and function of Catskill forests in the future. We will highlight a few key findings in each topic area, and we will also describe the long-term data sets we have accumulated, the network of research plots we have established, and our archive of environmental samples.

Status of Forest Science Program Research Efforts on the New York City Watershed. **Deborah Layton, NYC Department of Environmental Protection, email: DLayton@dep.nyc.gov**

Research related to forest ecosystems has been occurring on New York City water supply lands for more than 10 years. Studies have included those that gather long-term data on forest growth, mortality and regeneration, effects of silvicultural treatments, and deer herbivory as well as shorter projects that have collected information on micro-site conditions, soil variation, effects of opening areas to deer hunting, etc.

This presentation will highlight the various research studies and some of the more interesting findings to date, including limiting factors to forest regeneration (besides deer), variation of forest growth characteristics by watershed basin, and potential methods for creating/sustaining more vibrant, resilient ecosystems on the watershed.

Using Citizen Scientists and Birds to Assess Forest Health in the Catskills. **Ralph S. Hames, Rebecca Shirer, James D. Lowe and Alan White. Contact: Rebecca Shirer, Conservation Scientist, The Nature Conservancy, email:rshirer@tnc.org**

The Nature Conservancy and Cornell Lab of Ornithology began a joint project in the Catskills in 2006 to develop long-term monitoring using volunteer citizen scientists. The Cornell Lab's Birds in Forested Landscapes project was used by volunteers recruited by The Nature Conservancy to study the occurrence of various focal bird species at up to 55 study sites each year. The volunteers also assessed the invertebrate food supply available to birds and measured habitat characteristics. Preliminary analyses show strong correlations between the presence of focal species and the number of invertebrates found at the site. Other data collected by Cornell researchers at a subset of the study sites also show relationships between the mercury content of invertebrates and soil properties. Future analyses will relate the information collected by the volunteers to Nature Conservancy measures of forest health. Ultimately, we hope that this focal species approach using citizen scientists can be an efficient way to assess and monitor forest health in other areas besides the Catskills

Best Management Practice Implementation on Family Forests in the NYC Watershed. **Joshua D. VanBrakle, René H. Germain and John F. Munsell. Contact: Joshua VanBrackle, Wood Products Utilization and Marketing Specialist, Watershed Agricultural Council, email: jvanbrakle@nycwatershed.org**

New York City's (NYC's) water supply system provides over 1.3 billion gallons of water to over 9 million people daily while operating under an Environmental Protection Agency filtration avoidance waiver. The Watershed Agricultural Council's Forestry Program promotes water quality in the system's watersheds through cost-sharing, education, outreach, and subsidizing forest management plan creation. To evaluate the efficacy of one of these elements, management planning, in promoting Best Management Practices (BMP) implementation, field surveys of 48 recently harvested properties, 26 with plans and 22 without plans, were conducted in the summer of 2009 within the NYC watershed in Delaware County, NY. Properties were evaluated for BMPs by comparing post-harvest conditions to New York State BMP guidelines. A longitudinal component compared BMP implementation in 2009 against a similar study from 2002. Properties with plans had significantly better BMP implementation compared to those without plans for both skid trails and water diversion devices. Implementation was also better in 2009 compared to 2002, again with significance for skid trails and water diversion devices. The results indicate that BMP outreach efforts in this region have paid dividends on the ground. Nevertheless, wide ranging scores and poor scores for water diversion devices such as water bars suggest more work could be done encouraging BMP implementation on a broader scale.

RELATED POSTERS (SESSION 1)

<u>Persistent Large Woody Debris in Woodland Valley Creek.</u> Jenine Tobey, SCA Intern, Cornell Cooperative Extension of Ulster County. Contact: Elizabeth Higgins, Program Coordinator, Ashokan Watershed Stream Management Program, Cornell Cooperative Extension of Ulster County, email: emh56@cornell.edu

The 2008 assessment of Woodland Valley Creek documented the location with GPS coordinates and photographs of over 90 LWD accumulations. In 2010 we went back to the locations and documented which sites still had LWD present. Over 70 sites were identified with persistent. The LWD members (trees) were measured, the presence of absence of a root ball and size of root ball was noted, the bank-full width of the stream at the location was noted and the orientation of each of the members was documented. The intent was to see if there were any factors that were common to the persistent LWD sites. In October a 25 year flood went through Woodland Valley. We went back and documented which sites maintained their LWD and what change in size of accumulation or orientation occurred.

<u>Interpreting Catskill Natural History (through the eyes of the Great Smoky Mts NP).</u> George Profous, Forester, NYS DEC - Region 3, email: gvprofou@gw.dec.state.ny.us

The poster will illustrate some of the concepts applied interpreting the natural history of the Great Smoky Mountains National Park, a park visited by some 10 million visitors annually, and which, by law, does not charge an entree fee. Ideas for interpretation, fundraising, and the balancing of public need with private donations will be discussed, applying concepts from the Great Smoky NP to the Catskill Forest Preserve/Park.

<u>Forest Regeneration in New York State</u>. Becky Shirer and Chris Zimmerman. Contact: Chris Zimmerman, Conservation Ecologist, The Nature Conservancy, email: czimmerman@tnc.org

Forests depend on adequate regeneration of tree species to be healthy and sustainable. Regeneration can be limited by many factors including deer browse, competition from other species, and poor soil conditions. This study of regeneration in New York, using data and methods from the U. S. Forest Service, found that regeneration was adequate in 68% of plots for canopy species and 43% of plots for timber species. Canopy regeneration was poorest in the southeast portion of the state, including Long Island, the southern Hudson Valley, and southern Catskills. Regeneration in the Adirondacks was dominated by low-value timber species such as American beech and balsam fir. These results suggest that limited regeneration is a problem for forests in many areas and is of particular economic concern for timber species in over half of the state. In order to maintain our forests in the face of increasing threats including climate change, energy development, invasive species, and air pollution, we should improve our understanding of the causes of limited regeneration. A partnership of public and private entities is needed to improve the accuracy and detail of data collected on forest health and incorporate this new information into resource management decisions. Specifically, we recommend intensification of USDA Forest Inventory and Analysis (FIA) data plots, the gathering of additional regeneration data on FIA plots, better incorporation of forest health measures when setting deer management objectives, and broader monitoring of atmospheric deposition impacts on forest regeneration.

SESSION 2: ECOSYSTEMS-1

<u>Assessing threats to Catskill Mountain ecosystems: Collaborative studies in the Upper Esopus Creek.</u> B.P. Baldigo, M. McHale, A.G. Ernst, T.J. Ross, and A.J. Smith. Contact: Barry Baldigo, Aquatic Scientist, USGS, email: bbaldigo@usgs.gov

Pristine streams of the Catskill Mountains provide millions of people with high quality drinking water and numerous recreational opportunities. The quality of stream waters and health of aquatic and terrestrial ecosystems across this region are currently being threatened by increasing temperatures, changing rates of precipitation, altered timing and magnitude of storm-runoff events, new development, and newly introduced or invasive species. Data from past and current research and monitoring programs suggest that the recent trends in water quality, shifts in macroinvertebrate communities, and blooms of an invasive diatom, Didymosphenia geminata (didymo), in the Upper Esopus could be related to changes in forest health. Several collaborative studies were recently initiated in the Upper Esopus Creek to document the current condition of aquatic ecosystems and to quantify the potential effects of the Shandaken Portal on trout behavior, stream habitat, water temperatures, biotic communities, hydrology and water quality (turbidity), didymo, and the nutritional quality of periphyton. The status of ongoing studies will be summarized along with observations and provisional results for several efforts.

<u>Effects of Altered Hydrologic, Turbidity and Thermal Regimes on Rainbow and Brown Trout Populations in the Upper Esopus Creek</u> T.J. Ross, Bill Fisher, Barry Baldigo, Tom Baudanza, and Mike Flaherty. Contact: TJ Ross, MS student, Department of Natural Resources, Cornell University, email: tjr84@cornell.edu

The Upper Esopus Creek, component of the Catskill District Water Supply System for New York City, supports a world renowned rainbow and brown trout fishery. Upper Esopus Creek streamflow is supplemented by water releases from the Shandaken Tunnel, an underground aqueduct originating in the Schoharie Reservoir, which alter the hydrologic, turbidity and thermal regimes of the stream. Impacts of the tunnel releases on resident trout are unknown and are a point of contention between anglers and managers in the watershed. Addressing stakeholder concerns and enacting effective management requires further understanding of interactions between water releases and trout populations. We implanted resident and hatchery trout with radio transmitters and tracked them during the summer of 2009 to determine if rates of movement, thermal refuge use, and apparent survival differed in trout located upstream and downstream of the tunnel. Results indicated that summertime stream temperatures were not stressful to trout at either site, and apparent survival and average rates of movement were slightly greater in trout downstream of the diversion. During the summer of 2010, in addition to tracking fish movements with telemetry, we observed and measured trout habitat by underwater snorkeling. Initial results indicated that low streamflows resulted in less available, suitable trout habitat upstream from the Shandaken tunnel, and as a result, trout selected for specific habitats. Habitat selection appeared to be age-specific, with age-2 and older trout primarily occupying deep, slow-flowing, cover-rich habitats; age-1 trout primarily occupying shallow, faster-flowing, cover-rich habitats; and young-of-year trout primarily occupying shallow, riffle, cover-poor habitats. Fewer suitable habitats were available to age-2 and older trout than that available to age-1 and younger trout, resulting in more patchily distributed older fish. Implications of results will be discussed in relation to trout management in the Upper Esopus Creek.

<u>Stream barrier mitigation in the Delaware River Basin</u>. Gregg Kenney and Jamie Deppen. Contact: Gregg Kenney, NYS DEC, email: ghkenney@gw.dec.state.ny.us

Stream barriers, such as dams and hanging culverts, can negatively impact both aquatic species and species associated with riparian corridors. These types of barriers and altered hydrology were identified by New York's Comprehensive Wildlife Conservation Strategy as the fifth most commonly listed threat to New York's Species of Greatest Conservation Need (SGCN). The New York State Department of Environmental Conservation Bureau of Wildlife in Region 3 is addressing this problem in the Delaware River Basin by implementing a barrier mitigation project. The purpose of the project is to inventory biologically important barriers on streams and remove a number of those barriers located in important SGCN areas. After gathering expert knowledge on SGCN locations priority stream segments were identified. In these priority stream segments, potential aquatic barriers were identified remotely and assessed in the field using a standard protocol. A GIS database was created to store collected information including photographs, locations, barrier condition, and measurements that could help determine a species' ability to pass the barrier. Streams were searched upstream and downstream of some barriers for the presence of SGCN to help in the prioritization of barrier removal. Of roughly 800 potential barriers, over 80 biological barriers were identified on 40 of 76 streams surveyed thus far.

Many of these streams have had major flooding in the past and most models of future climatic conditions predict a significantly higher frequency of heavy rainfall events in the region. The next phase of this project will assist highway departments in replacing culverts with SGCN friendly road crossings in biologically important areas. These replacements will benefit SGCN, restore aquatic habitats, and allow communities to adapt to climate change.

Human Influences on Species Composition: Long Term Change in Otsego Lake, NY. Dr. Bill Harman and Holly Waterfield. Contact: Holly Waterfield, SUNY Oneonta Biological Field Station, email: meehanha@oneonta.edu

Data sets collected and organized by SUNY Oneonta Biological Field Station personnel over the last 43 years illustrate a disturbing trend in human influence on habitat, the introduction of invasive species and concurrent loss of native species in Otsego Lake. This trend parallels global trends in fresh water ecosystems as transportation technologies, world trade and international recreation has become available to more segments of the human population. We are aware of 24 aquatic species that have been introduced into Otsego Lake since early in the 20th century. Likewise we know of 54 species whose populations have been decimated during that time period. Significant losses can be directly attributed to stresses created by habitat alterations and aggressive exotic introductions.

Does the density of invasive rusty crayfish affect stream macroinvertebrates? Mark Kuhlmann, Anthony Prisciandaro, Megan Irland, Greg Hamilton, Sara Caldwell, and Ryan Oliver, Contact: Mark Kuhlmann, PhD, Biology Department, Hartwick College, email: kuhlmannm@hartwick.edu

Rusty crayfish (*Orconectes rusticus*) have invaded streams of the upper Susquehanna River catchment (New York, USA), replacing native crayfish and probably increasing overall crayfish density. Crayfish are important consumers and agents of disturbance in aquatic communities, so the introduction and expansion of rusty crayfish could affect the invaded community through the change in crayfish species composition, the increase in crayfish density, or some combination of the two. Other macroinvertebrate taxa may be prey of, competitors with, or subject to disturbance by crayfish and so are likely to be affected by changes in the crayfish assemblage. We conducted both a correlative field study and an enclosure experiment to investigate the effects of invading *O. rusticus* on the abundance, diversity, and composition of the stream macroinvertebrate assemblage. We sampled crayfish and macroinvertebrates at 13 sites on 4 streams in the upper Susquehanna River catchment that varied in crayfish species composition and density. We are also conducting an experiment in stream enclosures to test the effects of *O. rusticus* density on the macroinvertebrate assemblage.

In the field samples, total macroinvertebrate abundance, taxon richness, diversity, and density of individual taxa were not significantly correlated to either total crayfish density or the relative abundance of *O. rusticus*. In the first year of the experiment, increasing crayfish density caused a significant decrease in total macroinvertebrate density but did not significantly affect macroinvertebrate taxon richness or diversity. The density of some individual taxa were also significantly affected by crayfish density. Our experiment shows that rusty crayfish density can affect the stream community; the mechanism of these effects, and whether they differ from those of native crayfish species, remain to be determined.

RELATED POSTERS (SESSION 2)

An Assessment of Three Common Decontamination Products on the Invasive Algae Didymosphenia geminate. Samantha Root and Dr. Catherine O'Reilly. Contact: Catherine O'Reilly, Biology Program, Bard College, email: oreilly@bard.edu

Didymosphenia geminata, commonly known as “didymo” or “rock snot,” is an invasive freshwater diatom (algae) that is primarily spread to uninfected rivers and streams by contaminated fishing waders. Currently, there is no universal decontamination method for cleaning fishing gear and there are limited assessments of how well existing decontamination methods work. In an effort to determine the best decontaminant product for future decontamination stations at fishing access points, our experiment used small-scale models of decontamination stations in the laboratory setting. The effectiveness and stability of three commonly used decontaminant products (2% household bleach, 10% salt water, and 1% Virkon Aqua) were tested with D. geminata cells collected in the Esopus Creek in New York State. In our experiment, bleach was the most effective decontaminant product and Virkon Aqua was the most stable decontaminant product. Alarmingly, none of these three decontaminants were as effective on didymo samples as previous research claimed. Effectiveness of the decontamination products seemed to depend on two unexpected factors: (1) whether or not the D. geminata cells were attached to extracellular stalk material and (2) what date the didymo samples were collected. Since these three common decontaminant products are being used today, our rivers and streams might still be getting infected with didymo despite decontamination efforts.

Rock snot in a sick river: What causes didymo blooms in Esopus Creek? Richardson, DC; Achterberg, LA; Redfield, M; Root, S, Arscott, DA; Gibson, C; and Hollein, TJ Contact: David C. Richardson, Ph.D. Assistant Professor, Department of Biology, SUNY New Paltz, email: richardsond@newpaltz.edu

Abundance of the nuisance stream alga Didymosphenia geminata has unexpectedly increased in streams and rivers worldwide in recent decades. D. geminata (Didymo) is informally called "rock snot" because during blooms (i.e., periods of rapid spread), the diatoms produce copious amounts of extracellular polysaccharide stalks which causes individual cells to tangle and form a mat that resembles mucus. Recent reports over the past several years have identified D. geminata blooms in NY streams, including Esopus Creek above the Ashokan Reservoir in the Catskill Mountains. The causes of D. geminata blooms and its range expansion are not well understood. Potential controlling factors of D. geminata blooms include biotic (e.g., periphyton community dynamics, grazer influences) and abiotic factors (e.g. changes in water chemistry, climate, and watershed landscapes). Throughout the 2010 summer, we focused on the influence of abiotic variables including water chemistry and hydrology on D. geminata blooms by sampling seven locations along Esopus Creek ranging from the headwaters to the creek mouth at the Ashokan Reservoir. Three sampling locations were located above the Shandaken Tunnel ("the Portal"), which brings water into Esopus from the Schoharie Reservoir. We found didymo at 6 of 7 sites, including two sites above the Portal. When didymo was present, didymo covered 20% to 100% of the streambed, added 3 to 20 mg dry mass/sq. cm to the streambed sediments, and grew at a wide range of water velocities (0 to 1.5 m/s). Throughout the summer, sites with didymo present had higher pH, double the conductivity, higher sulfate concentrations, higher inorganic carbon, but, lower nitrate concentrations. Didymo growth appears linked to specific water chemistry, but independent of hydrology in Esopus Creek. Understanding the relationship between water chemistry and D. geminata abundance is crucial for effectively managing invaded sites and for predicting the sites most vulnerable to invasion.

Pearly mussels in the NY State Susquehanna Watershed, Paul H. Lord, Timothy Pokorny and Willard N. Harman, Contact: Paul Lord, Department of Physical Science, SUNY Oneonta, email: lordph@oneonta.edu

Pearly mussels (aka unionids) are endangered native mollusks with a complex life cycle which typically includes fish parasitism and which is easily disturbed by changes in watershed quality. There are four species identified, by the NY State Department of Environmental Conservation, as meriting greatest conservation need (SGCN) historically found in the NY State portion of the Susquehanna River Watershed. These SGCN are the brook floater (*Alasmidonta varicosa*), the green floater (*Lasmigona subviridis*), the yellow lamp mussel (*Lampsilis cariosa*), and the elktoe (*Alasmidonta marginata*). Historically, unionid sampling was done where convenient, normally at intersection of a waterway and a roadway. Since the current status of the four SGCN is unknown, we are estimating their populations. In 2008-2009, we mapped four rivers, the Susquehanna, the Chemung, the Chenango, and the Tioughnioga, using kayaks and GPSs, noting bottom character (riffle, run, or pool and bedrock, boulder, cobble, pebble, sand, silt or organic) and riparian uses and buffers (stable or unstable) and use (commercial, field, government, paved, residences, railroad, or woods) and buffer status. Additionally, we identified unionids and their locations whenever they were observed, and, in 2009, sought out locations with parameters we believed would support mussel populations. In 2010, we completed quantitative surveys along 15 distinct transect locations randomly chosen from the riffles, pools, and runs (five each) mapped previously. We sampled 982 $1m^2$ plots, for presence and number of pearly mussels, using SCUBA, snorkel, and view buckets and excavated 180 of those plots, to the depth of potential pearly mussel survival, to ascertain numbers of immature pearly mussels and to check our count of adults. Material excavated was washed through three sift boxes with increasingly smaller openings (smallest: 3mm). Preliminary results provide both encouragement and reasons for concern. We have identified a new unionid SGCN in the Susquehanna River Watershed: the Eastern pearlshell (*Margaritifera margaritifera*) which has been found in NY, but not in the Susquehanna's watershed. This mussel was found in the headwaters of the Otselic River. We found all four of the SGCN in multiple locations. The yellow lamp mussel, elk toe, and the green floater are alive in all four rivers surveyed. The brook floater is found in three of the four rivers. All unionids are impacted by dissolved oxygen losses, siltation, endocrine disrupting chemicals, and other watershed human impacts. Changes in water conditions and search methods provide contrasting results on pearly mussel surveys of the same river sections. Pearly mussel SGCN were found in areas below extended riffles (apparently thriving in the oxygenated waters) and in areas with minimally mobile substrates (presumably avoiding pulverization). We are intrigued by an observed trend that river location consistency with old maps is associated with more adult unionids. We did find young unionids buried in mobile sediments, but rarely did we find adults in such sediments. We are concerned that unionid habitat is degraded by fluctuating water levels and current velocities resulting from poor agricultural practices, urban sprawl, and stream channelization projects, and, most apparently, from stormwater inputs to rivers.

SESSION 3: ECOSYSTEMS-2

Habitat Mapping in the Town of Woodstock. Gretchen Stevens and Nava Tabak. Contact: Gretchen Stevens, Director, Biodiversity Resources Center, Hudsonia Ltd., email: stevens@bard.edu

Hudsonia Ltd.–a non-profit institute for environmental research and education–creates townwide habitat maps for use in planning and environmental reviews. These biodiversity assessments are intended to fill a gap in the information that decision-makers need in order to protect biological diversity, water resources, and ecosystem services. The Town of Woodstock, with its western half in the Ashokan Reservoir's watershed and nearly 6,000 ac in the Catskill Forest Preserve, is the latest addition to this mapping effort. Using remote sensing we will create a preliminary map of ecologically significant habitats in the town, including occurrences of regionally rare habitat types (such as oak-heath barrens), habitats that are often overlooked in environmental reviews (such as intermittent woodland pools), and common but important habitats that constitute the landscape matrix (such as upland forests and meadows). Next we will perform extensive field verification of the map. Along with the final map and a GIS database, we will produce a report with descriptions of the habitat types, the kinds of rare plants and animals they may support, our recommendations for effective conservation, and GIS analysis. These maps provide habitat and biodiversity information heretofore unavailable, presenting an overall biodiversity picture sweeping enough for comprehensive and large watershed planning, but with enough detail for use in reviewing site-specific development proposals. The townwide perspective helps municipal decision-makers understand the landscape connections that are essential for species, biological communities, and functioning ecosystems. Other towns with habitat maps from Hudsonia have incorporated the information into their comprehensive plans, zoning ordinances, open space plans, and routine reviews of development projects. We hope that future habitat mapping will extend to other portions of the Catskill Mountains, the Ashokan watershed, and neighboring towns, providing this important conservation planning tool to other stakeholders in the region.

Geochemistry and Ecology of Catskill Region High Elevation Wetlands. S. Parisio, M.S. Adams, A. Spodek-Keimowitz, K. Interlichia, W. Jobs, C. Halton, and S. Kroenke. Contact: Steven Parisio, New York State DEC, email: sxparisi@gw.dec.state.ny.us

New York State Department of Environmental Conservation staff are collaborating with the Olive Natural Heritage Society and the Vassar College Chemistry Department to study selected high elevation wetlands in the Catskill Mountain Region. Prior to initiation of field work, the first phase of the project involved extraction of data from the unpublished field notes of Michael Kudish and the 1985 Master's dissertation of Daniel Spada to create a GIS map layer and a datatable for more than one hundred high elevation wetlands previously studied by these two researchers. Sites selected for the current project are those which are highest in elevation, closest to the mountain summit or groundwater flow divide, least likely to be disturbed by localized human activity and most likely to exhibit ombrotrophic characteristics. Other criteria used in selecting study sites included areal extent, thickness of peat, presence of open water and site accessibility. True ombrotrophic bogs are rare in New York State and are highly vulnerable to climatic changes such as rising temperatures and atmospheric deposition of nitrogen. At each wetland, surface water chemistry is being evaluated based on field measurement of pH, temperature and dissolved oxygen and samples are being collected for laboratory analysis of major ions and trace elements. Ambient groundwater chemistry is also being determined by sampling of nearby springs. Species of vascular plants and sphagnum mosses are being surveyed. Current and past geochemical and species occurrence data will be evaluated for trends and relationships which may shed light on how these special ecosystems are being impacted by climate change and other environmental stressors.

Forest History Questions Nagging for up to Forty Years. Michael Kudish, email: mkudish@catskill.net

Discussion of the following seven questions:

1. Why the eastern Catskills high peaks have balsam fir caps and the western ones do not?
2. Why carbon-14 dates from peat in nearly Catskills 100 bogs range from a few hundred years to 14000 when the geologic basins are almost the same age?
3. How do the open fern glades form and disappear on the high ridgelines?
4. How did goldenrods and asters, common along valley roadsides, get to remote, high-elevation seeps?
5. Why are there oak-hickory-American chestnut-mountain laurel forests along portions of the East Branch Delaware Valley? And why have charcoal remains failed to date forest fires of unknown age?
    a. Where are the first-growth forests in the Catskills? Mapping continues as a "fine-tuning".
6. Where did the tracks go in the Catskills? *Volume IV* of *Mountain Railroads of New York State* to be published by the Purple Mountain Press in May 2011. Most of the forest-product industries will be included in this historic atlas.

<u>Towards a total view of Catskills Open Space Assets: Aggregating habitat and water data</u>. Abigail Weinberg, Manager of Conservation Research, Open Space Institute, email:aweinberg@osiny.org

On average, 60% of regionally important habitat and water quality resources in the four-county Catskill region are located on privately owned lands. The other 40% are located within the 550,000 acres of public or NGO- land reserved for permanent conservation. Aquifers, wetlands and riparian areas under natural cover are overwhelmingly located on private lands with less than 20% of each resource conserved. The region needs to identify ways to work with private landowners to assure proper stewardship of these lands and incentivize the retention of these resources.

For the purposes of this conference, I am only presenting data on habitat and water quality. The results of the broader study also examine the role of private ownership in protecting recreation and agricultural resources. Incorporating this data, we find slightly more than two-thirds (or 1.15 million acres) of priority farm, forestlands, habitat and waterways are privately owned. We further look at to what extent these resources impinge development. Using GIS analysis of a) existing development, b) regulatory and physical limitations to development, and c) the location of critical resources we identify the remaining "preferred growth areas". We compare the extent of preferred growth areas to anticipated development based on projected population growth. Our results identify approximately 520,000 acres of available for preferred growth and between 15,000 and 40,000 acres of anticipated development through 2035. The results of this study indicate there is enough room to more than triple the existing development foot print without negatively affecting privately-owned important farm and forestlands. However, the study also suggests that achieving such a "win-win" will require planning and coordination to ensure the proper placement of development and thus to facilitate the continuing vitality of the region's farm, wildlife, recreation and water values.

RELATED POSTERS (SESSION 3 and 4)

<u>The Importance of Determining Feasibility: A Case Study in Invasive Species Management.</u> Amanda Czechowski, TNC Intern. Contact: Contact: Chris Zimmerman, Conservation Ecologist, The Nature Conservancy, email: czimmerman@tnc.org

Second only to habitat loss, invasive species pose a major threat to biodiversity worldwide by altering ecosystem structure and function. Invasive species management can be costly and time consuming, so decisions must be well informed before they're implemented. Using tools to help determine the feasibility of control can help guide such decisions and minimize the occurrence of misplaced effort and funding.

Using a pilot control site for Pale Swallow-wort (*Cynanchum rossicum)* in Delaware County, NY, we can compare eradication efforts there to the courses of action recommended by a draft invasive species management decision tool. We can also look at the results of those actions (both actual and hypothetical) and how they fit into the larger picture of invasive species management throughout the Catskill Mountain Region.

<u>Smith Environmental Field Station: Living and Learning for a Sustainable Future</u>. Brian Hagenbuch, Mark Kuhlmann, Peter Fauth, Stan Sessions, and Zsuzsanna Balogh-Brunstad. Contact: Mark Kuhlmann, PhD, Biology Department, Hartwick College, email: kuhlmannm@hartwick.edu

The Robert R. Smith Environmental Field Station (Smith EFS) is located at Hartwick College's Pine Lake Environmental Campus (PLEC) in Delaware County, roughly eight miles from Oneonta, New York. Situated near the headwaters of the Susquehanna and Delaware Rivers in the western foothills of the Catskill Mountains, the PLEC is a multi-use facility that includes a 5 ha spring-fed, kettlehole lake, alder (Alnus) bog, swamps, mixed coniferous /deciduous forests, open fields, Charlotte Creek, and a river bottom flood plain. Smith EFS is used by Hartwick College faculty and students as a base of operations for field research and teaching. During the summer, Smith EFS hosts faculty and student researchers and field-based summer courses. Current research focuses on 1) Impacts of an Invasive Crayfish on a Stream Community (Kuhlmann), 2) Revisiting Acid Rain: Nitrate and Sulfate Deposition in the Upper Susquehanna River Basin (Balogh-Brunstad), 3) Organ Regeneration in Red Spotted Newts of Pine Lake (Sessions), 4) Collaborative Research on the Effects of Environmental Stressors on Amphibians (Sessions), and 5) Impact of Recreational Use of Public Lands on Biological and Ecological Diversity (Fauth). Facilities include a large teaching/ research laboratory (5 x 6m) a smaller dedicated research laboratory, storage/utility room (2.5 x 4 m), instrument room (2.5 x 3 m), full bath, and computer room (2 x 3 m). Equipment includes an explosion proof refrigerator, freezer, microwave, PH meter, top loading balances, six dissecting microscopes, six compound microscopes, drying ovens, computers and printers, and AV equipment. Field equipment includes small mammal traps, forestry equipment, aquatic sampling equipment, water testing kits, a dissolved oxygen meter, mist nets and traps for bird capture, seines and nets, and other basic limnology and ecology equipment. The Field Station has wireless internet access and maintains a collection of biology, ecology, and natural history books and literature. (www.hartwick.edu/pinelake.xml).

SESSION 4: ECOSYSTEMS-3

The Vascular Flora of the Catskills. Morton S. Adams and Steven Parisio. Contact: Morton (Sam) Adams, Catskill Institute for the Environment, email: madams@mail.nysed.gov

The Olive Natural Heritage Society undertook a survey of the vascular flora of the Catskill Mountain region of southeastern New York State in 1996. The survey includes a herbarium collection of authoratively determined voucher specimens and a database. Early results of the survey were reported by Parisio (*Common Vascular Plants of the Catskill Mountain Region)* at the Catskills Ecosystem Health Symposium, October, 1999 (www.catskillinstitute.org). An updated *Preliminary Checklist of the Vascular Flora of the Catskills* is available at www.onhs.org. The present survey built upon the work of Michael Kudish (Kudish, M. 1979. *Vegetational history of the Catskill High Peaks*. State University College of Forestry at Syracuse University) and Karl Brooks (Brooks, K. L. 1979-1984. *A Catskill Flora and Economic Botany* Vols. I-IV parts 1 and 2). The survey is ongoing and will continue to add to the known flora of the region and additionally focus on several aspects of the flora as it reflects changing conditions both biotic and abiotic.

1. Changes in the floral assemblage: We will examine species added or lost to the flora since Kudish or Brooks. We will be alert to possible human induced changes.
2. Changes in the range limits: Species at the boundary of their recorded distribution will be examined, as they may reflect abiotic effects of climate change.
3. Changes in the occurrence of named subspecies and varieties: Species may be genetically adapted to local conditions. Change in the pattern of morphologic characters may be an early indicator of environmental stress.

Changes in the flora of special habitats: The unique flora of sphagnum wetlands, mountain tops, refrigerated talas slopes, ravines and cliff faces will be monitored for change.

Collecting in Slide Mountain Wilderness and Sundown Wild Forest. Dr. Kerry Barringer and Paul Harwood. Contact: Paul Harwood, Herbarium Supervisor, Brooklyn Botanic Garden, email: PaulHarwood@bbg.org

Brooklyn Botanic Garden has been collecting plant specimens and amassing data on the flora of the New York City Area for the last twenty years. Through its New York Metropolitan Flora Project (NYMF) as well as other regional studies, BBG scientists have entered 402,000 records and collected 85,000 vouchers. This data has been important for botanists, ecologists, conservation groups and state agencies. We provide plant lists and detailed studies of problem genera, detect changes in regional flora and provide distribution maps on our website.

The Catskill Mountains, so important to the well-being of so many people in lower New York State, has large areas that have not been systematically collected. To help gain a better understanding of the flora, BBG is in its second year of collecting in the Slide Mountain Wilderness and Sundown Wild Forest , (approximately 77,000 acres) compiling a vouchered list of plants and providing data to the DEC Department of Forestry.

The Distribution of Invasive Plants in the Catskills Mountains. Chris Zimmerman and Barbara Dibeler. Contact: Chris Zimmerman, Conservation Ecologist, The Nature Conservancy, email: czimmerman@tnc.org

To develop sound invasive plant control strategies, comprehensive distribution data is needed. From 2004 to 2010, we surveyed roadsides and trails for 20 invasive plants in a 300,000-acre area in the Catskills Park. Three sampling techniques were used depending on the target species and survey objective. In 2004 and 2005, 356 0.5 Km belt-transects were sampled to determine the distribution of common invasive plants on roadsides and trails in and surrounding the Slide Mountain, Big Indian, Dry Brook Ridge, and Balsam Lake Mountain protected areas. Invasive plants were widespread on the road system, with 74% of the road transects contained at least one invasive. However, only 3 of the 50 trail transects (< 1%) were occupied by an invasive. Garlic mustard was the most abundant species, occurring in 77.7% of the road transects. Bush honeysuckle, multiflora rose and barberry were found in approximately half of road transects. State Route 28 supported a greater richness and higher density of invasive plants. In 2008 and 2010, we focused our survey efforts on less common invasive plants. We walked 54 miles of roads and trials and surveyed ~ 200 miles of roadside from a vehicle mapping the distribution of swallow-wort, Japanese stiltgrass, Asiatic bittersweet, giant hogweed and mile-a-minute vine. Seven swallow-wort occurrences were mapped in the park with two of the occurrences greater than ten acres size. Stiltgrass is widely distributed surrounding the Ashokan Reservoir and satellite infestations were found on Peekamoose and Woodland Valley Roads. We found numerous bittersweet occurrences along the State Route 28 corridor; however it was not detected past Big Indian. Giant hogweed and mile-a-minute were not found in the survey area, but both are present south of the Catskill Park. These data will aid in determining the feasibility of invasive plant control strategies in the Catskills.

DAY 2: NOVEMBER 18 (THURSDAY)

SESSION 5: WATER QUALITY-1

NYC DEP's Water Quality Monitoring Program in NYC's West of Hudson Watershed. Jim Mayfield, Section Chief of the Program Evaluation and Planning, DEP Division of Watershed Water Quality Science and Research, email: MayfieldJ@dep.nyc.gov>

In 2008 New York City's Department of Environmental Protection (DEP) updated its watershed water quality monitoring program. The resulting report satisfied a requirement in the 2007 Filtration Avoidance Determination (FAD) which stated: "As watershed protection programs develop and analytical techniques for key parameters change, it is necessary to reassess the monitoring program to ensure that it continues to support NYCDEP's watershed management program and that it can be used to evaluate the effectiveness of programs established under the FAD and MOA." The goals of DEP's Watershed Water Quality Monitoring Plan included providing an up-to-date, objective-based monitoring plan to help assess compliance and provide comparisons with established water quality benchmarks. In addition, monitoring data can help evaluate the source and fate of pollutants and the effectiveness of watershed protection programs. Also, the plan provided monitoring to assist in the evaluation of water quality status and trends to support an assessment of the overall effectiveness of watershed protection programs. The plan is a comprehensive program, encompassing all areas of watershed monitoring, including aqueduct monitoring sites, streams, and reservoirs. The implementation of DEP's Watershed Water Quality Monitoring Plan in the NYC West of Hudson Watershed will be presented with an emphasis on the stream sampling network. This network currently consists of 66 fixed-frequency stream sampling sites collected on a monthly basis for a variety of physical, chemical, and biological analyses. In addition to these water quality sites, stream discharge is measured by the USGS at 48 stream and reservoir release sites. DEP also installed and maintains a network of 20 meteorological stations throughout the watershed.

Trends in stream macroinvertebrate bioassessments in NYC Watershed Streams. Martin Rosenfeld, NYC DEP, email: mrosenfeld@dep.nyc.gov.

Since 1994, NYCDEP has been assessing the health of streams in its Catskill/Delaware watersheds by sampling benthic macroinvertebrate communities, using protocols established by the New York State Stream Biomonitoring Unit. Routine sites are sampled annually; "status" sites are sampled on a rotating basis. Routine sites are integrator sites, located on mainstems or important reservoir tributaries, or in streams in whose watersheds there is a significant potential for land use changes. Status sites are chosen to cover a wide geographic area and to represent a broad array of physical and chemical conditions. In addition, certain sites have been sampled specifically to monitor the impact to the water supply of new or proposed development, or in connection with special projects. Trend analysis was conducted on all 15 routine sites, and on 4 status and 6 other sites with a minimum 5-year sampling record, to detect long-term changes to the benthic community. Of the 25 sites examined, 24 displayed no significant trend (i.e., $p>0.05$), suggesting that habitat and water quality conditions in these indicator streams remained relatively stable during the period of record.

Catskill Stream Protozoan Monitoring Objectives. Christian Pace and Kerri Alderisio. Contact: Christian Pace, NYC DEP, email:cpace@dep.nyc.gov

New York City's Environmental Protection (NYCDEP) has monitored for Giardia and Cryptosporidium (oo)cysts throughout its watershed using EPA Method 1623HV since 2002. Fixed frequency and special investigation sample results from this period were used to determine mean values and 95th percentiles of sample concentrations for 18 studied stream sites in the Catskill and Delaware districts. In 2008, these calculations were used to develop a ranking system for highest protozoan occurrence with the purpose of refining the list of stream sites for a future sampling objective. The 2009 Watershed Water Quality Monitoring Plan includes eight of these sites determined to have the highest mean concentrations of Cryptosporidium and Giardia. As part of this objective, the location with the highest value has been the focus of increased upstream monitoring, in order to facilitate the identification of a point or non-point protozoan source.

The 95th percentiles of the data were used to establish guidelines for what is considered outside the normal range of results for each stream site. Results for the 95th percentile of Cryptosporidium concentrations were comparatively low at all sites (less than 4.0 oocysts per 50 L), while those for Giardia were much higher (up to 640.0 cysts per 50 L). As a guideline, the 95th percentile can readily be used to assist with decisions for re-sampling or potential upstream point source monitoring. Other factors, such as precipitation events and other on-site conditions during sampling should also be considered. It is recommended that these guidelines be recalculated annually. These established guidelines are a relatively new tool being used to aid water quality managers when determining whether a follow-up investigation should be considered for an elevated count.

SESSION 6: WATER QUALITY-2

Geologic Investigations Supporting Stream Management Strategies in the Ashokan Reservoir Watershed: A Status Report. Danny Davis, Andrew Kozlowski, John Rayburn, and Cory Ritz. Contact: Danny Davis, Geologist, Stream Management Program, NYC DEP, email: ddavis@dep.nyc.gov

The Ashokan Watershed Stream Management Program is coordinating with the NYS Geological Survey and the SUNY New Paltz REU Program to significantly improve the knowledge and interpretation of the distribution of the Pleistocene glacial and post-glacial deposits that are the primary in situ sources of suspended sediment that lead to turbidity in the Ashokan watershed. The improved knowledge base will be used to develop better informed stream management strategies to help reduce turbidity.

Implications for Stream and Floodplain Management of Hydrologic Trends in the Upper Rondout and Neversink Basins, Chris Tran, Ulster County Community College, email: TranC@dep.nyc.gov

Flood frequency probabilities were calculated for Rondout Creek near Lowes Corners, NY over a time period of 50 years using Log Pearson Type III Analysis. Results indicate that the magnitude of flows have increased over the record of this gage for the 1.25, 2, 10, 50, & 100 yearly return intervals. This trend suggests a more frequent occurrence of flows large enough to influence stream channel morphology and have implications for floodplain management.

Three-Dimensional Surficial Geologic Mapping, Shandaken Quadrangle, NY. Colby A. Smith, Andrew L. Kozlowski, Paul A. Stefanik. Contact: Andrew Kozlowski, Glacial Geologist\Senior Scientist, New York State Geologic Survey, email: akozlows@mail.nysed.gov

Drainage basins in the Catskill Mountains of southeastern New York State provide the majority of drinking water to the residents of New York City. One such catchment is that of Esopus Creek which is the main tributary to Ashokan Reservoir. Recently, unacceptably high turbidity levels have been intermittently recorded in the reservoir spurring geologic investigation into the source(s) of fine-grained suspended sediments responsible for the turbidity.

Surficial geologic mapping of the Shandaken Quadrangle in the upper reaches of Esopus Valley largely reveals till, deposited during the late Pleistocene glaciation, and alluvium and colluvium deposited during the Holocene. Evidence of lacustrine silt and clay, deposited in pro-glacial lakes dammed in the valley during deglaciation, are exposed only in limited exposures along Esopus Creek and its tributaries. Thus, in order to determine the lateral extent and thickness of fine-grained sediments three-dimensional mapping was required. A drilling campaign was undertaken in Esopus Valley including five holes distributed over 3 quadrangles. Preliminary results indicate extensive lacustrine deposits to thicknesses of 25 m and a variety of glacial stratigraphies that can be used to determine the deglacial history of the region.

Simulation Modeling for NYC Water Supply Operations to Control Turbidity – Spring 2010 Case Study. Mark S. Zion, Elliot M. Schneiderman, Donald C. Pierson, and Adao H. Matonse. Contact: Donald Pierson, Reservoir Modeling Program, NYC DEP, email: dpierson@dep.nyc.gov

Turbidity is a primary factor that potentially limits use of the NYC Catskill System Water Supply. The impacts of turbidity to the reservoir system can be mitigated by operating the system to minimize turbidity inputs to the terminal Kensico Reservoir while maximizing the storage and settling capacity of the up-basin Catskill System reservoirs. During turbidity events daily decisions are carefully taken to optimize system operations for turbidity control. To support these decisions, simulation models are used to evaluate alternative operational scenarios within a probabilistic framework.

In the spring 2010 a series of storms and accumulation of a deep snowpack lead to elevated levels of turbidity in Catskill System reservoirs, and raised concerns that future runoff could lead to even greater levels of turbidity. Model simulations were performed to analyze the use of the Ashokan waste channel and the blending of Catskill and Delaware System waters to minimize turbidity inputs to Kensico reservoir, and examine the implications of the large snowpack on turbidity inputs during the snowmelt season. Model results provided guidance for system operations through the spring 2010 season.

Aerial Orthoimagery, LiDAR, and Derived GIS Products in the NYC Watersheds. Terry Spies, Section Chief, GIS, NYC Environmental Protection, email: spies@dep.nyc.gov

In 2009-2010, DEP collaborated with the New York State Office of Cyber Security and Critical Infrastructure Coordination (NYS CSCIC) to collect wall-to-wall aerial data products over all NYC watersheds and aqueducts as part of NYS CSCIC's Digital Orthoimagery Program. DEP's datasets encompass a total area of approximately 2,700 square miles, and include 1 meter Light Detection and Ranging (LiDAR) based topography, 1 foot Leaf-off 4-band orthoimagery, and 1 foot Leaf-on 4-band orthoimagery. Aerial data were collected in Spring and Summer 2009 and delivered in Summer 2010.

Light Detection and Ranging (LiDAR) data collected via aircraft will produce a high resolution digital elevation model (DEM) of terrain for the watershed and specified buffer zone. LiDAR is the most efficient way to gather continuous 3-dimensional data in the shortest time period with the least cost, compared to individually surveying various watershed features or infrastructure using traditional land surveying methods. LiDAR data is currently undergoing further processing to derive enhanced hydrological stream networks and drainage delineations. This will provide DEP with more accurate watercourses for regulatory mapping and stream management activities, as well as more accurate watershed boundary determinations for Watershed MOA partnership and regulatory activities.

In addition, a concurrent project is underway to derive a high resolution level 4 land use and land cover dataset and an impervious surface data set from the orthoimagery. These data will enable the BWS GIS to continue to be a useful tool to perform analysis of land cover, estimate the effects of watershed management programs on long-term water quality, and support terrestrial and reservoir modeling of water quantity and quality in the watersheds. This presentation will illustrate some of the regulatory and analytical applications of these datasets at DEP.

RELATED POSTERS (SESSION 6 and 7)

Suspended Sediment and Turbidity in the Esopus Creek Watershed. Christiane Mulvihill, Jason Siemion, Michael R. McHale. USGS. Contact: Christiane Mulvihill, USGS New York Water Science Center, email:mulvihil@usgs.gov

Samples for suspended-sediment concentration (SSC) and turbidity analysis were collected monthly and during storms at four Esopus Creek mainstem sites and nine Esopus tributary sites between August 2009 and June 2010 to identify which sub-watersheds are the primary contributors of suspended sediment and turbidity to Esopus Creek. Preliminary analysis of mean and median SSC and turbidity indicate that Stony Clove Creek had the highest observed concentrations and turbidity; high SSC was also measured at Esopus Creek at Coldbrook, Esopus Creek at Allaben, and Woodland Valley Creek. Other sources of turbidity were Woodland Valley Creek, Broad Street Hollow, and Esopus Creek just downstream from the Shandaken Tunnel portal. Data from the four mainstem Esopus Creek sites indicate SSC and turbidity increase immediately downstream of the portal. Preliminary conclusions of the study are: 1) high SSC and turbidity are associated with storm runoff, 2) some tributaries remain slightly turbid during baseflow, and 3) useful correlations exist between SSC and turbidity and SSC and streamflow. The sources and loads of suspended sediment and sources of turbidity will be further defined when sufficient data is collected to model SSC and turbidity.

The Relation of Harvesting Intensity to Changes in Soil and Stream Chemistry in a Northern Hardwood Forest, Catskill Mountains, USA. Jason Siemion, Douglas A. Burns, Peter S. Murdoch, and Rene H. Germain. Contact: Jason Siemion, Physical Scientist, USGS New York Water Science Center, email:Siemion@usgs.gov

Previous studies have shown that clearcutting of northern hardwood forests mobilizes base cations, inorganic monomeric aluminum (Alim), and nitrate (NO3-) from soils to surface waters, but the effects of partial harvests on NO3- have been less frequently studied. In this study we describe the effects of a series of partial harvests of varying proportions of basal area removal (22%, 28%, 68%) on Alim, calcium (Ca2+), and NO3- concentrations in soil extracts, soil water, and surface water in the Catskill Mountains of New York, USA. Increases in NO3- concentrations relative to pre-harvest values were observed within a few months after harvest in soils, soil water, and stream water for all three harvests. Increases in Alim and Ca2+ concentrations were also evident in soil water and stream water over the same time period for all three harvests. The increases in Alim, Ca2+, and NO3- concentrations in the 68%

harvest were statistically significant as measured by comparing the one-year pre-harvest period with the one year post-harvest period, with fewer significant responses in the two harvests of lowest intensity. All three solutes returned to pre-harvest concentrations in soil water and stream water in the two lowest intensity harvests in 2 to 3 years compared to a full 3 years in the 68% harvest. When the results of this study were combined with those of a previous nearby clearcut and 40% harvest, the post-harvest increases in Alim, Ca^{2+}, and NO_3^- concentrations in stream water and soil water suggest a harvesting level above which the relation between concentration and harvest intensity changes; there is a greater change in concentrations per unit change in harvest intensity. This level was at 40 to 68% basal area removal for NO_3^- concentrations and >68% for Alim and Ca^{2+} concentrations. These results indicate that the deleterious effects on aquatic ecosystems that have been demonstrated for intensive harvests in northern hardwood forests of northeastern North America that receive high levels of atmospheric N deposition can be greatly diminished as harvesting intensity decreases below 40 to 68%. These results await confirmation through additional incremental forest harvest studies at other locations in northeastern North America.

SESSION 7: WATER QUALITY-3

Evaluating the Impacts of Climate Change on New York City Reservoir Watersheds: Program Development and Ongoing Challenges.
Don Pierson, Elliot Schneiderman, Mark Zion, Aavudai, Anandhi, and Adao Matonse. Contact: Donald Pierson, Reservoir Modeling Program, NYC DEP, email: dpierson@dep.nyc.gov

The New York City Department of Environmental Protection (NYCDEP) has developed a suite of computer models that simulate watershed hydrology, sediment and nutrient transport; reservoir eutrophication, turbidity transport; and reservoir system operation. These models when coupled together have been successfully used to evaluate watershed management effects on reservoir water quality. In 2008, NYCDEP adapted its modeling system to evaluate the additional potential effects of climate change on the NYC water supply. The program involved continued testing and improvement to the modeling system, as well as developing expertise in climate data analysis, and forest modeling. The purpose of this talk is to describe the rationale behind the development of our climate change research program, to give some initial results describing potential impacts of climate change on the water supply, and to identify uncertainty in our predictions. Future research challenges are also identified.

An Assessment of SOx, NOx and Hg Long-Term Monitoring Needs in New York State. **Gregory Lampman, Project Manager, Environmental Monitoring, Evaluation and Protection, NYSERDA email: ggl@nyserda.org**

In New York State, and regionally, many long-term monitoring programs have been developed or have evolved to collect data to better understand the effects of electrical generation related atmospheric pollutants (SOx, NOx and Hg) on ecosystems. These programs are often part of larger national (e.g. Temporally Integrated Monitoring of Ecosystems, Mercury Deposition Network), State (e.g. NYSDEC Strategic Monitoring of Mercury in Fish, NYSDEC Atmospheric Deposition Monitoring Network) or regional (e.g. Adirondack Long-Term Monitoring, Adirondack Effects Assessment Program, USGS Catskill's Stream Monitoring) programs with differing goals, methods and management. Individually these programs seek to fulfill their specific missions, but together they provide a patchwork of data that can be available for multiple uses (e.g. linking atmospheric deposition to biological impacts through critical loads assessments).

Effective long-term monitoring programs provide high-quality, reliable data that informs specific scientific or policy questions. Additionally, the most effective programs integrate their data collection efforts into research programs that use and reexamine the data for multiple objectives. Still, some criticize long-term monitoring programs as being expensive, wasteful, and of less value than applied scientific research. As such, it is essential that both funders and operators of long-term monitoring programs periodically reassess their programs and goals, and seek synergies with other monitoring programs to optimize their value and effectiveness.

NYSERDA's Environmental Monitoring, Evaluation and Protection (EMEP) program is developing an approach to undertake an evaluation of long-term monitoring needs for SOx, NOx and Hg deposition in New York. The goal is to develop a prioritized plan that provides for the efficient and effective long-term monitoring of these pollutants and their direct impacts on New York State's ecosystems (forests, soils, biota, surface water, groundwater). The proposed collaborative approach will be presented for discussion. Feedback and insights of the conference participants is welcomed.

Monitoring and Modeling the Acidification and Recovery of Catskills Waters and Soils. **Chris E. Johnson, Professor and Chair, Department of Civil and Environmental Engineering, Syracuse University email:cejohns@syr.edu**

Inputs of acidic deposition in the Catskills region are consistently among the highest in the United States. These inputs have declined considerably in the last two decades due to regulations limiting industrial emissions of sulfur and nitrogen. A recent regional assessment of surface waters and surface soils in the northeastern United States indicated that lake waters in the Catskills/Poconos region have experienced significant increases in pH and significant decreases in sulfate and aluminum (Al) concentrations during this period of decreasing strong acid inputs. However, acid neutralizing capacity (ANC), a good general indicator of the acid-base status of natural waters, has not increased significantly despite large declines in acid inputs. This sluggish recovery of ANC is largely due to a decrease in calcium (Ca) concentrations in surface waters. The continuing decline in surface-water Ca concentrations may be the result of long-term depletion of Ca from watershed soils, exacerbated by chronic acid deposition. The same regional survey showed that organic-horizon soils in the Catskills/Poconos region lost approximately 60% of their exchangeable Ca in 1984-2001, while acid inputs were declining. The loss of exchangeable Ca was accompanied by an equivalent increase in exchangeable acidity (primarily Al). The continuing acidification of soils calls into question the sustainability of the recovery of surface waters. We have initiated a research project to study these phenomena in the Catskills and Adirondacks through field and laboratory analyses and biogeochemical modeling. Work in the Catskills includes monthly monitoring of 12 streams, continuing work begun by Gary Lovett in the 1990s. We also plan to sample soils from 25 watersheds to establish a baseline for future monitoring of soil chemical change in the region. These data will facilitate a regional application of the PnET-BGC model to simulate changes in stream water and soil chemistry under alternative climate and deposition scenarios.