Abstracts

THE NORTHEAST NATURAL HISTORY CONFERENCE VII

APRIL 24 – APRIL 27, 2002

A FORUM FOR CURRENT RESEARCH

NEW YORK State Museum

The Northeastern Naturalist

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Contents

The Northeast Natural History Conference VII* is a joint project of the New York State Museum, the New York State Museum Institute, the New York State Biodiversity Research Institute, and the Northeastern Naturalist. The conference is held biennially at the New York State Museum. Previous conference abstracts and conference updates are available from the Natural History Conference website:
http://www.nysm.nysed.gov/nhc

Conference Organizer and Abstract Editor

Ronald J. Gill (New York State Biodiversity Research Institute)

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* The Natural History Conference was formerly known as the New York Natural History Conference.

The Effects of Invasive Plants on Natural Systems
Organized Papers Session

Organizers: *George* ***Robinson*** *(University at Albany, State University of New York, Department of Biological Sciences, Albany, NY 12222), and Cris L.* ***Winters*** *(University at Albany, State University of New York, Biodiversity, Conservation, and Policy Program, Department of Biological Sciences, Albany, NY 12222)*

Moderator: *Cris L.* ***Winters***

Winters, *Cris L. (University at Albany, State University of New York, Biodiversity, Conservation, and Policy Program, Department of Biological Sciences, Albany, NY 12222)*

Effects of Invasive Plants on North American Birds: What do we Really Know?

There is little scientific data to support the claim that the spread of invasive plants is detrimental to North American birds and other wildlife. A review of the scientific literature and interviews with land managers indicate that many birds species use invasive plant communities. Generalist bird species tend to favor these plant communities, although some specialist species nest, feed, and shelter in certain invasive plants. Habitat structure is a key feature of bird use, and vegetation density tends to be negatively correlated with bird use regardless of plant species. Food resources for birds are abundant in some invasive plant communities; other studies indicate lower insect herbivory on non-native plants. The interactions between invasive plants and birds are influenced by many indirect environmental factors, which are currently poorly understood. Those managing for invasive plants (control) and/or birds (population maintenance and increases) have little practical information upon which to base land management decisions, and there is little scientific data upon which to base invasive plant policies.

Kiviat*, Erik, and Karen* ***Moore*** *(Hudsonia Ltd., Annandale, NY 12504)*

Phragmites, Habitat, and Wildlife: A New Approach

During the past century the *Phragmites* population has exploded in northeastern states but we have few scientific data on *Phragmites* impacts on North American wildlife. An extensive review of literature and unpublished data indicates that *Phragmites* is more important to North American wildlife as habitat than food. More than 70 species of birds have been reported breeding in *Phragmites* stands. Yet certain specialists of, e.g., short grass or shrub habitats, are negatively affected by *Phragmites* invasion. Bird use of *Phragmites* in the non-breeding season includes roosting, foraging, and sheltering by many species, often in large numbers. Much less is known of mammal, reptile, and amphibian interactions with *Phragmites*, although many species eat *Phragmites*, or forage, sleep, or breed in it. Many wildlife species use *Phragmites* edges, mixed stands, and patchy stands more than the interiors of extensive, dense stands. A comparison of North American and European breeding bird faunas suggests that certain European species are closely associated with *Phragmites*, but that management of *Phragmites* stands and other factors play an important role in shaping the *Phragmites* fauna. European management methods include cutting, burning, grazing, or excavating to alter the architecture of *Phragmites* stands and favor specific animals, plants, and *Phragmites* products. The prevailing approach to management in North America is eradication with herbicide. Because *Phragmites* has many habitat functions, as well as providing other ecosystem services, we must learn to manage *Phragmites* by more selective methods to enhance particular functions. This will require research on wildlife presence and density but also behavior, productivity, and fitness of animals in *Phragmites* compared to alternate plant communities.

Tallamy*, Douglas W., and Rebekah M.* ***Baity*** *(University of Delaware, Department of Entomology and Applied Ecology, Newark, DE 19717-1303)*

Effect of Alien Plants on the Terrestrial Food Chain

A number of consequences of the introduction of alien plants have been recognized to date, including problems from competitive exclusion, altering the frequency of fire and the availability of water, and hybridization, but a potentially critical effect that has not been adequately addressed concerns the replacement of palatable native plant biomass with unpalatable

alien plant biomass. We used the plant and insect communities of an abandoned farm in eastern Pennsylvania to test the hypothesis that insect herbivores will only consume plant species with which they share an evolutionary history. We compared herbivory from mandibulate insects on a standardized leaf area of 12 species of woody and herbaceous alien plants with herbivory on 16 native species. Comparisons based on crude plant morphology, habitat and relatedness all showed significantly more herbivory (on average 10.7 fold) on native plants. Thus, we predict a 10.7 fold decrease in the biomass available for insectivores in landscapes dominated by non-native vegetation. Taxa such as passerine birds that rely entirely on arthropods while rearing young might be especially affected.

Maerz, *John C., Bernd* ***Blossey*** *(Cornell University, Department of Natural Resources, Ithaca, NY 14853-3001), Victoria* ***Nuzzo*** *(Natural Areas Consultants, Groton, NY 13073), and James K.* ***Liebherr*** *(Cornell University, Department of Entomology, Ithaca, NY 14853)*

Are Non-Indigenous Plant Invasions Affecting Woodland Salamander Populations?

Invasions by non-indigenous plants are considered a major threat to native species and ecosystems. We are investigating the impacts of several non-indigenous plant species on insect communities and woodland salamander populations in the northeastern United States. Preliminary results from our research on the impact of garlic mustard (*Alliaria petiolata*) invasions in New York suggest that garlic mustard may be enhancing the impact of other non-indigenous species, European earthworms, on leaf litter decomposition. At all sites studied, leaf litter removal by European earthworms was greater in areas invaded by garlic mustard than in areas without garlic mustard. Insect abundance is negatively correlated with European earthworm impacts on leaf litter levels, and salamander abundance showed a non-linear response to increasing impacts on leaf litter levels. We hypothesize that salamander abundance increases initially in response to the availability of earthworms as prey; however, the long-term effect of the exotic plant and earthworm interaction on litter erosion causes catastrophic collapses in insect populations that causes salamander populations to decline to near extinction. Our results suggests (1) that causes and impacts of non-indigenous plant invasions are linked to invasions by other non-indigenous species, and (2) that the responses of native species to non-indigenous species invasions can be non-linear and context dependent.

Rice*, Steven K. (Union College, Department of Biological Sciences, Schenectady, NY 12308)*

Invasive Black Locust Alters Nitrogen-cycling in a Pine-oak Community

Invasive nitrogen-fixing species alter nitrogen cycling within ecosystems, influence community dynamics and reduce the biodiversity value of natural systems. However, the effects of such species in intact, temperate ecosystems has received little study. We investigated the influence of the exotic, nitrogen-fixing black locust (*Robinia pseudoacacia*) on a pitch pine-scrub oak barrens (pine-oak) community using a series of six field sites that contained pine-oak stands adjacent to 20—35 year-old black locust stands. Soil nutrient contents, annual litterfall biomass and nitrogen, and soil nitrogen availability (net ammonification, net nitrification and total net N-mineralization) were assessed within five subplots in 0.06 ha plots established within each stand (total subplot n = 60). Black locust soils had 1.3–3.2 times greater total nitrogen concentrations relative to soils within pine-oak stands. Nitrogen availability was assessed using a series of four 20–21 d and one over-winter field incubations. During the growing season, nitrogen availability was greatly enhanced in black locust stands (374–704 µg N g soil^{-1} yr^{-1} in black locust versus 49.8–141 µg N g soil^{-1} yr^{-1} pine-oak stands). High N-mineralization rates in black locust stands were associated with an abundance of high nitrogen, low lignin leaf litter. On average, black locust stands returned 328.3 kg N ha^{-1} yr^{-1} in leaf litter compared with 88.2 kg N ha^{-1} yr^{-1} in pine-oak stands. Thus, black locust supplements nitrogen pools, increases nitrogen return in litterfall, and enhances soil nitrogen mineralization rates when it invades, nutrient poor, pine-oak ecosystems. Restoration of pitch pine-scrub oak barrens communities will require strategies that reduce such nitrogen loading.

Titus*, John E. (Binghamton University, Department of Biological Sciences, Binghamton, NY 13902)*

Vegetation Change in a Softwater Adirondack Lake: a Domestic Invasion

The vegetation in Raquette Lake in the Adirondack Mountains was sampled at two sites along the same transects in 1983 and again in 1999 or 2000. Substantial changes have occurred, in part because of an invasion by *Utricularia inflata*, a submersd macrophyte species previously reported from only two lakes in New York, both ca. 280 km southeast of Raquette Lake. *Utricularia inflata* has risen to become the most frequent species at both sites, occurring in 40% of the quadrats at one

and 60% of the quadrats at the other. Of the five most frequent species in 1983, four have declined significantly (χ^2 test; $P<0.01$) at one site and three at the other. *Utricularia inflata* was also found in First and Seventh Lakes of the Fulton Chain and in Limekiln Lake. Plants were likely dispersed as fragments on boats. This bottom-dwelling carnivorous species was observed growing atop both living and dead isoetids, suggesting that its invasion may be particularly detrimental to these low-growing rosette species.

Harman, *Willard N., and Matthew F.* ***Albright*** *(State University of New York College at Oneonta, Biological Field Station, Cooperstown, NY 13326)*

MONITORING CONTROL OF PURPLE LOOSESTRIFE USING LEAF-EATING BEETLES

Purple loosestrife (*Lythrum salicaria*) is a perennial that aggressively invades wetlands eliminating native species. Conventional methods of control have generally been unsuccessful. There are no native insect controls. Since 1992, European insects have been introduced to North America as biocontrol agents. In the spring of 1997, 100 beetles of *Galerucella calmariensis* and *G. pusilla* were introduced to Goodyear Swamp Sanctuary, Otsego County, NY. Since then we have monitored *Galerucella* presence, damage to loosestrife and recovery of native flora. The abundance of *Galerucella* eggs and adults has increased steadily since monitoring began. In 2000 purple loosestrife showed the first heavy damage due to herbivory. By the summer of 2001 purple loosestrife was completely defoliated; by early July, no evidence of loosestrife existed. Native plant species gained dominance. Swamp candles (*Lysimachia terrestris*), a native loosestrife, was expanding throughout the Sanctuary. For a brief period in mid-July, *Galerucella* adults were found on other plants. None were affected significantly. Dispersing beetles were found on purple loosestrife up to a mile away. New non-flowering shoots of purple loosestrife were observed by late August. Continued monitoring will illustrate the ability of *Galerucella* to re-colonize the site following changes in the availability of purple loosestrife for forage.

Developing an Invasive Plant Policy for New York State

Organized Panel Discussion

(Sponsored by the Invasive Plant Council of NYS)

Moderator: *Pamela. M.* ***Otis*** *(NYS Office of Parks, Recreation and Historic Preservation, Environmental Management Bureau, Albany, NY 12238)*

Overview: This workshop will feature representatives of agencies, associations and organizations operating in New York State and at a national level. Speakers will discuss their own institutional policies on monitoring, regulating, and managing invasive plant species, and will provide their unique perspectives on the question, "Would New York benefit from a statewide policy?" Topics will include fostering cooperation, anticipating effects of forthcoming federal regulations, and addressing benefits and costs (economic, environmental and political) of formulating/promoting statewide policies. Participants planning to attend this session are encouraged to visit the IPC NYS website [http://www.ipcnys.org/] to provide written comments for the speakers to address during the session. Written questions will also be solicited from the audience during the workshop.

Invited Panel Members:

Bartuska*, Ann. (The Nature Conservancy, Executive Director, Invasive Species Initiative, Arlington, VA 22203-1606)*
Kishbaugh*, P.E., Scott A. (NYS Dept. of Environmental Conservation, Bureau of Watershed Management, Division of Water, Albany, NY 12233-1011)*
Lyons*, Thomas B. (NYS Office of Parks, Recreation and Historic Preservation, Environmental Management Bureau, Albany, NY 12238)*
Falge*, John. (NYS Dept. of Transportation, Region 7, Watertown, NY 13601)*
Spada*, Dan. (Adirondack Park Agency, Ray Brook, NY, 12977)*
Dore*, Ed. (NYS Nursery/Landscape Association, Pendleton, NY 14094)*

Avian Research in the Northeast
Contributed Papers Session

Moderator: *Michael F.* ***Burger*** *(Audubon New York, Albany, NY 12203)*

Faccio*, Steven D. (Vermont Institute of Natural Science, Conservation Biology Department, Woodstock, VT 05091), and Ernest W.* ***Buford*** *(University of Vermont, School of Natural Resources, Burlington, VT 05405)*

Effects of the 1998 Ice Storm on Forest Bird Populations in Central Vermont

A damaging ice storm struck northern New England, New York, and adjacent Canada in January 1998, affecting nearly 7 million hectares of forest lands. Although relatively rare at this scale, such natural disturbances provide a unique opportunity to study the short- and long-term impacts on forest ecosystems and wildlife species. We investigated the storm's effects on breeding birds in a northern hardwood forest in central Vermont. Point counts at 6 ice-damaged study sites in the Green Mountain National Forest were used to compare post-storm bird abundance with pre-storm samples collected at the same points in 1993 or 1994, and at 5 control sites that were unaffected by the storm. In general, damage to canopy trees consisted of broken limbs and main stems, with some uprooted trees, significantly reducing % canopy cover ($P=0.038$), while basal area and dbh remained unchanged. Overall, mean bird abundance declined at ice-damaged sites while increasing at controls ($P=0.07$). Species richness increased at both treatments ($P<0.05$), while species diversity increased only at ice storm sites ($P<0.0005$). Three forest interior species declined in abundance ($P=0.038$), two of which were canopy-foragers (Red-eyed Vireo and Blackburnian Warbler), and one a ground-forager/nester (Ovenbird). Another ground-forager/nester, Dark-eyed Junco, was the only species to increase in abundance ($P=0.021$) after the storm, although Canada Warbler and Winter Wren showed increasing trends ($P<0.141$). These results are consistent with studies investigating bird responses to selective logging, particularly "group selection" and "single tree selection," suggesting that these management strategies may effectively mimic some types of natural disturbance events such as ice storms.

Hartley*, Mitschka J., Michael F.* ***Burger*** *(Audubon New York, Albany, NY 12203), and Jan* ***Beyea****, (Consulting in the Public Interest, Lambertville, NJ 08530)*

Effects of Tree Harvest Intensity on Forest Birds in New York

Most research into forestry effects on songbirds has emphasized that richness and individual species' abundances vary across a continuum of forest age and structure, but does not account for the fact that whole suites of species may respond similarly. As an alternative approach, we have performed analyses by ecological habitat group. We conducted bird and vegetation surveys in 71 northern hardwood stands in upstate New York from 1999—2001 and analyzed the responses of three groups of species: generalists, those that prefer young forests, and those that prefer mature forests (based on previously published studies). We also examined individual Watchlist bird species (species of conservation concern) to determine if their abundances were affected by the same variables and in the same fashion as were other birds in their habitat group. Statistical models predicting abundance and richness of the three habitat groups were more accurate than models of individual species or all species pooled, and provide a meaningful way to describe how birds respond to logging. Multiple regression models showed which habitat characteristics were most important for each group and Watchlist species, though basal area alone was significantly correlated with the abundance and richness of the young- and mature-forest groups, and most Watchlist species. In general, Watchlist species respond to logging much like other birds in their habitat group, though a few species do not, and thus may require individual attention.

Lambert*, J. Daniel, and Steven D.* ***Faccio*** *(Vermont Institute of Natural Science, Conservation Biology Department, Woodstock, VT 05091)*

Mountain Birdwatch: Monitoring Bird Populations in Montane Forests of the Northeast

New York, Vermont, New Hampshire and Maine contain approximately 110,000 ha of montane forest dominated by balsam fir (*Abies balsamea*). Although this habitat type covers < 0.5% of the region, its contribution to biodiversity is disproportionately high. Montane fir forests harbor a unique avian community that includes Bicknell's Thrush (*Catharus bicknelli*), the Northeast's only endemic bird species. Partners in Flight ranks Bicknell's Thrush as the highest conservation priority

among neotropical migrants in the Northeast. Rapid loss of wintering habitat in the Greater Antilles poses the most immediate threat to the species, while loss of breeding habitat to recreational and commercial development elevates the risk of extinction. Over time, climate change may exert profound impacts on Bicknell's Thrush by reducing the extent of balsam fir on northeastern mountains. In 2001, the Vermont Institute of Natural Science launched Mountain Birdwatch, a regional monitoring program for Bicknell's Thrush and other high-elevation songbirds. Mountain Birdwatch involves trained volunteers in the annual survey of 120 peaks, from the Catskills to Mount Katahdin. Preliminary data indicate that Mountain Birdwatch achieves > 90% statistical power to detect a 5% annual decline in Bicknell's Thrush within five years. Less than a decade will be required to detect a 2% annual decline. The power to detect population changes in other montane forest birds (e.g. Blackpoll Warbler, Swainson's Thrush) is even greater. Additional uses for the data include: monitoring changes in distribution, habitat modeling, designation of bird conservation areas, and regulatory review of proposed logging, tower construction, and ski area expansion.

***Mazzocchi**, Irene M., Mandi L. **Roggie** (New York State Department of Environmental Conservation, Bureau of Wildlife, Watertown, NY 13601), David J. **Adams,** and Robert L. **Miller** (New York State Department of Environmental Conservation, Bureau of Wildlife, Nongame and Habitat Unit, Albany, NY 12233)*

Status of Black Tern (*Chlidonias niger*) in New York State, An Endangered Species

Black Tern (*Chlidonias niger*) are a semi-colonial marshbird that have recently been listed as Endangered in New York State (NYS). In 1988, due to declining numbers, the Department of Environmental Conservation initiated a statewide status assessment of this species. In 1989, 95 sites in 14 counties were identified as historical or potential breeding locations and surveyed for Black Tern. Similar surveys were conducted in 1990, 1991, 1994, 1998, and 2001. In 2001, 155 pair of Black Tern nested at 14 locations. This is a 23% decline in the number of breeding pair since 1998, and a 34% decline since 1989. A peak of 284 breeding pair occurred in 1991. Seven sites supported 10 or more pair in 2001, totaling 134 pair or 86% of the breeding population. In comparison, six sites supported 10 or more pair in 1989, making up 65% of the population. The number of sites supporting 10 or more pair appears to be stable, although the total number of nesting sites has decreased from 28 in 1989 to 14 in 2001. Jefferson County has supported 58—77% of the total statewide population, suggesting that this species is at risk of extirpation in NYS. Black Tern research in NYS has also included monitoring of nest success, utilization of artificial nesting platforms, habitat analysis, banding and color marking of chicks and adults, contaminant analysis, and pre-migratory staging counts. A focused effort is needed to ensure that enough suitable habitat is maintained to support a sustainable population of nesting Black Tern in NYS.

***Morgan**, Michael R. (SUNY College at Brockport, Department of Biological Sciences, Brockport, NY 14420), John **Van Niel** (Finger Lakes Community College, Canandaigua, NY 14434), and Jessica A. **Morgan** (Iroquois National Wildlife Refuge, Basom, NY 14013)*

Characteristics of the Throat Patches of Hatch-year Bank Swallows (*Riparia riparia*)

We captured 86 hatch year (HY) Bank Swallows (*Riparia riparia*) over a two-month period at Montezuma National Wildlife Refuge. We assessed the degree of spotting and coloration of the throat patch on each individual. We found a range of descriptions of these traits in the published literature. Sixty nine percent (n=59) of birds we captured had spots on the throat covering more than 5% of the total throat patch area, while only 4% showed spotting covering more than 75% of the throat. Although 91% (n=78) of the birds showed a pinkish wash to the throat, 52% (n=45) showed only a trace amount. No significant changes in spotting or throat color were found throughout the season. More widespread study may show whether our results describe a regional phenomenon that differs with published accounts from other regions, or a reassessment of hatch-year Bank Swallow characteristics in general.

***Norment**, Christopher J. (SUNY College at Brockport, Department of Biological Sciences, Brockport, NY 14420)*

Status of Grassland Bird Research and Conservation in New York State

Grassland bird research and conservation should remain high priority activities in New York, as recent Breeding Bird Survey data indicate that obligate grassland birds continue to decline in New York and throughout the Northeast. Recent research has surveyed the distribution of grassland birds in the state, identified important areas for conservation, and elucidated important aspects of grassland bird/habitat relationships. In general, most obligate grassland birds in New York prefer grasslands that are large in area, with vegetation that is relatively low and less dense; exceptions include the Sedge Wren and Henslow's Sparrow. Current research needs include more studies on the breeding biology of less abundant species, effects of

habitat fragmentation and landscape composition on the persistence of small populations, the value of warm-season and cool-season grasses as grassland bird habitat, and effects of management activities on grassland succession. Current threats to grassland bird populations in the state include continuing farmland abandonment, conversion of pasture habitat to row crops, habitat fragmentation due to development, and potentially unsuitable activities on protected sites. Programs that can positively affect grassland bird conservation in New York include the Important Bird Areas Program of the National Audubon Society, the Wildlife Habitat Incentives Program associated with the Farm Bill, and Partners in Flight Bird Conservation Plans for physiographic regions in the state. While conservation of grassland birds should remain a high priority on suitable public lands, more effort must be expended to encourage conservation efforts on private lands.

***Ozard**, John W. (New York State Department of Environmental Conservation, Fish and Wildlife Services, Albany, NY 12233), Glenn **Johnson** (State University of New York College at Potsdam, Department of Biology, Potsdam, NY 13676), Jonathan L. **Foster** (U.S. Army Corps of Engineers, Sacramento, CA 95814), and Francoise **Schmid** (State University of New York College at Potsdam, Department of Biology, Potsdam, NY 13676)*

A Comparison of the Historic and Current Distribution of Spruce Grouse (*Falcipenis canadensis*) in New York's Adirondack Mountains

Populations of Spruce Grouse (*Falcipenis canadensis*) have apparently been declining in New York since the late 1800's. In "Birds of New York," Eaton (1910) writes, "It was formerly common throughout the tamarack and spruce swamps of the North Woods, but for many years it has become scarcer and scarcer, until now it is threatened with extermination in our State." The Spruce Grouse was first listed as *Threatened* in New York in 1983. In 1999, it was elevated to *Endangered* in New York because of a perceived continued population decline. A comparison of the historical distribution in New York with more recent inventories conducted in the late 1970's, 1980's and in 2000–2001 suggest a further decline in populations of this species and contraction of range. The historical decline may be explained by habitat fragmentation and loss due to timber harvest and flooding, but it is unlikely that these factors are contributing significantly to the recent population extirpations. Data from the 2000–2001 survey indicate that 12 of the 24 occupied sites identified between 1976 and 1987 are now extirpated. If Spruce Grouse are to survive in New York we must identify the causes of the recent decline and take an active role in management of the birds and their habitat.

***Schoch**, Nina (Adirondack Cooperative Loon Program, Ray Brook, NY 12977), David C. **Evers**, Chris **DeSorbo** (BioDiversity Research Institute, Falmouth, ME 04105), and John **Ozard** (New York State Department of Environmental Conservation, Albany, NY 12233)*

The Adirondack Cooperative Loon Program and Mercury in Adirondack Loons, 1998–2000

The Adirondack Cooperative Loon Program (ACLP) is a cooperative research and education effort studying the natural history of the Common Loon (*Gavia immer*) and the effects of anthropogenic impacts on Adirondack loon populations in New York State. The ACLP was initiated in the spring of 2001 to expand upon the contaminant research project conducted by BioDiversity Research Institute (BRI) and the Northeast Loon Study WorkGroup in the Adirondack Park from 1998–2000. The ACLP is a partnership of the Wildlife Conservation Society, Natural History Museum of the Adirondacks, NYS Dept. of Environmental Conservation, BioDiversity Research Institute, and Audubon Society of New York, Inc. In New York, 96 loons were sampled opportunistically in the Adirondack Park from 1998–2000. Based on risk categories developed from the literature and *in situ* studies by BRI and their collaborators, 17% of loons sampled in New York were estimated to be at risk from mercury contamination. Loons in high-risk categories were captured on acidic, low alkalinity lakes. Blood mercury levels in adults were higher than in juveniles, and adult males had higher blood and feather mercury levels than did females. The ACLP monitors the return rate and reproductive success of individually marked loons and organizes an annual loon census, in addition to continuing the contaminant sampling and banding. Education programs include school "Loon Scientist" programs, a citizen science website (www.adkscience.org/loons), and public presentations. The work of the ACLP is coordinated with other research projects studying loons and water quality throughout New York State and North America.

Applying Biodiversity Information to Conservation Goals
Organized Papers Session

Organizer and moderator: *Karen* ***Frolich*** *(Hudson River Estuary Program, NYS Department of Environmental Conservation, New Paltz, NY 12561, and New York Cooperative Fish and Wildlife Research Unit USGS-BRD, Cornell University, Department of Natural Resources, Ithaca, NY 14853)*

Introduction: A great deal of biological data is collected, but how do scientists ensure this information is used for biodiversity conservation? From writing popular articles to becoming a more active policy advocate, there are many ways to do this, but what is most needed are translations of biological and ecological information for a broader audience. This session will describe a number of initiatives intended to take biological information to non-scientists, including the general public, planners and policymakers. This session will be followed by a (20–40) minute panel discussion.

Johnson*, Elizabeth A. (Center for Biodiversity and Conservation, American Museum of Natural History, New York, NY 10024)*

An Overview of the New York State Biodiversity Project

The New York State Biodiversity Project was initiated in 1999 as a partnership among five New York organizations: the Center for Biodiversity and Conservation at the American Museum of Natural History, the New York State Biodiversity Research Institute, the New York State Department of Environmental Conservation, The Nature Conservancy, and the New York Natural Heritage Program. An important goal of this initiative is to compile, organize and make accessible available information about biodiversity so that it can be effectively used by diverse constituencies. The Environmental Law Institute, working in partnership with the Project steering committee, conducted a needs assessment of decision makers in New York State to identify what information is being used, its perceived adequacies, whether additional information is needed and, if so, in what format. Results indicated that most decision makers rely primarily on information from the Natural Heritage Program and state agencies, and would welcome additional data, especially if site specific, compatible, and presented electronically. The assessment highlights the need for the development of a statewide biodiversity inventory and assessment, education and outreach programs, and a central clearinghouse for biodiversity information and technical assistance. Enhancing the effectiveness of New York's biodiversity laws and policies is also important to conservation in the state. Based on the recommendations of the needs assessment, the Project is developing a website clearinghouse and a book about New York's biodiversity. Future biodiversity-related outreach will be continued by the New York State Biodiversity Research Institute.

Zappieri*, Jeffrey, and Michael* ***Corey*** *(NYS Department of State, Division of Coastal Resources, Albany, NY 12231)*

Using Biodiversity Information to Inform and Guide Development Activities in Coastal Areas of New York State

While collection of biodiversity data is currently receiving increased public recognition and support, the application of this information by resource managers is often characterized by fragmented, incomplete, or isolated efforts. One effort by managers in New York to use biodiversity information in a more comprehensive fashion to guide governmental decision-making is the State's Significant Coastal Fish and Wildlife Habitat program. Developed in response to public concern regarding accelerating habitat loss and impairment in the State's coastal zone, the program is based on a policy of protecting coastal habitats established in the New York Waterfront Revitalization and Coastal Resources Act of 1981. Critical coastal habitats were identified and evaluated by the Department of Environmental Conservation using criteria based primarily on inventories of vertebrate species and biological community types. Use and development guidelines were prepared for each habitat area, based on the particular susceptibilities and needs of species identified in the habitat area. This information is used by the Department of State in reviewing State and federal coastal zone projects for consistency with the State's coastal habitat protection policies.

***Howard**, Timothy G. (New York Natural Heritage Program, Albany, NY 12233-4757)*

PRIORITIZING NATURAL COMMUNITY AND RARE SPECIES INVENTORIES: LESSONS LEARNED

In 1997, through funding from the NYS DEC Hudson River Estuary Program, the New York Natural Heritage Program began a concerted effort at inventorying rare species and significant natural communities in the Hudson River Valley. Recently, we have focused on "hot spots" of biodiversity. Using existing biodiversity information and expert opinion, we delineated 25 "Significant Biodiversity Areas" (SBAs) in the lower Hudson River valley. We inventoried within 18 SBAs, ranging from 4,000 to 360,000 acres (average = 78,000 acres). SBAs represent 1.4 million acres and 37% by area of the 11 counties within the lower Hudson River Valley. Greater than 86% of rare species and natural communities known for the Hudson River Valley occur at least once in an SBA. More than 81% of occurrences of rare species and significant natural communities are inside SBA boundaries. The number of rare species found in an SBA increases with size, but this increase is not consistent among SBAs. Some appear to have much higher inherent levels of diversity than others. How have inventory efforts affected conservation planning in the Hudson River Valley? We discovered benefits and drawbacks of working within these large areas. Positively, many new rare species and significant communities were documented, adding to our knowledge of the region's biodiversity. Yet, SBAs may be too large to aid many local conservation planning efforts. We are working on ways to include other scales of biodiversity information to address this concern and to make this information useful for conservation planners at all scales.

***Richmond**, Milo, Leslie **Zucker** (New York Cooperative Fish and Wildlife Research Unit USGS-BRD, Cornell University, Department of Natural Resources, Ithaca, NY 14853), Stephen **Smith**, Magdeline **Laba** (Cornell Institute for Resource Information Systems, Cornell University, Ithaca, NY 14853), and Elizabeth **Hill** (Cornell University, Department of Crop and Soil Sciences, Ithaca, NY 14853)*

THE POTENTIAL OF PUBLIC LANDS FOR ACHIEVING CONSERVATION GOALS IN NEW YORK'S HUDSON RIVER VALLEY

The Hudson River Estuary Program offers a comprehensive plan to recognize, conserve, and protect biological resources found throughout the Hudson River Valley. One approach to reaching the conservation goals is to look first to those lands and waters that are already in the public trust, i.e., publicly owned. These include a widely scattered series of parcels under the aegis of New York's Department of Environmental Conservation, Office of Parks, Recreation & Historic Preservation, Transportation, State Affairs, State and Federal Military land and the N.Y. City reservoir buffer. Together, these public lands (404,386 acres) total 10% of all the land in the Hudson River Valley. In this project, we examine these public land holdings from the standpoint of their biological diversity and their contribution to overall species richness in the region. Further, we identify potential threats to these lands from human development and needs, invasive or overabundant species, and other possible threats. The major focus of our project is the development of a public lands digital database for use in land management. Compiling and delivering this information to the decision makers in a form that is easily understood and permits manipulation to address new issues is being accomplished via an ArcView interface. ArcView-based tools will assist land managers in resource assessment of public lands including: species composition; identification of threatened, endangered or species of special concern; type and fragmentation of the vegetative cover; proximity to other public lands and biodiversity areas; and human population density of adjacent lands.

***Frolich**, Karen (Hudson River Estuary Program, NYS Department of Environmental Conservation, New Paltz, NY 12561, and New York Cooperative Fish and Wildlife Research Unit USGS-BRD, Cornell University, Department of Natural Resources, Ithaca, NY 14853)*

HUDSON RIVER ESTUARY PROGRAM BIODIVERSITY OUTREACH

The Hudson Valley region of New York State has biodiversity of state and region-wide significance, which has been quantified, in part, by biological research funded by the Hudson River Estuary Program (HREP). Through its Biodiversity and Terrestrial Habitat subcommittee, HREP has developed threat-based strategies to protect these resources. Land use change is the key threat to biodiversity in the Hudson Valley. Considering that nearly all land use decisions are made at the local level, the HREP biodiversity outreach program partnership seeks to add biological information to the land use planning process. Outreach partners include the New York State Department of Environmental Conservation (DEC), Cornell University, the Metropolitan Conservation Alliance, and Hudsonia, Ltd., each partner brings a unique focus to the effort. The DEC/Cornell

program serves to use existing information, such as data from the New York Natural Heritage Program and the GAP analysis project, in local comprehensive and open space plans. Adding biological information to local plans is the basis for changes in zoning, subdivision design and local ordinances, which are among the tools available to local governments that can be used to protect natural resources. The DEC program is a technical assistance program, taking into consideration that many local land use decision-makers are volunteers and may not serve the community for more than a few years. Examples from projects in progress will be used to illustrate different approaches to achieving conservation goals.

***Schneller-McDonald**, Karen (Metropolitan Conservation Alliance, Pine Bush, NY 12566)*

Biodiversity Conservation at the Suburban-Rural Frontier

The Wildlife Conservation Society's Metropolitan Conservation Alliance develops innovative, locally based strategies that tackle ecosystem loss and urban sprawl in the New York City metropolitan region. This 12,000 square mile tri-state area exhibits a remarkable diversity of biological systems and supports a great diversity of animal and plant species—all within the political boundaries of 1,600 cities, towns and villages in 31 counties. Today this area faces the bleak prospect of permanently losing much of its rich biological heritage to a wave of suburban sprawl, fostered by a lack of informed land use decisions. Much of the action—both the habitat loss and the potential for preserving it—occurs at the local level. Home rule can translate into grassroots action for regional planning; what you do with your own back yard is also part of the larger picture. Within the current land use system, tools exist to enable informed decision-making. Scientists can have a significant role in providing information to local decision makers to promote better habitat stewardship and benefit wildlife and people. There is a great need to bridge the gap between biodiversity information and its application in actual planning practices. By promoting problem-solving research, interpreting biological data for decision-makers, and providing biodiversity education at the grassroots level, we can be part of the solution to some of the dilemmas caused by the clash of sprawl and conservation at the suburban-rural frontier.

***Bandle**, Carina J. (Hudsonia Ltd., Annandale, NY 12504)*

Citizen Science and Biodiversity Conservation in the Hudson Valley

With the publication of the Biodiversity Assessment Manual for the Hudson River Estuary Corridor, Hudsonia Ltd. has initiated a Biodiversity Education Project for communities and organizations interested in protecting local biological resources. As part of this project, land use planners and decision makers receive training in habitat identification and assessment. The training spans 8–10 months, and begins with intensive instruction in using soil maps, geology maps, topographic maps and aerial photos to predict the occurrence of ecologically significant habitats. The participants choose a study area, prepare preliminary habitat maps based on map analysis, and then visit those areas in the field to verify and refine the maps and to assess the quality of the habitats. For each group, the final product of the training is a map illustrating the distribution of significant habitats in the study area and a brief report describing those habitats and their ecological importance, the sensitivities and immediate threats, and suggested measures for conservation and management. The habitat maps will provide important information on ecologically significant habitats in the region, available from no other sources. Once local landowners, developers, and regulatory decision-makers know the locations of significant habitats, they can begin to implement measures to protect them. The information can be used to help identify the areas best suited for development and to determine the high priority areas for conservation.

Fish Distribution and Ecology
Contributed Papers Session

Moderator: *Robert* ***Daniels*** *(New York State Museum, Research and Collections, Albany, NY 12230)*

Schmidt*, Robert E. (Hudsonia Limited and Simon's Rock College, Great Barrington, MA 01230)*

Taxonomic Status of Mudminnows (Umbridae) in the Tidal Hudson River

There are two species of mudminnows in New York State, Eastern mudminnow (*Umbra pygmaea*) and central mudminnow (U. *limi*). Both of these species are found in the Hudson River watershed and they have been distinguished primarily on color pattern. A recent (1999) collection of mudminnows from Manitou Marsh, a fresh-tidal marsh near West Point on the Hudson River, was difficult to classify based on color pattern. Meristics and morphometrics done on New York State specimens of both species show specific differences other than color pattern that should allow unambiguous classification of northeastern mudminnows to species. Based on meristic and morphometric characters, the mudminnows from Manitou Marsh appear to be intergrades. This is the first evidence of natural hybridization between these two species. Biogeography of the Hudson watershed and the localization of the presumed hybrids suggests that this is a very recent event.

Coote*, Thomas W. (Antioch New England Graduate School, Keene, NH 03431, and Simon's Rock College, Great Barrington, MA 01230)*

Comparative Analysis of Fish Assemblages in Select Hudson River Tributaries

Restoration of river herring on the Hudson River and its tributaries, and the presence of dams on those tributaries, is a major concern for the State of New York and US fishery agencies. The State of NY has recently been investigating several tributaries for restoration, including the Rondout and Stockport Creek. One of the questions surrounding restoration of anadromous fishes is the impact of reintroducing those fish into systems that have evolved in their absence over periods of time dating as far back as several centuries. This study was designed to study the differences in fish communities above and below two dams, the Eddyville Dam on the Rondout, and the Claverack Creek dam at the confluence of Kinderhook Creek and Claverack Creek on Stockport Creek. To investigate the impacts of these two dams on river herring, two unimpeded tributaries, the Roelieff Jansen Kill and Catskill Creek were included. In addition to current compositional differences, this study provides base line data for all of the streams, which will be invaluable in assessing long-term changes in these communities. Fish surveys were conducted from September 2000 through August 2001, utilizing backpack electroshocking and gill netting to determine compositional differences among the streams. There were minor differences in species composition among the streams with the exception of a few uncommon species, and the presence of anadromous fishes on three of the streams. The diversity of fishes in the Rondout below the Eddyville Dam was considerable, and included all of the major anadromous fishes in the Hudson River, including American shad.

Strayer*, David L. (Institute of Ecosystem Studies, Millbrook, NY 12545), Kathryn* ***Hattala****, and Andy* ***Kahnle*** *(New York State Department of Environmental Conservation, New Paltz, NY 12561)*

Effects of the Zebra Mussel Invasion on Fish Communities in the Hudson River

The zebra mussel invasion of the Hudson caused large declines in phytoplankton, zooplankton, and deepwater zoobenthos, and increases in submersed plants and shallow-water zoobenthos. We hypothesized that this change in forage would lead to decreases in the abundance and growth of open-water fishes (e.g., *Alosa, Morone*) and increases in the abundance and growth of littoral fishes (e.g., centrarchids). Further, we predicted that the distribution of fish in the river would shift, with populations of open-water species moving away from the freshwater part of the estuary (where the zebra mussel is abundant) and populations of littoral species moving into the freshwater part of the estuary. Intervention analysis and multiple regression of 26 years of data collected by the electric utilities and 15 years of data collected by the NYSDEC on young-of-year fish showed large, widespread changes highly consistent with our hypotheses. We observed significant changes in abundance, growth, and distribution of both open-water and littoral fish species in the Hudson. Many of the changes we saw were large and involved species of commercial or recreational importance.

***Carlson**, Douglas M. (NYS Department Environmental Conservation, 317 Washington St., Watertown, NY 13601)*

Fishes of Nine Stream Basins of Northern New York: Rare—Common

Many of the fishes known as imperiled in other parts of their range continue as sustained populations in nine stream basins of northern New York. As a possible explanation, these streams are located in a rocky foothills region that is sparsely populated and therefore has undergone a lesser level of development. This study was primary directed at main channels of nine northern streams, from the Black River of Lake Ontario to the Poultney River of Lake Champlain. Fish records were inventoried from the early 1900s to present for the basins as well as for the streams, and there was a total of 102 fish taxa or 99 species identified. Seven fish species found here have been classified as "at risk" in the Northeast, yet five of these are sufficiently common in these basins to appear to not be "at risk" in New York State: eastern sand darters *Ammocrypta pellucida*, channel darter *Percina copelandi*, bridle shiner *Notropis bifrenatus*, American brook lamprey *Lampetra appendix*, northern brook lamprey *Ichthyomyzon fossor* and silver lamprey *I. unicuspis*. Three species, which are "at risk" or have become extirpated here, Atlantic (landlocked) salmon *Salmo salar*, lake sturgeon *Acipenser fulvescens* and round whitefish *Prosopium cylindraceum* are under restoration with hatchery supplementation. Some of the larger fish inhabitants of the streams are also of interest, as anglers are attracted to the walleye *Stizostedion vitreum*, muskellunge *Esox masquinongy*, and smallmouth bass *Micropterus dolomieui* and are now interested to see lake sturgeon. Distributional patterns of fishes among these streams also offer insight about their zoogeography and postglacial recolonization.

Whittier, *Thomas R. (Dynamac, Inc., U.S. EPA National Health and Ecological Effects Research Laboratory, Western Ecology Division, Corvallis, OR 97333), and Denis* **White** *(U.S. EPA National Health and Ecological Effects Research Laboratory, Western Ecology Division, Corvallis, OR 97333)*

Fish Species Occurrence Densities in Northeastern Lakes and the Extent of Non-Natives

A species' occurrence density is the proportion or number of habitat units (lakes in this case) in a region in which it is present. Reliable estimates of occurrence density should be useful to discussions and decisions about biodiversity, rare species, and non-native invasions. The Environmental Monitoring and Assessment Program (EMAP) used a probability-based design to survey fish assemblages in 203 lakes in the Northeast, during summers of 1991–1996. The survey design permits statistically rigorous estimates of the regional occurrence density of individual species. It is straightforward to calculate these estimates. However, one needs to assume that some under-sampling occurs, and some species will be difficult to document consistently. Thus, the direct-from-data estimates are likely to underestimate species' occurrence density. I present analyses of repeat-visit sampling to illustrate possible adjustments to single-visit sample estimates of occurrence density. In northeastern lakes, single-visit estimates appeared to be reliable for some species (e.g., bluegill, rock bass), but underestimated others (e.g., brown bullhead) by up to 23% of lakes in the region. I discuss these results in context of the extent of non-native fish, especially smallmouth and largemouth bass, in northeastern lakes in relationship to potentially at-risk species, such as brook trout and minnows.

Halliwell**, David B. (Maine Department Environmental Protection, Lakes Section, Augusta, ME 04333), Peter D.* ***Vaux *(The Nature Conservancy, c/o MDIFW, Bangor, ME 04401), and Tim* ***Obrey*** *(Maine Division of Inland Fish & Wildlife, Bangor, ME 04401)*

Exploring Maine Lake Fish Assemblages: 1939–2001

Historical freshwater fish data from Maine lakes statewide (Cooper et al. 1939–41) are directly compared to updated fish survey records based on recent state MDIFW and Federal EPA-USFWS EMAP (1991–94) sampling efforts, taking into account variations in fishing gear between sampling periods. Statewide extent of changes in Maine lake fish assemblages are documented, taking into account native vs. introduced fish species over time, as supported with fish stocking records. Past and current occurrences of native (e.g., chain pickerel) and introduced (e.g., black bass, black crappie) predators relative to varying levels of prey (minnow) species richness are analyzed and discussed. Golden shiner—a ubiquitous baitfish species introduced statewide, the non-resident (catadromous) American eel, blacknose and longnose dace—obligate stream dwellers, as well as stocked (non-reproducing) salmonid fish species in general, are all omitted from measures of fish species richness. The observed statewide distribution of non-indigenous fish species currently residing in inland Maine lakes, relative to past and existing water quality character of lakes is also explored. The following questions are addressed: (1) have significant changes occurred in total native lake fish species richness over time and if so, are these changes variable between major river drainage's in Maine? (2) is fish predator richness generally correlated with documented reductions in native minnow species biodiversity in Maine lakes? and (3) does the presence-absence of introduced white perch generally coincide with lake water quality impairments, as evidenced by nuisance summertime algal blooms?

***McDonnell**, Brian P., and Mark D. **Cornwell** (SUNY Oneonta Biological Field Station, Cooperstown, NY 13326, and SUNY Cobleskill, Animal Science Department, Cobleskill, NY 12043)*

Predator Diets Prior and Subsequent to Walleye (*Steizostedion vitreum*) Stocking in Otsego Lake

Eighty thousand pond fingerling walleye (*Stizostidion vitreum*) (45–60mm) were stocked in six locations in Otsego Lake in June and July of 2000–1. Survival of pond fingerling walleye in other New York lakes has been linked to predation by largemouth bass (*Microperous salmoides*), chain pickerel (*Esox niger)* and other littoral predators. Haul seines (70m length) in the rocky and weedy littoral of stocking locations were made several days prior to stocking and 1–2 days post stocking. Predators were retained and stomach contents were extracted using pulsed gastric lavage (stomach pumping). Diets 48-h after stocking of sampled rockbass (*Ambloplites rupestris*) (150–200mm) contained 91% walleye, yellow perch (*Perca flavescens*) contained 66% walleye, chain pickerel (125–230mm) contained 88% walleye, largemouth bass (130–215mm) contained 67% walleye and smallmouth bass (*Micropterus dolomieui*) (98–360mm) contained 7% walleye by number. Based on seining and electro-fishing predator abundance estimates in these littoral areas, we believe that walleye pond fingerlings are being preyed upon at 373 walleye/ha in the rocky littoral and 577 walleye/ha in the weedy littoral within the first 48-h post stocking. Additionally, walleye fingerlings are preyed on by a larger suite of predators in the littoral than previously hypothesized.

***Tibbits**, Wesley T. (State University of New York at Oneonta, Biology Department, Oneonta, NY 13820), and A. Kimberly **Wojnar** (State University of New York at Cobleskill, Fish and Wildlife Department, Cobleskill, NY 12187)*

Trophic Impacts of *Micropterus spp*. on Golden Shiners (*Notemigonus spp*.), and Brown Bullheads (*Ictalurus nebulosus*)

A physical and chemical limnological summary of Moe Pond Cooperstown, New York provided by McCoy et al. (1995) indicated a large population of golden shiners (*Notemigonus crysoleucas*). These planktivores reduced zooplankton mean size and biomass causing a reduction in algal grazing and a resultant reduced transparency. In 1999, Wilson et al. (1999) reported largemouth bass (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieui*) were stocked, from an unknown origin in to Moe pond. Further evaluation Tibbits (2000) indicated an increased bass population and levels of cohorts as well as a decreased golden shiner population, which in turn suggests top-down tropic cascade management. However, increased transparencies, reflective of reduced algal standing crop, was not observed.

***Foster**, John R., and Dylan **Sickles** (College of Agriculture & Technology, Fisheries and Aquaculture, State University of New York, Cobleskill, NY 12043, and Biological Field Station, State University College at Oneonta, Oneonta, NY 13820)*

The Long-Term Impact of the Channelization of a 1st Order Trout Stream, Leatherstocking Creek, N.Y.

Fifty-eight years prior to this study a segment of Leatherstocking Creek (Otsego County, N.Y.) adjacent to the Route-80 Bridge was widened and scraped level and the original stream substrate was removed and deposited on the bank to form a 2-3 foot levee. The purpose of this study was to examine various abiotic and biotic parameters in the channelized and adjacent unchannelized segments of this 1st order trout stream to determine if long-term effects of channelization persist after 58 years of undisturbed forest growth. Many negative impacts of channelization such as increase erosion, high water temperatures, siltation, etc., appear to have a short-term impact on stream ecology. After 58 years of undisturbed forest growth, these effects have been mitigated in Leatherstocking Creek. However, various aspects of habitat destruction, such as loss of pools, reduction in the size and depth of watered stream bed, reduction of dead-falls, large boulders and cover still has a significant negative impact on fish and invertebrate populations 58 years after channelization. For example, the number of brook trout per 100 m of unchannelized stream was 7–10 times higher than the number of trout per 100m of channelized stream. Thus, the positive effect that channelization had on flood protection of the Route-80 bridge, has resulted in a continuing long-term negative impact on the fisheries ecology of Leatherstocking Creek.

***O'Brien**, Shannon M., and Douglas E. **Facey** (Saint Michael's College, Department of Biology, Colchester VT 05439)*

INFLUENCE OF SEDIMENT SIZE AND SUBSTRATE COMPOSITION ON HABITAT SELECTION AND DISTRIBUTION OF EASTERN SAND DARTERS (*AMMOCRYPTA PELLUCIDA*) IN THE POULTNEY RIVER

Eastern sand darters (*Ammocrypta pellucida*) are a threatened species in both New York and Vermont. They inhabit clean, sandy substrates in several large tributaries of Lake Champlain, including the Poultney River. We studied distribution and abundance of eastern sand darters in the Poultney River, and looked for apparent preferences in substrate particle size. We collected sediment, fishes, and measured water velocity and depth in 4 to 7 plots at each of 17 different sites located along a one-mile stretch of the Poultney River on the New York–Vermont border. The areas we sampled were all less than one meter deep and had a velocity that was <1 m/sec. Sand darters preferred areas with substrate made up of a high percentage of particles between 0.23 and 0.54 mm in size. Fewer eastern sand darters were found in areas that had high percentages of very coarse particles. This suggests that eastern sand darters are selective about their habitat and might, therefore, be affected by changes in the composition of the substrate. We also evaluated sand darter distribution with respect to stability of adjacent riverbanks to try to determine whether there was any apparent correlation. Almost all sand darters were located in plots where at least one nearby riverbank was of moderate stability, and many were found between banks that were moderately to highly stable. No sand darters were found along a deeply meandering section of the river with high bank erosion.

***Harman**, Willard N., Matthew F. **Albright** (Biological Field Station, SUNY Oneonta, Cooperstown, NY 13326), David M. **Warner** (Cornell University, Department of Natural Resources, Ithaca, NY 14853), and Mark D. **Cornwell** (Biological Field Station, SUNY Oneonta, Cooperstown, NY 13326, and SUNY Cobleskill, Department of Animal Science, Cobleskill, NY 12043)*

TROPHIC CHANGES IN OTSEGO LAKE, NY FOLLOWING SUCCESSIVE FISH INTRODUCTIONS

Changes from the mid 1930's to present in Otsego Lake's pelagic community are described relative to alterations in trophic indicators and introduced organisms. In 1935 large zooplankton were common and controlled phytoplankton populations. The fish community was composed of cyprinids, yellow perch (*Perca flavescens*), walleye (*Stizostedion vitreum*), burbot (*Lota lota*), cold-water lake whitefish (*Coregonus clupeaformis*) and lake trout (*Salvelinus namaycush*). The littoral community comprised five species of centrarchids, brown bullhead (*Ictalurus nebulosus*) and chain pickerel (*Esox niger*). Summer Secchi transparencies ranged between 3.6–6.5 m and hypolimnetic waters were well oxygenated. Eutrophication indicators increased in the 1970s, with decreasing Secchi transparencies and increasing chlorophyll *a*. Cisco (*Coregonus artedi*) introduced in the 1930's dominated pelagic waters. In 1988, trophic indicators suggested reduced production, reflected by high Secchi transparency (4.7 m), maintenance of hypolimnetic oxygen and lower chlorophyll *a* (0.6 $\mu g \cdot l^{-1}$). With the 1986 introduction of alewife (*Alosa pseudoharengus*), an efficient planktivore, and their population irruption in 1988, trophic indicators reversed. Zooplanktivores crashed and large zooplankton were replaced by smaller *Bosmina* and rotifers. Salmonids thrived despite a reduced cold-water zone having suitable oxygen levels. Current chlorophyll *a* concentrations have increased (5.6–7.7 $\mu g \cdot l^{-1}$) and Secchi transparencies have decreased. In 2000–2001, 80,000 fingerling walleye (45–60mm) were stocked, adding fishing opportunity and increasing predation on alewife. Initial data indicate predation on walleye is significant though survivors grow well and prey on alewife. We postulate that increased predation on alewife may offset the aforementioned trends.

Aquatic Ecology
Contributed Papers Session

Moderator: *Robert E.* ***Schmidt*** *(Hudsonia Limited and Simon's Rock College, Great Barrington, MA 01230)*

Ladd*, John W. (New York State Department of Environmental Conservation, Hudson River Estuary Program, Ossining, NY 10562), Robin* ***Bell*** *(Columbia University, Lamont-Doherty Earth Observatory, Palisades, NY 10964), Roger D.* ***Flood*** *(State University of New York at Stony Brook, Marine Sciences Research Center, Stony Brook, NY 11794), Suzanne M.* ***Carbotte****, William B.F.* ***Ryan*** *(Columbia University, Lamont-Doherty Earth Observatory, Palisades, NY 10964), and Elizabeth* ***Blair*** *(New York State Department of Environmental Conservation, Hudson River Estuary Program, Annandale, NY 12504)*

Mapping Hudson River Estuary Benthic Habitats

In 1999 the New York State Department of Environmental Conservation (NYS DEC) through the Hudson River Estuary Program (HREP) and the Hudson River National Estuarine Research Reserve (HRNERR) began mapping the submerged aquatic habitats of the Hudson River Estuary. The initial phase of the project mapped 40 miles of the river with a suite of geophysical tools including multibeam swath sonar, sidescan sonar, and subbottom profiling using CHIRP and ground-penetrating radar. The geophysical data has been supplemented with sediment profile imagery (SPI) and sediment sampling including cores and grabs. The next phase of the program that began in 2001 is using these tools to complete the baseline mapping of the estuary from the Battery to Troy and will include pilot studies of temporal change and invertebrate habitat analysis. Data products include acoustic images and interpretive maps. The latter include maps of anthropogenic deposits, recently deposited fine-grained sediments, sediment grain size, bedforms, and river bottom morphology.

Nieder*, William C. (Hudson River NERR, Bard College, Annandale, NY 12504), Stuart* ***Findlay****, David* ***Strayer*** *(Institute of Ecosystem Studies, Millbrook, NY 12545), Eugenia* ***Barnaba,*** *Susan* ***Hoskins*** *(Cornell IRIS, Cornell University, Ithaca, NY 14853), Mark* ***Bain****, Geofrey* ***Eckerlin,*** *and Kathy* ***Mills*** *(NY Cooperative Fish & Wildlife Research Unit, Cornell University, Ithaca, NY 14853)*

Inventory and Functional Assessment of Submerged Aquatic Vegetation in the Hudson River Estuary

Submerged aquatic vegetation (SAV) has been recognized as an important component of a wide variety of aquatic ecosystems due to its contribution to primary productivity and its importance as habitat for fishes. Remote sensing is being used to document the spatial distribution of SAV beds in the Hudson River estuary. SAV beds (dominate species: water or wild celery, *Vallisnaria americana)* and Eurasian water-chestnut (*Trapa natans*) were mapped from true color aerial photographs acquired during periods of spring low tide from about mid-July through August, in 1995 and 1997 (stereoscopic coverage, at 1:14,400 scale). During the summers of 2000 and 2001, sixteen SAV beds were selected for intensive study to assess the habitat functions these beds provide to the estuary. Fish, macroinvertebrates, plant biomass and diversity, dissolved oxygen and turbidity were measured during times of peak plant biomass. Initial results suggest these beds supply oxygen to the river, provide habitat (either forage or protection) to the fish and refuge for macroinvertebrates in the freshwater tidal portion of the estuary. The relation between habitat and function is not as clear in the brackish reaches of the river at this time. Funding for this program has been provided by the New York State Environmental Protection fund through the New York State Estuary Program, the National Oceanic and Atmospheric Administration (NOAA), and the Hudson River Foundation.

***Urciuolo**, Rebecca J. (Marist College, Environmental Science Department, Poughkeepsie, NY 12601), Roseanne M. **Toscano**, (Marist College, Biology Department, Poughkeepsie, NY 12601), William H. **Shaw** (Marist College, Environmental Science Department, Poughkeepsie, NY 12601), James W. **Sutherland** (NYS Department of Environmental Conservation, Albany, NY 12233-3502), Charles W. **Boylen**, and Sandra A. **Nierzwicki-Bauer** (Rensselaer Polytechnic Institute, Darrin Fresh Water Institute, Bolton Landing, NY 12814)*

THE EFFECTS OF ACIDIFICATION ON ZOOPLANKTON COMMUNITY COMPOSITION IN ADIRONDACK LAKES

Pelagic zooplankton were collected between 1994 and 2001 from 30 lakes in the west central Adirondack Park, New York, that varied widely in pH and monomeric aluminum. Zooplankton were identified to rotifer and crustacean species and enumerated to obtain summer average densities and species richness. Regression analysis was used to compare summer average total zooplankton densities and species richness with the major acidification variables, pH and monomeric aluminum. Total rotifer and crustacean densities were slightly correlated with m-Al, but not with pH. Species richness was only slightly correlated with m-Al and moderately correlated with pH. Reasons for the relative insensitivity of species richness as a response variable will be discussed. A new response variable was obtained by determining the respective pH and m-Al levels at which a species disappears from the species pool, derived from the 30-lake set. The number of species present in the pool is linearly correlated with m-Al and curvilinearly correlated with pH. This is taken as evidence that the decline in zooplankton that occurs with acidification is more directly related to m-Al concentrations than to pH. The implications for tracking zooplankton recovery will be discussed.

***Toscano**, Roseanne M. (Marist College, Biology Department, Poughkeepsie, NY 12601), Rebecca J. **Urciuolo**, and William H. **Shaw** (Marist College, Environmental Science Department, Poughkeepsie, NY 12601), James W. **Sutherland** (NYS Department of Environmental Conservation, Albany, NY 12233-3502), Charles W. **Boylen**, and Sandra A. **Nierzwicki-Bauer** (Rensselaer Polytechnic Institute, Darrin Fresh Water Institute, Bolton Landing, NY 12814)*

SPECIES INDICATORS OF ACIDIFICATION AND LONG-TERM TRENDS IN SPECIES OCCURRENCE

Pelagic zooplankton were collected between 1994 and 2001 from 30 lakes in the west central Adirondack Park, New York, that varied widely in pH and monomeric aluminum. We looked for acid sensitive species that could serve as indicators of acidification or signs of possible recovery from acidification. A suitable indicator species would need to be widely distributed at easily observable densities under circumneutral conditions and be sensitive enough to disappear from the community during the early stages of acidification. Of the 20 species of micro-crustaceans encountered, 10 were relatively common and only two, *Eubosmina coregoni* and *Epischura lacustris* met the sensitivity criteria. We found 48 species of rotifers, 23 of which were relatively common. None met the sensitivity criteria. Many species were found at low densities in several circumneutral lakes and the common species were well distributed across the pH range. There were no common rotifer species that could only be found under circumneutral conditions. However, the percentage of *Keratella taurocepha* in the rotifer community was negatively correlated with pH. Summer average zooplankton densities varied greatly between 1994 and 2001. Possible reasons for this variation and the existence of long-term trends in the relative abundance of the common crustacean and rotifer species with respect to common acidification variables will be presented and discussed.

***Horvath**, Thomas G. (State University of New York, Biology Department, Oneonta, NY 13820), and Mark. D. **Cornwell** (Biological Field Station, Cooperstown, NY 13326)*

MEIOFAUNAL COMMUNITIES IN THREE DISTINCT NEARSHORE ZONES OF OTSEGO LAKE, NEW YORK

The nearshore zone around lakes is a dynamic habitat as shorelines experience lake-level changes and reshaping by wave action. Meiofauna (invertebrates 40–500 µm length) must recolonize these habitats after such severe disturbances. We used azoic sandy (psammon) sediment in 50ml tubes to assess recolonization differences among the eupsammon (middle beach zone), hygropsammon (beach within 1m of water's edge), and hydropsammon (permanently submerged). Samples were collected at 0, 1, 4 and 8 wk, and compared to 50-ml ambient samples to test when colonization was complete. Colonization was slower in the eupsammon (complete by wk8) than in the hygropsammon (wk1) and hydropsammon (wk4). Total meiofauna abundance (ambient samples only) was significantly higher in the hydropsammon than in the hygropsammon ($p<0.001$) and eupsammon ($p<0.001$), and significantly higher in the hygropsammon than in the eupsammon ($p=0.02$). In the eupsammon, maximum abundance was 9±2 animals/sample (mean±SE). Dominant taxa were cyclopoids and harpacticoids. In the

hygropsammon, mean abundance peaked by wk1 (79±14 animals/sample), then declined substantially thereafter (26±4 animals/sample by wk8), possibly due to lowering water level in the lake. Dominant taxa included oligochaetes, chironomids, cyclopoids, and harpacticoids. In the hydropsammon, mean abundance was 153±23 animals/sample, and tardigrads and chironomids dominated the fauna. Meiofaunal communities differ spatially and the habitats above the waterline appear susceptible to defaunation as water level drops.

***Albright**, Matthew F. (SUNY Oneonta Biological Field Station, Cooperstown, NY 13326)*

ENVIRONMENTAL IMPLICATIONS OF USING ORGANICALLY DERIVED DEICING PRODUCTS

Otsego Lake, Otsego County, NY, lies in the glacially overdeepened headwaters of the Susquehanna Valley. While generally considered meso-oligotrophic, recent trends in transparency, algal production and hypolimnetic oxygen consumption suggests increasing eutrophy. A precipitation based nutrient budget conducted in the early 1990s revealed that export rates of total phosphorus and suspended sediments to Otsego Lake were highest in a stream draining part of Cooperstown, NY, the only urban area in the watershed. The timing of that export implied that conventional deicing abrasives contributed substantially. In 1998, Cooperstown converted from abrasive/salt mixtures to MAGic Minus Zero™, a product produced from distillation processes, for deicing municipal roadways. A general concern about this product has related to its high total phosphorus content (initially 5,000 ppm, more recently 100 ppm). However, subsequent monitoring indicates somewhat lower exports of total phosphorus and sediment since that conversion.

Insects and Spiders
Contributed Papers Session

***Moderator:** Jason R. **Cryan** (New York State Museum, Research and Collections, Albany, NY 12230)*

***Bouton,** David W. (Naturalist, Mountain Meadow, Box 158, Davenport, NY. 13750)*

FROM CEMENT TO OLD SHOES: BUTTERFLY FOODS

The common perception of adult butterflies is of them gamboling carefree in the sunshine stopping occasionally to sip at a flower. Those more observant have noticed them feeding on dirt and other substances. The primary focus of this presentation is a series of field slides documenting various butterfly species feeding on a wide range of substances other than nectar—from new cement to old shoes, both locally and worldwide—with a summary of what nutrients they are actually obtaining.

***Dirig,** Robert (Bailey Hortorium Herbarium, Cornell University, Ithaca, NY 14853)*

TREASURE ON THE MOUNTAIN: ARCTIC BUTTERFLIES (GENUS *OENEIS*) IN THE NORTHEAST

The Arctics (genus *Oeneis*) are cryptically colored brown satyrid butterflies of Arctic/alpine and boreal habitats in the Northern Hemisphere. Four species occur in the Northeast, where they are Pleistocene relicts of very local distribution. Best known are the Katahdin Arctic (*O. polixenes katahdin*) and the White Mountains Arctic (*O. melissa semidea*), subspecies that occur only on the highest New England peaks. Katahdin Arctics fly in late June and July in even-numbered years, due to an unusual biennial life cycle. Protected as an endangered insect in Maine, this butterfly is restricted to Katahdin's Tableland, where its life history has not been thoroughly studied. The White Mountains Arctic is most easily seen near the summit of Mount Washington, New Hampshire. It shares the Katahdin Arctic's flight season, but differs in coloring, behavior, and microhabitat. Its caterpillars feed on Bigelow's Sedge (*Carex bigelowii*) in alpine meadows. The Jutta Arctic (*O. jutta*) lives on *Sphagnum*-heath bog mats, and flies in late May and June. Adults congregate in sheltered sunny openings, nectar at bog shrubs, and seem associated with Hare's Tail Cottongrass (*Eriophorum vaginatum*, ssp. *spissum*), upon which their larvae evidently feed. The Chryxus Arctic (*O. chryxus*) flies in spring over limestone outcrops and granitic balds near Ottawa, Ontario, and in adjacent Quebec, where its caterpillars eat Poverty Grass (*Danthonia spicata*) and other Poaceae. These butterflies are rare natural treasures that are difficult to see alive in our region.

***Dlugos**, Michael, and Peter **Weber** (State University of New York College at Oswego, Department of Biology, Oswego, NY 13126)*

DOES FIELD MOWING AFFECT BUTTERFLY ABUNDANCE?

Members of the order Lepidoptera occur in a wide variety of habitats throughout the world. Accordingly, research into the usefulness of various habitat management practices is essential to Lepidopteran conservation efforts. This study investigates the short and long term effects of field mowing on butterfly relative abundance. It was predicted that butterfly abundance would decrease immediately after mowing, but increase over the following year. Sampling was conducted from 1996 until 2001 using the Pollard walk method. Counts from three sampling sessions prior to mowing were compared to counts from three sessions immediately after mowing, as well as to counts on approximately the same day of the following year. Significance levels were computed through comparison of counts to the Poisson distribution, as well as through the non-parametric permutation and bootstrap tests. The smaller woodland openings produced significant decreases in abundance immediately after mowing, however, the remaining locations produced no significant differences. Two locations produced a significant increase in abundance one year after mowing, with the rest producing no significant differences in abundance. It was therefore concluded that mowing has a small effect on butterfly abundance in the short and long term.

***Lord**, Paul H. (Biological Field Station, SUNY Oneonta, Cooperstown, NY 13326)*

INTRODUCTION OF *ACENTRIA EPHEMERELLA* INTO LEBANON RESERVOIR FOR CONTROL OF *MYRIOPHYLLUM SPICATUM*

The aquatic moth, *Acentria ephemerella*, has documented potential for controlling the aggressive exotic aquatic macrophyte Eurasian water-milfoil, *Myriophyllum spicatum*. During the winter and spring of 2001, the Cornell University Research Ponds' staff cultured late instar caterpillars of *A. ephemerella*. Approximately 22,000 caterpillars were then introduced into three sets of experimental plots, which had been paired with control plots, in Lebanon Reservoir, Madison County, NY. All plots were monitored throughout the 2001 growing season for *M. spicatum* density, biomass, stem length and herbivores. Results show poor recruitment of *A. ephemerella* after emergence of the initially introduced caterpillars with no significant control of *M. spicatum*. A fish predation hypothesis for results noted is discussed.

***Ascher**, John S., and Karl **Magnacca** (Cornell University, Department of Entomology, Ithaca, NY 14853)*

BEE DIVERSITY IN THE FINGERLAKES REGION OF NEW YORK STATE: 1872–2002 (HYMENOPETERA: APOIDEA)

Bee diversity in the Fingerlakes Region of New York State was surveyed based on museum specimens (primarily in the Cornell University Insect Collection), published revisions, and new material collected during the survey period 1997–2001. Overall, 320 bee species were recorded belonging to all six families and 37 genera. 229 species (72%) were recorded during the survey period. Total diversity includes the majority of species known regionally (including 84% of the 383 bee species known from New York state) and is greater than that recorded by the few other reasonably comprehensive bee surveys available for localities in eastern North America. Floral relationships, host-parasite interactions, phenology, and other comparative ecological phenomena are discussed in the context of the bee fauna as a whole. Changes in the bee fauna over the past 130 years are documented. Fourteen species of Palearctic origin have become established in the study area, three of which were newly detected during the study period. Seven conspicuous native species have not been collected since 1940, including 3 boreal species likely to be adversely impacted by global warming. Two formerly prevalent species associated with the wetland plant yellow loosestrife are hypothesized to be extirpated from the study area and may be globally extinct. General implications of this study for bee surveys are discussed, including the difficulty of detecting and identifying rare and/or cryptic species, which comprise a substantial proportion of this and other bee faunas.

***Gambino**, Parker (American Museum of Natural History, Division of Invertebrate Zoology, New York, NY 10024)*

HYMENOPTERA BIODIVERSITY AT ADJACENT SHORELINE AND INLAND HABITATS IN RYE, WESTCHESTER COUNTY, NEW YORK

Hymenoptera were sampled over a two year period at Marshlands Conservancy, a natural area bordering Long Island Sound in Rye (Westchester County) New York. An aerial net was used to capture insects; the standard sampling session lasted 45 minutes. A mixed tidal marsh/scrub/deciduous forest area was sampled on eight dates during 2000 and twelve dates during 2001. An upland field/forest ecotone was sampled on twelve dates in 2001, matching those of the shore habitat. Hymenoptera

sampled included bees (22 genera), Sphecidae (sensu lato) (16 genera), and Vespidae (sensu lato) (10 genera). Specimens were determined to genus. A total of 48 genera were collected. No objective measures of abundance were made. Thirty-five genera were collected from both habitats, including 11 genera containing social species. Among taxa containing only solitary species, 10 genera were collected only from the shore habitat, and 3 genera were collected only from the upland field habitat, suggesting some degree of habitat specialization at the genus level. This study provides evidence for the importance of long term monitoring in describing the Hymenoptera fauna of even a small area. Of the 45 genera detected at the coastal habitat, only 29 (64%) were detected in consecutive years. Likewise, a complete regional checklist should include a diversity of local habitats, since even minor topographical changes may be reflected in different local faunas; only 35 (73%) of the total of 48 genera were detected in both adjacent habitats.

***Ovtsharenko**, Vladimir I. (American Museum of Natural History, Invertebrate Zoology, New York, NY 10024), Kefyn M. **Catley** (Rutgers University, Department of Learning and Teaching, New Brunswick, NJ 08901-1183), and Andrei V. **Tanasevitch** (All-Russian Institute on Nature Conservation, Moscow, Russia, 113628)*

Biodiversity of Spiders of the Black Rock Forest

At a State level the spiders of New York State are very poorly known. The last list of New York State spiders was completed by Crosby and Bishop in 1928 and it included 174 genera and 576 species. Kaston (1981) in his book "Spiders of Connecticut" recorded 184 genera and 462 species of spiders from Connecticut State, and 224 genera and 597 species from adjunct territories of Connecticut State. This example shows that the spider fauna of a much smaller state, Connecticut, is currently represented by more species than there are in the whole of New York State. Obviously, this poor state of knowledge needs to be addressed. As a result, our arachnological research in Black Rock Forest (BRF) has become the first spider survey for the last 70 years and in three years of the project development we have found 290 species of spiders in BRF. The data generated in the project are used as a general manual for teaching biodiversity to high school students at the American Museum of Natural History (AMNH) and are also studied in the new distance learning course "The Study of Spiders" created by the AMNH for high school teachers. The teachers and students are studying spiders using Internet connections and all field classes are based on the data from the BRF. An important aspect of BRF project is a creation of the database driven web site (http://research.amnh.org/entomology/blackrock).

***Smith**, Kimberly G. (University of Arkansas, Department of Biological Sciences, Fayetteville, AR 72701), Gene R. **Kritsky** (College of Mount St. Joseph, Department of Biology, Cincinnati, OH 45233), and G. **Motzkin** (Harvard University, Harvard Forest, Petersham, MA 01366)*

Periodical Cicadas in Massachusetts: Historical Effects of Land-use and the Demise of Brood XI

Year-classes of periodical cicadas (*Magicada* spp.) are referred to as broods and over the last 200 years at least 5 broods of 17-year periodical cicadas have been reported from the state of Massachusetts. The only extant brood in the state today is Brood XIV, found in western Cape Cod and southeastern Massachusetts, which should emerge again in 2008. This is a disjunct population of a brood that will emerge to the south along the eastern seaboard. The only other firmly established emergence was that of Brood XI, which had a total range of the Connecticut River Valley in Connecticut and Massachusetts, north to Hadley, and extreme southeastern Massachusetts. This brood declined over the 19th century during a period when forest cover reached a minimum of about 30% in the Connecticut River Valley, becoming extinct by the start of the 20th century. Periodical cicadas have limited dispersal capabilities and populations must remain large enough to satiate predators. The demise of Brood XI would appear to be directly linked to the clearing of forests for agricultural land, and represents one of the earliest examples of an extinction caused by land-use practices in North America.

***Bouton**, David W. (Naturalist, Mountain Meadow, Box 158, Davenport, NY. 13750)*

Surviving Predation in the Lepidoptera

Butterflies and moths are some of earth's major transformers of plant material into protein and as such are subject to incredibly high predation. On the average, only one out of every 200–350 eggs oviposited by a butterfly or moth will live through its life cycle to reproduce. To achieve even that level of survival, lepidoptera have evolved an intricate web of combinations of wing designs and behaviors in order for the individual to deter becoming a meal before it reproduces. This photographic presentation of local and worldwide lepidoptera, many of them in the field, documents some of these designs and behaviors, both well known designs and behaviors presented in the literature, and others just beginning to be understood.

New York Forests
Contributed Papers Session

Moderator: *Norton G.* ***Miller*** *(New York State Museum, Research and Collections, Albany, NY 12230)*

Kudish*, Michael (Paul Smith's College, Division of Forestry, Paul Smiths, NY 12970)*

13,000 Years of Catskills Forests

For the first time, peat has been extracted from many small, high-elevation Catskills bogs, radiocarbon-dated, and the plant macrofossils (wood, bark, leaves, needles, fruits, cones) identified. Some of my dissertation assumptions on the post-glacial forest history have proven incorrect and the surprises still pour in. Balsam fir probably arrived shortly after deglaciation, 13900 years before present. Only a few kilometers further west of where it is today, no record of it occurs in any of eight bogs up to 10200 years old; it must have disappeared quickly. Only in one bog is the fir disappearance date known: between 8200 and 6400 years b.p. Some contemporary historians do not realize that, claiming that the Catskills were mostly eastern hemlock, is indeed correct: their error is in the time, not the 18th century, but between 10200 and 4500 years b.p. In four western Catskills bogs, hemlock disappeared between 6500 and 4500 years b.p., confirming the general "crash" in the northeastern United States. However, in two other bogs, hemlock has been present continuously for up to 10200 years, suggesting local refugia. Red spruce was already present 6000 years b.p., more than twice as long as estimated for the Adirondacks; there is no evidence that red spruce ever migrated into the western Catskills where it is absent today. Yellow birch was well-established by 9500 years and beech 5200. In one bog, three-way sedge (*Dulichium*) and green alder were present 5200 years ago, but no trace of the former exists today for several km around, and no trace of the latter anywhere in the Catskills.

Slack*, Nancy G. (The Sage Colleges, Biology Department, Troy, NY 12180), and Thomas R.* ***Phillips*** *(645 County Route 7, East Schodack, NY 12063)*

Bryophytes and Lichens as Indicator Species of Adirondack Old Growth Forests

Many forests considered to be old growth occur in the Adirondacks of New York State. The bryophytes and lichens of such forests have not been previously studied systematically in the southern Adirondacks. Two such forests, one a never-cut forest along the Powley-Piseco Road north of Stratford, NY, the second an old growth forest not lumbered for over 100 years at Whitehouse near Wells, NY were intensively studied for bryophyte species and sampled for lichen epiphytes. These forests contain very large *Picea rubens, Betula alleghaniensis* and *Tsuga canadensis*, as well as *Acer saccharum*, *Fagus grandifolia*, and *Abies balsamea*. Of 90 species of bryophytes, ten species appear to be old growth indicators as compared with old growth forests studied by Slack and by C. Schmitt in the northern Adirondacks and by S. Cooper-Ellis in Western Massachusetts. Two species of *Lobaria* appear to be lichen indicators. Rare species of bryophytes differed in the two forests studied, probably a result of unusual habitats rather than time period since lumbering. A number of probable old growth indicator species were found in the Adirondacks but not in the larger Western Massachusetts study, partly due to climatic differences, but also perhaps to the larger extent of old growth forests in the Adirondacks.

Danoff-Burg*, James A. (Columbia University, Department of Ecology, Evolution, and Environmental Biology, New York, NY 10027), and Simon* ***Bird*** *(University of Wales, Center for Ecology and Hydrology, Bangor, Gwynedd LL61 5UP, Wales, UK)*

Hemlock Woolly Adelgid and Elongate Hemlock Scale: Partners in Crime?

The increased mortality of the Eastern Hemlock in North America has been primarily attributed to the invasion of the hemlock woolly adelgid (HWA). However in parts of the range of eastern hemlock, the elongate hemlock scale (EHS), another introduced Asian insect, also infests stands and weakens trees. An important step towards achieving the goal of reducing eastern hemlock mortality is to understand how these two exotic insects impact hemlock stands. To address this question, we estimated levels of infestation of HWA and EHS found on 153 trees along the length of an eastern hemlock stand in the Black Rock Forest, Orange County, New York. We also estimated the relative abundance of each of these insects and the levels of needle loss and new growth on these hemlock trees. Using these data, we then determined that both HWA and EHS abundance

was significantly correlated with the early stages of hemlock decline, as indicated by the suppression in new growth in infested trees. However, an advanced stage of hemlock health decline, as indicated by needle loss, was significantly correlated with EHS abundance but not HWA abundance. We suggest that HWA and EHS at least contribute equally to the decline of hemlocks at our field site, but that damaging outbreaks of EHS may be enabled by HWA feeding. Therefore, in areas where both HWA and EHS are abundant, forest managers interested in sustaining their eastern hemlock stands should strongly attempt to control both of these introduced pest species.

***Tessier**, Jack T. (College of Environmental Science and Forestry, State University of New York, Faculty of Environmental and Forest Biology, Syracuse, NY 13210)*

CONTINUAL LEAF PRODUCTION AND SENESCENCE IN *OXALIS MONTANA*

Understory plant species in northern hardwood forests encompass multiple patterns of leaf-longevity. Several authors have called *Oxalis montana* Raf. (common wood sorrel) a wintergreen herb, meaning that it keeps a cohort of leaves for one full year and as that cohort senesces it is replaced by a new one. I censused and labeled leaves in four populations of *Oxalis montana* in a northern hardwood forest of the Catskill Mountains, New York periodically for one full year beginning in November of 2000 to quantitatively document leaf-longevity in the species. A total of 220 leaves were labeled during the study. Multiple cohorts of leaves developed and senesced in less than one year in each of the four populations. In the extreme cases four leaves survived for at most 16 days while four leaves survived for at least 360 days. *Oxalis montana* did not function as a true wintergreen species during this year in the Catskills. Leaf-longevity in this species is therefore more versatile than previously believed. I suggest that this leaf-longevity strategy be termed 'continual-green' to describe the continual production and senescence of leaves throughout the year. The functional significance as well as the geographic and temporal extents of this leaf-longevity pattern in *Oxalis montana* remain to be determined.

***Vellend**, Mark (Cornell University, Department of Ecology and Evolutionary Biology, Ithaca NY 14853)*

GENETIC STRUCTURE OF *TRILLIUM GRANDIFLORUM* POPULATIONS IN PRIMARY AND SECONDARY FORESTS

Widespread abandonment of agricultural land in eastern North America has created a mosaic of forest patches that vary in their size and age. Seeds of herbaceous forest understory plants are generally dispersed only short distances, which should result in reduced genetic variation within populations in secondary vs. primary forest stands. I assayed variation at five allozyme loci in populations of *Trillium grandiflorum* (a long-lived, ant-dispersed forest herb) in seven primary and seven secondary forest stands in central New York, USA. Allelic richness was reduced in secondary vs. primary stands, though mean heterozygosity did not differ between stand types. Populations in secondary stands were genetically more similar to nearby populations in primary stands than to more distant populations in primary stands. These results provide the first evidence for genetic consequences of post-agricultural forest recovery in eastern North America, and provide further evidence for localized dispersal of forest understory plants in fragmented landscapes.

***Griffin**, Jake M. (Institute of Ecosystem Studies, Millbrook, NY 12545), Gary M. **Lovett** (Institute of Ecosystem Studies, Millbrook, NY 12545), Mary A. **Arthur** (University of Kentucky, Department of Forestry, Lexington, KY 40546), and Kathleen C. **Weathers**, (Institute of Ecosystem Studies, Millbrook, NY 12545)*

The Distribution and Severity of Beech Bark Disease in the Catskill Mountains

The distribution and severity of beech bark disease (BBD) in the Catskill Forest Preserve was measured between 1997–2000 during vegetation surveys conducted in 13 watersheds within the Preserve. Forest composition was measured using wedge prism surveys and fixed-area plot counts of canopy species. BBD severity on individual trees was ranked from 1 to 5, based on bark health and canopy loss. Final tallies were analyzed at multiple landscape scales to determine possible controls of disease distribution and severity. BBD was present on almost all beech individuals encountered >10cm, but was more severe in larger diameter classes. Mortality due to BBD also increased with diameter class. A positive relationship was found between BBD severity and relative beech basal area at the watershed scale (hundreds of hectares), but not found at smaller landscape scales. Successful long-range dispersal of the disease may therefore be dependent upon host density, while local conditions may control BBD severity within individual stands. The current extent of BBD in the Catskills suggests these forests are entering the aftermath phase of the disease's progression, and that BBD has become an endemic component of these forests.

***Pederson**, Neil, Gordon **Jacoby**, Ed **Cook** (Tree-Ring Laboratory, Lamont-Doherty Earth Observatory, Palisades, NY 10964), Dorothy **Peteet** (Paleoecology Laboratory, LDEO, Palisades, NY 10964), and Kevin **Griffin** (Plant Ecophysiology Laboratory, LDEO, Palisades, NY 10964)*

How Stable Will the Southern Temperate-Boreal Forest Ecotone Be? Ask the Trees!

A dichotomy exists in modeling studies on how stable the southern boreal forest in the northeast US will be in the face of greenhouse gas induced, climate change scenarios. The basis for the split primarily rests on assumptions of how trees at their southern range limit respond to heat stress. Dendroecological studies are useful in understanding the dynamic response of tree growth to temperature through time. In northern New York, the combination of several boreal species growing near their southern range limits and the lack of a precipitation gradient makes it an excellent region to investigate the impact of temperature on growth. Analysis of range margin, mature boreal trees will give insight into the future of stability of the southern temperate-boreal forest ecotone. For this study three species (*Picea glauca*, P. *rubens* and *Thuja occidentalis*), living near or at their southern range limit in the Hudson Valley were analyzed for their response to climate over the last 100 years. Climate response analysis shows that all three species are negatively correlated with growing season temperature, with differences for each species. Each species was also positively correlated with cool season temperatures. However, negative monthly correlations were often the strongest. Kalman Filter analysis reveals that while most monthly correlations were time stable, some negative correlations have become stronger during the 20th century. This analysis suggests that while there may be some vegetation inertia in canopy trees at the Hudson Valley ecotone, heat stress will play an important role in its stability.

Perishable Material Culture in the Northeast
Organized Papers Session

Organizer and moderator: *Penelope B.* ***Drooker*** *(New York State Museum, Research and Collections Division, Albany, NY 12230)*

Perishables in the Northeast

This introduction to the symposium presents an overview of the types of data and information on perishable material culture that have survived in the archaeological record of northeastern North America, with examples primarily from New York state.

Adovasio*, James M., and J.S.* ***Illingworth*** *(Mercyhurst College, Department of Anthropology and Mercyhurst Archaeological Institute, Erie, PA 16546-0001)*

Prehistoric Perishable Technology in the Upper Ohio Valley

Located on the extreme western margin of the Northeast and the northern periphery of the Mid-South, the Upper Ohio Valley affords a strategic, if highly episodic, view of prehistoric non-durable technology that extends back more than 12 millennia. The oldest perishables from the Northeast derive from this area and are directly dated to Pre-Clovis contexts at Meadowcroft Rockshelter in Pennsylvania. Thereafter, basketry, cordage, and related industries are sporadically represented by actual specimens or impressions up to and beyond European contact. The salient characteristics of this long perishable trajectory are summarized and compared to developmental trajectories elsewhere in eastern North America.

Adovasio*, James M. (Mercyhurst College, Department of Anthropology and Mercyhurst Archaeological Institute, Erie, PA 16546-0001), R. S.* ***Laub*** *(Buffalo Museum of Science, Buffalo, New York, 14211), J.S.* ***Illingworth*** *(Mercyhurst College, Department of Anthropology and Mercyhurst Archaeological Institute, Erie, PA 16546-0001), J. H.* ***McAndrews*** *(University of Toronto, Botany Department, Toronto, Ontario, Canada M5S 3B2), and D. C.* ***Hyland*** *(Mercyhurst College, Department of Anthropology and Mercyhurst Archaeological Institute, Erie, PA 16546-0001)*

Late Pleistocene/Early Holocene Perishable Technology at Hiscock, New York

The 1996 excavations at the Hiscock site in New York yielded an impression of a close diagonal twined, Z-twist weft textile with a continuous weft side selvage and, possibly, actual minute pieces of that textile. The specimen is generally associated with a concentration of white-tailed deer (*Odocoileus virginianus*) bones and originates in deposits of possible Late Pleistocene/early Holocene age. The technology, context, associations, and possible age of the specimen are discussed, and this unique item is placed in the larger framework of perishable developments in the New World.

Wymer*, Dee Ann (Bloomsburg University, Department of Anthropology, Bloomsburg, PA 17815)*

Hopewell Perishables

This paper will review the categories and nature of organic materials that have been identified for the Ohio Hopewell Moundbuilder culture. Special emphasis will be given to recent research that has identified new classes of materials under unusual preservation conditions with copper ceremonial artifacts. In addition, the author will emphasize the role that the identified organic materials may have played in Hopewell rituals centered on the dead and the larger ceremonial sphere embedded within earthwork and mound construction.

***Wimberly**, Virginia (University of Alabama, Department of Clothing, Textiles, and Interior Design, Tuscaloosa, AL 35487)*

OHIO HOPEWELL TEXTILES: VARIATION OF CHARACTERISTICS BETWEEN COPPER-ADHERING AND OTHER SPECIMENS

This paper presents the analysis of textile fragments adhering to copper artifacts from Ohio Hopewell burial mounds of Hopewell, Seip, Fort Ancient, Mound City, Liberty and Harness. Non-destructive analysis of the textile remains was used to gather data on fibers, yarn structures and fabric formation for discovering possible relationships between artifacts due to variations in the structural elements employed. Anomalous attributes of yarn elements within the twined structures occur repeatedly on artifacts from the same site. The mixture of yarn attributes may indicate multiple spinners supplying one textile creator with the necessary volume of yarns to create high thread count textiles more rapidly for ceremonial purposes. Once these anomalies were found the question became do these same anomalies occur in textiles from the same sites, but not attached to copper artifacts? The results of the analysis of textiles adhering to copper artifacts are then compared to the data from textiles analyzed by the author from the same Hopewell sites that were not attached to copper. Lastly, the compilation of information about yarn and fabric structures is compared to previously published analyses of Hopewell textiles by Church, Hinkle, and Song.

***Johnson**, William C. (Michael Baker Jr., Inc., Coraopolis, PA 15108)*

UPPER OHIO VALLEY CORDAGE TWIST DIRECTION AND POPULATION CONTINUITY/DISPERSAL, A.D. 1000–1635

The final twist direction of cordage as it is preserved as negative impressions on Native American ceramics in the Upper Ohio River Valley has been regularly documented for more than 25 years and has been the subject of a number of synthetic analyses and interpretations. The twist direction has been recorded for over 8,000 sherds derived from ca. 78 sites and 84 discrete components from the Late Prehistoric/Late Woodland and Protohistoric periods by a number of different researchers. This data bank has been used to demonstrate population continuity and integrity in southwestern Pennsylvania and contiguous areas across the Late Prehistoric and Protohistoric periods from ca. A.D. 1050–1635 as well as on the glaciated Allegheny Plateau in northwestern Pennsylvania during the Late Woodland interlude, ca. A.D. 1000–1580. This data has also been employed to argue for a late population dispersal from the glaciated Allegheny Plateau at the onset of the Neo-Boreal Climatic Episode. Conversely, it has also been marshaled to reject arguments for putative out-migrations from the lower Upper Ohio River Valley in the south.

***Bursey**, Jeffrey A. (University of Toronto, Department of Anthropology, Toronto, ON, Canada M5S3G3)*

ALMOST GONE: FINDING AND INTERPRETING PERISHABLE MATERIALS IN ONTARIO

Like many areas in the northeast, Ontario has produced few examples of wooden or other "perishable" artifact classes. In this paper, some examples of wooden and woven artifacts recovered from archaeological sites in southern Ontario will be reviewed. The focus of this paper, however, will be on inferences generated from pottery from the last thousand years of the prehistoric record. Two lines of evidence will be examined. First, the role of woven baskets and/or fabrics as technological components in the construction of pottery vessels will be examined. Secondly, the possible role of this medium in shaping the "style" of Iroquoian pottery will be explored.

***Petersen**, James B. (University of Vermont, Department of Anthropology, Burlington, VT 05405), and Malinda **Blustain** (Robert S. Peabody Museum of Archaeology, Phillips Academy, Andover, MA 01810-4113)*

NATIVE AMERICAN PERISHABLES FROM CONTACT PERIOD SITES IN COASTAL MAINE

Analysis of several samples of Native American textiles and other perishables excavated by Warren K. Moorehead from several sites in coastal Maine was undertaken as part of the process of NAGPRA repatriation at the R.S. Peabody Museum of Archaeology. Working with fragments preserved due to their association with copper/brass at the Sandy Point and Walker's Pond sites, this analysis has revealed something of the diversity of indigenous clothing and ornaments characteristic at the time of early European contact during the late 16th and early 17th centuries. This paper summarizes these details and places these rare finds within a broader regional diachronic and synchronic framework in northeastern North America.

***Ordoñez**, Margaret, and Linda **Welters** (University of Rhode Island, Department of Textiles, Fashion Merchandising and Design, Kingston, RI 02881)*

TEXTILES AND LEATHER IN SOUTHEASTERN NEW ENGLAND ARCHAEOLOGICAL SITES

Archaeologists in southern New England occasionally find textiles and leather adhering to metals in Native American burials and existing in micro-environments such as coffins and privies. New England's climate and soil are not conducive to the preservation of the textiles and leather. Such apparel helps us learn about the appearance of its early residents. Archaeologists have not always preserved textiles with the same care as non-perishable materials. With recent attention to issues of gender and the importance of the body, dress and appearance have been recognized as an important part of material culture. Textiles are listed and described in New England site reports dating from the 1920s. Archaeologists describe layers of textiles covering skeletal remains in cemeteries, yet only miniscule fragments are recovered. Perishables have a history of being difficult to recover from sites with variable climatic conditions, so they have been neglected in the archaeological record. In recent years, archaeologists have recognized the importance of textiles and leather, consequently improving their methods of excavation and treatment. This paper provides an overview of: characteristics of leather, particularly in shoes; characteristics of plant and animal fibers found in European and American textiles; conditions leading to preservation in wet sites; methods of excavation and on-site handling; preparation for analysis; and analytical methods. Examples will be drawn from textile fragments we have analyzed from five 17th–19th century archaeological sites in Rhode Island and Boston.

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BLUE ROOTS AND FUZZY DIRT: ARCHAEOLOGICAL TEXTILES FROM NATIVE AMERICAN BURIALS

When bones, coffin nails, and textile fragments were found in fill dirt from the accidental disturbance of an unmarked, undated Mashpee Indian cemetery, the Massachusetts Historical Commission (MHC) performed an emergency salvage operation. The presence of coffin nails from the graves of three individuals indicated that these were Christian burials. MHC asked the authors to analyze the textiles and establish a probable period of manufacture and use. Using both stereo and polarizing microscopes, we determined physical characteristics of over 650 fragments. All were wool, with 83 different fabric types represented. Construction details point to tailored, European-style clothing. (Other items such as burial pillows also probably were present.) Comparison to extant examples in New England collections indicates a date of late-eighteenth or early-nineteenth century for the clothing, and consequently for the burials. These conclusions are corroborated by the written record, which mentions the spinning and weaving skills of Mashpee Indians. Massachusetts archaeologists have told us of "blue roots" and "fuzzy dirt" that might have been textiles. The dirt-colored Mashpee textiles might easily have been overlooked since roots had grown through them. These fragile textile fragments provide information about textile production, sewing techniques, and possible modifications to European-style apparel that were uniquely Indian.

***Hamell**, George (New York State Museum, Research and Collections Division, Albany, NY 12230)*

SUSANNAH SWAN'S "WAMPUM BAG"

The materials, techniques, and convoluted history of a late seventeenth century New England twined bag, one of the earliest extant historical examples from this region.

Poster Abstracts

***Adams**, David (NYS DEC, Bureau of Wildlife, Albany, NY 12233), Thomas D. **Carroll** (NYS DEC, Bureau of Wildlife, Avon, NY 14414), and Bernd **Blossey** (Cornell University, Department of Natural Resources, Ithaca, NY 14853)*

A Status Assessment of Purple Loosestrife Biological Control Efforts in New York State, 1992–2001

Purple loosestrife (*Lythrum salicaria*) is an exotic invasive perennial, which has been documented to negatively impacted wetland dependant wildlife such as Black Tern (*Chlidonias niger*) and Least Bittern (*Ixobrychus exilis*). After decades of unsuccessful attempts to control purple loosestrife using mechanical, physical, and chemical means, the successful development of biological control by an international team of scientists in the early 1990s offered a new opportunity to better manage this species. After approval by federal and state regulatory agencies, two leaf beetles (*Galerucella calmariensis* and G. *pusilla*), a root feeding weevil (*Hylobious transversovittatus*), and a flower feeding weevil (*Nanophyes marmoratus*) were released throughout New York State. Monitoring protocols developed by Cornell University staff have been implemented to assess program effectiveness and evaluate changes in the vegetative community. This presentation will document the geographic distribution of the biological control agents released over the past ten years and summarize the results of on site monitoring by several independent parties. One of the initial biological control release sites in North America, Tonawanda Wildlife Management Area, is once again suitable breeding habitat for marshbirds and positive trends have been documented at several other locations. Although the current monitoring results are promising, the initial goal to reduce purple loosestrife abundance to approximately 10% of its current level over approximately 90% of its range will take quite some time to accomplish. An aggressive and coordinated effort will be required to maximize the geographic distribution of the biological control agents over a minimum time period with the limited resources available.

***Atkins**, Diane (Sullivan County Community College, Loch Sheldrake, NY 12759)*

Comparison of NYS Abiotic and Biotic Water Quality Testing Protocols

Water chemistry sampling can quickly detect and localize pollution sources, but makes no determination concerning health of the biotic community. Accepted protocol for chemical testing is limited to preliminary assessments. Basic monitoring of phosphates, nitrates, dissolved oxygen, pH, and temperature are used to determine the necessity of further chemical testing. Macro invertebrate (BMI) collection, thorough identification, and indices analysis is time consuming, but is an indicator concerning the health of aquatic biotic communities. Using both water chemistry (abiotic) and BMI (biotic) data obtained from three streams in Sullivan County, NY, this work addresses the correlation between the NYS Department of Environmental Conservation's (DEC) two types of monitoring efforts for determining credible inferences for future monitoring efforts. This work tests the protocol of the DEC indices for their effectiveness in the ultimate assessment of water quality.

***Bamberger,** Sarah J., Robert G. **Means**, James E. **Hutson**, Geraldine S. **Johnson** (New York State Department of Health, Bureau of Communicable Disease Control, Albany, NY 12237), Dennis J. **White** (New York State Department of Health, Bureau of Communicable Disease Control, Albany, NY, 12237, and University at Albany, School of Public Health, Rensselaer, NY, 12144), Stephen **Lukowski** (Albany County Health Department, Environmental Health, Albany, NY 12201), James **Cayea** (Clinton County Health Department, Environmental Health, Plattsburgh, NY 12901), John **Zukowski** (Columbia County Health Department, Environmental Health, Hudson, NY 12534), Suzanne **Wells** (Montgomery County Health Department, Public Health, Fonda, NY 12068), and Thomas **Austin** (Warren County Department of Public Works, Parks Department, Warrensburg, NY 12889)*

Mosquito Surveillance in the Capital District Region: Why, How and What?

The presence of mosquito-borne disease has been recorded in New York State as far back as the 18th century. In 1999, the first appearance of West Nile virus in the Western Hemisphere occurred in New York City. Prior to the arrival of West Nile virus, mosquito surveillance in New York State primarily focused on monitoring for Eastern equine encephalitis in known endemic locations including Long Island and several counties in Central New York. As a direct result of the detection of West Nile across the state, mosquito surveillance programs were re-introduced or established in numerous areas of the state including

the Capital District Region. Mosquito surveillance activities integrated several standard adult and larval surveillance techniques designed to begin establishing and monitoring composition and population dynamics of local species. During the summers of 2000 and 2001, seven of the fifteen counties within the Capital District Region participated in mosquito surveillance activities. For the region, approximately 33 species of mosquitoes were captured and viral testing was performed on 438 pools, each pool consisting of 10 to 50 mosquitoes. A single isolation of West Nile virus from Capital District mosquitoes was recorded during 2000 from *Ochlerotatus japonicus*. Information gathered during the 2000 and 2001 surveillance seasons will serve as a platform for establishing more uniform surveillance programs for upcoming seasons. Knowledge of local mosquito population dynamics aids researchers and local public health officials in understanding and assessing the potential risk of vector-borne diseases.

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Mosquito Training Modules on CD-ROM: E-learning for Mosquito Surveillance

The discovery of West Nile virus in New York State in 1999 led to the development of surveillance systems designed to monitor for the presence of mosquito-borne diseases. Based on the role of mosquitoes as potential vectors of West Nile virus, mosquito surveillance activities were recommended and reintroduced. In preparation for the establishment of mosquito surveillance programs throughout the state, training courses were initiated in the spring of 2000. The New York State Department of Health (NYSDOH), Arthropod-Borne Disease Program offered intensive three and four day training courses that focused on multiple aspects of mosquito biology and surveillance to Local Health Unit (LHU) staff. LHU staff members participated in the courses then returned to their respective counties with the goal of establishing countywide mosquito surveillance programs. In an effort to make knowledge gained in the course more accessible upon completion of the class, a CD-ROM based training module containing pertinent information is being developed for 2002. Information about who, what, when, where, why and how for mosquito surveillance has been included. Topics covered in the module are intended to make surveillance techniques more uniform across New York State, act as a teaching aid to train staff unable to attend NYSDOH courses and become a reference tool used to disseminate factual information concerning mosquitoes and mosquito-borne disease surveillance.

Batcher*, Michael S. (Consulting Ecologist and Environmental Planner, Buskirk, NY 12028), and George* ***Schuler*** *(The Nature Conservancy, Neversink River Program, Cuddebackville, NY 12729)*

Biophysical Aquatic Classification of the Upper Delaware Watershed

Freshwater systems are priorities for biodiversity conservation. To prioritize sites, aquatic communities and habitats need to be classified for comparison purposes. No classification for aquatic communities or habitats exists that is comparable to terrestrial community classification systems. The Upper Delaware was chosen to test methods developed by The Nature Conservancy to classify potential aquatic macrohabitats using abiotic variables. The study area is approximately 4,000 square miles, extending from the Delaware Water Gap to the headwaters. Using geographic information system (GIS) analyses, and existing data sets, categorical attributes of rivers and waterbodies were developed including watershed size, groundwater contribution, pH, organic input and others that affect the distribution of aquatic organisms. Using these attributes, the 4,941 reach segments in the RF3 database (USEPA) were grouped into 557 classes: 257 river segments, 75 impounded lakes or ponds, 76 impounded rivers, 134 lakes, 15 non-transport wetlands or islands. These classes were grouped into 39 ecological systems including lakes (9 systems), small rivers (21) and moderate and large rivers (9). Data on fish species from collection points in Pennsylvania and New York were used to determine the relationship between abiotic attributes and fish species presence/absence. Ordination and indicator species analysis indicated that watershed size, gradient, groundwater, organics and wetland influence might influence fish species presence/absence in rivers. These methods can be used to inform site selection for conservation or inventory. Further analyses are needed to address problems of precision and to incorporate water quality variables in determining the distribution of species.

***Boylen**, Charles W., Lawrence W. **Eichler**, Jeffrey **Bartkowski**, and Shannon **Shaver** (Rensselaer Polytechnic Institute, Darrin Fresh Water Institute, Bolton Landing, NY 12814)*

EXOTIC PLANT DISPERSAL THROUGH NEW YORK'S AQUATIC SYSTEMS: A CHRONOLOGICAL OVERVIEW

At every level of the aquatic food web, long-standing checks and balances have become dramatically eroded by the introduction of exotic, non-native species. Exotic species exhibit a profound effect on native plant populations, generally excluding all but the most hardy native species. These effects, echoed through the food web, affect phytoplankton, invertebrates, fish and humans. Moreover, nuisance aquatic plant growth frequently results in decreased lake water quality, interference with recreational access to lakes, reduced property values, degraded flood control structures, and impacts to the aesthetic quality of lakes and ponds. Some of the potentially most pervasive of invaders of New York State lakes and ponds are aquatic plant species such as Eurasian watermilfoil, Curley-leaf Pondweed, Fanwort, European Frogbit, and Waterchestnut. While there is general public awareness of the modes of introduction of the exotic species currently in New York State, new exotic aquatic plant species are also close at hand, namely Hydrilla and Parrotfeather. Furthermore, as exotic species common to the southern US have become cold-adapted, their northern range will undoubtedly extend into New York. One key component to successful management of exotic invasives is monitoring and detection. Mapping dates of initial appearance, to observe trends and rates of species dispersal, can allow for predictions of future infestations. The ability to recognize areas of high risk is necessary to develop educational programs and encourage monitoring known vectors of introduction.

***Briggs**, George M., and Tammi **LaFever** (SUNY-Geneseo, Department of Biology, Geneseo, NY 14454)*

THE INFLUENCE OF LEAF POSITION ON PETIOLE LENGTH IN SUGAR MAPLE

Most plants are presented with a problem of distributing leaves in such a way as to minimize the amount of self-shading. A number of species exhibit "leaf mosaics," with leaves displayed in such a manner that there is little overlap among them. We have been studying this phenomenon in sugar maple (*Acer saccharum* Marshall) with the goal of understanding both the features and the developmental events that result in leaf mosaics. In this study we observed the influence of petiole length in forming leaf mosaics. We found that petiole length varies with the position of the leaf along the branch in ways that reduce the amount of shading that leaves are exposed to. We noted two trends. One was that petiole length is longer in leaves further from the stem apex. Part of this was associated with a general trend of larger leaves in positions further from the tip but the ratio of petiole length to lamina length also increased in leaves further from the stem apex. A second trend we observed was that when pairs of leaves were oriented with one member of the pair above the branch and one member below, the leaf below the branch consistently had a longer petiole than that of the leaf above, reducing the shading by the leaf above. In contrast, when pairs of leaves were oriented "side-by-side" petiole lengths of each member of the pair were comparable. Possible developmental processes that might account for these patterns will be presented.

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DISTRIBUTION, SPREAD, AND SOIL ECOLOGY OF THREE WEEDS IN THE HEMPSTEAD PLAINS

The appearance of the Hempstead Plains, a remnant tall-grass prairie community surrounded by an urban landscape in Uniondale, NY, has been dramatically altered by multiple non-native plant invasions. Invasions may have especially strong effects on these native ecosystems. We evaluated some of the ecological impacts of non-native plants on a 1.72 ha portion of the Hempstead Plains. We found that the density of common mugwort (*Artemisia vulgaris*) increased overall over a four-year time interval, while the density of Himalayan bushclover (*Lespedeza cuneata*) was unchanged. The several paths and an old road present in the Plains do not appear to be routes for dispersal by *A. vulgaris*. However, *L. cuneata* and cypress spurge (*Euphorbia cyparissias*) were clumped along the path. All three species were present in higher densities along the north and south borders. Our greenhouse experiments revealed that these species can cause significant increases in pH in Plains soil, which may alter the abundance of essential chemical forms of soil nutrients and thereby decrease the ability of native plant species to compete. We emphasize the importance of expanding weed control to include areas surrounding fragments of rare open ecosystems such as the Plains, and of finding ways to clear paths that do not enhance weed dispersal. Weed control must be intensified if the rare native species remaining in the Hempstead Plains are to persist.

***Butler**, Jillian M. (Audubon New York, c/o Cornell Lab of Ornithology, Ithaca, New York 14850)*

ACHIEVING BIRD CONSERVATION AT NEW YORK'S IMPORTANT BIRD AREAS

In the mid-1980s, BirdLife International launched the first Important Bird Area (IBA) Program in Europe. Since then, programs have been established in the Middle East, Africa, and the Americas. In 1996, the National Audubon Society, the official IBA partner of BirdLife International, initiated an IBA program in New York State. The mission of Audubon New York's Important Bird Area Program (IBA) is to identify a network of sites that are essential for sustaining naturally occurring populations of bird species, and to protect or manage those sites for the long-term conservation of birds, other wildlife, and their habitats. In 1997, 127 IBAs were identified across New York State that vary in size, ownership, and habitat. Audubon New York is currently working towards the protection of IBAs by implementing a broad program based on advocacy, conservation planning, research and monitoring, and education and outreach. Examples of conservation successes include the passage of state legislation establishing a state bird conservation area program, partnering with towns and land trusts to identify critical habitats, supporting the purchase of land and easements, assisting land managers with technical information for bird and habitat conservation, and implementing volunteer monitoring programs. In addition to continuing our conservation efforts, the program will begin a second round of nominations at the end 2002.

***Byer**, Andrew, Justin **Cobis**, D.J. **Dean**, Era **Fuchik**, Kristen **Savage**, Richard **Shore**, Kimberly **Skinner**, and Eric **Lamont** (Riverhead High School, Department of Biology, Riverhead, NY 11901)*

RESTORATION AND MANAGEMENT OF FRESHWATER WETLAND HABITAT FOR ORCHIDS ON LONG ISLAND, NEW YORK

At the beginning of the 20th century, populations of the white-fringed orchid (*Platanthera blephariglottis*) were known to occur at 33 localities on Long Island, New York, based upon herbarium collections. By 1990, the number of known populations had decreased to 16 and several of those were being threatened with extirpation. One such threatened population occurred at Quogue Wildlife Refuge (QWR), in Suffolk County. During the 1980s, dozens of white-fringed orchids could be observed flowering in late July and early August in a small freshwater wetland at QWR. During the early 1990s, woody vegetation from the surrounding pitch pine-oak forest colonized the small wetland, shading out the orchids and drying up the wetland. In 1996, only six individual orchids produced flowering stems. It was feared that Long Island would lose yet another population of white-fringed orchid. In 1997, a group of students from Riverhead High School worked with members of QWR and NYSDEC to develop and implement a long-term restoration and management plan to remove woody vegetation from the wetland and re-establish habitat favoring the orchids. After implementing the plan during February 1997, the orchid population was monitored during the following years. During the summer of 2001, 88 orchids produced flowering stems; but as expected, woody vegetation was once again colonizing the open wetland. During the winter of 2002, the second phase of the management plan was implemented by once again selectively removing woody plants from the open wetland.

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CHANGES IN FISH SPECIES INHABITING FOUR ALLEGHENY STREAMS OVER 75 YEARS: RECOVERY?

Fish sampling in four Allegheny streams over 75 years showed an apparent loss of a few species, but also showed large gains in the number of native fish species. These gains, or the number of "native" species occurring after the 1960s as a percentage of those before 1937,were greatest for the Olean/Ischua Creek, Allegheny River and Conewango/West Conewango Creek), ranging from 126-150%. The fourth stream, French Creek, had a gain to only 104%, and this was cancelled-out by a loss of 7%. This study utilized collection records by several groups in four of the larger streams of the area to show changes in species richness. An additional level of habitat analysis with GIS previously compared patterns of land use to predict fish biodiversity. Those studies predicted the highest degradation to be in the western-most, French Creek. The earliest fish catches, in 1937, were probably reduced because they occurred when water quality was severely degraded near municipalities or industries. The subsequent improvements in water quality were greatest for the Allegheny River, and the species richness increased to 142%. Fish species accounting for these gains or recolonizations included mountain brook lamprey *Ichthyomyzon greeleyi*, grass pickerel *Esox americanus vermiculatus*, golden shiner *Notemigonus crysoleucus*, spotfin shiner *Cyprinella spiloptera*, quillback *Carpiodes cyprinus*, black redhorse *Moxostoma duquesnei*, yellow perch *Perca flavacens* and longhead darter *Percina macrocephala*. Smaller losses to species ranges were also important and were most severe for gilt darter *Percina evides*, tonguetied minnow *Exoglossum laurae* and bigeye chub *Notropis amblops*.

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Preliminary Analysis of Habitat Selection of a Declining Population of Canada Warblers in the Northern Forest of Vermont

The Canada Warbler, *Wilsonia canadensis*, is a long distance Neotropical migrant that breeds in northeastern United States. This is a Partner's-in-Flight listed "priority bird population" because of the steady declines detected by road-side surveys of the USGS Breeding Bird Survey (Sauer et al. 2001, Partners-in-Flight 2001), and the long-term Forest Bird Monitoring Project of the Vermont Institute of Natural Science (VINS; Faccio et al. 1998). In 2001 we measured and analyzed the vegetation at 56 of the VINS long-term monitoring point-count stations. All stations were within large tracts of protected forest stands. Habitats included cedar-fir (n = 5), hemlock (n = 5), northern hardwood (n = 22), oak-hickory (n = 10), red maple swamp (n = 4), and lowland spruce-fir (n = 10) forests. The 30 vegetation variables measured were analyzed using Bonferroni-adjusted, Wilcoxon two-sample test to determine which aspects of the forest vegetative structure Canada Warblers prefer. We found that Canada Warblers prefer sites with deeper leaf litter, greater total ground cover, greater forb, moss and downed log cover, lower canopy height, and a greater number of large (> 2.5 cm diameter) stems. Logistic regression of these eight factors accurately predicted (chi-sq = 29.8090, df = 8, P = 0.0002) the presence of Canada Warblers on 84% of the long-term stations, which was a good fit with the expected (chi-sq = 1.473, df = 1, P > 0.05). These vegetative components are useful indices predicting the occurrence of this sensitive species in the forests of Vermont.

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The Malacological Contributions of John C. Jay and His Impact on the Early Expansion of the American Museum of Natural History, New York

John Clarkson Jay was born in Rye, New York, in 1808; one of a long line of influential family members throughout United States history including New York assemblyman Peter Augustus Jay and Supreme Court Chief Justice John Jay. Dr. Jay would make his impact in natural history, particularly conchology; the study of shells. Jay was founder of the New York Lyceum of Natural History and an early Trustee of the American Museum of Natural History (AMNH). Jay accumulated over 50,000 specimens comprising 14,000 species of mollusks as well as over 1000 volumes on molluscan natural history costing him over $35,000. Through trade with eminent conchologists (C.B. Adams, J.G. Anthony, F.C. Baker, F. Cailliaud, I. Lea, W. Linsley, T. Prime, and G.B. Sowerby), Jay accumulated several type specimens as well as described 46 new species, most of which have been relocated and documented in the past year. Jay self-published four editions of his collection catalogue from 1835 to 1852 and a listing of the specimens collected by Commodore Mathew C. Perry's U.S. Naval Expedition to Japan in 1852-1854 which opened Japan to the West. Jay's mollusk collection and library were purchased by Catherine L. Wolfe in 1873-4 for $10,000 and donated to the AMNH in 1874 as a memorial to her father, John D. Wolfe, the museum's first president. The library reference collection was the foundation for the AMNH research library. The shell collection was the museum's first major endowed collection and was exhibited in its entirety from 1874 to 1911.

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The Laboratory for Conservation and Evolutionary Genetics: A BRI Funded Research Facility

Funding from the New York State Biodiversity Research Institute (BRI) has made possible a new multi-user molecular research facility at the New York State Museum. This facility, named the Laboratory for Conservation and Evolutionary Genetics (LCEG), makes available to Museum scientists the tools and techniques of modern DNA research, including nucleic acid extraction and purification from tissue samples, polymerase chain reaction (PCR) techniques for the amplification and cloning of target molecular markers, electrophoretic techniques for separating DNA fragments based on molecular weight, and digital photographic documentation of electrophoretic results. Current research being conducted in the LCEG deals with molecular phylogenetic investigations of various phytophagous insect families of worldwide agricultural importance. However, we envision future usage of the facility to extend to a broad range of taxonomic groups.

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BENTHIC ECOLOGY AND CHEMISTRY OF THE COXING KILL AND TRIBUTARY IN THE SHAWANGUNK MOUNTAINS

The Coxing Kill (CK) drains oligotrophic Lake Minnewaska, over quartzite Shawangunk conglomerate, through hemlock-northern hardwood forest. Thus, the stream is acidic and mildly buffered. Fountain Brook (FB) is tributary to the CK, flowing through exposures of Martinsburg shale, which provides alkalinity. The streams were compared for riffle invertebrate communities (Surber samples) and leaf decomposition (3 weeks in mesh bags). Stream chemistry was measured over time and length for both streams. At the time and place of Surber sampling, CK pH=4.86 and alkalinity=11mg/L and FB pH=5.13 and alkalinity=15mg/L. FB briefly raised the pH of the CK, but the effect was quickly diluted as the stream became more acidic. [Aluminum] and [manganese] increased along the length of the CK, corresponding to increased [hydronium]; [cadmium] decreased. In Nov. 2001 pH ranged from 7.46 at the confluence to 4.19 at a downstream site; Dec. values were 5.2–5.5. FB Nov. pH values were 6.78–8.28. Comparison between the CK and FB included mean invertebrate density 130 vs. 105/m^2 and family richness 18 vs. 14. Trichoptera were more abundant in CK, and Hydropsychidae was the most abundant family of all taxa in both streams. Decomposition was more rapid in FB than in CK for both red maple (*Acer rubrum*) and white oak (*Quercus alba*). The lower density and diversity of invertebrates in the more alkaline stream (FB) is contrary to previous findings and may be due to hydrologic conditions, since FB is also the smaller stream.

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CORRELATING CONDUCTIVITY, THE STREAM CONTINUUM, AND LONGITUDINAL PROFILE WITH POLLUTION INPUTS

As an approximate predictor of total dissolved ions, a longitudinal conductivity survey can serve as a quick and easy tool in detecting point/non point source water pollution origins. Nutrient inputs contribute additional ions above that of what is encountered naturally along the stream continuum and the longitudinal profile. Utilizing this premise, conductivity readings in Callicoon Creek, located in western Sullivan County NY, characterized a natural downstream accumulation of ions relative to increased drainage basin area and seasonal flows. However, the elevated conductivity readings of pollution impaired tributaries were easily detected against the longitudinal conductivity profile of the Callicoon Creek main stem. Elevated nutrients in sediments, macrophyte plant tissue, and stream water, corroborated the use of abnormally high conductivity readings as indicators of pollution impaired tributaries.

***Frank**, Jennifer A. (University at Albany, State University of New York, Department of Biological Sciences, Albany, NY 12222)*

THE EFFECT OF FOREST FLOOR COMMUNITY STRUCTURE ON LITTER INVERTEBRATE ABUNDANCE AND DIVERSITY

A study of the forest floor community in temporal deciduous forests was initiated in the spring of 1997. The research focuses on the relationship between salamanders, earthworms, litter invertebrates, and litter decomposition. Better understanding of the structure and function of detritus based food webs becomes increasingly important as species such as earthworms are introduced and others such as amphibians experience population declines. These alterations to the structure of the community could alter litter decomposition rates and therefore the amount of carbon held on the forest floor rather than being released into the atmosphere. Field enclosures were established at the E. N. Huyck Preserve in Rensselaerville, NY. A 2×2 factorial design was used with two levels of spotted salamander (*Ambystoma maculatum*), none and three, and two levels of earthworms, reduced and natural. A total of 16 enclosures were established with four for each of the four treatments. Invertebrates were sampled in the spring and fall from fall 1998 to fall 2000. Invertebrates were removed from approximately 500 g (wet weight) litter samples over 24 hours in the laboratory using invertebrate extractor devices. Invertebrates greater than .5mm were classified by taxonomic group. A total of 22 taxa were identified. Seven taxa had significant seasonal variation. Despite what appears to be similar habitat, there is significant site variation for 6 taxa. Preliminary analysis suggests that treatment effects were not statistically significant for most taxa. However, Lepidoptera larvae varied significantly between sites with and without salamanders.

***Gapp**, David A., Katie **Lee**, Sarah **McNeil**, Angela **Pagano**, and Hannah **Stahle** (Hamilton College, Biology Department, Clinton, NY 13323)*

Snapping Turtle Nest Destruction by Another Snapper

On June 7, 2001, a female *Chelydra serpentina* was observed nesting at the edge of a gravel road in Utica Marsh, an urban wetland next to the Mohawk River and lying partially within the city limits of Utica, New York. The nest site was 53 meters from the water on a direct line and within an approximate 30 x 60 m cleared area with the gravel road running along one margin. Several damaged snapper eggs from a prior nest in the soil being dug up by the female, and with continued digging, additional eggs surfaced. Palpation of the pelvic region of the nesting female indicated a full load of shelled eggs ready for oviposition. Nesting was completed within an hour, and numerous additional broken eggs were present around the site with three undamaged eggs remaining from the previous nest of an estimated 15–20 eggs. Palpation indicated that no eggs remained in the nesting female, and 23 eggs were recovered from the new nest. While snapper nest predation by other species is well established, it remains puzzling as to what mechanism other than chance led to this observed nest destruction by *Chelydra* in a low-density nesting area containing only 6 nest sites within this 1800 m^2 nesting area. Difference in soil structure does not appear to be a factor nor does relative openness of each nest site in the area. One could speculate whether olfactory cues may have contributed to selecting the first nest as the site to excavate.

***Gardner**, Geoffrey C. (University of Albany, Department of Biological Sciences, Albany, NY 12222)*

The Role of Density Dependence in Population Dynamics of the Beech Scale Insect (*Cryptococcus fagisuga*)

Pathogens and invasive pests are important mediators of ecological communities. The bark disease of American Beech (*Fagus grandifolia*) is an example of a disease invasion that has had a major impact on forest composition throughout New England in the past 50 years. The combined infestation of the European beech scale insect *Cryptococcus fagisuga* and the subsequent invasion of fungi (*Nectria* spp.), often kill more than 50% of beech trees greater than 10 inches in diameter in a forest stand. Because the insect scale must precede the fungus, it is the key component of disease spread. Despite this, there is very little work done in North America on its demography. I have examined the life cycle and population dynamics of the scale insect on beech populations in continuous forest inventory plots within the Edmund Niles Huyck Preserve. Results indicate that density of host infestation has no measurable affect on scale fecundity or dispersal behavior and that quality of host resources may play a large role in determining the level of scale insect infestation for the American beech. Growth rate, measured as the increase in density of scale colonies, indicate that (barring a massive genetic shift in beech populations) the disease will continue to strongly affect forests in Eastern NY, as clonal sprouts reach susceptible size.

***Giambanco**, Maria R. (Hofstra University, Dept. of Biology, Hempstead, NY 11549)*

The Use of Morphological Measurements to Identify Sex in Hatchling and Juvenile Diamondback Terrapins

Identifying sex in hatchling and juvenile diamondback terrapins is challenging since they have no distinct external sex characteristics. In the past the only ways to consistently sex these animals accurately was to either sacrifice the animal or perform laproscopic surgery. As part of a two year nest predation study at the Jamaica Bay Wildlife Refuge (part of the Gateway National Recreation Area), eggs were collected from nests and incubated in the laboratory at temperatures ranging from 26 degrees C to 34 degrees C. Hatchlings were raised in the laboratory and morphological measurements were made prior to performing laprocopic surgery and dissections to determine the sex of the turtle. Preliminary results suggest significant differences in certain morphological measurements which will allow for the non-lethal sexing of these turtles in the field. Using morphological measurements to determine sex in hatchling turtles may be extremely useful when dealing with situations or species in which it is impractical or inappropriate to use other sexing techniques.

***Guard**, Conan B., and Bruce A. **Gilman** (Finger Lakes Community College, Department of Environmental Conservation, Canandaigua, NY 14424)*

Organisms of the Honeoye Valley, New York

The Honeoye Valley consists of Honeoye Lake and its watershed, including the large inlet wetland complex that is home to the Muller Conservation Field Station of Finger Lakes Community College. Significant parcels of land within the Honeoye Valley have been protected by conservation organizations, creating a unique opportunity for the study and management of natural resources by college students. This poster presents our initial inventory of organisms that have been identified by scientists conducting ecological research in the Honeoye Valley during the last three decades. The checklists are relatively complete for amphibians, reptiles, birds, fish, mammals and vascular plants. The checklists for phytoplankton, zooplankton, molluscs, insects and nonvascular plants are preliminary. All species groups are deserving of further fieldwork and additions are expected to each list. Field research during the summer of 2002 will provide descriptions of natural communities with accompanying GIS maps overlain on recent digital images of the watershed.

***Halliwell**, David B. (Maine Department of Environmental Protection, Lakes Section, Augusta, ME 04333)*

Day-vs. Night-time Beach Seining in Down East Maine Lakes

Fish assemblages in three lakes located in Hancock County were sampled as part of the Eagle Hill Natural History Seminar Series hosted by the Humboldt Field Research Institute in Steuben, Maine. Two coldwater (Spring River Lake and Donnell Pond) and a warmwater (Molasses Pond) lake were sampled both diurnally and nocturnally during June 11–14, 2001. A 50-foot beach seine was deployed several times by an experienced sampling team in the same area during day- and night-time periods. Night-time beach seining captured a greater diversity of fishes, particularly in the warmwater Molasses Pond. Common shiner and fallfish were abundant in the coldwater lakes regardless of time of day, and were only rarely sampled in the warmwater lake. Redbreast sunfish, commonly found during both day and night-time beach seining in the coldwater lakes, were only captured seining after dark in warm-water Molasses Pond. Explanatory variables for species captured only during night-time seining (Spring River Lake—threespine stickleback and American eel, Donnell Pond—white sucker and yellow perch, and Molasses Pond—white sucker, yellow perch, and white perch) include differences in lake trophic states and variation in the relative intensity of recreational day use of sampled beaches. Warmwater Molasses Pond had heavy use during the days preceding sampling dates, while coldwater Spring River Lake experienced only moderate use, and the remotely located coldwater Donnell Pond had little, if any, observed human disturbances.

***Harrison**, James P. (Rensselaer Polytechnic Institute, Department of Biology, and Darrin Fresh Water Institute, Troy, NY 12180), and Charles W. **Boylen** (Rensselaer Polytechnic Institute, Department of Biology, and Darrin Fresh Water Institute, Troy, NY 12180)*

Seasonal Variations in Pelagic Fish Sighting Patterns with Respect to Increasing Anoxia

The completion of an annual hydroacoustic sightings profile, in conjunction with dissolved oxygen (DO) and temperature assessments accrued across a three-year study, revealed significant changes in diurnal and monthly fish distribution patterns. Ongoing research evaluates the correlation between these variations and changes in relation to increasing anoxic water encroachment, variations in sightings between littoral and pelagic zones, and potential abiotic and biotic influences. Detailed assessment of DO has revealed an annual anoxic water expansion from the benthic interface in spring, to epilimnetic waters by the fall. The variations in sighting patterns reveal strong changes to diurnal patterns with respect to pelagic species, alterations in littoral zone dispersions due to thermal declines in the fall, and potential correlations to the food web dynamics. The dynamics may suggest that these factors, and the influences they impart, necessitate anoxic water incursions by pelagic species.

***Hartel**, Karsten E (Museum of Compartive Zoology, Cambridge, MA 02138), Jon A. **Moore** (Florida Atlantic University, Juniper, FL 33458), James E. **Craddock** (Woods Hole Oceanographic Institution, Woods Hole, MA 02543), and John K. **Galbraith** (National Marine Fisheries Service, Woods Hole, MA 025543)*

Deep-water Fishes from off New England, with New Records for the Area

We have produced the first authoritative, annotated list of almost 600 species deep-sea fishes found below 200 meters from Cape Hatteras to the Scotian slope. The list is based on literature and many thousands of specimens in the Museum of Comparative Zoology, the Yale Peabody Museum, and the US National Museum. Recent deep-water fishing off the northeastern United States requires an understanding of the species distribution and necessitates this list. This deep fauna is often overlooked but must be incorporated as part of regional biodiversity analysis. Of the 600 odd species, we have determined that about 110 species represent at least a moderate range extension. Of those, 85 species are completely new regional distribution records and are a 14% increase in the number of species known in the area. The majority of new records are of species more typically found to the south. This highlights the strong influence of the Gulf Stream in transporting deepwater taxa northward. Many of individuals probably represent expatriates from reproducing populations to the south, yet the infrequent but regular collection of many of these species indicates that they represent a semipermanent component of the deepwater fauna off New England. A smaller portion of the range extensions shows new occurrences of more typically boreal species in the area which indicate the influence of the Deep Western Boundary Current, which brings colder water from the Labrador Sea southward along the continental slope.

***Hunsinger**, Kimberley Corwin (Cornell University, Department of Natural Resources, Ithaca, NY 14853), and John W. **Ozard** (New York State Department of Environmental Conservation, Fish and Wildlife Services, Albany, NY 12233-4754)*

New York State Breeding Bird Atlas Preliminary Results

New York State is currently conducting its second Breeding Bird Atlas project. In the first two field seasons of the project (2000 and 2001), 785 volunteer birders submitted records for over 2,900 of the 5,334 survey blocks. There are 160,827 breeding records in the database representing 245 species. New York State's first Atlas project, published as "The Atlas of Breeding Birds in New York State" (Andrle and Carroll 1988), provided valuable data on the distribution of breeding birds in the form of maps. Visual interpretations of maps derived from two field seasons of data from the current project, and the maps produced from the first Atlas suggest expansion in the distributions of some species, including Red-bellied Woodpecker, Canada Goose, Wild Turkey, Merlin, Bald Eagle, Peregrine Falcon, and Common Raven. Other species may disappear from some areas of the state. However, these changes cannot be confirmed until the project is completed. We will continue to watch as the distribution maps develop over the final three years of the project.

***Jordan**, Marilyn J. (The Nature Conservancy, Cold Spring Harbor, NY 11724), Bruce **Lund** (The Nature Conservancy, Moapa, NV 89025), and William A. **Jacobs** (The Nature Conservancy, Cold Spring Harbor, NY 11724)*

Effects of Mowing, Herbicide and Fire on *Artemesia vulgaris*, *Lespedeza cuneata* and *Euphoria Cyparissias*

The Hempstead Plains is a tall grassland community in Nassau County, Long Island, NY that once covered > 40,000 acres but has been almost entirely lost to urban development. Invasive, non-native plant species common near the disturbed periphery of a 19 acre grassland remnant include *Artemesia vulgaris* (mugwort), *Lespedeza cuneata* (Chinese lespedeza) and *Euphorbia cyparissias* (cypress spurge). Eighteen 10 m x 10 m experimental plots were established in 1991–1992 in areas of dense mugwort or lespedeza. Treatments included mowing once, twice or three times annually for three successive years; one herbicide application (Roundup at 0.10 oz/m^2) in 1992, 1993 or both years; one or two prescribed burns (spring or fall) in 1991–1995; or a combination of herbicide and burning. Ocular estimates of cover of every plant species were made in 1992–1995 and 2001. Results were assessed graphically. Mugwort, a clump-forming rhizomatous perennial, was nearly eliminated by either repeated mowing or herbicide application for 2–3 years, with little regrowth. Mugwort was not affected by dormant-season burning. Chinese lespedeza was not controlled by repeated mowing; effects of fire were variable. Although nearly eliminated by one herbicide application, lespedeza regrew (probably from the seed bank) and approached pre-treatment abundance within 2–6 years. Low-growing cypress spurge was not controlled by mowing, herbicide or fire and greatly increased in cover and extent, perhaps facilitated by removal of taller competitors. Invasive plant control methods and timing should be appropriate for target growth form, reproductive attributes, and competitive ability. Long term monitoring and follow-up are essential.

***Karrmann**, David E. (American Museum of Natural History, Education Department, New York, NY 10024-5192), Esmeralda **Cordero** (AMNH Intern, Louis D. Brandeis High School, New York, NY 10024), and Jill **Javier** (AMNH Intern, Fiorello H. LaGuardia High School of Performing Arts, New York, NY 10023)*

A Proposed Long-term Assessment of a Scattered *Chrysemys picta picta* Population

Black Rock Forest nature preserve (Orange County, NY, USA) provides a well-protected ecological community for study. The 3700 acres of the forest encompass 7 ponds separated by 200–800 meters. Watercourses providing obvious routes for testudinal translocation connect some, though this generally significantly increases linear travel distance ($\leq$ 1200 meters). In other cases significant ridgelines requiring total vertical displacement of $\leq$ 400 meters need to be traversed. Previous samplings of each pond have confirmed the presence of established populations of *Chrysemys picta picta* (Eastern Painted Turtle), and *Chelydra* s. *serpentina* (Common Snapping Turtle). Recorded population densities vary from over 80 confirmed individuals (C. p. p.) per pond, to less than a dozen. The only other aquatic turtle confirmed in the forest are two introduced specimens of *Chrysemys scripta elegans* (Red-eared Slider). An extended (3–5 year) program of mark-recapture (using a variety of capture methods—basking traps, feeding traps, dip netting), PIT tagging, and extensive data recording is planned, with the purpose of establishing a thorough census (including sex distribution, approximate ages, and growth data) of each pond (sub-population) and the overall forest population and distribution. It is expected that a rigorous mark-recapture program conducted until no new individuals are collected will lead to significantly more accurate estimates of actual population than traditionally employed statistical models based on random sampling. Comparison of capture records should assist mapping of gene flow between sub-populations by indicating movement of individuals from one pond to another.

***Kenaley,** Christopher P. (Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138), and Courtney M. **Peck** (Tufts University School of Veterinary Medicine, North Grafton, MA 01536)*

Domestic Cat Predation at the Interface of *Spartina* Saltmarsh, Hardwood Forest, and a Domestic Abode

Domestic cat predation (*Felis catus*) has long been recognized as an immediate threat to suburban and rural faunal assemblages. The hunting behavior of a pair of free-roaming, owned cats (FROCs) was observed intermittently over a span of 30 months (April 1999–October 2001). We recorded a total of 26 species taken. Other than vertebrates associated with domestic seed feeders, representatives of *Spartina* saltmarsh and hardwood forest communities were also taken. These include insectivorous passerine birds, rodents of the families Muridae and Sciuridae, voles, moles, and lagomorphs. This array of species indicates that these FROCs hunt beyond the feeders and lawns of the study area and into *Spartina* and hardwood habitats. This may legitimately threaten species of concern (i.e. *Ammodramus* sparrow, *Silvagus transitorius*). It is clear these FROCs, and many others may pose a legitimate threat to fragile vertebrate assemblages that abut suburban areas. To most affectively mitigate this threat, cat owners should confine their domestic cats to their homes. However, given the nature of both cats and owners, domestic confinement might prove impossible. In lieu of confinement, we recommend the following: strategic placement of feeders that discourage cat predation (i.e. feeders hung from structures inaccessible to cats); spay and neuter programs to address FROC overpopulation; placing on cats at an early age break-away collars equipped with a bell or some other obnoxious device. These measures would drastically reduce the risk to native vertebrate fauna.

***Lauro**, Brook (St. Johns University, Department of Computer Science, Mathematics and Science, Jamaica, NY 11439), and John **Tanacredi** (National Parks Service, Gateway National Recreation Area, Division of Natural Resources, Staten Island, NY 10305)*

Habitat Use of Nesting Crows at the Rockaway Peninsula, New York

This study examines habitat use for Fish Crows (*Corvus ossifragus*) and American Crows (*Corvus brachyrhynchos*) nesting in the vicinity of waterbird breeding locations at the Rockaway Peninsula, New York City, New York. Fish Crows nested more frequently at coastal dune habitat and salt marsh islands compared to American Crows who nested more frequently at residential/recreational locations. When the two species were compared for distance to potential foraging areas it was found that Fish Crows nested closer to the waters edge and to waterbird colonies while American Crows nested closer to a garbage source and to lawn. American Crows preferred to nest in non-native species of evergreen trees, especially Japanese Black Pine (*Pinus thunbergii*) planted at residential locations and a National Park. Fish Crows showed a preference for native species that were mainly deciduous. We conclude that Fish Crows, given their choice of general habitats, are probably a more serious predatory threat to waterbirds at this study site. Furthermore, locations where predatory threats to waterbirds are likely to be greatest are at edge locations where residential/recreational and natural habitats meet since both species nest and defend territories here.

Lawlor, *Frances M. (Swallow-wort Management Steward, CWNY Chapter, The Nature Conservancy, Pulaski, NY 13142), and Antonio* ***DiTommaso*** *(Cornell University, Department. of Crop and Soil Sciences, Ithaca, NY 14853)*

IMPACT AND MANAGEMENT OF THE INVASIVE PLANT *VINCETOXICUM ROSSICUM* (SWALLOW-WORT)

In recent decades, *Cynanchum rossicum* (swallow-wort) (Asclepiadaceae), a twining herbaceous perennial vine, has become increasingly invasive in central New York State and the Great Lakes basin. Native to central Europe, it has been present in eastern North America since at least 1889. Population increases are problematic in limestone-derived soils of the Lower Great Lakes basin. Spread is by polyembryonic, wind borne seeds. Capable of forming dense monospecific stands in full sun, in shrubby areas and in the understory of successional woodlands, swallow-wort out competes other successional plants to the detriment of native flora. Once established, it can move into less disturbed natural areas. Plants can establish on soils from drought stressed soils over bedrock to deeper, well-drained soils. Direct threats by this invasive species include the globally rare alvar communities in Jefferson County, oak openings in Monroe County, and rare species such as hart's tongue fern, *Phyllitis scolopendrium*, in Onondaga County. Perennial crops, tree plantations, pastures and no-till cropping systems are also susceptible to invasion. Preliminary studies have shown that the monarch butterfly, *Danaus plexippus*, will lay eggs on C. *rossicum* and its invasive congener, C. *nigrum*, but the larvae do not survive. Mechanical control of this plant is difficult due to perennating buds on the root crown. The use of herbicides has provided variable results with repeated applications over multiple years typically required for satisfactory control. Current research focuses on the population biology of the species as well as biological control options available.

Lindberg*, Allan J. (Nassau County Department of Recreation, Parks and Support Services, Division of Museum Services, Muttontown Preserve, East Norwich, NY 11732), Lois* ***Lindberg*** *(Nassau County Department of Recreation, Parks and Support Services, Division of Museum Services, Sands Point Preserve, Port Washington, NY 11050), and Alvin R.* ***Breisch*** *(New York State Department of Environmental Conservation, Endangered Species Unit, Albany, NY 12233-4754)*

THE TIMBER RATTLESNAKE—100 YEARS OF DECLINE IN TWO WESTERN CATSKILL COUNTIES

Until recently, comprehensive efforts to map species distribution have been primarily limited to species with greater economic or recreational value (e.g., game species and birds). Documenting historic range of many other species has been limited to select groups (e.g., salamanders), which makes comparison between current and historic ranges difficult, if not impossible. For many areas, museum specimens or published accounts do not exist or are so limited as to make a comparison not statistically valid. However, in the case of highly identifiable species such as the Timber Rattlesnake, Crotalus horridus, newspaper archives may be a suitable alternative to augment museum collections and notes. In this study, a historic range for C. horridus in Delaware and Sullivan Counties in New York State was developed from species accounts in the archives of The Walton Reporter, a Catskill regional newspaper, for the period 1890 to 1910. During this two-decade period we found 189 reports of encounters with timber rattlesnakes. In many cases, size, number of rattles, and even color phase was reported, adding to the validity of the reports. This historic range was then compared to the range for the two counties developed from the 1990 to 1999 New York State Amphibian and Reptile Atlas Project. This comparison clearly shows a more significant decline in range over the past 100 years than was previously documented. This study may also lead to the discovery of relict populations that have remained undetected during the last several decades.

Lutz*, Colleen M., David L.* ***Strayer****, Heather M.* ***Malcom****, and William* ***Shaw*** *(Institute of Ecosystem Studies, Millbrook, NY 12545)*

MACROINVERTEBRATES ASSOCIATED WITH AQUATIC PLANTS IN THE TIDAL HUDSON RIVER

Aquatic vegetation is an important part of river ecosystems, as a primary producer and as habitat for fish and invertebrates. We assessed the benthic and plant dwelling invertebrate communities associated with two species of aquatic plants, *Vallisneria americana* and *Trapa natans*, in the Hudson River outside of Tivoli South Bay, NY. We used sediment cores and a Downing sampler to collect benthic and phytofauna (plant-dwelling animals). The most common invertebrates were oligochaetes, chironomids, Sida (Cladocera), and Hydra (Cnidaria). T. *natans* had overall higher average densities of invertebrates than V. *americana*, and both kinds of vegetation supported much denser invertebrate populations than nearby unvegetated sediments.

***Madewell**, Shirley, Sarah E. **Hazzard**, and Gary S. **Kleppel** (Department of Biological Sciences, University at Albany, SUNY, Albany, NY 12222)*

WETLAND INTEGRITY AND URBAN SCALING IN THE HUDSON RIVER VALLEY

Urban development, particularly low-density, consumptive expansion outside cities, is a major contributor to the degradation of wetland ecosystems, that continues despite efforts at protection, and recognition of the valuable ecological services that wetlands provide. Since it is highly unlikely that development will cease in the Hudson Valley, we ask whether all types of development are equally damaging. That is, how do the distributions of people and infrastructure on the landscape affect wetland ecosystem integrity? This on-going study, which began in April 2001, involves a comparison between wetlands that drain rural landscapes, traditional small towns and suburban subdivisions. These communities are similar in population size but vary in population and structural distributions. We are comparing above ground primary production ($1m^2$ quadrats), macrophyte community composition, occurrence of invasive plant species, plankton community structure and function, and standard water quality parameters. We are also investigating the possibility that different "urban scales" are associated with different frequencies of sub-lethal mutagenesis among vertebrates. Wetlands that drain suburban watersheds exhibit higher conductivities, turbidity and levels of achloritic suspended solids than those that drain rural and traditional urban sites. They have fewer macrophyte species and higher proportions of invasives.

***Malcolm**, Glenna M. (Union College, Department of Biology, Schenectady, NY 12308)*

INVASIVE SPECIES TRANSFORM SOIL AND ALTER GROWTH AND COMPETITION OF NATIVE GRASSES

In pitch pine (*Pinus rigida*) scrub oak (*Quercus prinoides*, Q. *ilicifolia*) barrens communities, non-native, nitrogen-fixing black locust (*Robinia pseudoacacia*) trees increase soil nitrogen availability. Native plant communities that are restored on previously invaded sites are presented with a different soil environment that may influence plant growth and community dynamics. Plant growth and competition studies under controlled greenhouse conditions were conducted using two native grass species (Indian grass, *Sorghastrum nutans* and Big bluestem, *Andropogon gerardii*) grown in soils from pine-oak and black locust stands, and from a site where black locust was removed. Soils from within black locust stands had increased levels of nitrogen availability (NH_4^+, NO_3^-) which were assessed using a laboratory soil incubation technique. In addition, relative growth rates in both native grasses were enhanced in black locust soil and reduced in soils treated with oak mulch. Grasses grown in soil from pine-oak and locust harvest sites had similar relative growth rates. Thus, black locust has the potential to indirectly affect native plant communities that are restored on previously invaded sites. However, management strategies that reduce nitrogen availability may ameliorate this problem.

***McLean,** Meredith L. (Colgate University, Biology Department, Undergraduate Student, Hamilton, NY 13346), Timothy S. **McCay** (Colgate University, Biology Department, Assistant Professor of Biology, Hamilton, NY 13346), and Matthew J. **Lovallo** (Pennsylvania Game Commission, Bureau of Wildlife Management, Wildlife Biologist, Harrisburg, PA 17110-9797)*

DIET OF THE BOBCAT (*LYNX RUFUS*) IN PENNSYLVANIA

Diet of the bobcat in the mid-Atlantic region of the United States, and Pennsylvania in particular, is poorly known. Age, sex and time of year are thought to influence bobcat prey selection, but accounts vary. We studied the contents of 68 bobcat stomachs taken from Pennsylvania and identified prey items using macroscopic references and microscopic hair identification techniques. White-tailed deer (*Odocoileus virginianus*) and cottontail rabbit (*Sylvilagus floridanus*) occurred most frequently as prey. A larger percentage of male bobcats consumed deer (64%) than did females (31%); however, females consumed more cottontails (14%) than did males (7%). The variety of prey items appeared to increase with age, presumably due to an increase in predatory proficiency. Prey variety also seemed larger in the fall than in the winter. Winter weather reduces the availability of certain prey items (e.g. chipmunks) and may decrease the bobcat's ability to travel and hunt effectively.

***Mickelson**, John G. Jr. (CIESIN, Columbia University, Lamont Doherty Earth Observatory, Palisades, NY 10964)*

A Fisheries and Aquatic Resources (FAR) Portal for the Hudson River Watershed

The National Biological Information Infrastructure (NBII) (http://www.nbii.gov) is a broad, collaborative program sponsored by the United States Geological Survey (USGS) designed to increase access to data and information on the nation's biological resources. The NBII links diverse, high-quality biological databases, information products, and analytical tools and also works on developing new standards, tools, and technologies that make it easier to find, integrate, and apply biological resources information. The Fisheries and Aquatic Resources (FAR) node of the NBII is being developed to provide access to fisheries and aquatic resources information via the Internet. The FAR Node Web Portal features an extensive array of data including fish and bird species, watershed based data, socio-economic information, and essential framework data such as ortho-photography, roads, streams, as well as elevation and topographic data, and the USGS BRD National Fish Strain Registry. The FAR Node is being developed under the direction of the USGS Biological Resources Division (BRD) Northern Appalachian Research Lab (NARL) in Wellsboro, Pennsylvania. The NARL is partnering with Pennsylvania Spatial Data Access (PASDA) as well as the International Association of Fish and Wildlife Agencies (IAFWA) and the Center for International Earth Science Information Network (CIESIN) at Columbia University's Lamont Doherty Earth Observatory. PASDA and CIESIN are working together to develop an integrated and distributed information system to serve the fisheries and aquatic resources community. This poster presents an overview CIESIN's NBII FAR pilot project for the Hudson River watershed, which will include a major focus on invasive species issues.

***Molloy**, Daniel P., and Danielle M. **Crosier** (New York State Museum, Research and Collections, Albany, NY 12230)*

Everything You Wanted To Know about Zebra Mussels and More

Want to know even the most detailed minutiae about one of the most invasive species to cross the Atlantic? Want to get a free CD? This presentation is for you. It will highlight a recently issued CD entitled "Zebra Mussel Information System" (ZMIS) produced by the U.S. Army Corp of Engineers (system development and project funding) and the New York State Museum (scientific content). Using digital images and video in combination with hyperlinked text, the ZMIS CD is designed to allow easy access to a wide variety of information on zebra mussels. ZMIS was designed with a layering of information in order to allow benefit to a wide audience ranging from the general public to research professionals. Major sections include: interactive identification system to freshwater bivalves; monitoring and initial detection techniques; life history, ecology, and biology; management and control; annual distribution maps; environmental and economic impacts; strategies to slow the spread; how to assess a waterbody's risk of invasion; bibliography; information on the bioaccumulation of contaminants; and a list of North American vendors with products or services related to zebra mussel research and control.

***Prezant**, Robert S., Eric J. **Chapman** (Montclair State University, Department of Biology and Molecular Biology, Upper Montclair, NY 07043), and James A. **Beemer** (United States Military Academy, Natural Resources Branch, DHPW, West Point, NY 10996-1592)*

Molluscs of West Point Military Academy Drainages

The molluscs of five drainages on West Point Military Academy property in New York were surveyed. The different areas sampled were variously impacted by training activities on the military base and periodic draw-downs. About 35 species of molluscs were collected, including one very rare and presumed new species of small planorbid gastropod. Only two species of unionids were found (*Elliptio complanata*, *Pyganodon cataracta*). While a typical distribution of size classes for *P. cataracta*, the more abundant unionid, was found in most lakes, Lake Frederick held an unusually large number of smaller cohorts (L = 41–60mm) compared to other sites (L = >61mm). This could reflect the exceptionally abundant and dense population found in Lake Frederick. The hydrobiid *Amnicola limosus* was the most abundant mollusc recovered, commonly found in shallow, weedy areas of ponds and lakes. Shallow, ephemeral ditches held diverse communities that included *Aplexa elongata*, *Gyraulus circumstriatus*, *Pseudosuccinea columella*, *Pisidium casertanum* and *Pisidium rotundatum*. Additionally, two species of freshwater limpet (*Ferrissia walkeri* and *F. fragilis*), previously unreported from West Point, were found sympatrically on twigs in a slow moving elbow of one stream. The Popolopen drainage system held the highest diversity of molluscs in strong correlation with the overall size of this watershed.

***Prusinski**, Melissa A., Jason M. **Drobnack**, Monica M. **Martin**, Sarah J. **Bamberger**, Robert G. **Means** (New York State Department of Health, Arthropod-Borne Disease Program, Albany, NY 12237), and Dennis J. **White** (New York State Department of Health, Arthropod-Borne Disease Program, Albany, NY 12237, and State University at Albany, School of Public Health, Rensselaer, NY 12144)*

Lyme Disease Vector Ecology Habitat Survey of Capital District Mammal Trapping Sites

As part of the vector ecology component of a three-year study, funded by the Centers for Disease Control and Prevention (CDC), we conducted a comprehensive habitat survey at each of 12 ten-acre study sites where small mammals were collected and later tested for the causative agent of Lyme disease (*Borrelia burgdorferi*). *Ixodes scapularis* (Deer tick), the principal vector of B. *burgdorferi* in New York State, is dependant on habitat vegetation to acquire hosts and complete its life cycle. Site vegetation was characterized by forest cover type and associated understory species. Results from the Capital District Region are presented here. We calculated species composition and associated mast for all vegetation strata, overstory size class, average height, species dominance, and understory structure and percent coverage. Understory coverage was lower at our Otsego (27.81%) and Saratoga (18.48%) sites when compared to Albany (73.38%) and Rensselaer (67.52%). Albany was structurally dominated by shrubs and shrub-like trees (74.72%), while Otsego was dominated by wildflowers and other herbaceous species (70.34%). Overstory and understory mast types (represented by individuals or percent coverage by species) varied greatly. Otsego and Saratoga had a balanced selection of mast when compared to Albany and Rensselaer, which were dominated by one type. Ongoing analysis will be conducted to construct an ecological model predicting the degree of habitat suitability for *Ixodes scapularis* and the Lyme disease reservoir, *Peromyscus* sp. Investigation into habitat characteristics will aid researchers to better understand vector-host ecology and its influence on the Lyme disease cycle across New York State.

***Prusinski**, Melissa A., Monica M. **Martin**, Sarah J. **Bamberger**, Jason M. **Drobnack**, Robert G. **Means** (New York State Health Department, Arthropod-Borne Disease Program, Albany, NY 12237), John J. **Howard** (New York State Health Department, Arthropod-Borne Disease Program, Syracuse, NY 13202), JoAnne **Oliver**, Bruce D. **Ingersoll** (New York State Health Department, Arthropod-Borne Disease Program, Cornell University, Ithaca NY 14053), and Dennis J. **White** (New York State Health Department, Arthropod-Borne Disease Program, Albany, NY 12237 and State University at Albany, School of Public Health, Rensselaer, NY 12144)*

Regional *Borrelia burgdorferi* Infection in Small Mammals Across New York State

Small mammals were collected from 12 sites across New York State as part of a three-year vector ecology study funded by the Centers for Disease Control and Prevention (CDC). The purpose was to investigate the presence of, and spatio-temporal trends associated with *Borrelia burgdorferi*, the etiologic agent of Lyme disease, in small mammal populations. Using Kness Snap-E™ (Kness Mfg., Albia, IA) mousetraps, we collected 3,458 mammals from May to November in 1998, 1999, and 2000. Polymerase chain reaction (PCR) techniques were used to determine the presence of B. *burgdorferi* in ear tissue samples. The results have been grouped regionally, illustrating average yearly infection rates found in different geographic areas of New York State. The Mid-Hudson Valley, Capital District, Adirondack, Central, and Western Regions are represented. Small mammal infection rates increased in the Capital District Region (9.9% in 1998, 11.8% in 1999) and Adirondack Region (1.5% in 1998, and 6.2% in 1999), while infection rates for the Mid-Hudson Valley (20.7% in 1998, 12.4% in 1999), Central (7.5% in 1998, 0.2% in 1999), and Western (1.6% in 1998, 0.0% in 1999) regions all decreased during the first two years. Infection rates for all regions except the Capital District decreased in 2000, possibly influenced by the low capture rate experienced during that trapping season. Further research and analysis of site habitat characteristics and Lyme disease infection rates will be conducted in order to construct an ecological model to predict areas of potential geographic risk of human exposure to B. *burgdorferi*.

***Rachlin**, Joseph W., Antonios **Pappantoniou** (Lehman College of CUNY, Department of Biological Sciences, Bronx, New York. 10468), and Barbara E. **Warkentine** (SUNY Maritime College, Science Department, Bronx, NY 10465)*

A Faunal Survey of the Bronx River, New York

Studies of the fish and invertebrate populations of the Bronx River, New York have been ongoing since April 1999. As part of this survey of the fish and invertebrate fauna of the River we identified 20 species of fish and over 20 species of aquatic invertebrates, plus an additional six taxa of planktonic invertebrate larvae. Studies conducted in the Spring and Summer of 2001 focused on the estuarine portion of the River from its demarcation point near the Delancy Dam at the southern end of the Bronx Zoo to its mouth between Hunts and Clason Points. Our preliminary data indicates that this estuarine portion of the Bronx River serves as nursery grounds for several species of fish that are important to the local recreational fishery. There are

also viable populations of Blue Claw Crab, *Callinectes sapidus* that are actively fished by the local residents of the area. Continuing work in the Spring and Summer of 2002 will focus on the population dynamics and trophic interactions of several of these species in an effort to understand the resource partitioning of this estuarine community. The joint NOAA/CPF Partnership Grant for Restoration of the Bronx River is funding these studies.

Richardson, *Jennifer L. (Columbia University, CERC, New York, NY 10027), Justina* ***Ray*** *(University of Toronto, Faculty of Forestry, Toronto, ON, Canada M5S 3B3), Roland* ***Kays*** *(New York State Museum, Research and Collections, Albany, NY 12230), and Matthew* ***Gompper*** *(University of Missouri, Dept. of Fisheries and Wildlife Sciences, Columbia, MO 65211-7240)*

HABITAT REQUIREMENTS FOR FISHERS AND MARTENS IN THE ADIRONDACKS

The natural and anthropogenic history of the Adirondacks has created a mosaic of habitat types with various levels of disturbance and re-growth. This diversity presents an ideal opportunity to examine the habitat requirements and relationships of fishers (*Martes pennanti*) and martens (*Martes americana*), whose abundance and range vary throughout the park. We are addressing these questions with analysis of recent data on animal distribution in comparison with both fine- and broad-scale habitat measures. Stand level variables measured include (but are not limited to), canopy cover, woody debris and tree species diversity; Broad-scale variables include (but are not limited to), logging, roads, and human presence. These results should provide insights into current distributions and projections for the future status of these carnivores as habitats continue to both mature and face new disturbances. Incorporation of these results into management of the parks public and private lands will prove to be an effective tool for maintaining biodiversity in New York State.

Romanski*, Adrienne M. (Columbia University, Dept. of Ecology, Evolution, and Environmental Biology, New York, NY 10027), and James A.* ***Danoff-Burg*** *(Columbia University, Dept. of Ecology, Evolution, and Environmental Biology, New York, NY 10027)*

HUMAN FACILITATION OF INVASIVE EXOTIC SPECIES SPREAD: ANTHROPOPHILY AND ECOLOGICAL DOMINANCE SHIFTS

Human travel and commerce amplifies the spread of exotic species to novel regions. If unchecked by ecological processes, these organisms can threaten local biodiversity. This risk is particularly relevant for island ecosystems, whose organisms are often highly endemic and communities are susceptible to invasion. Such is the case on the Hawaiian Islands, where at least forty-three introduced ant species are currently extant and may ultimately decimate the existing biotic communities. Pitfall traps were used to evaluate the potential association between human-mediated disturbances (cattle grazing, suburban housing developments, and urban areas) and ant distribution. Preliminary analysis indicates that increasing ant abundance and richness reduces local invertebrate richness and abundance. Sites with minimal human disturbance contained the greatest diversity of non-ant invertebrates. If these preliminary trends are supported by our ongoing research, land managers and planners can use these observations to monitor and manage species with invasive potential.

Rubin*, Paul A., and Brian* ***Morgan*** *(State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY, 12484)*

GEOMORPHIC RECONSTRUCTION OF EMERGED AND SUBMERGED COASTLINES USING GIS TECHNOLOGY, MOUNT DESERT ISLAND, ME

Emerged and submerged coastal features (e.g., boulder beaches, sea stacks, drowned deltas) provide unique and important research sites because they faithfully record evidence of past geomorphic conditions on earth. Features associated with wave action along rocky coastlines were mapped on Mount Desert Island, Maine using a GPS unit. Emerged boulder beaches and sea caves reveal a continuum of changing sea and land levels between about 50 and 250 ft msl associated with deglaciation. Isolated emerged coastal features were found at elevations considerably higher than previously reported, thus providing evidence of higher coastal inundation. For example, a granite sea cave at an elevation of approximately 445 feet msl may provide evidence of the maximum glacio-isostatic rebound in Maine following the late-Wisconsinan retreat of the Laurentide Ice Sheet. We hypothesized that an abundance of boulder beaches spanning the 200 to 250 ft. msl elevation interval indicated an extended period when land rebound balanced sea volume increase associated with glacial retreat. Sophisticated GIS technology, coupled with Digital Elevation Model (DEM), aerial, topographic, and bathymetric data, was used to check for significant departures from the expected smooth decrease of land area with each interval of increasing elevation. Such areas could

indicate the presence of wave-cut platforms or benches associated with stillstands. No statistically significant benches were revealed. A series of GIS maps are presented that portray emerged coastal feature locations and reconstruct relict coastlines both below and above that of today. These maps reveal former, now drowned, lakes as well as islands and land bridges that have disappeared.

***Sacks**, Lauren, Kevel **Lindsay**, and James A. **Danoff-Burg** (Columbia University, Department of Ecology, Evolution, and Environmental Biology, New York, NY 10027)*

THE RELATIONSHIP BETWEEN INSECT AND PLANT DIVERSITY IN NEW YORK CITY COMMUNITY GARDENS

Previous research has shown that there is a positive correlation between insect diversity and plant diversity in agricultural and non-agricultural settings. For our research project, we examined whether this hypothesis held true in community gardens in Manhattan and Brooklyn. We chose these boroughs because of the grid-like nature and fragmentation of habitats, which affect movement and distribution of the insects. The community gardens in the city provide an excellent opportunity to test this hypothesis because they vary so much in level of plant diversity, are often close to insect reservoirs such as large parks, and were a manageable size for us in which to conduct our experiment. For our project we were particularly interested in the trophic interaction between plant diversity, herbivores (homoptera), and insect predators such as parasitic wasps (hymenoptera). Parasitic wasps lay their eggs in the bodies of the herbivores, therefore decreasing the amount of herbivores and thus decreasing the amount of plant damage. We hypothesized that as plant diversity increases, both homoptera and the parasitoid diversity will increase, while abundance of both types of insects will decrease.

***Schoch**, Nina (Adirondack Cooperative Loon Program, Ray Brook, NY 12977), David C. **Evers**, Chris **DeSorbo** (BioDiversity Research Institute, Falmouth, ME 04105), and John **Ozard** (New York State Department of Environmental Conservation, Albany, NY 12233)*

THE ADIRONDACK COOPERATIVE LOON PROGRAM—RESULTS OF THE FIRST YEAR

The Adirondack Cooperative Loon Program (ACLP) is a cooperative research and education effort studying the natural history of the Common Loon (*Gavia immer*) and the effects of anthropogenic impacts on Adirondack loon populations in New York State. The ACLP was initiated in the spring of 2001 to expand upon the contaminant research project conducted by BioDiversity Research Institute (BRI) and the Northeast Loon Study WorkGroup in the Adirondack Park from 1998–2000. The work of the ACLP is coordinated with other research projects studying loons and water quality throughout New York State and North America. The ACLP is a partnership of the Wildlife Conservation Society, Natural History Museum of the Adirondacks, NYS Dept. of Environmental Conservation, BioDiversity Research Institute, and Audubon Society of New York, Inc. In 2001, 30 loons, 26 of which were banded, were captured and sampled for contaminant and genetics research. A 75% (42/56) return rate was observed for loons banded in previous years, 93% (39/42) of which were observed with mates. 38% (15/39) of the mated returning birds successfully raised young to fledging. ACLP field staff and volunteers participated in a one-day census and observed 392 loons (327 adults and 65 young) on 131 lakes in NYS, 119 of which were in the Adirondack Park. Education programs and a citizen science website, www.adkscience.org/loons, were developed. Ten Adirondack seventh-grade classes participated in ACLP's "Loon Scientist" program, and over 20 presentations were provided to the public. A lead sinker awareness and exchange program will be initiated in 2002.

***Schultz**, Bertram, and Paul A. **Rubin** (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484), and Peter **Haberland** (Rosendale, NY 12472)*

GIS-BASED HISTORIC INVENTORY OF EARLY CEMENT DISTRICT INDUSTRIAL ARTIFACTS: SOUTHEASTERN NYS

The Rosendale and Kingston district in southeastern NYS, USA was the natural cement capital of the world from 1825 to about 1950. It is important to document the world-class historic value of this major economic industry before significant industrial artifacts are lost. Relict features remaining today include vast mines, kilns used to produce high grade hydraulic cement, and a canal and transportation network. The limestone belt worked by early miners is riddled with abandoned limestone mines. There is no comprehensive inventory of these features. Limestone (i.e., karst) aquifers are particularly vulnerable to contaminant inputs because no natural cleansing occurs. Formerly discrete karst aquifer systems were often integrated when mining operations discordantly cut across them. Today, extensive water-filled portions of these mines, strategically situated near or at the furthest downstream end of Rosendale and Kingston area karst aquifers, represent vast untapped groundwater reservoirs. Consideration of both mine and hydrologic features are important first steps in natural resource protection. Our research strives to document and portray these features via a geographic information system (GIS) data base. Work being

conducted includes a field-based global positioning system inventory of mines, mills, kilns, springs, caves, and karst features. Aerial photography is also being used to locate vertically-bedded mines. Digitized mine maps, a digital photography library, and GIS maps are being produced to graphically depict information and make it accessible to the community. We envision that this information will be useful as a tool to further community planning, to enhance ecotourism, and to protect groundwater resources.

***Sherman**, Elizabeth, Tariq **Allana**, Anna **Kicheva**, and Geremy **Schulick** (Bennington College, Natural Sciences, Bennington, VT 05201)*

Adaptations of Newts to Ponds of Different pH

The red-spotted newt *Notophthalmus viridescens* is widespread in eastern North America and is found in ponds with a wide range of pH. We have been studying two different populations of newts, one from a slightly alkaline pond in the Taconic Mountains with an average pH of 8.1 and the other from an acidic pond in the Green Mountains having an average pH of 4.6. The ponds of the Taconic Mountains are underlain by extensive limestone deposits which tend to buffer them. Ponds in the Green Mountains have a granitic base with little buffering capacity and have been acidified due, in part, to atmospheric acid deposition. Newts exhibit fidelity to their natal ponds and it is likely that different populations of newts have been isolated in ponds of different pH for many generations. This situation presents a compelling natural experiment in which the role of environmental pH in the evolution of newts may be examined. Preliminary data suggest that there are phenotypic differences among newts from ponds of different pH. In the lab, newts tend to select water with a pH comparable to that of their natal pond. They feed better in water having a pH of their natal pond. The percent body water of newts from the low pH pond is unaffected by pH but high pH newts lose body water in low pH. It is unclear if those differences derive from evolutionary adaptation or ontogenetic compensation or both.

***Terninko**, Anne B. (Finger Lakes Community College, Environmental Conservation Department, Canandaigua, New York, 14424), John **Newhouse** (Braddock Bay Raptor Research, Hilton, New York, 14468), and James **Hewlett** (Finger Lakes Community College, Science Department, Canandaigua, New York, 14424)*

Natal Dispersal in Eastern Red-tailed Hawks (*Buteo jamacensis*)

Natal dispersal in raptors has been widely studied, with the exception of Red-tailed Hawks (*Buteo jamacensis*). Differential dispersal has been documented between the sexes in some hatch year birds, and in many adult raptors in migration. This study will focus on documenting the timing of dispersal and variation in dispersal distance between sexes of hatch year Red-tailed Hawks. Banding records from Braddock Bay Raptor Research will be examined to determine if differences exist in timing of dispersal. Determining if differential dispersal exists in Red-tailed Hawks is difficult, as there is currently no simple method to sex these birds in the field. An additional objective of this study is to develop a field method for sexing Eastern Red-tailed Hawks, by correlating field measurements to sex. The birds are captured at the Braddock Bay Raptor Research banding blind, near Hilton, New York, on the South shore of Lake Ontario during spring migration and natal dispersal in August. Each bird is fitted with a U.S.F.W.S. aluminum leg band for identification purposes. Measurements including culmen, wing cord, hallux and weight are recorded for each bird. A blood sample is also collected from the basilic vein. The blood is analyzed at Finger Lakes Community College using Polymerase Chain Reaction (PCR). PCR targets sex-specific variations in an avian gene which provides a reliable method for the determination of sex. Comparing the field measurements to the sex of each bird should produce a matrix that will provide a method of sexing the birds in the field.

***Tuttle**, Sheila E. (Skidmore College, Department of Biology, Saratoga Springs, NY 12866), and David M. **Carroll** (Warner, NH 03278)*

Nest-to-water Movements and Habitat Use of Hatchling *Clemmys insculpta*

Post-emergent behavior of hatchling wood turtles (*Clemmys insculpta*) during their migration from nest to water was observed in August and September in southern New Hampshire. Hatchlings were powdered with fluorescent pigments and tracked at night with long-wave ultraviolet light. Of 53 hatchlings marked, 12 individuals were successfully tracked to a nearby brook. The mean time taken to reach a brook was 6.2 (1–24) days. Hatchlings were monitored daily from 0600 h until emergence from their terrestrial forms, or until 1300 h. Habitat selection was most frequently in herbaceous vegetative cover or on hayfield banks bordering sandpit nesting areas, and in dense woody and herbaceous ecotones along dirt roads. Mean (+/-SD) distance traveled per movement was 26.2+/-25.0 (0.2–109.0) meters (n=134). The total distance traveled to a brook averaged 131.7+/-119.7 (27.8–445.4) meters; mean travel rate was 23.4 +/-9.5 (14.5–40.0) m/day. Based on field observations, hatchling wood turtles used conspecific scent-trailing as well as vision and positive geotaxis. Auditory cues of rushing water may be employed as an orientation mechanism as hatchlings approach a brook.

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Home Range and Habitat Use of *Clemmys insculpta* in Southern New Hampshire

An intensive one-year (April 1993-June 1994) radiotracking study of ten adult and two juvenile *Clemmys insculpta* was conducted in southern New Hampshire in a study population of 82 marked turtles. Using a 20-meter grid method, home range sizes (mean +/-SD) were: adult males 5.8+/-3.3 ha, adult females 3.9+/-3.0 ha, and juveniles 6.0+/-6.8 ha. Home ranges among and between sexes and age classes overlapped spatially and temporally throughout the study. Habitat was evaluated by assessing habitat units based on the areas most frequently used by radio-tagged turtles. Fifteen of the habitat units were wetland in character (54%), and 13 were upland (46%). Among five cover types (herbaceous, shrub, tree, sapling, woody vine) shrub cover (42%) occurred most frequently within a habitat unit. During the active season, 57% (n=429) of the total captures (n=757) were aquatic. Females were more terrestrial than were males throughout the active season, seldom being observed in a brook during the summer. Males were more frequently encountered in water.

***Tuttle**, Sheila E. (Skidmore College, Department of Biology, Saratoga Springs, NY 12866), and James H. **Harding** (Michigan State University, Michigan State University Museum, East Lansing, MI 48824)*

Observations of Worm-stomping Behavior by Wood Turtles in Southern New Hampshire

It has been known for almost 20 years that wood turtles will thump the ground causing earthworms to surface, thus exposing them to the turtle predator. During a field study of 82 marked *Clemmys insculpta* in New Hampshire, the specialized foraging behavior known as worm-stomping was observed in two wood turtles between 1100 and 1730 h on seven dates (three in May, two in June, one each in August and September 1993), only the second such observation in a wild population. During episodes of worm-stomping that yielded earthworms, turtles worm-stomped in shrub-swamp habitat dominated by speckled alder (*Alnus rugosa*) within 3 to 15 m of a brook. Unsuccessful attempts took place in drier alder and willow (*Salix* sp.) habitat within 37 to 54 m of a brook. The number of observed stomps per stomping bout ranged from 4 to 45 stomps, with a mean of 10.7 stomps per bout (n=16 bouts). Five complete sessions where worms were caught lasted from 1.6 to 3.75 h per session. The rate of worm capture during five productive sessions (total 11.9 h) was 2.9 worms per hour (range 1 to 7 worms/h). On one occasion, only three worms were captured in 3 h (1.0 worms/h), but on another occasion 13 worms were caught in 1.85 h (7.0 worms/h) along with six slugs (Mollusca) also consumed in the same time period.

***Usai**, Michael L. (City University of New York Graduate Center, Ph.D. Program in Biology-Ecology, Evolution and Behavior, New York, NY 10016)*

Mesoscale Movement and Subpopulation Structure in a Canada Goose Metapopulation

Most studies of Canada Goose (*Branta canadensis*) dispersal and movement are conducted on either a large geographic (i.e. flyway) scale or on a small scale for management of individual flocks of nuisance geese. Few studies address movement and subpopulations on a mesoscale of tens of square kilometers where coordinated management may effect regional populations. Fewer still allow the scale to be varied. As part of a larger metapopulation study, 267 goslings were banded with red tarsal bands at 17 sites in Rockland County. Over 18 months of observation, 77.1% of resightings (N=1456) were within one kilometer of the banding site and 98% were within seven kilometers. There was no difference in median dispersal distances between the sexes ($p = .0704$), suggesting patterns of philopatry have not yet emerged in this age-class. First-year birds were significantly more likely to be resighted within the same hydrologic drainage basin in which they were banded than in another basin ($p=.002$) with distinct clumping patterns evident, suggesting separate subpopulations. Birds neck-collared as adults between 1993 and 1998 followed a similar pattern. Using nine years of census data, population correlation was low between the census sites and regression of pair-wise correlation coefficients against distance did not show any relationship on the countywide scale ($F=0.11$; $p=0.737$) suggesting local populations are uncoupled. Sites in the Hackensack River drainage did cluster out as a subpopulation ($F=9.42$; $p=0.037$) with distinct population dynamics. Although several other sites appear to cluster out, the relationships remain unresolved pending further analysis.

***Vogler**, Donna W. (State University of New York College at Oneonta, Biology Department, Oneonta, NY 13820), and Sue **Kalisz** (University of Pittsburgh, Department of Biological Sciences, Pittsburgh, PA 15260)*

NATURAL SELECTION FOR DELAYED SELFING IN *COLLINSIA VERNA* (SCROPHULARIACEAE)

The predictability of pollinators is often poor for spring ephemeral plants of temperate forests, consequently the likelihood of outcross pollen deposition is expected to play a central role in determining whether plant populations evolve floral traits that confer greater self pollination ability or greater pollinator attraction. Using the delayed selfing species *Collinsia verna*, we designed a series of field experiments to quantify the impacts of periodic pollen limitation, resource limitation, selective abortion, and the phenotypic distribution, timing and effectiveness of delayed selfing. In each of three Pennsylvania floodplain populations, pollinator composition varied significantly ($p < .001$) between 1997 and 1999 surveys. Using hand outcrossed flowers, emasculated flowers, and open pollinated flowers we detected significant pollen limitation in about a third of the intervals studied, and pollination levels varied both by population and by year. An 8% increase in fruit set could be attributed to directly to delayed selfing. We conclude that pollinator abundance is sufficiently variable to explain the evolutionary maintenance of delayed selfing in this species but that resource constraints may be an important factor restraining this impact. Moreover we suggest that other native species traditionally considered obligate outcrossers might also possess an overlooked delayed selfing mechanism contributing to their short-term persistence.

***Williams**, Ernest H. (Hamilton College, Biology Dept., Clinton, NY 13323), Theodore W. **Valenti** (Virginia Poly. Inst. St. Univ., Biology Dept., Blacksburg, VA 24061), and Daniel H. **Catlin** (Oregon State Univ., Dept. Fisheries and Wildlife, Corvallis, OR 97331)*

BEHAVIOR OF FROSTED ELFINS (LEPIDOPTERA) IN LUPINE PATCHES

In the northeast, the Frosted Elfin, *Callophrys irus*, is closely associated with its wild lupine hostplant, *Lupinus perennis*, and both are uncommon. To learn which features of the habitat are important to these butterflies, we observed the distribution and behavior of individuals from one population in the Rome Sand Plains, Oneida Co., New York. Males are conspicuously territorial, with territories in open sandy areas next to lupines where nearby trees funnel the flight of insects along narrow paths. Notably, the same locations were used for male territories in both 2000 and 2001. Males make short flights upward and then return with great fidelity to the same small patches of ground (no larger than 2m x 4m). Most flights last less than 5 sec; longer flights are associated with inspections and courtship of other Frosted Elfins. Males perch generally less than 10 cm above the ground and usually on the leaf litter. Females are seen more often perched on and flying among lupines than are males, which are seen more often in their sandy territories. Nectaring by either sex is rarely observed. An overlay of observations of Frosted Elfins on a map of lupine distribution at our study site shows that these butterflies are very closely associated with lupines and infrequently found more than 10m away. Habitat features important to the butterflies include abundant lupines, open sandy patches, and sparse trees.

***Wood**, Amy B. (ORISE, Fort Drum, Fort Drum, NY 13602), John D. **Holland** (Holland Lithic Laboratory, Buffalo Museum Buffalo NY 14211), Randy **Amici** (Colorado State University Survey Coordinator, Fort Drum NY 13602), and Laurie **Rush** (Federal Archeologist, Fort Drum NY 13602)*

LERAY CHERT IN A SPATIAL AND TEMPORAL CONTINUUM

LeRay chert is a lithic source exploited by groups throughout the Eastern Lake Ontario Region. Using regional sampling of collections an analysis of LeRay lithic material shows a shift in the procurement strategies of cultural groups from the region. From Paleo through late Archaic contexts exotic lithics are preferred for tool manufacture including Onondaga, Normanskill, and Flint Ridge Sources. During the Late Middle Woodland through Contact the dynamics of lithic procurement shift considerably toward selection of local materials. This shift has implications for understanding changes in migration, subsistence, settlement patterns, and cultural traditions throughout the eastern Lake Ontario Basin.

***Woods**, Kerry D. (Bennington College, Natural Sciences, Bennington VT 05201), and Kathleen M. **Doyle** (Green Mt. College, Poultney, VT 05764)*

COMPOSITIONAL PATTERNS IN THE FORESTS OF THE NORTHERN TACONIC MOUNTAINS

The northern Taconic Mts., along the border of VT and NY, create an ecological landscape distinct from the neighboring Adirondack and Green Mts. They are geologically complex, with bedrock varying from slates and schists to marbles, and topographically diverse, with maximum elevations over 1100 m. We analyzed compositional and environmental data from ca. 250 sample plots in mid- to late-successional forests to produce a preliminary description of compositional patterns on the Taconic landscape. Canopy composition generally reflects a typical "complex gradient" shaped by elevation and interactions between topography and moisture. This pattern is overlaid by influences of land-use history and may be made more complex by effects of soil chemistry. *Acer saccharum* generally dominates the landscape under mesic conditions below about 650 m, giving way on topographically dry sites to *Quercus rubra* (and *Q. prinus* on driest sites) with *Carya* spp. at lower elevations, and to *Fagus grandifolia* at higher elevations. Successional stands are less predictable. *Fraxinus americana* is typically important on mesic sites below 600 m, with *Quercus* and *Carya* spp. important on drier sites. Red maple (*A. rubrum*) and white pine (*Pinus strobus*) are important in some younger stands, perhaps associated with more acidic soils. Understory compositional patterns, while not yet fully analyzed, do not simply reflect overstory patterns, and may be more responsive to variation in soil chemistry and land-use history. At low-mid elevations, understory diversity can be very high in both moist and dry sites.

Black Creek Watershed; Ulster County, New York State
SUNY Ulster GIS Program
Organized Poster Session

***Organizer:** Paul A. **Rubin** (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Overview: The Black Creek is a unique waterway in eastern Ulster County. Four important factors combine to make the Black Creek exceptional: bedrock bounded channel segments that impound expansive wetlands, an abundance of wildlife species in largely undisturbed habitat, its beautiful natural setting, and, as yet, limited development. These are the qualities that attracted John Burroughs to live there and write his celebrated books seeking the preservation of nature.

Urban sprawl is now resulting in developmental pressure throughout the Black Creek watershed. Yet, at the same time concerned citizens are banding together to promote its highest and best use as a protected natural environment. This is evident in the form of several protected sanctuaries, and in the recent development of rail and canoe trails. Goals now under consideration by the community include: 1) preservation and protection of the Black Creek, 2) enhancement of local recreational and scientific opportunities, 3) promotion of ecotourism and related tourist dollar spending in the region centering around the Black Creek, 4) development of a watershed protection and management plan, 5) possible land and conservation easement acquisition supportive of these goals, and 6) possible attraction of State and Federal dollars supportive of these community goals.

Students in the SUNY Ulster GIS program are actively working with the community, environmental groups, and state and local agencies to develop a GIS data base that can be used to advance the above goals. This work was significantly augmented by detailed field, laboratory and research studies. Much of the work presented here involves sophisticated environmental analyses that build upon a series of step-wise GIS-based analyses. The GIS project team recognizes and acknowledges the resources provided by SUNY Ulster and support from the Ulster Community College Foundation, Inc. through a gift from the Vernon and Florence Roosa Foundation.

***McCooey**, Patrick J. (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Black Creek Corridor Preservation and Tourist Attraction; Ulster County NYS

A project team effort is underway to aid in showcasing and preserving the Black Creek corridor in Ulster County, New York State. Outdoor activities, lodging and historic sites, and roadways are portrayed in a comprehensive presentation of the Black Creek watershed and surrounding area. ESRI Geographic Information Technology (GIS) ArcView software was used in developing a promotional project layout. Project information was obtained from local Chamber's of Commerce, County and State tourism agencies, and private sector groups promoting preservation of land and historic sites. A large-scale map was produced using New York State Department of State digital ortho quarter quadrangles and USGS digital raster graphics. An overlay of county roads and municipalities provides needed directional information. Lodging, historic sites and other points of interest are presented in table format. This table was added to the project layout by geocoding site locations based on street addresses. A global positioning system unit was used to obtain geographic coordinates of points of interest without street addresses. Digital photography was used to enhance the final presentation.

***Ortega**, Ana (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

A GIS Illustration of an Eco-friendly Business, Black Creek Watershed, New York State

Rocking Horse Ranch Resort, located in Highland, New York, is an excellent example of how business can play a positive role in protecting a large tract of land. The Rocking Horse Ranch is nestled in the southeastern quadrant of the Black Creek drainage basin. The Pancake Hollow Brook, a tributary of the Black Creek, runs through the property and flows two more miles north to connect with the main stem of Black Creek. The resort sits on 500 wooded acres surrounded by apple orchards, sparkling lakes, and scenic mountains in the heart of the Mid-Hudson River Valley. As such, it provides great family vacations and stimulates the local economy while still harmonizing and preserving its natural surroundings. In this study the author uses ArcView 3.2 GIS software to showcase and compare the Rocking Horse Ranch's positive land use with the overall land use profile of the Black Creek Basin. Resort features (e.g., lakes, trails, and buildings) were placed into a Geographic Information System database. This information can be useful in conjunction with any future development that would seek to balance the economics of eco-tourism with the preservation of natural resources and habitats

***Stempek**, William (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

GIS Assessment of The John Burroughs Sanctuary, Ulster County, New York

The John Burroughs Sanctuary stands as the shining jewel of the Black Creek watershed in New York State's mid-Hudson Valley. It remains as mute testament to the awareness that the naturalist/writer John Burroughs passed on in his writings. Shortly after his passing, in 1921, The John Burroughs Association was formed and began to acquire and preserve land surrounding Burroughs' beloved Slabsides residence where many of his writings originated. The focus of this project is to help the association identify existing features and to plan for possible future development of trails and general usage. Updated and previously unavailable data can then be used to foster eco-tourism in the area and increase local awareness. New York State's aerial ortho-imagery and DEM (digital elevation model) data was used for GIS base mapping in ArcView GIS. Sources included the New York State GIS Clearinghouse and Cornell University's CUGIR data collection. Several software programs were used, including Eagle Point Survey and AutoCAD Land Development, to prepare a variety of data for use in GIS format. U.S. Army shareware, CORPSCON, was used to bring all data to a single UTM format. Existing trail data and unique feature locations were collected in the field using SUNY Ulster's Garmin GPS data collector and brought directly into ArcView GIS.

***Dido**, Robert J. (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Proposed Black Creek Canoe Trail GIS Project; Southeastern New York State, USA

The Black Creek, an estuary of the Hudson River, is a largely untapped recreational resource in Ulster County, New York. This project is a component of a larger study of the Black Creek watershed designed to accumulate and map geographic information. The proposal of a 9.5-mile canoe and land trail through the heart of this watershed would provide low impact public access to this region and increase public interest and appreciation of a unique ecological resource. Advocates and

interested parties supporting this proposal include the Greenway Council, Scenic Hudson, the Hudson Riverkeeper, the Adirondack Mountain Club, and the Town of Lloyd Environmental Conservation Council chaired by Sue Frampton. The proposal provides for a canoe/kayak water trail, as well as portages, access points, and parking areas. This proposed water trail would intersect the Hudson Valley Rail Trail, and enhance this existing recreational resource. The ArcView layout was prepared using a combination of NYS Department of State aerial photographs (DOQQs) and USGS topographic maps (DRGs) in a NAD 83 UTM projection, as well as hand held GPS-derived data to indicate the route and salient features. Portage locations are approximate and subject to future revision as the proposal progresses.

***Folsom**, Mark (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

TRAIL SYSTEM DEVELOPMENT IN THE BLACK CREEK WATERSHED; ULSTER COUNTY NYS

The Black Creek watershed has been identified as a valuable and unique resource. Located in the mid-Hudson valley on the western flank of the Hudson River, it is easily accessible to many potential visitors from the greater metropolitan area. More people are moving out from urban areas in search of their own open spaces. As a result, fewer areas are left untouched and available for wildlife habitat and passive forms of recreation. Linking existing trail networks (e.g., John Burroughs Nature Sanctuary, Shaupeneak Ridge Cooperative Recreation Area, Black Creek Forest Preserve) with new trails provides an excellent means of increasing public awareness of fragile and threatened undeveloped areas. Furthermore, trails provide a recreational resource compatible with sensitive environmental areas. The main focus of this project was to identify potential trail locations within the Black Creek watershed. Protection and preservation of trail lands may be possible via a combination of acquisition and conservation easements. The feasibility of enhancing existing trail networks through efforts of willing landowners, community and state interests, and environmental groups was also explored. Potential new trail locations were identified through examination of aerial photographs and topographic maps, and field reconnaissance. Fieldwork within the study area was conducted on foot using a handheld GPS receiver to locate potential trail segments. ESRI ArcView GIS software was used to generate trail maps. The Spatial Analyst extension was used to portray topographic relief.

***Ryan**, Eileen (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

CONSTRUCTION OF A GIS-BASED SHAUPENEAK RIDGE RECREATION AREA MAP; BLACK CREEK WATERSHED, NYS

The Shaupeneak Ridge Cooperative Recreation Area, situated on the flank of 980-foot Shaupeneak Mountain in Ulster County, New York is an important wildlife conservation area. The 570-acre recreational area was acquired by the Scenic Hudson Land Trust in 1994. This area, partially within the Black Creek watershed, protects wetland and forest habitats while providing a valuable recreational resource. A trail system in the cooperative recreational area provides hiking, birding, mountain biking, cross-country skiing, and hunting opportunities. Trail locations afford superb views of the Hudson River and Catskill Mountains, while Louisa Pond is available for non-motorized boating, fishing, and wildlife observation. A scenic cascading waterfall is accessed from the Violet Trail. The area is an ideal place to hike and enjoy the natural world. In addition, the NYS Department of Environmental Conservation conducts nature studies within the recreational area and teaches environmental education to school groups. The Shaupeneak Ridge Cooperative Recreation Area affords important protection to both mature hemlock stands and wetland ecosystems. Project work was conducted as a promotional tool, supportive of wildlife and habitat conservation. Trail locations and site features were determined with a handheld GPS receiver and plotted over an aerial photograph backdrop using ESRI GIS software. A map was generated portraying trail locations, a table with trail lengths, and assorted points of interest at the preserve. This map will be posted at the Poppletown Road access to the Shaupeneak Ridge and will be useful to all who visit the ridge.

***Vaeth**, Lynda (State University of New York at Ulster, Geographic Information Systems Program, Stone Ridge, NY 12484)*

THE BLACK CREEK FOREST PRESERVE: AN ECOLOGICAL, RECREATIONAL, AND EDUCATIONAL TREASURE

The Black Creek Forest Preserve is a 130-acre parcel surrounding the mouth of the Black Creek, a Hudson River tributary, in the town of Esopus, Ulster County, New York. Established in 1998 by Scenic Hudson, a non-profit conservation organization, the site consists of upland forests, rock ridges, streams, intertidal swamp forests, unforested wetlands, vegetated tidelands, fifteen vernal pools, and some 900' of rocky river shoreline. An ecological assessment prepared in 1998 by Spider Barbour of Hudsonia, Inc. reported the presence of 3 state-rare plants and 2 state-rare animals on site, and observed that 5 of the

vernal pools supported breeding amphibian populations. He concluded that the tidelands, vernal pools, and rock ridges were "the most exceptional and sensitive communities." A suspension bridge spanning the Black Creek and a network of hiking trails provide public access to the Preserve's diverse landscape and the Hudson River itself. Aside from the many casual visitors, crowds of fishermen are attracted each spring because the creek serves as a spawning area for herring. Among the Forest Preserve's most valuable functions, however, is that of an outdoor classroom. Geology students from SUNY New Paltz study the many rock outcrops and, in a program entering its fifth year, Americorps volunteers conduct environmental education classes on site for the Kingston city elementary and middle schools. Important site geographic data (e.g., trails, vernal pools, Hudson River) is presented on a GIS-based map.

***Keller**, Joan (State University of New York at Ulster, Geographic Information Systems Program, Stone Ridge, NY 12484)*

Development of a GIS-Based Bird Conservation Area: Black Creek Watershed, Southeastern, NYS

Diverse habitats in the Black Creek watershed in Ulster County, New York attract numerous bird species. Large portions of the watershed, while unprotected by sanctuaries, provide critical habitat for breeding and migratory birds, including waterfowl. Vast wetland complexes and large tracts of undisturbed forest currently attract game species, protected species, and species of special concern. Due to economic expansion and population growth, bird habitats are being destroyed in surrounding areas, creating a negative impact on the abundance of key species in this area. In an effort to promote continuous vigilant environmental protection and preservation of avian species in the Black Creek watershed, the research of birders was used to portray breeding and migratory habitats of selected species. The results were analyzed and are presented via a Geographic Information System (GIS) using ESRI ArcView software. Aerial photographs were used to delineate land-use throughout the Black Creek watershed. Land-use category breakout includes wetlands, ponds, deciduous forest, mixed forest, evergreen forest, and agricultural districts. This study links together current land coverages with breeding habitats favorable to specific bird species. Identification of habitats now sporting species of special concern was used to target similar habitats that, if protected, might provide areas capable of enhancing species populations. Comparative analysis of known bird habitat with land-use coverage data is an application well-suited to GIS technology. This information will help determine the appropriate criteria in seeking to have portions of the Black Creek watershed designated as Bird Conservation Areas, thus providing preservation and protection of avian species for current and future generation's enjoyment and educational opportunities.

***Joule**, Steve (New York State Department of Environmental Conservation, Bureau of Wildlife, New Paltz, NY 12561, and the State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Using GIS to Assess Herpetofaunal Diversity at Varying Spatial Scales

Reptile and amphibian communities can be viewed on three spatial scales. The site-specific scale measures the amount of within-habitat diversity (*alpha diversity*). This is in contrast to between-habitat diversity (*beta diversity*), which is a measure of the relationship among assemblages within the surrounding landscape. The regional perspective (*gamma diversity*) is a combination of both within-habitat and between-habitat diversity and yields a broad perspective of species diversity over a large geographic area. Reptiles and amphibians are adapted to a wide range of environments both on a global and local scale; thus, regional information may not accurately predict local assemblages because of the many biotic and abiotic factors influencing community structure. The NYSDEC recently completed the New York Amphibian and Reptile Atlas Project, which documented the occurrence and distribution of all reptile and amphibian species across the state. The atlasing was based on detecting the presence of a species within each of the 979 USGS 7.5' topographic quadrangle blocks covering all of New York State. The geographic area with the highest herpetofaunal species richness is the Lower Hudson Valley Region, including the Rosendale quad, which is one of the most species-rich (39 total species) quads in the state. On a local scale, much of the regional and statewide reptile and amphibian diversity results from the high degree of species richness that exists in the Black Creek Drainage Basin, including some species that are of management concern, such as the Northern Cricket Frog (*Acris crepitans*), listed as *Threatened* in New York State.

***Sullivan**, John T. (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, New York 12484)*

Identifying Potential Rich Fen Wetland Communities in the Black Creek Basin Using GIS

Rich fen wetlands are highly significant ecosystems due to their high biodiversity and tendency to support numerous species listed as rare, threatened, or endangered. Protecting these unique wetlands requires first identifying their locations in the landscape. However, personnel shortages and financial constraints make field reconnaissance of the immense area over which

they occur an inadequate method for locating new rich fens. Furthermore, current field-survey methods for discovering rich fens have not kept pace with the exponential increase in human development seen in many municipalities. These factors necessitate the development of a more efficient, regional approach to identifying rich fen wetlands. This research project's goal was to develop such an approach using a Geographic Information System. Previous work indicated a strong relationship between the occurrence of rich fens and the occurrence of specific geologic and soil conditions. Using this information, criteria for determining potential sites were established based on the geology, soil classifications, topography and land-use coverages of known rich fens within Ulster County, New York. A query of this database was made using the properties of the model, and locations that met these criteria were identified and designated as potential rich fen sites. Field reconnaissance was conducted to assess the accuracy of the model. The GIS model proposed here should significantly expedite the identification of potential rich fens for field survey, and more importantly do so on a regional scale.

***Skerritt**, Francis (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

GIS Portrayal of Non-Point Pollution Sources in the Black Creek Watershed; NYS

A key component of watershed management is the identification of areas that have the potential of contributing contaminants to stream and wetland receptors. Similarly, water quality assessment requires location and analytical information relative to possible sources of pollution. Through preliminary field reconnaissance, literature review, internet searching, and discussions with individuals in the watershed, potential non-point source pollution sites in the Black Creek basin were identified, some of which may warrant chemical and biologic study. Possible non-point sources are depicted on a large GIS map, complete with inset maps. Sites are broken down into two categories denoted by a 1 for more urgent need of study and a 2 for sites that require testing, but appear to pose less of a threat, if any. Higher priority (1) sites include A) The Hertel Landfill, an EPA Superfund site containing volatile organics and metals, B) a garage with a sand and salt shed, C) apple orchards that apply pesticides, D) a state run juvenile detention center, and E) the Florida-based CSX Transportation Company that owns and operates the former Conrail railroad line. Chemical defoliants, and possibly other contaminants, have been sprayed on the 3.5 mile stretch of CSX tracks within the watershed. Lower priority (2) sites include A) a paint ball survival area, B) an abandoned mine, C) sites with domestic animals, D) a transformer storage area, and E) a small sewage treatment plant. Sites were located using a handheld Global Positioning System, and then plotted using ESRI ArcView GIS software.

***Nickell**, Rima (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Agricultural Chemical Use in the Black Creek Watershed: Using GIS Technology to Depict Potential Nonpoint Pollution Sources

Agriculture in the Black Creek watershed (eastern Ulster County, New York) includes orchards, which historically have been treated with heavy-metal-based and other persistent chemicals to control diseases, insects and weeds. Extensive literature has identified nonpoint sources as significant pollutant contributors to groundwater and surface water resources with the potential to degrade streams and rivers. Development and other land use changes causing soil disturbance might potentially increase the risk of chemical transport to vulnerable aquatic ecosystems in the Black Creek basin. This study explores the implications relative to water quality. Research for this study was conducted to identify chemicals used historically and currently and their pertinent characteristics. The investigator obtained information from governmental agencies including the Cornell Cooperative Extension, Pennsylvania State University, NYS Department of Environmental Conservation, and USDA Natural Resources Conservation Service; environmental and agricultural organizations; agribusinesses such as Agway; and agricultural trade organizations. A Geographic Information System (GIS) database was established to portray historic and current orchard locations where chemical applications might leach into groundwater and surface water receptors. Identified chemicals were assessed in terms of their likelihood to enter and degrade surface water.

***Sheeley**, Debra A. (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Point Source Pollution Assessment using GIS; Black Creek Watershed, Ulster County NYS

Pollution, both point and non-point, poses a risk to stream and wetland water quality and the species they support. In New York, State Pollutant Discharge Elimination System (SPDES) permits are issued by the Department of Environmental Conservation. Ideally, permit issuance requires a hard look at stream low flow characteristics, the nature of low flow

(e.g., turbulent vs. water ponded in wetlands), existing water quality, cumulative chemical loads from other SPDES permits, health indices of receptor species, and the presence of threatened and endangered species. To provide critical information needed to help protect the Black Creek watershed and its wetlands, a GIS map of known pollution point sources was prepared. When coupled with water quantity and quality data, this information can aid town planners and environmental groups in protecting over-stressed and vulnerable areas, identifying areas requiring restoration of aquatic ecosystems, and making land-use planning decisions. The GIS map was designed to be updated as more information becomes available. Map development required researching existing SPDES permits throughout the Towns of Esopus, Lloyd, and Plattekill. In addition, SPDES outfalls were visited and located using a GPS unit. Data was obtained through the Freedom of Information Law and a NYS DEC web site. All outfalls were plotted using ESRI ArcView GIS software. To further assess potential pollution sources, information on chemical spills was obtained from the NYS DEC Division of Environmental Remediation, and plotted. This work is critical for the development of a comprehensive watershed protection and management plan.

***Terzella**, Dina, and Christopher **Johnson** (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Black Creek: Chemical Analysis and Macroinvertebrate Sampling, Ulster Co., NY

A study was performed in the Black Creek Watershed located in Ulster County, NYS. The watershed is comprised of lands located in the towns of Lloyd, Plattekill and Esopus. The study consisted of chemical analysis and macroinvertebrate sampling along three main branches of the Black Creek. These were labeled West Branch, East Branch and Main Branch (which began at the confluence of the West and East branches and ended at the Hudson River). The chemical analysis portion of the study was performed on ten sites. Air and water temperatures, conductivity and dissolved oxygen were collected on site. Tests to determine pH, turbidity, alkalinity, nitrate, inorganic phosphorus and total phosphorus were performed in the laboratory using the Hach DR/850 Kit. The presence of chloride was ascertained using silver nitrate as well as fecal coliform counts using millipore apparatus. Macroinvertebrate sampling was done in four of the sites. 100 count samples were collected from each site and identifications were made to the level of Family. Hilsenhoff's Tolerance Values and other parameters were applied into habitat assessment calculations to determine the habitat status. Two sites on the West Branch showed substantial negative impact occurring within the habitats. The site located near the Hudson River was unusual in that it showed minimal impact and contained organisms typically found in clean headwater streams. ESRI GIS maps and numerous charts were designed from the resulting data. Based on our findings, follow-up studies are being designed to further ascertain the status of the aquatic habitat within this watershed.

***Kelley**, Michelle A. (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY, 12484)*

Black Creek Watershed Assessment of Water Quality Depicted through ArcView GIS 3.2

The Black Creek watershed is 34 mi.2 in size and is located in southeastern New York State, USA. Home of the endangered Northern Cricket Frog and the late naturalist-writer John Burroughs. Documentation of current water quality in the Black Creek corridor is the first step in a watershed protection plan. Providing baseline data prior to future development and reveal the environmentally sensitive areas that are most contributing to water quality degradation. The primary cause of water quality degradation is non-point source pollution: agriculture, urban housing, commercial development, landfills, and salt garages. The impact of these gradually accumulates until water quality is dramatically reduced, endangering the overall health of this most valued resource. The goals of this water quality assessment are to: aid in development of a watershed protection plan, address current land uses and determine the areas of non-point source pollution, establish a basis needed for restoration projects, predict the future of the northern cricket frog, and overall protect and preserve this natural environment as John Burroughs would have done. The water quality parameters to be analyzed will be determined by the ongoing stream study class ENV204, at UCCC, conducted by Professor Michelle Rodden. The students of ENV204 will perform the actual analyses and sample collection. Graphic support of the water quality analysis will be through ArcView Geographic Information Systems version 3.2. The entire Black Creek watershed will be illustrated, highlighting the sample site locations, and the areas of non-point source pollution currently effecting water quality.

***Albrechtsen**, Cindy A. (State University of New York at Ulster, Geographic Information Systems Program, Stone Ridge, NY 12484)*

Full Build-Out and Land Use Analyses within the Black Creek Watershed using GIS

The Black Creek watershed is a viable self-sustaining environment which encompasses approximately 34 square miles. It is located within the southeastern quadrant of Ulster County, New York. The purpose of this project is to show the potential growth expansion throughout the watershed region by analyzing the Ulster County tax parcel data, Real Property System information, and the digitized zoning layers from the Towns of Lloyd, Plattekill, and Esopus. GIS technology was used to classify zoning, current land use, and parcel acreage. Vacant residential and agricultural parcels were identified and highlighted and then combined for a total potential build-out analysis. In compiling the build-out analysis, properties, which were identified as being unsuitable to build, and land which contained hydrological features were excluded from the sample. By comparing the zoning and current land use data coverages, agricultural, residential and vacant properties were highlighted as having the highest potential for suitable development. Once identified, larger parcels along the Black Creek were selected as having the highest priority for land conservation.

***Hubsch**, Robert D. (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

GIS-Based Geological Modeling of the Black Creek Watershed, Southeastern NYS

The Black Creek watershed is located in Ulster County, NY. The watershed is comprised of several sub-basins, has a dendritic drainage pattern modified by deformed sedimentary bedrock, and is part of the Hudson River estuary. The watershed has many bedrock-impounded lakes, ponds, and wetlands in a nearly natural state interspersed with areas modified by human use. The challenge is to plan and manage the needs of humans and still protect the Black Creek watershed. Watershed hydrology is controlled by bedrock and soil geology and topographic slope. Slope analysis was conducted using ESRI's ArcView spatial analyst extension and is portrayed with hillshading and 3-dimensional depictions. USGS and NYS Department of Transportation Digital Elevation Models for the watershed were modeled to portray the perspective of elevation. These models provide a base to study hydrology, biology, and human land-use in the watershed. A high percentage of steep slopes in the basin, coupled with clay-rich soils, strongly influence runoff rates. Both three dimensional analysis (using triangulated irregular networks) and hillshading provide excellent means of portraying topographic relief. However, 3-dimensional analysis permits an excellent means of accenting the ruggedness of the watershed's topography. Combining these views shows how the rugged topography of the region influences surface hydrology. Geographic information science is a powerful planning tool for managing and protecting the Black Creek watershed.

***Albrechtsen**, Cindy A. (State University of New York at Ulster, Geographic Information Systems Program, Stone Ridge, NY 12484)*

Environmental Analysis of Soils within the Black Creek Watershed using GIS Technology

The purpose of this project was to convert the Black Creek watershed soil survey data to a digital format. Once converted, the digital soil information will be used to identify areas zoned for residential and commercial development within the watershed and areas that could be targeted for land conservation. The methodology used to convert soils survey maps included the following: scan soil survey maps within the watershed region, georeference the scanned soil polygons, mosaic multiple soil maps together to form one database for the watershed region, convert the raster image to a vector polygon dataset, and attribute soil polygons with information contained in the Ulster County Soil Survey. Such detailed information will include soil classifications and physical and chemical properties of the soil. After the digital soils data was compiled, it was used as a key data layer to delineate critical environmental areas. This information was then used to identify soil areas unsuitable for development due to potential water quality risks.

***Morgan**, Brian, Cindy **Albrechtsen**, Robert **Dido**, Robert **Hubsch**, Paul A. **Rubin**, Debra **Sheeley**, Francis **Skerritt**, and Lynda **Vaeth** (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Development of a GIS-Based Land-Use Coverage: Black Creek Watershed, Southeastern NYS

Preliminary geologic and hydrologic field work indicates that portions of the Black Creek watershed in southeastern NYS may be particularly vulnerable to non-point source pollution. Because land development can lead to water quality degradation, sometimes exceeding the assimilative capacity of stream and wetland receptors, an important step in watershed protection is documentation of current land use. As part of our detailed characterization of the 55 km^2 Black Creek watershed, our

project team developed a GIS-based coverage to help assess the type and intensity of land-use, identify potential non-point sources of pollution, further community planning, and facilitate watershed protection strategies. We used a modified Anderson Level 2 Land Use/Land Coverage (LULC) classification scheme. Land-use was delineated using a combination of 1:24,000 mid-1990s NYS Department of State digital ortho quarter quadrangles (i.e., digital aerial photographs in a NAD 83 UTM projection), NYSDEC and USGS digital raster graphics, and field checking. Hundreds of ArcView polygon shapefiles were created to outline 19 Anderson classes with a minimum resolution of 100 m^2, using a working scale of 1:5,000 or greater. First level Anderson classification codes used were urban or built-up land, agricultural land, forest land, water, wetland, and barren land. Our GIS-based land-use coverage provides a much higher level of detail than the 1980s 1:250,000 NASA high altitude photo imagery developed on 200-meter grid center points. As of the mid-1990s, some three-quarters of the watershed was forested, indicating the value of developing a watershed protection strategy in the near future.

***Hubsch**, Robert, Cindy **Albrechtsen**, Robert **Dido**, Brian **Morgan**, Paul A. **Rubin**, Debra **Sheeley**, Francis **Skerritt**, Dina **Terzella**, and Lynda **Vaeth** (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Critical Environmental Area Delineation in the Black Creek Watershed, NYS via GIS Analysis

Geographic Information System (GIS) technology provides a means of comprehensively overlaying and analyzing multiple data sets. A project team approach was used to identify critical, environmentally sensitive areas in the Black Creek watershed in eastern Ulster County, NYS. Critical environmental areas (CEA) are defined as land areas where development might, or is, jeopardizing water quality and ecosystems. These hydrologically sensitive areas typically occur where the soil or bedrock porosity, sometimes in combination with steep hydraulic gradients, is capable of rapidly transmitting contaminants (i.e., to streams) through the subsurface or is hydraulically restrictive such that contaminants are discharged to the ground surface. Our CEA delineation maps build upon our previously completed field, laboratory, and GIS analyses. Primary GIS coverages used to delineate CEAs include hydrology, slope, soils, zoning, existing and potential land-use, undeveloped lands, water quality, floodplains, species diversity, endangered species, and species habitat. Protection of the most important environmental assets of a watershed requires information from many disciplines. To this end, delineation of well-supported CEA maps are an essential step in the development of a watershed protection and management plan. Once developed, CEA maps may be used to promote ecosystem preservation leading to habitat and species protection, to promote alternate land-use plans, and to provide data supportive of conservation easements or land acquisition. CEA overlays were developed using ArcView GIS technology.

***Sheeley**, Debra A., and Paul A. **Rubin** (State University of New York at Ulster, Geographic Information System Program, Stone Ridge, NY 12484)*

Land-Use Preservation Scenarios in the Black Creek Watershed Using GIS; NYS

The Black Creek is a unique waterway in eastern Ulster County, NYS. Its varied course extends almost 18 miles from its headwaters to the Hudson River. Four important factors combine to make the Black Creek exceptional: bedrock bounded channel segments that impound expansive wetlands, an abundance of wildlife species in largely undisturbed habitat, its beautiful natural setting, and, as yet, limited development. These are the qualities that attracted John Burroughs to live there and write his celebrated books seeking the preservation of nature. These same factors can be preserved while promoting the increasing demand for regional ecotourism, local recreational resources, and educational opportunities. In other areas of the world, numerous land-use options are currently in use by assorted groups and agencies that promote land preservation. Some of these are explored as potential options capable of bolstering local economics while preserving the wild heartland of Burroughs' backyard. One land-use option is portrayed as an example, using a relict gristmill foundation located at the north end of the Chodikee Lake wetland as a focal point. Reconstruction of this historic structure could be designed to attract tourists while maintaining and protecting a large tract of environmentally vulnerable land. Waterfalls and vast wetlands at this site could be central to hiking, canoeing, nature, and birding trails. Much like Minnewaska Lake is the central hub of Shawangunk Mountain trails and carriage roads, this location exudes wilderness with similar wildlife potential as the Bashakill Swamp. ESRI ArcView GIS software was used to generate promotional land-use maps.

***Moore**, Homer John III (State University of New York at Ulster, Geographic Information Systems Program, Stone Ridge, NY 12484)*

A MARKETING SCENARIO ON THE BLACK CREEK WATERSHED USING ESRI ARCVIEW GIS

The foundation of the Shattega gristmill, which once served as the hub of an early American settlement, is located in southeastern Ulster County near the town of West Park, New York. The restoration of this site as a business venture could help support the preservation of a beautiful scenic area with environmental, educational, and recreational values. Reconstruction could be funded from a number of sources including state and federal environmental programs, parks, wildlife conservation groups, private grants and foundations, and historical societies. This project presents a plan including several promotional tools to market the reconstruction and development of this site. ESRI ArcView GIS software was used to facilitate this presentation. A gift shop and a health food store could present a wide range of products including organic wheat, corn, rye flour, and bran as mill products, and gifts that are consistent with early American culture such as baskets, natural woven fabrics, hand made toys and wood products. A visitor center could be used as an educational facility focusing on wildlife, wetlands, natural history, and early American way-of-life. The viability of a reconstructed gristmill for tourist and educational purposes is explored through a comparative market analysis of other operational gristmills.

Archaeology and Anthropology
Contributed Papers Session

***Moderator:** Laurie **Rush** (Cultural Resource Section, Public Works, Fort Drum, NY 13602)*

***Amici**, Randy (Colorado State University CEMML, Fort Drum, NY 13602), Amy **Wood** (Oak Ridge Institute for Science and Education, Cultural Resources Section, Fort Drum, NY 13602), and Laurie **Rush** (Fort Drum Archaeologist, Cultural Resources Section, Fort Drum, NY 13602)*

THE PERCH LAKE MOUNDS: NEW PERSPECTIVES ON FUNCTION AND CULTURAL CONTEXT

The Perch Lake mounds in Jefferson County, NY have been a mystery since their discovery in the Nineteenth-Century. William Beauchamp (1901) conducted the first inclusive investigation of these earthworks. This was followed by William Ritchie's (1969) study. The latter work produced Carbon 14 dates ranging from 140 B.C. to 930 A.D. However, associated artifacts were not recovered during either investigation. Recent survey of Linnel Island identified a habitation district at a central locus within the mound complex. This site has produced the first set of diagnostic artifacts found in association with the mound complex. The artifact assemblage from this area supports Ritchie's hypothesis that the mounds were being constructed throughout the whole temporal span of the Middle Woodland.

***Babson**, David W., and Steven **Vaadi** (Oakridge Institute of Scinece and Education, Cultural Resources Section, Public Works, Fort Drum, NY 13602)*

COLD SPRINGS IN THE SUGAR BUSH: MAPLE SUGAR PROCESSING AT FORT DRUM, NEW YORK

Archaeological survey of Fort Drum, New York, has identified 32 maple sugar processing sites. These are isolated activity areas, on the back lots of 19th and 20th century farms, where maple sap was processed into sugar and syrup during spring runs of this sap. These products, auxiliary to the milk, butter and cheese produced by these dairy farms, provided income and linked area farmers into a national specialty market. This paper uses archaeological and oral history information to discuss the "other product" of New York's dairy farms.

***Cooney**, William A. (Oak Ridge Institute for Science and Education, Public Works, Cultural Resources Section, Fort Drum, NY 13602)*

THE POSSIBILITY OF WILD PLANT CULTIVATION BY NATIVE AMERICAN POPULATIONS OF NORTHERN NEW YORK

The importance of wild native plants in the prehistoric diets of Native Americans prior to the introduction of Zea maize and other tropical cultigens in North America is well documented in the Mid-continent for Chenopodium, Sumpweed, and Sunflower (Smith 1985) and our understanding of wild plant usage in New England has emerged recently through the work of Dewar and George (1999), McBride (1978, 1984, 1992), Morenon (1986), Bernstein (1990, 1992, 1993). Prehistoric plant usage in coastal and central New York has also been well documented (Bernstein 1993, Bodner 1999), however prehistoric plant usage in Northern New York known locally as "The North Country" has yet to be well documented. The purpose of this paper is to present an overview of the physiography of the Fort Drum area and the results botanical studies for prehistoric Native plant usage from four sites spanning the Archaic through Middle Woodland periods discovered on the Fort Drum Military Reservation.

***Keck**, Charlene A. (Colorado State University, Fort Drum, NY 13602)*

A COMPARISON OF CAMP DRUM I AND THE ST. LAWRENCE SITE ARCHAEOFAUNA

Little is documented about the subsistence strategies of the St. Lawrence Iroquois in northern New York State. Archaeological investigations at Camp Drum I (NYSM 3450) and the St. Lawrence Site (NYSM 3499) yielded a quantity of faunal remains. In this paper I present results of the analyses of these assemblages. Quantification measures consist of the Number of Individual Specimens (NISP) and the Minimum Number of Individuals (MNI). Meat weight is estimated using biomass formulae based on allometric scaling data. These data provide new information on St. Lawrence Iroquoian animal use during the late prehistoric period in northern New York State.

***Rush**, Laurie (Cultural Resource Section, Public Works, Fort Drum, NY 13602), and David W. **Babson** (Oakridge Institute for Science and Education, Cultural Resource Section, Public Works, Fort Drum, NY 13602)*

AN INVENTORY OF DISPERSED SOCIAL CENTER, RURAL INDUSTRY AND AGRICULTURAL PROCESSING SITES AT FORT DRUM, NEW YORK

The Cultural Resources Program at Fort Drum has recently completed an inventory of its Dispersed Social Center and Rural Industry and Agricultural Products Processing sites, representing two among the seven research contexts for the area's 19th and 20th century occupation. This inventory located over 140 sites in the field and assessed their condition and potential significance. Currently, 21 sites are being considered for protection including schools, churches, mills, maple processing sites, a quarry, a limekiln and a gold sluice. This paper also discusses integration and rectification of data from historical maps with field survey and Fort Drum's GIS database.

***Wonderley**, Anthony (Oneida Indian Nation, Legal-History Department, Oneida, NY 13421)*

THE ELDEST MEDICINE: RED OSIER DOGWOOD IN IROQUOIS FOLKLORE AND MYTHOLOGY

Of indifferent importance in the Iroquois pharmacopeia, this plant played a remarkably dramatic role in the native folklore of New York. Oral literature indicates red willow was used as an emetic internally and as a whip externally to purify the body following an encounter with the supernatural. Not only was its smoke considered a powerful substance, its branches were the main weapons employed to slay ferocious, other-worldly enemies. Documentary evidence can take red osier dogwood two centuries into the past. However, mythological evidence suggests this—the "eldest medicine"—may date to a much earlier age.

The History and Impacts of Maize-Bean-Squash Agriculture
Organized Papers Session

Organizers and Moderators: *John P.* ***Hart*** *(New York State Museum, Research and Collections, Albany, NY 12230), and Jane* ***Mt. Pleasant*** *(Cornell University, Department of Crop and Soil Sciences, Ithaca, NY 14853)*

Overview: At the time of European contact, most Native American agriculturists in the Eastern Woodlands of North America relied primarily on three crops, maize (*Zea mays* spp. m*ays*), common bean (*Phaseolus vulgaris*), and squash (*Cucurbita pepo*). These crops were often intercropped and consumed together. This symposium highlights current research on the history and antecedents of the crop complex and its impacts on Native American populations.

Usner*, Daniel H. (Cornell University, Department of History and American Indian Program, Ithaca, NY 14853)*

Iroquois Agriculture in Early American History

In order to grasp the significance of agriculture in Iroquois culture and history, it is necessary to rescue the political economy of American Indians during the colonial period from an ideological captivity practiced by early leaders of the United States. The characterization of Indian people across eastern North America as mainly hunters instead of farmers is deeply rooted in Euro-American thought and still influences our perception of Indian livelihood. This paper will disentangle the agricultural ways of the Iroquois people from the political ideas imposed on them by many outside observers. It will trace continuity and change in Iroquois economic life through the 17th and 18th centuries, underscoring the role of agriculture in Native Americans' adaptation to colonialism. Using the Iroquois experience as a case study, it will also explain how Jeffersonian agrarianism at the beginning of the 19th century downplayed the role of Indian agriculture and thereby concealed its importance from our view.

Mt. Pleasant*, Jane, and Robert F.* ***Burt*** *(Cornell University, Department of Crop and Soil Sciences, Ithaca, NY 14853)*

An Agronomic Assessment of the Three Sisters Hill System: Past and Present

In the Western hemisphere intercropping of corn and beans has been a common practice among indigenous farmers for more than three thousand years and is still widely used today in many parts of Central and South America. The inclusion of a cucurbit in this system is also widespread. In the northeast woodlands intercropped corn, beans and squash was a productive and stable agricultural system for several hundred years. The symbiotic relationship between beans and corn provides the foundation of the system while the addition of a cucurbit further complements the crop association. This cropping system addresses both nutrient management and pest control, including weeds, insects and disease. When the crops are planted in mounds, all aspects of crop production and soil management are affected. This three-crop planting system represents a sophisticated understanding of the dynamic interactions between agronomic plants and uses innovative methods to solve problems of plant population and spacing in a non- mechanized agricultural system. Data from replicated field experiments over the past 15 years at Cornell University using a traditional Iroquois open-pollinated flour corn, grown in association with beans and squash, will provide insight into the agronomic characteristics and potential of this system. Variables in plant population, spacing, date of planting, and their effects on crop yield, as well as comparisons with modern corn hybrids, all contribute to a more complete understanding of how the system functioned and the level of crop productivity it may have provided to Iroquois communities in the past.

Asch, *David L. (New York State Museum, Research and Collections Division, Albany, NY 12230)*

The Eastern North American Pre-maize Horticultural Complex

Cultivation of plants in eastern North America began at least 7000 years ago, and horticulture was demonstrably important in the diet of some groups by 3500 or 3000 years ago, long before maize entered the region. At least eight species, most of which now grow spontaneously over parts of eastern North America, comprise the pre-maize horticultural complex. This paper reviews supporting evidence that these plants were grown prehistorically, presents information about the prehistoric and modern phytogeography and ecology of these species, and discusses models of the development of the horticultural system.

***Hart**, John P. (New York State Museum, Research and Collections, Albany, NY 12230)*

THE ARCHAEOLOGICAL HISTORY OF MAIZE, BEAN, AND SQUASH IN THE NORTHEAST

The ability to directly date small, key crop remains recovered from archaeological contexts has significantly revised our understanding of the history of maize, the common bean, and squash in the Northeast. The resulting archaeological history of the three crops indicates a much more lengthy and complex history than previously thought. The potential implications for our understanding of the evolution of the maize-beans-squash intercropping system so widely documented during the early Historic period is discussed.

***Eubanks**, Mary (Department of Biology, Duke University, Durham, NC 27708-0338)*

THE ORIGIN AND EVOLUTION OF MAIZE (*ZEA MAYS* SSP. *MAYS* L.): A SYNTHESIS OF EVIDENCE FROM COMPARATIVE GENOMICS, EXPERIMENTAL PLANT BREEDING, AND ARCHAEOLOGY

Maize, referred to as corn in the United States, has been the cornerstone of American agriculture from its inception. The earliest macrobotanical remains of maize (*Zea mays* ssp. *mays* L.) in the archaeological record have all the basic characteristics of domesticated maize. Under domestication maize lost its ability for self-propagation and became completely dependent on humans for survival. Although there is scientific consensus that maize traces its descent from teosinte (*Zea* sp.), wild grasses endemic to Mesoamerica, questions concerning its ancestry remain. The conundrum of its origin is how a plant's seed-bearing inflorescence could be radically transformed from a small, shattering spike of 5–7 seeds embedded in hard fruitcases into an ear with hundreds of unprotected kernels on a large, non-shattering cob. This remarkable structure, unparalleled in the botanical kingdom, is a true anthropogenic artifact whose evolutionary history is intricately intertwined with cultural development and diffusion. Maize has many duplicate genes indicating, like wheat and most other grasses, more than one genome contributed to its genetic background. DNA fingerprinting of maize and related grasses indicates that its genetic constitution is a composite of the genomes of its two closest relatives, teosinte and gamagrass. This genetic evidence is supported by experimental crosses between teosinte and gamagrass that produced fertile offspring with the same morphological features of ancient maize. A summary of the molecular and experimental evidence will be followed by a look at how subsequent dispersals from the Mesoamerican cradle gave rise to the extraordinarily rich genetic diversity of maize.

***Gepts**, Paul (Department of Agronomy and Range Science, University of California, Davis, CA 95616-8515)*

ORIGIN AND DISPERSAL OF COMMON BEAN (*PHASEOLUS VULGARIS* L.)

The study of crop evolution attempts to identify the evolutionary forces that have shaped the current distribution of genetic, morphological, and physiological diversity in crop species as a consequence of their interactions with humans. Specific questions raised are the specific area of origin, the routes of dispersal both within and from the centers of domestication, the changes that the plant underwent as a consequence of domestication, and the interactions between the crop and its wild progenitor. Common bean has proven to be an outstanding model to answer some of these questions. It is the single most important legume species for direct human consumption. It also has a worldwide distribution and displays a wide array of morphological types, including seed types. Where did this species originate and how did it achieve its current distribution and variation? Molecular analyses have allowed us to pinpoint the center of origin prior to domestication and the two major centers of domestication in Middle America and the Andes, respectively. They have also allowed us to follow the paths of dispersal from these two centers of domestication within the Americas and to and from other bean growing areas elsewhere. Furthermore, the location of major genes for domestication in the bean genome and the effect of these genes on the distribution of genetic diversity between wild and domesticated types has been determined. In this presentation, I will give an overview of the major findings on these topics and will raise possible further issues to be studied.

***Smith**, Margaret E. (Dept. Plant Breeding, Cornell University, Ithaca NY 14853)*

TAILORING VARIETIES FOR CROP MIXTURES: FARMER BREEDING FOR MAIZE-BEAN-SQUASH SYSTEMS

The crop varieties grown in traditional agricultural systems evolved through a process of natural and human selection to be genetically tailored to those systems. Natural selection ensured that the varieties worked well in the climate, soils, pests, and crop mixtures that were present. Human selection is less well understood and may have either been intentional or inadvertent. We are learning more about the nature and effects of farmer selection based on studies of present-day farmer breeders, primarily in the

tropics. Their concepts and selection practices shed light on what impacts and achievements human selection might have had in agricultural systems like the maize-bean-squash system in pre-contact times. The state of our current understanding will be discussed as it relates to long-term selection done by farmer-breeders in the maize-bean-squash system. I will also discuss prospects for continued variety improvement in this agricultural system through farmer-participatory plant breeding, which takes advantage of both farmers' knowledge of their crops and agro-ecosystems and scientists' knowledge of genetics, experimental design, and statistics.

***Asch Sidell**, Nancy (Archeobotanical Consultant, Oakland, ME 04963)*

THE IMPACT OF MAIZE-BASED AGRICULTURE ON PREHISTORIC PLANT COMMUNITIES IN THE NORTHEAST

Quantitative analysis of carbonized plant remains from sites throughout the Northeast makes it possible to study changes in plant communities that ensued with the introduction of maize-based agriculture. In the Midwestern U.S., maize-based agriculture was preceded by a long period of cultivation and domestication of native species. In New England there is no credible evidence that cultivation of small native seeds preceded maize-based agriculture, although maize and native seed cultivation occurred at the same time in some parts of the Northeast. This paper discusses the nature of vegetation changes that coincided with adoption of maize agriculture in New England, New York, Pennsylvania, and North Carolina, based on archeobotanical indicators. Consideration is given to (1) the impact of maize-based agriculture on woody plant communities, as inferred from wood charcoal, nutshell, and seed analysis; and (2) the changes in frequency of annual and perennial herbaceous plants, in particular legumes, grasses, and *Chenopodium*.

***Neusius**, Sarah W. **(**Indiana University of Pennsylvania, Dept of Anthropology, Indiana, PA 15705), and Renee B. **Walker** (Skidmore College, Dept of Sociology, Anthropology and Social Work, Saratoga Springs, NY 12866)*

GARDEN HUNTING: PART OF NORTHEASTERN HORTICULTURAL SYSTEMS OR NOT?

Garden hunting, an animal procurement strategy documented among horticultural groups in tropical and temperate environments, is of obvious interest to the natural history of the northeastern United States. It is logical that maize-beans-squash horticulturists in the Northeast would have practiced garden hunting because such a strategy reduces competition for crops while providing high quality animal protein at low cost. Unfortunately, very little archaeological research has focused on animal usage as part of horticultural systems, even though ethnohistorical accounts and archaeological data suggest garden hunting should be investigated further. We propose that garden hunting is not an invisible strategy in archaeological assemblages. In the Northeast, species that may indicate garden hunting include ecotone dwelling animals such as deer, rabbits, foxes, skunks, woodchucks and other small rodents as well as many species of birds including bobwhites, grackles and crows. In addition, high diversity within a faunal assemblage may indicate the presence of garden hunting. In this paper, we demonstrate a methodology for documenting garden hunting and explore archaeological faunal data from post AD 1000 sites in a variety of Northeast contexts as an avenue for exploring the nature of garden hunting in this region. Our research provides a baseline for further study of animal exploitation as part of maize-beans-squash horticultural systems.

***Milner**, George R. (The Pennsylvania State University, Department of Anthropology, University Park, PA 16802)*

PATTERNS OF POPULATION GROWTH AND SUBSISTENCE CHANGE IN EASTERN NORTH AMERICA

Two of the foremost problems facing the contemporary world are high population growth and the relationship between people and essential resources. Archaeological data, despite its many inadequacies, can provide long-term perspectives on such issues extending back many thousands of years. Here population growth in prehistoric eastern North America is estimated using counts of sites from eight states (>90,000). Several thousand years of population growth during the initial occupation of this region were followed by a long period of stagnation that spanned much of the time when hunting-and-gathering was the sole way of life. Populations again increased during the last several thousand years of prehistory (about 0.06% per year), beginning when the first domesticated plants appear in the archaeological record. It has long been recognized that the move toward agriculture was a lengthy process. But a compilation of plant data from Eastern Woodlands sites shows that it proceeded in a step-wise (not gradual) pattern. This pattern of change—periods of stasis punctuated by episodes of rapid change—makes sense in terms of the organizational changes required of human societies to put into effect fundamentally new means of boosting productive outputs. This study highlights a major challenge facing archaeologists today: how do we go about making the fullest use of the unprecedented amount of information that is being amassed at such a great cost in time and effort?

The Adirondack Effects Assessment Program (AEAP)
Organized Papers Session

Organizer and moderator: *Charles W.* ***Boylen*** *(Rensselaer Polytechnic Institute, Darrin Fresh Water Institute and Department of Biology, Troy, NY 12180-3590)*

Overview of the Adirondack Effects Assessment Program (AEAP)

The EPA funded AEAP was established at Rensselaer Polytechnic Institute under the scientific direction of Sandra A. Nierzwicki-Bauer and Charles W. Boylen. The program was awarded in 1994 and is funded through 2007. This invited session has been organized as the first cohesive scientific presentation of this long-term environmental study that has followed a number of chemical and biological variables in a suite of lakes and ponded waters in the western Adirondacks. A program of this magnitude would not be possible without the establishment of collaborations with numerous scientists and co-investigators. James Sutherland at the NYS DEC and Greg Lawrence at USGS have served as coordinators of the lake surveys and watershed studies, respectively. Other collaborators have contributed to more specialized project components. The presentations that follow summarize and highlight the overall project findings to date.

Whittier*, Thomas R. (Dynamac, Inc., U.S. EPA National Health and Ecological Effects Research Laboratory, Western Ecology Division, Corvallis, OR 97333), Steve G.* ***Paulsen****, David P.* ***Larsen****, Spencer A.* ***Peterson****, Philip R.* ***Kaufmann*** *(U.S. EPA National Health and Ecological Effects Research Laboratory, Western Ecology Division, Corvallis, OR 97333), and Alan T.* ***Herlihy*** *(Department of Fisheries & Wildlife, Oregon State University, Corvallis, OR 97331)*

Plenary Paper: Indicators of Ecological Stress and Their Extent in the Population of Northeastern Lakes

The Environmental Monitoring and Assessment Program (EMAP) surveyed 345 northeastern lakes, during 1991–1996, in the first regional-scale survey to use a probability-based sampling design to collect biological assemblage data along with a broad range of physical and chemical indicators of stress to lakes. I focus on limnological topics, primarily, nutrient enrichment, acidification, and the extent and effect of impoundments, along with data on metals contaminants in fish, non-natives, and riparian disturbance. The results are presented as estimates of the extent to which the population of lakes in the Northeast were in impaired condition or subject to ongoing stress. Nearly half (47%) of the northeastern lakes were human-made impoundments; most of these were in the lowland ecoregions. Sediment diatom data indicate that natural lakes in the Northeast were rarely eutrophic in the past. In the 1990s, an estimated 24% of lakes and impoundments were eutrophic or hypereutrophic; 83% of these were impoundments. Acidification was the least extensive stress in the region, with 2% of lakes being acidic and another 12% being acid-sensitive. Fish in 24% of lakes had mercury concentrations exceeding 0.2 µg/g. Fish assemblages were extensively stressed by non-native species. Only 21% of lakes had no non-native fish, while 15% of lakes had more non-native species than natives. Shoreline alteration was fairly extensive, with 23% of lakes having visible evidence of human activity at half or more of the riparian assessment stations. Finally, I present a relative rankings of the extent of these stresses to Northeast lakes.

Boylen*, Charles W. (Rensselaer Polytechnic Institute, Darrin Fresh Water Institute, and Department of Biology, Troy, NY 12180-3590)*

The Adirondack Effects Assessment Program: Relationship to Historic Impacts of Acid Deposition on Adirondack Lakes

In 1994, the Adirondack Effects Assessment Program was established at Rensselaer's Darrin Fresh Water Institute with funding from the US EPA. The program was designed to provide chemical and biological data necessary to evaluate the effectiveness of the 1990 Clean Air Act legislation. The program is a scientific collaboration of state, federal and university investigators. In excess of 2800 lakes and ponded waters are found in the Adirondack region of NYS. Although the region as a whole is susceptible to acidic deposition, these waters vary considerably in the degree of impacts, both chemical and biological. Many are seriously impacted by acidic deposition with significant degradation in biotic resources. For the AEAP, 30 lakes

and ponded waters were chosen for extended study, in addition to supporting three atmospheric deposition sites and two stream systems. A synoptic sampling program including physical, chemical, and biotic variables was initiated with multiple samplings within a single season. Designed to assess the current state of different trophic levels as an estimate of ecosystem health, the study is unique in that it has provided baseline data upon which to evaluate long-term (temporal) changes in lake communities in this region. After 8 years of simultaneously evaluating the effects of acidification on water chemistry and multiple trophic levels in several types of lake systems, quantitative data on bacterioplankton, phytoplankton, zooplankton, aquatic plants and fish have provided insight into the interactive relationships between environmental factors and species abundance, biodiversity and possible indicator species.

***Raynal**, Dudley, Jack **Tessier** (State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210), and Alfred **Stamm** (State University of New York College at Oswego, Oswego, NY 13126)*

Sixteen-Year Trend of Atmospheric Deposition in the Northeastern US

In 1990, Congress passed amendments to the Clean Air Act requiring a decrease in emissions of sulfur dioxide and nitrogen oxides. Phase I of this plan began in 1995. We analyzed precipitation volume, wet deposition, and concentration of nitrate, sulfate, and sum of base cations measured at NADP sites in New York (NY), Vermont (VT), New Hampshire (NH), and Massachusetts (MA). We compared annual means prior to and following passage of the 1990 Clean Air Act and for six years after implementation of Phase I. Most NY sites exhibited a decline in sulfate deposition over the assessed time periods, whereas only one site in Vermont and the MA site displayed this trend. Only one of the monitoring stations recorded a significant decline in base cation deposition. The trend of decreasing sulfate deposition was driven by a decline in sulfate concentration rather than by precipitation volume. Three sites showed a decline in base cation concentration and several NY sites, but none in VT, NH, and MA had decreasing nitrate concentrations. None of the sites exhibited a significant change in precipitation volume and this factor appears to be overshadowing the declines in ion concentration and thus minimizing declines in ion deposition. Since current declines in ion concentration are not sufficient to result in decreased deposition at all locations further emission decreases may be in order.

***Sutherland**, James W. (New York State Department of Environmental Conservation, Division of Water, Albany, NY 12233-3508)*

Temporal Changes in Chemical Factors Associated with the Acidification of Adirondack Lakes and Ponds

The 30 lakes and ponds presently under investigation in the Adirondack Effects Assessment Program (AEAP) were selected to represent hydrologic categories that 1) are the most impacted by acidification and 2) may be most likely to demonstrate the effects of recovery. An evaluation of data collected from 1994 through 2001 reveals distinct trends of certain acidification analytes within particular hydrologic types. For example, nitrate (NO_3) concentrations have decreased steadily in 18 of the 30 waters with an associated rise in pH levels in many of these same waters. Twelve (12) of the waters are thin till, drainage systems that are the most susceptible to acidification impacts. Base-cation concentrations have increased steadily in 18 waters during the eight-year period. Sulfate (SO_4) concentrations have remained the same in 27 Program waters from 1994 through 2001, reflecting the fact that reductions in sulfate emission, and deposition, were achieved prior to initiation of the AEAP, beginning locally (New York State) during the late 1980's and spreading to a broad geographic scale immediately following the 1990 Clean Air Act Amendments. The trends documented in major acidification analytes are supported by parallel trends in some factors that are associated with productivity in lakes and ponds, including transparency of the water column and concentrations of total phosphorus, total nitrogen and chlorophyll *a*. Collectively, these results demonstrate the interactive relationships between environmental, chemical and biotic variables in Adirondack waters.

***Nierzwicki-Bauer**, Sandra A. (Rensselaer Polytechnic Institute, Darrin Fresh Water Institute, and Department of Biology, Troy, NY 12180-3590)*

Bacterial Diversity of Adirondack Lakes as Revealed by 16S rRNA Gene Sequences

Bacterial communities of several lakes in the Adirondack Mountains of New York State were characterized by amplification and sequencing of 16S ribosomal DNA. Analysis of sequences revealed a diverse collection of lineages, largely belonging to the class *Proteobacteria* (alpha, beta and gamma subdivisions), the phylum *Cytophaga-Flavobacteria-Bacteroides*, and the order *Actinomycetales*. Additionally, a number of the sequences were similar to those of the order

Verrucomicrobiales. However, many of the sequences obtained were not closely related to those of characterized species. Based on the sequence data, oligonucleotide probes have been designed, experimentally tested and are being used for a more rapid classification of major bacterial groups in acid stressed Adirondack lakes. The relative contributions of the groups of sequences differed among the lakes, suggesting that bacterial population structure varies and that it may be possible to relate aquatic bacterial community structure to water chemistry.

***Charles**, Donald F. (Academy of Natural Sciences, Patrick Center for Environmental Research, Philadelphia, PA 19103-1195)*

PHYTOPLANKTON ASSEMBLAGES IN LAKES STUDIED BY THE ADIRONDACK EFFECTS ASSESSMENT PROGRAM

As part of the Adirondack Effects Assessment Program (AEAP), we analyzed the phytoplankton assemblage composition of samples collected between 1994 and 1999 from a series of Adirondack lakes. The lakes encompass a gradient of acid and nutrient conditions. We observed approximately 225 species, mostly greens (~100), blue-greens (40), chrysophytes (30) and diatoms (30+); there were also several dinoflagellate species and various flagellated cryptophytes and euglenoids. Several distinct assemblages were found. They occurred under different acidity and nutrient conditions, and in different seasons and years. They included assemblages that were dominated by blue-green coccoids, colonial chrysophytes, dinoflagellates, greens and cryptophytes. Multivariate analyses were employed to explore and quantify differences in assemblage composition due to season or year and those due to acidity, nutrient, and other water chemistry conditions. This understanding will be used to assess the effects of acidification changes on phytoplankton, and to help determine if there are signs of biological recovery in response to recent changes in atmospheric deposition.

***Shaw**, William H. (Marist College, Environmental Science Department, Poughkeepsie, NY 12601)*

THE EFFECTS OF ACIDIFICATION ON ZOOPLANKTON IN THE ADIRONDACKS

Zooplankton community composition and species richness in the 30 AEAP lakes varied with respect to monomeric aluminum and pH. Species richness was strongly correlated with pH, but only weakly with aluminum. However, the disappearance of species from the species pool derived from the 30 lake set, was linearly correlated with aluminum and curvilinearly correlated with pH. This is taken as evidence that the alteration in community composition that occurs with acidification is more directly related to aluminum than to pH. The disappearance of fish from a lake is also suspected of playing a role in affecting community composition. Seven of the 30 lakes, which are probably fishless, have the lowest species richness. The species of Chaoborus found in the lakes supports the contention that the seven are indeed, fishless. Evidence from the examination of crustacean species richness found in other Adirondack lakes indicates that there is a decline in species richness that is independent of pH. In summary, there appears to be three components to the alteration in zooplankton community composition that occurs with acidification, a decline in pH, an increase in monomeric aluminum levels and the disappearance of fish. By inference, the recovery of the zooplankton community from acidification will probably require a return to pre-acidification pH and aluminum levels in addition to the return of fish to the lakes.

***Eichler**, Lawrence W. (Rensselaer Polytechnic Institute, Darrin Fresh Water Institute, Bolton Landing, NY 12814)*

SUBMERSED MACROPHYTE COMMUNITIES OF ADIRONDACK LAKES: RELATIONSHIP BETWEEN COMMUNITY STRUCTURE, ACIDITY AND DOC

The Adirondack Mountain region of upstate New York contains over 2800 lakes and ponds. Many of these now show considerable ecological stress due to gradual acidification from atmospheric deposition of sulfate and nitrate ions. A suite of 30 high altitude lakes representing a mixture of seepage, thin and medium till, and low and high DOC are being studied for chemistry and biota to address temporal shifts in the roles of factors important in acidification. Lake values of pH range from 6.9 to 4.6 and alkalinity from 136 to -28 µeq/L. The submersed and floating-leaved macrophyte communities of a subset of 18 lakes have been characterized via a modified line intercept method employing SCUBA diver transects. Plant communities have been delineated in terms of species present, percent cover, and percent frequency. When data were analyzed along chemical and pH gradients, shifts in species composition and abundance occurred. Fine-leaved and rosette forms displaced broad-leaf forms, dramatically altering littoral zone structure. Species richness and abundance declined with increasing acidity. These surveys provide a foundation or baseline to evaluate the effects of changing sulfate and nitrate deposition patterns on aquatic plant populations in this region.

***Daniels**, Robert (New York State Museum, Research and Collections, Albany, NY 12230)*

Fish Assemblages in Eleven Adirondack Lakes

Twenty-two species of fish were taken in eleven lakes in the southwestern quadrant of the Adirondack Park, Herkimer and Hamilton Counties, New York. Abundant species included brown bullhead, common shiner, golden shiner, white sucker, pumpkinseed and yellow perch. Four salmonids were taken, although they never represented more that 5% of the assemblage composition; only brook trout was taken consistently. Species richness ranged from 3 to 14 species per lake. Eight of the species were present in only one lake. Species composition and assemblage structure of these lakes is similar to that found in lakes throughout the area. Using mark-and-recapture techniques, population sizes were estimated for brown bullhead, white sucker, pumpkinseed, rock bass and yellow perch (minnow population size was estimated only once). We sampled Moss, Dart and Rondaxe Lakes annually. In these lakes, estimated population sizes were variable. Populations of some species were relatively constant among years within the lake; for example, the Dart Lake white sucker population ranged between 3500 and 5000 individuals. Whereas populations of other species varied; yellow perch in Dart Lake ranged between 2200 and 11000 individuals. The 14 commonly encountered species are represented by several size classes, indicating continued annual recruitment in all lakes.

***Lawrence**, Gregory B. (US Geological Survey, Troy, NY 12180)*

Acidification Status of Streams in the Western Adirondack Region

The western Adirondack region of New York is recognized as the area where acidic deposition effects have been greatest, with a concomitant acidification of a large number of lakes. Much less attention has been given to stream chemistry, although the US EPA Episodic Response Program identified chronic and episodic acidification in 4 streams in this region in the late 1980's. Regional assessments of stream chemistry, similar to that done for lakes, are lacking. Interest in the acidification status of both lakes and streams in the region has been rekindled by passage of the 1990 Clean Air Act Amendments. Twenty streams in the Old Forge–Inlet area have been sampled through the Adirondack Effects Assessment Program (AEAP), seasonally, since 1998, to determine their chemical characteristics. In four of these streams acid-neutralizing capacity (ANC) was below 10 $\mu eq\ L^{-1}$ on all sampling dates, indicating these streams are chronically acidified. In 17 of the 20 streams, an ANC value below zero was recorded at least once, with pronounced depressions in ANC, indicating that most streams still experience episodic acidification to levels that harm aquatic biota. Throughout the year, SO_4^{2-} is the predominant inorganic anion, although during snowmelt, NO_3^- concentrations can approximate SO_4^{2-} concentrations on a microequivalent basis in several of the streams. All watersheds show a consistent pattern of peak NO_3^- concentrations in April and minimum concentrations in early fall. None are effective at retaining NO_3^- throughout the year, indicating that these watersheds are all at a similar stage of nitrogen saturation in which consistent seasonal acidification occurs.

***Momen**, Bahram (University of Maryland, Department of Natural Resource Science, College Park, MD 20742)*

Temporal Chemistry Trends in a Set of Lakes in the Southwestern Adirondacks, New York

Twenty-five lakes in the southwestern portion of the Adirondack Park, New York, were sampled to address temporal changes with regard to a suite of lake water chemistry variables important in lake acidification. The study lakes included seepage and drainage types with low and high dissolved organic carbon. Three sets of data, collected from these lakes during summers of 1984-1987 (period I), 1994-1998 (period II), and 1999-2001 (period III) were compared using cluster analysis of lake water chemistry variables consisting of ANC, pH, SO_4^{2-}, NO_3^-, Na^+, Mg^{2+} and K^+. For period I, cluster analysis identified three major lake groups that matched sensitive, moderately sensitive and non-sensitive lakes based on their acidification status and geological setting. Sensitive lakes included seepage and thin-till lakes, while non-sensitive of lakes were included mostly medium-till non-acidic lakes. From 1984 to 2001, cluster analysis of data for all periods indicated that cluster membership remained the same for 14 lakes (56%). Four sensitive lakes (16%), four moderately sensitive lakes (16%), and 6 least-sensitive lakes (24%) were included in this category. While four lakes (16%) switched back and forth from sensitive to least-sensitive categories, six of the 15 original sensitive lakes (40%) seem to behave like moderately sensitive or least-sensitive lakes in the third period (1999-2001). None of the moderately sensitive or least-sensitive lakes have shown signs of temporal degradation.

Late Quaternary Landscapes of the Northeastern US
Organized Papers Session

Organizer and moderator: *Guy* ***Robinson*** *(Fordham University, Department of Biological Sciences, Bronx, NY 10458)*

Overview: The northward retreat of glacial ice opened up the region to colonization by assemblages of plants and animals. Late Pleistocene climate change went on to transform those communities even as the face of the land was reshaped profoundly due to the dynamics of deglaciation. Although the region must have undergone a similar course of events during earlier deglaciation episodes, the Holocene opened with most of the native large mammals lost to extinction. People also had arrived by the time the ice margin reached the St Lawrence Valley, eventually making their own mark upon the landscape and beginning the human prehistory of the Northeast.

Connally*, G. Gordon (New York State Museum Associate, Albany, NY 12230), Donald H.* ***Cadwell****, (New York State Museum, Research and Collections, Albany, New York), and Les* ***Sirkin****, (Emeritus Professor, Adelphi University,* deceased*)*

Late Pleistocene Environments of the Hudson Champlain Trough, New York

The late Pleistocene Woodfordian glacier reached its maximum advance across the Staten Island Narrows at -21.75 ka. The glacier receded northward up the Hudson and Champlain Valleys, interrupted by the Rosendale Readvance in the Mid-Hudson Valley at -16.02 ka, the Luzerne Readvance in the northern Hudson Valley at -13.15 ka, and the Bridport Readvance in the Champlain Valley at -11.90 ka. The ice margin cleared the St. Lawrence Valley by -11.70 ka. A great proglacial lake was impounded between the terminal moraine and the receding ice margin; Glacial Lake Hudson, south of the Hudson Highlands; Glacial Lake Albany when it expanded north of the Highlands. Most east and west tributaries supported similar lakes as evidenced by varved clays and silts, deltaic sands, and organic successions. As Lake Albany sought new and lower outlets, lower lake levels resulted. When the glacier cleared the St. Lawrence lowland, marine waters invaded the Champlain Valley, creating the Champlain Sea. Post-glacial isostatic rebound ended the marine phase at about -11.00 ka. During glacial recession, the Hudson, Wallkill, and Minisink Valleys had lacustrine environments in the valley and raw rock or glacial sediments in the uplands. Tundra vegetation followed the receding ice margin. Spruce, pine, and oak forests successively replaced tundra in the valleys, but tundra lasted longer in the uplands. Once lakes drained, lowlands featured lacustrine plains bordered by ice-contact stratified drift. In the Wallkill Valley, extensive paludal deposits resulted from vegetation filling former lakes (the Orange Co. muck farms). The Champlain Sea left marine clays bordering Lake Champlain. From Albany to Glens Falls, outwash and lacustrine/deltaic sands were reworked into aeolian sand plains, with migrating dunes, sometime between -11.70 and -5.71 ka.

Miller*, Norton G. (New York State Museum, Research and Collections, Albany, NY 12230)*

Late-Pleistocene Tundra in the Northeast: Evidence North and South of the Glacial Boundary from Fossil Plants

Recognition of tundra vegetation the fossil record has been a challenging problem in Quaternary paleoecology, because aerial, long-range transport of pollen obscures distinctions between vegetation types. Plant macrofossils (e.g., leaves, seeds), in contrast, are dispersed mainly over ground or by water and for short distances. They have great potential for untangling characteristics of small-scale vegetation at a high degree of taxonomic resolution. I have used macrofossils from glacial varves and basal sediment in kettle holes to decipher the occurrence and character of tundra floras on glaciated terrain (New York State, northeastward into Canada). Vascular plant and bryophyte floras of periglacial regions were diverse and phytogeographically varied during deglaciation. Plants of mesic and hygric calcareous habitats were common. Extirpation of lowland plant populations left species isolated in suitable alpine habitats in the northeastern mountains hundreds of km south of contemporary range limits. How far south did tundra vegetation occur during the latest Wisconsinan cold stage? Peat near Francis Mills (43 m; New Jersey Coastal Plain), deposited in a terrace at $26{,}720 \pm 120$ ^{14}C yrs, contains a strong tundra signal (*Arctostaphylos alpina*, *Dryas integrifolia*, *Empetrum* cf. *nigrum*) and 56% pollen of herbs. Sediments $16{,}080 \pm 60$ to $14{,}419 \pm 50$ ^{14}C yrs old in a small sinkhole pond at Kings Gap (206 m; south-central Pennsylvania, Cumberland Valley) contain a similar flora (*Betula glandulosa*, *D. integrifolia*, *E.* cf. *nigrum*, *Salix* spp., *Vaccinium uliginosum*). Spruce twigs and needles occur in the peat but are absent or weakly represented in the sinkhole sediment. These data argue for a long interval of cold, arctic or subarctic climate, during which characteristic frost-induced landforms in the unglaciated northern Appalachians may have originated.

***Peteet**, Dorothy M. (NASA/Goddard Institute for Space Studies, New York, NY 10025, and LDEO, Palisades, NY 10964), Terryanne **Maenza-Gmelch** (NYU, Dept.of Biology, New York, NY 10003), Dorothy **Kurdyla** (LDEO, Palisades, NY 10964), and Tom **Gulderson** (Center for AMS, Lawrence Livermore Labs, Livermore, CA 94551)*

Black Rock Forest, NY: A Carbon Sink during the Late-glacial

Mid-latitude forest ecosystems have been proposed as a "missing sink" for carbon today. The role of soils (including wetlands) in this proposed sink is unknown. How did past climate change affect net wetland carbon storage? An AMS-C-14 dated record of vegetational change from Sutherland Fen, NY in Black Rock Forest spanning the last 12,400 years is compared with existing data from nearby Sutherland Pond, NY. While the fen demonstrates the high carbon accumulation rate during the late-glacial compared to the Holocene, the pond does not. Macrofossils at both sites reveal the local dominance of spruce at the fen. Changes in hydrology, temperature, and vegetational composition have all contributed to the changes in fen carbon storage from the late-glacial to the present.

***Sherpa**, James M., Peter L. **Nester**, and Warren D. **Allmon** (Paleontological Research Institution, Ithaca, NY 14850)*

Comparative Taphonomy and Osteology of Three New Mastodon Skeletons from New York State

Three mastodon skeletons (*Mammut americanum*), two relatively complete and one incomplete, were discovered in 1999 and 2000 at three localities across New York State: Hyde Park, Dutchess County; Chemung County and North Java, Wyoming County. These finds were fully excavated and the materials are now housed at the Paleontological Research Institution in Ithaca, New York. The Chemung and Hyde Park Mastodons were found in situ in kettle pond sediments, and the North Java Mastodon was removed from a kame deposit. All three exhibit various signs of wear and abrasion, from pristine to highly degraded. The bones of the Hyde Park Mastodon, dated at around 11,500 yr B.P., are pristine, with more than 90% of the specimen recovered. The skeleton exhibits ossified growths and significant thinning of vertebral facets, affecting the animal in life. Skeletal damage, including obliquely fused hyoids, molar damage, and rib breakage and rehealing show potential trauma during life. There is comparable taphonmy between the Chemung and North Java Mastodons. The Chemung find appears to include bones of at least two proboscidians; one is much more complete than the other; one may be a mammoth. The bones are abraded in a manner suggestive of trampling by other animals. The North Java Mastodon shows considerable wear and scavenger gnaw marks, indicating that the bones were exposed to the elements for a significant amount of time before burial. Measurements of these remains suggest that this specimen may have been an adult female.

***Robinson**, Guy, David A. **Burney**, and Lida **Pigott Burney** (Fordham University, Department of Biological Sciences, Bronx, NY 10458)*

Palynological Clues to the Timing of Megafaunal Extinction in the Lower Hudson Valley

Landscape-level pollen, spore and charcoal particle analysis of four sites in southeastern New York State suggest arrival of humans and megafaunal collapse occurred perhaps a millennium in advance of the Younger Dryas climatic reversal. The onset of human activity in the region is inferred from an order-of-magnitude rise in microscopic charcoal concentrations. The distinctive spores of a dung fungus, *Sporormiella*, serve as a proxy for the intensity of the herbivory regime. *Sporormiella* values display a marked decline in the late glacial regional pollen stratigraphy, coinciding with the charcoal rise. Both events occur at a time when oak and other warm-adapted tree pollen types are rising. The overall pattern is consistent with megafaunal extinction many centuries before the return of boreal tree species, identified as a regional response to the Younger Dryas cooling event. AMS dates on bone collagen from late occurrences of mastodon and stag moose in the region lend further support to a reconstruction in which megafaunal collapse correlates with human arrival.

***Russell**, Emily W.B. (Rutgers University, Department of Biological Sciences, Newark, NJ 07102)*

Changing Forest Patterns in the Northeast, 300 Years Ago to the Present

People have been in North America at least since the end of the Wisconsinan glaciation. Discerning their influence on pre-Columbian ecosystems is difficult because vegetational patterns changed substantially under the influence of climate, especially in the first few thousand years after glacial retreat. One way to study the relative importance of human versus non-human factors in the last thousand years, when climate was relatively stable, is to compare vegetational patterns before the

onslaught of European settlers with those that have reestablished themselves over the last century. Patterns that are similar are under strong climatic and substrate influences, while differences may indicate human influence. Using 18th and early 19th century documents, I compiled a list of trees growing in Rensselaerville, NY to determine the composition of forests before they were cleared for farms and industry. Beech, sugar maple and hemlock dominated, with hemlock probably locally abundant in ravines and low areas along streams. This forest composition resembles the Catskill Mountains and the Finger Lakes region of New York, and differs from more southern forests by having less oak, hickory and chestnut, and from more northern forests by having less spruce. Forests that are regenerating today after abandonment of agricultural fields are composed primarily of the same species though probably in different proportions, with the addition of red oak, suggesting that climate exerts the major control over the forest type. The influence of native Americans is thus not apparent in the broad patterns, but may have been locally important.

***Burney**, David A., and Guy **Robinson** (Fordham University, Department of Biological Sciences, Bronx, NY 10458), and Paul S. **Martin** (University of Arizona, Department of Geosciences, Tucson, AZ 85721)*

ONWARD TO THE PAST: PALEOECOLOGY'S ROLE IN THE QUEST FOR A BETTER FUTURE

The initial coupling of natural and human systems is a moment in geological time of much scientific interest and considerable controversy in nearly every place colonized by prehistoric humans. The details of what happened in the late Quaternary in the wake of human arrival are potentially useful facts that could edify important environmental debates. The papers in this symposium illustrate that science has made progress on this topic in the Northeast, but also that the potential for additional discoveries concerning environmental change, extinction, and early human adaptation in the region is far from exhausted. Two related approaches are especially useful for testing causal hypotheses for the extinctions and models of prehistoric ecosystem dynamics. One of these is integrated site analysis—the study of fortuitous sites containing a broad ensemble of relevant fossil information, including vertebrate bones, invertebrate shells, palynomorphs, plant macrofossils, and human indicators, in a well-dated stratigraphic context spanning the time before, during, and after initial human arrival. The other is landscape-level paleoecology—the integration over ecosystem-scale geographic units of dated events in the fossil record that are crucial to hypothesis testing and model verification, particularly first evidence for humans, last evidence for extinct species, and proxy records of environmental change. Regardless of the cause or causes of the postglacial biotic transformations, one thing is clear: the Northeast today supports a diversity of large animals far lower than at any time in the preceding 40 million years. Until recently, ecologists and conservation biologists have completely ignored this important fact.

Mammals
Contributed Papers Session

***Van Niel**, John J., Robert A. **Wink**, and Karin A. **Wittmann** (Finger Lakes Community College, Canandaigua, NY 14424)*

PUBLIC SURVEY OF THE NATURAL HISTORY OF CHARISMATIC FAUNA OF NEW YORK

A question and answer survey was administered to 244 attendees of the NYS DEC Hunting and Fishing Days in Avon, NY (September 2000). The survey was designed to assess the beliefs of the attendees concerning both the history and current status of 13 animals in New York State. In addition, respondents were required to evaluate both their level of interest in observing each animal, and skill level in several outdoor wildlife activities: bird watching, hunting fishing, wildlife photography, and wildlife viewing. Finally, respondents provided demographic information such as gender, age, and level of education. Emphasis will be placed on the results from questions concerning timber wolf (*Canis lupus*), mountain lion (*Felis concolor*), moose (*Alces alces*), and coyote (*Canis latrans*). Recommendations for education will be discussed.

***Hill**, Elizabeth A., Stephen D. **DeGloria** (Cornell University, Department of Crop and Soil Sciences, Ithaca, NY 14853), and Milo E. **Richmond** (Cornell University, NY Cooperative Fish and Wildlife Research Unit, Department of Natural Resources, Ithaca, NY 14853)*

Improving Prediction Accuracy of a Wildlife Habitat Model

The ability to accurately predict species distributions using a wildlife habitat model is important for making conservation and land use decisions. Using geographic information systems (GIS), the New York State Gap Analysis Project integrated such factors as land cover and elevation to map suitable habitat for 366 vertebrate species statewide (Smith et al. 2001). Accuracy of the predicted distribution maps (PDMs) was assessed for all 366 species using a database of species observations. The results for mammal species were particularly low, with an average accuracy of 31.2%. We explored the possible causes of the low value, as well as likely ways to improve prediction accuracy, using the Hudson River Valley as a study area. The wildlife habitat model used to create the PDMs was refined by conducting an extensive literature review and new observational data was collected with which to validate the PDMs. We then conducted six accuracy assessment trials using the original and refined PDMs, the original and new species observation databases, and two new methods of validation. The new observational data improved the accuracy assessment more than the refined PDMs, but neither improvement was significant. The two new methods of validation significantly improved results, raising accuracy to 95.8% on average for all species examined. The new methods of accuracy assessment not only improved results, but also provided results at a finer spatial scale, which will be more useful for making conservation and land use decisions.

***Hoving**, Christopher L. (University of Maine, Department of Wildlife Ecology, Orono, ME 04469), Ronald A. **Joseph** (U.S. Fish and Wildlife Service, Old Town, Maine 04468), and William B. **Krohn** (U.S. Geological Survey, Biological Resources Division, Maine Cooperative Fish and Wildlife Research Unit, Orono, ME 04469)*

Geographic Distribution of Canada Lynx in Maine and the Northeast, 1833–1999

The contiguous United States population of Canada lynx (*Lynx canadensis*) has been listed as threatened under the federal Endangered Species Act. However, the historic distribution of Canada lynx in eastern North America is poorly understood. We used museum records, bibliographic records, and interviews to reconstruct the past distribution of Canada lynx in Maine, which is at the current southern limit of the species' distribution in the eastern United States. Prior to the 1900s, Canada lynx were much more widely distributed in eastern North America, ranging from Pennsylvania north into Quebec. After a thorough literature review, we found a total of 118 records, representing at least 509 individual lynx. Canada lynx were observed throughout Maine, 1833–1912, with the exception of coastal areas. After 1913 lynx were found throughout northern Maine, but had not returned to southern Maine by 1999. Records for other northeastern states and provinces suggest a contraction in the southern range of lynx circa 1900. Thirty-nine kittens representing at least 21 litters were distributed throughout northern and western Maine, 1864–1999. Although populations apparently fluctuated widely, in some years 200-300 lynx were harvested in Maine. Many naturalists noted that bobcats (L. *rufus*) expanded their range northward during the same period that Canada lynx range became smaller. Because Canada lynx have had a long presence in northern New England, and at times were relatively common, lynx merit serious consideration in conservation planning in this region.

***Myers**, Jonathan A., Mark **Vellend**, Sana **Gardescu**, and Peter L. **Marks** (Cornell University, Department of Ecology and Evolutionary Biology, Ithaca, NY 14853)*

Seed Dispersal by White-tailed Deer (*Odocoileus virginianus*) in Central New York

The white-tailed deer is the most abundant large herbivore in the northeastern United States. Yet, to our knowledge, the potential for deer to act as seed dispersal agents has not been studied in detail. We examined more than 100 pellet groups collected from forests in Tompkins County, New York for seed content and germination over a period of one year. Our results show that deer disperse the seeds of more than sixty species, including field and roadside plants (e.g. *Potentilla norvegica*, *Stellaria media*), invasives (e.g. *Lythrum salicaria*, *Rosa multiflora*, *Lonicera* spp.), and forest herbs (e.g. *Trillium grandiflorum*, *Poa alsodes*). Their ability to travel long distances, and to persist and thrive in a diverse range of habitat types, suggests that white-tailed deer could function as significant seed dispersal agents for a wide variety of plant species.

Broadwater, Kathrina (Hofstra University, Department of Biology, Hempstead, NY 11549)

RACCOON (*PROCYON LOTOR*) POPULATION SIZE AND MOVEMENTS AT JAMAICA BAY WILDLIFE REFUGE

A population of raccoons was introduced to Ruler's Bar Hassock, Jamaica Bay Wildlife Refuge, Long Island, in approximately 1990. This area is a prominent nesting beach for diamondback terrapins (*Malaclemys terrapin*), and now mammalian predation significantly reduces egg survivorship. I have begun collecting data on raccoon population size, growth rates and movements to determine the scope of the problem and how much the raccoon population relies on the terrapin eggs for survival. In summer and fall 2001 and winter 2002 I used live traps to capture raccoons, which were sedated and marked using ear tags. I recorded mass, body length, right hind foot length, sex, relative age, general health, and location of capture. In total I had 100 raccoon captures over 28 trap nights. 58 of these were recaptures; a total of 42 different raccoons were caught and marked. One raccoon was recaptured as many as 13 times. Reproduction was clearly occurring, as was growth and movement. Several raccoons originally captured in the terrapin nesting area in June were recaptured elsewhere in the Refuge in September. To develop a high degree of confidence in the estimated total population size and seasonal movements, trapping will continue throughout the 2002 season. I have had considerable difficulty radio tracking these raccoons but will try again in 2002. Once the size and movements of the population are established, there will be an evaluation of raccoon management options, to be implemented during the 2003 season.

Distribution and Ecology of Amphibians and Reptiles
Contributed Papers Session

Moderator: *Todd W.* ***Hunsinger*** *(New York State Museum, Research and Collections, Albany, NY 12230)*

Hunsinger*, Todd W. (New York State Museum, Research and Collections, Albany, NY 12230), David E.* ***Karrmann*** *(American Museum of Natural History, Education Dept. New York, NY 10024-5192), Scot M.* ***Magnotta*** *(University of Hartford, Biology Department, West Hartford, CT 06117), and Peter R.* ***Warny*** *(34 Bridle Path, Port Washington, NY 11050)*

THE SNAKES OF STERLING FOREST STATE PARK, NY, USA

Herpetological surveys were conducted in Sterling Forest State Park (SFSP) from March 1999 to present. Located in Orange County, New York, USA, the ecologically diverse 17,719 acre park consists of six major waterbodies, wetland complexes, mature forests, and early successional habitat. Eleven species of snakes representing four major taxa were recorded from SFSP. Containing 65% of the State's snake fauna, SFSP is an important resource. Data obtained on the distribution, abundance, behavioral ecology, and natural and life histories of these species will be presented, focusing on the Northern Racer (*Coluber constrictor*), Black Rat Snake (*Elaphe obsoleta*), Northern Copperhead (*Agkistrodon contortrix*), and Timber Rattlesnake (*Crotalus horridus*). The implications of the three species not confirmed during this study, Smooth Green Snake (*Liochlorophis vernalis*), Eastern Hognose (*Heterodon platyrhinos*), and Brown Snake (*Storeria Dekayi*) will also be discussed. The current snake assemblage will be placed in a historical context. Predictions for the future based on the ecology of the species and current and future land use will be addressed.

McGowan*, Edwin M. (State University of New York at Binghamton, Department of Biological Sciences, Binghamton, New York 13902), and William H.* ***Martin*** *(Rt. 3, Box 804, Harpers Ferry, WV 25425)*

ACORNS, RODENTS, AND RATTLESNAKES: EVIDENCE OF TRITROPHIC INTERACTIONS IN OAK FORESTS

The direct effects of acorn crops on mast-consuming rodent populations have only recently been incorporated into studies of species-level interactions in oak forests. Absent from these studies, however, are analyses of the indirect effects of mast crops on rodent predators. We examine possible effects of acorn crops on the Timber Rattlesnake (*Crotalus horridus*), a widely distributed small mammal predator in eastern oak forests, using long-term (ca. 20 years) records of rattlesnake reproductive output (litters seen/year) and acorn counts and estimates for the same time period and geographic area. We predicted that a large acorn crop in year 1 would lead to greater prey availability and a peak in rattlesnake mating in year 2. An increase in rattlesnake reproduction would be expected in year 3 due to long-term sperm storage and delayed ovulation in this species. Conversely, we predicted that acorn failure in year 1 would limit rattlesnake reproduction in year 3. Consistent with these predictions, we found a significant correlation between red oak (*Quercus rubra*) acorn crop size and the number of rattlesnake litters seen two years later during the 20-year period. Significantly, the greatest and least number of litters seen overall followed the largest and smallest acorn crops, respectively, by the predicted 2-year lag. We discuss this possible tritrophic interaction by examining the life histories of the component species in the context of the eastern oak-forest community.

***Brown**, William S. (Skidmore College, Department of Biology, Saratoga Springs, NY 12866)*

LONGEVITY IN FREE-LIVING TIMBER RATTLESNAKES (*CROTALUS HORRIDUS*)

An interesting question in field demographic studies of long-lived vertebrates is: How long do they live? One problem in answering this question is that, as in many reptiles, variation in growth rates results in variable age with size (body mass). In northern timber rattlesnakes, large adult males are presumably—but not necessarily—also old. A 22-year mark and recapture study presently being conducted in northeastern New York is achieving data that estimate the ages of snakes marked as young adults and recaptured as large adults over recapture intervals of 18 to 20 years. Using data from known-age individuals initially marked as neonates and recaptured as 8 to 12-year-olds, a conservative estimate is that it takes about 10 years for a male to achieve a body mass of 1000 grams. Males first marked in 1980–82 at estimated ages of 6–10 yr (body mass 500–1000 g) were recaptured in 2000–2001 as large adults weighing 1300 to 1600 grams; as of their last capture, these snakes are judged to be 25 to 28 years old. Because these snakes may be still alive, their ages should be treated as minimum longevity estimates. Due to annual variations in capture probabilities, long-term studies are necessary to document longevity in the wild of reptiles such as *Crotalus horridus* in northern cold-climate environments.

***Breisch**, Alvin R. (New York State Department of Environmental Conservation, Endangered Species Unit, 625 Broadway, Albany, NY 12233-4754), Peter K. **Ducey** (State University of New York at Cortland, Department of Biological Sciences, Cortland, NY 13045), and John W. **Ozard** (New York State Department of Environmental Conservation, Fish and Wildlife Services, Albany, NY 12233-4754)*

THE MOST COMMON SALAMANDER IN NEW YORK: HISTORIC VS. CURRENT PERSPECTIVES

In 1941, Sherman C. Bishop stated in *The Salamanders of New York* that the "dusky salamander is perhaps the commonest and most widely distributed species in the state." In a careful examination of his published records, it is apparent that he more frequently collected northern dusky salamanders (*Desmognathus fuscus*) than any other salamander species despite extensive field work with a number of species in a variety of habitats. His own published maps suggest that although *D. fuscus* was very abundant at some sites, several species, including the northern two-lined salamander (*Eurycea bislineata*), the red-spotted newt (*Notophthalamus viridescens)*, and the red-backed salamander (*Plethodon cinereus*), were more widely distributed than the northern dusky salamander. In this paper we compare Bishop's distribution maps, which are based on approximately 2,100 salamander reports from pre-1940 with the information collected during the 10 year effort of the New York Amphibian and Reptile Atlas Project (1990–1999), which includes approximately 14,000 salamander reports. We also report on modern studies of salamander densities conducted in a range of habitats in New York State. We discuss differences in the data from the beginning to the end of the 20th century in light of changes in land use practices. Interestingly, regional distributions of most NY salamanders have not declined, although major changes in local abundances are suspected. Only two species, the eastern tiger salamander (*Ambystoma tigrinum*) and the long-tailed salamander (*Eurycea longicauda*), have a significantly smaller range now than they did historically.

***Faccio**, Steven D. (Vermont Institute of Natural Science, Conservation Biology Department, Woodstock, VT 05091)*

POST-BREEDING EMIGRATION AND HABITAT USE OF RADIO-TAGGED JEFFERSON AND SPOTTED SALAMANDERS IN VERMONT

Temporary pool-breeding salamanders inhabit terrestrial forested habitats for the majority of the year. Yet wetland regulations and forestry Best Management Practices rarely consider these upland areas for protection. Those that do, generally establish a buffer zone of arbitrary width. A better understanding of the area requirements of pool-breeding salamanders is needed to develop biologically relevant buffers for conservation. I used radiotelemetry to investigate the post-breeding emigration, and terrestrial habitat use of two syntopic mole salamander species. Sixteen adult salamanders (8 *Ambystoma jeffersonianum*, 8 A. *maculatum*) were radiotracked for a mean of 164 days (SE = 5.1). Eleven individuals were tracked to overwintering sites (5 *A. jeffersonianum*, 6 *A. maculatum*). Emigration distances from breeding pool edge varied widely (range = 30–219 m) with a mean of 112.8 m (SE = 19.9) for both species combined. Combining data from this and other studies, a salamander "life zone" that would encompass 95% of the population was calculated, resulting in an area extending 175 m from a pool's edge. Two types of small mammal burrows (deep vertical tunnels, and highly branched horizontal tunnels) were used almost exclusively as terrestrial refuges. In general, Jefferson and spotted salamanders utilized well-shaded, deciduous forest stands with abundant logs and stumps. Their habitat use also showed a strong association with high densities of vertical mammal tunnels, suggesting this resource may be limiting. Biologically-defined salamander life zones should be identified as critical wildlife habitat and considered in forest management strategies.

***Burke**, Russell L. (Department of Biology, Hofstra University, Hempstead, NY 11549)*

THE ECOLOGY OF ITALIAN WALL LIZARDS *PODARCIS SICULA*, IN NEW YORK, USA

Italian wall lizards (= "ruin" lizards), *Podarcis sicula campestris*, have been successfully introduced to two locations in the U.S., both at about the same latitude as their native range. The Long Island population appears to have originated near Rome, Italy. Both U.S. locations have about the same average temperatures as Rome, but much colder winter minimums. The introduction onto Long Island occurred in Garden City in 1967. The population now numbers at least 5,000 and is spreading rapidly in Nassau county. We investigated the freeze tolerance, food habits, parasite load, reproductive cycling, survivorship, seasonal and diel behavior of this population. They are not freeze tolerant, and so must overwinter below the freeze line. Their food habits closely parallel those of their conspecifics in Italy, and show some sex-specific specialization. They are nearly free of gut parasites, but appear to be carrying some blood parasites. They seem to mature faster and more often than conspecifics in Italy, which is surprising because they are active for a smaller portion of the year and for less time each day. Their impact on native species is probably small, but this is likely to change as they spread into the rest of New York.

***Pomfret**, Brian M. (Royal Botanical Gardens, Hamilton, Ontario, L8N 3H8, Canada)*

WHY DID THE TURTLE CROSS THE ROAD?

Cootes Paradise is a 250 hectare coastal wetland located on the extreme western shore of Lake Ontario. Surrounded by encroaching urban development, over the years the area's wetland habitat has been much degraded through the actions of pollution, changes in Lake Ontario's water level cycle, and the abundance of non-indigenous invasive species. Cootes Paradise is part of the Hamilton Harbour aquatic system, which has been identified by the International Joint Commission as one of 43 Areas of Concern in the Great Lakes. Royal Botanical Gardens, and many partners, are currently implementing a restoration plan for Cootes Paradise aimed at restoring biotic abundance and diversity to this once lush wetland. While remaining relatively abundant, recent research has indicated that the Common Snapping Turtle (*Chelydra serpentina serpentina*) population in Cootes Paradise is experiencing a moderate change in population structure. A roughly 1:1 male to female ratio was recorded in the mid-1980's, while a 2:1 male to female ratio was recorded in the mid-1990's. A study in 1999 of several roadways surrounding the marsh showed that female snapping turtles frequently build nests in the loose gravel of road margins and that many of these turtles fall victim to vehicle-related mortality. In 2001 Royal Botanical Gardens commenced a pilot-scale project creating snapping turtle nesting habitat in suitable areas away from roadways in an effort to reduce vehicle-related mortality. Monitoring of the created nesting habitat will commence in 2002. Should the project prove successful, it will form the basis of a wider-scale effort.

***Gapp**, David A., and Pearl R.T. **Gapp** (Hamilton College, Biology Department, Clinton, NY 13323)*

DIABETES IN THE COMMON SNAPPING TURTLE, *CHELYDRA SERPENTINA*: AN UPDATE

Between, 1993 and 1995 a diabetes-like syndrome was diagnosed in eight common snappers based on fasting hyperglycemia (193 ± 68.3 mg/dl, mean ± SEM) and glucose intolerance. Although animals appeared normal at collection, 7 of 8 animals died within 1.5 to 28 days after onset of testing. Upon necropsy, no overt signs of internal tissue or organ wasting were apparent. Of snappers trapped from all sites during 1993–95, diabetics represented 4.8% of the total, however, all but one animal came from a single location, Utica Marsh, where diabetic animals represented 14.9% of all snappers tested from that site. Immunocytochemical staining for insulin appeared normal and suggested that absence of pancreatic insulin was an unlikely contributory factor. Insulin resistance also did not seem to be a factor since administration of porcine insulin to one affected animal induced a transient a reduction of circulating glucose. Since1993–95, the incidence of this syndrome has dropped steadily. A few animals were diagnosed in 1996, but thereafter, the incidence became increasingly rare, and only one new case (in 1999) has been discovered in the past five years. Diabetes as an endocrine pathology in reptiles is exceedingly rare, and one can only speculate as to whether it was attributable to environmental toxicants, microbial pathogens, genetic factors or a combination of etiologies. Utica Marsh is an urban wetland that has been subject to industrial contamination, current and historical. As such, environmental contamination represents a likely etiology for this pathology in the Utica Marsh snappers.

***Bossert**, Marc, and Matt **Draud** (C.W. Post of Long Island University, Dept. of Biology, Brookville, NY 11548)*

THE STATUS OF DIAMONDBACK TERRAPINS IN BAYVILLE MARSH, LONG ISLAND

We have been studying a terrapin population in Bayville Marsh, a shallow embayment of the Long Island Sound, just west of Center Island, New York. Terrapins are found in two distinct concentrations (apparently with little movement between the two), separated by just over 3 km. Turtles in both of these primary areas have been studied in the past, in 1969 (mainly the eastern side) and in 1991 (mainly the western side). Both previous studies indicated large breeding populations, but also warned of evidence of sparse recruitment. Our goal was to reexamine the terrapins in these areas and compare our findings with the past studies. Here we report the results of a capture-recapture study, including estimated population size, sex ratio, and size frequencies. We have now captured nearly 200 adult terrapins and have recaptured several that were initially tagged in 1969 and 1991. We will also report on our classification of potential nesting habitat in the area, nesting behavior, and hatching success.

***Draud**, Matt, and Marc **Bossert** (C.W. Post of Long Island University, Dept. of Biology, Brookville, NY 11548)*

SEMI-AQUATIC HABITAT USE BY DIAMONDBACK TERRAPIN HATCHLINGS IN A NEW YORK ESTUARY

We conducted a mark-recapture study of hatchling diamondback terrapins in Oyster Bay Harbor, an ecologically and economically important estuary in southern New York. From August to October 2001 we captured 217 recently emerged hatchlings in the upper intertidal marsh, mainly in two types of vegetation, *Spartina patens* and *Distichlis spicata*. Chi-square analyses reveal that the hatchlings prefer *S. patens* over other available vegetation and habitat types. Over the same time period, we recaptured 40 of the 217 hatchlings (4 turtles recaptured twice, and 2 turtles recaptured three times). The median time between captures was 6.5 days (mean = 13.5 days; range = 0.5–61 days) and the median distance between captures was 10 m (mean = 17.3 m; range = 0–114 m). Fecal samples from 20 hatchlings revealed that the recently emerged hatchlings were eating, and preyed mainly upon the intertidal gastropod, *Melampus sp*. However, the average carapace length and mass of recaptures was not significantly different those of initial captures. Our data demonstrate that the hatchling terrapins in Oyster Bay use the upper intertidal marsh, rather than subtidal habitats, in at least their first summer after emerging.

***Karrmann**, David E. (American Museum of Natural History, Education Department, New York, NY 10024-5192), Esmeralda **Cordero** (AMNH Intern, Louis D. Brandeis High School, New York, NY 10024), and Jill **Javier** (AMNH Intern, Fiorello H. LaGuardia High School of Performing Arts, New York, NY 10023)*

A PROPOSED LONG-TERM ASSESSMENT OF A SCATTERED *CHRYSEMYS PICTA PICTA* POPULATION

Black Rock Forest nature preserve (Orange County, NY, USA) provides a well-protected ecological community for study. The 3700 acres of the forest encompass 7 ponds separated by 200–800 meters. Watercourses providing obvious routes for testudinal translocation connect some, though this generally significantly increases linear travel distance ($\leq$ 1200 meters). In other cases significant ridgelines requiring total vertical displacement of $\leq$ 400 meters need to be traversed. Previous samplings of each pond have confirmed the presence of established populations of *Chrysemys picta picta* (Eastern Painted Turtle), and *Chelydra* s. *serpentina* (Common Snapping Turtle). Recorded population densities vary from over 80 confirmed individuals (C. p. p.) per pond, to less than a dozen. The only other aquatic turtle confirmed in the forest are two introduced specimens of *Chrysemys scripta elegans* (Red-eared Slider). An extended (3–5 year) program of mark-recapture (using a variety of capture methods - basking traps, feeding traps, dip netting), PIT tagging, and extensive data recording is planned, with the purpose of establishing a thorough census (including sex distribution, approximate ages, and growth data) of each pond (sub-population) and the overall forest population and distribution. It is expected that a rigorous mark-recapture program conducted until no new individuals are collected will lead to significantly more accurate estimates of actual population than traditionally employed statistical models based on random sampling. Comparison of capture records should assist mapping of gene flow between sub-populations by indicating movement of individuals from one pond to another.

***Hunsinger**, Todd W. (McGill University, Department of Natural Resource Sciences, Quebec, Canada H9X 3V9, and New York State Museum, Research and Collections, Albany, NY 12230)*

A Field Technique to Determine Gender in Juvenile Wood Turtles (*Clemmys insculpta*)

Carapace to plastron (CL:PL) ratios has proved to be a valid technique to determine gender in juvenile *Clemmys insculpta* in New York State. Data obtained from museum specimens and living turtles shows that adults exhibit marked sexual dimorphism in CL:PL ratios. Adult males (n= 36) have a CL:PL ratio of 1.12±0.02, adult females (n=53) have a CL:PL ration of 1.04±0.02. Mark and recapture and radiotelemetry studies of juveniles from two populations for periods of three and five years indicates that juveniles show predictable sexual dimorphism in CL:PL ratios. Adults develop detectable secondary sexual characteristics at a carapace length of approximately 160 mm. CL:PL ratios can be used to accurately determine gender in turtles at carapace lengths of 100mm. Applying this technique will benefit research on gender-specific behavior and mortality rates for juvenile Wood Turtles.

Botany
Contributed Papers Session

***Moderators:** Charles J. **Sheviak**, and Norton G. **Miller** (New York State Museum, Research and Collections, Albany, NY 12230)*

***Young**, Stephen M. (New York Natural Heritage Program, NYSDEC, Albany, NY 12233)*

New York's Rare Plants—State of the State

Since the early published floras of the 19th century New York botanists have documented plants they thought were rare in the state. The number of plants that were listed by the state as rare increased from ten flowering plants and all ferns in 1933 to 352 plants in 1979. Presently the New York Natural Heritage Program tracks 588 plants as rare but this number has decreased from over 600 plants in past years. The number of taxa has changed not only because of the destruction of rare plant populations but because there have been changes in taxonomy, discovery of new rare plant populations, changes in criteria for ranking and site delineation, and increased knowledge about the status of New York's flora in general. Since 1946 twenty-four species that were once considered extant have not been seen in over twenty years and four extant species are now considered extirpated. The status of many of the remaining extant rare species continues to improve as a result of increased botanical surveys since the mid-1980s. Many species that had not been seen in over two decades or more, or were considered extirpated, have been relocated.

***Utter**, James M., Jessica **Burneston**, and Rebecca **Simpson** (Purchase College, SUNY, Natural Sciences Division, Purchase, NY 10577)*

Light the Way to Conservation of a Rare Plant

Devil's bit (*Chamaelirium luteum*), a dioecious lily, is known to occur at less than a dozen sites in New York and has recently become a State-listed Threatened Species. Four populations in Dutchess County, N.Y. have been monitored for over 15 years, during which a decline in flowering and population size has been recorded. In fall 1995, seven 100 m^2 plots were cleared of all woody vegetation to test the hypothesis that reduced light availability was the cause of the problem. Five of the experimental plots were in forested habitat that had not dramatically changed during the past ten years, while three of the plots were in old-field habitat where the shrub canopy had closed markedly during the period. Following canopy removal, flowering increased each year in the experimental old-field plots, while control plots remained low. Experimental plots in the forest habitats had a two-year lag before any flowering occurred and only a modest response was seen after five years. Plant vigor, as indicated by leaf number, increased in both habitats from 1995 to 2000; "old-field plants" responded faster and more dramatically than those in the forest. However, invasive plant species and deer grazing have also increased in the experimental plots following clearing. We conclude that habitat manipulation is a useful strategy in conserving this species. Forested sites will require a larger canopy opening than the shorter stature shrub-dominated habitats and subsequent control of invasive plants will be important.

***Lamont**, Eric E. (Riverhead High School, Department of Biology, Riverhead, NY 11901)*

PRELIMINARY STUDIES ON THE TAXONOMIC STATUS OF "FERNALD'S GOLDENRODS"

During his botanical career at Harvard University, Merritt Lyndon Fernald (1873–1950) described 13 new species of goldenrod in the genus *Solidago*. The current taxonomic status of "Fernald's goldenrods" is primarily based upon studies of holotypes at Harvard University Herbaria (HUH). Preliminary studies indicate that Fernald had a keen eye for morphological variation within a taxon, many of his new species of *Solidago* were narrowly defined endemics sometimes known only from the type locality. During the pioneering botanical era in which Fernald worked the concept of a plant species was different in several respects from current concepts; consequently, some taxa originally described as distinct species are recognized as varieties of a nominate species or as taxonomic forms or hybrids. Several names proposed by Fernald have been relegated to synonomy. The following species of *Solidago* are the focus of this taxonomic research: S. *anticostensis*, S. *bartramiana*, S. *calcicola*, S. *chlorolepis*, S. *chrysolepis*, S. *deamii*, S. *klughii*, S. *mensalis*, S. *neurolepis*, S. *perlonga*, S. *pringlei*, S. *simulans* and S. *victorinii*. Additionally, the following species are also included in the study but to a lesser degree because they were not initially described by Fernald as new species (these taxa include transfers from *Euthamia* to *Solidago* and elevation of varieties to species; eg., S. *cutleri* was initially described by Bigelow in 1824 as S. *virgaurea* var. *alpina* and later elevated to species level by Fernald in 1908): S. *cutleri*, S. *farwellii*, S. *hirtipes*, S. *moseleyi*, and S. *polycephala*. Finally, it is noteworthy to report that Fernald also described 20 infraspecific taxa of *Solidago*.

***Fuchik**, Era, Justin **Cobis**, and Eric **Lamont** (Riverhead High School, Department of Biology, Riverhead, NY 11901)*

RESTORATION AND MANAGEMENT OF FRESHWATER WETLAND HABITAT FOR ORCHIDS ON LONG ISLAND, NEW YORK

At the beginning of the 20th century, populations of the white-fringed orchid (*Platanthera blephariglottis*) were known to occur at 33 localities on Long Island, New York, based upon herbarium collections. By 1990, the number of known populations had decreased to 16 and several of those were being threatened with extirpation. One such threatened population occurred at Quogue Wildlife Refuge (QWR), in Suffolk County. During the 1980s, dozens of white-fringed orchids could be observed flowering in late July and early August in a small freshwater wetland at QWR. During the early 1990s, woody vegetation from the surrounding pitch pine-oak forest colonized the small wetland, shading out the orchids and drying up the wetland. In 1996, only six individual orchids produced flowering stems. It was feared that Long Island would lose yet another population of white-fringed orchid. In 1997, a group of students from Riverhead High School worked with members of QWR and NYSDEC to develop and implement a long-term restoration and management plan to remove woody vegetation from the wetland and re-establish habitat favoring the orchids. After implementing the plan during February 1997, the orchid population was monitored during the following years. During the summer of 2001, 88 orchids produced flowering stems; but as expected, woody vegetation was once again colonizing the open wetland. During the winter of 2002, the second phase of the management plan was implemented by once again selectively removing woody plants from the open wetland.

***Olivero**, Adele M. (New York Natural Heritage Program, NYSDEC, Albany, NY 12233-4754)*

CLASSIFICATION AND RANKING OF CALCAREOUS FENS IN NEW YORK

Calcareous fens are rare natural communities that support many rare species in New York including the globally imperiled Cryan's buckmoth (*Hemileuca* sp. 1), the federally threatened bog turtle (*Clemmys muhlenbergii*) and a number of state rare plants. Calcareous fens differ from other wetlands in that they are open peatlands associated with groundwater discharge areas and calcareous bedrock. The New York Natural Heritage Program recently completed a three-year project that focused on collecting plot data from the highest quality calcareous fens in the Heritage database, mapping each fen using aerial photos, and consistently classifying and ranking each fen. During the project, current information was collected from seventy calcareous fens across the state. Products of the project include updated descriptions of the fen types based on analysis of the plot data and a key to the fen types. This past summer, we began looking for new calcareous fens in the area of calcareous bedrock in northeastern Dutchess County that continues into Massachusetts and Connecticut. Nine fens were documented and compared. The fens were ranked based on their size, condition, and also by mapping and quantitatively analyzing their surrounding landscapes. The presentation will summarize these calcareous fen studies.

***Ganger**, Mike T. (Massachusetts College of Liberal Arts, Department of Biology, North Adams, MA 01247)*

FACTORS AFFECTING REPRODUCTIVE SUCCESS IN CLONAL HERB: THE IMPORTANCE OF RAMET CONTEXT

Canada mayflower (*Maianthemum canadense* Desf.) is a rhizomatous, perennial herb common to the understory of mixed deciduous-coniferous forests in New England. Mayflower genets are composed of ramets that in a given year may be either flowering (with 2–3 leaves and a terminal inflorescence consisting of 4–35 perfect flowers) or vegetative (with 1 leaf and no inflorescence). Several experiments and studies have been undertaken in the past few years to determine what factors affect allocation of resources to current and future seed maturation in Canada mayflower. Factors explored include ramet-specific variables (age, number of years prior to flowering, pollen availability, and number of times previously flowered) and a genet-related variable (ramet context). Ramet context is here defined as the identity of ramets directly basipetal and acropetal on a monopodial rhizome system. Current seed maturation was found to be related to pollen availability and ramet context.

***Howard**, Timothy G., Shane **Gebauer**, and Troy **Weldy** (New York Natural Heritage Program, NYSDEC, Albany, NY 12233-4757, www.nynhp.org)*

A NEW TOOL FOR PRODUCING HIGH QUALITY HERBARIUM LABELS

The New York Natural Heritage Program has created an easy-to-use herbarium label-making program based upon Dick Mitchell's updated checklist of the New York State Flora. The purpose of this presentation is to explain the functionality and benefits this computer database brings to all botanists in the region. The database runs within Microsoft Access and can be used as a database of your collection as well as a tool to easily generate and print herbarium labels. Many fields are linked to other datafiles (e.g. Dick Mitchell's 2002 Database & Revised Checklist of New York State Plants, listing of New York's counties and towns), eliminating spelling errors and allowing easy data entry. Once a full species name is chosen the database can determine family names, common names, and naming authorities; eliminating the need for this information to be entered again. This product shines as a tool for streamlining and simplifying the printing of customized herbarium labels. The use of the database will also allow for easy updates to the new digital NY Flora Atlas. During this session, we will demonstrate how to use the program and provide attendees with a means to receive free copies.

***Flinn**, Kathryn M. (Cornell University, Department of Ecology and Evolutionary Biology, Ithaca, N.Y. 14853)*

SPORE DISPERSAL AND FERN COLONIZATION OF POST-AGRICULTURAL FORESTS IN TOMPKINS COUNTY

As abandoned fields revert to forests across much of the northeast, herbaceous understory communities seem especially slow to recover. Many plants characteristic of forests that were never cleared for agriculture (primary) remain absent from mature post-agricultural forests (secondary). While short-distance dispersal may control the distributions of some species—those whose seeds only ants carry, for instance—the legacy of past land use may also include persistent environmental changes that inhibit the subsequent processes of germination, establishment, growth, or reproduction. Even among the ferns, with ostensibly similar dispersal capabilities and habitat requirements, species like *Polystichum acrostichoides* grow more abundantly in primary forests, whereas others like the *Dryopteris* species thrive in secondary stands. To begin to specify stages that limit colonization, I measured spore dispersal both on the wind and in the soil and compared species' distributions across treefall pits and mounds. At two sites with adjacent primary and secondary forests, where P. *acrostichoides* was restricted to the primary stands, spores trapped and prothalli germinated from soil cores were nearly ubiquitous yet varied widely in abundance. Cores from primary forests produced more prothalli than those from secondary; the density of prothalli did not, however, decrease with distance from primary forest. In surveys of distribution across microtopographical features at two primary forest sites, nearly all fern species occurred more frequently on mounds. Although less abundant, spores are certainly present in secondary forests, and a lack of suitable microsites for establishment may be more important in limiting colonization.

***Peteet**, Dorothy M. (NASA/Goddard Institute for Space Studies, New York, NY 10025, and LDEO, Palisades, NY 10964), Dorothy **Kurdyla** (LDEO, Columbia University, Palisades, NY 10964), and Tom **Gulderson** (Lawrence Livermore Labs, Livermore, CA 94551)*

EVOLUTION OF THE HUDSON ESTUARY: MARSH CLUES TO ENVIRONMENTAL HISTORY

Sediment, pollen, and macrofossil stratigraphy from sediment cores is coupled with high-resolution AMS C-14 dating to document the history of climate and land-use change in the Hudson Estuary over 6000 years. Sites ranging from Jamaica Bay northward to Iona Island record changes in foraminifera, charcoal, and local vegetation that accompany shifts in salinity. Regional vegetational shifts implied from pollen stratigraphy document the decline in tree abundance with the arrival of Europeans, and the subsequent reforestation since 1900.

***Cogbill**, Charles V. (Plainfield, VT 05667)*

PRESETTLEMENT VEGETATION SURVEYS IN NEW ENGLAND AND NEW YORK

The lotting surveys from towns in New England and New York provide a unique opportunity to derive quantitative documentary evidence on past forests and provide a baseline for changes over the past 200 years. I have located records from over 600 towns representing more then 180,000 individual trees in the archives of land division surveys done prior to settlement (1763–1820). The collation of town-wide witness tree relative frequencies is a spatially explicit empirical estimate of the vegetation composition across the Northeast before confounding land use. In northern areas, five ubiquitous taxa (beech, spruces, maples, hemlock, and birches) composed several community types with distinctive variants in the north, the Taconics, and the Champlain Valley. Consistent with the Siccama Enigma, the early composition was dominated by beech (37%). Maples (12%) were consistently distributed with peak abundance in Vermont. Hemlock (12%) had a patchy distribution with pockets of abundance, including the eastern Adirondacks. Birches (9%) were a species group with higher abundance in the mountains or to the north where Spruce became the dominant. White pine was consistently uncommon with very low (<1%) abundance on the uplands. Town-wide composition clearly expresses the generally gradual compositional gradients across broad biophysical regions. All southern regions were dominated by oaks, with white oak being the most common. A dramatic "oak-beech" tension zone or ecotone separated the oak-pine vegetation in the major southern valleys from the hardwoods to the north. Fire was frequent only in the Hudson-Champlain corridor and windthrow was a low-level background disturbance.

***Dirig,** Robert (Bailey Hortorium Herbarium, Cornell University, Ithaca, NY 14853), and John F. **Cryan** (New York State Department of Environmental Conservation, Long Island City, NY 11101)*

NEW AND NOTEWORTHY LICHEN RECORDS FOR LONG ISLAND, NEW YORK

New and interesting lichen records are presented for Long Island, New York, USA, obtained since the publication of Irwin M. Brodo's comprehensive lichen flora in 1968. **Parmeliaceae:** "Iceland Moss" (*Cetraria arenaria*) is still locally abundant at sandy sites in eastern Suffolk County, but is vulnerable, and has disappeared from the famous Hempstead Plains of Nassau County. The Lettuce Lichen (*Platismatia tuckermanii*), a scarce species of Atlantic White Cedar (*Chamaecyparis thyoides*) swamps, is reported from four new localities near Riverhead. Thallus tips of the Furrowed Shield Lichen (*Parmelia sulcata*) are used as nest ornamentation by the Eastern Wood-Pewee (*Contopus virens*); and *P. sulcata*, the Wrinkled Shield Lichen (*Flavoparmelia caperata*), Rough Shield Lichen (*Punctelia rudecta*), and a *Physcia* sp. (Physciaceae) for the same purpose by the Ruby-throated Hummingbird (*Archilochus colubris*). **Cladoniaceae:** Common Reindeer Lichen (*Cladina rangiferina*) and Star-tipped Reindeer Lichen (*C. stellaris*) are disappearing for unexplained reasons; and Sprawling Reindeer Lichen (*C. submitis*) is reported from the North Shore for the first time. **Umbilicariaceae:** Four rock tripes, which are very rarely found on large glacial erratics, include Pennsylvania Rock Tripe (*Lasallia pensylvanica*—a new species record for Long Island), the Toadskin Lichen (*L. papulosa*), Smooth Rock Tripe (*Umbilicaria mammulata*), and Muhlenberg's Rock Tripe (*U. muehlenbergii*).

***Haines**, John (New York State Museum, Research and Collections, Albany, NY 12230)*

TOXIC MOLD AND YOU

For an unlucky few, "toxic mold" has become a debilitating health factor, for others it is a lucrative business opportunity, and for some it is the chance to seek huge financial settlements, and the only thing upon which we can agree is that something is out of control. Mold in buildings is not a new phenomenon and may not have changed significantly in half a century. What has changed is attitudes towards microbes in our environment including those in the air we breathe in our homes and workplaces even though they are the same molds as those in our natural environment. Molds are news. A sequence of events starting with the tragic death of an infant in Cleveland in 1993, and eventually involving prime-time media coverage, movie personalities, a 32 million dollar legal settlement, and new legislation, has brought airborne molds and fungal toxins into the public awareness. One of the issues to come from this is the necessity of measuring exposure. Scientists will be dealing with the following questions in the near future. What do we measure and how do we measure it? How much of what we measure is too much, and what effect does mold in buildings have on human health?

Documenting Biodiversity on the Landscape
Contributed Papers Session

*Moderator: David **VanLuven** (New York Natural Heritage Program, NYSDEC, Albany, NY 12233-4757)*

***Edinger**, Gregory J. (New York Natural Heritage Program, NYSDEC, Albany, NY 12233-4757)*

State of the State Community Classification: The Past, Present, and Future

The Past (Reschke 1990): The first edition of *Ecological Communities of New York State* by Carol Reschke was published in 1990 and quickly became the primary source for community classification in the state. Its success and acceptance by a wide range of users was driven by its lofty goal to be an all-inclusive classification intending to fulfill a long-standing need. The original, and continued, goal of this classification is to include all ecological communities of the state, even those created by humans. This allows users of this classification to describe and map nearly any ecological community encountered in the state. The Present (Edinger et al. 2002): While the second edition includes over two dozen new communities and revised descriptions for most of the remainder, it is impressive to see how much of the first edition remains unchanged. This attests to the fact that Ecological Communities of New York State was thoroughly researched and ahead of its time. We have reached a time when the amount of additions and changes to the 1990 classification warranted the publication of this second edition. This edition retains much of the content and format of the original. The Future: The next edition of this classification will likely be even more comprehensive and designed to be readily accessible via the Internet. The NY Natural Heritage Program plans to have both editions of Ecological Communities of New York State posted on the worldwide web (http://www.nynhp.org). In addition, we have plans to produce more informative community "fact pages" on the web, that will likely include digital photographs, statewide distribution maps, vegetation coverage data, cross-walks to other classifications, and more.

***Cordeiro**, James R. (Nature Serve, Science Division, Boston, MA 02111)*

Mapping Species Populations and Assessing Their Viability-Element Occurrence Specifications in the Natural Heritage Network

NatureServe is a non-profit organization dedicated to providing knowledge to protect our natural world. Working in partnership with a network of scientific experts, NatureServe helps protect the environment by improving public understanding of biodiversity and developing information about rare and endangered biota and threatened ecosystems. A key activity is to collect, manage, analyze, and distribute detailed information resulting in the most comprehensive and current database of at-risk species and ecosystems for the Western Hemisphere. An Element Occurrence (EO) is an area of land and/or water in which a species or natural community is/was present. EOs are based on Heritage Methodology and are used by a Natural Heritage Network of 50 U.S. states, all Canadian provinces, and selected Latin American countries to assess distribution, habitat, biogeography, and biological diversity trends. Such information can be used in conservation, ecoregional planning, environmental review, scientific research, education, and management. As the foundation of conservation site identification activities, EOs must be consistently accurate and useful. Element occurrence specifications (EO specs) and element occurrence rank specifications (EO rank specs) help insure this accuracy. Recent effort has been placed on completing EO specs for all species tracked in the Network's databases. Currently, I am creating specifications for freshwater invertebrates and terrestrial snails. For these groups, specifications are created for element groupings (i.e. mussels, crayfishes) as opposed to individual species due to similar ecological requirements, lack of habitat requirement knowledge, and the vast number of species in question. Input is encouraged particularly in addressing viability for freshwater invertebrates.

***Mickelson**, John G. Jr. (CIESIN, Columbia University, Lamont Doherty Earth Observatory, Palisades, NY 10964)*

Towards Delineating Detailed Ecological Land Units in Lower New England Using Multi-temporal Landsat Imagery

Researchers at the Center for Earth Science Information Network (CIESIN) at Columbia University's Lamont Doherty Earth Observatory, are embarking on a land cover mapping project containing the greater NY/NJ/CT metro region. At the most basic level, we are seeking to improve the spatial and thematic detail of digital land cover/vegetation information available to

a number of disciplines within the region. Applications earmarked for such data products include simple inventory needs to forest/resource management and ecoregional planning efforts to more intricate ecological modeling (climate change, biodiversity trends) and faunal habitat dynamic (GAP) assessments. At the very least we urgently need to establish adequate biotic baseline from which future change and impact assessments can be measured against. Encouraging trends in both satellite data pricing structures and computer hard/software capabilities have combined to enable the types of repeatable, cost-effective, landscape scale assessments that such baselines can be extended from. Building upon the approach and methodologies employed by similar projects, (e.g.GAP programs), seasonal Landsat Thematic Mapper satellite imagery will be layer stacked and integrated with biogeographic data (geology, elevation, slope, aspect, soils), to construct a detailed vegetation classification. While final spatial and taxonomic units are being resolved, efforts will be made to construct classes that will be understandable and relatable to existing ecological and vegetation classification and land cover mapping efforts (National Vegetation Classification System, (NVCS), TNC, USFS, SAF, USGS).

***Oldham**, Michael J., and Kara E. **Brodribb** (Ontario Natural Heritage Information Centre, Ministry of Natural Resources, Peterborough, Ontario, Canada K9J 8M5)*

Plant Conservation Targets for the Ontario Portion of the Great Lakes Ecoregion

The Ontario Natural Heritage Information Centre and the Nature Conservancy of Canada are collaborating to generate a "conservation blueprint" for biodiversity on the Ontario side of the Great Lakes ecoregion. The methodology of this project involves setting plant, animal and vegetation community conservation targets, and capturing the best examples of these targets across the landscape in a portfolio of sites. Plant conservation targets were selected if they met one or more of the following criteria; globally imperiled, declining, vulnerable, endemic, disjunct or were designated as being "at risk" by the Ontario and/or Canadian governments. Identifying species of global conservation concern, officially designated species at risk, and endemic species was relatively simple, however the process used to identify disjunct species was more involved. There are three main categories of disjunct plant species in the Great Lakes basin, based on their floristic affinity: western, arctic-alpine, and Atlantic coastal plain. The conservation blueprint project provided an opportunity to review previously published lists of disjunct species and update them based on new information. By integrating information from a variety of sources on known occurrences of these plants we were able to eliminate plants previously believe to be disjunct in the Great Lakes, but whose distribution is now known to be more widespread. The discovery of new species occurrences in the Great Lakes basin, particularly the north shore of Lake Superior, resulted in the addition of species not previously considered as disjuncts. The methodology and results of this work will be presented.

***Smith,** Charles R. (Department of Natural Resources, Cornell University, Ithaca, NY 14853), Milo E. **Richmond** (NY Cooperative Fish and Wildlife Research Unit, Cornell University, Ithaca, NY 14853), and Stephen D. **DeGloria** (Department of Crop and Soil Sciences and Cornell Institute for Resource Information Systems, Cornell University, Ithaca, NY 14853)*

The New York Gap Analysis Project—Results and Conclusions

The New York Gap Analysis Project (NY-GAP) was completed in 2001. Aided by earth observing satellites and geographic information systems, gap analysis assesses the degree to which native animal species and plant communities are represented in our present-day network of conservation lands. The goal is to identify "gaps" in the conservation fabric: at-risk species and biological communities that occupy areas receiving little or no protection. Administered through the Biological Resources Division of the U.S. Geological Survey, the National Gap Analysis Program involves working partnerships with over 500 federal, state, and local agencies; universities; and private organizations, such as the NYS Department of Environmental Conservation, the NY Natural Heritage Program, and Cornell University. NY-GAP activities produced databases and maps depicting patterns of land cover, land management, and biodiversity at a level of detail and extent never before achieved. NY-GAP data indicate that forested cover types are well represented on protected lands (land carefully managed with habitat conservation as a primary goal); that nearly all shrublands and grasslands are privately managed; that a large proportion (72%) of terrestrial vertebrate species in the state have less than 10% of their predicted distributions on protected lands; and the habitats of nearly all reptile species (97%) and a majority of amphibian species (75%) are potentially under protected. The complete NY-GAP report, metadata, and data are available on a set of 2 CDs; ordering information can be found at http://www.dnr.cornell.edu/gap/finishedproduct.html.

***Weldy**, Troy (New York Natural Heritage Program, NYSDEC, Albany, NY 12233-4757, www.nynhp.org), Richard **Mitchell** (New York State Museum, Research and Collections, Albany, NY 12230), and Robert **Ingalls** (Rensselaer Polytechnic Institute, Computer Science Dept., Troy, NY 12180)*

A New York Digital Flora Atlas

In 1990, a "Preliminary Vouchered Atlas of New York State Flora" was produced by the New York Flora Association, to stimulate field work and gathering of vouchered county records. The "NYFA Atlas" has been distributed to over 600 NYFA members, and has been a great tool for New York botanists; however, with each passing year there has been a greater need to update. As more herbaria across New York began entering newly accessioned collections into databases and after the 1990 NYFA Atlas was converted to a digital format, an updated atlas seemed possible. Data from the digitized 1990 atlas were combined with those of various herbaria who provided existing databases (particularly the New York State Museum and the Brooklyn Botanic Gardens). Gathering the data into a single location allowed easy production of new maps. Beginning in January 2002, new distribution maps based on compiled records from voucher specimens were created. These maps will soon be available on the web at www.nyflora.org. Since these maps are now in electronic format, future species-distribution updates will be simplified. Plans are already underway to produce a digital atlas in 2003 that will dynamically link the compiled database to a web platform, thereby allowing instant creation of up-to-date maps. During this project, Mitchell's checklist and database of New York State Plants were revised through collaboration of the current authors, and individual checklists were created for each county. This conference presentation will provide a live demonstration of the NY Flora Atlas in its new format.

Albany Pine Bush Preserve Research
Organized Papers Session

***Moderator and Organizer:** Neil A. **Gifford** (Albany Pine Bush Preserve Commission, Latham, NY 12110)*

***Gifford**, Neil A., and Joel **Hecht** (Albany Pine Bush Preserve Commission, Latham, NY 12110)*

Karner Blue Butterfly, (*Lycaeides melissa* samuelis) Population and Habitat Restoration Monitoring Results: Implications for Successful Recovery in the Albany Pine Bush Preserve, NY

The 2,750-acre Albany Pine Bush Preserve is one of the best remaining worldwide examples of an inland pitch pine–scrub oak barrens (PPSOB) and contains more than 19 globally rare plant and animal species, including the Karner blue butterfly (Kbb). The Karner blue is a state and federally endangered species. Restoration of disturbed areas to improve Kbb habitat will help Preserve managers work toward state and federal recovery goals and compliment remaining high quality pine barrens without introducing potentially detrimental disturbance to the barrens. Ten years of Kbb sub-population monitoring in the Albany Pine Bush Preserve illustrates the vulnerability of remaining extant sites and the need for aggressive habitat restoration efforts (e.g., clearing, planting, watering, weed removal, etc.). In the Preserve more than 10 acres of former habitat are being actively restored, including old fields, roadsides, a former parking lot, and habitat dominated by invasive plants. Pre-restoration research and post restoration monitoring has shown that historical land use impacts persist and effect restoration effectiveness. Sites dominated with invasive black locust (*Robinia pseudo-acacia*) experience significant changes in soil chemistry and plant community composition and structure, compared to PPSOB sites. Population size three years post- treatment, at a four-acre former parking lot, shows a 7,000-stem increase in Karner blue larvae obligate host-plant, *Lupinus perennis perennis*, in two growing seasons. This illustrates that while restoration efforts may vary in cost and effectiveness based on the degree of residual habitat alteration from an earlier condition, it is feasible to restore Kbb habitat from highly altered land uses.

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URBANIZATION, THE PINE BUSH, AND KARNER BLUE BUTTERFLY POPULATION DYNAMICS

Historically, ecological disturbances and Native American settlement patterns maintained open habitat for Karner blue butterflies (*Lycaeides Melissa samuelis* Nabokov) in New York. The Karner blue and its obligate hostplant, blue lupine (*Lupinus perennis*), have persisted in some developed areas because moderate anthropogenic disturbances mimic beneficial ecological disturbances. However, protected Karner blue populations are increasingly exposed to urbanization and extreme disturbances. We hypothesize that development at preserve boundaries is a risk to protected Karner blue populations. Particularly for Lepidoptera, metapopulation theory predicts that perturbations of the balance between colonization and extinction rates can be catastrophic. We conducted a study to investigate whether patterns of development can influence metapopulation processes for Karner blues. Mark-release-recapture methodology was used to observe dispersal of butterflies among several subpopulations separated by a transportation corridor within the Albany Pine Bush Preserve. Dispersal across roads occurred, but was limited by traffic and wind. Small, isolated habitat patches were unproductive, but had comparatively high rates of immigration and emigration. Butterflies moved freely between preserve land and developed areas. We conclude that increased development at preserve boundaries could adversely impact both peripheral and protected Karner blue subpopulations. Peripheral subpopulations may provide stability by serving as stepping-stones to more robust or protected subpopulations, but Allee effects may limit their persistence. By isolating subpopulations and exacerbating Allee effects, any development or increase in traffic that impedes dispersal could limit colonization potential, increase local extinction probability, and jeopardize metapopulation viability. Incorporating preserve design into the urban planning process could mitigate future development.

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EVALUATING STRATEGIES TO RESTORE NITROGEN LIMITATION FOLLOWING BLACK LOCUST INVASION

In the Albany Pine Bush, the invasive, nitrogen-fixing black locust tree (*Robinia pseudoacacia*) supplements soil nitrogen stores and enhances rates of nitrogen cycling. Restoration of native communities on sites formerly occupied by black locust is complicated by elevated soil nitrogen availability that alters successional trajectories. We evaluated management strategies to reduce soil nitrogen using the CENTURY model. This model simulates carbon and nitrogen dynamics in biomass and soil pools. Site parameterization used 30-year averages for temperature and rainfall. Soil data (texture, organic matter, nitrogen content, bulk density) were derived from sampling six pitch pine-scrub oak communities within the Albany Pine Bush. An open pine-oak community was modeled using a grassland parameterization that is similar to the restoration target community. When run to equilibrium, modeled soil carbon and nitrogen content, and nitrogen mineralization rates were not significantly different from field values. Black locust invasion was simulated using parameters from published data and model results were similar to field values found in 20–35 year old black locust stands. Tree harvest and restoration to reduce soil nitrogen were modeled. Following harvest, nitrogen availability (i.e., nitrogen mineralization rates) returned to pre-invasion levels after 3 years; however, soil nitrogen contents remained elevated for decades. Both cropping (biomass harvest) and burning at 5-year intervals resulted in significant reductions in soil nitrogen content. These results suggest that restoration efforts would benefit from reseeding of target plants after three years following a lowering of nitrogen availability and by regular cropping or burning.

***Beachy**, Brian L., and George R. **Robinson** (University at Albany, Department of Biological Sciences, Albany, NY 12222)*

INVADING TREES AND BREEDING BIRDS IN THE ALBANY PINE BUSH

Point counts were used to study the effects of invading black locust (*Robinia pseudo-acacia*) and aspen (*Populus tremuloides, P. grandidentata*) trees on breeding birds in the Albany Pine Bush (APB). These were conducted in four habitats: pitch pine (*Pinus rigida*)–scrub oak (*Quercus ilicifolia, Q. prinoides*) barrens and thickets, pitch pine–scrub oak forest, black locust dominated forest, and aspen dominated forest. Two hundred twenty point counts of eight minute duration were conducted at fifty-five points between 14 May and 4 July 2001. Vegetation surveys were conducted at each point along two 100 meter transects. Fifty-one bird species were recorded during the study, with 45 species found at two or more points and 39 species at four or more points. Species distribution among the habitat types was varied. Characteristic APB birds such as Prairie Warbler (*Dendroica discolor*) and Field Sparrow (*Spizella pusilla*) were found only in barrens and thickets, while Pine

Warbler (*Dendroica pinus*) was found only in pitch pine dominated forests. Another characteristic species, Eastern Towhee (*Pipilo erythrophthalmus*), was found in all surveyed habitats, but in lower abundance in black locust and aspen dominated areas. Birds found primarily in invaded areas, such as Rose-breasted Grosbeak (*Pheucticus ludovicianus*) and Red-eyed Vireo (*Vireo olivaceus*) are regional forest generalists. Changes in plant composition and vegetation structure caused by the invasion of black locust and aspens may be altering avian communities in the APB.

***Parker**, Karl E. (NYS Department of Environmental Conservation, Schenectady, NY 12306)*

USE OF THE ALBANY PINE BUSH BY WHITE-TAILED DEER, AN INTERIM REPORT

During 2001 and 2002, seven white-tailed deer were captured in the Albany Pine Bush Preserve by use of a tranquilizer gun fired over bait. Deer were fitted with radio transmitters and cattle ear tags in order to evaluate their use of this urban-suburban preserve and adjoining lands. Deer were tracked one to two times per week and locations determined either through triangulation, or through visual observation of the animal. The four deer captured in 2001 remained within 0.5 to 1.5 km of the capture site throughout the year, with 2 notable exceptions. Contact with one of the two adult does was lost in mid-June 2001. However, in early February 2002, a citizen reported sighting this animal 5 km miles north of the capture site, where it has remained. In mid-November, a yearling buck ventured 4 km west of the capture site, where he was shot and wounded. This deer returned immediately to the Preserve and has since recovered. The home ranges of the collared deer, as well as their use of Preserve lands, and adjoining private properties, is discussed. Case histories of several of the deer are also presented. Evaluating deer movements and landscape use patterns may help provide biological justification for priority land acquisitions for the growing Preserve, and may identify ways to better manage the deer population in this archery-only area.

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HOME RANGE AND DIET OF EASTERN COYOTES FROM A SUBURBAN FOREST PRESERVE

Although coyotes (*Canis latrans*) have been in Northeastern America for over 50 years, little is known about their ecology. Given their large body sizes and the heavy forest cover of the Northeast, it has been hypothesized that they have a significantly different ecology than their smaller relatives that primarily use open habitats of the west. For wildlife managers, this lack of information is a special concern for animals living in suburban areas, where there is high potential for conflict with humans, as seen in the west. Using radio-tracking and fecal analyses, we are studying coyotes in the Albany Pine Bush Forest Preserve (APB). This suburban preserve is a complex assemblage of mixed pine-deciduous forests fragmented by interstates, local roads, neighborhoods, and the Albany Landfill. While the total size of APB (ca. 12 km^2) is smaller than the typical coyote home range reported in the literature, we estimate that 2–3 packs inhabit this area, using home ranges averaging less than 5 km^2. Preliminary analyses indicate that 80–85 % of the resident coyote home ranges are within natural forest, rarely overlapping with neighborhoods or commercial areas. Nocturnal radio tracking reveal that most coyote foraging occurs within the interior of APB forest fragments and surrounding natural areas. 1.5 years of monthly scat surveys and analyses (n=207 samples) shows that coyotes predominately forage for "natural" foods: 44.6% cottontail rabbits, 28.4% White-tailed deer, 16.2% small mammals, 8.2% plant, and 1.7% misc. Garbage has only been found in 0.4% of samples, and domestic cat (kitten) only once (0.5)(<1%). We will discuss our results in comparison with the ecology and behavior of western coyotes, especially that of problem animals in western suburban neighborhoods.

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THE ECOLOGICAL EFFECTS OF CARNIVORES ON SMALL MAMMALS AND SEED PREDATION

Top carnivores, such as the eastern coyote (*Canis latrans*), have the potential to affect entire ecosystems. This study examines the "mesopredator release hypothesis" (Crooks & Soule 1998) in the Albany Pine Bush where coyotes have recently appeared. Focus is on relationships between carnivore communities and two indicators of their effects on lower trophic levels: small mammal abundance and related seed predation rates. Seed predation is of particular importance to the Albany Pine Bush in the conservation and restoration of native plants. Relative abundance of small mammals was sampled in forest fragments of varying size. Seed predation on pitch pine (*Pinus rigida*), wild blue lupine (*Lupinus perennis*) and New Jersey tea (*Ceanothus americanus*) was then studied in the same locations, identifying small mammal seed predation and recording their preferences. Woodland fragment size and shape are associated with differences in the small mammal community and the quality and quantity of seed predation.

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Pitch Pine (*Pinus rigida* Mill.) Recovery Following a 1995 Pine Barrens Fire on Long Island, NY

Recovery of pitch pine after a catastrophic fire on Long Island, NY in August 1995 was quantified over four growing seasons. Sampling site selection was based on fire intensity and on pre-fire community type. Seedling establishment and survival was measured in 300 m^2 plots located at 6 sampling sites. Basal sprouting of trees was measured in 5 10 x 10 m plots at each of the sites. Pre-fire pine density was based on the density of charred pine stems in the 10 x 10 m plots. Pre-fire density of pitch pine varied from 460 to 4280 stems/ha. There was a dramatic decline in the percent of sprouted trees from 1996 (40.0%) to 1997 (12.2%) followed by a slight increase to 1999 (15.7%). Sprouts accounted for 15–733 trees/ha by 1999, certainly insufficient to replace the original number of trees. Seedling densities varied from an initially high of 5000-39800 seedlings/ha in 1996, decreased precipitously in number in 1997 and then more gradually to 4000–11600 seedlings/ha by 1999. Seedling density seems to have stabilized at an average of 7500/ha having formed a reverse J shaped growth curve. Together, sprouts and seedlings comprise the recruits that will eventually replace the pre-fire individuals. Recruit numbers have declined from a high of 16731/ha in 1996 to 7776/ha in 1999. At this point we can say that there are sufficient recruits to replace the original 1720 stems/ha.

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The Response to Fire by the Vegetation of Two Peatlands in Maine

Two Maine peatlands were studied to examine the effects of fire on the vegetation, including lichens and bryophytes. Great Heath in Washington County was burned in 1982 and the burned area was well documented in photos. It served as the primary study site. Wight Heath in Hancock County burned in 1993, adding supporting information. I paired relevés straddling the fire line in both peatlands. In Great Heath *Gaylussacia dumosa* was the only vascular plant with significantly more biomass in the burned area. At Wight Heath *Chamaedaphne calyculata* was significantly taller in the unburned portion. There were no significant differences in cover of bryophyte species at Great Heath; however, at Wight Heath *Sphagnum fuscum* was significantly more abundant in the unburned area. The lichens are slower to recover. In Great Heath *Cladonia crispata* was the dominant species in the burned area. *Cladina rangiferiana* and *C. mitis* were codominant in the unburned areas of both peatlands and were nearly absent from the burned portion. TWINSPAN conducted on Great Heath data first divided the relevés by location within the peatland rather than burned and unburned areas, suggesting that environmental gradients are more influential than the fire on plant communities 18 years after the fire. Subsequent divisions separated the burned and unburned relevés. DCA also revealed that the burned and unburned areas have distinct communities, largely due to the lichens.

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