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Ice, Trees, and People:
An Integration of Research, Education, and Management

March 28 -29, 2001
Syracuse, NY

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The primary objective of this conference is to share the results of research that has been performed since the 1998 Ice Storm with foresters, land managers, and natural resource professionals. Topics for posters and presentations will include ecosystem impacts, forest management, human dimensions, and future implications, with an emphasis on practical applications and solutions. Additionally, the conference will outline preliminary recommendations for dealing with future episodes of large-scale forest disturbance.

Conference Location: All sessions will be held at the Hotel Syracuse at 500 S Warren, Syracuse, New York.

Lodging: A block of rooms is available for overnight lodging for the night of March 28 at the Hotel Syracuse. The special conference room rate is $70 per night. Call the Hotel Syracuse at (315) 422-5121 and ask for the Ice Storm Research Conference rate when you reserve your room. Deadline for assured room reservations is February 28, 2001.

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Ice, Trees, and People:
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Presentation Abstracts

Abstracts are in alphabetical order by author's last name.

Insect-Host Relations in Ice Damaged Northern Hardwood Stands

Douglas C. Allen and *Al Stevenson*, State University College of Environmental Science and Forestry, Syracuse, NY 13210

In January 1998, an ice storm caused severe crown breakage to northern hardwood stands in upstate New York. The hypothesis tested in this study was that trees damaged by this storm were susceptible to secondary wood-boring insects. Three ice storm-damaged stands in the Adirondack Park region were intensively sampled in 1999 and 2000 to evaluate the relationship between ice storm damage and abundance of secondary insects and insect-caused defects associated on the main boles of ice-damaged trees. Three 1/5th-acre plots were established in each stand where all trees greater than 8 inches dbh were felled. Sample sizes for major tree species were: *Acer rubrum* L. (153), *A. saccharum* Marsh. (118), *Prunus serotina* Ehrh. (61), *Fraxinus americana* L.(57) and *Fagus grandifolia* Ehrh. (44). No statistically significant (p=0.05) relationship was found in 1999 between the presence of secondary insects and amount of ice storm damage (percent broken branches). In 2000, sample trees were evaluated for density (# galleries / in^2) of secondary insects, rather than just their presence or absence on tree boles, in relation to amount of ice storm damage. There was no statistically significant (p=0.05) relationship between the amount of ice storm damage and density of secondary insects. Examinations for insect-caused defects showed that secondary insects were not successfully breeding in ice damaged trees. Results indicate secondary insects were most likely to occur on dead branches ($p<0.0001$) and branch breakage was not a significant factor in determining susceptibility to attack. In conclusion, this aspect of the study indicated secondary wood boring insects posed no threat to three northern hardwood stands in upstate New York for two years following the ice storm of 1998. In 2000, Lingren funnel traps were baited with ethanol and wood chips from sugar maple, black cherry and white ash. Control traps were baited with ethanol alone. The only secondary insect responding significantly to the treatments (p=0.002) was *Phloeotribus liminaris* (Harris), the peach bark beetle. More of these beetles were caught in the black cherry + ethanol treatment than in control traps.

Effects of the Ice Storm on Urban Forests, and Implications for the Future

Jerry Bond, Science Adviser, Davey Resource Group

In the first section of this presentation, 3 long-term research projects carried out on the urban forest after the '98 Ice Storm will be outlined:

- Canopy recovery retrospective: a look backward at the recovery of the Rochester urban forest after the '91 Ice Storm, with particular attention to trees with canopy damage levels > 75%

- Canopy recovery prospective: a survey of the surviving North Country urban forest, and a study of the recovery differences among maples.

- Urban forest health monitoring: the establishment of permanent forest health plots in 4 communities in New York and New England.

The second section will describe significant new tools developed for mitigating the consequences for urban forests and foresters of future ice storms:

- Tree Emergency Manual: a handy guide for public tree managers that walks them through post-storm problems and prepares them for the next tree emergency.

- Storm Damage Assessment Protocol: a credible and reliable method for quickly estimating the levels and cost of damage to the urban forest from a disastrous storm.

• Revision of Removal Criteria: a review of potential changes in post-storm decision procedures suggested by '98 Ice Storm research.

Understanding and Addressing the Forestry-related Educational Needs of People Impacted by the January 1998 Ice Storm

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The January 1998 ice storm created significant changes in rural and urban landscapes and thus affected not only ecological functions but also opportunities for residents and communities to maintain their livelihoods and pursue various land management options. We conducted four surveys with various stakeholders groups to: (1) evaluate a special Stewardship Incentive Program available to woodland owners affected by the ice storm (SIP-ICE); and (2) evaluate educational efforts aimed at these groups after the storm and assess future educational needs. We found that property damage among woodland owners from the ice storm varied widely, with almost half of the respondents saying they did not have any damage and approximately one-quarter saying all of their wooded property was damaged. Timber and woodlot management was the topic most respondents were interested in learning more about. Respondents said the best method to reach them with information was via newsletters and special mailings. Our survey of SIP-ICE applicants found that they were generally satisfied with the program. On average, respondents rated DEC foresters, Farm Service Agency staff, and consulting foresters between good and excellent on all characteristics queried. All staff were rated particularly courteous and helpful. DEC foresters were a source of technical information for most people and overall, applicants were satisfied with the amount and quality of technical information they received. A survey of maple producers found that almost half of respondents said they thought about the possibility of future ice storms when they made changes to their current maple syrup operation. Sugar bush management and sugar bush damage assessment were the topics cited most often by respondents as important for future educational communications. The last survey, conducted with tree care managers, found that most of them also thought about the possibility of future ice storms when making tree care decisions. The top priorities for continuing education topics, based on respondents' interests, included information on legal issues and various topics focused on pruning. Mailings and newsletters would be the best way to reach most of these respondents, followed by workshops. Policy implications of these findings will be discussed.

Effects of Conventional Versus Salvage Logging on Wildlife Communities in Adirondack Hardwood Stands

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Differences in timber harvest methods and natural disturbance regimes cause forests to have different structural characteristics, (e.g. basal area), which can affect the animal communities found in managed forests. The 1998 ice-storm was a major natural disturbance in northern Adirondack forests. Its effects on forest structure in a given stand are a function of two things: actual damages caused by the storm, and whether or not the stand was salvage-logged. Because disturbances of this kind are uncommon, there is little research on how salvage-logging affects wildlife, and whether its effects differ compared to stands logged with conventional silvicultural methods. The objective of our research is to describe how various management practices affect faunal diversity in Adirondack northern hardwood forests. Specifically, we examined how harvest intensity (inversely related to residual basal area) affects faunal diversity, and whether or not those effects differ between conventional and salvage logging. During the summers of 1999 and 2000 we sampled 40 different stands (10 ha each) to measure vegetation characteristics and wildlife distributions. Each year 10 of these stands were in the central Adirondacks, where there was no ice-storm damage, and 18 stands were in St. Lawrence County, NY (hereafter northern ADK), which received severe ice-storm damage. The northern ADK sample included eight stands cut before the ice-storm by typical silvicultural methods ("conventional logging"), eight cut after (and in response to) the ice-storm ("salvaged") and two controls that have not been harvested in over 75 years. In both areas, we chose stands that varied along a gradient of harvest intensity. Our wildlife surveys focused on the richness and abundance of three taxa. We counted breeding birds at a series of standardized point counts. Amphibians were sampled by time-constrained area searches. Carrion beetles (*Sylphidae*) were collected at a pair of baited traps, for future analysis. We measured a host of structural and vegetative variables within each stand. These data allow us to understand which structural elements of habitat were most important for each group of animals. Preliminary analyses, combining all study sites, show a strong relationship between vegetation variables and the abundance of both birds and terrestrial amphibians. As expected from previous studies, there is a significant increase in abundance of mature-forest

birds as residual basal area increases; conversely, as basal area decreases early-successional birds significantly increase in abundance. Many of these relationships hold separately within stand groups, especially in conventionally logged stands. However, even in salvaged stands, where the range of basal area was relatively narrow, significant relationships were found, especially for early successional birds. In any case, ANCOVA analyses indicate no statistically significant differences in the slopes of regression lines or in adjusted means for salvage versus conventionally logged stands. Thus, general knowledge of how forest management affects wildlife in conventional stands, developed in this and earlier studies, can be brought to bear on both salvaged and conventional stands, particularly for early-successional birds. Our data indicate that salvaged stands were generally cut more intensively than were conventionally logged stands. Thus, salvage logging has a predictable influence on wildlife communities, and typically creates conditions whereby early-successional birds are very abundant. Mature-forest birds would likely be more abundant if residual stocking was higher.

The Good, Bad and Ugly: Impacts of the January 1998 Ice Storm on Streams and Streamsides of the Adirondacks, NY

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Ice storms are a recurring disturbance in temperate landscapes and can have major impacts on forest systems, as well as on human communities. However, little research has evaluated the impact of ice storms on associated aquatic systems. We have been examining the impacts of the January 1998 ice storm on the streamsides and streams of the eastern Adirondacks. In 1999, our goals were: 1) to inventory canopy damage within the streamsides, 2) to assess impacts on woody debris and in-stream habitat, and 3) to evaluate the contribution of landscape position to ice storm impacts. 43 sites, including 32 -1st order sites and 11 associated 3rd order sites, distributed across five watersheds were inventoried. There were significant differences in the canopy damage experienced by different tree species and the degree of canopy damage was strongly influenced by landscape position. Increased canopy damage was significantly associated with several in-stream parameters, including increased availability of woody debris dams and greater stream width.

The second phase of the project, initiated in 2000, consists of two projects examining ice storm impacts upon associated biota, specifically: a) stream fish and invertebrates, and b) streamside roots. The first study is evaluating the importance of woody debris dams to fish and invertebrate populations in the ice storm-impacted streams. Fish and stream invertebrate abundance has been estimated in paired replicates of reference and removal reaches prior to and subsequent to removal of woody debris dams in 1st, 2nd, and 3rd order streams. To date, reduced abundance and biomass of brook trout have been observed following debris dam removal in 2nd order streams. The root study is quantifying rooting patterns a) at a reference streamside through time, and b) at five 1st order and four 3rd sites characterized by varying amounts of ice storm damage. Root biomass peaked consistently at 20-30 cm below ground and changed seasonally. Ice storm-damaged areas had significantly less root biomass as compared to undamaged sites.

Overall, our findings indicate that ice storms are an important influence within the streams and streamside habitats of the Northeastern U.S. The direct damage to the streamside tree canopies is translated into the associated streams and downstream habitats. The availability of woody debris dams is increased, and provides critical habitats for fish and aquatic invertebrate communities. The 1998 Ice Storm was responsible for decreases in underground root biomass, and likely altered the associated streamside functions of erosion control or groundwater filtering. These findings complement the more extensive literature on ice storm impacts in terrestrial systems. However, they also suggest that ice impacts in streamsides are providing surprising benefits, in the form of woody debris habitat for fish, that are critical for sustainability of the aquatic ecosystem.

Results of Ontario's Forest Science Efforts Following the 1998 Ice Storm

R.A. Lautenschlager, Ontario Ministry of Natural Resources, the Ontario Forest Research Institute, 1235 Queen Street East, Sault Ste. Marie, ON P6A 2E5 [Email: r.a.lautenschlager@mnr.gov.on.ca]and
Cathy Nielsen, Ontario Ministry of Natural Resources, Southcentral Science Section, Concession Road, P.O. Bag 2002, Kemptville, ON K0G 1J0.

The 1998 ice storm, which caused extensive damage from eastern Ontario and New York to the Atlantic Ocean, led to a variety of economic and ecological questions. Following the storm the Ontario Ministry of Natural Resources, working with other organizations, developed short- and the longer-term plans, designed to document the consequence of that storm [Lautenschlager and Nielsen 1999 – For. Chron. 75(4):633-641]. Science initiated was the result of a synthesis of

specific questions raised by governments, concerned publics, and/or stakeholder groups. Communication plans, designed into this study, have and continue to transfer all significant information gathered to those groups and external colleagues. To date, science efforts have produced: 1) a low-level aerial survey of forests in the damaged area; 2) extension notes for homeowners, landowners, maple syrup producers, plantation owners, natural resource agencies, and municipalities; 3) information for media and natural resource education groups; 4) standardized assessment techniques and training for those assessing damage and making recommendations; 5) literature reviews and synthesis; and 6) management guidelines. Research is underway across the mixedwood (Great Lakes-St. Lawrence forest region) forests of eastern Ontario. A replicated (35 1 ha blocks) post-storm experiment in "active" sugar-bushes was established in 1999. Each block was subdivided into 4 equal plots treated with: dolomitic lime (2000 kg/ha); phosphorus and potassium (each at 200 kg/ha); lime, phosphorus and potassium (2,400 kg/ha); or nothing (control). A companion experiment (3 1 ha blocks) is documenting affects of interactions between fertilizers and understory vegetation control. Data (foliar nutrients, root starch, sap sweetness, sap volume, taphole closure, and tree growth) documenting treatment effects, plus other data (foliar biomass, ground vegetation, microclimate, soil, and soil microbial communities) are being collected. Research in woodlots and plantations is documenting effects of damage to a variety of managed plots which were monitored before the storm; examining disease, stain, decay, and selected insect damage probabilities in broadleaf and conifer stands; documenting insect responses to damage in red pine plantations; and developing economically based decision-support tools for managing damaged pine, and maple stands and post-damage remedial treatments. . In addition, attempts are being made to scale stand level biological and economic information up to the landscape level. Conclusions from these studies will be available in January 2002.

The Next Ice Storm: What to Do?

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Ice, snow, and wind have frequently damaged forests of Northeastern North America, and had a major effect on hardwood stands of New York State. The certainty of future losses to similar natural events demands preparedness to insure reasonable responses. Recent assessments funded by the NYS Department of Environmental Conservation, the US Forest Service, and the New York Center for Forestry Research and Development provide insights that should help forest managers and landowners in the future.

Patience and caution should prevail, with deliberate assessment of ownership objectives and on-site conditions preceding any decision-making. Rehabilitation and salvage cutting should reflect a priority for dealing with the most urgent needs first, and for logically covering an entire forest with treatments fitted to the severity of damage and level of long-term losses anticipated. Evidence suggests that de-branched trees of upper canopy positions will likely survive and develop new crowns. Many stands in New York had ones of acceptable potential at about 30-35 foot intervals, allowing a rehabilitation cutting to a residual of about 40-45% relative density. But in doing the silviculture, managers must control logging to prevent damage to root systems and lower boles, and restrict skidding to times when the soil with support the machinery without deep rutting.

De-branched trees of upper canopy positions had extensive crown regrowth by the end of two growing seasons. Most should live. Decay discoloration and decay will likely enter the main stem through large branch stubs, and particularly in trees that receive basal or root injuries during salvage operations. Even so, landowners need not rush into hasty logging, since the value of de-branched trees will not decrease rapidly. Ones with broken tops appear more likely to die and deteriorate.

Stands damaged by ice accumulation during January 1998 have a bright understory, and herbaceous plants and existing tree seedlings have flourished. The openness also has stimulated the growth of advance beech seedlings and saplings, and that species may prevent regeneration of other trees where it occurs in abundance. Ferns have also proliferated on the more poorly drained soils, and will likely also interfere with new tree regeneration. These kinds of interfering plants will require attention in the future.

Experience following the January 1998 ice storm shows that landowners have time to evaluate their lands and to develop deliberate plans for dealing with the damage. Where ownership objectives encourage retention of a stand for future development, managers can safely keep de-branched trees of upper canopy positions at a uniform spacing. In current stands, these may include sufficient numbers for about 40-45% relative density. They will develop new crowns that should once more close the canopy,

Tree Response to Ice Storm Injury in Thinned and Unthinned Hardwood Stands

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In January of 1998, a severe ice storm struck the northeastern United States and parts of southeastern Canada. Thinned forest stands may be more prone to ice injury than stands which had not been recently thinned, but may recover more readily. This hypothesis was tested at four sites across central Maine. At each site, a thinned and unthinned stand was located. Injury and recovery measurements were made on individuals of five hardwood species. There was a recognizable difference in injury between species. However, based on preliminary findings, no significant difference in injury between thinned and unthinned areas was noted. Vigor measurements suggested that recovery may be better in thinned stands. Crown recovery data is still being analyzed, but most trees are expected to eventually recover.

Effects of the 1998 Ice Storm on New York's Forests and Management Implications

Thad E. Yorks[1], *Donald J. Leopold*[1], *Kenneth B. Adams*[2], *Shawn L. Carter*[1], *Karl A. Didier*[1], *James P. Gibbs*[1], *David H. Griffin*[1], *Paul D. Manion*[1], *William F. Porter*[1], *Benjamin D. Rubin*[1], and *Steven S. Woods*[1]

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The January 1998 ice storm affected many components of northern New York's forests. To better understand the ecological effects of the storm and thereby prepare us for making sound silvicultural recommendations in the event of future storms, we have been studying impacts of the ice storm on overstory trees, understory vegetation, white-tailed deer, several invertebrate taxa, and herpetofauna. Many intriguing patterns are evident, but because data analyses are not yet complete for several aspects of our research, many of our results are preliminary.

To assess relative damage among tree species, detailed condition information, including numbers of broken branches ≥5 cm diameter, broken tops, and healthy branches, was recorded for 5434 living trees >9 cm dbh from 603 ten-basal-area-factor prism plots (3 per forest stand) at 201 random points (stands) throughout the affected region of New York (Manion, Griffin, and Rubin). Twenty five percent of the sample stands had ≥20% branch breakage. Bigtooth aspen, northern red oak, red maple and eastern white pine had the most breakage. Comparison of potential mortality due to ice damage (i.e., mortality of trees with ≥75% of branches broken) to mortality expected without ice damage suggests that the ice storm may alter the health of 16-25% of the forest area but this is not sufficient to alter the health or sustainability of the larger forest system.

To assess the response of understory vegetation to ice damage, understory vegetation was intensively sampled in three northern hardwood stands that experienced moderate to heavy ice damage and an undamaged control stand (Woods and Leopold). Each stand contained 12 plots for which percent canopy removal was determined, and each plot contained eight 0.25-m^2 subplots in which percent cover and stem density were recorded for each vascular plant species. Preliminary results indicate that the overall stem density and percent cover of herbaceous plants increased as a result of the ice storm, presumably due to changes in ambient light and moisture in the understory. Increases in stem densities were primarily from species present prior to the ice storm. Specifically, there was a greater abundance of hay-scented fern and New York fern in damaged stands than in the control stand.

The ice storm damaged rare jack pine-pitch pine barrens in northeastern New York. We have been quantifying tree damage and fuel loading in these stands and evaluating restoration cutting in damaged stands as a management alternative for regenerating jack pine (Yorks and Adams). Ice damage was variable among stands with 52-94% of trees exhibiting ice damage. Based on crown damage intensity, we predict that tree mortality due to the ice storm will be 16-55%. Restoration cuttings in some damaged stands were completed from 1998-2000. Jack pine seedling density in the 1998 restoration cutting was 21,000 ha^{-1} one year after harvest, while no jack pine seedlings were observed in an adjacent uncut stand. Future work will include damage assessment in additional stands and continued monitoring of seedling survival after restoration cutting.

We are investigating interactions among white-tailed deer, competing vegetation (e.g., hay-scented fern), amount of canopy disturbance, and patterns of hardwood regeneration across northern New York (Didier and Porter). We are testing the use of fencing and herbicide treatments to control deer and competing vegetation, respectively, to ensure successful hardwood regeneration. We are trying to determine if regeneration in heavily disturbed sites will overwhelm

deer, such that their impact is low compared to lightly disturbed stands, and we are examining interactions of rehabilitation operations and deer impacts on regeneration. We are also investigating broad-scale patterns of hardwood regeneration to see how these patterns relate to deer density, soils, and acid deposition.

Canopy damage resulted in substantial inputs of woody debris to forest floors. To assess impacts of this woody debris on invertebrates and herpetofauna, we established 40 plots across a gradient of canopy damage, measured volumes of downed woody debris, collected ground beetles, spiders, and carrion beetles, and estimated herpetofaunal abundance at each plot (Carter and Gibbs). We used pitfall and baited traps to collect ground beetles, spiders, and carrion beetles, and cover object transects to estimate herpetofaunal abundance at each plot. We are determining associations between amounts of canopy damage and corresponding species abundance and richness. We are also examining experimentally the relative contributions of different types of woody structure to faunal diversity by tracking temporal changes in community composition. To this end, we established 32 plots within an unmanaged northern hardwood forest, collected pre-treatment data for the previously described taxa, and subsequently removed combinations of leaf litter and woody debris from randomly assigned plots. Preliminary results suggest that spiders may respond to amounts of fine woody debris needed for web attachment and foraging, ground beetles may require deep leaf litter for predator avoidance, and salamanders may need decayed coarse woody debris for successful homeostasis.

Though preliminary, our results generally indicate that the 1998 ice storm was not "catastrophic" in its effects on northern New York’s forests.

Ice, Trees, and People:
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Poster Abstracts

Abstracts are in alphabetical order by author's last name.

Ice Storm Canopy Damage as a Contributor to Structural Forest Complexity and Faunal Species Diversity

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Forest ecosystems arguably contain the most diverse biotic communities on earth, largely because of abundant, spatially-partitioned biomass that provides many niches. One critical component helping to maintain faunal species diversity within temperate forests may be downed coarse and fine woody debris (CWD, FWD). Canopy damage sustained during the 1998 ice storm event resulted in substantial inputs of structurally-complex woody debris to forests of the northeastern United States. Our goal is to examine the effect of this natural disturbance event on species diversity of trophically important taxa, thereby providing a basis for management and conservation of forest biodiversity. We established 40 sampling plots (1999-2000) in northern New York state across a previously determined gradient of canopy damage (0-56 %) and measured the volume of downed CWD (> 5 cm diameter) and FWD (< 5 cm diameter). We used pitfall and baited traps to collect ground beetles (Carabidae), spiders, and carrion beetles (Silphidae), and cover object transects to estimate herpetofaunal abundance at each plot. We will use linear and nonlinear regression techniques to elucidate associations between amounts of canopy damage and corresponding species abundance and richness. We are also examining experimentally the relative contributions of different types of woody structure to faunal diversity by tracking temporal changes in community composition. We established 32, 10×10-m plots within an unmanaged hardwood forest, collected pre-treatment data for the previously described taxa, and subsequently removed all possible combinations of leaf litter, CWD, and FWD from randomly assigned plots. Preliminary results suggest unique associations between individual taxa and structural forest components. Spiders may respond to amounts of FWD needed for web attachment and foraging, ground beetles may require deep leaf litter for predator avoidance, and salamanders may need decayed CWD for successful homeostasis.

The Impact of Deer on the Regeneration Layer of Disturbed Northern Hardwood Forests in Northern New York

Karl A. Didier and *William F. Porter,* SUNY-ESF, Illick Hall 242, 1 Forestry Drive, Syracuse, NY 13210 [Phone: (315) 470-4847 Email: kadidier@syr.edu]

It is uncertain whether stands disturbed by the ice-storm will successfully regenerate valuable hardwoods. Browsing by deer on regeneration could shift composition from highly to less valuable species, such as beech or herbaceous species. Our objectives are to (1) assess the impact of deer on regeneration relative to the extent of canopy disturbance, and (2) assess the spatial patterns in regeneration and deer impact across the ice-storm area. We constructed 25 exclosures over a gradient of canopy disturbance and paired each exclosed area with an unexclosed area. Disturbance was indexed by canopy openness, which was measured using fish-eye photographs. As expected, after one growing season, exclosed areas did not differ from unexclosed areas for any vegetation class. High disturbance areas differed from low disturbance areas only for trees 1-6 ft. in height. More time is necessary for understory development before deer impacts will be detectable. Vegetation surveys scheduled for this summer may reveal deer impact, especially in heavily disturbed areas. We are determining spatial patterns in regeneration data from the ice-storm and U.S. Forest Service using spatial autocorrelation and kriging procedures, and then relating patterns to broad-scale ecological variables, including deer densities, competing vegetation, and soil factors. Preliminary results using Forest Service data indicate that sugar maple regeneration is higher in the northeastern Adirondacks than other areas. Although this broad-scale pattern is detectable, fine-scale variability limits it strength. Multivariate analysis using explanatory variables which exhibit broad-scale patterns holds promise for describing regeneration patterns.

Social Aspects of Ice Storm Recovery – Public/Private Cooperation

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The effects of the January 1998 ice storm that hit the northwoods of New York, Vermont, and New Hampshire are still evident today. The response to such natural disasters takes many forms, but in order to be fully successful, efforts must transcend boundaries of public and private ownership. Using this event as a case study, we are investigating the potential for cooperation between municipalities and private forest landowners. Aspects of cooperation include public assistance to landowners, access to technical information, and use of expert advice in decision making. Telephone interviews of public officials in the affected counties within New York state were conducted. The survey covered the extent to which municipalities received assistance for long term forest management after the storm, the extent to which municipalities were able to aid private landowners, and opinions of public officials regarding the possibility for public-private partnerships. Preliminary results will be presented in the poster.

Early Crown Rebuilding on Ice-Damaged Trees

Martin Kraemer and *Ralph Nyland,* SUNY-ESF, 1 Forestry Drive, Syracuse, NY 13210

During Summer 2000, patterns of branch loss and crown regrowth were measured on 63 northern hardwoods from three sites in the northern Adirondacks. We included sugar maple (*Acer saccharum Marsh.*), red maple (*Acer rubrum L.*), black cherry (*Prunus serotina Ehrh.*), and white ash (*Fraxinus americana L.*). Sample trees were at least 8-inch dbh and part of the upper canopy, with light to nearly complete crown loss. After felling, we recorded the placement, condition, and diameter of all brancheson the trees. Then we randomly selected four epicormics and four residual (unbroken or partially broken) branches and measured their lengths, diameters, and the number of lateral branches growing from each branch. In the case of the residual branches, the distance to each lateral branch and it's length was measured as well.

All sample trees had at least one residual branch after the ice storm. All trees had new shoots within the crown. The percent of epicormic branches were: sugar maple 9%, red maple 12%, black cherry 37%, and white ash 55%. These data indicate that the severity of damage increased by species from: sugar maple < red maple < black cherry < white ash. Further crown development seems likely. Detailed results will be available at the conference.

The Ice Storm and It's Economic Effect on Timber and Recreational Opportunities

John J. O'Donnell, *John E. Wagner,* and *Hugh O. Canham*, SUNY-ESF, 1 Forestry Drive, Syracuse, NY 13210 [Phone: (315) 479-8478]

In January of 1998, an ice storm affected the counties of Jefferson, Lewis, St. Lawrence, Franklin, Essex, and Clinton of northern New York State. The devastation resulted in damage in varying degrees across nearly three million acres of property of public and private ownership. The purpose of the project is to quantify, from existing data, past research and collected data, the economic impacts the ice storm had on timber resources, recreational resources and on the entire affected region. Throughout the data collection phase of the research, additional data, not directly related to the ice storm but none the less important, became available. This additional data is essential as it may provide other reasons for economic losses and gains within the ice storm region. The study is separated into three parts of which are considered important aspects to the economy of northern New York State. The three parts assess the impact of the ice storm on timber resources, recreational resources including camping and snowmobiling, and the impact of the ice storm on the region as a whole. The ice storm impacted an estimated 42.26 MMBF of hardwood timber at an estimated value of $9.86 million dollars. Additionally, softwood losses (species other than white pine) amounted to 71.56 MMBF at an estimated value of $2.13 million dollars.

Public and private campgrounds were affected an estimated $1.55 million dollars. This results in a 3.69% loss to estimated regional camping expenditures of $41.92 million dollars and 0.7% of estimated state camping expenditures of $211.43 million dollars.

Additional research regarding the ice storm and snowmobiling is currently underway and results will be available by March 28, 2001.

Monitoring the Impact of the 1998 Ice Storm on the Forest Health in Northern New York

B.D. Rubin, P.D. Manion and *D.H. Griffin,* SUNY-ESF, 1 Forestry Drive, Syracuse, NY 13210

We established a set of random latitude and longitude coordinates and visited 201 locations on both private and public and in northern New York to assess the impacts of the ice storm on forest health. At each location, we sampled trees ³ 3.6 inches diameter at breast height (dbh) on three 10 BAF (basal area factor) prism plots and saplings (0.6 in. 3.5 in. dbh), herbaceous and shrubby vegetation on nine 5 ft. radius subplots. In addition, we collected data on the environmental conditions at the site including topographic, drainage, soil and land use history information, as well as digital photographs of the canopy structure. For each tree sampled we recorded species, dbh, and information on whether it was alive or dead, on its physical structure, on its biotic or abiotic disease problems (if any), and on its crown characteristics. For understory vegetation we measured percent cover by species or genus. Each plot was marked so that it can be re-sampled in the future to evaluate the specific impact of prior health, crown position, and level of damage on the long term survival of individual trees and stands. Trembling aspen, red oak, red maple and white pine were among the most heavily damaged species. Red pine, balsam fir, paper birch and eastern hemlock suffered little damage. The heaviest damage was sustained in a band through north-central St. Lawrence, Franklin and Clinton counties. However, some locations with severe and moderate levels of damage were scattered throughout the entire sampling area including areas to the South of the areas of heavy ice accumulation. This indicates that a certain amount of winter damage is a normal occurrence. The research has been published as follows:

Manion, P. D. and D. H. Griffin. 2001. 1998 Ice damage in New York forests: assessment of impact. Proceedings of Ice Storm Symposium. Jan 29. Cortland, NY. USDA Forest Service Report (in press).

Manion, P. D., B. D. Rubin and D. H. Griffin. 2000. Ice damage impacts on the health of forests in northern New York. Ice Storm 1998 Forest Research Conference. Ottawa, Canada. Oct 19-22. Submitted to *For. Chron.*

Rubin, B. D. and P. D. Manion. 2000. Impacts of the 1998 ice storm on forest structure and potential consequences for forest health and succession in northern New York. Ice Storm 1998 Forest Research Conference. Ottawa, Canada. Oct 19-22. Submitted to *For. Chron.*

Providing Timely Educational Assistance to Forestry Stakeholders Following the January 1998 Ice Storm: Integrating Extension and Research

Peter Smallidge, Gary Goff, Lewis Staats, Rebecca Schneider, Cliff Kraft, Nancy Connelly, Tom Brown, and *Jerry Bond*, Cornell University, Department of Natural Resources. Ithaca, NY 14853 [Phone: (607) 255-2115]

The January 1998 ice storm damaged several million acres of forest land in northern New York and drastically impacted private landowners, maple producers, and their natural resource professional service providers. The nature of the storm and it's affect on the land and the people warranted an immediate, timely, and integrated extension and research effort. Cornell University and Cornell Cooperative Extension (CCE) campus- and county-based personnel worked together on educational and research goals to increase awareness of private forest landowners to safety issues, sources of assistance, and strategies for management. Activities included preparing newsletter articles, compiling materials on management practices, directed mailings, landowner workshops, Master Forest Owner volunteer focus group discussions, and a timber taxation workshop for foresters and CPAs.

Competitively funded projects were completed through Cooperative Extension county educators and included projects on agroforestry, urban tree care training, and volunteer training and demonstration areas. Cornell campus and CCE-Monroe initiated research projects to address ice storm issues that included: human dimension studies of educational and technical programs; maple sugar bush recovery, riparian and in-stream habitat, and urban forest canopy damage. Educational efforts reached hundreds of private landowners and scores of natural resource professionals they interact with. Preliminary efforts focused on awareness with four workshops delivered with NYS DEC partnership to landowners, three urban forestry short-courses for tree care managers, and a mass mailing prepared for private forest owners of the region. County based initiatives focused on the ability of people to return to a normal and functional life, and targeted needs such as income generation by maple producers while their sugar bush recovered.

The diversity of extension projects has increased landowner awareness of resources available, people they can contact for assistance, and natural resource management issues to avoid. The human dimensions research documented the positive impacts of educational and technical assistance programs, and importantly an awareness of how stakeholders reacted to the ice storm disaster. For example, DEC successfully met the technical needs of most (71%) forest landowners and one-third of landowners made additional but unfunded forest improvements as a result of their involvement in the SIP program. Also, the majority (73%) of maple producers received educational assistance and the Cornell Maple Program and CCE were the primary sources of assistance. Cornell based resources received a usefulness rating of 4.0 out of 5.0 by maple producers. Educational needs of natural resource professionals were addressed with two targeted workshop efforts. One effort focused on professionals who prepare taxes for private forest landowners and for foresters who advise those landowners. Using USFS expertise, the workshop delivered a day long program that

guided participants to an improved understanding, especially as related to the ice storm damage. Secondly, as part of the NYSAF summer meeting in 1999, a field tour of ice storm sites allowed for presentation of preliminary research results and interactions between field practitioners and research scientists. Cornell's integrated extension and research network allowed for timely and effective delivery of services and products.

Insect-Host Relations in Ice Damaged Northern Hardwoods

A.L Stevenson and *D.C. Allen*, SUNY-ESF, 1 Forestry Drive, Syracuse, NY 13210 [Email: alsteven_02@yahoo.com, dcallen@mailbox.syr.edu]

In January 1998, an ice storm caused severe crown breakage to northern hardwood stands in upstate New York. The hypothesis tested in this study was that trees damaged in this ice storm were more susceptible to secondary wood-boring insects. Three ice storm-damaged stands in the Adirondack Park region were intensively sampled in 1999 and 2000 to evaluate the relationship between ice storm damage and abundance of secondary insect infestations and insect-caused defects associated with the main boles of ice-damaged trees. Three 1/5th-acre plots were established in each stand where all trees greater than 8 inches dbh were felled. Sample sizes for major tree species encountered were n=153 for *Acer rubrum* L., n=118 for *Acer saccharum* Marsh., n=61 for *Prunus serotina* Ehrh., n=57 for *Fraxinus americana* L. and n=44 for *Fagus grandifolia* Ehrh. No statistically significant ($p<0.05$) relationship was found in 1999 between the presence of secondary insects and amount (% broken) of ice storm damage. In 2000, sample trees were evaluated for density (# galleries / in^2), rather than just the presence of secondary insects occurring on main bole in relation to amount (% broken) of ice storm damage. There was no statistically significant ($p<0.05$) relationship between the amount of ice storm damage and density of secondary insects. Examinations for insect-caused defects showed that secondary insects were not successfully breeding in ice damaged trees. Results indicate secondary insects were most likely to occur on dead branches ($p<0.0001$) and branch breakage was not a significant factor in determining whether a branch would be colonized. In conclusion, secondary wood boring insects posed no threat to ice damaged northern hardwood stands in upstate New York for two years following the ice storm of 1998. In 2000, Lingren funnel traps were baited with ethanol and wood chips from sugar maple (*Acer saccharum*), black cherry (*Prunus serotina*) and white ash (*Fraxinus americana*), in addition to control traps baited with ethanol alone. The only secondary insect responding significantly to the treatments ($p=0.002$) was *Phloeotribus liminaris* (Harris), the peach bark beetle. Greater numbers of these beetles were caught in the black cherry and ethanol treatment than in the other trap treatments.

Ice Storm Impact and Management Implications for a Pine Barrens in Northeastern New York

Thad E Yorks, SUNY-ESF, Syracuse, NY 13210 [Phone: (315) 470-6760 Email: teyorks@syr.edu] and *Kenneth B. Adams*, Plattsburgh State University, Center for Earth and Environmental Science, Plattsburgh, NY 12901 [Phone: (518) 564-3041 Email: kenneth.adams@plattsburgh.edu]

The January 1998 ice storm caused heavy damage to the largest *Pinus banksiana-P. rigida* barrens in northeastern New York. The barrens contain some of the southernmost stands of *P. banksiana* and northernmost stands of *P. rigida* in the eastern US. We are quantifying tree damage and associated fuel loading in these stands and evaluating restoration cutting as an alternative to prescribed burning for regenerating *P. banksiana*. Permanent plots established in 1993-1994 in five stands were resampled in 1999 to evaluate ice storm impact on stand structure; fuel loading was quantified in 2000. Ice damage was variable among stands with 52-94% of trees exhibiting at least some damage. Based on crown damage intensity, we predict that tree mortality due to the ice storm will be 16-55%. Because pre-ice storm *Pinus* regeneration was absent or sparse in these stands, forest managers are concerned that ericaceous shrub species may eventually replace *Pinus*. In an attempt to regenerate *P. banksiana* in damaged stands, restoration cuttings were completed on 225 ha from 1998-2000. Restoration cuttings reduced fuel loadings by chip-harvesting trees with serious crown damage and served as a mechanical treatment of cones on fallen branches. *Pinus banksiana* seedling density in the 1998 restoration cutting was 21,000 ha^{-1} one year after harvest, while no *P. banksiana* seedlings were observed in an adjacent uncut stand. Future work will include damage assessment in additional stands of varying age and species composition and continued monitoring of seedling survival in stands receiving restoration cutting.

Response of *Dennstaedtia punctilobula*, *Dryopteris intermedia*, *Polystichum acrostichoides* and *Thelypteris noveborensis* to Ice Storm Disturbance and Timber Harvest in Hardwood Forests of Northern New York

Steven S. Woods and *Donald J. Leopold,* SUNY ESF, 1 Forestry Drive, Syracuse, NY 13210 [Phone: (315) 278-5683 Email: sswoods@mailbox.syr.edu, dentro@mailbox.syr.edu]

Ice storm disturbances are unique. Ice storms of the magnitude of the January 1998 event are rare and therefore the effects on the forest understory vegetation remain widely unknown. Because natural disturbances are impossible to predict pre-storm data are most often unavailable. For this reason, this study examined fern stem density and cover of four fern species in harvested stands where pre and post disturbance data were available as well as ice damaged stands and then compares ice damage and harvest disturbances with regard to fern response. Response of herbaceous plants to changes in ambient environmental conditions that may occur as a result of ice storm disturbance can potentially affect understory species diversity or richness, wildlife habitat quality, recreational uses and future forest composition.

The understory vegetation was intensively sampled in four northern hardwood stands in northern New York that experienced moderate to heavy levels of ice damage from the January 1998 ice storm. Three stands in the Catskill mountain region of New York that were partially harvested in 1996 and 1997 were also sampled from 1995 through 2000. All stands contained an overstory composed primarily of *Acer rubrum*, *Acer saccharum*, *Prunus serotina* and *Fraxinus americana*.

Qualitative canopy assessment was used to obtain the percent canopy removal estimate on ice storm-damaged plots while canopy removal was calculated as the percent difference between pre-harvest and post-harvest basal area. The species, percent cover and number of stems were recorded for all plants smaller than 2.54cm diameter at breast height (dbh) occurring on eight subplots per plot.

Correlation results indicate that many factors affect the response of fern species to overstory removal. Residual plot basal area, percent canopy removal and the density of hardwood seedlings between 91.5 cm and 183 cm tall and seedlings between 183 cm tall and 2.54cm dbh were found to be correlated with percent ground cover and stem density of each of the four fern species. Cover and stem density of *Dennstaedtia punctilobula, Dryopteris intermedia,* and *Thelypteris noveborensis* increased following light (0-18%) and heavy (20-36%) timber stand improvement (TSI) cuttings. Cover and stem density of *Dryopteris intermedia* increased throughout the sampling period on clearcut plots while the cover and density of hay-scented fern initially increased but began to decline two years following clear cutting.

Results indicate that canopy removal resulting from ice storm and harvest can result in increases in fern stem density and cover. However, results also indicate that residual basal area equivalent and density of suppressed hardwood seedlings may be equally important to fern response. The positive response of fern species to canopy removal may result in increased competition between economically important hardwood seedlings and fern species.

Ice, Trees, and People:
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Preliminary Agenda

Wednesday, March 28

Noon **Registration**

1:00 pm **Opening Speaker**- *Jim Beil*, NYS Department of Environmental Conservation (NYS DEC)

1:30 **Human Dimensions Session**

Moderator: *Valerie Luzadis*, SUNY College of Environmental Science & Forestry (SUNY-ESF)

Understanding and Addressing the Forestry-related Educational Needs of People Impacted by the 1998 Ice Storm, *Nancy Connelly*, Cornell Cooperative Extension
Economic Impact Analysis of Timber Losses, Recreational Impact, and Regional Impact of the 1998 Ice Storm, *Hugh Canham*, SUNY-ESF
Helping People through Cooperative Extension Activities in New Hampshire Related to the 1998 Ice Storm, *Karen Bennett*, University of New Hampshire Cooperative Extension

3:00 **Break**

3:30 **Ecosystems Impacts Session**

Moderator: *Pete Smallidge*, Cornell Cooperative Extension

Storm Injury and Tree Damage Related to the 1998 Ice Storm: Lessons to Be Learned, *Walter Shortle*, USDA Forest Service
The Good, the Bad, and the Ugly: Ice Storm Impacts on Streams and Stream-sides, *Cliff Kraft* and *Rebecca Schneider*, Cornell University
Effects of the 1998 Ice Storm on New York's Forests and Management Implications, *Thad Yorkes*, SUNY-ESF
Susceptibility of Ice-Damaged Trees to Secondary Insect Pests: Is Salvage Needed?, *Doug Allen*, SUNY-ESF

5:30 **Poster Session and Reception**

7:00 **Dinner on your own**

Thursday, March 29

6:30 am **Breakfast on your own**

7:30 **Coffee and Registration**

8:00 **Forest Management Session**

Moderator: *Ed White*, SUNY-ESF

Management Strategies for Reducing Impacts of Salvage Logging on Birds and Herpetofauna, *Mitschka Hartley*, Audubon Society
Effects of the Ice Storm on Urban Forests and Implications for the Future, *Jerry Bond*, Davey Tree
Results of Ontario's Forest Science Efforts Following the 1998 Ice Storm, *R.A. Lautenschlager*, Ontario Ministry of Natural Resources
Response of Trees to Ice Storm Injury in Thinned and Unthinned Hardwood Stands, *Julie Swisher*, University of Maine, Orono, ME
Recovery and Sap Production of NY Sugarbushes Following the 1998 Ice Storm, *Lew Staats*, Cornell University [retired]

9:40 **Break**

10:10 **Practitioner's Panel**

Moderator: *Bruce Barnard*, NYS DEC

Don Brown, NYS DEC
Herb Boyce, Consulting forester, Jay, NY
Wayne D. Young, Domtar Communications Papers

11:00 **"The Next Storm"**

Moderator: *Jim Beil*, NYS DEC

New York Perspective on What Has Been Learned from the 1998 Ice Storm and How to Implement That Knowledge after the Next Major Ice Storm, *Ralph Nyland*, SUNY ESF
Forest Service Region-wide Perspective on What Has Been Learned and What Measures Will Be in Place to Help People the Next Time, *Gail*

Michaels, USDA Forest Service

11:50 **Closing Remarks**- *Frank Dunstan,* NYS DEC

Ice, Trees, and People:
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March 28 -29, 2001
Syracuse, NY

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The primary objective of this conference is to share the results of research that has been performed since the 1998 Ice Storm with foresters, land managers, and natural resource professionals. Topics for posters and presentations will include ecosystem impacts, forest management, human dimensions, and future implications, with an emphasis on practical applications and solutions. Additionally, the conference will outline preliminary recommendations for dealing with future episodes of large-scale forest disturbance.

Conference Location: All sessions will be held at the Hotel Syracuse at 500 S Warren, Syracuse, New York.

Lodging: A block of rooms is available for overnight lodging for the night of March 28 at the Hotel Syracuse. The special conference room rate is $70 per night. Call the Hotel Syracuse at (315) 422-5121 and ask for the Ice Storm Research Conference rate when you reserve your room. Deadline for assured room reservations is February 28, 2001.

Continuing Forestry Education Credit
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Contact: Please contact Jason Denham regarding your poster presentation by February 28, 2001 and submit electronically the title, authors, meeting contact, and abstract (no more than 500 words). Please indicate any special needs that you may have for your poster and also note that all information submitted will be included in a Proceedings. Jason Denham contact information: 518-457-7370 or jpdenham@gw.dec.state.ny.us

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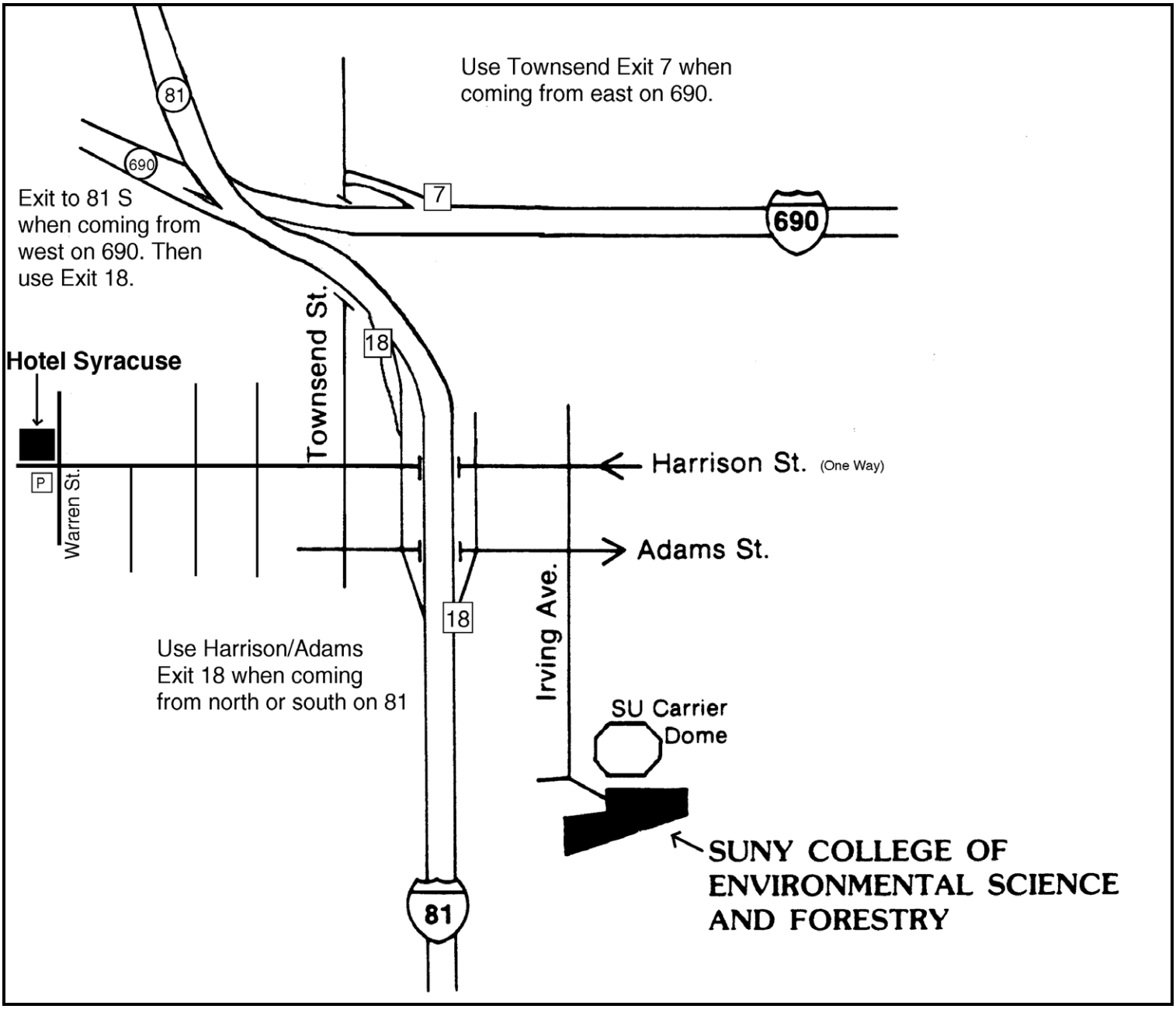
Location Map



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Poster Titles

Ice Storm Canopy Damage as a Contributor to Structural Forest Complexity and Faunal Species Diversity, *S. L. Carter,* and *J. P. Gibbs,* SUNY-ESF

The Impact of Deer on the Regeneration Layer of Disturbed Northern Hardwood Forests in Northern New York, *Karl A. Didier* and *William F. Porter,* SUNY-ESF

Effects of Conventional Versus Salvage Logging on Wildlife Communities in Adirondack Hardwood Stands, *Mitch Hartley, Mike Burger*, National Audubon Society of New York State, and *Jan Beyea*, Consulting in the Public Interest, Lambertville, NJ

Social Aspects of Ice Storm Recovery – Public/Private Cooperation, *Katherine M. Goslee* and *Valerie A. Luzadis*, SUNY-ESF

Early Crown Rebuilding On Ice-Damaged Trees, *Martin Kraemer* and *Ralph Nyland*, Forestry Department, SUNY-ESF

The Ice Storm and It's Economic Effect on Timber and Recreational Opportunities, *John J. O'Donnell, John E. Wagner* and *Hugh O. Canham*, SUNY-ESF

Monitoring the Impact of the 1998 Ice Storm on the Forest Health in Northern New York, *B.D. Rubin, P.D. Manion* and *D.H. Griffin,* SUNY-ESF

Providing Timely Educational Assistance to Forestry Stakeholders Following the January 1998 Ice Storm: Integrating Extension and Research, *Peter Smallidge, Gary Goff, Lewis Staats, Rebecca Schneider, Cliff Kraft, Nancy Connelly, Tom Brown,* and *Jerry Bond*, Department of Natural Resources, Cornell University

Insect-Host Relations in Ice Damaged Northern Hardwoods, *A.L Stevenson* and *D.C. Allen*, SUNY-ESF

Ice Storm Impact and Management Implications for a Pine Barrens in Northeastern New York, *Thad E Yorks,* SUNY-ESF and *Kenneth B. Adams*, Center for Earth and Environmental Science, Plattsburgh State University

Response of *Dennstaedtia punctilobula*, *Dryopteris intermedia*, *Polystichum acrostichoides* and *Thelypteris noveborensis* to Ice Storm Disturbance and Timber Harvest in Hardwood Forests of Northern New York, *Steven S Woods,* and *Donald J. Leopold,* SUNY-ESF

Poster Abstracts

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Registration

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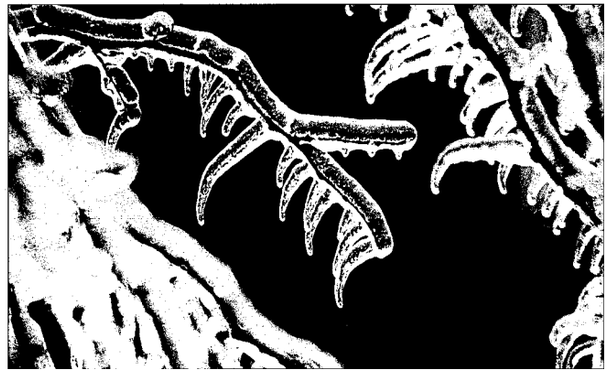

March 28-29, 2001

Hotel Syracuse
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Preliminary Agenda & Call for Posters

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Jason Denham contact information: 518-457-7370 or jpdenham@gw.dec.state.ny.us

Preliminary Agenda

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NOON Registration

1:00 PM Opening Speaker- *Jim Beil,* NYS Department of Environmental Conservation (NYS DEC)

1:30 **Human Dimensions Session**

Moderator: *Valerie Luzadis, SUNY College of Environmental Science and Forestry (SUNY-ESF)*

Understanding and Addressing the Forestry-Related Educational Needs of People Impacted by the 1998 Ice Storm, *Nancy Connelly,* Cornell Cooperative Extension

Economic Impact Analysis of Timber Losses, Recreational Impact, and Regional Impact of the 1998 Ice Storm, *Hugh Canham,* SUNY-ESF

Ice, Trees, and People: *An Integration of Research, Education, and Management*

Helping People through Cooperative Extension Activities in NH Related to the 1998 Ice Storm, *Karen Bennett*, University of New Hampshire Cooperative Extension

3:00 Break

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Storm Injury and Tree Damage Related to the 1998 Ice Storm: Lessons to Be Learned, *Walter Shortle*, US Forest Service

Ice Storm Impacts on Adirondack Stream-sides and Streams, *Cliff Kraft* and *Rebecca Schneider*, Cornell University

Effects of the 1998 Ice Storm on New York's Forests and Management Implications, *Thad Yorkes*, SUNY-ESF

Susceptibility of Ice-Damaged Trees to Secondary Insect Pests: Is Salvage Needed?, *Doug Allen*, SUNY-ESF

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THURSDAY, MARCH 29

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Moderator: *Ed White*, SUNY-ESF

Management Strategies for Reducing Impacts of Salvage Logging on Birds and Herpetofauna, *Mitschka Hartley*, Audubon Society

Effects of the Ice Storm on Urban Forests and Implications for the Future, *Jerry Bond*, Davey Tree

Recovery and Sap Production of NY Sugarbushes Following the 1998 Ice Storm: Implications for the Sugarbush Industry, *Lew Staats*, (retired) Cornell University

Response of Trees to Ice Storm Injury in Thinned and Unthinned Hardwood Stands, *Julie Swisher*, University of Maine

9:40 **Break**

10:10 **Practitioners Panel**

Moderator: *Bruce Barnard*, NYS DEC

Don Brown, NYS DEC

Herb Boyce, Consulting forester, Jay, NY

Wayne Young or *John Iverson*, Domtar Inc.

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New York Perspective on What Has Been Learned from the 1998 Ice Storm and How to Implement That Knowledge after the Next Major Ice Storm, *Ralph Nyland*, SUNY-ESF

Forest Service Region-wide Perspective on What Has Been Learned and What Measures Will Be in Place to Help People the Next Time, *TBA*, US Forest Service

Closing Remarks, *Frank Dunstan*, State Forester, NYS DEC

NOON **Adjourn**

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Syracuse, New York

March 28-29, 2001

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