

WILDLIFE CONSERVATION SOCIETY ADIRONDACK PROGRAM



SCIENCE FROM THE FIELD, 2000–2010

INTRODUCTION & CONTENTS

Dear Reader,

THE Wildlife Conservation Society's Adirondack Program was created in 1994 to promote wildlife conservation and healthy human communities, using research, community partnerships, and public outreach. Its creation was a response to a perceived absence of applied science and community-based conservation, two key pieces of the conservation story, in this landscape. We saw a critical need for field science, both to ground conservation debates in good information and to help guide conservation priorities. Though as scientists we embrace science for its own sake, we can only accomplish our mission if we ensure that our science informs policies that affect the future of this landscape we all know and love.

Thanks to the generous support provided by the Overhills Foundation, we offer here a selection of some of our scientific findings from afield in the last decade. Our goal is to give a specific Adirondack context and some Adirondack data to apply to some of our key conservation challenges. We take a muddy boots approach to conservation and pride ourselves on being the folks in the woods doing the work. What you see here reflects local research, done by local people.

This publication is divided between two sections: Biological Surveys and Impact Studies. The first describes the basic inventory work we have done in some of our region's most important habitats. The

second describes our efforts to try to understand the impacts of what we perceive to be some of the critical stressors to wildlife in our landscape. It includes a variety of studies – large and small, long-term and short-term– with a variety of messages.

Besides the science, we summarize and, where possible, make recommendations for conservation actions. We hope these will play an important role in steering future conversations. We also hope that others will weigh in on these messages. Many different groups, with missions ranging from pure science to education, advocacy, and community engagement, are working to protect the Adirondacks. Our aim with this publication is to present findings that will help and complement the efforts of the numerous people and organizations dedicated to this landscape. We hope that you find the ideas interesting and thought provoking, and can use them to help protect our great park.

Michale Glennon, Ph. D.
Director of Science, WCS Adirondack Program

This document is a production of the Adirondack Program of the Wildlife Conservation Society. Michale Glennon, Leslie Karasin, Heidi Kretser, and Zoë Smith supplied data and ideas and helped with content and editing. Some 40 field assistants, acknowledged under the individual projects, helped with collecting the data. Bill Brown, Jerry Jenkins, Leslie Karasin, Steve Langdon, Julie Maher, Larry Master, John Ozard, and Ed Vorisek supplied pictures. Jerry Jenkins designed, wrote, and illustrated the publication. Funding for its preparation and production came from a generous grant from the the Overhills Foundation.



Michelle Brown in old growth

CONTENTS

Part I: Biological Surveys

Loon Census 4

Lowland Boreal Surveys 6

Plants of Old-Growth Forests 8

Champlain Hills' Forests 10

Photo Gallery 12

Part II: Impact Studies

Risk Factors for Boreal Birds 14

Mercury in Loons 16

Exurban Development I 18

Exurban Development II 20

Ski Development and Mountain Birds 22

Carbon Releases From Development 24

Climate Driven Decline of a Boreal Plant 26

Study Sites 28

Selected Adirondack Program Publications 29

Cover photos, clockwise: Leslie Karasin on Whiteface; Michale Glennon in Spring Pond Bog; Heidi Kretser measuring a loon, and Jerry Jenkins by the Marion River.



Michale Glennon at Spring Pond



Leslie Karasin at Massawepie Lake

LOON CENSUS

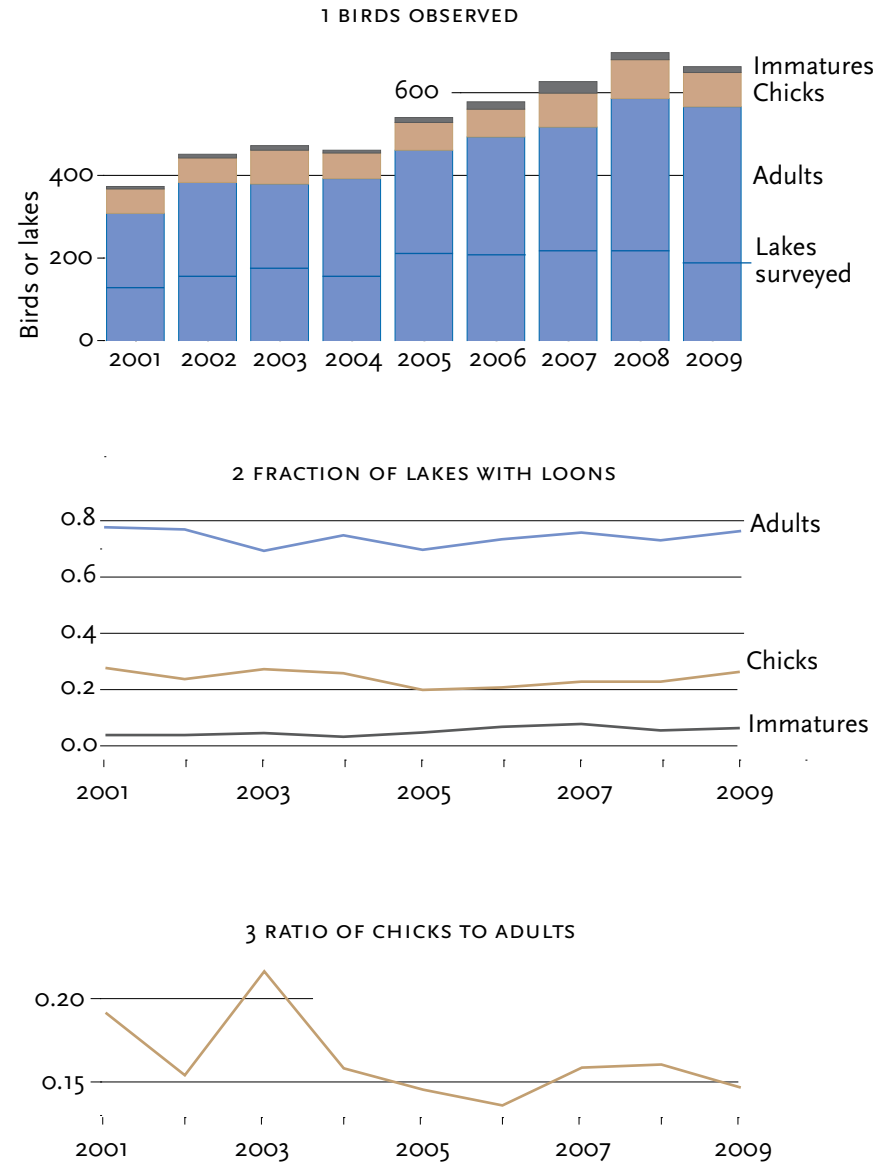
FOR the last 9 years, volunteer observers have counted loons on Adirondack and near-Adirondack lakes. The census, which is co-ordinated with other censuses in the Northeast, takes place on the third Saturday in July. Observers visit a lake of their choice between 8 a.m. and 9 a.m. and report the number of adults, chicks, and immatures they see. The number of lakes and observers varies from year to year, creating statistical uncertainties. But the census is still one of the most extensive loon surveys anywhere and provides our most detailed picture of the distribution of loons in the Adirondacks.

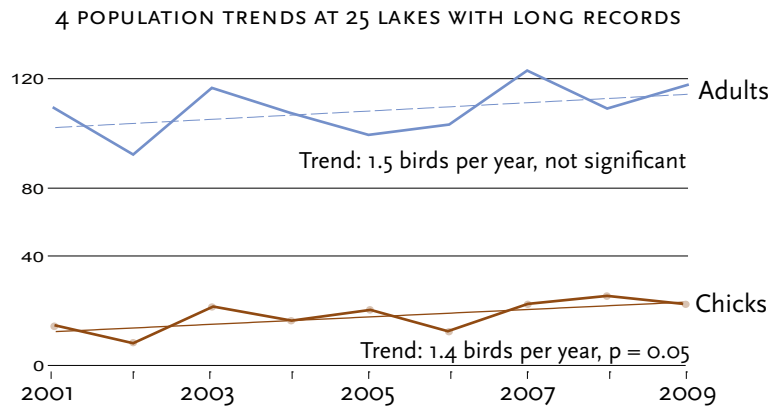
Over the nine years of the survey, the total number of birds observed each year has roughly doubled (1). Most of this is the result of increases in the number of observers (from 255 to 515) and in the number of lakes included (from 130 to 200). During this time the composition of the population and fraction of the lakes that have loons have been surprisingly constant (2,3). On average, 75% of the lakes surveyed had loons, and there was one chick for every six adults.

Please note that since the lakes are selected by the volunteers, this does not mean that 75% of the lakes in the park have loons. Volunteers may well prefer lakes with loons to lakes without them.

Given the year-to-year variation in the number of lakes and the number of observers, it is difficult to determine population trends or numbers of chicks per pair. We can, however, look at the population trends at the 25 lakes for which we have continuous records, and map the productivity per survey team (4,5). The results suggest steady populations and spatially random fluctuations in productivity.

SUMMARY: Based on nine years of census data from over 500 volunteer observers, the Adirondack loon population is relatively stable, with no signs of either rapid growth or rapid decline. Chicks occur throughout the park, and there were no major differences in the number of chicks in different parts of the park. We estimate that the total Adirondack population is between 1,500 and 2,000 birds and that, in mid-summer, there is about one chick for every six adults.



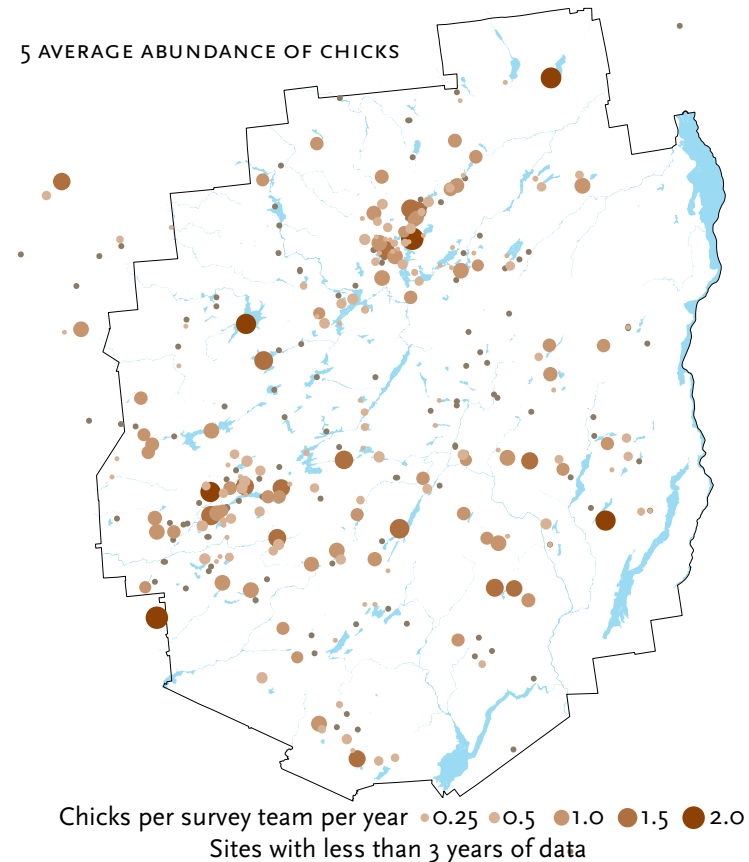


TRENDS AND PRODUCTIVITY: Population trends are best measured by repeated observations on the same set of lakes. The graph above shows the total number of adults and chicks at 25 lakes for which we have 9 years of data. The total population at these lakes seems to have risen slightly, at rates of about 1.5 adults and 1.4 chicks per year. These are small numbers, and probably not accurately measurable; given the uncertainties in the survey, the best we can say is that the population has, on average, been fairly stable.

Loon productivity is usually measured by observing the number of chicks produced by individual territorial pairs. The Adirondack data do not provide this, but do let us calculate the ratio of chicks to adults (3), which is lower than the per-pair productivity because some adults aren't mated. On average, there were 0.16 chicks for every adult.

We can also estimate the number of chicks observed per survey team per year. The map at right shows the average values; only sites with three seasons of data or more are scaled.

The results suggest that lakes averaging more than one chick per observer are widely distributed in the park, and that there are no areas of notably high or low productivity. In particular, there is no apparent lack of chicks in the southwestern lakes, where mercury deposition (p. 16) is believed to be highest.



Project: Adirondack Loon Census

Date: 2001–2010

P.Is.: Dr. Nina Schoch, Zoë Smith

Assistants: D. Andrews, E. DeBolt, J. Doyle, W. Gleason, B. Gross, F. Guevara, H. and S. Hawley, J. Heintz, K. Henry, L. Karasin, G. Lee, A. Marino, G. McDonnell, J. Merriman, D. Namerow, K. Ormerod, V. Pagano, C. Pershyn, A. Sauer, M. Shubert, J. Tibbles, and E. Whitcraft.

Analysis: Jerry Jenkins

Collaborators: BioDiversity Research Institute, N.Y.S. Department of Environmental Conservation, Wild Center, Audubon Society of New York

Major Funders: BioDiversity Research Institute, Disney Wildlife Conservation Fund, Nordlys Foundation, Conservation Research Foundation, Freed Foundation

LOWLAND BOREAL SURVEYS

THE Lowland Boreal is an ensemble of about 300,000 acres of conifer forests and boreal wetlands, found in many parts of the Adirondacks but most abundant and continuous in the outwash valleys of the northwestern portion of the park (1). The wetlands here, though surrounded by temperate forests, are boreal in scale and composition. They are the southernmost place in North America where large bogs, open river corridors, and many characteristic boreal animals and plants occur.

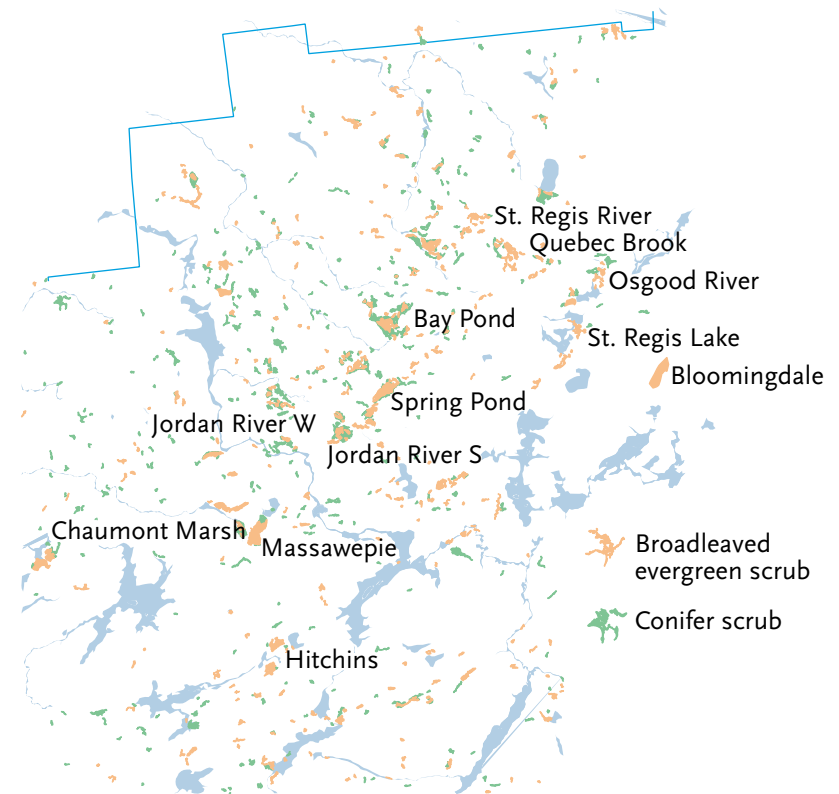
All the communities of the Lowland Boreal are threatened by climate warming. We think it important, both for science and conservation, that we keep them under observation. We would like to know whether they are already changing, which species are gaining and which losing, and if there are conservation interventions that might help the threatened species survive.

To observe change you need a baseline. For the last ten years, two WCS projects have been gathering baseline information in the Lowland Boreal. Dr. Michale Glennon's Boreal Bird project maps boreal birds and models their population trends (2). Jerry Jenkins' Big Bog project documents plant occurrence and vegetation structure in large open wetlands (3).

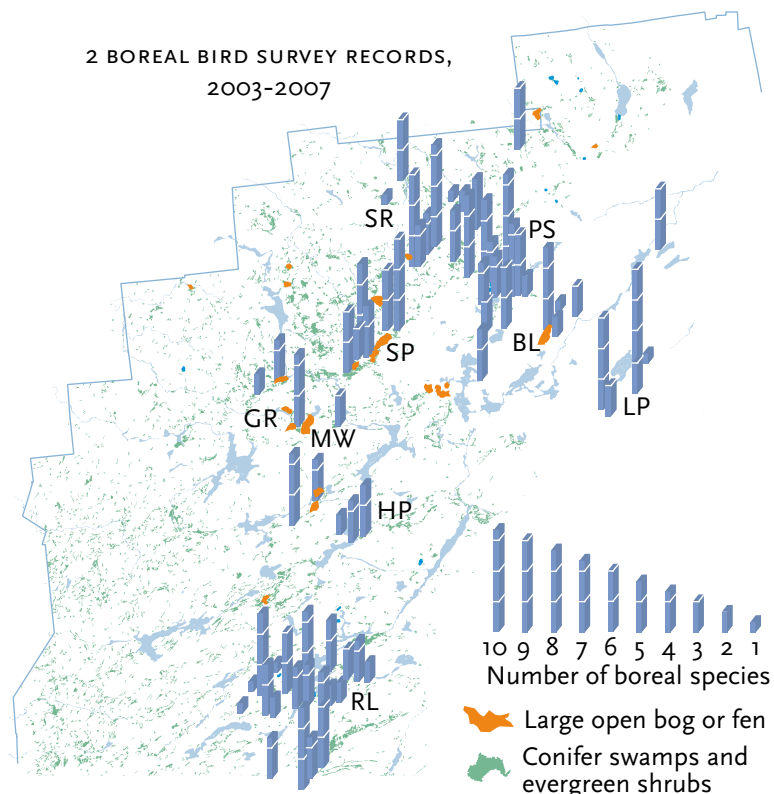
Our studies have shown that these large wetlands are the biological heart of the Adirondack Lowland Boreal. They are the most intact and diverse boreal habitats we have. They are also, we believe, the places that will determine whether the lowland-boreal species can survive coming warming. We would like to help these species survive; before we have any chance of doing that, we have to know who they are and how they are changing.

SUMMARY & RECOMMENDATIONS: The Adirondack Lowland Boreal, and especially the big wetlands which are its biological core, contains many species that are threatened by climate change. Continued survey and monitoring will be essential to understand how climate changes are affecting them. Additional protection of critical areas may offset some of the effects of climate change.

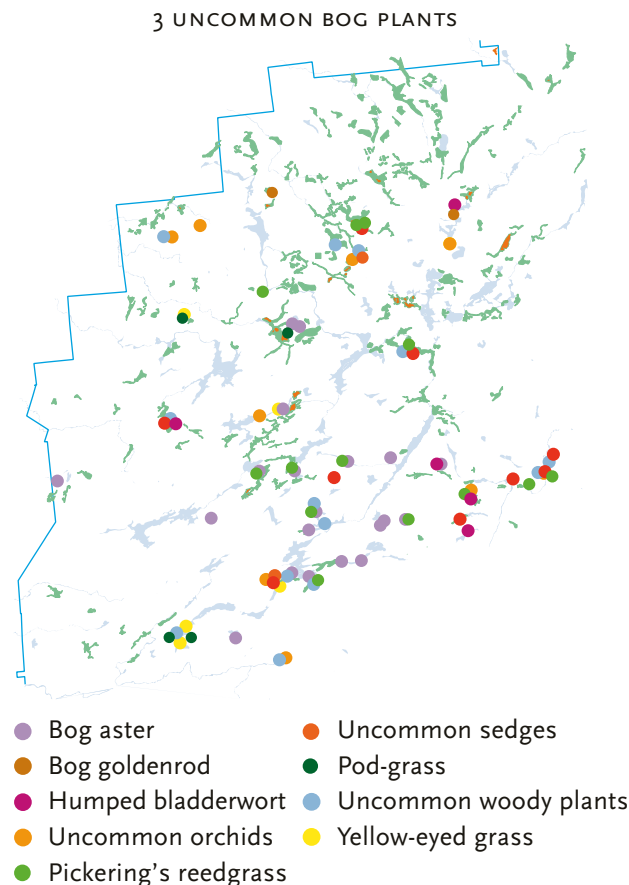
1 THE BIG NORTHWESTERN BOGS AND FENS



Heart Pond in Spring Pond Bog



BL Bloomingdale	PS Paul Smiths	SR St. Regis River
GR Grass River	LP Lake Placid	MW Massawepie
HP Hitchens Pond	RL Raquette Lake	SP Spring Pond



Zoë Smith and assistant in the McCauley Mountain Bog

Projects: Status and Distribution of Boreal Birds, Big Bog Survey

Dates: 2000-2010.

P.I.s.: Dr. Michale Glennon, Jerry Jenkins.

Assistants: Alan Belford, Brian Keelan, Brian McAllister, Evan Obercian, Fuat Latif, Gary Lee, Kevin Jablonski, Nicholas Laviola, Melanie McCormack, Valerie Stein, Kendra Ormerod

Analysis: Michale Glennon, Jerry Jenkins

Collaborators: Northern New York Audubon, SUNY-ESF, New York Natural Heritage Program, Adirondack Chapter of the Nature Conservancy

Major Funders: N.Y.S. Department of Environmental Conservation, Olympic Regional Development Authority, Northern New York Audubon, Freed Foundation, Adirondack Chapter of the Nature Conservancy

PLANTS OF OLD-GROWTH FORESTS

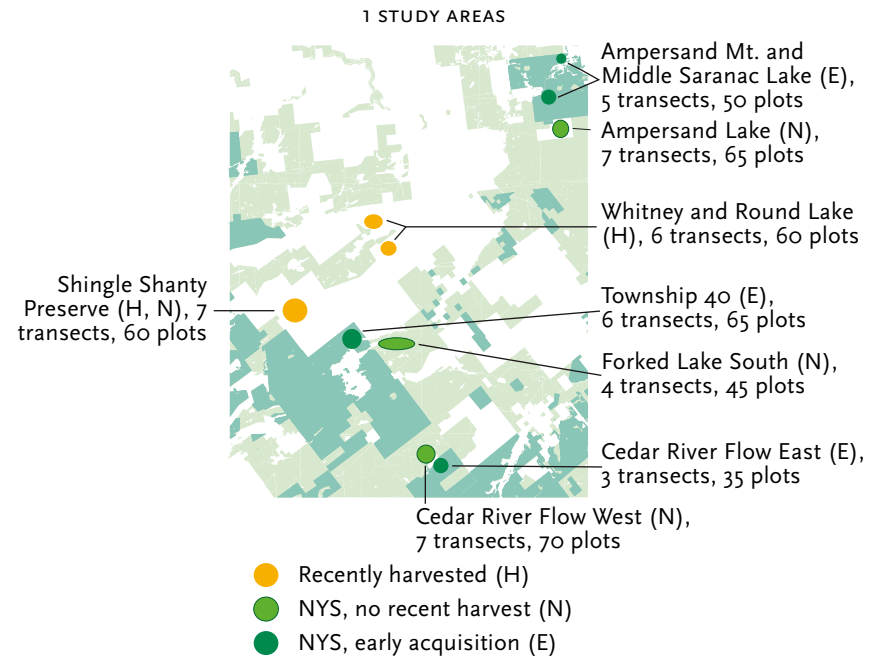
THE Adirondacks, if Barbara McMartin is correct, contain nearly 500,000 acres of old growth. The trees in these forests have been well studied. The understory plants have not. When this study began in 2008, there had not been an understory vegetation study in Adirondack old growth in 30 years, and there had not been a general floristic inventory since 1931.

The study had two objectives. The first was to find out if Barbara's conjecture that most of the lands acquired by the state before 1895 had old growth was correct. The second was to find out if the understory plants of old-growth differed from those of harvested forests. Several birds and animals are restricted to, or commoner in, unharvested forests. The question was whether there were any comparable plants.

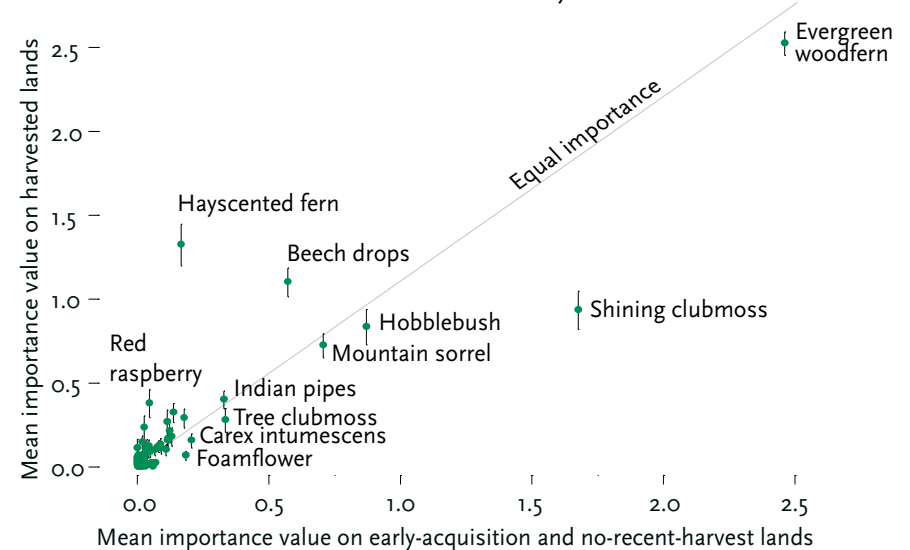
The answer to the first question was a clear yes. There were large trees on all the transects in early-acquisition forests (1). The ease with which they could be found suggested that most early-acquisition lands do indeed contain some old growth and many contain a lot. Their size and abundance speak to the importance of Adirondack old growth: there are few other places with trees like these in North America.

The answer to the second question was an equally strong no. No understory plants were restricted to old-growth, and only a few were more common in old-growth than in harvested woods (2,3), and in fact old-growth forests tended to have lower understory diversity than harvested ones (4). The only caveat to these results is that the spring ephemerals were not sampled at all and a few other early-senescent species sampled poorly. If there are any forest-interior plants to be found by future work, they will likely be found in these groups.

SUMMARY: Large old trees, ranging from grand to magnificent, occurred in every early-acquisition forest that was examined and in many no-recent-harvest ones as well. There were, however, no special understory plants associated with them. The conservation value of these stands, which is very high, seems to depend on the size and age of the trees rather than the uniqueness or diversity of their associated understories.

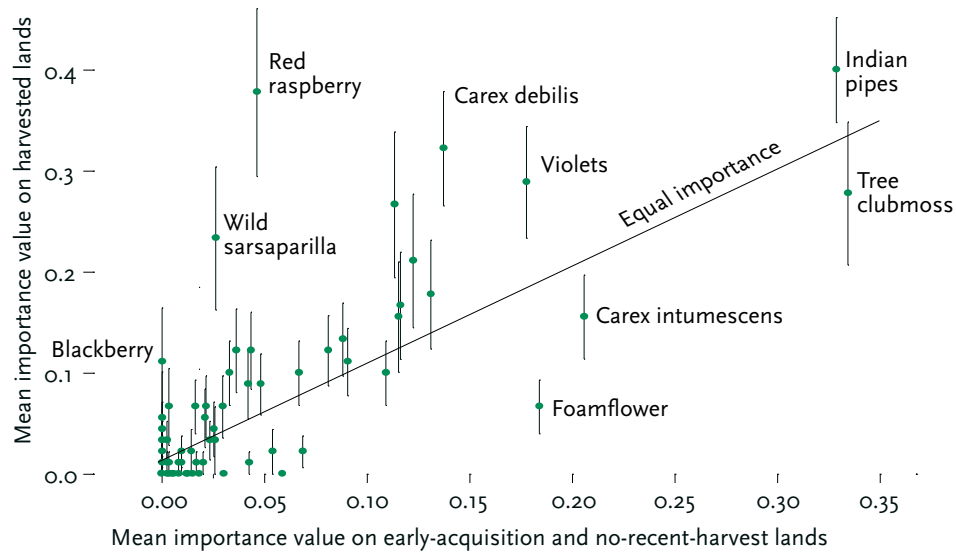


2 IMPORTANCE VALUES OF UNDERSTORY SPECIES ON HARVESTED AND UNHARVESTED LANDS: MAJOR SPECIES

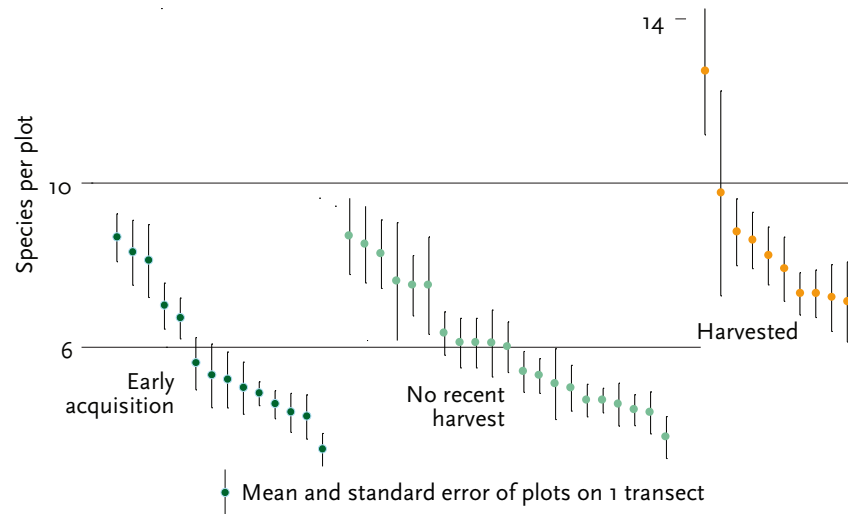


The importance value is a measure of abundance combining frequency and cover. It ranges from 1 (rare) to 4 (over 50% cover).

3 IMPORTANCE VALUES OF UNDERSTORY SPECIES ON HARVESTED AND UNHARVESTED LANDS: MINOR SPECIES



4 RANKED MEAN PLOT DIVERSITY BY TRANSECT AND CONDITION



Old-growth yellow birch in early-acquisition woods east of the Cedar River Flow

Project: Forest-Interior Plants in Unharvested Adirondack Forests

Date: 2009

P.I.: Jerry Jenkins

Assistants: Alan Belford, Michelle Brown, Steve Langdon, Glenn Motzkin

Analysis: Jerry Jenkins

Collaborators: Shingle Shanty Preserve and Research Station

Major Funders: Northeastern States Research Cooperative

CHAMPLAIN HILLS' FORESTS

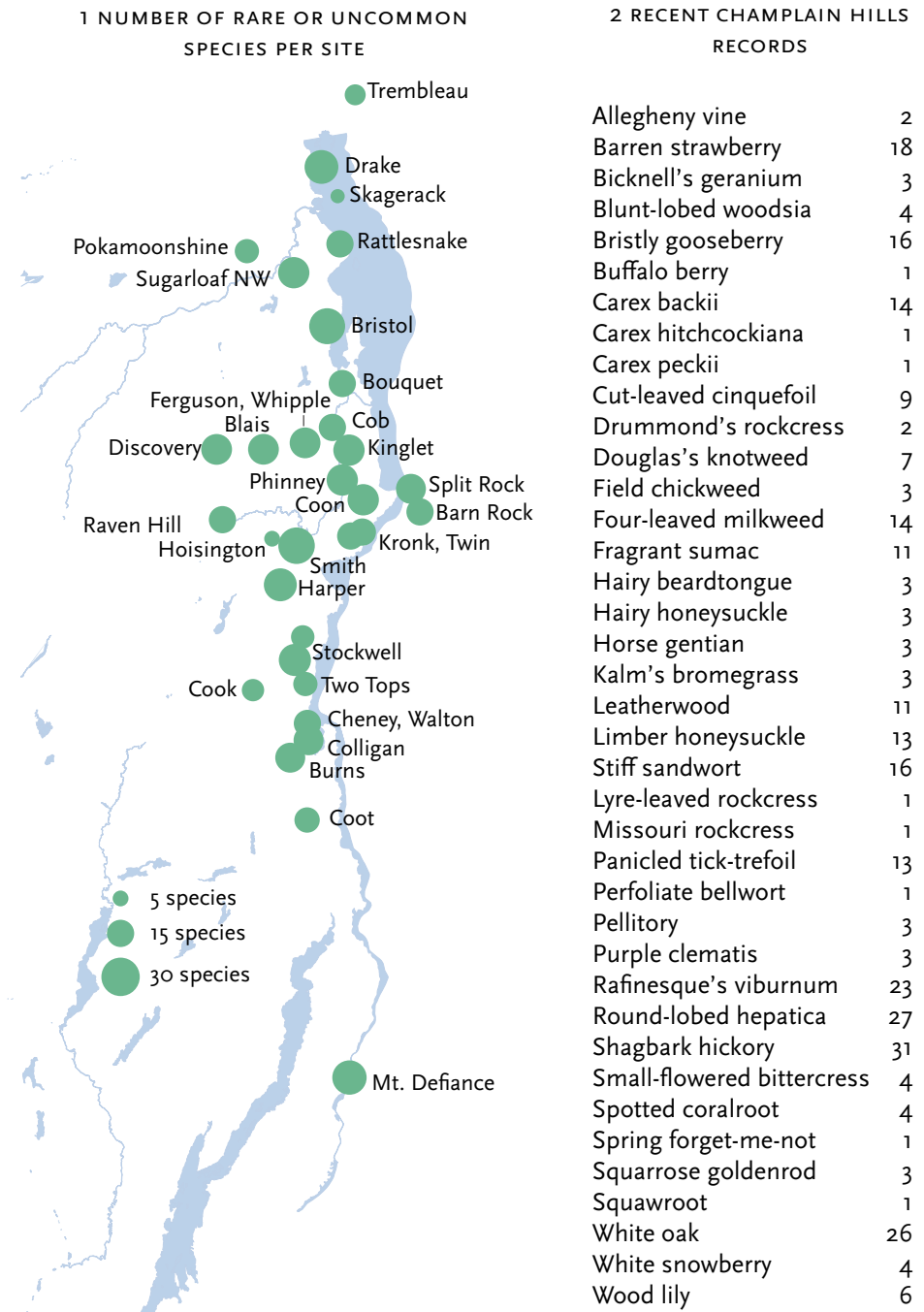
If you want to see high diversity forests with special plants, the places to look are the rocky benches and glades of the Champlain Hills.

The Champlain Hills are a range of small, rugged hills in the oak zone between the higher Adirondacks and Lake Champlain. Their lower slopes have been logged or farmed and are very ordinary. Their upper slopes, which contain stunted forests and are mostly too rocky to log, are biologically rich. The sources of their richness are part geographical and part ecological. They are the northernmost place reached by many species of the central Appalachians. And they are one of the few places in our area where species of dry and moist limy soils are equally well represented (4).

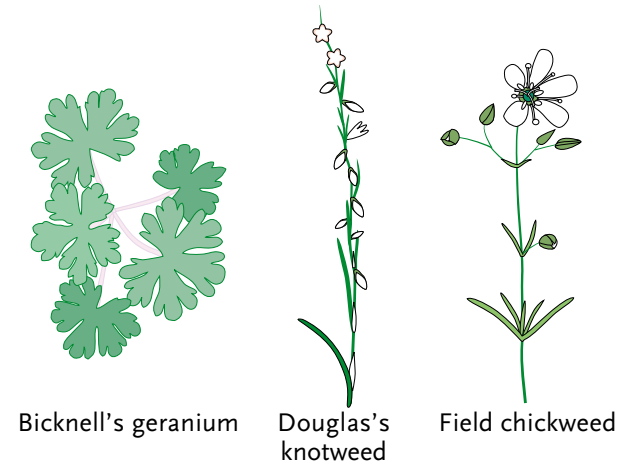
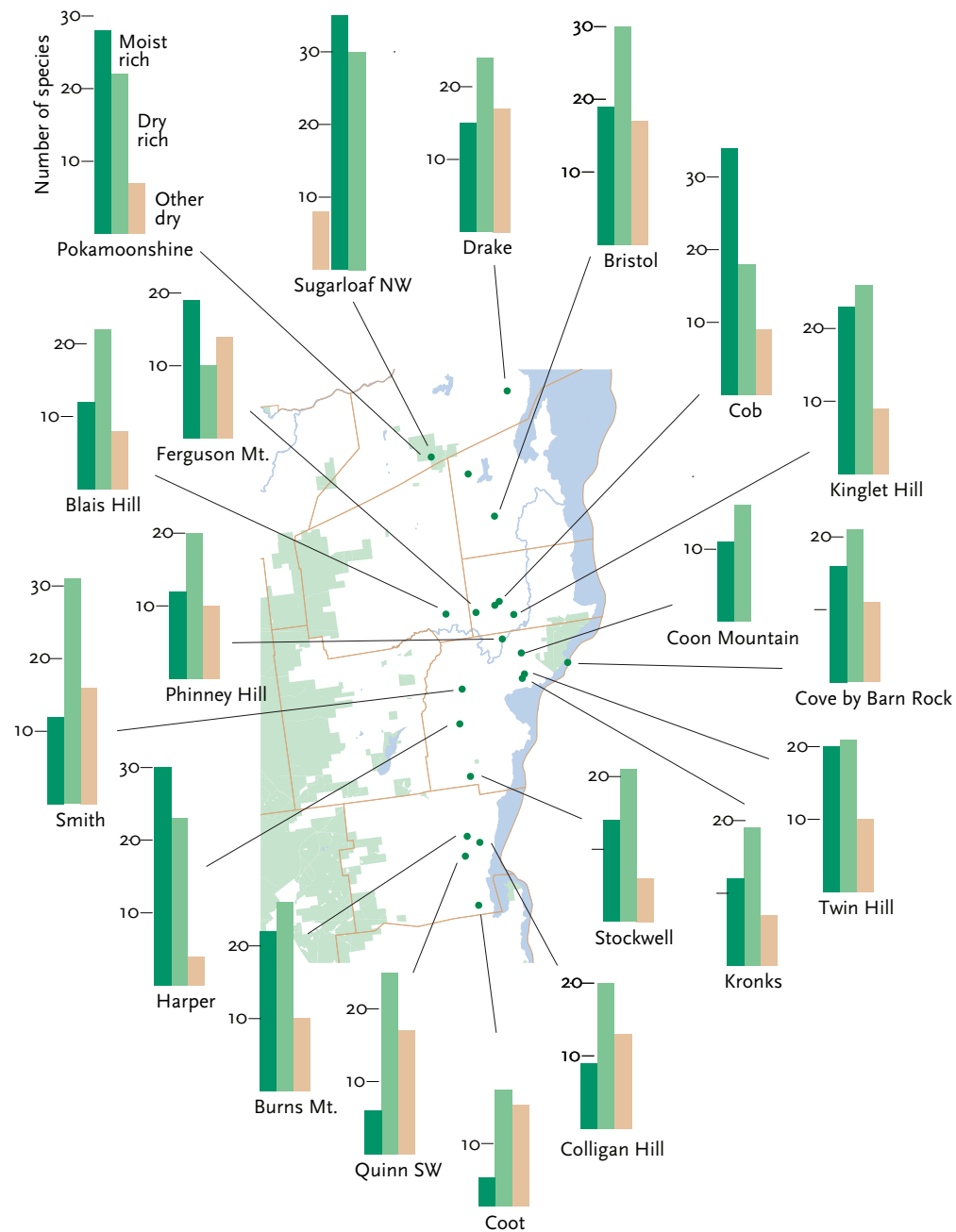
Jerry Jenkins and his field crews have done inventory work in the Champlain Hills since 2004, and have data on 31 hills (1,2). These 31 hills are plant diversity hotspots. Collectively, they contain 170 species that are ecologically specialized in the sense that they are not found in ordinary forests or on ordinary outcrops. Seventy of these species are uncommon or rare in northern New York. Individually, they typically have between 30 and 50 ecologically specialized species each, of which 15 to 20 are rare or uncommon species in New York State (1,3).

These densities are the highest in the Adirondacks, and some of the highest in the Northeast. Other Adirondack communities may equal them at the best sites. But no other community in our area produces them so consistently at site after site. For forest plant diversity, they are the best we have, and very good indeed.

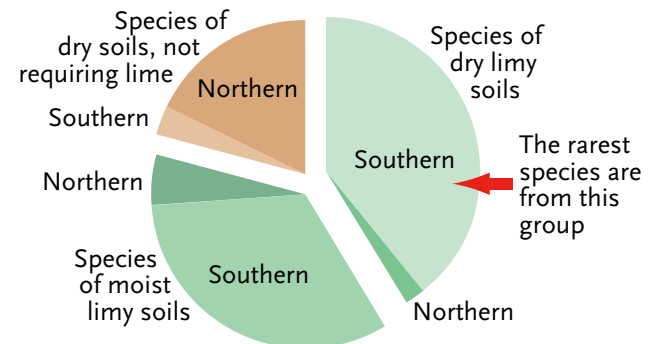
SUMMARY & RECOMMENDATIONS: The Champlain Hills contain 31 known sites with high-diversity floras. These sites have great importance for biodiversity conservation. Currently only three sites are protected, and none are incorporated in larger conservation areas. We strongly recommend additional protection, at both the local and the landscape scale, for the highest diversity sites..



2 NUMBERS OF ECOLOGICALLY SPECIALIZED SPECIES AT THE 2007 CHAMPLAIN HILLS SITES



4 ECOLOGICAL AFFINITIES OF 170 SPECIALIZED CHAMPLAIN HILLS SPECIES



Project: Champlain Hills Survey

Date: 2004–2008

P.I.: Jerry Jenkins

Assistants: Bill Brown, Brett Engstrom, Celia Evans, Peter Jenkins, Barbara Lott, Leah Nelson, Patti Smith, David Werier

Analysis: Jerry Jenkins

Collaborators: Black Kettle Farm, Adirondack Chapter of the Nature Conservancy

Major Funders: Adirondack Chapter of the Nature Conservancy

PHOTO GALLERY



Alan Belford



Peter Jenkins



Barbara Lott and Celia Evans



Quentin Hays with a flying squirrel



Ed McNeil



Glenn Motzkin and Michelle Brown



Spring Pond Bog



Meacham Lake Outlet



Old growth near the Cedar River Flow



Glades on Cob Hill

RISK FACTORS FOR BOREAL BIRDS

SINCE 2003, Dr. Michale Glennon and her field assistants have been studying the distribution and population changes of birds in lowland boreal wetlands. Their work focuses on eight northern species that are widely distributed in the Adirondacks but absent or rare south of here, and thus might be indicators of climate change.

One of the goals of the study is to estimate the population trends and determine which species are currently declining and in most danger of going extinct in the Adirondacks.

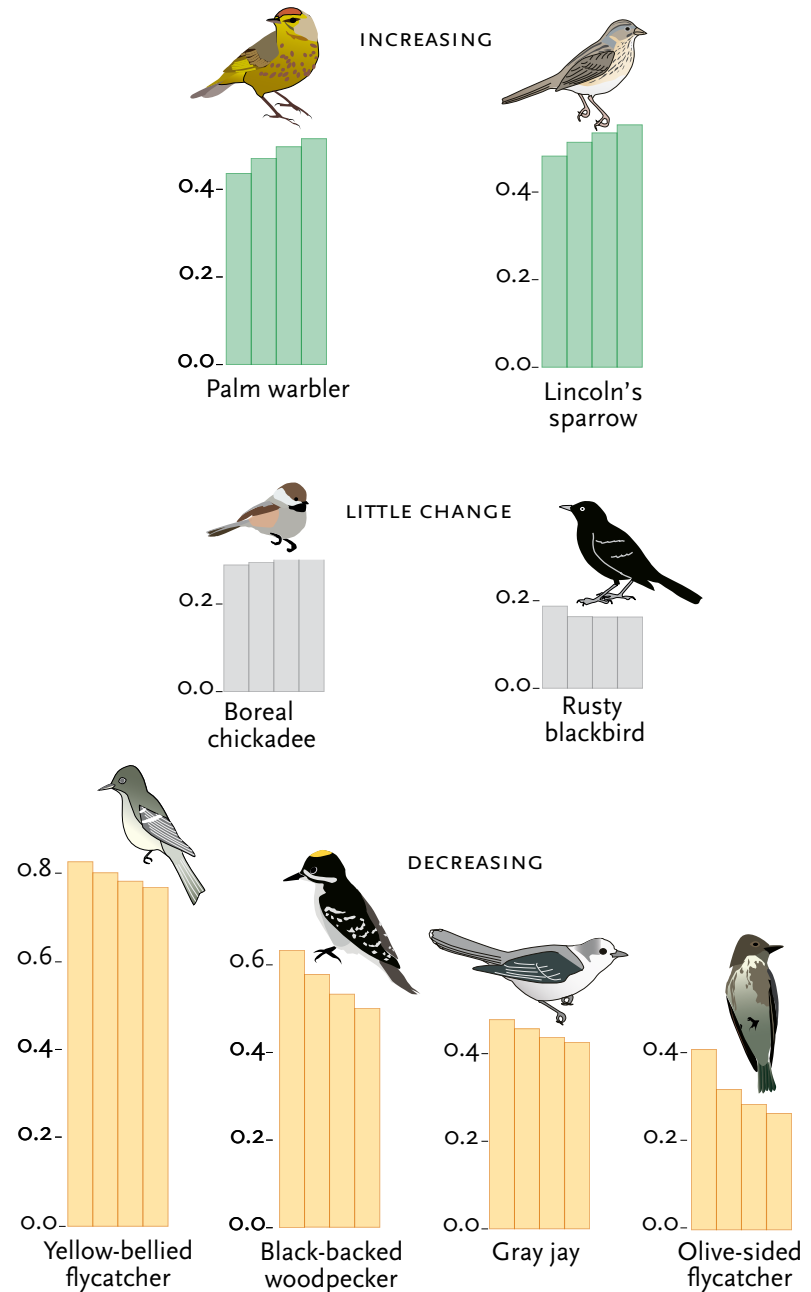
Because these are rare species, their detectability is low, and it is impossible to estimate their abundances directly. Instead, the standard method is to count how often the bird is seen or heard using a standardized observing protocol. The resulting counts are then used to fit a maximum-likelihood model that simultaneously estimates the occupancy (the probability that bird will occur in a randomly selected wetland), the habitat preferences, and the detectability of the species.

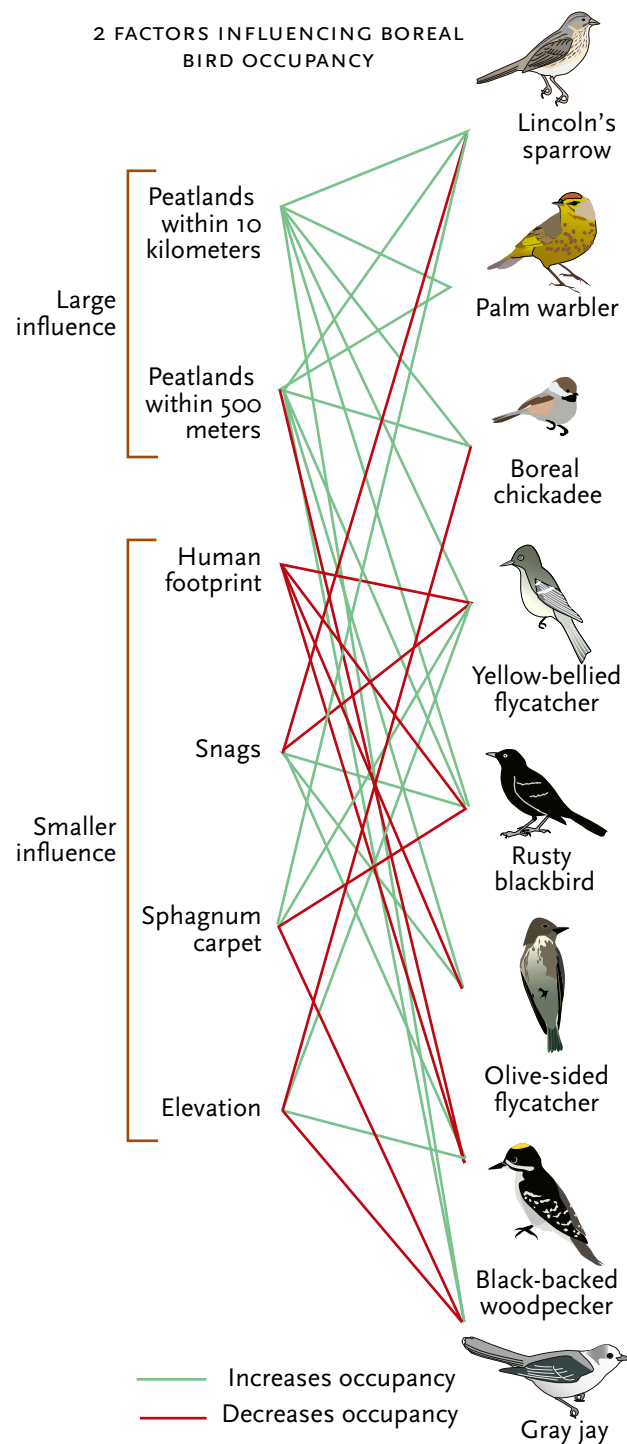
The results suggest that 2 of the 8 species are increasing, 2 stable, and 4 decreasing (1). They also show that 7 are strongly associated with peatlands, and that 4 are adversely affected by buildings, power lines, and roads (“human footprint,” 2). Other environmental factors have weaker and more mixed effects.

These results give a short-term estimate of risk. They can be combined with longer-term population trends to give the risk matrix at the far right (3). This suggests that the palm warbler and Lincoln’s sparrow are relatively secure; that the olive-side flycatcher, rusty blackbird, and black-backed woodpecker at relatively high risk, and that the status of the gray jay, boreal chickadee, and yellow-bellied flycatcher is uncertain.

SUMMARY & RECOMMENDATIONS: Boreal birds are currently showing striking changes in occupancy. Four of the 8 species studied declined during the last four years; 5 are currently declining throughout North America. The reasons for the declines are uncertain; climate impacts are possible but unproven. Further research and monitoring are essential.

1 ESTIMATED BOREAL BIRD OCCUPANCY 2007–2010





3 RISK FACTORS FOR BOREAL BIRDS

Population Trends

	North America	Adk. 1985–2005	Adk. 2007–2010	Extinction vs. colonization	Human footprint
Olive-sided flycatcher	●	●	●	●	●
Rusty blackbird	●	●	●	●	●
Black-backed woodpecker	●	●	●	●	●
Gray jay	●	●	●	●	●
Boreal chickadee	●	●	●	●	●
Yellow-bellied flycatcher	●	●	●	●	●
Lincoln's sparrow	●	●	●	●	●
Palm warbler	●	●	●	●	●

● Decreasing occupancy or negative effects from human activity
● Stable occupancy ● Increasing occupancy

Extinction vs. colonization is green when the rate of establishment of new populations equals or exceeds the rate of extinction of existing ones. It is red when the reverse is true.

Projects: Status and Distribution of Boreal Birds in the Adirondack Park

Dates: 2003–2010.

P.I.s: Dr. Michale Glennon

Assistants: Brian McAllister, Melanie McCormack, Gary Lee, Fuat Latif, Alan Belford, Kevin Jablonski, Brian Keelan, Evan Obercian, Nicholas Laviola, Valerie Stein, Kendra Ormerod.

Analysis: Michale Glennon

Collaborators: SUNY-ESF, New York Natural Heritage Program

Major Funders: N.Y.S. Department of Environmental Conservation, Olympic Regional Development Authority, Northern New York Audubon, Freed Foundation

MERCURY IN LOONS

MERCURY, a neurotoxic element that alters physiology and behavior, is one of our most dangerous environmental poisons. It is both toxic at small concentrations and able to accumulate in tissue: animals retain much of the mercury in the food they eat and pass it on to whoever eats them. As a result, top carnivores may have tissue mercury concentrations ten million times higher than the background concentrations in soil and water.

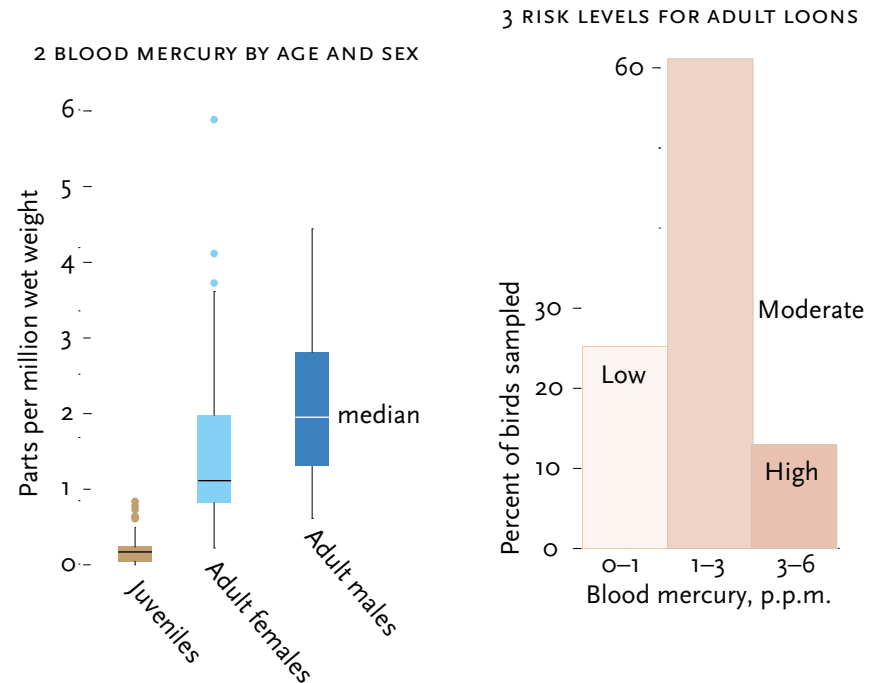
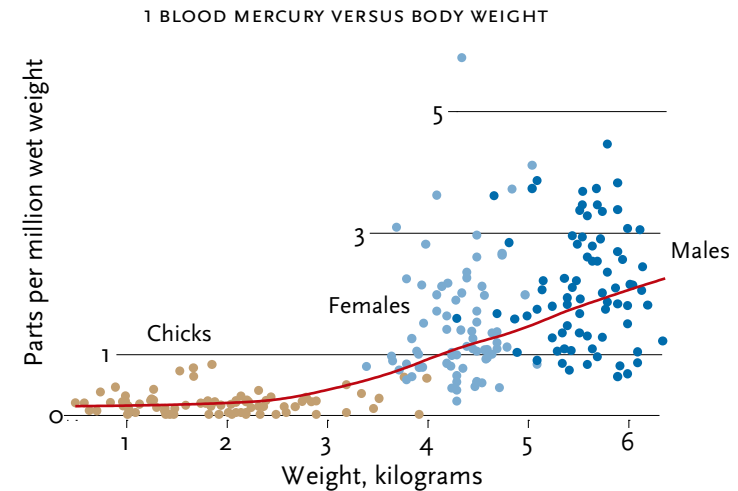
Loons feed high on the food chain and so are at considerable risk of mercury poisoning. To estimate this risk, Dr. Nina Schoch and her colleagues measured mercury levels in the blood of 229 loons from 68 Adirondack lakes. As expected, the concentration depended on age and weight (1). Adults were about 8 times higher than chicks, and males, which are about 30% heavier than females and can't excrete mercury in eggs, were about 25% higher than females (2).

Researchers believe that adult loons with over 1 part per million of mercury in their blood are at moderate risk and those with over 3 parts per million at high risk. By this standard, 74% of the adult loons sampled were at either moderate or high risk.

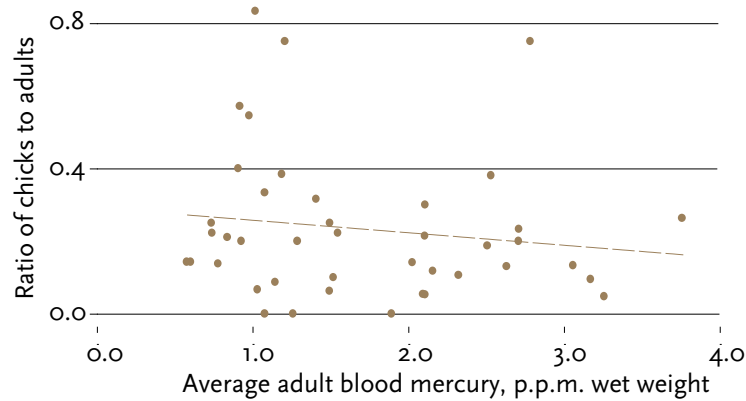
The mercury levels of the loons at different lakes vary widely. There is no simple geographic pattern, but it may be significant that 5 of the 7 lakes with the highest loon mercury levels were in the southwest Adirondacks where deposition is the highest (5).

No significant correlation was found between the average blood mercury levels at a lake and the ratio of chicks to adults at that lake as determined by the loon census (5). Since both measurements are crude, this is not surprising. More detailed studies with banded birds are currently underway and should yield better information about the relationship between blood mercury and reproductive success.

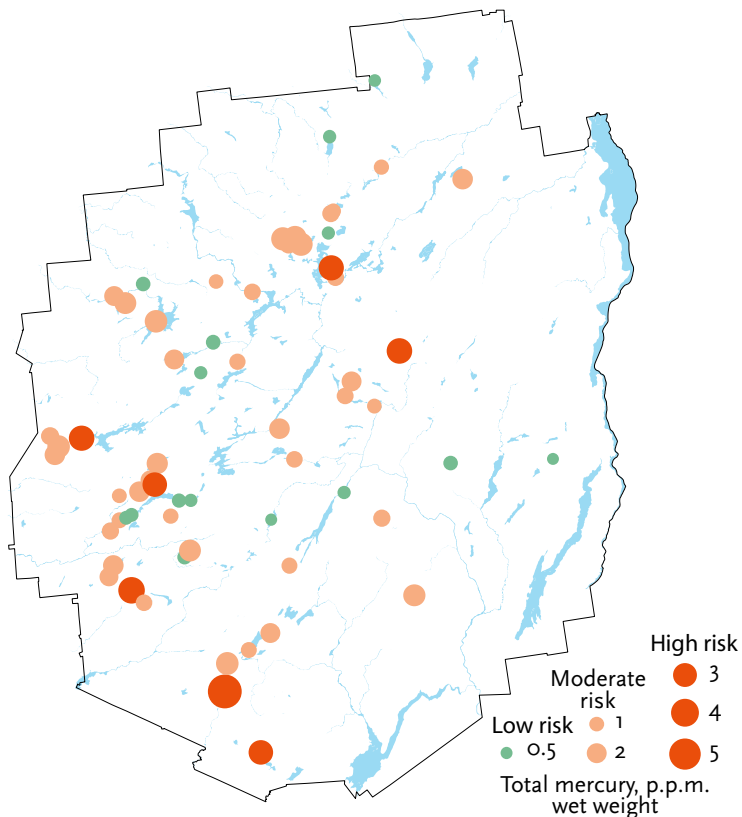
SUMMARY & RECOMMENDATIONS: Three-quarters of adult Adirondack loons have over 1 part per million mercury in their blood and are at moderate or high risk of mercury poisoning. The long-term survival of loons in the Adirondacks will depend both on reducing this mercury load and on reducing as many other threats and stresses as possible.



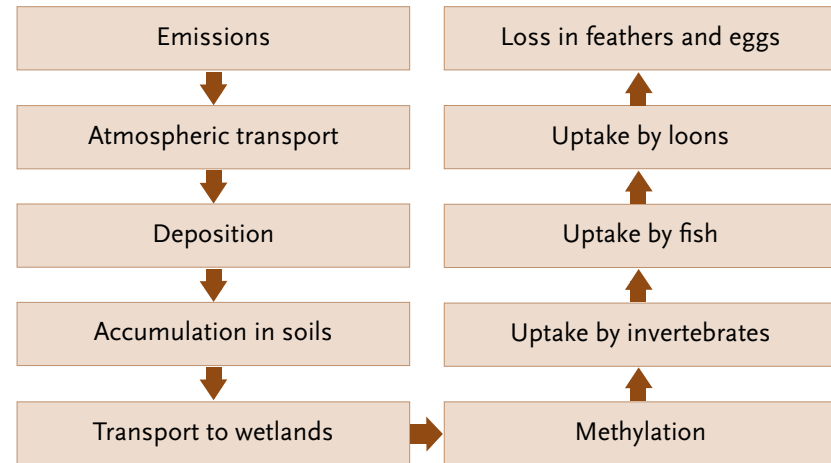
4 ABUNDANCE OF CHICKS VERSUS BLOOD MERCURY



6 AVERAGE MERCURY CONCENTRATIONS IN ADULT LOONS



5 THE MERCURY CASCADE



Project: Mercury Levels in Adirondack Loons

Date: 2001–2010

P.Is.: Dr. Nina Schoch, Dr. David Evers

Assistants: Amy Sauer, Gary Lee, Heidi Kretser, Leslie Karasin, Michale Glennon, Zoe Smith, Amanda Marino, Nicole Crist, Dianne Waters, Dolores and Amy Fleischut, Bill Kitchen, Amy Daley, Liz Jordan, Andrea Grout, Brian McAllister, Mike Hough, Holli Howard, Mary Beth Warburton, Grace McDonnell, Stacey Low, Paul Smiths Watershed Stewards, Charlotte Demers and students from the Adirondack Ecological Center, Melinda LaBarr, Mike Prescott, Ellen Alric, Carolyn Spilman, Kerry Alexander

Analysis: Jerry Jenkins

Collaborators: BioDiversity Research Institute, N.Y.S. Department of Environmental Conservation, Audubon Society of New York, Wild Center

Major Funders: N.Y.S. Energy Research and Development Authority, Freed Foundation, Disney Wildlife Conservation Fund, Nordlys Foundation, Conservation Research Foundation, N.Y.S. Department of Environmental Conservation, Audubon Society of New York, Wild Center.

EXURBAN DEVELOPMENT I

EXURBAN development is development that takes place on lots of 5 acres or more in previously undeveloped lands. In the Adirondacks this typically means building houses and roads in forests.

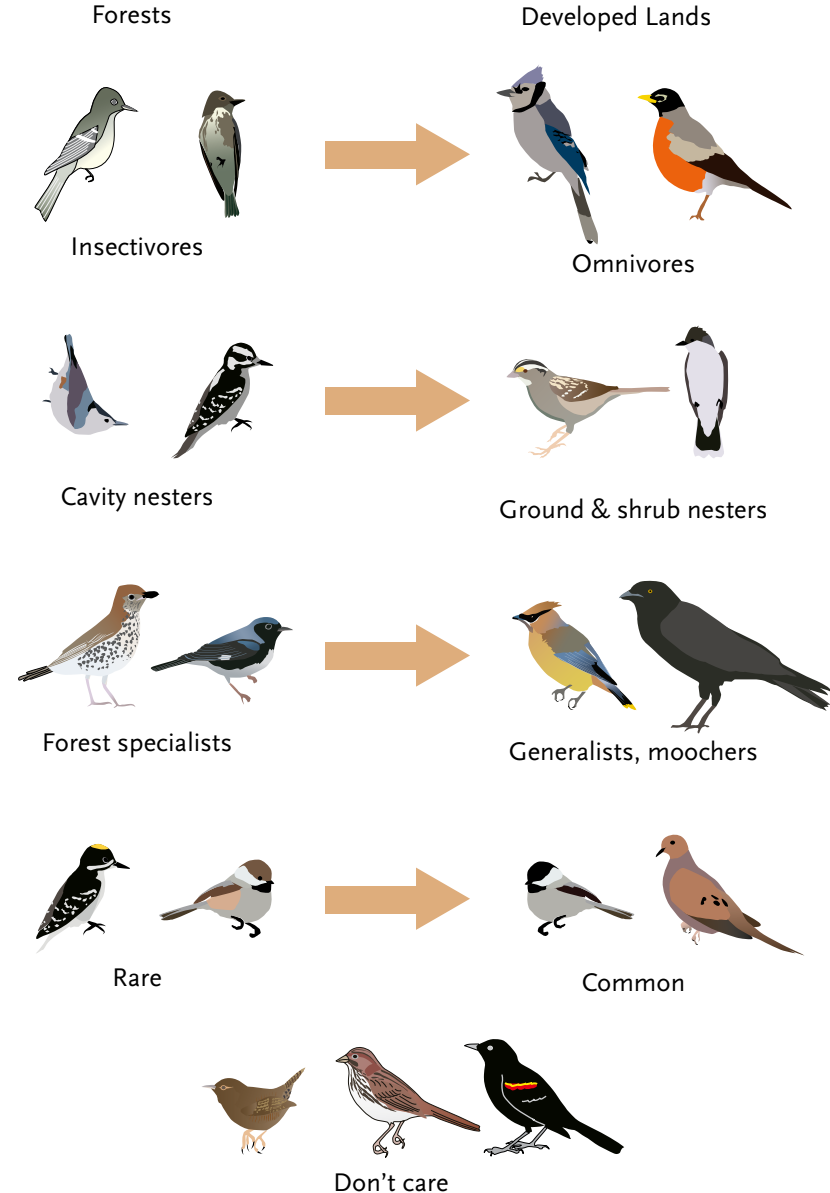
Such development represents a major ecological change. It removes trees and dead wood, creates openings, and alters the microclimate. The adjoining woods become noisier, less sheltered, and vulnerable to invasion by domestic animals and alien species. The openings provide new habitats and food sources and often support a group of relatively tough, generalist omnivores—raccoons, jays, crows—that compete with more specialized forest species.

Since 2004, Dr. Michale Glennon and her coworkers have been looking at the effects of exurban development on wildlife. They have measured the distance that the effects of development extend into forests, compared the effects of developments in the Adirondacks to ones in the Yellowstone area, and are currently doing before-and-after studies of several new houses.

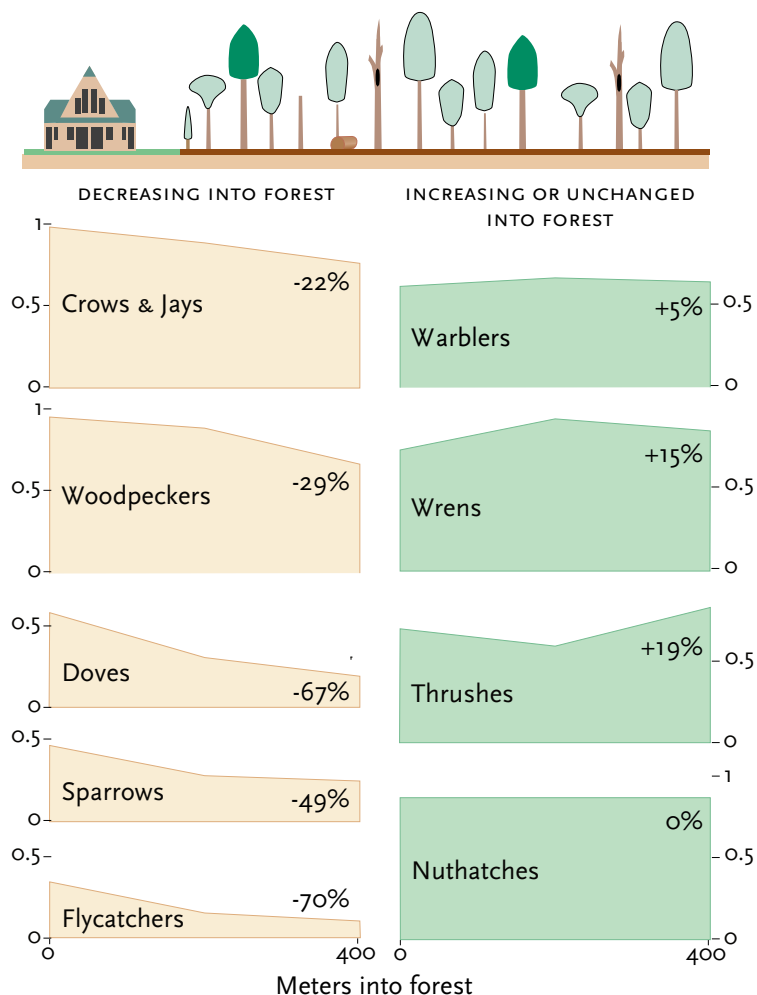
The graphs here summarize the distance study. Observers counted birds within 100-meter circles, centered on the forest edge and at points 200 and 400 meters into the forest. The birds divide into two groups. Those in the left column of Diagram 2 do well in developed areas and decrease at points further into the forest. Those in the right column are less common in the development and increase at points further in. The groups tend to replace one another, and so the number of species and the total number of birds don't change much (3).

The composition, however, does. New development replaces a group of forest birds of restricted distribution with a group of birds that follow people and development and can live almost anywhere. Since some forest birds are already decreasing in eastern North America, this shift has troubling implications, which we summarize on p. 21.

1 BIOLOGICAL CHANGES AFTER DEVELOPMENT



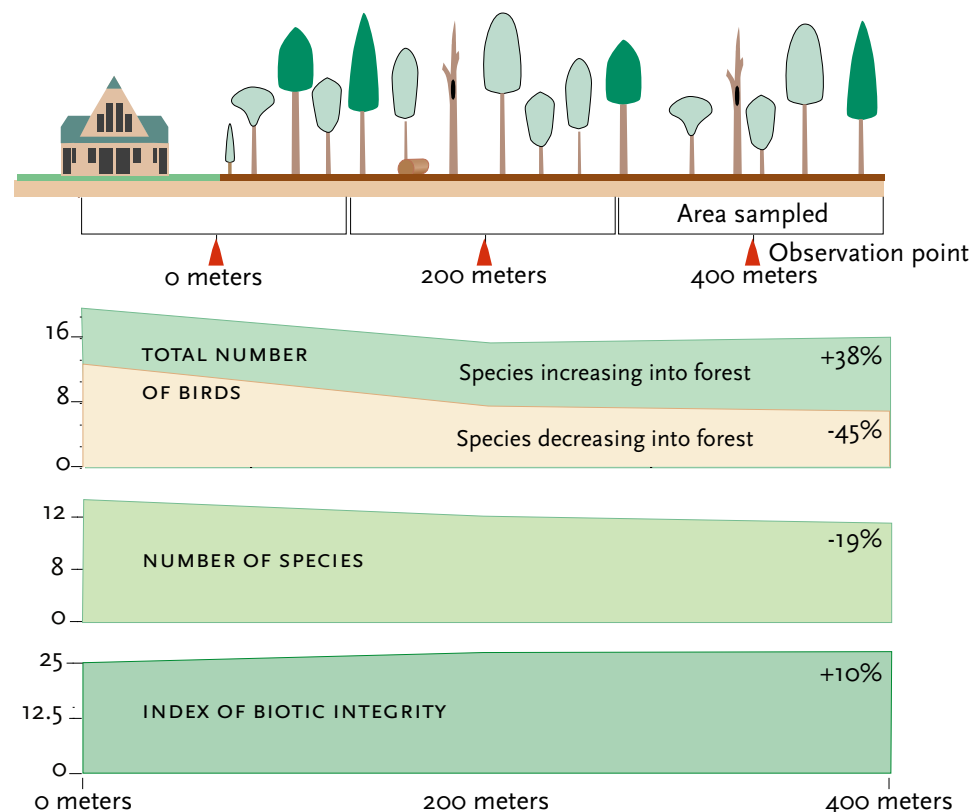
2 CHANGES IN OCCUPANCY OF BIRD FAMILIES FROM FORESTED TO DEVELOPED LANDS



The figures above show the estimated occupancy (probability that the bird will occur at this distance at a randomly selected site) for different bird families at the edge of the lawn and at points 200 and 400 meters into the woods. As on p. 14, occupancy ranges from 0 to 1.

In the figure at right, the total number of birds is the number of individuals recorded. The *Index of Biotic Integrity* is a standardized measure of how much the composition of the birds resembles that of an undisturbed Adirondack woods.

3 MEASURES OF THE DISTANCE EFFECT ON BIRDS



Project: Impacts of Exurban Development on Wildlife

Date: 2007–2010

P.Is.: Dr. Michale Glennon, Dr. Heidi Kretser

Assistants: Alan Belford, Brian McAllister, Cynthia Martino, Kendra Ormerod, Kristel Guimara, Melanie McCormack, Quentin Hays, Tiffany O'Brien

Analysis: Michale Glennon

Collaborators: Approximately 30 Adirondack landowners

Major Funders: N.Y.S. Biodiversity Research Institute

EXURBAN DEVELOPMENT II

BESIDES forests, exurban development occurs in post-agricultural and naturally open lands. The ecology is different but, as a recent WCS study shows, the biological consequences can be similar.

The study compared the abundance of birds in three developments each in the Adirondacks and the Madison Valley (Greater Yellowstone region, western Montana) with nearby controls. In the Adirondacks the controls were in forests; in the Madison Valley they were in open rangeland with scattered trees. The study focused on 11 families that had at least one species (not necessarily the same) in both study areas. Most of these families turned out to be sensitive to development.

The graphs show the results. All 11 families occurred at both developed sites in both study areas. Both areas showed strong contrasts between developed and control sites (2). In the Adirondacks 4 families increased and 7 decreased; in Yellowstone, 6 increased and 5 decreased. In the Adirondacks, average decreases exceeded increases. In Yellowstone, the increases exceeded the decreases. In the west, it appears, some go and some come. In the east, most go.

Even though the species and the landscape in Yellowstone were different from those in the Adirondacks, the general principles illustrated on p. 19 still applied. The species with specialized diets or habitat requirements decreased. The generalists and disturbance tolerant species increased. The losers were, once again, the regional specialties that give the undeveloped areas their ecological character. The winners were the tramps and moochers that go anywhere people go.

Project: Spatial Distributions of Species in Exurban Landscapes

Date: 2007

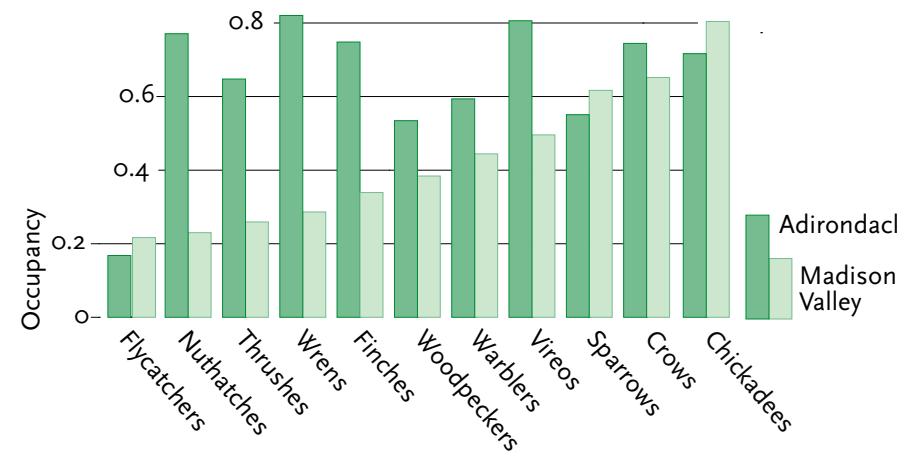
P.I.s.: Dr. Michale Glennon, Dr. Heidi Kretser

Assistants: Brian McAllister, Eric Atkinson

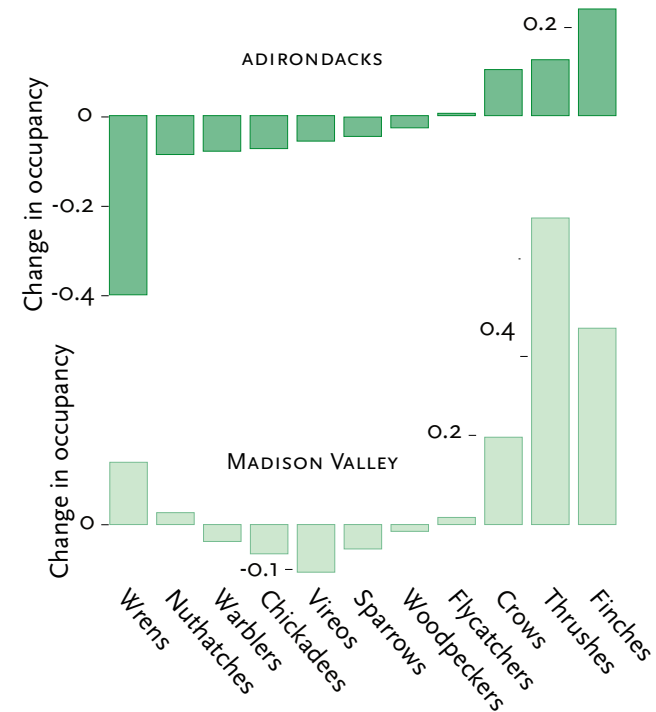
Analysis: Michale Glennon

Major Funders: National Science Foundation

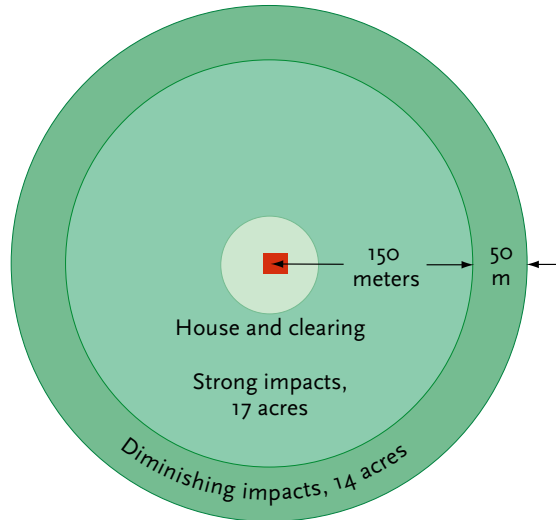
1 OCCUPANCY OF SELECTED BIRD FAMILIES, UNDEVELOPED PLOTS



2 CHANGE IN OCCUPANCY FROM UNDEVELOPED PLOTS TO DEVELOPED PLOTS



3 IMPACT ZONES FOR A HOUSE AND CLEARING



Exurban development, Manchester, Vermont. This area was continuous forest in 2007.

SUMMARY: The overall picture from these studies is that while development may increase the total number of birds and the total number of species, it decreases their ecological and geographic diversity, replacing the specialists characteristic of a particular habitat or region with a homogenous group of generalists. Because many of the birds that decrease with development are forest species, and because the Adirondacks are one of the major forests reserves of North America, development in the Adirondacks thus threatens precisely those species that it is important that the Adirondacks protect.

Within the overall picture, three particularly important Adirondack details are that:

- 1 The forest areas affected by development are much larger than the developed area (3). A single house in a small clearing has strong effects up to 150 meters away. These effects create an impacted zone of 17 acres, with diminishing effects on up to 14 acres beyond that. Thus a few small holes can have a big effect. In the worst case, ten scattered houses could alter the ecology of 31% of a 1000-acre tract.

2. Although the areas subject to development are small compared to the protected lands in the Adirondack Forest Preserve, they still have biological importance. This is partly because development targets some types of lands like shores and valley bottoms that are rare in the Forest Preserve, and partly because it impacts rare and specialized species whose populations are already small.

- 3 Developments may harm the birds that use them as much or more than the birds that avoid them. For species like buntings and juncos, developments may be *ecological traps*: places that offer them food and nest sites but also expose them to increased competition and predation.

Finally, it is worth noting that these results for Adirondack birds are paralleled by those for other animals in other places. Development, it appears, is development, pretty much wherever it occurs. Adirondack developments may appear benign because they are relatively scattered and have a lot of woods around them. But they still have the same biological effects as larger developments in more urban settings. And they also have the same potential, if they continue to multiply, of making equally large changes in our landscape and biology.

SKI DEVELOPMENT AND MOUNTAIN BIRDS

Ski development in some ways resembles residential development. It creates openings and edges and results in intense use in some parts of the year. But ski trails are only lightly used during the nesting season and do not seem to support large populations of the alien species and aggressive generalist that occur around houses. For this reason, their biological effects may be less damaging.

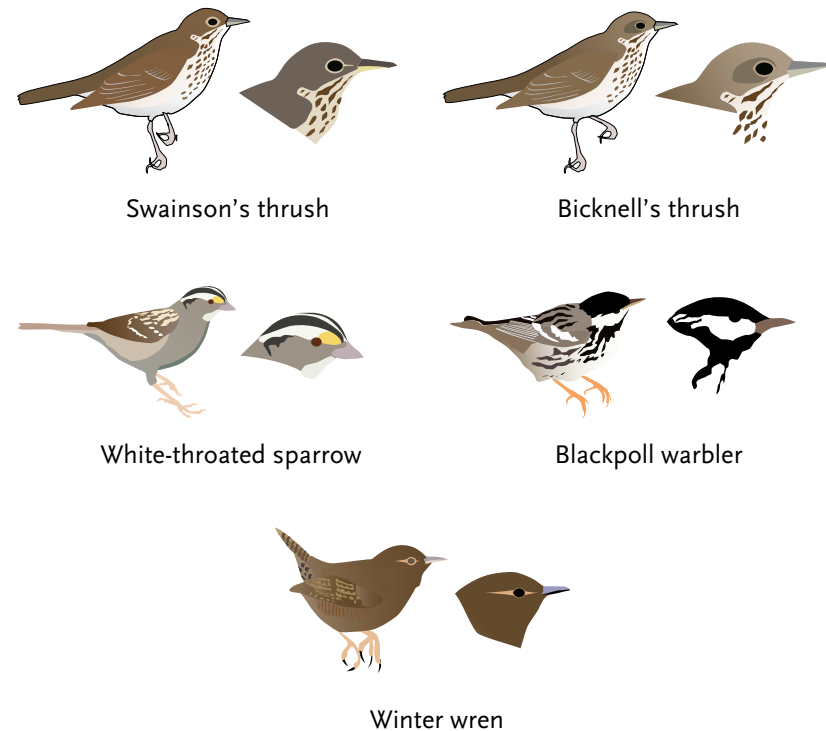
This was the case at Whiteface Mountain, where the Olympic Regional Development Authority commissioned WCS to study the effects of a new lift and ski trails on mountain birds. The study began in 2004, and gathered four years of data before construction and three years after. It was, as small-scale bird studies always are, somewhat coarse-grained. Forest birds are counted mostly by ear, and so observation points have to be at least 200 meters apart to avoid counting the same birds at different points. This limits the number of points that can be placed in a given area and hence the statistical power of the analyses that can be done.

The study included five mountain species. Three, the two thrushes and the blackpoll warbler, are boreal or near-boreal species that are near their southern range-limits here. The other two, the white-throated sparrow and winter wren, are more widely distributed cold-temperate forest species.

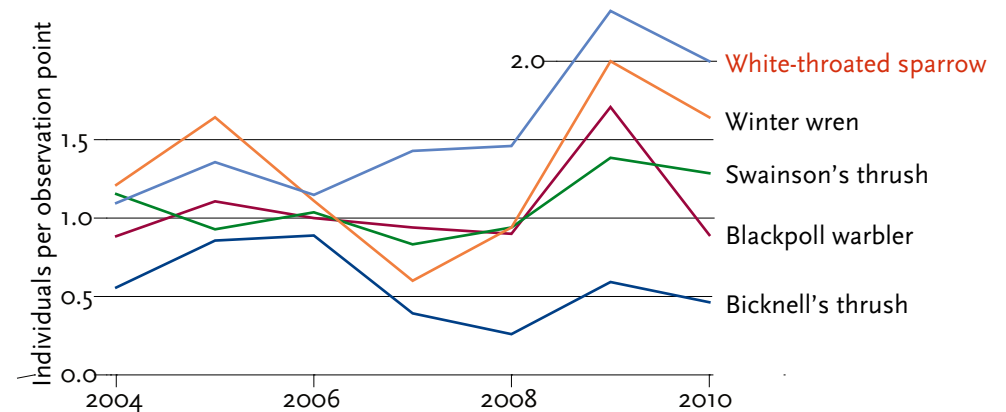
The results suggest that the trails had no discernible impact on the boreal species and may have had a positive effect on the other two. No species avoided existing trails or declined significantly when the trails were built. Whitethroats and winter wrens, seemed, on average, to like trails. Overall numbers fluctuated greatly, but were generally as high or higher after construction than before.

SUMMARY: The small number of study points makes it hard to draw definite conclusions. The target species in this study were apparently unharmed by ski trail development. None of them avoided the new trails or decreased in abundance; two may have benefited. Whether this would be true of more intense development with breeding season use is unknown.

1 SPECIES INCLUDED IN STUDY

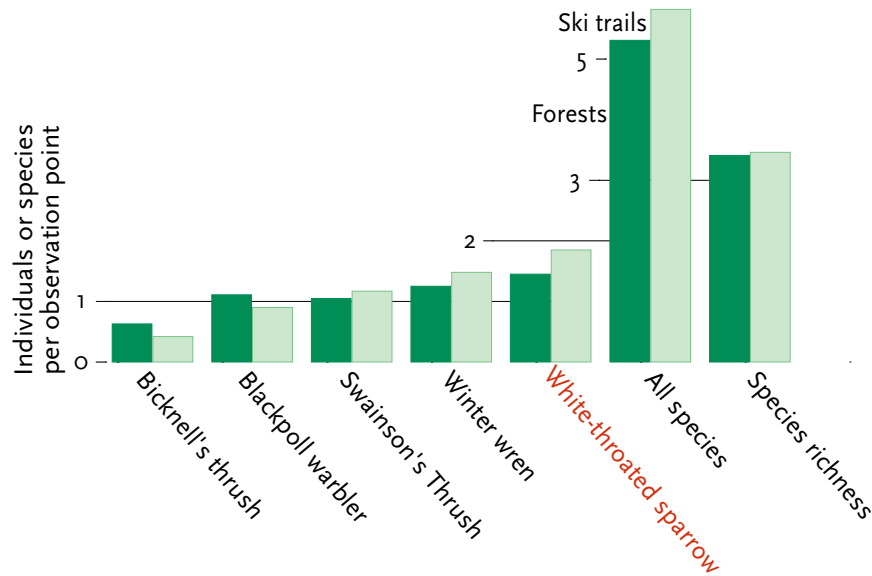


2 TRENDS IN BIRDS ON WHITEFACE MOUNTAIN

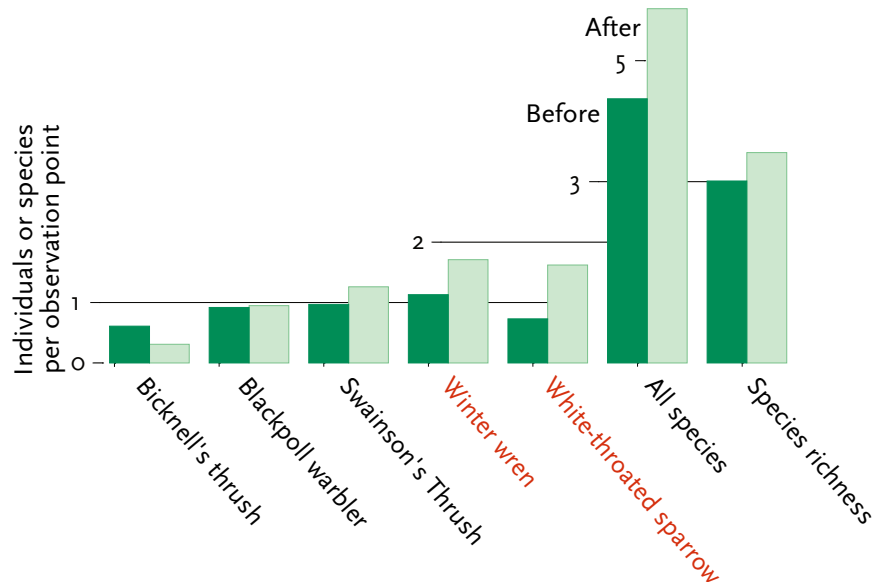


The trend for the white-throated sparrow is statistically significant at $p < 0.05$; the others are not.

3 BIRD ABUNDANCE IN FORESTS AND ON TRAILS

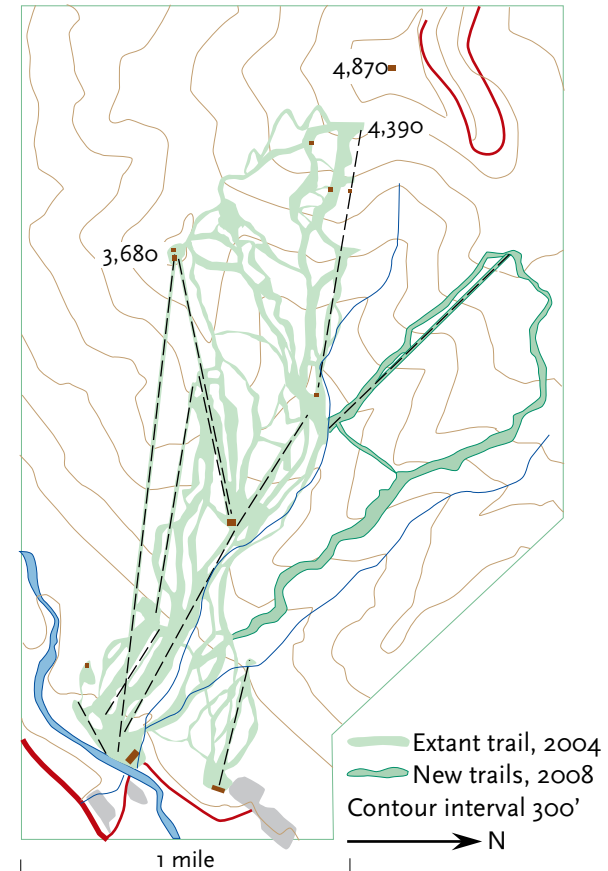


4 BIRD ABUNDANCE BEFORE AND AFTER TRAIL CONSTRUCTION



Species in red show a statistically significant difference ($p < 0.05$) between forest and trail or before and after.

5 WHITEFACE MOUNTAIN SKI AREA



Project: Use of Whiteface Mt. by Montane Birds

Date: 2004–2010

PIs.: Dr. Michale Glennon, Leslie Karasin, Chad Seewagen

Assistants: Quentin Hays, Steve and Sunita Halasz, Matt Maloney, Chad Jemison, Mark Dettling, Taralynn Reynolds, Brian McAllister

Analysis: Michale Glennon

Collaborators: N.Y.S. Department of Environmental Conservation, Olympic Regional Development Authority, Vermont Center for Ecostudies

Major Funders: Olympic Regional Development Authority, Northern New York Audubon

CARBON RELEASES FROM DEVELOPMENT

WHEN houses are built in a forest, carbon is released to the air. Some comes from fossil fuels, some from the creation of permanent openings. Either way, it has climate impacts. If we want to assess the full effects of forest development, we have to estimate the carbon releases.

The diagrams show how this is done. They assume a medium-sized house with 2 acres of grounds and roads. They only account for above-ground carbon. Carbon from soils is also released during development; the flows are significant but difficult to quantify.

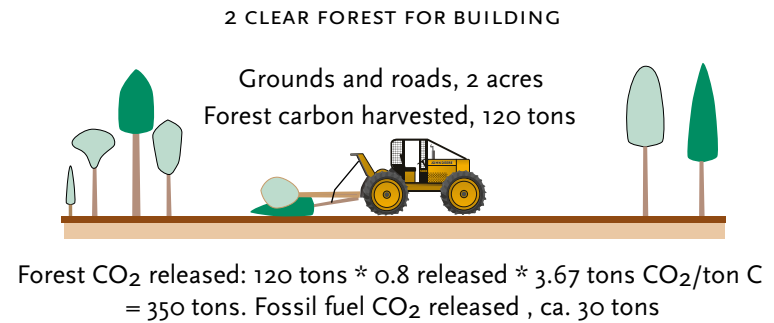
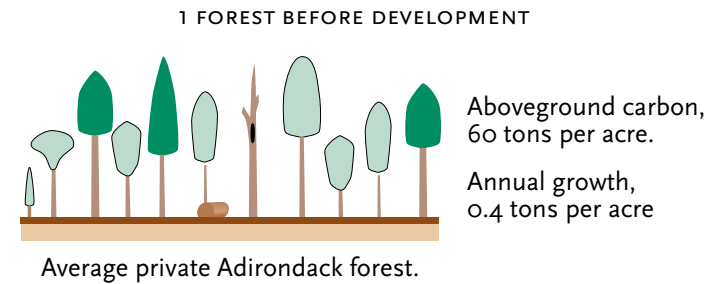
The first step is to estimate the carbon stores and growth rate of the forest to be developed (1). For simplicity, we assume an average private Adirondack forest; for a better estimate we would need forest inventory data.

The next step is to account for the carbon released in clearing the land (2). We assume that all the aboveground carbon is harvested and that, as is typical in Northeastern harvests, 80% of it will be back in the air in 20 years time. Adding, as a rough estimate, 10% for the carbon from the fossil fuels used to harvest and process the wood and converting to tons of carbon dioxide, the total released is 380 tons of CO₂.

Next are the emissions from construction (3). Manufacturing the materials for and building a 4,000-square foot house releases about 65 tons of CO₂. The lumber in the house stores about 40 tons of CO₂. This gives a net release of 25 tons of CO₂.

Last is the carbon from heating and lighting the house (4). We assume that the house is heated with oil and uses grid electricity and that the average energy required is about 17 kilowatt hours per square foot per year. Burning the oil and providing the electricity then releases 25 tons of CO₂ per year, or 500 tons in 25 years.

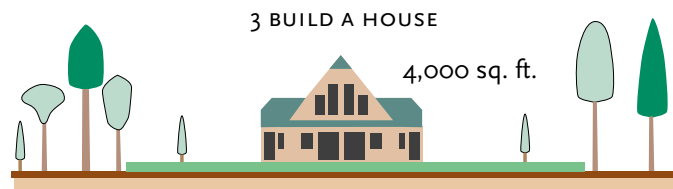
SUMMARY & RECOMMENDATIONS: Development within forests releases large amount of carbon when land is cleared, and comparable amounts over time when the houses are powered by fossil fuels. The releases from a few houses can reverse the carbon balance of a large property. The carbon costs of new houses are thus significant, and need to be considered when evaluating the impacts of residential development in forests.



For comparison, the last two figures show what the carbon balance might have been if the forest had been left undeveloped. If the forest is left unharvested it removes 60 tons of CO₂ from the air over 20 years (5). If it is harvested sustainably and used to provide fuel for heating it can replace approximately 110 gallons of fuel oil a year and prevent the emission of 24 tons of CO₂ over 20 years (6).

The total climate impacts of the development are measured in carbon-years (the amount of carbon released times the time it spends in the air) and correspond to the shaded portions of Diagram 7. In the first 20 years the clearing of the land has the greatest effect, followed by the releases from heat and electricity. In the next 20 years heat and electricity will catch up.

Note that the rate at which carbon is released by development greatly exceeds the rate at which the forest can store carbon naturally. It would take about 170 acres of forest, storing carbon for a year, to recapture the carbon released when the two acres were cleared. And it would take about 9 acres, permanently dedicated to carbon storage, to recapture the fossil fuel carbon released by the house's heat and lights.

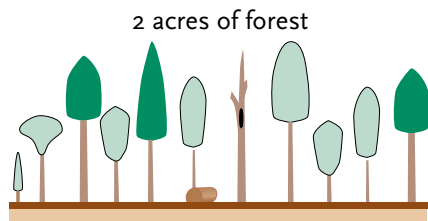


Forest carbon stored in lumber, 40 tons CO₂. CO₂ released by manufacturing and construction, 65 tons. Net CO₂ release, 25 tons.



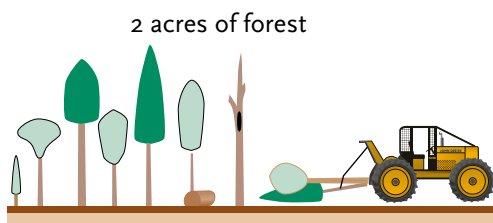
Average fossil fuel use = 70,000 kilowatt hours per year
Average CO₂ emissions, 0.7 lbs/kWh = 25 tons per year
Total 20-year emissions, 500 tons.

5 ALTERNATELY, ALLOW FOREST TO GROW FOR 20 YEARS



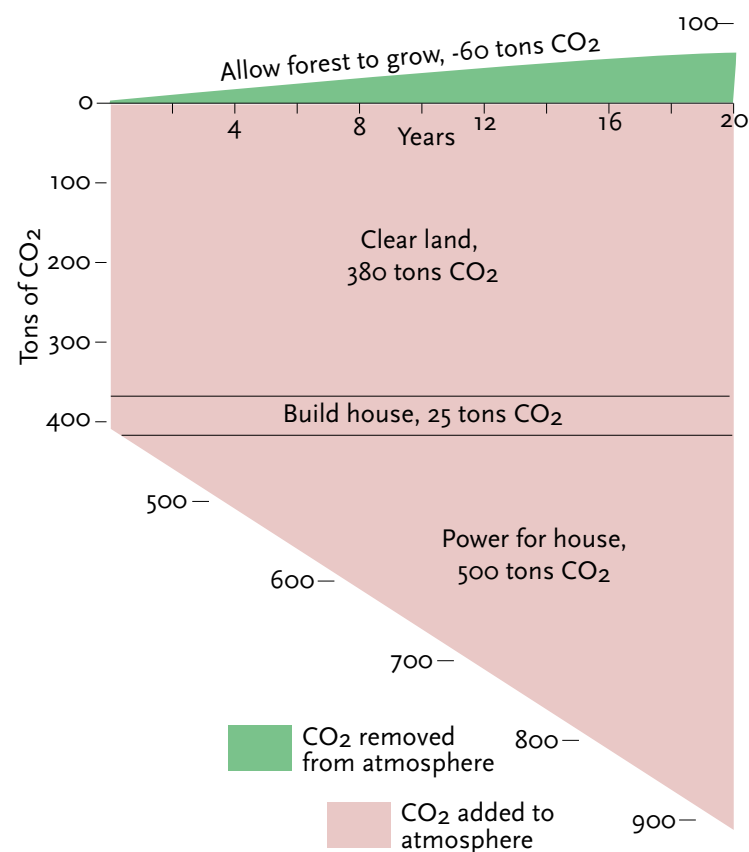
CO₂ stored, 3 tons per year. Total CO₂ stored, 60 tons

6 ALTERNATELY, HARVEST SUSTAINABLY AND BURN THE WOOD



Fuel produced, 1.3 tons dry wood per year. Replaces 110 gallons heating oil per year, and avoids emitting 1.2 ton CO₂ per year.

7 TWENTY-YEAR CLIMATE IMPACT OF A 2-ACRE DEVELOPMENT



The pink figure shows the climate impact (tons of CO₂ × years in air) of the carbon added to the atmosphere by clearing 2 acres of land, constructing a 4,000 square foot house, and operating it for 20 years. The green figure shows the climate impact of leaving the two acres undeveloped and letting the forest grow for 20 years.

Project: Carbon Costs of Development

Date: 2008-2010

P.I.: Jerry Jenkins

Analysis: Jerry Jenkins

Collaborators: Dr. Charles Canham

Major Funders: Cary Institute of Ecosystem Studies, Wild Center

CLIMATE DRIVEN DECLINE OF A BOREAL PLANT

As climate warms, species near their southern range limits suffer from stress and increased competition and may decrease in numbers and go locally extinct. Such range-limit extinctions are well known and are, increasingly, being reported from many parts of the world.

Identifying the causes for their declines—the attribution problem—is harder to do. Here we report on a case in our area for which the attribution is clear: a northern plant with a 20-year population decline caused by increased mortality in hot, dry summers.

The cut-leaved anemone, *Anemone multifida*, is a subarctic plant with a northern and western distribution. Its southernmost population in the East is in a rock gorge at Winooski Falls, Vermont, where it has lived for over 100 years. It is rare in eastern North America: the nearest populations going north are in northern Maine and Quebec.

With the support of the Winooski One Partnership, which owns a hydro-electric station at the falls, Jerry Jenkins and Debbie Benjamin have monitored the Winooski anemones since 1988. Over this period, the population metrics have trended downward, showing sharp declines in hot dry summers and holding steady or making at most small gains in colder wetter ones (1).

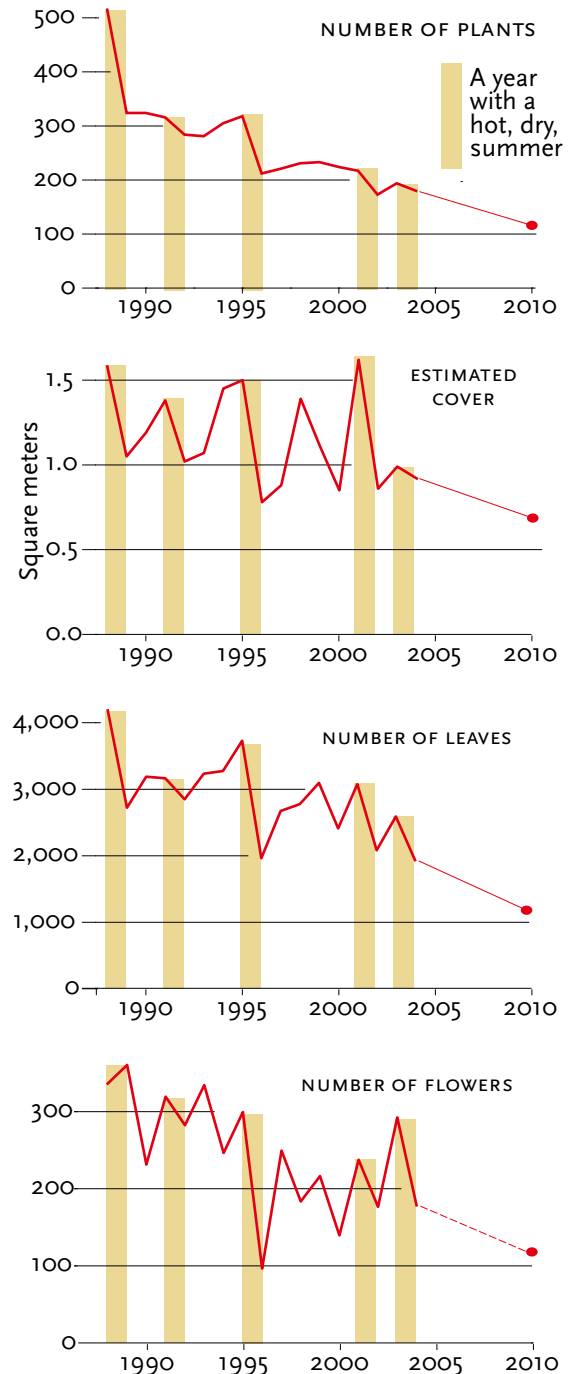
The cause is an excess of adult mortality over recruitment. Recruitment is poor even in the best years. Mortality exceeds recruitment slightly in the good years, and dramatically in the bad ones (3).

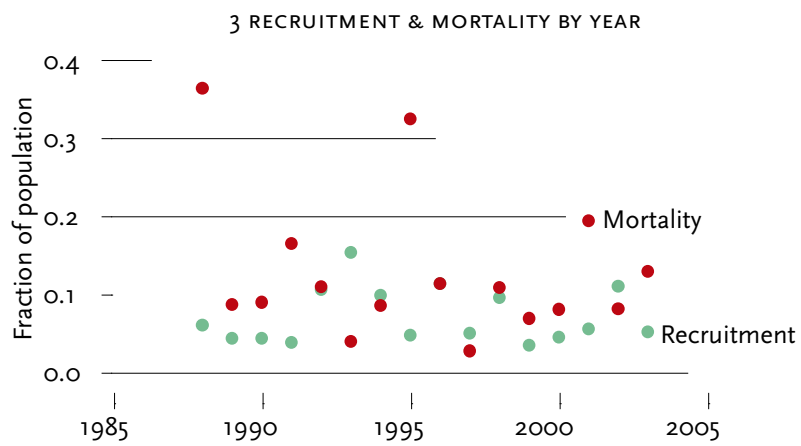
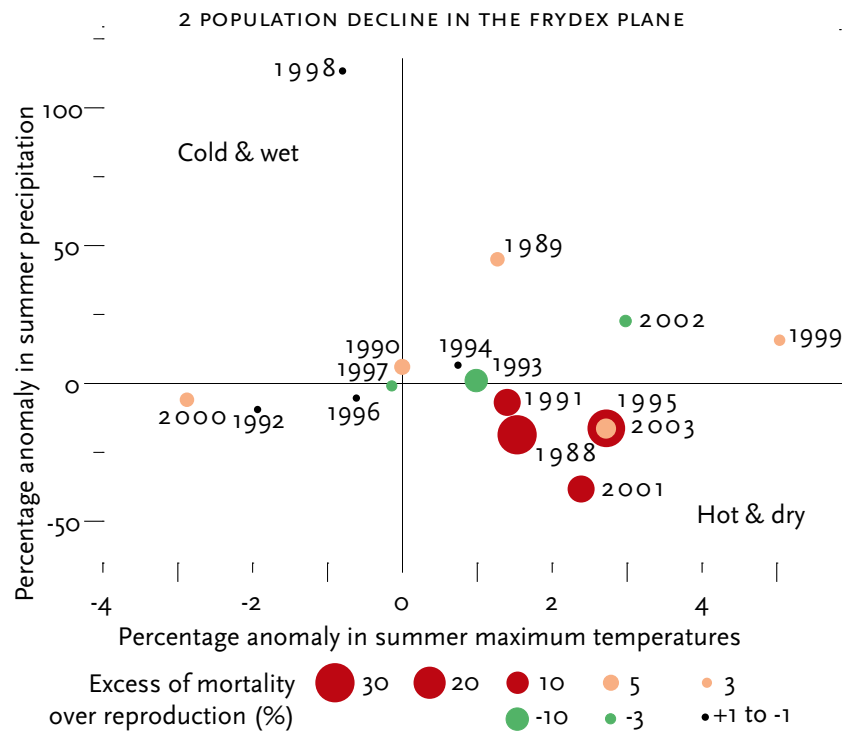
The excess mortality, in turn, is closely linked to summer temperatures and rainfall, which can be mapped in a climate-stress plane, the *Frydex plane* (2). In a clear demonstration of the linkage of mortality and climate, all the years with excessive mortality fall in the lower right quadrant of this plane, where summer rainfall is low and temperature high.



SUMMARY & RECOMMENDATIONS: The Winooski anemones, which no longer have any good years, are likely headed for a climate-driven extinction. Other declining northern species may be in the same situation. We need, but do not have, the kind of detailed monitoring that would allow us to identify them.

1 POPULATION METRICS

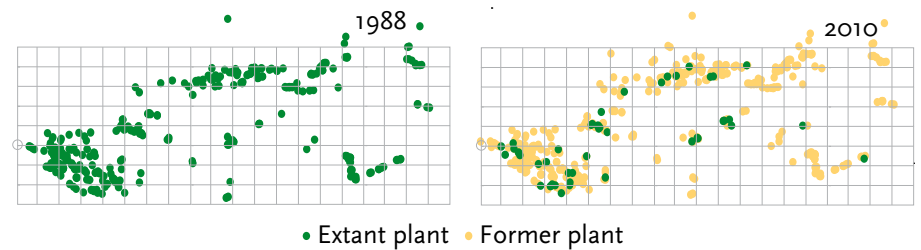




4 ANEMONE POPULATIONS AT WINOOSKI FALLS



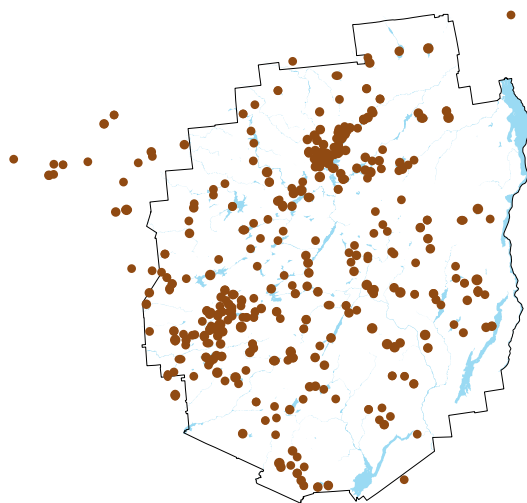
5 POPULATION CHANGES ON THE ISLAND



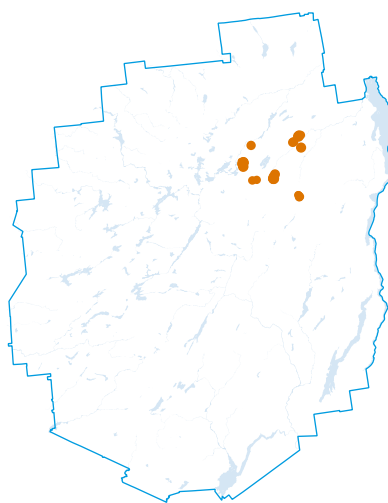
Project: Population Trends in Cut-leaved Anemone, Winooski, Vt.
 Date: 1988–2010
 P.I.: Jerry Jenkins
 Assistants: Debbie Benjamin
 Analysis: Jerry Jenkins
 Major Funders: Winooski One Partnership

STUDY SITES

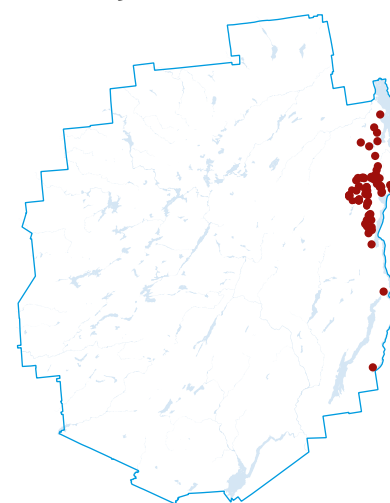
1 LOON PROJECT



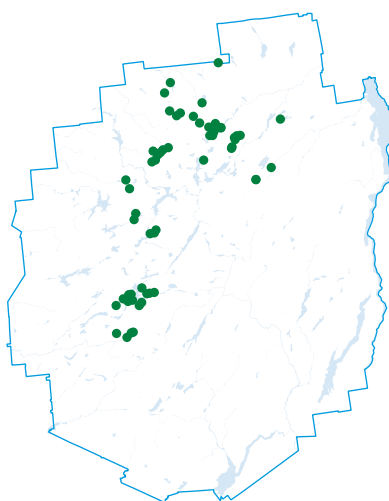
2 EXURBAN DEVELOPMENT



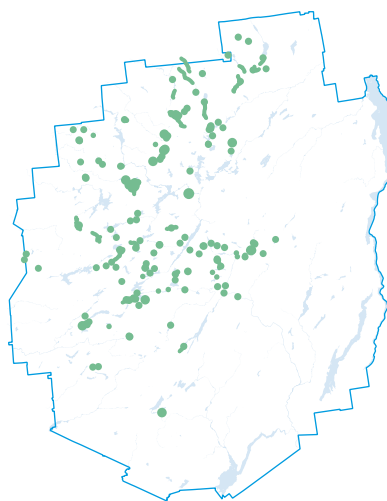
3 CHAMPLAIN HILLS



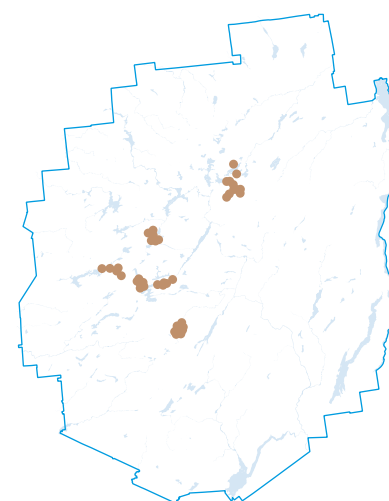
4 LOWLAND BOREAL BIRDS



5 LOWLAND BOREAL PLANTS



6 OLD GROWTH



SELECTED ADIRONDACK PROGRAM PUBLICATIONS

Except as noted, all the following are published by the Wildlife Conservation Society Adirondack Program, WCSAP. Many are available on-line at www.wcsadironacks.org.

Anemone Decline

Jenkins, J. 2010. *The Decline of the Cut-leaved Anemone, Anemone multifida, at Winooski Falls, Vermont, 1988–2010*. WCSAP.

Boreal & Montane

Glennon, M.J. 2010. *Distribution and Abundance of Boreal Birds in the Adirondack Park*. WCSAP.

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Jenkins, J. 2004. *The State of the Adirondack Lowland Boreal, Part I: Composition and Geography*. WCSAP.

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———. 2007. "Impacts of land use management on small mammals in the Adirondack Park, New York." *Northeastern Naturalist* 14(3): 323–342.

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Kretser, H., Hilty, J., Glennon, M.J., Burrell, J., Smith, Z., and Knuth, B.A. 2009. "Challenges of governance and land management on the exurban/wilderness frontier in the USA." In Anderson, K., et al., eds, *Beyond the Urban-rural Divide*. Emerald Group Publishing Limited, UK.

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Jenkins, J., and Keal, A. 2004. *The Adirondack Atlas: A Geographic Portrait of the Adirondack Park*. Syracuse University Press.

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Karasin, L. 2003. *All Terrain Vehicles in the Adirondacks: Issues and Options*. WCSAP.

Loons and Mercury

Schoch, N., 2002. *The Common Loon in the Adirondack Park: An Overview of Loon Natural History and Current Research*. WCSAP.

Schoch, N., Evers, D., Lane, O., Yates, D., Duron, M., Hames, R., and Lowe, J., 2010. *Biogeography of Mercury Contamination in New York*. BioDiversity Research Institute.

Old-Growth Plants

Jenkins, J., 2010. *Do Unharvested Adirondack Forests Contain Forest-Interior Plants?* WCSAP.

Wildlife and People

Anon, 2009. *Make Room for Wildlife: A Resource for Local Planners and Communities in the Adirondacks*. WCSAP.

Beckmann, J. P., Karasin, L., Costello, C., Matthews, S., and Smith, Z., 2008. *Coexisting with Black Bears: Perspectives from Four Case Studies Across North America*. WCS.

Kretser, H., Curtis, P.C., Francis, J.D., Pendall, R.J., Knuth, B.A., 2009. "Factors affecting perceptions of human-wildlife interactions in residential areas of Northern New York and implications for conservation." *Human Dimensions of Wildlife Management* 14(2): 102–118.

Kretser, H., Curtis, P.C., Knuth, B.A., 2009. "Landscape, social, and spatial influences on perceptions of human-black bear interactions in the Adirondack Park, NY." *Human Dimensions of Wildlife Management* 14(6) 393–406.

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THE WILDLIFE CONSERVATION SOCIETY ADIRONDACK PROGRAM
Promoting wildlife conservation and healthy human communities in the Adirondacks
through applied research, community partnerships, and public outreach.

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