

Characteristics of Faunal Communities Before and After Residential Development in the Adirondack Park

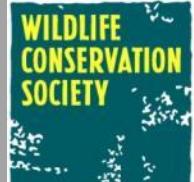
Theme 1

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Residential development results in significant impacts to wildlife communities, many of them similar across multiple taxonomic groups. These changes occur within a very short time frame after construction and may relate to predation pressure.



ADIRONDACKS

Funding support for this project was provided by the Northeastern States Research Cooperative (NSRC), a partnership of Northern Forest States (New Hampshire, Vermont, Maine, and New York), in coordination with the USDA Forest Service. <http://www.nsrforest.org>

Project Summary

Current research suggests that large-scale fragmentation resulting from exurban development may decrease biotic integrity, alter species behavior and composition, and increase human-wildlife conflict. This type of development is largely understudied by ecologists and almost no studies have been conducted comparing pre- and post-development faunas in any ecosystem type. We surveyed bird, mammal, amphibian, and plant communities before and after residential development at the site of 2 new homes constructed in the Adirondacks of New York State. Birds were sampled using standard point count methods, mammals with live trapping, track plates, and camera traps, and amphibians via timed searches. We conducted surveys at both locations in summer 2008 and again in summer 2010. Homes were constructed on both sites during 2009. We used an occupancy modeling approach to investigate changes to these ecological communities after construction, using a multi-season model to explore changes in the members of the species pool present at each site after construction. We modeled changes to relative species richness after construction for bird, mammal, and amphibian communities and investigated the likelihood of local colonization and extinction at each of these sites based on body size and family as well as population, reproductive, activity/movement, habitat use/preference, and feeding/foraging characteristics. For the most part, relative species richness increased after homes were constructed, but underlying community structure changed. For birds, probability of colonization after construction was most closely tied to migratory strategy, where local extinction probability was most closely related to clutch size, feeding guild, and migratory strategy. For mammals, colonization probability was related to length of gestation, age at maturity, lifespan, and family while extinction probability was related to family, activity and movement behavior, and feeding guild. For amphibians, both colonization and extinction probability were related to hatching date, habitat use/preference, and family. Across all taxa, winning strategies that allow for colonization or persistence after home construction are: nesting in cavity or underground, omnivory, large body size, and relatively long periods of nesting, gestation, and time to maturity. Losing strategies which enhance the likelihood of local extinction following residential construction, conversely, are: nesting on the ground or breeding in a vernal pool, specializing on just one or two food types, small body size , breeding early, hatching fast, and maturing fast. We provide suggestions for steps landowners may take to help maintain representative suites of species after residential construction.

Background and Justification



- Habitat loss is a primary driver behind the decline of numerous species across a multitude of taxa.
- Low-density residential development or “exurban development” on large, rural acreages (5-40 acres) is the fastest growing form of land use change in the U.S. today and is rapidly transforming rural America’s most wild places (Brown et al. 2005).
- Because it leaves the majority of the landscape physically unchanged, there is a common perception that exurbanization is harmless to biodiversity and is more environmentally responsible than urban and suburban land uses (Maestas et al. 2001).
- Mounting evidence links exurbanization to significant alterations in the ecology and integrity of biological communities (e.g., Glennon and Porter 2005, Hansen et al. 2005).

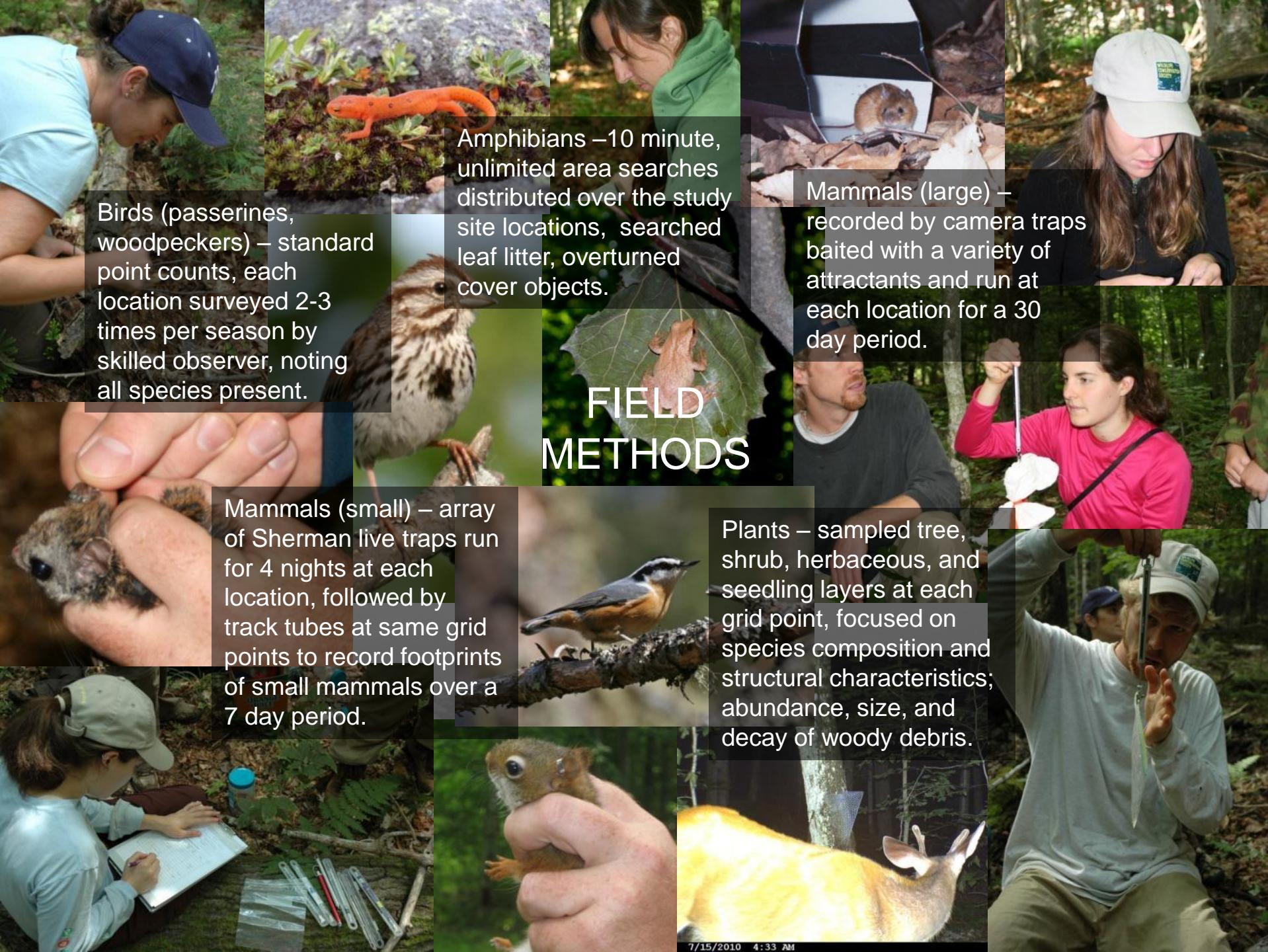
Background and Justification

- The vast majority of studies of exurban development have occurred through examination of areas on which development has already occurred. Few studies have examined ecological communities before and after residential construction to document specific changes to wildlife communities and the speed at which they occur.
- Comparing the pre- and post-development fauna to understand the types of species and functional ecological roles which may be altered by development will help to provide information about the aspects of residential development that have the greatest impacts on wildlife.
- This development pattern is prevalent throughout the Northern Forest and elsewhere. Understanding how wildlife respond to exurban development will help us to determine recommendations and tools for planners to implement projects in ways that will minimize negative impacts to local ecosystems.

Methods



- Initially signed up 5 landowners, 3 unable to build due to economic recession.
- Two remaining homes located in northern Adirondacks, large lots (5 and 14 acres), isolated, closest houses \geq 200m distant.
- Sampled bird, mammal, amphibian, and plant communities.
- Sampling in summer 2008 (pre), 2009 (during, 1 home only), and 2010 (post).
- Also sampled control sites 2009 and 2010; findings presented here for construction sites only, 2008 and 2010.
- Employed 2 full time field technicians in each season, as well as occasional volunteers.
- Interviewed owners about attitudes toward wildlife and management activities undertaken around the home.



Birds (passerines, woodpeckers) – standard point counts, each location surveyed 2-3 times per season by skilled observer, noting all species present.

Amphibians – 10 minute, unlimited area searches distributed over the study site locations, searched leaf litter, overturned cover objects.

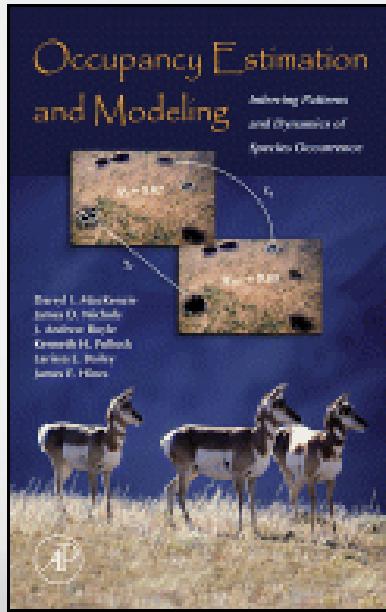
Mammals (large) – recorded by camera traps baited with a variety of attractants and run at each location for a 30 day period.

FIELD METHODS

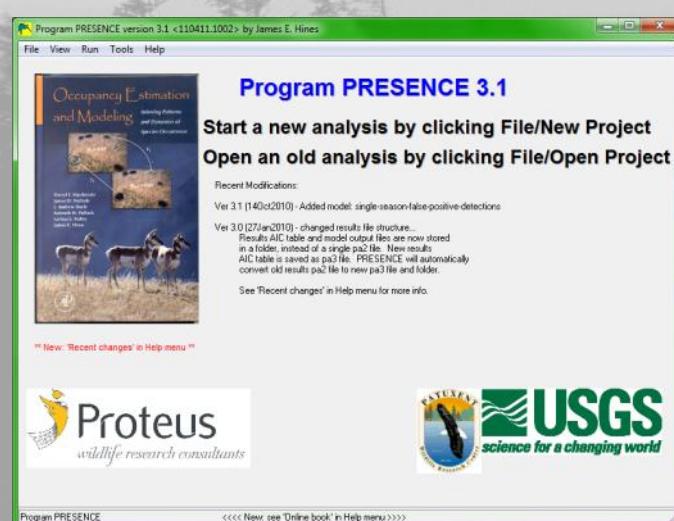
Mammals (small) – array of Sherman live traps run for 4 nights at each location, followed by track tubes at same grid points to record footprints of small mammals over a 7 day period.

Plants – sampled tree, shrub, herbaceous, and seedling layers at each grid point, focused on species composition and structural characteristics; abundance, size, and decay of woody debris.

Analytical Methods



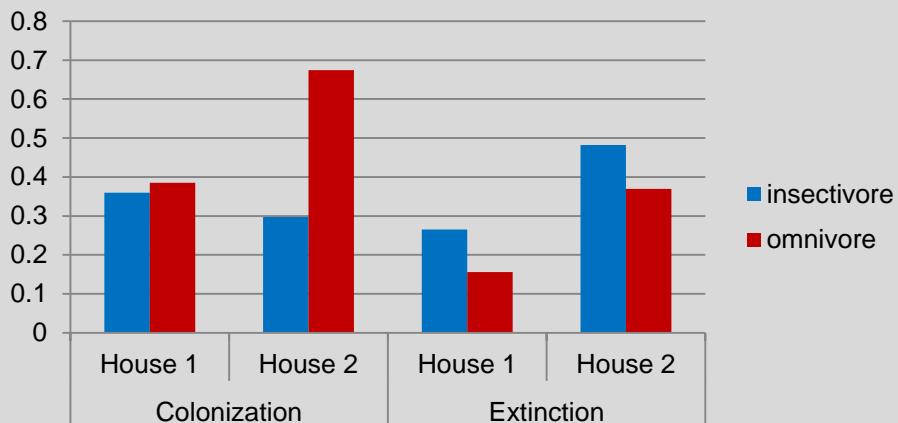
- Occupancy modeling framework; community level methods of MacKenzie et al. 2006; multi-season model to investigate changes in relative species richness before and after construction
- Investigated ecological characteristics (population, reproductive, activity/movement, habitat use/preference, feeding/foraging characteristics, family) associated with probability of local colonization and extinction at each site following home construction.
- Analogous to a standard multi-season model using species as “sites”
- Probability of local colonization = probability that a species absent at time t (pre-construction) occupies the site at time t+1 (post-construction); probability of local extinction = probability that species present at time t is absent at time t+1
- Potential species pool developed from field guides, species lists for the region
- Separate analysis for each of our study sites, for each taxa



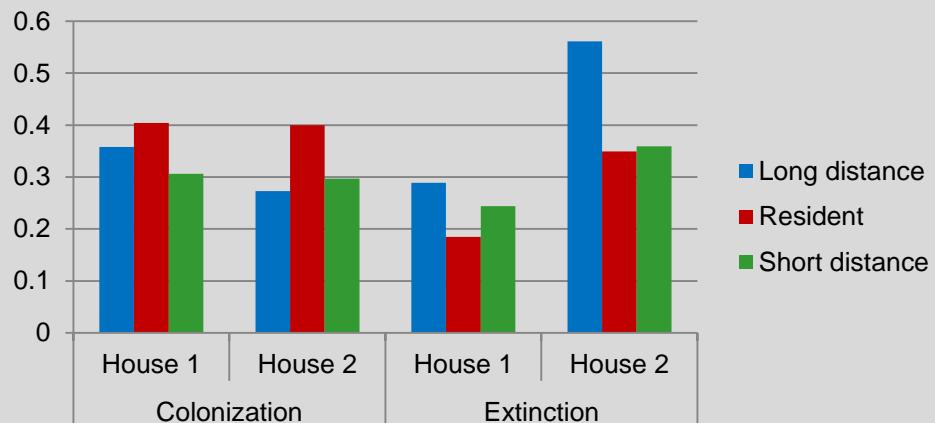
Results: Birds



Probability of Local Colonization and Extinction by Feeding Guild



Probability of Local Colonization and Extinction by Migratory Strategy

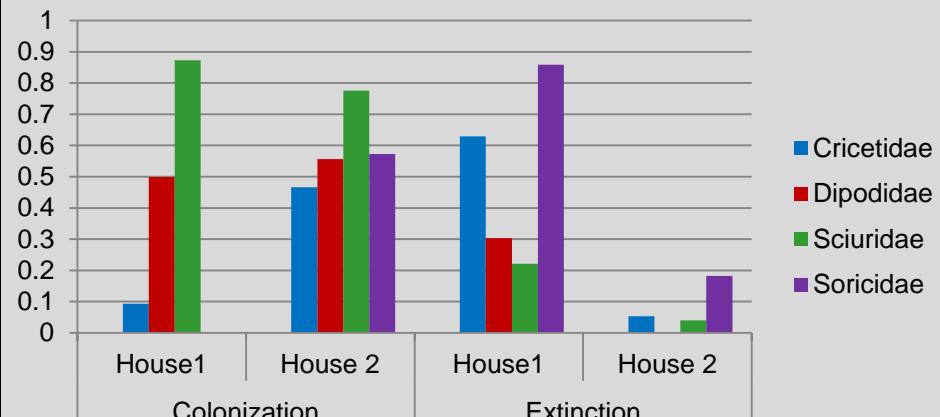


- Probability of colonization most dependent on migratory strategy, family
- Probability of extinction dependent on feeding guild, migratory strategy, family
- Most likely to decline after construction – ground and shrub nesters, Neotropical migrants, area sensitive species, insectivores, foliage gleaners, small bodied species, those with small clutch sizes; thrushes, tanagers, grosbeaks

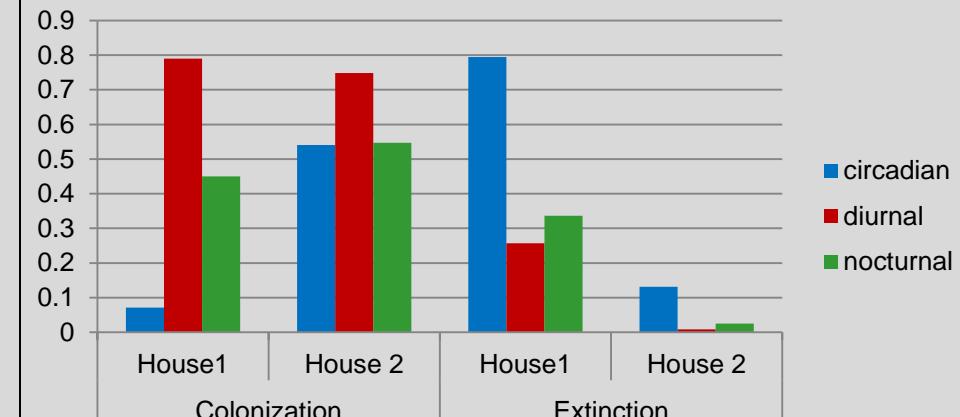
Results: Small Mammals



Probability of Local Colonization and Extinction by Family



Probability of Local Colonization and Extinction by Active Period

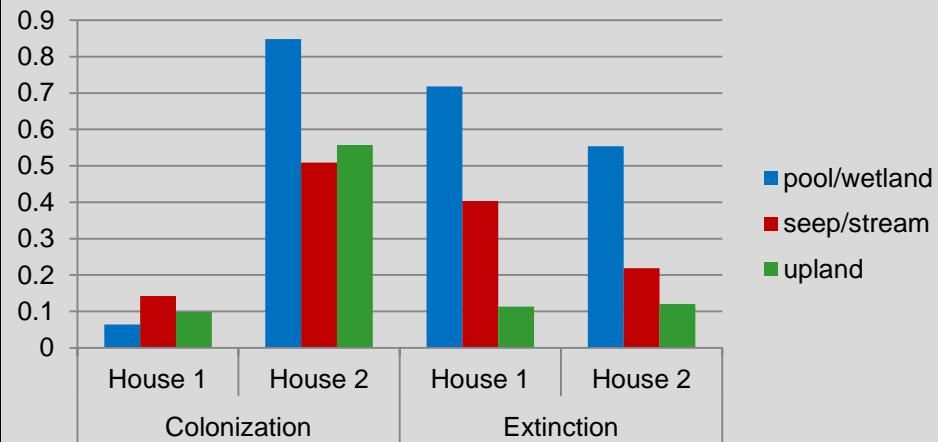


- Probability of colonization most dependent on family
- Probability of extinction dependent on feeding guild, movement/activity patterns, family
- Most likely to decline after construction – ground nesters, fossorial or semi-fossorial species, food specialists, circadian species, non-hibernators, small bodied species, species with large litters and short gestation, short-lived species, shrews

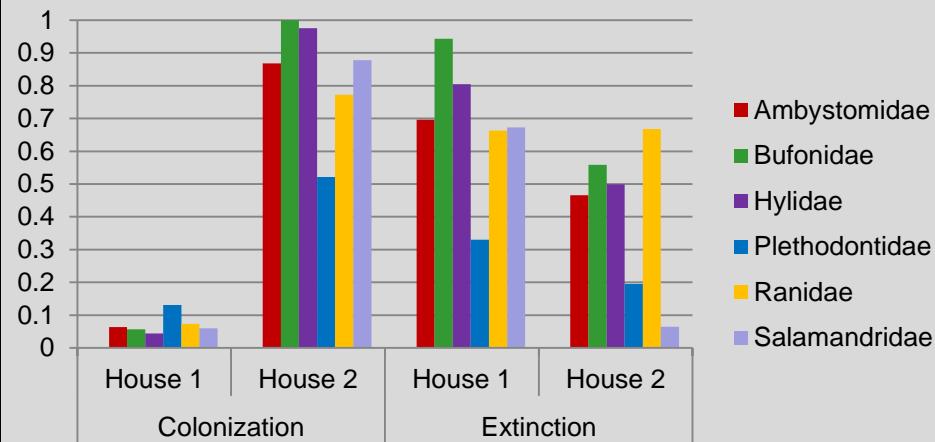
Results: Amphibians



Probability of Local Colonization and Extinction by Breeding Habitat



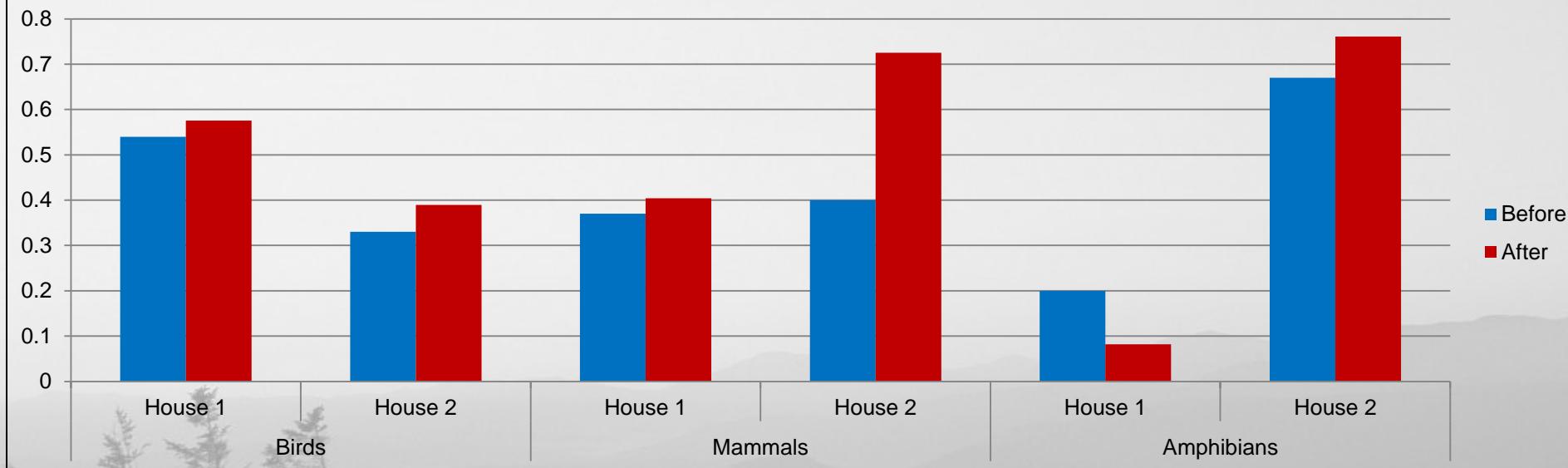
Probability of Local Colonization and Extinction by Family



- Probability of colonization most dependent on breeding habitat, family
- Probability of extinction also dependent on breeding habitat, family
- Most likely to decline after construction – vernal pool or wetland breeders, species with life spans <10 years, locally migratory species, hibernators, large bodied species, species which breed early, hatch quickly, mature quickly; toads, treefrogs, true frogs

Results: Richness

Relative Species Richness Before and After Residential Construction for Three Taxa



- Relative species richness (proportion of potential species pool present) increased in nearly all cases after construction
- Increase in richness generally underlain by decrease in ecological specialization
- For small mammals, post-construction captures weighed less and had sex ratios skewed toward females

Winning and Losing Strategies Across All Taxa



You have a better chance of colonizing/ persisting after residential construction if you:

- Nest in a cavity or underground
- Are willing to eat many foods
- Are large
- Live long
- *Take your time with egg/nestling/gestation stage, grow slowly, mature late

You have a better chance of going locally extinct after residential construction if you:

- Nest on the ground
- Specialize on just one or two foods
- Are small
- Are short-lived
- *Breed early, hatch fast, grow up quick



Conclusions

- Residential construction causes significant changes to wildlife communities within short periods of time, often despite the best intentions of landowners
- Species richness likely to increase, but often accompanied by decreases in ecological specialization
- Findings consistent across taxa, amphibians a slight exception - reflective of differing habitats at our two study sites, and probably the most sensitive taxa
- Local colonization and extinction more closely tied to relatively tightly constrained ecological and evolutionary characteristics (e.g., clutch size, life span, migratory strategy, body size) than more adaptable characteristics such as habitat use
- Importance of small body size and ground nesting behavior to local extinction probability suggests that predation pressure may be a key variable in shaping effects to wildlife from the exurban environment
- Landowners may be able to enhance the likelihood of maintaining a full suite of species post-construction by protecting vernal pools, safeguarding nest sites such as cavity trees and rock piles, and avoiding the use of pesticides which negatively impact local food sources (insects)

Outreach: What have we done with the science?

Expert: More amphibians likely to be found on site

June 8, 2011

By JESSICA COLLIER - Staff Writer (jcollier@adirondackdailyenterprise.com) , Adirondack Daily Enterprise

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TUPPER LAKE - An expert witness for Adirondack Wild testified

Tuesday that since he was able to find 11 species of amphibians on the Adirondack

- Talked about it ad nauseam
- Worked with local planning boards
- Provided technical expertise
- Provided expert testimony
- Worked with the Adirondack Park Agency on subdivision review and policy reform
- Used it to get another grant – NSF

Green groups hammer on resort's wildlife impact

By JESSICA COLLIER - Staff Writer (jcollier@adirondackdailyenterprise.com) , Adirondack Daily Enterprise

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RAY BROOK - Green group attorneys continued Wednesday to argue that the consultants who prepared application materials for the Adirondack Club and Resort could and should have done more study into the resort's potential impact on wildlife on the project site.

State Adirondack Park Agency staff had asked the LA Group, the Saratoga-based consultant group that wrote the project's APA application, to analyze the impact on wildlife, referring to standards outlined in a paper written by the Wildlife Conservation Society's Michael Glennon and Heidi Kretser called "Impacts to Wildlife from Low Density, Exurban Development."

Protect the Adirondacks attorney John Caffrey went through the

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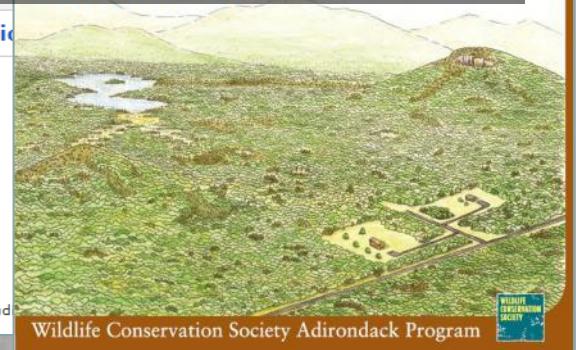
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Wildlife Conservation Society Adirondack Program

Implications for the Northern Forest

- Our study sites are very characteristic of the Northern Forest in general, and results can probably be generalized to similar habitats in this region
- Residential development has significant impacts to wildlife communities, even on very short time scales, but...
- Small actions by private landowners may help to maintain species richness in areas of residential construction
- The Wildlife Conservation Society's Make Room for Wildlife program provides a forum to disseminate the results of this research to local and regional planning boards, regulatory agencies, and private landowners
- Regional efforts such as the Staying Connected Project, Two Countries One Forest, and the North Atlantic Landscape Conservation Cooperative can benefit from these findings in their efforts to enhance and maintain wildlife habitat and connectivity throughout the northeastern US and Canada

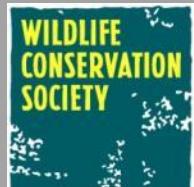
Future Directions

- Our project, like everything, was hit by the recession, and as a result we had only 2 sites on which to conduct our work. Repeating these efforts with a larger number of houses would enable us to determine if these results are representative of effects from most newly-constructed, single exurban homes.
- We sampled only 1 year prior to, and 1 year following construction. Conducting this work on a longer temporal scale would also help us to understand whether the changes we observed persist over long periods of time.
- We sampled small mammals primarily, with large mammals sampled only by camera traps. Extending this work to encompass a greater proportion of the mammalian community, as well as other taxa (e.g., insects), would be informative.
- This project has helped us to leverage funding for a large scale study funded by the National Science Foundation, in which we will compare the effects of exurban development in the Adirondacks and the Madison Valley region of Montana, using a combined ecological and sociological approach. This work will help us to better understand the *mechanisms* which underlie changes to wildlife communities and elucidate ways in which negative impacts to wildlife from residential development can be minimized.

List of Products

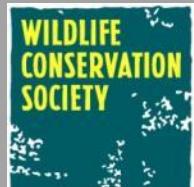
This work is either directly described in or contributed to the following:

- Publications
 - WCS Adirondack Program. 2009. Make Room for Wildlife: A Resource for Local Planners and Communities in the Adirondacks. Wildlife Conservation Society, www.wcsadirondacks.org.
 - WCS Adirondack Program. 2011. Science from the Field, 2000-2010. Wildlife Conservation Society, 29pp., www.wcsadirondacks.org.
- Presentations
 - Impacts to wildlife from exurban development: Lessons from the Adirondacks – SUNY-ESF Ranger School, 2012; North Country Community College, 2011; Northeast Ecosystems Research Cooperative Conference, 2010; Wildlife Conservation Society Science Day meeting, Adirondack Nature Conservancy, 2010; Adirondack Park Agency, 2010; Adirondack Roundtable Meeting, 2009; New York State Biodiversity Research Institute Lecture Series, 2009
 - Land use planning with wildlife in mind: Lessons from local science – Adirondack Nature Conservancy 2009; Lake George Land Conservancy, 2009



List of Products

- Websites
 - Researcher profile, NSRC, www.nsrcforest.org
 - Impacts of low density, residential development, WCS research, <http://www.wcsnorthamerica.org/tabcid/3860/Default.aspx>
- Leveraged grants:
 - NSRC 2010, Theme 4: Impacts to wildlife from the ecological consequences of exurban development in the Adirondack Park II: evaluating the ecological road effect zone.
 - National Science Foundation 2010: Identifying common patterns in diverse systems: a socio-ecological approach to evaluating the effects of exurban development on avian communities.
- Testimony:
 - Prefiled Testimony of Michale J. Glennon, Ph.D., and Heidi E. Kretser, Ph.D., Group 2, Issue 1, in the matter of the Application to Construct the Adirondack Club and Resort by Preserve Associates, LLC; State of New York Adirondack Park Agency, APA Project No. 2005-100.



ADIRONDACKS

Acknowledgements

- Northeastern States Research Cooperative
- Alan Belford, Kendra Ormerod, Quentin Hays, Kristel Guimara, Tiffany O'Brien, Carrianne Pershyn, Zoe, Ruby, and Griffin Smith, Leslie Karasin, Leena and Owen Keal, and Kim, Dana, Jon, and Will Holmlund
- Adirondack Park Agency, especially Mark Rooks and Dan Spada
- Larry Master
- Two extremely generous and kind Adirondack homeowners