A collaborative network for monitoring impacts of climate and landscape changes on forest-dependent mammals in the Northeastern U.S.

Paul Smith's COLLEGE

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Final Report

Forest Ecosystem Monitoring Cooperative Subaward No: 34650SUB00000469 |
Paul Smith's College, Natural Science Department

Grant/Reporting Period: 1 August 2023 – 1 August 2024

Project Title:

A collaborative network for monitoring impacts of climate and landscape changes on forest-dependent mammals in the Northeastern U.S.

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DOI: https://doi.org/10.18125/okd849

I. Rationale

A central theme in the field of ecology is understanding spatiotemporal drivers of species distributions and abundance and the importance of this work is more critical than ever. This proposal directly addresses the core issue that standardized wildlife occurrence data collected at appropriate temporal and spatial scales, required to explore these drivers, are largely absent in the Northeastern U.S.

These data are critically important to understand climate and landscape changes on several species of management concern in the Northeast region. In this area, several species of forest-dependent mammals have recovered portions of their range, including American marten (*Martes americana*), fisher (*Pekania pennanti*), bobcat (*Lynx rufus),* Canada lynx (*Lynx canadensis*), and moose (*Alces alces*). However, significant threats to these species and their persistence on this landscape remain, necessitating the collection of robust monitoring data. For example, recent work on carnivores has demonstrated the critical role of abiotic conditions for mediating competitive interactions among martens, fishers, and coyotes (*Canis latrans*). In particular, snowpack and temperature have been implicated as important drivers of these interactions, with deeper snow and lower temperatures favoring marten (Manlick et al. 2017, Jensen and Humphries 2019, Pauli et al. 2022) and Canada lynx (Sirén et al. 2021); therefore, continued trends in milder winter conditions will likely have profound impacts on these species, their competitors, and lower trophic levels. Other research has demonstrated both direct and indirect effects of habitat fragmentation via wind power infrastructure on marten movements and intraguild interactions with other carnivores, which gain access to deep snow areas in higher elevations through roads (Sirén et al. 2017). Other larger mammals, like moose, are experiencing significant population declines in New England from winter tick (*Dermacentor albipictus*), which have benefitted from milder winters through increased survival and an extended questing period in the fall (Dunfey-Ball 2017, Ellingwood et al. 2020, Debow et al. 2021).

These examples highlight the need to closely monitor a focal group of species in the Northeastern U.S., that have been, and will continue to be, impacted by climate and habitat changes. Importantly, these impacts will not occur in isolation of species and land management decisions and policies implemented by government agencies and private landowners. Unfortunately, state and federal agencies are constrained by a lack of available resources and jurisdictional boundaries that preclude coordinated, long-term monitoring across large spatial scales. Therefore, we addressed this significant challenge by developing wildlife monitoring networks that rely on close partnerships. First, the Adirondack Inventory & Monitoring (AIM) Network is a collaborative that equips, trains, and coordinates a community of scientists and students to deploy and maintain monitoring sites using a standardized camera trap survey protocol (AIM 2021), developed by Sirén (2020). Based at SUNY ESF, the network currently consists of 29 partners including NGOs, NYS government agencies, biological field stations, universities, and high schools that work throughout northern NY. Secondly, AIM is a partner with the Northeast Wildlife Monitoring Network (NEWMN), with primary responsibilities for data management and technical support. This network is also using the Sirén (2020) protocol and currently consists of 14 collaborators including federal, state, and tribal government agencies, and universities spanning New England.

II. Objectives

1. Maintain and expand a network of long-term camera trap stations to collect wildlife occurrence and climate data in northern New York, with particular focus on monitoring:

    a. Species of Greatest Conservation Need and management concern, including moose, snowshoe hare (*Lepus americanus*), long and short-tailed weasels (*Mustela* spp.), American marten, fisher, and bobcat,

    b. Use of sensitive, important, and rare ecological communities, including boreal (high-elevation [>850 m] and lowland), transitional boreal-deciduous, and old growth forests, and

    c. Use of landscape linkages that facilitate movements by other wide-ranging mammals.

2. Maintain and expand capabilities of the network's data management infrastructure to facilitate QA/QC, processing, archival, and sharing of data among regional partners and natural resource agencies.

III. Methods

Using a 4-km^2 sampling grid, we selected a systematic cluster of sample units (3-15) from our northern NY study area to provide broad representation of ecological communities and capture elevational gradients that have strong effects on abiotic conditions and wildlife occurrence. Additional sample units have been selected to focus our efforts within boreal, transitional boreal-deciduous, and old growth forests, and landscape linkages identified by The Nature Conservancy, Staying Connected Initiative (https://stayingconnectedinitiative.org/) in NY.

Our monitoring sites are primarily located on public lands (via a Volunteer Stewardship Agreement) in Adirondack Park managed by the New York State Department of Environmental Conservation (NYSDEC) and private lands associated with biological field stations and ecological preserves.

Figure 1. Camera trap station including snow stake. The visual attractant (turkey feather) is placed at the top of the stake and the olfactory attractant (skunk lure) is mounted on the back side.

Within each sample unit, we deploy a single camera trap (Browning, Bushnell, or Reconyx) with a minimum spacing of 800 m between stations. The camera's field of view is centered on a 160-cm long snow stake set approximately 4-5 m from the camera; therefore, wildlife detections result in the simultaneous recording of snow depth (Figure 1; Appendix B). Each snow stake is marked with the sample unit identification number at the top. An olfactory and visual attractant (skunk lure and turkey feather, respectively) are placed at the top of each snow stake. Cameras are checked at least once during the survey period. Site-level data (e.g., location, equipment used, habitat, and the presence of wildlife tracks/sign) are recorded for camera trap deployments, checks, and demobilizations using ArcGIS Survey123 (ESRI, Redlands, CA). Importantly, this protocol results in high cumulative detection probabilities for terrestrial mammals that occur in the Northeast (including our focal species; Sirén 2020) and the appropriate spatiotemporal matching of wildlife occurrence and climate data.

IV. Results

<u>Objective 1: Maintain and Expand Network</u>

During the grant period we maintained our existing network of monitoring sites at 143 sample units in Adirondack Park and the St. Lawrence Valley (Figure 2). We conducted 60 camera checks, which included collecting and replacing SD cards, replacing batteries, repairing damaged snow stakes, adding new lure, and replacing damaged (e.g., by bears) or malfunctioning cameras. Additionally, we deployed camera traps at nine new sample units (Figure 3); five in the High Peaks Wilderness Area (high elevation boreal), three in the northern Adirondacks (conservation easement lands and lowland boreal/transition boreal), and one in the West Canada Lakes region of the southern Adirondacks (transitional boreal/old growth). High levels of black bear (*Ursus americanus*) activity in the Adirondacks during the summer and early fall 2024, resulting in damaged snow stakes and/or cameras at multiple existing sample units, precluded completion of new camera deployments to avoid damage and loss of assets. Remaining deployments of cameras will occur in October and November 2024 in the northern Adirondacks, where few sample units are currently being surveyed. In particular, this region contains significant lowland boreal forest communities and supports the highest density moose population in Adirondack Park, and thus will add significantly to our current wildlife monitoring program.

Figure 2. Sample units (143; black hexagons) where camera traps are deployed as part of the Adirondack Inventory & Monitoring (AIM) Network, northern New York. Landcover types shown include lowland boreal (blue-green), high-elevation boreal (dark green), and transitional boreal-deciduous (tan) forests.

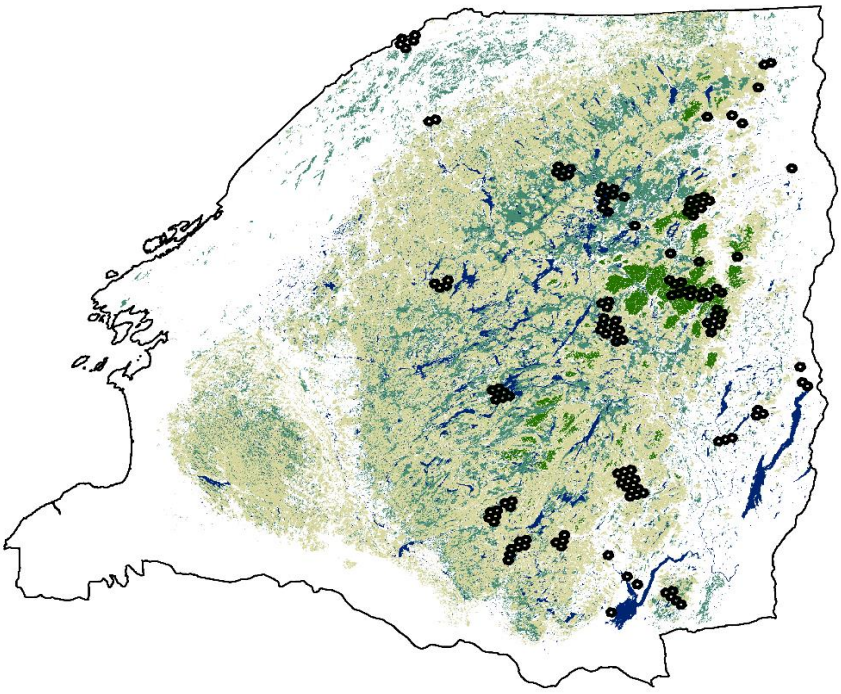

Figure 3. New camera deployments in the High Peaks Wilderness Area (left) and northern Adirondacks (conservation easement lands; right).

During the first phase of this project (Jan 2021 – July 2023, we collected approximately 100,000 images, of which 50,175 contained wildlife detections after processing with AMMonitor (Balantic and Donovan 2020). During the second phase covered by this grant, we collected an additional 90,024 images between Aug 2023 and Aug 2024. These images have not been processed yet, but AI tools including MegaDetector and MegaClassifier v0.1 will be used within the WildTrax platform for automated filtering and tagging of images, respectively. Visual inspection of these images revealed that we detected most

small to large-bodied terrestrial mammals that occur in northern NY, highlighting the effectiveness of our multispecies survey protocol. Moreover, we detected all species within our focal group, including moose, snowshoe hare, fisher, bobcat, American marten, and weasels (Figure 4).

Figure 4. Example camera trap image collected from the High Peaks Wilderness Area, Adirondack Park, New York, August 2023.

Objective 2. Data Management Infrastructure

During the grant period, we greatly expanded our capability to facilitate field data collection and organize and process large image sets. A significant deliverable of this project was completed in May 2024, when we published our first data set in USGS ScienceBase (Jensen et al. 2024). This dataset and associated media files contained in 'Adirondack Inventory & Monitoring (AIM) Network Volume 1 (2021-2023) can be accessed by FEMC partners and the scientific community here: https://www.sciencebase.gov/catalog/item/66200a1ed34e7eb9eb7ed4a9

In October 2023, the AIM Network transitioned from storing data and image files at the University of Vermont to the WildTrax platform (https://wildtrax.ca). During the grant period, we established our project on this platform, updated and cleaned our SQLite database of camera deployments/checks, organized image files for upload to WildTrax, and developed a new draft version of our ArcGIS Survey123 form for field data collection. Additional data releases and/or publications will occur as image processing, tagging, and verification have been completed.

V. Other Network Accomplishments

We presented a paper at the Northeast Association of Fish and Wildlife Agencies annual meeting in April 2024 entitled ***"Northeast Wildlife Monitoring Network (NEWMN): A unifying framework for regional collaboration using multiple camera trap methods"*** (Siren, A.P.K, J. Clark, R.M. Cliché, C.B. Callahan, J.R. Kilborn, C.S. Bernier, K.D. Gieder, P.G. Jensen, R. Patry, and L.S. Prout).

VI. Significant Deviations

None.

VII. Acknowledgements

This work was made possible through a generous grant from the Forest Ecosystem Monitoring Cooperative (FEMC), and I appreciate the assistance of Elissa Schuett, FEMC Program Manager. I thank the Adirondack Inventory & Monitoring Network partners (Appendix A) that conducted field work and contributed data. Vanessa Rojas (SUNY ESF), and Alexej Sirén, Larry Clarfeld, and Therese Donovan (UVM) contributed significantly to the development of the ArcGIS Survey123 form and data workflow. Paul Smith's College provided valuable administrative support for this grant, and I appreciate the assistance of Zoe Smith and Heather Coleates.

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Appendix A. Current partner organizations of the Adirondack Inventory and Monitoring (AIM) Network.

Adirondack Mountain Club (ADK)
Northeast Wildlife Monitoring Network (NEWMN); University of New Hampshire
NYSDEC Division of Fish and Wildlife
NYSDEC Division of Lands and Forests
NYSDEC St. Lawrence Habitat Improvement Project
Paul Smith's College
Shingle Shanty Preserve and Research Station
SUNY Albany; ARSC Whiteface Mountain Field Station
SUNY College of Environmental Science and Forestry (SUNY ESF)
SUNY ESF; Adirondack Ecological Center
SUNY-ESF; Ranger School
SUNY Plattsburgh
SUNY Potsdam
The Nature Conservancy (TNC); Adirondack Chapter
Keene Central School
Lake Placid Central School
North Country School
North Warren Central School
Northville Central School
Northwood School
Saranac Central School
Saranac Lake Central School
Ticonderoga Central School