Predicting Density and Occurrence of Keystone and Umbrella Species Using Drone-based LiDAR

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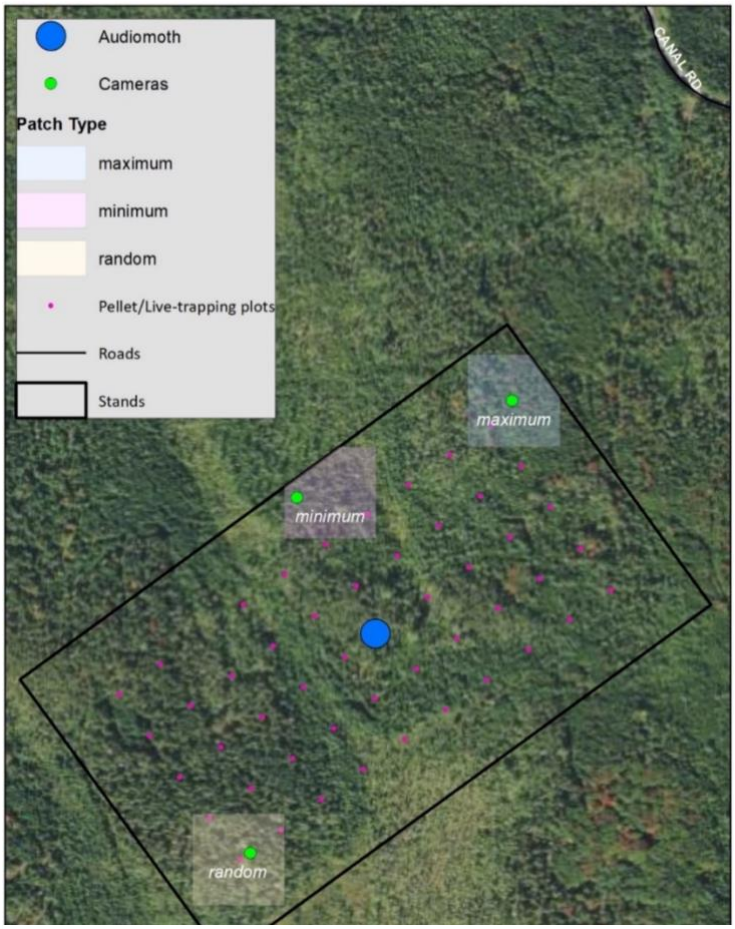
Project abstract

NSRC researchers will use drone-based LiDAR to identify and predict forest structural conditions critical for snowshoe hare and American marten in the Northern Forest. Identifying the habitat overlap between an early- and a late-successional species should indicate high biodiversity and inform forest management and conservation in the region. Researchers will work with existing data on hare abundance, marten occurrence, and vegetative structure. They will compare LiDAR with Structure from Motion (SfM) technology and sample a range of forest sites. They will then identify stand attributes and landscape conditions that maximize hare abundance yet provide habitat for martens. To determine if co-occurrence of these species results in higher biodiversity, researchers will collect data on songbird and mammal species richness. Researchers expect findings to reveal how microhabitat influences biodiversity at varying scales and inform forest management to balance wildlife and economic needs. This research will provide tools and guidance for large landowners to map and manage forests and economic opportunities for small businesses and hobby drone users to map smaller parcels. This work will increase forest survey efficiency and broaden public participation in natural resource management and biodiversity conservation.



Site map (1 of 14 sites) used for monitoring snowshoe hare abundance (pellet plot/live trapping plots), collecting data on species occurrence (cameras), and capturing the sounds of songbirds and other wildlife species using acoustic dataloggers (Audiomoth). The acoustic dataloggers will be deployed during the spring of 2022. All of these sites are being mapped using drone-based LiDAR. These data will be linked with ecological and vegetative data to understand the effects of forest disturbance and microhabitats on biodiversity.

Summary of progress in 2021

During the 2021–2022 fiscal year, we conducted remote sensing and ecological surveys at 14 sites in the Nulhegan Basin (NB) and White Mountain National Forest (WMNF). Specifically, drone-based LiDAR surveys were conducted at 7 of the 14 sites and presurvey planning was completed at all sites. Pellet surveys were counted and cleared during the fall of 2021 at all 14 sites to index snowshoe hare abundance. Additionally, 42 remote cameras were established at the 14 sites at a density of 3 per site. We also solidified plans for siting acoustic monitors and purchased 14 units that will be deployed during the spring 2022 season. We held

two meetings during the past year with project collaborators to share research findings and plan upcoming activities. Additionally, we hired one part-time field manager to conduct ecological surveys (Katelyn Courtot) and aid with remote sensing surveys. Finally, we hired one graduate student from the University of Massachusetts (Jahiya Clark) to analyze the wildlife occurrence and snowpack data collected using cameras.

Problems or changes

PI Alexej Siren moved from University of New Hampshire to University of Vermont, as PI Sirén took a position at the Vermont Cooperative Fish and Wildlife Research Unit with Dr. Therese Donovan. Sirén is now leading the project from UVM, while Michael Palace leads from University of New Hampshire. Dr. Donovan will contribute her extensive knowledge and expertise with automated acoustic dataloggers to the project. We did not experience any major problems or make any changes to the workplan or objectives of the research project.

Collaboration with USFS

Half of our sites are on USFS land (WMNF) and one of the project collaborators – Leighlan Prout – is a USFS employee. As such, we are in regular contact with USFS to coordinate research activities. As part of their involvement on this project, they have purchased 7 of the 14 acoustic dataloggers that will be placed on the WMNF. Additionally, USFS has offered support in the form of permitting and assistance with fieldwork. It is expected that results from our research will be used for managing lands to maintain or promote biodiversity on the WMNF.

Plans for 2022

For the upcoming year we have planned the following research and administrative actions. First, we plan to conduct remaining drone-based LiDAR flights during the spring and fall. As part of our research objectives, we will also compare LiDAR with other technologies (structure from motion; SfM) to determine the applicability of our approach for non-academic stakeholders. These efforts will be led by Co-PIs Palace and Sullivan. We also plan to deploy all the acoustic dataloggers during the spring and early summer and remove these during the fall. The data from these surveys will be processed by Co-PI Lutz and his colleagues at Dartmouth College. The remote cameras will continue to be checked each season (4 times/year) and pellet surveys will be conducted in the spring and fall. Additionally, we plan to conduct vegetative stem counts in all 14 sites to differentiate between previous work that aggregated stem and seedling counts. These efforts will be supported by Co-PI D'Amato lab at the University of Vermont. We also plan to analyze preliminary data and submit papers to peer-reviewed ecology and remote sensing journals as a proof-of-concept that we can use as a foundation for our completed work. To engage project cooperators that provided written support, we intend to host workshops and meetings with them to ensure that we are getting their input on the applicability of our research. Finally, we have decided to hold monthly meetings to increase communication and facilitate research planning.

Photo of an American marten (Martes americana) at one of our camera stations in the WMNF. This photo was captured by K. Courtot who is the field manager for our project.