Wildlife in the WUI: Investigating Forest Characteristics and Impacts on Mammalian Diversity in the Wildland-Urban Interface

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Project Abstract

Across the United States, housing development in forests has created a vast and rapidly expanding wildland-urban interface (WUI), where housing is intermixed with or adjacent to forests. As of 2010, 28% of forest in the Northern Forest region was found in WUI areas, with 8% of the region's forest becoming in the WUI since 1990, a 40% increase in the amount of forest in WUI in those two decades. Housing development pressure will likely continue and may accelerate due to relocation to rural areas in response to COVID-19. It is important to learn from past trends to understand how future decisions will impact the region's biological diversity. Researchers will develop methods to inform land use policies and practices, identify opportunities to conserve wildlife diversity, and anticipate human-wildlife interactions. Researchers will compare forest structure and composition inside and outside the WUI across the Northern Forest landscape. They will quantify impacts of housing development on forest stand diversity, biomass, regeneration, standing dead trees, and downed woody material, with implications for wildlife habitat suitability. They will then investigate impacts of the WUI on diversity, distribution, and behavior of mammals such as fisher, coyote, red and gray fox, white-tailed deer, and small species. They will generate a model to select field study sites for non-invasive camera traps, live-capture/recapture of small mammals, and vegetation sampling. This study aims to better understand the state of the Northern Forest and measure impacts from housing development on native biological diversity. The findings will provide new information to guide decision-makers when updating open space planning while balancing sustainable housing development.

Progress in 2022

During 2022, USFS Northern Research Station collaborators completed analyses of forest landscape and structural change across 24 northeastern states (Sonti et al. 2023). While this broad-scale regional analysis extends beyond the NSRC Northern Forest Region, the peer-reviewed analysis provides a rigorous foundation to continue our investigation. As housing development increased and forested lands correspondingly transitioned from non-WUI to WUI and old-WUI, Sonti et al. found evidence of impaired ecological landscapes, increased aboveground biomass and carbon storage, and indications of impaired forested regeneration with fewer saplings, seedlings, and dead trees. These results underscore the potential for changes to other ecological functions and services. The wildlife component of the investigation began with securing trail cameras and initiating field-testing of systematically deployed, paired cameras to improve wildlife detection. In total, 48 cameras collected 45,469 photos (49.5 GB of data) during 5 weeks of sampling, including detection of 20 species. Additionally, Siena College IACUC protocol was approved and the NYSDEC License to Collect and Poses initiated. Two Siena College student field technicians assisted with literature review, camera trap deployment, photo analyses, sampling time estimation, refining field protocols, and conducting preliminary vegetation at camera trap locations.

Problems or Changes

Dr. Jonathan Knott, USFS Northern Research Station, has joined the collaboration and is assisting with modelling forest composition change using two decades of remeasurements of USDA Forest Service Forest Inventory and Analysis (FIA) plots across New York, New Hampshire, Vermont, and Maine. The analysis will assess variability

in forest composition and composition change across WUI change classes (old WUI, new WUI, and non-WUI). This analysis adapted an approach from text mining research, called latent Dirichlet allocation, to identify five dominant forest communities of the region. Using mixed-effects beta regression models to assess how the proportion of each community changed over time demonstrated fir-spruce and maple-beech-birch communities are the most common communities of the region. Therefore, we are selecting maple-beech-birch dominated forest stands to control for variation across the WUI change classes.

Plans for 2023

In 2023, we plan to implement the first full sampling effort to quantify wildlife across the WUI change classes (non, new, and old WUI strata). By mid-March, we intend to complete our analysis and modelling efforts to guide the stratified randomized selection of 2023 sampling sites. Once completed, the next step will involve site visits to confirm model identification and site selection of targeted forests, followed with securing permission from landowners (mid-March through May). Two research assistants will assist with contacting landowners, visiting, and confirming sites for inclusion in the study. During summer, sampling will target a minimum of 10 sites in each of the three WUI classes. For each site, we will run an array of three trail-cameras for three months and monitor cameras approximately every four weeks. Photo review and data entry will begin immediately following the first series of camera checks. Additionally, we will conduct capture-recapture population estimation by deploying Sherman small mammal live-traps, deploying arrays of 49 (7x7) traps at select sampling sites across the WUI classes. Four field research technicians will assist with field research during summer 2023. Two field research technicians will continue to wrap up field sampling and conduct data review and entry through fall 2023. Once completed, initial occupancy modelling and population estimation will commence, and insights gained will be used to refine sampling efforts during summer 2024. Two abstracts for oral conference presentations have been submitted to IALE-NA Annual Meeting in March and the ESA meeting in August 2023.

Collaboration

Wildlife in the WUI is an interdisciplinary research project being conducting in direct collaboration with USFS Northern Research Station staff. In fact, this particular project is a next step, extension of research initiated by the USFS collaborators (Sonti et al. 2023). Rachel Riemann's research interests span fragmentation and urbanization of forested lands, accuracy assessment of geospatial data, geospatial modeling of forest characteristics, improving estimates of tree canopy cover, and science dissemination and community engagement. Nancy Sonti's research interests focus on urban forests and include ecophysiology, forest inventory and analysis, and use and value of urban natural areas. Miranda Mockrin brings extensive experience with mapping and analyzing growth of the Wildland-Urban Interface. Recently, our collaboration expanded to include Jonathan Knott. His interests include climate science and forest community modelling and collaborating by expanding our efforts to quantify forest community change and refine our efforts to select study sites in time for field sampling in 2023.

Publications

Handy, K. July 23, 2022. Siena professor leads multi-year research on wildlife-urban landscape. The Daily Gazette. Schenectady, New York

Sonti, N. F., R. Riemann, M. H. Mockrin, and G. M. Domke. 2023. Expanding wildland-urban interface alters forest structure and landscape context in the northern United States. Environmental Research Letters 18:014010. https://doi.org/10.1088/1748-9326/aca77b