

Spring 2024 ENVS 401B Project Statements

From conflict to coexistence: a data-driven approach to human-wildlife interactions in Vermont

The Context

The world is changing. You know this, I know this – whether by numbers that track a spike on a graph, or the strange awareness that the snow is gone too soon – we all have our ways of documenting the climatic shifts that confront us. But it is not just us; we are not alone in striving to make sense of and adapt to conditions that challenge our ways of life. Species in the state of Vermont are also responding to the ecological changes wrought large on the landscapes they depend on. Critically, they must learn to live alongside us in this increasingly unpredictable world we have built, whether by reading the new phenology of hunting seasons and a warmer climate or in following the new maps of fences, roads, and forests that form a checkerboard across once contiguous habitat.

The study of human-wildlife interactions may seem restricted to a narrow realm of biology. In fact, our relationship with wildlife cross cuts disciplines – it shows us *who we are* and reflects *what we value*. How we see ourselves as humans, either as separate from or part of the natural world around us (including non-human animals), is a part of our identity that permeates a constellation of environmental perspectives and policies. In the context of a changing Vermont, understanding how to identify human-wildlife conflict and present paths towards coexistence represents an opportunity to bring scientific data into decision-making. But, more importantly, it provides an opportunity for dialogue across stakeholder groups that may otherwise not engage with each other about the future of Vermont communities and ecosystems. Close examination of Vermonter's relationships with wildlife through time can help us understand larger changes in the state's past that impact its environment today. Consider: if catamounts and wolves were not persecuted to extirpation, would we have such a high prevalence of Lyme disease? What were watersheds really like prior to the historical decimation of beaver populations? And, why are some mammals called “furbearers” when technically all mammals have fur?

We will engage with human-wildlife conflict and coexistence through a primarily data-oriented approach, drawing on our skills as environmental scientists who are well-versed in the language of spreadsheets, literature reviews, geographic information systems, and computer code. Yet we will also hone our individual identities as humans who interact with other humans and non-human animals in shared spaces and shared futures; our emphasis on community science means we will inclusively invite others to join us in an endeavor that is often otherwise restricted to academic scientists. We will explore landscapes with the eyes of a wildlife biologist and through the lenses of neighbors and resource users. You will spend time outside in these landscapes (and, perhaps, with some of these animals) and develop your own story of where you fit as both a scientist and a person in these ever-changing systems that so urgently need our data and our care.

N.B. These are complex issues with deep roots. Our topics and projects may at times appear to conflict with each other *superficially* if not dissected thoroughly. Our task is to approach these topics with a scientific lens and provide data as a menu for decision-makers. You will explore how scientists navigate spaces of contention and must cultivate your own personal sense of ethics in informing policy and in respectfully engaging with those with whom you may disagree.

Project #1: At a crossroads: mapping wildlife corridors to support connectivity across shared spaces

Community partner: Carolyn Dash & others, Bristol Conservation Commission

The purposes of the Commission are: (a) to develop and maintain an inventory and conduct studies of the Town of Bristol's (Town) natural, scenic, and recreational resources and other lands which have historic, educational, cultural, scientific, architectural, or archeological values in which the public has an interest (subsequently referred to as social resources) and to assist in planning for their conservation for the continuing benefit of the townspeople of Bristol; (b) to recommend to the legislative body the acquisition of property interests to protect and conserve the Town's natural and social resources; (c) to protect all water and wetland resources; (d) to foster the protection of sensitive natural areas and species; (e) to increase awareness of conservation and recreational goals in overall land use planning and zoning; (f) to allow for recreational uses on acquired lands which are consistent with conservation goals and have a minimum impact on the land; (g) to conduct a broad education program on issues which have an impact on local natural and social resources; (h) to make recommendations to and cooperate and communicate with town officials, commissions, groups, and organizations having similar concerns and with appropriate agencies of the regional, state, and federal government.

The Project

The combination of climate and land use change is radically altering the pathways available for species to move through their ecosystems. Development in the form of roads and loss of contiguous forest blocks can result in both higher mortality rates as well as decreased genetic diversity, ultimately causing extirpation. Though Vermont is in the process of reforestation relative to colonial agriculture baselines, species in the state are still vulnerable to the same processes that cause decline elsewhere, and we have the potential to shape future persistence of wildlife populations through careful attention to corridor designation – spaces in which wildlife can safely move between suitable habitats across a matrix of human infrastructure.

This project builds on the studies of two Middlebury undergraduates, Lauren Gemery '23 and David Goldsmith '24, who have worked to collate resources and conduct preliminary camera trap studies in town parks to highlight potential research directions. In this heavily map-based project, you will work with the BCC to update their town wildlife corridor and connectivity maps in preparation for the 2025 Bristol Town Plan. You will creatively develop an approach that integrates traditional wildlife tracking (e.g., tracks and scat), targeted camera trapping, surveys of residents, and quantitative geospatial datasets such as Biofinder to identify key wildlife corridors. You will expand on the use of indicator species to facilitate efficient designation of suitable areas (e.g., sensitive species such as fishers and otters).

This project has the potential for field work in the form of wildlife tracking and camera trapping at select road crossings and park areas in Bristol. This project is ideal for students with backgrounds in geography and conservation biology. Expertise in GIS/other mapping approaches will be highly relevant, and wildlife tracking skills from BIOL 308 will be vital to any field work. This will be a 5-person group.

Key Outcomes

- Develop several geospatial products that analyze and display data relating to wildlife occurrence, crossing, and habitat suitability across multiple species
- Reach out to stakeholders and potentially survey residents for local ecological knowledge
- Create data analysis/visualization pipelines that can be utilized by the BCC in the future without the direct support of Middlebury students

Project #2: Safeguarding species of greatest conservation concern: updating the Vermont Wildlife Action Plan

Community partner: Alyssa Bennett, Vermont Department of Fish & Wildlife

The department's mission is "the conservation of fish, wildlife and plants and their habitats for the people of Vermont." Other challenges include providing quality fish and wildlife-based recreation and reaching Vermonters with the best possible information about these resources. The Vermont Fish & Wildlife Department is one of three departments in the Agency of Natural Resources.

[Link to the 2015 Vermont Wildlife Action Plan](#)

The Project

The State Wildlife Grants program is “the nation’s core program for preventing endangered species listings” by strategically funding efforts to conserve wildlife and habitats. Since its creation in 2001, Vermont has received \$400-660,000 annually in funding through this program. To be eligible, states must develop a Wildlife Action Plan that is updated every ten years. Vermont’s last plan was in 2015 and therefore must be updated by 2025 to remain eligible. The Plan is intended to be used by a broad audience in Vermont, including state agencies such as VT Fish & Wildlife, conservation non-governmental organizations, sportsmen’s organizations, and even private landowners. The Plan is typically developed by agency staff, local conservation and wildlife organizations, and academic researchers. Students involved in this project will therefore have an important opportunity to concretely contribute to conservation directives for the state of Vermont. Your work will establish a baseline for future reports to build on and compare with to determine patterns of change.

In this project, you will contribute to the 2025 Wildlife Action Plan through contributing to a science-based dataset of for Vermont’s mammal Species of Greatest Concern (SGCN), with a particular focus on small mammals. Example species include the masked shrew, smoky shrew, hairy-tailed mole, New England cottontail, snowshoe hare, southern flying squirrel, southern bog lemming, rock vole, and muskrat. For these mammals, you will work to describe habitat needs, identify potential threats to their survival, highlight key research needs, and propose conservation strategies.

You will draw on existing databases (such as a previous 401’s [Vermont Small Mammal Atlas](#) supported by the Vermont Center for Ecostudies) as well as generate new data on occurrences through engagement with museum and community science databases and interviews with wildlife biologists and other sources of knowledge. The findings of previous reports have emphasized the importance of collaboration and data sharing across stakeholders. You will therefore play an important role not only in gathering data, but in creating a network of those with academic expertise or local ecological knowledge about your focal species. You may also wish to raise awareness about some of these SGCN through the development of public facing products that highlight the need for more data on elusive species.

This project is particularly well suited to students who are creative about data types and science communication, and who are interested in Vermont mammal species (especially small mammals and mammal taxonomy). Contributing to such an assessment may be particularly advantageous to those interested in working for government agencies. This will be a **4-person** group.

Key Outcomes

- Update our knowledge of small mammal SGCN through quantitative synthesis of occurrence and habitat suitability as well as qualitative insight from experts and local ecological knowledge
- Consider ways to raise the research and public profile of understudied SGCN
- Follow guidelines for state Wildlife Action Plans to ensure Vermont is eligible for future funding

Project #3: Community-based camera trapping: an inclusive approach to documenting wildlife on private lands

Community partner: Zapata Courage, Ripton Conservation Commission

Ripton is a small town (<1000 people) in Addison County that was chartered in 1781. It is the location of the Bread Loaf Writer's Conference and was once home to Robert Frost. It is also bordered by the Green Mountain National Forest and Middlebury College lands. Conservation Commissions may inventory natural resources and purchase and administer municipal lands for the purpose of conservation. A topic the Ripton Conservation Commission pays close attention to is the ongoing battle with invasive species.

The Project

Vermont's landscapes are a patchwork of private and public lands with varying conservation priorities. Wildlife do not know how to follow property lines, and thus academic studies focused solely on public lands will not capture the true picture of Vermont ecosystems. While town conservation commissions are most concerned with managing municipal lands, overlooking wildlife on private lands also means missing opportunities to engage with a wider range of people in the science of their surroundings in a community. Community science (also known as citizen science) programs invite members of the public to join scientists in developing and executing research projects together, expanding the range of people who can participate in science. One popular example is iNaturalist, a platform that allows anyone to upload photo observations, and the data are used by scientists to map species distributions, detect invasive species, and even quantify ecological interactions. Many town conservation commissions have taken advantage of this type of approach, in which residents share their observations of wildlife informally using annotated town maps. Camera traps – devices that motion-triggered to capture images of moving animals – have also been proposed as a way to include species occurrence data from privately owned lands while simultaneously opening opportunities to include more people in the research.

While such initiatives generally succeed in fostering an appreciation of local wildlife, they have often fallen short of the goal of generating standardized datasets that can be analyzed with scientific methods suitable for planning. Community science methodologies have been well developed for use in urban ecology studies, where the restrictions on accessing private land are obvious, but have been less implemented in rural areas. In this project, you will work to develop best practices for standardized community science approaches to monitoring wildlife across both public and private lands. You will review the literature to come up with a scientifically appropriate set of analyses appropriate to address the science-based questions of the Ripton Conservation Commission, such as documenting species activity patterns and areas of high priority for connectivity. Your design should allow community members to accurately generate datasets in a scalable way. Importantly, you will consider accessibility and inclusivity in all stages, ensuring that everyone has equal access to equipment. This project would ideally be carried out by a combination of students with interests in science communication, community engagement, wildlife management, and/or public outreach. Knowledge of camera trapping is not required, but this project should include at least one person who has taken BIOL 308. Field work may be included as part of site visits and community camera trap demonstrations. This will be a **5-person** group.

Key Outcomes

- Assess wildlife monitoring needs of Ripton Conservation Commission and connect them to relevant metrics in the scientific literature
- Develop standardized protocols for collecting and recording data that can be executed by members of the general public
- Explore suitable platforms for displaying data that can automatically incorporate new data, such as R shiny apps
- Create a prototype for a wildlife monitoring kit available through the public library

Project #4: Believing in beavers: can Vermont's largest rodent contribute to climate resilience planning?

Community partner: Bob Galvin, Vermont Beaver Association / Animal Wellness Action

Animal Wellness Action is an organization with a mission of helping animals by promoting legal standards forbidding cruelty. Animal Wellness Action champions causes that alleviate the suffering of companion animals, farm animals, and wildlife. To prevent cruelty, we promote enacting good public policies and we work to enforce those policies. To enact good laws, we must elect good lawmakers, and that's why we remind voters which candidates care about our issues and which ones don't. We believe helping animals helps us all.

The Project

Beavers are North America's largest rodent and are widely considered to be ecosystem engineers whose activities can significantly shape the structure and function of landscapes. While previous research has focused on the positive relationship between beavers and fisheries (e.g., salmon) and wetland restoration, there is now an urgent demand for data regarding how beavers may make watersheds more resilient to the effects of climate change. In western North America, beavers have been called "nature's best firefighters", as their damming behavior alters water drainage patterns and can buffer the impacts of drought. In eastern North America, however, the effects of climate change manifest differently; in Vermont, we have seen such effects most recently in the form of devastating floods. Could beavers help build a more resilient Vermont?

Unfortunately, it's not so simple. One persistent issue facing Vermont and other areas in the northeast is uncertainty regarding whether beaver populations are recovering to fill their previous ranges or are expanding into new areas, as historical overharvest during the North American Fur Trade (17th-19th centuries) has shifted our sense of what a "normal" beaver population is. The second issue is perhaps even more complex: there are many ways that beavers are valued in Vermont, and the topic of beaver management can evoke strong sentiments regarding the tensions between livelihoods, recreational practices, conservation, and animal welfare. The Vermont Department of Fish & Wildlife currently regulates beavers as furbearing mammals with open harvest seasons for licensed trappers. While upwards of 500 beavers were trapped for fur in 2012-13, fewer than 150 were trapped in 2021-2022, reflecting a downward trend. However, beavers are not trapped solely for fur; many are trapped as "nuisance" animals as a result of conflicts with landowners over damming behaviors. How might existing trapping regulations either promote or hinder the ability of beavers to support climate resilience in Vermont?

You will delve deep into the literature on beaver ecosystem services to consider how we economically value beavers in ways not solely related to their fur, and consider what existing economic valuation tools may be appropriate for Vermont (e.g., InVEST). You will also review existing trapping legislation, consider diverse stakeholder perspectives, and select case studies of relevance to Vermont, from both across North America and from reintroductions in the UK. This project would ideally be carried out by a combination of students with backgrounds in economics and conservation biology (including one BIOL 308 alumnus). This is the most policy-oriented project. This will be a 4-person group.

Key Outcomes

- Literature review of beaver ecosystem services and suitable economic valuation methods
- Conduct mock cost/benefit analyses for beaver damage mitigation/ beaver watershed benefits
- Literature review and interviews of how beavers have benefitted climate resilience in other areas
- Produce documents suitable for policy-makers as well as for more general public audiences such as town conservation commissions