

14th Northeastern Alpine Stewardship Gathering

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Oral Presentations

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Findings on alpine birds from the second Maine bird atlas

The second Maine Bird Atlas offered an incredible opportunity to examine current breeding ranges and distribution changes in Maine birds. Alpine birds were a particular challenge, as they nest in areas that are hard to access for atlasers. Specialized techniques and protocols were used to maximize our ability to detect these species. By aligning our protocol with the Mountain Birdwatch, we could combine our data with theirs and build an overall picture of alpine birds in the northeastern United States. From the Maine Bird Atlas, specifically, we used data generated from the second atlas (2018-22) to estimate patterns of breeding distribution, breeding density, and documented changes from the first breeding bird atlas (1978-83). For some of our better-studied species, like Blackpoll Warbler and Olive-sided Flycatcher, we have new density estimates that give us conservation targets and estimates of habitat preferences. For all species, we have new estimates of breeding distribution, and a comparison to what changes we've seen in the first atlas. Some of our alpine birds have changed significantly over 40 years, with Blackpoll Warbler, Canada Jay, Boreal Chickadee, and Black-backed Woodpecker being among the largest shifts. However, we are not sure whether these changes reflect real shifts in distribution or simply increased ranges of effort in the alpine zone. The Atlas is coming out later this fall, and you can see all of these patterns and changes yourself very soon. Moreover, we've compiled all our Atlas data, protocols, and data management and analysis scripts online for people to use, so if researchers or managers want to do something new or visualize things in a new way, it's all available. We know our mountain-top habitats are changing rapidly, and projects like the Maine Bird Atlas can help us understand those changes. But we can't do it alone. With Bird Atlases occurring only every 20 years at most, we'll only get snapshots of changes in these systems. Hopefully, the Atlas can help us prioritize research efforts on these species and collect the data that we need to understand what's happening in these ecosystems.

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Eight-year study finds balsam fir recruitment increasing in alpine zone on Mount Moosilauke

The future of alpine plant communities has been a subject of concern because of climate change for many years. It has been widely predicted that trees would move upslope with warming, invading open areas and threatening alpine plants that can live only above treeline. Treeline advance is a particular concern in the Northeast because of the limited extent of alpine habitat in the region. The dominant tree at treeline in the White Mountains is balsam fir (*Abies balsamea*). To assess the threat this species represents to alpine plant communities and to obtain baseline information needed to measure the degree of change in firs' future performance, in 2013 I established 17 transects, each 100 m² and extending from treeline upslope 50 m. Each year until 2021, I recorded the position of each fir and measured its height. I report here the annual growth increments and rates of relative growth, survival, and recruitment, comparing firs' performance in exposed west-slope transects with their performance on the ridgetop and on the more sheltered southeast ridge. I also evaluate the possible effect of distance from treeline on growth, survival, and recruitment. I use a 65-year record of weather in a nearby research forest to consider the possible effects of changing climate conditions on firs' performance. The data show that fir seedling density increased by 52% during the eight-year study period, so firs occur now in growing numbers above treeline, where few trees previously survived. Growth rates vary greatly with firs' height, and the smallest grew very little on average. Survival rates were generally high, although the smallest firs are the most vulnerable. Finally, I use recent advances in our understanding of treeline form and the conditions that produce those forms to evaluate the meaning of changes in fir seedling density on Mount Moosilauke. Abrupt treelines such as those on Moosilauke result from seedling mortality, and increased seedling survival is predicted with warmer winters, as are now occurring. Preliminary dating of trees that occurred in the transects when the study began shows that fir recruitment increased in the 1990s.

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High-resolution satellite mapping of persistent snowbeds above treeline across the northern Appalachian region

Snowbeds with persistent late-season snow cover are among the most ecologically significant alpine environments, supporting diverse plant communities. Alpine snowbed plant communities are vulnerable to climate warming via changes in exposure, water availability, and plant phenology. Despite their ecological significance and at-risk status, their geographic distribution within alpine zones is poorly understood in many regions. New high-resolution satellite constellations provide the opportunity for spatially and temporally dense tracking of snow extent and snowmelt timing across alpine zones globally. A newly developed PlanetScope snow melt-out date (SMOD) algorithm provides 3m resolution maps of SMOD for the years 2017-2025, validated by comparison to in-situ sensors (ME = 1.7d, MAE = 6.3d, RMSE = 8.7d, and R² = 0.807 for n = 227) and coarser satellite platforms. For 35 alpine zones in the northern Appalachian region of the USA and Québec, differences between early- and late-snowfree areas are primarily seen in wind exposure (late SMOD areas = 0.29 wind effect index units lower than early SMOD; pval < 0.001) and slope (late SMOD = 5.7° steeper; pval < 0.01) rather than sun exposure or elevation. These snowbeds are highly consistent spatially across years, but SMOD varies interannually based on weather; total seasonal snowfall is not determinative of late-season snowbed persistence. While these new snowbed maps will be a vital resource for alpine

ecologists in northeastern North America, there is a need for assessments of longer-term (multidecadal) trends in snowbed distribution and persistence across this region.

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Biogeography of the Gol'tsy flora of northeastern North America

This study analyzes three datasets describing the biogeography of gol'tsy vegetation (barren mountaintop plant communities beyond treeline) in northeastern North America south of the Saint Lawrence River. First zones, the collation of the location of northeastern sites with at least a few of a list of 64 vascular plant species with affinity to the alpine (treeless mountain) zone maps the spatial geography, particularly the elevational-latitude distribution, of gol'tsy communities in the region. Analysis of these data from mountains, ridges, ledges, and coastal strands reveal a strong correlation with summer temperature regime, with significant modification due to exposure, edaphic (substrate) factors, or hydrology. Second species, a tally of vascular species found on 153 summits/ledges includes 673 species found in the alpine zone. The distribution of each of 64 predominantly alpine species document alpine floristics and is clearly displayed by mapping this matrix. Furthermore a nested temperature analysis of these data shows a very low randomness (strong nestedness where the sites with a larger flora have the full range of alpine species while the sites with lower numbers support only the increasingly more common species). In island biogeography theory, this indicates that an original full post-glacial composition of species has been limited by area size and habitat diversity not alterations through extirpations or migrations. This is consistent with the limited records of modern summit extirpations and lack of inter-summit migration. Third communities, a collation of historical sampling (1959 - 2026) of the vegetation on 693 transects (containing 10,780 small fixed area plots) displays the detailed quantitative abundance of species in various alpine communities. There are relative few common dominants, moderate numbers of less abundant widespread species, only three endemics, and a series of rarities restricted to special habitats. An ordination of this matrix indicates a continuum of composition among seven nodes (herbaceous snowbank; krummholz edge heath snowbank; *Diapensia* heath; mixed meadow heath; sedge meadow; bogs; rocky cliffs/ledges/gullies). Apparently the gol'tsy vegetation in the northeast became established with all current species soon after the glacier retreat and remained in approximately the same location with the same composition for the last 8000 years. Given the long stability and that the unchanging underlying topography (exposure, drainage, substrate) and restricted locations remote from climate zones, any future change in climate (temperature or precipitation including snow) suggest only modest changes in the biogeography of gol'tsy.

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Conserving Maine mountain lakes: Integrating science and conservation values to inform the knowledge-action gap

Aquatic ecosystems are hotspots of biodiversity, biogeochemical processing, and recreation, yet these ecosystems can be overlooked when conservation planning focuses on terrestrial ecosystems. While conserved forests and watersheds are one of the most effective tools for protecting freshwater ecosystems, incidental protection does not ensure that aquatic ecosystems are adequately represented in conservation priorities. In Maine's mountain region, there are 90 high-elevation lakes (> 600 meters above sea level) that are broadly recognized as high-value, unique ecosystems, but there has been no systematic analysis to identify conservation gaps or priorities. Here, we aimed to identify the conservation gaps and priorities for mountain lakes in

Maine. Using existing spatial datasets, we conducted a conservation gap analysis of all 90 high-elevation lakes in Maine and identified which lakes and watersheds were not included in currently conserved parcels. This effort to focus on waterbodies across a 5-million-acre landscape was supported by the Maine Mountain Collaborative (MMC), a coalition that fosters on ongoing, close collaboration between 12 conservation organizations that work at multiple scales and geographies across the region. We distributed a survey to MMC members and partners to identify conservation priorities for mountain lake ecosystems and facilitated two focus groups to refine conservation priorities and apply rankings to specific waterbodies. We found that nearly half of mountain lakes lie outside of conserved watersheds, while lakes on tribal lands remain unaccounted for in many conservation datasets. The survey revealed intrinsic, ecological, and scientific values were important conservation values, while climate change, overuse and visitation, and invasive species were perceived to be the greatest threats to mountain lake ecosystems. In the two focus groups, we identified seven high-priority lakes within unconserved parcels and discussed strategies for future conservation. The culmination of the project is a conservation database and interactive website with lake monitoring data that is an accessible tool for MMC partners to plan and act at a large geographic scale while connecting conservation and research efforts.

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Climate change refugia in northern Appalachian mountain lakes

In response to global environmental change, mountain lakes present a duality: they may act as sensitive sentinels of change while, simultaneously, providing refugia across the landscape by preserving certain habitat characteristics. Research on climate-change refugia in aquatic systems often emphasizes cold water habitats located in high-elevation regions, but this concept remains understudied in lakes and ponds compared to riverine systems. Furthermore, the role of high-elevation refugia is uncertain as these regions experience rising temperatures, loss of snow and ice, and other regional changes. Here, we describe ice and water temperature dynamics in two sets of small, remote lakes in the northern Appalachian Mountains, ranging from 76 to 955 m above sea level, and evaluate the role of elevation in supporting cold habitat conditions. We found that ice persisted on average 8 days longer in high elevation (>500 m) lakes compared to lower elevation sites, and water temperatures warmed faster but maximum temperatures remained lower in high-elevation lakes. We also examined organismal phenology and community composition across elevations; zooplankton phenology was driven by water temperature, and high- and low-elevation lakes supported different zooplankton assemblages. These patterns suggest that subalpine mountain lakes with longer ice duration and cooler summer temperatures may serve as important climate-change refugia, even as they warm over time.

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Does introducing genotypes from warmer populations aid alpine restoration under climate change? Insights from the Sustainable Summits Project

Northeastern alpine and subalpine ecosystems host a remarkable array of glacial relict species that are increasingly threatened by rapid climate change. For example, species distribution models predict that 98% of currently suitable habitat for three-toothed cinquefoil (*Sibbaldiopsis tridentata*) in Maine will become unsuitable as maximum summer temperatures rise. Preserving these climate-vulnerable populations may require active management such as assisted gene flow: introducing individuals from warmer populations presumed to be adapted to higher temperatures. However, assisted gene flow has rarely been rigorously tested outside of forestry.

We tested assisted gene flow with three-toothed cinquefoil by collecting plants from 31 locations across the Northeast and planting them in cool and warm common gardens on Cadillac Mountain in Acadia National Park, Maine. Each garden received three treatments: local plants alone, and mixtures of local plants with plants from either warmer or climatically similar sites. After five years of monitoring survival and cover, cover was lower in the warmer garden, but mixed-source plantings did not outperform local plants in either garden. To understand why, we genotyped 285 plants from 28 source populations at ~1,900 genetic markers. Three results help explain the poor assisted gene flow results. First, the region's populations form a single connected gene pool, with differentiation increasing gradually with distance and no genetic signal of temperature adaptation. Second, warm and climatically similar sources were genetically indistinguishable. Third, the Cadillac Mountain population was among the most genetically diverse and least differentiated populations, and mixing sources increased neither gene diversity nor the number of alleles captured by more than a small margin, compared with the same number of Cadillac plants. These findings challenge a key assumption of assisted gene flow: that populations from warmer sites carry distinct, heat-adapted genetic variation. For large, diverse local populations, sourcing plants across a site to avoid repeatedly sampling the same clone may matter more than importing plants from elsewhere. Before implementing assisted gene flow, managers should test whether source populations differ from local ones in climate-relevant ways, which genetic surveys can do relatively quickly. Combining genetic surveys with field experiments, as we did here, provides the strongest basis for evaluating assisted gene flow.

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Alpine slide: the rapid descent of legal protections for alpine zones in New England's National Forest Inventoried Roadless Areas and how communities are pushing back

Home to unique flora, fauna and exceptional outdoor recreation, alpine areas within the White and Green Mountain National Forests (WMNF and GMNF) contain more than half of the alpine zones in the Northeast. Despite their significance, these National Forest alpine zones are poorly protected and increasingly under threat. In total, there are 4,144 acres of alpine habitat in the WMNF and one acre within the GMNF. The vast majority of these ecosystems occur within New Hampshire's Presidential Range (~2,792 acres) and Franconia Ridge (~230 acres). Of these alpine areas, 1,189 acres (28.7%) have no durable protection whatsoever. Approximately 1,385 acres (33.4%) have statutory protection from the Wilderness Act. The largest portion of these alpine habitats, totaling 1,571 acres (37.9%), is protected by the 2001 Roadless Area Conservation Rule, or Roadless Rule. In 2025, the Trump Administration initiated a process to rescind the Roadless Rule, which would open 45 million acres of national forests to roads and industrial activities, nationwide. This includes about 260,000 acres in the WMNF and GMNF. Over the last six months, conservation organizations and concerned citizens have come together in New England for a grassroots campaign to raise awareness about the impacts this could have on our two national forests and mobilized thousands of local residents to submit comments in opposition. From gathering in local churches and libraries, to meeting with our members of congress, to speaking out in the media, to generating thousands of public comments, we've demonstrated the power of people coming together to defend the places they love. This presentation will explore the past, present, and future of alpine area management in the WMNF, what is at risk if the roadless rule is in fact rescinded, and how you and your organizations can legally engage in advocacy to defend our national forests.

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Canary in the alpine: Classification and temporal vegetation composition shifts in Adirondack alpine snowbed communities

The alpine zone of New York's Adirondack mountains has long been recognized as a unique ecological system with varied vegetation assemblages occupying the different habitat conditions above treeline. In light of the changing climate and the expected associated changes in composition, a quantitative baseline study of plant communities was initiated in 2008. The study which included 17 Adirondack summits (52 transects, 255 subplots) found and described three clear plant community groupings: alpine sedge/dwarf shrub meadows, alpine heath, and alpine snowbank. The snowbank community in particular may be most impacted by the changing climate due to shifts in precipitation patterns and length of snow cover. Therefore, due to their unique species diversity and vulnerability, alpine snowbed communities have the potential to serve as early detection or 'canary' communities that can inform scientific understanding of the timing and physical manifestation of a changing alpine ecosystem. Considering this, the snowbed communities sampled in the 2008 study were resampled in 2024 to evaluate the temporal changes in composition and structure over a 16-year period. The relationship between snowbed vegetation cover change and environmental variables was then explored to predict characteristics of future snowbed refugia areas and understand likely compositional scenarios. Analysis of change in these transects indicates that Adirondack snowbed communities are experiencing increased species diversity ($p=0.004$) and stable overall cover, with snowbed obligate species expanding at sites with more northerly aspects (Estimate=237.07, $p=0.0483$). These communities appear to be resisting displacement while showing early indications of compositional shifts associated with microtopography and aspect.

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In the footsteps of Merritt Lyndon Fernald: Tracing postglacial colonization of the Gaspé Highlands through arctic-alpine biodiversity

The Chic-Chocs mountain range harbours a rich assemblage of arctic-alpine plant species and varieties. However, the biogeographical history of this flora remains poorly understood. Early hypotheses suggested that arctic-alpine plants persisted locally on ice-free nunataks during the last glaciation, but more recent evidence indicates that the entire mountain range was ice-covered. Postglacial colonization therefore likely tracked deglaciation, beginning on summits that emerged earlier in the western Chic-Chocs before subsequently progressing eastward as suitable areas became ice-free. Such a colonization history should have left a detectable signatures on the biodiversity of the mountain flora, both among and within species. To investigate this postglacial biogeographic legacy, we assessed the spatio-temporal relationships between deglaciation chronology and patterns of arctic-alpine species richness as well as genetic structure and diversity, across three sectors distributed along the west-east axis of the mountain range.

A literature review combined with a contemporary floristic inventory yielded more than 3400 occurrence records. We also collected ≥ 150 individuals of each of three diploid arctic-alpine species, *Carex bigelowii*, *Arctous alpina* and *Salix uva-ursi*, for genotyping. Arctic-alpine species richness was consistently higher in the western than in the eastern Chic-Chocs, despite the smaller area of alpine and subalpine habitat in the west. This pattern was partly associated with deglaciation chronology, consistent with a legacy of postglacial colonization from west to east. Preliminary genomic analyses based on 6800 to 13000 high-quality markers also revealed west-east genetic structure in *C. bigelowii* and *A. alpina*, a pattern further supported by phylogenetic analyses. However, the three species exhibited moderate differentiation and genetic substructure

within western and central sites despite their geographic proximity. Patterns of genetic diversity do not support our hypothesis of a west-to-east decline following deglaciation in each species. Further analyses are needed to disentangle the respective contributions of deglaciation history, habitat availability, and other landscape processes to contemporary patterns of genetic structure and diversity. Nevertheless, because the postglacial history of alpine tundra islands remains poorly understood in northeastern North America, our results highlight how deglaciation and subsequent colonization may have jointly shaped biodiversity at both inter- and intraspecific levels. Reconstructing these historical legacies is essential for improving predictions regarding the response of alpine vegetation to anthropogenic climate change, which is particularly rapid in alpine and northern environments.

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Mapping the Future of AT Conservation: Maine Appalachian Trail Geospatial Information for Conservation

Beginning in 2020, the Maine Appalachian Trail Land Trust created a groundbreaking model for analyzing land along the A.T. in Maine for conservation: the MATGIC system. MATGIC - an acronym for Maine Appalachian Trail Geospatial Information for Conservation - was created in partnership with the National Park Service and Appalachian Trail Conservancy out of the need to have comprehensive mapping and data specifically for conserving the greater Appalachian Trail region. It combines the latest scientific data on climate resilience and ecological factors with human-based data like hiking trails, motorized trails, and even historic sites. It is a remarkable tool for assessing threats to the A.T. landscape and targeting parcels for conservation solutions. This presentation will be an overview of some of the functions of the MATGIC system that are of interest to a broader audience - not just those who work in land conservation - and it does not require GIS or other specialized knowledge.

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From summit stewardship to an Alpine Stewardship Center: Building an integrated model in the White Mountains

The Alpine Stewardship Center (ASC) emerged from a collaborative planning process within the Northeast alpine stewardship community in 2022. This built on the existing Franconia Ridge Summit Steward Program, first proposed by the Franconia Ridge Working Group (FRWG) and launched in 2018. Administered by the World Trails Network – Hub for the Americas (WTN Americas), the ASC was designed as a collaborative project with the U.S. Forest Service and other regional partners, and serves as the flagship for a growing network of collaborative field schools within the Pan American Trails Network. Since beginning operations in 2023, the Center has developed into a broader experiment in integrated alpine stewardship, bringing together trail management and restoration, visitor education, recreation-ecology research and monitoring, university education, professional development, volunteer engagement, and regional and international exchange. This presentation reports on the ASC's progress through the 2026 field season and what we have learned from bringing these activities together. Professional Summit Stewards now provide sustained field presence on Franconia Ridge and, beginning in 2026, the Crawford Path, combining visitor engagement with trail tending, monitoring, and resource protection. Professional and volunteer trail restoration, including work on the Old Bridle Path, connects alpine stewardship with sustainable trail design and reconstruction. The White Mountain Environmental Field School, offered with Binghamton University, brings students, stewards, and

visiting professionals together for five weeks of field-based study and applied research focused on recreation ecology and visitor-use management. Research and monitoring include visitor counters, photo-point monitoring, GPS-based trail-condition assessment, and studies of crowding and off-trail behavior. Training and education are also expanding through activities such as the Artists Bluff workshop for professionals and through collaboration with other alpine stewardship programs across the Northeast. The ASC also connects this regional work to a wider exchange of ideas. Pan American Trails Fellows from Latin America participate directly in White Mountain programs, while relationships with other field schools and trail initiatives across the Americas allow approaches developed in the Northeast to be compared with trail stewardship and protected-area management in different ecological and cultural settings. Rather than presenting any one program as the model, the ASC approaches stewardship in its broadest sense: the long-term practice of caring for a place. What becomes possible when trail management and restoration, research and monitoring, education, professional exchange, and visitor engagement are brought together as parts of that shared practice?

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Where growth season shrinks: the plants fighting the clock

Elevation reduces air temperature and consequently shortens the growing season in mountainous environments. How widespread plant species acclimate to this pervasive constraint remains poorly understood. This study aimed to determine whether a general pattern of phenological acclimation emerges among common plant species distributed along an elevational gradient in the Gaspé Peninsula. We monitored leaf and reproductive phenophases for 45 plant species across 61 sites, where hourly air temperatures were recorded from 2009 to 2019. Our results indicate that many species adopt a shared strategy that enables them to complete their annual life cycle within the shorter time available at higher elevations. For several taxa, this pattern also reflects increased exposure to winter cold and longer daylengths during spring at higher elevations. Overall, phenological plasticity appears to be a key mechanism allowing plants to cope with the substantial climatic variation across their regional ranges.

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Acadia National Park visitation: A case study with AllTrails Public Lands Program

Accurate visitation data is essential for managing recreation, allocating resources, maintaining trails, and providing an understanding of the activity within a protected area. Traditionally, protected areas rely on trail counters to gather visitation data. However, trail counters are expensive, require installation and maintenance, can only be deployed at a limited number of locations, and need to be manually downloaded. As the world looks to technology for solutions, protected areas are no different. Many studies in the last 10 years have looked at the possibility of social media, cell phone data, and other technology to improve the process of collecting visitation data. This project explores the use of visitation data from the AllTrails Public Lands Program as a tool for estimating physical trail use. The AllTrails Public Lands Program is a free to use program that can be applied to by public land managers. The program allows the user to edit the trails within their protected area, visualize movement through heat maps, and records visitation on each trail. Visitor counts on the AllTrails Public Lands Program are characterized as someone who records and saves a trip on the app AllTrails. Once their trip is saved, the user is recorded as a unique visitor in the workflow. The data ranges from the number of visitors in the

protected area over an entire year, to the number of visitors on a singular trail on any given day. Initial work focuses on trails in Acadia National Park, where AllTrails visitation data are compared with Eco-Counter records across multiple trails and dates. Trail characteristics such as length, elevation gain, route type, and difficulty within the trail network are considered as potential factors affecting the relationship between digital and physical visitation measurements. Ultimately, this research evaluates how digital recreation data may complement traditional monitoring systems and expand the spatial coverage of visitor-use information available to public-land managers.

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Functional trait adjustment strategies in two hawkweed (Pilosella) species colonizing a montane environment

Phenotypic variability allows plants to acclimatize to a wide range of environmental conditions, which, in the case of exotic species, could favour their colonization in new environments. In this study, we examined the relationship between intraspecific variability of functional traits and environmental conditions in two hawkweed species (*Pilosella officinarum* and *P. caespitosa*) along a distance gradient in the Gaspé Peninsula mountains. This gradient follows the axis of trails that successively cross a low-altitude anthropogenic zone, a forest zone and a final zone corresponding to the alpine summit. A number of trends have been generated, suggesting that different selection strategies are put in place as colonization proceeds. Plus, low altitudes, which are heavily colonized by *Pilosella*, contain greater intraspecific variability than higher-altitude zones. A filtering effect would thus operate in favor of certain individuals with phenotypes more advantageous for survival or dispersal between the different zones of the gradient. To further explain this variability, causal links between local environment and phenotype were established. This made it possible to interpret how individuals allocate their resources in order to produce a maximum number of fruits, a critical factor for colonization success. For example, vegetative reproduction increases with altitude. This can have a direct or indirect effect on traits and, ultimately, on the number of fruits per plant, particularly through environmental variables such as canopy cover and organic matter thickness. Despite their taxonomic proximity, the two species of the genus *Pilosella* react differently to their environment, and this would be due to the phenotypic plasticity of their trait. This study thus enables us to evaluate and compare the invasiveness of these two species under the changing environmental conditions of the mountain environment.

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Updates from the Mt. Washington alpine warming experiment

Alpine ecosystems in the Northeastern US are relatively rare but have outstanding ecological significance regarding biological diversity, ecosystem-level feedbacks to lower elevation forests, and providing recreational opportunities for millions of users. Unfortunately, widespread degradation of alpine ecosystems from heavy recreational use is common across the region. Further, climate and other global change drivers are likely to significantly increase degradation; however, there is currently conflicting information about the vulnerability of alpine ecosystems and individual species in the Northeast. Protecting, restoring, and increasing the climate resilience of these unique ecosystems requires a better understanding of the vulnerability of Northeast montane flora to climate change. To address this knowledge gap, I will discuss updates from the ongoing artificial warming experiment (AWE Project) taking place in the Presidential Range of New Hampshire. This experiment uses an open-top chamber (OTC) network to simulate future warming and to directly test alpine plant climate vulnerability via survival and physiological metrics

and model this response in the context of projected climate change. This work takes place in a context where our group plans to host a series of workshops with diverse stakeholders to identify montane management and research priorities, particularly as they relate to climate change, and based on this expert knowledge, review current approaches to management issues and widely-accepted models of climate change vulnerability for montane ecosystems in the Northeast. Our work will help provide a roadmap for montane management in the region to ensure the long-term sustainability of alpine ecosystems for decades to come.

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Nature is AWESome: The relationship between nature, awe, spirituality, and well-being

The transformative power of experiencing wilderness is evident in countless works of art as well as in the growing number of visitors to nature-based tourist destinations. Over just the past few years, a growing body of research has focused on understanding those transformative experiences people have in nature and how they lead to measurable improvement in well-being. One dimension of this area of research that has received recent attention is the role of awe. People experience awe as a specific emotion in a variety of settings including when listening to music, viewing art, participating in organized religion, engaging in collective activities (e.g. dance and ceremonies), and through encounters with nature. As a distinct emotion, awe is expressed with specific facial expressions, including raised eyebrows and an open mouth. People experiencing awe also utter common verbal expressions such as “wow” and “whoa.” Several pathways have been proposed to explain how experiencing awe benefits physical and mental health. This talk will focus on this recent research linking nature, spirituality, awe, and well-being. It will also invite participants to reflect on how experiencing awe in nature relates to their personal experience and to their professional work.

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Science and collaboration in support of local management – Assessing the impact of winter recreational activities

The Manicouagan-Uapishka Biosphere Region (MUBR) plays a key role in scientific data collection in the mountains. As a UNESCO Biosphere Reserve, it supports research and education, while also supporting science-informed decision-making within the designated territory. The Uapishka Mountains have been the subject of long-term monitoring for the past five years, coordinated by the MUBR and many research partners. The collected data are then presented to the management committee and the Quebec Ministry of the Environment to manage the protected western part of the massif. The management committee consists of all the stakeholders in the region such as Indigenous communities, recreational activities organizations (hiking, skiing, snowmobiling) and together they hold meetings to assess their concerns, ideas and needs and they set up master plans and mechanisms to ensure that activities be carried out with as little impact as possible. A concrete example of a collaborative science project rooted in the management of the mountain massif concerns the impact of snow compaction caused by winter activities in the Uapishka mountains. Indeed, during winter, skiers and snowmobilers travel across the mountains in search of deep powdered snow. The MUBR developed its own protocol to assess the impact of skiing and snowmobiling on snow compaction, and, ultimately on low-growing highaltitude vegetation. The protocol inspired other mountain regions of Quebec, such as the Gaspésie National Park who contacted the MUBR to collaborate on adapting the protocol to their mountains. The Manicouagan-Uapishka Biosphere Region and the Uapishka Mountains

are brilliant examples of collaboration between mountain regions and the role that scientific data can play in the management of an isolated mountainous area.

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Does mimicking nature improve mountain summit restoration?

On the mountain summits of Acadia National Park, a mosaic of low-growing vegetation occupies sheltered ledges, hummocks, rock crevices, and depressions within an expanse of granite bedrock. Even at relatively low elevation, subalpine communities and state-rare species (e.g. boreal blueberry) persist in the exposed conditions and cool, coastal climate. These summit landscapes are also increasingly popular areas for recreation, and off-trail use combined with heavier rainfall events has resulted in vegetation loss and erosion of the thin, acidic native soil. Beginning in 2016, park managers and partners established experimental restoration plots on Cadillac mountain to test methods for revegetation. Cadillac summit, which is accessible via motor road, is subject to high visitation and already had vegetation roped off to prevent further loss. Through continued monitoring, this initial phase of restoration research demonstrated that heavily impacted summit areas would not recover without the addition of soil. Seeding with locally collected species had mixed results, while planting plugs was not successful enough to replicate on less accessible summits. The second phase of summit restoration in Acadia National Park proposed to expand restoration areas to two other peaks, with updated methods that aim to mimic nature. Early results of this phase two have shown promising trends in effectively restoring vegetation. Seeding with early-successional forbs and graminoids to mirror natural selection has brought back vegetation quickly. Refining erosion control materials to simulate a deep layer of leaf litter has increased seed germination. Soil amendments to adjust restoration soil composition have proven effective in nursery settings, with more to be learned from in-field applications. An effort to mimic the microtopography of this subalpine environment showed inconclusive results, though methods will be reevaluated. Future work will address the maintenance of these restoration areas and possible expansion to restore boreal blueberry. We will continue to learn from applied efforts to address these external stressors on Acadia's summit ecosystems.

Posters

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Comparing latitude with altitude to unravel factors associated with biogeographical boundaries

Vegetation zonation across northeastern North America reflects the combined influence of contemporary environmental gradients and the legacy of postglacial colonization. East of the Great Lakes, the territory formerly covered by the Laurentide Ice Sheet encompasses a broad latitudinal continuum along which vegetation has assembled throughout the Holocene. Here, we aim to characterize the major plant assemblages of this region, identify the environmental factors associated with their distribution, and evaluate how these assemblages may respond to future climate change. We will first harmonize large-scale forest and vegetation plot datasets from governmental and open-access sources across Canada and the northeastern United States. Using Latent Dirichlet Allocation (LDA), we will identify plant assemblages and estimate their

relative representation within sampled communities. Climatic and edaphic variables will then be related a posteriori to these assemblages to characterize their environmental associations and delineate biogeographic structure at a subcontinental scale. We will then use the pronounced altitudinal climatic gradient of the Gaspé Peninsula as a complementary system to investigate vegetation responses to anticipated climate change. Because steep climatic gradients occur over relatively short geographic distance in mountainous areas, this system provides an opportunity to compare patterns of vegetation turnover with those observed along the much broader latitudinal gradient, which are likely to be more dispersal-limited. Species Distribution Models (SDMs) will be used to project potential future distributions of the regional flora under alternative climate change scenarios. These projections will provide the input for a second LDA model to infer potential future plant assemblages. By comparing present and projected assemblages, we will assess whether future climates could promote the emergence of novel, non-analogue communities and identify species and assemblages most responsive to environmental change. Comparing patterns along latitudinal and altitudinal gradients will allow us to evaluate whether similar environmental constraints generate comparable plant assemblages across contrasting spatial contexts. This framework will improve our understanding of the processes structuring northeastern North American vegetation and its potential reorganization under climate change.

Bogucki, Taylor | Friends of Acadia

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Acadia National Park visitation: A case study with AllTrails Public Lands Program

Accurate visitation data is essential for managing recreation, allocating resources, maintaining trails, and providing an understanding of the activity within a protected area. Traditionally, protected areas rely on trail counters to gather visitation data. However, trail counters are expensive, require installation and maintenance, can only be deployed at a limited number of locations, and need to be manually downloaded. As the world looks to technology for solutions, protected areas are no different. Many studies in the last 10 years have looked at the possibility of social media, cell phone data, and other technology to improve the process of collecting visitation data. This project explores the use of visitation data from the AllTrails Public Lands Program as a tool for estimating physical trail use. The AllTrails Public Lands Program is a free to use program that can be applied to by public land managers. The program allows the user to edit the trails within their protected area, visualize movement through heat maps, and records visitation on each trail. Visitor counts on the AllTrails Public Lands Program are characterized as someone who records and saves a trip on the app AllTrails. Once their trip is saved, the user is recorded as a unique visitor in the workflow. The data ranges from the number of visitors in the protected area over an entire year, to the number of visitors on a singular trail on any given day. Initial work focuses on trails in Acadia National Park, where AllTrails visitation data are compared with Eco-Counter records across multiple trails and dates. Trail characteristics such as length, elevation gain, route type, and difficulty within the trail network are considered as potential factors affecting the relationship between digital and physical visitation measurements. Ultimately, this research evaluates how digital recreation data may complement traditional monitoring systems and expand the spatial coverage of visitor-use information available to public-land managers.

Ebner, Liam | Adirondack Mountain Club

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Establishing an alpine-focused teaching herbarium in the Adirondacks

In an era seeing herbaria around the world close and consolidate, we've established a new alpine-focused teaching herbarium at the Adirondack Mountain Club (ADK) in Lake Placid, NY. Specimens collected for this herbarium will be used to aid ADK summit stewards in alpine plant identification, especially for botany field technicians conducting the Alpine Population Study. Botany field technicians hired for this survey are entry level technicians and may not have the experience needed in alpine plant identification, especially graminoids. Other uses of the herbarium include serving as a teaching aid in natural history presentations, supporting botanical research, and contributing to occurrence records for New York's and the Northeast's alpine. Specimens collected on the NYS Forest Preserve were collected under a NYSDEC Temporary Revocable Permit, expiring at the end of the 2026 field season. To date, the herbarium has over 215 specimen collections, with a handful yet to be completely determined to a species level. 36 families are represented in these collections, with the most represented being Poaceae and Ericaceae. 10 alpine summits are represented through the collections, with five additional collection sites including a remote backcountry river, sub-alpine summits, and a high-elevation lake. Collection efforts have been focused on the alpine summits while ADK retains an active permit, but efforts will shift to completing a thorough botanical catalog of the Heart Lake Program Center in future years.

French, Dan | SUNY-ESF

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Associating trails support with trail user activities and motivations in the U.S. northeast

Public support is a key part of public-facing stewardship organizations, yet the motivations of the public to take support actions are understudied. This poster examines how trail users' primary activities and motivations relate to trail user support for trails. Intercept survey data was collected during 2022 and 2023 at eighteen sites across six high-use recreation areas, yielding 2,518 valid responses, as part of an investigation of trail user preparedness in the Northeastern United States. Specific survey questions within that dataset have been selected for comparison here to investigate additional insights. Survey participants were asked about the way(s) in which they support their trails in a multiple select question, with primary results of 45% offer no support and 44% give financial support (24% combined volunteering and support in other ways). With results dominated by no support or financial support, it is important to seek out underlying reasons for these two groups. In the same survey, trail user motivations were measured using a multiple select question with nature (77%) as the primary motivation. Trail user primary activity was also measured using a multiple select survey question with hiking (83%) as the leading response. These findings act as a basis to investigate if relationships exist between trail user activity and their support for trails, and trail user motivation and support for trails.

Jofery, Tori | Maine Appalachian Trail Club

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Above and beyond treeline: Cultivating a collaborative alpine stewardship culture at Saddleback Mountain

Saddleback Mountain (4120 ft) and The Horn (4023 ft) are two of the most popular and most accessible Maine 4000-footers on the Appalachian Trail. With the ski resort's reopening and new development in 2020, Saddleback Mountain has seen unprecedented visitor use, as verified by Ridgerunner data collected from 2017-2026. While the ascent to Saddleback from the Appalachian Trail is a strenuous ~12-mile round-trip day hike from Route 4, many visitors choose to access the summit via the ski slope trails from Saddleback Resort, a ~4-mile round-trip hike from the base lodge and parking area. Meetings with Saddleback Resort have also confirmed year-round use at the summit, including viewing the summit in ski boots, out-of-bounds skiing, and spring skiing.

As part of a greater cooperative management plan between organizations including the Maine Appalachian Trail Club, the Appalachian Trail Conservancy, and the National Park Service, an interest in protecting the Saddleback alpine zone emerged, with discussions involving actionable goals that should help strengthen these efforts through education, maintenance, and project management. This effort, spearheaded by Tori Jofery, MATC volunteer site supervisor of the Saddleback Ridgerunner, with help from Leah Beck, ATC Maine Regional Manager, and support from other key organizations, can be summarized into the following goals the MATC has been working towards:

1. Official signage on the ski slope boundary
2. Rent a leash station for day hikers with unleashed dogs
3. Cairn rebuilds for year-round summit navigation
4. Impact monitoring of alpine plants along the Appalachian Trail
5. Review of ridgerunner data reports and impact of chairlift operation on visitor use
6. Moving ridgerunner base camp closer to the summit
7. Better strategies and techniques for stewardship: string barriers, plant infographics, etc.
8. Ongoing meetings with resort staff and partnering organizations
9. Volunteer ambassador program
10. Proposal/ideas for the old ridgerunner site at Piazza Rock for Outreach and Education

The goal is to share and discuss progress with these efforts, as well as meet with other experts to share successful techniques and strategies for educating the communities and public who live and visit this region. Understanding the impact of increased trail use in a fragile environment will help shape future education and maintenance, and, optimistically, create a new culture of stewardship.

Langlois, Ariane | Université du Québec à Rimouski

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Analogies and differences between elevation and latitude

Latitudinal and elevational gradients are frequently viewed as ecological analogues because both involve lowering temperatures. They have long served as natural laboratories for studying how climatic conditions at high elevation or latitude influence the ecology, evolution, distribution, and

functioning of organisms. Despite this similarity, elevational and latitudinal gradients differ fundamentally in other climatic drivers, spatial structure, and ecological characteristics. For instance, atmospheric pressure and its related oxygen and CO₂ concentrations decline sharply with elevation but remain relatively constant across latitudes. In addition, daylength increases strongly with latitude but varies little with elevation. Elevational gradients are also characterized by pronounced environmental heterogeneity over short distances, whereas latitudinal gradients span much larger spatial scales. In contrast, the close proximity of ecosystems along elevational gradients can influence patterns of movement, dispersal and land use by organisms and human populations. Consequently, similar thermal environments may not necessarily generate equivalent ecological and evolutionary responses. Understanding the similarities and differences between elevational and latitudinal gradients provides a valuable framework for using mountain ecosystems to address broad-scale ecological and evolutionary questions. An interdisciplinary, broad-scale study is underway to address the following question: How can the comparative study of elevational and latitudinal gradients may provide new knowledge for understanding how the environmental drivers shape the functions and dynamics at the organismal, community and geo-ecosystem levels.

Mabley, Claudia | Green Mountain Club

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Photomonitoring of alpine vegetation on Mount Mansfield

In 2004, the Green Mountain Club began a photomonitoring study to examine the status of trailside alpine vegetation, and the effectiveness of the GMC's Backcountry Caretaker program. Locations with evidence of trampling-induced vegetation loss were chosen along the ridgeline of Mount Mansfield, Vermont's highest peak and the site of the largest amount of alpine vegetation in the state. Replications of the study were conducted in 2015, 2021, and most recently in 2026 to assess vegetation recovery or loss at designated sites with different stewardship strategies. Two types of photographs were taken: 24 transects and 64 quadrats. Transect photographs are landscape-style images that were examined qualitatively, while quadrat photographs comprise a one-square-meter frame placed on the ground to monitor selected survey plots over multiple years. Quadrat photographs were analyzed using Markovian Random Field image classification software, which groups the material within the images by type: vegetation, rock, or soil. Vegetation coverage increased in 48 quadrats, decreased in 8 quadrats, and remained at 100% vegetated in 8 quadrats. Overall, there was an 8.27% growth in vegetation coverage from 2015 to 2026. Evidence showed that vegetation recovers best when the trail is well defined, most notably around puncheon. Additionally, the physical characteristics of the sampling location are a better indicator of management effectiveness than the management type. Management practices such as string fencing and scree walls were found to be effective alongside the edge of the trail, but less effective as a deterrent in areas with popular viewpoints or appealing rest spots. Both the transect and quadrat data show the impact of trail management decisions on revegetation, and highlight the role of Caretakers in overseeing these practices and educating the public on their importance.

Murray, Georgia | Appalachian Mountain Club

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Monitoring northeast alpine pollinators and educating gateway communities

Pollinators have been declining worldwide but little is known about the status of Northeast alpine pollinator-plant networks or even baseline presence-absence of pollinators above treeline. Appalachian Mountain Club and partners began monitoring pollinators in the alpine zone around Lakes of the Clouds hut in 2025 to build a database of visual and genetic pollinator visitation on important alpine plants as well as the invasive dandelion. We are utilizing low impact methods including camera traps, eDNA, iNaturalist, and visual surveys to document pollinator plant interactions. This three-year project includes creating educational materials and engagement opportunities in the regions around the White Mountain alpine areas. Educational efforts focus on habitat and connectivity in mountain landscapes. Initial results after two monitoring seasons indicate a high presence of flower flies (Syrphids) and thrips, the latter being small insects that feed on plant material but may be important alpine pollinators, with fewer Bombus or Lepidoptera visits. This is similar to other high elevation environments, yet this work is the first to document this here in Northeast alpine areas. Camera traps showed high interception of pollinator-plant visitation dominated by thrips. iNaturalist is a strong engagement tool paired with trainings and curation, and, along with visual surveys, can provide additional observational certainty of the types of pollinators visiting alpine plants. Finally educational events, print material, and programming has been well received and will be a continued important path towards engaging regional communities in the importance of pollinator habitat and the broader ecosystem benefits.

Nelsen, Colleen | College of the Atlantic

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Modeling the future of a species: Vaccinium boreale

Coastal areas, alpine, and subalpine places have significant potential to act as climate refugia. These habitats are relatively buffered from the effects of contemporary climate change, providing an area for the persistence of ecological, physical, and cultural resources. Many sensitive and rare species may be limited to these areas of refugia with climate change. Species distribution models calculate the current climatic conditions that a species can tolerate and use that information alongside future climate scenarios. These models can guide research and management priorities as they further our understanding of range shifts and distribution changes. As species are responding to climate change in a myriad of ways, these models can also illuminate the specific environmental changes that species are responding to. Currently, climate refugia for six floral species found within Acadia National Park (ANP), ME, have been mapped. This includes species such as Sibbaldiopsis tridentata, Empetrum nigrum, and Arctostaphylos uva-ursi. I aim to expand the information on species distributions by mapping potential refugia of Vaccinium boreale (boreal blueberry), a species of interest for the park. ANP is currently at the lower extents of V. boreale's range and represents one of few populations found in Maine. As the climate warms, this species may be unable to persist in their current locations. Effective management of park resources would benefit from accurate predictions of which areas can continue to be inhabited by this species.

Sperduto, Dan | Eastern Alpine Alliance

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Alpine snowbanks of eastern North America: A flexible sampling method for analysis of diversity, biogeographic patterns, and community classification

Alpine snowbanks (snowbeds) harbor the majority of rare alpine species in the region despite occupying a minority of alpine terrain, underscoring the critical importance of these habitats at a continental scale. A rangewide analysis of snowbanks of eastern North America has grown in recent years to include robust samples from the White Mountains (NH), Mount Katahdin (ME), Uapishka/Monts Groulx (Que), Monts Chic-Chocs and McGerrigles (Que), the Lewis Hills (Newf), and scattered plots elsewhere in Newfoundland and Iceland. Study objectives are to describe plant biogeographic patterns across eastern North American snowbanks, including estimates of richness, frequency, abundance, rarity, and vulnerability of constituent species, classification of communities, and identification of critical refugia. Analyses will proceed in a hypothesis-driven framework. Core areas of late-melting snowbanks depicted on aerial photography were specifically targeted, as were gullies, headwalls, and snow-collecting lee-positions that contained snowbed-restricted species. Most of the ~250 vegetation plots collected to date follow a nested plot design, with species presence recorded in 1, 4, 25, 100, and 400m² areas, and percent cover by species in the 25 m² unit. The 25m² plots are temporarily marked, photographed, and recorded in a permanently referenced fashion. Nested plots allow for plotting of species area curves. Estimates of diversity (richness) can be derived at multiple scales for snowbank ecosystems, including alpha (habitat scale, e.g., snowbed community scale), beta (multiple snowbed types), and gamma diversity (e.g., mountain range scale). Nested plots have also been arrayed around summits in the Uapishka as a rapid, permanently referenced sample approach (similar to the GLORIA method), reflecting its applicability to other objectives. Environmental attributes recorded include slope, aspect, geomorphic setting, vegetation height, microtopography, elevation, soil depth and type, area occupied locally by the type, and the surrounding matrix of other communities. It is expected that more northern positions on the northeast trending latitude-elevation treeline gradient, perennial wetness (rills, seepage) and sapric soils, snowbed area, and herbaceous snowbanks will be positively associated with species richness, and will contain more Arctic-alpine species (vs. species with boreal or north-temperate distributions). Further, snowbeds in ultra-mafic, calcium-rich, and calcium-poor geologic substrates are expected to have distinct floristic signatures that reflect known assemblages in regional and local floras.

Sperduto, Dan | Eastern Alpine Alliance

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Eastern Alpine Alliance: Tundra Without Borders

One of the big challenges facing conservation of alpine areas in the east is rooted in geography: great distances stretch between isolated mountain ranges and their home-range advocates, spanning two countries, four provinces, four states, and two languages. Yet valuable connections have been forged across these distances, resulting in important advances in alpine research and conservation, often highlighted at Stewardship Gatherings and other meetings. In this spirit, and building on the legacy of Beyond Ktaadn, we announce the formation of the Eastern Alpine Alliance (Alliance Alpine de l'Est), an initiative with three objectives: 1) Research - to promote and

implement critical research across boundaries using established and novel protocols; 2) Exploration - to explore remote and little-known eastern alpine ranges to establish inventory baselines, and to probe poorly documented facets of familiar peaks; and 3) Community - to build community and regional partnerships across borders – from New York to Labrador – through collaborative field work; regular forums (remote and in person) to exchange results and knowledge; and through diverse outreach efforts. The conservation of eastern alpine areas for future generations depends on our working together, performing compelling research in the mountains, sharing the spirit of exploration and discovery, and passing on our enthusiasm for these amazing ecosystems.

Tirrell, Andrea | University of Maine, Coastal Maine Botanical Gardens

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Alpine plant persistence in microrefugia: Using SDMs to assess current and future scenarios for a G3 alpine taxa in the northeastern United States, Solidago leiocarpa DC.

Solidago leiocarpa DC. is a rare alpine herb endemic to the alpine zones of the northeastern United States and southern Quebec. The distribution of this species within the region is representative of many other northeastern alpine species: regionally (and often globally) rare, yet likely able to withstand a multitude of microclimatic conditions across high elevation landscapes that encompass a wide range of dramatic topographies and climates. However, it remains unclear how populations of a globally and regionally rare alpine species might respond to climate change and increased warming, considering the potential importance of microsite characteristics to their growth and reproduction. Assessing the current and potential future distributions of *S. leiocarpa* is essential to its continued conservation, as even minor habitat loss could push this species and others towards local extirpation or extinction from the region as a whole. In particular, this study will pay special attention to the current potential distribution of this species based on modern climate data (or the fundamental niche) compared to the habitats it actually inhabits (or the realized niche) could shed light on whether climate or some other driver(s) might impact the future distribution of *S. leiocarpa* populations. We are obtaining occurrence data for *S. leiocarpa* from online records via the GBIF database, my own field surveys completed from 2021-2022 across Maine, New Hampshire, and Vermont (Tirrell et al, In Review), surveys conducted by the PEACC research group from 2025-2026 across Maine, New Hampshire, Vermont, and New York, and surveys conducted by natural heritage programs across the northeast. This data will then be used in species distribution models coupled with microclimate data to 1) assess overlap between the current distribution of *S. leiocarpa* and its potential distribution (i.e. realized vs. fundamental niche) and 2) extrapolate potential future distributions based on future climate scenarios to inform conservation planning for this taxon.

Breakout Sessions

Brooks, Erik | Camden Hills State Park

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Volunteer Empowerment

Now in my fourth season (running mid-April through Thanksgiving) as the Trails Supervisor for Camden Hills State Park, I have worked with dozens of volunteers on projects ranging from routine trail maintenance to building stone staircases, and some invasive plant removal. During this time I have developed strategies for teaching skills to volunteers who may be new to trail work, and am now seeing most volunteers finish the day feeling excited about their accomplishments and thankful for the skills they learned (and usually a little tired). By starting with the big picture – such as the durability, drainage, or change in hiker behavior that we are trying to achieve – and then introducing key safety concerns and scattering in the technical tips, volunteers are able to jump into the work quickly and much more effectively than when the big picture is missing. “Volunteer training” that I have seen elsewhere often omits the concepts behind what makes a structure successful, and thus its effectiveness may suffer and volunteers may feel like laborers rather than problem-solvers. While some trail crews assign volunteers to making crush, I can effectively engage them in building a staircase on day one, building in them a huge sense of accomplishment. They may also enjoy smashing rocks, but they will return if they feel partially responsible for the awesome stonework. In this session I hope to engage other land and trail stewards who work with volunteers to discuss how to transform education into empowerment. We will talk about a variety of trail work activities volunteers may engage in, and the particular challenges of each one. Through a discussion format, we can all share our strategies for success and our challenges yet to be solved, and can all learn from each other.

(60-90 mins)

Capers, Robert | University of Connecticut, Rhodora

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Alpine special issue of Rhodora

Editors at *Rhodora* are planning an all-alpine issue, and we are organizing this session to let alpine researchers, educators and stewards know about this opportunity and to encourage discussion about what should be included. We are inviting proposals for one or two comprehensive review papers but also for shorter papers that focus on research, stewardship or education related to particular alpine communities in northeastern North America. We plan to publish this edition in 2027. Are you doing research in the alpine you would like to publish? Are you involved in a stewardship project or education program that has demonstrated success? Is there something you would like to see in the special edition even if you are not involved personally? Have you identified significant changes in the amount or the kinds of research being done (or that *should* be done) in the alpine? Join us with your ideas. If you are a student researcher, we have editors who can help shape your ideas into a publishable paper. *Rhodora* is a quarterly journal published by the New England Botanical Society with a long (100+ year) history of publishing important research on alpine plant communities, including their bryophytes and lichens.

(45 mins)

Chipman, Jonathan | Dartmouth College

Jonathan.W.Chipman@dartmouth.edu

Remote sensing applications for research and management in northeastern alpine landscapes

Remote sensing from aerial and spaceborne sensors offers many benefits for landscape-scale research in ecology, and for natural resource conservation and management. In this breakout session, participants will discuss applications of remote sensing for alpine zone stewardship and research in the northeastern mountains. Datasets that may be considered include lidar for plant canopy height and structure; multispectral and hyperspectral imagery for mapping plant communities and assessing their properties, or for mapping snow cover; thermal imagery for ecohydrological applications; and historical photography for retrospective studies of changes in treeline, plant communities, and human impacts on the alpine zone. Additional topics to consider could include the role of remote sensing in complementing field observations (and vice versa), cross-regional comparisons, and opportunities for collaboration and data-sharing. This breakout session is intended for both those who are curious about what remote sensing might offer, and those who are already using it in research or stewardship.

(45 mins)

Jofery, Tori | Maine Appalachian Trail Club

tjofery@matc.org

"Horror stories" of stewardship

Join Tori Jofery, former MATC Ridgerunner and current MATC Vice President, for a Halloween-themed breakout session. This breakout combines sharing creative writing, storytelling, and group discussions about "scary" experiences in stewardship that stewards have encountered in real life. Students and stewards are encouraged to hear and share stories related to some worst-case scenarios with visitor use, de-escalating tough interactions, making difficult decisions outside of your comfort zone, and other frightening situations related to their fields. The goal is to listen, reflect, and grow with your peers, exchange best practices, and leave feeling better equipped to handle difficult situations in the future.

(60 mins)

Weiss, Jill | SUNY-ESF

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ASANE 2: Recreation and stewardship in the Northeast Data Share-Out

This session provides an opportunity for project partners and collaborators to review and discuss findings from the ASANE 2 Recreation and Stewardship in the Northeast study. Drawing on 2,518 valid survey responses collected during 2022-2023, the project generated a rich dataset examining outdoor recreation, preparedness, perceptions, and related topics across popular hiking sites in the Northeast. This study moves to address a 10+ year gap in understanding the actions and interests of trail users in the region.

The session will begin with a presentation of key findings from the study, including cross-cutting results and highlights from partner-specific questions incorporated into the survey. Participants will gain a better understanding of the breadth of information collected and how the findings may inform recreation management, conservation practice, outreach, and future research efforts.

Following the presentation, participants will engage in an open discussion focused on interpretation of results, opportunities for application, and priorities for future analyses and dissemination.

The workshop will also provide an opportunity to identify collaborative pathways for moving the dataset forward, including publications, reports, management applications, and additional funding opportunities.

As principal investigator of the project, Dr. Jill Weiss will share project outcomes, discuss current analytical and capacity limitations, and facilitate a conversation about how partners and stakeholders can help maximize the value and impact of this unique regional dataset.

Open to research partners and interested parties.

Participants will leave with:

- An overview of key study findings
- Results related to partner-specific questions
- A shared understanding of project strengths and limitations
- Opportunities for future collaboration and data use

(60 mins)

Workshops

Crews, David | Waterman Fund

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The mountains and forests of Japanese tanka poetry

Japanese tanka is a very old form of poetry that comes out of this region as early as the seventh century common era. These short poems of five lines are marked by presence, attention and awareness, especially as it relates to the living world. Join us as we create a reading circle that comes close to meditation as we explore the mountains and forests of ancient Japan. If participants are feeling abundantly curious, we could even try writing some tanka of our own.

(60 mins)

Flight, Tim | Western Maine Audubon

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The Intersection of Birds, Snowmaking, and Wastewater Treatment

Take a walk at the Carrabassett Valley Sanitary District's Snowfluent Plant to learn about the unique role snowmaking plays in the treatment of wastewater in Carrabassett, and why birders flock to this inviting bird habitat.

(90 minutes)

Kenway, Lester | Maine Appalachian Trail Club

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Trail work in the alpine/high mountain areas

A panel of 3-5 trail workers who have conducted trail construction projects in alpine areas will discuss techniques and construction practices that have been successful (or not) to mitigate impacts of hikers:

- Stabilizing damaged areas
- Directing/containing hiker traffic
- Restoring plant life
- Other

10-to-15-minute PowerPoint/oral presentations from each member of the panel with time for questions. Discussion period afterwards.

(60 mins)

Mazurowski, Jason | Northeast Wilderness Trust

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Reading the Maine Woods

When Henry David Thoreau first visited the Maine Woods, he described them as “all mossy and moosey”—larger, wilder, and far more expansive than the forests around his infamous pond in Concord, Massachusetts. Since then, generations of agriculture, timber harvesting, and development have transformed the region. Yet across parts of Maine, forests that were heavily managed in the past are once again growing older and beginning to recover some of the structure and complexity associated with mature and old forests.

Join Northeast Wilderness Trust's Wildlands Ecologist Jason Mazurowski for a field-based introduction to reading the landscape. Using basic forestry equipment, we will examine how individual trees and broader stand structure can help reveal a forest's disturbance history.

Along the way, we will discuss forest recovery, natural disturbance, passive rewilding, and consider what allowing forests to grow older and wilder can mean for the future of Maine's expansive North Woods.

(90 minutes)

Overcast, Issac & Gill, Jacquelyn | University of Maine

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***Co-creating a Framework for Northeast Alpine Plant Stewardship* (*Invite only*)**

Alpine plant communities in the Northeast are scattered across mountains that are managed by federal and state agencies and non-government organizations with varying conservation mandates and resources. NEASG is one of the few occasions where alpine researchers, land managers, conservation practitioners, Indigenous researchers and leaders, students, and other interested parties are brought together under the umbrella of Alpine Stewardship. This broad-based group includes folks who have been working on alpine research and conservation management for years, as well as others who are earlier in their careers and who are interested in alpine stewardship but may still be finding their path and how they want to contribute. We propose to leverage the unique composition of this group to convene a workshop targeted toward co-creation of questions on alpine plant biodiversity stewardship in an age of climate change, and identification of challenges and opportunities to management implementation (especially with respect to our diverse backgrounds). A primary goal will be to identify shared priorities and strengthen connections across this community.

The nucleus of this workshop emerges from an NSF Biodiversity on a Changing Planet grant awarded to a group of researchers across the University of Maine, University of Vermont, Bennington College, the University of Hawaii, and the Appalachian Mountain Club. This grant will collect high-resolution biodiversity data for 12 alpine peaks across the Northeast, and will develop new machine learning tools to integrate this data with the goal of developing predictive models of future alpine plant biodiversity change. A major goal of this grant is to develop new predictive tools that are useful for management and conservation. This convening is partly in the interest of enumerating with the community a prioritized set of co-developed questions or areas of uncertainty surrounding future biodiversity responses in the alpine, what data and information are needed but otherwise currently lacking to address these topics, and the types of predictive tools or forecasting outcomes that would be most useful for guiding decision-making around alpine biodiversity conservation under global change.

We will use mixed small-group discussions to explore common challenges and opportunities across management jurisdictions. Topics may include barriers to monitoring, access to fine-scale climate and environmental data, sharing and integrating datasets, genetic diversity and its role in adaptation, restoration, and population resilience, seed collections and translocation, and coordination of management strategies across isolated alpine habitats. A central goal will be to identify barriers to collaboration and opportunities where shared infrastructure, protocols, data resources, forecasting models, and expertise could improve stewardship across the region.

Our plan includes a concurrent session for students and early-career researchers that will focus on current challenges and future aspirations for Northeast alpine plant research. Participants will begin this session with a round of lightning talks to share research questions and establish common vocabularies. Following this, participants will break into small groups and discuss challenges and opportunities for alpine research from their own perspectives. These groups will

then share their ideas with the convened interagency and NGO partners, creating an opportunity for two-way exchange between emerging researchers and practitioners.

The workshop will conclude by synthesizing priorities, unanswered questions, and opportunities for collaboration. We envision developing a catalog of these which can be revisited at future NEASG meetings, providing continuity and a center of mass for anchoring coordinated efforts toward future alpine stewardship. By centering the workshop on listening and co-creation, we aim to ensure that future research and predictive tools are responsive to the needs, constraints, and priorities of the people responsible for understanding and stewarding northeastern alpine ecosystems.

(3 hrs)