Photo: Collared pika, Sophie Gilbert

THE ALASKA SMALL MAMMAL GROUP 2021 NEWSLETTER

Introduction

Small mammals are important members of Alaska's terrestrial wildlife community – they represent a large proportion of the state's mammalian diversity and play critical roles as herbivores, insectivores, seed dispersers, disease vectors, and prey species.

This newsletter highlights current research and monitoring projects investigating small mammals across the state of Alaska. These studies are providing important information on small mammal abundance, ecology, genetics, parasites, and response to changing ecosystems in Alaska.

For more information or to join the Alaska Small Mammal Group, please contact Katie Christie or Amanda Droghini.

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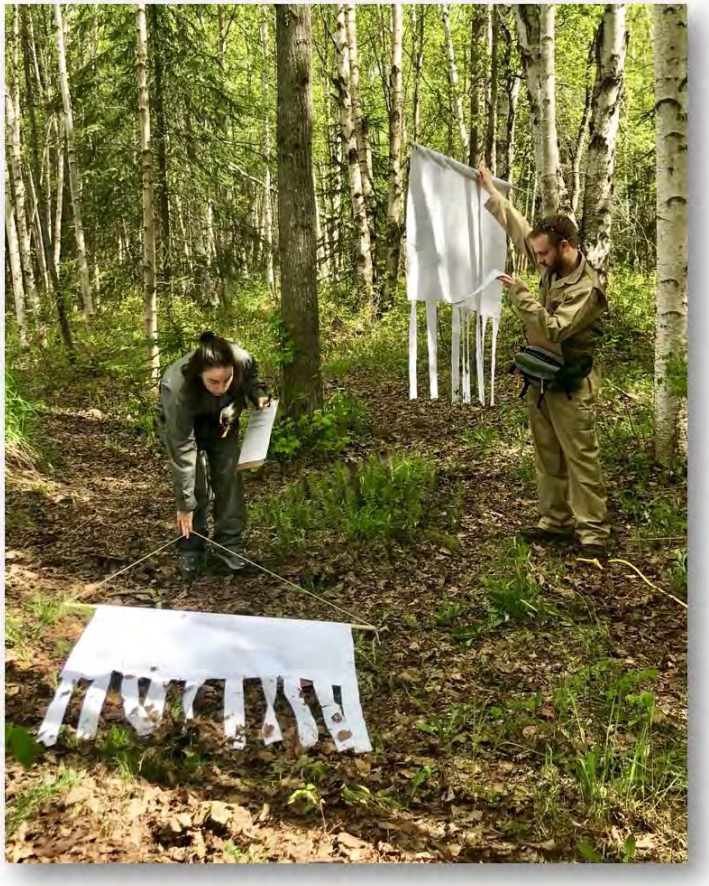
Tick Monitoring

By Rachel Kelty

In the summer of 2020, Dr. Micah Hahn and the Alaska Center for Conservation Science continued research on the prevalence of ticks and tick-borne pathogens in small mammal species in Anchorage. As part of this study, we live-trapped small mammals in three Anchorage parks: Far North Bicentennial, University Lake, and Kincaid. At each site, we deployed 100 Sherman traps and 6 Tomahawk traps for three consecutive nights. In addition to recording the sex, weight, species, and collecting ticks from trapped mammals, we also took ear punches and blood samples this year in order to assess the prevalence of tick-borne pathogens.

Overall, 72 small mammals were captured (including five recaptures) of 4 different species: meadow vole (*Microtus pennsylvanicus*, n = 3), northern red-backed vole (*Myodes rutilus*, n = 41), masked shrew (Sorex cinereus, n = 26), and American red squirrel (*Tamiasciurus hudsonicus*, n = 2). Ticks were observed on 16 individuals. We collected 21 blood samples, 15 tick samples, and 54 ear punch samples. Tick samples are currently being processed to determine the species and extract DNA for testing. Tick samples and biological samples from the small mammals will also be tested for a panel of common tick-borne pathogens.

The multi-year study is funded by Alaska INBRE (IDeA Network for Biomedical Research Excellence) and is aimed at understanding the risk of ticks and tick-borne pathogens in Alaska through several avenues including habitat suitability modeling, the Alaska Submit-A-Tick Program, and active tick surveillance from small mammal trapping and vegetative tick drags.



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St. Paul Island Shrew Research

By Andrew Hope

Ben Wiens (MS program, Kansas State University) is near completion of a conservation genetics assessment of the Pribilof Island shrew (*Sorex pribilofensis*). In 2019 we attended the annual Bering Sea Days STEM education event at the St. Paul School. We taught students of all ages about the unique ecology and evolution of the island fauna, including the shrew, and worked with them to collect a rigorous sample of shrews and their parasites for genetic analyses. Since then we have generated a dataset spanning three types of genetic markers, including maternally inherited mitochondrial DNA, 20 nuclear microsatellite loci, and ~11,000 single nucleotide polymorphisms (SNPs). Using this tiered genomic dataset, we have begun investigating evolutionary and demographic history of this shrew at high resolution.

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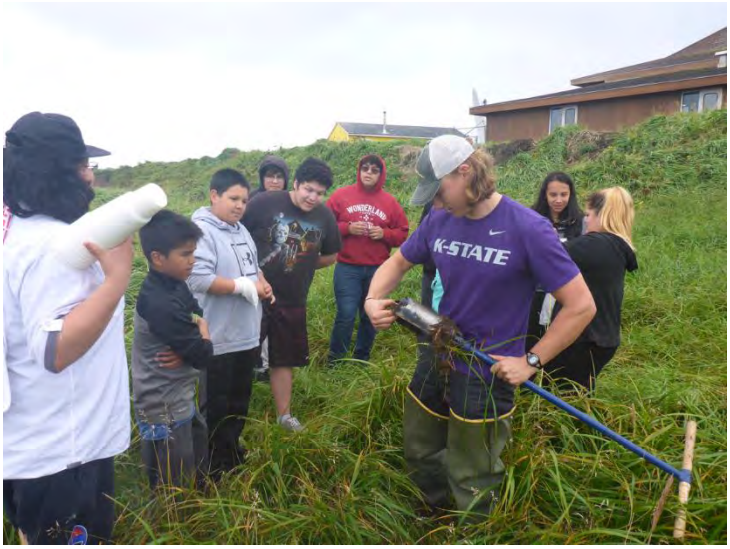
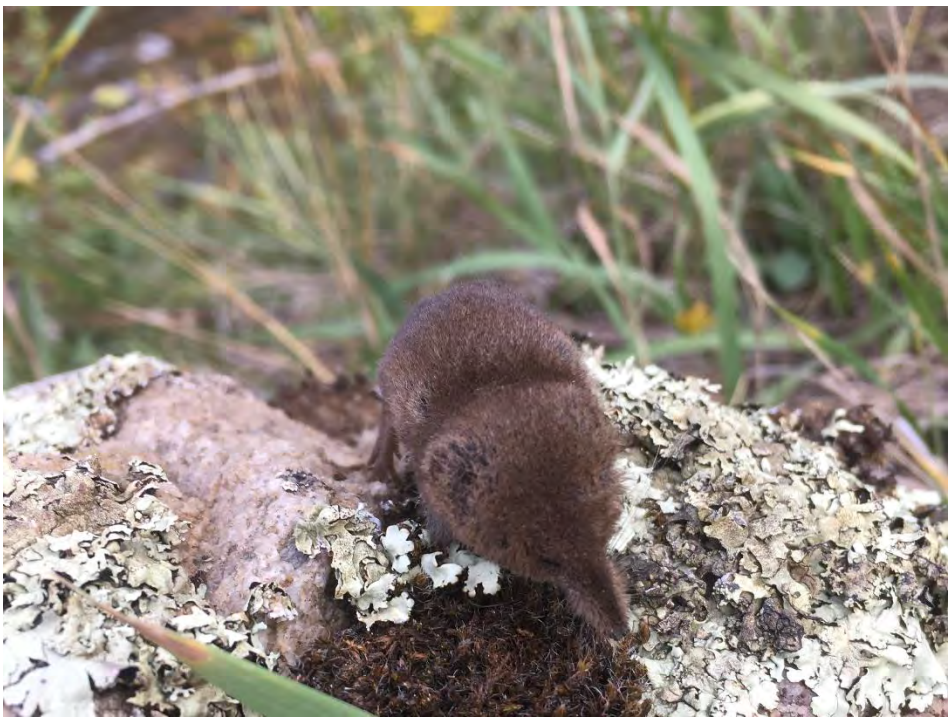


Our results show a dramatic loss of genetic diversity within this shrew. Compared to closely related mainland shrews, genetic diversity within the Pribilof Island shrew is orders of magnitude lower across all three types of genetic markers. This matches with our demographic analyses, which show a continuously shrinking effective population size over the last few thousand years, reflecting a long-term erosion of genetic diversity, despite local population densities in 2019 being abundant. We also find support for the rapid speciation of the Pribilof Island shrew from mainland shrews since island isolation ~14,000 years ago. Through our analysis of the SNP data we have also begun to identify areas of the genome that are potentially under selection in this shrew, hinting at adaptive change. This has allowed us to investigate the evolutionary processes that have led to this shrew's distinct genetic signal. Our results highlight the roles of both neutral genetic drift and adaptive natural selection in the speciation process, and confirm the uniqueness of the Pribilof Island shrew.

We are also working on putting these findings in context with the larger island biological community. This includes trying to resolve host-parasite relationships, investigating the co-evolutionary histories of these parasites alongside their host shrews, and understanding the role of introduced species such as potentially invasive molluscs in facilitating novel host-parasite interactions. We are preparing these data for publication in 2021.

Photo: Ben Wiens digging shrew pitfall traps with highschool students behind school on St. Paul in Elymus habitat.



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Population genomics of shrews in southeast Alaska

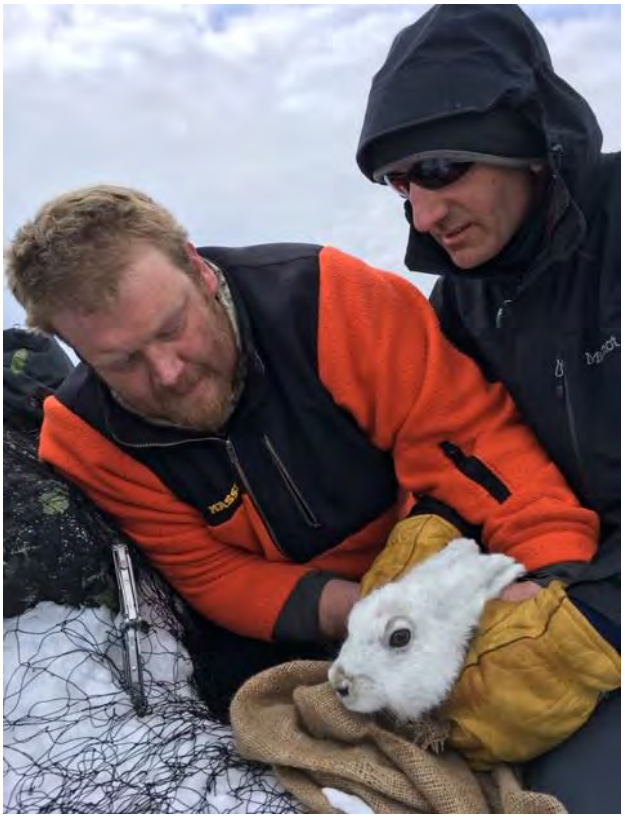
By Toni Androski

Toni Androski is a PhD student in Joe Cook's lab at the University of New Mexico. She is researching the population genomics of *Sorex monticola* and closely related species in the *Sorex vagrans* complex. The montane shrew has a large range spanning from northern Alaska to the Sierra Madre Occidental in Mexico with significant subspecific genetic structure. Three distinct lineages occur in the southwestern U.S., the northwestern U.S., and along the north Pacific coast, including the Alexander Archipelago and adjacent coastline west of the Coast Range. These lineages were shaped by Pleistocene glacial cycles, undergoing repeated isolation in ice-free refugia during Pleistocene glacial periods, followed by population expansion and secondary contact during warm interglacials. For the first stage of her research, she is using museum samples from the Museum of Southwestern Biology, the University of Alaska Museum of the North, and the Denver Museum of Nature and Science to conduct a range-wide population genomic assessment of *S. monticola*. With the detail afforded by whole-genome sequencing, she will identify the timing and geographic origins of population expansions and contractions throughout the Pleistocene and Holocene. Toni will also compare autosomal and mitochondrial genomic data to determine the extent to which reticulate evolution (e.g. hybridization) has shaped current patterns of diversity in the *S. vagrans* complex. She plans to conduct additional sampling in Southeast Alaska, where a contact zone between coastal and continental lineages of *S. monticola* is hypothesized to occur.

The Alaska Hare Project

By Rick Merizon

Alaska hare (*Lepus othus*) have long been a widely used recreational and subsistence food source for many residents of rural western Alaska. However, vital rates, geographic distribution, and current population trends remain very poorly understood. Current abundance of this species is believed to be well below average in most areas of its current range throughout western and southwestern Alaska. This study will attempt to document general movement and mortality of a small sample of individuals using GPS necklace collars. Individuals will be captured using live traps and bow nets. Secondly, this study will evaluate a long-term population monitoring technique by genotyping individuals through pellet collections at discrete locations throughout the species range in western Alaska. Due to the reclusive nature of this species, pellet related population monitoring may be the most efficient and cost-effective method for the ADF&G to institute a long-term population trend monitoring program. Overall project objectives are to 1) estimate population size and determine best methods for population monitoring, and 2) estimate seasonal/annual movements of Alaska hares and assess implications on management strategies.



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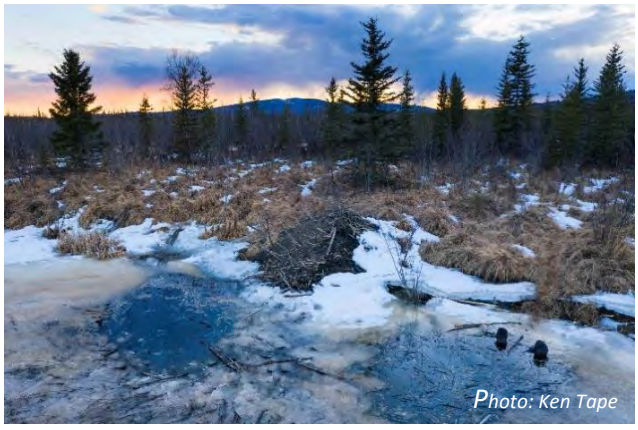
Beavers in Arctic Tundra Ecosystems

By Ken Tape

We are underway with a beaver research program that involves collaborations between USGS, NPS, and UAF, and involves funding from the USGS Water Quality Partnership, NSF, and pending collaborations with other land managers. Scientists leading this work are Ken Tape and Ben Jones (UAF), Mike Carey (USGS-ASC), Brett Poulin (USGS Boulder), Jon O'Donnell (NPS), Jason Clark (UAF) and others. These studies focus on mapping of current beaver ponds in select arctic tundra regions, and determining whether beavers colonized the area recently. We will be instrumenting beaver ponds to determine physical and biological impacts, such as thawing permafrost or changes to water quality or fish abundance. These objectives will provide a clearer picture of how extensive beaver engineering is in the arctic tundra, and what the implications are for terrestrial and aquatic lowland ecosystems.



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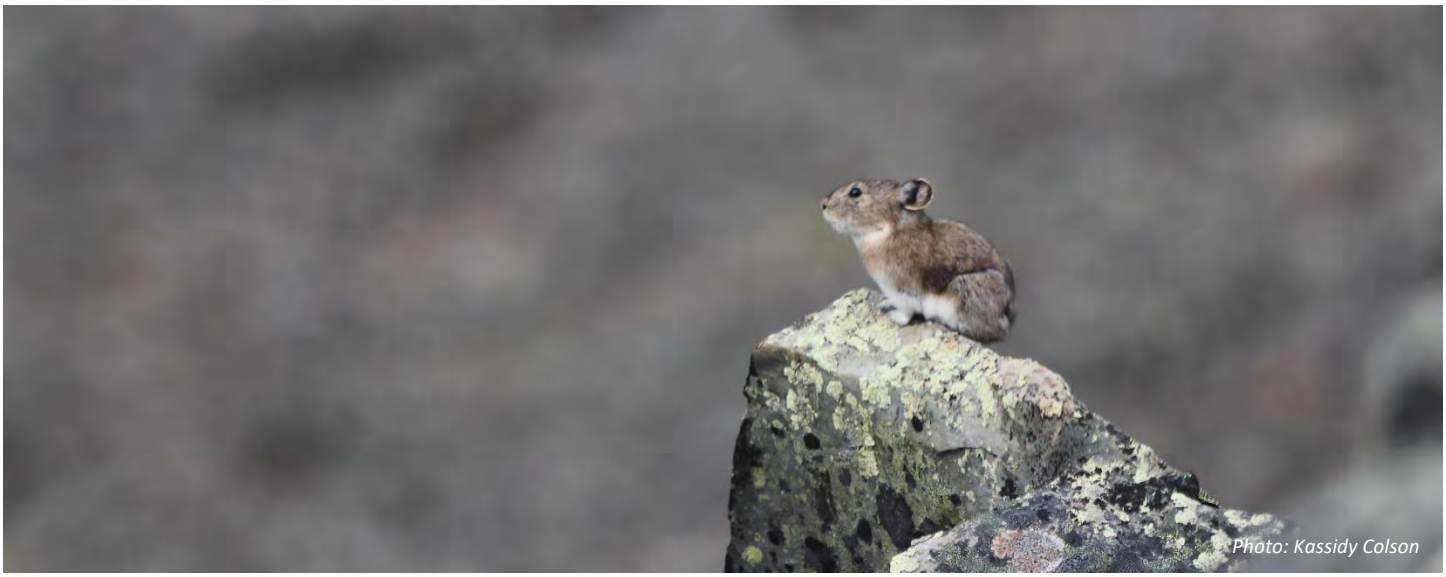

Collared Pika Surveys

By Jeff Wagner

Researchers from the Alaska Center for Conservation Science (ACCS) at the University of Alaska Anchorage began surveys for collared pika (*Ochotona collaris*) across the state of Alaska during the 2018 summer field season in an effort to understand patterns in pika occupancy and abundance across space and time. A total of 47 sites in alpine talus habitat were surveyed over two summers, including sites in Southcentral Alaska, Denali National Park, and along the Denali and Steese highways. At each site, ACCS field crews searched talus patches within a 250-m radius area using a double-observer transect approach. Many of the sites surveyed had historical records of occupancy by pikas from previous decades and most (but not all) of these sites were still occupied. Data analysis began in late 2019 by using spatially explicit distance sampling data collected along the transects to estimate site-level density of pikas. This analysis revealed several ecological variables that are potential drivers of local abundance, including latitude and mean summer temperature. The explanatory power of these, and other environmental covariates, will be further investigated in an analysis of occupancy based on haypile detection/non-detection data as a proxy for recent pika activity. Collectively, the information obtained over the course of this study will enhance our knowledge of how pika occupancy and abundance are influenced by environmental change in Alaska.

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Collared Pika Genetics

By Hayley Lanier

Despite being one of the most charismatic small mammals in Alaska, relatively little is known about the collared pika across much of its range. For example, while we know that pikas are talus specialists, we know very little about how the discontinuous nature of this habitat influences population structure or conservation risk for this species. Our research is focused on understanding the role of landscape features in shaping population persistence and connectivity in collared pikas – key parameters for understanding the potential persistence of populations in a rapidly changing arctic. Specifically, we are interested in quantifying rates of dispersal among pika populations and testing models of source/sink dynamics to determine the potential for

pika population survival as shrubline increases. Our field work relies on a combination of pika mark/re-sight to track demographic trends, distance sampling to quantify population size, and collection of ecological co-variates. We are also using a reduced-representation genomic approach (3RAD sequencing) to develop a wide panel of SNP loci with which to assess genetic diversity, relatedness, and gene flow among populations. Led by Dr. Hayley Lanier, Mammalogy Curator at the Sam Noble Museum at the University of Oklahoma, and OU PhD student Giovanni Tolentino Ramos, we are also working closely with Dr. Katie Christie, ADFG and the Alaska Pika Project, to use standardized survey and data collection approaches and with Dr. Link Olson, at the University of Alaska Museum, to broaden our geographic and temporal sampling.

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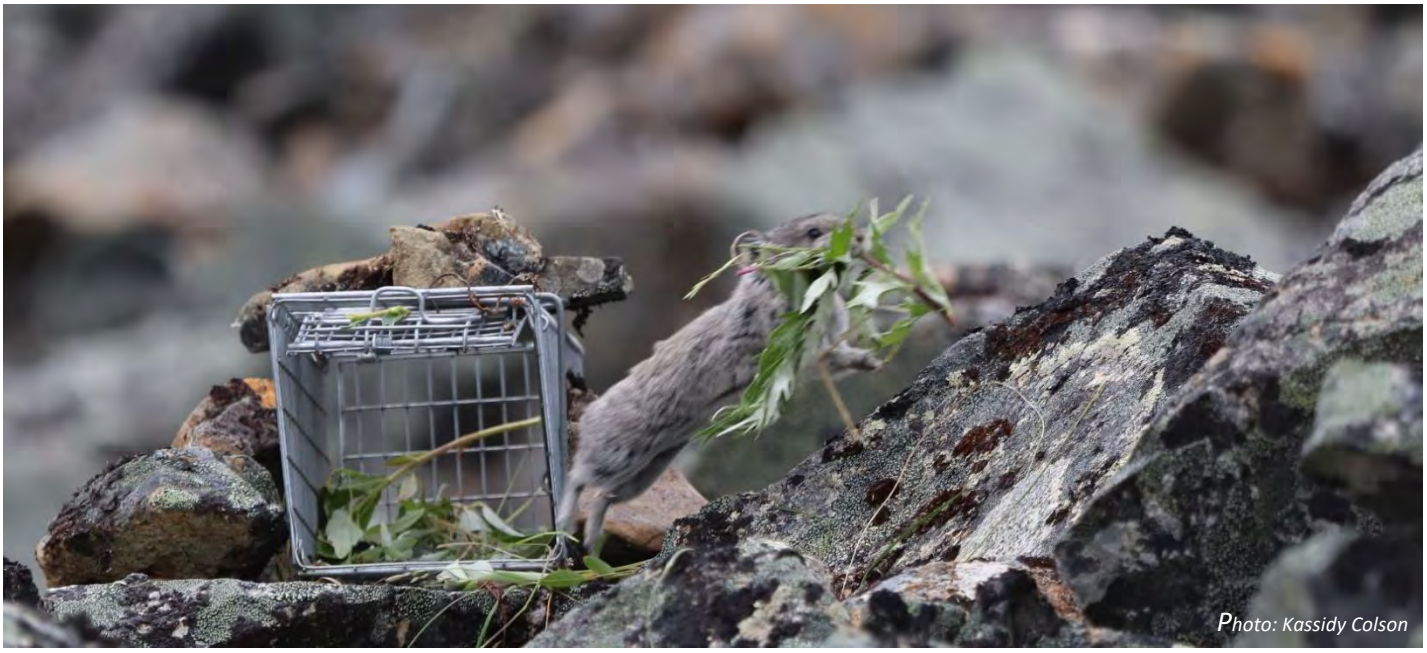

Collared Pika Survival and Diet

By Katie Christie

The ecology and behavior of collared pikas is currently not well understood, but this species may be vulnerable to shrub expansion and a warming climate in Alaska. In light of these concerns, there is an urgent need for information on how abundance, survival, and reproduction are influenced by environmental change across their range. Working with researchers from the University of Alaska Anchorage, Joint Base Elmendorf-Richardson, the University of Idaho, Washington State University, Colorado Mesa University, and the University of Oklahoma, we are a) conducting a mark-recapture study of pikas to estimate adult and juvenile survival, b) assessing stress levels of pikas across an elevational gradient, and c) quantifying dietary selectivity and nutritional quality of different forage types. So far, we have captured and tagged 134 pikas and sorted 143 winter food cache samples. We found that collared pikas cache a broad diversity (133 species) of shrubs, forbs, ferns, grasses, mosses, and lichens for the winter. We conducted 25 cafeteria trials with individual pikas to understand selection of different alpine shrubs, grasses, and forbs. We are currently analyzing the data and look forward to another productive field season in 2021.

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Herbivore-Plant-Soil Associations in the Warming Arctic

By Rebecca Rowe

My lab group is interested in the population dynamics and resource use of voles and lemmings. Our current project, with a team of interdisciplinary collaborators, focuses on how these herbivores impact carbon and nutrient cycling in the arctic tundra through consumption of live plant tissues, creation of winter nests, and deposition of wastes (urine and feces). To quantify these impacts, we are conducting mark-recapture surveys and using field experiments (enclosures) to measure a suite of plant, litter, and soil variables under different disturbance regimes (i.e., pulse, press, and no herbivory) at three sites (near Nome, Toolik Field Station, Utqiagvik) in northern Alaska.

Photo: Brooks Range, Wikimedia commons

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JBER Long-Term Ecological Monitoring (LTEM)

By Colette Brandt

Small mammal monitoring is part of the broader Long-term Ecological Monitoring (LTEM) management framework conducted on Joint Base Elmendorf-Richardson (JBER). In 2013, 122 permanent plots were established to monitor long-term ecological change. The sites are stratified across all vegetative communities throughout JBER and designed to complete 10 percent of the sites each year on a rotational basis.

LTEM sites have served as the basis for wildlife plot sampling that include breeding bird and small mammal surveys, as well as provide accurate assessment of the condition of vegetative systems on JBER necessary to managing the training and natural resource environment. The goal of this project is to provide key insight to the natural resources on JBER to support management decisions to ensure sustainability of these resources for mission support of natural training environments. Objectives of the small mammal monitoring are to: 1. Document small mammal species occurrence; 2. Collect data that will support long-term trend analysis; and 3. Document small mammal distribution within vegetation communities.

Starting in 2017, JBER also began collecting ticks from small mammals during the LTEM surveys. The JBER wildlife biologist works with the State of Alaska, Division of Environmental Health State Veterinarian (the Office of the Alaska State Veterinarian) for this portion of the study. This also contributes to the boarder tick study being conducted with the State of Alaska.

The LTEM is intended to meet installation-wide ecosystem monitoring and assessment goals set identified in the 2016 JBER Integrated Natural Resources Management Plan as mandated by the Sikes Act (16 United States Code 670 et seq.), Department of Defense instruction (DoDI) 4715.03 and Air Force Instruction (AFI) 32-7694.

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Photo: Colette Brandt

Northern Alaska Ecotone Research

By Andrew Hope

MS student Molly Jones working in my lab will focus her thesis on investigating hybridization dynamics between *Sorex cinereus* and *Sorex ugyunak* along the ecotone between boreal forest and Arctic tundra through northern Alaska. This research is one avenue stemming from extensive expeditionary small mammal sampling through the ARCN and Arctic-NWR federal lands and State lands across northern Alaska, including surveys by Joe Cook from ~2005 and also by myself and crews from 2010 onwards in a series of field sampling trips. These mammal resources are now yielding insight to contemporary evolutionary processes as well as ecological community turnover but it's ongoing work. This MS thesis is just starting, but I have preliminary evidence for hybridization between these shrews based on a large microsatellite dataset. Molly will be using genomic sequencing to better understand the extent and dynamics of gene flow among these species and spatially across Alaska.

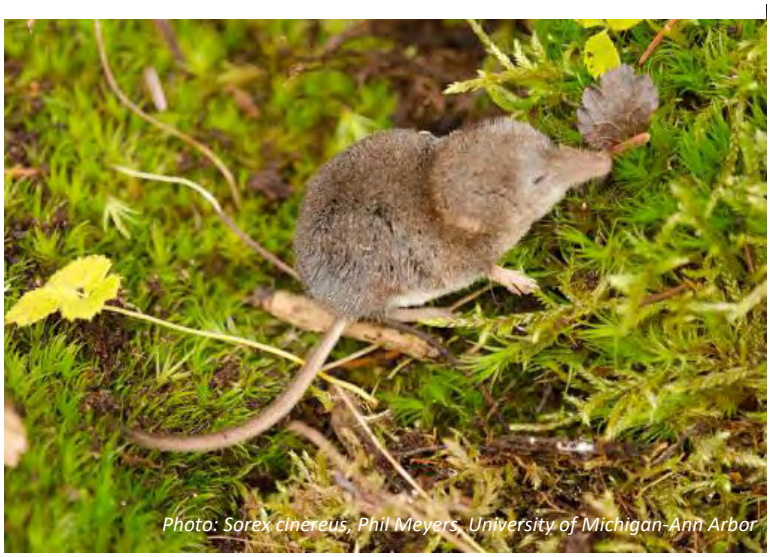

Photo: Sorex cinereus, Phil Meyers, University of Michigan-Ann Arbor

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Ranking small mammal species based on conservation needs

By Rachel Kelty

Interested in learning more about small mammal species in Alaska? Maybe you are looking for a recent literature review, or perhaps you need a method to prioritize species for conservation action. You can find conservation reports and range maps for over 100 Alaskan vertebrates, including 26 small mammal species, on our website. All the reports on our website have been updated and reviewed by species' experts in the last two years as part of the Alaska Species Ranking System (ASRS). The ASRS is a tool that synthesizes information and then ranks vertebrate taxa according to their conservation concern in Alaska. The ASRS was developed in partnership with the ADFG Threatened, Endangered, and Diversity Program.

If you end up consulting some of these reports, whether for personal interest or for work, please send us an e-mail. We'd love to receive your feedback to better serve the users, agencies, and organizations that benefit from these products.

Currently, Amanda Droghini (ACCS) and Katie Christie (ADF&G) are working on a manuscript that combines ASRS ranking results for small mammals in Alaska and an expert elicitation identifying threats to species of conservation concern.

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