ACA grants in biodiversity

biennial report

2016/2017

Alberta Conservation Association

Dear Conservationists,

It is my pleasure to present this Biennial Report of the ACA Grants in Biodiversity Grant Program supporting graduate level research. Now in our 23rd year of operation, this program continues to be an excellent initiative of which I am proud to be involved.

Our understanding of conservation and the environment in Alberta has once again benefitted from the work of these students. New insights continue to be uncovered in our understanding of iconic species such as elk, bighorn sheep and mountain goats in the foothills; current issues such as depletion of pollinators, CWD expansion and climate change are explored; and insights into intersection of nature and industry continue to be uncovered. All this work expands our knowledge of, and respect for, the natural heritage of this province. I trust this new knowledge will assist all of us to make wise decisions about these resources – whether you are an interested citizen or decision-makers in local communities, scientific arenas, or halls of government.

On behalf of the Alberta Conservation Association, I want to thank Syncrude for their ongoing financial commitment that makes this program possible. Further appreciation goes to the numerous scientific reviewers, members of the adjudication committee, Todd Zimmerling, the ACA Board, and Tracy Stewart in particular for the contributions they make to this program's success. Your combined commitment to the vision and support of scientific post-secondary education in this province is both admirable and necessary to shape upcoming generations of conservationists – and indeed all of us – that call Alberta home.

I trust you will find the following pages interesting, informative and inspiring.

Kind Regards,

Dr. John K. Pattison-Williams

Director, ACA Grants in Biodiversity

John K. Pattison
ACA Director

Tracy Stewart
ACA Adminstrator

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Photo Acknowledgements

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Cover photo: Julia Shonfield

A great gray owl (*Strix nebulosa*) perched on a pipeline post

Final Reports
of students funded
2014 and 2015
2 to 47

Progress Reports
of students funded
2016
48 to 57

Final Reports

Species Differences in White-tailed and Mule Deer Male Courtship Behaviour

Jason I. Airst
University of Winnipeg, M.Sc.
Dr. Susan Lingle, Supervisor

Looking at deer through a spotting scope. Credit K. Saboraki

White-tailed and mule deer are closely related species that coexist on many sites in western North America. Although studies have described aspects of courtship behaviour for each species alone, no quantitative comparisons have been made where the species live together. To test whether differences described in the literature reflect fundamental species differences or are instead due to habitat conditions, I conducted continuous observations of 229 males, which ranged in size, on an open grassland study site during the 2014 and 2015 breeding seasons. As reported elsewhere, males of both species almost exclusively used tending bonds (serial pair-breeding) during late-stage courtship, even though this habitat was extremely open and might be expected to lead to harem breeding (male courting multiple females at once). Mule deer males were more likely than white-tailed males to court females in groups with multiple males and females, and tolerated other males courting in the same group at the same time. In contrast, white-tailed males almost exclusively tended females in isolated pairs, due in part to increased aggression between white-tailed males during late-stage courtship. Species differences in male courtship behaviour were consistent with species differences in antipredator and social behaviour, and were not due to varying habitat conditions.

Thermal Adaptation in a Parasitic Nematode of Wild Sheep in North America

O. Alejandro Aleuy
University of Calgary, Ph.D.
Dr. Kathreen Ruckstuhl, Supervisor
Dr. Susan Kutz, Supervisor

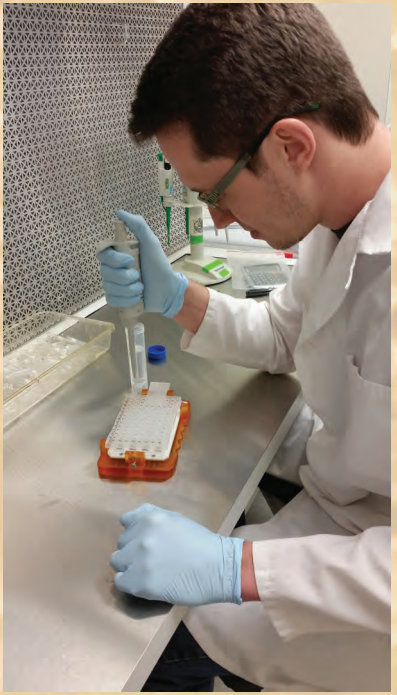
Since parasites represent at least half of the biodiversity of the world, the effect of climate change on host-parasite interactions is gaining increasing attention. My research investigated how a nematode species reacts to changing temperature and how phenotypic traits associated with temperature varies across different locations. I focused on the free-living stages of *Marshallagia marshalli*, a nematode that infects the abomasum of wild sheep. Although it has been negatively associated with body condition and pregnancy in Dall's sheep, little research has been conducted on this parasite in North America. After an extensive survey, I determined that *M. marshalli* is an important component of the parasitic fauna of bighorn sheep and Dall sheep. Prevalence rates, among 26 populations sampled from New Mexico to the northern Yukon, ranged from 50 to 100%. My experimentation on the free-living stages of *M. marshalli* determined that it is capable of developing from egg to infective larvae and surviving for up to 6 months using only internal reserves. *Marshallagia marshalli* from Alberta has a wide thermal range and is capable of developing in less than 3 weeks in a range of temperatures between 17-25ºC. When comparing larvae sourced from New Mexico, Idaho, Alberta, and the Yukon, size variation was greater in populations from higher latitudes. This may be an adaptation to cope with a greater varying thermal environment in higher latitudes. Accounting for differences in local thermal adaptation among parasites will help to predict the effect of climate change on parasite-host dynamics and life histories.

Incubators made by Alejandro to test thermal tolerance in *M. marshalli*

Impacts of Harvest and Management Strategies on Walleye Populations

Brandon E. Allen
University of Calgary, M.Sc.
Dr. Sean Rogers, Supervisor

Managed populations exhibit different phenotypic and genetic signatures from their natural counterparts. These phenotypic and genetic signatures are a result of size-selective harvest, artificial stocking, and translocation of species outside their native range. I examined the effects of harvest on growth and genetic structure of Walleye (*Sander vitreus*) in Alberta which are a heavily managed species currently recovering from population collapse. First, growth curves were modeled using data from 53 populations, each of which was managed using a variety of management strategies. The variation in growth curves were found to be associated with management strategies and abiotic lake properties such as lake depth and surface area. This suggests that populations under similar environmental and management conditions exhibit similar patterns in growth. Second, tissue samples were collected from 6 populations between the years 2000 and 2005, in addition to Smoke Lake having historic scales collected from 1973. Individuals were sequenced in order to characterize their genetic composition. I found that lakes which have been managed as separate populations may in fact be a singular genetic cluster. Furthermore, we observed a large reduction in estimates of genetic diversity between 1973 and 2005 in Smoke Lake which was likely a result of overharvest in this population. Collectively, this research illustrated that harvest might be affecting the genetic diversity of these populations, and in turn affecting growth curves. This emphasizes the importance of using both genetic and phenotypic data in order to assess the effects of harvest and management in our fisheries.



Brandon using magnetic beads to select for large fragments of isolated Walleye (*Sander vitreus*) DNA

Mapping Amphibian Distribution in Northeastern Alberta Using Bioacoustic Surveys

Natasha Christine Annich
University of Alberta, M.Sc.
Dr. Cindy Paszkowski, Supervisor
Dr. Erin Bayne, Supervisor

Habitat loss and fragmentation is a major concern for rare species in the northeastern corner of Alberta. The growth of the energy sector in this area is cause for alarm and demands an evaluation of the rare animals occupying the landscape. Wetlands in this area are poorly understood, and there is a need for further research to evaluate distribution and habitat use by amphibian species. Pond-breeding amphibians require suitable aquatic and adjacent terrestrial habitats to satisfy both larval and adult life stages. Both Canadian toads and western toads are listed as data deficient within the province, indicating a lack of knowledge surrounding these species. Audio recorders were used to identify unique locations of both species. I used bioacoustic detections of toads to generate habitat models and better understand what key landscape features were important for each species. Both toads showed a strong selection for sandy environments and further demonstrated the need for both open water and upland habitats. In an effort to account for noise pollution due to human activity, I am also looking at using the bioacoustic data to compare the effects of chronic industrial noise to passive traffic noise on amphibian calling behaviour.

Natasha and one of her study species, the Canadian toad

Reliable Warning Signals For the Prevention of Wildlife–Train Collisions

Jonathan Backs
University of Alberta, Ph.D.
Dr. John Nychka, Supervisor
Dr. Colleen St. Clair, Supervisor

Trains collide with and kill wild animals, potentially threatening vulnerable populations of animals and degrading the ecosystems to which these animals contribute. I invented and built an inexpensive electronic wildlife warning system to provide animals with signals of train approach that could augment the animals' own senses. I predicted that presenting these signals at a consistent time in advance of train arrival (30 seconds) will cause animals to learn to associate the signals with approaching trains and leave the tracks earlier than they would if the warning signals were not present. I am currently testing the system on the Canadian Pacific railway within Banff National Park, and preliminary data are consistent with my predictions. This technology may make it possible to reduce collisions with grizzly bears in the mountain parks and has potential application to many other locations where railways and wildlife co-occur.

Train-activated camera trigger (top) and tree-mounted remote camera (bottom), used to observe animals as they respond to trains and track-mounted warning signals

Using Genetic Tools to Characterize Alberta Bull Trout Populations

Emma Carroll
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Dr. Steven M. Vamosi, Supervisor

Across its native range, the extent and abundance of Bull Trout (*Salvelinus confluentus*), Alberta's provincial fish, are in decline. This threatened native species is dependent on extensively connected, cold, clean headwater habitats and is sensitive to fragmentation from land use changes. Habitat specificity and sensitivity can produce genetic isolation, yielding genetic patterns that, when ignored, can impede the success of conservation efforts taken to protect Bull Trout across Alberta. I aimed to characterize Bull Trout populations within the Athabasca River basin using molecular tools to reveal genetic diversity and differentiation of each population and compare these metrics to Bull Trout populations in neighbouring North and South Saskatchewan River basins. In my study, I sampled Bull Trout across Alberta's Rocky Mountain and Eastern Slope regions and extracted DNA from a non-lethal fin clip taken from each individual. I found that Bull Trout populations genetically clustered based on river basin of origin, showing genetic differentiation from one another, yet with similar levels of genetic diversity. Within the Athabasca River basin, I uncovered five genetically differentiated populations; some contained within 10 kilometers while others encompassed hundreds of kilometers. At the river basin level, my results suggest longstanding evolutionary differences, supporting the need for conservation designation at this scale. Within the Athabasca River basin, my results create a baseline understanding of Bull Trout population genetics within the upper reaches of the Athabasca River basin, revealing genetic differences between populations that should be considered when deciding how and where to implement management and conservation efforts.

Emma returning a Bull Trout to the lake after taking a non-lethal fin clip

Response of Ground-Beetle (Carabidae) Assemblages to Harvest and Wildfire Disturbances in Lodgepole Pine Forests of Western Alberta, Canada

Vincent Del Bel Belluz
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Dr. John Spence
Dr. Pádraig J. Duignan

Periodic forest disturbance from human activity or natural events provide a mosaic of different habitats on the landscape. Conditions in these habitats differ based on the time since the disturbance event and thus heterogeneous patterns of forest types on the landscape allow for proliferation of many faunal communities. Therefore, there are higher levels of biodiversity than if the landscape was a homogenous expanse of just one forest condition. Exploring the dynamics of how biodiversity differs between forests of different successional stages post-disturbance is important to understanding the long-term effects of how fire and harvest activity affect species assemblages on the landscape. This study explores how carabid assemblages change through post-harvest and -fire regeneration, with a focus on late-stage succession of forests more than 30 years in age. In addition, there is a historical record of carabids in these forest stands that have allowed for a direct comparison of assemblages since last sampling 20 years prior. The results have shown that assemblages in stands that are more than 40 years old have shown signs of convergence to old-growth forests that are more than 120 years old. This includes those that are from fire and harvest disturbances, which are different only in younger stages of succession. In addition, *Carabus chamissonis*, a large bodied, old-growth specialist species has seen a substantial decrease in its abundance from the landscape in the 20 years since last sampling has been observed. Overall, this means that harvest activity does not immediately pose a threat to most carabid assemblages, if done in a way that allows for habitat heterogeneity. However, there are clear concerns for species that require stable and adequate reserves of old-growth forests.

Pinned specimen of *Calathus advena*, one of the more common carabids caught during the study

Genetic Patterns of Terrestrial Mountain Snails in Southern Alberta

Zach W. Dempsey
University of Lethbridge, M.Sc.
Dr. Theresa Burg, Supervisor
Dr. Cameron Goater, Supervisor

Terrestrial mountain snails face many unique problems, one of which is dispersal. Mountain snails are found on 'sky islands,' isolated and elevated plateaus surrounded by lowlands. A primary goal of my research was to determine the population genetic patterns of mountain snails in Cypress Hills, a sky island in the southeast corner of Alberta, and the Rocky Mountains near Waterton and Crowsnest Pass. I collected samples from 342 snails and used DNA markers to determine their relationship to other populations. Two sizes of mountain snails are found in Cypress Hills: a large snail (~ 15.6 mm) that prefers aspen covered slopes, and a small snail (~ 8.5 mm) that prefers dry, shrubby slopes. The small snails were *Oreohelix cooperi*, an endangered species believed to be only found in the Black Hills and the large snails were two different species; one that has never been described and the other a widespread species. The widespread species was also found in the Rocky Mountain study site with a second closely related group which evolved in situ. My data suggest at least three independent colonization events of Cypress Hills and one of the Alberta Rockies with a complex history stretching back to the last ice age.

Mountain snails awakening from hibernation. These snails were used in breeding trials to determine if these species can hybridize

Spatial Heterogeneity of Buffaloberry in Relation to Forest Canopy Patterns and Its Importance for Grizzly Bear Resource Selection

Catherine K. Denny
University of Alberta, M.Sc.
Dr. Scott Nielsen, Supervisor

Spatial heterogeneity inherent in the environment influences how animals respond to their surroundings, especially as it relates to the variability of their food resources. Heterogeneity in specific elements of vegetation, such as the spatial pattern of a single plant species, can be defined based on patch distribution and abundance. Patterns of plant food resources at the landscape-scale are particularly important for wide-ranging wildlife species that perceive surrounding heterogeneity at a broad spatial extent. Canada buffaloberry (*Shepherdia canadensis*) is a shrub common to montane and boreal forests of western North America with its fruit being a primary seasonal resource for birds and mammals, including grizzly bears (*Ursus arctos*). My objectives were to relate the spatial heterogeneity of buffaloberry shrubs to forest canopy patterns, and to examine how buffaloberry shrub heterogeneity affects grizzly bear resource selection during the fruiting season. To address these, I measured forest canopy and buffaloberry shrub presence along 2-km transects in the Rocky Mountain foothills of west-central Alberta, Canada, and analyzed grizzly bear GPS radio-telemetry data. I found that buffaloberry patch heterogeneity was positively related to evergreen canopy heterogeneity, but was unrelated to that of deciduous canopy. Surrounding buffaloberry shrub abundance and variability in fruit density were the most important factors explaining grizzly bear habitat selection during the fruiting period. Clarifying the landscape heterogeneity of food resources and how this influences animal habitat use can provide insight into how consumer-resource interactions may be altered in the future, and can thus inform wildlife conservation and management.

Ripe buffaloberry fruit in the Rocky Mountain foothills of west-central Alberta

Hormones Help Reveal the Effects of Disturbance on Grassland Songbirds

Paulson G. Des Brisay
University of Manitoba, MNRM
Dr. Nicola Koper, Supervisor
Dr. Marty Leonard, Supervisor

The mixed grass prairie region of Canada is currently undergoing rapid oil development. This human disturbance may have ecological impacts that are not detectable using species abundance and distribution. I examined how oil wells and the associated roads influence the health of Savanah sparrows, Baird's sparrows (a species of special concern), and chestnut-collared longspurs (a threatened species). I took blood samples from birds living near and far from active oil wells around Brooks, Alberta and measured levels of corticosterone, which is a hormone that increases when a bird is living in stressful conditions. My results suggest that even if birds don't avoid oil wells and roads they may be impacting their health. Roads were more commonly associated with deviations from normal levels of corticosterone, and are associated with impacts on settlement patterns, physical condition, and reproductive success. Reducing the amount of roads constructed and clustering future oil wells may help reduce the impact of these disturbances on grassland bird communities.

A dutiful male chestnut-collared longspur preparing to enter a trap in order to feed his nestling. Even after being captured and blood sampled they always return to the nest to continue parental care

Utilizing a Moisture Index to Identify Plant Diversity and Resilience

Laureen F. I. Echiverri
University of Alberta, M.Sc.
Dr. Ellen Macdonald

To identify areas to target for conservation, we need to improve our ability to identify diversity patterns across a landscape. In addition, as anthropogenic activity continues to expand, we also need to better understand how human activity affects biodiversity. In my study, I explored the use of the depth-to-water index—a moisture index derived from remotely-sensed topographic data—to address these research gaps. In particular, I examined the ability of the depth-to-water moisture index to identify understory vegetation diversity patterns in three boreal forest types: conifer-dominated, mixedwood, and deciduous-dominated stands. I also explored how the relationship between the depth-to-water index and the understory vegetation were affected by harvesting. I found that the depth-to-water index was related to the understory vegetation, with the relationship differing between the three forest types. For example, I found higher plant diversity and abundance on the drier sites of conifer-dominated stands. In addition, I found that these relationships were affected by harvesting. Unlike, the un-harvested stands, harvested conifer-dominated stands had higher diversity on wetter sites. Lastly, I found that the effects of harvesting within each forest type varied along the depth-to-water gradient. For example, in conifer-dominated stands we found that wetter sites were less resilient to the effects of harvesting than drier sites, while in deciduous-dominated stands, drier sites were less resilient. My results show the depth-to-water moisture index can identify patterns in understory diversity and resilience to harvesting and can therefore be used to select areas to be targeted for conservation.

Trientalis borealis **found in the understory of boreal mixedwood forests**

The Influence of Pathogen plus Precipitation on Limber Pine

Barb Gass
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Dr. Amy Angert, Supervisor

Multiple disturbances including an introduced fungal pathogen (White Pine Blister Rust) and climate change has made the native limber pine an endangered species in Alberta and caused its recommendation for federal Species at Risk listing. Although known for its capacity to tolerate harsh environments, how this tree will respond to these combined stressors is unclear. Resilience to fluctuating conditions requires diversity within a species, and because needles are the focal point for rust infection as well as critical for survival due to their role in energy capture and water loss, I examined the distribution and extent of variation in limber pine needle traits to determine if they could be used to indicate successful adjustment to novel environments. Using needles of trees originating from Alberta to New Mexico and comparing those that had been exposed to the rust with their counterparts that had not, I found a correlation between needle traits and rust-resistance that may interrelate with concurrent water availability changes. Results suggest that exposure to the rust causes an increase in leaf size in survivors to compensate for the cost of defense. However, because larger leaves require additional water, this implies that effective rust-resistance may be dependent on future climate scenarios, with increased rainfall potentially buffering resistance or drought stress accentuating it, therefore leading to higher mortality. Additionally, to facilitate future management and conservation strategies, seedlings from my original research have been contributed to another adaptation study as well as to a restoration project.

Barb sampling needle tissue of a limber pine in the Crowsnest Pass

Monitoring of Amphibians in Jasper National Park Using eDNA Metabarcoding

Haley Glass
University of Calgary, M.Sc.
Dr. Steven Vamosi, Supervisor

Amphibian monitoring surveys in Jasper National Park (JNP) are currently performed every three years and requires a lot of manpower and expert identification skills in difficult sampling conditions to search for signs of its five amphibian species: the wood frog, Columbia spotted frog, western toad, long-toed salamander, and boreal chorus frog. Aquatic species leave DNA signatures in the water in the form of feces, urine, sloughed tissue, and mucous, which is known as environmental DNA (eDNA). My research objectives were to assess the feasibility of an eDNA monitoring survey in JNP and design a metabarcoding primer to detect the five amphibians of interest. I sampled 21 ponds in May 2016 that had amphibians present in the past three sampling periods, and no connection between sites to prevent possible spread of DNA. Visual surveys were performed following the JNP amphibian sampling protocols and three eDNA water samples were taken at each site. Back in the lab, I was able to successfully extract the eDNA from samples. I then tested the metabarcoding primers I designed and two additional primers from the literature. The primers were successful on positive controls but were unable to amplify DNA in the water samples. I modified the lab protocols to try and increase sensitivity, but ultimately too many inhibitors were detected and I could not proceed with DNA sequencing. My research concluded that eDNA monitoring is not a feasible method for surveying amphibian populations in JNP, likely due to specific conditions of its stagnant ponds.

An adult wood frog caught in a small pond in western JNP

Peatland Reclamation on an Oil and Gas Mine Site

Mallory Hazell
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Dr. Lee Foote, Supervisor

A peatland is wetland ecosystem where the production of plant biomass exceeds the rate of decomposition, resulting in the build-up of dead and decaying plant material. Peatlands have important functions regionally and globally, such as housing rare plant species, regulating water flow, maintaining landscape biodiversity, purifying water, and storing carbon. Unfortunately most of Alberta's peatlands are located in the boreal region and peatlands have therefore been greatly affected by oil and gas mining. New provincial directives require that some peatlands be reclaimed to peatlands (instead of other wetland types); however, natural peatlands take thousands of years to develop, and are therefore difficult to re-create. My study is located in Syncrude Canada's constructed Sandhill Fen, which serves as an instrumental research watershed, and looks at the use of peat and water sedge (*Carex aquatilis*) for fen reclamation. I am interested in what happens to peat after it's been placed for reclamation and what combination of peat depths and moisture levels provide the best conditions for the survival and spread of water sedge. Preliminary results suggest that peat shrinks in the first two years after it's been placed, and that 30 cm of peat shrinks more significantly than 5 cm of peat. This has important implications for deciding what initial peat depths are necessary to achieve an end goal. In addition, moisture appears to be a better indicator for water sedge survival than peat depths, and therefore peat may not be required to establish a water sedge community for fen reclamation projects.

Mallory measuring peat depths and water sedge cover in her plots. Two plots can be seen on the right side where wooden stakes mark their corners

Assessing Recreation Impacts on Large Mammals in Kananaskis Country, Alberta

Cheryl Hojnowski
University of California, Berkeley, Ph.D.
Dr. Justin Brashares, Supervisor

Grizzly bears are threatened by expanding human activities throughout their range. In Kananaskis Country, recreation is increasing steadily, and some animals appear to be adjusting their behavior to coexist with visitors. This project aims to understand how grizzly bears and other large mammals modify their behavior in response to human use in the front country. It also seeks to identify small-scale, front-country "refugia" for grizzly bears. In 2015, I fitted 4 adult female and 1 adult male bear with GPS collars, which were programmed to take locations every 30 minutes. I also continued to monitor one adult female from 2014. To better understand human use of the landscape, I deployed a combination of trail counters, remote cameras, and vehicle counters to quantify hikers, bikers, and vehicles on 23 trails and 2 major roads in the Kananaskis Valley and Peter Lougheed Provincial Park. Remote cameras also recorded large mammal presence on trails. Over the coming year, I will analyze these data to determine 1) grizzly bear movements and habitat selection in response to human use dynamics, and 2) wildlife use of trails in relation to timing and intensity of recreational activities.

Field assistant Sandra deploys a camera on the Three Isle Lake Trail. ACA funding allowed the project to train four undergraduate and Master's students

Interactions Between a Gall-Wasp and Its Invasive Hawkweed Host

Gregory D Holmes
University of Lethbridge, M. Sc.
Dr. Rob Laird, Supervisor
Dr. Rosemarie DeClerck-Floate, Supervisor

My goal was to explore the interactions between a potential biocontrol agent, the gall-wasp *Aulacidea pilosellae*, and their invasive *Pilosella* hawkweed hosts. The first experiment used soil nitrogen availability and wasp presence to explore their impact on *P. officinarum* (mouse-ear hawkweed) performance. My results indicate that increased nitrogen availability improves plant vegetative growth, while also interacting with *A. pilosellae* to reduce vegetative growth. As the *P. officinarum* host plants cannot compensate for the resources removed by galling and insect feeding, this suggests that this wasp may be an effective agent at controlling this invasive species. However, I did not detect any nitrogen effects on wasp performance, though further experimentation is suggested to elucidate multigenerational effects of improved soil nitrogen on wasp performance. The second experiment explored how the host species utilized for galling affects wasp performance through two generations. This allowed me to investigate maternal effects, which appeared to only influence offspring performance when the mother had utilized *P. caespitosa* (meadow hawkweed), but not *P. glomerata* (yellowdevil hawkweed). I subsequently discovered that *P. caespitosa* is also the better offspring host, with significantly larger galls and heavier larvae arising from this host than *P. glomerata*. This wasp has been observed galling several hawkweed species in their native range, so these results may help indicate the appropriate *Pilosella* species to target in a biocontrol programme. Similarly, identifying the underlying site fertility that increases agent performance and/or impact on the target weed species has important implications for present and future biocontrol programmes. plant biodiversity in mature lodgepole pine ecosystems.

How we collect large numbers of wasps as they emerge in the lab. They are very small, and chew their way out of the galls. These are all sexually mature females that can immediately start laying eggs within the leaf midribs of their host

Forestry and Conspecific Attraction Affect Canada Warbler Habitat Use

Anjolene R. Hunt
University of Alberta, M.Sc.
Dr. Erin Bayne, Supervisor

Conservation of avian species at risk requires information defining important habitat and threats to that habitat. However, conclusions about habitat use and responses to threats may be inconsistent when behavioural phenomena, rather than habitat cues, drive use of an area. Growing evidence suggests that conspecific attraction may drive use patterns by some bird species (i.e. individuals are more likely to use areas near members of their own species). While forestry has been identified as a threat to Canada Warbler habitat in some regions of the breeding range, studies in other regions suggest it can create productive breeding habitat. In 2014 and 2015, I tracked Canada Warblers in boreal Alberta to quantify how forestry and conspecific attraction influence habitat use and reproductive activity at multiple scales. I found fewer Canada Warblers in areas with more harvesting. When they were present in harvested areas, they were typically near adjacent unharvested forest and near conspecifics, and spent more time in parts of their home range nearest to conspecifics. I did not detect any impacts of forestry on reproductive activity, but found that individuals in areas with high densities of conspecifics had lower pairing success. These results suggest that forestry poses a threat to Canada Warblers in Alberta, and that reported use of harvested areas may be influenced more by conspecific attraction than by attributes of harvested areas themselves. Hence, protection of unharvested stands in Alberta, particularly where territories are already established, should be prioritized to support the species' clustered distribution.

This male Canada Warbler has been fitted with a unique coloured leg band combination so researchers can identify and track him throughout the breeding season

Host Phenology and Potential Saprotrophism of Ectomycorrhizal Fungi in the Boreal Forest

Stefan F. Hupperts
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Dr. Justine Karst, Advisor
Dr. Simon Landhäusser

Ectomycorrhizal plants allocate a portion of photosynthetically derived carbon to ectomycorrhizal fungi - organisms that colonize roots to acquire carbon and provision nutrients to their hosts. Seasonal changes in photosynthetic capacity of trees induce fluctuations of carbon stored in roots, and may therefore influence the amount of carbon provided to ectomycorrhizal fungi. Though traditionally considered dependent on trees for carbon, recent work suggests ectomycorrhizal fungi can mobilize carbon from soil organic matter and plant litter. Two models exist to explain carbon mobilization by ectomycorrhizal fungi. Under the 'saprotrophy model', decreased carbon allocation may induce saprotrophic behavior in ectomycorrhizal fungi, resulting in the decomposition of organic matter to mobilize carbon. Alternatively, under the 'nutrient acquisition model', decomposition may instead be driven by mining by fungi for nutrients locked within carbon compounds. I tested whether phenology-induced shifts in carbon stored in ectomycorrhizal roots of aspen affected secretions of organic matter degrading enzymes by ectomycorrhizal fungi. Ectomycorrhizal roots from aspen were collected across eight sites in northeastern Alberta and analyzed during four phenological stages: winter, spring, summer, and autumn. I found enzyme secretion to be relatively constant across phenological stages. However, low-biomass ectomycorrhizal fungi appear to have a greater ability to degrade complex carbon compounds when compared to high-biomass ectomycorrhizal fungi, suggesting that ectomycorrhizal fungi have discrete functional traits. Further, these findings support the nutrient acquisition model, and suggest that decomposition by ectomycorrhizal fungi is driven by nutrient foraging rather than saprotrophy.

Stefan collecting ectomycorrhizal fungi from roots of mature aspen in northern Alberta

Connectivity of Alberta Ruffed Grouse Populations as Revealed Through Genetic Analysis

Ashley Jensen
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Dr. Theresa Burg, Supervisor
Dr. Andrew Iwaniuk, Supervisor

Habitat fragmentation can prevent individuals from dispersing across the landscape, effectively inhibiting connectivity between populations. Moreover, the presence of suboptimal habitat between populations may also play a role in determining population connectivity. Grasslands and contiguous coniferous forest are unsuitable habitat for ruffed grouse (*Bonasa umbellus*), and can therefore act as barriers to movement for this species, which requires early successional mixed forest. I obtained genetic samples from 156 ruffed grouse through a combination of live-trapping and collecting sample donations from hunters throughout Alberta. This research is a first look into the genetic structure of ruffed grouse, and the results reveal two genetically distinct groups: one in southern Alberta, and the other encompassing central and northern Alberta. Furthermore, these two groups are highly differentiated from all other surveyed populations in North America. When patterns of population structure were analyzed for correlations with environmental variables, the results suggested that a combination of physical barriers (i.e. mountain ranges), and the distribution of suitable habitat for the species are mediating gene flow (and therefore population connectivity) in Alberta. My work illustrates the importance of evaluating how environmental variables influence gene flow at multiple spatial scales, and adds to the growing body of evidence that environmental factors impacting population connectivity may be complex, and even marginal habitat may restrict connectivity. These results could aid in predicting how populations of ruffed grouse will respond to changing environmental conditions in the future, and provide the necessary information to maintain the integrity of vital movement corridors between populations.

Ashley holds a live-trapped ruffed grouse that has been sampled and is about to be released

Detection of Grizzly Bear Predation Using GPS Collar Data

Joseph Kermish-Wells
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Dr. Marco Musiani, Supervisor

Identifying predation events is important in predator-prey studies to accurately determine kill rates of predators. However, obtaining this information for large predators is often restricted by the cost and labor of fieldwork. Past studies using telemetry and site visits to find predation events were often investigated long after the kill event due to limited data retrieval options on collars and also to decrease researcher-carnivore-conflicts. These issues lead to reduced identification of carcass remains because of site deterioration and consumption by other predators or scavengers. For this reason, frequency with which data are received from collars can also be problematic, particularly if prey carcasses are small such as neonatal ungulates. In this study, I created a methodology to detect predation events of omnivorous grizzly bears. Applying this method to data downloaded from satellite-based Global Positioning System (GPS) collars on grizzly bears, I successfully reduced delays between predation events and site visits and identified the majority of predation events previously identified using random site visits. I also used a modelling approach to assess the probability of finding a predation event using only space-time information derived from data collars, and individual bear characteristics such as bear age and sex. Given the presence of a predation event, I also successfully predicted whether a predation event contained a prey of small or large body size. My GPS-satellite data combined with my methodology makes fieldwork more efficient while improving detection of predation sites.

Joseph working in the field

Determinants of Colony Success in Wild Bumble Bees

Rola A. Kutby
University of Calgary, Ph.D.
Dr. Ralph Cartar, Supervisor

My research examines how a suite of environmental factors affected the establishment, growth and reproduction of bumble bee colonies. I studied 13 sites distributed along 300 km of the eastern slopes forests of SW Alberta. At each site, I set out 24 nest boxes (12 in ground, 12 on trees) for potential occupation by nest-searching spring queens. Their fate was related to environmental traits measured at each site in each month from June to August, including: food availability (flowers), food continuity (persistence of flowers), level of parasitoids, number of competitors, and weather. Food availability and continuity were examined by estimating flower abundance and diversity among six 150 m transects in each site three. Monthly parasitoids loads were estimated by measuring emergence of parasitoids of 20-30 bees captured at each site, and reared in the lab. Weather data were obtained from 13 different weather stations, each within 50 km of my sites. Competitor densities were obtained monthly during floral censuses, and from densities of insects observed to visit flowers captured in 6 sets coloured pan traps, each set with 12 traps, in each site. My analysis of these data are ongoing, but there are already detectable effects of weather, floral abundance, and food continuity on colony performance. Outcomes of my research can inform conservation and management of temperate forest bumble bees and their plant mutualists.

Rola installing bumble bee boxes and recording GPS locations

Coyote Occurrence Relative to People in Glenbow Ranch Provincial Park

Jamie Heather Lantz
University of Calgary, M.Sc.
Dr. Shelley M. Alexander, Supervisor

Lethal coyote control is often used as a mechanism to reduce human-coyote conflict. However, coyote persecution may lead to pack fragmentation, resulting in more females breeding. Over the long term, this may increase coyote numbers. The ineffectiveness of lethal control as well as the important ecological role of coyotes demonstrate that human-coyote coexistence is crucial. Consequently, my research explored how coyotes and people shared Glenbow Ranch Provincial Park, Alberta with the goal of providing insight on potential management strategies. Between June 2014 and June 2015, I used non-invasive methods, including scat surveys and camera trapping, to collect data on high and low human use trails. Results indicated that coyote trail occurrence was highest during the fall and winter compared to the summer. This pattern may have been related to a decrease in the number of park visitors as winter neared. Additionally, coyote occurrence was greater on trails during the nighttime versus the daytime and morning/evening twilight periods; coyotes possibly increased their nocturnal activity to avoid park visitors. Results also demonstrated that the probability of coyote occurrence decreased as the number of vehicles and cyclists increased. Specifically, cyclists were a stronger predictor of coyote occurrence versus vehicles. Taken together, these results highlighted patterns of possible coyote avoidance of people. Should this be the case, it might be beneficial to reduce/alter human trail use during seasonal coyote resource-stress times, such as the pup-rearing season. For example, implementing specific trail closures or minimizing cyclist trail access could potentially reduce human-coyote conflict.

Jamie switching out camera batteries and replacing the camera's memory card

Assessing the Stress Response in Minnows Downstream of Municipal Wastewater Effluent

Analisa Lazaro-Côté
University of Calgary, M.Sc.
Dr. Leland J. Jackson, Supervisor
Dr. Mathilakath M. Vijayan
Supervisor

Municipal wastewater effluent (MWWE) discharged to aquatic ecosystems contains nutrients, pharmaceuticals and personal care products that are not completely eliminated during wastewater treatment processes. This is concerning because these compounds are biologically active at low concentrations, and their effect(s) on non-target organisms remain poorly understood. Previous studies with fish have demonstrated that chronic exposure to municipal wastewater effluent compromises their adaptive response to additional stressors by disrupting the functioning of the stress axis. In this study, longnose dace (*Rhinichthys cataractae*), which are native to the Bow River, were collected upstream and downstream of two wastewater treatment plants in Calgary, Alberta. These small-bodied fish are excellent sentinels because they are abundant, have small home ranges, and, therefore, should reflect the state of their local environment. The objective of my study was to determine whether long-term exposure to MWWE compromises the adaptive stress response of longnose dace in the Bow River, Calgary, Alberta. To do this, I assessed how longnose dace responded to a standardized handling disturbance. I measured the organismal stress response, including changes in whole-body cortisol, glucose, and lactate levels to quantify differences in stress performance capacity. This research may assist in identifying current challenges with safe wastewater discharge, validate new biomarkers of contaminant exposure in fish, and help maintain healthy ecosystems and biodiversity of our waterways.

Dissecting minnows in the field

The Role of Biodiversity in the Production of Fish Biomass in Canadian Freshwater Ecosystems Beetle

Preston Lennox
University of Lethbridge, Ph.D.
Dr. Joseph Rasmussen, Supervisor

Our climate is changing, and along with it fish habitat is changing as well. Evidence for this is all around us, but perhaps nowhere in Canada is it more apparent than here in Southern Alberta, where the Oldman River began shedding its ice in January. Amidst these changes, researchers are forecasting declines in freshwater fish diversity, and understanding how this species loss will affect ecosystem processes has become a central theme in aquatic science. Of particular interest to me is the process through which fish communities convert available food resources into biomass. As such, I set out to study lakes and streams across Canada, encompassing a wide range of community diversity to gain a better understanding of how species compete and interact with each other, and how these interactions influence a community's ability to produce fish biomass. What I've found is, at lower levels of diversity (1-7 spp), increasing species richness promotes greater (more diverse) utilization of available food resources, which in turn leads to higher biomass production. However, at higher levels of diversity (8+ spp), this relationship is much more variable, and seems to indicate that freshwater ecosystems eventually reach a form of food web consumer-saturation, at which point all available resources are being utilized and additional species contribute only to added competition. In terms of management, the implications of this "saturation" are two fold; for provinces with high diversity (Ontario), the effects of species loss may be masked in ecosystems already at saturation. However, for species depauperate provinces (Alberta), the effects of species loss will likely be much more pronounced, and will therefore require more immediate conservation action.

Preston trying to find some shade for himself, and his fish, while they wait to be weighed, measured and returned to the stream

Conservation Genetics of *Mimulus guttatus* in Alberta: The Contribution of Geographical and Genetically Distinct Refugia to Species Management

Yan Liu
University of Calgary, Ph.D.
Dr. Jana C Vamosi, Supervisor

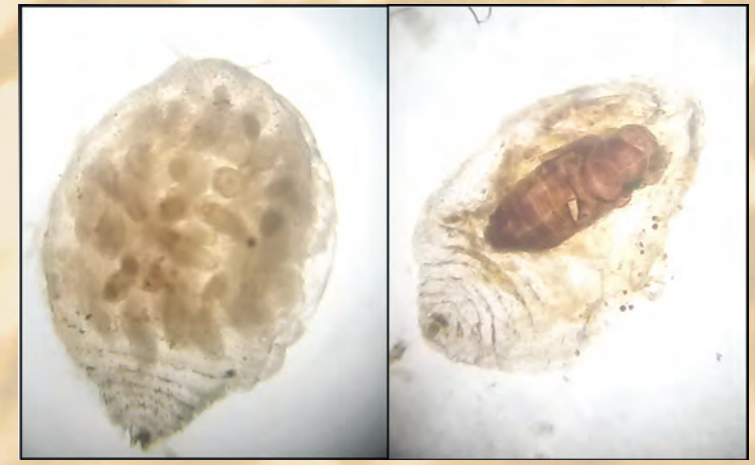
Mimulus species have become key systems for investigating the genetics of speciation, inbreeding depression, mating system evolution, and floral adaptations, in part because it is a genetically variable species. While *M. guttatus* is common in the US, according to the Conservation Status Ranks in Alberta, *Mimulus* is considered a rare species in Alberta. *Mimulus guttatus* is an ideal organism to test hypotheses regarding the contribution of demographic history of the species as the reasons for its rarity, which can then influence our ability to successfully conserve this native species. I concentrated the study on populations of *M. guttatus* that occupy both alpine and prairie habitats. I used 12 codominant markers to estimate genetic diversity in 96 individuals from 6 populations. Assessing the genetic diversity of *M. guttatus* within the geographical context, I found a strong correlation between genetic and geographical distances. The data provides evidence for historical contingency (via geologic and glacial events) restricted gene flow, followed by continued limits on regional demographical expansion. My analysis using genetic structure and haplotype variation determined the location of refugia and migration routes. I speculate that routes of gene flow in *M. guttatus* are now interrupted by anthropogenic and natural damage, such as coal mining, construction of a cobble dam, and a severe river flood that combined with climate oscillations, are determining factors contributing to the *Mimulus* population size decline, and lineage fragmentation. The recovery strategies should potentially consider controlled crosses across these barriers in order to increase the level of genetic diversity among the populations.

Yan and field assistant sampling *Mimulus guttatus* (individual plant in photo inset) and recording the habitat along the ditch in the Crowsnest Pass

Ecology of a Resident Parasitic Wasp and Evaluation of its Potential use in European Elm Scale Management

Caitlin Mader
University of Alberta, M.Sc.
Dr. Nadir Erbilgin, Supervisor

European elm scale (*Eriococcus spurius*) is an important pest of urban elm trees in western North America, but no effective biocontrol agent has been found to manage it. The goal of this project was to identify the importance of natural enemies in the stability of Calgary's European elm scale populations, to inform the degree to which they can be integrated into management practices. I documented the life history of *Coccophagus gossypariae*, a little studied Aphelinid parasitoid of European elm scale. New information on this parasitoid includes that it has at least three generations per year, and that it overwinters as larvae inside its host. I found that in this system, the relative timing of parasitoid and host life cycles is especially key to the impacts of the parasitoid on its host's populations, as the parasitoid's effects on host reproduction rate are more important than its effects on host mortality. The project also examined other environmental conditions required to maintain European elm scale populations at levels meeting management objectives, as this system requires a suite of approaches available to urban foresters; Spatial analyses of the degree to which different sites were reinfested with European elm scale after they were treated with insecticide revealed that untreated elms in an upwind direction of the treated tree are predictable and important factor in reinfestation rate, as European elm scale larvae spread using wind currents.



Parasitism interferes with European elm scale's ability to produce offspring. The left image on the left shows an adult female European elm scale (around 4 mm long), with its body nearly filled with its own developing eggs. The right image shows an adult female that was parasitized. Instead of developing eggs, its body contains only a single, nearly mature parasitic wasp, nearly ready to emerge to the outside world

Using Social Behaviour to Avoid Predators

Petra L. McDougall
University of Calgary, Ph.D.
Dr. Kathreen E. Ruckstuhl, Supervisor

Group-living in prey species likely evolved, in part, as a response to predation. Not only does group living provide safety in numbers (dilution effect), it also provides a larger number of eyes to scan for danger. Group members are therefore predicted to benefit from 1) engaging in behaviours that help them to remain in a group, and 2) attending to behaviours in others that suggest the presence of a predator. My research predicts that these two issues are related through a common phenomenon – behaviour contagion.

Behaviour contagion is automatic, non-conscious mimicry of others' behaviours (e.g. yawning, feeding, human laughter), and is arguably the glue that holds social groups together. My results from group-living bighorn sheep indicate that behaviour contagion and spatial proximity are tightly correlated. Behaviour contagion also varies with age and postural alignment (facing the same direction), but not with dominance or association. With this information we can predict which individuals will be influential group members and how the decisions of these individuals affect the health and survival of their group.

Behaviour contagion is suggested to help individuals synchronize and coordinate their behaviour so that the group remains cohesive. If individuals behave differently from others, they may drift apart from the group

The second part of my work investigates how behaviour contagion contributes to the spread of information about predators. Using video data from both observational samples and predator detection experiments, I am examining differences in vigilance cues (e.g. gaze duration, ear position, presence of chewing, etc.) between routine and predator-induced vigilance to determine whether particular cues increase the likelihood of contagion. The use of social information for predator avoidance suggests that group members benefit from more than just dilution.

Alberta's Achilles Heel: An Investigation of the Features of Susceptibility of Albertan Balsam Poplar to Canker

Ahmed Najar
University of Alberta, Ph.D.
Dr. Nadir Erbilgin, Supervisor
Dr. Barb Thomas, Supervisor

Though a resilient cornerstone species, poplars show vulnerability to *Sphaerulina musiva* the causal agent of stem canker. I conducted several experiments to assess the response of poplars across a genetic and geographic gradient to the pathogen. Results indicate a diverse genetic mixtures of poplars in a North-South transect in Alberta. The genotypic data indicates the presence of classes of pure species and their hybrids particularly with regards to *Populus trichocarpa* and *P. balsamifera*, both of which have shown various levels of susceptibility to *S. musiva*. I combined these classes with the phytochemical signature (fatty acids, phenolic glycosides, benzoic acid derivatives) from infected and non-infected poplars. Some chemical compounds were biomarkers for certain poplar species and some were novel contributions to the literature. These markers have a great potential to become the target of future breeding programs in Alberta and Canada. Some compounds were associated with resistant genotypes while others are induced or depleted after inoculation with *S. musiva*. Additionally, the difference in phytochemical signature between pure species and hybrids revealed to be related to both genetic and geographic structures of those species. Similarly, resistance to the pathogen was also function of the genetic and the provenance of the clones. This could inform about the mix of species that should be used in repopulation.

Labmate Guncha helping clean aphids manually after biocontrols failed. Chemical treatments cannot be used as it might interfere with the experiment

Ultimately, I hope my results will help bridge the gap between the genotype and phenotype in the light of infection and harness the ecological meanings of the phytochemicals studied.

Moose Refugia from Predation by Wolves in the Athabasca Oil Sands

Eric W. Neilson
University of Alberta, Ph.D.
Dr. Stan Boutin, Supervisor

Areas near human disturbance may become prey refugia when predators avoid human activities more than their prey leading to decreased predation rates and/or increased prey population growth. Alberta's Athabasca oil sands region (AOSR) is home to moose (*Alces alces*) and wolf (*Canis lupus*) populations and is characterized by extensive human disturbance including open pit mines, tailings ponds and industrial facilities. I examined the extent to which moose could be released from predation near Alberta's Athabasca oil sands due to wolf avoidance of mining infrastructure. Using moose and wolf GPS telemetry, I compared use of natural habitats and distance to mining features to the availability of these variables. For moose, I also modeled an interaction between disturbance distance and the distribution of wolves to assess whether moose exposure to wolves varies with proximity to human activity. Moose selection for areas near large mining facilities was higher than wolves. Most wolves avoided areas within 10 and 5 km of facilities whereas a minority of wolves exhibited an equivocal response to areas within 2.5 km of facilities. Moose exposure to wolves increased with distance to mines indicating that use of areas in proximity to human disturbance releases moose from predation by wolves. Human induced prey refugia could increase moose population growth to densities past which it can be limited by predation and increase human-moose conflict. Next, I will corroborate the distribution of moose and wolves using remote camera data and examine the distribution of moose-killed wolves estimated from telemetry data.

Eric flying in a helicopter to check locations of moose killed by wolves

Assisted Migration to Mitigate the Effects of Climate Change on Rare Plants

Jennine L.M. Pedersen
University of Alberta, M.Sc.
Dr. Scott E. Nielsen, Supervisor
Dr. S. Ellen Macdonald, Supervisor

If the climate changes as projected, some plant species will be unable to disperse quickly enough to keep pace with their current climate niche; this could result in extinctions or local extirpations. To prevent this loss of biodiversity assisted migration - i.e., actively moving plants to a location where the climate is expected to be suitable in the future - has been suggested as a proactive conservation tool. I conducted assisted migration trials of the northern blazing star (*Liatris ligulistylis*); a perennial forb considered rare and range-restricted in Alberta. I moved seed and mature plants to four geographic locations along a north-south gradient in Alberta and planted mature plants into soil from either their collection site (source) or into soil at the translocated site (recipient). Overall my assisted migrations to the north were successful with mature plant survival, growth and flowering similar to or exceeding levels in this species' current range. Seedling establishment was also significantly higher north of this species' current range, while being very low to the south. Source soil led to greater flower bud production at all sites, and higher seed sets south of this species' current range, but recipient soil led to greater seed sets within and north of this species' current range. These results suggest this species will be vulnerable to future climate change within its current range; this plus dispersal barriers make this species an ideal candidate for assisted migrations. However, to determine the true success of this tool future assisted migration trails will be required along with continued monitoring.

Jennine conducting population surveys of the northern blazing star in North Bruderheim Provincial Recreation Area

Effect of Invasive and Native Plant Density on Native Plant Pollination

Angela M. Phung
University of Alberta, M.Sc.
Dr. Cameron Carlyle, Supervisor
Dr. Jessamyn Manson, Supervisor

Invasion by non-native plants pose a serious threat to native plant species by competing for important resources such as water, light, and even pollinators. Invasive plants can have a positive, negative, or neutral effect on native plant pollination by attracting pollinators away from or towards native plants. Both the relative density of invasive and native plants in the environment could affect pollinator visitation to native plants. To test this, I set up thirty circular plots (20 m2 diameter) with variable densities of a native (*Astragalus agrestis*) and invasive plant (*Astragalus cicer*). *Astragalus cicer* is a common forage crop introduced from Europe that may be invasive in some native grasslands. I recorded pollinator visitation to one native and invasive plant per plot using video cameras. Interestingly, the native *A. agrestis* had five times more pollinator visits and a larger number of visits from leafcutter bees compared to *A. cicer*. As numbers of *A. agrestis* flowers increased, so did the number of pollinators that visited. However, I did not find that the relative plant density or relative floral density of native *A. agrestis* to invasive *A. cicer* affected pollinator visitation rates to *A. agrestis*. Although my results suggest that *A. cicer* does not negatively affect native plant pollination through effects on pollinator visits, future studies can look at whether the efficacy of native plant pollination is affected by *A. cicer* pollen deposited on native plant stigmas.

Bumble bee collecting nectar or pollen from *Astragalus cicer*

Constraints on the Recovery of a Population of Bighorn Sheep

Gabriel Pigeon
Université de Sherbrooke, Ph.D.
Dr. Fanie Pelletier, Supervisor

A group of grazing bighorn sheep led by female yellow-4

Conditions experienced at a young age can influence future individual fitness via their effect on reproduction and survival. Early-life environment can affect adult, for example, through carry-over effects on body mass. Cohort effects occur when individuals born at the same time suffer the same long term consequences from being exposed to the same environmental conditions. Cohort effects can induce important lagged effects of these environmental conditions on population dynamics. The aim of my project was to quantify the influence of those effects in marked bighorn sheep to better understand how environmental variations can affect population growth rate. I used robust statistical methods to quantify the importance of cohort effects and identify their environmental drivers. I investigated the potential effects of density, local weather as well as large scale climatic index. Cohort effects explained a significant proportion of the variance in recruitment (34%). Neither large scale climate index nor local weather variables were good predictors of cohort effects on future survival or recruitment. Density at birth however, explained a large portion of variation in recruitment between cohorts. The probability of reproducing once maturity is reached went down by almost 50% over the range of density at birth observed. My results show that cohort can introduce a large amount of heterogeneity in a population and have the potential to cause important lagged effects of density. These strong cohort effects partly explain the slow recovery of the population after the population crashed in the 90s.

The Influence of Agriculture on Waterbirds in Non-permanent Marshes

Heather M. Polan
University of Waterloo, M.Sc.
Dr. Rebecca Rooney, Supervisor

Waterbirds have important ecological, social, and economic values, including contributing to plant and insect dispersal, providing birdwatching opportunities and many waterbirds are popular gamebirds. I studied non-permanent marshes, which provide valuable habitat for waterbirds due to their shallow water and small size. Due to their small size, many have already been destroyed and those that remain in the landscape are at risk to infilling, ditching and drainage for agriculture. My project aimed to characterize the waterbirds within non-permanent marshes and gain insight on how agriculture influences the waterbirds present in the marshes. I studied 48 non-permanent marshes across a gradient of disturbance, from reference to highly disturbed, and found over 2500 individual waterbirds and documented 84 different species over two years. In the highly disturbed wetlands, habitat generalist species like Red-winged Blackbird, Black-billed Magpie and Mallard were more abundant. In contrast, marshes within undisturbed landscapes more frequently had specialist species such as Marbled Godwit and Willet. The waterbird assemblages I found could be predicted by a combination of land cover and site-level characteristics. The most important variables in predicting assemblages were forest and shrub cover in the surrounding landscape, cattails in the site, and cover of open water within the surrounding landscape. Understanding how the landscape and site-level characteristics of wetlands influence waterbirds will enable us to test the utility of waterbirds as indicators of non-permanent marsh condition in future studies. Additionally, my results are especially important in anticipating what waterbird species could decline as a result of continued agricultural encroachment into non-permanent wetland catchments.

Male Red-winged Blackbird

Causes and Consequences of Variation in Bighorn Sheep Milk

Limoilou-Amélie Renaud
Université de Sherbrooke, Ph.D.
Dr. Fanie Pelletier, Supervisor
Dr. Marco Festa-Bianchet, Supervisor

Lactation is an adaptation unique to mammals, yet little is known about inter individual variability in milk composition in wild populations. How much do individual females differ in milk composition and why? Does that variation affect growth and survival of their young? And do females adjust milk composition according to annual changes in their environment? Only a few study systems present the opportunity to follow marked individuals from birth to death, and to compare milk composition with individual life-history traits. I investigated maternal and environmental sources of variation in bighorn sheep milk, and their potential consequences for lamb mass at weaning. A unique feature of my study is that females can be sampled multiple times within a season, and over several years. I measured milk fat, protein, sugar and mineral concentration in samples collected from 30 females of known age, body mass and reproductive status. My results show that milk composition varies more from year to year than among individual ewes in the same year. Part of this variation is explained by differences in timing of spring green-up. More importantly, milk composition influenced lamb mass at weaning, a critical trait for lamb overwinter survival.

Limoilou holding a bighorn lamb after performing biological measurements. Growth of lambs in the Ram Mountain population was analysed in light of variation in maternal milk composition

Influence of Timber Retention on Wood Frog Abundance in Post-Harvest Mixedwood Forests

Matthew P. Robinson
University of Alberta, M.Sc.
Dr. Scott Nielsen, Supervisor

Habitat loss and alteration are major factors contributing to amphibian population declines. Timber harvesting and subsequent regeneration can alter forest habitat and habitat use patterns, resulting in local declines in amphibians. Wood frogs (*Lithobates sylvaticus*), like other aquatic-breeding amphibians, require terrestrial habitat for refuge, forging, and overwintering. These terrestrial habitats are often associated with closed-canopy deciduous forest. Variable retention timber harvesting involves retaining live trees during harvest in patterns that mimic natural disturbance. EMEND (Ecosystem-based Management Emulating Natural Disturbance) is a forest management experiment in northwest Alberta that assesses retention levels required to achieve both sustainable timber harvest and conservation goals in the Boreal Mixedwood. The purpose of this study was to determine if wood frog terrestrial habitat use was limited in different retention levels and forest types in 17-year post harvest forest stands. I measured abundance of wood frogs in 4 levels of retention harvest (clearcut [0%], 20%, 50%, and unharvested control [100%]) and 2 forest types at EMEND. I found no significant difference in capture rates among retention levels in either forest type. Interestingly, captures in conifer forest sites were comparable to those in deciduous sites, suggesting natural regeneration of deciduous species such as aspen and understory vegetation growth may help provide suitable terrestrial habitat for wood frogs in post-harvest conifer forests. These results provide new information on wood frog habitat use in managed forests in the boreal mixedwood and will help inform future forest management in Alberta.

Adult wood frog in conifer-dominated forest stand

Effects of Industrial Noise on Owls in Northeastern Alberta

Julia Shonfield
University of Alberta, Ph.D.
Dr. Erin Bayne, Supervisor

Noisy environments can interfere with an animal's ability to detect communication signals. Owls use vocal communication to attract mates and defend territories, and use acoustic cues made by prey to aid in prey capture. Chronic noise from industrial operations could mask owl calls and interfere with detecting acoustic cues from prey (mainly small rodents), but these potential impacts have not been well studied. The objectives of this project were to determine whether owls avoid forested areas surrounding industrial noise sources, and whether small mammal abundance was affected by industrial noise. I conducted passive acoustic surveys for owls in the Lower Athabasca region of Northeastern Alberta, in the spring of 2013, 2014 and 2015 using autonomous recording units deployed at noisy and quiet sites. At the scale of a home range, owls were found to be equally likely to occupy noisy sites compared to quiet control sites, but at a smaller scale were less likely to use an area as noise levels increased. To determine if prey availability is affected by industrial noise, a small mammal mark-recapture study was conducted in the summer months of 2014 and 2015. Small mammal abundance was largely unaffected by noise, indicating that prey availability is similar in noisy and quiet areas. This study contributes to the expanding body of research on impacts of anthropogenic noise on animals. Understanding how owls and their prey respond to noise on the landscape is necessary to predict the extent of habitat degradation due to noise.

A red-backed vole (*Myodes gapperi*), a common rodent trapped during the live-trapping study, and an important part of the diet of several owl species in Northeastern Alberta

The Influence of Nitrogen and Phosphorus on Dissolved Oxygen in the Bow River

Jarvis G. Singer
University of Calgary, M.Sc.
Dr. Leland Jackson, Supervisor

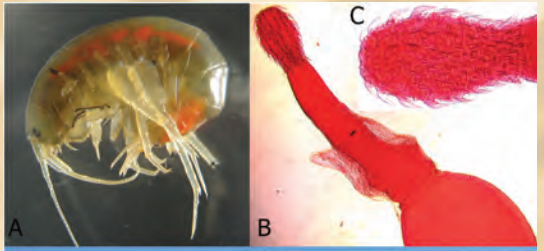
Jarvis collecting a rock for an algae sample

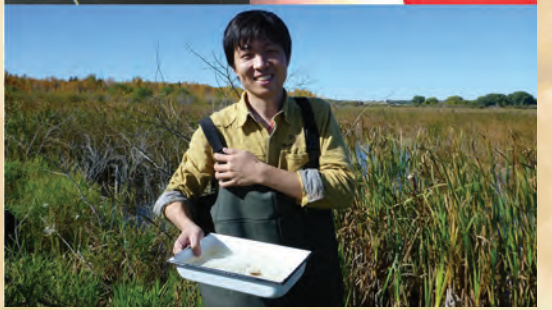
Low dissolved oxygen (DO) concentrations occur in rivers with high nitrogen and phosphorus loading because nutrients increase algae and rooted underwater plant growth. DO concentrations fluctuate diurnally as a function of algae and aquatic vegetation due to dominant daytime photosynthesis and nighttime respiration. Rivers with high respiration have a greater potential for low DO at night, though the relative contribution from algae compared to rooted underwater plants is unknown. Furthermore, algae and aquatic plant growth may be limited differently by nitrogen and phosphorus at different locations. Understanding the role that nitrogen and phosphorus play in limiting different primary producers is crucial to effectively reduce nutrient pollution that targets primary producers that most drive low DO concentrations. I studied stretches of the Bow River and compared DO concentrations from pre-2013 flood, when rooted underwater plants were present, to DO concentrations post-2013 flood, when rooted underwater plants were absent but algae continued to be present. I found nighttime DO concentrations in the rooted underwater plant-absent Bow River to be greater than when rooted underwater plants were present. I also found, through the results of my second study, that algae and rooted underwater plants are limited by different nutrients at different locations along the Bow River. Overall, my findings suggest reducing nutrients that most limit the growth of underwater rooted plants would most improve low DO concentrations.

What Affects Parasitic Worms in Freshwater Amphipods in Edmonton Water Bodies?

Zhuoyan Song
University of Alberta, Ph.D.
Dr. Heather Proctor, Supervisor

Acanthocephala (thorny-headed worms) are common parasites in freshwater amphipods (a.k.a. 'scuds'). In Alberta, many of them use the amphipod *Gammarus lacustris* as an intermediate host for their larval stage, and then are transmitted via predation into the guts of waterfowl for their adult stage. Some acanthocephalans (e.g., *Polymorphus minutus*) may cause damage in waterfowl. Therefore, understanding factors affecting acanthocephalan prevalence in *G. lacustris* will be helpful for evaluating the potential infection risk that waterfowl face. In this study, I sampled *G. lacustris* and acanthocephalans from 36 natural and man-made water bodies in and near Edmonton across four field seasons between 2015 and 2016. In total, I found five acanthocephalan species, all of which belong to the genus *Polymorphus*. I also explored the effects of age and size of water body, waterfowl and *G. lacustris* abundance, and water quality on acanthocephalan prevalence in *G. lacustris*. I found that waterfowl abundance and waterbody age were significantly positively correlated with prevalence. Surprisingly, there was no significant correlation between acanthocephalan prevalence and abundance of their amphipod hosts. The positive relationship between prevalence and both waterbody age and waterfowl abundance suggests that time available for the colonization by amphipods and acanthocephalans, and waterfowl usage could be the primary factors affecting acanthocephalan prevalence in *G. lacustris*. These findings will help us to understand the waterfowl-Gammarus-acanthocephalan system in urbanized areas, and how features of water bodies are correlated with these waterfowl parasites.





Zhuoyan with his host-parasite study system: a parasitized *Gammarus lacustris* (A) and a larval acanthocephalan (B) with its proboscis (C)

Bacterial Diversity in Ticks That Parasitize Alberta Wildlife

Janet L. Sperling
University of Alberta, Ph.D.
Dr. Katharine Magor, Supervisor

***Ixodes pacificus* tick. Credit T. Barbin, used with permission**

Ticks are arthropod parasites that carry important diseases of Alberta wildlife. Each species of tick carries a whole community of bacteria that may affect disease-causing species of bacteria. Understanding the identities and relative abundances of the assemblages of bacteria associated with Alberta's ticks is important for understanding what makes a tick healthy. It may be possible to control ticks by tipping the balance of species in their bacterial community to favour bacteria that are pathogenic to the tick. Knowing the bacteria associated with each species of tick may also allow monitoring to inform public health policy. My ACA funded survey of Lyme disease carrying *Ixodes scapularis* ticks in Alberta showed greater proportions of three bacterial families: Rickettsiaceae, Enterobacteriaceae and Pseudomonadaceae. Each of these bacterial groups contains species that cause wildlife diseases. *Ixodes* ticks in Alberta that carry Lyme bacteria carry a greater diversity of families of bacteria. This raises the question of whether ticks carrying Lyme disease are more likely to be co- infected with more than one pathogen. My project used DNA sequencing of multiple regions of a marker gene to allow the full diversity of bacteria to be detected. Then I compared ticks using these markers to more confidently designate ticks as positive or negative for Lyme disease. I am now working to describe the exact genotype of Lyme bacteria found in Alberta ticks, to determine whether the ticks and their bacteria came from locally established populations or were being brought in by migratory birds.

Risk of Predation for Elk in a Multiple Predator System

Eric G. Spilker
University of Alberta, M.Sc.
Dr. Evelyn Merrill, Supervisor

Understanding how large carnivores interact to distribute themselves across a landscape is an important first step toward determining how they collectively pose risk to their shared prey. In this study, I quantified multi-carnivore predation risk to elk in the upper Red Deer River watershed of Alberta. During summers 2014—2016, I used detection dogs to collect over 1400 scats of grizzly and black bears, cougars, lynx, wolves and coyotes. I used these scat locations, combined with data from remote cameras to determine the distribution of each predator species and explore how interactions between species may influence distribution. Our preliminary results suggest that areas selected for by smaller-bodied predators are influenced by the distribution of larger-bodied predators, but not vice-versa. I then used locations where elk were killed by known predators and species-specific distribution maps to compare how predator distribution relates to risk of predation. Multi-species predation risk quantified from this study can be used to assess forage-predation risk trade-offs of different migratory segments of the elk population in this region.

Eric and detection dog in the field

Bee Conservation in Alberta's Grasslands: Using Cleptoparasites as Indicator Taxa

Ashton B. Sturm
University of Alberta, M.Sc.
Dr. Cameron Carlyle, Supervisor
Dr. Jessamyn Manson, Supervisor

Cleptoparasite *Nomada* with host bee *Andrena* on a canola (*Brassica napus*) flower. Credit M. Kohler

Bees play a vital role in terrestrial ecosystems by providing pollination services that support biodiversity and sustainable food production. Alberta is a hot spot for bee diversity and supports over 300 species of wild bees. Due to their small size and inconspicuous features, bees are a challenging group to study and identify. Yet, bee populations are declining due to a host of threats and monitoring of bee communities is required. A potential strategy to overcome this challenge is to identify an indicator taxa or guild that can reflect community level patterns. Cleptoparasitic bees are nest parasites on other bees, and through evolutionary time, have lost the ability to carry pollen making them completely reliant on host bees for reproduction. Over two field seasons I surveyed bee communities in canola fields and grasslands to test whether the abundance of cleptoparasites predicted the abundance of i) host bees ii) non-host bees and iii) the overall bee community. I found mixed results supporting the use of cleptoparasites as an indicator taxa. When floral resources were low, cleptoparasite abundance predicted the abundance of the overall community including hosts and non-hosts. However, when floral resources were high there was no relationship between cleptoparasites and the rest of the bee community. Cleptoparasites do not appear to be reliable indicators for bee community abundance. However, further research investigating why the relationship between cleptoparasites and bees change with floral resources would be of ecological interest.

Contributions of Wild and Managed Pollinators to Hybrid Seed Canola

Riley J. Waytes
University of Calgary, M.Sc.
Dr. Ralph Cartar, Supervisor
Dr. Shelley Hoover, Supervisor

I studied the behaviour of pollinators in production fields of hybrid canola seed, or 'hybrid canola', in Southern Alberta. To produce hybrid seed, pollen must travel from patches of hermaphroditic (pollen-producing, 'male') plants to patches of female plants, which is facilitated by insect pollinators. Managed pollinators (honey and alfalfa leafcutting bees, both European bee species) are commonly used to pollinate hybrid canola. I investigated the extent to which native pollinators (bee and fly species) also contributed to pollination. I first compared the pollination effectiveness (how well pollinators deliver pollen to a flower) of managed bees, bumble bees, and hoverflies. Bumble bees delivered pollen to flowers at a similar effectiveness to managed pollinators. Hoverflies delivered lower amounts of pollen per visit. However, native pollinators were less frequent than managed ones; over the season, only 11% of plots were visited by native bees, compared to 30% visited by hoverflies, and still more being visited by honey bees and leafcutting bees (64% and 78%, respectively). Rather than directly contributing to pollination, the major contributions of native pollinators seem to be in increasing the tendency of managed pollinators to move between male and female plants. Both managed bee species showed a tendency to visit a single flower morph (male or female) in a foraging bout. However, a higher diversity of pollinators in a male patch resulted in managed pollinators switching more between male and female flowers. Increased pollinator diversity should lead to better pollination of hybrid canola.

A native bumble bee visits a female canola flower

Songbird Response to Vegetation Regeneration on Reclaimed Well Sites

Scott J. Wilson
University of Alberta, M.Sc.
Dr. Erin Bayne, Supervisor

Industry is required to reclaim oil and gas well sites in Alberta, with the intention of recovery to an equivalent ecological function as prior to disturbance. Songbird community response to forest regeneration following various types of disturbance is well studied. However, limited information exists on how communities change with vegetation recovery on reclaimed oil and gas infrastructure. The objectives of this study were to use acoustic methods to determine how vegetation regeneration influenced songbird use of reclaimed well sites.

Fellow student calibrating equipment at one of the reclaimed well sites surveyed

Songbird communities were surveyed on reclaimed well sites at different stages of regeneration in the boreal forest natural region of Alberta in 2015 and 2016. Grids of time-synced microphones were placed over the well site footprint. The singing locations of birds were triangulated within the well site footprint by using the time of arrival difference of vocalizations to subsequent microphones.

Species associated with early stages of forest regeneration frequently sang from reclaimed well sites, including alder flycatcher and clay-coloured sparrow. Species more sensitive to disturbance such as ovenbirds sang from reclaimed well sites as canopy cover became more similar to the adjacent forest. Reclamation strategies which promote structural complexity of woody plants on well sites should be beneficial for upland songbird communities.

Influence of Habitat and Disturbance on Ground Beetle Assemblages in the Mixedwood Boreal Forest

Linhao Wu
University of Alberta, Ph.D.
Dr. John Spence, Supervisor

Lunch time and fighting with mosquitos

Ground beetles are diverse and sensitive to environmental changes, and react strongly to industrial-scale harvests; they have been considered as good bioindicators. Using un-harvested stands as controls, I examined the effects of several levels of retention harvest (10, 20, 50 and 75%) relative to clear-cuts (c. 2% retention) on ground beetle assemblages in four cover types of boreal mixedwood forests at the Ecosystem Management by Emulating Natural Disturbance (EMEND) Project in northwestern Alberta. I collected ground beetles data during the frost-free seasons of 2014 (15 years after harvest) in 114 compartments at EMEND. There were six pitfall traps in each compartment and each trap was visited four times from mid May to late August. Results show that ground beetles recovered more quickly over 15 years toward pre-harvest condition after partial retention harvest than after standard clear-cuts. Recovery of species composition toward that of un-harvested stands varied inversely with harvest intensity. I aim to contribute useful information about temporal variation of ground beetle assemblages in response to disturbance and habitat change. Data and analyses from this unusual long term data study should improve our understanding of assemblage dynamics among forest-dwelling ground beetles, and through such understanding, improve conservation of biodiversity and the sustainability of forestry on managed landscape.

Understanding Detection Distances Using Acoustic Bird Surveys

Daniel A. Yip
University of Alberta, Ph.D.
Dr. Erin Bayne, Supervisor

Point counts are one of the most common methods for censusing avian abundance. In many studies, the relative difference in bird count is used to estimate change in abundance over time and space. However, the use of relative abundance as a metric assumes that the distance at which birds are detected remains the same for different species with varying song frequencies and amplitudes. Many studies also assume that detection remains the same across different habitat types. I quantified differences in observer detection and sound attenuation rates between different forest types, roadside vs non roadside environments, and between methods of recording avian sounds (i.e. humans vs wildlife recorders) to highlight violations of this assumption and provide suggestions on how to correct for differences between roads and forests by adjusting for effective area sampled. I found these factors to significantly affect observer detection distance and, without correction, can bias estimates of avian density and abundance.

Setting a SongMetre wildlife recorder to record bird song near Calling Lake, AB

Progress Reports 2017

Implications of nitrogen limitation in cyanobacteria in shallow lakes

Susan Anderson (M.Sc.)
University of Calgary
Supervisor: Leland Jackson

Blue-green algae blooms are thought to be increasing in frequency in Alberta and worldwide. The blooms threaten both aquatic ecosystems and surface drinking water, and can restrict fishing and swimming at recreational lakes. My project is important because it looks at how increased salinity (sulfate) could limit the growth of blue-green algae and whether blue-green algae produce toxins in relation to nutrients.

Susan is measuring conductivity in a lake east of Strathmore, AB

Causes and consequences of size-asymmetric competition in a native grassland

Charlotte Brown (M.Sc.)
University of Alberta
Supervisor: JC Cahill

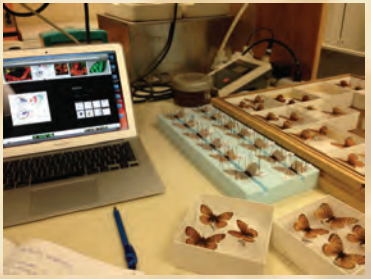
The degree of size-asymmetric competition, or when larger individuals in a community take up a disproportionate amount of resources relative to their size, is a potential mechanism influencing species co-existence. Understanding the factors driving size-asymmetric competition as well as its relative importance on community structure will allow us to 1) determine the conditions under which size-asymmetric competition will be strongest and 2) clarify the broader implications of size-asymmetry in structuring communities.

Experimentally thinned plots within the aspen parkland. Picture taken at the Roy Berg Kinsella Research Ranch, AB

Characterizing Alberta species of silverspot butterflies to support ecological assessments

Erin Campbell (M.Sc.)
University of Alberta
Supervisor: Felix Sperling

Despite new genomic tools, species boundaries in many groups remain difficult to characterize due to complex evolutionary relationships; yet, understanding how species form is essential for effective conservation and management initiatives. My work combines new genomic approaches with traditional systematics to clarify the relationships between Albertan species of silverspot fritillaries, an enigmatic group of butterflies that are steadily declining across North America.

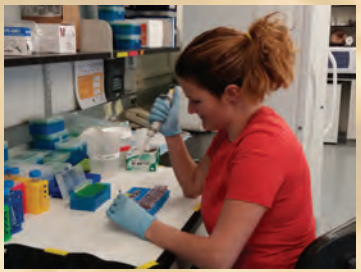


Morphological character scoring of pinned Speyeria in the lab

Determining genomic characteristics of caribou in Alberta for management and conservation practices

Maria Cavedon (Ph.D.)
University of Calgary
Supervisor: Marco Musiani

With my project, I am analyzing both ecological and genetic characteristics of caribou individuals belonging to different Albertan herds to determine the genetic basis of ecological (e.g. differences in habitat selection), behavioral (e.g. sedentary vs sedentary animals) and morphological differences between them. I will use this information, together with existing behavioral, ecological, geographical and genetic information to determine groups of individuals with similar and discrete characteristics and, as a consequence, to determine caribou Conservation Units. Practically, this information could be used by wildlife managers, decision makers and other interest groups to formulate practices that contribute to the long term conservation of caribou in Alberta.



Maria extracting DNA from caribou blood samples

Does heterogeneity in rangeland health predict biodiversity in Alberta's southern grasslands?

Craig DeMaere (M.Sc.)
University of Alberta
Supervisors: Cameron Carlyle and Edward Bork

Rangeland health is a common metric used by public lands agrologists and industry to assess grazing impacts on the ecological functions of Alberta's rangelands. Understanding the relationship between rangeland health and biodiversity will provide insight for managing cattle to support biodiversity.

Plant species sampling in a pasture utilized for the grasslands range health and biodiversity project. ©ABMI. Used with permission

Search and rescue: Detection and translocation of rare plant species in the Lower Athabasca

Jacqueline Dennett (Ph.D.)
University of Alberta
Supervisor: Scott Nielsen

If we do not detect species during survey we lose the ability to conserve them through mitigation. Understanding when, where, and how detection varies and evaluating the success of mitigative translocation allows both industry and researchers to improve by providing valuable information and recommendations.

Jacqueline assesses the growth and survival of *Carex oligosperma* (few-seeded sedge) transplants at one of three experimental sites in northern Alberta. This recipient site is a perched bog, a sphagnum layer which has formed over a substrate that is impenetrable to water

Prescribed fire and whitebark pine recovery strategies: Natural regeneration in relation to fire severity

Luiz Drummond Salvador (M.Sc.)
University of Alberta
Supervisor: Mike Flannigan

This research project is important to better understand the role that fire plays in the ecology of whitebark pine at its northern range. Understanding how early post fire whitebark pine regeneration occurrence and abundance responds to fire severity will help provincial and federal conservation agencies to develop better strategies for working with prescribed fires and wildfires as restoration and conservation tools.

Whitebark pine seedling establishing after prescribed fire applied by Parks Canada in 1998 in northern Banff National Park

Phenological and genomic determinants of elevational range limits in *Rhinanthus minor L.*

David Ensing (Ph.D.)
Queen's University
Supervisor: Christopher Eckert

Under climate change, alpine species have been some of the first to go extinct and remaining montane and alpine species are predicted to be at increased risk. By monitoring natural populations, conducting reciprocal transplants, and investigating genetic variation in the annual plant yellow rattle (*Rhinanthus minor*) across elevation, we can clarify the factors that currently limit its elevational distribution, which will be crucial if we are to manage it, and other species, for the future.

Measuring naturally occurring yellow rattle (*Rhinanthus minor L. Orobanchaceae*) juveniles in May in the Kananaskis Valley, Alberta

Responses of furbearers to variable green-tree retention harvesting in conifer-dominated boreal forest

Caroline Franklin (Ph.D.)
University of Alberta
Supervisor: Ellen Macdonald

Furbearers have important ecological, economical, and cultural values. A better understanding of the responses of furbearers to varying levels of green-tree retention harvesting will contribute to development of effective sustainable forest management practices aimed at mitigating the negative effects of tree harvesting on Alberta's fauna.

A lynx in northwestern Alberta

Habitat utilization of boreal songbirds in response to linear feature width and vegetative recovery

Jocelyn Gregoire (M.Sc.)
University of Alberta
Supervisor: Erin Bayne

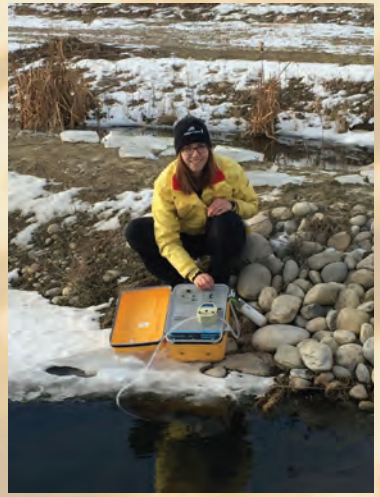
The evolution of technology in the petroleum industry will further promote in-situ methods of extraction and increase habitat fragmentation in the boreal forest through the creation of linear features. Efficient methods of studying fine scale edge effects on species at risk will help to define critical habitat within the industrialized region so that land-use planning can more effectively account for species conservation.

Jocelyn gathering data

Using environmental DNA to detect and assess species abundance of At Risk Alberta fishes

Jori Harrison (M.Sc.)
University of Calgary
Supervisor: Sean Rogers

Using environmental DNA to detect aquatic biodiversity is of interest in Alberta where most industrial activity takes place in remote locations. Characterization and testing of an assay to detect closely related Alberta species is crucial to understanding and interpreting these results.



Filtering water samples at the ACWA research streams in December 2016

Investigating the effects of oil and gas infrastructure on the stress physiology and body condition of nestlings of two species of grassland songbirds

Alexandra Heathcote (M.Sc.)
University of Manitoba
Supervisors: Nicola Koper

The expansion of oil and gas development in southeastern Alberta may be impacting vulnerable avian populations by altering their ability to respond to stressful stimuli like anthropogenic noise. By using experimental playback units this study will isolate noise from its physical source of disturbance to better understand the impacts of anthropogenic noise on grassland songbirds during a vulnerable life history stage.

Measuring wing chord length of a chestnut-collared longspur (*Calcarius ornatus*) nestling

Linking hierarchical habitat relationships of common nighthawks in a dynamic landscape

Elly Knight (Ph.D.)
University of Alberta
Supervisor: Erin Bayne

Understanding what types of habitat species require is a fundamental aspect of wildlife conservation, particularly for species at risk, but disentangling these habitat relationships can be difficult for species that have nocturnal and complex life histories. My project uses variation in the type and rate of acoustic signal to differentiate between nest site, territory, and other types of habitat components, and uses these acoustic proxies to study Common Nighthawk habitat use at multiple hierarchical scales.

Elly holds a Common Nighthawk that has been tagged with a radio transmitter for tracking and observation of acoustic behaviour

Evaluating the potential of using ornamental coloration of tree swallows as a non-invasive indicator of aquatic pollution

Natalia Lifshitz (Ph.D.)
University of Alberta
Supervisor: Colleen Cassady St. Clair

This project will help develop a non-invasive technique to monitor the effects of environmental pollution on wild birds. Also, this will be the first study to investigate if iridescent plumage coloration correlates with metal pollution.

Taking a digital photograph of a male tree swallow against a standard background with a color reference. This will allow us to quantify and analyze coloration using an image processing software

Response of ferruginous hawks (*Buteo regalis*) to transmission line construction and decommissioning

Nicholas Parayko (M.Sc.)
University of Alberta
Supervisor: Erin Bayne

The effects of transmission lines on nesting ferruginous hawks (*Buteo regalis*) are relatively unknown. In southern AB, ferruginous hawks appear to select transmission towers as nesting sites when they are present. This study aims to determine how ferruginous hawk nest success, re-use, and densities are impacted when nesting on or in the presence of transmission towers.

Ready to release a recently transmittered male ferruginous hawk that had been nesting on a transmission tower in SW Alberta

Behavioural transmission of Chronic Wasting Disease in mule deer and white-tailed deer

Kelsey Saboraki (M.Sc.)
University of Winnipeg
Supervisor: Susan Lingle

Chronic Wasting Disease (CWD) is a fatal prion disease that threatens wild populations of deer, elk and moose. CWD is more common in mule deer than in white-tailed deer, and in males of both species than in females. My project aims to determine to what extent behaviour can explain the differences in disease prevalence between species and between sexes.

A mule deer male engages in 'risky behaviour' while courting a female at the McIntyre Ranch in Southern Alberta

Effects of mountain pine beetle on understory vegetation in lodgepole pine forests in Western Alberta

Julie Steinke (M.Sc.)
University of Alberta
Supervisor: Ellen Macdonald

As mountain pine beetle continues to move outside of its historical range into unprecedented areas in Alberta, it is unknown how lodgepole pine forests in Alberta will respond to this new disturbance type. Understanding changes to understory vegetation resulting from canopy changes is important to understand how forest dynamics and successional pathways may change over time, and to aid in future management and planning of these forests.

The canopy of a simulated mountain pine beetle partially killed stand

The use of migratory bird spring arrival timing and song phenology to inform habitat preference and quality

Emily Upham-Mills (M.Sc.)
University of Alberta
Supervisor: Erin Bayne

The purpose of most acoustic bird surveys is to determine presence or absence of a species, but the increasing use of acoustic recording units (ARUs) now allow for added value in bird surveys. The objectives of this research are to determine if ARU data can be used to predict breeding status in the Olive-sided Flycatcher based off song rate and to compare breeding success among habitats to inform critical habitat identification for species at risk songbirds.

Emily holding an Olive-sided Flycatcher

Mandate

This grant program has been established to increase knowledge of flora and fauna in Alberta and to support Alberta-based research, consequently, all work proposed for funding must take place in Alberta. The location of a student's university is of no consequence but their research must be done here.

We support research by graduate students in Alberta, and grants are for up to a maximum of $20,000 distributed over a 2-year funding period. Awards are made in early April each year. Mean award amounts are close to $11,000.

Serious potential applicants should visit our web site (http://www.acabiodiversity.ca) where information is updated annually, and application forms may be downloaded.

Terms of Reference of this Program

The ACA Grants in Biodiversity have been established to:

- increase knowledge of Alberta's heritage of living resources, specifically the flora and fauna,
- support research by graduate students in Alberta, and
- promote the development of highly qualified, Alberta-based conservation biologists.

Who is Eligible to Apply?

The Grants Program is open to graduate students doing work in Alberta. Applicants must be associated with a university as a graduate student (see specific limits of eligibility on our website).

Mandate

Research Mandate

The program supports research in fields of biodiversity, conservation biology and ecology, all broadly construed; all kinds of organisms are covered. The program was broadened in 2004 to encompass management responses of Alberta flora and fauna. Applications can deal with the study of Alberta's flora and fauna at any biological level, but such studies should be directly anchored in the real world. Applications will be adjudicated on the basis of: 1) research merit; 2) reasonable budget; and 3) ability of the applicant to conduct the proposed project.

Deadline: The deadline for receipt of applications is December 1 (or the last business day before December 1) each year.
Check http://www.acabiodiversity.ca for exact deadline.

For more information please contact:

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Reviewer Appreciation

Every application received for an ACA Grants in Biodiversity competition is sent to at least three volunteer reviewers. We appreciate the time, expertise, and effort of our reviewers for the last two years:

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The ACA Grants in Biodiversity invites proposals from graduate student from any approved research university, regardless of province or country, to apply for financial support to conduct research on basic biology or management of Alberta's flora or fauna. We support studies of conservation biology, biodiversity, ecology and management, all broadly defined. All taxa of living organisms are acceptable. Proposal strengths may emerge from their logic, clarity, usefulness, general interest, or discovery; however a high level of scientific merit is essential.

For more details on program, applications, deadlines and sponsors see:

Biodiversity Grants:
http://www.acabiodiversity.ca/

Alberta Conservation Association:
http://www.ab-conservation.com

Program goals are to:

- Increase knowledge of Alberta's living resources, notably flora and fauna.
- Enhance training of highly qualified graduate students working in conservation biology in Alberta.
- Support the ACA's mission to promote conservation of Alberta resources.