ACA grants in biodiversity

biennial report

2008/2009

Alberta Conservation Association

The ACA Grants in Biodiversity is proud to present this overview of the projects supported during the last two years. This marks the 15th year of this highly competitive grant for Alberta Graduate students, and during this time, ACA has awarded its three millionth dollar and funded its 300th research project within the popular biodiversity grant. With such a history (longer than the existence of ACA itself!) we see students from an earlier generation that were supported by this Biodiversity grant who are now entering mid-career and holding important positions in government, industry and academia. ACA has reason to be proud of this long-term investment in the way conservation is practiced in Alberta.

The funds that undergird the ACA Grants in Biodiversity come from the license sales to hunters and anglers in Alberta as well as smaller amounts from private donations and corporate sponsorships. Such a diversified funding source is a focused strength and explains why all funded research must be done in Alberta on Alberta issues. In recent years, the ACA Board of Directors has recognized that top quality science is the first prerequisite; the Board has also encouraged a broadening of the program topics to recognize the value of proposals that show benefits to hunters and anglers (our primary funders) as well as Alberta's broader community. Consequently, since 2005, the ACA Grants in Biodiversity has been slowly evolving to allow consideration of somewhat more applied projects related to scientific management, ecological problems, and new ways of understanding/protecting resources.

Lee Foote

Tracy Stewart

This year the complementary grant program offered by ACA (the ACA Grant Eligible program) has allotted $350,000 in funds to support the best wildlife and conservation proposals in Alberta by researchers other than graduate students. Consequently, we welcome the ACA Grant Eligible program and now encourage post doctoral fellows to apply to that program instead of the smaller Biodiversity Grants program.

In 2008 we were sad to see Margaret Foxcroft, the long time administrator of our program, leave us for a more leisurely work load and more time with grandchildren. In her usual helpful style, before leaving, Margaret got our new head administrator, Tracy Stewart, up to speed for her first full review and adjudication cycle. I extend my many thanks to Margaret and my appreciative welcome to Tracy for stepping up to this job. Behind the scenes we have used approximately 100 anonymous reviewers and call on five exceptional workhorse adjudicators from U of L (Dr. Joe Rasmussen), U of C (Dr. Michael Quinn), and U of A (Dr. Colleen Cassady St. Clair), as well as Drs. Peter Aku and Doug Manzer from ACA . I truly appreciate their expertise, collegiality and the days they have given to this program.

We have had a great 2008 and 2009 and look forward to 2010 and 2011 – stay tuned!

Lee Foote, University of Alberta
Director, ACA Grants in Biodiversity

Final Reports
of students funded
2006 and 2007
2 to 35

Progress Reports
of students funded
2008
36 to 41

Final Reports

Gastropod Community Responses to Harvesting in Boreal Mixedwood Forests

Year 2 Final Report

Suzanne E. Abele
University of Alberta, M.Sc.
Dr. Ellen Macdonald , Supervisor
Dr. John Spence, Supervisor

Gastropods have an important role in forest ecosystems as decomposers, herbivores, and prey items. Understanding how gastropod communities are affected by forest harvesting is important to ensure their legacy on the landscape. My objectives in this study are to: i) conduct an overall diversity survey of the gastropod fauna in deciduous, mixed-wood, and coniferous stands of the northern Alberta mixedwood forest; ii) examine the effects of partial and complete harvesting on gastropod fauna; and iii) describe gastropod microhabitat variation in relation to bryophyte diversity and cover. Research was conducted at the EMEND (Ecosystem Management Emulating Natural Disturbance) research site located in the Peace River region. Sampling was focused in unharvested stands of different forest types, and harvested stands of a single forest type with varying degrees of green tree retention. I used three collection methods: board traps, hand searches, and soil samples. Fourteen species have been collected and identified. Results show that different gastropod communities exist in different stand types, with the majority of species being most abundant in stands with a high deciduous component. Rarely collected species are more strongly associated with specific environmental parameters than more commonly collected species. When harvesting is introduced to the system, distribution patterns are adjusted at both stand and microsite levels, and these responses differ between species. Harvesting with higher levels of green tree retention maintains a gastropod composition more similar to that of an unharvested forest.

Collecting snails and slugs from board traps

Causes of Bat Fatalities at Wind Energy Installations in Alberta

Year 1 Final Report

Erin F. Baerwald
University of Calgary, M.Sc.
Dr. Robert Barclay, Supervisor

Wind energy is one of the fastest growing energy sectors in the world. Southern Alberta currently has 16 wind farms with ~400 total turbines producing ~400 MW, and numerous other projects in various stages of development. In 2005, bat fatalities (13/turbine) were found at a new wind energy installation. The fatality rate at this particular wind farm was distinctive in the area; most other sites had fatality rates < 1 bat/turbine/year. Subsequent monitoring of that and other, newer sites has shown an average bat fatality rate of between 10 and 18 bats/turbine/year at newer, taller turbines in south-western Alberta. The timing and composition of fatality is comparable with other North American wind energy installations; the majority of fatalities are migratory tree bats (silver-haired and hoary bats) and occurred during fall migration. Using acoustic monitoring and carcass searches, I am examining variation in fatality rates and bat activity levels across seven wind facilities across southern Alberta. Bat fatality and activity varied from site to site, night to night, and turbine to turbine. I am currently analyzing data to determine whether variation is related to weather variables, turbine height, and turbine location. Such correlations may suggest mitigation strategies. Using weather correlations, I performed a mitigation experiment in 2007 and successfully reduced bat fatalities by 52% at one site. We also discovered that barotrauma (decompression) is a significant cause of bat fatalities at wind turbines, and this discovery may also lead to mitigation strategies.

Recording site data at a southern Alberta wind energy site

Edge Effects on Songbird Productivity in the Boreal Forest

Year 2 Final Report

Jeffrey R. Ball
University of Alberta, Ph.D.
Dr. Erin Bayne, Supervisor

Energy extraction in the boreal forest is requiring a growing network of pipelines, seismic lines, and roads. This network of corridors alters the movement patterns of forest and non-forest species, which may reduce the reproductive success of edge-nesting songbirds by increasing the frequency that nests are found by predators and brood parasites. This study measured edge-proximity effects on nest fate and nest productivity, and identified which species predated nests in two boreal landscapes: a single-corridor forest in the Northwest Territories (NT; 2005, 2006), and a multi-corridor forest in northwest Alberta (AB; 2006, 2007). Contrary to expectations, survival probability of ground nests declined with increased distance from the forest edge in both landscapes. Survival probability of shrub nests and nest productivity was unrelated to edge proximity and did not differ between landscapes. One possible explanation for this result is that video monitoring identified all nest predators to be boreal forest species. Red squirrels and Sharp-shinned Hawks were important nest predators in both NT and AB; American marten, black bear, and deer mice were also important in AB. I did not detect any nest predations by non-forest predators nor did I find evidence of brood parasitism even though these non-native predators and Brown-headed Cowbirds were observed in one or both landscapes. Future analyses will assess whether the observed predators avoid forest edges and/or whether edge-nesting songbirds have access to additional food resources, which would allow adults to deliver higher quality prey, reduce provisioning frequency, and reduce nest detection probability by predators.

Video camera monitoring a nesting Swainson's Thrush

Predaceous Diving Beetles Effects on Boreal Pond Communities

Year 2 Final Report

Danielle Cobbaert
University of Alberta, Ph.D.
Dr. Suzanne E. Bayley, Supervisor

In fishless ponds and wetlands of boreal Alberta, large predaceous macroinvertebrates, such as diving beetles, are the top predators. These aquatic insects are the main food source for buffleheads, mallards and other waterfowl that depend on these shallow water bodies for breeding habitat. As top predators in the aquatic food chain of these ponds, what effects do diving beetles have on the abundance and diversity of other organisms in the pond community? I tested the effects of *Dytiscus alaskanus*, a predaceous diving beetle, on other macroinvertebrates, zooplankton, and algae. The experiment consisted of enclosures with and without diving beetles in six ponds. In diving beetle enclosures the number of other aquatic predators, snails and small crustaceans such as *Gammarus lacustris* (amphipods) decreased. Diving beetles indirectly increased the abundance and diversity of the zooplankton community. In turn, the zooplankton grazed on phytoplankton which lowered phytoplankton concentrations in enclosures with diving beetles. The diving beetles' predation on snails resulted in reduced scraping by snails and increased algae concentrations attached to the enclosure walls. Overall, the results show strong effects of diving beetle populations on macroinvertebrate biomass and community composition, and strong indirect effects on zooplankton through to algae. Given that diving beetles are widespread and abundant in ponds and wetlands of northern Alberta, the assemblages of algae, zooplankton and other macroinvertebrates are likely regulated in part by diving beetle predation.

Female *Dytiscus alaskanus*

Linear Feature Effects on Boreal Forest Small Mammals

Year 2 Final Report

Amy F. Darling
University of Alberta, M. Sc.
Dr. Erin M. Bayne, Supervisor

Increases in energy sector development have produced numerous linear clearings in Alberta, such as roads, pipelines, and power lines, which are contributing to habitat conversion, fragmentation and subsequent effects on wildlife. I examined whether linear disturbances function as novel habitat or produce novel edge habitat for small mammals in boreal forest northwest of Manning, Alberta. I also studied the role of food resources in causing small mammal responses to linear clearings. Linear features had higher relative abundance of meadow species such as jumping mice and meadow voles than did forest, and lower abundance of forest species such as red-backed voles, and heather voles. Deer mice were equally abundant in linear clearing and forest habitat, and peaked in abundance near forest edge. Using stable isotope analyses of 15N and 13C, I found that meadow voles, deer mice and red-backed voles maintain unique diets regardless of capture habitat. Ongoing gut content analysis confirms that red-backed voles consume more fungi than the more insectivorous deer mice. In future analyses, I expect to find less fungus and more insects on, and close to, pipelines than in the forest interior. Linear features could increase food resources for some small mammals, and eliminate resources for others, thus driving changes in relative abundance and small mammal community composition. Small mammals are key ecosystem components for avian, and furbearing predators. They also function as seed dispersers or consumers as well as effects on nutrient cycling. Thus, changes in distributions of small mammals could have far-reaching ecosystem consequences and should be considered when evaluating energy sector development impacts.

Juvenile red-backed vole with notched ear

The Ecology and Biodiversity of Fungi Growing on Mosses

Year 2 Final Report

Marie L. Davey
University of Alberta, Ph.D.
Dr. Randolph S. Currah, Supervisor

Despite the prevalence and importance of mosses in the boreal habitats that dominate northern Alberta, little is known about the micro-fungal species that inhabit them. A survey of micro-fungal species growing on the common boreal mosses *Hylocomium splendens*, *Aulacomnium palustre*, and *Polytrichum juniperinum* has identified 65 species, of which four are putatively new to science. Four species have been identified as pathogens or parasites of mosses and their unique ecology has been characterized. *Pseudoventuria muscivora* penetrates moss host cells through a combination of mechanical force and degradative enzymes and can complete its life cycle within a single host cell, reproducing either sexually or asexually. *Sclerotinia* sp. infects the root-like rhizoids of its host moss and then spreads internally until the entire plant has been colonized by the fungus. *Kretzschmaria* sp. rapidly infects and kills moss, but moss colonies can recover through the production of new individuals with darkly pigmented, thickened cell walls that are resistant to attack by the fungus. *Coniochaeta velutina* penetrates moss rhizoids and sporulates within them, without killing the host moss. The diversity of fungal species isolated from moss hosts, and the four case studies of pathogenesis and parasitism between fungi and mosses suggest the fungi inhabiting mosses represent untold biodiversity within the boreal region and have unique ecological interactions with their hosts.

***Pseudoventuria muscivora* emerging from a single leaf cell of its host moss.**

Impact of Climate Change and Defoliation on Fescue Prairie Plant Diversity and Community Composition

Year 1 Final Report

Eliza S. Deutsch

University of Alberta, M.Sc.

Dr. Edward Bork, Supervisor

Understanding the response of Alberta grasslands to a warming climate is important for sustainably managing the biodiversity and productivity of these systems. Grazing is historically and ecologically important in Alberta grasslands, and analysis of the combined impacts of elevated temperatures and defoliation can improve our understanding of plant community responses to predicted climate change under current land-use practices. I examined how warming and defoliation alter plant diversity and composition in a rough fescue grassland in the Aspen Parkland ecoregion. To achieve the necessary treatment effects, I used open-top, circular greenhouse shelters to warm plots, and defoliated plots by manually clipping all plants to a 5 cm height in mid-June of 2006. While the diversity of plots decreased immediately after defoliation, warming appeared to offset this decline through an increase in species richness, with plots exposed to greater temperatures showing a trend towards an increase in richness and diversity into the second year. Changes in temperature also altered grassland species composition, apparently because warming can differentially affect the tolerance of various plant species to defoliation. For example, warming reduced vegetative reproduction of *Festuca hallii*, a grazing-sensitive grass species, and decreased sexual reproduction efforts in *Stipa curtiseta*, a co-dominant grass. In contrast, warming improved the post-defoliation recovery of select dicot species including *Comandra umbellata* and *Aster falcatus*. This research contributes information that will help to develop methods of mitigating the effect of elevated temperatures on grassland community diversity through managing the intensity or seasonality of grazing.

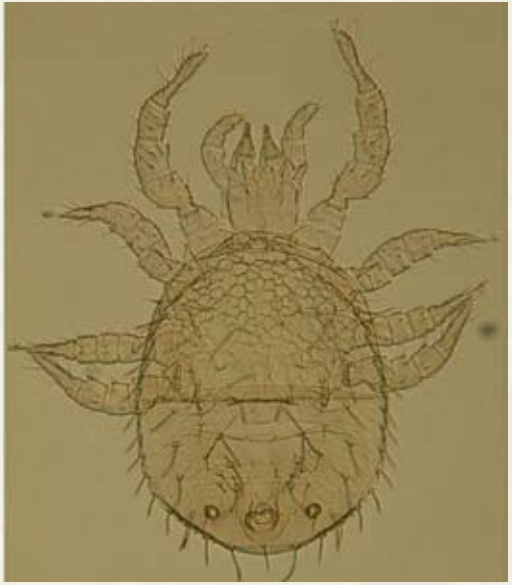
Eliza taking plant measurements in an open-top greenhouse chamber

Mesostigmatan Mite Assemblages of the Boreal Mixedwood Forest Floor

Year 2 Final Report

Irma Diaz
University of Alberta, PhD.
Dr. Sylvie Quideau, Supervisor

The boreal forest is characterized by different forest cover types (coniferous, mixed and deciduous). Forest cover type influences many properties of the forest floor, including organic matter composition, nutrient availability, and structural and functional diversity of microbial communities. In turn, microarthropods such as mesostigmatan mites may be influenced by these different factors. Mesostigmatan mites are free-living predators that may influence soil nitrogen and the regulation of other soil microarthropod populations. My overall objective was to characterize the biodiversity of mesostigmatan mites from coniferous, mixed and deciduous forest at the EMEND (Ecosystem Management Emulating Natural Disturbance) experimental site located in northwestern Alberta. Mites were identified to the levels of species when possible or genus and morphospecies when they were not readily identifiable to species with existing literature. I found that mixed forests have the highest richness of mesostigmatan mites, including some taxa that are new records for Canada. Coniferous and deciduous forests have lower mesostigmatan mite richness. Furthermore, mesostigmatan mite communities differ between coniferous and deciduous stands. Some taxa seemed specific to certain forest types. For example, *Gamasellus vibrissatus* was the most abundant mesostigmatan mite in deciduous forests and mites of the genus *Trachytes* sp in coniferous forests. Members of the family Zerconidae inhabited all forest cover types. Forest floor moisture content may be an important factor affecting the abundance of mesostigmatan mites. This work has shown that forest cover type, probably mediated through forest floor properties is an important determinant of these mesostigmatan mite communities.



Zerconidae mite from the mixed forest in northwestern Alberta, Skeironozercon cf. tricavus

The Leafroller Moth Assemblages in Disjunct Montane Habitats

Year 2 Final Report

Jason J. Dombroskie
University of Alberta, Ph.D.
Dr. Felix A. H. Sperling, Supervisor

The montane in Alberta consists of dry, high-elevation mixed forest and fire-dependant grassland. This habitat is located in a few separated valleys in Alberta and is also one of the most imperilled ecozones in the province, mainly because it is often the best place to build transportation corridors. The montane is also very important habitat for several large mammal species. Leafroller moths (Tortricidae) are a diverse group of small moths with over 350 species in Alberta and include many species that are habitat or host plant specific. I sampled three montane habitats (Jasper National Park, Kootenay Plains Ecological Reserve, Porcupine Hills) regularly through the season, as well as locations in the boreal and prairies of Alberta and montane in British Columbia. I collected over 250 species, including several new for the province or country and several new to science. The species assemblages were compared and preliminary results indicate that Jasper shows strongest affinities to Kootenay Plains and the boreal, and both Kootenay Plains and Porcupine Hills show strong affinities to the prairies. There are great differences in the species assemblages between the montane sites which illustrates the uniqueness of each one and the need for protection for all of them. Several species in common to all sites will now be sequenced to determine population level genetic differences.

***Clepsis persicana*, more commonly known as the White-triangle Tortrix**

Fish and Waterfowl Assemblages

Year 2 Final Report

Ceitlynn A. Epners
University of Alberta, M.Sc.
Dr. Suzanne Bayley, Supervisor
Dr. William Tonn, Supervisor

Wetland lakes in the Boreal Transition Zone of Alberta are naturally productive systems that provide important breeding and moulting habitat for many species of waterfowl. Identification of important waterfowl habitat is essential for waterfowl conservation. Waterfowl conservation strategies should also consider the influence of fish on waterfowl populations. Fish can compete with waterfowl for macroinvertebrate prey and can negatively affect wetland water quality. To examine the relative importance of biotic (fish) and abiotic (wetland-lake habitat) forces on waterfowl density and waterfowl composition, I surveyed the environmental characteristics, the fish communities and the waterfowl communities of 30 wetland-lakes. The study found that waterfowl were most influenced by the wetland-lake habitat but that fish presence did negatively impact waterfowl density. Waterfowl density increased with lake productivity even in lakes that were eutrophic (very nutrient rich). Waterfowl density was also twice as great in fishless lakes than in lakes with fish. Competition between fish and waterfowl may be occurring to a minor extent during the breeding season when macroinvertebrate food resources are particularly important for waterfowl. These findings will contribute to current Ducks Unlimited Canada wetland-waterfowl modeling initiatives and can help guide priority habitat for waterfowl conservation in the Boreal Transition Zone.

Ceitlynn sampling for fish in a wetland-lake

Selenium Dynamics in Canadian Rocky Mountain Lakes

Year 2 Final Report

Barbra L. Fortin
University of Alberta M.Sc.
Dr. David. W. Schindler, Supervisor

Selenium (Se) is an essential trace element that is toxic to organisms at high concentrations. Se contamination in the aquatic environment can originate from natural (i.e., rock weathering) or anthropogenic (i.e., burning of fossil fuels, combustion of coal and mining activities) sources. Se bioaccumulates in plankton, benthos and fish. Concentrations of Se in some aquatic systems exceed guidelines to protect the health of human and wildlife consumers. High Se concentrations can result in fish reproductive failure. I examined Se concentrations in 12 lakes in Southeastern Banff and Kananaskis Country, Alberta. Inveterbrate mean Se concentrations ranged from 0.696 – 14.654 mg Se/kg dw. Five invertebrate orders had mean Se concentrations which exceeded both normal background levels (<2 mg Se/kg dw) and concentrations that could cause health effects in their bird consumers (>2.9 mg Se/kg dw). Four invertebrate orders had mean Se concentrations which could cause sublethal effects in their fish consumers (>4-8 mg Se/kg dw). I also found that mean Se concentrations in fishes ranged from 6.334 – 10.732 mg Se/kg dw. All species of fish had means which exceeded the normal backround range (<1-4 mg Se/kg dw) and some fishes had Se concentrations which surpass those which cause fish sublethal effects (7-9 mg Se/kg dw). I also found that brook trout from Johnson Lake and lake trout from Lake Minnewanka and Spray Lakes showed a significant increase (average of 33%) in Se concentrations in 2007 when compared to those sampled in the early 1990s or 2001.

Barb with brown trout

Effect of Energy Development on Grassland Birds

Year 2 Final Report

Laura E. Hamilton
University of Alberta, M.Sc.
Dr. Cindy Paszkowski, Supervisor

Grassland bird populations are in decline in North America due to loss of prairie habitat. While direct loss of habitat is the main cause, fragmentation from increased human use often exacerbates conditions, making areas of remaining prairie undesirable to grassland birds. My study examined how human disturbances on native prairie in Southern Alberta relate to energy development (construction of well sites, junctions, pipelines, and trails, and introduced exotic grass species) for three grassland bird species: Savannah Sparrow, Chestnut-collard Longspur, and Sprague's Pipit. I investigated the relative abundance of birds in relation to categories of disturbance, the size of males' territories and their characteristic vegetation cover. I found that relative abundance, territory size, and habitat structure did not vary with the density of disturbance. Sparrows and Pipits avoided low-impact trails but were largely indifferent to well sites and pipelines whereas Longspurs avoided low-impact trails only in areas with low disturbance. Taller, exotic grass, introduced prior to 1992 but still being spread by wind and vehicles, was found less often and in smaller patch sizes in both Pipit and Longspur territories compared to the surrounding landscape and adjacent unused areas. I was unable to determine any effect of energy development on nesting success because few nests were located, but I created a background reference for nesting success in the area that did not exist previously.

Laura measuring a Sprague's Pipit chick to get background nest success and chick size information for CFB Suffield

Effects of Human Activity on Alberta's Boreal Biodiversity

Year 2 Final Report

Diane L. Haughland
University of Alberta, Ph.D.
Dr. Stan Boutin, Supervisor

The Alberta Biodiversity Monitoring Institute (ABMI) is a taxonomically-diverse, correlative monitoring program with the goal of assessing status and trends of biodiversity. I am cooperating with ABMI to develop methods for summarizing trends in species diversity by quantifying species turnover (differences in diversity between sites). To do so, I am assessing their ability to characterize undisturbed boreal ecosystems, and the deviation from expected with increasing amounts of human activity. Because the ABMI began implementation in 2007, the human activity gradients in their surveyed sites are incomplete. During Summer 2007 and 2008, I collected data to complement existing gradients by surveying 31 sites that filled gaps in human activity and ecological gradients. Data were collected via standardized, rapid biodiversity assessments of songbirds, soil springtails and mites, lichens, bryophytes, polypore fungi, and vascular plants at 15 lowland black spruce bog and 16 upland mixedwood sites. Sites were moderately to highly impacted by oil and gas activity, complementing the sites sampled by ABMI with little to no human activity within a 1 km radius. Preliminary observations showed that human activity reduced the abundance of native species, but species often were able to persist in fragments and habitat edges, suggesting that species turnover is small until most of the site has been directly disturbed. Lichens and soil athropods seem to be most sensitive to disturbance, while vascular plant communities appear to be the most resilient. Once all specimens of all taxa collected in the field are identified (scheduled for June 2009), these preliminary observations will be tested more vigorously.

Timothy (*Phleum pratense*) commonly is found in the boreal wherever human activity occurs

Rising Treeline in the Rockies: Implications for an Alpine Butterfly

Year 1 Final Report

Kurt Illerbrun

University of Alberta, M.Sc.

Dr Jens Roland, Supervisor

A combination of long-term climatic shift and altered forest fire regimes contributes to rising treeline in many areas of the Rockies. In the front ranges, one significant consequence of treeline encroachment is the reduction and fragmentation of ridge-top meadows, home to the Alpine Apollo butterfly (*Parnassius smintheus*). Previous research in Kananaskis Country has shown adult butterfly movement is adversely affected by tree growth in formerly open habitat. However, little is known of treeline effects, either direct or indirect, on other stages of the Apollo's lifecycle. I examined larval feeding behaviour and related it to distance from treeline, paying particular attention to the impact of treeline on availability of the Apollo's sole larval food source, Lance-leaved Stonecrop (*Sedum lanceolatum*). Results show Stonecrop grows more densely *near* treeline, while Apollo larvae prefer to feed more heavily on plants *far* from treeline. As treeline encroaches and all points in the remaining meadow are effectively closer to treeline, larvae may have no choice but to consume less attractive Stonecrop plants near-treeline. My results therefore suggest rising treeline may reduce preferred larval food sources, even while overall Stonecrop numbers and adult Apollo mobility remain at acceptable levels.

Kurt photographs Stonecrop distributions for later analysis

Horned Grebe Habitat Selection on Constructed Wetlands in Northwestern Alberta

Year 2 Final Report

Eva C. Kuczynski
University of Alberta, M.Sc.
Dr. Cindy Paszkowski, Supervisor

Degradation of wetlands in the Peace Parkland region of northwestern Alberta has resulted in a loss of breeding habitat for waterfowl and other birds. However the need for road construction material has resulted in the creation of borrow-pits which may function as habitat for breeding waterbirds. The Horned Grebe is one such species that has been declining throughout its western Canadian range and has been observed to nest on roadside constructed ponds in Alberta and the Northwest Territories. In 2007 and 2008, I repeatedly surveyed 201 roadside borrow-pit ponds located in the Peace Parkland – Boreal mixed woods transition zone, as well as 18 small natural reference wetlands. I conducted stable isotope analysis, invertebrate and water chemistry sampling on a smaller subset of these ponds, to examine the available food base and quality of waterbird habitat. Occurrence of horned grebes on borrow-pits was high (36%); use was higher and chicks were produced more frequently on borrow-pits than observed on natural wetlands in the Peace Parkland or constructed wetlands elsewhere in Canada. I also observed use of borrow-pits by an additional 23 species of waterbirds. I found that horned grebes prefer large ponds in agricultural areas with abundant peripheral emergent and riparian vegetation and without beaver activity. Horned grebes avoid ponds with evidence of disturbance by humans. Constructed wetlands can benefit horned grebes, serving as a source of recruitment of young to the population. My study generated recommendations for pond construction to conserve horned grebe populations.

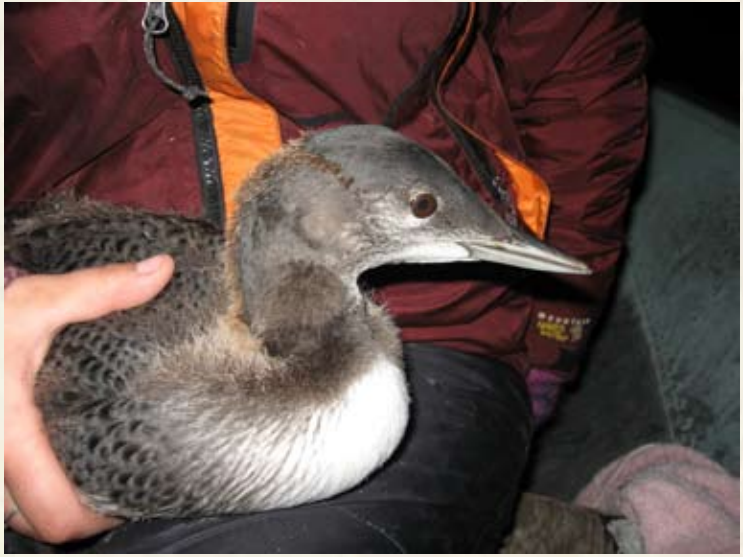
A horned grebe nest

Patterns of Contaminant Accumulation in Common Loons Breeding in the Canadian Rocky Mountains and Foothills

Year 2 Final Report

Sarah I. Lord
University of Alberta, Ph.D.
Dr. David Schindler, Supervisor
Dr. Gordon Court, Supervisor

Common Loons (*Gavia immer*) are fish-eating diving birds that are symbolic of the Canadian wilderness. Because of their position at the top of the aquatic food chain, loons have been extensively used as a bio-monitoring species for mercury, pesticides, and other human-produced pollutants in the northeastern USA and eastern Canada. These chemicals cause a variety of developmental and behavioral problems in loons that ultimately lead to reduced breeding success and population decline. Assessing the contaminant burden in loons in the Rockies is important because many lakes in the Rockies have fish with mercury levels that surpass those found in the mercury 'hotspots' of eastern North America. In June – August 2007, I took blood and feather samples from 42 adult and juvenile loons from 23 lakes in the Rockies. Captured loons were colour-banded for demographic analyses. Chemical analysis of the samples is ongoing, and when completed I will build a predictive model to examine the relationships between contaminant concentration, position in the food chain, elevation, latitude, and other biological and geographical variables. This will allow us to identify high-risk and low-risk loon populations in the Rockies.



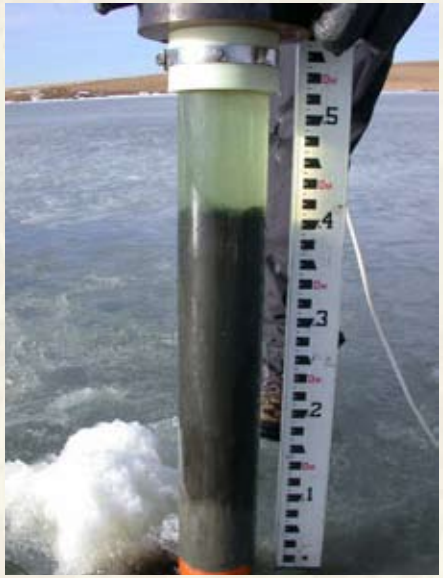
Juvenile Common Loon being banded at Wabamun Lake

Salinity and Water Clarity in Shallow Prairie Lakes

Year 2 Final Report

Heather M. (Boyd) Maheux
University of Calgary, Ph.D.
Leland J. Jackson, Supervisor

Shallow lakes are important sources of biodiversity and provide valuable breeding habitat for migratory waterfowl. Warm and dry conditions predicted for the Canadian prairies should increase evaporation from shallow prairie lakes, making them more saline. Increased salinity can impact ecology and biodiversity of lakes in a number of ways. One of these is through the influence on phytoplankton abundance, the microscopic plants at the base of the aquatic food web. When phytoplankton are highly abundant, lake waters turn turbid (i.e., murky) and restrict the amount of light reaching the lake bottom so that bottom-dwelling plants, such as rooted macrophytes, can't grow. Macrophytes can be desirable because they provide habitat for insects and fish as well as some waterfowl. I am studying how the relationship between salinity and phytoplankton relates to water clarity in shallow Alberta lakes. I have collected water samples from twenty shallow prairie lakes in southern Alberta and am analyzing those samples for phytoplankton abundance, phytoplankton community composition, nutrient concentrations and salinity to identify present-day relationships between salt content and phytoplankton in those lakes. I have also collected sediment cores from the bottoms of 12 of my study lakes. Finally, I am using fossils within the cores to study how historical changes in salinity relate to transitions between clear and turbid states of those lakes. This research will help us understand how future changes in climate and lake salinity will affect water quality in Alberta's shallow prairie lakes.



Core sample

The Habitat Value of Energy Sector Wellsites for Boreal Birds

Year 2 Final report

Dr. C. Lisa Mahon
University of Alberta, Postdoctoral Fellow
Dr. Erin M. Bayne, Supervisor

Oil and natural gas exploration and development annually account for most of the estimated 40,000 ha of land disturbed by industrial activity within the province of Alberta. Natural gas wellsites result in the creation of small clearings (approximately 100 x 100 m) with a high degree of degradation. For boreal forest birds, the habitat value of other early seral habitats (harvest units, burns) has been previously investigated, although the value of wellsites as habitat is currently unknown. My field research revealed three primary findings. First, wellsites supported less than half the bird species found in forest edge and forest interior habitats. I identified 50 species of birds during the survey period; 37 species were found in forest habitat, 41 species were found in forest edge habitat, and 15 species were found in wellsite habitat. Second, forest edge habitats supported the highest bird species abundance for all nesting guilds indicating a positive edge effect. Bird species richness and abundance and the abundance of canopy species, cavity species, shrub species, and ground species were highest in forest edge habitats. The total abundance of birds found in forest edge habitats (22.69) was almost twice that of forest interior habitats (12.88). Third, habitat type and vegetation floristics, rather than vegetation structure, predicted bird community composition. In general, wellsites provided habitat for a small number of open habitat and shrub-associated species (e.g. Le Conte's Sparrow), while highly diverse forest edge and forest habitats provided habitat for a larger number of open habitat, shrub, and forest-associated species (e.g. Warbling Vireo, Black-capped Chickadee).

Slowly regenerating natural gas wellsite within a boreal mixedwood forest near Calling Lake in northern Alberta

Foraging Efficacy and Replacement of Top Piscivorous Predators in Aquatic Food Webs

Year 2 Final Report

Andrea M. McGregor
University of Alberta, Ph.D.
Dr. A. Lee Foote, Supervisor
Dr. Michael G. Sullivan, Supervisor

In the last 100 years Lac La Biche, located in northeastern Alberta, has changed from a system with walleye (*Sander vitreus*) as the top fish-eating predator, to one where Double-crested Cormorants (*Phalacrocorax auritus*) are at the top of the aquatic food chain. Along with the major prey species in the lake, (yellow perch (*Perca flavescens*)), cormorants and walleye have been identified as the main species that define and drive the system. Recent and historical changes to the fishery have altered the ways in which these species interact. My investigation of the Lac La Biche ecosystem is intended to investigate the interactions of these species in an ecosystem context to achieve the following objectives: (1) assess the efficacy of different management alternatives in achieving the restoration of a traditional fish community structure; (2) examine the existence and stability of alternate stable states in freshwater food webs. Addressing these objectives requires an ecosystem-level research approach. Understanding how and why these changes have occurred using traditional experimental designs is often not possible due to the number of variables that may be impacting the system, consequently I will create simulation models to examine such complex questions. Substantial fieldwork was conducted between 2006 and 2008 to collect high quality data for parameterizing the model with realistic fish and cormorant population values. Preliminary results should be available by the summer of 2009.

Yellow Perch captured in a beach seine on McGuffin Lake

Consequences of Plant Foraging Behaviour in a Native Alberta Grassland

Year 2 Final Report

Gordon G. McNickle
University of Alberta, Ph.D.
Dr. James F. Cahill, Supervisor
Dr. Michael K. Deyholos, Supervisor

Alberta has some of the largest continuous areas of native grassland remaining on the planet. An understanding of the processes that make these ecosystems function is critical for the continued existence of many native Alberta species. I am interested in the role that plant root activity plays in basic ecosystem processes. Everyone knows that animals use specific behaviours to search for food, yet few people think of plants as organisms which exhibit behaviour, yet they do. Plant roots actively move through soil in search of nutrient patches and, like animals, plants are very good at finding "food". In nature, individual plants must compete with each other for access to nutrients in the soil and the outcome of these belowground "battles" can have dramatic consequences for the structure and function of ecosystems. However, it is difficult to measure the activities of plant roots because the fine roots of different species are visually indistinguishable, which has historically made it impossible to measure root foraging in natural communities. ACA Biodiversity funding allowed me to develop a molecular DNA method to identify root samples of different species. Application of this method in the future will allow me to:

1) determine for the first time how plant roots search for nutrients in natural communities and;

2) understand how differences in plant behaviour can influence the coexistence of the diverse array of Alberta plant species.

Gordon sampling native Alberta grasslands

The Effect of Selenium on Rainbow Trout and Brook Trout

Year 2 Final Report

Lana L. Miller
University of Lethbridge, Ph.D.
Dr. Alice Hontela, Supervisor

Selenium (Se) is an essential element that can be toxic at concentrations only slightly greater than the dietary requirement. In areas with high selenium in the bedrock, anthropogenic activities, such as coal mining, can expose this rock to weathering processes mobilizing Se into lakes and streams. Rainbow trout appear to be more sensitive to Se toxicity than brook trout even though they are closely related. To investigate these differences, juvenile rainbow trout and brook trout were stocked into Se-contaminated and reference end pit lakes and samples were collected after 0, 6, 12, and 18 months. Rainbow trout had higher growth rates than brook trout in all of the lakes except the lake with the highest selenite levels. Rainbow trout put their energy into growth, while brook trout store more of their energy. Additionally, rainbow trout had more liver glutathione (a molecule that cycles with Se to cause cellular damage) than brook trout, and rainbow trout from Se-contaminated lakes had more liver lipid peroxidation (indicator of cellular damage) than did brook trout. Thus, brook trout may have a competitive advantage over rainbow trout in Se-contaminated habitats as they may have less Se-induced damage than the rainbow trout. In north-western Alberta, native Athabasca rainbow trout in Se contaminated streams compete with introduced brook trout. Data from my study can be used to help explain the loss of rainbow trout from these Se-contaminated streams, manage these populations, and contribute to species specific Se risk assessments in other areas.

Determining body fat content using bioelectrical impedance analyses

Landscape Genetics: Predicting Chronic Wasting Disease Spread in Mule Deer

Year 2 Final Report

Stephanie M. Nakada
University of Alberta, M.Sc.
Dr. David Coltman, Supervisor

Chronic wasting disease (CWD) is a fatal, neurological, prion disease affecting cervid populations in North America. In wild deer of western Canada, over 220 confirmed cases have been reported since 2000, most of which were in mule deer. The potential risk of further CWD spread and the consequent socio-economic impacts have made this a major wildlife management issue calling on a necessity for research concerning disease transmission dynamics in deer populations throughout western Canada. I will predict disease spread in mule deer using landscape genetics and through sequencing techniques to ascertain mule deer movement patterns between potentially susceptible populations. I have produced DNA profiles for over 2,700 deer across Alberta, Saskatchewan and British Columbia to determine the genetic diversity and relatedness of deer and to identify landscape features (i.e. rivers) that are potential barriers to mule deer movement. I have already examined twenty geographic areas and have found very little genetic delineation between these areas indicating there are few natural barriers to deer movement or disease spread in these locations. However, there does appear to be somewhat less genetic connectivity or movement of populations between the Rocky Mountain and grassland/parkland natural regions indicating the prevalence of CWD is likely to increase in these areas before reaching the mountains. Sequencing of the prion protein gene, PRNP, has also revealed associations between genetic mutations and disease status that may be indicators for differences in incubation periods that will help determine the rate of CWD spread.

Mule deer doe and fawn in Jasper National Park, Alberta

Intra-Sexual Relationships in Bighorn Rams

Year 2 Final Report

Graeme O. Pelchat
University of Calgary, M.Sc.
Dr. Kathreen Ruckstuhl, Supervisor

Graeme identifying bighorn rams at Sheep River Provincial Park

The reason social ungulates aggregate the way they do remains unclear. Optimal foraging, achieved through synchronizing foraging activity, is a likely reason ungulates tend to group according to sex. How and why animals of the same sex group is uncertain. Male bighorn sheep (rams) within populations separate into multiple groups. Within groups, rams interact in order to compete for social rank. Sometimes interactions involve more than two rams. Coalitions are an example of cooperative behaviour, defined as two rams cooperating to outcompete a single ram. I tracked bighorn sheep during 2005 and 2006 to document association and interaction patterns among rams at the Sheep River Provincial Park. As males aged, they associated with fewer animals, however the strength of their associations increased. Rams were more likely to associate with partners closest in age. Coalitionary patterns of interaction were not explained by genetic relatedness. Rams involved themselves in fights only when they were higher ranked than both other individuals, and they targeted rams that were closest in rank. These results indicate that rams associate as predicted by optimal foraging strategies, and interact in a manner that leads to stability of the social hierarchy. These results further our understanding of the behavioural dynamics of bighorn sheep populations.

Spider Assemblages in Mixedwood Forests After Variable Retention Harvest

Year 2 Final Report

Jaime H. Pinzon
University of Alberta, PhD
Dr. John Spence, Supervisor
Dr. David Langor, Supervisor

In western Canada, fire is one of the main disturbances that shape the structure of boreal systems by maintaining a mosaic of successional stages. As a consequence, forest managers are implementing harvesting strategies to emulate fire as an approach for maintaining biodiversity and preserving ecosystem integrity. Spiders constitute an important component of invertebrate diversity in northern mixed-wood boreal forests, providing important ecosystem functions; hence, as generalist predators, spiders maintain invertebrate populations in equilibrium and as prey, constitute a significant food source for some vertebrates.

The effects of harvesting practices on spider assemblages is poorly known; thus, I studied how variable retention harvesting (dispersed & aggregated retention) affects the composition and diversity of spiders. Results indicate that harvesting reduces habitat heterogeneity having a significant effect on species composition. As harvesting intensity increases (in terms of percent cover removed), assemblages tend to be more homogeneous and thus less diverse. However, some structural features that are lost in traditional clear-cutting are maintained by leaving 10-20% of the trees after harvesting. Results also suggest that by leaving aggregated retention patches within harvested areas, a greater number of features are preserved on the landscape which facilitates more similar species assemblages to pre-disturbance condition and thus, serving as effective disturbance "life boats". Knowledge gained by this project is relevant for forest managers to better understand the effects of management practices on invertebrates (i.e. spiders) and their effectiveness for conservation and sustainability purposes.

Jaime and his field assistant Emily collecting spiders from a canvas sheet

Evolutionary Consequences of Trophy Hunting in Bighorn Sheep

Year 2 Final Report

Jocelyn Poissant
University of Alberta, Ph.D.
Dr. David Coltman, Supervisor

In Alberta, many populations of bighorn sheep are subjected to severe unlimited-entry hunting of trophy rams. Over time, selectively removing large rams possessing fast-growth genes can lead to a decrease in average population horn size and body mass. This is because slow-growing rams escaping harvesting are preferentially allowed to pass on their genes to the next generations. By combining field data from a population of sheep for which almost all individuals have been tagged and measured over the last 35 years (Ram Mountain, Alberta) with advanced genetic analysis being carried out at the University of Alberta, I am seeking to better understand the environmental and genetic mechanisms controlling horn growth and body mass in wild sheep. My results will provide crucial information about the influence of trophy hunting on the genetic integrity of natural populations and ultimately help wildlife managers to implement appropriate recovery/management plans.

Rams inside the trap

Using Beetles to Evaluate Forest Management Alternatives in Alberta

Year 2 Final Report

Matthew P. Pyper
University of Alberta, M.Sc.
Dr. John Spence, Supervisor
Dr. David Langor, Supervisor

Determining appropriate sizes of retained forest patches is important for biodiversity conservation

Many forestry companies in Alberta have adopted a new harvesting system that retains patches of live trees within harvested blocks. These patches can function as critical habitat reserves for biodiversity, and promote a healthier biological community within regenerating stands after harvesting. However, forest managers lack information about what size these retained patches must be to conserve biodiversity, and how best to place them within harvest blocks. To study patch characteristics such as these, scientists often use one group of species as 'indicators' of how biodiversity as a whole might respond to forest harvesting. Beetles are often used as these 'indicators' and have been shown to be extremely useful for studying forest management alternatives. I studied the response of 92 species of ground beetles and rove beetles to harvesting practices in order to determine appropriate patch sizes and patch placements which maximize beetle conservation. I found that beetles were conserved best in retained forest patches that were greater than 2-5 hectares in size. This size is larger than that currently used by most companies in Alberta. I also determined that patches closer to the unharvested forest conserved more rare species than those farther, and thus more isolated, from the unharvested forest. These results suggest that: 1) managers can utilize larger retention patches to promote beetle conservation in managed forests; and 2) placing patches closer to the unharvested forest will increase their conservation potential.

Assessing Wetland Construction in Alberta's Oil Sands: Marsh Vegetation as a Reclamation Target

Year 2 Final Report

Dustin Raab
University of Alberta, M.Sc.
Dr. Suzanne Bayley, Supervisor

Working at a reclaimed wetland, Fort McMurray, Alberta

Large tracts of pristine boreal forest and wetlands are being destroyed as oil sands development continues in northern Alberta, and this land must be reclaimed after the mining is completed. The landscape prior to mining is composed of 60% wetlands, mostly peatlands, which are critical habitat for many native species. Thus far, wetland reclamation efforts have produced a few small shallow marshes. Future constructed wetlands are projected to cover 450 km2 after mining, and regulators require a way to assess the health of these extensive areas. Marsh wet-meadow and emergent plant communities are often good indicators of wetland health, thus I undertook a comparison of the plant community in oil sands constructed marshes and natural reference marshes ranging in salinity from fresh to subsaline. Understanding changes in vegetation across a range of salinity is essential to determining whether the plant communities assembled in constructed marshes are impaired or fall within the natural range of variability. I surveyed vegetation in 45 wetlands: 25 boreal marshes unaffected by development and 20 reclaimed marshes. The wet meadow plant community structure differed significantly among the pond types. Reference sites had higher densities of the native sedge *Carex atherodes*, whereas physically and chemically disturbed oil sands sites had higher densities of invasive species. Such aspects of the marsh vegetation community show promise in indicating reclamation success in the oil sands and will be combined to produce a tool to assess overall wetland health and track reclamation progress.

Dispersal of Mountain Pine Beetles in Host and Non-host Forest Habitats

Year 2 Final Report

Tyler G. Reid
University of Calgary, M.Sc.
Dr. Mary Reid, Supervisor

Dispersal of animals through a landscape constitutes an integral component of forestry management practices, however, few studies have used empirical data to quantify this dispersal. The mountain pine beetle (*Dendroctonus ponderosae*) is one species that is of ecological and economic importance to the forests of Alberta, yet knowledge of its dispersal behaviour is limited. Mountain Pine Beetles rely on pheromone communication to locate and coordinate mass attacks to overcome host tree defenses. This communication system is affected by microclimate conditions, such as wind speed and temperature, which are largely affected by forest structure. I used mark-recapture experiments in a variety of forest landscapes to quantify the effects of forest structure and composition on the dispersal behaviour of mountain pine beetles. I found that more marked beetles were caught in pheromone traps as tree density around those traps increased, and as wind speed decreased. Beetles also tended to fly with the direction of the wind. Wild beetles were caught in every study site, including those that contained no host trees. This would indicate that management treatments eliminating host material may not suppress the dispersal of the beetles across a landscape, but may only reduce local attack levels by altering microclimates that affect the ability to locate hosts. I also examined the effects of markings on beetle survivorship and condition, and found that marking powder significantly increases the loss of water weight in individuals. This result may influence mark-recapture study design, as marked individuals may be making different dispersal decisions based on reduced body condition, and results of mark-recapture studies may not accurately represent natural populations.

Mountain pine beetle marked with a green fluorescent powder for identification

Understanding Invasion of Kentucky Bluegrass into Rough Fescue Grasslands

Year 2 Final Report

Steven C. Tannas
University of Alberta, Ph.D.
Dr. Edward W. Bork, Supervisor

Foothills rough fescue (the provincial grass) dominates the grasslands of south-western Alberta. Though large tracts of these grasslands have been preserved from cultivation, these grasslands are under threat of invasion by Kentucky bluegrass, a species capable of displacing plants of the native community. I am measuring the invasion and competitive ability of Kentucky bluegrass with rough fescue in established native grasslands, highly disturbed restoration projects, controlled garden experiments and in the greenhouse. These experiments test the ability of bluegrass to invade under: different nitrogen and water gradients, in the presence or absence of grazing, and under a variation of rough fescue densities with the goal of finding a successful method to preserve and restore these grasslands. This ongoing research has shown many interesting dynamics between the two species. Reduced nitrogen levels (through sawdust application) significantly reduced the growth of Kentucky bluegrass, but had mixed results one year after establishment on rough fescue depending on the whether greenhouse-started plugs, seed or mature cuttings were used. Cutting up mature rough fescue plants and planting them in soil with sawdust benefited the fescue, while greenhouse-started plugs and seeding treatments did not benefit. Seeding failed on all soil preparation treatments. The competitive ability of a mature rough fescue plant does not appear to exist in establishing seedlings though greenhouse-started plugs and mature cuttings appear to bypass this vulnerable life stage.

Measuring species cover

Population Genetics of Bull Trout in Southwest Alberta

Year 1 Final Report

Will G. Warnock
University of Lethbridge, M.Sc.
Dr. Joseph Rasmussen, Supervisor

A subadult migrant bull trout is fin clipped, tagged and released

Bull trout are a fish native to the cool streams of the Alberta Rocky Mountains. The species has experienced severe declines in population distribution and abundance in the 20th century due to overharvest by anglers and habitat degradation. The last major stronghold of bull trout in Southwestern Alberta occurs above the Oldman River Reservoir, into which the Castle, Crowsnest and upper Oldman Rivers flow. Bull trout use the small tributaries of these rivers for spawning and as juvenile nurseries. The purpose of my research was to characterize population interconnectedness in these rivers using genetic tools. I found that both the Oldman and Castle Rivers contain several unique populations of bull trout, and that gene flow between these populations is rather low. I also used these tools to assign large migratory bull trout which were caught in the mainstream of the rivers back to their population of origin. Current fisheries conservation techniques attempt to manage fish as populations, therefore results of this study may be used to characterize proper management units of fish in the study area.

Plankton Communities in Mountain Lakes of Alberta in a Changing Climate

Year 2 Final Report

Paul Weidman
University of Alberta, Ph.D.
Dr. David Schindler, Supervisor
Dr. Rolf Vinebrooke, Supervisor

Climate change is expected to have the greatest impacts on aquatic species adapted to cold and stable climate regimes in alpine and polar environments. Effects on lakes will include reduced snow and ice cover, increased water temperature, and changes in terrestrial run-off, which will affect dissolved organic carbon concentrations that in turn regulate growth of bacteria and algae. The main objective of my doctoral research was to determine the ability of keystone alpine zooplankton species to tolerate climate-related changes in temperature and dissolved organic carbon in mountain lakes of Alberta. I conducted a year-round survey of 12 mountain lakes that had the same keystone alpine zooplankton species, but were located over a gradient of 1000 meters in elevation. Among lakes, mean annual water temperatures ranged over five degrees Celsius and dissolved organic carbon varied by several-fold. High densities of keystone omnivorous zooplankton *Hesperodipatomus* occurred in nine months of the year and were correlated with dissolved nutrients. High densities of herbivorous zooplankton *Daphnia* occurred only in 3 months of the year and were correlated with water temperature. I also conducted a laboratory experiment where several alpine and montane zooplankton communities were subjected to increased temperature (+7oC) and dissolved organic carbon (+2X). In alpine populations, warming and dissolved organic carbon both decreased *Hesperodiaptomus* adults and eggs by 87% and 100%, while *Daphnia* adults increased by 95%. In montane populations, egg production decreased by 62% in *Hesperodiaptomus*, but increased by 420% in *Daphnia*. Therefore, several lines of evidence suggested that continued climate change will favor more adaptable *Daphnia*, which will disrupt mountain lake food webs by causing a shift towards greater herbivory.

Collecting samples in Middle Rowe Lake, Waterton Lakes National Park

The Effects of Nutrient Enrichment on Tadpole Growth and Survival

Year 2 Final Report

Arthur V. Whiting
University of Alberta, Ph.D.
Dr. Cynthia Paszkowski, Supervisor

Elevated levels of nutrients (particularly phosphorous) due to runoff from agriculture, cattle and urban sources, are a growing threat to freshwater ecosystems. I examined how differences in wetland nutrients influence tadpole ecology and the success of two abundant and widespread Alberta amphibians: boreal chorus frog and wood frog. Surveys at wetlands and experimental stocking of tadpoles in experimental tanks were used to explore the effects of nutrient enrichment on tadpole growth and diet, and the influence on recruitment to metamorphosis. Sixteen wetlands located in croplands, pastures and within Elk Island National Park were monitored in 2006 and 2007.

Arthur supervises Curtis filling cattle tanks used for rearing tadpoles at different nutrient concentrations

We found that densities of wood frog tadpoles negatively affected chorus frog growth rates, which may reduce the probability of metamorphosis prior to pond drying. Diet overlap between the two species occurred at several wetlands. Nutrient addition to cattle tanks showed that elevated nutrients increased growth of chorus frogs but growth was greater in the absence of wood frog tadpoles. Consistent with other studies, wood frog tadpoles did not respond to increased nutrients. Direct competition for food is not likely responsible for the growth reduction as chorus frog tadpoles grew slower even when wood frog tadpoles were confined to mesh cages in a common aquarium. Tadpole density within agricultural ponds was lower than park ponds suggesting either poor survival of tadpoles to metamorphosis or poor survival within the terrestrial habitat. However results from both venues suggest that agricultural ponds permit the successful development of tadpoles to terrestrial frogs, and that terrestrial survival may be the greatest threat to amphibians in altered landscapes.

Molecular Tracking of a Recent Co-invasion in Alberta

Year 2 Final Report

Bronwyn W. Williams
University of Alberta, Ph.D.
Dr. David Coltman, Supervisor
Dr. Heather Proctor, Supervisor

Biological invasions are of great concern to conservationists and managers due to frequently observed detrimental impacts of invaders on native biodiversity. Until recently, the northern crayfish, the only crayfish species in Alberta, could be found in the province only in the Beaver River drainage near the Saskatchewan border. However, the northern crayfish has recently become invasive, spreading into interior Alberta along multiple river systems. The objective of this research is to determine the mode and source of invasion of the northern crayfish into Alberta using newly developed molecular markers and population genetics methods applied to both the crayfish and associated obligate ectosymbionts and potential co-invaders, branchiobdellidans, or crayfish worms. Natural upstream dispersal would indicate recent changes in habitat or environment, allowing rapid colonization into previously unoccupied areas whereas human-mediated translocation of northern crayfish would likely be a result of bait movement or illegal introductions. Preliminary genetic data from collections across Alberta and Saskatchewan suggest that current distributions of crayfish in Alberta results from a combination of natural dispersal and human-mediated translocation. Results also indicate that the distribution of branchiobdellidans is not entirely coincident with the distribution of crayfish, suggesting that there may be different environmental tolerances or dispersal barriers for the host and symbiont. Ongoing analyses will allow for detailed reconstruction of the colonization. The resulting model of invasion will provide managers with the tools to make important decisions regarding control and prevention of spread of the northern crayfish or conservation of affected species or habitats.

Bronwyn searching for crayfish in southern Saskatchewan

Progress Reports

Habitat and prey selection of an isolated cougar (*Pumar concolor*) population

Michelle Bacon
University of Alberta, M.Sc.
Dr. Mark Boyce, Supervisor

Understanding the rapid expansion of cougars in Cypress Hills is a management issue. Moose, elk and deer are important cougar food in Alberta.

Michelle tracks radiocollared cougars

Mechanisms of brown-headed cowbird expansion in the boreal forest

Erin Cameron
University of Alberta, Ph.D.
Dr. Erin Bayne, Supervisor

Erin's research challenges some dogma about Brown-headed cowbird roles as nest parasites

A banded and radio-tagged female cowbird

Molecular diagnostic tools for assessing gastrointestinal parasites in wild cervids

Nathan deBruyn
University of Calgary, MSc.
Dr. Susan Kutz, Supervisor

Nathan's groundbreaking work on parasites is important to game and non-game species and will benefit management.

Nathan in the lab identifying a gastrointestinal nematode from a woodland caribou

Immunogenetic variation in immunocompetence: selection and fitness of Columbian ground squirrels

Jamie Gorrell
University of Alberta, Ph.D.
Dr. David Coltman, Supervisor

Jamie uses ground squirrel mating patterns to test important questions of wildlife genetic diversity.

Columbian ground squirrel

Population response of fathead minnows to alarm substance and predator cues

Jennifer Jung
University of Alberta, M.Sc.
Dr. Bill Tonn, Supervisor

Jennifer's work shows the interplay between game fish and forage fish.

Fathead minnows are marked with acrylic paint for identification

Mating systems of Richardson's ground squirrel (*Spermophilus richardsonii*)

Nora Magyara
University of Lethbridge, M.Sc.
Dr. Gail Michener, Supervisor

Nora's work on mating will help unravel the genetic system evolved in Richardson ground squirrels.

Nora removing a juvenile Richardson's ground squirrel from a live trap to obtain a tissue sample for paternity analysis

Modeling dispersal and road mortality of prairie rattlesnakes in southern Alberta

Adam J. Martinson
University of Calgary, M. Sc.
Dr. Cormack Gates, Supervisor

Few species are as directly vulnerable to highway traffic as snakes. Alberta roads may limit rattlesnakes in the prairies.

Adam preparing to inject a prairie rattlesnake with a PIT tag

Roads and long-toed salamanders in Waterton Lakes National Park

Katherine Pagnucco
University of Alberta, M.Sc.
Dr. Cindy Paszkowski, Supervisor

Katherine is examining ways to reduce habitat fragmentation for long-toed salamanders.

An amphibian tunnel in Waterton National Park

Impacts of logging on the bumble bee-influenced pollination community

Christian Pengelly
University of Calgary, M.Sc.
Dr. Ralph Cartar, Supervisor

The interplay of forest management and flower production may be a critical determinant of bee community dynamics.

Christian measuring bumble bee pollination rates

The effects of weather patterns and climate change on the denning behavior of grizzly bears

Karine Pigeon
Université Laval, M.Sc.
Dr. Steeve Côté, Supervisor

To better manage bears in Alberta, it is critical to understand limiting factors. Might dens be such one limitation?

Karine taking grizzly bear den measurements

Salinity and submerged aquatic plant communities in boreal marshes

Rebecca Rooney
University of Alberta, PhD.
Dr. Suzanne Bayley, Supervisor

Salinity, both natural and human-caused, must be accounted for in our understanding of wetland habitats.

Rebecca's crew makes sure all samples are accounted for before leaving

Wildlife crossing structures for grizzly and black bear populations in the Bow Valley, Alberta

Michael Sawaya
Montana State University, PhD
Dr. Steven Kalinowski, Supervisor

Michael is studying gene flow facilitation by wildlife crossings in Banff National Park.

Grizzly bear crossing the Trans-Canada Highway in Banff.

Amphibian breeding, movement patterns and habitat selection within urbanized landscapes

Brett Scheffers
University of Alberta, M.Sc.
Dr. Cindy Paszkowksi, Supervisor

Urban wildlife is very important to most Albertans. Brett examines wood frogs on human-created ponds.

An urban stormwater pond. Suitable wood frog habitat?

Population structure and phylogeography of mountain goats within Alberta and across North America

Aaron Shafer
University of Alberta, Ph.D.
Dr. David Coltman, Supervisor
Dr. Steeve Côté, Supervisor

Aaron continues earlier ACA- supported students working mountain goat ecology.

Aaron and an immobilized female mountain goat

Do wolves become livestock killers because of environmental conditions?

Carly Sponarski
University of Calgary, M.Sc.
Dr. Marco Musiani, Supervisor

The ACA is very interested in predator/livestock conflicts and Carly's work will help manage such conflicts more effectively.

The wolf/livestock interface in southern

Forest tent caterpillar parasitoid community shifts across the 'front' of advancing outbreaks in Alberta

Jennifer Waller
University of Alberta, M.Sc.
Dr. Jens Roland, Supervisor

Jennifer is examining the natural enemies of forest pests.

An open stand that would be fully leafed out except for the forest tent caterpillar herbivores

Disturbance from climate change and grazing: the role of grassland seed rain and seed banks in Alberta Grasslands

Shannon White
University of Alberta, M.Sc.
Dr. James F. Cahill Jr. , Supervisor

Shannon's work is pivotal to understanding the management of threatened grassland habitats.

Shannon laboriously sieving plant parts

Saproxylic beetle - deadwood habitat associations

Charlene Wood
University of Alberta, M.Sc.
Dr. John Spence, Supervisor

Charlene works towards classifying dead wood; an important component of Alberta forests.

Charlene checking a beetle trap

First Nations reserves and Metis settlements as diversity hotspots in agricultural landscapes

Natasha Young
University of Alberta, M.Sc.
Dr. Dennis Gignac, Supervisor

An interplay between social and ecological landscape management may provide important ecological refuges

Natasha examining small ecological reserves

Nitrogenous air pollution, biodiversity and ecosystem function of alpine ponds

Jim Zettel
University of Alberta, M.Sc.
Dr. Rolfe Vinebrooke, Supervisor

Knowing if we are polluting pristine alpine lakes is the first step towards their protection.

Jim filtering water at an alpine lake

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 fund graduate students and Post Doctoral Fellows. 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 and postdoctoral fellows 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 and postdoctoral fellows doing work in Alberta. Applicants must be associated with a university, either as graduate students enrolled in a graduate program or as postdoctoral fellows (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 generally in the first week of November of each fall.
Check http://www.acabiodiversity.ca for exact deadline.

For more information please contact:

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Kofi Garbrah is the expert in the University of Alberta Digital Teaching Resources Laboratory who digitally constructed this document. Many thanks to him for an excellent creative job, especially on the new cover design.

The ACA Grants in Biodiversity invites proposals from graduate student or post-doctoral fellows 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 Cooperative Conservation Research Unit:
http://www.biology.ualberta.ca/accru/

Alberta Conservation Association:
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 and post-doctoral fellows working in conservation biology in Alberta.
- Support the ACA's mission to promote conservation of Alberta resources.