

Welcome  
Bienvenue

Let's go green!  
Soyons ou "vert"!

The 40<sup>th</sup> Ontario Ecology and  
Ethology Colloquium

at Laurentian University / à l'Université Laurentienne  
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### Evolution, Ecology and Behaviour of Bats

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My research explores the interfaces between animal behaviour, ecology and evolution. The diversity of bats makes them ideal for this kind of work. I will talk about the evolution of bats, stressing echolocation and how this can lead off into other directions. A central question about bat evolution ... echolocation first? flight first? Simultaneous? I will speak about the ways that echolocation leads off into more general behaviour and to ecology.

One also could call it .... evolution through a bat's ear ...

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### On the Importance of Being Interdisciplinary

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The value of being interdisciplinary is stressed through a variety of examples: the dinosaur extinctions debates, the global warming non-debate, Kenneth Miller's Finding Darwin's God, the nature of racism, and my own recent work on universal human rights. The ultimate point is that being interdisciplinary is an epistemic value and should be recognized as such.



### **Adding Infest to Injury: Will Forest Tent Caterpillar (*Malacosoma disstria* Hübner) Outbreaks Be More Intense in Stressed Forests?**

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The forest tent caterpillar (*Malacosoma disstria* Hübner) (FTC) has an outbreak cycle of approximately 10 years; however, smaller spatial scale analyses show some regions have longer or more frequent periods of high defoliation. This may be a result of forest fragmentation, pollution or other stressors that may affect FTC directly or indirectly through their hosts or parasitoids. Population dynamics of FTC were examined to investigate how stress may alter severity and frequency of defoliation. We developed a spatially-explicit agent-based model to study how stress may affect population fluctuations by altering fecundity, dispersal or feeding behaviour of the forest tent caterpillar (FTC) or its parasitoids. We find that increasing FTC fecundity, FTC dispersal or parasitoid mortality resulted in more severe outbreaks while decreasing parasitoid fecundity or searching efficiency resulted in an overall elevation of defoliation. Parasitoid efficiency was the most effective parameter for altering FTC defoliation. Since plant stress has been shown to alter several of these parameters in nature due to changes in food quality, habitat suitability, and chemical cue interference, our results suggest that forests affected by stressors such as climate change and pollution will have more severe and widespread defoliation from these insects than surrounding unaffected forests.

### **Effects of perceived predation risk on morphology, development, and behaviour of Northern Leopard Frogs (*Lithobates [Rana] pipiens*) across life stages**

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Many organisms show plasticity in their morphology and behaviour in response to changes in environmental conditions. Tadpoles can alter tail and body shape, activity levels, and colouration in response to perceived predation risk. Timing of development has also been found to be plastic, as some frog species can accelerate or decelerate hatching and metamorphosis in response to predator cues. While much research has been conducted on quantifying specific responses during a particular life stage, far fewer studies have followed responses from the egg through to metamorphosis. Recent studies suggest that there are windows of sensitivity during development, and that variation in the embryonic environment may affect an individual's later plastic ability. My research will explore whether exposure to predator (dragonfly larvae; *Anax spp.*) cues during embryonic development affects the developmental timing of Northern Leopard Frog (*Lithobates [Rana] pipiens*) tadpoles, and whether tadpoles exposed as embryos differ in their plastic abilities compared to predator-naïve tadpoles. Preliminary results suggest tadpoles that are exposed to predator cues as embryos do not show the same plastic responses to perceived predation risk as tadpoles which are predator-naïve.



### The effects of past industrial damage and current urbanization on phytoplankton communities in Sudbury lakes

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Phytoplankton are an essential, but often overlooked member of freshwater communities. Like other freshwater groups, such as fish, benthic invertebrates and zooplankton, phytoplankton have suffered adverse effects from industrial damage that took place in Sudbury's mining past. Although recovery has been documented among these groups, phytoplankton communities may not have fully recovered to their pre-industrial assemblage and this may be a result of more recent disturbances, mainly urbanization. Using data from five urban lakes and four remote lakes, we examined the effects of multiple water chemistry parameters on the relative abundance of the six major groups of phytoplankton. Using Redundancy Analysis (RDA) we determined that the urban lakes seem to show a recovery pattern towards lower metal levels as expected, while remote lakes show little change over time regarding all water chemistry parameters. Interestingly certain urban lakes also show a tendency towards increased urban effects (increased nutrients, DOC and sodium). Ordination diagrams of these data suggest that chrysophytes and diatoms are most strongly correlated with these trends. Although similar studies have found increases in these groups accompanying metal and pH recovery, these data suggest that urban factors may be playing an important role in the development of future phytoplankton assemblages in the Sudbury area, and likely other urban-impacted areas.

### Physiological responses of the African cichlid *Pseudocrenilabrus multicolor victoriae* under long-term hypoxia acclimation

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The African cichlid, *Pseudocrenilabrus multicolor victoriae* has shown different levels of plasticity to varying dissolved oxygen (D.O.). Here, we analyzed the metabolic capacity of the F1 offspring from three populations with different dissolved oxygen histories (annual D.O. means: Bunoga  $7.53 \pm 0.13$  mg l<sup>-1</sup>, Kahunge  $3.76 \pm 1.70$  mg l<sup>-1</sup> and Kantembwe  $0.21 \pm 0.12$  mg l<sup>-1</sup>). Individuals from each population were raised under two oxygen regimes, normoxia and hypoxia, for one year. In general, individuals raised under hypoxia displayed higher levels of PK, LDH and CCO in the heart; lower levels of CCO, CS and MDH in the liver, and lower brain CS activity. No effect of dissolved oxygen or site of origin was found in the muscle. Overall, the ANCOVAs analyses showed that despite the long term lab raising conditions, site of origin also played a significant role in determining the levels of enzyme activity in the liver only.





**Conservation of northern biodiversity: Population genetics patterns observed in populations of wood frogs (*Lithobates sylvaticus*) in the James Bay area**

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Wildlife managers now utilize several methods to assess the health of wild-life populations. Complementing ecological assessment, population genetics patterns can infer genetic health of the assessed populations and can indicate which population is in need of management to conserve the species' genetic integrity. Northern landscapes offer an interesting platform to study population genetics, as resident species had to migrate following the retreat of the glaciers to colonize these landscapes, thus exhibiting the genetic fingerprints of numerous founder effects, decreasing the genetic variation available for adaptation. Amphibians consist of great model organisms to study population genetics as they have limited dispersing abilities, they are often philopatric to breeding sites, and they are one of the first organisms to be affected by environmental disturbances. To investigate the genetic health and describe the persistence and resilience of amphibians in northern landscapes, the genetic characteristics of populations of wood frogs (*Lithobates sylvaticus*) in the James Bay area were assessed.

**Host-parasite evolutionary ecology: an extended version**

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More and more reviews published at the frontier between ecology and evolution legitimates the connection between community ecology and evolutionary biology which promotes the identification of how genetic variation and evolution in one species may shape the ecological properties of communities and in turn how community variables and processes modulate evolutionary processes and patterns. In this opinion paper, we consider that host-parasite interactions are particularly prompt to reveal such connections. We discuss how specific mechanisms occurring at evolutionary or ecologically significant frame may have cascading repercussions on each other and how local environment may further influence these patterns suggesting that host-parasite interactions should be seen as being a functional mosaic made of both ecological and evolutionary determinants. This later consideration finally advocates a logical extended evolutionary-ecology conceptual playground for the investigations of host-parasite interactions. In parallel, barriers between disciplines also tend to be broken as illustrated by an increasing amount of multidisciplinary collaborations that minimize methodological issues as well as time and financial effort to conduct larger multidisciplinary research programs. Both these conceptual and methodological advances suggest that such integrative approaches could be the rule rather than the exception, and comfort our idea that host-parasite evolutionary ecology as a field of research has now evolved to a degree of maturity never reached before.



## Sex- and size-biased predation by a solitary wasp and its effect on prey phenotype

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The solitary sphecid wasp, *Isodontia mexicana* provisions significantly more female prey than male prey. In Ontario, the majority of *I. mexicana* prey consists of *Oecanthus* tree crickets. We tested hypothesis that wasps prefer female tree cricket prey because larger prey is preferred, since female tree crickets are known to be larger than males. We also examined the strength and form of viability selection on cricket phenotype as a result of wasp predation. We found that wasps are indeed taking significantly more adult females than would be in a representative sample of the hunted population, and that adult prey samples are significantly larger than adult samples taken from the surviving tree cricket population. A multivariate selection analysis revealed that wasp predation is selecting for crickets with longer legs and smaller bodies. Viability selection by wasp predation also acts on different combinations of traits in male and female tree crickets.

## If a bird flies in the forest, does anyone hear it?

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Insectivorous birds impose strong selection pressures on insects to evolve mechanisms for predator detection and avoidance. We tested the hypothesis; flying birds produce passive acoustic cues to their insect prey. First, we recorded the flight sounds of two species of insectivorous bird as they attacked insects. Sounds produced by an insectivorous bird (*Sayornis phoebe*) were recorded as it approached and attacked tethered insect prey. Chickadee (*Poecile atricapillus*) flight sounds were also recorded as they approached a stationary food item. Both Eastern phoebe and Black-capped chickadee flight sounds were found to be broadband, repetitive signals, extending from zero to 96kHz. These sounds overlap with the hearing range of several hearing insects (butterflies, moths, crickets) that are attacked by birds. Neurophysiological and playback techniques were used to determine if moths (*Trichoplusia ni*) are capable of hearing the flight sounds produced by an approaching aerial insectivore. The moth auditory system reliably encoded the temporal (repetitive) pattern of an approaching bird's attack flight. Our results demonstrate that insectivorous birds provide potential acoustic cues to their insect prey that may pose a selection pressure on the hearing of these insects.



### Restoration Ecology: Establishing reference conditions to direct the rehabilitation of mine stockpiles in the Hudson Bay Lowland

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Mining activity in the Hudson Bay Lowland is creating non-acid generating stockpiles that must be rehabilitated to upland habitat dominated by native species. To expedite revegetation, we require a better understanding of plant succession and soil-plant relationships on existing upland environments in this region. The objectives of this study are to:

- i. Describe plant communities and soil profiles
- ii. Group sites, plant communities and soils by successional stages
- iii. Describe the mean and range of conditions
- iv. Construct a series of reference conditions

Key vegetation and soil characteristics were sampled along a successional chronosequence of well-drained riverbank sites near the De Beers Victor Mine, Ontario, Canada (n = 39). Isolated uplands were examined along a 150 km east-west geological chronosequence beginning at James Bay (n = 34).

Methods reflect those of the forest ecosystem classification program in northern Ontario, in which (i) vegetation was described in a 10 m x 10 m plot, (ii) trees were sampled using a cruising prism, and (iii) soils were determined by describing a soil pit. Variables included vegetation structure and cover, species richness and species composition, forest mensuration and soil physical and chemical characteristics.

Relationships among site types will be analysed using multivariate tools. The variability determined will provide parameters for creating suitable novel ecosystems.

### Breeding habitat selection by the Loggerhead Shrike in Ontario: a hierarchical analysis

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Despite the important effects of habitat selection on ecology and evolution, little is known about how territorial animals choose them. For migratory birds, breeding habitat determines the acquisition of critical resources and affects brood success. Population sizes of the Loggerhead Shrikes (*Lanius ludovicianus*) have been declining precipitously across their range in North America. The reasons for their decline are poorly understood, although habitat loss is suspected to be a key factor. In this study we found that the shrikes follow hierarchical habitat selection, preferentially choosing specific macrohabitats at a landscape level, and microhabitats within them. At the landscape level, larger habitat patches were used and re-used based on their large size and the reproductive success the preceding year. Also, patches closer to other suitable patches were preferred, providing preliminary evidence for conspecific selection. Within habitat patches territory sizes in Southern Ontario were similar to those in other parts of the range and they expanded when the young fledged. The types of perches, nest sites and groundcover were chosen non-randomly. Understanding a species habitat selection is key to the design and implementation of management strategies and contributes to a better understanding of habitat choice by grassland birds in general.



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### The Cost of Macroparasitism on a Rodent Host

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Life history theory predicts that all organisms have finite energy reserves. In order to optimize fitness, individuals must make trade-offs in allocating energy between survival, growth and reproduction. Parasites have the ability to negatively impact host fitness and shift the balance of energy trade-offs. The aim of this study was to determine the relationships among parasite load and indicators of host condition and reproductive success in a free-living population. Both internal and external parasite levels, immune status, body condition as well as reproductive success were evaluated in a population of North American red squirrels (*Tamiasciurus hudsonicus*). I hypothesize that heavily parasitized individuals must allocate more energy towards immune function. As energy stores are finite, this will inevitably reduce the resources available for growth and reproduction. This study reveals evidence that parasite infection impacts reproductive success but not measures of immune function or body condition. Reproductive success decreased as endoparasite richness increased, suggesting that parasites compromise reproductive output. Both ectoparasite intensity and endoparasite richness increased with an index of boldness suggesting that increased activity increases the risk of infection. Relatively few studies have been conducted within an ecological context incorporating multiple aspects of host fitness in relation multiple parasite infections.

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### Hypoxia as an effective barrier to gene flow : Genetic Differentiation of the African cyprinid *Barbus neumayeri*

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Freshwater hypoxia is a growing occurrence in the modern world. With increasing pollution, global climate change and chemical dumping, eutrophication of waters is of ever increasing concern. The African great lakes are home to one of the widest radiations of cichlids and cyprinids. The everflowing rivers and papyrus choked tributaries of these lakes vary in dissolved oxygen concentration both spatially and temporally. This is due to low incident light, little mixing of the water column and high organic decomposition. In Uganda, *Barbus neumayeri*, a non-air breathing cyprinid inhabits the Lake George water shed and its surrounding tributaries. We used this species as a model organism to determine 1) if hypoxia can effectively separate populations of *B. neumayeri* and cause genetic divergence between populations and 2) if such divergence was present, what were the proportions explained by hypoxia and geography. Our findings indicate that oxygen regime does play a role in genetic divergence of populations; with hypoxic populations being genetically similar to each other but different from normoxic populations. In addition, normoxic populations that are geographically close show genetic similarity.





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**Correlated evolution among phenology and floral traits****Hensel, Lisa**

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The time and pattern of mating can be an important determinant of an organism's reproductive success. For animal-pollinated plants the timing and pattern of flowering influences reproductive success by controlling the overlap of mating with temporally variable abiotic and biotic conditions. In temperate deciduous forests, spring ephemerals are plant species that flower prior to canopy closure and generally require a biotic pollen vector, such as a bumblebee, for mating to occur. Reproductive success in spring flowering species may be limited by temporal variation in early spring climatic conditions and pollinator availability. To alleviate the constraints on reproductive success it has been suggested that spring ephemeral species may have converged in flowering phenology and floral colour. Here, we use a molecular phylogeny of the angiosperms to investigate the proposed correlation between a spring flowering phenology and white floral colour. This analysis will enable us to evaluate the ecological hypotheses that have been proposed to explain the correlation between flowering phenology and floral colour.

**Using multiple approaches to compare dispersal rates in Painted Turtles and Snapping Turtles****Keevil, Matthew**

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Dispersal affects many aspects of ecology and life history but is difficult to observe in long-lived organisms because it occurs infrequently at the temporal scale of most observational studies. We will combine long-term mark-recapture datasets with other data sources in a comparative analysis of dispersal in Snapping Turtles (*Chelydra serpentina*) and Painted Turtles (*Chrysemys picta*) in Algonquin Provincial Park, Ontario. Literature reports suggest that Snapping Turtles are genetically homogeneous and this, along with observations of overland movement and previous analyses of the datasets, leads us to predict higher rates of dispersal for Snapping Turtles compared to Painted Turtles. Dispersal will be evaluated using microsatellite-based estimates of gene flow, observation of turtles on roads, and mark-recapture data. Three approaches will be used within the mark-recapture analysis: 1) inferring dispersal from discrepancies between survivorships estimated from recapture rates of marked juveniles compared to survivorships estimated from fecundity and adult recruitment, 2) comparing proportions of marked and unmarked recruits, and 3) examining the proportions of marked hatchlings recaptured at natal and distant patches. Increased knowledge of dispersal dynamics will improve understanding of the role that they play in phylogeography and life history evolution as well as the threats posed by inter-patch mortality sources.



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**The invasion of a native pollination network by *Lythrum salicaria*: Is pollen transport context-dependent?**

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Field and laboratory studies have found that, when presented with two or more flower types, pollinators prefer to forage on flowers that are most common, or flowers they have previously experienced. In the context of alien plant invasions, natural plant communities may be relatively robust to invasion if a novel plant species has to achieve a certain density in order to receive pollinator attention. Previous research indicates that invasive plants are most successful at invading established plant-pollinator networks when they were more closely related to natives. Presumably, this phenomenon is the result of invasives co-opting pollinators from closely related natives, as pollinators are less likely to discriminate between species with similar floral colour and morphology. In the summer of 2010 we plan to study the role of community context on the probability of invasion by *Lythrum salicaria* (Purple loosestrife). Our proposed methods involve monitoring and comparing patterns of pollinator visitation to experimentally introduced arrays of *L. salicaria* and its close relative *Decodon verticillatus* (swamp loosestrife) in naturally occurring invaded and uninvaded communities.

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**Interactions between metal contamination and VA-mycorrhizae in red maple (*Acer rubrum* L.) seedlings**

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Mycorrhizal infection is essential for promoting growth of most trees. Mycorrhizal infection also is known to influence a plant's response to heavy metals. The reciprocal interactions between metal contamination and different strains of VA- mycorrhizal infection in red maple seedling roots, was tested in a growth chamber pot experiment over 7 weeks. The treatments were Cu/Ni-contaminated and non-contaminated substrate, and mycorrhizal inoculum from within the contaminated Sudbury area, outside this area, or no inoculum.. Preliminary results indicate that the origin of mycorrhizal inoculum influences the plant's response to metal contamination.



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**Identification of suitable plant species for restoring disturbed and new uplands in the Subarctic: A functional ecology approach****Laurin, Cory**

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The use of local native plants is becoming a prerequisite for the restoration of disturbed lands. Our objective is to characterize the common species of upland vascular plants to select suitable candidate species to reclaim these newly created uplands at the Victor Mine and lead them towards successful revegetation. A total of 67 upland vascular plant species covering a range of vegetative forms were sampled with a minimum of three populations per species. A set of 16 easily-measured plant traits were measured on each population to infer plant species responses and effects to ecosystem processes in the subarctic. These traits include canopy height, Raunkiaer life form, life span, leaf size, specific leaf area, leaf thickness, leaf toughness, leaf tissue pH, inrolling of lamina, woodiness, distance between ramets, shoot phenology, propagule mass, propagule mass/area, seed mass and seed shape. For each population, habitat characteristics were measured (canopy cover, soil texture, soil pH and conductivity). Species will be classified into functional groups using multivariate analyses to determine species types (i.e. best dispersers, best colonizers). The protocols formulated through this study will be useful for the rehabilitation of disturbed sites in the subarctic.

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**Ecology of herpetofaunal populations in tailings wetlands in Sudbury, Ontario****Leduc, Joel**

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Since the 1920's, Sudbury, Ontario has emerged into one of the world's largest metal producers. The mining and smelting industries have left a devastating ecological footprint on the Sudbury landscape with metal-contaminated substrates and acidified waters near the smelting facilities and tailings wetlands. We tested the hypothesis that the perturbations caused by to smelting activities have a negative effect on ecological aspects of amphibian and reptile populations on the tailings wetlands of Xstrata Nickel. We examined the differences in herpetofaunal amphibian and reptile abundance, diversity, biomass, body length and reproduction among three impacted wetlands situated at Xstrata Nickel, Falconbridge, Ontario in comparison with a non-tailings wetland located at the Laurentian Conservation Area, Sudbury, Ontario. Day and night field surveying and sampling were performed two to three times per week for an entire breeding season (22 May – 24 September, 2009). We found significant differences in abundance, biomass, and reproduction, but no differences in species richness or body size in a target species, the green frog (*Rana clamitans*), among sites. The three impacted sites demonstrated lower abundance and biomass than the control site, and fewer species were reproductively active. Our findings indicate that the tailings wetlands may not be able to sustain the large dynamic communities present at non-tailings wetlands, and that herpetofaunal communities may be negatively impacted within the tailings wetlands.



### Challenges in recovering benthic invertebrate communities: Bottom-up top-down controlled or functionally impaired?

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In Sudbury, ON Canada lake food webs are recovering from acidification and metal contamination. While some communities are on the way to recovery, food web function is still impaired. Benthic invertebrates form a crucial part in the food webs of these lakes. Their community and biomass is usually governed by influences from the top down (fish predation) and bottom up (resource availability). In Sudbury, they face the additional challenge of a toxicity effect due to metal contamination of water and sediment. We investigated these effects on benthic invertebrate biomass and compare them to an undisturbed reference system. The conducted survey reveals no difference in benthic invertebrate biomass between Sudbury and reference systems. However, the dynamics shaping the invertebrate biomass are different between the areas. Sudbury invertebrate biomass is strongly influenced by increasing fish community complexity as well as a still very strong toxicity effect. The distribution of resources appears to be a factor as well. Generally, we conclude that benthic invertebrate biomass is not different from reference systems, the mechanisms shaping the community as well as the function of the interactions are however very different.

### From wallflower to weed: Natural regeneration of introduced red oak (*Quercus rubra* L.) in Germany

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Northern red oak (*Quercus rubra* L.) is an important hardwood tree species that is failing to regenerate across its native North American range, yet behaves as an invasive species across Central Europe following its late 18th century introduction. Our research provides a case study of red oak regeneration in three German forests. Environmental and plant community data were quantified at 77 plots (4 m<sup>2</sup>) according to three forest strata; low understorey, tall understorey and overstorey. Red oak was present in all strata in all cases; regenerating to extents largely unseen in North America. In the low understorey, red oak seedling density exceeded 110 stems m<sup>-2</sup> and was greatest at sites most recently subjected to selective cutting. Seedlings were also favoured by acidic and relatively infertile soils but were reduced under dense tall understorey. The tall understorey was sparse in two of the three forests, likely due to invasive graminoid competition and deer browsing. In the absence of strong tall understorey competition, red oak seedlings under canopy gaps grew directly into dense thickets occupying the tall understorey. Our study indicates that current silvicultural practices are maintaining a mid-successional and periodically disturbed environment ideally suited for the regeneration niche of red oak.



## Post-release acclimatization of elk (*Cervus elaphus*), introduced to Ontario

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Once native to Ontario, elk (*Cervus elaphus*) were extirpated in the 1800's due to over-harvesting and anthropogenic habitat alteration. In the 1950s, an elk herd was established in the Burwash region, 30 km south of Sudbury, which was reduced to approximately 40 individuals by 1994. In the hope of establishing a sustainable population, elk were introduced from Alberta from 1998 to 2001, and the herd has been monitored since 1998 using radio telemetry. One objective of this study is to analyze the spatial behaviour and habitat selection of Burwash elk in order to study acclimatization of the introduced elk. After introduction, we predicted that elk would initially have large home ranges and large daily movements as they explored their new habitat. We expected this exploratory period to be followed by a 'leveling off' period (i.e., a reduction in home range size) indicating acclimatization. In addition, we expected changes in habitat selection and shifts in the locations of home ranges as elk settled into their new habitats. The selected acclimatization variable showed significant differences in all release groups between 1 and 3 years post-release, with 2 years post-release being the most common. Home range size was the most powerful indicator of acclimatization. This project provides a unique opportunity to use various methods of analysing spatial behaviour and habitat selection as tools to estimate the time of acclimatization for introduced animals. In addition, it provides fundamental knowledge on the effectiveness of reintroductions for restoring wild populations. This knowledge is essential for planning efficient population management.

## Allometry of the baculum and sexual size dimorphism in fishers and martens

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Genitalia are among the most variable of morphological traits, and recent research suggests that this variability may be the result of sexual selection. For example, large bacula may undergo post-copulatory selection by females as a signal of male size and age. This should lead to positive allometry in baculum size. In addition to hyperallometry, sexually selected traits that undergo strong directional selection should exhibit high phenotypic variation. Nonetheless, in species in which pre-copulatory selection predominates over post-copulatory selection (such as those with male-biased sexual size dimorphism), baculum allometry may be isometric or exhibit negative allometry. We tested these ideas using data collected from two highly dimorphic species of the Mustelidae, the marten (*Martes americana*) and the fisher (*Martes pennanti*). Allometric relationships were weak, with only 3.9 to 10.9% of the variation in baculum length explained by body length. Because of this weak relationship, there was a large discrepancy in slope estimates derived from ordinary least squares and reduced major axis regression models. Allometric slopes that are less than one (using the OLS regression model), a very low proportion of variance in baculum length explained by body length, a general concordance between the allometric slopes of baculum length and a putative non-sexual trait (chest girth), and low CV values all point to stabilizing selection rather than sexual selection as the evolutionary force shaping variation in baculum length. We hypothesize that this pattern is because post-copulatory selection plays a smaller role than pre-copulatory selection (manifested as male-biased sexual size dimorphism). We suggest a broader analysis of baculum allometry and sexual size dimorphism in the Mustelidae and other taxonomic groups, coupled with a comparative analysis and phylogenetic contrasts to test our hypothesis.





**Takeoff and Landing: inter-patch dispersal of aquatic invertebrates****Sciullo, Luana**

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Species dispersal has the potential to impact population dynamics and biotic interactions in local communities; therefore to understand its influence, quantifying the inter-patch movement of species is needed. We quantified dispersal of aquatic invertebrates in a Jamaican rock pool metacommunity over an eleven day period considering 3 vectors: wind, overflow and animal transport. 24 pools situated at different distances from dense vegetation and ocean were fitted with traps designed to intercept dispersers. Replicated wind and animal traps consisted of water-filled containers, while overflow was accomplished through artificial pool flooding. A total of 1,912 invertebrates were intercepted from 22 species: Copepoda (47%), Ostracoda (36%), Rotifera (12%), Cladocera (3%), Insecta (1%) and other (1%). Overflow dispersed on average  $65.0 \pm 23.1$  individuals, while wind dispersed  $11.58 \pm 2.96$  and animals only  $0.42 \pm 0.23$ . The surrounding environment (i.e. distance to vegetation/ocean, as well as distance to neighbouring pools) had no detectable influence on abundance or species richness dispersed by each vector. Notably, pool and dispersing assemblages differed in species composition, such that species most abundant in pools were not necessarily the most abundant among dispersers. These results not only imply a high dispersal capacity of aquatic invertebrates, but also hint at a potential evolutionary trade-off between dispersal ability and successful colonization/integration into a new community.

**Acoustic and vibratory signals of the bark beetle, *Ips pini* (Say)  
(Coleoptera: Scolytidae)****Sivalingham, Senthurran**

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Bark beetles (Scolytidae) are responsible for costly economical and environmental damage to North American coniferous forests. Research in their acoustic communication has shown acoustic signals produced during pre-mating, distress, and aggressive behavioural interactions. Although, these signals are important for reproduction, surprisingly little is known about the reception and processing of these signals. To better understand hearing in bark beetles, it is essential to characterize the various types of acoustic signals produced. However, characterizations of acoustics signals are limited to the temporal aspects, while important spectral details are lacking. Furthermore, it is unclear whether stridulation in bark beetles invokes substrate vibrations, and if beetles are using airborne or solid-borne vibrations to communicate with each other. In this study, we recorded the air-borne, and solid-borne acoustic signals of the bark beetle species, *Ips pini*, during various behavioural contexts, and describe the physical characteristics of these signals. Our results show that: 1) bark beetle acoustic signals evoke both air-borne and solid-borne vibrations; and 2) air-borne vibrations contain substantive high frequency components. This study is the first to demonstrate solid-borne vibration in bark beetles, and provides further insights into the complexity and functional significance of acoustic communication in bark beetles as well as possible sensory mechanisms.



## **Wetland-sourced organic matter as a subsidy for recovering littoral invertebrate communities in metal-stressed watersheds**

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Watersheds with productive wetland and forest cover provide a steady flow of organic materials and nutrients to receiving lakes. Littoral zone ecotones are the focal point of this concordance, and littoral benthic invertebrate communities in small, oligotrophic lakes are highly dependent on watershed subsidies. Many anthropogenically-impacted watersheds are heavily depleted of hydrologically active organic matter and nutrient sources, which appears to delay the recovery of downstream ecosystems. This study used nine catchments and associated streams in a smelter-impacted watershed to investigate the importance of terrestrial sources of organic matter to recovering littoral invertebrate communities. The proportion of fine (< 250 µm) organic matter (FPOM) in exported particulate material increased with wetland area (almost 50% of the variation in FPOM explained). Diversity of littoral benthic invertebrates increased with FPOM, and proportional and total amount of FPOM explained over 75% of the variation in diversity. Wetlands and other areas of organic soil appear to play a key role in the recovery of aquatic communities in such severely stressed lakes should probably be the focus of much of the early remedial work.

## **Temporal trends of mercury accumulation in fish across northern Ontario**

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Mercury is a primary contaminant of concern in fish of boreal shield lakes due to its adverse health effects on humans. Over the last 150 years, anthropogenic emissions have increased mercury loadings to the boreal shield via atmospheric transport. Mercury deposited in boreal lakes is methylated, bioaccumulated in all biota, and biomagnified along the food chain reaching its highest concentrations in piscivorous fishes. In recent decades, efforts have been made to reduce mercury emissions in North America. But have these reductions led to declining mercury concentrations in fish of boreal lakes? The Ontario Ministry of Environment (OMOE) and the Ontario Ministry of Natural Resources (OMNR) have been monitoring fish mercury levels in Ontario lakes since the early 1970s. In this study, we present a temporal trend analysis of mercury in 7 species of fish across Ontario lakes over the last 30 years. By comparing fish mercury levels between two time periods (1974-1981, 2005-2010), we can reflect on the overall impact of emission reduction initiatives. An ANCOVA model adjusting for length was used to estimate mean mercury levels intra-specifically across sampled lakes. Historic mean mercury concentrations (1974-1981) were then compared to current mean mercury concentrations (2005-2010) using paired-comparisons t-tests.



### Impact of habitat quality on disease and stress and subsequent consequences to fitness correlates in the eastern foxsnake

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Habitat destruction and fragmentation are the leading causes of biodiversity loss. In this study I investigate the impact of habitat quality on stress and parasitic infection as well as consequences on key fitness correlates for the endangered eastern foxsnake in southwestern Ontario. Eastern foxsnakes specialize on marsh and open prairie habitats of which very little remain in southwestern Ontario due to agricultural development. I quantified stress level in 90 individuals by classifying heterophil/lymphocyte (H/L) ratios from blood smears collected throughout the summers of 2007 to 2009. Subsequently, I compared stress with habitat suitability of capture sites spanning low to high quality areas. I also assessed the relationship between habitat quality and body condition as well as between stress and two fitness correlates: growth rate and body condition. Regression analyses revealed no relationship between H/L ratios and habitat quality. Habitat suitability and body condition were also uncorrelated. Prevalence of hemogregarine parasites in my collected sample was very low therefore no comparisons between incidence and intensity of parasite infection and habitat quality or fitness could be made. The results from this study suggest that individuals captured from low quality habitats experience neither an elevation in stress levels, at least insofar as H/L ratios are an adequate proxy, nor a reduction in our fitness correlates compared to individuals from higher quality habitats.

### The Effect of Flooding on the Spatial Ecology of Spotted Turtles (*Clemmys guttata*) in a Southern Ontario Population

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Many studies have focused on the effects of anthropogenic habitat alterations on animals, but little attention has been given to the effects of natural changes in habitat. The purpose of this study was to examine the effects of flooding caused by beavers on the spatial ecology of the federally endangered Spotted Turtle (*Clemmys guttata*) in an isolated bog that was historically drained for peat extraction. I examined home range size, daily distances moved, and habitat use before and after flooding. I predicted that home range sizes and movements would be greater after flooding because the increased water level would make more of the bog available to the turtles. I predicted a change in habitat selection as more aquatic habitats became available post-flooding. Using radio telemetry, 19 turtles were tracked for two active seasons (2008-2009) to determine spatial patterns during the flooded conditions. I used historical data collected by the Ontario Ministry of Natural Resources to represent Spotted Turtle spatial patterns before flooding conditions. Daily movements and home range sizes were significantly larger during post-flood conditions compared to pre-flood conditions. After flooding, there was a strong preference for the drainage ditches and flooded zones throughout the active season. The beavers appear to have created positive environmental conditions for Spotted Turtles within the site; however future work is needed to determine how Spotted Turtle nesting and hibernation habitat has been affected by the flooding conditions. Understanding the response of Spotted Turtles to this natural change in habitat will help biologists determine the best management plan to protect the critical habitat and survival of this species at risk.





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