Centre de la science de la biodiversité du Québec
Quebec Centre for Biodiversity Science

# Colloque CSBQ 2011
# QCBS 2011 Symposium

**7 au 9 décembre - December 7 to 9**
**Montréal**

## BIENVENUE / WELCOME

J'aimerais vous souhaiter la bienvenue au deuxième colloque annuel du Centre de la science de la biodiversité du Québec (CSBQ). Bien que notre colloque de l'année dernière nous soit toujours frais en mémoire, beaucoup de travail a été accompli au CSBQ depuis. La diversité et le nombre de participants présents au colloque attestent du chemin parcouru.

La transition d'un centre en développement à une institution établie s'est effectuée en douceur pour le CSBQ. Nous avons accueilli de nouveaux membres provenant de disciplines multiples, telles que la biologie, l'anthropologie et le droit. Cette croissance s'est aussi réalisée par l'ajout de nouveaux projets de recherche sur des sujets comme l'évolution, les savoirs traditionnels et les comptes d'écosystèmes, qui se sont additionnés aux multiples autres projets en cours. Nos étudiants ont reçu plus de 48 000$ pour permettre leur participation à des ateliers de formations et pour diffuser le fruit de leurs travaux à travers le monde. En tant que centre, nous développons des outils pour faciliter l'accès aux données, métadonnées et méthodes relatives à la biodiversité. En interaction constante avec nos membres, nous continuons d'évoluer dans le cadre de notre mission.

La recherche réalisée par les membres du CSBQ et leurs collaborateurs à attiré l'attention des médias, entreprises, paliers gouvernementaux, et organisations non-gouvernementales. Ces partenaires ont sollicité le CSBQ pour obtenir des avis ou obtenir de l'information pour alimenter leurs efforts en science de la biodiversité et en conservation.

Pendant que le CSBQ prend du galon au Québec, la reconnaissance de l'importance de la science de la biodiversité grandit à l'échelle mondiale. Il est plus que jamais nécessaire et possible d'inclure la science de la biodiversité dans les décisions politiques, et cet objectif est rendu possible grâce à la création formelle de la Plate-forme intergouvernementale scientifique et politique sur la biodiversité et les services écosystémiques (IPBES). De plus, le succès de l'Année internationale de la biodiversité en 2010 a motivé l'ONU à déclarer la période 2011-2020, décennie de la biodiversité.

Ces événements et accomplissements, ainsi que le succès de ce colloque, placeront le CSBQ dans une excellente position pour son évaluation en vue de son renouvellement par le FQRNT en 2012. Cette année encore, nous avons une formidable variété de présentations orales et d'affiches. Des panels d'experts aborderont les enjeux liés au partage des données, aux aires protégées, et à la biodiversité urbaine. Nous sommes extrêmement fiers d'être les hôtes d'un atelier

mettant en valeur le projet du CSBQ sur la biodiversité et les entreprises et soulignant les liens multiples entre la biodiversité, l'économie et la société.

En terminant, j'ai hâte de vous rencontrer pour le cocktail dans le magnifique Centre sur la biodiversité de l'Université de Montréal, inauguré cette année.

En espérant que vous apprécierez le colloque,

*Andrew Gonzalez, Directeur du CSBQ*

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I would like to extend a warm welcome to everybody attending the second annual conference of the Quebec Centre for Biodiversity Science (QCBS). While our first symposium seems like yesterday, the QCBS has achieved a great deal since then. The diversity of participants at this event is testament to our progress.

Most significantly, the QCBS has transitioned from a centre under development to an established institution. We have added new members from multiple disciplines including biology, anthropology and law. An extraordinary variety of new collaborative research projects spanning evolution, traditional ecological knowledge in the North and ecosystem accounting has accompanied this growth. Our students have received over $48,000 in funding to support opportunities for training and sharing their research around the world. As a centre, we are developing a range of new tools for scientists to access biodiversity data, metadata and information about methods. Through ongoing communication with our members, we continue to evolve and further fulfill our mission.

The QCBS and its core – the members and their research – have attracted the attention of the business community, the Quebec government, the media, school teachers and nongovernmental organizations, who have all approached the QCBS seeking advice, partnerships and information to support their work in biodiversity science and conservation.

Just as the QCBS has gained recognition in Quebec this past year, awareness of the importance of biodiversity and biodiversity science has grown on an international scale. The potential for biodiversity science to inform policy took a major leap forward with the formal establishment of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services. Building on the success of the International Year of Biodiversity during 2010, the United Nations agreed to a Decade on Biodiversity from 2011–2020.

These events and achievements should stand the QCBS in good stead in 2012 as it comes under evaluation for renewal by FQRNT. A successful symposium will create impetus. This year we have a wonderfully diverse mix of research

presentations and posters. Expert panels will address data sharing, protected areas and biodiversity in cities. We are also proud to be hosting a half-day workshop showcasing the QCBS Business and Biodiversity project and highlighting the many linkages between biodiversity, the economy and society.

Finally, I look forward to seeing you at the cocktail in the stunning new Université de Montréal Biodiversity Centre.

We hope you enjoy the event.

*Andrew Gonzalez, QCBS Director*

## LE CSBQ / ABOUT THE QCBS

Inauguré en 2009, le Centre de la science de la biodiversité du Québec est un réseau stratégique composé de 80 chercheurs et quelques centaines d'étudiants de huit universités du Québec, d'un organisme public, et d'un ministère du gouvernement fédéral. Le centre est financé par les Fonds de recherche du Québec - Nature et technologies ainsi que par plusieurs universités partenaires.

Le CSBQ facilite la collaboration et la transdisciplinarité en science de la biodiversité, favorise une recherche et des programmes de formation de calibre international et adopte un rôle de premier plan dans les débats académiques et publics sur les enjeux liés à la biodiversité.

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Launched in 2009, the Quebec Centre for Biodiversity Science (QCBS) is a strategic research network comprised of eighty researchers and several hundred students from eight Quebec universities, a public organization and a governmental department. The centre is funded by the Fonds de recherche du Québec - Nature et technologies as well as several university partners.

The QCBS facilitates collaborative and cross-disciplinary biodiversity science, fosters world class research and training and plays a lead role in academic and public debates about biodiversity-related issues.

**Partenaires / Partners**

# TABLE DES MATIÈRES / TABLE OF CONTENTS

Bienvenue / Welcome ..... i
Le CSBQ / About the QCBS ..... iv
Programme du Colloque CSBQ / QCBS Symposium program ..... 2
Présentations en plénière / Plenary talks ..... 5
Panels ..... 8
Horaire des presentations de recherche / Research presentation schedule..... 17
Résumés des presentations orales / Oral presentation abstracts ..... 24
Résumés des affiches / Poster abstracts ..... 80
Remerciements / Acknowledgements .....111
Liste des participants / Participant list .....113

## PROGRAMME DU COLLOQUE CSBQ / QCBS SYMPOSIUM PROGRAM

**Jeudi, 8 décembre 2011 / Thursday, 8 December 2011**

| | | |
|---|---|---|
| 9:00-9:15 | Mot de bienvenue | Welcome and opening |
| 9:15-10:15 | **Conférencier principal: Michael Donoghue:** *Faire le lien entre écologie et évolution pour comprendre la biodiversité et les changements globaux* | **Opening speaker: Michael Donoghue:** *Reconnecting ecology and evolution to understand biodiversity and global change* |
| 10:15-10:30 | Pause | Break |
| 10:30-12:00 | **Présentations de recherche, session 1** *1A: Conservation, gouvernance et éducation* *1B: Animaux en mouvement* *1C: Dynamiques des écosystèmes et des communautés* | **Research presentations, session 1** *1A: Conservation, governance and education* *1B: Animals on the move* *1C: Community and ecosystem dynamics* |
| 12:00-13:00 | Lunch | Lunch |
| 13:00-14:15 | **Présentations de recherche, session 2** *2A: Réponses aux changements climatiques* *2B: Théorie de l'évolution et nouveaux paradigmes* *2C: Adaptation et paléobiologie* | **Research presentations, session 2** *2A: Responding to a changing climate* *2B: Evolution and changing paradigms* *2C: Adaptation and paleobiology* |

**Jeudi, 8 décembre 2011 / Thursday, 8 December 2011**

| | | |
|---|---|---|
| 14:15-15:30 | Session d'affiches | Poster session |
| 15:30-17:00 | **Panel: *Construire un réseau d'aires protégées dans le nord du Québec*** | **Panel: *Building northern Québec's protected areas network*** |
| 17:45-20:00 | Réception au Centre sur la biodiversité (inscription à l'avance) | Reception at Centre sur la biodiversité (advance registration required) |

**Vendredi, 9 décembre 2011 / Friday, 9 December 2011**

| | | |
|---|---|---|
| 8:30-9:15 | **Conférencier: Olivier Rukundo**<br>*Le Protocole de Nagoya sur l'accès et le partage des avantages;*<br>*Le plan stratégique pour la diversité biologique et les Objectifs d'Aichi pour la biodiversité* | **Speaker: Olivier Rukundo**<br>*The Nagoya Protocol on Access and Benefit Sharing;*<br>*The Strategic Plan for Biodiversity and the Aichi Biodiversity Targets* |
| 9:15-10:15 | **Présentations de recherche, session 3**<br>*3A: Structure du paysage*<br>*3B: Génétique et systématique*<br>*3C: Invasions biologiques* | **Research presentations, session 3**<br>*3A: Landscape structure*<br>*3B: Genetics and systematics*<br>*3C: Biological invasion* |
| 10:15-10:30 | Pause | Break |

**Vendredi, 9 décembre 2011 / Friday, 9 December 2011**

| | | |
|---|---|---|
| 10:30-12:00 | **Panel: *Initiatives pour l'intégration et l'accès aux données sur la biodiversité*** | **Panel: *Initiatives for biodiversity data integration and access*** |
| 12:00-13:00 | Lunch | Lunch |
| 13:00-14:00 | **Présentations de recherche, session 4**<br>*4A: Biodiversité dans les paysages agricoles*<br>*4B:Invasions biologiques; gestion de l'habitat*<br>*4C: Écologie fonctionnelle* | **Research presentations, session 4**<br>*4A: Biodiversity in agricultural landscapes*<br>*4B: Biological invasion; habitat management*<br>*4C: Functional ecology* |
| 14:00-14:15 | Pause | Break |
| 14:15-15:45 | **Panel: *Ceintures vertes, réseaux écologiques et l'avenir de la biodiversité dans les regions urbains*** | **Panel: *The future of biodiversity in urban areas: from greenbelts to ecological networks*** |
| 15:45-16:00 | Clôture | Closure |
| 16:15-18:00 | 5 à 7 de clôture au Brasserie Benelux | Closing happy hour at Brasserie Benelux |

## PRÉSENTATIONS EN PLÉNIÈRE / PLENARY TALKS

**Jeudi, 8 décembre 2011 / Thursday, 8 December 2011**
**9:15-10:15**

### FAIRE LE LIEN ENTRE ÉCOLOGIE ET ÉVOLUTION POUR COMPRENDRE LA BIODIVERSITÉ ET LES CHANGEMENTS GLOBAUX

Je soutiendrai, en utilisant une série d'exemples, que l'intégration des perspectives écologiques et évolutives offrent la chance de comprendre la biodiversité, sa distribution et son évolution probable dans le contexte des changements globaux. Cette connaissance est essentielle pour arriver à créer une société durable.

**Michael Donoghue**

Michael J. Donoghue, un professeur Sterling d'écologie et biologie évolutive de l'Université Yale, concentre ses recherches sur la diversité et l'évolution des plantes. Il est l'auteur de plus de 180 articles scientifiques et a été un chef de file dans l'initiative « Tree of Life » visant à reconstruire l'histoire évolutive de tous les organismes vivants. Il a participé à l'élaboration de la base de données TreeBASE qui entrepose les connaissances phylogénétiques. Ses projets de recherche l'ont mené d'Amérique Latine jusqu'en Chine, et il a joué un rôle majeur au sein de DIVERSITAS. Dr. Donoghue est member du U.S. National Academy of Sciences et de l'American Academy of Arts and Sciences.

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### RECONNECTING ECOLOGY AND EVOLUTION TO UNDERSTAND BIODIVERSITY AND GLOBAL CHANGE

I will argue, using a series of examples, that the integration of ecological and evolutionary perspectives provides the best hope of understanding biodiversity, its distribution, and its likely changes in the face of global change. This knowledge is critical to achieving a sustainable society.

**Michael Donoghue**

Michael J. Donoghue, Sterling Professor of Ecology and Evolutionary Biology at Yale University, focuses his research on the diversity and evolution of plants. The author of more than 180 scientific papers, Donaghue has been a leader in the movement to reconstruct the entire Tree of Life. He helped build and coordinates a relational database of phylogenetic knowledge called TreeBase. His research has taken him to Latin America, China and elsewhere, and he has played a prominent role in DIVERSITAS. Dr. Donoghue is a member of the U.S. National Academy of Sciences and the American Academy of Arts and Sciences.

**Vendredi, 9 décembre 2011 / Friday, 9 December 2011**
**8:30-9:15**

## LE PROTOCOLE DE NAGOYA SUR L'ACCÈS ET LE PARTAGE DES AVANTAGES

Le Protocole de Nagoya sur l'accès aux ressources génétiques et le partage juste et équitable des avantages découlant de leur utilisation a été adoptée par la Conférence des Parties à la Convention sur la diversité biologique lors sa dixième réunion le 29 Octobre 2010 à Nagoya, au Japon. La présentation donnera un aperçu des principales caractéristiques du protocole de Nagoya. En particulier, la présentation mettra en évidence la façon dont le protocole va créer une plus grande certitude juridique et la transparence pour les fournisseurs et utilisateurs de ressources génétiques.

## LE PLAN STRATÉGIQUE POUR LA DIVERSITÉ BIOLOGIQUE ET LES OBJECTIFS D'AICHI POUR LA BIODIVERSITÉ

La dixième réunion de la Conférence des Parties, tenue du 18 au 29 Octobre 2010, à Nagoya, préfecture d'Aichi, au Japon, a adopté un Plan stratégique révisé et actualisé pour la biodiversité, comprenant les cibles de biodiversité d'Aichi, pour la période 2011-2020. La présentation donnera un aperçu de la mission et des les objectifs stratégiques ainsi que 20 cibles, collectivement connues comme les cibles d'Aichi. La présentation mettra en évidence comment le plan stratégique constitue un cadre souple pour l'établissement d'objectifs nationaux et régionaux et elle favorise la mise en œuvre cohérente et efficace des trois objectifs de la Convention sur la diversité biologique.

**Olivier Rokundo**

Olivier Rukundo est un responsable des programmes de la section du Protocole de Nagoya au sein du Secrétariat de la convention sur la diversité biologique (CDB). Avant de rejoindre le Secrétariat de la CDB, M. Rukundo a eté conseiller juridique au sein de la section du savoir traditionnel, des ressources génétiques et des expressions culturelles traditionnelles de l'Organisation Mondiale de la Propriété Intellectuelle (OMPI). Il a également eté conseiller juridique de l'Agence allemande de coopération interne sur une nomination spécifique à l'Initiative de développement des capacités ABS pour l'Afrique. Il était le conseiller juridique du Groupe africain lors des négociations sur le régime international d'accès et partage des avantages. M. Rukundo détient un BA (North. Iowa), un double LL.B./ BCL (McGill) et un LL.M en Propriété Intellectuelle de l'Université de Turin / Académie mondiale de l'OMPI.

## THE NAGOYA PROTOCOL ON ACCESS AND BENEFIT SHARING

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity was adopted by the Conference of the Parties to the Convention on Biological Diversity at its tenth meeting on 29 October 2010 in Nagoya, Japan. The presentation will provide an overview of the key features of the Nagoya Protocol. In particular, the presentation will highlight how the Protocol will create greater legal certainty and transparency for both providers and users of genetic resources.

## THE STRATEGIC PLAN FOR BIODIVERSITY AND THE AICHI BIODIVERSITY TARGETS

The tenth meeting of the Conference of the Parties, held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan, adopted a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for the 2011-2020 period. The presentation will provide an overview of the mission and strategic goals and 20 targets, collectively known as the Aichi Targets. The presentation will highlight how The Strategic Plan serves as a flexible framework for the establishment of national and regional targets and it promotes the coherent and effective implementation of the three objectives of the Convention on Biological Diversity.

### Olivier Rokundo

Olivier Rukundo is a Programme Officer in the Nagoya Protocol Unit of the Secretariat of the Convention on Biological Diversity. Prior to joining the SCBD, Mr. Rukundo was as a legal consultant within the Traditional knowledge, genetic resources and traditional cultural expressions Unit of the World Intellectual Property Organization (WIPO). He also served as legal consultant the German Internal Cooperation Agency on a specific appointment to the ABS Capacity Development Initiative for Africa. He was the legal adviser to the African Group during the negotiations of the International regime on access and benefit sharing. Mr Rukundo holds a BA (North. Iowa), a joint LL.B./B.C.L. (McGill), and an LL.M in Intellectual Property from the University of Turin/WIPO Worldwide Academy.

# PANELS

**Jeudi, 8 décembre 2011 / Thursday, 8 December 2011**
**15:30-17:00**

## CONSTRUIRE UN RÉSEAU D'AIRES PROTÉGÉES DANS LE NORD DU QUÉBEC

## BUILDING NORTHERN QUÉBEC'S PROTECTED AREAS NETWORK

### Panélistes / Panelists:

- François Brassard, Coordonateur scientifique / Scientific coordinator, Direction du patrimoine écologique et des parcs, Ministère du Développement durable, de l'Environnement et des Parcs
- Murray Humphries, Professeur agrégé / Associate Professor, Department of Natural Resource Sciences, McGill University
- Rodney Mark, Chef - Chief, Cree Nation of Wemindji
- Monica Mulrennan, Professeure agrégée / Associate Professor, Department of Geography, Planning and Environment, Concordia University
- Modérateur / Moderator: Colin Scott, Professeur agrégé / Associate Professor, Department of Anthropology, McGill University

Québec compte compléter un réseau d'aires protégées couvrant au moins 12 % du territoire du Plan Nord d'ici 2015; une proportion qui sera portée à 50% en 2035. Cet ambitieux réseau couvrira près de 1,2 millions de kilomètres carrés et sa construction sera jalonnée par une multitude de facteurs complexes, et elle ne deviendra possible que par la coopération entre les nations québécoises, Cris, Inuits et innues. Ce panel portera sur l'interaction entre les facteurs écologiques, culturels, et politiques qui sont essentiels pour la création des aires protégées dans le nord du Québec. Les panélistes partageront leurs perspectives au sujet des défis et opportunités auxquels doit s'attendre le Québec afin de construire son réseau d'aires protégées dans le nord et de respecter son engagement du Plan Nord envers la sauvegarde de la biodiversité. Ils vont également discuter de leurs expériences respectives liées à la création des aires protégées terrestres et marines, avec une attention particulière à la création de la Réserve de biodiversité Paakumshumwaau-Maatuskaau et de l'aire de conservation marine Marine Tawich.

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Québec's Plan Nord calls for a completion of northern Québec's protected area network so that by 2015, at least 12% of the area is in protected areas, to be

increased to 50% by 2035. Building this network, in this area covering nearly 1.2 million square kilometers, will require the cooperation of Quebec, Cree, Inuit and Innu Nations. This panel will focus on the interplay of the ecological, cultural, social, and political factors that are key to the creation of protected areas in northern Québec. Participants in this panel will share their perspectives about the challenges and opportunities for Québec as it works to build its protected areas network in the north and its Plan Nord commitments to safeguarding biodiversity. They will discuss their own experiences working on terrestrial and marine protected areas, with a special focus on the creation of the Paakumshumwaau-Maatuskaau Biodiversity Reserve and the Tawich National Marine Conservation Area initiative.

**Vendredi, 9 décembre 2011 / Friday, 9 December 2011**
**10:30-12:00**

## INITIATIVES POUR L'INTÉGRATION ET L'ACCÈS AUX DONNÉES SUR LA BIODIVERSITÉ

## INITIATIVES FOR BIODIVERSITY DATA INTEGRATION AND ACCESS

### Panélistes / Panelists:

- Isabelle Aubin, Écologiste / Ecologist, Service canadien des forêts/Ressources naturelles Canada / Canadian Forest Service/Natural Resources Canada
- Anne Bruneau, Professeur titulaire / Professor, Département de sciences biologiques, Université de Montréal
- Guillaume Larocque, Professionel de recherche / Research Professional, Centre de la science de la biodiversité du Québec / Quebec Centre for Biodiversity Science
- Frédéric Poisson, Écologue / Ecologist, Ministère du Développement durable, de l'Environnement et des Parcs
- Modérateur - Moderator: Luc Brouillet, Professeur titulaire / Professor, Département de sciences biologiques, Université de Montréal

Les données scientifiques liées aux sciences de la vie et de la terre ont une valeur certaine pour les projets pour lesquelles elles ont été récoltées, mais elles peuvent être aussi servir à des recherches futures, parfois sans lien apparent avec le but original. Afin de permettre à toute la communauté d'utiliser efficacement ces données, elles doivent être rendues accessibles et intégrées de façon logique. Au Canada, plusieurs initiatives en ce sens existent. Les panélistes présenteront des projets d'envergure nationale pour l'intégration et la mise en ligne de données biologiques, qu'il s'agisse de données de traits fonctionnels de végétaux, de cadre de référence écologique du paysage nordique, ou de données de collections biologiques. Les panélistes aborderont les défis humains, technologiques et institutionnels, ainsi que les stratégies de financement de ces projets. Ils présenteront des exemples concrets d'utilisation des données pour des questions de recherche.

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Scientific data related to life and earth sciences have a unique value for the projects for which they were collected, but they can also be used for future

research, sometimes without obvious connections to their original purpose. To enable the entire scientific community to effectively use these data, they must be made accessible and integrated in a logical manner. In Canada, several initiatives are working toward these ends. Panelists in this session will present projects of a national scope for the integration and online access of biological data, including data about functional traits of plants, ecological reference framework data for the north, and data from biological collections. Panelists will address human, technological and institutional challenges, as well as the challenges and strategies for financing these projects. They will present concrete examples of the use of data in a research context.

## LE RÉSEAUTAGE DE BASES DE DONNÉES COMME OUTIL FACILITANT LA COLLABORATION SUR DES PROJETS DE RECHERCHE À LARGE ÉCHELLE : DEUX INITIATIVES DU SERVICE CANADIEN DES FORÊTS

*Isabelle Aubin*
*Service canadien des forêts / Canadian Forest Service*

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Les changements sans précédent auxquels font face les écosystèmes forestiers à l'échelle de la planète ont stimulé l'émergence de nouvelles approches et outils diagnostiques nécessitant de larges jeux de données. La mise en réseau de données et d'informations scientifiques permet d'intégrer des données à diverses échelles spatiales ou disciplinaires afin de générer du savoir répondant aux grandes questions de l'heure. Ces intégrations représentent des défis financiers et opérationnels comme la communication entre les bases de données et l'ontologie, mais avant tout humain. Afin d'assurer leur succès et leur pérennité, ces initiatives doivent trouver le point d'équilibre entre les besoins et les droits des utilisateurs, des gestionnaires et des fournisseurs de données. Deux initiatives en développement au Service Canadien des Forêts seront présentées : 1) TOPIC : un réseau Canadien de bases de données de traits; 2) Forest change : un portail qui hébergera un large éventail d'information lié aux changements climatiques. Au cours de cette présentation, j'aborderais les objectifs, motivations, structure et fonctionnement de ces initiatives. Je discuterais également de leur positionnement au sein des initiatives internationales et de leurs développements futurs.

## CANADENSYS AND COLLEAGUES: MOBILIZING BIODIVERSITY DATA ACROSS CANADA

*Anne Bruneau*
*Université de Montréal*

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The recent report by the Canadian Council of Academies noted that Canadian biological collections hold more than 50 million specimens, containing a wealth of information that could potentially inform biodiversity-related decisions. Estimates indicate a similar number of observational data. However, this Canadian biodiversity information is highly fragmentary, with substantial gaps in the digitization of the collections and with only a fraction of the data available online. In response to this, Canadensys (www.canadensys.net) was established to coordinate efforts to publish biodiversity data from university collections and botanical gardens. Headquartered at the Université de Montréal Biodiversity Centre, this consortium comprises 11 universities and five botanical gardens, and unites 34 Canadian researchers. Canadensys collectively holds over 13 million specimens, of which approximately 20% are now databased. We have begun publishing these datasets as downloadable Darwin Core Archives through our own web portal; the data also are available through the Global Biodiversity Information Facility (GBIF). Over the past two years Canadensys, the Canadian Biodiversity Information Facility (CBIF, www.cbif.gc.ca) and NatureServe Canada (www.natureserve.ca) have begun collaborating to ensure compatibility of data and to represent Canada at international biodiversity informatics conferences. The next logical step in this process of coordinating efforts is to involve other data-holding networks as well as a broad cross-section of Canadian data users in academia, government and industry. Advances in informatics tools, standards and expertise make this a perfect time to tackle the need to increase access to and use of biodiversity information by orders of magnitude via a Canada-wide effort.

## MISE EN PLACE D'OUTILS POUR LA DÉCOUVERTE ET LE PARTAGE D'INFORMATION SUR LA BIODIVERSITÉ DU QUÉBEC

*Guillaume Larocque*
*Centre de la science de la biodiversité du Québec*

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Les données et métadonnées (informations sur les données) sur la biodiversité collectées et entreposées par différents chercheurs, ministères, et autres organismes québécois ne sont pas répertoriées de façon uniforme dans une infrastructure centralisée. Cette situation met en péril la pérennité de l'information collectée et rend difficile la recherche sur le suivi des populations. Le Centre de la science de la biodiversité du Québec (CSBQ) a mis en place différentes initiatives afin de faciliter l'accès aux données et métadonnées sur la biodiversité du Québec et je présenterai deux de ces initiatives. En partenariat avec les Zoological Record de Thomson Reuters, j'ai développé un outil web (Biodiversity Articles Mapper, http://www.qcbs.ca/bam) qui cartographie les lieux où des données sur espèces animales ont été collectées et publiées dans les articles scientifiques. Cet outil, qui répertorie présentement plus de 7000 entrées, fait appel à différentes bases de données pour identifier le géocodage des noms de lieux, les liens vers les articles scientifiques, la hiérarchie taxonomique de chaque espèce et les noms vernaculaires. Je présenterai aussi brièvement une autre des initiatives du CSBQ, qui est le fruit d'une collaboration avec NatureServe Canada, et dont l'objectif est la création d'un formulaire pour l'entrée de métadonnées sur les études de terrain qui permettra de faciliter le partage d'informations entre les différents chercheurs et intervenants. Pour être efficace, cette initiative nécessitera la collaboration des personnes et institutions en charge de la collecte et de l'entreposage de données.

## ATLAS DE BIODIVERSITÉ DU QUÉBEC NORDIQUE

*Frédéric Poisson*
*Ministère du Développement durable, de l'Environnement et des Parcs*

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Le ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) a développé, depuis trente ans, une double expertise : la compréhension de l'organisation spatiale du milieu physique avec le cadre écologique de référence et une connaissance des espèces menacées ou vulnérables et des communautés végétales avec le Centre de données sur le patrimoine naturel du Québec (CDPNQ). Le but du projet d'Atlas de biodiversité du Québec nordique est de proposer un outil d'intégration des connaissances sur les espèces, les communautés, les habitats et les processus de perturbations. Une grande partie de ces connaissances proviennent des données de l'inventaire du Capital nature mené dans les années 80 sur les territoires de la Baie-James et de la Côte-Nord. Nous avons obtenu des données sur la flore de l'Herbier Louis-Marie et la faune aviaire du Regroupement QuébecOiseaux grâce aux fonds du projet d'Atlas. De plus, nous avons aussi mené une campagne de terrain au mois de juillet 2011 dans le secteur de Kangiqsujuaq. L'intégration des connaissances se fait à l'aide d'un SIG qui permet d'analyser ces différents thèmes et de les mettre en relation - lien entre milieu physique et communautés végétales, liens entre communautés végétales et espèces. De nouvelles informations émergent et permettent une compréhension de l'organisation spatiale de la biodiversité à différents niveaux de perception sur l'ensemble du territoire. À partir de ces résultats, des fiches écologiques peuvent être montées constituant une forme de diffusion des données et analyses pour le public.

**Vendredi, 9 décembre 2011 / Friday, 9 December 2011**
**14:15-15:45**

## CEINTURES VERTES, RÉSEAUX ÉCOLOGIQUES ET L'AVENIR DE LA BIODIVERSITÉ DANS LES RÉGIONS URBAINES

## THE FUTURE OF BIODIVERSITY IN URBAN AREAS: FROM GREENBELTS TO ECOLOGICAL NETWORKS

### Panélistes / Panelists:

- Oliver Hillel, Administrateur de programmes / Programme Officer, Secrétariat de la convention sur la diversité biologique / Secretariat for the Convention on Biological Diversity
- Faisal Moola, Directeur des sciences / Director Terrestrial Conservation and Science Program, David Suzuki Foundation
- Jérôme Dupras, Doctorant / Doctoral candidate, Département de géographie, Université de Montréal; Conseiller scientifique pour le projet de ceinture verte de Montréal / Science Advisor to Montréal greenbelt project
- Andrew Gonzalez, Professeur agrégé / Associate Professor, Department of Biology, McGill University
- Moderatrice - Moderator: Danielle Dagenais, Professeure adjointe / Assistant Professor, École d'architecture de paysage, Université de Montréal

Ce panel explorera la gestion et la conservation de la biodiversité dans les zones urbaines et peri-urbaines grâce aux ceintures vertes et aux réseaux écologiques. Les conférenciers aborderont les ceintures vertes sous divers aspects : les études scientifiques de réseaux écologiques sous-jacentes à leur conception; leur mise en valeur économique; ainsi que les défis politiques et de gouvernance permettant leur mise en place et leur maintien. Le panel se terminera par une discussion ouverte sur les ceintures vertes et les réseaux écologiques à Montréal, dans le sud du Québec, à Toronto et à Sao Paolo, Brésil.

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This panel will explore the ecological, economic, and social dimensions of managing and conserving biodiversity in and around urban areas through greenbelts and ecological networks. Speakers will address the ecological science underlying the design of greenbelts and ecological networks, economic valuation of greenbelts, and the political and governance challenges associated with establishing and maintaining greenbelts. The panel will include discussion of greenbelts and ecological networks in Montréal, southern Québec, Toronto, and Sao Paolo, Brazil.

## HORAIRE DES PRESENTATIONS DE RECHERCHE
## RESEARCH PRESENTATION SCHEDULE

**Session 1:**
**Jeudi 8 décembre, 10:30-12:00 / Thursday 8 December, 10:30-12:00**

### 1A: CONSERVATION, GOUVERNANCE ET ÉDUCATION
### CONSERVATION, GOVERNANCE AND EDUCATION

| | | | |
|---|---|---|---|
| 10:30-10:45 | Governance and marine protected areas in Québec | Layton-Cartier, Geneviève | Concordia University |
| 10:45-11:00 | Protected area strategies and indigenous peoples: Exploring dimensions of governance in Chile | García, Magdalena | Concordia University |
| 11:00-11:15 | Exploring local responses to community-based environmental monitoring in northern regions using GPS-equipped handheld devices with a touch screen CyberTracker interface | Brammer, Jeremy | McGill University |
| 11:15-11:30 | Shifting targets in the tundra: are calving grounds of migratory caribou really protected in Northern Québec? | Taillon, Joëlle | Université Laval |
| 11:30-11:45 | Formidable obstacles to protecting biodiversity | Kettenbeil, Peter Scott | COVABAR |
| 11:45-12:00 | Beginning a dialogue: How can biodiversity education be incorporated into curricula? | Hillel, Oliver | Convention on Biological Diversity |

### 1B: ANIMAUX EN MOUVEMENT
### ANIMALS ON THE MOVE

| | | | |
|---|---|---|---|
| 10:30-10:45 | Movement, home range and vulnerability in the commercially fished Nile perch (Lates niloticus) in Lake Nabugabo, Uganda | Nyboer, Elizabeth | McGill University |
| 10:45-11:00 | Measuring spatial-temporal home range use in animal-movement data using the Beta-Binomial distribution | Bonnell, Tyler | McGill University |

| | | | |
|---|---|---|---|
| 11:00-11:15 | Gardons le contact : comparaison des indices de chevauchement des domaines vitaux pour l'évaluation du taux de contacts intraspécifique chez le Raton laveur | Robert, Karine | Université de Sherbrooke |
| 11:15-11:30 | How does the road-density extinction threshold depend on the configuration of the road network and on the road avoidance behavior of the species? | Jaeger, Jochen | Concordia University |
| 11:30-11:45 | Assessing habitat availability and connectivity for the jaguar Panthera onca, in the Yucatan peninsula, Mexico | Gomez-Garcia, Paola | McGill University |
| 11:45-12:00 | L'apport de la technologie GPS au suivi de la dynamique de fusion-fission des groupes : exemple du rut du renne Rangifer tarandus. | Body, Guillaume | Concordia University |

## 1C: DYNAMIQUES DES ÉCOSYSTÈMES ET DES COMMUNAUTÉS COMMUNITY AND ECOSYSTEM DYNAMICS

| | | | |
|---|---|---|---|
| 10:30-10:45 | Shedding light on nutritional interactions: litter production by neighbours contributes to overyielding in a tropical tree plantation | Sapijanskas, Jurgis | AgroParisTech ENGREF - McGill University |
| 10:45-11:00 | Dissecting intraguild predation: The relative contribution of predation and competition to the maintenance of intraguild prey | Granados, Monica | McGill University |
| 11:00-11:15 | Dynamics in competitive metacommunities: Fitness inequality and niche differentiation | Pedruski, Michael | McGill University |
| 11:15-11:30 | Tester l'Hypothèse du Gradient de Stress avec des détritivores aquatiques: Implications pour les relations biodiversité-fonctionnement de l'écosystème | Fugère, Vincent | Université McGill |

| | | | |
|---|---|---|---|
| 11:30-11:45 | Zooplankton biodiversity in the ponds of Mont Saint-Hilaire, Quebec and the search for spatial insurance in changing environments | Thompson, Patrick | McGill University |
| 11:45-12:00 | Using localized interaction framework to measure and model ecosystem dynamics | Wong, Edward | McGill University |

**Session 2:**
**Jeudi 8 décembre, 13:00-14:15 / Thursday 8 December, 13:00-14:15**

## 2A: RÉPONSES AUX CHANGEMENTS CLIMATIQUES RESPONDING TO A CHANGING CLIMATE

| | | | |
|---|---|---|---|
| 13:00-13:15 | La vulnérabilité des espèces aux changements climatiques au Québec | Gendreau, Yanick | Université du Québec à Rimouski |
| 13:15-13:30 | Projected distribution of the white-footed mouse with climate change: a question of time and space | Roy-Dufresne, Emilie | McGill University |
| 13:30-13:45 | Genetic structure of white-footed mouse populations from sky-islands in southern Québec: impact of climate warming and fragmentation on the spread of Lyme Disease | Rogic, Anita | McGill University |
| 13:45-14:00 | Patterns of genetic structure and diversity in eastern North American Betula species based on chloroplast and nuclear DNA markers: Influence of glacial history and introgression | Thomson, Ashley M. | Concordia University |
| 14:00-14:15 | Effects of deepened thermocline on zooplankton community dynamics | Gauthier, Joanna | Université du Québec à Montréal |

## 2B: THÉORIE DE L'ÉVOLUTION ET NOUVEAUX PARADIGMS
## EVOLUTION AND CHANGING PARADIGMS

| | | | |
|---|---|---|---|
| 13:00-13:15 | Why does species evenness cause under-yielding? | Mikkelson, Gregory M. | McGill University |
| 13:15-13:30 | A new approach to understanding the regulation of zooplankton community structure | St-Gelais, Nicolas F. | Université du Québec à Montréal |
| 13:30-13:45 | The effects of nutrient co-limitation and stoichiometric imbalances on ecosystem dynamics | Marleau, Justin | McGill University |
| 13:45-14:00 | The role of diversity and sex during evolutionary rescue | Lachapelle, Josianne | McGill University |
| 14:00-14:15 | Hurry up and adapt before you go extinct | Osmond, Matthew | McGill University |

## 2C: ADAPTATION ET PALÉOBIOLOGIE
## ADAPTATION AND PALEOBIOLOGY

| | | | |
|---|---|---|---|
| 13:00-13:15 | Spatiotemporal variation in guppy colour: exploring a mosaic of adaptation | Gotanda, Kiyoko M. | McGill University |
| 13:15-13:30 | Variation des patrons de plasticité phénotypique et de sélection sur la date de ponte entre populations de mésanges bleues | Porlier, Mélody | Université de Sherbrooke / Centre d'Ecologie Fonctionnelle et Evolutive, France |
| 13:30-13:45 | Linking phylogenetic and niche community states: emergent patterns of community assembly and structure | da Silva, Renato Henriques | Université du Québec à Montréal |
| 13:45-14:00 | Diversity of frog crabs throughout geologic time: the dawn and dusk of body plan | Luque, Javier | Université de Montréal |
| 14:00-14:15 | Hemichordate biominerals and the evolution of deuterostome skeletons | Cameron, Chris | Université de Montréal |

**Session 3:**
**Vendredi 9 décembre, 9:15-10:15 / Friday 9 December, 9:15-10:15**

## 3A: STRUCTURE DU PAYSAGE / LANDSCAPE STRUCTURE

| | | | |
|---|---|---|---|
| 9:15-9:30 | The effects of density, habitat properties, and traits on habitat selection | Jacobson, Bailey | Université du Québec à Montréal |
| 9:30-9:45 | Influence of landscape structure on ecosystem service provision | Liss, Kate | McGill University |
| 9:45-10:00 | Ecosystem service provision and landscape composition: insect herbivory in fragmented forests | Maguire, Dorothy | McGill University |
| 10:00-10:15 | How many monkeys does this forest feed? Long-term patterns in forests recovering from different land uses, Kibale National Park, Uganda | Jacob, Aerin L. | McGill University |

## 3B: GÉNÉTIQUE ET SYSTÉMATIQUE / GENETICS AND SYSTEMATICS

| | | | |
|---|---|---|---|
| 9:15-9:30 | Sharp genetic discontinuity across a unimodal Heliconius hybrid zone | Arias, Carlos F. | McGill University |
| 9:30-9:45 | Genetic structure and diversity of Citrus medica in natural and domesticated populations in the Eastern Himalayan region of Northeast India | Barbhuiya, Atiqur R. | Concordia University |
| 9:45-10:00 | Molecular systematics of Bamboo species in the Eastern Himalayan region of Northeast India | Singha, Lal Bihari | Concordia University and North Eastern Regional Institute of Science & Technology |
| 10:00-10:15 | Évolution de la biodiversité végétale malgache durant le Tertiaire: systematique et biogéographie de légumineuses menacées d'extinction. | Babineau, Marielle | Université de Montréal |

## 3C: INVASIONS BIOLOGIQUES
## BIOLOGICAL INVASION

| | | | |
|---|---|---|---|
| 9:15-9:30 | Niche expansion in a surviving endemic fish following invasion of a top predator? | Sharpe, Diana | McGill University |
| 9:30-9:45 | Predicting peak refugia for mitigating impacts of invasive predatory fish | Reid, Andrea | McGill University |
| 9:45-10:00 | Using import records to estimate the probability of aquarium fish establishment | Bradie, Johanna | McGill University |
| 10:00-10:15 | Back-calculation of source populations from recruitment patterns: application for early detection of AIS | Edwards, Paul K. | McGill University |

**Session 4:**
**Vendredi 9 décembre, 13:00-14:00 / Friday 9 December, 13:00-14:00**

## 4A: BIODIVERSITÉ DANS LES PAYSAGES AGRICOLES
## BIODIVERSITY IN AGRICULTURAL LANDSCAPES

| | | | |
|---|---|---|---|
| 13:00-13:15 | Biodiversity assessment using the FIGS approach for important agronomic/functional traits | Bari, Abdallah | International Center for Agricultural Research in the Dry Areas |
| 13:15-13:30 | Effet de bordure et spécificité des pollinisateurs indigènes dans la culture du bleuet nain | Moisan-De Serres, Joseph | Université Laval |
| 13:30-13:45 | Effects of forest patch size and isolation on ecosystem service provision and biodiversity in an agricultural landscape | Mitchell, Matthew | McGill University |

## 4B: INVASIONS BIOLOGIQUES; GESTION DE L'HABITAT
## BIOLOGICAL INVASION; HABITAT MANAGEMENT

| | | | |
|---|---|---|---|
| 13:00-13:15 | Déterminants de la végétation des milieux humides aménagés pour la sauvagine dans le Québec méridional | Courchesne, Geneviève | Université Laval et Canards Illimités Canada |
| 13:15-13:30 | Les graines sont les principaux vecteurs de propagation du roseau commun exotique (Phragmites australis) | Albert, Arnaud | Institut de recherche en biologie végétale / Université de Montréal |
| 13:30-13:45 | The role of functional diversity in invasion resistance of resident plant communities: a large field experiment with common reed | Byun, Chaeho | McGill University |
| 13:45-14:00 | Comparing models of human mediated dispersal of freshwater invasives | Chivers, Corey | McGill University |

## 4C: ÉCOLOGIE FONCTIONNELLE
## FUNCTIONAL ECOLOGY

| | | | |
|---|---|---|---|
| 13:00-13:15 | Réponses fonctionnelles des communautés animales et végétales aux hautes densités de cerfs de Virginie : l'île d'Anticosti comme laboratoire pour utiliser les traits de trois niveaux trophiques | Bachand, Marianne | Université Laval |
| 13:15-13:30 | Spring loaded reproduction: effects of body condition and population size on gestation rate in migratory caribou. | Pachkowski, Melanie | Université de Sherbrooke |
| 13:30-13:45 | Les déterminants du succès reproducteur des mâles Hirondelle bicolore | Lessard, Andréanne | Université de Sherbrooke |
| 13:45-14:00 | Size does matter: Organisms of most similar size show congruent diversity patterns | Velghe, Katherine | McGill University |

## LES GRAINES SONT LES PRINCIPAUX VECTEURS DE PROPAGATION DU ROSEAU COMMUN EXOTIQUE (PHRAGMITES AUSTRALIS)

*Albert, Arnaud*[1]*; Lavoie, Claude; Brisson, Jacques; Belzile, François*

[1]Institut de recherche en biologie végétale/Université de Montréal

La sous-espèce introduite du roseau commun est considérée comme l'une des plantes les plus envahissantes du Québec. Elle peut se propager par fragments végétatifs ou par reproduction sexuée, mais l'importance relative de ces deux mécanismes dans l'établissement de nouvelles populations est inconnue. La variation génétique a été examinée entre et au sein de plusieurs populations dans deux habitats : les fossés de drainage routiers et des marais d'eau douce. 99 colonies linéaires ont été sélectionnées au hasard le long de l'Autoroute 20, et 10 colonies circulaires dans le Parc national des Îles-de-Boucherville. Une stratégie d'échantillonnage à deux échelles a été utilisée. Au premier niveau, un échantillon foliaire d'un individu situé au centre de chaque colonie a été collecté. Au deuxième niveau, huit autres échantillons foliaires ont été récoltés le long des colonies linéaires ou selon les axes cardinaux des colonies circulaires. Six marqueurs microsatellites nucléaires ont été utilisés sur chaque échantillon d'ADN. Parmi les 99 colonies autoroutières, au premier niveau, 81 génotypes différents ont été observés. Au deuxième niveau, 71 colonies contenaient un unique ou deux génotypes différents, et les 28 colonies restantes comprenaient entre trois et neuf génotypes. Dans les marais, au premier niveau, toutes les dix colonies différaient. Au second niveau, neuf des colonies étaient composées de neuf individus identiques. Ces données suggèrent que les graines jouent un rôle prépondérant dans l'établissement initial de nouvelles populations (haute diversité génétique entre colonies), après quoi la propagation asexuée contribue à l'expansion locale de ces populations (faible diversité génétique au sein des colonies).

## SHARP GENETIC DISCONTINUITY ACROSS A UNIMODAL HELICONIUS HYBRID ZONE

*Arias, Carlos F.*[1]*; Rosales, Claudia; Salazar, Camilo; Castaño, Jully; Bermingham, Eldredge; McMillan, W. Owen; Linares, Mauricio*

[1]McGill University

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Hybrid zones are considered as natural laboratories for the study of diversity and variation among populations, providing a range of distinctive levels of differentiation in a continuum that can lead to speciation. We performed a combined analysis of mtDNA, AFLPs, microsatellites, color pattern candidate genes and random nuclear loci among two neotropical butterfly races, Heliconius cydno cydnides and Heliconius cydno weymeri, that form a hybrid zone in the Cauca Valley of Colombia. Collections of butterflies from the hybrid zone showed that, is largely composed of individuals of hybrid phenotype and mixed ancestry based on both AFLPs and microsatellite loci. Nonetheless, there is a striking mtDNA discontinuity and strong genetic differences at all the molecular markers. The sharp break on random neutral markers together with the strong mtDNA clustering of cydnides with the cydno race from the Magdalena valley and weymeri with the cydno race from the pacific coast suggest a north colonization of the cauca valley by cydnides and a recent trans-andean colonization of the cauca valley by weymeri. Mate choice experiments showed that cydnides males had incipient assortative mating. Moreover, cydnides males' courtship allopatric cydno females as much as their own color patter females. Thus, the hybrid zone studied here represents an early stage in the speciation process but is different from other Heliconius contact zones where warning coloration has evolved in parapatry/sympatry whereas in this case color pattern divergence began in allopatry and mate choice preference is evolving as a by-product of direct selection against hybridization.

## ÉVOLUTION DE LA BIODIVERSITÉ VÉGÉTALE MALGACHE DURANT LE TERTIAIRE: SYSTEMATIQUE ET BIOGÉOGRAPHIE DE LÉGUMINEUSES MENACÉES D'EXTINCTION

*Babineau, Marielle[1]; Bruneau, Anne*

[1]Université de Montréal

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L'établissement de la flore malgache au tertiaire demeure sujet à débat. Plusieurs hypothèses sont proposées: pont d'îlots, radeaux végétatifs, dispersion par les animaux, etc. La famille des Légumineuses englobe plusieurs genres endémiques à Madagascar dont le groupe monophylétique composé des genres Delonix, Colvillea et Lemuropisum. Ce groupe comprend treize espèces dont onze se retrouvent sur la côte ouest de Madagascar dans la forêt sèche du Nord et les fourrés arides du Sud. Deux autres espèces sont en Afrique de l'Est. Cette étude vise à mieux comprendre les forces géographiques et évolutives qui expliquent la répartition actuelle de ces espèces menacée d'extinction. Des analyses de parcimonie et bayesienne de séquences chloroplastiques et nucléaires ont été effectuées pour reconstruire la phylogénie du groupe. La faible différenciation génétique observée suggère une diversification rapide des espèces, ainsi qu'une specialisation écologique dans deux clades distincts. Un clade comprend les espèces africaines et trois espèces malgaches largement répandues et l'autre les deux genres monospécifiques Colvillea et Lemuropisum ainsi que les cinq autres espèces de Delonix majoritairement restreintes aux fourrés arides. Les analyses de datation et de biogéographie, suggèrent une origine au sud de Madagascar vers 18 Ma suivie d'une dispersion des espèces africaines vers 15 Ma. Ce patron de repartition peut s'expliquer soit par une dispersion par les oiseaux ou par le passage par îlots le long de la fracture de Davies. Le clade "fourré aride" mérite un effort de conservation accrue puisqu'il est diversifié taxonomiquement et regroupe des espèces ayant un statut de conservation critique.

## RÉPONSES FONCTIONNELLES DES COMMUNAUTÉS ANIMALES ET VÉGÉTALES AUX HAUTES DENSITÉS DE CERFS DE VIRGINIE : L'ÎLE D'ANTICOSTI COMME LABORATOIRE POUR UTILISER LES TRAITS DE TROIS NIVEAUX TROPHIQUES

*Bachand, Marianne[1]; Poulin, Monique; Pellerin, Stéphanie; Moretti, Marco; Aubin, Isabelle; Tremblay, Jean-Pierre Tremblay; Côté, Steeve*

[1]Université Laval

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La croissance actuelle des populations de cerfs en Occident est un exemple flagrant de surabondance chez une population animale terrestre. Les hautes densités de cerfs peuvent mener à la surexploitation de la végétation entraînant des cascades trophiques. Les hautes densités de cerfs de Virginie sur l'île d'Anticosti ont altéré la composition et la structure végétale des forêts et celles des espèces animales associées. Ce projet vise à quantifier la réponse fonctionnelle des plantes, des carabidés et des oiseaux d'Anticosti aux hautes densités de cerfs. Il est basé sur un dispositif de broutement contrôlé comptant trois niveaux de densité comparés à des densités naturelles. Nous avons inventorié les plantes, les carabidés et les oiseaux du dispositif six ans après sont instauration. Des analyses multivariables (ex : Indval) nous ont permis d'identifier les traits des plantes et des animaux associés aux diverses densités. À haute densité de cerfs, les plantes présentaient, entre autres, des organes de storage, des rhizomes et une dispersion abiotique. À faible densité, les plantes avaient des fruits charnus, de larges graines et un feuillage érigé. Les carabidés trouvés à haute densité occupent les substrats d'argile et ceux trouvés à faible densité ont une période d'activité annuelle longue. Les oiseaux herbivores étaient associés aux hautes densités alors que les oiseaux insectivores et glaneurs étaient associés aux faibles densités. Ces résultats sont cruciaux pour mieux comprendre les processus gouvernant la réponse fonctionnelle des communautés végétales et animales à la surabondance de grands herbivores et ainsi favoriser la résilience des écosystèmes qu'ils affectent.

## GENETIC STRUCTURE AND DIVERSITY OF CITRUS MEDICA IN NATURAL AND DOMESTICATED POPULATIONS IN THE EASTERN HIMALAYAN REGION OF NORTHEAST INDIA

*Barbhuiya, A. R.*[1]*; Dayanandan, S.*[1]*; Khan, M.L.*[2]

[1]Concordia University
[2]Guru Ghasidas University, India.

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Citron (Citrus medica L.) is a medicinally important species of citrus native to India and occurs in natural forests and home gardens in the foothills of the Eastern Himalayan region of Northeast India. The wild populations of Citron in the region have undergone rapid decline due to natural and anthropogenic disturbances and most of the remaining individuals of Citron are found in fragmented natural forests and home-gardens in the region. In order to assess the genetic structure and diversity of Citron in wild and domesticated populations, we analyzed 219 individual of C. medica collected from four wild and eight domesticated populations using microsatellite markers. The genetic analysis based on five polymorphic microsatellite loci revealed an average of 13.40 allele per locus. Analysis of molecular variance (AMOVA) results showed higher genetic diversity among- than within-populations. The analysis of population structure revealed five groups, primarily corresponding to geographical location of the populations. The knowledge gained through this study is invaluable for devising genetically sound strategies for conservation of Citron genetic resources in the region and for understanding the evolutionary consequences of plant domestication.

## BIODIVERSITY ASSESSMENT USING THE FIGS APPROACH FOR IMPORTANT AGRONOMIC/FUNCTIONAL TRAITS

*Bari, Abdallah[1]; Street, Kenneth; Mackay, Michael; Endresen, Dag Terje Filip; De Pauw, Eddy; Amri, Ahmed*

[1]International Center For Agricultural Research in the Dry Areas

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Assessing plant biodiversity for useful traits is of increasing importance if we are to sustain agriculture production as the impacts of climate change put mounting pressure on agro-ecosystems. The yield potential of crops depends largely on a combination of 50-60000 trait loci within the plant genome. Looking for useful rare alleles within such a large number of trait loci can be a daunting process. FIGS, which stands for Focused Identification of Germplasm Strategy, is a trait-based approach that was conceived to search specifically for rare alleles using, as a surrogate, the environment; based on the hypothesis that agro-biodiversity is likely to reflect the selection pressures of the environment in which it evolved and was originally sampled. The distribution patterns of adaptive traits, as is the case for species distribution, are likely to be the result of environment, natural selection and local selection pressures. Using this premise a FIGS approach was used to mine genebank accessions for novel sources of variation leading to the identification of several new important alleles/functional variations for crop improvement, such as disease and insect resistance. Variations at most of these traits have been long sought for in crop improvement. This paper presents the conceptual framework, along with several different methods that have been used in searching/mining for trait variants, before discussing some of the results with a focus on traits.

## L'APPORT DE LA TECHNOLOGIE GPS AU SUIVI DE LA DYNAMIQUE DE FUSION-FISSION DES GROUPES : EXEMPLE DU RUT DU RENNE RANGIFER TARANDUS

*Body, G.* [1]*; Holand O. ; Weladji R.*

[1]Concordia University

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L'étude des déplacements des animaux et de la sélection de leurs habitats a mis en valeur l'intérêt de la biodiversité. Cette étude a depuis quelques années été largement facilité par l'utilisation de la technologie GPS. Cependant les recherches actuelles restent centrées sur les comportements individuels. Certains champs de recherche s'intéressent plutôt aux relations inter-individuelles permettant notamment de comprendre l'importance des liens existant entre les individus ainsi que les compromis entre décision individuelle et décision de groupe. Les populations animales présentant une dynamique de groupe de type de fusion-fission (primates, dauphins, éléphants, rennes) sont alors d'un intérêt particulier. Notre étude présente pour la première fois le suivi de la dynamique de fusion-fission des groupes avec une grande précision grâce à la technologie GPS. Une population expérimentale de rennes Rangifer tarandus a en effet été entièrement équipée de collier GPS, et nous présentons ici les premières données et les méthodes nécessaires à leurs études. Ce design expérimental particulier nous permettra d'étudier, entre autres, les stratégies de sélection sexuelle des femelles rennes.

## MEASURING SPATIAL-TEMPORAL HOME RANGE USE IN ANIMAL-MOVEMENT DATA USING THE BETA-BINOMIAL DISTRIBUTION

*Bonnell, Tyler R.*[1]*; Dutilleul, Pierre; Chapman, Colin A.; Reyna-Hurtado, Rafael; Sengupta, Raja*

[1]McGill University

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The movement behaviour of organisms play an important role in many ecological systems, and can be important in wildlife management. As organisms move through their environment, they generate movement patterns, which are a result of landscape structure and individual decisions made by the organism. These patterns are spatial and temporal in nature. We propose a new method to analyse these patterns which estimates the intensity of habitat use. This measure aims to capture the aggregation, through time and space, of the organism's movement. Using 2D movement data (e.g. point patterns) we use a grid surface to count visited and non-visited areas in time and in space. We then fit the beta-binomial distribution to these counts and estimate theta, a parameter of this distribution which, in our application, measures the variation in the probability of visits across time and space. We apply this method to simulated primate movement data where we control for movement behaviour. We then apply the method to movement data collected from 4 primate species. The applications of this metric could be useful in understanding ecological systems in which intensity of home range use is an important factor, such as: the relationship between host and parasite, seed dispersal and foraging behaviour.

## USING IMPORT RECORDS TO ESTIMATE THE PROBABILITY OF AQUARIUM FISH ESTABLISHMENT

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Over 28 million fishes representing over 220 species are imported to Canada annually. If, and when, individuals are released to the wild, they can pose an establishment risk. Indeed, the aquarium trade is one of the top 5 pathways for non-indigenous species (NIS) introduction and establishment. Previous research on the aquarium vector has quantified the probability of live release, identified fish at risk for invasion, and qualitatively described the relationship between establishment and propagule pressure. Our study models the relationship between propagule pressure and establishment for the aquarium trade using Canadian live fish imports data as a surrogate for propagule pressure. We quantify the likelihood of invasion, the Allee effect associated with invasions, and the uncertainty in these estimates. Despite the relatively coarse data available, there is a need to generate these estimates for use in risk analyses. We use bayesian methods to parameterize our model and characterize uncertainty. The results of this study will not only help quantify the probability of NIS establishment via the aquarium trade, but can be used by policy makers to guide the decisions regarding potential import restrictions.

## EXPLORING LOCAL RESPONSES TO COMMUNITY-BASED ENVIRONMENTAL MONITORING IN NORTHERN REGIONS USING GPS-EQUIPPED HANDHELD DEVICES WITH A TOUCH SCREEN CYBERTRACKER INTERFACE

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The observations of community members on the land form the basis of local ecological knowledge (LEK) systems and could be integrated into community-based environmental monitoring (CBEM). There are numerous advantages to CBEM, it can: integrate LEK with scientific inquiry, build trust between communities and institutionalized science, engage community members in the scientific process, generate community-oriented data for management decisions and represent a low-cost method of monitoring in the North. However there are numerous obstacles to CBEM including: potential incompatibilities between LEK and scientific approaches, lack of funds, non-systematic data collection, volunteers losing interest, defining ownership of the data and difficulty linking monitoring results to decision makers. A promising new approach to CBEM involves combining rugged GPS-equipped handheld computers with touch-screen software to simplify field data collection, enabling rapid and systematic recording of sightings by community users. CyberTracker (CyberTracker Software Ltd, http://www.cybertracker.org) is one such software system. Ideally, this technology should allow a variety of observers to quickly record detailed, accurate, systematic and georeferenced information regarding biodiversity and the environment. We have conducted community consultations exploring responses to the CyberTracker system in several northern communities including: Old Crow, Yukon; and Wemindji, Mistissini, and Kangirsujuaq, Québec. This presentation will describe the CyberTracker system, outline responses from consultations in these communities and explore the potential for CyberTracker based CBEM in Canada's North.

## THE ROLE OF FUNCTIONAL DIVERSITY IN INVASION RESISTANCE OF RESIDENT PLANT COMMUNITIES: A LARGE FIELD EXPERIMENT WITH COMMON REED

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We assessed through a two-year field experiment the effectiveness of restoring resident plant communities to suppress early invasion of Phragmites australis, a notorious wetland invader in North America. We hypothesized that (1) certain functional group of wetland plants would resist early invasion of P. australis best; (2) biological resistance of resident communities would increase as species richness or functional diversity increases. We simulated a situation where seeds of P. australis arrive on bare ground wetland soil after biological disturbance. We sowed diverse mixtures of seeds from a species pool of 39 wetland plants together with seeds of P. australis as treatment. In each mixture, 4, 8, or 16 wetland plants were chosen from a species pool of functional groups such as Ruderal, Competitor, and Stress tolerator. Applying seed mixture from Ruderal reduced Phragmites invasion the most successfully among functional groups in the first year of the experiment. The seed mixture from Ruderal and Competitor resisted to the invasion of P. australis better than the mixture from only Ruderal in the second year. There was no significant relationship between the number of species in seed mixtures treatment and the invasion of P. australis. Overall, our research implies that restoration of resident communities should favor fast growing ruderal species, which will create a dense plant cover and resist early invasion of common reed. Our findings support the importance of functional diversity rather than species diversity in restoration to prevent early establishment of P. australis.

## HEMICHORDATE BIOMINERALS AND THE EVOLUTION OF DEUTEROSTOME SKELETONS

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Biominerals are key morphological features of echinoderms and vertebrates, but their origins are unclear. Here we report on the discovery of biominerals in hemichordates, including the acorn worms Saccoglossus bromophenolosus and Ptychodera flava galapagos. Like echinoderm ossicles, those of acorn worms are composed of calcium carbonate and are secreted extracellularly by sclerocytes. Furthermore, the sea urchin skeletal C-type lectin domain proteins, matrix metalloproteases, and carbonic anhydrases are present in Saccoglossus kowalevskii, the tunicate Ciona intestinalis and mouse (Mus musculus), whereas MSP130 and related skeletal element proteins are almost exclusive to urchins and worms. These results suggest that mineralized tissue likely predate the echinoderms and that the genomic toolkit used to form skeletal tissue existed in their common ancestor with hemichordates and chordates.

## COMPARING MODELS OF HUMAN MEDIATED DISPERSAL OF FRESHWATER INVASIVES

*Chivers, Corey*[1]*; Leung, Brian*

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Human mediated dispersal has been shown to be the most important vector for the spread of invasive species. Several models have been proposed to characterize the spatial pattern of human movement between discrete patches, such as inland lakes, and thereby predict how individual organisms are likely to spread across a given landscape. There have been two prominent models in the literature which have been employed to predict human movement patterns: 1) Gravity models, which use the size of, and distance to a location to characterize its attractiveness, and 2) Random utility models, which assume that individuals decide where to travel by maximizing a utility function, only part of which is known to the analyst. To determine which approach best captures actual behaviours, we conducted a survey of recreational boaters in Ontario and used individual trip outcomes (n=2354 unique trips) to parameterize both models. We compare the ability of each to capture the real behaviour of boaters. We found that gravity models are significantly better at capturing the real patterns of recreational boaters in Ontario. Further, we assess the consequences of model choice on spread forecasts via a series of simulation experiments. Our results suggest that model choice can have a substantial effect on predicted rates of spread as well as the predicted invasion risk across individual sites. The results of this study will inform future modeling efforts to create better risk assessments for use by resource managers.

## DÉTERMINANTS DE LA VÉGÉTATION DES MILIEUX HUMIDES AMÉNAGÉS POUR LA SAUVAGINE DANS LE QUÉBEC MÉRIDIONAL

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Canards Illimités Canada (CIC) a aménagé plus de 200 milieux humides au Québec afin qu'ils se développent en marais pour la sauvagine, mais aucun suivi de leur végétation n'est effectué. Le but de ce projet était donc de mieux comprendre la dynamique végétale de ces marais aménagés en vue d'en faire une meilleure gestion. Au total, 291 points, répartis dans 29 marais intérieurs d'eau douce, ont fait l'objet d'un échantillonnage de la végétation et de mesures de la profondeur d'eau. Pour chaque marais, les données suivantes ont été recueillies à partir des dossiers de CIC : l'âge de l'aménagement, la vocation précédente du site, la superficie et les récentes modifications du niveau d'eau. Le pourcentage de recouvrement des principaux éléments paysagers a été quantifié à l'intérieur de rayons d'analyse allant de 250 m à 5000 m. Pour répondre aux objectifs, des analyses multivariées ont été employées. Les résultats de l'analyse de groupement montrent que la végétation des marais se structure en 16 communautés végétales distinctes. La présence des communautés est fonction de l'âge du marais alors que leur distribution à l'intérieur des marais est déterminée par la profondeur d'eau. L'abondance des espèces dans les différents marais est expliquée par trois variables du paysage, soit la part occupée par le fleuve, la forêt mélangée et les cultures intensives dans le paysage et par aucune variable de l'aménagement. Dans un contexte de gestion adaptative, ce projet permettra de réviser et bonifier les programmes de suivi et d'entretien des milieux humides de CIC.

## LINKING PHYLOGENETIC AND NICHE COMMUNITY STATES: EMERGENT PATTERNS OF COMMUNITY ASSEMBLY AND STRUCTURE

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Over the past few decades, community structure and assembly mechanisms (i.e., habitat filtering vs. competitive exclusion) have been increasingly studied using phylogenetic and/or trait-based approaches, allowing both more accurate and generalizable results. The species environmental niche, which dictates in which communities it may be present and its potential performance within, however, has often been overlooked. Here we propose a combined approach, classifying communities (over, under, randomly dispersed) based on the levels of phylogenetic relatedness and niche similarity of the species within. This along with a new index we term "Community Placement", which evaluates how closely a particular community's environmental conditions are to constituents preferences, allows for the uncovering of emergent patterns and mechanisms of community assembly. To illustrate the utility of this approach, we applied it to a lake-fish dataset comprised of 8412 lakes across Ontario, using the Mean Pairwise Distance index to evaluate relatedness, marginality (i.e., niche position) to evaluate similarity and placement and null models to determine significance. Of the 27 possible classification patterns, a single pattern accounted for 4391 lakes (52%), these found to be phylogenetically random and under-dispersed in niche similarity and community placement. Only 6% of lakes were over-dispersed with respect to phylogeny while none were for similarity or placement. These results highlight the dominance of habitat filtering over competition. The latter seems to have small or null influence on the structuring processes of temperate lake-fish communities, or at most, is counter-acting the effects of habitat filtering leading to communities appearing as if randomly assembled.

## BACK-CALCULATION OF SOURCE POPULATIONS FROM RECRUITMENT PATTERNS: APPLICATION FOR EARLY DETECTION OF AIS

*Edwards, Paul K.*[1]*; Leung, Brian*

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Invasive species establish in new regions, spread, and begin to cause harm. Often this sequence can conclude before any management can take place - after which it is very difficult to control the invasion. Thus, the earlier one can find and manage new populations, the greater the number of management options and greater their efficacy. Locating propagule sources is particularly challenging in aquatic and marine systems where direct observation of submerged adult populations are time consuming and costly. Locating larval recruitment is usually comparatively easy to do. The well-established ecology of spread models may be employed in reverse to determine not where the larvae of a source may go, but instead to zero in on what source locations may have produced an observed pattern of larval settlement. We have built a model to estimate the probable source locations based on patterns of observed recruitment, using Bayesian methods. The model outputs a map of suggested search locations and confidence. We apply this model to a recent invasive marine tunicate incursion to both validate its performance and to demonstrate the management utility of such a framework as a rapid response tool.

## TESTER L'HYPOTHÈSE DU GRADIENT DE STRESS AVEC DES DÉTRITIVORES AQUATIQUES: IMPLICATIONS POUR LES RELATIONS BIODIVERSITÉ-FONCTIONNEMENT DE L'ÉCOSYSTÈME

*Fugère, Vincent*[1]

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L'Hypothèse du Gradient de Stress (HGS) suggère que le stress environnemental influence les interactions interspécifiques de manière à ce qu'une augmentation du stress résulte normalement en des interactions nettes graduellement plus positives. Ces changements de polarités des interactions pourraient ensuite influencer les relations biodiversité-fonctionnement de l'écosystème (B-FE). Quoique l'HGS ait reçu beaucoup d'attention de la part des chercheurs en écologie des communautés travaillant avec des végétaux, cette hypothèse ne fut que très rarement appliquée à des communautés animales. Pour pallier ce manque, nous avons conduit une expérience de décomposition de matière organique terrestre dans les ruisseaux dans laquelle nous avons manipulé la qualité de la matière organique (stress de ressource) pour ensuite mesurer la polarité des interactions interspécifiques entre invertébrés décomposeurs. Tel que prédit par l'HGS, nous avons observé des interactions plus positives en conditions de stress de ressource élevé. Par contre, en fouillant dans la littérature pour trouver d'autres expériences pouvant être réinterprétées selon l'HGS, nous avons observé qu'une diversité de relations stress-interactions interspécifiques était possible. Bien que le patron de base proposé par l'HGS ne semble pas caractériser les interactions interspécifiques de détritivores aquatiques, les interactions dépendaient du stress environnemental dans presque tous les cas observés, ce qui souligne l'importance d'incorporer plus explicitement le stress environnemental dans les expériences de B-FE avec des animaux.

## PROTECTED AREA STRATEGIES AND INDIGENOUS PEOPLES: EXPLORING DIMENSIONS OF GOVERNANCE IN CHILE

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Over the last decade, local governance arrangements for protected areas (PAs) have received increasing attention from scholars, practitioners and policy makers. Through an exploration of the Chilean State relations with indigenous peoples, this presentation provides an understanding of the complexity and diversity of protected area governance arrangements and, analysis of particular instances of indigenous resistance, accommodation and negotiation in seven cases of state–managed PAs. Articulations between state agents and indigenous groups have depended on several factors and vary among cases; historical relations in respect to time and space, indigenous identity and current political strategies, from the local to the international scale, have served to produce a highly textured governance landscape that spans from coercion to co-management. Semi-structured interviews were conducted with representatives of state agencies, non-government organizations, academics and indigenous leaders in Chile and complemented with document analysis of state's reports and management plans of PAs. The understanding of indigenous peoples' experiences in the context of PAs in Chile has major implications for the efforts to address the rights and interests of indigenous peoples globally with respect to PAs. The findings are expected to contribute to PA policy-making by highlighting opportunities and challenges for improving PA governance.

## EFFECTS OF DEEPENED THERMOCLINE ON ZOOPLANKTON COMMUNITY DYNAMICS

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Several factors, both abiotic and biotic, influence the succession and vertical distribution of organisms living in freshwater lake. Thermal stratification is one of the key structuring factors for organisms present within the pelagic environment. The most prominent feature of thermal stratification, the thermocline depth, can be altered by changes in wind stress affecting the lake surface. Increased wind velocities can be induced by altering the landscape around lakes (deforestation, forest fires) or through climate change, for which more frequent and violent storms with strong winds are expected. The main objective of our research was to assess the effect of changes in lake thermal stratification and the accompanying mixing on zooplankton succession, vertical distribution and functional diversity through time. The experiment consisted of an experimental deepening of the thermocline in one basin of a three basin lake (Lac Croche, Québec, Canada) through mixing. The experimental basin (3) was compared to a control one (1) which had no thermal alteration, and with an intermediate basin (2) acting as a thermal buffer with thermocline deepening, but no mixing. To artificially deepen the thermocline, a solar powered lake mixer was used. Biotic and abiotic data were collected in profile in all three basins at their deepest points every week during the ice-free season. Control data were collected in 2007 prior to manipulation, and in 2010 when no mixing occurred, with 2008-2010 as experimental years. Preliminary results show that the deepening of the thermocline significantly altered the phenology of plankton succession.

## LA VULNERABILITÉ DES ESPECES AUX CHANGEMENTS CLIMATIQUES AU QUÉBEC

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Les interventions visant à protéger les espèces indigènes et leurs habitats naturels doivent dès aujourd'hui tenir compte des changements climatiques, un stress additionnel dont l'intensité augmentera dans le futur. Pour ce faire, les différentes organisations qui œuvrent en conservation doivent avoir accès à des outils d'analyse pour évaluer qu'elles seront les impacts potentiels des changements climatiques sur les espèces et leur habitat. Dans le cadre du projet CC-Bio (http://cc-bio.uqar.ca/), qui examine les effets des changements climatiques sur la biodiversité au Québec, nous avons modélisé la niche climatique de 713 espèces et avons projeté ces niches dans le climat de 2050. Parallèlement, à l'aide du « Climate change vulnerability index » (CCVI) développé par NatureServe, nous avons évalué la vulnérabilité de 317 espèces (189 oiseaux, 57 arbres, 52 plantes, 19 amphibiens) aux changements climatiques projetés pour le Québec en 2050. En plus d'évaluer la vulnérabilité des espèces liée à des caractéristiques biologiques, le CCVI permet d'intégrer dans l'analyse les projections de déplacement des niches climatiques. Nous avons comparé certaines caractéristiques biologiques entre les différents groupes taxonomiques examinés et aussi entre espèces à l'intérieur de ces groupes. Les principales caractéristiques que l'analyse a identifiées comme rendant les espèces vulnérables sont; la capacité de dispersion, l'alimentation, les barrières anthropiques et naturelles de même que les relations interspécifiques. À notre connaissance, très peu d'études à travers le monde ont combiné les deux approches afin d'identifier les espèces les plus susceptibles d'être affectées par les changements climatiques.

## ASSESSING HABITAT AVAILABILITY AND CONNECTIVITY FOR THE JAGUAR PANTHERA ONCA IN THE YUCATAN PENINSULA, MEXICO

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Continental-scale initiatives are crucial for the conservation of carnivores with large distribution range, but habitats are mostly managed at the landscape scale. In Mexico, the Yucatan peninsula maintains some of the most important jaguar populations in the northern part of the range; networks of habitats need to be mapped to identify areas for conservation. Our goal was to provide spatially-explicit information for the conservation and management of jaguar habitats in the Yucatan Peninsula. First, we developed habitat models for the jaguars based on the best available field records and land-use land-cover data. Second, we used the habitat maps generated by the models and census data to identify areas important to maintain connectivity among existing populations. We found that the best corridors were concentrated along the east coast where there was the shortest distance between stepping-stones (3.37±1.79 km), whereas the longest distance was at the northern tip of the peninsula (146.19±184.22 km). Suitable habitat patches are not always restricted to protected areas. Forests have been maintained on productive land often associated with community-based forestry. Nevertheless, the most suitable corridors might be under pressure from tourist development because of their location along the Caribbean coast and road network developing plans.

## SPATIOTEMPORAL VARIATION IN GUPPY COLOUR: EXPLORING A MOSAIC OF ADAPTATION

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Natural selection is an important force structuring the biodiversity we observe today. Understanding spatial and temporal patterns of selection, and the resulting mosaic of adaptation, will help us to understand how natural populations respond to ongoing environmental change. Given the difficulties of accurately measuring selection in nature, we have chosen to quantify spatial and temporal variation in an adaptive trait as a proxy for spatial and temporal variation in selection. We focused on Trinidadian guppies, Poecilia reticulata, which exhibit a spatially varying balance between natural and sexual selection: females generally prefer males with brighter colour spots (sexual selection), but this colour might increase their mortality at sites with strong predators (natural selection). More recent work, however, suggests temporal variation in selection is occurring. To formally evaluate spatial and temporal contributions to trait variation, we partitioned the variance in male colour pattern between six sites (across two rivers and two predation intensities) and six consecutive years. We found that site effects, especially those related to predation, are indeed an important determinant of male guppy colouration, supporting previous findings based on a single time period. Interestingly, we also found that colour patterning within a site was relatively consistent across the timeframe of our study. This indicates that sites that do not exhibit the expected colouration patterns (having little orange despite a low predation regime, for example) are not flukes due to sampling error or stochasticity, but are instead consistent exceptions in need of further investigation.

## DISSECTING INTRAGUILD PREDATION: THE RELATIVE CONTRIBUTION OF PREDATION AND COMPETITION TO THE MAINTENANCE OF INTRAGUILD PREY

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Trophic interactions among species are depicted as asymmetrical and directional - its constituents arranged in increasing size where the species on the left succumbs to predation from the species on the right. Trophic interactions, however, do not subscribe to this paradigm. Top predators can both consume and compete with adjacent species in intraguild predation thus forming loops in the chain. However, given competition and predation act in concert, the impact of each process on the intraguild prey is unknown. In this paper we use a filter feeding intraguild predator to disentangle predation from competition and assess the relative contribution of predation and competition on intraguild prey. Blue mussels, *Mytilus edulis*, and brine shrimp nauplii, *Artemia franciscana*, were used as the intraguild predator and prey respectively. *Isochrysis galbana*, a single celled flagellated algae, functioned as the common resource. The experiment was arranged along four treatments: absence of competition, predation or both processes and a treatment where both processes where operating. Experiments were performed in microcosms containing an initial inoculation of *Artemia*, *Isochrysis*and one suspended mussel. Predation was controlled by manipulating the mesh size of the pouches to either permit or prevent predation on *Artemia* by mussels. Competition was removed by subsidizing the microcosms in accordance with the number of algal cells removed by mussels. The results of the experiment indicated the impact of predation is greater than competition, however the strength of predation was mediated by resource availability, which was determined by strength of competition between mussels and *Artemia*.

## BEGINNING A DIALOGUE: HOW CAN BIODIVERSITY EDUCATION BE INCORPORATED INTO CURRICULA?

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[1]Secretariat of the Convention on Biological Diversity & Nature Connection

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While many educational institutions in Quebec from CEGEP down are currently treating sustainability as an intrinsic value rather than as the instrumental value that it is, all too often the link to biodiversity and environmental information/conservation fails to make it into curricula. Among the barriers to biodiversity education are widespread lack of knowledge of ecological principles, the complexity of the subject, and a lack of pedagogical resources and toolkits. While a wealth of information is available on the internet – and even more at universities and in post-graduate programs, few non-specialists know where to start and how to apply such knowledge in their courses. Some possible starting points and procedures will be considered, including a possible template method that could be use in competency-based teaching in Quebec as well as in more traditional teaching methods. Unfortunately, the lack of lower-level non-specialist biodiversity education is not solely a problem in Quebec. It is a global issue which will only worsen as more of the world's human population becomes urban. This problem leads to a problem for researchers. Incorporating traditional knowledge into both science and education will become more difficult as we lose more species and as the increasingly urbanized population lose traditional knowledge. It is important to science and society to retain such information.

## HOW MANY MONKEYS DOES THIS FOREST FEED? LONG-TERM PATTERNS IN FORESTS RECOVERING FROM DIFFERENT LAND USES, KIBALE NATIONAL PARK, UGANDA

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Despite increasing loss and degradation of tropical rainforest, conservationists frequently overlook the ability of disturbed forest to conserve biodiversity. Understanding how land use history affects forest succession and regrowth is vital to restoring degraded forest, especially to support wildlife populations. We used long-term data on forest dynamics in Kibale National Park, Uganda to examine patterns in forest change and evaluate how regenerating forest can provide food for five primate species. Data were collected for up to 39 years on tree species and size in four unlogged sites and eight degraded sites regenerating after burning, logging, farming, or reforesting with native or exotic trees. We calculated changes in tree species diversity and structure within and between sites and over time, using statistical clustering to identify similar sites. We used existing relationships between tree size and the abundance of leaves and fruit to assess how forest with different land use histories can feed primates. Our results showed that lightly logged forest had more similar species diversity and structure to unlogged forest than heavily logged, burned, farmed, or reforested sites. Some regenerating forests can support substantial primate populations: currently, sites excluded from fire provide more food than those replanted with native trees, and lightly logged forest provides equal food to unlogged forest while heavily logged forest does not. To accelerate ecosystem restoration, land managers must actively monitor and manage succession in degraded forest, particularly focusing on food trees for target wildlife populations.

## THE EFFECTS OF DENSITY, HABITAT PROPERTIES, AND TRAITS ON HABITAT SELECTION

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Regular patterning in community structure is often found across heterogeneous systems. While community ecologists have long focused on the role of inter-specific trait variation for species distributions (e.g., environmental filtering vs. competition), the influence of intra-specific variation is now beginning to be appreciated. Such a consideration, however, remains largely overlooked within fundamental population-level theories such as habitat selection. Indeed habitat selection proposes that at low population densities conspecifics occupy a single preferred habitat, individuals viewed as identical and interchangeable with those utilizing non-preferred habitats at higher densities. The purpose of this study was to investigate how habitat selection changes across densities and the influence of intra-specific morphological variation for such habitat use. Four density trials were conducted within an artificial stream comprising distinct microhabitats (pool, run, riffle) for each of four natural-stream species; creek chub and Johnny darter (pool), mottled sculpin and blacknose dace (riffle). Contrary to the assumptions of habitat selection, conspecifics were found to show distinct preferences, found within preferred and non-preferred areas even at low densities. As expected, intra-specific variation played a large role in differential habitat use with large phenotypic differences occurring between individuals in alternative habitats at such lower densities (differential adaptation), decreasing as density increased (an averaging effect). Ecological consequences for the degree of polymorphism we expect through time follow where low densities (high phenotype matching) may produce large variation through disruptive selection, the opposite occurring at high densities (low matching); a potential explanation for the vast discrepancies found between lake and stream systems.

## HOW DOES THE ROAD-DENSITY EXTINCTION THRESHOLD DEPEND ON THE CONFIGURATION OF THE ROAD NETWORK AND ON THE ROAD AVOIDANCE BEHAVIOR OF THE SPECIES?

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Road networks reduce landscape connectivity and increase wildlife mortality. Therefore, the monitoring systems for biodiversity and sustainable development in Switzerland have recently implemented an indicator of landscape fragmentation. I used a spatially explicit individual-based simulation model of population dynamics to (1) identify extinction thresholds as a function of road density and to (2) investigate how these thresholds depend on (a) the spatial configuration of road networks and on (b) the behaviour of the animals at roads. The results indicate that road configuration matters and that large un-fragmented areas should be kept un-fragmented. The thresholds depend on the behaviour of the animals at roads, e.g., the degree of road avoidance, which, in turn, depends on traffic volume. In addition, the effects of road networks have long response times leading to an extinction debt. However, transportation authorities argue that not enough is known about the thresholds, and more research would be needed before they would slow down with road construction. This constitutes a "fragmentation spiral", because research has been (and may always be) unable to catch up. This situation is contrary to the precautionary principle. Empirical studies comparing landscapes with differing road network configurations should be conducted to test the model predictions, to improve the model, and to provide a better foundation for planning highway networks. Limits to curtail landscape fragmentation should be introduced, at least for the time until the thresholds and the extinction debt are known.

## FORMIDABLE OBSTACLES TO PROTECTING BIODIVERSITY

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In 1991, as the founding President of the local Citizen's association, board member of both CREM and the Coalition Verte and member of the Comite Habitation Planification Urbain of the Montreal Chamber of Commerce; organized a milestone master degree level study with the Urban Planning Department of McGill titled: A Working Model to Integrate Sustainable Development Principles To the Planning Process. The study was focused on the territory of Notre Dame de Ile Perrot. Three (Green) municipal councillors were recruited to work with the students. Comprehensive inventories of all spawning and nesting areas for species critical to maintain Bio-Diversity were accomplished with the help of biologists with the Quebec's MNR. Strategies to preserve to most important spawning & nesting sites were undertaken and the Perrodamois Land trust was created to facilitate potential collaboration with Nature Conservancy Canada. A historical spawning area for Northern Pike & Muskies was restored. Much to the surprise of the administrators of these projects , high stakes land speculation, collusion between the regulatory sector and the construction industry were found to be the biggest obstacle to sustainable development and maintaining breeding populations sufficiently high to sustain local & regional Bio-Diversity. The island of Ile Perrot is a most studied island because of its location at the confluence of the St. lawrence & Ottawa Rivers and its unique fauna and diverse rare species populations. 20 years later, the lessons learned for this experience are very important to assist other researchers & groups to effectively protect their shorelines, riverbeds and forested habitat from poorly planned development. They will be presented in bullet format to stimulate questions and discussions among Symposium participants.

## THE ROLE OF DIVERSTIY AND SEX DURING EVOLUTIONARY RESCUE

*Lachapelle, Josianne*[1]*; Bell, Graham*

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There are a number of factors that can affect the rate of adaptation of a population to a changing environment. They include the rate of environmental change, the severity of the stress, population size, and the amount of genetic variation available to natural selection. The overall objective of our study was to investigate how differing amounts of genetic variation affect the likelihood of being rescued by evolution during environmental degradation. We subjected populations of the unicellular alga Chlamyomonas reinhardtii to an environment supplemented with an increasing concentration of NaCl, which strongly inhibits growth, and a constant environment without added NaCl. We had 6 kinds of populations that differed by their level of initial diversity (low, high) and their sexuality (asexual, facultative sexual, obligate sexual). A massive extinction period occurred between 10 g/L and 12 g/L NaCl, where 31% of the lines went extinct. Only 35% of the lines survived up to 24 g/L NaCl, with the obligate sexual and high diversity population type having the highest number of surviving lines. The degree of adaptation, estimated by cell density during reciprocal transplants, is highest in the obligate sexual lines, while no significant difference is observed between high and low diversity lines. These results suggest that sex played a more important role than the initial amount of diversity in increasing the probability of survival during environmental degradation. This is possibly because the genetic variance generated by recombination overwhelmed the amount of standing genetic variation put in at the start of the experiment.

## GOVERNANCE AND MARINE PROTECTED AREAS IN QUÉBEC

*Layton-Cartier, Geneviève*[1]*; Mulrennan, Monica*

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Marine protected area (MPA) creation is widely acknowledged as a valuable tool for marine conservation, a recognition reiterated at the recent Conference of the Parties of the Convention on Biological Diversity in Nagoya (Oct. 2010). However most countries have made limited progress in this area, including Canada which has protected less than 1% of its EEZ. The purpose of this study was to conduct a comparative analysis of four MPA cases in Québec – one designated MPA (Saguenay-St. Lawrence Marine Park), two approved MPA projects (Manicouagan Peninsula and Magdalen Islands) and one proposed MPA project initiated by the Cree Nation of Wemindji (Tawich) – in terms of their governance structure, the web of relations among different stakeholders involved and the challenges and successes encountered during their planning phases. The methods included a document analysis of MPA designation and management legislation as well as semi-structured interviews with key stakeholders identified at Québec's 1st MPA Forum (June 2010). Various themes have emerged from the research, including the need for: transparency from government agencies, educational programs on MPAs in pre-planning stages, functional participation mechanisms, and MPAs to be nested within broader management of coastal/marine resources. This research is intended to advance the establishment of MPAs by providing insights from a diversity of stakeholder perspectives based on past experiences and current circumstances.

## LES DÉTERMINANTS DU SUCCÈS REPRODUCTEUR DES MÂLES HIRONDELLE BICOLORE

*Lessard, Andréanne*[1]*; Garant, Dany*

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Le succès reproducteur est un paramètre clé à obtenir pour déterminer l'aptitude phénotypique individuelle et prédire la persistance d'une population naturelle. Chez les espèces d'oiseaux montrant un taux important de fertilisations hors couple, différents traits peuvent potentiellement maximiser le succès reproducteur obtenu à l'intérieur et à l'extérieur du couple social. L'Hirondelle bicolore (Tachycineta bicolor) montre un des taux de fertilisations hors couple les plus élevés chez les oiseaux, entraînant possiblement une grande variance dans le succès reproducteur des mâles. Cette étude porte sur une population d'hirondelles bicolores suivie pendant 5 ans où des analyses génétiques ont permis de déterminer l'étendue de la variation et les déterminants du succès reproducteur des mâles. Nous utilisons les données obtenues sur plus de 750 évènements de reproduction, et montrons que les jeunes issus de fertilisation hors couple représentaient plus de 50% des oisillons analysés et étaient présents dans plus de 85% des couvées. Le nombre de paternités obtenues au total (PT), dans le couple (PDC) et hors couple (PHC) est corrélé négativement à la présence de parasites, et le nombre de PHC est corrélé positivement à la longueur de l'aile. La densité de la population influence positivement le nombre de PHC, et modifie l'effet de certains traits sur le succès reproducteur. Finalement, il ne semble pas y avoir de compromis entre le nombre de PDC et PHC et ces différentes relations sont stables dans le temps.

## INFLUENCE OF LANDSCAPE STRUCTURE ON ECOSYSTEM SERVICE PROVISION

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Quantification of ecosystem services (ES) - the benefits that people obtain from the environment - can be valuable for managing multifunctional landscapes. Models are often used to estimate ES for planning and landscape management decisions in the absence of direct measurements, but projections based on composition of different landcover types have been shown to be a poor representation of the true distribution of service provision. The use of estimates based on composition neglects the critical role of landscape configuration (spatial arrangement of landcover types) in the flow and quality of benefits. A set of metrics characterizing aspects of both landscape configuration and composition were calculated for 136 municipalities in two watersheds in Southern Quebec. Through comparison with values measured for 12 ecosystem services in the same municipalities, we identify the aspects of landscape structure most strongly correlated with service provision. Structural equation models are used to combine statistical relationships with hypothesized qualitative causal pathways and determine which mechanisms and interactions are responsible for observed relationships. Where measured service provision is found to be strongly linked with components of configuration such as connectivity, shape of landcover patches, and relative position of each landcover type, these ecosystem services are less likely to be well-represented by models based on landcover composition.

# Diversity of Frog Crabs Throughout Geologic Time: The Dawn and Dusk of a Body Plan

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One of the most enigmatic groups of living crabs is the Raninoida, or "frog crabs", characterized by unusually elongated and relatively smooth carapaces, well suited to their cryptic burrowing lifestyle. We use the large phenotypic disparity and relatively abundant fossil record of this group to examine general trends in their evolution and diversity throughout time. The most basal raninoids from the Cretaceous (~140 My.) had broader and highly ornamented carapaces, more similar to other true crab morphologies than to their modern frog–like relatives. Contrary to previous thought, the innovation of an elongate body plan, as seen in modern frog crabs, is the derived condition rather than primitive, known for the first time during the late Aptian (~115 My.) from a single genus and new species from the Neotropics. A rapid diversification during Albian times (~112 to 99.6 My.), led to a worldwide distribution of the frog crabs (2 families, 10 genera and ~31 species). During this time, the Earth experienced global temperatures much warmer than today, with a low equatorial–pole temperature gradient, high global sea level, extensive large epicontinental seas, and various events of oceanic anoxia. The body plan evolution, and episodes of diversification and extinction seen on the Raninoida throughout time, appear to be synchronous with some of the major environmental disturbances in the last ~130 My. Increased understanding of diversity in the past may contribute to our understanding of how some recent organisms might respond under similar conditions.

## ECOSYSTEM SERVICE PROVISION AND LANDSCAPE COMPOSITION: INSECT HERBIVORY IN FRAGMENTED FORESTS

*Maguire, Dorothy*[1]*; Buddle, Dr. Christopher M.; Bennett, Dr. Elena M.*

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Large-scale landscape transformation and habitat loss due to human disturbances are among the greatest threats to ecosystem integrity. Agricultural development and urban expansion have reduced natural areas and increased fragmented landscapes, which reduce biodiversity and influence ecosystem functioning. These changes can affect the range of services provided by forests in agricultural landscapes by affecting their susceptibility to insect pest outbreak. The objective of this research was to quantify the relationship between landscape composition, the regulation of insect herbivory and ecosystem service provision. Sugar maple-dominated fragmented forest patches in the Monteregie of Quebec were selected based on different landscape qualities such as size and isolation (based on regional GIS data and FRAGSTATS landscape metrics). Rates of herbivory were quantified for both canopy and understory sugar maple trees since this species is a valuable economic commodity in Quebec. Regulation of herbivory by tree host and natural enemy diversity was assessed in order to determine the role of biodiversity in preventing outbreaks of defoliating insects. This research will result in the characterization of landscape features responsible for regulating insect outbreaks at municipal scales. This information is highly relevant to land-use planning and will affect how we manage landscapes to maximize societal benefits from fragmented forest ecosystems.

## THE EFFECTS OF NUTRIENT CO-LIMITATION AND STOICHIOMETRIC IMBALANCES ON ECOSYSTEM DYNAMICS

*Marleau, Justin*[1]*; Loreau, Michel*

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In ecology, it is commonly assumed that only one nutrient at any given time can limit the productivity of ecosystems. This assumption, known as Liebig's Law of the Minimum, has been invoked to argue for phosphorus limitation of temperate lakes and nitrogen limitation of terrestrial ecosystems. However, recent theoretical and empirical evidence have cast doubts about the applicability of Liebig's Law to ecosystems for two reasons: multiple nutrients can be limiting to a primary producer community simultaneously (co-limitation) and other components of the ecosystem (e.g. decomposers, herbivores) can change the limiting nutrient due to stoichiometric imbalances. In this presentation, we examine the effects of having both co-limitation and stoichiometric imbalances in an ecosystem model. Our results indicate that both phenomena can alter the qualitative dynamics of the ecosystem. Therefore, in situations where such phenomena are likely to occur such as species-rich communities, models based on Liebig's Law may lead to incorrect conclusions and should be modified to include co-limitation and stoichiometric imbalances.

## WHY DOES SPECIES EVENNESS CAUSE UNDER-YIELDING?

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Increasing the number of species in an ecosystem generally causes over-yielding (an increase in total abundance, biomass, and productivity). However, current evidence indicates that increasing the other component of species diversity (the evenness with which abundance, biomass, and productivity are distributed among species) causes *under*-yielding. In this presentation I will present some of this evidence and invite speculation about why this should be, and what the implications are for biodiversity research and conservation.

## EFFECTS OF FOREST PATCH SIZE AND ISOLATION ON ECOSYSTEM SERVICE PROVISION AND BIODIVERSITY IN AN AGRICULTURAL LANDSCAPE

*Mitchell, Matthew*[1]*; Bennett, Elena; Gonzalez, Andrew*

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Human modified landscapes provide multiple ecosystem services (ES) such as food, clean water and climate regulation. Land use change alters landscape spatial structure, leading to changes in patterns of biodiversity and, in turn, changes to ecosystem function and ES provision. In particular, landscape connectivity - the degree to which a landscape facilitates species movement - plays a critical role in influencing biodiversity, ecosystem function, and likely ES as well. However, we do not completely understand how connectivity, biodiversity and ecosystem functions interact to determine ES provision. I investigated how the size and isolation of forest fragments in agricultural landscapes east of Montréal influence biodiversity, ecosystem function and the provision of multiple ES in adjacent soybean fields. I measured multiple ES, including insect pest regulation, crop yield, soil formation and water quality regulation; as well as insect and forest plant diversity. Results suggest that insect pest regulation and herbivory change with distance to forest and that forest patch isolation alters these patterns. A negative relationship between insect diversity and crop yield was also present. These results will be used to develop models that link land use patterns with biodiversity and ES provision, allowing local stakeholders to manage for multifunctional landscapes.

## EFFET DE BORDURE ET SPÉCIFICITÉ DES POLLINISATEURS INDIGÈNES DANS LA CULTURE DU BLEUET NAIN

*Moisan-De Serres, Joseph*[1]*; Fournier, Valérie; Chagnon, Madeleine*

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Depuis plusieurs années, les producteurs comptent quasi uniquement sur l'abeille domestique (Apis mellifera) pour la pollinisation du bleuet nain (Vaccinium angustifolium). Dans les dernières décennies, une diminution des colonies d'abeilles est observée mondialement. Les pollinisateurs indigènes pourraient pallier en partie le déclin des abeilles. Les objectifs du projet sont de faire une évaluation de la dispersion des pollinisateurs indigènes dans les cultures de bleuets nains et d'étudier l'influence des brise-vent sur les communautés de pollinisateurs. Nous cherchons aussi à connaître les espèces les plus spécialisées dans la pollinisation du bleuet. La capture des spécimens s'est déroulée dans quatre bleuetières situées dans la région du Lac-St-Jean durant la période de floraison du bleuet, de 2009 et 2010. Les quatre traitements suivants ont été comparés : Brise-vent naturel, Brise-vent à une rangée d'arbres, Brise-vent à deux rangées d'arbres et Bordure de forêt. Deux transects contenant trois rangées de pièges-soucoupes disposés à 0, 30 et 60 m de la bordure des brise-vent ou de la forêt ont été échantillonnés à 4 reprises, sur une période de 12 jours. Nos résultats démontrent que l'influence des brise-vent semble peu importante au niveau de l'abondance des communautés de pollinisateurs en général, mais affecte de façon plus importante les pollinisateurs nécessitant des sites de nidification particuliers. Nous supposons que les brise-vent et la bordure de forêt ont un impact faible sur les pollinisateurs retrouvés dans la culture du bleuet nain dû au fait que la majorité de ceux-ci ne dépendent pas des milieux boisés pour leur nidification.

## MOVEMENT, HOME RANGE AND VULNERABILITY IN THE COMMERCIALLY FISHED NILE PERCH (LATES NILOTICUS) IN LAKE NABUGABO, UGANDA

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My research investigates consequences of fishing pressure on the behaviour and condition of Nile perch, an invasive, predatory fish that has fuelled extremely important fisheries in the Lake Victoria region of East Africa. There is evidence that spatially heterogeneous fishing of Nile perch in Lake Nabugabo, Uganda, has coincided with habitat-associated divergence in diet and morphology. My project aims to characterize movement patterns and home range size of Nile perch between wetland and open-water habitats to determine the mechanisms by which fishing contributes to ecological divergence in this species. We used radio telemetry to track 14 Nile perch for 5 months and analyzed these data in ArcGIS to produce estimates of home range size, average daily movement, and habitat use. Net surveys were conducted to determine habitat-specific fishing pressure. The results of this study show that Nile perch exhibit high site tenacity, low daily movement, and small home range sizes. These data suggest that ecological interaction between forest edge and wetland components of this population may be lower than expected. These results have implications for the community-based Beach Management Units (BMUs) that have been set in place to manage the Nile perch fishery, as the success of BMU depends in part on their ability to manage a distinct subset of a Nile perch population.

## HURRY UP AND ADAPT BEFORE YOU GO EXTINCT

*Osmond, Matthew*[1]*; de Mazancourt, Claire*

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Individuals are adapted to their environment. When the environment changes, individuals become mal-adapted and population abundances decline. Some populations go extinct, others persist. Here we present a model of how mutation, demography, and competition may interact to determine a population's chance of persisting. We derive an expression for the maximum rate of adaptive evolution a population can achieve and compare this to the severity of environmental change. The rate of adaptation - and chance of persisting - increases with mutation rate and variance, the strength of selection, carrying capacity, and decreasing generation time. Persistence in the face of change is a race: hurry up and adapt before you go extinct. Our work attempts to open the hood of the competing machinery.

## SPRING LOADED REPRODUCTION: EFFECTS OF BODY CONDITION AND POPULATION SIZE ON GESTATION RATE IN MIGRATORY CARIBOU

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In many ungulates, including caribou, female fecundity is affected by body condition and has important effects on population dynamics. In other ungulates, females adopt a conservative reproductive strategy, reducing reproductive effort at high population density. We investigated what factors affect the probability of gestation in adult female caribou from the Rivière-George herd. We used five years of data (1980, 1984, 1986, 1987 and 2002) that spanned various population sizes and trends. Similar to other populations of migratory caribou, the probability that a female was pregnant in spring increased with body mass and percentage of body fat. The probability of gestation appeared to be reduced by high warble infestation. The proportion of females pregnant varied between years and population size had a negative effect on gestation rates. However, females of similar mass were pregnant regardless of whether the population was increasing at low density, had reached a peak, or was high and declining. Compared to other ungulate species that reduce maternal expenditure at high density, female caribou of the Rivière-George herd may have a risk-prone reproductive strategy.

## DYNAMICS IN COMPETITIVE METACOMMUNITIES: FITNESS INEQUALITY AND NICHE DIFFERENTIATION

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Niche theory suggests that only one species should persist in ecological communities per niche or limiting resource, yet this prediction is routinely violated in non-laboratory environments. To solve this paradox ecologists have increasingly turned to examining the organization of competitive communities in terms of niches and neutrality, and more recently towards studying competition in terms of equalizing mechanisms (those governing fitness inequality) and stabilizing mechanisms (those governing niche differentiation). We present preliminary results from an experimental framework designed to allow manipulation of fitness inequality and niche differentiation in model communities of freshwater diatoms undergoing pairwise competition for a common limiting resource (silicate). Previous results indicated that fitness inequality, quantified by the difference in competitors' R* values for a limiting resource, is capable of predicting competitive exclusion in the absence of niche differentiation, both under conditions of single patch competition and in dispersal limited homogeneous metacommunities. Current work to be presented includes the creation of single patch communities with minimal fitness inequality, where competitive outcome is predicted to be primarily stochastic, and the creation of heterogeneous metacommunities, where niche differentiation is predicted to allow competitive coexistence even in patches with significant fitness inequality. We suggest that rephrasing competition theory in terms of fitness inequality and niche differentiation allows simultaneous attention to the importance of fitness inequality, stochasticity, dispersal, and niche differentiation without recourse to a niche-neutral dichotomy.

## VARIATION DES PATRONS DE PLASTICITÉ PHÉNOTYPIQUE ET DE SÉLECTION SUR LA DATE DE PONTE ENTRE POPULATIONS DE MÉSANGES BLEUES

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En milieu naturel, les organismes font continuellement face à une variation spatio-temporelle de leur environnement. Un mécanisme important permettant aux individus de faire face à ces variations est la plasticité phénotypique, soit la capacité d'un individu à moduler son phénotype en fonction de l'environnement. Cependant, nous avons peu de connaissances sur les mécanismes responsables de la présence et de la variabilité intraspécifique de plasticité en milieu naturel. Nous avons comparé les patrons de plasticité et de sélection de la période de reproduction (date de ponte) dans quatre populations de mésanges bleues (Cyanistes caeruleus), en utilisant des données récoltées de 1976-1998 à 2010. Nous avons montré la présence de plasticité de la date de ponte en fonction de la température dans toutes les populations, les femelles se reproduisant plus tôt lors des années plus chaudes. Cependant, une variation inter-individuelle dans les patrons d'ajustement de la date de ponte à la température était uniquement présente dans deux des quatre populations. De plus, nous avons mis en évidence la présence de sélection directionnelle pour une date de ponte plus hâtive dans les deux populations ne présentant pas de variation inter-individuelle de la plasticité. Nos résultats montrent que des différences considérables dans les patrons de plasticité phénotypique peuvent exister entre populations d'une même espèce à une fine échelle spatiale. De plus, à notre connaissance, il s'agit de la première démonstration d'une interaction entre les patrons de sélection et de plasticité phénotypique en milieu naturel.

## PREDICTING PEAK REFUGIA FOR MITIGATING IMPACTS OF INVASIVE PREDATORY FISH

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Exotic predatory fishes can have dramatic negative impacts on native fishes; however, the magnitude of these effects is governed by the degree of overlap in the distribution of invasive predators and native species. Areas on the margins of the distributional boundaries of an invader may be exploited by native fishes as refugia from predation. In the Lake Victoria basin of East Africa, where the dramatic increase in introduced Nile perch (Lates niloticus) coincided with the decline or disappearance of hundreds of indigenous species, wetlands serve as important structural and low-oxygen refugia for native fishes from Nile perch predation. My research aims to characterize finescale patterns of habitat use by fishes in the wetlands of Lake Nabugabo, a small satellite of Lake Victoria. I examine whether the variation in fish assemblage structure is predictable based on a suite of physico-chemical and biological features and test the hypothesis that there is an optimal distance into the refuge that minimizes invader impact.

## GARDONS LE CONTACT : COMPARAISON DES INDICES DE CHEVAUCHEMENT DES DOMAINES VITAUX POUR L'ÉVALUATION DU TAUX DE CONTACTS INTRASPÉCIFIQUE CHEZ LE RATON LAVEUR

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Les facteurs qui affectent les interactions sociales entre les individus sont de plus en plus étudiés. Néanmoins, les contacts intraspécifiques à fine échelle ont rarement été quantifiés sur le terrain. Le chevauchement des domaines vitaux est donc utilisé par les chercheurs comme un indice du taux de contact, en supposant que ces deux variables sont positivement corrélées. Cependant, peu d'études ont pu vérifier cette supposition. Notre objectif était de quantifier le taux de contacts intraspécifique dans une population de Raton laveur (Procyon lotor) à l'aide de collier de type « contact logger » afin d'explorer la relation entre le taux de contacts et le chevauchement des domaines vitaux. Pour ce faire, nous avons calculé le chevauchement entre les domaines vitaux de 121 dyades durant l'été et l'hiver 2010, en utilisant des indices qui utilisent respectivement 1) la proportion de l'espace partagé (HR) ou 2) le chevauchement en prenant en compte l'utilisation de l'espace (UDOI). Nous avons ensuite quantifié la corrélation entre ces indices et le taux de contacts. Nos résultats suggèrent qu'il existe une corrélation positive entre le chevauchement des domaines vitaux et le taux de contact intraspécifique. Par contre, la force de la corrélation varie entre les saisons pour l'indice UDOI. En effet, elle est plus forte en hiver, lorsque les animaux sont plus grégaires. Nos résultats montrent aussi que les indices qui considèrent l'utilisation de l'espace semblent plus efficaces. Dans ce contexte, le chevauchement des domaines vitaux pourrait donc être un bon indicateur des contacts entre individus.

## GENETIC STRUCTURE OF WHITE-FOOTED MOUSE POPULATIONS FROM SKY-ISLANDS IN SOUTHERN QUÉBEC: IMPACT OF CLIMATE WARMING AND FRAGMENTATION ON THE SPREAD OF LYME DISEASE

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Climate change is predicted to be the strongest in temperate northern regions, and its impact on ecosystems has become much apparent over the last few decades. In the last 25 years, the white-footed mouse, Peromyscus leucopus, has expanded its northern limit into Southern Québec. This range expansion has been linked to changes in climate (an increase of 0.5°C in average annual temperature in the Montérégie region over the last 50 years), and is of special concern because P. leucopus is the primary host for the ticks carrying the bacterium responsible for Lyme disease. A thorough literature search reveals that there is no current information on how quickly the mice are migrating into Southern Québec, or if they are establishing successful populations on the mountains and forest fragments found scattered throughout the region. I propose to study the genetic variation of different P. leucopus populations found on both mountains and in several forest fragments between each mountain, and to study the genetic flow between these populations to determine the level of connectivity between each sky-island. The information obtained from my study will be pertinent to merge with ongoing Lyme disease studies in Québec to determine its threat to the Monteregian locals and to the province of Québec.

## PROJECTED DISTRIBUTION OF THE WHITE-FOOTED MOUSE WITH CLIMATE CHANGE: A QUESTION OF TIME AND SPACE

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In 2010, Lyme disease became a nationally reportable disease in the southern provinces of Canada, including Québec, with an increase in the number of Canadians infected. This was associated with an expansion of the range of the tick Ixodes scapularis which transmits the disease. This range expansion is a result of increasing temperatures allowing northward migration of the tick, but also possibly the expansion of biological vectors that carry the tick. The white-footed mouse (Peromyscus leucopus) is a predominant host for the tick's larval life stage and a reservoir for the bacterium Lyme borreliosis responsible for the disease. The mouse population is currently increasing in Southern Québec. Prediction of the future distribution of the white-footed mouse could indicate where future cases of Lyme disease will occur. A presence/absence model (BioMod) is used to determine how the mouse population will progress over Québec territory in time and space, and to what extent climate change will facilitate this expansion. Possible factors (snow cover, minimum temperature, landscape characteristics, and photoperiod) driving the distribution of the white-footed mouse in Southern Québec are assessed with BioMod using projections of future climate from the Canadian Regional Climate Model. The maps of possible future distribution that will be obtained are essential to better determine risk zones for Lyme disease at its most northern areas in North-America.

## SHEDDING LIGHT ON NUTRITIONAL INTERACTIONS: LITTER PRODUCTION BY NEIGHBOURS CONTRIBUTES TO OVERYIEDING IN A TROPICAL TREE PLANTATION

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The dramatic loss of biodiversity due to deforestation and the growing amount of land allocated to monoculture tree plantations urges us to identify the mechanisms underlying the relationship between tree diversity and the functioning of forested ecosystem. Since trees simultaneously compete for light, water and nutrients, disentangling the contributions of above and below-ground interactions comes as a necessary first step. We developed methods to detect diversity effects mediated by below-ground interactions and applied them to a biodiversity experiment conducted in a tropical tree plantation displaying transgressive overyielding. A synthetic gradient of diversity (plots with 1, 3 and 6 species) was established in 2001 by planting more than 5000 trees of native species over ca. 6 ha in central Panama. By comparing year 5 and year 10 after planting, we found that diversity effects on growth built up over time. Diversity effects were overall of the same magnitude for canopy and shaded trees so that competition for light could be rejected as the only explanatory mechanism. We further developed linear mixed-models of individual tree growth explicitly partitioning the effects of neighbours into the effects of shading and the residual effects of litter production. These models indicate that nutritional interactions contributed to overyielding and produced species-specific pairwise interactions differing in both magnitude and direction. Our results highlight the temporal and spatial scales issues arising in biodiversity experiments with trees and put emphasis on the often neglected below-ground interactions.

## NICHE EXPANSION IN A SURVIVING ENDEMIC FISH FOLLOWING INVASION OF A TOP PREDATOR?

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Invasive species can have profound impacts on community composition, particularly when they involve the introduction of a top predator. Introduced predators often extirpate or decimate native prey populations; while at the same time potentially facilitating (via competitive release) a subset of native species able to persist in their presence. Can such facilitation allow for niche expansion in resilient native species? The introduction of the predatory Nile perch (Lates niloticus) in the Lake Victoria basin in East Africa drastically reduced the lake's fish diversity, and thus provides a compelling natural experiment to test for niche expansion in surviving natives. From a diverse community of 500+ fish species in the early 1980s, Lake Victoria is now dominated by only three species: the resilient native cyprinid Rastrineobola argentea, and two introduced fishes: the Nile perch and Nile tilapia. We asked whether R. argentea has expanded its dietary niche coincident with this extreme reduction in fish abundance and diversity. We used a combined approach, testing for differences in niche width of R. argentea both across space (invaded vs. uninvaded lakes) and through time (before vs. after the Nile perch introduction). We found evidence for an increase in dietary niche width through time in Lake Victoria, but the same pattern was not evident when comparing contemporary populations from invaded vs. uninvaded lakes. Understanding dietary shifts in R. argentea in response to the introduced Nile perch will be critical for managing the expanding R. argentea fishery; now a major source of food and employment in the region.

## MOLECULAR SYSTEMATICS OF BAMBOO SPECIES IN THE EASTERN HIMALAYAN REGION OF NORTHEAST INDIA

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Bamboo, the woody members of the family Poaceae, comprises over 1500 species world-wide, and about 130 species belonging to 23 genera occur in India. About 89 species of bamboo are known to occur in the Eastern Himalayas and most of the species are endemic to this region. Due to phenotypic plasticity of morphological traits associated with diverse climatic and edaphic conditions of the region and unavailability of reproductive structures, systematics of bamboo species in Northeast India remain poorly understood. The present study is aimed to gain insights into phylogenetic relationships among 45 species of bamboo belonging to 16 genera. The phylogenetic analysis based on nucleotide sequences of the psbA-trnH inter genic region of the cpDNA grouped members of genera Bambusa and Dendrocalamus into two distinct clades. However, the phylogenetic relationships of species of Oxytenanthera, Neomicrocalamus, Pseudosasa, Sasa and Thyrsostachys remained unresolved. The subtribe Bambusinae and Melocanninae showed polyphyletic relationships whereas, Arundinariinae and Shibataeinae were monophyletic. Further analysis using multiple genes from nuclear and ribosomal regions as well as morphological data to resolve the phylogeny of bamboos in Northeast India is currently in progress.

## A NEW APPROACH TO UNDERSTANDING THE REGULATION OF ZOOPLANKTON COMMUNITY STRUCTURE

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Traditionally, zooplankton community structure studies have revolved around classical predictors of biodiversity in lakes such as morphometry and primary productivity. While the green carbon pathway (from phytoplankton to fish) is well established in trophic studies, recent works have demonstrated a significant contribution of bacterial mobilized carbon to sustain zooplankton communities, but the effect of both pathways on zooplankton diversity remains unclear. Moreover, simple community properties, such as biomass and taxonomic diversity, do not capture the complexity of interactions of zooplankton with his environment (e.g. carbon acquisition), which highlights the need to develop more adequate indices based on functional characteristics. Taking these notions into account should allow to develop a mechanistic understanding of the processes regulating communities. Toward this goal, we propose to integrate, into the classical approach, variables associated to: (i) the provenance of carbon and (ii) zooplankton functional diversity. We account for this in our study of zooplankton communities across landscapes of lakes by using the ratio of primary production to bacterial production (PP:BP). We do so to distinguish between lakes where phytoplankton vs. bacteria are the main energy mobilizers, representing alternate pathways by which matter and energy are passed through food webs. Furthermore, by using functional diversity rather than taxonomically-based indices, we were able to identify the mechanistic basis for the observed responses to the different food web structures. Our preliminary results show that zooplankton community structure and functional diversity differ between lakes which are at the extremes of these energy and carbon flow pathways.

## SHIFTING TARGETS IN THE TUNDRA: ARE CALVING GROUNDS OF MIGRATORY CARIBOU REALLY PROTECTED IN NORTHERN QUÉBEC?

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Industrial development, expansion of human populations and climate change increasingly affect critical habitats of arctic species. Over the last decades, several herds of migratory caribou have declined in North America, and stakeholders have set a priority on protecting calving grounds. In Québec, migratory caribou calving grounds are legally defined as Wildlife Habitats under the Loi sur la conservation et la mise en valeur de la faune. Within the defined calving ground, activities that may affect caribou habitat are prohibited. There is, however, no evaluation of the overlap of Wildlife Habitats with the areas that are used yearly by migratory caribou. We assessed changes in the location of migratory caribou calving grounds over 35 years by the Rivière-George (RG) herd and 15 years by the Rivière-aux-Feuilles (RAF) herd, in Northern Québec and Labrador. We also evaluated the proportion of annual calving ground within protected Wildlife Habitats (WHs) established to protect caribou calving grounds. The annual size and location of calving grounds changed substantially over time: calving ground size remained relatively stable for the RAF but it declined over 85% for the RG. The location of calving grounds moved 300 km northward in the Ungava peninsula for the RAF and shifted over 230 km back and forth to the Labrador coast for the RG. Despite recent modifications, legally designated WHs in Québec protected less than 20% of the RG and RAF calving grounds. Protection of calving grounds of migratory caribou must consider the dynamic use of space by adult females. We present recommendations on the use of available monitoring data to better protect calving grounds of migratory caribou.

## ZOOPLANKTON BIODIVERSITY IN THE PONDS OF MONT SAINT-HILAIRE, QUEBEC AND THE SEARCH FOR SPATIAL INSURANCE IN CHANGING ENVIRONMENTS

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Understanding how environment and space interact to determine community composition is central to ecology. This is increasingly evident as species ranges are shifting in response to globally changing environmental conditions. The composition and functioning of future ecological communities will be dependant upon whether or not species can re-sort on the landscape to find environments that are suitable for them to live. Theory suggests that biodiversity can act as a form of spatial insurance whereby organisms reshuffle between habitat patches as the environment changes, stabilizing overall ecosystem functioning. However, spatial insurance relies on the presence of species that differ in their environmental tolerances, as well as habitats that differ in their environmental conditions. We conducted a survey of the zooplankton biodiversity within the 26 ponds in the Gault Nature reserve on Mont St Hilaire, Quebec in order to: 1) describe the communities and determine how environmental conditions vs dispersal limitation affect their composition; and 2) determine how much variation in environmental conditions exists within the reserve that could act as the basis for spatial insurance. In light of this, we will discuss how the current composition and zooplankton biodiversity is likely to affect the resistance and resilience of this metacommunity to future change and discuss future work that will test these predictions.

## PATTERNS OF GENETIC STRUCTURE AND DIVERSITY IN EASTERN NORTH AMERICAN BETULA SPECIES BASED ON CHLOROPLAST AND NUCLEAR DNA MARKERS: INFLUENCE OF GLACIAL HISTORY AND INTROGRESSION

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This study investigates the chloroplast- (cpDNA) and nuclear-DNA based genetic structure and diversity of Betula alleghaniensis, B. lenta, and B. papyrifera in eastern North America. Universal chloroplast microsatellite markers were used to assess cpDNA diversity and to determine the geographic distribution of haplotypes. Levels of polymorphism were low, with 7, 3, and 4 haplotypes recovered for B. alleghaniensis (n = 84), B. lenta (n = 28), and B. papyrifera (n = 28-84) based on 3 polymorphic markers from 61 sites across the geographic range. Extensive haplotype sharing within geographic regions was observed between B. alleghaniensis and B. papyrifera providing strong evidence of cytoplasmic introgression. In contrast, B. lenta generally did not share haplotypes with other species. The phylogeographic pattern for B. alleghaniensis and B. papyrifera was congruent throughout areas of sympatry with distinct eastern and western populations, and a distinct Atlantic coastal haplotype which may have originated from a northeastern coastal refugium. In contrast, no clear phylogeographic pattern was observed for B. lenta, as one haplotype dominated throughout its range. Preliminary results based on 10 polymorphic nuclear microsatellite markers revealed high levels of allelic diversity in B. papyrifera and B. alleghaniensis, as would be expected for species which occupied multiple LGM refugia and possess a broad contemporary geographic distribution. In contrast, low levels of allelic variation were observed in B. lenta, consistent with the hypothesis of past population bottlenecks and/or strong genetic drift associated with persistence in a single glacial refugium during the LGM.

## SIZE DOES MATTER: ORGANISMS OF MOST SIMILAR SIZE SHOW CONGRUENT DIVERSITY PATTERNS

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Species losses are occurring across the globe at rates equivalent to those of mass extinction events. In light of current biodiversity declines, the monitoring of biodiversity has become an important aspect of ecosystem management and species conservation. Because performing biodiversity censuses of all taxonomic groups is prohibitively costly, biodiversity indicators have been used to estimate the species richness of taxonomic groups within certain regions. Cross-taxon congruence is a method of biodiversity estimation that relies on the assumption that the diversity of one taxonomic group can be used to predict the diversity of another. To improve the predictive ability of cross-taxon congruence in aquatic ecosystems, we evaluated whether organisms of more similar size would display stronger cross-taxon congruence as opposed to those that vary greatly in size. To test this hypothesis, we conducted a field survey of ten lakes and then coupled these results to a meta-analysis of the published literature. The results from both our field study and meta-analysis revealed that the strength of cross-taxon congruence was dependent on body size. Organisms most similar in size showed stronger cross-taxon congruence, compared to organisms which differed in size by orders of magnitude. Body size is an important predictor of the efficiency of cross-taxon congruence because it correlates to many life history characteristics of organisms and defines the way in which organisms interact with the physical environment. We suggest that future studies performing cross-taxon congruence in aquatic ecosystems use indicators of similar size to increase their success at predicting the biodiversity of taxonomic groups where cost-effective conservation and management actions are needed.

## USING LOCALIZED INTERACTION FRAMEWORK TO MEASURE AND MODEL ECOSYSTEM DYNAMICS

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Drawing from key insights of bacterial social evolution theory, we outline how focusing on the mechanism of localized organismal interactions provides a way to observe, quantify and model ecosystem dynamics. Not only do landscape constraint and network organize species distributions, so do species endogenous pattern formations at smaller scale simultaneously. We show how time-series abundance and spatial distribution data of species or functional groups can be used to parameterize dynamical models that forecast changes in ecosystem properties, including possible loss of ecosystem functioning because of changes in resource or landscape constraints.

## IMPACT OF LANDSCAPE STRUCTURE ON THE FORAGING BEHAVIOR OF THE KING VULTURE

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Seasonal tropical forests of the southern Yucatan Peninsula are dynamic ecosystems under great pressure from human activities. The spatial heterogeneity resulting from the fragmentation of these forests should have important effects on the process of habitat selection. In species with large home ranges, such as the King Vulture (Sarcoramphus papa), an avian scavenger of neotropical forests, the selection of feeding sites can be influenced by landscape composition and configuration at the landscape scale. Although this species has been observed feeding at carcasses in both forested (Lemon 1991) and open areas (Clinton-Eitniear 1981), mechanisms underlying the King Vulture's choices of feeding sites are poorly understood. This study aims at understanding the effects of landscape structure on the feeding strategies of the King Vulture. To achieve this goal, carcasses were installed in the southern Yucatan Peninsula according to a paired design, in summer 2010 and spring 2011. Use of carcasses was assessed at two spatial scales (local and landscape) in two types of environment (open and forest). Other variables, such as the distance to closest road, village and large forest tract were included in the model. Preliminary results indicate that landscape composition and related interspecific competition have an impact on the foraging behavior of the King Vulture. Understanding the ecological impacts of changes in landscape structure will facilitate the design of conservation strategies for this species, which provides many vital ecological services.

## TANDEM DUPLICATION AND CODON SELECTION ARE IMPORTANT MOLECULAR EVOLUTIONARY FEATURES OF FUNCTIONALLY IMPORTANT GENES IN ARCTIC PLANTS

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Molecular aspects of arctic plants specializations are not yet well understood. Previously, we have shown that arctic Oxytropis (Fabaceae) overexpress stimulus response genes compared to their temperate Oxytropis relatives, and that many of these are members of gene families. However, the evolutionary relationships and evidence of positive or negative selection could not be assessed from the initial ESTs data. Additionally, the influence of growth conditions on gene expression profile was not characterized for each of the four Oxytropis species (two arctic and two temperate). Here, using q-RT-PCR and sequence isolation from gDNA, followed by phylogenetic analyses and detection of codons under selection, we show that one cold dehydrin "47" is responsive to climate in both temperate species, but remains highly expressed in the two arctic species in cold or temperate conditions. This change in expression profile contrasts with the sequence conservation of that gene. Expression profiles for the two PR-10 genes surveyed suggest subfunctionalization, where one species express one gene (PR-10 "61"), and the three other species express the other gene (PR-10 "13"). Detection of positive selection in only the complete set of Oxytropis PR-10 suggests that novel protein variants are recruited when plants colonize contrasting habitats, after which negative selection is more prevalent. The phylogenetic analyses further suggest that both PR-10 and cold dehydrins expanded by tandem duplication in the genus prior to arctic and temperate species evolution. Tandem duplication and codon selection in genes functionally important in arctic plants represent unsuspected features of these highly specialized plants.

## TESTING THE CITY BIODIVERSITY INDEX (CBI): HOW TO MEASURE CONNECTIVITY?

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Cities can contribute significantly to global efforts to reduce the rate of biodiversity loss. The City Biodiversity Index (CBI) was developed as a tool to evaluate the state of biodiversity in cities and to provide insights for improving conservation efforts. It was proposed at the 9th Meeting of the Conference of the Parties (COP-9) to the Convention on Biological Diversity (CBD) by the Minister for National Development of Singapore, Mr. Mah Bow Tan, in May 2008. Three expert workshops in 2009, 2010 and 2011 were organized by the National Parks Board of Singapore and the Secretariat of the CBD in collaboration with the Global Partnership on Cities and Biodiversity to develop the index. The CBI includes 23 indicators such as the proportion of natural areas in the city. The poster will present the CBI with a focus on indicator 2 which measures connectivity of natural areas. The current method used for this indicator is inconsistent. We propose an improvement that will produce more reliable results without compromising practicality in the application of the metric. The new version is based on the effective mesh size method which has been slightly modified in order to keep calculations simple. We apply the new and old versions to Montreal in collaboration with the Ville de Montreal, Direction des grands parcs et du verdissement. Montreal agreed to test the CBI. Improving the method will provide a better account of the state of connectivity which may have implications for Montreal's conservation efforts.

## CYCLING OF VERTEBRATE ALPHA DIVERSITY PRECEDING THE CRETACEOUS MASS EXTINCTION (65MA): EVIDENCE FROM THE LATEST CRETACEOUS OF CENTRAL CANADA

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Vertebrate microsites are an invaluable tool in the study of paleoecology. These accumulations of small vertebrate fossils (teeth, scales, bone fragments etc) allow for the quantification and description of temporal and spatial paleobiodiversity trends. When coupled with paleoclimate indictors such as stable isotope analyses and plant macrofossil data, insight may be gained as to how climatic factors influenced biodiversity in both time and space. Here we examine the relationships between climate, area and biodiversity during the last half million years of the Cretaceous period in central Canada. Data from 36 vertebrate microsites, together containing some 9000 vertebrate microfossils, were collected from the base of the latest Maastrichtian (65Ma) Upper Frenchman Formation to the K-Pg boundary clay in Grasslands National Park, Saskatchewan. Stratigraphic level surveys were performed to assess the relative stratigraphic position of each microsite, and the depositional environment of each was documented. Diversity appears to peak in at least three stratigraphic horizons, with horizons of lower diversity situated between them. Both the number of sites and the diversity within the sites decreases dramatically in the last 10m below the K-T boundary. The alpha diversity cycles may be associated with the large-scale, repetitive depositional cycles of ironstone, mudstone and sandstone observed throughout the study area. This study demonstrates that local vertebrate alpha diversity may have been fluctuating with local environmental conditions until just prior to the K-T extinction, and suggests that alpha diversity may have been waning just prior to the extinction event itself.

## ENHANCED AND CONSTANT PRODUCTIVITY IN IMPOVERISHED AND FLUCTUATING ENVIRONMENTS

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Many kinds of ecosystems can maintain stable, high levels of productivity despite scarce resources in a changing environment. We have analyzed theoretical models of nutrient cycling to clarify the mechanisms for maintaining this apparent paradox. Moreover, we confront the models with biological processes and data of the littoral community of Lake Tanganyika, an African Rift Valley lake. Our results suggest that the frequency of inputs which can increase the variability of the stocks and flows do not influence their average magnitude. However, the consumer was the main factor which can stabilize function, by decreasing variability. Enhanced productivity hinges on the efficacy of autrophs to take up nutrient subsidies and of grazers to cycle nutrients, consistent with grazing optimization theory. The intensity of cycling between herbivores and primary producers is governed by a balance between grazing and recycling rates, which can trade-off in their effect on stability. In this context, maintenance of functioning, in terms of constancy and magnitude, depends on the intensity of coupling between consumers and the resource. For Lake Tanaganyika, this suggests that climate warming and fishing will strongly affect long-term ecosystem functioning. Taken together, the results highlight the importance of feedbacks between ecosystem processes and the behaviours of biota for predicting ecological consequences of global change and exploitation.

## PTERIDOPHYTE DIVERSITY IN URBAN FORESTS

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The maintenance of biodiversity in urban forests is a challenge owing to the increased demand of these sites for recreational activities. To better preserve the diversity of indigenous plants and animals in these ecosystems it is therefore essential to understand the environmental factors that can lead to changes in their composition. The purpose of this study is to determine the relationship between the distribution of pteridophytes in urban forests and landscape factors such as forest patch size, isolation, surrounding disturbances and heat island. Pteridophytes were sampled in 82 forest patches of the Montreal region (Quebec, Canada). Landscape variables were determined through the use of satellite images, land use maps and field surveys. Data were analyzed using regression models and multivariate techniques. In total, 39 taxa of pteridophytes were identified in the 82 forests sampled, and among them Dryopteris × neowherryi W.H. Wagner a new taxon for the Quebec province. Preliminary results indicated that pteridophyte richness was correlated to the area of patches, the vicinity of industrial areas as well as the distance of the nearest forest larger than 10 ha and 200 ha (R2adj = 0.75 ; Pperm. <0.001).Results from this study will help decision makers to define conservation priorities by given them some rules to ensure the long-term maintenance of biodiversity in urban forests.

## LE DÉVELOPPEMENT DU PROGRAMME DE SUIVI DE LA BIODIVERSITÉ EN FONCTION DES CHANGEMENTS CLIMATIQUES AU QUÉBEC FAIT APPEL À VOUS

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Les changements climatiques (CC) sont susceptibles d'avoir des impacts sur la biodiversité. La question est de savoir quelle sera la réponse des espèces, en terme d'adaptation, de changement d'aire de répartition ou de risque d'extinction, qui entraînerait une diminution de la biodiversité. Pour répondre à cette question pour le Québec, le gouvernement souhaite mettre en place, en collaboration avec des chercheurs universitaires, un programme de suivi de la biodiversité afin de détecter des changements dus aux CC. Vous pouvez aider à la réussite du projet de deux façons, en répondant à un sondage internet et en aidant l'équipe développant le programme à compiler une base de métadonnées sur les suivis et les bases de données traitant de biodiversité existant. Le sondage de 13 questions vous donne l'occasion de partager votre opinion sur les priorités qui devraient guider le programme afin de s'assurer qu'il reflète les priorités du plus grand nombre d'acteurs ayant des intérêts dans la biodiversité. La mise en place d'une base de métadonnées sur la biodiversité (des données sur les données et non pas les données elles-mêmes) vise à s'assurer que le nouveau programme de suivi ne double pas les efforts d'échantillonnage déjà déployés dans la province. Cette base de métadonnées sera également mise à la disposition des chercheurs du Québec afin de favoriser la collaboration entre les projets. Si vous êtes intéressés à répondre au sondage ou si vous avez de l'information sur des données de biodiversités, passez voir notre affiche. Merci pour votre aide et votre participation!

## GENETIC STRUCTURE AND DIVERSITY OF TRADITIONALLY CULTIVATED RICE (ORYZA SATIVA) VARIETIES IN NORTHEAST INDIA

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Northeast India is considered as one of the centers of the domestication of rice, and a home for a large number of landraces and traditionally cultivated varieties. We have analyzed the genetic structure and diversity of 32 rice accessions from Northeast India using 8 microsatellite loci. A total of 101 alleles with an average of 12.63 per locus were detected. The average effective number of alleles per locus and Shannon diversity index were 5.32 (1.00-8.72) and 1.68 (0.00-2.40) respectively and suggests a high level of genetic diversity among rice varieties grown in this region. Higher FST value (0.78) also implies a significant genetic differentiation among the different varieties. Analysis of population structure using the program STRUCTURE revealed three genetically distinct groups. Most of the varieties grouped into one cluster while some of the highly traditional varieties clustered into a separate group, and the winter cultivated varieties, commonly known as Boro rice grouped in to a separate cluster highlighting the genetic distinctiveness of these varieties. The resulting information is invaluable for devising strategies for conservation and sustainable use of rice genetic resources of the region.

## DEVELOPMENT OF A WETLANDS CONSERVATION NETWORK APPROACH BASED ON ECOSYSTEM SERVICES MAINTENANCE

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Wetlands in northern regions of the province of Quebec are still barely undisturbed by human activity. Yet, the impending increase in environmental pressure from industrial development and natural resource extraction may degrade or even convert these key ecosystems. Recently, interest has aroused for the development of a conservation planning approach that will ensure the sustainable development of the northern wetlands in regard to human welfare and biodiversity conservation. This study aims to adapt an approach that focuses on the valuation and the maintenance of ecosystem services attributable to wetlands. While some ecosystem services are directly linked to biodiversity, it is still unclear if it is possible to achieve traditional conservation goals, namely biodiversity maintenance, by prioritising the wetlands that provide the highest amount of ecosystem services. To answer this question, conservation network selection algorithms will be used to generate a range of conservation scenarios according to different criteria, such as coarse and fine filters, the value and quantity of ecosystem services, and the representativeness of wetlands and their connectivity. These scenarios will then be compared to identify the best approach for selecting conservation areas and the optimal amount of conservation areas.

## FROM 'OCEAN-BOTTOM' TO 'MOUNTAIN-TOP': INUIT LANDSCAPE ETHNOECOLOGY IN THE EASTERN CANADIAN ARCTIC

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For Inuit in the subarctic-boreal transition zone of north-eastern Canada, an intimate knowledge of local biodiversity and the environment is crucial for successful traditional activities. This study examined how Inuit of Nunatsiavut label and classify features of their local landscape, by recording terminology in their language Inuktitut. During interviews, community members (mostly Elders) were shown photographs from around the region, and were asked to point out and name salient landscape features. The majority of landscape features labelled related to the region's hydrology (e.g. 'river', 'lake', 'ocean') and geo-physical features (e.g. 'mountain', 'valley', 'island'), with ecological factors (such as plant associations, animal habitats) also being important (e.g. 'treed-place', 'shrubby-place', 'wetland'). Inuit categories generally corresponded closely to academic classifications, with some exceptions likely due to their significance to traditional Inuit lifestyle (e.g. 'berry-patch', 'dry-wood place', 'egg-place'). Most generic ecotopes were labelled by linguistically unanalyzable names, e.g. tasik 'pond/lake', Kigittak 'island', sitjak 'shore/beach'. These basic terms were often modified to create a more specific level of classification, e.g. types of tasik: tasikuluk 'small lake', tasilukuluk 'very small lake'. Other landscape features were labelled by complex descriptions, such as napâttuit issua KakKangi 'treeline' (literally, 'tree-border on the mountain'). The criteria that Inuit use to recognize different ecotopes and habitats can be an important complement to the more quantitative approach used in Western science. Integration of Inuit landscape nomenclature and categorization with academic perspectives can help inform discussions concerning sustainable development, land use, and conservation of subarctic biodiversity and Inuit language and culture.

## GENETIC VARIANCE IN WHITE-FOOTED MICE POPULATIONS THROUGH SPATIAL AND TEMPORAL SCALES

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The aim of this project is to investigate genetic variance in the white-footed mouse Peromyscus leucopus in the context of climate change and expanding range limits. Using microsatellite and AFLP (Amplified Fragment Length Polymorphism) analyses, genetic variances will be established between three white-footed mouse populations on a north-south axis, stretching from a central point in their northern distribution (Chicago) to their northernmost distribution limit (around Trois-Rivières in southern Québec). Additionally, populations from Mont Saint-Hilaire (MSH) will be studied from 1960 – when MSH was the northernmost distribution limit, and from 2008 – when MSH had become more central within the northern distribution. The spatial data will allow us to understand genetic differences (or similarities) between leading edge and central populations, and to better characterize population responses to climate change. If range expansion is driven by climate change, we predict that there will be little genetic differentiation between central and edge populations. However, if range expansion reflects expansion into new niche space, we predict divergence between edge and central populations because only certain genotypes are likely to be well suited to the new environment. The temporal study will show change in population structure at a single locale over time, allowing us to see what happens to a population post range expansion. If the temporal data matches with the spatial data, we will be able to fit those results to the climate change expansion hypothesis, and this will give us a powerful tool to predict population changes following climate-driven range expansion.

## USING FUNCTIONAL DIVERSITY AS AN INDICATOR OF RESTORATION SUCCESS OF CUT-OVER BOG

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A trait based approach was used to evaluate the long term restoration success of the herbaceous community in an exploited peatland restored via moss layer transfer. In order to understand the herbaceous dynamics after restoration, the peatland has been monitored prior to restoration and biannually during ten years, in two drainage conditions, and compared to unexploited peatland. The analysis showed that traits of the herbaceous community found prior to and in early stage after restoration (associated to soil having an acidity higher than 5.7, from ruderal and wetland habitat, with mycorrhiza and exotic species and found in mesic soil conditions) did not persist in latter stage after restoration, which presented a different set of traits (carnivorous, associated to a large amplitude of water preference and sexual reproduction). The traits composition of latter stage after restoration appeared to converge toward the reference ecosystem (large seed, associated to humid conditions and from a forest or peatland habitat). Nevertheless, the latter stage after restoration presented less trait diversity than the reference ecosystem, especially in peat fields. In addition, the species diversity and functional dispersion pattern vary among the drainage conditions. In the latter stage after restoration, both measures decreased in peat fields while it remained stable in ditches. This suggests that different initial topography in restoration might help increase the functional diversity of managed ecosystem.

## SEEDLINGS GROWTH AND SURVIVAL UNDER DENSE ACANTHUS PUBESCENS COVER IN KIBALE NATIONAL PARK, UGANDA

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Large canopy openings created by logging activities in tropical forest provide suitable conditions for some opportunistic shrub and herbs species that take advantage of the surge in resources to colonize disturbed sites. Such plant species in the system may interfere with tree seedling establishment, growth and survival to limit regeneration. To mention a few, the densification of the plant cover following the rapid colonisation of disturbed sites can alter the light regime and the nutrient supply or modify herbivore behaviour, thus impeding tree seedling growth and survival. In Kibale National Park (Uganda), some old logging sites are mainly covered by the dense stands of Acanthus pubescens Engl.. In these sites, tree regeneration appears to be inhibited. In this study, we were interested to identify the ecological processes underlying such regeneration collapse. To do so, we designed a factorial experiment to evaluate the influence of herbivory and vegetation cover on the growth and survival of transplanted tree seedlings. Two environments (Acanthus pubescens stands and secondary forests), two level of vegetation cover (presence or absence of the understory vegetation layer) and two level of herbivory (with or without) were compared. We found no evidence to support the hypothesis that herbivory is significantly higher under a dense A. pubescens cover. However, seedling growth was positively influenced by the removal of the A. pubescens cover, suggesting that competition for resources, mainly light, might be important.

## LE MÉLÈZE LARICIN : À L'ASSAUT DES MONTAGNES DES ENVIRONS DE KANGIQSUALUJJUAQ, NUNAVIK

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De nombreux travaux ont montré que la limite des arbres, à l'interface forêt boréale-toundra, est sensible à la température, puisque l'établissement et la croissance des espèces arborescentes y sont grandement limités par les conditions climatiques rigoureuses y prévalant. Ainsi, une expansion rapide des populations à la limite des arbres est envisageable en réponse au réchauffement climatique. Toutefois, l'apparente inertie de certaines limites suggère l'importance de contraintes écologiques à l'échelle locale. Les objectifs de ce projet sont donc de caractériser et de quantifier l'importance relative du climat et des contraintes écologiques sur la dynamique de la limite altitudinale des arbres près de Kangiqsualujjuaq (Nunavik), où on observe une importante colonisation du mélèze laricin au-delà de la limite des arbres et une absence de réponse de l'épinette noire. Nous avons ainsi cartographié, récolté, daté et mesuré la croissance des individus le long d'un gradient altitudinal (d'une vallée forestière au sommet d'une colline). Les résultats préliminaires suggèrent l'établissement et la survie de nombreux mélèzes au-delà de la limite des arbres, particulièrement depuis les années 1990. On constate également une importante augmentation de la croissance radiale du mélèze depuis la décennie 1990. La croissance en hauteur montre une tendance similaire, peu importe la position le long du gradient. L'absence de réponse de l'épinette noire pourrait être reliée aux contraintes écologiques inhérentes à la région. Ces résultats suggèrent que la biodiversité végétale aux environs de Kangiqsualujjuaq pourrait être affectée suite à la colonisation de certaines collines par le mélèze en réponse au réchauffement actuel.

## SUCKLING AND ALLOSUCKLING IN REINDEER, RANGIFER TARANDUS

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The suckling of offspring from females other than their own mother is referred to as allosuckling. To study the causes and functions of allosuckling, we will observe semi-captive reindeer, Rangifer tarandus (Linnaeus 1758). We will test four hypotheses: (1); milk-theft, calves opportunistically allosuckle; (2) mismothering, misdirected maternal care; (3) benefit hypothesis, allosuckling calves benefit by increasing mass gain; and (4) compensation hypothesis, allosuckling calves compensate for nutritional and/or growth deficiencies. Allosuckling will be observed for the first 10 weeks of lactation in a group of captive reindeer, R. tarandus, composed of 25 mother-calf pairs. We will collect the frequency, duration and positions adopted during (parallel, perpendicular, and antiparallel) suckling and allosuckling bouts using the scan sampling and the ad libitum methods of data collection. The mothers and their calves will be weighed every week. We will assess the influence of mass of calves and mothers at calving, calf sex, birth order, social rank, and the age of mothers on allosuckling in reindeer. We will be studying a reindeer population from the Kutuharju Field Reindeer Research Station in Kaamanen, Finland (69°N, 27°E). This herd is composed of semi-domestic reindeer that are free ranging for most of the year excluding the calving and rutting periods. These animals are managed and harvested by the Finnish Reindeer Herders Association, therefore, we are able to continuously gather information on the ecology and behaviour of the individual reindeer.

## THE DISTRIBUTION OF WOODLAND CARIBOU AND MOOSE IN RELATION TO FORESTRY OPERATIONS IN NEWFOUNDLAND'S 'WOLFLESS' BOREAL FOREST

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Forestry operations can have a major impact on local biodiversity by altering the landscape, and in turn changing the species composition of the area. In the boreal forest, moose (Alces alces) generally increase in harvested areas which attracts more predators while woodland caribou (Rangifer tarandus caribou) respond by spatially separating themselves from moose and harvested landscapes because of the higher perceived risk of predation. We examined the distribution of caribou and spatial overlap of caribou, moose and a new caribou predator, the coyote (Canis latrans) in central Newfoundland. Here, harvested landscapes are common and the ungulates natural enemy, the wolf (Canis lupes) is absent. A distance based approach was applied to 4 caribou to examine if they use areas further from cutovers than by chance. Habitat information was derived from the locations of observed moose, caribou and coyote signs collected opportunistically throughout the summer of 2011. The caribou are generally closer than expected to harvested areas and moose and caribou do not display the same spatial separation patterns from each other as elsewhere in North America. All three animals appear to utilize the same environments in similar proportions. Caribou do not appear to completely abandon recently harvested areas unlike other studies possibly as an adaptation to lower risk attributed to these areas. The higher overlap between caribou and moose compared to other studies, may be due from the absence of their shared natural enemy.

## PHYLOGEOGRAPHY OF THE WHITE-FOOTED MOUSE, PEROMYSCUS LEUCOPUS, AND THE SPREAD OF LYME DISEASE

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Our study aims to assess the impact of global warming on the spread of an emerging zoonosis in Québec, Lyme disease. The spirochete bacterium, Borrelia burgdorferi is the pathogen responsible for this infection and it is transmitted from one mammal to another by the black-legged tick, Ixodes scapularis. The white-footed mouse, Peromyscus leucopus, is the main reservoir of the bacterium in Québec. It is predicted that the rise in average temperature leads to the expansion of the range of the tick to the north, together with the mouse P. leucopus. Ticks and specimens of P. leucopus have been sampled in several regions of Southern Québec, including the Montérégie, Estrie and Centre-du-Québec, as well as some points on the North Shore of the St. Lawrence River, as the limit distribution of P. leucopus is not very well defined in Québec. The purpose of the study is to construct phylogenetics trees representing the relationships between different populations of mice sampled to predict the pattern of possible spread of Lyme disease in Québec. The analysis will be based on the observed distances between some mitochondrial (cytochrome b and D-Loop) and nuclear (Rag1) genes.

## IMPACT OF THE INVASIVE PHRAMITES AUSTRALIS ON BIRDS OF FRESHMWATER MARSHES OF EASTERN CANADA

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A Eurasian genotype of the common reed (Phragmites australis) is rapidly invading freshwater marshes of North America and changing plant communities, but the impact of this grass species on birds is poorly known. Several bird species use freshwater marshes as feeding and nesting grounds during the breeding period. The main objective of this study was to evaluate the impact of the common reed on the composition of bird assemblages, and to see whether feeding behaviour is affected by the presence of dense populations of this invasive plant. We collected data on songbirds using point counts in different vegetation types, and conducted counts and behavioural observations of waterfowl and wading birds. Because invertebrates represent an important food source for marsh birds, we also sampled invertebrates in common reed stands and other vegetation types. Point count data indicated that bird assemblages of common reed stands were species rich, and did not significantly differ from those of other vegetation types found in marshes. Bird assemblages of dry common reed stands were, however, somewhat different than those of wetter sites. Waterfowl also seemed to avoid common reed stands for feeding. There was no significant difference in invertebrate biomass or diversity between vegetation types. Bird data, associated with other data from fishes and amphibians recently collected, suggest that common reed stands are by no means biological deserts, and that their bad reputation in North America is overstated. Our study only gives partial support for controlling the expansion of the plant in marshes.

## DIVERSIFICATION DE BANDES RIVERAINES AGRICOLES À L'AIDE D'ESPÈCES ARBUSTIVES INDIGÈNES

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La présente étude a pour principal objectif de déterminer le potentiel d'établissement d'arbustes indigènes peu utilisés pour l'aménagement de bandes riveraines agricoles en comparant leur performance à des espèces fréquemment employées. Des plantations sur les replats et les talus de bandes riveraines ont été mises en place dans le Bas St-Laurent, en Montérégie et dans Portneuf. Les espèces installées en replat sont: Cornus stolonifera (témoin), Shepherdia canadensis, Rosa blanda, Spiraea alba et Corylus cornuta. En talus, Salix petiolaris (témoin), Myrica gale, Salix eriocephala, Cornus rugosa et Cephalanthus occidentalis sont les espèces testées. Après deux saisons de croissance, S. canadensis et M. gale présentent les plus faibles taux de survie, soit 88% et 77% pour le replat et le talus respectivement. Dans les trois régions, S. canadensis a présenté de moins bonnes performances que le témoin au niveau de la croissance et de la cote de santé générale. De plus, la cote de santé générale de C. cornuta et de R. blanda était inférieure à celle du témoin pour la région de Portneuf seulement. En talus, toutes les espèces ont performé aussi bien ou mieux que le témoin en ce qui a trait à la croissance et à la cote de santé générale, à l'exception de M. gale en Montérégie. Les variations observées quant à la qualité d'enracinement des plants de même que les différents niveaux d'envahissement par les espèces compétitrices ne semblent pas liées aux résultats de survie ni à ceux pour la cote de santé.

## MOLECULAR PHYLOGENY OF SALIX (SALICACEAE) IN ORDER TO CHARACTERIZE THE ORIGIN OF NATIVE S. ERIOCEPHALA : A NEW PERSPECTIVE FOR BIOMASS PRODUCTION

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Fast growing willows (Salix sp.) are increasingly used in Europe and North America for biomass production and other environmental applications. However, the phylogeny of willows is incomplete, which slows down the selection of suitable native species and the development of improvement programs. Salix includes around 500 species worldwide, mainly in temperate and cold regions of the Northern Hemisphere, and more than 100 species are found in North America. A phylogeny including introduced species already in usage along with native species could help uncover clades with suitable native species for biomass production, such as S. eriocephala. We gathered leaf material from ca. 50 native diploid willows and introduced cultivated species. We sequenced the chloroplastic gene matK, the ITS region, and the nuclear gene calcineurin-like phosphoesterase. Phylogenetic analyses were carried out using parsimony and Bayesian approaches and Populus was used as the outgroup.. A first analysis used matK and ITS to identify clades in the genus. Two major clades were found in the analyses, one of which included the species of interest. We then focused on those clades where cultivated introduced species and S. eriocephala were included for a second analysis using calcineurin-like phosphoesterase. The phylogenetic tree indicates that species of interest might have an evolutionary relationship. Polyploid willows will eventually be added to the analysis as they are also potentially useful in environmental applications. More nuclear markers must also be developed to increase the resolution of our analysis.

## LA VISION COMMUNE DE LA CEINTURE VERTE ET BLEUE DU GRAND MONTRÉAL - THE COMMON VISION FOR A GREEN AND BLUE BELT OF GREATER MONTREAL

*Les Amis de Meadowbrook*

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This poster provides a résumé of "La vision commune de la ceinture verte et bleue du Grand Montréal - The Common Vision for a Green and Blue Belt of Greater Montreal". This Shared Vision was developed by a number of organizations including les Partenaires du parc écologique de l'archipel de Montréal, the Green Coalition, the Conseils régionnaux de l'environnement of Montreal and Laval (which are umbrella groups representing hundreds of member organizations), as well as The David Suzuki Foundation, Héritage Laurentien and Les Amis de Meadowbrook. This vision was explicitly endorsed by a very large number of presenters at the recent public consultations by the Montreal Metropolitan Conmmunity on its proposed new urban plan (le plan métropolitain d'aménagement et de développement - the "PMAD").

## HOW MANY STOCKS COULD THERE BE? SPATIAL ORGANISATION OF THE YELLOW PERCH (PERCA FLAVESCENS) IN LAKE ST. PIERRE

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Yellow perch (Perca flavescens) represents an important socio-economical resource in Lake St. Pierre. To ensure the persistence of this species in the face of increasing anthropogenic pressures, it is important to understand the population dynamics and the mechanisms responsible of those processes. Yellow perch is known to display natal site fidelity behavior. When individuals always reproduce at their natal site, subdivision in multiple populations and local adaptations may occur. It is possible to detect these processes according to genetic signal associated with individuals' reproduction. This study aims at determining the organization of yellow perch population within Lake St. Pierre by using recently emerged larval individuals collected during the last decade. AFLP (Amplified Fragment Length Polymorphism) was used to confirm the correlation between genetic composition of individuals and spawning sites. Then variations at microsatellite loci were used to further investigate the organization of these populations. These results are expected to be helpful to the management of this species.

## MORPHOLOGICAL VARIATION OF THE RED-BACKED VOLE (MYODES GAPPERI) IN QUÉBEC

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Mammals often display gradients of morphological variation (in both size and shape) across a species range. Latitudinal patterns of morphological variation have frequently been attributed to adaptation to the local environment. One classic example is Bergmann's rule, which states that endotherms living in colder environments tend to be larger than their conspecifics experiencing warmer temperatures. The foundation of populations by distinct lineages (with distinct morphologies) within a species should also be considered as an underlying mechanism for intraspecific morphological variation. The objective of this study is to examine the morphological variation of the red-backed vole (Myodes gapperi) in Québec and identify environmental and phylogenetic factors that may influence this variation. We are investigating specimens from 10 distinct populations distributed along an approximately 1000 kilometers latitudinal gradient. Morphology is described by the outline of the first upper molar (M1) and of the mandible of adult individuals, using the Elliptical Fourier analysis. The phylogenetic relation between populations will be determined by analysing the cytochrome b gene (cyt b) from the mitochondrial DNA (mtDNA) of at least 5 individuals per population. The main axes of morphological differentiation between populations (identified by a canonical variate analysis) will be regressed on climate factors estimates from BIOCLIM and primary productivity estimates from EALCO. Preliminary results from 7 populations indicate that in tooth morphology there are strong correlations between latitude and both the main axis of morphological variation (PC1) and the first axis of morphological differentiation (CA1).

## ADAPTATION OF MICROALGAE TO NUTRIENT FERTILIZATION

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Experimental evolution has predominantly focused on survival and adaptation of organisms subject to stressful changes in their environment. However, in many cases, environmental change shifts conditions towards the optimum of a species. Current theory may not be well suited to predicting the response of organisms to this type of changes. We investigate the adaptation of soil micro-algae to the addition of a variety of fertilizers. We isolated and tested soil micro-algae from plots of the Park Grass Experiment at Rothamsted Research, UK, which have been subject to fertilization treatment continuously for over 150 years. This research explores evolutionary theory in new contexts.

## THE EFFECT OF LANDSCAPE STRUCTURE AND FRAGMENTATION ON THE DISTRIBUTION OF THE WHITE-FOOTED MOUSE (PEROMYSCUS LEUCOPUS) IN MONTÉRÉGIE, QUÉBEC

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The white-footed Mouse (Peromyscus leucopus) is currently at the Northern limit of its range in Québec. It is a key host for the black-legged tick (Ixodes scapularis) which carries and transmits Lyme disease, an emerging disease in Québec. This project aims to assess the effect of fragmentation on the distribution of the white-footed mouse in the Monteregian area in Québec. Physical and ecological variables of P. leucopus were used to parameterize a Habitat Suitability Model (HSM) to predict the distribution of the mouse. The HSM was used to create a resistance raster and various computer programs and GIS tools were used to model the connectivity of P. leucopus populations across the landscape. The models predicted two major branches that forecast P. leucopus gene flow across the Monteregian landscape. Additionally, we found that Mont St-Hilaire has relatively high connectivity compared to the other Monteregian hills. The models also predicted the location of potential corridors that connect major habitat patches such as Mont St-Hilaire, Rougemont and Yamaska to the rest of the landscape. This model will be useful for future work on connectivity between P. leucopus populations, as it points out the most probable landscape pathways or corridors by which they are connected. Spatial data on the distribution of the white-footed mouse will be used to further adapt and validate the model. A better understanding of the mechanisms of dispersal of the white-footed mouse is essential if we are to anticipate the pattern of emergence of Lyme disease in Southern Québec.

## WHAT CAN WE LEARN FROM USING LANDSCAPE PATTERN METRICS OVER LARGE AREAS? LESSONS FROM MAPPING REPRESENTATIVE LANDSCAPES OF QUÉBEC

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The Province of Quebec is composed of a wide array of landscape patterns. Can we quantitatively summarize landscape patterns and map them onto geographical space? In a context of monitoring biodiversity, quantitatively obtained national scale information on spatial distribution of landscape patterns are lacking. Such exercise may give insights on landscape conditions and help managers visualize broad scale trends in patterns' distribution across Quebec. In this research, we explored what relevant ecological information could emerge from using landscape pattern metrics over the Province of Quebec. Starting with the Earth Observation for Sustainable Development of forest (EOSD) datasets, a national land-cover classification, we partitioned the province into 1400 individual 900km2 landscapes. For each individual, we calculated 2000 pattern metrics. Metric values were used to measure similarities between all pairs of landscapes. Using similarity values as inputs, we adapted a clustering algorithm that simultaneously groups similar objects and objectively identifies the best representatives of each group. Outputs were used to generate meaningful ecological information based on landscape patterns: best representative landscapes, similar pattern regions, and representativeness of patterns across regions. Our flexible multivariate quantitative method transcends traditional qualitative techniques in vegetation pattern maps. It allows us to evaluate the accuracy of our landscape pattern regions, to process thousands of ecological factors and adapt it to multiple scientific needs. We believe our maps of landscape pattern regions could reasonably be integrated in future multivariate ecological mapping and thus, add relevant information on how landscape structures are observable from space.

## BIODIVERSITY AND STRUCTURE OF CLADOCERAN COMMUNITY IN URBAN PONDS

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Urban ecology and biodiversity are often overlooked and rarely get the attention they deserve. The overall objective of the study was to determine spatial patterns in biodiversity and community structure of Cladocera in urban ponds. We evaluated the relative influence of water quality, land use and food web interactions on cladoceran community. Biodiversity patterns were based on species composition and species abundance. During the month of July of the summer of 2010, 18 waterbodies of various types were sampled for surface-water-dwelling cladocerans. Cladoceran communities were sampled by means of a 3L bucket, which was repeatedly dipped in surface water in order to obtain a 30L sample. Samples were analyzed and confronted against environnemental variables in a redundancy analysis (RDA) to seek out main drivers of cladoceran communities. Local species richness proved to be relatively low, cladoceran species richness is quite high for the whole island. 26 species of cladocera belonging to 3 of the 4 main cladoceran families were found. Main contributors to cladoceran diversity were species of the family Chydoroidae, which comprised a third of the obtained species and were highly endemic. Even within Daphniidae, true daphnids contributed little to species richness. Our studies show that cladoceran communities are shaped by both local variables such as phytoplankton quantity/quality or fish presence and more landscape variables such as land usage around the waterbody or waterbody management procedures. Most notably, the practice of pond drainage during the winter favored the development of characteristic species assemblages. A variation partitioning scheme was employed to assess the relative importance and significance of each fraction (local vs. landscape). Both fractions were considerable and significant. These results highlight the fact that, when in an urban context, care should be given to variables at multiple scales and that more consideration should be given to anthropic factors.

## FORAGING STRATEGY OF BLACK HOWLER MONKEYS: HOW PREFERENCES AND SPATIAL KNOWLEDGE OF RESOURCES INFLUENCE MOVEMENTS

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Human induced habitat fragmentation and destruction is a critical issue for the conservation of primates. Thus, understanding the underlying processes involved in primate foraging becomes essential. The goal of this research was to identify the foraging strategy of the threatened black howler monkey (Alouatta pigra), and determine how spatiotemporal knowledge of their resources is involved in foraging. Based on food preferences previously reported for black howlers, we tested if they move with higher probability to: a) preferred tree species; b) high quality patches of trees; c) trees where they had previously eaten. We modeled individual movements of black howlers of Calakmul Biosphere Reserve using a recently developed modeling approach that extends resource selection functions (RSF) into a Markov Chain framework. We found that, at a small spatial scale, monkeys tend to choose the closest and the most preferred tree species. At a larger spatial scale, monkeys tend to move away from preferred trees where preferred resources have been eaten in earlier visits. It appears that the spatial knowledge of black howlers enables them to remember the location of visited trees, and therefore to forage away from these trees. However, we found no evidence of goal-directed movements in the foraging for preferred food items.

## LANDSCAPE-MEDIATED COMPETITION BETWEEN TREE SWALLOWS AND HOUSE SPARROWS IN FARMSCAPES

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Landscape structure can influence competitive interactions among species. In agro-ecosystems, maximizing yields to meet the needs of a growing population have been centerfield for the last half century, and has thus resulted in diverse consequences for the agrifauna. We studied the influence of agricultural intensification (landscape structure) on the abundance and distribution of House Sparrow (Passer domesticus; HOSP), and the consequences of its presence and density on the nesting habitat selection of Tree swallows (Tachycineta bicolor; TRSW) and the competitive interactions between these species. TRSW are aerial insectivores, a group of birds highly affected notably by the increasing use of pesticides and fertilizers in intensive agroecosystems. We counted House Sparrows in 40 farms from 2008 to 2010 (3 to 5 10-min point counts/farm/year). We detected 1860 sparrows, with 0 to 12 birds recorded in a single visit (mean ± sd : 0.36 ± 1.41). N-mixture models accounting for imperfect detection showed that sparrows were more abundant in agro-intensive systems, especially in interaction with cattle and building density. Then, we illustrated with GLMM that swallow nest-box occupancy was reduced by the density of sparrows and by proximity to buildings, that offer shelter and nest sites to sparrows. These results highlight the important role of anthropogenic alterations on agro-ecosytems and illustrate a landscape-mediated competition pressure, not yet documented in farmscapes. Considering that both species are declining rapidly, this research stresses the importance of multi-factor and multi-species analyses to disentangle the factors of population decline.

## COMPARER DIFFÉRENTS SCÉNARIOS DE CONSERVATION : UN SYSTÈME D'AIDE À LA DÉCISION POUR MESURER LES EFFETS DES CONTRAINTES MINIÈRES SUR LA REPRÉSENTATIVITÉ AU MOYEN NORD

*Saucier, Frédérique*[1]*; Cumming, Steve; Schmiegelow, Fiona*

[1]Boreal Ecosystems Analysis for Conservation Networks (BEACONs)

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Le groupe de recherche BEACONs s'intéresse à la planification de la conservation adaptée aux grands écosystèmes largement restés intacts comme les forêts boréales du Plan Nord. Dans cette étude, nous présentons un système d'aide à la décision basé sur les principes de la conservation systématique qui est une méthode reconnue pour allouer efficacement les ressources afin de protéger la biodiversité. Le système que nous avons développé permet de synthétiser une grande quantité d'information en résultats guidant les choix lors de la planification de la conservation sur un vaste territoire. Les outils que nous avons développés permettent

- de comparer différents scénarios de conservation selon leur capacité à représenter la diversité écologique du territoire;
- de connaître quelles sont les configurations spatiales de réseaux d'aires protégées les plus optimales en regard de leur représentativité pour un scénario de conservation donné;
- d'identifier les zones prioritaires à la représentation des écosystèmes selon leur contribution à l'atteinte de la représentativité optimale pour un scénario donné.

Un tel système nous permet de mesurer rapidement l'impact de nos décisions et la présence de contraintes à l'instauration d'aires protégées sur la représentativité du réseau de conservation. Nous avons testé notre système au Moyen Nord du Québec (zone entre le 49e et 55e parallèle) en comparant la représentativité de scénarios de conservation couvrant 12 et 17% du territoire et qui prenaient en compte ou non la présence des titres miniers comme contrainte à la planification de nouvelles aires protégées. Les résultats démontrent que les contraintes minières réduisent le potentiel de représentativité optimal pour chacun des scénarios de 12 et 17%. Les zones identifiées comme prioritaires à la représentation des écosystèmes des différents scénarios peuvent servir de base de négociation avec les autres utilisateurs du territoire pour un aménagement équilibré et durable du territoire qui ne se fera pas au détriment de la diversité biologique.

## LYME DISEASE AND THE WHITE-FOOTED MOUSE IN QUÉBEC

*Suter, Daniel*[1]*; Gaitan-Camacho, Jorge; Lapointe, Francois-Joseph; Ogden, Nicholas; Millien, Virginie*

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Our project studies the combined effects of climate change and habitat fragmentation on the expansion of the mouse species P. leucopus (the white-footed mouse) and its implication in the spread of Lyme disease in Southern Québec. Many Lyme disease studies focus on the distribution and propagation of ticks. Our study approaches the subject from another angle, using molecular markers to better understand the range expansion patterns northward of the mice as reservoir species for Lyme disease. More specifically, our project consists of a study of the phylogeography and gene flow of the white-footed mouse (Peromyscus leucopus) in Southern Québec, in relation with forest fragmentation and climate warming. We are creating a climate model based on habitat and environmental variables key to the establishment of white-footed mouse in the region. We relate this data to climate change and habitat fragmentation, to predict the future expansion of P. leucopus. Our results will help to better anticipate the current and future public health risks posed by Lyme disease in Québec.

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