CENTRE DE LA SCIENCE DE LA BIODIVERSITÉ DU QUÉBEC
QUEBEC CENTRE FOR BIODIVERSITY SCIENCE

Photos:
Dr. A. Hendry, Dr. M. Loreau and Wikipedia

QCBS Annual Symposium

Biodiversity Science in Quebec: 2010 and beyond

November 30 - December 2, 2010

New Residence Hall, McGill University
3625 Avenue du Parc
Montréal, Québec, Canada

In the name of the Québec Centre for Biodiversity Science (QCBS) we are delighted to welcome you to the first annual edition of the annual Centre's meeting. The QCBS was launched in February 2010, the outset of what has been a big year for biodiversity.

The UN International Year of Biodiversity has brought both good and bad news. The Global Biodiversity Outlook 3 confirmed what we all knew, that we are failing to reduce the rate of biodiversity loss at regional and global scales, and The Economics of Ecosystems and Biodiversity (TEEB) report confirmed that it is the poorest people who are suffering most from this biodiversity loss. These realizations have stimulated all sectors of society to act, and many positive steps have been taken in response.

Of note: Internationally, the intergovernmental and multi-stakeholder meeting, held in Busan in June, resulted in the establishment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). IPBES, like the IPCC, will enable the scientific community to translate knowledge about biodiversity into targeted policy action. Whilst, the 10th meeting of the Conference of the Parties (COP10) of the Convention on Biological Diversity, held in Nagoya, Japan, in October resulted in many positive outcomes, including the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization, and a new Strategic Plan for Biodiversity for 2011-2020.

In association with these events, many countries and institutions have released summary reports on the state and trends of biodiversity science. Of note in Canada are the "Ecosystem Status and Trends 2010" report by Federal, Provincial and Territorial Governments and the Council of Canadian Academies' report, "Canadian Taxonomy: exploring biodiversity, creating opportunity". Both reports confirm that Canadian ecosystems are under pressure and that more resources must be invested in Canadian biodiversity science.

The QCBS network exists to foster Québec's impressive expertise in biodiversity science, and the conference will showcase our

diverse array of talent and knowledge. It will be a wonderful opportunity for exchange between our collaborators and partners in academia, the private sector and government. I expect that we will all learn a great deal over the comings days.

Many thanks to the QCBS team for making the conference happen, and to all the invited guests, speakers and presenters for their participation.

I am sure the first QCBS conference will be a resounding success.

Dr. Andrew Gonzalez
QCBS Director

Tuesday, November **30**	**Wednesday,** December **1**	**Thursday,** December **2**
QCBS member registration & breakfast **8h – 8h30**	Breakfast & registration / **8h – 8h30**	Breakfast / **8h – 8h30**
QCBS member assembly **8h30 – 10h45**	Presentation: **Biodiversity and ecosystem services 8h30 – 9h30** (Speakers: J.-P. Revéret and E. Bennett)	Presentation: **Climate change and biodiversity science in northern Québec / 8h30 – 10h40** (Speakers: D. Berteaux and A.Cuerrier)
General symposium registration / **10h – 11h**	Concurrent student presentations – session 1 **9h30 – 10h35**	Break / **10h40 – 11h**
Opening speaker: Thomas Lovejoy: **State and trends of biodiversity science in Canada 11h – 12h**	Break **10h35 – 10h50**	Concurrent student presentations – session 4 (3 separate rooms) / **11h00 – 12h10**
Lunch – sponsored by the Council of Canadian Academies / **12h – 13h30**	Presentation: **Biodiversity in Québec: 400 years of human and natural history / 10h50 – 11h10** (Speaker: A.Simard)	Lunch / **12h10 – 13h**
Panel: **Developing biodiversity assessments for business: a collaborative approach for Québec 13h30 – 15h30**	Concurrent student presentations – session 2 / **11h10 – 12h15**	Panel: **Multi-sector perspectives on the nexus between biodiversity science, policy, and practice in Canada 13h – 15h** (Panelists: M. Kerry, P. Wilson, S.Noguer, D. Hodder)
Poster session / **15h30 – 16h30**	Lunch / **12h15 – 13h15**	Break / **15h – 15h20**
Mixer/opening cocktail **16h30 – 17h30**	Panel: **Opportunities for developing collaboration amongst research centres to foster a Québec Biodiversity Observation Network 13h15 – 15h30** (Speakers: P.Peres-Neto, C. Buddle, A. Gonzalez, D. Hyde)	**Perspectives on progress made in 2010, the International Year of Biodiversity / 15h20 – 16h30** (Speakers: J. Lemire, M. Loreau, A. Gonzalez)
	Break / **15h30 – 15h50**	Closing of the symposium / **16h30 – 17h**
	Concurrent student presentations – session 3 **15h50 – 17h**	Closing cocktail / **17h – 18h**

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Panels and Presentations

Day 1 – Tuesday, November 30, 2010

Opening speaker: Thomas Lovejoy

State and trends of biodiversity science in Canada

Dr. Thomas Lovejoy, Biodiversity Chair at the Heinz Center for Science, Economics and the Environment in Washington, D.C., will present an overview of the findings of the Council of Canadian Academies' Expert Panel on Biodiversity Science and will share his perspectives on the events of the International Year of Biodiversity.

Panel: Developing biodiversity assessments for business: a collaborative approach for Québec

(Panelists: Joël Houdet and John Finisdore)

Although societies rely on biodiversity and biological resources, these resources are often given little priority in decision-making and policy, largely due to the challenges of assessing their value. The Millennium Assessment has raised awareness of the importance of ecosystem services, and consequently the idea of assessing the value of biodiversity has attracted greater attention. Methodological approaches used to quantify biodiversity value require data and tools that are only partially developed, thus limiting their usefulness for organizations. Biodiversity assessments can play a major role in mitigating biodiversity loss and fostering more sustainable management of biodiversity. Invited speakers will discuss the necessary steps toward developing tools for biodiversity assessment for organizations in Québec. A discussion panel will follow the presentations.

Day 2 – Wednesday, December 1, 2010

Presentation: Biodiversity and ecosystem services in Québec

(Speakers: Jean-Pierre Revéret and Elena Bennett)

The Millennium Ecosystem Assessment has raised awareness of the importance of ecosystem services. QCBS members from the social and natural sciences are actively involved in research to improve our understanding of the linkages between and values of ecosystem services and biodiversity. The speakers for this session will present their approaches for studying biodiversity and ecosystem services through presentations of their current work in southern Québec.

Panel: Opportunities for collaboration amongst research centres to foster a Québec Biodiversity Observation Network

(Panelists include: Pedro Peres-Neto, Christopher Buddle, Andrew Gonzalez, Douglas Hyde)

For ecological as well as economic reasons, biodiversity science is an area of major strategic importance to Québec, Canada, and the entire world. Québec's Strategy and Action Plan for Biodiversity (2004-2007) highlighted the importance of sound management of the province's biodiversity. Addressing these challenges requires a new level of collaborative research in both the natural and social sciences. This panel will explore ways of better integrating biodiversity science through collaborations among the existing strategic research networks in Québec.

Day 3 – Thursday, December 2, 2010

Presentation: Climate change and biodiversity science in northern Québec

(Speakers: Dominique Berteaux and Alain Cuerrier)

One of the first projects developed through the QCBS, funded by Ouranos for the MDDEP, synthesized and integrated the existing literature on the impacts of climate change on biodiversity. The two presentations in this session will highlight the expected effects of climate change in northern Québec, in terms of biological and human dimensions. The speakers will also present the emerging biodiversity science questions and challenges that their research seeks to address in the nordic region of Québec.

Presentation: Biodiversity in Québec: 400 years or human and natural history

(Speaker: Anouk Simard)

Currently, it is estimated that 17% of the wildlife species in Québec are in a precarious situation. Thus the threat to biodiversity is very tangible. Yet not so long ago, Québec was still synonymous with a wild and unspoiled land, known for its closeness with nature. What has happened in the last 400 years, since the arrival of the first settlers, the onset of exploitation of the land and industrialization, to arrive at the present awareness of the issues threatening ecosystems in Québec? We propose here to monitor different aspects of biodiversity in Québec, including changes in the distribution of habitats and species of native fauna, the introduction of exotic species, and the first threats to wildlife. We will also provide a brief overview of the changes in levels of awareness, régulation, and acquisition of knowledge. A deeper understanding of Québec's biodiversity also requires a better understanding of our history!

Panel: Multi-sector perspectives on the nexus between biodiversity science, policy, and practice in Canada
(Panelists: Mara Kerry, Peigi Wilson, Sylvie-Nuria Noguer, Daniel Hodder)

This panel is co-hosted by the QCBS and the Canadian Friends of the Convention on Biological Diversity, a civil society association hosted by the Canadian Environmental Network. Invited panelists, representing business, nongovernmental organizations, aboriginal communities, and local government, will share their perspectives on improving the diffusion of biodiversity science into decision-making across sectors; key biodiversity science questions of interest to their organizations; ways of involving non-academic sectors in biodiversity science including through citizen science; and ways of bridging traditional knowledge and western biodiversity science.

Closing session: Perspectives on the progress made in 2010, the International Year of Biodiversity
(Speakers: Jean Lemire, Michel Loreau, Andrew Gonzalez)

Invited Speakers' Portfolio

A compilation of short biographies of each speaker, in order of the symposium program

Dr. Thomas Lovejoy
Biodiversity Chair, Heinz Center for Science, Economics and the Environment

A tropical biologist and conservation biologist, Thomas Lovejoy has worked in the Amazon of Brazil since 1965. From 1973 to 1987 he directed the World Wildlife Fund-U.S., and from 1987 to 1998 he served as Assistant Secretary for Environmental and External Affairs for the Smithsonian Institution in Washington, D.C. He was the World Bank's Chief Biodiversity Advisor and Lead Specialist for Environment for Latin America and the Caribbean and Senior Advisor to the President of the United Nations Foundation. He served as President of the Heinz Center for Science, Economics, and the Environment from 2002 and 2008, and moved to the newly created Heinz Center Biodiversity Chair in August 2008.

Dr. Lovejoy conceived the idea for the Minimum Critical Size of Ecosystems project, he originated the concept of debt-for-nature swaps, and he is the founder of the public television series Nature. In 2001 he was awarded the prestigious Tyler Prize for Environmental Achievement and in the 2008 BBVA Foundation Frontiers of Knowledge Award. Dr. Lovejoy served on science and environmental councils or committees under the Reagan, Bush, and Clinton administrations. He received his B.S. and Ph.D. (biology) degrees from Yale University.

Dr. Joël Houdet
Consultant, Accountants@Law & President, Synergiz

An expert in environmental biology and accounting, Joël Houdet is in charge of the project of integrating biodiversity into business strategies within the nonprofit Orée. Founded in 1992, Orée seeks to develop a collective reflection and to apply concrete solutions for integrated environmental management at the landscape level. Before joining Orée, Joël Houdet studied science and management on three different continents, including at the University of Adelaide and Monash University in Australia, at Rhodes University in South Africa, and with the Groupe Supérieur de Commerce de la Rochelle in France. He has also worked for the French Development Agency and within an accounting firm, where he gained extensive knowledge on the connection between economics, accounting, taxation, and ecosystems.

John Finisdore
Associate, World Resources Institute (WRI)

John Finisdore is an Associate at the World Resources Institute (WRI), a nonprofit organization that works with business, government and civil society to confront urgent environmental challenges through projects in global climate change, sustainable markets, ecosystem protection, and environmentally responsible governance. He leads WRI's Business & Ecosystem Services Project that is advancing business strategies, markets, and policies that align corporate performance with ecosystem stewardship. At WRI, he built the Business & Ecosystems Leadership Group, coauthored the Corporate Ecosystem Services Review, and is working on several ecosystem valuation, agriculture, and forestry initiative. John Finisdore has years of field experience in Central America, Indonesia and the South Pacific where he worked at the intersection of economic development and the environment. His sector portfolios include conservation, poverty reduction, small enterprise development, supply chains, and agriculture, and forestry.

Dr. Jean-Pierre Revéret
Professeur, Département stratégie, responsabilité sociale et environnementale, École des sciences de la gestion, UQAM

An environmental economist, Jean-Pierre Revéret has been a professor in the Department of Strategy and Social and Environmental Responsibility, in the School of Management Sciences at UQAM since 1979. He specializes in the field of sustainable development and natural resource management, focusing specifically on issues combining the environment, socio-economic factors and biodiversity. Jean-Pierre has held numerous positions since obtaining his Ph.D. in Economics at the University of Clermont-Ferrand in France. Notable among these, through an inter-institutional loan, he was Director of the Department of Environmental Management at the International University of the French Language for African Development (Senghor University) in Alexandria (Egypt) in 1992 and 1993. As Deputy Director of the International Academy of the Environment in Geneva, he was responsible for developing and coordinating programs specifically related to sustainable development, climate change, biodiversity, trade and the environment. Jean-Pierre Revéret's wide scope of expertise has allowed him to collaborate with UNESCO, the United Nations Conference on Trade and Development (UNCTAD), the World Bank, CIDA, and Environment Canada.

Dr. Elena Bennett
Assistant Professor, Department of Natural Resource Sciences & McGill School of Environment

Elena Bennett is an Assistant Professor at McGill University in the Department of Natural Resource Sciences and in the McGill School of Environment. She received her Ph.D. in Limnology and Marine Sciences from the University of Wisconsin, where she also worked as a postdoctoral researcher from 2002 to 2005. Currently, research in her lab centers around how different types of ecosystem services interact across the landscape and how to manage landscapes to provide multiple ecosystem services. Research includes the trade-offs between agricultural production and water quality, ecosystem services in urban areas, development of indicators of beneficial management practices, and the history and future of agriculture in southwestern Québec. Elena Bennett was a major contributor to the Millennium Ecosystem Assessment and has published many papers on ecosystem services in major international journals.

Dr. Pedro Peres-Neto
Associate Professor, Department of Biology, UQAM

Pedro Peres-Neto is an Associate Professor in the Department of Biology. He received his Master's degree from Federal University of Rio de Janeiro (Brazil) and his PhD degree in Zoology at University of Toronto. After participating in a postodoctoral project with the University of Québec at Trois-Rivières and the University of Montréal, he became an Associate Professor in the Department of Biology at University of Regina in 2005, before transferring to UQAM a year later. His research interests are related to community and aquatic ecology. By combining observational and quantitative approaches, Pedro aims to determine how distinct factors (species level-traits, habitat choice, landscape ecology, species interactions, etc.) contribute to the assembly of aquatic communities. He has recently obtained a grant from the Ouranos Consortium to direct a research project, in collaboration with the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) and the Ministère des Ressources naturelles et de la Faune (MRNF), that aims to measure the effects of climate change on the biodiversity of Québec

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Dr. Christopher Buddle

Associate Professor of Insect Ecology, Department of Natural Resource Sciences, McGill University

Christopher Buddle is an Associate Professor of Insect Ecology in the Department of Natural Resource Sciences at McGill University (MacDonald Campus). His research interests are varied, from canopy ecology to integrated pest management and biodiversity of arthropods in Arctic Canada. He is interested in understanding the links between habitat features, ecosystem processes and arthropod biodiversity. Christopher Buddle currently leads the Northern Biodiversity Program, a collaborative research initiative that aims to document changes in Canada's northern arthropod fauna and to evaluate the effects of ecological changes on the abundance and diversity of arthropods. Christopher Buddle collaborates with the University of Québec at Rimouski on research about terrestrial arthropods in high arctic food webs on Bylot Island.

Dr. Andrew Gonzalez

Director of QCBS; Associate Professor and Canada Research Chair in Biodiversity, Department of Biology, McGill University

Andrew Gonzalez, Director of the Québec Centre for Biodiversity Science, is an Associate Professor and Canada Research Chair in Biodiversity in the Department of Biology at McGill University. He obtained his PhD in Biology in 1998 from Imperial College, London. He then spent six months as a postdoctoral researcher at the University of Paris VI, in France, before accepting an Assistant Professor position there for four years. In September 2003 he moved to McGill University. Trained as a community ecologist, Andrew Gonzalez now works on three major themes: 1) the evolutionary ecology of biodiversity loss in changing environments, 2) the link between biodiversity and ecosystem functioning in fragmented landscapes, 3) the socioeconomic drivers of biodiversity change, in particular the impacts of economic inequality. He has also combined experimental and theoretical methods to address the problem of antibiotic resistance in pathogenic microbes.

Douglas Hyde

Executive Director of Nature Serve Canada

Douglas Hyde is the Executive Director of NatureServe Canada. Prior to joining Nature Serve Canada, he worked for Environment Canada where he served as co-chair of Canada's National Recovery Working Group under the RENEW (Recovery of Nationally Endangered Wildlife in Canada) program, and as chair of the federal government's Interdepartmental Policy Committee on implementation of the Species at Risk Act (SARA). Additionally, Doug oversaw the Recovery Information Management System, a web-based system to track the development of more than 350 recovery strategies for species at risk, during his time as Environment Canada's Chief of Recovery. As the former National Coordinator of Canada's Habitat Stewardship Program for Species at Risk, he was responsible for managing $10 million annually to support more than 150 conservation projects across Canada, for which he developed a web-based project management system. Mr. Hyde has also been involved in a number of other projects over the years, including creating the first edition of the Canadian Biodiversity Information Network (CBIN), facilitating discussions regarding the North American Biodiversity Information Network, and creating a web-based registry under the Canadian Endangered Species Protection Act, a precursor to SARA's public registry. For the Commission for Environmental Cooperation, he helped to establish the North American Bird Conservation Initiative and has supported the North American Marine Protected Areas Network.

Dr. Dominique Berteaux
Professor in Biology at the Université du Québec à Rimouski (UQAR), Director of the BioNord research group

Dominique Berteaux is a professor in Biology at the Université du Québec à Rimouski and an expert in conservation and mammalogy. His area of expertise includes mammalian ecology, the functioning of northern ecosystems, and biodiversity conservation. He holds the Canada Research Chair in Conservation of Northern Ecosystems, whose primary focus is to better understand the functioning of northern ecosystems as well as the impacts of anthropogenic factors. He is also the Director of the BioNord research group, created in 2002, and interested in the diversity and conservation of northern ecosystems, which are becoming increasingly threatened by problems associated with global change. Dominique Berteaux has played a major role in the development of the CC-Bio project, the first project on biodiversity and climate change supported by the Ouranos consortium.

Dr. Alain Cuerrier
Associate Professor, Department of Biological Sciences,
Institute for Research in Plant Biology;
Botanist, Montréal Botanical Garden

Alain Cuerrier is a botanist at the Montréal Botanical Garden and an Associate Professor in biological sciences within the Institute for Research in Plant Biology (*Institut de Recherche en biologie végétale. IRBV*), an organization founded by the Université de Montréal and the City of Montréal. Alain Cuerrier specializes in ethnobiology, ethnozoology and ethnobotany. Specifically, he participate in studies regarding folk classifications, medicinal plants of the First Nations of Canada, such as antidiabetic and potentially antioxidant plants, and the traditional knowledge of the Inuit of Nunavik and the Cree of Québec. Alain Cuerrier supervises numerous graduate students in research projects related to plant biology at both the molecular and ecosystem levels.

Anouk Simard
Biologiste, Service de la biodiversité et des maladies de la faune, Ministère des ressources naturelles et de la faune

Anouk Simard has worked as a biologist for the Department of Biodiversity and Wildlife Disease of the Ministry of Natural Resources and Wildlife/Wildlife sector (*Service de la biodiversité et des maladies de la faune du Ministère des ressources naturelles et de la faune, MRNF/secteur faune*) since 2009. She recently completed a Ph.D. in the Department of Biology at Laval University, and she holds a B.Sc. degree in Environmental Science from McGill University. For her doctoral research, Anouk studied with the Centre for Northern Studies (*Centre d'études nordiques, CEN*) the effect of environmental variation on the demography and life history of white-tailed deer on Anticosti Island. She tested management methods for reducing deer density in order to promote plant regeneration. Anouk Simard has participated in research projects on topics including the diet of birds of prey in Saskatchewan (with McGill University), the reproductive success of waterfowl (with Ducks Unlimited), and biodiversity in agricultural areas (with Purdue University in Indiana). Anouk Simard also worked with the Wildlife Conservation Society on the conservation of riparian habitats in Oregon, California and Wyoming, and she participated in an internship in Burkina Faso, where she studied a range of environmental issues. Her research interests include wildlife management, plant-herbivore relationships, forest ecology, population dynamics, and ecosystem modeling. Currently, Anouk Simard is focused on invasive alien species, climate change, and biodiversity loss. She is writing the Strategy and Action Plan of the MRNF on exotic species, and she coordinates and participates in various research projects related to this strategy.

Mara Kerry
Director of Conservation, Nature Canada

Mara Kerry is the Director of Conservation at Nature Canada. She has an undergraduate degree in International Development Studies and a graduate degree in Forest Ecology from the University of Toronto. Mara Kerry joined Nature Canada in April 2000 to manage and develop the organization's international program in conjunction with BirdLife International. She is now leading the conservation team with a mix of passion and solid scientific understanding. Previously, she worked as a consultant with Environment Canada's Environmental Adaptation Research Group on climate change issues and with the Commission for Environmental Cooperation on the development of region-wide action plans for chemical management in Canada, Mexico and the USA.

Sylvie-Nuria Noguer
Senior Manager, Corporate Responsibility and Sustainable Development, Samson Bélair / Deloitte & Touche

Sylvie-Nuria Noguer is Senior Manager in Deloitte's Sustainability and Climate Change team in Montréal. She has 19 years of experience in project management, advisory and audit services in the field of environment and sustainable development. She provides advisory, training, facilitation and audit services in corporate social responsibility strategy, management and reporting, to private companies in different sectors (oil & gas, energy and utilities, mining, tourism and air transportation, automotive, retail, consumer business), as well as to public organizations. She has contributed to the Canadian Business and Biodiversity Council since its creation and has been involved in the development of the first compendium of Canadian companies' good practices in biodiversity, launched in June 2010 and in the Canadian business and biodiversity guidelines. Sylvie Noguer has an engineering degree in general mechanics, with a specialization in psycho-sociology of organizations. She has a master's degree in business administration and a master's degree in environmental engineering and management from the Ecole Nationale Supérieure des Mines de Paris. She is also an accredited mediator by the Institute of Mediation and Arbitrage of Québec.

Peigi Wilson

Lawyer and independent consultant

Peigi Wilson has worked for the United Nations Environment Program, the Assembly of First Nations, the Canadian Government and various Indigenous governments and organizations. She is presently an independent consultant specializing in indigenous and environmental law and policy. Peigi serves on the Board of Directors of the Centre for Indigenous Environmental Resources and is a National Trustee with the Canadian Parks and Wilderness Society. She has an honours degree in History and Political Science, a Bachelor of Law, and a Master of Laws. Peigi is Métis. She lives at Crow Lake, Ontario.

Daniel Hodder
Division Head, Strategic Management - Research and Development, Management of large parks and greening, City of Montréal

Daniel Hodder has twenty-five years of experience in the field of sustainable urban development. He holds a BA in Anthropology and an MA in Urban Planning. Since 2002, he has worked as section chief in the Department of large parks and urban nature for the City of Montréal. He is responsible for the development and implementation of the policy of protection and enhancement of natural environments, which aims to increase the area of protected areas on the island of Montréal through the implementation of conservation projects and coordination of the negotiation process, which requires special skill to resolve complex issues and harmonize different interests. In 2005, he completed training in negotiation and mediation at the Consensus Building Institute of Massachusetts Institute of Technology.

Jean Lemire

Biologist, oceanographer, and filmmaker,
Fondation SEDNA

Jean Lemire is a biologist, oceanographer, and filmmaker. He was born in Drummondville, Québec and studied biology at universities in Montréal and Sherbrooke. His first scientific research focused on marine mammals, in particular humpback whales near the Mingan Islands and Hawaii. His first cinematographic works, beginning in 1987, showed a growing interest in the oceans and their wildlife. Jean Lemire has since emerged as a filmmaker and director of numerous documentaries for cinema and television. From 2002 to present, he has led a series of scientific and cinematographic expeditions aboard his ship Sedna IV, notably the Antarctic Mission (*The Last Continent*, 2005). The goal of these expeditions is to raise public awareness about global warming and about the urgency to take action to preserve the planet. He created the Sedna Foundation, whose mission is to promote environmental action through education, adventure, and research. Jean Lemire has received numerous awards and prizes, such as the Gold Medal of the Royal Canadian Geographical Society (2004), the Canadian Environment Award (2007), and most recently, the Midori Biodiversity Award, awarded during the COP-10 biodiversity meeting in Nagoya, Japan (2010).

Michel Loreau
Professor and Tier 1 Canada Research Chair in theoretical ecology, Department of Biology, McGill University

Michel Loreau is a Professor and Canada Research Chair in theoretical ecology in the Department of Biology at McGill University. After receiving his Ph.D. from the Free University of Brussels (ULB, Belgium), he was research assistant and senior research assistant for the National Fund for Scientific Research (Belgium), assistant lecturer and lecturer at the Free University of Brussels, program manager at the Science Policy Office (Belgium), and professor at Pierre and Marie Curie University (Paris, France). Michel Loreau has participated in the editorial boards of the leading ecology journals, including *Ecology Letters*, *The American Naturalist*, *Ecology*, *Ecological Monographs* and *Oecologia*. He is currently a member of the editorial board of *PLoS Biology* and of the advisory board of *Frontiers in Ecology and the Environment*. He is also head of the Section *Community Ecology and Biodiversity* of the Faculty of 1000. Michel Loreau has served on numerous national and international scientific committees, such as the Scientific Committee of DIVERSITAS, the international program of biodiversity science, and the International Steering Committee of the consultative process towards an International Mechanism of Scientific Expertise on Biodiversity. His current research aims to make a theoretical synthesis between the widely separate fields of ecosystem functioning, community organization, and evolution of species. His primary research theme is the relationship between biodiversity and ecosystem functioning.

Oral Presentations Timetable

Concurrent student presentations

December 1st, 2010

Session 1A: Host and parasite relationship

9:30-9:45	Dargent F. Mixed-species group formation as potential mechanism of parasite resistance for guppies
9:45-10:00	Jensen H. Changes in the resistance of a traditional crop variety conserved on –farm to a fungal foliar pathogen
10:00-10:15	Frankel V, Invasive snails bring parasites to the Panama Canal: New tests for ecology and evolution
10:15-10:30	Lauron-Moreau A. Caractérisation temporelle du complexe d'espèces de l'oïdium des chênes

Session 1B: Restoration & Conservation

9:30-9:45	Garver G. A preliminary survey and overview of ecological restoration in Québec
9:45-10:00	Rayfield B. Incorporation of consumer-resource spatial interactions in reserve design
10:00-10:15	Byun C. Restoration of native plant cover to suppress early invasion of common reed
10:15-10:30	O'Farrill G. Resources beyond borders: fragmented resources connectivity reveals the effectiveness of a protected area in Mexico

Session 1C: Response to changing environment

9:30-9:45	Friesen C.N. To breed or not to breed: does low oxygen affect sex hormones in an African cichlid?
9:45-10:00	McNeil G. Breathing and breeding: The role of an environmental stressor (low oxygen) is driving divergence in a sexually selected trait
10:00-10:15	Albert C.H. Sampling in ecology and evolution – Bridging the gap between theory and practice

Session 2A: Invasive species

11:10-11:25	Simard A. A new mention of an aquatic invasive species at the northern limit of its range: dynamics of an Asiatic clam population in association with power plant in the Saint-Lawrence
11:25-11:40	Trumpickas J. Impacts of introduced predatory fishes in Ontario lakes: Assessing the roles of evolutionary naiveté and predator richness
11:40-11:55	Nyboer E. Ecological divergence in the commercially fished nile perch (*Lates niloticus*) in Lake Nabugabo, Uganda
11:55-12:10	Kipp R. Impact of an invasive fish on benthic communities in the upper St. Lawrence River

Session 2B: Valuation

11:10-11:25	Briceno T. The integration of ecological principles in environmental valuations

11:25-11:40	Dupras J. Combiner l'évaluation contingente et le choix d'options répétées dans un contexte agricole. L'étude du Ruisseau Vacher dans la région de Lanaudière
11:40-11:55	Hagan J. Comment parle-t-on de la biodiversité forestière ? Valeur monétaire, valeur intrinsèque et discours hybrides.
11:55-12:10	Roy, R. The willingness to pay for biodiversity: a comparative approach of methods

Session 2C: Behavioral Ecology

11:10-11:25	Reyna-Hurtado R. Searching in heterogeneous and limiting environments: Foraging strategies in the white-lipped peccary (*Tayassu pecari*)
11:25-11:40	Gray S. Fish in muddy waters: the effect of turbidity on fish phenotypes and persistence
11:40-11:55	Bonnell T. Linking landscapes to disease: red colobus foraging behavior and its implications for the spread of disease in logged forests
11:55-12:10	Bergeron P. Anticipatory and response behaviors to a single predictable pulse resource drive population dynamic in eastern chipmunk (*Tamias striatus*)

Session 3A: Plant diversity and ecosystem function

15:50-16:05	Isbell F. How many species are needed to maintain functional grassland ecosystems?
16:05-16:20	Girard M.

	Influence de la biodiversité florale dans la mosaïque des cultures de *Vaccinium* sur les performances des colonies d'abeilles
16:20-16:35	D'Astous A.
	Approche par groups fonctionnels pour l'évaluation du succès de restauration d'une tourbière – suivi de 10 ans

Session 3B: Urban biodiversity

15:50-16:05	Asch P.
	Efforts communautaires pour protéger et accroître la biodiversité autour de Montréal
16:05-16:20	Mimouni E.
	Biodiversité des communautés invertébrées des étangs urbains de l'île de Montréal
16:20-16:35	Latour R.
	Le champs des possibles: promoting an urban biodiversity reserve

Session 3C: Genetics and phylogeny

15:50-16:05	Villaverde T.
	Cryptic diversity and phylogeography of *Carex capitata* (Cyperaceae): a bipolar species complex
16:05-16:20	Babineau M.
	Phylogeny and biogeography of endangered Malagasy legumes: the genus *Delonix*
16:20-16:35	Moses M.
	Genetic diversity of hot pepper (*Capsicum chinensis*) in the Neotropics
16:35-16:50	Gagnon E.
	Testing variable chloroplast and nuclear markers in *Caesalpinia sensu lato* (Caesalpinioideae)

December 2nd, 2010

Session 4A: Simulation and modeling

11:00-11:15 Haller B.
Speciation in complex habitats

11:15-11:30 Sapijanskas J.
Cascading extinctions, functional complementarity, and selection in two-trophic level model communities: a trait-based mechanistic approach

11:30-11:45 Rodrigue N.
Improving the computational speed of phylogenetic model ranking with data-augmentation-based thermodynamic integration

Session 4B: Community dynamics

11:00-11:15 Low-Décarie E.
The effect of elevated CO_2 on growth and competition in experimental phytoplankton communities

11:15-11:30 Velghe K.
Phosphorous as a driver of diatom and cladoceran diversity across lakes and over time

11:30-11:45 Pedruski M.
Dynamics in competitive metacommunities: fitness inequality and niche differentiation

11:45-12:00 Jacobson B.
Quantifying and disentangling dispersal in metacommunities: How close have we come? How far is there to do?

Presentation Abstracts

In alphabetical order of presenting author

Sampling in ecology and evolution - Bridging the gap between theory and practice

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Sampling is a key issue in ecology and evolution. The importance of developing a sampling design tailored to specific questions has already been discussed in the literature and has provided useful tools and recommendations to sample and analyse ecological data. However, sampling issues are often difficult to overcome in ecological studies due to apparent inconsistencies between theory and practice, often leading to the implementation of simplified sampling designs. Moreover, we believe that classical sampling principles which are based on estimation of means and variances are insufficient to fully address many ecological questions that rely on estimating relationships between a response and a set of predictor variables over time and space. Our objective is thus to highlight the importance of selecting appropriate sampling space and sampling design, and using prior knowledge of the study system to estimate models or complex parameters. Using a simulation study we reveal how the selection of the space, in which the sampling is designed, influences the patterns that can be ultimately detected. We also demonstrate the inefficiency of common sampling designs to reveal response curves between ecological variables and climatic gradients. Response-surface methodology, which has rarely been used in ecology, turned out to be much more efficient than more traditional methods. A use of prior knowledge, simulation studies and model-based designs can help defining appropriate sampling designs. However, making inferences

while fulfilling requirements of both sampling theory and field work logistics also requires the development of methods to estimate unbiased nonlinear ecologically relevant parameters.

Efforts communautaires pour protéger et accroître la biodiversité autour de Montréal.

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Directeur d'Héritage Laurentien, Membre des amis de Meadowbrook
Partenaire pour le parc Écologique de l'Archipel

D'année en année, les milieux naturels autour de Montréal sont soumis à de multiples pressions qui résultent en une perte de milieux et, subséquemment, une réduction de la diversité biologique. Sans nécessairement posséder toutes les connaissances précises sur la diversité biologique de chaque milieu touché, les résidents notent ces pertes et se regroupent au sein d'organismes communautaires afin d'agir. À Montréal, les organismes agissent tant à l'échelle de sites spécifiques qu'au niveau de la mise en place de concepts de mise en réseau de milieux naturels à la grandeur de la région métropolitaine de Montréal. Que font-ils? Quelles les considérations associées à leurs actions? Quels sont les impacts de leurs projets sur la diversité biologique? La présentation suivante abordera ces questions en introduisant quelques-uns des projets promus par les organismes communautaires de la région dont tout particulièrement :

1. La création d'un concept de trames et ceintures vertes et bleu du grand Montréal
2. La création d'un parc écologique touchant l'ensemble de l'Archipel de Montréal appuyé par quelques 80 organismes communautaires incluant une douzaine de villes et arrondissements et
3. Quelques mesures spécifiques dont la protection du terrain Meadowbrook, dans le sud-ouest de Montréal et diverses mesures de contrôle d'espèces envahissantes.

La présentation terminera en abordant la question de liens pouvant être tissés entre les scientifiques et les organismes communautaires afin que ces deux groupes, travaillant trop souvent séparément l'un de l'autre, puissent s'aider mutuellement et ainsi maximiser la diversité biologique autour de Montréal.

Phylogeny and biogeography of endangered Malagasy legumes: the genus *Delonix*

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The Leguminosae is the angiosperm family with the highest number of genera endemic to Madagascar. One of these is *Delonix*, which comprises eleven species: two occur in East Africa and the nine others are endemic to Madagascar. All of the Malagasy species have a precarious conservation status. However, the unresolved phylogenetic relationships within the genus limit the implementation of effective conservation actions. This study aims to clarify the phylogenetic status of *Delonix*, which is considered to be paraphyletic with regards to two monospecific genera (*Lemuropisum edule* and *Colvillea racemosa*). Our analyses are based on sequences from the chloroplast *trnL-F* region, the ribosomal *ITS* and the low copy nuclear gene *Leafy*. The matrices are analysed separately and in a combined analysis using parsimony and Bayesian methods. Results show the two nuclear matrices to be incongruent with each other, suggesting conflicting gene histories or paralogy. The *Delonix/Colvillea/Lemuropisum* clade is well supported and the genus *Delonix* is considered paraphyletic due to the nested position of *L. edule*. The exclusion of *C. racemosa* by the *trnL-F* and *ITS* analyses, and the phylogenetic relationships between the *Delonix* species, support the classification based on morphological studies. The African *Delonix* occur together in a distinct clade illustrating a certain genetic uniqueness, although all the analyses suggest a secondary origin for the African species. Many species are not supported as

monophyletic suggesting high intraspecific allelic variation consistent with gene flow. Therefore, conservation efforts should focus on the protection of the three naturally diverse areas of *Delonix* in Madagascar.

Anticipatory and response behaviors to a single unpredictable pulse resource drive population dynamic in eastern chipmunk (*Tamias striatus*)

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Our aim was to investigate how patterns of activity, reproduction and survival are affected by variations in availability of beech seeds, the main storable food item for chipmunks on the study site. Our eastern chipmunk population has been monitored systematically since 2005, on a 25ha study site located in a deciduous forest of southern Québec. We found that chipmunks were able to anticipate fall seed production of beech trees. During summer, chipmunks stopped above ground activity if they anticipated no seed production (mast) the upcoming fall. In this context, they remained underground until the next spring (from July to May). Reproduction was also completely inhibited during springs following no mast falls. On the contrary, when chipmunks anticipated fall masting of beech trees, they remained active during the summer and initiated reproduction to synchronized juvenile emergence with fall seed availability. They also reproduced the following spring. Capture-mark-recapture analyses revealed that there was no significant effect of beech seed production on survival, except for juveniles during a year of very low beech seed production. Also, we found that chipmunk population growth was mainly driven by beech seed production, through a direct relationship between beech seed production and chipmunk reproduction. Our results suggest that anticipation and plastic behaviors of chipmunks allow them to maintain high survival when resources are limited and reproduce only

during mast years. Although chipmunks can consume a variety of food items, such results highlight the importance to identify key species that drive animal population growth.

Linking landscapes to disease: red colobus foraging behaviour and its implications for the spread of disease in logged forests

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A case study is presented examining the effects of logging on the transmission of disease in a population of red colobus monkeys. In this study we use an agent-based modelling approach to simulate red colobus foraging behaviour utilizing extensive observational data. With this framework we are able to alter the simulation landscape, in this case the distribution of red colobus resources, to determine disease related impacts. We find that there is an optimal distribution of resources which facilitate the spread of disease within the simulated population. The characteristics of this distribution are similar to logged areas within our study site.

The integration of ecological principles in environmental valuations

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As environmental valuations become more widespread, their accuracy and their relevance to the discipline of ecology need to be improved. In this study, it is argued that analyzing the process of environmental valuations from an ecological perspective will help to improve interdisciplinarity. In essence, environmental valuations involve the translation of ecological functions into monetary values. However, given the different natures of these disciplines, important information

can be lost in translation. Ecological assessments focus on functions, structures and processes that make ecosystems resilient. Economic valuations assign value as expressed and interpreted by consumers in a market setting. The aim of this study is to propose more interdisciplinary approaches by analyzing the integration of ecological principles in environmental valuations. The research begins with a characterization of the epistemologies of ecology and economics and the principles that they adhere to. The second part is an analysis of the integration of ecological principles in different valuation methods using illustrative examples from a case study of watershed agricultural ecosystems in Québec. The inclusion of supporting functions and resilience parameters are used to measure adherence to ecological principles. Production-side valuations such as productivity change measures and defensive expenditure costs will be compared to demand-side valuations such as stated preference surveys. Results as well as framework limitations will be discussed and analyzed in terms of the ecological principles proposed.

Restoration of native plant cover to suppress early invasion of common reed

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Wetlands are essential habitats to support biodiversity, but this function is threatened by invasive plants. Restoring diverse native plant communities could be an effective countermeasure to prevent early plant invasion that often follow disturbances. This approach, however, raises many challenging questions about species choice, species combination, and habitat restoration. Ecological principles from community ecology and invasion theory can possibly guide restoration practices better than conventional 'trial and error' approach. The exotic *Phragmites australis* (common reed) is one of the most notorious wetland invaders in North America and causes a remarkable decrease in biodiversity in invaded ecosystems. Our

overall objective is to assess the effectiveness of restoring diverse native plant communities to suppress early invasion of *P. australis*. Based on inhibition succession and competitive hierarchy theories, we first hypothesize that plant cover that establishes early and fast with tall and large leaf area and high biomass will be effective to control *P. australis*. We determine the effect of 11 native plants' cover traits on invasion resistance in mesocosm experiments. Preliminary results suggest that fast growing annual plants, such as *Bidens cernua,* are necessary to control seedling establishment in the first year. In following year, some perennial plants, such as *Scirpus cyperinus,* reduced the number of emerging *P. australis* significantly. In addition, large scale field experiment is ongoing to test the relationship between functional diversity and invasion resistance based on empty niche theory and limiting similarity. Our research will contribute to understanding the role of biodiversity in invasion resistance and developing effective restoration methods.

Mixed-species group formation as a potential mechanism of parasite resistance for guppies

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When forming groups, animals show a strong preference to do so with conspecifics, but mixed-species groups do occur in the wild. Mixed-species aggregations have received limited attention and although some theoretical considerations have been presented, empirical support is still scarce. Understanding the mechanisms of heterospecific group formation could illustrate why, under certain conditions, similar species coexist. The two main theories proposed for heterospecific group formation are increased predator defence when conspecifics are scarce, and reduced competition relative to monospecific groups through differential resource consumption. As a

model, we used wild populations of the Trinidadian stream fishes *Poecilia picta* (picta), *Poecilia reticulata* (guppy) and their ectoparasite *Gyrodactylus sp*. Both Poeciliid species coexist and form heterospecific shoals where their distribution ranges overlap. In this system neither mechanisms holds: at sites where heterospecific groups occur both species are highly abundant and their stomach contents are similar. Therefore we propose an alternative theory that mixed-species group formation is a mechanism for parasite resistance. We sampled three rivers in the island of Trinidad and collected 40 individuals per species at three different sites (picta only, guppy only and heterospecific shoals) per river. Our results show that guppies, but not pictas, have lower parasite burdens when in mixed shoals. By forming mixed shoals, guppies could gain similar benefits to those of equally sized monospecific groups but presumably at a lower cost due to reduced *Gyrodactylus* transmission. This is the first study to propose parasite reduction as a mechanism for mixed-species shoal formation.

Approches par groupes fonctionnels pour l'évaluation du succès de restauration d'une tourbière – Suivi de 10 ans

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La tourbière de Bois-des-Bel (BDB) a été restaurée en 1999-2000 et sa strate herbacée est beaucoup plus abondante que dans les tourbières ombrotrophes naturelles. Afin de cibler les mécanismes écologiques qui structurent cette communauté, les différentes espèces d'herbacées ont été caractérisées pour leurs traits biologiques afin de déterminer ceux pouvant expliquer le potentiel des espèces à s'établir et/ou persister sur le site. Afin d'évaluer le succès de restauration de BDB, j'ai associé des groupes fonctionnels aux 1) tourbières de référence (n=7), 2) au site de BDB avant sa restauration, 3) ainsi qu'aux différents stades post-restauration de BDB. Un inventaire de présence/absence d'espèces sur une grille systématique de ~5675 points a été effectué en 1999 (pré-restauration), 2001, 2003, 2005,

2007 et 2010 à BDB. Les herbacées ont été caractérisées pour leur statut indigène et leur habitat préférentiel au Québec ainsi que pour les traits fonctionnels suivants : cycle de vie, présence de mycorhize, préférence en eau et en lumière, etc. Les traits fonctionnels significatifs ont été identifiés par la méthode de 4ième coin alors que les groupes fonctionnels ont été déterminés à partir du groupement de Ward. Les annuelles, les espèces exotiques, les espèces qui ont des mycorhizes et qui sont associées aux habitats rudéraux arrivent à s'établir plus facilement les premières années suivant la restauration mais ne persistent pas. L'évaluation de sites restaurés à long terme est primordiale pour assurer l'efficacité écologique des méthodes employées. Mon utilisation d'une approche par traits fonctionnels pour BDB s'inscrit dans cet objectif.

Combining Contingent Valuation and Choice Experiment in an Agricultural Context. The study of Vacher brook in the Lanaudiere region (Québec)

Jerome Dupras, Jean Reveret & Jeremy Laurent-Luchetti
UQAM

This study explores, in a Québec rural context, the possibilities of combining two well-known valuation methods - the Contingent Valuation (CV) and the Choice experiment (CE) - in a single integrated assessment. The CV was used to elicit the global value that the local population attributes to a set of improvements in their environment. Three scenarios were evaluated: the progressive integration of the existing but not yet respected environmental legislation for farmers, the adoption of a fish diversity program and the adoption of a program involving more landscape aesthetic actions. The CE was used to rank each improvement independently giving a priority ordering of each component to policy-makers. During this assessment, four environmental attributes were retained: water quality in terms of hierarchical uses, diversity of landscape, and two others directly linked to biodiversity (fish diversity related to increased interest in fishing and bird diversity in terms of bird-watching interest). Results show an

interesting potential to capture the social and environmental complexity of agricultural dynamics and could constitute an efficient and practical approach for policy-makers.

Invasive snails bring parasites to the Panama Canal: New tests for ecology and evolution

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Parasites are increasingly recognized as important drivers in ecological and evolutionary processes. However, the spread of parasitic diseases by invasive species is a primary concern for public health, economic productivity and the conservation of biological diversity. Understanding the factors that drive the establishment of invasive species and facilitate the transmission of their parasites in novel communities is critical for efforts working to manage the spread of parasitic diseases by invasive species. The interaction of biological invaders with distinct abiotic and biotic factors also provides the opportunity to test a broad spectrum of hypotheses in ecology and evolution. However, a variety of biological and ecological factors may interact in concert to drive the demographic success of some exotic species. Therefore, the integration of multiple hypotheses may be necessary to adequately appreciate the complexity and address the impacts of biological invasions. Using field surveys, laboratory experiments and phylo-genetic analysis, I explore ecological and evolutionary interactions that facilitate the establishment of an invasive snail, Melanoides tuberculata, and the introduction of parasites in the Panama Canal. My results describe the frequency, diversity and distribution of parasites interacting with this invasive snail and quantify the limited reproductive affect of parasitic castration by a widespread introduced parasite, Centrocestus formosanus. This study elucidates ecological and evolutionary factors that facilitate the transmission of parasitic diseases by invasive snail hosts.

To breed or not to breed: does low oxygen affect sex hormones in an African chichlid?

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Human activities (e.g., eutrophication) are increasing the global occurrence of a widespread environmental stressor, aquatic hypoxia (low dissolved oxygen). Recent studies have demonstrated that hypoxia can interfere with reproductive processes of fish by altering embryo development, gonad formation, and sex hormone levels. The objective of this study was to investigate effects of hypoxia on sex hormone levels in the mouth-brooding African cichlid *Pseudocrenilabrus multicolor*, a fish that persists across a gradient of oxygen regimes in the field from extreme hypoxia to normoxia. We predicted variation in sex steroid levels between populations from divergent oxygen environments and tested this by (a) validating a non-invasive technique of hormone measurement and (b) quantifying variation in sex steroid levels for *P. multicolor* from a hypoxic swamp and normoxic lake site transferred to lab and held under their "home" oxygen conditions. Results of the validation study support use of a relatively new, non-lethal technique of hormone measurement. We detected no population level variation in sex hormone levels in *P. multicolor* females or in brooding frequency. These findings suggest that swamp-dwelling *P. multicolor* develop compensatory mechanisms to mitigate effects of hypoxia on sex steroid levels and frequency of reproduction. Comparative studies of *P. multicolor* and endemic cichlids from the same basin will now be used to detect endocrine disruption associated with hypoxia in narrow-ranging species.

Testing variable chloroplast and nuclear markers in *Caesalpinia sensu lato* (Caesalpinioideae)

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The genus *Caesalpinia* sensu lato (s.l.) is composed of about 150 legume species distributed across the globe, the majority of which are found in tropical dry forests. Many aspects of the classification and evolution of this group remain unclear, including generic and species delimitations. For example, while it has recently been proposed to reinstate 8 genera from within *Caesalpinia s.l.,* previous studies have failed to find solid evidence from molecular phylogenetic analyses due to insufficient variation in selected markers or to under-sampling of the group. To resolve this issue, we've conducted pilot tests on ten highly variable chloroplast markers and nine nuclear markers, allowing us to select the most useful regions for a robust *Caesalpinia s.l.* phylogeny. Currently, preliminary results from individual and combined phylogenetic analysis of 5 markers (*ITS, trnL, rps16, trnD-trnT and ycf6-psbM),* which contains some 75 species belonging to *Caesalpinia s.l,* show strong support for some of the proposed reinstated genera, while others groups appear to segregate into more clades than expected. These findings are a first step towards a revised taxonomic classification of the group, and a starting point to develop *Caesalpinia sensu lato* as a model for studying the biogeography of seasonally dry tropical forests.

A Preliminary Survey and Overview of Ecological Restoration in Québec

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Ecological restoration is an important tool for biodiversity conservation. This study presents a preliminary survey and overview of ecological restoration and related activities in Québec. The survey focuses on restoration of peatlands and wetlands; restoration of lakes and waterways; species-driven restoration; and restoration in protected areas. The methodology primarily involved searches of scientific and gray literature related to ecological restoration in Québec. Additional information was obtained through informal interviews with Québec ministries, restoration experts and non-governmental organizations. Definitions of the Society of Ecological Restoration served as a primary guide. Assessing ecological "restoration" in Québec against ecological integrity, historical fidelity, community engagement and other accepted criteria for ecological restoration yields a wide range of results. Peatland restoration following peat mining is the most sophisticated example when assessed against those accepted ecological restoration criteria. Restoration of other wetlands is less rigorous, in part because Québec lacks a no-net-loss requirement for wetlands. Species-driven restoration efforts are hampered by insufficient controls on habitat destruction or fragmentation, although most recovery plans for threatened or vulnerable species lay the groundwork for restoration. Overall, the restoration activities surveyed evince the lack of a comprehensive, consistent approach to ecological restoration in Québec. No thorough survey of ecological restoration in Québec has been conducted. This study helps fill that gap with a preliminary overview of how ecological restoration is defined and practiced in Québec. The survey could lead to a more coordinated and consistent approach to ecological restoration both within the province, and between Québec and other jurisdictions.

Influence de la diversité florale dans la mosaïque des cultures de *Vaccinium* sur la performance des colonies d'abeilles domestiques introduites pour la pollinisation.

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L'accessibilité à une flore diversifiée est très importante pour le développement des colonies d'abeilles domestiques introduites dans une culture pour offrir un service de pollinisation. Notre étude visait à déterminer l'impact de la diversité florale environnante sur la santé des colonies d'abeilles introduites dans les cultures de bleuet nain (*Vaccinium augustifolium*) et de canneberge (*V. macrocarpon*) au Québec. Les résultats suggèrent que les monocultures de bleuets nains n'offrent pas une flore adéquate pour l'élevage optimal du couvain. Les plantes qui furent le plus butinées dans cet environnement, *Alnus* et *Taraxacum*, sont déficientes en certains acides animés essentiels à l'abeille. La diminution de la surface de couvain dans les monocultures de bleuets en juin pourrait donc être expliquée par des carences alimentaires. En juillet, la flore pollinifère fut moins riche qu'en juin, mais de meilleures qualités nutritionnelles. Les taxons dominants furent les Brassicaceae, *Trifolium* et *V. macrocarpon.* Malgré la diminution de la surface du couvain dans les monocultures de bleuets, l'état de santé des colonies s'améliora lors de leur séjour dans les cannebergières du même traitement, sans toutefois atteindre le même niveau de santé que les colonies qui eurent accès à une flore davantage diversifiée pendant la même période. Cette étude aura aussi permis d'acquérir des techniques d'identification de pollen frais, une expertise rare et qui permet l'étude de la diversité pollinifère.

Fish in muddy waters: The effects of turbidity on fish phenotype and persistence

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Aquatic biodiversity is being lost at an unprecedented rate, rivalling that of tropical forests. One of the main factors driving this loss is increased turbidity; an environmental stressor that imposes behavioural, morphological, and physiological costs on fishes. Our goal is to integrate morphological, behavioural, and physiological studies to understand how fishes respond to increased turbidity. To accomplish this we are using several lines of investigation, including: (1) the response of a widespread African cichlid, *Pseudocrenilabrus mutlicolor*, to natural turbidity gradients; and, (2) the response of the Canadian Endangered Pugnose Shiner, *Notropis anogenus*, and related shiners to increased turbidity. *P. multicolor* is found over a range of turbidity, from clear swamps to turbid rivers, while *N. anogenus* have been extirpated from locations experiencing high turbidity from anthropogenic sources, suggesting that *P. multicolor* copes with this stressor while *N. anogenus* does not. We found that *P. mulitcolor* reared under turbid conditions are less active and perform fewer social behaviours than do those reared in clear water, regardless of population of origin (i.e. parents from naturally clear or turbid environments). Progressive acclimation studies, in which turbidity is increased slowly and behaviour monitored daily, revealed that schooling behaviour breaks down with increased turbidity in *N. anogenus*, but less so in *N. heterodon* (a closely related, non-threatened shiner). Both experiments show behavioural responses to turbidity, even though the turbidity levels used here were very low compared with those found in anthropogenically disturbed waters, suggesting that even minor environmental disturbance may be detrimental to aquatic biodiversity.

Comment parle-t-on de la biodiversité forestière ? Valeur monétaire, valeur intrinsèque et discours hybrides.

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Historiquement, la valeur de la forêt se résumait à la valeur économique de la seule matière ligneuse. Au cours des dernières décennies les valeurs associées à la forêt et à sa biodiversité se sont diversifiées. Afin de gérer cette pluralité, le gouvernement a recours à la participation du public. L'objectif de ma recherche était de comprendre quelles stratégies discursives les participants à la Commission Coulombe (2004) ont utilisées pour faire valoir leurs points de vue et dans quelle mesure ils ont été entendus par le MRNF. J'ai donc effectuée une analyse discursive de documents inspirée par la méthode de Fairclough (1992, 2003). Les résultats obtenus confirment que différentes valeurs sont associées à la biodiversité. Considérée comme une valeur intrinsèque par plusieurs environnementalistes, elle est perçue sous l'angle de sa valeur économique par les associations récréotouristiques et sous un angle socioculturel par les autochtones. Des alliances sont possibles entre groupes ayant des valeurs différentes dans la mesure où ils poursuivent des objectifs de protection similaires. Au terme de la Commission, les discours hybrides (Bakhtin, 1981) combinant les valeurs économique, sociale et environnementale sont valorisés comme moyen d'atteindre un consensus. Sur le terrain, ces discours hybrides peuvent être l'objet de rapports de pouvoir, de telle sorte que l'une des trois valeurs en présence pourra être survalorisée. Ces constats permettent de mieux comprendre le rôle des valeurs dans la gestion de la biodiversité et d'ainsi produire des stratégies prenant en compte la dimension sociopolitique à l'œuvre dans sa gouvernance.

Speciation in complex habitats

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It has previously been shown that adaptation to different environments, together with local competition for resources, can promote speciation. Earlier theoretical work, however, has been limited to particularly simple types of spatial structure: linear environmental gradients and spatially discrete metapopulations. This has left unaddressed effects on the propensity for speciation originating from more realistic patterns of spatial environmental heterogeneity, such as nonlinear gradients and spatially continuous patchiness. We expect such complex spatial heterogeneity to be important, given the intimate feedbacks between spatial variation, dispersal, and local adaptation. Prior work has also been divided regarding the importance of geographic isolation for the process of speciation; uniting these perspectives has been difficult because no single theoretical model has spanned the continuum from allopatry to sympatry. We have therefore extended an established spatially explicit individual-based model of speciation along linear environmental gradients, to elucidate the consequences of these more complex spatial patterns and the varying degrees of geographic isolation they cause. We confirm previous findings that intermediate levels of spatial environmental heterogeneity most strongly promote speciation. Additionally, our analysis highlights the importance of patchiness for the existence of refugia in hostile environments; such refugia give opportunities for colonization, local adaptation, and speciation. We reveal novel quantitative relationships between the propensity for speciation and spatial environmental characteristics. Finally, we discuss the implications of these findings for conservation biology and ecosystem management.

Quantifying and disentangling dispersal in metacommunities: how close have we come? How far is there to go?

Jacobson, Bailey & Peres-Neto, P.R.
Université du Québec à Montréal

Much of ecological research centers around discovering the underlying factors for species distribution; three such factors are of central importance: local environment, landscape features and dispersal. While all have been simplified in the past, the recent increase in metapopulation and metacommunity research makes being able to quantify dispersal all that much more necessary. In order to increase our knowledge about metacommunities in the ‘‘real world’’, it is clearly time to start thinking critically about whether and how the methods that are currently available for measuring dispersal within metapopulations can be adapted. The goal of this contribution is to present and argue the technical difficulties involved in measuring dispersal within metacommunities through: (1) discussing the merits and pitfalls of some potential direct and indirect methods for studying the effects of dispersal at the metapopulation and metacommunity level; (2) discuss the types of questions that can be tackled at the metacommunity level in light of methodological decisions; and (3) make the point that the technical difficulties of measuring dispersal for multiple species may leave us with little other options than using indirect methods to estimate dispersal in metacommunities.

Changes in the resistance of a traditional crop variety conserved on-farm to a fungal foliar pathogen

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Traditional varieties of crop plants are often conserved in seed banks (*ex situ*) as a reservoir of genetic diversity, e.g., for use in breeding. When this is done, the process of selection and adaptation to fungal pathogens in their native environment is halted. Because plants and pathogens co-evolve via gene-for-gene interactions it has been suggested that it may be preferable to conserve crop species in their native environment (*in situ*), as this is expected to ensure continued adaptation to emerging pathogen strains. To our knowledge, this hypothesis has never been explicitly tested. Here we examine whether populations of a traditional variety of barley from Morocco (*Hordeum vulgare* ssp. *vulgare*) conserved *ex situ* for 23 years show a decline in resistance to the endemic pathogen species (powdery mildew, *Blumeria graminis* f.sp. *hordei*) compared with populations of the same variety of barley that have been continuously cultivated (conserved *in situ*) in the region. We used in vitro assays and field trials to assess the resistance of the two collections of *H. vulgare.* Contrary to expectations, the *ex situ*-maintained germplasm did not show a significant decrease in resistance to eight specific isolates of powdery mildew. In field trials, however, where plants were exposed to mixed populations of naturally occurring mildew inocula (as opposed to inoculation with specific isolates) there were collection-specific changes in resistance. These findings are interpreted with respect to the question of continued co-evolution between host resistance and the population of *B. graminis* pathotypes in the environment.

How many species are needed to maintain functional grassland ecosystems?

Forest Isbell and Michel Loreau
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Biodiversity is rapidly declining worldwide. There is consensus that species extinctions can lead to subsequent declines in ecosystem functioning and ecosystem services, but it remains unclear whether this will happen after few or many species become extinct. If species are functionally redundant, then most species extinctions will not decrease ecosystem functioning, and few species could sufficiently provide ecosystem services. Alternatively, if species are functionally unique, then most species extinctions will decrease ecosystem functioning, and most species will be needed to sustain the provision of ecosystem services. Here we found that although relatively few grassland plant species promoted ecosystem functioning in a single functional context (i.e., when one ecosystem function was measured in one set of environmental conditions), most of the species promoted ecosystem functioning when many times, places, functions, and global change scenarios were considered. Specifically, while only ~4 species promoted one function during one year at one place under one global change scenario, 120 of the 157 species included in these studies promoted ecosystem functioning in at least one context. Furthermore, our results suggest that more species would have promoted ecosystem functioning if these studies had included more species, and that all species would have promoted ecosystem functioning if more times, places, functions, and changes were considered. Thus, we conclude that grassland plant species are functionally unique. This implies that these species are unique enough to stably coexist, and that all of these species are needed to maintain ecosystem multifunctionality at large spatiotemporal scales in a changing world.

Impacts of an invasive fish on benthic communities in the upper St. Lawrence River

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An invasive alien fish, the Eurasian round goby (*Neogobius melanostomus*), has become abundant throughout the lower Great Lakes–St. Lawrence River system. We examined the potential for this benthivorous predator to alter invertebrate community diversity and algal biomass on cobble substrates. During the summers of 2008 and 2009, macroinvertebrates and benthic algae were sampled across sites with varying goby densities in the upper St. Lawrence River. Data from sites in 1994 and 2004–2006 were also available for comparisons with pre-invasion conditions. Macroinvertebrate community composition varied significantly among samples grouped into categories based on goby density and time since invasion. Macroinvertebrate diversity and dominance by larger-bodied taxa declined with increasing goby density. The density and biomass of dreissenid (zebra and quagga) mussels did not vary consistently with goby density, in contrast to studies in the Great Lakes. The biomass of all non-dreissenid taxa was negatively correlated with increasing goby density across sites. Negative effects were most pronounced on the density and biomass of gastropods. Benthic algal biomass increased with goby density across sites, suggesting a trophic cascade driven by negative impacts on gastropods and other algivores. Our study suggests community-level and ecosystem-level impacts of the expanding goby population in the St. Lawrence River.

Le Champ des Possibles: promoting an Urban Biodiversity Reserve

Roger Latour (Writer. Photographer), Sara Finley (Water resources engineer), Marke Ambard (Environmental sociologist), Thierry Martin (Citizen activist), Owen Mc Swiney (Architect), Alexander Kenny (Economist. Associate fellow CISDL)

Les Amis du Champ des Possibles is a non-profit group which was formed to preserve an existing urban green space as an Urban Biodiversity Reserve. The site is located in the Mile End district of Montréal and forms an important link in the city's bio-corridor along the train tracks. Since the closure of a freight yard in the mid 1980s, the site has developed under its own guidance. Species have train-hopped from all over the North American continent (and internationally, via the Carmelites Convent's adjoining walled garden). The wind, birds, and animals (humans included) have also brought seeds here: the site is now one of the most biodiverse sites in central Montréal. Our group has compiled a list of over 150 observed species, and we contend that this zone and others like it have the potential to provide important ecological services and to increase urban biodiversity overall. The members of our voluntary group come from a variety of disciplines including: biology; horticulture; architecture; urbanism; landscaping; science; art; journalism; photography; and design. A major interest is how we can analyze and exhibit the site, so as to shift perception regarding its current value and future potential. We also organize educational activities: the historic and botanical tours offered by specialists demonstrate a keen public interest in the potential of this space. We have established a relationship, as an advisory committee, with the municipal government of the Plateau arrondissement. We are working towards the classification of the site as a scientific pilot project for researching urban biodiversity and alternative methods of soil decontamination. The site represents a concrete example for considering how this type of facility could be established and operated in Montréal.

Développement d'outils moléculaires pour évaluer la diversité des saules du Québec

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Les saules, *Salix sp.*, est un genre diversifié qui comprend environ 450 espèces. On les trouve presque partout dans l'hémisphère nord sauf dans les zones désertiques et tropicales. Au Québec, les espèces du genre *Salix* représentent près de 30% de la flore ligneuse indigène. Cependant, la fiabilité de l'identification des différentes espèces est faible étant donné que la reconnaissance est fondée sur des caractères morphologiques souvent difficiles à visualiser. La présente étude a pour objectif d'adapter des outils moléculaires permettant de distinguer les espèces de *Salix* entre elles, d'obtenir une mesure de leur diversité génétique et d'établir une phylogénie du genre en Amérique du Nord. L'extraction de l'ADN génomique obtenu à partir d'échantillons récoltés sur plus de 50 espèces en collection à l'arboretum du Jardin botanique de Montréal a permis de séquencer les régions ITS, NTS et PRK. Le traitement des données acquises a mené à la modélisation de trois arbres phylogénétiques. Les résultats illustrent la diversité génétique des espèces de *Salix* originaires du Québec et permettent de les distinguer. Par conséquent, cette approche préliminaire d'identification est applicable sur une partie des espèces, et les démarches futures s'étendront à l'ensemble des saules indigènes d'Amérique du Nord, illustrant ainsi la biodiversité du genre *Salix*. Concrètement, ces travaux seront un atout dans des études de population ou de phylogéographie, et pourront servir dans des programmes d'amélioration des saules nord-américains.

The effect of elevated CO_2 on growth and competition in experimental phytoplankton communities

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We report an experiment designed to identify the effect of elevated CO_2 on species of phytoplankton in a simple laboratory system. Major taxa of phytoplankton differ in their ability to take up CO_2, which might lead to predictable changes in the growth rate of species and thereby shifts in the composition of phytoplankton communities in response to rising CO_2. Six species of phytoplankton belonging to three major taxa (cyanobacteria, diatoms and chlorophytes) were cultured in atmospheres whose CO_2 concentration was gradually increased from ambient levels to 1000 ppm over about 100 generations and then maintained for a further 200 generations at elevated CO_2. The experimental design allowed us to trace a predictive sequence, from physiological features to the growth response of species to elevated CO_2 in pure culture, from the growth response in pure culture to competitive ability in pairwise mixtures, and from pairwise competitive ability to shifts in the relative abundance of species in the full community of all six species. CO_2 altered the dynamics of growth in a fashion consistent with known differences among major taxa in their ability to take up and use CO_2. This pure-culture response was partly successful in predicting the outcome of competition in pairwise mixtures, especially the enhanced competitive ability of chlorophytes relative to cyanobacteria, although overall statistical support was weak. The competitive response in pairwise mixtures was a good predictor of changes in competitive ability in the full community. Hence, there is a potential for forging a logical chain of inferences for predicting how phytoplankton communities will respond to elevated CO2. It is clear that much more extensive experiments will be required to validate this approach in the much more complex environments and diverse communities of natural systems.

Breathing and breeding: The role of an environmental stressor (low oxygen) in driving divergence in a sexually selected trait

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Understanding links between biodiversity loss and environmental change is a central issue in conservation science. One approach to understanding potential response to environmental change is to explore variation among populations of species that cross strong physico-chemical or biotic gradients. We apply this approach to examine the role of an environmental stressor (low oxygen) in driving divergence in sexually selected traits (colour) in a haplochromine cichlid fish. In this group of fishes, sexual selection by females for brightly coloured males is an important factor underlying reproductive isolation. Specifically, this study aims to quantify the interaction of low oxygen (hypoxia) and diet on colour in the cichlid *Pseudocrenilabrus multicolor victoriae*. This species inhabits a broad gradient of dissolved oxygen from extremely hypoxic swamps, to hyper-eutrophic lakes, to well-oxygenated rivers. An interpopulational study across oxygen gradients in the field will be used to quantify correlations among hypoxia, diet, and sexually selected traits, and a laboratory study is ongoing to explore the degree to which variation in the field can be explained by environmentally-induced developmental response to oxygen levels and diet. This system and approach will contribute to our understanding of the ecological and evolutionary consequences of a widespread environmental stressor (hypoxia) on sexually selected traits that are potentially important to the maintenance of metapopulation structure in this system and may provide important insights into the potential adaptive response of more stenotypic species to environmental change.

Biodiversité des communautés invertébrées des étangs urbains de l'ile de Montréal.

Mimouni El-Amine & Pinel-Alloul Bernadette
Université de Montréal

La perte de la biodiversité et sa conservation sont parmi les problématiques les plus pressantes de ces dernières décennies. Alors que la perte de la biodiversité est connue et bien documentée, la compréhension des phénomènes menant vers le maintien de la biodiversité dans les milieux naturels ou anthropisés est toujours mal connue. La plupart des études sur la biodiversité est dirigé vers des milieux connus comme recelant une grande richesse et diversité, que l'on considère comme des "points chauds" de la biodiversité. Bien que cette observation soit vraie, elle a tendance à détourner l'attention des chercheurs, qui de ce fait portent peu d'intérêt aux réservoirs moins bien connus de la biodiversité. Malgré le fait qu'ils soient vus injustement comme de simples réservoirs d'eau sans vie, ne servant qu'à un but purement esthétique, de nos jours, les plans d'eau urbains peuvent aussi servir de refuges pour la biodiversité. Ces derniers (comprenant les lacs, les étangs, les marécages, etc ...) suscitent de plus en plus l'attention des chercheurs. Leur densité élevée et leur dispersion plus ou moins isolée les rend susceptibles à une forte endémicité. Ainsi, en dépit d'une diversité alpha (diversité intra-site) plus faible, ils contribuent fortement à la diversité gamma (diversité régionale). Afin de démontrer cette caractéristique unique des plans d'eau urbains, nous avons échantillonné durant l'été 2010 18 plans d'eau de types variés sur l'ile de Montréal. Les communautés phytoplanctoniques, benthiques et zooplanctoniques ont étés échantillonnées de manière à prendre en compte à la fois la variabilité intra- et inter-site. Nos résultats montrent que ces sites ont une quantité modérément élevée d'espèces, mais une forte endémicité. Ainsi, ces sites devraient êtres perçus en tant que "réservoirs de la biodiversité urbaine" et nous suggérons que plus d'attention et de recherches soient accordés à ces plans d'eau.

Genetic diversity of hot pepper (*Capsicum chinense*) in the Neotropics

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Hot pepper (*Capsicum. chinense* Jacq.), one of the commercially most important pepper species grown in the Caribbean region, is well known for its high pungency and distinct flavor profile and promises to be a source of a new agricultural industry for the region. At present, very little is known about the genetic diversity of this species in the Caribbean and as such there has been slow progress to improve landraces through breeding methods. The objective of the study was to assess the diversity of hot pepper and its structure within the Caribbean basin and to determine its genetic relationship to those in South America, the centre of origin of the species. DNA isolated from 201 accessions of *C. chinense*, representing various geographical regions where the species is found, were amplified using arbitrary primers to generate 138 polymorphic and reproducible RAPD markers. Nei's and Shannon's diversity indices for *C. chinense* in the Caribbean (0.218; 0.343 respectively), were lower as compared to (0.28; 0.419), in South America. The study also showed the existence of three genetically distinct clusters within *C. chinense.* The largest cluster consisted of accessions from Upper Amazon, the Guianas including Venezuela, and the Caribbean. The other major cluster was represented by accessions from the Lower Amazon region. Another distinct but small cluster consisted of samples solely from the Greater Antilles. Microsatellite markers are now being used for further investigating the genetic diversity and structure of *C. chinense* .

Ecological Divergence in the commercially fished Nile perch (L*ates niloticus*) in Lake Nabugabo, Uganda

Elizabeth Nyboer & Lauren Chapman
McGill University

My research investigates consequences of fishing pressure on the behaviour of Nile perch, an invasive, predatory fish that has fuelled extremely important fisheries in East Africa, but at the cost of catastrophic loss of native fish biodiversity, in particular endemic haplochromine cichlids. There is evidence that spatially heterogeneous fishing of Nile perch in Lake Nabugabo, a satellite of Lake Victoria, coincides with lowered catch per unit effort and habitat-associated divergence in diet (high vs. low predation on endemic cichlids) and morphology. My project aims to characterize patterns of growth, age, and diet of Nile perch between wetland and open-water habitats in Nabugabo, and to quantify movement patterns to determine whether ecological divergence between habitats is transient, ontogenetic, or represents distinct phenotypes within the population. A long-term stomach-content data set will be analyzed to quantify at what size and age, and in what habitats Nile perch prey on endemic cichlids. Otoliths will be used to estimate fish age, and movement patterns will be determined through radio telemetry and mark-recapture techniques. Nile perch are key in shaping both functional and species diversity of fishes in the Lake Victoria region of East Africa. Decreases in Nile perch abundance are facilitating resurgence of some indigenous fishes; however, ecological divergence in the distribution and diet of Nile perch may threaten the viability of current faunal refuges in the region.

Resources beyond borders: fragmented resource connectivity reveals the effectiveness of a protected area in Mexico

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The maintenance of landscape connectivity is important for the persistence of ecosystem function and structure, specially given the current rates of land use transformation and climate change. However, little attention has been given to the connectivity of critical resources, such as water, within habitats. Our study area in the Greater Calakmul Region of the Yucatan Peninsula is undergoing climate change. From 1950 to 2009 the mean change in precipitation was approximately 16% and climate models suggest increased drying in the future. This decrease in precipitation influences water availability in the area, as water is only present in seasonal waterholes. We performed a graphical analysis of the connectivity of the waterhole network for four species: Baird's tapir (*Tapirus bairdii*), spider monkey (*Ateles geoffroyi*), jaguar (*Panthera onca*) and white-lipped peccary (*Tayassu pecari*). We treated waterholes as nodes and linked those pairs that fell within the range of the species maximum known dispersal distance. Water availability determined the connectivity of the landscape. We deleted waterholes from the network based on their size. We found the waterhole network is very sensitive to the lost of waterholes and fragments easily when small waterholes disappear. The constant use of waterholes by humans in the area calls for urgent conservation plans of these critical resources in the area. In addition, resource connectivity analyses are necessary to improve our understanding of reserve functioning and functional habitat connectivity in highly seasonal landscapes.

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 competing for a common limiting resource (silicate). Preliminary results indicate 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. Future directions include 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 offers the potential to allow simultaneous attention to the importance of fitness inequality, stochasticity, dispersal, and niche differentiation without recourse to a niche-neutral dichotomy.

Incorporating consumer-resource spatial interactions in reserve design

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The persistence of species in reserves depends in large part on the persistence of ecological interactions that maintain functioning ecological communities. Despite their importance, however, ecological interactions have not yet been incorporated into terrestrial reserve-selection methods. We develop a general method for incorporating consumer-resource interactions into spatial reserve-selection using the conservation prioritization software Zonation. This method protects spatial consumer-resource interactions by protecting areas that maintain the connectivity between the distribution of consumers and resources. We illustrate our method with a conservation planning case-study of a mammalian predator, American marten (*Martes americana*), and its two primary prey species in a forest management unit in the boreal forest in Québec, Canada. We selected reserves comprising 12% of the management unit using nine alternative reserve-selection methods that had different combinations of predator and prey habitat distribution maps, species-specific connectivity layers, and interaction connectivity layers. Including consumer-resource interactions in reserve-selection resulted in more spatially aggregated reserves while still maintaining local habitat quality. This spatial aggregation was a direct consequence of modeling the spatial needs of the interacting consumer and resources. Maintaining species interactions within reserves will reduce the risk of species extinctions and allow resident ecological communities to function, persist, and provide ecosystem services. Our method for maintaining connectivity between consumers and their resources within reserves applies under the most extreme cases of either complete spatial overlap or complete spatial segregation of consumer-resource habitat distributions. We anticipate that this method will become an important tool for conservation planners to identify areas

that are most important for the maintenance of consumer-resource interactions in landscapes containing many interacting species with different needs.

Searching in heterogeneous and limiting environments: Foraging strategies in the white-lipped peccary (*Tayassu pecari*)

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Searching for patchy-distributed, highly-localized, and seasonally variable resources in heterogeneous environments poses challenges for social species living in cohesive groups. Here, we studied the searching strategies of a highly social mammal, the white-lipped peccary (*Tayassu pecari*), in the Calakmul Biosphere Reserve, Mexico. Calakmul is a semi-dry tropical forest where important resources, such as water and food, are patchy distributed and temporarily scarce. We found that white-lipped peccaries searched some areas intensively, but occasionally performed long directed movements that took them well away from previous searched areas. This pattern fitted well the recently proposed Lévy-walk animal movement model, a model which optimizes searching resources that are patchy distributed. Groups also concentrated foraging activities around a few places with water during the dry season behaving as central place foragers. In addition, we documented coordinate travel associations between groups and elaborated on possible ecological benefits of such associations. When resources were limited, such as during the dry season, groups combined searching strategies to be close to water sources while occasionally searching areas located far away. We discuss the potential adaptive values of such behavioral strategies for social species living in strongly heterogeneous environments.

Improving the computational speed of phylogenetic model ranking with data-augmentation-based thermodynamic integration

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In Biodiversity science, phylogenetic substitution models are of central importance for quantifying evolutionary distances and for mapping the relatedness of species. With the increasing number of phylogenetic substitution models recently proposed, there is a need for accurate and fast methods to perform model selection. However, the most popular computational approach used in Bayesian phylogenetic contexts, the Bayes factor approximated with the harmonic mean estimator (HME) (Newton & Raftery, 1994), has proved unstable (Lartillot & Philippe, 2006). Here, we present a computational approach that combines two recent developments: *thermodynamic integration* (TI) (Lartillot & Philippe, 2006) for accurate calculation of Bayes factors, and *data-augmentation* (DA) (Rodrigue et al., 2008) for efficient Markov chain Monte Carlo computation. Based on a real data set of vertebrate □ -globin genes, we show (i) that the novel approach enables the fast evaluation of very complex codon models, that would take years to assess with standard (non-DA) methods, and (ii) that Bayes factor estimated with the HME approximation selects over-parameterized models, while the TI approximation appears unbiased. We discuss the many possible sampling approaches than can be readily envisioned, exploiting various combinations of existing methodological innovations, and from which there is hope of having a more efficient and reliable computational framework for comparing hypotheses under a given model, as well as model ranking for Bayesian phylogenomic analysis.

The willingness to pay for biodiversity: a comparative approach of methods

Roy, Rene. & Thomassin, Paul
McGill University

The study presented compares the willingness to pay values from two different stated preference methods, choice modeling (CM) and contingent valuation (CV). Both CM and CV approaches can be used to estimate the value of biodiversity for policy purposes. The CM approaches estimates the implicit prices of the attributes of the good in question. The CV approach used was a multiple bounded discrete choice (MBDC) format. The WTP values were estimated for different food products that contained different environmental and health attributes. The two methods were found to generate statistically different WTP estimates for tomatoes and pork and were statistically similar for milk. The difference seems to reside in the model specification; when the attributes were analyzed as nonlinear, the WTP estimate using the CM method was statistically similar to the one estimated with the CV method. While CM allows more flexibility than CV modeling, CM tends to generate higher estimates when the modeling includes continuous variables. Therefore, special attention is necessary when simulating WTP values from implicit prices derived from CM results.

Cascading extinctions, functional complementarity, and selection in two-trophic-level model communities: A trait-based mechanistic approach

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The influence of diversity on ecosystem functioning and ecosystem services is now well established. Yet predictive mechanistic models that link species traits and community-level processes remain scarce,

particularly for multitrophic systems. Here we revisit MacArthur's classical consumer resource model and develop a trait-based approach to predict the effects of consumer diversity on cascading extinctions and aggregated ecosystem processes in two-trophic-level systems. We show that functionally redundant efficient consumers generate top-down extinction cascades. This counterintuitive result reveals the limits of the functional redundancy concept to predict the consequences of species deletion. Our model also predicts that the biodiversity–ecosystem functioning relationship is different for different ecosystem processes and depends on the range of variation of consumer traits in the regional species pool, which determines the sign of selection effects. Lastly, competition among resources and consumer generalism both weaken complementarity effects, which suggests that selection effects may prevail at higher trophic levels. Our work emphasizes the potential of trait-based approaches for transforming biodiversity and ecosystem functioning research into a more predictive science.

A new mention for an aquatic invasive species at the northern limit of its range: dynamic of an Asiatic clam population in association with power plant

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Exotic species recognized to invade freshwater ecosystems tend to be overrepresented by highly fertile and tolerant species, such as filter feeder molluscs (bivalves). Accordingly, the Asiatic clam (*Corbicula fluminea*), a hermaphrodite bivalve, is recognized as one of the most economically and environmentally damaging aquatic invasive species in United-States and Europe. Until now, water temperature in winter still limited the northern distribution range of this species in America, its survival being compromised under 2°C. Recently, the presence of the Asiatic clam was nevertheless detected in several northern

regions, including the Great Lake watersheds, the Connecticut river, the Lake Champlain canal and Lake George. In fall 2009, we also discovered the presence of *C. fluminea* in the St.-Lawrence River, i.e, in the discharge plume of the nuclear power plant Gentilly-2 (Bécancour, Québec, Canada). In order to document the most northern mention of the species, we set up, in 2009, 21 sampling stations upstream and downstream the nuclear station and collected bottom sediments. We found between in average 368 alive specimens per m^2 (in addition to shell remains), varying in size from few millimetres and up to 25 mm, which confirmed the establishment of an Asiatic clam population in the St. Lawrence river. So far, we have not found any specimens upstream the nuclear station, but individuals were still present at least 3.5 km downstream the station. The next step will be to determine the risk that the Asiatic clams establishment elsewhere in the St.-Lawrence river. The presence of the Asiatic clam in Québec is worrying as climate change could favour the success of this species in northern watersheds. It is essential to rapidly document the new establishment of species known to be invasive, before they dramatically modify aquatic ecosystems, as observed for other invasive mussels, such as the zebra (*Dreissena polymorpha*) and the quagga mussels (*Dreissena rostriformis bugensis*).

Impacts of introduced predatory fishes in Ontario lakes: Assessing the roles of evolutionary naiveté and predator richness

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Introduced predators are a major cause of extirpations, particularly in insular habitats such as islands and lakes, and such dramatic impacts are generally hypothesized to be caused by prey naiveté in the

recipient community. Negative impacts on native communities are also expected to increase with introduced predator richness. We test both these hypotheses using fish community data from over 9000 lakes in Ontario, where the ranges of native large-bodied littoral piscivores – such as largemouth bass *Micropterus salmoides*, northern pike *Esox lucius*, rock bass *Ambloplites rupestris*, smallmouth bass *Micropterus dolomieu* and walleye *Sander vitreus* – are expanding into lakes in which they are not native. We hypothesized that if naiveté can evolve relatively quickly (since the last glaciation), then naturally predator-free lakes would have naive prey populations that could be extirpated following predator introduction and lakes with native predators should contain populations of prey adapted to living with predators. Lakes with introduced smallmouth bass did contain fewer species of cyprinid fishes (an important prey item) than lakes without predators, but cyprinid richness was no different than in lakes with native smallmouth bass. Furthermore, the presence of each predator on its own was associated with a reduced level of cyprinid richness, but cyprinid richness varied unpredictably in the presence of multiple predators. This study highlights the complex influence of predators on native diversity.

Phosphorus as a driver of diatom and cladoceran diversity across lakes and over time

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Aquatic ecosystems are among the most vulnerable to reductions in biodiversity. In North America, the extinction rates of freshwater organisms have been estimated as being some the highest in the world. Eutrophication has been identified as a significant driver of aquatic biodiversity, but it is not yet clear how changes in nutrients affect biodiversity or interact with other ecosystem processes (e.g. fish predation) at large scales. For our study, we used paleolimnological techniques to investigate the effects of phosphorus (a limiting nutrient

in aquatic ecosystems) and fish predation on the species richness of diatoms and cladocerans across broad spatial and temporal scales. Paleolimnology offers a novel approach to biodiversity questions as it allows for the investigation of temporal and spatial scales which are otherwise not available using contemporary ecological data. Our study looks at temperate lakes located in southern Québec and the Northeastern United States that span a large phosphorus gradient (5 – 250 µg/L). Our preliminary results indicate that the diversity of diatoms and cladocerans decreases as phosphorus increases both across lakes (R^2=0.30 and R^2=0.21, $p<0.05$, respectively) and time (R^2=0.20, $p>0.05$ and R^2=0.79, $p<0.001$, respectively). Possible explanations for this pattern include: 1) the interaction between high productivity and planktivorous fish predation and 2) the occurrence of cyanobacteria dominance at high phosphorus levels. Our results show a consistent pattern where increases in nutrients correlate to lower species richness in both diatom and zooplankton assemblages that are preserved in lake sediments.

Systematics and phylogeography of Carex capitata s.l. (Cyperaceae): a bipolar species complex.

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Carex capitata s.l. is a complex of 1-3 taxa variously treated as either separate species (*C. capitata* s.s., *C. arctogena*, *C. antarctogena*) or as a single species sometimes comprising multiple varieties or subspecies. Circumpolar in distribution, this species complex is unusual since it also occurs in Patagonia; it is one of only 30 bipolar plant species known. The aim of this study is to explore phylogeographic patterns in the *Carex capitata* complex to potentially reconstruct the origins of its current bipolar distribution. Five nuclear microsatellites regions and chloroplast (*matK, rps16, atpFH*) sequences from 48 individuals representing the morphological and

geographical variation in the complex were analyzed using maximum parsimony, Bayesian inference and statistical parsimony. Three strongly supported groups (>95%PP) were found in all analyses, corresponding to *C. capitata* s.s., *C. arctogena* and a previously unrecognized lineage, which we refer to as *Carex 'yabadabadoo'*. *Carex capitata* s.l. consists of three taxa that were genetically isolated before the last glacial maximum (18 kya). Bipolar *C. arctogena* populations are probably the result of recent bird dispersal. *Carex 'yabadabadoo'*, a segregate of *C. arctogena*, is genetically divergent from all other complex members and it occurs in a region that escaped glaciations. This new taxon might be a relic that has survived in its current range over many glacial cycles. On the contrary, *C. capitata* s.s. and *C. arctogena* occur in the formerly glaciated regions of North America; their current distributions are most likely due to post-glacial dispersal from northern refugia.

Poster Abstracts

In alphabetical order of presenting author

Impact de la structure du paysage sur la quête alimentaire du sarcoramphe roi

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Les forêts tropicales saisonnières sont des écosystèmes très dynamiques qui subissent de fortes pressions anthropogéniques. Certaines espèces sont particulièrement vulnérables aux modifications du paysage. Par exemple, le sarcoramphe roi, Sarcoramphus papa, une espèce de la guilde de charognards forestiers néotropicaux, présente un déclin de ses populations à travers son aire de répartition. La cause de ce déclin semble la perte d'habitat, mais les causes proximales sont inconnues. L'objectif de cette étude est de comprendre les effets de la structure du paysage sur la quête alimentaire du sarcoramphe roi. Pour atteindre cet objectif, des carcasses sont réparties selon un dispositif pairé dans une région d'étude située au sud de la péninsule du Yucatan, au Mexique. L'utilisation par le sarcoramphe roi de ces carcasses est évaluée à deux échelles (l'une locale nichée dans le paysage) pour deux différents types de milieux (ouverts ou forestier). Les effets de la distance aux routes, aux villages et aux massifs forestiers les plus proches, ainsi que l'abondance des compétiteurs sont aussi considérés. Les résultats préliminaires de l'étude indiquent que les variables du paysage, mais aussi les relations interspécifiques, ont un impact sur la quête alimentaire du sarcoramphe roi. Cette étude permettra de comprendre les répercussions écologiques de la fragmentation du paysage sur le sarcoramphe roi et facilitera le design de stratégies assurant la persistance de cette espèce qui fournit un service écologique essentiel.

Evolution and Diversity of *Citrus species* in the Eastern Himalayan Biodiversity *Hotspot.*

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The Indian subcontinent has a rich and varied heritage of biodiversity and is home to the three of the 34 "global biodiversity hotspots". The mountainous northeast India covers a large tract of the two biodiversity hotspots and is considered as one of the centres of the diversity of primitive flowering plants. We are currently investigating the phylogeny and evolution of one of the widely distributed and the commercial source of citrus fruits of the genus *Citrus*. The northeast region of India is considered to be one of the major centers of diversity of *Citrus* species comprising over 17 species and 52 varieties along with a large number of endemic and endangered species. Three cpDNA regions *viz*., trnL-trnF, trnA-trnG and rps16 of 23 *Citrus* species were PCR amplified, sequenced and analyzed using ClustalW, PAUP* and MacClade software packages. The sequence data grouped *Citrus* species into eight different groups. The separation of *C. medica* and *C. reticulata* in distinct sub-clusters supports their distinctiveness as the true basal species. Three different wild species *viz*., *C. megaloxycarpa, C. volkameriana* and *P. trifoliata* formed a separate cluster and *C. aurantifolia* and *C. limon* clustered together revealing their common origin. A detailed phylogenetic analysis incorporating nucleotide sequence data of multiples genes as well as morphological data is currently in progress.

Genetic diversity in traditionally cultivated rice varieties in the Eastern Himalayan region of Northeast India

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Rice (*Oryza sativa*) is one of the oldest and most important domesticated crops and grown worldwide in diverse agroclimatic, edaphic, and topographic conditions. The diversity of indigenous rice varieties in the Eastern Himalayan region of Northeast India is very high and includes many landraces and several related species in the wild. At least 10,000 indigenous rice cultivars and 8 species of wild relatives are reported from the region. The detailed understanding of the genetic diversity and structure of traditionally cultivated rice varieties of the region is crucial for conservation and sustainable use of rice genetic resources. Altogether 30 varieties of rice representing different regions and cultivation types and one wild species (*O. officinalis*) were chosen to assess the genetic diversity using microsatellite markers. Eight selected primer pairs amplified altogether 86 alleles with and average of 10.75 per locus. The percentage of polymorphic loci was 87.50 and a significant genetic variation among different rice varieties were detected (Shannon's Information index: 0.00 – 2.44; mean 1.63 ± 0.89). UPGMA cluster analysis of genetic similarity data also indicated high genetic variation among the rice varieties of northeast India (coefficient ranging from 0.04 to 1.00). This information should be taken into consideration for implementing effective conservation programs to conserve rice germplasm in Northeast India.

Wright's shifting balance theory and the diversification of aposematic signals

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Despite accumulating evidence of selection in natural systems, the importance of random drift opposing Wright's and Fisher's views continue to be a subject of controversy. Interestingly, both theories have been independently proposed to explain the geographical diversification of aposematic signals. In the present study, the effects of drift and selection were assessed from population genetics and predation experiments on poison-dart frogs, *Ranitomaya imitator,* of Northern Peru. We specifically focus on the transient zone between two monomorphic but distinct aposematic signals. We show that between zones of high predation regions of low selection reveal the effects of drift, enabling the diversification of phenotypes without significant loss of fitness. These new phenotypes may then colonise alternative habitats if successfully recognised and avoided by predators. These results, consistent with the expectations of the Wright's shifting balance theory, reveal the interplay between drift and selection as determinant processes in adaptive diversification.

Climate change and thermal refugia for eastern Canadian salmonids

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Temperature regime is an important characteristic of streams and rivers as it influences both abiotic and biotic processes. In particular, salmon and trout respond to temperature fluctuations by moving into cooler areas when temperatures exceed their upper tolerances. Such areas are increasingly recognized as a significant aspect of stream habitat, as they provide refugia for salmonids during summer months. Given the possibility of stream warming resulting from human land

use practices and/or climate change, thermal refugia could become essential in sustaining salmonid populations. Accordingly, this study first investigates how recent advances in temperature monitoring techniques can allow improved characterization of thermal refugia dynamics. It then explores how telemetry can be useful in understanding more precisely how Atlantic salmon and brook trout use cold water areas in warm streams. Lastly, it puts novel modelling methods into use so as to predict future stream temperatures based on regional climate scenarios. Preliminary results from this study are promising and may have significant implications for freshwater resource management in Canada and elsewhere.

Développement d'outils moléculaires pour évaluer la diversité des saules du Québec

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Les saules, *Salix sp.*, est un genre diversifié qui comprend environ 450 espèces. On les trouve presque partout dans l'hémisphère nord sauf dans les zones désertiques et tropicales. Au Québec, les espèces du genre *Salix* représentent près de 30% de la flore ligneuse indigène. Cependant, la fiabilité de l'identification des différentes espèces est faible étant donné que la reconnaissance est fondée sur des caractères morphologiques souvent difficiles à visualiser. La présente étude a pour objectif d'adapter des outils moléculaires permettant de distinguer les espèces de *Salix* entre elles, d'obtenir une mesure de leur diversité génétique et d'établir une phylogénie du genre en Amérique du Nord. L'extraction de l'ADN génomique obtenu à partir d'échantillons récoltés sur plus de 50 espèces en collection à l'arboretum du Jardin botanique de Montréal a permis de séquencer les régions ITS, NTS et PRK. Le traitement des données acquises a mené à la modélisation de trois arbres phylogénétiques. Les résultats illustrent la diversité génétique des espèces de *Salix* originaires du Québec et permettent de les distinguer. Par conséquent, cette approche préliminaire d'identification est applicable sur une partie des

espèces, et les démarches futures s'étendront à l'ensemble des saules indigènes d'Amérique du Nord, illustrant ainsi la biodiversité du genre *Salix*. Concrètement, ces travaux seront un atout dans des études de population ou de phylogéographie, et pourront servir dans des programmes d'amélioration des saules nord-américains.

Spatial and temporal variation in the morphology of red-backed voles (*Myodes gapperi*) in Québec

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Morphological variation between populations across a species geographical range is often observed in mammals. This variation may be due to different environmental conditions that drive morphological adaptation or to distinct phylogenetic affiliation among populations. Climatic gradients are frequently associated with geographic gradients of morphological variation; one of the most general biogeographical rules, Bergmann's rule, states that individuals of endothermic species living in colder climates are larger in body size than individuals found in the warmer part of the species' range. This trend is often linked to latitudinal gradients, due to the strong correlation between latitude and temperature. Other morphological traits are also found to vary with the environment. Populations belonging to different lineages may also exhibit differences in morphology. The objective of this project is to investigate if there is a latitudinal trend in size and morphological variation among populations of the red-backed vole (*Myodes gapperi*) in Québec. Using historical museum specimens, we will also investigate if the pattern of spatial variation observed today is constrained by temporal trends within populations. We will perform morphometric analyses using cranial and dental measures of voles collected from nine different sites spread in a latitudinal transect of approximately 1000 Kilometers. We will also measure voles previously collected (Redpath Museum and Canadian Museum of Nature collections) at some of these sites. Phylogenetic analyses using mitochondrial DNA will be carried out in order to evaluate to what

extent the patterns of morphological variation are related with phylogeographic factors.

The effect of fishing pressure on nutrient cycles in spatially subdivided littoral ecosystems in Lake Tanganyika

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Lake Tanganyika is a large, oligotrophic lake with high primary productivity and low nitrogen (N) and phosphorus (P) levels in the water column. The maintenance of high primary productivity despite low levels of nutrients is due to the efficient N and P recycling of the fish community, who represent the largest pools of N and P within the lake. The fish species within Lake Tanganyika differ in their N:P stoichiometries, their N:P recycling ratios and their food preferences. Furthermore, certain fish species seem to only be able to persist within the rocky shores of the littoral zone and are reluctant to traverse through sandy shores. The purpose of our study is to examine how the nutrient cycles (N and P) within the spatially subdivided littoral zone will be affected by increasing fishing pressures, whose effects are currently being documented. To do so, we construct a meta-ecosystem model for littoral zone with explicit consideration of the movement of nutrients, fish and primary producers between local ecosystems. We hypothesize that there should be differences between N and P supply levels through nutrient cycling without fishing due to local species differences. We also hypothesize that since fishing pressure is not distributed equally between species, large changes in fish N:P stoichiometry and N:P recycling ratios should occur, which may lead to reduced primary productivity. We present are preliminary results from our model and discuss some of their implications for the fish community in Lake Tanganyika.

De la compétition à la sélection : le rôle des caractéristiques populationnelles et de la chasse aux trophées dans le potentiel évolutif d'une population sauvage d'ongulés

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La compétition pour les ressources est centrale dans le processus d'évolution puisqu'elle est un mécanisme par lequel la sélection peut opérer. Dans le contexte de la sélection sexuelle, il est important d'explorer les facteurs qui influencent l'intensité de cette compétition pour la reproduction et *in fine* l'opportunité pour la sélection. Cette compétition pourrait être modulée par les fluctuations en i) densité, ii) sexe ratio opérationnel et iii) structure d'âge des individus en compétition. Notre étude a pour but de quantifier l'effet des variations démographiques sur le succès reproducteur des béliers du mouflon d'Amérique (*Ovis canadensis*) et d'explorer les effets potentiels de la chasse au trophées sur la reproduction des mâles. Pour ce faire, nous utilisons un suivi longitudinal de capture marquage recapture de 490 béliers de la population de Ram Mountain en Alberta. Le pedigree de la population est reconstruit depuis 1987 grâce à des analyses moléculaires qui permettent de connaître le succès reproducteur des béliers. Nous montrons que le nombre de femelles dans la population influence positivement l'opportunité pour la sélection. Nous montrons également que la chasse aux trophées aurait un effet négatif sur l'opportunité pour la sélection chez cette espèce polygyne. Nos résultats confirment que la chasse au trophées doit être considérée comme une force évolutive potentielle en action dans les populations sauvages. Enfin, nous suggérons qu'il est important de considérer les caractéristiques populationnelles aussi bien dans l'étude de la sélection sexuelle que dans la gestion des populations sauvages.

Le Champ des Possibles: promoting an Urban Biodiversity Reserve

Owen Mc Swiney (Architect), Roger Latour (Writer. Photographer), Sara Finley (Water resources engineer), Marke Ambard (Environmental sociologist), Thierry Martin (Citizen activist), Alexander Kenny (Economist. Associate fellow CISDL)

Les Amis du Champ des Possibles is a non-profit group which was formed to preserve an existing urban green space as an Urban Biodiversity Reserve. The site is located in the Mile End district of Montréal and forms an important link in the city's bio-corridor along the train tracks. Since the closure of a freight yard in the mid 1980s, the site has developed under its own guidance. Species have train-hopped from all over the North American continent (and internationally, via the Carmelites Convent's adjoining walled garden). The wind, birds, and animals (humans included) have also brought seeds here: the site is now one of the most biodiverse sites in central Montréal. Our group has compiled a list of over 150 observed species, and we contend that this zone and others like it have the potential to provide important ecological services and to increase urban biodiversity overall. The members of our voluntary group come from a variety of disciplines including: biology; horticulture; architecture; urbanism; landscaping; science; art; journalism; photography; and design. A major interest is how we can analyze and exhibit the site, so as to shift perception regarding its current value and future potential. We also organize educational activities: the historic and botanical tours offered by specialists demonstrate a keen public interest in the potential of this space. We have established a relationship, as an advisory committee, with the municipal government of the Plateau arrondissement. We are working towards the classification of the site as a scientific pilot project for researching urban biodiversity and alternative methods of soil decontamination. The site represents a concrete example for considering how this type of facility could be established and operated in Montréal.

Identification of representative landscapes: what's the state of land cover patterns in Québec?

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From north to south, the Province of Québec is characterized by a wide variety of landscapes. Can a small set of landscapes represent the land cover composition and spatial configuration of the whole Province? In a context of biodiversity, would these representative landscapes reveal any significant changes compare to the composition and spatial configuration found on the bioclimatic domain map? The main goal of this research is to determine landscapes that best summarize land cover patterns of each bioclimatic domain in the Province of Québec. Beginning with the Earth Observation for Sustainable Development of forest (EOSD) datasets, a national land-cover classification of Landsat satellite images, we partitioned the province with more than 1500 individual landscapes along the National Topographic System 1:50000 map sheet borders. For each of them, we calculated over 2000 landscape metrics. These metric values were used to quantitatively compare patterns to calculate a measure of similarity between all pairs of landscapes. Using similarity values as inputs, we adapted a recent computer science pattern recognition algorithm that simultaneously groups similar objects and objectively identifies the ones that best represent each group. Expected outputs, small sets of representative landscapes along with their five most similar siblings, will demonstrate patterns that best represent patterns of each bioclimatic domains of Québec. This set of representative landscapes can be useful for biodiversity studies through identifying representative sampling landscapes for long-term, broad-scale studies. Such representative landscapes could help scientists determine whether, for example, land cover patterns remain consistent with expectations based on climate.

Can an invasive plant affect the development of Wood frogs (Lithobates sylvaticus)?

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In the context of declining amphibian populations, the introduction of exotic animal species has been the subject of numerous studies. Nevertheless, exotic invasive plant species can modify substantially wetland structure, and have a significant impact on animal diversity. We studied the consequences of the establishment of the exotic common reed (*Phragmites australis*) on amphibian populations. We hypothesized that the decrease of available space and the modification of the wetland structure could reduce larval anuran development. We tested this hypothesis by studying the larval development of the wood frog (*Lithobates sylvaticus*) during an experiment in mesocosms placed in the field. We recreated several homogeneous habitats with different densities of reed (low and high) and a control habitat without reed. Tadpoles were placed in the mesocosms and were followed during six weeks until metamorphosis. The results show that the stage development of tadpole is lower (nearly two Gosner stages) in the highest density of common reed but the survival rate does not vary across reed density. Furthermore, the size and the mass of the tadpoles did not differ between treatments.

Spatiotemporal foraging strategy of black howler monkeys: Do they know where and when to go?

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Outre les perturbations anthropogéniques modifiant les habitats des primates, les perturbations phénologiques des ressources provoquées par les changements climatiques pourraient aussi menacer leur survie à long terme. Il est donc important de connaitre les processus impliqués dans la recherche alimentaire pour prédire l'effet de variations dans la disponibilité des ressources. Le but de cette étude est de déterminer la stratégie de recherche alimentaire utilisée par les singes hurleurs du Guatemala (*Alouatta pigra*), de relier cette stratégie avec la disponibilité spatiotemporelle des ressources et d'évaluer le niveau de connaissance des singes de l'emplacement et de la phénologie des arbres clés. Trois troupes de singes hurleurs de la région de Calakmul ont été suivies dans le but de tracer les trajectoires parcourues. Les arbres visités ont été identifiés et leur état phénologique a été déterminé. La disponibilité spatiale et temporelle des ressources dans les territoires de ces troupes a été vérifiée par un suivi phénologique de 400 arbres de la diète de cette espèce de singe hurleur. Les résultats préliminaires montrent que les singes hurleurs utilisent plus fréquemment certaines aires dans leurs territoires correspondant à la présence de figuiers (Ficus spp.) ou de zapotes (Manilkara zapota), éléments préférés dans leur diète. Une modélisation bayésienne tenant compte des caractéristiques physiques des mouvements et de l'attraction pour certains arbres nous permettra de déterminer si les donnés empiriques peuvent provenir de déplacements dirigés par la connaissance spatiotemporelle de la disponibilité des ressources.

Evolution of the population structure in the invasive rodent species *Peromyscus leucopus* from sky-islands in Southern Québec: impact of geographic barriers and climate warming

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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. It can dramatically affect the habitat of species, which might then generate new environmental selective pressures resulting in rapid phenotypic change. 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 and is of special concern because *P. leucopus* is the primary host for the ticks carrying the bacteria responsible for Lyme disease. Over the last 50 years, there has been an increase of 0.5°C in average annual temperature in the Montérégie region, and climate warming has been linked with rapid change in the Peromyscines' morphology. I propose to study these effects by examining morphological and genetic variation in *P. leucopus* in the Monteregian sky islands over the last 50 years. My hypothesis is that if climatic change has generated consistent selective pressures on *P. leucopus*, morphological changes will be similar in the different mountain population replicates. I will study populations of *P. leucopus* that were recently caught in the field as well as museum specimens collected over the last 50 years, before the acceleration of climate change. My study will provide a better understanding of the effects of rapid climate change on morphological and genetic evolution in mammals and will ultimately shed some light on the pattern of expansion of Lyme disease in Southern Québec.

Comparative phylogeography of *Betula alleghaniensis*, *B. lenta*, and *B. papyrifera* in eastern North America: influence of introgression; niche breadth, and glacial history.

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This study investigated the chloroplast DNA (cpDNA) -based phylogeographic structure 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 introgression. In contrast, *B. lenta* generally did not share haplotypes with other species. The phylogeographic pattern for *B. alleghaniensis* and *B. papyrifera* is 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. No clear phylogeographic pattern was observed for *B. lenta*, as one haplotype dominated throughout its range. Further investigation of patterns of genetic variation and hybridization/introgression within these species is currently underway utilizing 10 polymorphic nuclear microsatellite markers.

The Challenges of Integration and Related Research Issues in Québec: from Water to Biodiversity

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In an effort to reform water governance in Québec, the Government adopted, in June 2009, the "Loi affirmant le caractère collectif des ressources en eau et visant à renforcer leur protection'' (Act to Declare the Common Nature of Water Resources and to Reinforce their Protection) . The Province also instituted Integrated Water Resources Management by watershed (IWRM) for all of mainland Québec. Shortly after, the Conseil de la Science et la Technologie (CST) gathered a group of experts to develop a research strategy to apply IWRM. The research strategy was developed as part of the Perspectives STS Project started in 2003 by the CST in concert with other ministerial partners. As a foresight-type study , the objective of the Perspectives STS is to identify the challenges that Québec will face over the next several years and to determine how research could contribute to the development of solutions. Equally, the Project aims to educate all sectors of Québec society about the importance of their contribution to solving water-related issues. Natural resources management and sustainable development are the 7th and final challenge for which integration issues between the various components of water management in Québec will be addressed. The proposed areas of intervention of this strategy are very similar to those discussed in the field of biodiversity. Commonalities and synergies emerge.

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