



Biodiversity
2010 and Beyond
Science and Collections

**2010 SPNHC & CBA-ABC
Joint Conference**

*Ottawa, Ontario, Canada
May 31 to June 5, 2010*

Program & Abstracts



25th Anniversary

SPNHC

ADVANCING COLLECTIONS CARE



hosted by



Errata

(28 May 2010)

CBA-ABC Development Symposium
Thursday, June 3, 2010 – Room 1140
1:30 – 4:10 PM

****Please follow program on page 18, but
not the program on page 36, which is
incorrect****

Schedule Change

**Thursday, 3 June 2010, Morning, Room
1130; SPNHC – Digitizing Initiatives**

8:40 – 9:00 no talk

9:00 – 9:20 Peters - The Global Plants Initiative (GPI)
and the California Academy of Sciences

9:20 – 9:40 Zetzsche - DNA Bank Network –
Referencing DNA with specimens, sequences and
publications based on GBIF web services

9:40 – 10:00 Mishler -The Jepson Flora Project and the
Consortium of California Herbaria

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(We regret that the hard copy index is
incorrect.)

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Welcome to the first Joint SPNHC – CBA/ABC Conference!

We are pleased to welcome you to Ottawa for what promises to be a stimulating and engaging meeting. We are delighted to have participants from across Canada, and from eleven additional countries, including Australia, Belgium, Denmark, France, Germany, Jordan, Netherlands, New Zealand, Sweden, United Kingdom, and the United States. Thank you all for participating in the meeting!

With 2010 declared “The International Year of Biodiversity” by the United Nations, this gathering of natural history collection professionals and botany specialists will offer many exciting opportunities for “cross-fertilization” of ideas and transfer of knowledge among participants. All participants are invited to attend any of the concurrent sessions that are of interest.

We hope you enjoy the meeting and your time in Ottawa.

Sincerely,

The SPNHC – CBA/ABC Local Organizing Committee
Canadian Museum of Nature

The **Society for the Preservation of Natural History Collections (SPNHC)** is an international organization devoted to the preservation, conservation and management of natural history collections. Its members have a strong interest in the value of natural history collections and the role they play in society for understanding the history of life and the factors influencing global environmental change.



www.spnhc.org

The **Canadian Botanical Association / L'Association Canadienne de Botanique (CBA/ABC)** is the national organization for botanists in Canada, representing Canadian Botany and botanists in matters of local, national and international importance. The preservation of botanically significant areas is of special interest.



www.cba-abc.ca

Welcome from the CBA-ABC President

Dear Members of CBA-ABC and SPNHC,

It is with great pleasure that I welcome you to the first ever joint meeting of our two societies. Without a doubt this will be a memorable event given that it is being held during the "International Year of Biodiversity", SPNHC will be celebrating its 25th anniversary, and we will have a chance to explore Ottawa's recently renovated Canadian Museum of Nature in its 100th year. All of these events, as well as the numerous symposia and contributed talks and posters, will no doubt set the seeds for future collaborations, as well as a basis for future joint meetings between our societies.

Sincerely,

Rodger Evans

President, Canadian Botanical Association / L'Association Canadienne de Botanique

Welcome from the SPNHC President

Welcome! Bienvenue!

I want to offer a very sincere welcome to all attending the 25th annual meeting of the Society for the Preservation of Natural History Collections. We are excited that you are able to join us as we celebrate our 25th Anniversary. This meeting is also special since it is the first such joint meeting that SPNHC has held with a discipline-oriented scientific society; as a botanist, I could not be more pleased that the Canadian Botanical Association (CBA/ABC) is our partner at this meeting. Networking efforts are underway among botanical collections; I also welcome members of the Consortia of Northeastern Herbaria and Canadensys who are joining us. The theme of the meeting, *Biodiversity 2010 and Beyond – Science and Collections*, reflects not only the United Nations declaration of 2010 as the "International Year of Biodiversity" but also the need to continue to stress the importance of collections in biodiversity studies.

We all need to offer a special word of thanks to our host committee and host institution, the Canadian Museum of Nature. They have developed a stimulating schedule of presentations, discussions, workshops, and social events for the delegates from both societies to sample during the week. I thank all who are making presentations, leading workshops, participating in our vendor area, etc. – without your participation the meeting would certainly be a rather empty affair rather than the lively meetings that SPNHC members have come to expect.

Enjoy this time of fellowship and learning!

Rich Rabeler

President, Society for the Preservation of Natural History Collections

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General Conference Information

Registration & Information Desk

The conference registration and information desk will be located in Tabaret Hall. It will be open during the following hours:

Monday, May 31	01:00 PM – 08:00 PM
Tuesday, June 1	08:00 AM – 06:00 PM
Wednesday, June 2	08:00 AM – 06:00 PM
Thursday, June 3	08:00 AM – 06:00 PM
Friday, June 4	08:00 AM – 06:00 PM
Saturday, June 5	08:00 AM – 01:00 PM

Breaks and Meals

Breakfast will not be provided.

Morning and afternoon breaks will be provided for all conference participants. All breaks will be held in Tabaret Hall.

Lunch will be provided for all participants as follows:

Monday	• with SPNHC Committee Meetings
Tuesday	• with Field Trips
Wednesday	• at the SPNHC Special Interest Group (SIG) and CBA/ABC Sectional Meetings [<i>Lunches are reserved for individuals who registered for these meetings online</i>]
Thursday	• at the Vendor's Lunch
Friday	• at the SPNHC Annual Business Meeting and the CBA/ABC Poster Session
Saturday	• with Workshops and the Field Trip

Dinner will be provided as follows:

Tuesday	• at the Icebreaker Soirée
Wednesday	• at the SPNHC Mixer (CBA/ABC: on your own)
Thursday	• at the CBA/ABC Mixer and SPNHC Banquet
Friday	• at the CBA/ABC Banquet and the SPNHC council meeting (non-council SPNHC: on your own)

~ See page 112 for a list of nearby restaurants ~

Social Events

Joint SPNHC-CBA/ABC Icebreaker Soirée

Tuesday, June 1

6:00 – 10:00 PM

Tabaret Hall, University of Ottawa

SPNHC Mixer

Wednesday, June 2

6:00 – 10:00 PM

Victoria Memorial Museum Building,
Canadian Museum of Nature

CBA/ABC Mixer

Thursday, June 3

6:00 – 10:00 PM

Victoria Memorial Museum Building,
Canadian Museum of Nature

SPNHC Banquet

Thursday, June 3

6:00 – 11:00 PM

Cafeteria of the Jock Turcot University Centre,
University of Ottawa

CBA/ABC Banquet

Friday, June 4

6:00 – 11:00 PM

Cafeteria of the Jock Turcot University Centre,
University of Ottawa

Wi-Fi Access

Wi-Fi will be available to all conference participants in the Desmarais Building and in Tabaret Hall.

Notes to Speakers

Please pre-load your presentation onto the computer in your presentation room *before* the beginning of your session. On the desktop of each computer, there will be a folder for each of the sessions that will take place in the room. A preview room will be available.

Posters and Poster Session

Posters will be on display for the duration of the meeting on the third floor of Tabaret Hall. If you are presenting a poster, please hang your poster after you register. The placement of your poster in Tabaret Hall corresponds to its number (see page 49). Materials to hang your poster will be available at the registration desk.

The SPNHC Poster Session will take place from 4:00 – 5:30 PM on Wednesday, June 2.

The CBA/ABC Poster Session will take place from 12:00 – 2:00 PM on Friday, with lunch included for all registrants. All poster presenters should plan to be at their posters during this period. Judging for the Iain and Sylvia Taylor Award will take place at this time.

Posters should be taken down during the afternoon of Friday, 4 June, after 2:00 PM.

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SPNHC's 25th Anniversary Celebration

In 1985, the Society for the Preservation of Natural History Collections (SPNHC) was created to meet the concerns of a growing number of individuals involved with the development, management, and care of natural history collections. After 25 years of existence, the Society continues to be unique among natural history professional organizations, particularly because of its ever increasing international scope and its multidisciplinary approach to collections management and care.



In celebration of the Society's 25th Anniversary, a number of activities are planned during the Conference to recognize the Society and its members' many accomplishments over the years. Among the planned activities, you will not want to miss the recognition ceremony during Thursday evening's banquet, acknowledging the special contribution of the founding members of SPNHC. A special display at the Tradeshow will evoke memories of past events and highlight our major achievements in the promotion of collections care.

Special *Collection Forum* Volume for SPNHC's 25th Anniversary

Deadline for manuscript submissions: July 10, 2010



To celebrate the Society's 25th Anniversary, we are inviting submission of manuscripts for a special Volume 25 of *Collection Forum*, the internationally respected, peer reviewed journal of the Society for the Preservation of Natural History Collections (SPNHC).

Papers published in *Collection Forum* are intended to reflect the spirit of SPNHC, a multi disciplinary organization composed of individuals who are interested in development and preservation of natural history collections. Natural history collections include specimens and supporting documentation, such as audio-visual materials, labels, library materials, field data, and similar archives. Preservation refers to any direct or indirect activity providing continued and improved care of these collections and supporting documents. The Society actively encourages the participation of individuals involved with all aspects of natural history collections. Publication selection criteria have been revised recently to reflect the fact that papers in *Collection Forum* do not only address research on natural history collections care. Visit the SPNHC website for further information on *Collection Forum* and instructions to authors, or contact the Editor, Dr. Susan Butts, to discuss the suitability of your paper for inclusion in *Collection Forum*.

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Dr. M. v/d Stoelstraat 39
Voorschoten
NETHERLANDS 2251RK
Contact person: Andries J vanDam
T: +31 615 676 299
E: ajvandam@alcomon.com

All Packaging Company Inc

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USA
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T: 816-842-3711
E: eliottg@allpacko.com

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Contact person: Jean Paquet
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E: jeanpaquet@wennet.qc.ca

Atlantic Paste & Glue/CatchMaster

170 53rd Street
Brooklyn, NY 11232
USA
Contact person: Ed Dolshun
T: 347-525-8493
E: dolshun@optonline.net

The Campbell Center for Historic Preservation Studies

203 East Seminary Street
Mt Carroll, IL 61053
USA
Contact person: Sharon Welton
T: 815-244-1173
E: programassistant@campbellcenter.org

Canadian Conservation Institute

1030 Innes Road
OTTAWA, Ontario
Canada K1A 0M5
Contact person: Shanna Stevens
T: 613-998-3721, x278
E: shanna.stevens@pch.gc.ca

Canadian Museum of Nature

PO Box 3443, station D
Ottawa, ON K1P 6P4
Canada
Contact person: Elizabeth McCrea
T: 613-566-4785
E: lfournier@mus-nature.ca (assistante)

Carr McLean Limited

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Canada M8W 4X2
Contact person: David Hatherley
T: 1-800-268-2123
E: glennw@carmclean.ca

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TOPEKA, KS 66601
USA
Contact person: Bruce Danielson
T: 785-234-2244
E: bdanielson@deltadesignsltd.com

Electronic Imaging Materials Inc

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KEENE, NH 03431
USA
Contact person: Nancy Coleman
T: 603-357-1459
E: nancy@eiminc.com

Flora of North America Association

PO Box 716
POINT ARENA, CA 95468
USA
Contact person: Nancy Morin
T: 613-269-4605

GA International Inc

3208 avenue Jacques-Bureau
LAVAL (Québec)
Canada H7P 0A9
Contact person: George Ambartsoumian
T: 450-973-9420
E: george@ga-international.com

Gallery Systems Inc

261 West 35th Street, 12th Floor
NEW YORK, NY 10001-1902
USA
Contact person: Anna J. Kisluk
T: 646-733-2239 x.235
E: anna@gallerysystems.com

Gardex Chemicals Ltd

7 Meridian Road
ETOBICOKE, Ontario
Canada M9W 4Z6
Contact person: Karen Furguele
T: 416-675-1638
E: kfurguele@gardexinc.com

Gaylord Bros

7282 William Barry Boulevard
SYRACUSE, NY 13212
USA
Contact person: Christine Allen
T: 413-268-3811
E: christine.allen@gaylord.com

The Glassblowing Shoppe

900 – 275 Slater Street
OTTAWA, Ontario
Canada K1P 5H9
Contact person: Richard Otoo
T: 613-216-2570
E: Richard@theglassblowingshoppe.com

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Judith Price / Canadian Museum of Nature
Jeff Saarela / Canadian Museum of Nature
Anouk Rousseau / Canadian Museum of Nature
Julian Starr / University of Ottawa
Laurie Consaul / Canadian Museum of Nature
Jennifer Doubt / Canadian Museum of Nature
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Wilda Corcoran / Canadian Museum of Nature
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Program

Jean-Marc Gagnon / Canadian Museum of Nature
Judith Price / Canadian Museum of Nature
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Registration

Peter Frank / Canadian Museum of Nature
Michèle Steigerwald / Canadian Museum of Nature
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Max Joly / Canadian Museum of Nature
Nadine Tremblay / University of Ottawa
Sherryl Monette / University of Ottawa

Social Events and Catering Arrangements

Nancy Boase / Canadian Museum of Nature
Roger Baird / Canadian Museum of Nature
Carolyn Leckie / Canadian Museum of Nature
Luci Ciperá / Canadian Museum of Nature

Field Trips

Laurie Consaul / Canadian Museum of Nature
Gisèle Mitrow / Agriculture and Agri-Food Canada

Workshops

Kamal Khidas / Canadian Museum of Nature
Micheline Beaulieu-Bouchard / Canadian Museum of Nature
Jean-Marc Gagnon / Canadian Museum of Nature
Luci Ciperá / Canadian Museum of Nature

Marcie Kwindt / Canadian Museum of Nature
Robert Waller / Protect Heritage Corp.
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Clare Valentine / The Natural History Museum, London
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SPNHC 25th Anniversary Activities

Janet Waddington / Royal Ontario Museum
Ann Pinzl / Carson City, Nevada
Susan Butts / Yale University-Peabody Museum
Cathy Hawks / Falls Church, Virginia
Elana Benamy / Academy of Natural Sciences of Philadelphia
Deb Trock / California Academy of Sciences

Greening Initiatives

Jennifer Doubt / Canadian Museum of Nature
Kieran Shepherd / Canadian Museum of Nature
Margaret Currie / Canadian Museum of Nature

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Susan Swan / Canadian Museum of Nature
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The advertisement includes a screenshot of the University Products website. The website header features the logo "universityproducts THE ARCHIVAL COMPANY" and a search bar. A navigation menu includes: PHOTO PRODUCTS, ARCHIVAL STORAGE, CONSERVATION MATERIALS, EQUIPMENT & TOOLS, LIBRARY PRODUCTS, EXHIBIT FURNITURE, COLLECTORS STORAGE, NEW PRODUCTS, SPECIAL OFFERS, and QUICK ORDER. The main content area is titled "ARCHIVAL STORAGE SOLUTIONS" and shows several open boxes. To the right is a "REGISTER TODAY" button with the text "EXPEDITE FUTURE ORDERS, ACCESS YOUR ACCOUNT AND ORDER HISTORY" and the "ARCHIVAL QUALITY 100% Guaranteed" logo. Below the main content are four small product images with captions: "Caring for American Indian Objects" (a basket), "Archival Polyester Mounting Corners" (a flower), "Archival Quality Clothes Hanger and Hanger Kit" (a hanger), and "Self-Adhesive I/Film Frame Sealing Tape" (a roll of tape).

Biodiversity is life



Biodiversity is our life

Program At-A-Glance

Wednesday • 2 June 2010 • Morning	
08:30 - 09:00	ByTowne Cinema - Announcements & Welcome (DiCosimo, LaLonde, Rabeler, Evans, Gagnon) (Chair: J.-M. Gagnon)
09:00 - 10:00	Keynote Speaker: Paul Hebert - A Census of All Life
10:00 - 10:40	Break (40 min)
10:40 - 12:00	Panel on Biodiversity Informatics Megastrategies: A Global Vision (Chair: J. Macklin) -- Walter Berendsohn, EDIT Guy Baillargeon, Encyclopedia of Life (EOL) Anne Bruneau, CANADENSYS Vishwas Chavan, GBIF John R. Wieczorek, American Bioinformatics Initiatives

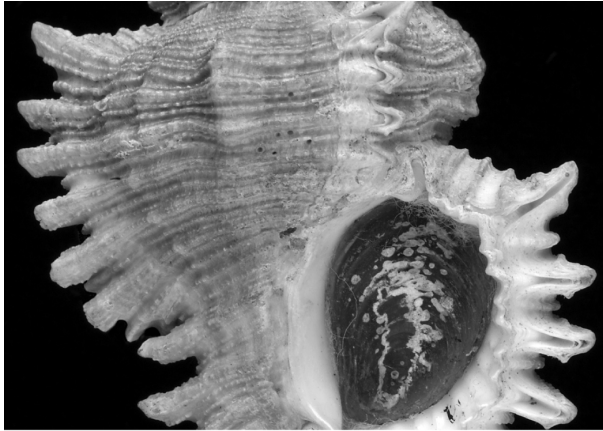
Wednesday • 2 June 2010 • Afternoon			
12:00 - 02:00	Lunch @ SPNHC SIG Meetings	Lunch @ CBA Section Meetings	
02:00 - 02:10	SPNHC: Collections Digitization (Chair: Chris Norris) Room 1160	Symposium: Dispersal in Fungi and Plants (Chair: Hugues Massicotte) Room 1140	Systematics Contributed Papers (Chair: Julian Starr) Room 1150
02:10 - 02:30	Ford - A comprehensive look at data digitization and mobilization in a natural history museum: Challenges and initiatives at the Museum of Comparative Zoology, Harvard University	Seifert – The grey zones of microbial dispersal: The importance of collections, databases and taxonomists for understanding biological invasions (40 min)	Allen - The tortoise and the hare: contrasting phylogeographic patterns in western North American species of <i>Bistorta</i> (Polygonaceae).
02:30 - 02:50	Molineux - An inventory for all seasons: methods for gathering data using volunteers		Ciotir - Phylogeography of <i>Bartonia</i> species in North America and conservation implications of branched <i>Bartonia</i> , a possible new species for Ontario
02:50 - 03:10	Waddington - Flat file to relational: The evolution of a type catalogue of invertebrate fossils	Lachance - Floricolous Yeasts and the Microbial Ubiquity Model (40 min)	Dickinson - What is Suksdorf's hawthorn (<i>Crataegus suksdorfii</i>)?
03:10 - 03:30	Slawski - High-throughput digitization of museum source documentation		Sokoloff - Systematics and conservation of Fernald's Milkvetch: cpDNA, AFLPs and morphometric analyses do not support taxonomic recognition.
03:30 - 04:00	Break (30 minutes)		
	Tabaret Hall 3rd Floor	Dispersal Symposium continued Room 1140	Systematics continued Room 1150
04:00 - 04:20	SPNHC Poster Session	Windham – A peek inside the black box: investigating factors affecting long-distance dispersal and sporophyte establishment in seed-free vascular plants (40 min)	Babineau - Phylogeny and biogeography of endangered Malagasy legumes: the genus <i>Delonix</i>
04:20 - 04:40			Lo - The associations of biogeography and reproductive system with fruit color polymorphism in the Himalayan Mountain-ash (<i>Sorbus</i> ; Rosaceae).
04:40 - 05:00		Ackermann – The physical ecology of pollen dispersal (40 min)	Wright - The evolution of reproduction in <i>Cuscuta</i> : a glimpse into the sex lives of parasitic plants
05:00 - 05:20			Elisens - Ethnobotany of the southern plains: Plant usage among the Kiowa, Comanche, and Plains Apache
05:30 - 06:30		Ecology Discussion: Re-introduction: when, where and how? 5:30 PM @ The Royal Oak on Laurier	Teaching Section Meeting Tabaret Room 319
06:00 - 10:00	SPNHC Mixer – Victoria Memorial Museum Building, CMN		

Thursday • 3 June 2010 • Morning				
08:30 - 8:40	SPNHC - Collections and the Web (Chair: Andy Bentely) Room 1160	SPNHC - Digitizing Initiatives (Chair: Richard Sabin) Room 1030	CBA-ABC Systematics Symposium -- Roles and Status of Canadian Herbaria (Chair: Tim Dickinson) Room 1140	CBA-ABC Plant Development Contributed Papers (Chair: Arunika Gunawardena) Room 1150
08:40 - 9:00	Norris - Web 2.0, social networking, and the future of on-line collections access	Peters - The Global Plants Initiative (GPI) and the California Academy of Sciences	Berbee -- Capturing the missing diversity among BC fungi and a plan to build understanding of fungal belowground ecology	Lord - The lace plant: a new model organism to study both developmental and induced programmed cell death
09:00 - 9:20	Hoffman - Introducing CollectionSpace, a collection management system and foundation for research	Mishler -The Jepson Flora Project and the Consortium of California Herbaria	McDevit - Acquiring DNA sequence data from dried archival (type) red algal collections for the purpose of applying specific epithets to contemporary molecular species: a critical assessment	Rantong - Isolation of cDNAs of genes involved in programmed cell death (PCD) in lace plant (<i>Aponogeton madagascariensis</i>)
09:20 - 09:40	Prather - CollectionsWeb Update: Building a Community of Natural History Collections	Zetzsche - DNA Bank Network – Referencing DNA with specimens, sequences and publications based on GBIF web services	Cayouette - Changing values of Canadian herbaria from the 19th to the 21st century	Lyssa - The fortuitous observation of endophytes in the dwarf mistletoe <i>Arceuthobium americanum</i>
09:40 - 10:00	Colosi - Re-curating the fluid-preserved mammals of the Yale Peabody Museum of Natural History: Methods and discoveries		Metsger - Tapping the international herbarium network to 'plant' Life in Crisis: the Schad Gallery of Biodiversity, at the ROM	Ross Friedman - Identification of a gender-specific marker in the dwarf mistletoe (<i>Arceuthobium americanum</i>) using random amplified polymorphic DNA (RAPD) analysis
10:00 - 10:40	Break (40 min)			
	SPNHC Collection Management I (Chair Ann Molineux) Room 1160	SPNHC: GBIF Discussion Session (Chair: Vishwas Chavan) Room 1130	Systematics Symposium continued Room 1140	Plant Development continued Room 1150
10:40 - 11:00	DeMouthe - Storage and documentation of gemstones & other precious objects	Towards demand-driven publishing of Natural History Collections Data: Recommendations of the GBIF GSAP-NHC TG Chavan, Vishwas	Cota-Sanchez - Herbarium data management and display using Specify: SASK collection as example	Macdonald - Nodule development in E151 (sym15), a low-nodulation pea mutant
11:00 - 11:20	Kerbey - Keep, cut or pour into the foundations - Why preserve rock collections?		Barkworth - Herbaria - of value beyond systematics	Al Khateeb - In vitro propagation and characterization of phenolic content, antioxidant and antimicrobial activity of <i>Cichorium pumilum</i> , an endangered medicinal plant from Jordan
11:20 - 11:40	Palumbo - Conservation issues within natural history collections: The restoration of colour		Brouillet - Assessing the state and trends of biodiversity sciences (taxonomy and collections) in Canada: An introduction to the Council of Canadian Academies' Expert Panel process	CBA-ABC Mycology Contributed Papers: Lim - Phylogenetic structure of ectomycorrhizal fungal communities of western hemlock on northern Vancouver Island changes with forest age and stand type
11:40 - 12:00	Harding - Birds, beasts and botanicals: identifying organic materials in ethnographic collections		Sears - How Canadian herbaria are being utilized in the 21st century	Piercey-Normore - Biodiversity of species and natural products of lichen-forming fungi in the genus <i>Cladonia</i> .
12:00 - 1:30	SPNHC & CBA-ABC Lunch (Vendors' Lunch) Tabaret Hall Chapel			

Thursday • 3 June 2010 • Afternoon				
01:30 - 01:40	NSERC session Room 1120	SPNHC DemoCamp (Chair: Amanda Neil) Room 1130	CBA-ABC Symposium: Plant Insect Interactions (Chair: Art Davis) Room 1140	CBA-ABC Ecology & Conservation Contributed Papers: (Chair: Arthur Fredeen) Room 1150
01:40 - 02:00	St-Onge - NSERC Program News and 2010 Discovery Grant Competition Results (20 min)	Lafferty - SALIX, a semiautomatic label information extraction system using OCR	Jetter - Slippery plant surfaces: from chemistry to ecology (40 min)	Paradis - The "mire-forest" transition in raised bogs of eastern Canada: identification of ecotonal species*
02:00 - 02:20	NSERC Workshop: How to prepare a Discovery Grant application (1 hour)	Best - A framework and workflow for extraction and parsing of herbarium specimen data		Fredeen - Epiphytic macrolichen diversity in subboreal British Columbia
02:20 - 02:40		Rios - Georeferencing natural history collections data Using GEOLocate	Kobyilinski - Epiphytic N2-fixing cyanolichens: Important spokes in the wheel of diversity, but what to the nitrogen cycle?	
02:40 - 03:00		Wieczorek - Georeferencing Natural History Collections with BioGeomancer	Davis - Flower development and nectar production in relation to insect pollination (40 min)	Jones - Mixed-mating plant responds positively to climate extremes
03:00 - 03:30	Break (30 minutes)			
	SPNHC-Collection Management II (Chair: Jean DeMouthe) Room 1120	SPNHC DemoCamp continued (Chair: Amanda Neil) Room 1130	Plant Insect Interactions Symposium continued Room 1140	Ecology & Conservation continued Room 1150
03:30 - 03:50	McAlister - Biodiversity, Collections and The Natural History Museum - An Interactive Approach	Ung - Xper?: introducing e-Taxonomy.	Shorthouse - Manipulation of plant development by cynipid wasps attacking Canada's wild roses (40 min)	Waterway - Quantitative comparisons of <i>Carex</i> seed banks in old-growth forest, using nuclear ribosomal spacers as DNA barcodes to identify seedlings
03:50 - 04:10	Allen - Long term storage method for oversized anthropology collections	Bentley - Specify 6 innovation and collaboration		Da Silva - Influence of an invasive plant species on plant pollinator interactions: Evidence for facilitation
04:10 - 04:30	Watkins-Colwell - Something's Fishy at the Peabody: The Ichthyology Collection at the Yale Peabody Museum of Natural History	Riccardi - Integrating specimens, images, and ontologies	CBA-ABC Systematics and Phytogeography II: Gillespie - Plant collecting by canoe: botanical explorations of Tuktut Nogait National Park and vicinity, Northwest Territories.	Petersen - Assessing the efficacy of buffer strips in sustaining bryophyte diversity in montane forests in the BC Interior.
04:30 - 04:50	Brunel - The Institut québécois de la biodiversité (IQBIO) and Quebec's natural history collections	Macklin - Herbarium Networks Part IV: Demonstration of a prototype web interface for a 'Filtered Push' network to enable discovery, filtering, and annotation of botanical and other natural history specimen data.	CBA/ABC Annual General Meeting Room 1160	
04:50 - 05:30				
06:00 - 10:00			CBA-ABC Mixer – Victoria Memorial Museum Building, CMN	
06:00 - 11:00	SPNHC Banquet Unicenter Cafeteria			

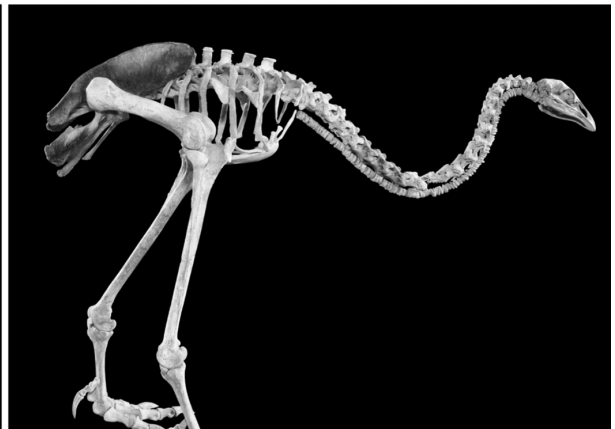
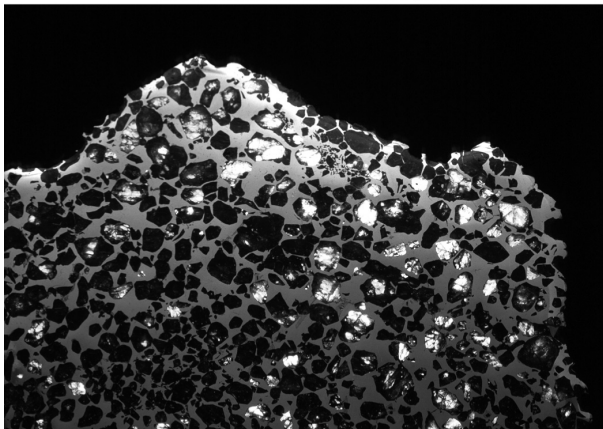
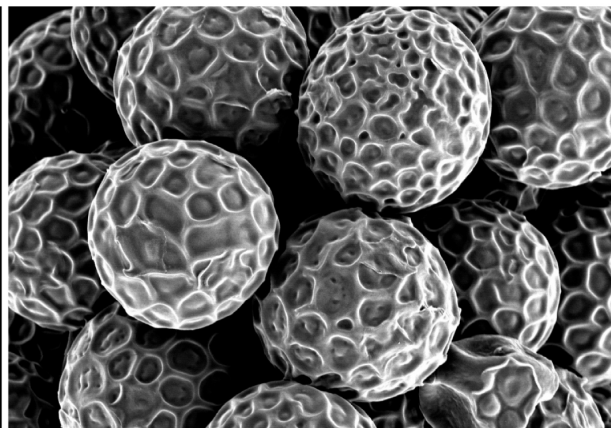
Friday • 4 June 2010 • Morning				
08:30 - 08:40	SPNHC: Digitizing Herbaria (Chair: Gregory Watkins-Colwell) Room 1120		CBA-ABC Teaching Section (Chair: Cindy Ross Friedman) Room 1140	CBA-ABC Symposium - Global Plant Conservation (Chair: Danna Leaman) Room 1150
08:40 - 09:00	Doran - Preserving GOD: Curatorial and digitization challenges in the Charterhouse School Herbarium.		Frego - Calling or culling: the influence of our teaching metaphors (40 min)	Hendrickson - The once and future strategy: the global response to the plant conservation crisis
09:00 - 09:20	Tse - Catharine Parr Trail Scrapbook: Microfade testing of Herbaria Collection and Exhibition Decisions			Galbraith - Canada's Response to the Global Strategy for Plant Conservation
09:20 - 09:40	Poncy- An overview of the renovation of the Paris Herbarium			Small - Superstar plants as a key to public and political support for conservation
09:40 - 10:00			Fredeen & Young - BIOL 304: A new upper division plant structure and function course with a society and environment context	Farr - CITES as a tool for sustainable use of plants
10:00 - 10:40	Break (40 min)			
	SPNHC: Digitizing Herbaria cont'd (Chair: Gregory Watkins-Colwell) Room 1120	SPNHC: Virtual Herbarium (Chairs: J. Macklin & R. Rabeler) Room 1130	Teaching continued Room 1140	Global Plant Conservation Symposium continued Room 1150
10:40 - 11:00	Morin - The Biodiversity Heritage Library: 28 million pages of taxonomic literature & you	Macklin & Rabeler - How will we digitize the 70 million+ plant specimens housed in United States herbaria?	Teaching Panel (1 hour 20 minutes)	Davis - The CBD in practice: challenges for collections and research
11:00 - 11:20	Sweeney - Digitization workflow in the Yale University Herbarium	Discussion session: Follow-up to Macklin & Rabeler "Developing a digital U.S. biological collections national resource: First steps towards a strategic plan" and "US Virtual Herbarium" [1 hour]		Open Discussion
11:20 - 11:40	Campbell - DNA and tissue banking at The New York Botanical Garden			CBA-ABC Ecology & Conservation Symposium (Chair: Adrienne Sinclair) Catling - Three BIG QUESTIONS about databasing natural history collections
11:40 - 12:00				Doubt - The Cutlery Moss and other capers: Managing the herbarium for species conservation
12:00 - 02:00	SPNHC Annual Business Meeting (Lunch Included) Room 1160		CBA/ABC Poster Session with judges (Lunch Included) Tabaret Hall 3rd Floor	

Friday • 4 June 2010 • Afternoon				
02:00 - 02:10	SPNHC: Digitizing Invertebrate Collections (Chair: Tim White) Room 1160	Room 1130	CBA-ABC Systematics & Phytogeography Contributed Papers III (Chair: Laurie Consaul) Room 1140	Ecology Symposium continued from a.m. Room 1150
02:10 - 02:30	Morris - Imaging and innovative workflows for efficient data capture in an Entomological collection: The MCZ Lepidoptera Rapid Data Capture Project.	Consortium of Northeastern Herbaria Meeting	Rodrigues - Molecular systematics of the parasitic genus <i>Conopholis</i> (Orobanchaceae)	Vasseur - Changes in plant communities: approaches to visualize spatial or temporal changes.
02:30 - 02:50	Sikes - Digitization of the University of Alaska Museum Insect Collection		Fazekas - Community structure of arbuscular mycorrhizal fungi (AMF) on root tissue identified by DNA barcoding	Nault - SEM'AIL: a public restoration program for wild leek (<i>Allium tricoccum</i> Ait.) in Quebec; a species threatened from overharvesting.
02:50 - 03:10	Mayer - How (and how not) to survey a systematic invertebrate paleontology collection for locality data		Chouinard - A practical test of DNA barcodes for identifying the Cariceae (<i>Carex</i> & <i>Kobresia</i> , Cyperaceae) of North America, north of Mexico	Lyashevskva - What does it mean to value biodiversity?
03:10 - 03:40	Break (30 minutes)			
	SPNHC: The Lighter Side (Chair: Judith Price) Room 1160	Room 1130	Systematics continued Room 1140	Ecology continued Room 1150
03:40 - 04:00	Dougherty - The History of Paleontology at the Geological Survey of Canada	Continued: Consortium of Northeastern Herbaria Meeting	Kuzmina - A DNA Barcode reference library for the vascular plants of Churchill, Manitoba	Bérubé - How paleoecological tools can help planning restoration projects?
04:00 - 04:20	DeMouthe - Reverend James Downstream: A pioneer in early natural history collecting		Saarela - DNA barcoding the vascular plant flora of the Canadian Arctic	Pouliot - Is there a link between the presence of vascular plants and the initiation of <i>Sphagnum</i> moss hummocks in bogs?
04:20 - 05:20	KE Emu NHSIG Room 1120	Weresub Lecture (1 hour) Ernie Brodo - Travels with a Lichenologist Room 1160		
05:20 - 06:20			CBA-ABC Incoming Executive Meeting - Tabaret Room 309	
06:00 - 09:00	SPNHC Council Meeting Tabaret Hall Chapel			
06:00 - 11:00			CBA-ABC Banquet Unicenter Cafeteria	



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DETAILED PROGRAM

Monday, 31 May 2010

1:00 – 8:00 PM Registration
Tabaret Hall

8:30 – 5:00 PM SPNHC Committee Meetings
Tabaret Hall

8:30 – 9:45	Room 303	Mentorship Committee
	311	Documentation Committee
9:45 – 10:00	Rotunda	- Break -
10:00 – 11:15	311	Best Practices Committee
	303	Publication Committee
11:15 – 12:30	309	Long Range Planning
	378A	Finance Committee
12:30 – 13:00	112	Lunch
13:00 – 14:15	311	Membership Committee
	303	Conservation Committee
14:15 – 15:30	309	25th Anniversary Committee
15:30 – 15:45	378A	Education and Training Committee
15:30 – 15:45	Rotunda	- Break -
15:45 – 17:00	311	Web Committee
	309	Conference Committee
	303	Ethics Committee

6:00 – 10:00 PM SPNHC First Council Meeting
Tabaret Hall, Room 112

Tuesday, 1 June 2010

8:00 AM – 6:00 PM Registration
Tabaret Hall

8:30 AM – 4:30 PM Field Trips

Buses for all field trips will depart from the University of Ottawa. Please meet on the lawn in front of Tabaret Hall at 8:30 AM.

The Quyon Alvar

Duration: Full-Day (8:30 a.m. – 4:30 p.m.)

Guide: Jacques Cayouette, Agriculture and Agri-Food Canada

Gatineau Park & Tree Identification

Duration: Full-Day (8:30 a.m.- 4:30 p.m.)

Guides: Jean Lauriault & Friends of Gatineau Park

Geology for Geophytes

Duration: Full Day (8:30 a.m. – 4:30 p.m.)

Guides: Jean Dougherty, Jan Ayslworth, and Ann Therriault, Geological Survey of Canada

Biking Ottawa Waterways: National Capital Nature

Duration: Full Day (8:30 a.m.– approx. 4:30 p.m.)

Guides: Kieran Shepherd and Jennifer Doubt, Canadian Museum of Nature

Tour at Agriculture and Agri-Food Canada (AAFC) at the Central Experimental Farm

Duration: Half-Day (8:30 a.m.- 12 p.m.)

Guides: Gisèle Mitrow, Scott Redhead, Owen Lonsdale, Jean-Pascal Gratton, Crispin Woods and Robert Glendinning

Tour of the Canadian Museum of Nature Collections, Natural Heritage Building, Gatineau, Québec

Duration: Half-Day (1 p.m. to 4:30 p.m.)

Guides: Wilda Corcoran, Jerry Fitzpatrick and the Collections Division Staff

5:00 – 6:00 PM CBA/ABC Outgoing Executive Meeting
Tabaret Hall, Room 309

6:00 – 10:00 PM Joint SPNHC-CBA/ABC Icebreaker Soirée
In front of Tabaret Hall, University of Ottawa
- food and cash bar



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Wednesday, 2 June 2010 • Morning

8:00 AM – 6:00 PM Registration
Tabaret Hall

8:30 – 12:00 PM SPNHC & CBA/ABC Joint Plenary Session
ByTowne Cinema
325 Rideau Street, Ottawa

- The ByTowne Cinema is a 10 minute walk from campus. For walking directions from the University of Ottawa, see map on page 116.

Chair: Jean-Marc Gagnon

8:30 – 9:00	<p>Opening Remarks & Announcements</p> <p>Joanne DiCosimo, President & CEO, Canadian Museum of Nature André E. Lalonde, Dean of Science, University of Ottawa Richard Rabeler, President, Society for the Preservation of Natural History Collections (SPNHC) Rodger Evans, President, Canadian Botanical Association (CBA/ABC) Jean-Marc Gagnon, Chair of the Local Organizing Committee, SPNHC-CBA 2010</p>
9:00 – 10:00	<p>Keynote Speaker</p> <p>A Census of All Life Paul Hebert, University of Guelph</p>
10:00 – 10:40	<p>- Break -</p>
10:40 – 12:00	<p>Panel on Biodiversity Informatics Megastrategies: A Global Vision</p> <p>Chair: James Macklin</p> <ul style="list-style-type: none"> • Guy Baillargeon - Canadian Biodiversity Information Facility (CBIF) • Walter G. Berendsohn. – European biodiversity informatics initiatives • Anne Bruneau – Canadensys • Vishwas Chavan – Global Biodiversity Information Facility (GBIF) • John R. Wiczorek – American Bioinformatics Initiatives <p><i>~Please see the abstracts for details about and full authorships for these initiatives~</i></p>

Wednesday, 2 June 2010 • Afternoon

12:00 – 2:00 PM Lunch & Meetings

SPNHC Special Interest Group (SIG) Meetings — Lunch Included

- 1. Transport of specimens – dangerous goods and country specific issues** (Andy Bentley), Desmarais, Room 1140
- 2. Destructive analysis** (Sula Vanderplank), Tabaret Hall, Room 0019
- 3. WEB 2.0: The potential to improve collections access and data quality** (Kelly Sendall), Tabaret Hall, Room 323
- 4. Creative destruction - How to survive in and with your new building** (Deb Trock), Tabaret Hall, Room 309
- 5. Integrated pest management** (Sue Ryder), Tabaret Hall, Room 250
- 6. Orphan collections and their excess baggage** (Ann Molineux), Tabaret Hall, Room 317
- 7. Volunteers: Building and keeping a viable workforce** (Katherine Day), Tent in front of Tabaret Hall
- 8. Conservation and “The Rest of the Museum”** (Carolyn Leckie and Luci Cipera), Tabaret Hall, Room 303
- 9. Botany collections management** (Jennifer Doubt & Linda Hollenberg), Tabaret Hall, Room 333

CBA/ABC Sectional Meetings — Lunch Included

(Note: Lunches are reserved for those who signed up for one of these meetings during online registration. If you did not sign up, you are responsible for your own lunch.)

- **Systematics & Phytogeography** – Tabaret Hall, Room 325
- **Ecology & Conservation** – Tabaret Hall, Room 315
- **Plant Development** – Tabaret Hall, Room 319
- **Mycology** – Tabaret Hall, Room 327

*****The Teaching Section will meet later today at 5:30 (Wed, 2 June), in Tabaret Hall, Room 319. All CBA/ABC members with an interest in teaching are invited to attend this meeting!**

2:00 – 3:30 SPNHC Contributed Papers: Collections Digitization

Chair: Chris Norris

Desmarais, Room 1160

2:10 – 2:30	A comprehensive look at data digitization and mobilization in a natural history museum: Challenges and initiatives at the Museum of Comparative Zoology, Harvard University Ford, Linda S., Haley, Brendan, Morris, Paul J.
2:30 – 2:50	An inventory for all seasons: methods for gathering data using volunteers Molineux, Ann, Humer, Judy, McCulloch, Christine
2:50 – 3:10	Flat file to relational: The evolution of a type catalogue of invertebrate fossils Waddington, Janet

3:10 – 3:30	High-throughput digitization of museum source documentation Slawski, Jessica R.
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2:00 – 3:30 SPNHC Poster Session

Tabaret Hall 3rd Floor

2:00 – 5:20 CBA/ABC Symposium: Dispersal in Fungi and Plants

Co-sponsored by: CBA/ABC Mycology Section & Systematics and Phytogeography Section

Organized by: Hugues Massicotte, Shannon Berch & Tim Dickinson

Chair: Hugues Massicotte

Desmarais, Room 1140

2:10 – 2:50	The grey zones of microbial dispersal: The importance of collections, databases and taxonomists for understanding biological invasions Seifert, Keith A.
2:50 – 3:30	Floricolous yeasts and the ubiquity model Lachance, Marc-André
3:30 – 4:00	– Break –
4:00– 4:40	A peek inside the black box: investigating factors affecting long-distance dispersal and sporophyte establishment in seed-free vascular plants Windham, Michael
4:40 – 5:20	The physical ecology of pollen dispersal Ackermann, J.

2:00 – 5:10 CBA/ABC Contributed Papers: Systematics & Phytogeography I

Chair: Julian Starr

Desmarais, Room 1150

2:10 – 2:30	The tortoise and the hare: contrasting phylogeographic patterns in western North American species of <i>Bistorta</i> (Polygonaceae) <u>Allen, Geraldine A.</u> , Marr, Kendrick L., McCormick, Laurie J., Hebda, Richard J.
2:30 – 2:50	Phylogeography of <i>Bartonia</i> species in North America and conservation implications of branched <i>Bartonia</i>, a possible new species for Ontario <u>Ciotir, Claudia</u> , Freeland, Joanna, Mathews, Katherine, Struwe, Lena, Korol, Burke
2:50 – 3:10	What is Suksdorf's hawthorn (<i>Crataegus suksdorfii</i>)? <u>Dickinson, Timothy A.</u> , Talent, Nadia J., Lo, Eugenia Y. Y.
3:10 – 3:30	Systematics and conservation of Fernald's Milkvetch: cpDNA, AFLPs and morphometric analyses do not support taxonomic recognition <u>Sokoloff, Paul C.</u> , Gillespie, Lynn J.

3:30 – 4:00	- Break -
4:00 – 4:20	Phylogeny and biogeography of endangered Malagasy legumes: the genus <i>Delonix</i> Babineau, Marielle, Bruneau, Anne
4:20 – 4:40	The associations of biogeography and reproductive system with fruit color polymorphism in the Himalayan Mountain-ash (<i>Sorbus</i>; Rosaceae) Lo, Eugenia Y. Y.
4:40 – 5:00	The evolution of reproduction in <i>Cuscuta</i>: a glimpse into the sex lives of parasitic plants Wright, Michael A. R., Costea, Mihai
5:00 – 5:20	Ethnobotany of the southern plains: Plant usage among the Kiowa, Comanche, and Plains Apache Elisens, Wayne

5:30 – 6:30 CBA/ABC Teaching Section Meeting

Tabaret Hall, Room 319

5:30 PM CBA/ABC Ecology & Conservation Section Discussion

The Royal Oak on Laurier Avenue

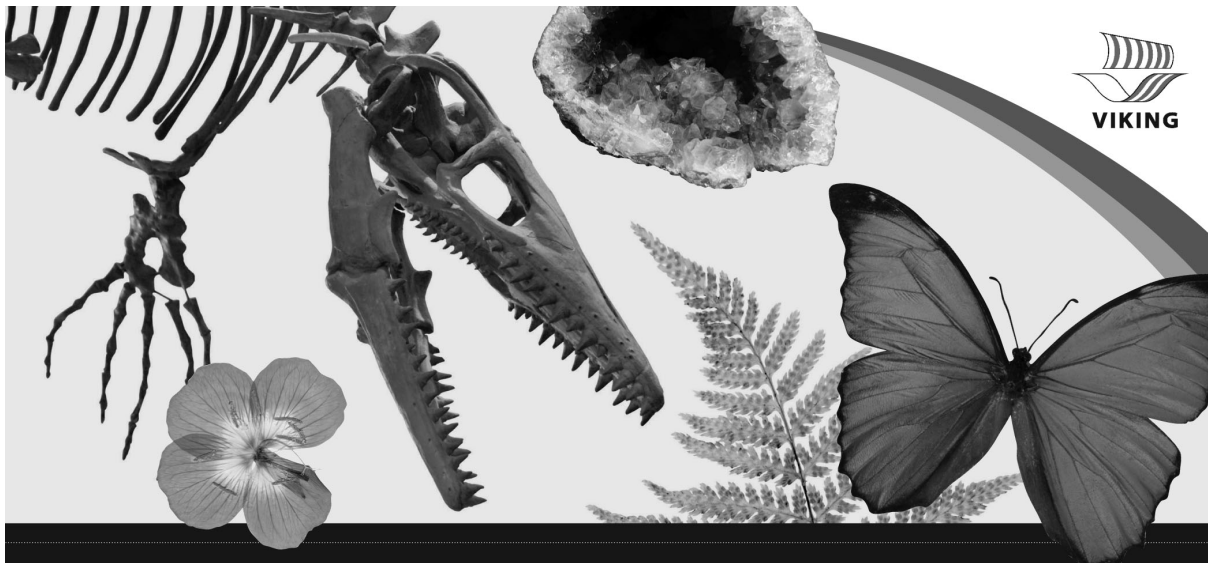
161 Laurier Ave. East, Ottawa, located at the edge of the University of Ottawa campus, one block east of Tabaret Hall.

This year's discussion will address the question: **Re-introduction - When, How and Where?**, with a focus on the issues and conditions when re-introduction is being considered in sites where a species has been extirpated. Come share your views and questions on this important topic!

6:00 – 10:00 PM SPNHC Mixer

Victoria Memorial Museum Building, Canadian Museum of Nature

Buses will leave from Tabaret Hall between 5:30 – 6:30 PM; they will leave the Museum between 9:30 – 10:15 PM. The museum is a short walk (ca. 20 min) from the University (see map on page 116).



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Thursday, 3 June 2010 • Morning

8:00 AM – 6:00 PM Registration
Tabaret Hall

8:30 – 10:00 SPNHC Contributed Papers: Collections and the Web

Chair: Andrew Bentley
Desmarais, Room 1160

8:40 – 9:00	Web 2.0, social networking, and the future of on-line collections access <u>Norris, Christopher A.</u> , Butts, Susan
9:00 – 9:20	Introducing CollectionSpace, a collection management system and foundation for research Hoffman, Christopher R., Doran, Andrew S., Moe, Richard L., McGrath, Patrick, Mishler, Brent D.
9:20 – 9:40	CollectionsWeb Update: Building a Community of Natural History Collections Prather, L. Alan
9:40 – 10:00	Re-curating the fluid-preserved mammals of the Yale Peabody Museum of Natural History: Methods and discoveries <u>Colosi, Jordan G.</u> , Zyskowski, Kristof, Watkins-Colwell, Gregory J.
10:00 – 10:40	- Break -

8:30 – 10:00 SPNHC Contributed Papers: Digitizing Initiatives

Chair: Richard Sabin
Desmarais, Room 1030

8:40 – 9:00	The Global Plants Initiative (GPI) and the California Academy of Sciences <u>Peters, Rebecca</u> , Trock, Debra K.
9:00 – 9:20	The Jepson Flora Project and the Consortium of California Herbaria <u>Mishler, Brent D.</u> , Baldwin, Bruce G. , Moe, Richard L. , Markos, Staci
9:20 – 9:40	DNA Bank Network – Referencing DNA with specimens, sequences and publications based on GBIF web services <u>Zetzsche, Holger</u> , Droege, Gabriele, Gemeinholzer, Birgit
10:00 – 10:40	- Break -

10:40 – 12:00 SPNHC Contributed Papers: Collection Management I

Chair: Ann Molineux
Desmarais, Room 1160

10:40 – 11:00	Storage and documentation of gemstones & other precious objects DeMouthe, Jean F.
11:00 – 11:20	Keep, cut or pour into the foundations - Why preserve rock collections? Kerbey, Helen C.
11:20 – 11:40	Conservation issues within natural history collections: The restoration of colour Palumbo, Bethany
11:40 – 12:00	Birds, beasts and botanicals: identifying organic materials in ethnographic collections Harding, Deborah G.

10:40 – 12:00 SPNHC Discussion Session: GBIF GSAP-NHC Task Group

Chair: Vishwas Chavan
Desmarais, Room 1130

10:40 – 12:00	Towards demand-driven publishing of Natural History Collections Data: Recommendations of the GBIF GSAP-NHC TG Chavan, Vishwas
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8:30 – 12:00 CBA/ABC Symposium: Roles and Status of Canadian Herbaria

Co-sponsored by: CBA/ABC Systematics & Phytogeography Section and Mycology Section
Organized by: Tim Dickinson, Hugues Massicotte & Shannon Berch
Chair: Tim Dickinson
Desmarais, Room 1140

8:40 – 9:00	Capturing the missing diversity among BC fungi and a plan to build understanding of fungal belowground ecology <u>Berbee, Mary L.</u> , Harrower, Emma, Lim, SeaRa, Dee, Jaclyn, Ceska, Oldriska, Kroeger, Paul
9:00 – 9:20	Acquiring DNA sequence data from dried archival (type) red algal collections for the purpose of applying specific epithets to contemporary molecular species: a critical assessment Saunders, Gary W., <u>McDevit, Daniel C.</u>
9:20 – 9:40	Changing values of Canadian herbaria from the 19th to the 21st century <u>Cayouette, Jacques</u> , Small, Ernie

9:40 – 10:00	Tapping the international herbarium network to 'plant' Life in Crisis: the Schad Gallery of Biodiversity, at the ROM Metsger, Deborah A.
10:00 – 10:40	– Break –
10:40 – 11:00	Herbarium data management and display using SPECIFY: SASK collection as example Cota-Sánchez, J. Hugo
11:00 – 11:20	Herbaria - of value beyond systematics Barkworth, Mary E.
11:20 – 11:40	Assessing the state and trends of biodiversity sciences (taxonomy and collections) in Canada: An introduction to the Council of Canadian Academies' Expert Panel process Brouillet, Luc
11:40 – 12:00	How Canadian herbaria are being utilized in the 21st century Sears, Christopher J.

SPNHC 2011

The 2011 joint meeting of the Society for the Preservation of Natural History Collections and the Natural Science Collections Alliance will be held in San Francisco, hosted by the California Academy of Sciences. The new Academy building is the first and only LEED (Leadership in Energy & Environmental Design) Platinum certified museum and was recently given the Urban Land Institute's Award for Excellence. One evening event and tours of the collections and the building will be offered during the meeting.

The meeting's theme is "Sustainability and Collections" and will be held at the spectacular Hotel Kabuki, located in the heart of Japantown. This venue will provide a unique and exciting setting for the meeting, and is within walking or easy public transport distance of most of the iconic attractions in San Francisco. Field trips will include visits to such diverse localities as the Monterey Bay Aquarium, redwoods, the wine country, the Pt. Reyes Bird Observatory, and the San Andreas fault.

来年会おう
See you Next Year!

CAS/SPNHC Local Organizing Committee

California Academy of Sciences



8:30 – 11:20 CBA/ABC Contributed Papers: Plant Development & Mycology

Chair: Arunika N. Gunawardena
Desmarais, Room 1150

8:40 – 9:00	The lace plant: a new model organism to study both developmental and induced programmed cell death <u>Lord, Christina E.</u> , Gunawardena, Arunika N.
9:00 – 9:20	Isolation of cDNAs of genes involved in programmed cell death (PCD) in lace plant (<i>Aponogeton madagascariensis</i>) <u>Rantong, Gaolathe</u> , Gunawardena, Arunika N.
9:20 – 9:40	The fortuitous observation of endophytes in the dwarf mistletoe <i>Arceuthobium americanum</i> <u>Martin, Lyssa L.</u> , Ross Friedman, Cynthia M., Phillips, Lori A.
9:40 – 10:00	Identification of a gender-specific marker in the dwarf mistletoe (<i>Arceuthobium americanum</i>) using random amplified polymorphic DNA (RAPD) analysis Dwarka, Arvin, <u>Ross Friedman, C.M.</u> , MacKay, M.E. , Nelson, Don
10:00 – 10:40	– Break –
10:40 – 11:00	Nodule development in E151 (sym15), a low-nodulation pea mutant <u>Macdonald, Emily</u> , Guinel, Frédérique
11:00 – 11:20	In vitro propagation and characterization of phenolic content, antioxidant and antimicrobial activity of <i>Cichorium pumilum</i>, an endangered medicinal plant from Jordan <u>Al Khateeb, Wesam</u> , Hussein, Emad, Al Odat, Mohammad
11:20 – 11:40	Phylogenetic structure of ectomycorrhizal fungal communities of western hemlock on northern Vancouver Island changes with forest age and stand type <u>Lim, SeaRa</u> , Berbee, Mary L.
11:40 – 12:00	Biodiversity of species and natural products of lichen-forming fungi in the genus <i>Cladonia</i> Kotelko, R., <u>Piercey-Normore, M. D.</u>

Thursday, 3 June 2010 • Afternoon

12:00 – 1:30 PM Vendor’s Lunch – Tabaret Hall

All meeting participants are invited to head over to Tabaret Hall to visit the vendors. Lunch will be provided.

1:40 – 3:00 PM NSERC Session

Desmarais, Room 1130

1:40 – 2:00	NSERC Program News and 2010 Discovery Grant Competition Results St-Onge, M. NSERC staff will provide an overview of Program news and results of the 2010 Discovery Grants competition. There will be an opportunity for questions following the presentation.
2:00 – 3:00	NSERC Workshop: How to prepare a Discovery Grant application This one-hour workshop presented by NSERC staff will cover the Form 180 process, the Discovery Grant evaluation process (principles, criteria & ratings), the Conference Model and tips for preparing a Discovery Grant application.

3:30 – 4:50 SPNHC Contributed Papers: Collection Management II

Chair: Jean DeMouthe

Desmarais, Room 1120

3:40 – 4:00	Biodiversity, Collections and The Natural History Museum - An Interactive Approach McAlister, Erica J. A.
4:00 – 4:20	Long term storage method for oversized anthropology collections Allen, Joel
4:20 – 4:40	Something's Fishy at the Peabody: The Ichthyology Collection at the Yale Peabody Museum of Natural History Watkins-Colwell, Gregory J.
4:40 – 5:00	The Institut québécois de la biodiversité (IQBIO) and Quebec’s natural history collections Brunel, Pierre

1:30 – 4:50 SPNHC DemoCamp

Chair: Amanda Neil
Desmarais, Room 1130

1:40 – 2:00	SALIX, a semiautomatic label information extraction system using OCR <u>Lafferty, Daryl L.</u> , Landrum, Leslie
2:00 – 2:20	A framework and workflow for extraction and parsing of herbarium specimen data Best, Jason, Moen, William E., Neill, Amanda K.
2:20 – 2:40	Georeferencing natural history collections data Using GEOLocate <u>Rios, Nelson E.</u> , Bart, Henry L.
2:40 – 3:00	Georeferencing Natural History Collections with BioGeomancer Wieczorek, John R., Spencer, Carol L., Bloom, David A.
3:00 – 3:30	- Break -
3:30 – 3:50	Xper²: introducing e-Taxonomy <u>Ung, Visotheary</u> , Vignes-Lebbe, Regine
3:50 – 4:10	Specify 6 innovation and collaboration <u>Bentley, Andrew</u> , Beach, James, Spears, Rod
4:10 – 4:30	Integrating specimens, images, and ontologies <u>Riccardi, Greg</u> , Mast, Austin, Miranker, Dan, Cilloniz, Ferner, Beach, James, Spears, Rod
4:30 – 4:50	Herbarium Networks Part IV: Demonstration of a prototype web interface for a 'Filtered Push' network to enable discovery, filtering, and annotation of botanical and other natural history specimen data <u>Macklin, James A.</u> , <u>Morris, Paul J.</u> , Iloabachie, Chinua, Kelly, Maureen, Lowery, David, Morris, Robert A., Tremonte, Donna, Wang, Zhimin

1:30 – 4:10 CBA/ABC Symposium: Plant-Insect Interactions

Sponsored by: CBA/ABC Plant Development Section

Organized by: Art Davis Chair: Art Davis

Desmarais, Room 1140

1:40 – 2:20	Manipulation of plant development by cynipid wasps attacking Canada’s wild roses Shorthouse, Joe D.
2:20 – 2:40	Slippery plant surfaces: from chemistry to ecology Jetter, Reinhard
2:40 – 3:00	Discussion
3:00 – 3:30	– Break –
3:30 – 4:10	Flower development and nectar production in relation to insect pollination <u>Davis, Arthur R.</u> , Vogel, Stefan, Caswell, Wade D., Stephens, Danielle T., Mack, Jaimie K.
4:10 – 4:50	The physical ecology of pollen dispersal Ackermann, Joe

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4:10 – 4:30 CBA/ABC Contributed Papers: Systematics & Phytogeography II

Chair: Julian Starr
Desmarais, Room 1140

4:10 – 4:30	Plant collecting by canoe: botanical explorations of Tuktut Nogait National Park and vicinity, Northwest Territories <u>Gillespie, Lynn J.</u> , Saarela, Jeffery M. , Consaul, Laurie L. , Bull, Roger D.
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1:30 – 4:30 CBA/ABC Contributed Papers: Ecology & Conservation

Chair: Arthur Fredeen
Desmarais, Room: 1150

1:40 – 2:00	The "mire-forest" transition in raised bogs of eastern Canada: identification of ecotonal species' <u>Paradis, Étienne</u> , Rochefort, Line
2:00 – 2:20	Epiphytic N2-fixing cyanolichens: Important spokes in the wheel of diversity, but what to the nitrogen cycle? <u>Kobylnski, Ania</u> , Fredeen, Arthur L.
2:20 – 2:40	Epiphytic macrolichen diversity in subboreal British Columbia <u>Fredeen, Arthur L.</u> , Kobylnski, Ania
2:40 – 3:00	Mixed-mating plant responds positively to climate extremes <u>Jones, Natalie T.</u> , MacDougall, Andrew S.
3:00 – 3:30	– Break –
3:30 – 3:50	Quantitative comparisons of <i>Carex</i> seed banks in old-growth forest, using nuclear ribosomal spacers as DNA barcodes to identify seedlings <u>Waterway, Marcia J.</u> , Schmah, Camille, Rivers, Allison, Rogic, Anita, Lechowicz, Martin J., Flinn, Kathryn M.
3:50 – 4:10	Influence of an invasive plant species on plant pollinator interactions: Evidence for facilitation <u>Da Silva, Elizabeth M.</u> , King, Vashti M., Sargent, Risa D.
4:10 – 4:30	Assessing the efficacy of buffer strips in sustaining bryophyte diversity in montane forests in the BC Interior <u>Petersen, Christine L.</u> , Baldwin, Lyn K., Karakatsoulis, John, Black, Scott, Bradfield, Gary E.

4:30 – 5:30 CBA/ABC Annual General Meeting

Desmarais, Room 1160

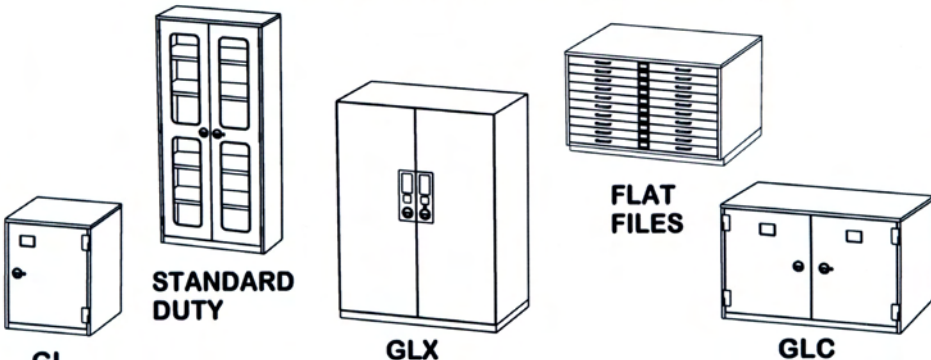
All CBA/ABC members are encouraged to attend this meeting!

6:00 – 11:00 PM **SPNHC Banquet** (pre-purchased tickets required)
Cafeteria of the Jock Turcot University Centre, University of
Ottawa

6:00 – 10:00 PM **CBA/ABC Mixer**
Victoria Memorial Museum Building, Canadian Museum of
Nature


Buses will leave from Tabaret Hall between 5:30 – 6:30 PM; they will leave the Museum between 9:30 – 10:15 PM. The museum is a short walk (ca. 20 min) from the University (see map on page 116).

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Friday, 4 June 2010 • Morning

8:00 AM – 6:00 PM Registration
 Tabaret Hall

8:30 – 12:00 SPNHC Contributed Papers: Digitizing Herbaria

Chair: Watkins-Colwell
 Desmarais, Room 1120

8:40 – 9:00	Preserving GOD: Curatorial and digitization challenges in the Charterhouse School Herbarium <u>Doran, Andrew S.</u> , Humphrey, Tom, Beidleman, Richard G.
9:00 – 9:20	Catharine Parr Traill Scrapbook: Microfade testing of Herbaria Collection and Exhibition Decisions <u>Tse, Season</u> , <u>Cipera, Luci</u> , Leckie, Carolyn
9:20 – 9:40	An overview of the renovation of the Paris Herbarium <u>Poncy, Odile</u> , Guiraud, Michel
10:00 – 10:40	- Break -
10:40 – 11:00	Cataloging Hidden Archives of Western American Botany and Beyond. The On-line Database of the University and Jepson Herbaria <u>Doran, Andrew S.</u> , Kasameyer, Amy, Beidleman, Richard G.
11:00 – 11:20	The Biodiversity Heritage Library: 28 million pages of taxonomic literature & you Morin, Rebecca A.
11:20 – 11:40	Digitization workflow in the Yale University Herbarium Sweeney, Patrick W.
11:40 – 12:00	DNA and Tissue Banking at The New York Botanical Garden <u>Campbell, Lisa M.</u> , Quenzer, Megan E. , Simpson, Joshua, Tulig, Melissa

10:40 – 12:00 SPNHC Discussion Session: Digitizing Herbaria

Chairs: James Macklin & Richard Rabeler
 Desmarais, Room 1130

10:40 – 12:00	How will we digitize the 70 million+ plant specimens housed in United States herbaria? <u>Macklin, James A.</u> , <u>Rabeler, Richard, K.</u>
	<i>Discussion of "Developing a digital U.S. biological collections national resource: First steps towards a strategic plan" and "US Virtual Herbarium"</i>

8:30 – 12:00 CBA/ABC Teaching Section

Chair: Cindy Ross Friedman

Desmarais, Room 1140

8:40 – 9:20	<p><u>SPECIAL LECTURE ON TEACHING</u> Calling or culling: the influence of our teaching metaphors Frego, Kate - University of New Brunswick, St John campus <i>Winner of a 3M Teaching Fellowship in 2008</i></p>
9:20 – 9:40	<p>Cleaning up: making soap with plant materials Dalrymple, Leah C., Frego, Kate</p>
9:40 – 10:00	<p>BIOL 304: A new upper division plant structure and function course with a society and environment context Fredeen, Arthur L., Young, Jane P.</p>
10:00 – 10:40	<p>– Break –</p>
10:40 – 12:00	<p><u>TEACHING PANEL DISCUSSION</u> Best Botanical Teaching Practices: Reaching Students in the Classroom, Lab, and Field Moderated by: Frédérique Guinel (Wilfrid Laurier University) & Vipen Sawhney (University of Saskatchewan)</p> <p>The CBA/ABC Teaching Section is proud to host this Panel Discussion. The panelists from institutions across Canada, all of whom have been recognized for teaching excellence, will discuss aspects of teaching and learning as these processes occur in different settings and will engage the audience in discussion of ideas and technologies that work in three different teaching environments.</p> <p>The panel:</p> <ul style="list-style-type: none"> • Mihai Costea, Wilfrid Laurier University • Art Davis, University of Saskatchewan, • Kate Frego, University of New Brunswick, • Larry Peterson, University of Guelph, and • Jane Young, University of Northern British Columbia

8:30 – 11:20 CBA/ABC Symposium: Is there a future for plants? The UN Biodiversity Convention’s Global Strategy for Plant Conservation

Organized by: Danna J. Leaman & David A. Galbraith

Chair: Danna J. Leaman

Desmarais, Room 1150

The aim of this symposium is to promote engagement in the Global Strategy for Plant Conservation (GSPC) in the professional botanical community in Canada. Despite being in its 8th year as a strategy of the Convention on Biological Diversity, and considerable work promoting it by some sectors, overall awareness of the GSPC in Canada remains low. The GSPC is now going through the final stages of a peer-review and revision process, culminating hopefully in the adoption of the revised strategy by the Parties to the Convention on Biological Diversity, meeting in Nagoya, Japan, in October 2010. As 2010 is the International Year of Biodiversity, it seems fitting to highlight the GSPC and to seek new and exciting pathways to engagement with a variety of sectors in Canada.

8:40 – 9:00	The once and future strategy: the global response to the plant conservation crisis Hendrickson, Ole
9:00 – 9:20	Canada's response to the Global Strategy for Plant Conservation Galbraith, David A.
9:20 – 9:40	Superstar plants as a key to public and political support for conservation Small, E.
9:40 – 10:00	CITES as a tool for sustainable use of plants Farr, Kenneth R.
10:00 – 10:40	- Break -
10:40 – 11:00	The CBD in practice: what does it mean for collections? Davis, Kate
11:00 – 11:20	Discussion

11:20 – 12:00 CBA/ABC Symposium: Data Recording: Legacy for Biodiversity Conservation (continued after lunch)

Sponsored by: CBA/ABC Ecology and Conservation Section

Organized by: Adrienne Sinclair & Liette Vasseur

Chair: Adrienne Sinclair

Desmarais, Room 1150

This symposium will examine the issues regarding data recording and information databases from the perspectives of field ecology to museum collection and information networks.

11:20 – 11:40	Three BIG QUESTIONS about databasing natural history collections Catling, Paul M., Mitrow, Gisèle
11:40 – 12:00	The Cutlery Moss and other capers: Managing the herbarium for species conservation Doubt, J.

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Friday, 4 June 2010 • Afternoon

12:00 – 2:00 CBA/ABC Poster Session & Judging
 Tabaret Hall – *Lunch Included*

SPNHC Annual Business Meeting
 Desmarais, Room 1160 – *Lunch Included*

2:00 – 3:10 SPNHC Contributed Papers: Digitizing Invertebrate Collections

Chair: Tim White
 Desmarais, Room 1160

2:10 – 2:30	Imaging and innovative workflows for efficient data capture in an Entomological collection: The MCZ Lepidoptera Rapid Data Capture Project Morris, Paul J., Eastwood, Rod, Ford, Linda S., Haley, Brendan, Goldman-Huertas, Benjamin
2:30 – 2:50	Digitization of the University of Alaska Museum Insect Collection Sikes, Derek
2:50 – 3:10	How (and how not) to survey a systematic invertebrate paleontology collection for locality data Mayer, P. S.
3:00 – 3:40	- Break -

3:40 – 4:20 SPNHC Contributed Papers: The Lighter Side

Chair: Judith Price
 Desmarais, Room 1160

3:40 – 4:00	The History of Paleontology at the Geological Survey of Canada Dougherty, Jean
4:00 – 4:20	Reverend James Downstream: A pioneer in early natural history collecting DeMouthe, Jean F.

2:00 – 3:50 CBA/ABC Ecology Symposium (continued from AM)

Chair: Adrienne Sinclair
Desmarais, Room 1150

2:10 – 2:30	Changes in plant communities: approaches to visualize spatial or temporal changes Vasseur, L.
2:30 – 2:50	SEM'AIL: a public restoration program for wild leek (<i>Allium tricoccum</i> Ait.) in Quebec; a species threatened from overharvesting Nault, <u>Andrée</u> , Vasseur, Claire
2:50 – 3:10	What does it mean to value biodiversity? Lyashevskaya, Olga
3:10 – 3:40	- Break -
3:40 – 4:00	How paleoecological tools can help planning restoration projects? <u>Bérubé</u> , Vicky, Lavoie, Claudie, Rochefort, Line
4:00 – 4:20	Is there a link between the presence of vascular plants and the initiation of <i>Sphagnum</i> moss hummocks in bogs? <u>Pouliot</u> , Rémy, Rochefort, Line

2:00 – 4:10 CBA/ABC Contributed Papers: Systematics & Phytogeography III

Chair: Laurie Consaul
Desmarais, Room 1140

2:00 – 2:20	Molecular systematics of the parasitic genus <i>Conopholis</i> (Orobanchaceae) <u>Rodrigues</u> , Anuar, Colwell, Alison, Stefanovic, Sasa
2:20 – 2:40	Community structure of arbuscular mycorrhizal fungi (AMF) on root tissue identified by DNA barcoding <u>Fazekas</u> , Aaron J., Sikes, Benjamin A., Klironomos, John, Newmaster, Steven G.
2:40 – 3:00	A practical test of DNA barcodes for identifying the Cariceae (<i>Carex</i> & <i>Kobresia</i>, Cyperaceae) of North America, north of Mexico <u>Chouinard</u> , Brianna N., Naczi, Robert F. C., Starr, Julian R.
3:00 – 3:30	- Break -
3:30 – 3:50	A DNA Barcode reference library for the vascular plants of Churchill, Manitoba <u>Kuzmina</u> , M., Johnson, K., Barron, H., Hebert, P.
3:50 – 4:10	DNA barcoding the vascular plant flora of the Canadian Arctic <u>Saarela</u> , Jeffery M., Gillespie, Lynn J., Consaul, Laurie L., Bull, Roger D., Chouinard, Brianna N., Abraham, Paul, Starr, Julian R.

4:10 – 5:10 CBA/ABC Weresub Lecture - ALL ARE INVITED!

Sponsored by the CBA/ABC Mycology Section

Chair: Hugues Massicotte

Desmarais, Room 1160

The Weresub Lecture is an annual CBA/ABC lecture sponsored by the CBA Mycology Section, who select and invite a distinguished scientist working in a mycology-related discipline to deliver the lecture at the annual CBA/ABC meeting. It is named in honour of Dr. Luella K. Weresub (1919-1979), a well-known mycologist who worked at the Biosystematics Research Institute of Agriculture Canada.

4:10 – 5:10	<p>Travels with a Lichenologist</p> <p>Irwin (Ernie) Brodo</p> <p>Research Lichenologist Emeritus, Canadian Museum of Nature</p> <p>In my perambulations over the years while working as a lichen taxonomist at the Canadian Museum of Nature, I have encountered dozens of especially interesting and often significant lichens. This talk will review some of the most fascinating of these, placed in a somewhat chronological, and geographic, context.</p>
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5:20 – 6:00 PM CBA/ABC Incoming Executive Meeting

Immediately following the Weresub Lecture - Tabaret Hall, Room 309

6:00 – 11:00 PM CBA/ABC Banquet (pre-purchased tickets required)

Cafeteria of the Jock Turcot University Centre, University of Ottawa

- Society awards for 2009-2010 will be presented at the Banquet
- Special Dinner Lecture:

Lucille Clifton's Feasts: Reflections on Biocultural Diversity in Western Canada

Nancy Turner, University of Victoria

CBA/ABC Awards

The Lawson Medal

The Lawson Medal, the most prestigious award of the CBA/ABC, was established "to provide a collective, formal expression of the admiration and respect of botanists in Canada for excellence in the contribution of an individual to Canadian botany". It is named in honour of Dr. George Lawson, who is generally regarded as Canada's first professional botanist.

The Lawson Medal is awarded annually in two categories of eligibility:

- (A) Recognition of a single outstanding contribution to botanical knowledge (monograph, book or series of papers) by a Canadian botanist at any stage of his/her career, and;
- (B) Recognition of cumulative, lifetime contributions to Canadian botany by a senior researcher, teacher or administrator.

Mary E. Elliott Award

The Mary E. Elliott Award is given to an individual for meritorious service to CBA/ABC. This award was first awarded in 1978 in memory of Mary E. Elliott, who was a victim of homicide in September, 1976. She had just completed four consecutive years of service on the Board of Directors (as Secretary, Vice President and President), and was just at the beginning her term as Past President at the time of her death. Mary Elliott was a plant pathologist and mycologist who spent 28 years with Agriculture Canada at the Central Experimental Farm in Ottawa. She was well known for her work on the taxonomy and biology of the Sclerotiniaceae.

Awards for Papers Published by Students in 2009

Alf Erling Porsild Memorial Prize - for the best student paper in Systematics and Phytogeography, honouring the memory of the eminent Arctic botanist Alf Erling Porsild.

J. Stan Rowe Award - for the best student paper in Plant Ecology, established to celebrate the life and work of Stan Rowe, eminent Canadian plant ecologist.

Taylor A. Steeves Award - for the best student paper in Plant Development, Structure or Morphology, established to honour Taylor Steeves' numerous contributions to the CBA/ABC and botany.

Luella K. Weresub Memorial Award - for the best student paper in Fungal Biology, established in memory of Dr. Luella Kayla Weresub, a well-known Canadian mycologist who worked at the Biosystematics Research Institute of Agriculture Canada.


Awards for Best Student Poster and Presentation

Lionel Cinq-Mars Award

Award for the best student oral presentation given at the CBA/ABC Annual Meeting.

Iain and Sylvia Taylor Award

Award for the best student research poster presented at the CBA/ABC Annual Meeting.



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Saturday, 5 June 2010

8:00 AM – 1:00 PM Registration
Tabaret Hall

8:30 – 4:30 Field Trip

Botanical hike in Gatineau Park

Guide: Lynn Gillespie, Canadian Museum of Nature
Please meet at Tabaret Hall, ready to go by 8:30 AM.

9:00 – 4:30 Workshops

All participants should meet in front of Tabaret Hall no later than 8:15 AM. Buses will leave for workshops two and four at 8:30 AM sharp.

1. Lichen Identification

Instructors: Irwin M. Brodo and Pak Yau Wong, Canadian Museum of Nature
Room BSC 302, Biological Sciences Building, University of Ottawa

2. Integrated Pest Management

Instructor: Tom Strang, Canadian Conservation Institute
Canadian Conservation Institute, 1030 Innes Road, Ottawa ON K1A 0M5 Canada

3. Georeferencing

Instructors: John R. Wieczorek, Carol Spencer, and Heather Constable (University of California, Berkeley) and Peter Desmet (Canadensys)
Desmarais, Room 1120

4. Designing Facilities for Fluid Preserved Collections

Panelists: Walt Crimm, Ewing Cole-RDLA; Clare Valentine, Darwin Center, Natural History Museum, London; Robert Waller, Canadian Museum of Nature
Canadian Museum of Nature, Natural Heritage Building, 1740 Pink Road, Gatineau, QC

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Posters

CBA/ABC

– Ecology and Conservation –

1. **Bryophyte flora associated with decaying black spruce logs in black spruce forest**
Arseneault, Julie, Bergeron, Yves, Fenton, Nicole
2. **Development of a Canadian Early Detection and rapid response framework for invasive plants**
Dollard, Cheryl, Lindgren, Cory
3. **Conservation genetics of a rare lichen *Ramalina sinensis* through the analysis of DNA sequence data**
Francisco de Oliveira, Patrícia M., Souza, Anete P., Piercey-Normore, Michele D.
4. **Threat status assessment and geographic distribution patterns of rare and endangered plants**
Kricsfalussy, Vladimir V., Trevisan, Nicholas
5. **Imported herbal medicines *Cuscuta* and *Striga* may pose a threat to Canadian biodiversity**
Mechanda, Subbaiah M., Darbyshire, Stephen J.
6. **Combining fire and grazing to restore prairies invaded by crested wheatgrass in Grasslands National Park**
Otfinowski, Rafael, Fitzsimmons, Michael, Sturch, Adrian
7. **Do wildfires and clearcuts produce the same understory community succession through time?**
Paquette, Myriam, Bergeron, Yves, Fenton, Nicole, Pothier, David
8. **Ecology of the rare Western Silvery Aster**
Robson, Diana B.
9. **The effects of hydrology on the plant community structure of the tall grass prairie**
Sheffield, Ryan W. J., Markham, John H.
10. **Species relationships in the *Gagea reticulata* species complex utilizing nucleotide sequences of the low-copy nuclear gene malate synthase and flow cytometry data**
Zarrei, Mehdi, Wilkin, Paul, Ingrouille, Martin J., Leitch, Illia J., Buerki, Sven, Fay, Mike F., Chase, Mark W.

– Ethnobotany –

11. **Restoration of culturally important native plants for educational and cultural purposes: Case example of riceroot [*Fritillaria camschatcensis* (L.) Ker-Gawl and *F. affinis* (Schult.) Sealy; Liliaceae] in Squamish First Nation Territory**
Joseph, Leigh J.
12. **Documentation of traditional ecological knowledge of Prophet River First Nation for protection of plants and plant gathering sites**
Young, Jane P., Wolf, Brian, MacKay, Cathy, White, Angela

– Mycology –

13. **Plant metal uptake and soil metal bioavailability in the AM mycorrhizosphere**
Audet, Patrick, Charest, Christiane
14. **Mycoheterotrophic plants: the pinnacle of evolutionary plant-fungal specialization**
Massicotte, Hugues B., Melville, Lewis H., Tackaberry, Linda E., Luoma, Daniel L., Peterson, R. Larry
15. **Psammophilic *Hudsonia* is ectomycorrhizal!**
Massicotte, Hugues B., Melville, Lewis H., Tackaberry, Linda E., Peterson, R. Larry

– Plant Development –

16. **Diversity of Type I Polyketide Synthase genes in *Cladonia uncialis***
Abdel-Hameed, Mona, Sorensen, J., Piercey-Normore, M. D.
17. **Flower, fruit and seed structure and ontogeny in the epiphytic cactus *Epiphyllum phyllanthus* (Cactaceae)**
Almeida, Odair, Paoli, Adelita, Souza, Luiz, Cota-Sánchez, J. Hugo
18. **Unusual rhizome vasculature in *Maianthemum***
Heckel, Marta
19. **Characterization and diversity of superoxide dismutase (SOD) in two freshwater algae**
Ismaiel, Mostafa S., El-Ayouty, Yassin M., Piercey-Normore, Michele D.
20. **A microscopic study on the initiation and development of floral organs of flax (*Linum usitatissimum*)**
Schewe, Lauren C., Sawhney, Vipen K. , Davis, Arthur R.
21. **Comparative developmental morphology of aerial and submerged leaves in *Myriophyllum aquaticum***
Shafiullah, M., Lacroix, Christian
22. **Two types of polyketide synthase genes in species of *Ramalina* suggest high chemical diversity**
Timsina, Brinda, Sorensen, John, Stocker-Wörgötter, Elfie, Piercey-Normore, Michele D.
23. **The construction of nodulation maps to study nodule distribution in legumes**
Zupancic, John, Macdonald, Emily, Guinel, Frédérique, Znotinas, Nora

– Systematics and Phytogeography –

24. **Plant DNA barcodes correctly identify all field collections of *Carex* and *Kobresia* (Cyperaceae) from the Canadian Arctic Archipelago**
Abraham, Paul, Chouinard, Brianna N., Saarela, Jeffery M., Starr, Julian R.
25. **Morphological diversity, phylogenetics, and mating systems of single spore cultures from two Reindeer lichens**
Athukorala, Sarangi N. P., Piercey-Normore, Michele D.

26. **Hybridization of European *Crataegus monogyna* (Maloideae or Pyreae; Rosaceae) with two North American hawthorn species**
Burgos Garcia, Hernando A.
27. **How many taxa in *Sporobolus vaginiflorus*? . . . What does the collection say?**
Catling, Paul M.
28. **Evidence for the effect of grazing by domestic horses on vascular plant diversity in a foothills prairie in western Alberta**
Catling, Paul M., Kostiuk, Brenda
29. **History of insect pest control in the AAFC National Collection of Vascular Plants**
Catling, Paul M., Mitrow, Gisèle
30. **AAFC researchers discover ...A wolf in sheep's clothing on the move**
Catling, Paul M., Mitrow, Gisèle
31. **Recent trends in the role of the AAFC National Collection of Vascular Plants**
Catling, Paul M., Mitrow, Gisèle
32. **Systematics of the Korean and northeastern Chinese *Allium* (Alliaceae) species based on morphological and molecular data**
Choi, Hyeok-Jae, Jang, Chang-Gee, Oh, Byoung-Un, Cota-Sánchez, J. Hugo
33. **Correlating pollen size and ploidy level in Suksdorf's hawthorn**
Chun, Yi-Min, Lee, Jason
34. **Native orchids as bioindicators in the southern Arctic**
Consaul, Laurie L., Ip, Morgan A., Catling, Paul M., Kudluarok, Sarah, Tookalook, Lucy Mary, Doubleday, Nancy C.
35. **Vascular plant diversity in Canada's southern Arctic: new baseline data and significant floristic discoveries in Tuktut Nogait National Park and vicinity, Northwest Territories**
Consaul, Laurie L., Saarela, Jeffery M., Gillespie, Lynn J., Bull, Roger D.
36. **Out of the technological Stone Age: Improving the collections and Collections Management Systems at UBC Botanical Garden and Centre for Plant Research**
Mosquin, Daniel P. K., Zhuang, Beryl C., La Fontaine, Eric P., Graham, Sean W.
37. **Modeling molecular evolution from population-genetic theory, and non-parametric statistical devices**
Rodrigue, Nicolas, Philippe, Hervé, Lartillot, Nicolas
38. **Using plant DNA barcodes to identify the hosts for the root-colonizing fungi, *Neolecta irregularis* and *Roeslerina radicella***
Starr, Julian R., Redhead, Scott A., Ginter, Anna, Dalpé, Yolande, Tanney, Joey B.

SPNHC

39. **Boxing the bad boys: native and conservation storage solutions for ethnographic feathered objects**
Anderson, Gretchen E., Harding, Deborah G., Mowery, Tasha
40. **A framework and workflow for extraction and parsing of herbarium specimen data**
Best, Jason¹, Moen, William E.², Neill, Amanda K.
41. **To 2010 and beyond! - An adventure in training**
Blewett, B.
42. **Validating collections: taxonomy, faunistics, databases, Red Data Books and Site Quality Assessment studies at the RBINS Entomology Department**
Dekoninck, W., Hendrickx, F., Baert, L., Wauthy, G., Constant, J., Drumont, A., Limbourg, P., Gerard, Y., Nicolas, L., Peeters, M., Strobbe, F., De Vuyst, M.-P., Van Nieuwenhove, C., Grootaert, P.
43. **Cataloging hidden archives of western American botany and beyond. The on-line database of the University and Jepson Herbaria**
Doran, Andrew S., Kasameyer, Amy, Beidleman, Richard G.
44. **Georeferencing labels at the National Herbarium of Canada**
Doubt, J., Wise, P.
45. **Innovations in marine mammal specimen preparation: indoor salt-water maceration**
Flannery, Maureen E., Dumbacher, John P.
46. **Corrosion and cleaning: what to do with ancient metals?**
Fregni, Giovanna
47. **When the last taxonomist leaves, does the collection die?**
Gardner, Erika
48. **The Bishop Museum Vertebrate Zoology Collection**
Garetano, Lydia
49. **Integrated pest management challenges in a retrofitted building for Yale Peabody Museum of Natural History collections**
Jones, Lynn A., Pupedis, Raymond J.
50. **Reorganising and rehousing of the world's oldest and largest Lepidoptera collection at The Natural History Museum, London**
Martin, Geoff
51. **Moving 90's science to the digital age**
Patsch, Elizabeth
52. **The Redlegged Ham Beetle (*Necrobia rufipes*) treatment using carbon dioxide fumigation at Smithsonian Institution's Museum Support Center**
Powell, Michelle A., Tanner, G. Jackson
53. **Improving GEOLocate to better serve the natural history collections community**
Rios, Nelson E., Bart, Henry L.

54. **Cataloguing collections: a tool for collection management and an instrument for cataloguing data**
Sablon, Rose, Yassine, Loufa
55. **Collections risk assessment at the Denver Museum of Nature & Science**
Southward, J.A., Thorwald, H. H., Muething, G., Waller, R. R.
56. **Managing grid lock**
Woodward, Susan M.

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The Canadian Museum of Nature is pleased to host the Arctic Biodiversity Symposium November 18, 2010, in Ottawa, Canada, in celebration of the International Year of Biodiversity.

The aim of the symposium is to frame our current understanding of the fast-changing state of Arctic biodiversity. Leading scientists will present groundbreaking research and explore early findings from the International Polar Year. Topics will include global

outlooks on climate change and biodiversity, critical ecosystem and species research, effects of change on traditional uses of biodiversity, and emerging tools for modelling and monitoring Arctic ecosystems.

This gathering will provide a timely opportunity for the scientific community, biodiversity stakeholders and decision-makers to identify the most urgent issues and strategic priorities for future research in this unique environment.

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ORAL PRESENTATION AND POSTER ABSTRACTS
(in alphabetical order)

POSTER

Diversity of Type I Polyketide Synthase genes in *Cladonia uncialis*

Abdel-Hameed, Mona¹, Sorensen, J.¹, Piercey-Normore, M. D.²

¹Department of Chemistry, University of Manitoba, Winnipeg, Manitoba, R3T 2N2, Canada; ²Department of Biological Sciences, University of Manitoba, Winnipeg, Manitoba, R3T 2N2, Canada

Lichens (symbiotic associations between fungi and algae) are known producers of a variety of secondary metabolites. Fungal polyketides constitute a large family of these secondary metabolites, which have a high degree of structural diversity. The biosynthesis of these polyketides are governed by type I polyketide synthase (PKS) enzymes which possess a multidomain structure. Of particular interest is the lichen *Cladonia uncialis*, which produces both usnic acid and squamatic acid as secondary metabolites. The objectives of this study were 1) to isolate in part or in whole the PKS genes in *Cladonia uncialis*, and 2) to investigate diversity in their expression levels. Based on the catalytic domains required for the synthesis of the key polyketide intermediates, degenerate primers along with gene specific primers were used to amplify fragments of non-reducing PKS genes present in *Cladonia uncialis*. The expression of the two paralogs was determined through reverse transcription PCR. The presence of secondary metabolites was determined using TLC and HPLC analytical techniques. We have obtained what appear to be two paralogs of non-reducing PKS genes in *Cladonia uncialis*. Nucleotide BLAST comparison with other PKS sequences shows that one of the amplified fragments matches an usnic acid producing species. The other amplified fragment matches a sequence from a squamatic acid producing species. Usnic acid was detected by both TLC and HPLC; however, squamatic acid could not be detected in this experimental specimen. High diversity of gene paralogs and transcripts in this species has hampered the ability to isolate a single gene. But high diversity in these genes may explain the plasticity and variation of secondary compounds found in nature. The influence of environmental conditions on gene expression is also discussed.

POSTER

Plant DNA barcodes correctly identify all field collections of *Carex* and *Kobresia* (Cyperaceae) from the Canadian Arctic Archipelago

Abraham, Paul^{1,2}, Chouinard, Brianna N.^{1,2}, Saarela, Jeffery M.², Starr, Julian R.^{1,2}

¹Canadian Museum of Nature, Research Division, PO Box 3443, Station D, Ottawa, Ontario, K1P 6P4, Canada;

²University of Ottawa, Department of Biology, Gendron Room 160, 30 Marie Curie, P.O. BOX 450, Station A, Ottawa, Ontario, K1N 6N5, Canada

In a previous study, we evaluated the potential of six proposed DNA barcoding loci (*matK*, *rpoB*, *rpoC1*, *rbcl*, *atpF-atpH*, *psbK-psbI*) for identifying sedges in the Canadian Arctic Archipelago. Since its completion, two of these loci, *matK* and *rbcl*, have been chosen as plant barcodes and are now supported by BOLD (Barcode of Life Databases). Here, for the first time, we test the accuracy of this ecoregional *matK* + *rbcl* barcoding database for identifying unknown samples to species and for highlighting species not in the database. Our analyses consider 105 samples collected in 2008 from the Western (Victoria Island) and Eastern (Baffin Island) Arctic. All unknown samples sequenced were first processed by a third party in order to replicate a situation where unknown leaf tissues would be sent for identification to a barcoding facility such as the CCDB (Canadian Centre for DNA Barcoding). Analyses using tree-based and algorithm-based methods either correctly identified samples to species (103/105) or they highlighted the presence of species (two, one sample each) not in the existing database. Although our previous barcoding studies on a North American scale have suggested that only 40% of species might be identified to a single name by the database, these results suggest that an ecoregional approach could significantly improve the accuracy of the *matK* + *rbcl* databases currently being developed for plants.

ORAL

In vitro propagation and characterization of phenolic content, antioxidant and antimicrobial activity of *Cichorium pumilum*, an endangered medicinal plant from Jordan

Al Khateeb, Wesam¹, Hussein, Emad¹, Al Odat, Mohammad²

¹Department of Biological Sciences, Yarmouk University, Irbid-Jordan; ²Department of Food Science, Jordan University of Science and Technology, Irbid-Jordan

Cichorium pumilum belongs to the Asteraceae, the largest family of dicotyledonous plants. It is used widely in the daily diet of many Mediterranean areas. Propagation of *C. pumilum* through seed is difficult since seeds lose viability upon storage, and plants originating from seed have genetic variability which is not preferred in producing uniform plants. Plant tissue culture is a useful tool for both multiplication of the genus and studying its medicinal importance and secondary metabolites production. The objectives of this research were to develop an effective *in vitro* propagation protocol for *C. pumilum* and to evaluate their phenolic content, antioxidant and antimicrobial activity. Successful *in vitro* multiplication of *C. pumilum* was achieved on MS medium supplemented with benzyladenine (BA) at 1.5 mg l⁻¹ and 0.5 mg l⁻¹ NAA. On the other hand, *in vitro* rooting was successfully achieved on MS media supplemented with different concentration of auxins. Results showed a high phenolic content as well as high antioxidant activity of *C. pumilum* tissues. The antibacterial activity of *C. pumilum* extract was assayed *in*

in vitro by agar disc diffusion and agar well diffusion methods against 10 different bacterial species. The ethanolic and the methanolic extract (60°C) of wild plant and *in vitro* tissues showed antibacterial activity for most of the bacterial strains tested. The efficient *in vitro* production systems developed in this study provide sterile and consistent tissues for investigation of bioactivity and germplasm conservation of *C. pumilum*.

ORAL

The tortoise and the hare: contrasting phylogeographic patterns in western North American species of *Bistorta* (Polygonaceae)

Allen, Geraldine A.¹, Marr, Kendrick L², McCormick, Laurie J.¹, Hebda, Richard J.²

¹University of Victoria, Department of Biology, PO Box 3020 Station CSC, Victoria, BC V8W 3N5, Canada; ²Royal British Columbia Museum, Natural History Section, 675 Belleville St., Victoria, BC V8W 9W2, Canada

The distributions of genotypes among plant populations reflect the past migration patterns of species, and can suggest how their ranges may shift in the present. We investigated the spatial distribution of chloroplast DNA haplotypes in three arctic-alpine bistorts (*Bistorta vivipara*, *B. bistortoides*, and *B. plumosa*) over most of western North America. We sequenced DNA from two plastid noncoding regions (the *trnS-G* and *psbA-trnH* spacers) in plants from 165 localities. Two species, *B. bistortoides* (southern BC to New Mexico) and *B. plumosa* (northern BC to Alaska and eastern Asia) exhibited fairly high levels of genetic variation, with distinct plastid haplotypes found in each sample locality. In contrast, *B. vivipara* (widely distributed at higher latitudes and elevations in North America) had lower genetic variation, with little geographic structure. These differences likely reflect the differing Pleistocene history and reproductive modes of these species. *Bistorta bistortoides* is an arctic tundra species of largely Beringian distribution; *B. plumosa* is a subalpine to alpine meadow species occurring almost entirely south of the glacial boundary. Both species reproduce exclusively by seed. *Bistorta vivipara* is a high-polyploid meadow and tundra species that is widely distributed in both unglaciated and previously glaciated regions of North America. It rarely produces seed, but instead reproduces vegetatively via bulbets borne in the inflorescence. These resistant propagules may have facilitated rapid spread of this species into its current range.

ORAL

Long term storage method for oversized anthropology collections

Allen, Joel

Smithsonian Institution, National Museum of Natural History, Museum Support Center, Collections Support Services, MRC 117, PO box 37012, Washington, D.C. 20013 USA

This presentation is an overview of how the Collections Support Services crew designed and built approximately 450 aluminum pallets with aluminum frames and foam

support structures, along with Nomex fabric covers, for the long term storage of oversized anthropology collections stored at the Museum Support Center in Suitland, Maryland. It will include a brief discussion of the methods used, and photographs of the process and completed pallets.

POSTER

Flower, fruit and seed structure and ontogeny in the epiphytic cactus *Epiphyllum phyllanthus* (Cactaceae)

Almeida, Odair^{1,2}, Paoli, Adelita², Souza, Luiz³, Cota-Sánchez, J. Hugo¹

¹Dept of Biology, University of Saskatchewan, Saskatoon, Canada; ²Depto de Botânica, IB, Universidade Estadual Paulista - UNESP/RC, Brazil; ³Depto de Biologia, Universidade Estadual de Maringá, Brazil

Epiphyllum phyllanthus (L.) Haw. is a widely distributed species across South America. It occurs in humid forests as an epiphyte and is cited on the Red List of the International Union for Conservation of Nature. This study is aimed at understanding the development of flower and seed in this species. The goals were twofold: 1) to analyze the morpho-anatomical floral structure and 2) to carry out a morpho-anatomic and ontogenetic study on the pericarp and seed. Flower buds, mature flowers, fruits, and seeds were collected in Paraná and São Paulo States, Brazil, and fixed, processed and analyzed using a light microscope and a scanning electron microscope. The flower is sessile and epigynous with a well-developed hypanthium. The androecium has many stamens with tetrasporangiate and bithecal anthers. The gynoecium is syncarpous with 9-10 carpels. The ovary has inverted vascular bundles and exhibits a similar pattern to that observed in *Pereskia*. The nectariferous region occurs on the inner surface of the hypanthium. The stigma has 9-10 lobes with a secretory epidermis. Following fecundation, the ovary undergoes a phase of intense meristematic activity and cell growth. The mature fruit has bright pinkish-purple coloration and smooth surface. The ovule is circinotropous, bitegmic, crassinucelate, with long funiculus and nuclear endosperm. The seeds are campylotropous and black. The ventral part of their outer surface exhibits a differentiated relief: the whitish hilum-micropylar region with the aril. The embryo is curved with lipoprotein reserve. The perisperm and the endosperm persist in mature seeds and do not have reserve substances. The flower features denote that the pollination syndrome in this species has a relationship with hawkmoths. Some of the fruit characteristics (retention of water and mucilage) as well as premature seed development may provide a microenvironment favorable for viviparity.

POSTER

Boxing the bad boys: native and conservation storage solutions for ethnographic feathered objects

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This poster examines the pros and cons of native storage techniques in the museum setting. Conservation-grade solutions are presented for a variety of object types and materials. Challenges of size, manufacturing technique, and fragility are addressed.

Although native methods are preferred where viable, they can be adapted with the use of archival materials. Often as not, reduction of handling requires alternative approaches. Examples of innovative storage systems are drawn from the Amazon Basin ethnographic collection of the Carnegie Museum of Natural History.

POSTER

Bryophyte flora associated with decaying black spruce logs in black spruce forest

Arseneault, Julie, Bergeron, Yves, Fenton, Nicole

Chaire industrielle CRSNG-UQAT-UQAM en aménagement forestier durable, Université du Québec en Abitibi-Témiscamingue, 445 boulevard de l'Université, Rouyn-Noranda (Québec), J9X 5E4, Canada

Bryophytes account for a large proportion of plant diversity in boreal forests and are sensitive to microclimatic changes. Woody debris represents an ephemeral substrate, dynamic in time and space, suitable for the establishment and maintenance of rich bryophyte communities as it buffers changes in humidity. Forest harvest has a negative impact on woody debris availability by harvesting trees and relocating and crushing existing woody debris. This study aims to measure the effects of two harvesting techniques on the spatial repartition of woody debris and on the bryophytes community that colonizes them. Our main hypotheses are: (1) total richness of bryophytes species will be higher in sites where woody debris are evenly distributed and all decomposition classes represented, (2) canopy openness reduces woody debris quality (decomposition class, softness, size and incident light level) and quantity, resulting in fewer epixilous species and the establishment of *Sphagnum* spp.. The three study sites are located in homogenous stands of black spruce (*Picea mariana*, (Mill.)) prone to paludification in western Quebec. Each site includes a clearcut, a partial cut and an old growth forest (control). In each treatment, woody debris quality was recorded for 25 woody debris pieces. On every piece of debris, 3 microplots were sampled for bryophytes. Species difficult to identify in the field were collected. Initial results suggest a tendency towards species loss, dominance of sphagna and fewer available pieces of woody debris after CPRS, while partial cuts seems more similar to the old growth forest. As epixilous bryophyte diversity has never been evaluated in this area, our results will permit a better comprehension of the population dynamic of bryophytes growing on woody debris in managed black spruce forest and will suggest the harvesting technique best suited to preserve habitat quality and species diversity.

POSTER

Morphological diversity, phylogenetics, and mating systems of single spore cultures from two Reindeer lichens

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Reindeer lichens in the genus *Cladina* are the main winter diet for caribou and reindeer, and along with Sphagnum moss, form the dominant vegetation cover in northern ecosystems. Since these will be some of the first organisms to be influenced by climate change an understanding of the reproductive biology and phylogenetic history will be important for continued maintenance of northern caribou and reindeer herds. The objectives of this study were 1) to study the morphological development of single spore colonies obtained from *C. rangiferina* and *C. arbuscula*, 2) to estimate a phylogenetic history within the group, and 3) to examine the diversity of mating systems between two species. Single spores were ejected from apothecia obtained from the same and different podetia. From each apothecium, single spores were observed for colony characteristics for 3 months. The DNA was then extracted from half of each colony and internal transcribed spacers (ITS) 1 & 2 of the nuclear ribosomal DNA were sequenced and a BLAST search was performed to confirm identity. The mating systems were studied using mating-type alleles (MAT1 & MAT2). Current results show that ascospore germination occurred after about 21 days in both species, but colony morphology was highly variable within and between species. *Cladonia arbuscula* and *C. rangiferina* form monophyletic species among other reindeer lichens. Currently, results from the mating systems of the two species suggest they are heterothallic. However, further studies may reveal presence of the other mating type allele. This study provides a significant contribution to the existing knowledge of mycelial development and mating type alleles in lichen-forming fungi and to the potential sustainability of northern Reindeer lichens in light of climate change.

POSTER

Plant metal uptake and soil metal bioavailability in the AM mycorrhizosphere

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The arbuscular mycorrhizal (AM) symbiosis, an association between the roots of most herbaceous plants and the Glomeromycotan fungi, is recognized for enhancing plant acquisition of nutrients and water. Recent studies have also shown also its role in regulating soil metal bioavailability via mycorrhizal-induced processes. In a greenhouse experiment, we designed a compartmental system involving a sunflower cultivar and an AM fungus to study the impact of roots (rhizosphere), roots and hyphae (mycorrhizosphere), or strictly extraradical hyphae (hyphosphere) on plant growth, metal uptake and soil conditions, using the micronutrient zinc (Zn) as a typical metal contaminant. We showed that mycorrhizosphere plants had lower Zn uptake (especially in shoots and flowers) and a lower incidence of leaf chlorosis than rhizosphere plants at the highest soil-

Zn concentrations. These results are likely related to mycorrhizal-induced biosorption processes that reduce metal bioavailability to delay the onset of metal toxicity. We also observed that mycorrhizosphere plants cause a slight alkalization of the soil whereas rhizosphere plants tend to acidify it, then having important consequences toward the soil-Zn bioavailability and nutrient leaching. Altogether, we consider the AM mycorrhizosphere to be a key factor in environmental remediation by buffering plant growth conditions and enhancing soil resiliency.

ORAL

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 conservation status ranging from vulnerable to critically endangered. However, the unresolved phylogenetic relationships within the genus limit the implementation of specific and effective conservation efforts. This study aims to clarify the phylogenetic status of the genus *Delonix*, which is considered to be paraphyletic with regards to two endangered monospecific genera also endemic to Madagascar (*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 data matrices are analysed separately and in a combined analysis using parsimony and Bayesian methods, with and without indel coding. The ITS data resulted in the trees with the fewest homoplasies. For the two nuclear markers, the coding of indels revealed a higher proportion of parsimony informative characters, but the two matrices are not congruent with each other, suggesting conflicting gene histories or paralogy problems. The *Delonix/Colvillea/Lemuropisum* clade is generally well supported and the genus *Delonix* is considered paraphyletic due to the nested position of *C. racemosa* and *L. edule*. The majority of the species are not supported as monophyletic suggesting a high intraspecific allelic variation consistent with gene exchange among species. The African *Delonix* occur together in a distinct clade illustrating a certain genetic uniqueness, but the tree with the highest resolution suggests a secondary origin for the African species. Because of the apparent poor delimitation, morphologically and molecularly, of the endemic Malagasy species within this trigenetic clade, conservation efforts should be oriented towards the protection of the diminishing habitat of these endangered species.

ORAL Plenary Panel

A new development phase for the Catalogue of Life.

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The Catalogue of Life (CoL) 2010 Annual Checklist published by Species 2000 and the Integrated Taxonomic Information System (ITIS) includes 1.25 million species assembled from an array of 77 taxonomic databases covering plants, animals, fungi and micro-organisms. This represents approximately 2/3 of the currently estimated 1.9 million world's known species. CoL is a major resource used by other large international projects such as GBIF, Encyclopedia of Life, iBOL and others, but for many taxonomic groups it continues to be deficient and incomplete. Thanks to new major funding provided by the European Community, CoL can now expand its architecture into a new multi-hub network that will allow direct integration of new data from regional databases. The project is also developing a number of new web services to improve quality control, facilitate dissemination and automate updates to end users and partners. Furthermore, CoL is engaged in discussions with other large international biodiversity projects to considerably expand interactions in order to address taxonomic gaps and accelerate progress towards completing world coverage of the Catalogue.

ORAL

Herbaria - of value beyond systematics

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Herbaria are best known as a resource for floristic and taxonomic research and as the location of people who can identify plants. Their importance in these regards cannot be underestimated but developments in chemistry, geographic information systems (GIS), and informatics have, extended their value into new arenas. Analytical techniques in chemistry now require minuscule quantities of a compound, so minuscule that curators will often permit the destructive sampling needed by various studies. The best known consequence is the use of herbarium specimens in phylogenetic studies but such techniques also enabled detection of an invasive strain of *Phragmites australis* and changes in furanocoumarin levels in wild parsnip seeds after introduction of the parsnip webworm. The historical perspective herbarium specimens provide has also been used to show that changes in stomate and trichome density with CO₂ levels. Changes in GIS, coupled with the distributional information on herbarium specimens, makes it easier to identify potential restrictions on current distributions, predict areas where a species is likely to occur, and evaluate the impact of climate change on its distribution. Informatics permits aggregating vast amounts of information from multiple sources, thereby providing new insight into species distributions and the distribution of individual traits. Such work has shown that the C4 grass clades grow in cooler but drier areas than their C3 sisters. None of these observations would have been possible without the unique combination of botanical, historical and geographic information provided by herbarium specimens.

ORAL DemoCamp

Specify 6 innovation and collaboration

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The Specify Software Project offers Specify 6 and allied applications for museum and herbarium research data processing. Specify 6 handles specimen information for computerizing collection holdings, for tracking specimen and tissue management transactions, and for mobilizing species occurrence data to the Internet. Specify runs on Windows, Mac OS X, and Linux computers; it is free and open source licensed. Specify 6.0 was released on 10 April 2009. Specify 6 has an intuitive user interface and customizable data forms aimed at streamlining routine collections data tasks while preparing and validating collection information for research analysis. Specify has numerous features including robust support for paleontological data, field notebooks, file attachments, GUIDs, hierarchical storage locations, data uploads through the Specify Workbench and Excel, repository agreements, accession logging, conservation treatments, collection object containers, along with numerous additional functions. Specify 6 supports the use of record sets for various types of processing, such as georeferencing with GEOlocate, label and report printing, and importing and exporting, and Specify's data model now handles all institutional collections within a single database for simplified administration. A couple of our many innovative Specify 6 collaborations will be highlighted, showcasing a wide array of data entry facilitation and augmentation tools both already incorporated and planned for our collections management software. These tools not only facilitate rapid data entry and augmentation of data but also foster collaborative, community based collections management.

ORAL

Capturing the missing diversity among BC fungi and a plan to build understanding of fungal belowground ecology

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Fungi are essential to plants in roles including beneficial mycorrhizal partnerships, yet many if not most ectomycorrhizal fungal species that occur in western Canada have yet to be included among specimens in herbaria or sequences in GenBank. Illustrating the problem, in our ecological studies, 30% of the fungal DNAs extracted from ectomycorrhizal roots from Vancouver Island BC represented species in the genus *Cortinarius*. Of the ~60 species detected as DNAs, only 14 matched sequences from known species. With support from the Beaty Museum of Biodiversity and from the Genome BC Science Opportunities fund, we are building the database of voucher specimens and DNA sequences for mushrooms in *Cortinarius* and also, *Inocybe*, two large genera of mycorrhizal fungi. Through recent donations of

specimens from regional collectors (including coauthors of this abstract) we more than doubled the number of Beaty Museum *Cortinarius* specimens and more than tripled holdings of *Inocybe*. We determined ribosomal DNA internal transcribed spacer region sequences for ~500 new *Cortinarius* specimens and we are in the process of sequencing the *Inocybe* DNAs. We release data promptly to GenBank and we provide preliminary phylogenies upon request, to encourage systematic research into the many taxonomic problems in these genera. This project provided research opportunities for seven undergraduate students, two of whom are now continuing with M.Sc. research in mycology. Using our new *Cortinarius* sequence database, we more than doubled the number of our *Cortinarius* environmental DNAs that can be matched to a specimen. The new specimens and sequences serve as an important link connecting isolated fragments of DNA from environmental samples to a whole fungus including a complete genome.

ORAL Plenary Panel

European Distributed Institute of Taxonomy and LifeWatch

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The European Commission supports various initiatives aimed at networking and integrating biodiversity research in Europe. A central role was played by a number of "Network of Excellence" projects that unite a high number of participants from the respective field and count(ed) with substantial budgets. In the area of systematics and collections, the Consortium of European Taxonomic Facilities (CETAF) initiated the "European Distributed Institute of Taxonomy". EDIT includes 23 collection institutions making an effort to integrate taxonomic research at multiple levels, such as research policies, collection management, training, outreach, and research infrastructures. Much of EDIT's resources are devoted to biodiversity informatics, an area where the need for - and the benefit of - collaboration among the institutions seemed obvious. Project efforts specifically address the workflow and data processing needs of taxonomists, from data collection in the field to the publication of research results. The central effort is the creation of an "Internet Platform for Cybertaxonomy", that directly assists taxonomists in their daily work, increase the efficiency of producing taxonomic revisions, checklists, inventories, etc., and make the results of the work accessible without delay. The Platform is to improve and assure reusability of data, support individual work as well as collaborative work, integrate existing software tools, and provide new open source software that conforms to international standards. EDIT's efforts and those of other EU funded networks are being brought together by a large-scale infrastructure initiative called LifeWatch. Among a multitude of other tasks, LifeWatch has identified the issue of providing collection metadata as one of the core activities to be carried out during its construction phase. Being in the last year of its 36 months Preparatory Phase project, a decision on the go ahead for LifeWatch is expected by the end of this year.

ORAL

How paleoecological tools can help planning restoration projects?

Bérubé, Vicky, Lavoie, Claudie, Rochefort, Line GRET, Université Laval, QC, Canada

Historical reconstitution of vegetal communities allow us to study dynamic and evolution of an ecosystem at temporal scale. In an ecological restoration scenario, paleoecological analysis is a method to characterize reference ecosystem which is an essential step to elaborate realistic goals and success criteria. The goal of this study is to understand the development of a disturbed peatland in order to forecast the range of variation in the postrestoration communities. Four peat cores were sampled at different places in Bic-St-Fabien peatland, QC, one in adjacent unmined peatland and three in abandoned section after peat harvesting activities. Results of macrofossil analysis showed that peatland initiation began with terrestrialization of a shallow lake. The following three stratigraphic zones are composed of minerotrophic vegetation. Historical study done in 1942 suggested that the abandoned section followed a different development and was ombrotrophic prior to the beginning of industrial activities. However, following peat extraction, soil level regressed at the minerotrophic stage. Consequently, minerotrophic vegetation should be reintroduced during site restoration, particularly, brown mosses from Amblystegiaceae family, herbaceous species and small shrubs. This historical analysis showed similarity between past and present communities. Therefore, vegetation sampling in natural regional minerotrophic peatlands can be used as supplementary information source for the reference ecosystem description.

ORAL DemoCamp & POSTER

A framework and workflow for extraction and parsing of herbarium specimen data

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Millions of specimens in museums and herbaria worldwide need to be digitized to be accessible to scientists. A key challenge faced by all biodiversity collections is determining a transformation process that yields high-quality results in a cost- and time-efficient manner. The University of North Texas's Texas Center for Digital Knowledge (TxCDK) and the Botanical Research Institute of Texas (BRIT) are developing a web-based application workflow for combining human and machine processes to facilitate the transformation of herbarium label data into machine-processable parsed data. The workflow and framework, called the Apiary Project (www.apiaryproject.org), are made possible through integration of a variety of existing technologies and the application of standards developed by the Taxonomic Databases Working Group and the Dublin Core Metadata Initiative. The workflow interfaces will allow the human

participants to inspect and analyze the digital herbarium sheet images and extract textual components with the assistance of software technologies such as Optical Character Recognition (OCR) then parse this text into standardized metadata elements. The workflow will provide a final quality control where specimen records are evaluated for accuracy and completeness.

POSTER

To 2010 and beyond! - An adventure in training

Blewett, B.

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The origins of the the Kew International Diploma Programme and its development into the current suite of courses presently available, including the Regional sub-programme, leading to a consideration of possible developments in a post 2010 world. How best can the collections community deliver training to underpin research and conservation after reaching the '2010 Biodiversity Target' and experiencing a World Financial Recession?

ORAL

Assessing the state and trends of biodiversity sciences (taxonomy and collections) in Canada: An introduction to the Council of Canadian Academies' Expert Panel process

Brouillet, Luc

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The Council of Canadian Academies (CCA) is an independent, not-for-profit corporation that supports science-based, expert assessments (studies) to inform public policy development in Canada. The Council draws upon the intellectual capital that lies within its three Member Academies – the Royal Society of Canada: The Academies of Arts, Humanities and Sciences of Canada; the Canadian Academy of Engineering; and the Canadian Academy of Health Sciences. In 2009, the CCA was asked by the Minister of Canadian Heritage, on behalf of the Canadian Museum of Nature, to establish an Expert Panel on the State and Trends of Biodiversity Science in Canada. The Expert Panel comprises 15 members and is chaired by Dr. Tom Lovejoy. The Panel's charge focuses specifically on the state of taxonomic and biosystematics research in Canada. Surveys of taxonomists and of Canadian collections have been conducted, as well as a public call for evidence. The full report will be released by the end of 2010. More information on the Expert Panel and the CCA can be found at: (<http://www.scienceadvice.ca/biodiversity.html>).

ORAL Plenary Panel

Canadensys – a pan Canadian biodiversity informatics network and consortium

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Biological collections are replete with taxonomic, geographic, temporal, numerical, and historical information. This information is crucial for understanding and properly managing biodiversity and ecosystems, but is often difficult to access. Canadensys (www.canadensys.net), operated from the Montréal Biodiversity Centre, is a Canadian-wide effort to unlock the biodiversity information held in university biological collections. In its initial phase, the network focuses on data from three of the most ecologically diverse and economically important groups of organisms: plants, insects, and fungi. At this time, the consortium includes 11 participating universities, five botanical gardens, and two museums, which collectively house over 13 million specimens. We aim to digitize, georeference, and share 3 million records in the next five years via a network of distributed databases, compatible with the Canadian biodiversity information network (CBIF) and the Global Biodiversity Information Facility (GBIF). Canadensys uses and promotes biodiversity information standards, such as Darwin Core, the TDWG Access Protocol for Information Retrieval (TAPIR) and Globally Unique Identifiers (GUIDs). A central webportal will allow access to specimen data (including images and geospatial information) in combination with data from other sources like the Database of Canadian Vascular Plants (VASCAN) and the Catalogue of Life. Partner institutions are involved in regional and provincial electronic atlas projects, produce dynamic species pages, electronic keys and virtual museums, provide taxonomic treatments and data for major international initiatives, such as Flora North America and Encyclopedia of Life, and serve as nodes for data hosting of smaller institutions. By enabling the sharing of these data, Canadensys will allow for their synergistic cross-analysis with geospatial and environmental models. This will enhance both our understanding of global environmental issues and the development of sound biodiversity policies across the country.

ORAL

The Institut québécois de la biodiversité (IQBIO) and Quebec's natural history collections

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Two Canadian provinces lack a state museum of natural history, Quebec and Prince Edward Island. In Quebec, this governmental negligence in a province with such a large continental territory adjacent to extensive marine areas prompted a group of concerned Quebec scientists to launch IQBIO in 2004, a non-profit organization dedicated to the knowledge and preservation of Quebec's

biodiversity. The group had previously received in 2003 a grant from the Quebec Government in order to survey and build up a register of the numerous natural history collections scattered in Quebec. Our register now contains 240 names of collections, defined by major taxonomic and ecological criteria, held by 126 owners, 72 (57%) of which are private scientists and amateurs without any governmental or institutional mandates and attendant resources, 23 (18%) are universities or colleges, and only 14 (11%) are governmental services. Most collections (216) are based on taxonomic samples, only 24 holding ecological samples of biodiversity. As expected, taxonomic collections are mostly devoted to insects (27%) and vascular plants (14%), followed by fungi and birds (6%). A few major collections will be preserved with high standards in the new Montreal Biodiversity Centre, under construction, but without a complementary major infrastructure, many important collections of various sizes, especially of vertebrates and aquatic invertebrates, will remain dispersed, under funded and at risk in the near future. Since IQBIO aims for the time being at offering "research services", such as up-to-date online metadata or technical help and advice on collections, rather than doing research itself, adequate funding remains a major problem.

POSTER

Hybridization of European *Crataegus monogyna* (Maloideae or Pyreae; Rosaceae) with two North American hawthorn species

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It is well documented that *Crataegus monogyna*, a European hawthorn species that has been introduced to North America, is able to hybridize with other hawthorn species in the Old World. However, there have been only two studies regarding its hybridization with other hawthorns in the New World. A molecular approach was chosen to gather information on the hybridization patterns of *C. monogyna* with *C. punctata*, an Ontario native species, and hybridization with *C. suksdorfii*, found in Oregon. We used 13 microsatellite primer pairs from apple (*Malus domestica*; Rosaceae) that had been previously proven to work in population genetics studies of other hawthorn species. All of the primers were found to work with DNA extracted from seeds of all three species, and the conditions for the PCR reactions were optimized for each primer. With the primers selected and the conditions optimized, microsatellite data can now be collected in order to infer hybridization patterns. To gain a better understanding of the ecological success of introduced hawthorn *C. monogyna*, a statistical analysis of the seed production per fruit and per pyrene was also performed. It was found that although the native species have a greater number of pyrenes per fruit, the percentage of pyrenes that actually contain seeds is not 100%. Based on these results the advantages that *C. monogyna* possesses in competing with the native hawthorn species are discussed.

ORAL

DNA and Tissue Banking at The New York Botanical Garden

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DNA sequence data are being increasingly and routinely used in academic and applied research. Many biological resource centers are developing or planning to develop collections of readily available, specifically prepared materials for generating DNA sequence data for biodiversity research. In the face of rapid decline of biodiversity, DNA and tissue banks aim to conserve genetic biodiversity for current and future research by providing long-term storage of these materials. At The New York Botanical Garden (NYBG), samples comprising the DNA bank are primarily used by NYBG scientists, students in the Graduate Studies program, visiting scholars, and interns. In recent years, accessions have surged beyond the plant and fungal groups studied by staff scientists due to escalated efforts to document dwindling biodiversity and as a result of large scale multi-institutional projects (e.g. TreeBOL). Through funding from NSF, NYBG has embarked on a project to curate and database its DNA Bank and make the holdings known to the scientific community via an internet-searchable catalog. As a result of this initiative, policies governing acquisitions, use of these research materials including depletion, use of their associated data, and safety and security were formalized. We will discuss materials selected for curation and improved storage efficiency, as well as the work flow that was developed and how it interfaces with NYBG scientists. We will present the database schema developed for the science division's KE EMu specimen database to unite DNA Bank samples with their vouchers.

POSTER

How many taxa in *Sporobolus vaginiflorus*? . . . What does the collection say?

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Poverty Dropseed (*Sporobolus vaginiflorus*) is one of the most stress tolerant species of plants in eastern Canada, where it thrives in extremes of drought and heat. Renowned botanists Merritt L. Fernald in 1950 and William G. Dore in 1980 accepted three infraspecific taxa: *Sporobolus vaginiflorus* (Torr. ex Gray) Alph. var. *inaequalis* Fernald, *S. vaginiflorus* var. *ozarkanus* (Fernald) Shinnars, and *S. vaginiflorus* var. *vaginiflorus*. The most recent monographs of the group have lumped var. *inaequalis* and var. *vaginiflorus* without an explanation leaving the two infrataxa, *vaginiflorus* and *ozarkanus*. Dore reported that the three varieties had different areas of occurrence in eastern Ontario which supported his recognition of the three infrataxa, but the area of total range covered by this geographic observation

was rather restricted to draw conclusions. Subsequent authors treating this group did not follow up on Dore's observation with an exploration of ecological differences. To determine the extent to which ecology supported three infrataxa, all eastern Ontario herbarium specimens at CAN, DAO and QK were identified and (1) associated with habitat including rivershore, roadside, alvar, and granite barren, and (2) were plotted on a map of eastern Ontario showing alvar landscapes to provide a visual association and to expand use of the data for specimens lacking habitat information. Both of these procedures suggested a strong association of both var. *vaginiflorus* and var. *ozarkanus* with alvars and suggested that these two are ecologically similar while var. *inaequalis* is the most distinct. The presence or absence of hair on the lemma may be a less important character than the elongation of the lemma which separates the ecologically distinct var. *inaequalis*. Ecological data suggest that if only two infrataxa are recognized they should be var. *inaequalis* and var. *vaginiflorus* (including var. *ozarkanus*) contrary to the recent classification.

POSTER

Evidence for the effect of grazing by domestic horses on vascular plant diversity in a foothills prairie in western Alberta

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The few studies of the effects of grazing on Canadian prairie biodiversity involve cattle, but there are 350,000 horses in Alberta, especially in the biodiversity-rich montane parklands, and the number is increasing. To gather evidence for the impact of light grazing by domestic horses on parkland prairie biodiversity, data were gathered on all vascular plants present in 50 one m² quadrats in each two adjacent sections of a continuous prairie glade of uniform soil and elevation. The two sections are said to have had very similar vegetation prior to being separated by a fence 25 years previously, after which one section was grazed by domestic horses in late summer and fall. A total of 93 species were recorded in quadrats. Of these, 83 species occurred in the area without horses and 69 occurred in the area with horses. The measurements of biodiversity that include evenness and heterogeneity were higher for the area grazed by horses when cover data was used but not when frequency data was used. The area grazed by horses had more species that were common and frequent while the area without horses had a few dominants along with a large number of other species that were rare and had little community impact as a consequence. Individual sites appear to be rich and capable of different expressions of biodiversity supporting the concept of pre-settlement prairies as patches that were ever changing due to differences in a restricted grazing regime associated with occurrence of free-ranging native ungulates. The reduced amount of change and many severely grazed areas in modern prairie patches leads to rarity and local extirpation. While it is important to protect ungrazed and lightly grazed areas, the moderate grazing of domestic

horses can have a beneficial effect on biodiversity of a prairie parkland landscape.

POSTER

History of insect pest control in the AAFC National Collection of Vascular Plants

Catling, Paul M., Mitrow, Gisèle

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The Tobacco Beetle (*Lasioderma serricorne*) feeds on dried plant material, is the major pest of herbarium collections of dried plants around the world and is responsible for almost all damage in the AAFC collection. With vigilance, between 1948 and 1986 the damage was controlled, but it was never totally stopped. Control was achieved with fumigation of methyl bromide, mothballs (naphthalene), vapona, Paradichloro-benzene, and pyrethrins combined with silica gel to form a powder. In 1983 freezing was initiated to replace the fumigations with poisonous chemicals. Experiments revealed that Tobacco beetles could survive most chemicals and a degree of freezing. As a result of space limitations an automatic compactor was installed in 1987. Whenever the compactor was opened or closed many aisles would open with the result that exposure to flying beetles was by 20 times greater than before. In 1989 climate control was first recommended to the director. As it happened entomologists had been studying the ecology of Cigarette Beetles in an attempt to control them as a major pest of stored food products. Through a survey of the literature, a climate control plan developed quickly. Until it could be installed, interim measures were taken including use of Pyrethrin insecticides and dichlorvos (vapona) in form of strips and regular fumigation with DDVP smoke bombs. As soon as the climate control system was established in 1992 the temperatures were maintained below 18° C (65° F) and beetles disappeared and all damage ceased. This cheapest and safest method of pest control was not mentioned in reviews of pest control in herbaria until in the 1990s. As a result of reference to older literature, some collection managers are unaware of the remarkable success of climate control in ridding herbaria of pest insects and the added benefits of human safety and preservation of archival materials.

POSTER

AAFC researchers discover ...A wolf in sheep's clothing on the move

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European Common Reed arrived in Canada in 1910 disguised as a rare native plant that was already here. It did not attract much attention until it recently when it entered a phase of increasingly rapid expansion. AAFC botanists have a very special tool for discovering plants in disguise. It is a collection of over 1.5 million plant specimens collected throughout Canada over the last two centuries. It was not until 2001 that the plant was discovered as a wolf in sheep's clothing, the European

Common Reed, *Phragmites australis* subsp. *australis*, a wicked sister to the native American plant which it closely resembles. Analysis of traits with respect to time and habitat indicated that plants lacking red colour, having small flowers, and occupying nutrient-rich habitats were invaders. Without the collection including a time sequence, this discovery would not have been possible. Once the invader was identified, it attracted attention and was soon documented as an aggressive plant that thoroughly dominates many places where it grows, has a devastating effect on native biodiversity and can also be a serious pest of agriculture. Twenty-two plant collections in museums, universities, and government departments across Canada co-operated to make a database of 1740 records available online. The database has received 71,512 questions over the past year. By comparing the climate and substrates of regions where the plant already occurs and analyzing data on its rate of spread, it is possible to predict that it will be common in the prairie provinces within one or two decades. It is likely to become an agricultural problem in the irrigation districts and to have a huge impact on reducing native biodiversity in prairie wetlands. The advantage of knowing this early is that there is some time to prepare for it thereby vastly reducing the potential costs of control.

POSTER

Recent trends in the role of the AAFC National Collection of Vascular Plants

Catling, Paul M., Mitrow, Gisèle

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The AAFC National Collection of Vascular Plants includes over one million sheets of light cardboard, each with one or more pressed and dried plant specimens and a data label. The collection includes about 50,000 plant species, about 20% of the world total and 62% of it is from Canada. Most of the specimens are pest species or crop relatives, the priorities of Agriculture and Agri-Food Canada. The specimens have been identified by botanical experts and are thus an extremely valuable resource. In many respects the collection is one of the best in Canada and one of the best in the world. It has two primary roles: (1) providing accurate identifications and comprehensive information and (2) supporting plant classification research as part of an international network. Despite a small reduction in staff over the past 14 years, annual report statistics show an increase in activity with respect to both major roles. Incoming loans of specimens have increased suggesting an increase in staff activity in classification research. Being part of an international network allows AAFC crop and weed scientists address Canadian research priorities by borrowing specimens from around the world. Also as a contribution to classification research, the number of visitors accommodated over the period has increased. The number of clients for information and identifications in connection with control, monitoring, research, and international and domestic agreements and legislation has also increased. These increases do not include use of a website developed over the period. We attribute the increases to increasing environmental problems especially concerning invasive alien plants, increased need for information related to

plant classification, and increased interest in the protection of biodiversity. The data support the suggestion that the roles of major plant collections are increasing in importance. The roles have not changed substantially since the collection was first developed in 1886.

ORAL

Three BIG QUESTIONS about databasing natural history collections

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What does it cost, how is quality assured and why is it essential? The cost of creating a database with names, locations, habitats, dates etc., varies with the kind of material. Plant specimens can be databased at a rate of 100 per day but this includes adding new data such as latitude and longitude in decimal degrees to allow mapping. The work can be done with varying costs by permanent staff, students or volunteers. Clients are sometimes willing to assume the costs and databases can often be co-operatively shared with partners. Data quality is a major consideration and no specimen data should be entered into a database without ensuring that it is correctly identified. Data are only of high quality if they are fit for their intended use. It is important to appreciate the needs of users. Data quality is best delivered as part of a vision including both policy and strategy. Data should be archived and protected like specimens for use by future generations. Taxonomic, spatial, collection and descriptive data all have differing quality requirements. Metadata provide a way of describing data and its limitations. The specific uses of primary species occurrence data are in the thousands, but they can be classified into approximately 20 major areas of use, including predicting spread of invasive plants, understanding the status of rare and endangered species, environmental risk assessment, documenting biodiversity and identifying priority targets, and identification of the characteristics of wild crop relatives for crop improvement. With a multitude of uses and users, databases help to make natural history collections increasingly relevant, which leads to increased support, but the best results are obtained through the development of thoughtful policies, and it is equally important to remember that data is judged on the basis of access, use and benefit.

ORAL

Changing values of Canadian herbaria from the 19th to the 21st century

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Plant collections in Canadian herbaria have always served several essential purposes of systematic botany. Of course, preserved specimens are indispensable to document the flora of Canada and its regions. This allows taxonomists to identify plants and discover previously unrecognized plants. Type specimens in herbaria are

especially important for proper documentation of new taxa. As the biological sciences have grown in sophistication, herbaria are increasingly taking on new functions. Herbarium specimens record when and where species occur over time, and in what habitats, and it is now possible to analyze biogeographical and ecological patterns on a historical basis. Herbaria will be more important in these regards as climate change and urbanization continue to alter Canada's flora. Conservation of a country's flora is both a moral imperative and an economic necessity, and herbaria are critical to documenting threats to Canada's plants and habitats and adopting strategies to preserve endangered species. Herbaria such as DAO also document plants of agricultural importance, and herbarium collections of extinct cultivars are often important to understanding the nature of modern cultivars. Numerous scientific studies have been based on mistakenly identified experimental material, so it is clear that herbarium vouchers should routinely be deposited. Recently, minute DNA samples from herbarium collections are serving to clarify evolutionary relationships among species. Perhaps the most exciting prospect lies in the possibility in the future of using such small samples from herbarium collections to regenerate extinct races and indeed even extinct species! Canadian herbaria, like others in the world, are threatened by economic constraints. It is therefore important to emphasize the growing importance of herbaria to the biological sciences in particular, and to society in general.

ORAL Plenary Panel

Towards demand-driven publishing of Natural History Collections Data: Recommendations of the GBIF GSAP-NHC TG

Chavan, Vishwas

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During past decade, efforts are being made to expedite the digitization and publishing of primary biodiversity data held by the natural history collections. However, to date less than 5% of estimated 3 billion specimens have been digitized. This calls for a comprehensive strategy and action plan for demand-driven digitization and for publishing of NHC data. To address this issue, GBIF constituted the Global Strategy and Action Plan for mobilization of Natural History Collections Data (GSAP-NHC) Task Group in July 2008. GBIF GSAP-NHC submitted its draft report, which posits that a demand-driven approach makes the size of the digitization of NHC task realistic, i.e. fundable. This talk will present the salient recommendations of the GSAP-NHC TG. The possible uptake of these recommendations by the professional NHC communities such as SPNHC, SciColl, etc. will be further discussed.

POSTER

Systematics of the Korean and northeastern Chinese *Allium* (Alliaceae)

species based on morphological and molecular data

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The systematics of the Korean and northeastern Chinese *Allium* species was investigated based on extensive sampling for morphological and molecular characters. The goals of this study are: 1) to expand the current knowledge about seed testa sculpture by including unstudied species and different accessions of already reported taxa, 2) to re-evaluate the proposed intrageneric classification recently proposed by Friesen et al. (2006), focusing on the polyphyletic nature of the nrDNA ITS phylogeny together with seed and pistil characters, and 3) to discuss the molecular phylogenetic hypothesis resulting from the analysis of ITS sequences in relation to the evolution of pistil morphological characters that have been traditionally used to define some subgeneric groups. We will also discuss whether morphological characters support monophyletic groups identified by ITS data. Our study indicates that testa sculpture, pistil morphology, and ITS sequences are useful taxonomic characters to delimit subgeneric and sectional levels in the genus *Allium*. Our results revealed that subgenus *Cepa* is not a monophyletic group. Also, the systematic significance and trends in pistil evolution were inferred based on the optimization of ovary types on the ITS-generated tree in relation to outgroup taxa. The clades obtained with molecular data are supported by pistil morphology. Other important findings suggest that the presence of various ovarian hood-like appendages in Korean and northeastern Chinese *Allium* species is quite likely a new, derived character; the number of ovules likely evolved from several to one; and the tripartite to trilobed stigma and trigonous style are interpreted as ancestral characters in *Allium*. Therefore, the *Allium* species from Korea and northeastern China, excluding cultivated taxa, were reclassified into twelve sections in nine subgenera, with subgenus *Cepa* as the most recently diverged group.

ORAL

A practical test of DNA barcodes for identifying the Cariceae (*Carex* & *Kobresia*, Cyperaceae) of North America, north of Mexico

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With more than 480 species, the Cariceae comprise approximately 3% of the native vascular flora of North America, north of Mexico. Common to every habitat type and dominant in many, this significant group of morphologically-reduced, wind-pollinated plants is often overlooked owing to the difficulties associated with species identification. Previously, we established a DNA barcoding database using the chloroplast region *matK* for 516 of the 530 Cariceae taxa (1410 individuals) currently recognised in the Flora of North America (FNA) region. Here, we test this continental database using 44 unknown samples of leaf tissue submitted by Cariceae specialists from across FNA. To avoid bias, all tissues were processed by a third party and the resulting sequences were first compared to the entire North American sequence database, and then to smaller regional reference databases (states, provinces, territories) using both tree- and algorithm-based methods. On a continental level, DNA barcoding was able to correctly identify 20 (45%) of the unknown collections to a single name with all remaining samples placed within groups of 2 to 21 taxa that contained the correct name as determined by morphology. On a regional level, DNA Barcoding correctly identified 26 samples (59%) with all remaining samples (18 or 41%) resolved to a group of no more than 8 species. Our results suggest that a regional approach to DNA barcoding could efficiently identify or narrow the possible species names for unknown samples.

POSTER

Correlating pollen size and ploidy level in Suksdorf's hawthorn

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Crataegus L. has been problematic in taxonomy due to variation in ploidy level, apomixis, and extensive hybridization. Previous studies show *Crataegus suksdorfii* (Sarg.) Kruschke comprises diploid (2x), triploid (3x) and tetraploid (4x) individuals in Western North America and others document possible correlations that can be exhibited between ploidy level and pollen size in some *Crataegus* L. species. Using Alexander's stain, acetolysis with safranin stain and light microscopy, we measured pollen grains to determine whether pollen size and stainability can be used as a predictor of ploidy level in *Crataegus suksdorfii* species. Our samples comprised of *C. suksdorfii*, and comparative material of a closely related species, *C. douglasii*, and of the naturalized Eurasian diploid species, *C. monogyna*, that hybridizes with *C. suksdorfii*. Results of our samples showed all diploid specimens, five out of thirteen *C. suksdorfii* samples, have high stainability compared to eight out of the thirteen *C. suksdorfii* species that are composed of triploids and tetraploids, suggesting greater viability of diploid pollen grains. Pollen grain size, however, exhibits a more complex relationship between ploidy level, taxon, and size which is the primary focus of this project.

ORAL

Phylogeography of *Bartonia* species in North America and conservation implications of branched *Bartonia*, a possible new species for Ontario

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Bartonia paniculata subsp. *paniculata* is a relict Atlantic Coastal floristic element threatened in Canada for which a conservation management plan has been in place since 2003. It has a disjunct presence in Canada and United States. In Canada the subspecies is found only in a few specialized habitats in Ontario, in populations which are separated from the rest of subspecies range by about 600 km. We are studying the genetic variability of Branched *Bartonia* (*B. paniculata* subsp. *paniculata*) by comparing samples collected from Ontario and United States. Our goal was threefold: 1) to test species boundaries and determine whether or not *Bartonia* in Ontario is a new species needing its taxonomic and conservation status re-evaluated, 2) to gain insight into some of the past phylogeographic processes that have shaped the current distributions of Ontario endemic plants, and 3) to reconstruct the phylogenetic relationships within the *Bartonia* genus. We sequenced five chloroplast regions from *B. p.* subsp. *paniculata* sampled from Ontario and USA populations, and from other five *Bartonia* species. All of the gene regions revealed some level of variability; two were coding genes (*rbcL* and *matK*) and three were non-coding intergenic spacers (*trnH-psbA*, *trnL-trnF* and *trnT-trnL*). *RbcL* and *matK* regions are used as universal DNA barcodes to delimitate species and subspecies in plants. Our results strongly suggest that the Ontario populations are not only disjunct populations, but are in fact unique taxonomic groups: genetic distance values between USA populations of *B. paniculata* subsp. *paniculata* were equivalent to genetic distance values between different species of *Bartonia*. Additional work will be required before we can determine whether or not Ontario *B. p. paniculata* be reclassified as novel species or subspecies; regardless, our data provide strong support for a more rigorous conservation management plan of *B. p.* subsp. *paniculata* in Ontario.

ORAL

Re-curating the fluid-preserved mammals of the Yale Peabody Museum of Natural History: Methods and discoveries

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The Yale Peabody Museum fluid-preserved mammal collection comprises more than 850 specimens collected over a span of 150 years. With funding from an NSF Collections Improvement Grant, we at the Peabody Division of Vertebrate Zoology recently finished re-curating this collection. The re-curation process consisted of cataloguing specimens into the museum database, re-jarring specimens, labeling specimens with thermal-printed archival labels, updating taxonomy, and verifying specimen identifications. In addition, nearly half of the specimens were either completely unidentified or only identified to the taxonomic rank of order. We identified all but a few of these specimens at least to the rank of family, and we were able to identify most of them to the genus or species level. Some of these newly-identified specimens represent range extensions for their species, a finding which serves to highlight the importance of natural history collection care and re-curation efforts as we strive to understand Earth's biodiversity. Challenges that arose during the re-curation process will also be discussed.

POSTER

Native orchids as bioindicators in the southern Arctic

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The question of when climate change is having an effect on terrestrial biota of the Southern Arctic Ecozone can be inferred by the appearance of new species from the south. These may be referred to as "new flora indicators," and, to be useful, they should be: (1) obvious and easily identified; (2) at, but not north of the Taiga Ecozone boundary; (3) able to respond to change rapidly; (4) not reliant on microhabitats associated with trees; and (5) have demonstrated colonizing ability. Plant collections (herbaria) provide accurate information on the distribution of plants and their characteristics that help to select the most useful bioindicators based on these criteria. Northern Green Orchid (*Platanthera aquilonis*) is one of the 10 best of 1300 plants in Northwest Territories and Nunavut. The flowers produce thousands of seeds which are like dust particles and can be carried great distances. The fourth and most northern record of Northern Green Orchid in the Southern Arctic Ecozone of Nunavut was made on the Belcher Islands during the International Polar Year (IPY) Project 2007-2008. As part of this initiative local people collected plants and photographs to serve as baseline datasets that monitor and create discussion on climate change and related socio-environmental impacts. The plants were archived in a collection in Sanikiluaq where they have promoted great interest and discussions about the changing landscape. Members of the local community including elders look forward to undertaking more extensive surveys and

discussions of this plant in 2010 to determine whether it has moved northward, as collections suggest. This kind of interest here and elsewhere in the north will provide current and continuing understanding of climate change effects and provides an example of botanists from southern Canada and northern community members working together to share their knowledge.

POSTER

Vascular plant diversity in Canada's southern Arctic: new baseline data and significant floristic discoveries in Tuktut Nogait National Park and vicinity, Northwest Territories

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Exploration of the flora of the Canadian Arctic has been ongoing for almost two centuries, yet many regions remain under-explored. In 2009 we explored the southern Arctic flora of Tuktut Nogait National Park (TNNP) and vicinity in the northeastern Northwest Territories, about 2 degrees north of the treeline zone. Our plant inventories near the southern edge of the Arctic ecozone provide comprehensive baseline data that should facilitate detection of new species arrivals associated with climate change. Of our almost 1000 collections representing over 240 vascular plant taxa, at least one fifth are noteworthy. We found extralimital stands of balsam poplar (*Populus balsamifera*) growing fully in the tundra, well beyond the 'normal' range of the species in Canada, which is generally reported as extending to the treeline. Several of the species that we found in this arctic ecozone are typically of Boreal affinity. We report many species range extensions within Canada and the NWT (e.g., *Botrychium lunaria*, *Equisetum palustre*, *Carex concinna*, *C. garberi*, *Draba oligosperma*, *Lomatogonium rotatum*, and *Myriophyllum sibiricum*). Many of our collections are the first records for TNNP and vicinity.

ORAL

Herbarium data management and display using Specify: SASK collection as example

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The W. P. Fraser Herbarium (SASK) of the University of Saskatchewan ranks among the top 10 herbaria in Canada and is the primary institution devoted to the documentation and study of Saskatchewan's flora. As of March 1, 2010, SASK's systematic collection has nearly 180,000 specimens featuring vascular plants, bryophytes, and lichens. With collections covering 125 years, SASK is the national institution hosting the most comprehensive chronological, historical, taxonomic, and geographic coverage of Saskatchewan plants, an important component of Canadian biodiversity. SASK's main goal is to make available online to the general community the wealth of biological information contained in its museum

specimens via a biodiversity informatics program. To achieve this, in 2005 SASK personnel started using Specify, versatile computer software that allows the sorting of specimens in various categories. The storing and digitization of specimen information in our bioinformatics database system is supported by Specify. With a server storing our database specimen information, we are providing remote access to our valuable natural history collection. To date, we have digitized label information of around 38,000 voucher specimens. This long-term ongoing searchable database project involves the production of high-resolution images of vouchers specimens, which will be attached to label information and distributional maps with topographic, ecoregion, and soil type layers. Several special collections such as type and historical specimens as well as provincial rare species, are available in our database system. Overall, SASK's digitization provides a provincial platform that will serve as a basis for better conservation practices, decisions and policy making regarding biodiversity preservation and management at the regional and national levels.

ORAL

Influence of an invasive plant species on plant pollinator interactions: Evidence for facilitation

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The introduction of an invasive species to a community can result in a variety of novel ecological interactions for natives, ranging from facilitative to competitive. In this study, we investigate the potential for a co-flowering invasive plant, *Lythrum salicaria* (Purple Loosestrife), to compete with a native of the same family, *Decodon verticillatus* (Lythraceae), for pollinator services. Field observations of pollinator foraging patterns (pollen quality) and visitation rates (pollen quantity) show that visitation rates to *D. verticillatus* branches were lower in two of three invaded sites than in uninvaded sites. To determine if potential differences in pollen quality/quantity translate into altered reproduction in *D. verticillatus*, we quantified pollen limitation in three invaded and two uninvaded populations. Contrary to our expectations for competitive interactions, our results indicate a facilitative interaction between *D. verticillatus* and *L. salicaria*. Uninvaded sites show increased pollen limitation over invaded sites ($p < 0.05$), in spite of lower average pollinator visitation. We discuss our findings and their implications for invaded communities.

ORAL

Cleaning up: making soap with plant materials

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For a 3rd-yr Economic Botany course, we designed a lab exercise in which students made hand soap from plant products. There were several learning objectives spanning theoretical as well as practical aspects: (1) to

understand “cold process” soap making, in terms of procedure, reactants, reaction (saponification), and products; (2) to compare the processes and ingredients of hand-made vs. industrial soap production; and (3) to understand the properties by which soap acts as a cleaning agent. Using a detailed handout that introduced the history and chemical reaction as well as the step-by-step methodology, a class of 25 students made soap using vegetable shortening, lye (sodium hydroxide) and their choice of additional oils and additives (e.g. colourants, fragrances). By the end of the 3-hr lab, their soap was left to set in molds. It was removed from the molds in the next 48 hrs, and was left to cure for several weeks. Along with a description of the lab exercise, we will explore pedagogical aspects (student learning and perception) and describe how learning objectives of this lab can be adapted to suit a variety of courses by shifting the emphasis to, e.g., chemistry (saponification, lye production), history of soap-making, or sources and properties of plant vs. animal oils. A copy of the exercise, with a list of required materials, will be made available.

ORAL

Flower development and nectar production in relation to insect pollination

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Owing to mankind's dependence on certain insect species for fruit and seed production of many agricultural and horticultural crops, perhaps no plant-insect interaction is as well recognized and appreciated as that which has involved the co-evolution of insects as pollinators. Foraging insects, initially enticed by floral colour and fragrance, regularly turn their attention to the procurement of food sources such as nectar and/or pollen, or other floral rewards such as oils or shelter. Such movements of insect visitors to flowers often result in pollen deposition on the stigma. Nectaries – diminutive floral glands that secrete nectar – are located in a wide range of angiosperm species and tend to occupy locations within a flower that facilitate pollination. In this presentation, studies of various developmental and structural features of floral nectaries from our research projects will be discussed in the context of insect pollination, including various patterns of formation and distribution of modified stomata on nectary surfaces; comparative structure and nectar production by nectaries in heterostylous species such as *Lythrum salicaria* (purple loosestrife); and floral spur development and differences among various species in terms of the structure and location of the flower's nectar-secreting tissue. A long-term objective of this research is to advance our knowledge of nectary development, structure and function in order to maintain and even enhance the success of pollination by insects in future.

ORAL

The CBD in practice: challenges for collections and research

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2010 is a critical year for biodiversity professionals. The 10th Conference of the Parties (COP10) to the Convention on Biological Diversity (CBD) will examine the results of key initiatives such as the 2010 Biodiversity Target and the Global Strategy for Plant Conservation, and decide how to proceed post 2010 with revised targets. COP10 will also decide whether to adopt a Protocol on access to genetic resources and benefit-sharing (ABS), currently in negotiation. Although there is no specific ABS target in the GSPC, its plant conservation actions take place politically in an ABS-concerned world, with a focus on partnership and benefit-sharing. As libraries of biodiversity, ex situ collections such as botanic gardens and museums are key players in CBD implementation, and their relationships with biodiverse countries and users in non-commercial and commercial research sectors are coming under intense scrutiny. The Protocol on ABS, if adopted, is likely to usher in more stringent rules in many countries, and also provide mechanisms for compliance with these rules by users in other countries. In particular, researchers will likely need to get a ‘certificate of compliance’ before collecting or carrying out research in many countries, and research institutions will need to be able to keep track of, and report on, these certificates or other permits. However, the Protocol may also result in helpful clarity and certainty on ABS issues - which currently are often bewildering and risky - and promote closer partnerships and greater trust, necessary for successful long-term conservation efforts. It is vital for collections managers and researchers to be aware of and involved in new CBD developments, and some practical CBD implementation measures and tools will be discussed.

POSTER

Validating collections: taxonomy, faunistics, databases, Red Data Books and Site Quality Assessment studies at the RBINS Entomology Department

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The main objectives of the Entomology Department of RBINS (Belgium, Brussels) are collection management, scientific research (Taxonomy and Systematics, Chemical ecology, Evolutionary ecology and speciation, Faunistics, Biomonitoring and Nature Conservation) and public service. Management of the Scientific collections are the core activity of the Department. The collections compile more than 10.000.000 specimens of insects and arachnomorphs and these originate from the Palaearctic (Europe: mainly Belgium and neighboring countries); the Afrotropical region, the Oriental (mainly Southeast Asia, South China, Malaysia, Singapore, Indonesia, Cambodia

and Thailand) and the Neotropics (Galápagos islands). Some of the collections are world renown as for instance Selys Longchamps Odonata collection (873 primary types and ca. 45.000 specimens), Fain's Acari collection (115.000 slides and 1.500 primary types), the Staphylinidae collection of Fagel and Fauvel, the Cerambycidae collection of Lameere and the Elateridae collection of Candèze. So far most of the important and voluminous collections have been digitalized. RBINS ICT service has developed the research tool "Darwin" which is a database comprising 283.736 digitized information covering 1 900.000 specimens from the RBINS collections. Especially databases of insect and spider groups, with information of Belgian voucher specimens have a long tradition (Ground beetles: 250.000, Spiders: 50.000, Dance flies: 25.000, Ants: 12.000). For most insect groups the oldest specimens were collected before 1950 some even already in 1820. Some of these databases have been used to compile Documented Red data books that contain knowledge on insect distribution, protection of threatened habitats/species, documented lists with data on rarity, distribution, microhabitat and ecology of all Belgian species. The end-users of these databases and Red data books are diverse: Ministries and governments, Universities, Private sector, EC and Public services. Moreover they are a useful tool for conventions, studies, applications, projects and websites. Based on the latter media and using the databases, all necessary information to implement Site Quality Assessment studies based on insects and spiders in different habitat types of Flanders and Belgium is available.

ORAL

Reverend James Downstream: A pioneer in early natural history collecting

DeMouthe, Jean F.

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The Rev. Downstream was an icon in the world of Victorian-age museum work. His labeling and documentation methods are as unique as they are random, obscure and annoying. This paragon of a natural history collector was discovered one rainy February by the geology staff at the California Academy of Sciences. A colleague called inquiring about a label in their collection that read merely "from farther downstream." It was decided that this actually meant to say "from Father Downstream." And the rest is history. Over a period of several months, a comprehensive bibliography and life history were compiled, and some of the good Reverend's labels were found throughout the Academy's collections. As time went on, other institutions have located more of Downstream's specimens in a wide variety of collections. Colleagues in all fields of natural history are urged to search their collections for evidence of this man's tasteful yet erratic labels, and to keep his methods in mind at all times while collecting and recording specimens for posterity.

ORAL

Storage and documentation of gemstones & other precious objects

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Gemstones, carvings, spheres, beads, and other similar objects may be composed of a wide variety of materials, including organics, inorganics, and synthetics. Challenges facing anyone dealing with these collections include environmental considerations, storage materials and structures, documentation, and security.

Storage of these types of specimens can be consistent with other collections held by an institution, while at the same time being appropriate for the unusual shapes or materials present. This could mean the use of containers and labeling systems produced for the commercial gemstone market. Traditional marking of objects by writing or otherwise attaching a catalog number to the specimen may not be possible or advisable. In these cases, each unique object can be characterized by using a set of careful and detailed measurements of size, weight, and optical properties. To facilitate this, specialized tools may be used, including electronic weighing devices, calipers, and various pieces of optical equipment such as a refractometer, polariscope, and an ultraviolet light. If these tools are not available on site, they can often be borrowed from other departments or friendly local jewelers. The database or catalog should be modified to provide suitable fields or other locations for the data acquired by these methods. For example, fields could be added for refractive index and luminescence. Carat or troy weight can be a calculated value in a separate field, linked to the actual measurements recorded in grams.

Besides the physical care and documentation of these objects, it is crucial to have a detailed written collections policy. This should include staff responsibilities, handling procedures, standards of care for the collection, and protocols for loans, exhibits, and other activities that may affect the collection.

ORAL

What is Suksdorf's hawthorn (*Crataegus suksdorfii*)?

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North American black-fruited hawthorns in the Pacific Northwest and Rocky Mountains that have approximately 20 stamens per flower have been referred to *Crataegus suksdorfii* (Sarg.) Kruschke. This is increasingly problematic, since we now know that these plants comprise diploids, autotriploids, allotriploids, and allotetraploids. Not only that, there appears to be some basis for reviving Heller's name, *C. gaylussacia*, for at least one of these cytotypes. Lectotypification of Sargent's name is needed, as is a decision whether (and how) to apply the name suggested by David Douglas, *C. brevispina*. New data, including flow cytometric determinations of ploidy level and morphometric analyses are added to recently published analyses of molecular variation. A biologically meaningful interpretation of these

organisms will require an understanding of reproduction in the various cytotypes. Such an interpretation will, of necessity, also require choosing a species concept that fits the data and seems likely to have some potential for being applied to other species complexes in the genus.

POSTER

Development of a Canadian Early Detection and rapid response framework for invasive plants

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Invasive plants are recognized as a significant threat to Canada's environment, economy, and society, including human health. Increasing trade, travel and tourism is expected to increase the risk of introductions. As part of the Invasive Alien Species Initiative, the Canadian Food Inspection Agency is coordinating development of an Early Detection and Rapid Response (EDRR) framework to protect natural resources, industry, market access and health of wildlife and humans from the negative impacts of invasive plants. The EDRR approach is intended to prevent invasive plants from establishing and spreading as well as to ensure effective response with minimal impact on other species or environments. To foster the development of national and regional capacity to respond to invasive plants, the three key components of the Canadian EDRR model : (1) detection and identification; (2) assessment; and, (3) planning and response, each with specific objectives.

ORAL

Preserving GOD: Curatorial and digitization challenges in the Charterhouse School Herbarium

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Charterhouse is a 400 year old English public (private) school located southwest of London outside the Town of Godalming, hence the herbarium was given the standardized designation: GOD. The Charterhouse School Herbarium houses 'long-missing' records for biodiversity of Surrey and Greater London and beyond. Volumes used for the first Flora of Surrey are included in the collections. Unique records for little known collectors such as James Edward Moxon and Rev. Tullie Cornthwaite, in addition to better known botanists such as John Drew Salmon and William Gardiner, are filed in the herbarium. In 2007, after carefully considering an appropriate repository for this historic collection, Charterhouse School chose the University Herbarium at the University of California, Berkeley as the institution to house, document and make available specimens of a collection that has been out of circulation for at least decades. A priority before

documentation was to ensure appropriate, archival, and pest-free storage for the collection and then identify/document principal collectors and the geographic scope of the herbarium. Curation and annotation of specimens was the next concern but because of the unique arrangement, care had to be taken not to spoil some of the more ornamental bound volumes and alternative methods had to be established. Lastly, the collection needed to be made available on the web for interested researchers. The choice of database and use of authority files was a key concern in addition to having the input of local experts to resolve handwriting, identify collectors, and enter label and inferred data. The use of the Botanical Society of the British Isles herbaria@home project to allow data for collections to be entered by volunteers will bring the historical biodiversity of this unique collection to the World Wide Web.

POSTER

Cataloging hidden archives of western American botany and beyond. The on-line database of the University and Jepson Herbaria

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In 2009 the University and Jepson Herbaria received a Cataloging Hidden Collections Grant from the Council on Library and Information Resources to catalog our botanical archives. The end result of this project will be a searchable online database, created using open source archival management software, of our archives, one of the primary resources for the history of western American botany from the 1860's on. The archives of the University and Jepson Herbaria contain letters and field books of at least 200 individuals in addition to documents, photographs, slides and correspondence from scientists around the globe. This collection fills in gaps in the history of the California Academy of Sciences, San Francisco, whose records were destroyed in the 1906 earthquake. While the main focus of the archives is on California, the geographic scope of the archives is world-wide, documenting world-wide botanical expeditions including seven trips to South America. The personal papers of women botanists, including Ynes Mexia, Laura May Dempster, and Annetta Carter, are well represented. Highlights from the archives include renowned botanist Willis Jepson's papers including 62 field books, 25 research books and 25,533 letters in 52 volumes; John and Sarah Lemmon's correspondence, field books and manuscripts, including veteran J. Lemmon's sketches of Confederate prisons; and Dr. Lincoln Constance's extensive correspondence with university faculty and botanists world-wide. Our correspondents range from Asa Gray and William Hooker, to John Muir. Subjects encompass the formation of Sierra Club and Save-the-Redwoods League. The image collection represents an historical record of people and ecological sites worldwide, and thumbnails of images will be made available in the online database. This poster documents our progress to date in improving digital and physical access to these unique resources.

ORAL

**The Cutlery Moss and other capers:
Managing the herbarium for species
conservation**

Doubt, J.

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The vulnerability of bryophyte and lichen species in various geopolitical jurisdictions has only been addressed recently compared with that of vascular plants. Involvement of the National Herbarium of Canada in this work has provided new insights (and highlighted some old ones) regarding the ways in which herbaria can participate well in the development and dissemination of information relevant to species conservation. Decisions related to collection development, collection documentation, and collection access all affect the success of conservation data application, and they should take these outcomes into consideration. Furthermore, substantial collection and conservation benefits may be derived from partnerships with other herbaria and with Conservation Data Centres. Herbaria and CDCs are similar in their preoccupation with accurately documenting plant occurrences through time and space, and in their emphasis on service to a diversity of clients, offering opportunities to share data entry and improvement initiatives, and to collaborate in making data accessible. With respect to archiving and applying information, they boast complementary strengths, suggesting effective partnerships to increase the vouchering of specimens documenting studies upon which land management decisions are made, to develop and promote specimen label standards, and to demonstrate the direct public value of scientific collections. For cryptogams, an additional key challenge in contributing to species conservation exists in recruiting and facilitating the work of scientists and amateurs with field expertise in the growing fields of bryology and lichenology. Collections and collection staff form an increasing proportion of resources available to meet this challenge.

POSTER

**Georeferencing labels at the National
Herbarium of Canada**

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Retrospective georeferencing can represent a considerable challenge for herbaria. The National Herbarium of Canada was established in the late 1880s, with specimens collected as early as 1766. Portable Global Positioning System units became commonplace in the 1990s, leaving hundreds of thousands of specimen labels to the attention of collection 'detectives' tasked with determining geographic co-ordinates for collecting localities. Automated approaches to georeferencing offer promising prospects to curators faced with handling large quantities of data. To date, we have found that the cost of manual georeferencing is worth the reduction in errors and uncertainty with respect to the widely variable applications of geographic information from herbarium specimens. The application of herbarium data to species

conservation research and management decisions, in particular, requires a clear measure of the certainty associated with co-ordinates. The National Herbarium of Canada has instituted a georeferencing label documenting the methods, rationale, and accuracy of georeferenced co-ordinates, to facilitate the future evaluation and application of label data.

ORAL

**The History of Paleontology at the
Geological Survey of Canada**

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Paleontology research has been an integral part of the work conducted by the geological Survey of Canada (GSC) since 1842. Over nearly 170 years, there have been many individuals involved in paleontological research at the GSC, each with an interesting aspect to the work they were doing. Together, these paleontologists set the biostratigraphic framework for mapping Canada's vast landmass and amassed one of the largest Type collections in the world. The presentation will highlight some of the accomplishments of this parade of personalities, blocked out in 50 year intervals. Paleontology research was a central component of GSC's work from the beginning and continues to play an important role as a fundamental part of geological research.

ORAL

**Identification of a gender-specific marker
in the dwarf mistletoe (*Arceuthobium
americanum*) using random amplified
polymorphic DNA (RAPD) analysis**

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Dwarf mistletoes (genus *Arceuthobium*) are parasites of conifer species in western North America, causing disease and death in the host trees. Differentiation between the male and female plants of the dioecious dwarf mistletoe is not possible until the plant reaches sexual maturity -- typically as late as five years following infection. It would be useful to discriminate between the males and females earlier in the life cycle, ideally with a simple genetic marker. While dioecious, the dwarf mistletoes possess no identifiable sex chromosomes, so karyotyping is not a viable option. We explored random amplified polymorphic DNA (RAPD) analysis to investigate differences between genders. A variety of arbitrary 10-mer primers were selected or designed for RAPD analysis of somatic tissue from isolated male and female dwarf mistletoe tissue collected near Kamloops, British Columbia. A 900 base-pair (bp) female-specific DNA fragment was generated with primer "OPB-18". The fragment was cloned into DHa *E. coli* cells and sequenced; the sequence of the fragment did not correspond to any known gene when compared to those stored in the GenBank using BLAST alignment software. Sequence characterized amplified

region (SCAR) primers were then designed for a more robust screening of the dwarf mistletoe samples. The study has provided a mechanism to differentiate male and female dwarf mistletoe at the genetic level, and has made a contribution toward the genetic analysis of these parasites in British Columbia and their gender evolution.

ORAL

**Ethnobotany of the southern plains:
Plant usage among the Kiowa, Comanche,
and Plains Apache**

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The Kiowa, Comanche, and Plains Apache (KCA) were nomadic Bison hunting and gathering tribes that were linked historically and contiguous geographically in the southern and western Great Plains since the 17th century. They have been closely associated since EuroAmerican contact, were confederated in 1867, and shared a reservation from 1867 to 1901 in southwestern Oklahoma where most tribal members reside today. Because each tribe has remained in its ancestral region and has been the focus of ethnobotanical investigations, the KCA provide the best window for generating a southern plains ethnobotany. Collectively, the KCA utilized 157 vascular plant species native to North America representing 122 genera in 60 families. The major categories of usage were edible plants (82 species), ritual and medicinal plants (76 species), plants used for material culture (68 species), and species used for personal care and adornment (14). Many plants used by the KCA have a long history of usage based on the presence of 44 species that appear in the archaeobotanical record. The KCA have a rich ethnobotanical heritage, although traditional knowledge is disappearing rapidly.

ORAL

**CITES as a tool for sustainable use of
plants**

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While perhaps best known for regulation of trade in animal species, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has from its inception in 1975, afforded equal attention to plant species, with the aim of ensuring international trade in specimens of wild plants does not threaten their survival. As a result, the Convention can be viewed as a highly focused tool for facilitating the sustainable use of plant species and for advancing the targets of the Global Strategy for Plant Conservation of the Convention on Biological Diversity. Currently, some 28,700 species and subspecies, including plants traded internationally as medicinal products, pharmaceutical compounds, timber products, non-timber forest products and herbarium specimens are regulated under the Convention. The increasing complexity of regulating trade in threatened plants and plant products traded globally has resulted in the development of a wide range of science and policy approaches including specific annotations, electronic permitting systems, trade data capture and tracking of

specimens, all of which contribute to effective management and sustainable use of plants and plant products.

ORAL

**Community structure of arbuscular
mycorrhizal fungi (AMF) on root tissue
identified by DNA barcoding**

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Despite the prevalence of association of Arbuscular mycorrhizal fungi (AMF) across the vascular plants, relatively little is known regarding local diversity and community structure of AMF. In a pilot project, we use DNA barcoding to examine the mutualism between six plant species and the AMF fungi that colonize their roots. Root tissue of six plant species were sampled at three different root size classes per species (thick, medium, and fine root). DNA extracts of root samples were analysed for both AMF and plant identification. 75% of root fragments were successfully sequenced for a portion of the plastid gene *rbcl*, all of which had their identity confirmed via comparison with a previously generated library. Initial AMF analyses using T-RFLP of the ribosomal large subunit (LSU) region were not highly repeatable, however there was significant correlation between failure to amplify both the plant plastid gene *rbcl* and the AMF LSU region. To determine the AMF species colonizing the root fragments we focussed on a subset of three plant species for which we were able to amplify plastid sequences from all root fragments. 48 AMF clones from each root size class of each species were evaluated for unique nucleotide sequences of the ribosomal LSU region, and identified using BLAST to Genbank sequences. Sequence data from the AMF indicate that the community structure of AMF fungi varies with host plant species, and with root size. Our results show that barcoding can provide important insights into the organization and diversity of below ground community structure, and plant-fungi interactions.

POSTER

**Innovations in marine mammal specimen
preparation: indoor salt-water
maceration**

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Maceration, the process of soaking a specimen in water until all of the flesh is removed, is a common method used to prepare skeletal material of dead, stranded marine mammals for use in osteological collections. Museums generally use warm fresh water for this process, however many facilities located along both coasts have had success utilizing the ocean to clean large whale specimens. Although located 2.5 miles from the Pacific Ocean, the California Academy of Sciences (CAS) in San Francisco, CA has had salt water piped into its aquarium since 1963 through a 6"-diameter underground pipe. As

part of a National Oceanic and Atmospheric Administration (NOAA) Prescott Grant received in the fall of 2008, the CAS Department of Ornithology and Mammalogy installed and tested a 300-gallon, indoor, salt-water maceration tank in order to utilize this supply of salt water for the preparation of marine mammal specimens. We used cold salt water to successfully prepare skeletons of yearling California sea lions (*Zalophus californianus californianus*) in less than half the time taken with cold fresh water but twice the time needed with hot fresh water. Results of our experiment indicate that salt water cleans and degreases skeletons thoroughly in a short amount of time, has minimal odor, and is most effective when kept cold and changed daily. Although salt-water maceration does not necessarily save preparation time compared to hot fresh-water maceration, it does provide additional benefits, such as effective degreasing and easier cartilage removal. Thus, we recommend cold salt-water maceration as an effective technique for preparing particularly greasy marine mammal specimens.

ORAL

A comprehensive look at data digitization and mobilization in a natural history museum: Challenges and initiatives at the Museum of Comparative Zoology, Harvard University

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In a recent Report from the Interagency Working Group on Scientific Collections, biological collections were recognized to be the keepers of critical information that not only contain data for discipline-specific research but also help to provide data for issues on a global scale such as climate change, biodiversity loss, emerging diseases, invasive species and other environmental challenges. In general, the primary reason that prevents Natural History Museums from being recognized as core participants in this world arena is the limited accessibility of their data. Many museums are working to address this challenge and find many bottlenecks, ranging from financial, technical to political, in their efforts to capture and provide their data. The Museum of Comparative Zoology, which recently celebrated its 150th anniversary, is home to ten research collections and 21 million specimens. Louis Agassiz founded the MCZ on the commitment that collections are an integral and fundamental component of zoological research and teaching. In today's world, this commitment is more relevant than ever and online availability of the collections is a high-priority directive for the museum. Multiple museum-wide, cross-discipline initiatives are underway to promote digitization of the collections, data quality enhancement, and mobilization of the data. Major challenges include the need to integrate individual projects from multiple collections to meet immediate research needs and maintain long-term, museum-wide goals. Curation and longevity of the museum's data are

an ongoing concern and best practice strategies are implemented to advance the data life cycles.

POSTER

Conservation genetics of a rare lichen *Ramalina sinensis* through the analysis of DNA sequence data

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Ramalina sinensis is an uncommon lichen-forming fungal species in Manitoba and is confined to arid sandy habitats in the south western and eastern portions of the province. The fungus associates with a green alga in the genus *Trebouxia*, and contains abundant apothecia but nothing is known about the genetic variation of its symbionts. Reasons why some lichens are rare may include habitat disappearance, low genetic variation, loss of sexual reproduction, or the inability to switch photobionts to adapt to different ecological habitats. The purpose of this study is to understand the factors that determine the rarity of the species *R. sinensis*. To achieve this objective we examined the phylogenetic position and the population structure of the fungus, using primers to amplify the Internal Transcribed Spacer (ITS) of the ribosomal DNA (rDNA), beta-tubulin and elongation factor genes in comparison with the related species *Ramalina americana*. We also studied the genetic variation in the algal partner using primers for the ITS rDNA and actin gene regions. Variation in 23 samples of *R. sinensis* from four populations (trees) was compared with three samples of *R. americana*. Although *R. sinensis* is sometimes difficult to distinguish from the more variable *R. americana* using morphological features, its basal position in a recent phylogenetic study suggests low chemical variation. Preliminary results suggest fungal variation is present in the species. To apply methods for conservation of the rare lichen *R. sinensis*, it is essential to understand the genetic variability of both symbionts, the population size, and the phylogenetic position of the species.

ORAL

BIOL 304: A new upper division plant structure and function course with a society and environment context

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The more traditional courses of plant morphology & anatomy and plant physiology were recently fused and recast and placed in the context of society and environment at the University of Northern British Columbia, Prince George, BC. The new course, offered for the first time this past winter semester (2010), is called BIOL 304 Plants, Society and Environment. This course encompasses more contemporary issues relating plants, society and environment, but still possesses a foundation

of knowledge regarding plant structure and function. In the lectures, students are introduced to the relationships between morphological, anatomical and physiological characteristics of plants, and the societal/human uses and impacts on plants, and in turn, the way in which the environment is involved. The lecture portion of the class is divided into five contemporary themes: Forests, Forestry & Fiber; Croplands, Agriculture & Food; Minerals, Mining & Reclamation; Energy, Industry & Production; and Recreation, Tourism & Green Space. Each theme is composed of three parts: Jane Young's lectures on morphology & anatomy, Art Fredeen's lectures on physiology, and paper discussions that relate to the specific themes. The laboratory portion of the course has no lab manual, instead requiring each student to conceive of and implement an independent research project, essentially a "mini-thesis" where students devise and carry out an experiment on a topic related to the course objectives, then write up and present their findings at a course symposium. This course has it all: upper division plant biology, present day issues, lively discussions, and independent/student-driven research – all integrated to provide students with both real-world understanding and problem-solving skills.

ORAL

Epiphytic macrolichen diversity in subboreal British Columbia

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In mature, wet sub-boreal spruce and fir forests of central British Columbia, macrolichen biomass is mostly found aboveground as epiphytes in host trees, while bryophyte biomass and diversity is almost exclusively on the forest floor. Epiphytic macrolichen diversity in these wetter sub-boreal spruce and fir forests can be quite diverse, in many cases rivalling the diversity of vascular plants in the surrounding forest. Single-rope tree-climbing techniques were used to gain access to the canopies of these forests to assess the vertical zonation of macrolichen epiphyte diversity and biomass in two types of stands: those with high (high sites) and low (low sites) epiphytic macrolichen biomass loadings. In particular, we were interested in exploring the relationship between diversity of macrolichens and their biomasses within the different classes of macrolichen epiphyte (i.e. hair, chlorolichen and cyanolichen). That many of these lichens have important ecological roles makes the understanding of the biomass and diversity relationships all the more important. One of the major ecological roles that we are assessing in a parallel study is the contributions of N₂-fixing cyanolichens to forest nitrogen. [This work will be discussed in a talk at these same meetings by the same authors.] However, irrespective of the functional contributions that this lichen diversity makes to forest function, it represents a sizeable and important component of overall forest diversity that is likely underappreciated by forest managers and the public in general. We will highlight some of the species that make up this wonderful, but rarely seen, community of epiphytes in the world above the forest floor.

POSTER

Corrosion and cleaning: what to do with ancient metals?

Fregni, Giovanna

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The internet is full of advice to amateurs about how to clean and care for coins and other metal artefacts. But how useful is the available information? Even in pre-internet days some forms of corrosion were exacerbated by poorly understood conservation techniques. The chemistry of non-ferrous corrosion is complex and not easily treated, and some treatments have the potential to do more harm than good. At the request of a volunteer project at the Science Museum of Minnesota, a campaign of experiments using various techniques for cleaning and treating corrosion was undertaken using commonly found chemicals as described on popular websites. Prior to the experiment, all the bronze used exhibited forms of corrosion and tested positively for Bronze Disease. They were then subjected to treatment in order to see how the metal and the corrosion product would be affected and if there was any validity in the various treatments popularized on the internet. Results varied from pieces exhibiting no visible corrosion to individual examples being encased in a thick layer of corrosion. Many websites purporting to offer 'tried and tested' advice often only mirror information from other sites without verifying the effectiveness of specific treatments. The proliferation of such unverified information can potentially cause well-meaning members of the public to inadvertently damage family heirlooms or pieces in private collections. Although conservators are frequently called upon for advice about caring for these objects they are often under-informed about the range of techniques and their effects recommended by internet sources. It is hoped that by knowing what information is available on the web, conservators can give more informed advice about caring for non-ferrous metals.

ORAL

Calling or culling: the influence of our teaching metaphors

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As scientists and educators, we all have a metaphor for what we do, whether we make it explicit or not. Are students empty vessels to be filled? Logs waiting for the kindling to set them alight? Applicants for a special club with limited membership? Our metaphors for teaching are windows into who we are and how we relate to our students. My journey as an educator has been strongly influenced by my reflection on the metaphors I have used. Analysis of them has provided insight into my teaching "weak points", and the reciprocal way in which my metaphors shape my life as my life shapes my metaphors.

ORAL

Canada's Response to the Global Strategy for Plant Conservation

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The Global Strategy for Plant Conservation (GSPC) is a cross-cutting program under UNEP's Convention on Biological Diversity (CBD) with the intention of mobilizing efforts to halt the extinction of plant diversity globally. Unique within the CBD, it arose because of grass-roots efforts by botanists in 1999. It brings attention to the extinction of plants and the resulting loss of potential for social and economic benefits. The GSPC introduced the concept of targets into international biodiversity negotiations and policies, as it consists of 16 targets indicating progress toward five goals: understanding and documenting plant diversity, conserving plant diversity, using plant diversity sustainably, promoting education and awareness about plant diversity, and building capacity for the conservation of plant diversity. In Canada response to the GSPC has been mixed. There has been considerable interest in the potential of the strategy in some sectors, but there have also been concerns about how the targets, expressed at the global level, relate to programs and policies at the national level. Furthermore, to date there has been only one major program in Canada linked to the GSCP, an NGO-funded project involving botanical gardens that which ran from 2003 through 2006. In 2010 the GSPC is being revised. A national response has been prepared that seeks to build on existing programs and identify potential new programs supporting the targets. For example, Target 5 is the protection of at least 50% of areas important for plant diversity at the global level. Unlike some countries, Canada does not have criteria to designate Important Plant Areas. The GSPC can bring attention to such issues and promote cooperation to address them.

POSTER

When the last taxonomist leaves, does the collection die?

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Herbarium specimens are particularly vulnerable to damage from insect pests and neglect. The herbarium collection at California State Polytechnic University, Pomona, was no exception. This collection had undergone many changes, with its boom in the 1960's through the 1980's with over six thousand specimens, to its decline of six hundred within the past decade. During the height of the collecting days, the university supported many courses in plant taxonomy, field collecting, and professors interested in the flora of the region, however as funding diminished and a new chair of the Biology department took charge it was clear that the department chair did not hold any value for the enormous botanical collection. Field classes decreased in size as well as the number of faculty involved in botany and in 2004 the last plant taxonomist retired, leaving the collection in the hands of a professor who did not have experience in herbaria or curatorial management. The six hundred specimens that comprised the whole collection were vouchers of the Voorhis Ecological Reserve, one of the last Coastal Sage Brush stands in California. If these historical vouchers continued being destroyed by the tobacco beetle we would have lost

valuable information about an ecosystem where many graduate students perform their botany projects. I gathered a group of students to help me restore the herbarium, first by repairing the specimens and curating the collection, and later creating a database accessible to students online. The project has helped integrate students from various backgrounds, and encouraged them to think about ways they could utilize the skills learned from the herbarium into their area of study.

POSTER

The importance of integrated pest management: maggot mania – a case study of the Bishop Museum Vertebrate Zoology Collection

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Integrated Pest Management (IPM) is a vital part of collection management. It is critical that collection staff keep a regimented, consistent, IPM schedule for long-term preservation of Natural History collections. A well thought out collection room layout is important for ensuring an easy and effective IPM routine. These considerations include a buffer zone between storage cabinets and the wall, which is helpful for monitoring pest traffic along the walls, and for condensation issues in certain climate zones. It is also important to keep the cabinets off the floor allowing full visibility, and eliminating hiding and nesting areas for pests. The following considerations will be explained in a case study involving the Vertebrate Zoology dry collection room, at the Bishop Museum in Honolulu, Hawai'i. During a routine bi-weekly IPM schedule, almost 20 maggots were found on the sticky traps used to line the walls of the collection room. Upon further inspection, it was discovered that dead birds trapped in a wall space were the source of the insects. The careful and diligent IPM procedures used in this collection allowed a fast reaction and helped staff find the source and fix the problem before any damage was done. This emergency situation brought to light aspects of IPM that collection staff may not commonly take into consideration, such as the construction of the collections building. This aspect is important if an emergency situation should occur. Collection staff with IPM knowledge must be involved in the planning and design of renovations to existing collection spaces, renovations turning an existing area into a collection space, and the construction of new collection spaces.

ORAL

Plant collecting by canoe: botanical explorations of Tuktut Nogait National Park and vicinity, Northwest Territories

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Botanical exploration of the Canadian Arctic has been ongoing since the early 1800s, yet there remain substantial gaps in our understanding of the flora of this

large and difficult-to-access region. In July 2009 we conducted extensive botanical inventories and established long term vegetation monitoring plots in Tuktut Nogait National Park (TNNP) and vicinity in the northeast corner of mainland Northwest Territories. We explored and collected first by canoe along the Hornaday River, and then by helicopter along the coast and in the spectacular canyons of the lower Brock River. We made 864 vascular plant collections, including many first records of species for both TNNP and the region as a whole (e.g., *Draba oligosperma*, *Pedicularis lapponica*, *Plantago canescens*, *Stellaria crassifolia*), with many also representing significant range extensions (e.g., *Koenigia islandica*, *Myriophyllum sibiricum*, *Plantago eriopoda*, *Puccinellia arctica*). Based on our 2009 collections and a reexamination of nearly all known existing plant collections, the known vascular plant flora of the region comprises 268 species, of which 214 are known from Tuktut Nogait National Park. Sixteen species are considered of potential conservation concern in the Northwest Territories, including one globally rare species (*Mertensia drummondii*).

ORAL

Birds, beasts and botanicals: identifying organic materials in ethnographic collections

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The anthropology collection manager has a great advantage in working in a natural history museum. Access to professionals and collections in other disciplines assists in identifying the source materials used in manufacture of various ethnographic artifacts. Despite the diversity of available expertise and materials, not all the sources can be identified within one museum's collections. With the assistance of research associates, Carnegie Museum of Natural History actively acquired systematic collections in the Amazon Basin in the 1970s through early 1990s. This paper uses items of Amazonian personal adornment (necklaces, headdresses, ear ornaments, armbands, etc.) to illustrate the process of identification. A wide range of natural materials is represented, identified to genus and species.

ORAL

A Census of All Life

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Despite 250 years of scientific effort, most species remain unknown. However, the last three decades have seen a radical advance in our understanding of biodiversity, reflecting the increasing ease of accessing DNA sequences. The earliest and most dramatic impacts involved the smallest organisms. Twenty years ago, DNA analysis provided the first glimpses of vast empires of tiny life - archaeal, bacterial and protistan. However, it is now clear that sequence diversity in short genomic regions, DNA barcodes, can also be a powerful tool in revealing the

diversity of multi-cellular life, by easing the identification of known species and expediting the discovery of new ones. Motivated by a desire to understand biodiversity and the forces that have shaped it, a major DNA barcode program is now underway. Expect a barcode library for 500K species by 2015. Expect automated systems supporting both field identifications and massive biodiversity screens by 2020. Expect a barcoded world by 2030.

POSTER

Unusual rhizome vasculature in *Maianthemum*

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Maianthemum Wigg. is a genus of perennial rhizomatous herbs that grow across North America, Europe, and Asia. The rhizome size and morphology of these plants vary greatly from species to species, and these characters have been used both in keys and in developing classifications. Despite the importance of rhizome characters in *Maianthemum*, rhizome anatomy has been largely ignored until now. We show, however, that unexpected rhizome anatomy is present in the genus and is correlated with the morphological distinction between slender, leptocaul, rhizomes and thick, pachycaul, ones. Some of our observations come from North American species not included in a recent molecular phylogeny of *Maianthemum*. We have therefore collected sequence data from these species, and using Bayesian and maximum-parsimony analyses based on the chloroplast genes *trnLF*, *rpl16*, *rps16*, and *psbA-trnH*, have produced an updated phylogeny in order to investigate any evolutionary trends in anatomy. The leptocaul habit, with its vascular cylinder instead of a scattered atactostele, appears to have arisen multiple times, possibly as a consequence of shifts in foraging strategies.

ORAL

The once and future strategy: the global response to the plant conservation crisis

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Parties to the Convention on Biological Diversity (CBD) adopted the Global Strategy for Plant Conservation in 2002. The Strategy's objective is to halt the current and continuing loss of plant diversity. The Strategy includes 16 outcome-oriented global targets set for 2010. Although not all targets have been fully achieved, the Strategy is widely regarded as having succeeded in mobilizing and focusing the efforts of the plant conservation community. In tandem with related work under the CBD on protected areas, taxonomy, sustainable use, and communications, education and public awareness, the Strategy is making a tangible on-the-ground contribution to plant conservation. At the May 2010 meeting of the CBD's scientific advisory body Parties will consider a consolidated update of the Strategy, including new global targets for 2011-2020. This talk will report on the outcomes of the discussions of

this meeting, prospects for continuing work on plant conservation under the Convention, and links to the broader renewal of the Strategic Plan of the Convention for the post-2010 period.

ORAL

Introducing CollectionSpace, a collection management system and foundation for research

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CollectionSpace (<http://www.collectionspace.org>) is an open source, web-based software application for the description, management, and dissemination of museum collections information. UC Berkeley has selected CollectionSpace as the strategic platform for museum collections across campus due to its modular design, its capacity for customization and interoperability, its flexible hosting requirements, and most importantly its ability to support collections-based research, education, and public service. In this presentation, we will demonstrate CollectionSpace and talk about UC Berkeley's approach to data migrations, customizations, and full deployments of the system. The presentation will feature our deployment work for two members of the Berkeley Natural History Museum consortium, the University & Jepson Herbaria and the Phoebe A. Hearst Museum of Anthropology. As the project team approaches the release of version 1.0 of CollectionSpace, UC Berkeley and the other CollectionSpace partners are reaching out to other institutions and individuals in order to build a strong, collaborative community that can sustain CollectionSpace into the future. The Berkeley Natural History Museums are working together with the CollectionSpace project to build a set of templates and documentation that will help other natural history collections deploy CollectionSpace. This presentation is associated with the Canadensys-UC Berkeley Biodiversity Databases Collaboration, a bilateral project of the Canada-California Strategic Innovation Partnership (CCSIP).

POSTER

Characterization and diversity of superoxide dismutase (SOD) in two freshwater algae

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All living organisms are subject to several kinds of oxidative stress, which affects all aspects of cell function and metabolism. Cells that are exposed to these stresses can develop mechanisms to alleviate the harmful effect of the environmental stress. One of these mechanisms is production of superoxide dismutase (SOD), which is known as an effective antioxidant defense mechanism

against free radicals reported to be present in cells exposed to oxidative stress. The objectives of this study were 1) to examine the activity and expression of iron superoxide dismutase (Fe-SOD) in two freshwater algae under different ecological stresses, *Spirulina platensis* and *Chlorella ellipsoidea*, and 2) to examine gene diversity within species and between related species. Our studies revealed that upon exposure to sublethal levels of stress (heavy metals, pH, and salinity), both algae contained high levels of Fe-SOD activity. Partial isolation and purification of the Fe-SOD gene from *Spirulina platensis* and *Chlorella ellipsoidea* was done for the purpose of detecting SOD expression levels by Real Time Polymerase Chain Reaction (RT-PCR) under stress conditions compared with expression under normal conditions. The gene is diverse even among members of the same species. This diversity is discussed relative to gene function for these two algae.

ORAL

Slippery plant surfaces: from chemistry to ecology

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Plant leaves, stems, fruits and flowers are covered by a skin consisting of the polyester cutin and of waxes. These mixtures of homologous mono-functional aliphatics perform a number of crucial functions in protecting the plant against the biotic and abiotic environment. A small portion of the waxes, exposed at the very surface of the plant, is of prime importance in interactions with pathogens and insects. We have developed methods that allow the selective removal and chemical analysis of these 'epicuticular waxes'. Depending on the plant species and organ, individual constituents accumulate to high concentration and then form microscopic crystals protruding from the surface. For example, stem surfaces of the ant-plants in the genus *Macaranga* (Euphorbiaceae) are covered with threadlike crystals formed by triterpenoids. They reduce the adhesive force of insect feet and hence limit insect mobility on the plant surface, representing a mechanical barrier to walking insects. Similarly slippery surfaces on the inside of *Nepenthes* pitchers are formed by special aldehydes accumulating in the wax. The biosynthesis of the compounds responsible for the slippery surfaces will be discussed.

POSTER

Integrated pest management challenges in a retrofitted building for Yale Peabody Museum of Natural History collections

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In 2006 Yale University purchased the Bayer Pharmaceutical facility located in West Haven, Connecticut as part of a campus expansion plan. The Yale Peabody Museum of Natural History (PM) was allocated 80,000 square feet within one of the building complexes of this facility built in 1965. The process of converting the

former manufacturing building into usable museum storage space introduced an entirely new scenario for pest management. The goals were to determine what pests may already be occupying the building and eradicate them, determine ways to seal out future pests, and to establish a monitoring program. Baseline pest data was collected using standard sticky traps throughout PM spaces before, during, and after construction. Data was used to assess pest problems and in conjunction with proposals from an independent IPM contractor, strategic actions to eliminate these pests were initiated. A year long survey of pest activities throughout the building was also performed after occupation by the museum staff and the collections. The results showed seasonal variation in pest diversity and pest populations and indicates the need for further building renovations to help reduce these populations. Predominantly, an occurrence of Psocopteran blooms in restricted areas, have not responded to initial treatments. Collaborations with both the Yale University Art Gallery and British Art Center have been initiated to monitor pests throughout the entire complex and form a unified multi-institutional approach to integrated pest management.

ORAL

Mixed-mating plant responds positively to climate extremes

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Climate extremes can affect plant fitness, but the implications for mixed-mating species are unclear because: 1) mixed breeding may give flexibility that buffers change, and 2) climate change co-occurs with other factors (invasion, pollinator declines) that may overwhelm or exacerbate climate effects. We tested both issues with a cleistogamous violet, *Viola praemorsa*, which produces facultatively outcrossing chasmogamous (CH) flowers in the spring and obligately selfing cleistogamous (CL) flowers in the summer. We experimentally increased temperature and moisture limitation in late spring prior to the peak in CH production, to test the effects of a sudden and intense climatic event on plant growth, reproductive dynamics including resource allocation to CH vs CL flowers, pollinator limitation, and the response of the surrounding plant community composed mostly of aggressive exotic grasses. Contrary to expectations, the violet demonstrated mostly positive responses to climatic perturbation, which were not detectable in the surrounding community. Despite significantly increasing average daily maximum of 2.5°C, in line with projected future temperature increases for this region (southwestern BC), plants were significantly larger and produced more CL fruit. Pollination was limiting seed set and there was no evidence of reproductive tradeoffs between the flower types. The violet appeared to capitalize on the warmer and drier conditions through increased growth and reproduction by post-drought flowers. Given that the suppressive exotic grasses showed no differences, this boost favoring the violet could play an important role in persistence by allowing it to increase its relative fitness under certain climatic conditions. On the other hand, there could be negative effects. Species responding plastically to the environment may deplete

stored resources, affecting performance in subsequent years, when conditions may not be favorable.

POSTER

Restoration of culturally important native plants for educational and cultural purposes: Case example of riceroot [*Fritillaria camschatcensis* (L.) Ker-Gawl and *F. affinis* (Schult.) Sealy; Liliaceae] in Squamish First Nation Territory

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Riceroots (both *Fritillaria camschatcensis* and *F. affinis*) were important food plants to the Squamish First Nation of British Columbia. The populations of both of these species in the Squamish territory are very sparse due to habitat loss. There is currently a great interest on behalf of the Squamish Nation to explore opportunities for restoring the populations of these two species back to levels that would be high enough for a certain level of food harvesting. Towards this end, we plan to plant propagules (bulblets) of these species, along with other culturally important plants, into a native plant garden to be located close to the Squamish estuary. In this setting, experimental propagation and harvesting mimicking traditional practices can be carried out without further depleting existing populations. Careful observation and monitoring of the experimentally growing *Fritillaria* species will provide new insights into past practices and understandings of the growth patterns and life cycles of these plants. There is great cultural and ecological importance in strengthening the populations of these two food plants for future generations to enjoy.

ORAL

Keep, cut or pour into the foundations - Why preserve rock collections?

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Deciding to register, and continue to care for, a rock collection that appears to be of little interest can seem a waste of resources. Specimens are frequently neglected and, in extreme cases, important specimens have been incorporated into foundations, used as door stops, and even deliberately burned! However, rocks - if properly conserved and curated - can have value in many different ways. It is often the case that the value of a specimen will be judged by the celebrity of its collector or by its beauty. However, as curators, we have a duty to consider a wider definition of 'value' for the objects in our care. One consideration when determining the value of a rock specimen is the accessibility of the field area: many early collectors risked life and limb recovering rock samples to help us explain newly discovered lands. Other rocks have archaeological, social and industrial links to human activity that add extra significance beyond their value as natural history specimens. In addition, rock samples are almost unique in that their aesthetic value may be improved by techniques such as cutting and polishing.

Conversely, destructive sampling can add value by revealing their inner structure and composition (though the ethics of permanently altering a specimen must also be considered). Finally, something as simple as good documentation can change the value of even a dull grey stone.

ORAL

Epiphytic N₂-fixing cyanolichens: Important spokes in the wheel of diversity, but what to the nitrogen cycle?

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Forest canopy research has revealed rich epiphytic lichen communities that represent a critical interface between the atmosphere and the soil. In diverse old growth sub-boreal spruce forest ecosystems of central British Columbia, epiphytic cyanolichens make important contributions to biological diversity, but their importance to nitrogen (N)-cycling in these forests has not yet been adequately quantified. Cyanolichens are lichens with cyanobacterial symbionts that can contribute nitrogen to forests by fixing atmospheric N₂ gas into available, reduced forms such as ammonium (NH₄⁺). Variations in the ratios of the natural abundance of the stable isotopes of N (i.e. 14N:15N) in forest ecosystem components represent an important in situ method to estimate N inputs from biological N₂-fixation. We use this method to look at the importance of epiphytic cyanolichens to nitrogen inputs in sub-boreal forest ecosystems of central interior BC. Four old growth sub-boreal forest sites were chosen based on cyanolichen abundance and diversity, 2 high sites and 2 low sites. Interior hybrid spruce (*Picea glauca* × *engelmannii*) and subalpine fir (*Abies lasiocarpa*) trees were randomly selected at high and low sites and access into canopies achieved through a single rope technique. Lichen, conifer needle, and soil samples were obtained and their 15N:14N, %N, 13C:12C, %C contents measured using a continuous flow gas isotope ratio mass spectrometer. Comparisons between stable isotope ratios between high and low sites were made. We then assembled a dynamic nitrogen cycle model of our forests based on information from this study and previous work. An outcome of the model was that sub-boreal forests with high cyanolichen abundance should have isotopically lighter N (i.e. more 14N), indicative of greater inputs of biologically fixed N. We will specifically address the fit of our data with model expectations and overall contributions of epiphytic cyanolichens to the N cycle in sub-boreal forests.

ORAL

Biodiversity of species and natural products of lichen-forming fungi in the genus *Cladonia*

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The ecosystems that make up the province of Manitoba are varied including Arctic, mixed aspen parkland, boreal

on precambrian shield and glacial till, and others. Habitat diversity provides opportunity to support a diversity of species. Species of lichen-forming fungi are known for producing an array of secondary compounds (natural products) that have both diagnostic and plastic attributes. A combined approach to examine biodiversity in terms of species and natural products in a province with varied ecosystems may reveal unusual or unexpected species or natural products. The objectives of this study were 1) to examine the biodiversity of species and natural products by lichen-forming fungi in the genus *Cladonia* across Manitoba, and 2) to determine whether changes in substrate may influence diversity within species. Collections for objective 1 were made for all species of *Cladonia* from four ecosystems in Manitoba. Collections for objective 2 were made for *C. pyxidata* and *C. pocillum* across Canada. Thin layer chromatography was used to detect presence of secondary compounds and soil pH was correlated with chemical and species morphology of *C. pyxidata* and *C. pocillum*. Species diversity is comparable with that of other provinces but remains incomplete for Manitoba. Unusual and variable chemotypes are reported for some species of *Cladonia*. Although chemistry was not affected by pH in these species, a positive correlation was found between morphology and soil pH suggesting a change in morphological species with a change in pH. The absence of monophyly and the effect of pH on morphology may suggest ecological divergence in this group of closely related species. The relationship between biodiversity and environmental influence is discussed.

POSTER

Threat status assessment and geographic distribution patterns of rare and endangered plants

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Effective protection of plant species on the edge of extinction is an important challenge facing conservation biologists. As concerns over biodiversity loss continue, research and conservation efforts are being directed towards rare and endangered plant species. However, they tend to focus on the taxonomy and conservation status of individual species, often ignoring questions at a larger scale. Recent studies suggest that the assessment of rare and endangered plants combined with their geographic distribution patterns at different scales could be a very useful way in which to set conservation priorities and planning (Baillie 2004). We intend to integrate a threat status assessment with distribution patterns of rare and endangered plant species in Saskatchewan, Canada. Nearly one-third of all vascular plants in the province are believed to be rare (Harms et al. 1992; Hammermeister et al. 2001; etc.), of which only less than 5% are listed as "at risk" by provincial and federal legislation (Harms 2003). Data on the categories of current conservation status, distribution, ecological traits, habitat affinities, biotic and abiotic threats, and known conservation efforts of each provincially rare and endangered plant species' will be collected from the web, published sources and herbarium specimen records. These data will be inputted to a database, wherein the broad

fields will be subdivided into specific sub-fields for data analysis. Our studies will broadly document and describe patterns of Saskatchewan's rare and endangered plant species, which may be useful to design efficient, large-scale conservation strategies that successfully target the most extinction-prone taxa. This research will also help to identify gaps in the existing network of protected areas in Saskatchewan.

ORAL

A DNA Barcode reference library for the vascular plants of Churchill, Manitoba

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Because Arctic plant communities are particularly vulnerable to climate change, much research is being devoted to monitoring their composition at sites throughout the north. These studies require rapid, accurate identifications, often of specimens that lack diagnostic floral characters. The present study examines the role that DNA-based identifications can play in aiding such identifications by testing the effectiveness of DNA barcoding on a well-studied flora. Because of its location on the boreal forest/tundra ecotone, the Churchill area has a diverse flora that provides a good opportunity to test the effectiveness of the primary plastid regions selected for plant barcoding (*rbcl*, *matK*). The present investigation examined more than 900 specimens representing 300 species of vascular plants, including both freshly collected specimens (60%) and others from herbaria (40%). Standard protocols generated *rbcl* sequences from 95% of the fresh specimens and from 85% of the herbarium samples (mean age 20 years). Sequencing success was lower for *matK*, reflecting less effective primer binding (76% of fresh, 45% of herbaria samples). The sequence information from these two genes distinguished all species that were members of monotypic genera at Churchill and provided at least a generic-level assignment for all species in genera with two or more species. Congeneric species were considered as resolved when individuals of different species showed at least one consistent diagnostic difference. Among the 146 species from polytypic genera with *rbcl* data, 42% gained species-level identifications, whereas *matK* delivered species-level resolution for 52% of 103 species with data for this gene. Cases of compromised resolution were particularly common in the genus *Salix* and the family *Poaceae*. Despite this incomplete resolution, barcode data revealed five cases of misidentified herbarium specimens, and enabled the identification of field specimens which were otherwise too immature to identify.

ORAL

Floricolous yeasts and the ubiquity model

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It is often assumed that microorganisms are more or less randomly distributed across the biosphere and that any available niche will be filled by a suitable guild of microbial species. The contemporary version of the microbial ubiquity model (Fenchel and Finlay) posits that by virtue of their small size, microorganisms disperse at a rate such that they are essentially ubiquitous. Advocates of microbial biogeography counter that niche characteristics and geographic history both are of importance. I shall review some of our knowledge of the global distribution of yeasts found at the insect-plant interface, showing that examples of both models exist. Yeasts that are vectored by insects that feed and breed in flowers or other plant parts are clearly subject to strong selection, such that each type of insect-plant ecosystem is expected to harbor a guild of species that meet certain growth requirements. However, members of such guilds, when compared in different biogeographic regions, often show a high degree of endemism that must be attributed to geographic history on a broad time scale. My examples will be drawn principally from yeasts of the nitidulid beetle-flower and cactus necrosis ecosystems, which will be contrasted to some human-associated species.

ORAL DemoCamp

SALIX, a semiautomatic label information extraction system using OCR

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The use of Optical Character Recognition (OCR) software to read label data coupled with software to transfer those data into a database has been a goal in recent years. If the process of extracting data from specimens could become automated or partially automated, then the databasing numerous specimens held in herbaria could be greatly accelerated. Full automation may be impossible because labels are so variable in format and quality that checking for accuracy at some stage will always be needed. One of us (Lafferty) has developed a program, SALIX, that includes an open-source OCR program (Tesseract) and facilitates moving data from label image files to a database file. It can also work with external OCR programs (e.g., ABBY 5.0) available with some scanners. We have used this system and have improved it to the point where it has become a practical alternative to typing into a database. When OCR results are good and the labels are information-rich (e.g., with extensive habitat descriptions) we believe SALIX is faster than typing. Using SALIX has the advantage of including a photographic record of each label. Furthermore, all the processing is in the control of the operator and the necessary equipment and software are relatively inexpensive. A moderately priced digital camera and SALIX are all that are needed. SALIX parses the OCR output to a database semi-automatically and the user is watching and facilitating the process, so mistakes can be corrected immediately. As SALIX is used it records that certain words are more likely to belong to particular fields and the parsing is improved. Over 14,000 specimen records have been processed with SALIX, which has facilitated making improvements in the program and its operation. Copies of SALIX are available upon request.

ORAL

Phylogenetic structure of ectomycorrhizal fungal communities of western hemlock on northern Vancouver Island changes with forest age and stand type

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To relate the belowground ectomycorrhizal fungal species to environmental variables, we compared ectomycorrhizal communities from five stand types with different histories and different levels of tree productivity. Study plots were located in 24-year-old regenerating Cedar-Hemlock stands with three different fertilization regimes; 300-year-old old-growth Cedar-Hemlock stands; and 82-year-old mature Hemlock-Amabilis fir stands. We analyzed cloned DNA sequences from 100 ectomycorrhizal root tips per sample, four samples per plot and three plots per stand type. We detected 147 fungal operational taxonomic units among sequences from a total of 1435 DNA clones. Of the environmental variables, foliar nitrogen correlated most closely with fungal species composition. Foliar nitrogen was lower on regenerating stands and higher on the older forests. Fertilization did not increase the similarity between the regenerating Cedar-Hemlock and mature Hemlock-Amabilis fir stands even though the tree productivity was similar. When we considered phylogenetic distances between the observed fungal species, the regenerating stands, regardless of their fertilization history, had lowest diversity and most closely related species (phylogenetic clustering). In contrast, the older stands had higher phylogenetic diversity and showed phylogenetic evenness. Environmental filtering with selection for a relatively small number of traits may have been operating to minimize the phylogenetic diversity in the regenerating stands. Phylogenetic evenness may be explained by an increase in the complexity of the forest floor environment as stands age, leading to an increase in the number of niches and selecting for a community of fungi that were more distantly related than expected by chance. Phylogenetic methods for community ecology have been developed only recently, and this is the first time a transition from phylogenetic clustering to phylogenetic evenness has been described for ectomycorrhizal fungi. We hypothesize that similar transitions will be detected in future studies of ectomycorrhizal fungal succession at other sites and under other environmental conditions.

ORAL

The associations of biogeography and reproductive system with fruit color polymorphism in the Himalayan Mountain-ash (*Sorbus*; Rosaceae)

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Fruit color polymorphisms are a widespread phenomenon in flowering plants. There are three competing but not mutually exclusive hypotheses for such a phenomenon.

One is that fruit color is constrained by phylogeny, in which closely related species are expected to evolve with similar color. Second is that fruit color evolves by environment, e.g., latitudes, elevation, and canopy structure that vary in the quantity of incipient light. Third is that fruit color co-evolves with diversity and abundance of frugivores. In Rosaceae, red, black, and white are the common color seen among fleshy fruit species. The Mountain-Ash (*Sorbus*) group contains approximately 80 species that are widespread in the northern temperate regions and species produce either red or white fruits. To examine how the red and white-fruited species are interrelated, and more broadly, to test the three respective hypotheses for fruit color variation, phylogenetic relationships were constructed based on five chloroplast and three nuclear gene regions with 76 described species. White-fruited species were found to form a monophyletic group sister to the clade that contains exclusively red-fruited species. Fruit color appears to have changed once from red to white followed by three reversals back to red. Despite fruit color, species of the two clades indicate a significant difference in diversification rate. Such a rate disparity appears to be associated with polyploidy and apomixis occurring in several of the white-fruited species. While fruit color could be constrained by phylogeny in *Sorbus*, we also found differences in the distribution of different fruit color species. White-fruited species occur mostly in the mountainous region of southeast China and northern India, whereas red-fruited species are found at lower latitudes in East Asia, North America, and Europe. Fruit color could be evolved by a combination of evolutionary and ecological factors at least in *Sorbus*. Whether similar correlations are observed in the other groups and how frugivores influence fruit color polymorphism merit further investigations.

ORAL

The lace plant: a new model organism to study both developmental and induced programmed cell death

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The lace plant, *Aponogeton madagascariensis* is an aquatic plant which forms perforations in its leaves between longitudinal and transverse veins, through developmentally regulated programmed cell death (PCD). Many questions regarding the differences and similarities between developmentally regulated and environmentally induced cell death are still unanswered, and a time line for organelle changes in both forms of cell death in plant systems is still unclear. To better elucidate differences and similarities between the two forms of PCD, protoplasts isolated from control areas of the lace plant were heat shocked at 55°C for 20 minutes to induce cell death. Following heat induced PCD organelles including the mitochondria, nucleus, vesicles and cytoskeleton were examined via confocal microscopy in order to better understand organelle characteristics including origin, movement and fate. This organelle tracking is also currently under investigation in whole lace plant leaves focusing on the regulated form of PCD. Organelle characteristics will then be compared between the

developmentally regulated and environmentally induced forms of cell death. This examination of organelles will allow for the first ever opportunity to compare both forms PCD within one species of plant. Interestingly, initial results show numerous characteristics of PCD in the heat induced system, including plasma membrane blebbing, vesicle formation, drastic mitochondrial and cytoskeleton changes, and nuclear condensation. Thus far these organelle changes appear to be shared with the developmentally regulated system. Further experiments are required in order to characterize each organelle on an exceedingly in depth level and to create a detailed time line of cellular changes for both forms of cell death in one species.

ORAL

What does it mean to value biodiversity?

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We are trying to quantify biodiversity; the degree of difference within biological systems. In a meta-review of biodiversity literature I have identified 53 studies measuring biodiversity across several ecological communities, containing 189 different measures of biodiversity. Ideally, we would have a single measure to unify biodiversity assessments across science. Given the multidimensional nature of biodiversity, in practice, we search for a minimal necessary and sufficient set of metrics (m^*). Starting with a formal analysis of measures of biodiversity, I constructed a manifold permutation matrix from which m^* must be found. Using simulated ecological communities composed from species and selected by taxonomic sampling I have tested various indices of biodiversity. I have used multivariate statistics to examine the sensitivity and degree of relatedness of biodiversity indicators. The results show how an orthogonal set of biodiversity metrics can be formed and select for the most sensitive to easily measured properties of the community.

ORAL

Nodule development in E151 (sym15), a low-nodulation pea mutant

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Root nodules form when a mutualistic relationship is established between legumes and rhizobia. While the former receives assimilated nitrogen, the latter gains carbohydrates. A plant mechanism known as autoregulation of nodulation (AON) is used to monitor the number of nodules produced because the formation of these new structures is costly. The nodules which first emerge elicit a signal which travels to a receptor in the shoot; upon perception of this root-signal, a shoot-signal is produced and translocated to the root where it inhibits further nodule emergence. AON-deficient (AON-) mutants have increased nodule number, a large nodulation interval, increased nodule mass per plant, increased nodule number in nitrate presence, and a less developed lateral root system. The association studied here is that of pea and its microsymbiont *Rhizobium*; E151 (sym15), a

pea mutant with delayed nodulation, is used as a tool to understand better the AON process. In contrast to the wild-type, E151 shares with AON-mutants large nodulation intervals and large nodules. Thus, E151 nodules emerge in a scattered pattern throughout the entirety of the root system and have a unique multi-lobed morphology. Interestingly, they are scarce, apparently because of an arrest of their meristems. I am studying E151 nodule development to assess whether the nodules arrested early in growth abort or if they are merely dormant. I am observing the nodules, which were labelled at emergence, over time by growing inoculated plants in plastic pouches. I am monitoring a nodule by taking its photographs at regular intervals. If over time, this nodule increases in size, this would mean nodule dormancy; on the contrary, if no further growth occurs, then the nodule would have aborted. I will relate location, morphology, size, and time to assess whether or not E151 early-formed nodules abort. Results will be discussed in view of AON.

ORAL DemoCamp

Herbarium Networks Part IV: Demonstration of a prototype web interface for a 'Filtered Push' network to enable discovery, filtering, and annotation of botanical and other natural history specimen data

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The Filtered Push (FP) project will demonstrate interactions with a prototype network through a newly developed web client. A user can discover and data records known to the network and all annotations based on these records. We illustrate a user interface for three core uses of the network: "find duplicates", "I am interested in", and "make annotation". A find duplicates search enables fast lookup of the collector, collector number, and date collected fields with an ability to filter records returned by the network. These fields support searching by exact match, fuzzy matching, and regular expression pattern matching to enhance the discovery of appropriate records. The "I am interested in" case allows researchers to mine existing network knowledge for thematic queries, for example queries on specific taxa or geography, and to receive notifications of new data and annotations in the network relevant to an existing query. Annotation of records allows users to contribute knowledge about records in their result sets which may be new determinations, additional knowledge about the record, or quality-related issues such as corrections of data capture errors. New annotations are processed and distributed by the network to the relevant owner(s) of the record(s), and made discoverable by any FP client, including the web client. The web client also allows users

to download datasets based on their queries in various formats. For more information on the Filtered Push project in general please visit our wiki:

http://www.etaxonomy.org/wiki/index.php/Filtered_Push

ORAL

How will we digitize the 70 million+ plant specimens housed in United States herbaria?

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While there is no easy answer to the question posed in the title, we will present (and later discuss) some of the issues of interest that arose in a workshop sponsored by the National Science Foundation to discuss how to make significant progress toward that goal. The 65 participants included curators, researchers, collection managers, information technologists, informatics specialists, and stakeholders, who together focused on issues involved in advancing a US Virtual Herbarium (USVH); digitizing and mobilizing specimen-based botanical information housed in the more than 600 herbaria throughout the United States. The group discussed three broad goals including the digital capture of all specimen-based information, including images; improving the efficiency of data capture and enhancing the quality of this data through the development of tools, standards, and best practices that can be implemented into established workflows; and recognizing that it is critical to further support and maintain both curatorial and taxonomic expertise associated with collections. This is currently a US initiative which we envision as evolving into a North American framework which, given the global nature of our collections, must also interface with our global partners. While a regional structure is evolving and many collections have digitization efforts underway, full digitization remains a daunting task without a large influx of new resources. This effort may benefit from the recently-released strategic plan for funding the digitization of all US biological collections. Of the nine task forces that were created at the workshop, one of the most pertinent involves developing tools to better describe collections and what they hold using an expanded metadata clearinghouse. We hope the discussion will provide feedback on the USVH concept, metadata efforts, and the strategic plan from those with experiences in other regions.

POSTER

Reorganising and rehousing of the world's oldest and largest Lepidoptera collection at The Natural History Museum, London

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The demolition of the old Entomology Building and the opening of the new Darwin Centre at the Natural History

Museum enabled the structure and organization of the Lepidoptera collections to be re-developed. In 2005 the Lepidoptera collection was moved out of the old Entomology building (which was demolished to make way for the Darwin Centre) to an offsite store in south London some 5 miles away from the main museum site. This collection consists of approximately 10 million specimens housed in 80,000 drawers of differing sizes and condition. The collection is rich in type material (125,000 primary types) and the oldest specimens go back as far as the late 1700's. For such an important collection, it is imperative that it is housed and organized in a way that facilitates any collection based research including taxonomy, biodiversity and climate change. The four years spent off site allowed the Lepidoptera Curatorial team to undertake a complete reorganization of the collection including incorporating accessional collections into the main collection. The collection is now considerably more accessible, with all the families being located together and researchers now have all associated material in one locality. The poster will outline the history of the collection organization, the methods of the reorganisation, the logistics of the collection move and the impact of the move into the Darwin Centre on collections research.

ORAL

The fortuitous observation of endophytes in the dwarf mistletoe *Arceuthobium americanum*

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Arceuthobium americanum (American dwarf mistletoe), an obligate parasite of both *Pinus contorta* (lodgepole pine) and *P. banksiana* (jack pine), inflicts considerable damage to the Canadian forest industry. It is unusual among parasites as both the parasite and host are vascular plants; this close co-evolutionary relationship complicates the control of *A. americanum*. During cell culturing of *A. americanum* the presence of fungal endophytes, symbiotic fungal species, in *A. americanum* tissue was noticed. The suspected endophytes always originate from the center of the cut tissue of *A. americanum* before spreading onto the culture media, never from the culture media itself. This property is highly suggestive of a symbiotic relationship rather than contamination. These endophytes display selective antifungal activity, helping to protect *A. americanum* from pathogenic fungi. Disruption of the protective endophytes could represent a viable solution to controlling the *A. americanum* pest. In fungal identification it is common to sequence the internal transcribed spacer (ITS) of the ribosomal RNA gene. The ITS of the most common suspected endophyte matches the genus *Phoma*, a known endophyte of other plants. Differential staining was completed to confirm the presence of fungi in the tissue of healthy mistletoe.

POSTER

Mycoheterotrophic plants: the pinnacle of evolutionary plant-fungal specialization

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Mycoheterotrophic plants lack chlorophyll and therefore are dependent on associated symbiotic fungi and third party autotrophic plants for their carbon needs. There are 400 mycoheterotrophic species in 87 genera and 10 families of angiosperms. Among these are 10 genera in the subfamily, Monotropoideae (family Ericaceae). In this subfamily, there is considerable specificity between plant host and fungal symbionts; however, all fungal species involved form ectomycorrhizas with a wide variety of autotrophic trees and shrubs. Based on our studies of 5 of the 10 genera in the Monotropoideae, as well as published literature, consistent structural features characterize these mycoheterotrophs: a fungal mantle, a Hartig net confined to the host epidermis, and 'fungal pegs', hyphae that enter epidermal cells but are then enclosed in host-derived finger-like wall projections. These wall modifications are similar to those of transfer cells involved in short-distance transport of nutrients in other systems. The unique structural characteristics of the host-fungus interaction have been used to describe this association as a separate mycorrhiza category known as 'monotropoid'.

POSTER

Psammophilic *Hudsonia* is ectomycorrhizal!

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Most species in the family Cistaceae are found in the Mediterranean basin. Several hosts are of special interest due to their associations with truffle species, while many are important pioneer plants in disturbed areas and in soil stabilization. For these reasons, understanding their root systems and their associated fungal symbionts is important. Most structural studies of mycorrhizas in this family involve two genera, *Cistus* and *Helianthemum*. The present study uses light and scanning electron microscopy to examine the structural features of mycorrhizas in two North American species, *Hudsonia ericoides* L. and *Hudsonia tomentosa* Nutt. Root systems of both species are highly branched with most fine roots colonized by mycorrhizal fungi. Based on morphological features, several mycorrhizal fungi were identified; structural details also provided evidence of more than one fungal symbiont for each host species. The mycorrhizal features observed for both *H. ericoides* and *H. tomentosa* are

shared by the majority of woody angiosperm ectomycorrhizas: all mycorrhizas had a multi-layered fungal mantle, Hartig net hyphae confined to radially elongated epidermal cells, and no intracellular hyphae. Although the Hartig net was confined to the epidermis, the outer row of cortical cell walls lacked suberin, a known barrier to fungal penetration. Mycorrhizas in *H. ericoides* and *H. tomentosa* differed from those of *Cistus* and *Helianthemum* species which have a Hartig net that extends into the root cortex as well as intracellular hyphae that are often present. Future *in situ* studies might further explore the limits of location and sampling times as well as other variables such as soil properties on the mycorrhizal status of *Hudsonia* species.

ORAL

How (and how not) to survey a systematic invertebrate paleontology collection for locality data

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The problem: How to conduct a quick survey of a large, systemically arranged, invertebrate paleontology collection at the Field Museum to learn how many specimens in the collection are from the Michigan Basin.

Methods: The collection is not on a database and only partially cataloged. The only way to access data for the entire collection is by handwritten labels stored with the specimens. An initial survey was conducted on the Devonian brachiopod systematic collection by randomly selecting three drawers from each cabinet (~15% of this collection) and recording the locality data for every specimen in the drawer. Although the drawers were arranged alphabetically by genus and species names, my assumption was that the locality data would be random and not correlated with these names. A second survey was conducted of this entire collection (7069 specimen lots) and the results were compared. Results: 45% of the specimen lots surveyed are from the Appalachian Basin, 15% are from the Michigan Basin, 15% are from the Illinois Basin, 15% are from the Iowa Basin, and the remaining 10% are from around the world. The error in the initial partial survey was greater than anticipated. Using a computer spreadsheet additional surveys were conducted virtually. Comparing surveys of equal size, randomly selecting individual specimen lots yield results with significantly less error than sampling all specimen lots in randomly selected drawers. Explanation: My assumption was false. Specimens of the same species tend to be arranged in the collection by locality and some species are restricted to a single locality or appear that way due to collection biases. Therefore, specimens in a drawer are more likely to be from the same locality than randomly selected specimens. A better way to conduct this survey is to randomly sample 15% of specimen lots in every drawer.

ORAL

Biodiversity, Collections and The Natural History Museum - An Interactive Approach

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2010 is the international year of Biodiversity and this theme is emphasised within the new Darwin Centre at The Natural History Museum, which was officially opened in 2009. Biodiversity and biodiversity loss are serious global concerns. By providing highly visible facilities to carry out and improve taxonomic research, the Museum demonstrates the importance of this work to the general public. The centre houses parts of the Entomology and Botany collections, the Angela Marmont Centre for UK Biodiversity (AMC), and combines state-of-the-art science with increased public outreach. The majority of the Entomology collection is now housed in modern, pest-proof and environmentally controlled collection areas. Several sections are now on display (behind glass) to the public. There are also new imaging laboratories and increased molecular and wet laboratories. This talk will concentrate on the impact the new facilities have had on the Entomology Department, particularly the Diptera collections and Staff. As well as the physical changes there has been a culture change, with scientific staff no longer hidden behind closed doors which has resulted in many positive outcomes. Through staff-visitor interactions, regular updates on blogs and the Museum webpage, as well as having the museum collections database on line, we can now disseminate scientific information to a much wider audience with increased speed. School, public and research visits have increased as well as our interactions with the amateur taxonomic groups/forums. This has led to increased donations of material and identification of existing museum specimens, thus filling gaps within the collection and identification of existing material. Increased numbers of volunteers can now be accommodated and many are utilised to sort spirit material (sometimes this dates back 40 years). New species to science and species not present in the collections are regularly discovered within these. Although incredibly early in the life of the building, and with the AMC not yet open, the new centre is already having a positive effect on public outreach, research and the museums collections.

POSTER

Imported herbal medicines *Cuscuta* and *Striga* may pose a threat to Canadian biodiversity

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Several species of parasitic plants are exported from China for medicinal purposes, including *Cuscuta*, *Striga* and several genera of Orobanchaceae (*Orobanche*, *Boschniakia* and *Cistanche*). Samples of *Cuscuta* (seeds only) and *Striga* (whole plants) were obtained from Chinese herbal medicine retail sources in Ottawa to determine the possibility of their introduction to Canada through this pathway. Tetrazolium staining and germination tests indicated that *Cuscuta* seeds were 10–30 % deeply stained (i.e., probably viable) with about 2–8% germination. Seeds of *Striga*, although 45% were deeply stained with tetrazolium, germination was

negligible and failed in most tests (germination was observed in only one seed). Sequences of nuclear and plastome regions, obtained by Polymerase Chain Reaction amplification and direct sequencing, were compared with those from known samples using the Basic Local Alignment Search Tool with the National Center for Biotechnology Information nucleotide database. Sequences from the *Cuscuta* seed sample most closely matched those of *C. approximata* and *C. australis*. Sequences from the *Striga* seed sample were most closely matched with those of *S. asiatica*, which was consistent with the morphological characteristics of the whole-plant sample. These findings indicate that the herbal medicine trade provides a pathway for the importation of viable seeds of non-native parasitic plants and poses a threat to Canadian biodiversity.

ORAL

Tapping the international herbarium network to 'plant' Life in Crisis: the Schad Gallery of Biodiversity, at the ROM

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Life in Crisis: the Schad Gallery of Biodiversity opened at the Royal Ontario Museum in May 2009. The 10,000 square foot gallery is populated with over 2500 specimens of plants, animals and fungi. The incorporation of plant material from around the world into a museum gallery of this kind poses many challenges. Traditional dried specimens are neither sexy enough to compete with animal mounts nor robust enough to withstand exposure to light. Botanically accurate models are costly, time consuming to make, and dependant on the availability of fresh plant material. Commercially available plant reproductions are limited in scope and scientifically inaccurate. These challenges were addressed and overcome by a close collaboration between the ROM's artist and its botanists. Two and three dimensional plant preservation techniques were combined with photography, fabrication, modeling and painting to produce realistic and durable specimens that stand on their own. Collections of plant specimens and reference material were made by tapping into the world-wide network of botanists and field naturalists connected to herbaria, botanic gardens and museums. Monkey pot fruits were obtained from Brazil, *Cacao* from Puerto Rico, lichen-covered rocks from Churchill Manitoba, *Salicornia* from a university field trip in Nova Scotia, *Heliconia* from Hawaii, and data on the dry season colour of elephant grass from the University of Nairobi. The botanical community's enthusiasm for showcasing the biodiversity of plants allowed us to "plant" an entire gallery in record time.

ORAL

The Jepson Flora Project and the Consortium of California Herbaria

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California is a global 'biodiversity hotspot,' with a rich, highly endemic, and endangered flora. Localized moisture, soil, and microclimatic conditions give rise to a rich and unusual biota, with many endemics; the state's flora numbers 7400 terminal taxa (i.e., species, subspecies, varieties), of which 6270 (85%) are native and 2331 (32%) are endemic, far more than in any other state, including Hawaii. The Jepson Flora Project (JFP) is a statewide collaboration dedicated to providing detailed, rigorous, and current information on the California flora through innovative use of electronic and print media. Rapid documentation of newly discovered, native and naturalized plant taxa in California and advances to in understanding of relationships, ecological attributes, distributions, and endangerment of California plants makes integrative approaches to floristics and systematics an urgent need. The central requirement is up-to-date classifications that reflect phylogeny and that represent the full diversity of well-supported, minimal evolutionary lineages. The Consortium of California Herbaria (CCH) was founded in 2003 to share data and facilitate the databasing of specimens of California plants in the state's herbaria; there are 17 participating herbaria at present. Currently, more than 1.1 million records are available at the CCH site (<http://ucjeps.berkeley.edu/consortium>). Approximately half of these records have been georeferenced, county-by-county, and work is actively ongoing. These records are used routinely by local, state and federal agency personnel, non-profit conservation organizations, the general public, and botanists worldwide to ask questions about geographic distribution, habitat requirements, and associations among species. These data provide a baseline against which future change can be measured, enabling researchers to track the impact of climate change. Integration of the JFP and the CCH involves continuing development of on-line resources for applications ranging from plant identification, to horticulture, detailed range maps, and flora-wide analyses of ecological and biogeographic questions in a phylogenetic framework.

ORAL

An inventory for all seasons: methods for gathering data using volunteers

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The time was fall 2007 and a repository of 4.5 million specimens, the challenge to find type specimens remaining in the general collection. The goal is to transfer those elusive specimens to the new type facility, conserve and image them as part of an NSF-funded project. These collections have never been fully inventoried below the level of general drawer content. Data relating to many specimens are only available as labels and not available in any database, catalog or card index. We determined that a full inventory was the most valuable approach, allowing an overall conservation upgrade and assessment of collection condition at the same time.

Initial plans involved gathering a workforce, all volunteers; developing input forms and strategies for data input; training that workforce and setting them to work in the repository. Tracking physical progress of the project is

helped by the GIS map system. The initial plan proved problematic. Key issues included the assumption that the workforce would be interested in or competent with digital input and a failure to make adequate use of the partial inventories gathered for various segments of the collections during previous projects.

By spring 2008 a vastly improved strategy was instituted. A total volunteer workforce is retained, better use is made of available digital records, form entry is simplified, and constant monitoring of data has reduced the error rate. Summer 2009 results include transfer of more than 500 type and figured specimens, basic upgrades made to inventoried specimens, historic labels encased in plastic, zones of mold, Bynes or pyrite reactions are noted, affected specimens moved to the climate-controlled quarters, and about 30,000 new specimen lots have been added to the catalog. Estimated date for inventory completion is Spring 2012 with most types recovered by winter 2010.

ORAL

The Biodiversity Heritage Library: 28 million pages of taxonomic literature & you

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The Biodiversity Heritage Library (BHL) is a consortium of twelve major natural history museum libraries, botanical libraries, and research institutions working to digitize, serve, and preserve the legacy literature of biodiversity. This body of work is delivered online via the BHL portal (<http://www.biodiversitylibrary.org>) for open access and responsible use as a part of a global Biodiversity Commons. As part of the Encyclopedia of Life (<http://www.eol.org>), the Biodiversity Heritage Library is an active participant in the effort to document life on Earth. Librarians, curatorial staff, and collections managers know that research in systematic biology requires the consultation of a wide variety of publications. It is common to consult literature spanning several centuries, at least from Linnaeus to the present day. All too often, scholars find themselves unable to access these materials, particularly in geographically isolated locations and in the developing world. To help address this problem, the Biodiversity Heritage Library provides full-text legacy taxonomic literature free-of-charge to anyone with an internet connection. Researchers also have the opportunity to participate in "crowdsourced" initiatives to create a site that functions not simply as a digital library, but as a dynamic resource for scholars, curatorial staff, collections managers, and others in the natural history community. This presentation is designed to provide an overview of the Biodiversity Heritage Library, introduce use of the BHL portal, and demonstrate new initiatives and enhancements.

ORAL

Imaging and innovative workflows for efficient data capture in an Entomological collection: The MCZ Lepidoptera Rapid Data Capture Project

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One bottleneck for natural science collections digitization is efficient data capture of collections without bulk data sources (such as ledgers), where specimen handling is necessary for data capture. In a rapid data capture project in the Lepidoptera collection in the Entomology Department at the Museum of Comparative Zoology, we gain efficiency by separating specimen handling from data capture, through imaging both labels and specimens, and then capturing label data from the images. We have developed an innovative method of pre-capturing data that applies to sets of specimens, and associating these data with individual specimens by embedding it in machine readable barcodes that are included in the images. In this workflow, we print new taxon labels containing the current determination, higher taxonomy, and drawer placement, each applying to a set of specimens in a unit tray. This taxon label is printed in both human and machine readable forms, (JSON encoded in a QRCode barcode). Unit trays are brought to an imaging workstation, where the taxon label is placed on a carrier, a specimen is removed from the unit tray, the pin labels are removed (in order) placed on the carrier, and the specimen is placed on the carrier. A two sided numeric barcode label is added. The labels and the specimen are imaged. Pin labels are reassembled in order, with barcode label last. The taxon label is left on the carrier, and the process is repeated with the next specimen in the unit tray. Current determination, higher taxonomy, drawer placement, and specimen number are read by software from the barcodes in the image (using a Java application and the open source ZXing library), with failover to OCR and machine parsing of the taxon label. The images are then presented to data entry personnel and entomologists for data capture and enhancement.

POSTER

Out of the technological Stone Age: Improving the collections and Collections Management Systems at UBC Botanical Garden and Centre for Plant Research

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The University of British Columbia Botanical Garden and Centre for Plant Research (UBC BGCP) is a member of Canadensys, a group of Canadian university-based biological collection institutions. Funded for its initial five years by the Canadian Foundation for Innovation (CFI), Canadensys has a mission to unlock the data held by its member institutions and share the data via a network of distributed databases, compatible with other biodiversity information networks (e.g., the Global Biodiversity Information Facility). UBC BGCP identified two

challenges to address with its share of the initial funding: 1) an inability to share data with biodiversity information networks; and 2) the substandard quality of the biodiversity information and documentation surrounding its valuable wild collections. For the past fifteen years, UBC BGCP has used a DOS-based botanical garden collections management system, BGAS3. While sufficient for internal needs, BGAS3 is highly restricted with respect to sharing data with biodiversity information networks; transitioning to new software was identified as a necessity in order for UBC BGCP to become a Canadensys data provider. After an assessment of existing systems, UBC BGCP adopted Bauble, an open-source botanical garden collections management system. In the past year, UBC BGCP has helped the development of this freely-available and freely-adaptable software. The results of work by CFI-funded biodiversity information technicians to increase the quality of biodiversity information (data about identification or verification of 30% of the garden's wild-collected material) and documentation (data surrounding voucher specimens, leaf tissue samples and photographs emphasizing phenology) are also being currently captured by Bauble or are in future development plans. In addition to meeting UBC BGCP's data sharing and collections management needs, the adoption of Bauble is transforming workflow at the garden as well as provoking ideas for continued development to increase the value of UBC BGCP's collections to researchers and the public.

ORAL

SEM'AIL: a public restoration program for wild leek (*Allium tricoccum* Ait.) in Quebec; a species threatened from overharvesting

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In 1995, wild leek (*Allium tricoccum*) was the first to be legally designated vulnerable species in Qu bec. Commercial sale of its edible bulbs is forbidden and harvest is controlled. Despite a major reduction of harvests in natural populations, every spring, several thousands of bulbs are ceased by wildlife agents. Obviously, further protection measures needed to be developed. In 2000, SEM'AIL was launched by the Montreal Biodome to increase public awareness and contribute to the species restoration in the wild. The program includes two aspects: 1) educational activities (animation, conferences, papers and brochures); and 2) a public sowing program. Wild leek seeds were collected in autumn prior distribution, from 3-4 large populations in each target region. Landowners interested to get implicated into the species conservation by planting seeds on their land, were invited to apply. From 2000 to 2004, nearly 1 million seeds were distributed to 1117 forest landowners in the five regions of Southern Qu bec mostly affected by overharvesting: Mont r gie, Laurentides, Lanaudiere, Outaouais and Estrie. Also, 370 000 ceased bulbs were replanted through the program. Participants were committed to monitor once a year, for five years, their plantation in order to estimate germination, survival and plant size. About 60% of landowners actively participated to the monitoring. Seedling emergence was

reported in 80% of sites. Mean germination rates varied among years and regions, from 27 to 48%. Wild leek grows very slowly; leaf width increased from about 0.45 cm the first year to 1.5 cm after five years. This shows clearly to the landowners, how slowly this long-lived perennial is growing, and discouraging harvest. Such a visible and pro-active conservation/restoration campaign is providing a unique opportunity to raise public awareness and stimulate participation. SEM/AIL has been funded by the Ministry of Environment of Québec, Montreal Biodome and Canada Trust.

ORAL

Web 2.0, social networking, and the future of on-line collections access

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Traditionally, on-line collection access has been a one-way process involving the delivery of static collections data and images to users via the worldwide web. With the explosive growth in social networking technologies, this paradigm appears increasingly outdated. Second-generation collections databases will enable users to manipulate the data they retrieve via queries; to group, tag, annotate, and share it, and to feed back these amendments to provider institutions. For researchers, this will provide a cyberinfrastructure to build collaborative on-line research networks that are centered on collection records. These same toolsets can be used to greatly improve public accessibility; tagging will increase resource discovery, annotation will allow users to add personal narratives as easily as a taxonomic opinion, and the ability to be groups will allow them share these with friends and family. Teachers will be able to use these databases as a supporting infrastructure for classroom activities and students will be able to share the results of their class work. These developments will present institutions and collection managers with new challenges, both technical and policy-based. In this presentation we will explore some of these challenges in the context of a project to reshape the Paleontology Portal, a first generation collections portal for paleontology collections, into a fully interactive computational infrastructure for scientific research and tool for public discovery of collections.

POSTER

Combining fire and grazing to restore prairies invaded by crested wheatgrass in Grasslands National Park

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Exotic plants threaten the endemic diversity and function of native ecosystems. Some species important to local economies continue to be cultivated in areas adjacent to protected areas. One of these, crested wheatgrass (*Agropyron cristatum* (L.) Gaertn.), a Eurasian plant introduced to southern Saskatchewan for forage, continues to invade native prairies from cultivated areas. Invading plants alter the diversity, structure, and standing biomass of prairies and impact their use by endemic species. Here, we present research from Grasslands National Park to restore native prairies invaded by crested wheatgrass. Treatments include combinations of prescribed burning and timed, intensive grazing and are used to reduce seed production by the invading plants. In April of 2009, a 70 ha area was burned and grazed by cattle in June. We used ten permanent transects (1 m by 100 m) to measure seed head production in crested wheatgrass during late summer of 2008 and 2009: five in a control area and five in the 2009 treatment area. In the absence of grazing and burning, seed head production exceeded pre-treatment levels by 190% to 1600%. Mean seed head densities per transect ranged from 5.3 to 18.9 seed heads/m² in 2009 and 0.6 to 5.9 seed heads/m² in 2008. Inside the treatment area, 2009 seed head production means on transects were 11% to 22% of that observed in 2008. Mean crested wheatgrass seed head densities per transect in the treatment area ranged from 0.2 to 2.1 seed heads/m² for 2009 (post-treatment) and from 2.1 to 10.1 seed heads/m² for 2008 (pre-treatment). Grazing will continue inside the burned area during 2010 and 2011. Initial burning and timed, intensive grazing will be followed by spraying of crested wheatgrass and seeding of native species. Results of our research will contribute to the restoration of areas invaded by crested wheatgrass within Grasslands National Park and provide valuable methods for the restoration of native prairies throughout Western Canada.

ORAL

Conservation issues within natural history collections: The restoration of colour

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This study focuses on the justification and development of new techniques for restoring faded colour to ornithological taxidermy specimens. The colour fading of taxidermy caused by environmental factors is the greatest cause of deterioration for material of this type. Light especially can cause irreversible damage to taxidermy mounts and although much has been published regarding why this occurs, such as literature by C.V Horie, there is a substantial gap in research concerning techniques for the restoration of colour to feathers. The ethical debate is controversial since the process is irreversible due to the science of feathers and not the materials used. However, regarding the purpose of the mount, be it for private clients or public museums, such a process can be justified. This research focuses on techniques of restoring colour with minimal effect to the mount. This includes the intelligent use of dyes and acrylic inks to develop and create accurate and natural results, with materials that can be easily sourced by any institution. When

preventative conservation has failed, restoring taxidermy with such methods provides Natural History institutions with the opportunity to save both economic and environmental resources and potentially preserve the longevity of their collections.

ORAL

The "mire-forest" transition in raised bogs of eastern Canada: identification of ecotonal species

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Ecotones are generally recognized as biodiversity hotspots. They harbor species of adjacent ecosystems, but they can also provide a unique habitat for ecotonal species. An example of a rich ecotone is the wet minerotrophic band surrounding raised bogs. In Europe, this is known as a *lagg* (swedish word) and it is usually dominated by fen vegetation. Although raised bogs are abundant in the Maritime Provinces of Canada, plant communities surrounding these peatlands are poorly known in America. To fill this gap in our knowledge of peatland ecology, the "mire-forest" gradient has been characterized in twenty raised bogs of New-Brunswick during summer 2009. Presence/absence of species was recorded at 0,5 m intervals along transects perpendicular to the forest wall. Split Moving Window Dissimilarity Analysis was used to detect abrupt changes in community composition. In almost every case, a particular shrub community (*Alnus incana* ssp. *rugosa*, *Rhododendron canadense*, *Ilex* (*Nemopanthus*) *mucronata*, *Viburnum nudum* ssp. *cassinoides*) can be delimited between the mire expanse and the forest. *Carex trisperma* is always present where shade becomes deeper. Sometimes, between the mire expanse and the shrubby swamp, there is another open community with typical fen species (*Calamagrostis canadense*, *Myrica gale*, *Iris versicolor*). Overall, the width of the transition zone between the open bog and the forest ranges between 0 m (no ecotonal community) and 53 m.

POSTER

Do wildfires and clearcuts produce the same understory community succession through time?

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In the Canadian boreal forest, wildfire initiates stand renewal with return intervals differing between regions. However, with the intensification of forestry practices in some forest regions, harvest has become the dominant mechanism for stand renewal. Even if clearcuts are the harvest type that best recreates the impacts of wildfires, habitat characteristics diverge considerably between disturbance types. The impact of this divergence in habitat characteristics has not been well documented for the eastern boreal forest. The objective of this study is to

contrast understory succession after wildfire and after clearcut in the North Shore region of Québec. We hypothesize that understory plant communities will differ in terms of biodiversity, species richness and species abundance between stands initiated by wildfires and clearcuts and that specifically pioneer pyrophilic species will be associated with burned stands while both pioneer and residual species will be found in clearcuts, increasing the level of plant diversity. This study is based on two chronosequences that recreate stand succession after wildfire (200 years) and clearcut (80 years). Twenty-eight post-clearcut stands in six age classes and twenty-five post-fire stands in five age classes were inventoried. In each stand, percent cover of understory species and stand structure variables were measured. Our preliminary results indicate that after clearcuts, species richness is greater in younger stands (20-30 years) than in all older age classes. There was no difference in the Shannon Index or evenness among age classes. After wildfires, richness was higher in younger stands (0-50 years) and subsequently fluctuated among age classes. Stands between 50 to 100 years since fire had a lower biodiversity index than younger and older stands. This project will ultimately provide information on understory species distribution in post-disturbance habitat and succession, which is useful for the development of ecosystemic management practices in Québec boreal forests.

POSTER

Moving 1940's science to the digital age
Patsch, Elizabeth

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As a GWU intern and contractor with the National Museum of Natural History (USNM) I work with the field notes, illustrations, and specimens taken and collected by Leonard P. Schultz during Operation Crossroads: the test of the atomic bomb that took place in the Bikini Atoll in 1946-47. Schultz was called upon by the United States Navy to study the effects of radiation on the fishes of the region. My presentation will reflect the work I have done with the collection and its influence on the material. I will include problems encountered during the work performed and describe in detail the process used to preserve the Schultz research materials. Each completed entry means I curate the objects; insuring proper housing, correcting information throughout the container, and culling multiple prints to a maximum of two high-quality duplicates per print or transparency. A Mylar sleeve covers the film sleeve and the transparency; a center seal separates the two. To slow damage from acidic paper, I remove the back of each film sleeve. All remaining duplicates and prints are placed in individual Mylar sleeves. Materials are stored in buffered cardstock, four-flap folders labeled with the object number and scientific name of the fish depicted in the transparency. All information is recorded digitally in the computer database KeEmu, including digital images. This project achieves three tasks: Rehousing transparencies, sleeves, and prints in archival materials delays the deterioration of this important information. Entering the information into the KeEmu database and the USNM online catalog provide access of the information to a wider audience. A permanent, digital record of the

research and findings of Schultz exists in the event the original documents deteriorate or suffer damage.

ORAL

The Global Plants Initiative (GPI) and the California Academy of Sciences

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In 2003, the Andrew W. Mellon Foundation began funding a digital database of botanical type specimen images and label data for the African Plants Initiative (API) followed by the Latin American Plants Initiative (LAPI) in 2007. These projects have evolved into today's "Global Plants Initiative" (GPI). The GPI was originally designed to electronically repatriate images of type specimens collected from continental Africa, Madagascar, and surrounding islands; by its third year, the Initiative funded nearly 50 partner institutions. Today, the project has developed a global focus with approximately 160 participating partner institutions. In addition to high-resolution botanical type specimen images, the database includes collection information, photographs, botanical illustrations, taxonomic and other relevant literature, and related data. To date, more than 700,000 botanical specimen images are available on the JSTOR beta-site. The California Academy of Sciences began active participation in 2008 with our Latin American and African type specimen images; we continue to image type specimens from our worldwide collection and thus far have submitted 7200 images. Immediate benefits of the GPI initiative include: 1) electronic access to type specimen images by more than one researcher simultaneously; 2) reduction in the need to travel to repository institutions; 3) a significant reduction in type specimen loans with a corresponding reduction in potential loss or damage during shipment. Other benefits resulting from this funding include the ability to make high resolution images of individual specimens, and obviating the need to send special and/or fragile collections by mail. Herbaria with more than 500 type specimens are encouraged to apply for funding for this project. Additionally, herbaria with fewer type specimens may participate as part of a consortium or with the assistance of a partner institution.

ORAL

Assessing the efficacy of buffer strips in sustaining bryophyte diversity in montane forests in the BC Interior

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Small mountain streams make up a large portion of the watershed in interior British Columbia and are ecologically important yet are neglected under current BC forestry

regulations. Debate exists over the riparian buffer widths necessary to maintain floristic diversity. The purpose of our research was to examine the effectiveness of different riparian canopy treatments (clear-cut, one-sided buffer, two-sided buffer & continuous forest) and buffer width in maintaining riparian bryophyte diversity and functional group representation. We examined 30 riparian sites in B.C. Interior Montane Spruce forests. Bryophyte, vascular plant and shrub diversity were determined using a nested sampling design. Generalized linear models indicated that the bryophyte community in clear-cut riparian areas was significantly different than the bryophyte community found in riparian sites with a buffer (one sided & two-sided) or in continuous forest, however the response varied among bryophyte functional groups. In general, the frequency and richness of old-growth associated bryophyte groups (liverworts, perennial stayers, closed canopy species, humus or log associated species) were statistically similar among riparian sites with canopies, including one-sided and two-sided buffers, than without canopies. Disturbance associated bryophyte groups (colonists, open canopy species, and mineral soil/rock associated species) were significantly more abundant in clear-cut riparian sites than sites with canopies; however their richness did not vary among the canopy treatments. Multivariate ordination also found buffer width and remaining canopy cover within 50 m radius strongly affected the bryophytes in the riparian sites with buffers, whereas disturbance appeared to affect species composition in clear-cut riparian sites. Linear regressions supported the importance of intact riparian forest with other habitat quality variables (soft CWD & concavity). Our results have important management implications as they indicate that even small buffers can mitigate forestry impacts on riparian areas adjacent to small, high-elevation streams.

ORAL

An overview of the renovation of the Paris Herbarium

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In 2006 the Museum national d'Histoire naturelle launched an ambitious project to renovate the entire Paris Herbarium, with three major objectives: increasing the collections storage capacity of the existing building; creating a controlled environment for collection preservation; and renovating the collection itself. The renovation of the building is being implemented in successive phases concerning both staff offices and collection storage space. The work started in August 2009 and should be completed by 2012 with 2400 m² fitted with compactors. The first renovated room was delivered in April 2010. T-RH will be monitored but not controlled at low temperature, so researchers will be able to work inside the collection rooms; this will be mitigated by strong IPM. The renovation of the collection, which is estimated to comprise over 10 million specimens, includes three operations: the decades-old backlog (about 10% of

the total) will be integrated (specimens are being mounted and filed); a virtual herbarium will be created (scanning of all herbarium sheets). The collection will be organized according to taxonomy. Flowering plants, which are currently split into main geographic areas, will be reorganized in a unique sequence updated to follow the APG3 classification. Treating the backlog has started in 2008 and takes place in the building itself; it should be completed at the end of 2011. Reconditioning, scanning and filing is undertaken outside the Museum and follows the phases of the renovation of the building. The collections are being reinstalled in the compactors as soon as each room is renovated. The virtual herbarium, once completed, will be central for outreach and citizen science; using web 2.0 approach, the virtual herbarium should be turned into a proper database.

ORAL

Is there a link between the presence of vascular plants and the initiation of *Sphagnum* moss hummocks in bogs?

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Factors involved in the initiation and evolution of the hummock-hollow patterning in boreal bogs include the establishment of particular life forms of vascular plants and *Sphagnum* species, as well as asymmetrical competition, facilitation and other interactions between both types of plants. To determine if vascular plants can facilitate the initiation of *Sphagnum* hummocks, and consequently the differentiation of bog microtopography, three experiments were conducted (one on the field and two in greenhouse). The effect of life forms or structures provided by vascular plants was studied on *Sphagnum* length increment, biomass and cover. As the three-dimensional structure of vascular plants varies depending on the species, two functional group typically found in bogs were targeted: ericaceous shrubs and Cyperaceae. Inert structures imitating young unbranched trees were also used. Under low covers of vascular plants, *Sphagnum* length increment, biomass accumulation and thus hummock formation were helped by the structuration provided by *Eriophorum* species, ericaceous shrubs or imitation of young trees. However, under dense canopies of vascular plants, moss length was still promoted, but *Sphagnum* stems were etiolated and fluffy, *Sphagnum* stem densities low and biomass accumulation too small to initiate clear hummock-hollow patterns. Plant interactions change gradually in hummock-hollow patterning as the *Sphagnum* hummocks become well developed. At the onset of pattern initiation, where abiotic stress is important, facilitation events are much more frequent. Vascular plants protect mosses from drought by creating adequate microhabitats. With accumulation of *Sphagnum* mosses, hummocks become drier and cover of ericaceous shrubs increase. Their presence, as well as young trees, enhances the patterning by strengthening hummocks. During patterns accentuation, positive interactions between *Sphagnum* mosses and vascular plants are possibly replaced by competition as the abiotic stress decreases. Briefly, our three experiments give a strong

evidence of vascular plant usefulness in hummock's formation and maintenance, especially under drier growing conditions.

POSTER

The Redlegged Ham Beetle (*Necrobia rufipes*) treatment using carbon dioxide fumigation at Smithsonian Institution's Museum Support Center

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Smithsonian Institution Museum Support Center (MSC), USA

The Redlegged ham beetle (RLHB) is a lesser known museum pest of museum artifact collections. The beetle is an incidental resident of many osteology preparation laboratories. *N. rufipes* are often not visible by external inspection of the bones, and materials not properly treated can unknowingly carry eggs and larvae into collections areas. MSC's integrative pest management plan involves verifying the efficacy of our carbon dioxide treatment of objects and artifacts in killing all life phases of RLHB. Preliminary findings of Phillips and Hasan using carbon dioxide treatment at 24°C to kill RLHB show that larvae and pupae treated at \approx 70% concentration CO₂ for 144 hours had approximately 90% and 60% mortality respectively. Our 21 day, 21°C, <6% oxygen treatment kills most adult museum pests. We performed trials on cultures of larvae and adults. All larval test cultures died and controls survived and developed. Adults in the controls and test cultures all died likely due to lack of moisture/adequate RH. These encouraging findings allow us to tentatively state that our anoxic treatment will successfully kill RLHB at all life phases. We are currently running tests for 1, 2 and 3 week intervals with larger numbers of adults, larvae and pupae to confirm the findings.

ORAL

CollectionsWeb Update: Building a Community of Natural History Collections

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The CollectionsWeb Research Coordination Network (RCN) is in its third year of funding from the U.S. National Science Foundation. An update and review of activities and progress will be provided. During the past three years three workshops have been held dealing with issues related to natural history collections. The first workshop addressed the opportunities of small collections in research, outreach, and education; the second addressed on the role of collections in contemporary systematics and taxonomy; and the third addressed new research opportunities emerging from integrating data across taxonomic collections. The findings of these three workshops will be discussed, as well as other activities of CollectionsWeb, including a survey of the status of natural history collections and a catalogue of innovative, collections-based educational activities. Information will be provided about future opportunities to be involved in CollectionsWeb activities, including competitive

internships and three additional workshops planned for the last two years of funding.

ORAL

Isolation of cDNAs of genes involved in programmed cell death (PCD) in lace plant (*Aponogeton madagascariensis*)

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Lace plant is an aquatic monocot belonging to the family Aponogetonaceae. It forms perforations in its leaves as a part of its normal developmental growth. The process of perforation formation is extremely regulated and has been shown to be orchestrated by developmental programmed cell death (PCD). The perforations are accessible and perforation formation is highly predictable; this makes lace plant an attractive model system for the study of developmentally regulated PCD in plants. Even though it is a good model for studying cell biological aspects of PCD in plants, no molecular work has been carried out in lace plant. This is the first molecular research carried out in lace plant. This research involves optimising protocols for RNA extraction, cDNA synthesis and isolation of cDNA for target genes. cDNA for some genes involved in PCD were also isolated. Through the degenerative primers approach, lace plant 288 bp ETR 1 and 1002 bp ubiquitin fragments were isolated. The ETR 1 fragment contains one of the functional domains, histidine kinase A (HisKA). The polyubiquitin 10 fragment is comprised of a 681 bp protein coding region and a 321 bp untranslated region. mRNA levels of these genes at the different stages of perforation formation were studied. Ubiquitin showed equal mRNA levels across all the different stages of lace plant perforation formation; surprisingly ETR 1 mRNA levels were higher in window stage leaves as compared to pre-perforation and mature stage leaves. Based on these results, we proposed a new model for ETR 1 expression during lace plant perforation formation. Preliminary amplification of metacaspases was also observed in this study. An EST database for lace plant window stage leaves constructed in this research also revealed several PCD associated genes such as 20S proteasome beta-subunit, cytochrome P450 monooxygenase and WRKR transcription factors.

ORAL DemoCamp

Integrating specimens, images, and ontologies

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This presentation will demonstrate how to add value to digital specimen catalogs by creating associations with images and ontologies. These associations create opportunities for discovery and data integration, and for

illustration of catalogs and ontologies. This demonstration will show the integration of the Specify specimen management toolkit, the Morphbank image repository system, and the Morphster ontology management and annotation system in the following steps: 1. Attach an image to a specimen record in Specify and add keywords describing the image; 2. Export the image and specimen record to Morphbank; 3. Search Morphster for image terms and find both the appropriate ontology terms and the exported image and specimen record in Morphbank; 4. Add the ontology terms to the image; 5. See the ontology annotation in the Specify record.

ORAL DemoCamp

Georeferencing natural history collections data Using GEOLocate

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The GEOLocate project is an ongoing effort to develop and promote software for the purpose of assigning geographic coordinates (latitude and longitude) to the data associated with the biological specimens housed in the vast archives of the world's natural history museums. Since its initial release in 2002, GEOLocate has undergone numerous refinements to improve upon usability, and expand capabilities. Among the latest advancements are user-defined locality expressions, KML exports and multi-lingual & collaborative georeferencing. This demonstration will provide an in-depth look at the existing capabilities with a special focus on collaborative georeferencing. Support for this project is provided by the U.S. National Science Foundation.

POSTER

Improving GEOLocate to better serve the natural history collections community

Rios, Nelson E., Bart, Henry L.
Tulane University Museum of Natural History, Building A-3 Wild Boar Rd., Belle Chasse, LA 70037 USA

The GEOLocate project is an ongoing effort to develop and promote software for the purpose of assigning geographic coordinates (latitude and longitude) to the data associated with the biological specimens housed in the vast archives of the world's natural history museums. Since its initial release in 2002, GEOLocate has undergone numerous refinements to improve upon usability, and expand capabilities. Among the latest advancements are user-defined locality expressions, KML exports and multi-lingual & collaborative georeferencing. Recent funding is allowing us move from the traditional standalone desktop application to a lightweight client application functioning via remote distributed services. Specifically, we are developing webservices for natural language processing and georeferencing of collecting event data while improving core algorithms for greater efficiency and accuracy, implementing uncertainly calculations and improving data verification via customizable integration of online map services. In addition, client interface components will integrate with the Specify 6 workbench to provide accurate georeferencing and verification from within Specify. These changes to GEOLocate will not only

enhance the capture of geo-coordinate data from existing electronic collection records and newly digitized records; it will support the next generation of research use of natural history collection data. This poster will describe many of the latest advancements, including the developmental roadmap, examine the efficiency of GEOLocate and provide a comparison with other georeferencing frameworks. Support for this project is provided by the U.S. National Science Foundation.

POSTER

Ecology of the rare Western Silvery Aster

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Western Silvery Aster (*Symphyotrichum sericeum*) is a nationally threatened plant found in southern Manitoba and Ontario. Preliminary research indicated that low seed production may be negatively affecting this species. Research was conducted in 2008 and 2009 to (a) determine the frequency and constancy of insect visitors, (b) determine if pollen is limiting seed production, and (c) determine if clipping and/or fertilizing can be used to stimulate flower production. Insect visitation rates to Western Silvery Aster and the more common co-flowering plant Showy Goldenrod (*Solidago nemoralis*) were similar but the constancy of the visitors was lower to the rare species. In a pollination experiment, seed production in *S. sericeum* was significantly higher when flowers were pollinated by hand, but only when flowering first commenced in late August. None of the treatments applied (e.g. clipping, fertilizing with nitrogen and both), significantly increased height, the number of capitula per stem or seed production over the control; clipping actually decreased stem height and capitula production. In summary, pollen limitation and possibly low overall soil nutrient levels, affect seed production but not light.

ORAL

Molecular systematics of the parasitic genus *Conopholis* (Orobanchaceae)

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Little is known of the evolutionary relationships within populations and between species of *Conopholis*, a small holoparasitic genus belonging to the Broomrape family, with highly reduced vegetative morphology. In its most recent taxonomic classification, *Conopholis* is described as having two species, *C. americana* and *C. alpina*. The former is found across eastern North America while the latter is found in the southwestern North America (southwestern U.S., Mexico, and Central America). In addition, *C. alpina* is comprised of two varieties (the typical variety and var. *mexicana*). This classification is based on a combination of presence/absence of morphological characters along with a number of quantitative traits such as the size and relative proportions of calyces and bracts. To assess the relationships among populations and to determine if the current taxonomic hypothesis is reflected

in a molecular phylogeny, we conducted the first phylogenetic study of *Conopholis* using plastid (*trnM-E* intergenic spacer and *clpP* gene/intron) and nuclear (*phyA* intron) sequences from a wide taxonomic sampling covering its entire geographical range. The results reveal that reciprocal monophyly between the two proposed species has not yet been achieved. *C. alpina* is paraphyletic and shows evidence of at least two distinct lineages. Specimens found in Costa Rica and Panama form a separate clade from those located in northern Mexico and the southwestern United States. In addition, a few populations from southern Mexico are found interspersed in the clade that otherwise contains all samples of *C. americana*. While the monophyly of *C. americana* is not recovered according to these results, it nevertheless could not be rejected with confidence. Altogether, these analyses reveal three distinct lineages indicating that there could be a minimum of three species within the genus. A fine-scale morphometric analysis is underway to determine if there are morphological features that could further corroborate our molecular results.

POSTER

Modeling molecular evolution from population-genetic theory, and non-parametric statistical devices

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Modeling the relations between genotype and fitness is a major goal of molecular evolutionary biology, in the hopes that a quantified mapping of these relations could constitute the theoretical bedrock upon which to understand the generative mechanisms of biodiversity. We explore a model of codon substitution constructed from a global specification of mutational properties, and a site-heterogeneous specification of selection profiles at the amino acid level. The model is inspired by population genetic principles, and is part of recent efforts aimed at inferring population genetic-type features from inter-specific data only. In contrast with previous related models, based on either a single amino acid selection profile for the entire alignment, or a distinct selection profile for each site, we integrate recent developments in nonparametric statistical approaches used in amino acid level models to propose a mixture-type modeling that provides a compromise between these two extremes. We explore features of the model when applied to real protein-coding datasets, as related to site-specific inferences of selection regimes, as well as distributions of selection coefficients. Finally, we discuss potential applications and extensions to the modeling approaches.

ORAL

DNA barcoding the vascular plant flora of the Canadian Arctic

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Accurate identifications of Arctic plant species are critical for monitoring and understanding potential changes in their distributions and community assemblages in response to climate change. Following the recent consensus on the plastid genes *rbcL* and *matK* as 'core' markers for a multi-locus plant DNA barcode, we are moving forward with production of DNA barcode data for all of the vascular plant species of the Canadian Arctic, a large and (relatively) easily-defined eco-geographical region with a distinctive flora. So far, we have produced barcode data for some 500 individuals representing over 225 taxa. When considered at this regional level, most genera are consistently differentiated. Species-level discrimination varies dramatically among lineages. For example, DNA barcodes distinguish 95% of the sedge species (*Carex*, *Kobresia*) in the Arctic Archipelago, whereas we observe no plastid variation among Arctic species of *Salix*. Overall, DNA barcoding performs quite well for Arctic plants. A complete species-level database will no doubt facilitate future ecological and systematic research on the Arctic flora.

POSTER

Cataloguing collections: a tool for collection management and an instrument for cataloguing data

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The Royal Belgian Institute of Natural Sciences (RBINS) houses one of the major natural history collections of the world including an invertebrate collection with a worldwide scope and comprising over 10,000,000 specimens (insects and arachnomorphs not included). In 2005-2008 the Federal Belgian Science Policy department started an ambitious digitization program of the national collections. The RBINS participated in this program by cataloguing its library, digitizing its out of print publications and cataloguing its collections. To this end the RBINS main collections management software, DaRWIN, was established in 2006. When the Department of Invertebrates committed to the program, it was decided to approach the cataloguing project on two levels: first as a tool for collection management that created the opportunity to improve our curatorial standards and skills, and second as an instrument for cataloguing data and make them available via the internet. When selecting the collections we used the following criteria: (1) the scientific value of the material (types), (2) collections facing the loss of in-house expertise within the next few years, (3) Belgian fauna, and (4) collections of special international interest. We also tried to cover the taxonomic range of the collections. Hitherto, we focused on Mollusca (types, historical collection, Belgian marine fauna and Polyplacophora), Cnidaria, Echinodermata (Holothuroidea) and several crustacean sub-collections. Before we started

cataloguing, we evaluated the storage conditions and improved the storage materials of the specimens. Since the data associated with the objects is invaluable, these were checked where possible. Beginning of 2009, DaRWIN became accessible on the internet. Fortunately, the federal digitization project was extended for another two years. At the moment we have catalogued about 95 000 samples, each year adding 25,000 new records. With the current staff it will take at least another generation, only to complete cataloguing the current material (excluding any growth of the collections). Without extra means and staff, we will have to choose even more carefully the collections we will work on next if we want to maintain the current collection standards.

ORAL

Acquiring DNA sequence data from dried archival (type) red algal collections for the purpose of applying specific epithets to contemporary molecular species: a critical assessment

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To contend that molecular tools have dramatically changed algal systematics is to grossly understate what has been a remarkable revolution. Initially emphases were placed on resolving evolutionary relationships and their corresponding taxonomic changes. More recently, under the banner DNA barcoding, molecular tools are being applied to floristic studies challenging our traditional concepts on species diversity and distribution, indeed even our definition of a species. In our work on the Canadian flora, we have made significant advances in our understanding of algal diversity through an approach termed molecular-assisted alpha taxonomy – collect, sequence, cluster specimens based on genetic species groups, go back and review the ecological, biogeographical, morphological and anatomical attributes and bring all of the information together in a holistic or integrative species concept. This approach shows substantial promise to revolutionize our understanding of algal diversity and I will highlight some of our successes. However, the task of matching these contemporary collections to published names (on the basis of morphological and anatomical collections) can be overwhelming and many researchers have simply resorted to informal names for cryptic species complexes. Ideally we could recover DNA sequence from type material to compare directly to our contemporary collections. We have conducted a study to explore the methods of recovering viable sequence from archival material and have discovered that these methods are not without their pitfalls. Powerful tools can lead to equally powerful errors if not used with due caution, and reconciliation of the new data and conclusions with the traditional type-based system of taxonomy (as outlined in our various nomenclatural codes) can be difficult. These issues will be explored in the context of advancing algal floristics and taxonomy.

POSTER

A microscopic study on the initiation and development of floral organs of flax (*Linum usitatissimum*)

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Flax (*Linum usitatissimum* L) is an important crop in Saskatchewan and worldwide. However, there is no detailed microscopic study available on the development of flax flowers. By using scanning electron and light microscopy, this study examined the pattern of initiation and development of floral organs of flax (cv. CDC Bethune) in order to establish a key of morphological and anatomical stages during development. Floral organs were initiated in the following order: sepals, stamens, petals, gynoecium and nectaries. The five sepals were initiated in a helical pattern followed by five stamens which initiated simultaneously in opposite position to the sepals. Petals arose simultaneously as well, in a position alternate to the stamens and sepals. The gynoecium, with five carpels, was produced from the remaining, central region of the floral apex. Early stages of development were dominated by anther growth with gradual filament extension throughout maturation, followed by rapid elongation shortly before anthesis. Early gynoecium development occurred predominantly in the ovary, and ovule initiation began prior to enclosure of the carpels, which occurred after the formation of bilobed anthers. Anther and ovary growth was followed by a period of style elongation, with the differentiation of papillate stigmas occurring simultaneously with style growth. A notable feature of styles was their twisted growth pattern. Petal enlargement lagged behind the development of other floral organs, but they eventually grew rapidly to enclose the inner whorls after style elongation had begun. Flask-shaped nectaries bearing stomata developed on the external surface of the filament bases after the styles had extended beyond the anthers.

ORAL

How Canadian herbaria are being utilized in the 21st century

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As repositories of the world's biota, biological collections represent the foundation of biological knowledge. When these collections are well preserved and made readily available for an indefinite period of time they ensure that this biological knowledge is accurate and reliable. In general, the rate at which new specimens were added to collections in herbaria increased throughout the 19th and 20th centuries. As the tools that scientists use to explore the natural world have further diversified with the dawn of the molecular and computer ages, the number of new specimens being added to collections in herbaria over the last thirty years has been in decline. This decline has been well quantified and reported but it is not clear how or if herbarium usage has also diminished during this time. While previous surveys of Canadian herbaria were

concerned with general statistics about their collections, this survey seeks to establish who is depositing new specimens, exactly how collections are being used, by whom, and how often. These data will help to demonstrate the current value of Canadian herbaria to the scientific community, government and the general public while establishing a baseline for future studies.

ORAL

The grey zones of microbial dispersal: The importance of collections, databases and taxonomists for understanding biological invasions

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Invasive alien species are a hot topic in the news all over the world. They are presented as real-life horror stories, exploiting deep human fears of horrible monsters (ugly insects) and disfiguring, painful diseases (invisible and deadly microbes). But how do we know when a species is invasive in the first place? How much of our fear is biological xenophobia, and how much can be supported by hard science? The science of biological invasions interfaces with the national interests inherent in plant quarantine and extends to basic questions of geographical and temporal occurrence of species. How much do we actually know about the distribution of even very common microorganisms? This presentation will consider several recent and anticipated future events involving plant quarantine, including the possible consequences of a hypothetical 'invasion' of a fictional country by one of the commonest moulds on Earth. Standards of proof for fungal identification will be discussed, and an emphasis will be placed on the critical role that biological collections play in the detection, monitoring and risk assessment of putative biological invasions. International initiatives, such as DNA barcoding, have the potential to enhance coordination and consistency of response between cooperating countries. Open access to biological data will ensure that all parties have access to the same information, reducing putative quarantine incidents based on faulty scientific assumptions, and ensure that scarce remediation resources are effectively deployed.

POSTER

Comparative developmental morphology of aerial and submerged leaves in *Myriophyllum aquaticum*

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Myriophyllum aquaticum is a member of Haloragaceae family and generally aquatic in nature. It is a simple-leaved plant with highly dissected leaves consisting of several lobes. It can produce two morphologically different forms of leaves based on whether they are aerial or submerged. We hypothesize that the early stages of development of both aerial and submerged leaves of

Myriophyllum aquaticum are similar, and the visual and morphological differences appear during later stages of leaf development. A comparative developmental study of aerial and submerged leaves of *M. aquaticum* was conducted using scanning electron microscopy to test this hypothesis. Leaf primordia in the first 4 or 5 plastochrons followed very similar developmental pathways. The two leaf forms began to differ in appearance after plastochrons 4 or 5, before all the lobes were initiated. Differences in epidermal cell morphology, lobe development, and presence of appendages on the leaf were the most obvious manifestations of varying growth conditions. This study sets the context for a comparison of Knox-like gene expression patterns during leaf development in *M. aquaticum*.

POSTER

The effects of hydrology on the plant community structure of the tall grass prairie

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The tall grass prairie varies in the distribution and abundance of plant species in space and time. My research looks at whether these changes in vegetation correspond to environmental variation, specifically soil water conditions. Recent studies have found strong trends between grassland plant species distribution and soil water stress. Water availability can limit plant growth and survival in two ways: water logged soils create anaerobic soil conditions and dry soils create water limitation. Thirty permanent plots were set up at each of three different locations at the predominantly lowland Tall Grass Prairie Preserve in Southern Manitoba. Surface soil water content, depth of aerobic soil and depth to water table were measured at each plot on a weekly basis throughout the past two growing seasons. Presence and abundance data for all plant species was also collected. Community types were classified using a cluster analysis of the vegetation. Soil water stress was quantified with linear regression by predicting the number of days until each plot reached a threshold stress value. Species and community types were discriminated by their water logging and water limitation stresses. Both individual species and community types show a trade-off of being found at either waterlogged or water limited locations. Although the three sites appear similar, the hydrology and its effects on vegetation structure differ depending on the site. Soil hydrology has been found to be a determining factor of vegetation structure in these tallgrass prairie communities. Hydrology should be considered in future tallgrass prairie conservation especially in the flooded conditions characteristic of Manitoba.

ORAL

Manipulation of plant development by cynipid wasps attacking Canada's wild roses

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The induction of plant galls by cynipid wasps is considered the most complex insect-plant relationship in the natural world. Rather than move about plants chewing tissues or sucking fluids, as do most insects, gallers stimulate their host plants into developing novel structures that provide their sessile larvae with highly nutritious cells and shelter. Galls become physiological sinks attracting nutrients from beyond the attacked host organ to the tissues lining the larval chambers. There are 13 species of cynipid wasps inducing galls on wild roses of Canada and in all cases, control of developmental events of the attacked region passes from the plant to the insect. Tissues that appear within galls are strikingly different from those of the host organ. Although adult wasps are difficult to distinguish, each species induces a structurally distinct gall in a specific region of the host plant. Galls of each of the 13 species of cynipids of the genus *Diplolepis*, all of which are found on various species of roses across the country, will be briefly examined. The developmental events that occur from the time eggs are deposited until the galls mature in late summer will be illustrated for two species of wasps (*D. nodulosa* and *D. spinosa*) that induce galls on stems and two species (*D. polita* and *D. nebulosa*) that induce galls on leaves. *D. nodulosa* induces a small, single-chambered gall on the stems of *R. blanda* whereas *D. spinosa* induces a multi-chambered gall on the stems of *R. blanda*. *D. polita* induces single-chambered galls on the adaxial surface of leaves of *R. acicularis*, whereas *D. nebulosa* induces single-chambered galls on the abaxial surface of leaves of *R. blanda*.

ORAL

Digitization of the University of Alaska Museum Insect Collection

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The University of Alaska Museum Insect Collection, started in 2000, has grown to almost 50,000 cataloged and barcoded specimens representing approximately 1,250 species. This talk will describe the short history of this collection, the databasing and barcoding methods being used under a recently acquired National Science Foundation Biological Research Collections Grant, and provide details on digital imaging and the museum's online database system, Arctos. Additionally, information on the checklist of Alaskan terrestrial arthropods, now at almost 7,000 species will be provided.

ORAL

High-throughput digitization of museum source documentation

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As good stewards, one of the most important things in a museum environment is to preserve the contents of original source documentation. Inevitably, the original will deteriorate and will have to be reproduced in some way. Digitization is a way of transforming the original information in its physical form to a digital form which will allow access to archival information. Digital preservation

allows copies to be used in several places without having to handle the original. Catalogs, ledgers, field notebooks and journals can now be digitally preserved without past worries of fading ink and broken spines. The Peabody Museum, in collaboration with three other departments at Yale University, was given the opportunity to use Kirtas robotic scanners for one year in an attempt to preserve original museum source documentation. All source materials were identified and prioritized into three groups: 1) High priority-Ledgers and catalogs, 2) Medium priority-Field notebook/Journals, and 3) Low priority-Loose leaf materials/correspondence. Each document was then evaluated for copyright status and when verified, would then be digitized. Anything too large to fit on the machine was digitized using a camera mounted on a tabletop tripod. This presentation provides a look at procedures that were developed, problems that occurred, a summary of our results and the benefits of digitization.

ORAL

Superstar plants as a key to public and political support for conservation

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Public and consequently political support is critical for conservation of natural areas and their biodiversity, both domestically and internationally. Because 80% of the world's biodiversity and 80% of its people are in developing, poor nations while 85% of the world's money and 95% of its scientists and engineers are in rich industrialized nations, solutions to the biodiversity crisis require strong backing by the latter. "Superstar species" (ones that are extremely well known and respected) can play critical roles in mobilizing support for conservation, both in pragmatic and emotional respects. Wild animal superstars include a few photogenic mammals (notably the "charismatic megafauna"), birds, and butterflies. Aside from their ecotourism value, their appeal is emotional rather than practical, based on human concepts of beauty and power, and consequently how the world would be poorer without them. By contrast, the public has become alarmed about the reduction of fish and other sea creatures because they provide much food for humans, although these relatively unattractive species lack charisma. In the plant world, giant trees and some beautiful or bizarre species evoke profound emotional responses in humans, and indeed their preservation has been a principal basis for the creation of many nature preserves. Key superstar medicinal plants threatened in the wild include the cancer-curing Madagascar periwinkle (*Catharanthus roseus*) and Pacific yew (*Taxus brevifolia*), and Chinese star anise (*Illicium verum*), the source of Tamiflu that is an essential tool against pandemic flu. The value of threatened wild plants for breeding major crops is well represented by a rare wild corn (*Zea diploperennis*), which has contributed about \$5 billion annually to corn improvement.

ORAL

Systematics and conservation of Fernald's Milkvetch: cpDNA, AFLPs and

morphometric analyses do not support taxonomic recognition

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Fernald's Milkvetch - *Astragalus robbinsii* var. *fernaldii* is a narrowly endemic legume found at only five sites in the Quebec-Labrador border region of the Straits of Belle Isle. Listed by COSEWIC as a taxon of "Special Concern", its phylogenetic position with respect to two closely related taxa, *Astragalus eucosmus* and *Astragalus robbinsii* var. *minor*, has been poorly resolved. This is due to high variability in the diagnostic characters, and a taxonomic history wrought with reclassification. To clarify the taxonomic position of Fernald's Milkvetch we used cpDNA sequences (*ycf6-trnC* and *trnC-rpoB* intergenic spacers), AFLPs and morphology. Parsimony and Bayesian analysis of the cpDNA data distinguished *A. eucosmus* from *A. r. minor*, and the majority of *A. r. fernaldii* samples were found associated with *A. eucosmus*. Three of the five sampled *A. r. fernaldii* populations also possessed the *A. r. minor* haplotype, while AFLPs revealed no clustering by taxon, or population structure of any sort. Morphometric analysis of 19 quantitative and qualitative variables indicates that *A. r. fernaldii* is closer in morphology to *A. eucosmus* than *A. r. minor*, and that stipe length in *A. r. fernaldii*, a critical diagnostic character, is not significantly different from that seen in *A. eucosmus*. These results suggest that gene flow between populations and taxa is likely occurring within the Blanc Sablon area, and that *A. r. fernaldii* is not reproductively isolated from either taxon. On the basis of the close relationship seen in the cpDNA and morphology data between *A. r. fernaldii* and *A. eucosmus* we believe the taxonomic rank of variety for *A. r. fernaldii* is unwarranted, and this taxon be transferred to *A. eucosmus*. As a result, conservation of this narrowly endemic variety should shift from an emphasis on the taxon to focus on preserving genetic variability within *A. eucosmus* in Atlantic Canada.

POSTER

Collections Risk Assessment at the Denver Museum of Nature & Science

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The Denver Museum of Nature & Science (DMNS) with funds from the Institute of Museum and Library Services-Museums for America program completed a risk assessment of collections in storage. The DMNS collections contain more than one million objects dispersed in 49 locations, only one of which has conditions that meet optimal museum standards. The other 48 locations are crowded and lack one or more important feature such as fire detection and suppression systems, centralized security, or temperature and relative humidity controls. These conditions jeopardize long-term

stewardship, restrict public access, and place human safety at risk. Risks to the collections had been identified in previous conservation assessments. Still, the DMNS lacked a comprehensive and balanced understanding of all risks affecting collections in storage. A more holistic understanding was required for operational preservation funding and is critical for the inevitable trade off decisions that will occur in the value engineering phases of facility concept and design that are scheduled to be in 2010 as the Museum prepares to build a new collections storage facility. The poster discusses the process and outcomes of the risk assessment as it occurred at the DMNS. Of the one million objects, staff identified 31 collection units to evaluate. A comprehensive list of risks was developed based on the Cultural Property Risk Analysis Model (CPRAM) developed at the Canadian Museum of Nature.

POSTER

Using plant DNA barcodes to identify the hosts for the root-colonizing fungi, *Neolecta irregularis* and *Roeslerina radicella*

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Plant-fungal root associations (mycorrhizal, saprotrophic, parasitic) are of great ecological and economic importance, but linking hosts to fungi is often problematic. This is especially true in large trees where colonised rootlets may be distant from the stem and so delicate and interwoven in soil blocks as to make it difficult to trace them to their origin. Here we demonstrate the use of the recently chosen plant DNA barcodes *rbcl* and *matK* for determining the host plant species of two enigmatic root-colonising Ascomycota, *Neolecta irregularis*, the most basal ascomycete to produce multicellular filamentous fruiting bodies, and *Roeslerina radicella*, a species of uncertain phylogenetic relationship in the Ascomycota. Megablast searches and phylogenetic analyses of sequences obtained from rootlets colonised by *Neolecta irregularis* in intact soil blocks at two distant localities (Thunder Bay, Ontario and Gatineau, Québec) suggest that this fungus may have a single host, at least in Canada. This method was also used to determine the host genus for *Roeslerina radicella*. Plant DNA barcodes may thus prove to be a quick and efficient means of identifying fungal hosts from the rootlets found in soil blocks when ordinary methods are insufficient.

ORAL

Digitization workflow in the Yale University Herbarium

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The Yale University Herbarium houses over 350,000 specimens of fungi, algae, lichens, mosses, and vascular plants from throughout the world. As part of an effort to document our holdings and to make our collection more widely accessible, we are digitizing our Connecticut vascular plant specimens. Our digitization workflow results in a high resolution image and a catalog record for each specimen. To increase throughput, we utilize a variety of custom applications and scripts and OCR (HERBIS) and voice-recognition software. One particularly useful part of our routine is a custom built, web-based data entry form that interfaces with a MySQL database. This form provides auto-complete functionality and permits data entry from images of specimen labels, the latter allowing for distributed, off-site human mediated capture of label data. High resolution, archival images are stored on Yale University's digital assets management system (DAM), which provides several benefits including automatic generation of image derivatives and a simple method for sharing images over the internet. Over the past two years we have imaged and databased over 35,000 specimens using only part-time, student labor and volunteers. It is hoped that parts of our workflow will be useful to digitization activities that focus on other collections in the state and region.

POSTER

Two types of polyketide synthase genes in species of *Ramalina* suggest high chemical diversity

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Polyketide synthase (PKS) genes code for polyketides that exhibit a diversity of form and function in a broad range of organisms. Two types of polyketides include the wA-type (non-reduced) and the MSAS-type (partially reduced) that are synthesized by a number of lichen-forming fungi. Most fungal PKS genes consist of clusters of genes containing a minimal set of three domains. Two of these domains, the ketosynthase (KS) and acyl transfer (AT) domains, were used in this study to examine the evolutionary history among species of *Ramalina* and to better understand chemical diversity in the genus relative to gene function and polyketide production. Nucleotide sequences of the KS, AT PKS regions, and the internal transcribed spacer region of ribosomal DNA (ITS rDNA) were used to estimate phylogenetic histories among members of *Ramalina*. Two types of PKS genes, MSAS-type and wA-type, were detected in the same thallus for all species examined. Despite the presence of both types of polyketides in all except three species (*R. sinensis*, *R. thrausta*, and *R. menziesei*), which contained usnic acid

only, both types of genes were present in all species. North American species of *Ramalina* are scattered among the European and Australian species. The significance of this finding relative to environmental influence on gene expression and chemical diversity is discussed.

ORAL

**Catharine Parr Traill Scrapbook:
Microfade testing of Herbaria Collection
and Exhibition Decisions**

Tse, Season¹, Cipera, Luci², Leckie, Carolyn²

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The Catherine Parr Traill Herbaria Collection consists of 25 scrapbooks compiled between 1866 and 1898. This is the largest known collection of Parr Traill plant pressings. They consist mainly of pressed plant species, present in southern Ontario, mounted directly on scrapbook pages or on unbound paper sheets. Many pages contain handwritten notes that are important to the specimens. This unique collection is expected to have relevance to research on species conservation and environmental change. Eleven of these scrapbooks were chosen by the nature artist, Barbara Gamble, to accompany her Exhibit Barbara Gamble: Natural Affinities. Many herbarium specimens are known to be sensitive to light exposure, resulting in colour change and/or fading. This leads to significant loss of aesthetic and study value. In order to determine the risk of fading during exhibition, items that are proposed for exhibition were tested using the Oriol microfade tester. Microfade testing is a non-destructive technique for direct identification of the light sensitive colourants on objects. The technique involves shining a high intensity UV-free light spot (~0.3mm diameter) directly on an object, and recording any colour change that occur. The lightfastness properties are expressed as ISO blue wool lightfastness categories. The technique is most useful for identifying highly light sensitive colourants (ISO blue wool 1-3). Pages of the scrapbooks that were proposed for exhibition were tested by microfading. These include flower petals, leaves, insects, ink and crayons. Of the 89 areas tested, approximately 70% were categorized as having high sensitivity to light while the remainder has medium sensitivity. Among the most sensitive are inscription inks, and pink and blue flower petals. The CCI Light Damage Calculator was used to estimate the percent change in colour for three lighting scenarios as well as for the planned exhibition. Based on these results, 6 pages of the scrapbook were chosen for the exhibit.

ORAL DemoCamp

Xper²: introducing e-Taxonomy

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Computer Aided Identification (CAI) systems provide users with the resources to relate morpho-anatomic

observations with taxa names and to subsequently access other knowledge about the organisms. They have the ability to manage descriptive data, make identifications through interactive keys and are essential for both authors and users of biodiversity information. Xper² version 2.0 is one of the most user-friendly software in its category and provides a complete environment dedicated to taxonomic descriptions management. It assists taxonomists with knowledge acquisition for identification keys and with publication of descriptive data by providing a large panel of tools, including analysis facilities (comparison of taxa or descriptors used), full traceability of information and knowledge (by adding references or external links). Xper² provides excellent support for automatic on-line publication of descriptive data and free access keys, as well as for exporting of datasets for phylogenetic and systematic research. It focuses on interoperability between systems and can import and export into structured descriptive data format (TDWG-SDD), and export to HTML and Nexus formats. Written in Java, it is available on Windows™, Mac™, or Linux, in French, English or Spanish versions. With its intuitive interface Xper² is aimed at professional taxonomists as well as naturalists who merely want to identify specimens using a ready-made application. Xper²'s users are taxonomists, teachers, fauna and flora experts (for biodiversity monitoring or survey) and ecologists. Quite similar to Lucid and Delta-Intkey, Xper²'s main qualities lie on a real easiness of use, a rich range of included tools which helps the users in any daily tasks (i.e. editing and analysing descriptive data, web publishing ...) and Xper² is free of charge and can be downloaded at: <http://lis-upmc.snv.jussieu.fr/lis/?q=en/resources/softwares/xper2>. In the context of distributed taxonomy, Xper² provides you with a highly efficient and user-friendly environment to manage, share and collaborate in the e-Taxonomy era.

ORAL

**Changes in plant communities:
approaches to visualize spatial or
temporal changes**

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Plant communities change over time and this is especially true in regions where human activities or derived impacts from human activities such as climate change add pressures on the communities. Capturing the information of the ecology of communities over a long period of time can be of great value as we had shown in a study of the salt marshes of Kouchibouguac National Park of Canada (KNP) in New Brunswick. However data analyses and subsequent presentation often cause challenges. While some people use single parametric analysis techniques, others prefer multivariate analysis to acquire the appropriate information. In most community studies, species diversity remains a core concept. It is expressed in terms of richness, evenness or abundance. This may look as a simplified way to interpret complex data but it can be very useful to compare between time periods or space. In this presentation, using the data from a previous study of salt marshes in KNP, I examine the usefulness of two analytical methods, diversity indices and multivariate analyses. In this case, the diversity indices

are visualized in a three-dimensional volume along the axes of richness, abundance, and evenness. Through this example, it is possible to show that various methods can help evaluate the changes either spatially or temporally. The interpretation of the results should be carefully looked at as different approaches can influence future monitoring or management of biodiversity and communities.

ORAL

Flat file to relational: The evolution of a type catalogue of invertebrate fossils
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The Royal Ontario Museum began digitizing its collections of invertebrate, plant and trace fossils in 1971. Since then the database has undergone at least five platform transitions, starting with a PDP-8 computer using paper tape and 8 track magnetic tape, through the PARIS system of the Canadian Heritage Information Network (CHIN), and currently using MS-Access 2003. Each transfer has brought its own challenges and opportunities. As early as 1978, a type catalogue was published for which the content was generated from the collections database – a revolutionary alternative to manual typesetting, but one still requiring considerable “human intervention.” In 2007 the transfer from a flat file to a relational platform was started. As well as forcing a thorough data-cleaning exercise, this move has for the first time made it possible to create meaningful records for each publication event for a given specimen, previously only recorded through ungainly abbreviations and annotations. A gradual reorganization and relabeling of the type and figured collections is underway. Priority is being given to a recently adopted orphaned collection, to significant historical collections, and to material currently subject to intensive active research. To date, about half the records (4600) have been upgraded, with new citation records. An important spinoff is the ability to generate up to date type catalogues for significant sections of the collection and to make them available on the Web.

ORAL

Quantitative comparisons of *Carex* seed banks in old-growth forest, using nuclear ribosomal spacers as DNA barcodes to identify seedlings

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The soil seed bank is a hidden component of species diversity that varies in its similarity to the above-ground vegetation depending on habitat type and time since disturbance. Disparity between above-ground plant communities and soil seed banks tends to be high in forests, moderate in wetlands, and lower in open grasslands. Identification of seeds or seedlings of sedges

(*Carex*, Cyperaceae) is difficult and many seed bank studies list only *Carex* spp. The old-growth forest at Mont-St-Hilaire, Quebec, has >60 *Carex* species, representing 10% of the flora. We studied the *Carex* seed bank in 60 previously inventoried upland and wetland plots (50m²) on the mountain, pooling soil subsamples to total 1 L of soil/plot. Over a 20-week period, emerging sedge seedlings were identified by their 3-ranked leaf arrangement and grown until large enough to provide leaf samples for DNA extraction and amplification of the external transcribed spacer region (ETS) of nuclear ribosomal DNA. ETS sequences were analyzed with sequences of all *Carex* species in the area to identify them. The 30 upland plots yielded a total of 476 individual sedges (*Carex* spp. and *Scirpus atrovirens*) while the 30 wetland plots yielded 1011 individuals, more than half of which belonged to the 3 most prolific sedges on the mountain (*C. gynandra*, *C. crinita*, and *C. prasina*). Correspondence between sedge species in above-ground vegetation and the soil seed bank was low in the wetland sites, but even lower in the upland sites. Even infrequent species like *C. houghtoniana* and *C. backii* were often found in sites distant from known locations on the mountain. The winged seeds of *Carex* section *Ovales* were frequent in sites both near and far from adult individuals, probably due to significant canopy removal by the 1998 ice-storm of 1998, which dramatically increased their abundance along trails.

ORAL

Something's Fishy at the Peabody: The Ichthyology Collection at the Yale Peabody Museum of Natural History
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Natural History collections at Yale began in 1802 with the Silliman collection. The Collection grew and in 1866 O. C. Marsh began the Yale Peabody Museum of Natural History. The Ichthyology collection increased significantly when the Bingham Oceanographic Collection formally became part of the Peabody Museum in the early 20th century. The early collection represented taxonomic diversity and was primarily marine in origin. In recent decades the collection has become a repository for fishes from diverse regions such as Atlantic Seamounts, Antarctica, and the Americas. Presently the fish collection includes specimen lots from 42 U.S. States, including the District of Columbia representing more than 1,238 taxa (including marine taxa). Since 2006 the collection has increased by nearly 50% (annual growth rate of over 2,000 specimen lots). Presently the Ichthyology collection at the museum contains over 23,000 specimen lots, 314 type specimen lots (more than 925 individuals of 191 nominal taxa), and over 18,000 tissue samples.

ORAL Plenary Panel

Coping with Success

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Natural history collections share the challenge of demonstrating their value through the extent to which they are used. With perennial and increasing pressure on collections to demonstrate their value comes a rise in the importance of finding affordable means of doing so.

The vertebrate distributed database networks (MaNIS, HerpNet, ORNIS, and FishNet2) offer holdings of global geographic coverage and benefit from increasing global participation. These networks have faced and resolved some of the fundamental social and technological issues associated with data sharing, and have thereby created an opportunity to increase the use of collections. One metric of the success of these networks is the number of participating collections as an indication of the perceived benefits of participation in the face of real costs. The vertebrate networks have already doubled the original targets of the projects, reaching a combined total of 168 collections (April 2010). Requests to join outstrip our capacity to provide technical assistance, resulting in an ever-growing wait list. A second metric of success is the rate of flow of information from the networks. That this metric reflects an increase in the use of the collections is supported by increased numbers of loan requests and publications resulting directly from participation. The current rate of data acquisition from the four networks is currently estimated to be 2.5 million records, nearly 5% of the combined data, per week. Overwhelming success has revealed the limitations of the existing systems to serve the increasing scope and usage that have occurred, spawning a new suite of social and technological data sharing challenges. Current exploratory research under the NSF-funded SilverLining project aims to demonstrate vividly the costs, potential, and implications for a scalable network with performance characteristics that do not depend on the amount of data, the number of participants, or the number of users. This research will be applied to the replacement of the four existing vertebrate networks with VertNet, an architecture that requires no servers managed by participants and portal hosts - one that can grow, perform, and provide a platform for applications and workflows rather than merely providing an inherently limit mechanism for the acquisition of data.

ORAL DemoCamp

Georeferencing Natural History Collections with BioGeomancer

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BioGeomancer (BG) is an easy-to-use, online automated georeferencing application for use with natural history collections' specimen localities. We will provide an overview of the online georeferencing workbench, demonstrate how to edit georeferences, and how to download results. Georeferencing is the process of describing a textual locality using geospatial terms (e.g., coordinates, reference system, uncertainty). BioGeomancer implements the GBIF (Global Biodiversity Information Facility) Guide to Best Practices for Georeferencing and offers both single and batch processing modes. It can understand and georeference textual descriptions for 12 common locality types, such as features, offsets from features, and lat/longs. Underlying

data sources include CONUS TIGER Census Data, Geographic Names Information System (GNIS), National Transportation Atlas Database, and Global Administrative Layers (GADM), among others. Users of this application include ORNIS, HerpNet, the International Rice Research Institute, 16 International Georeferencing Workshops, and numerous natural history collections, resulting in over 5.9 million georeferences in 5600 projects to date. >

ORAL

A peek inside the black box: investigating factors affecting long- distance dispersal and sporophyte establishment in seed-free vascular plants

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Extant seed-free vascular plants comprise two monophyletic lineages (ferns and lycophytes) successively sister to seed plants. These clades are unique among land plants in having life cycles that alternate between gametophytic and sporophytic "generations" (chromosomally and morphologically distinct plant bodies) that are physically independent for most of their existence. Migration is achieved through wind dispersal of spores much smaller than the propagules of seed plants, and both diaspore size and morphology affect this process. Once the spores descend to earth, successful establishment of new populations depends on a variety of factors including 1) arrival of the diaspore(s) in habitats conducive to spore germination and gametophyte maturation, 2) the composition of gametophyte populations currently occupying the habitat, 3) the breeding system of the species involved, and 4) environmental tolerances of newly-formed sporophytes. Ongoing studies suggest that the sporophyte (rather than the "insubstantial and ephemeral" gametophyte) is the weak link in this chain of events. Also, polyploidy, which is extraordinarily common among seed-free vascular plants, is found to play role at every step in the processes of dispersal and establishment.

POSTER

Managing Grid Lock

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Most curated natural history collections are organized hierarchically in a combination of systematic, geographic, and chronologic order. Uncurated collections of material may also be housed in expansion cabinets amidst the curated material. In the ROM Mammal collection space has reached a premium, resulting in sections of the curated collection becoming grid locked. Insufficient space exists to reorganize drawers to effect the insertion of new material. Consequently a means of logically housing and documenting overflow material had to be developed. Through a combination of reorganization and consolidation of uncurated material, a number of 'Overflow' cabinets were 'created' to permit the orderly installation of curated material. A means of visually

identifying and textually cross-referencing the affected drawers and cabinets was developed to facilitate locating material.

ORAL

The evolution of reproduction in *Cuscuta*: a glimpse into the sex lives of parasitic plants

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Cuscuta (Convolvulaceae), the dodders, constitute a genus of ca. 200 species of stem parasites with subcosmopolitan distribution. Although some *Cuscuta* species are weedy and a minority (~15) can be serious crop pests, only minimal study of their reproductive biology has been conducted. Traditionally, *Cuscuta* has been regarded as a genus of selfers due to their weedy habits, disjunct distributions and scattered reports of self-compatibility in a handful of species. However, for some species there exist reports of putative pollinators in the literature. We examined the diversity of breeding systems found in *Cuscuta* through variation in pollen and ovule production, as well as floral phenology, anatomy and morphology across the genus. Using closed flower buds from herbarium specimens we were able to sample 142 species for pollen/ovule ratios. While ovule numbers were a constant four per flower, pollen production ranged over three orders of magnitude from several hundred pollen grains to over twenty thousand grains per flower in some Mexican species. The data indicate that *Cuscuta* use a spectrum of mixed-mating system strategies, with a minority of species almost exclusively selfing or outcrossing. Pollen-ovule ratios were regressed against twenty floral characters to examine patterns of correlation, of which stigma width ($R^2=0.3080$), stigma surface area ($R^2=0.2951$) and floral tube length ($R^2=0.2856$) showed significance. The role of the infrastaminal scales, a floral structure unique to *Cuscuta*, is here narrowed to pollinator reward or defense against seed predators through the secretion of a lipid substance onto the ovary surface from the tips of the scales' fimbriae.

POSTER

Documentation of traditional ecological knowledge of Prophet River First Nation for protection of plants and plant gathering sites

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The development of high grade roads in northeastern BC has potential impacts on First Nations traditional plants

and plant gathering areas. The main objectives of the present study are: 1) to document and preserve the traditional ecological knowledge (TEK) of Prophet River First Nation (PRFN) and 2) to enhance decision-making related to land and resource management (e.g. oil and gas development). The first year of this project involved several meetings among partners that resulted in: 1) production of a solid and workable Memorandum of Understanding that addresses fully the Intellectual Property Rights of PRFN, 2) creation of a level of trust among partners so that the project could continue into the second year of study, and 3) completion of the first field interviews with the PRFN community, involving many members of PRFN including Elders and youth, to document TEK of PRFN about plants and plant gathering sites. Further interviews will take place in the 2010 field season to continue documentation of this important knowledge. The final deliverables of the project will include a PRFN community booklet that will summarize the project findings, and a mapping database that will allow PRFN to readily provide input to industry referrals. The knowledgebase produced from this research will provide a framework allowing PRFN to independently and effectively work with industry to mitigate impacts to traditional plants and plant gathering locations. This two year study is funded by the Science and Community Environmental Knowledge (SCEK) fund.

POSTER

Species relationships in the *Gagea reticulata* species complex utilizing nucleotide sequences of the low-copy nuclear gene malate synthase and flow cytometry data

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Gagea Salisb. sensu lato (including *Lloydia* Salisb. ex Rchb., Liliaceae) is a bulbiferous, geophytic, perennial genus comprising c. 70 to 285 species, depending on the author. It is restricted to temperate and subtropical regions of Eurasia, with a few species in North Africa and North America. The *Gagea reticulata* (Pall.) Schult. & Schult. fil. species complex, which belongs to section *Platyspermum* Boiss., is distributed from Central and Northern Iran to the Himalayas, with derived taxa in eastern Middle Asia and North Africa. The complex comprises twelve named taxa in Iran. The monophyly of the *G. reticulata* species complex has been demonstrated by analyzing 552 molecular sequences from the nuclear ribosomal ITS and plastid (*rp116* intron, *trnL* intron, *trnL-F* spacer, *matK* and the *psbA-trnH* spacer) DNA regions. However, the analysis failed to provide sufficient resolution of the species within the complex, which instead formed a polytomy. Species relationships within the *G. reticulata* species complex were examined by cladistic and network analyses using 625 cloned

sequences of the low-copy gene malate synthase (MS) isolated from 134 Iranian populations. In addition, the relative DNA contents of 150 individuals belonging to 110 populations were estimated using flow cytometry (FCM). The FCM analyses revealed that two levels of DNA content (“diploid” and “tetraploid”) were present. However regardless of these different ‘ploidy’ levels, three copies (loci) of the MS gene were present in each individual analysed even though multiple alleles were present at each loci. The ancestral genotype of MS is present in *G. setifolia* which is centered in Central and Northern Iran but the presence of this genotype in several other groups indicates that introgressive hybridization has played an important role in the evolution of the *G. reticulata* complex.

ORAL

DNA Bank Network – Referencing DNA with specimens, sequences and publications based on GBIF web services

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The biological collections aim to facilitate research on biodiversity and increase awareness to the threats the living world is facing today. Most natural history collections harbour different complementary collections. Thus, to comprise information of all curated accessions, specimen collections and inferred analytical data management and data integration has been a main challenge. The DNA Bank Network bridges the yawning gap between natural history collections and molecular sequence databases by providing online references to analysed specimens and inferred molecular data. Here we present all components of the DNA Bank Network’s data architecture including the interaction with internal as well as external databases. The data model is based on GBIF infrastructure ensuring its long-term stability and potential for expansion by further partners. The open source DNA Module has been developed for DNA data record, management and to add links to GenBank accessions and publications. Scientific customers can search for and order DNA samples via a central web portal. While all recorded data belonging to a DNA sample are provided from stable, disparate primary databases these data are compiled as into synoptic virtual datasets by the Network’s web portal during a query. Since partial dataset are made available as GBIF web services advantages of the implemented data model are fourfold. Partial datasets remain locally administrated by data providers. Data can be curated/updated so that dealing with redundant copies can be avoided. Furthermore, taxonomic verification can be accomplished by annotation when digital vouchers are available. Thus, the synoptic dataset always represents the current state of knowledge. The Network established technically optimized DNA storage facilities enabling long-term deposition of well documented DNA and tissue samples after project completion for all biological research. Thus, material remaining from previous studies is made available to other researchers being in agreement to act with consideration on genetic resources.

POSTER

The construction of nodulation maps to study nodule distribution in legumes

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As a result of mutualism between legumes and rhizobia, nodules form on the plant roots. Although much work has been done to study nodulation in terms of growth and development, to our knowledge nodule distribution on the root system has not been documented precisely. To fill this gap, we previously developed nodulation maps where the root system was placed on a grid with the primary root aligned with the vertical axis, and lateral roots spread perpendicularly to it to allow for nodule counting and locating. These maps proved to be useful in showing the position and density of the nodules in space and time. In our lab, they have become a tool to compare mutants as well as plants subjected to different hormonal treatments. For example, using the maps, we determined that although both pea mutants E151 (sym15) and R50 (sym16) had been classified previously as low nodulators, the former has much less nodules than the latter and may be placed in a category on its own; moreover, we characterized E151 as a delayed nodulator. However, the counting of the nodules is a tedious task and requires extensive amounts of time and manpower. The goal of the present study was to develop software which eliminated the tedious portion of the experiment, thus expediting the process. Through collaboration with computer scientists, a program is being developed whereby nodulation maps can now be produced from scanning photographs taken during different experiments. Specifications for both plant manipulation and picture taking had to be carefully established so that uniformity and accuracy are maintained for data analysis. The program is now being finalized and will be tested for replicability as well as for efficacy for other legume species.

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RESTAURANTS AND BARS

Areas to explore:

West – take the footbridge across the canal, and continue west about 3 blocks to Elgin St. On Elgin, go either right (north) or left (south). There are lots of excellent establishments.

North – the Byward Market (north of Rideau St., west of Dalhousie St) has so many restaurants, pubs, bistros, etc., that we will just recommend a few of our favourites.

Name	Address	Phone	Distance (km)	Price Range	Style
Within a dash of the University					
The Second Cup	153 Laurier Ave E	613-232-6921	0.1	<\$15	Coffee, lunch, snacks
Le bac à frites	Simard Hall corner - Parking lot "K"	613-234-5454	0.2	<\$15	French fries
Perfection, Satisfaction, Promise	167 Laurier Ave E	613-234-7299	0.2	<\$15	Vegetarian
Pavarazzi's Gourmet Pizza	223 Laurier Ave E	613-233-3222	0.4	<\$15	Pizza take-out
Subway	231 Laurier Ave E	613-565-8888	0.4	<\$15	Sandwiches and salads
Johnny Pizza	233 Laurier Ave E	613-236-9500	0.4	<\$15	Pizza
Timothy's World Coffee	234 Laurier Ave E	613-567-8181	0.4	<\$15	Coffee, snacks
Sindria	124 Osgoode St	613-231-5522	0.5	<\$15	Lebanese
Father and Sons Restaurant	112 Osgoode St	613-234-1173	0.5	\$10-25	Burgers, pizza, sandwiches
Kwon's Korean Bar-B-Q	332 Wilbrod St	613-236-8371	0.7	\$15-30	Korean
The House/La Maison	191 Somerset St E	613-565-9585	0.7	\$10-25	Pub grub
University Tavern	196 Somerset St E	613-235-7777	0.7	\$10-25	Pizza, burgers
Café Nostalgica	603 Cumberland St	613-562-5800 x3000	0.8	<\$15	Breakfast, lunch, dinner
Govinda's Vegetarian Buffet	212 Somerset St E	613-565-6544	0.8	<\$15	Vegan (in the Hare Krishna Temple)
Trio	33 Nicholas St (in Novotel)	613-760-4771	0.5	\$15-25	Tasting plates
Avant Garde Bar and Gift Store	135 Besserer St	613-321-8908	0.5	\$25-50	Relaxed, trendy, Russian
Daly's - Westin Hotel	11 Colonel By Dr	613-560-7333	0.8	\$50-60	Fine dining
East African Restaurant	375 Rideau St	613-789-7397	0.9	\$10-25	Ethiopian

Byward Market					
Takara Japanese	366 Dalhousie St	613-241-6582	0.6	\$15-30	Japanese, sushi
Palais Imperial Chinese Restaurant	313 Dalhousie St	613-789-6888	0.8	\$25-50	Chinese
Courtyard Restaurant	21 George St	613-241-1516	0.9	\$15-50	Canadian, eclectic
Santé Restaurant	45 Rideau St	613-241-7113	0.9	\$25-50	Globally inspired
Royal Thai Restaurant	272 Dalhousie St	613-562-8818	1.0	\$25-50	Thai
Zaks Diner	14 Byward Market Square	613-241-2401	1.0	\$10-25	24 hr diner
E18teen	18 York St	613-244-1188	1.0	\$50-70	Fine dining
Sweetgrass Aboriginal Bistro	108 Murray St	613-562-3683	1.0	\$50-60	Aboriginal

Elgin Street area					
Anthony's On Elgin	274 Elgin St	613-235-7027	1.1	\$20-40	Italian
Bridgehead Coffeehouse	282 Elgin St	613-234-0002	1.1	<\$15	Fair trade coffee
Swagman Jack's Bar & Grill	283 Elgin St	613-233-2219	1.1	\$20-40	Pub grub
Green Tea Noodle and Sushi	5A-280 Elgin St	613-233-2888	1.2	\$15-30	Asian
Big Daddy's Crab Shack And Oyster Bar	339 Elgin St	613-569-5200	1.3	\$20-40	Seafood
The Manx	370 Elgin St	613-231-2070	1.4	\$15-30	Fusion

Pubs/Bars

Name	Address	Phone	Distance (km)
Royal Oak	161 Laurier Ave E	613-230-9223	0.2
Urban Well	244 Laurier Ave E	613-234-2914	0.4
Moon Dog Pub & Grill	238 Laurier Ave E	613-233-3624	0.4
Maison Acadienne	191 Somerset St E	613-565-9585	0.7
V.J.'s	150 Laurier Ave W	613-234-0925	0.8
Highlander Pub	115 Rideau St	613-562-5678	0.8
Aulde Dubliner	62 William St	613-241-0066	0.8
Mayflower	247 Elgin St	613-238-3731	1.0
Heart and Crown	67 Clarence St	613-562-0674	1.0
Fox and Feather	283 Elgin St	613-233-2219	1.1
Sir John A.	284 Elgin St	613-567-2746	1.2
Drumlin's Pub	321 Somerset St E	613-233-4807	1.2
Lieutenant's Pump	361 Elgin St	613-238-2949	1.4
The Manx	370 Elgin St	613-231-2070	1.4

Notes

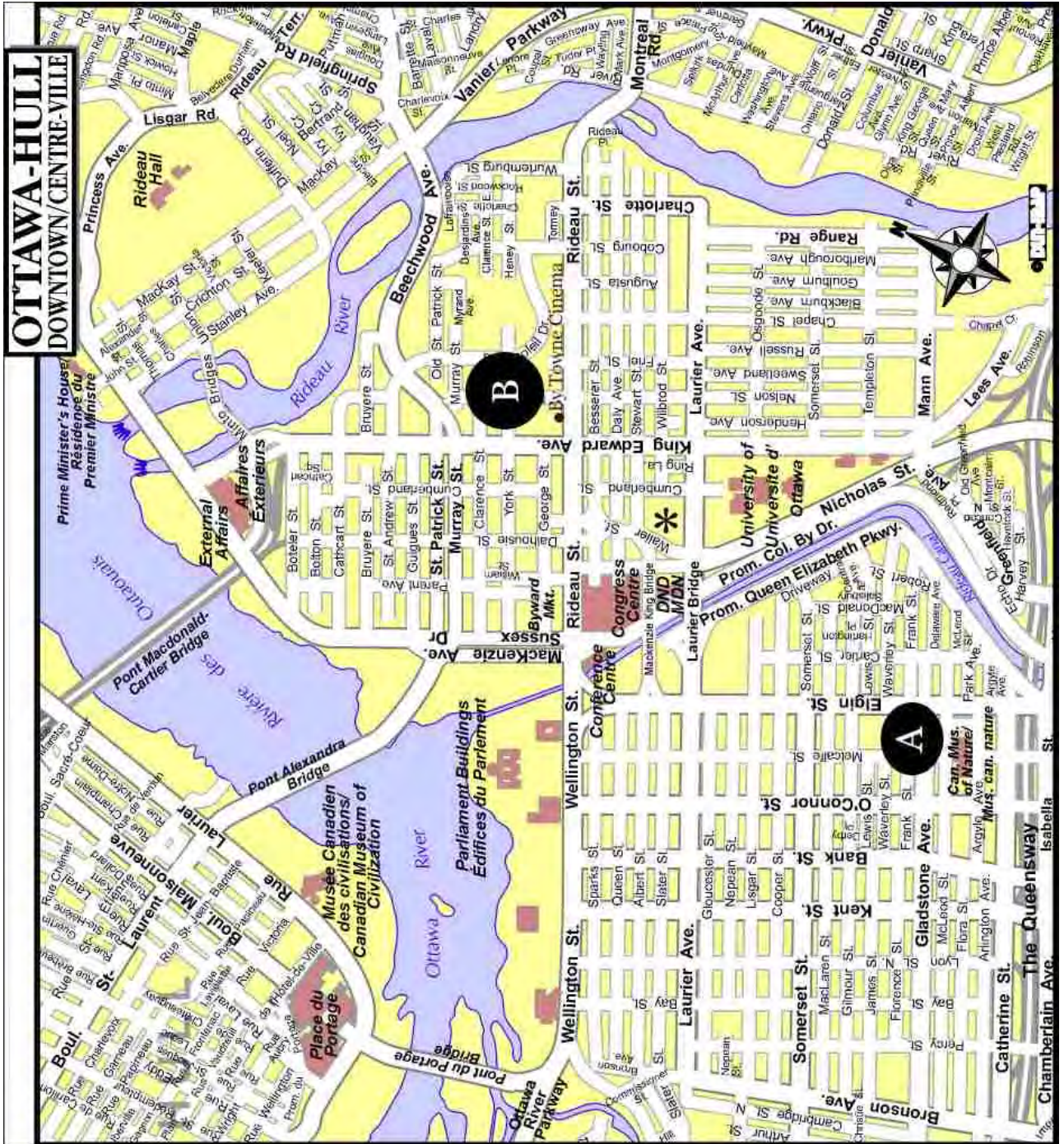
Notes

MAPS

A – Victoria Memorial Museum Building, Canadian Museum of Nature

B – ByTowne Cinema

Asterisk between A and B – Tabaret Hall (main conference venue)

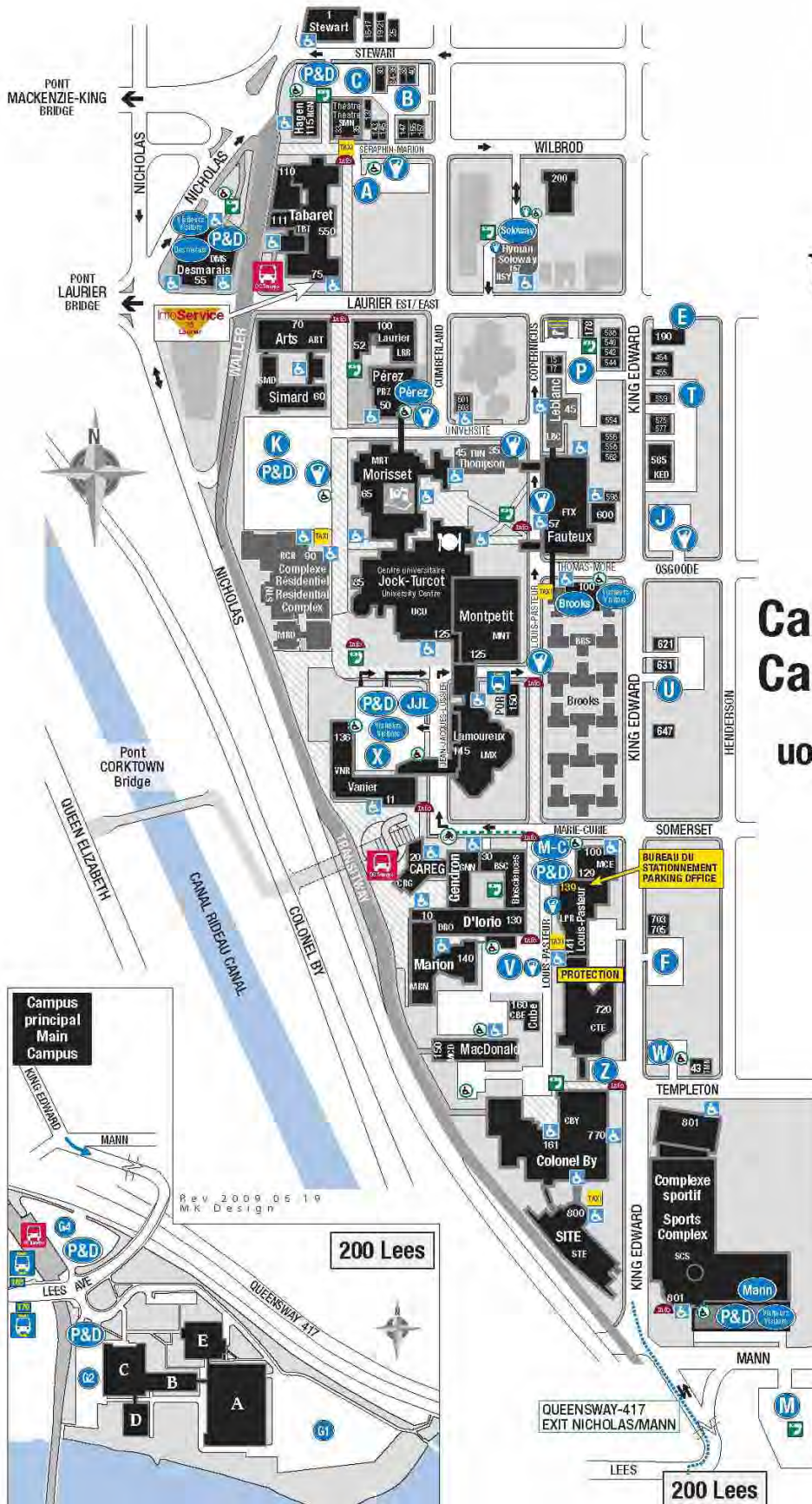




uOttawa

Carte de campus Campus Map

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Légende / Legend

- Stationnement Parking Lot
- Distributrice de permis Pay & Display Parking
- Parcomètre Meter
- Accès Access
- Stationnement visiteurs Visitors Parking Lot
- Stationnement accessible Accessible Parking
- Navette Shuttle
- OC Transpo
- Bibliothèque Library
- Information
- Taxi - point d'embarquement Taxi Pick-up Point
- Cafétéria Cafeteria
- Téléphone de secours Emergency Telephone