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The Canadian Botanical Association Bulletin



Bulletin de l'Association Botanique du Canada

December/Décembre 2011. Volume 44 No.3/N°3

President's Message:

Botanical visions for a common future

I often tell my students that they have a unique opportunity before them: they can start investing their energy to become acquainted with botanical landscapes (and the plants within them) and, if they do this, their lives will be changed forever! It is most rewarding when, at the end of a semester of dendrology or plant taxonomy, students acknowledge this fact and report that they have begun to look at their surroundings very differently... Botany can change one's world!

At the end of the day, the gift of consciousness is the only window we possess to peek into the natural world. Metaphorically speaking, we have but a few moments to marvel at the diversity of plant architecture, to explore their distribution and ecology, to decode their genetic intricacies, to be moved by a late autumn color palette, indeed to celebrate the undeniable planetary contribution afforded by plants. Dear student, please stop texting for a moment and take a walk on the wild side...

The English pioneer and naturalist Gilbert White, in his celebrated 'Natural History of Selborne' (1789), is said to have written to his friend Daines Barrington that one "should study plants philosophically and investigate the laws of vegetation".

"Vegetation", he said, "is highly worthy of our attention, as it is of utmost consequence to mankind". It could not have been better stated! Indeed, the challenges of understanding the laws of botanical landscapes, their plant species constituents, and their interactions with all other organisms in the biosphere are now, more than ever, critically important.

Will societies in the future have access to knowledgeable and thoughtful botanists capable of resolving issues related to the worldwide challenge of food, fiber and fuel sustainability, when today botany and related plant sciences are viewed as less important or, perhaps, as less fulfilling career options? This, at a time when we surpass the milestone of 7 billion humans on earth! What will the next generation of botanists look like in terms of research support and technological surroundings? Will we be like scientists relying on Star Trek tricorders® for advice, or will we be more like earth gardeners, attempting to save and grow heritage seeds in mega-greenhouses to feed the planet?

With appropriate themes revolving around the future of botany and the next generation, the Botany 2012 Steering Committee is working hard to "Make it so!" in Columbus, Ohio, with a program that will undoubtedly be out of this world. The CBA will co-sponsor and organize 4 symposia that will include some wonderful speakers! I am most grateful to those who have already spent many hours on both sides of



Hugues Massicotte

Canadian Botanical Association Bulletin

The CBA Bulletin is issued three times a year (in theory in March, September and December) and is available to all CBA members in electronic format or for an additional fee, in hard copy.

Information for submitting texts

All members are welcome to submit texts in the form of papers, reviews, comments, essays, requests, or anything related to botany or botanists. Any medium is acceptable for submission but electronic documents are likely to speed up the publication. For detailed directives on text submission please contact the Editor (see below). For general information about the CBA, go to the web site: <http://www.cba-abc.ca>

Association Botanique du Canada Bulletin

Le Bulletin de l'ABC paraît trois fois par année, normalement en mars, septembre et décembre. Il est envoyé à tous les membres de l'ABC.

Soumission de textes

Tous les membres de l'Association sont invités à envoyer des textes de toute nature concernant la botanique et les botanistes (articles, revues de publication, commentaires, requêtes, essais, etc.). Tous les supports de texte sont acceptés. L'utilisation de documents électroniques peut accélérer la publication. Pour des renseignements détaillés sur la soumission de textes, veuillez consulter le rédacteur (voir ci-dessous). Infos générales sur l'ABC à l'URL suivant: <http://www.cba-abc.ca>

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Next issue / Prochain numéro

Texts for the next issue, **45(1)**, must be received **before March 5th 2012**

La date de tombée des textes du prochain numéro, le no **45(1)**, est le **5 mars 2012**

Published in Peterborough, December 1st 2011
Publié à Peterborough, le 1 décembre 2011

SSN 0008-3046 (paper/version papier)
ISSN 1718-8164 (electronic format/version électronique.)

the border to make this joint meeting a success during July 7-11th, 2012.

"To boldly go...."! Hoping many of our members do!

Sincerely,
Hugues Massicotte

Message du Président:

Visions botaniques pour notre avenir en commun.

Je dis souvent à mes étudiant(e)s qu'ils (elles) ont une occasion unique devant eux(elles): investissez votre énergie pour vous familiariser le plus tôt possible avec les paysages botaniques qui vous entourent (et leurs plantes constituantes) et votre vie sera à jamais changée! C'est donc très encourageant lorsque, à la fin d'un semestre de dendrologie ou de taxonomie végétale, ils (elles) reconnaissent cela et nous disent qu'ils (elles) regardent leur environnement de façon très différente ... la botanique peut changer votre monde!

En fin de compte, notre conscience individuelle est la seule fenêtre que nous possédons pour observer le monde naturel. D'une manière métaphorique, nous n'avons que quelques instants dans cette vie pour admirer la diversité architecturale des plantes, pour explorer leurs distributions et écologies, pour décoder leurs complexités génétiques, pour s'émouvoir de la palette des couleurs d'automne, bref pour célébrer l'apport indéniable des plantes à l'échelle planétaire. Cher(e)s étudiant(e)s, arrêtez de "texter" pour un moment et prenez une longue marche dans l'arrière-pays...

Le pionnier et naturaliste anglais Gilbert White, dans sa célèbre 'Histoire naturelle de Selborne' (1789), écrivait à son ami Daines Barrington que l'on «devrait étudier les plantes philosophiquement et examiner les lois de la végétation». "La vegetation", dit-il, "est bien digne de notre attention, puisqu'elle est d'une importance cruciale pour l'humanité". On n'aurait pas pu mieux le dire! En effet, les défis pour comprendre les lois botaniques des paysages terrestres et aquatiques, et aussi pour mieux connaître les espèces de plantes et interactions avec tous les autres organismes dans la biosphère, sont toujours énormes et bien réels.

Notre société future aura-t-elle accès à des botanistes informé(e)s, capables de relever le défi énorme de soutenir les productions mondiales de nourriture, de fibre ligneuse et de bio-énergie, surtout lorsque la botanique n'est pas considérée importante ou comme un choix de carrière prometteur, au moment où nous survolons le cap des 7 milliards d'humains sur la planète bleue? Quelle sera donc la prochaine génération de botanistes, en terme de support de recherche ou soutien technique? Serons-nous comme des scientifiques qui manipulent des Star Trek Tricordeurs® pour recevoir des conseils judicieux, ou serons-nous des jardiniers spécialisés, affairés à faire croître des semences du patrimoine sous serres gigantesques pour nourrir les terriens?

Avec une thématique appropriée qui se propose d'examiner l'avenir de la botanique et la prochaine génération de botanistes, le Comité directeur de "Botanique 2012" travaille fort pour faire de "Columbus, Ohio" une réalité, avec un programme qui sera sans doute hors de ce monde. L'ABC co-parraine et organise 4 colloques qui regroupent d'excellent(e)s conférencier(e)s! Je suis très reconnaissant à ceux et celles qui ont déjà investi de nombreuses heures des deux côtés de la frontière pour faire de notre conférence conjointe un succès du 7-11 Juillet, 2012.

"Pour s'aventurer audacieusement là où..."! En espérant que vous pourrez nous rejoindre!

Très sincèrement,
Hugues Massicotte

White, G. (1789). The Natural History and Antiquities of Selborne. London: Cassell & Company.



Laurie Consaul continues with her long road to recovery. We wish her well. We would also like her to know that we are thinking of her! In her absence, Christine Maxwell has kindly agreed to take on the role of Acting Secretary.

Association News/ Nouvelles de l'association

Dre Liette Vasseur recevra le Prix des pionniers de la conservation de 2011



Sudbury... Bob Rogers, président de l'Office de protection de la nature du District du Nickel (OPNDN), et les membres du Conseil général sont très fiers d'annoncer que le 17 novembre 2011, Dre Liette Vasseur recevra le prestigieux Prix des pionniers de la conservation A.D. Latonnell de 2011 au Nottawasaga Inn à Alliston, en Ontario.

L'A.D. Latonnell Symposium, qui se déroulera du 16 au 18 novembre 2011, est l'une des plus importantes conférences annuelles en Ontario qui porte sur des questions liées à l'environnement et à la conservation. Un rassemblement dynamique de professionnels de la conservation, l'événement attirera plus de 1000 personnes sur la période de trois jours. Le thème de la conférence de 2011 est Un avenir clair comme l'eau de source.

« Dre Vasseur est l'exemple des principales caractéristiques d'un titulaire du Prix des pionniers Latonnell », affirme Bob Rogers. « Liette est une personne dévouée qui a fait des contributions et réalisé des accomplissements ayant un impact à long terme par ses efforts académiques, ses études et ses travaux communautaires dans les domaines de la conservation et de la gestion des écosystèmes ». Dre Vasseur a mentionné qu'elle « aime beaucoup le travail communautaire car il me permet d'utiliser les résultats de mes études fondamentales et appliquées dans le monde réel. Les changements climatiques et la dégradation de l'environnement sont des questions sérieuses qui exigent et qui continueront d'exiger qu'on poursuive ces deux types d'études. Il est un grand honneur pour moi de recevoir le Prix des pionniers de la conservation », exprime Dre Vasseur. « Le Grand Sudbury démontre la force et la cohésion d'une communauté qui vise à progresser et qui représente un excellent modèle à suivre. »

Dre Vasseur est professeure titulaire à Brock University. Auparavant, elle était vice-présidente associée à la recherche à l'Université Laurentienne, à Sudbury. Pendant son séjour à Sudbury, soit de 2006 à 2008, Dre Vasseur a siégé au Conseil général de l'OPNDN. Au fil des ans, Dre Vasseur a été reconnue en Ontario, au Canada et partout au monde pour ses efforts dans les domaines de l'adaptation aux changements climatiques, du renforcement des capacités et du développement de communautés durables. Liette a agi comme mentor et formatrice auprès de nombreux étudiants aux niveaux d'études universitaires de premier, deuxième et troisième cycle.

« Il sera pour moi ainsi que pour les autres membres de l'OPNDN un grand honneur d'accompagner Liette le 17 novembre lorsqu'elle recevra cette marque de

reconnaissance bien méritée », déclare Bob Rogers, président de l'OPNDN. « Comme femme hautement respectée dans le domaine des sciences, la contribution importante de Dre Vasseur aux sciences et au développement communautaire est une source d'inspiration pour les hommes et les femmes en sciences et pour la prochaine génération des défenseurs de la science citoyenne. »

Dr. Liette Vasseur to Receive 2011 Conservation Pioneer Award

Sudbury... Nickel District Conservation Authority (NDCA) Chair Bob Rogers and the Members of the General Board are extremely pleased to announce that Dr. Liette Vasseur will receive the prestigious 2011 A.D. Latonnell Conservation Pioneer Award on November 17, 2011 at the Nottawasaga Inn in Alliston, Ontario.

The A.D. Latonnell Symposium from November 16 to 18, 2011, is one of Ontario's largest annual conferences focussing on environmental and conservation issues.

Attracting over 1,000 people over a three-day period, it is a vibrant gathering of conservation professionals. The theme of the 2011 conference is Water: The Future of the Source.

"Dr. Vasseur exemplifies the important traits of a Latonnell Pioneer Award recipient," said Bob Rogers. "Liette is a dedicated individual who has made long-term contributions and achievements through her academic, research and community-based work in the fields of conservation and ecosystem management."

Dr. Vasseur noted that, "working with communities is great as it brings the basic and applied research that I do into the real world. Climate change and environmental degradation are serious issues that require and will continue to require both types of research." "I am honoured to receive the Conservation Pioneer Award," said Vasseur. "Greater Sudbury demonstrates the strength and cohesion of a community that strives to move ahead and is a great model to follow."

Dr. Vasseur is a Full Professor at Brock University. Prior to that Liette was Associate Vice-President of Research at Laurentian University in Sudbury. While in Sudbury Dr. Vasseur served on the NDCA General Board from 2006 to 2008. Dr. Vasseur has been recognized over the years in Ontario, across Canada and around the world for her work associated with climate change adaptation, capacity building and developing sustainable communities. Liette has mentored and trained many students at the undergraduate, graduate and post-graduate level.

"I along with others from the NDCA will be deeply honoured to be with Liette on November 17th when she receives this well-deserved recognition," stated NDCA Chair Bob Rogers. "As a well respected woman in science, Dr. Vasseur's significant contribution to science and community development is an inspiration to the women and men of science and the next generation of citizen science advocates."

Sad News

We are sad to learn that **Pierre Dansereau**, CC, GOQ, FRSC passed away on September 28th 2011 just a few days away from his 100th birthday. An obituary will be published in the March 2012 Bulletin.



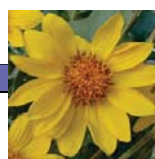
Botany 2012



The CBA/ABC is coordinating four exciting symposia with the Botanical Society of America during "Botany 2012: The Next Generation" and four other societies. Participating societies include the Botanical Society of America (BSA), the American Bryological and Lichenological Society

(ABLS), the American Fern Society (AFS), and the American Society of Plant Taxonomists (ASPT). The meeting will take place at the Greater Columbus Convention Center in Columbus Ohio. After the call for symposia closed on October 28, 2011, the CBA was approved four symposia for speakers in ecology, teaching, developmental biology, and mycology. The CBA mycology section can enjoy the company of the American Lichenologists from ABLS who share similar fungal interests, and the Canadian bryologists can also exchange bryomania with the American bryologists of the ABLS. We look forward to a rewarding exchange of ideas between the Canadian, American, and other botanists in all four sections in Ohio during the 2012 conference.

Michele D. Piercey-Normore,
Vice President, CBA/ABC



Botany 2012



Make your plans NOW!

July 7-11 2012

Columbus Convention Center
Columbus, Ohio



Additional Association News

Memorandum of Understanding with CSP-NRC and great BOTANY subscription discounts!

In July 2011, the CBA signed a Memorandum of Understanding with Canadian Science Publishing (CSP, trading as NRC Research Press) affirming our shared desire to cooperate with each other, and among other objectives to promote publication of Canadian research in botany and enhance the profile of the journal Botany, as well as cross marketing each other to both the national and international communities. One of the benefits is that CSP provides CBA members with very substantial discounted rates for electronic and (or) paper subscriptions to Botany. We strongly encourage members to take advantage of such rates. For instance, you can subscribe for 2012 electronically for \$50, a great savings!

This coming year, the executive of the CBA will discuss the possibility of including an automatic e-subscription to Botany when you renew your membership. Members would receive a further discounted price of \$25, however, membership rates would have to be reviewed. We will need to know your thoughts on this issue when we initiate our forum, and appreciate your participation to this discussion.

HM.

NRC RESEARCH PRESS 2012 ANNUAL SUBSCRIPTION RATES FOR SOCIETIES						
Journal	Print	Mandatory Electronic	Non-Mandatory Electronic	Mandatory Print & Electronic	Non-Mandatory Print & Electronic	Extra Postage outside Canada
Biological Sciences						
Botany (formerly Canadian Journal of Botany)	\$175	\$25	\$50	\$200	\$225	\$60



Continuance and the new Canada Not-for-Profit Corporations Act

It had to happen one day! After nearly a century, the Canada Corporations Act, governing federal corporations, is getting a make-over! I am grateful to Liette Vasseur for alerting us to this issue!

The new Canada Not-for-Profit Corporations Act (NFP Act) establishes a new set of rules for federally incorporated not-for-profit corporations in Canada, and the CBA is one of these corporations. Consequently, all NFP corporations are now in a transition period until October 17, 2014. The CBA will strike a committee in the coming year to initiate the process of replacing the letters patent, by-laws and articles of continuance to obtain a Certificate of Continuance and file new by-laws complying with the new NFP Act, akin to a new constitution.

To this end, the CBA membership will be asked to approve the final documents before they are filed in Ottawa. The process seems to be well described but will require hard work and some introspection. We will report regularly in the Bulletin and the website in the coming months about this critically important step regarding the Association's future.

The silver lining is that the by-laws will be modernized in the process (a task the executive was about to embark on) – All this just in time to celebrate the CBA's 50th anniversary!

HM.



Photo: Hugues Massicotte

News From the Sections

Mycology Section



Photo: H Massicotte

With our colleagues from the BSA, Darlene Southworth and Ann Hirsch, the Mycology section is delighted to announce the symposium "Rhizosphere interactions: the root microbiome" as part of Botany 2012 in Columbus, Ohio. The symposium is partially sponsored by the Mycological Section, the Ecological Section, and the Development and Structural Botany Section of BSA, and the CBA. Plants are never fully separate from other organisms. In addition to their diverse relationships with fungi, plants also interact with bacteria and other organisms that alter the soil environment of roots and influence each other. How can we understand this "superorganism?" What approaches allow us to relate diversity with function and to model the interactions? We have a superb line up of 6 speakers so far: Melanie Jones (UBC), Charles Greer (NRC and McGill U.), Kari Dunfield (U. of Guelph), and Ragan Callaway (U. of Montana), Martha Hawes (U. of Arizona) and Ann Hirsch (UCLA). We will have a finalized list for the next Bulletin and these will also be posted soon on the BSA website. We are also discussing possible speakers for the Weresub lecture in 2012 so if you have suggestions, please forward to us. An additional reminder to members (faculty and students) to please consider forwarding names and dossiers of those who may be eligible for the **Luella K. Weresub Memorial Award** for best paper on mycology authored by a student and published in 2011.

As always, we welcome all who might be interested in joining the Mycology section, as well as all myco-comments/thoughts for our section and for the Bulletin!

Hugues Massicotte and Shannon Berch, Section Chairs

Development Section News

Students are encouraged to submit applications for the Taylor A. Steeves Award. It was established to honour Taylor Steeves for his numerous contributions to the CBA and to botany. For more information or to submit applications or nominations, please contact the current chair of the Development Section, Dr. Arunika Gunawardena (arunika.gunawardena@dal.ca), Biology Department, Dalhousie University, before May 1st 2012

Arunika Gunawardena, Section Chair.

Ecology and Conservation Section

The Ecology section submitted a proposal for a symposium at Botany 2012 in Columbus, Ohio, which has been accepted by the organizers. The title is: "Transplantations and relocation of species at risk: learning from the past to plan for the future". A number of exciting speakers are planned. This symposium has been proposed by the Ecology and Conservation Section of the CBA following discussions at both the Ottawa and Halifax meetings. In the 1980's, a position paper regarding transplantation of species at risk was developed by the CBA. Since then researchers, NGOs and governmental agencies have continued to examine this strategy as a possible way of avoiding species extinction or extirpation from an area. The CBA decided that it was time to review the position paper. Given that people from a variety of sectors are transplanting (recovery teams, industry, municipalities, etc.), it may be most efficient at this time to simply advocate that experts engaged in transplanting projects should be contacted and that three key conditions be in place - management, monitoring, and enforcement. It is apparent from the previous discussion that regardless of the reason for transplanting, the conditions to help ensure success may always be the same - the involvement of an expert in the ecology of the species/natural area at hand, the land is secured, and there is ongoing management, monitoring and enforcement. The CBA and its membership, for example, could become an information resource for organizations involved in transplanting, in terms of experts and guidance. However, to do so and to revise the position paper, this symposium followed by a round table discussion will be important to first receive information about the lessons learned from the past and then discuss from these experiences the best practices or criteria that should be considered as well as the future research needed to continue developing this strategy. Since the United States of America and many members of the BSA have also had also experience in this area, a joint symposium on this topic at the next meeting will be an effective way to collaborate and possibly develop a new position paper on this topic.

The Ecology and Conservation section is still looking for volunteers to judge the Lionel Cinq Mars oral competition and the Iain and Sylvia Taylor Poster competition at Botany 2012. If you plan to be at the meeting in Columbus, we certainly encourage you to help support our students by becoming a judge.

Stan Rowe Award The Stan Rowe Award is given to a student who has recently published an excellent manuscript in a peer review journal in ecology. Please consider nominating a deserving student for the Stan Rowe award! You don't have a student to nominate? Consider identifying papers that have been published by a student and could be considered for the award.

A reminder... The section is also looking for volunteers to serve on two subcommittees. These are the subcommittee on acquisition of lands and other similar initiatives for species at risk or natural habitat conservation and the subcommittee on lessons learned from transplantations and relocation of species at risk.

Liette Vasseur and Art Fredeen, Section Chairs.

(Continued)

Teaching Section

The Teaching Section has planned a joint symposium with the BSA, titled "Are we having a broader impact?" for the 2012 meeting in Columbus, Ohio. We (Stokes S. Baker, Santokh Singh and Phil Gibson) submitted the joint teaching symposium proposal to the Botanical Society of America (BSA), which has recently been accepted. This symposium is jointly sponsored by the Teaching Sections of BSA, CBA/ABC. We have six invited speakers for this symposium. CBA/ABC has invited two speakers and the BSA has invited four speakers. Over the past 30 years, science education has undergone significant transformations at many institutions. Lectures have become more interactive with greater emphasis on active learning. Likewise, laboratory sessions have shifted from predominantly demonstration and observation-based sessions to more inquiry-focused exercises. Both accreditation agencies and funding agencies have placed a greater emphasis in demonstrating the broader impacts of curriculum on student learning. Educators and students alike report that curricular changes have enhanced student learning and improved the classroom and laboratory experience. However, identifying the individual effects of specific curricular changes and rigorously quantifying improvements in student learning presents a challenge to many scientists. A large body of literature exists on effective assessment, but many scientists are not familiar with the well-established theory and procedures of education assessment. In this symposium, presenters will describe their efforts at science education reform and describe their experiences and approaches to assessment and evaluation. The symposium covers a breadth of topics from assessment of individual exercises to assessment of larger curricular efforts. The symposium will provide useful information to promote greater expectations for evaluating our effectiveness in science education. The speakers will be: Jean Becker, Santokh Singh, Kimberly Tanner, Jose Herrera, Phil Gibson and Chris Haufler. More details will appear in the next issue of the Bulletin.

Santokh Singh, Section Chair

Regional Undergraduate Conferences

The CBA/ABC awards prizes for the best botanical presentations at Regional Undergraduate Conferences, where Honours students are presenting the results of their research projects. We encourage CBA/ABC members to attend if they are able.

Science Atlantic (formerly APICS) Undergraduate Biology Conference

March 9-11 2012, Mount Allison University, Sackville, NB
At press time the dates are tentative.

Ontario Biology Day

Laurentian University in Sudbury is to be the host for Ontario Biology Day (OBD) in the spring of 2012. The (still tentative) dates are Friday, March 16th to Sunday, March 18th.

14th Annual British Columbia Regional Undergraduate Research Conference

The University of British Columbia (Okanagan Campus, located in Kelowna) will be the host for this conference in late March or early April. (The date is still to be confirmed.) Undergraduate students from UBC-O, The University of the Fraser Valley, Thompson Rivers University, Trinity Western University, and the University of Northern British Columbia are welcome to come and present a poster and/or a talk about their research. For more information, please contact Patricia Lasserre, Associate Dean of Students and Curriculum (patricia.lasserre@ubc.ca) and Dr. Louise M. Nelson, Associate Dean Research, Irving K. Barber School of Arts and Sciences at UBC-O (louise.nelson@ubc.ca).



Photo: Hugues Massicotte

CBA-ABC Student Awards

~Awards for Students Papers published in 2011~

Alf Erling Porsild Memorial Prize

Award honoring the memory of the eminent Arctic botanist Alf Erling Porsild. Applications/nominations for students who published a paper in plant systematics and/or phytogeography (as senior author) during the previous year should be sent to the current Chair of the Systematics and Phytogeography Section of the CBA/ABC (Dr. Hugo Cota-Sanchez, Dept. of Biology, University of Saskatchewan; e-mail: hugo.cota@usask.ca) before May 1st 2012.

J. Stan Rowe Award

Award established to celebrate the life and work of Stan Rowe, eminent Canadian Plant Ecologist. Applications/nominations for students who published a paper in plant ecology should be sent to the co-Chairs of the Ecology Section of the CBA/ABC (Dr. Liette Vasseur and Dr. Art Fredeen, Brock University; e-mail: lvasseur@brocku.ca) before May 1st, 2012.

Taylor A. Steeves Award

Award established to honour Taylor Steeves' numerous contributions to the CBA/ABC and botany. Applications/nominations for students who published a paper in plant development, structure or morphology should be sent to the current Chair of the Plant Development Section of the CBA/ABC (Dr. Arunika Gunawardena, Dalhousie University, Halifax NS; e-mail: arunika.gunawardena@dal.ca) before May 1st, 2012.

Luella K. Weresub Memorial Award

Award established in memory of Dr. Luella Kayla Weresub, a well-known Canadian mycologist who worked at the Biosystematics Research Institute of Agriculture Canada. The award is open to all undergraduate or graduate students working on fungi. Applications/nominations for students who published a paper in fungal biology should be sent to the co-Chairs of the Mycology Section (Dr. Hugues Massicotte and Dr. Shannon Berch, University of Northern British Columbia; e-mail: hugues@unbc.ca) before May 1st, 2012.

CBA-ABC Conference Awards

Student Travel Bursaries: John Macoun (Graduate) and Keith Winterhalder (Undergraduate)

Provide partial financial assistance for travel by a student (or students) to Annual Meeting to present a paper (Lionel Cinq-Mars competition) or a poster (Iain and Sylvia Taylor competition).

Eligibility:

- Open to all student members of CBA/ABC.
- Students must present a paper (Lionel Cinq-Mars competition) or a poster (Taylor competition) at the Annual CBA/ABC Meeting.
- No student may receive more than one travel bursary while registered for the same degree.
- Students must apply no later than the submission deadline for abstracts to the Annual Meeting.
- The application must contain the following documents:
 - A copy of the abstract of the paper to be given at the Annual Meeting.
 - A supporting letter from the student's Supervisor (must include a statement that the student is engaged in research;
 - The student's curriculum vitae (one page);
 - A letter of recommendation from another member of the student's research committee.

Applications should be sent to the President of CBA/ABC (Dr. Hugues Massicotte, University of Northern British Columbia; e-mail: hugues@unbc.ca) before May 1st, 2012.

Lionel Cinq-Mars Award

Award for best oral presentation by a student of his or her own research at Annual Meeting.

Eligibility and Evaluation:

- Any bona fide (under-)graduate student enrolled at a Canadian institution of higher learning, as well as Canadian students at foreign institutions, are eligible. Every effort will be made to ensure that each student in the competition has a fair evaluation and an equal chance of winning the award.
- Oral presentation will be evaluated by a panel of judges chaired by the President-Elect. The merit of each paper will be judged on the basis of content (60%) and presentation (40%). All students who wish to compete for this award must indicate this by checking the appropriate box on the 2012 Annual Meeting abstract submission form.

Iain and Sylvia Taylor Award

Award for best student research poster presented at Annual Meeting.

Eligibility and Evaluation:

- Any bona fide (under-)graduate student enrolled at a Canadian institution of higher learning, as well as Canadian students at foreign institutions, are eligible. Every effort will be made to ensure that each student in the competition has a fair evaluation and an equal chance of winning the award.
- Posters will be evaluated by a panel of judges chaired by the Vice-President of CBA/ABC. All students who wish to compete for this award must indicate this by checking the appropriate box on the abstract form. Abstracts must be submitted for the Annual Meeting at which the student will compete for the Award.

ABC/CBA Prix Étudiants

~Prix pour les articles publiés par les étudiants durant 2011~

Le Prix Commémoratif Alf Erling Porsild

Prix honorant la mémoire de l'éminent botaniste de l'arctique Alf Erling Porsild. La mise en candidature d'étudiants ayant publié un article en phytogéographie ou systématique végétale (comme auteur principal) durant l'année précédente devrait être envoyée au président de la section systématique et phytogéographie des plantes de l'ABC/CBA (Dr. Hugo Cota-Sanchez, Dept. of Biology, University of Saskatchewan; e-mail: hugo.cota@usask.ca) avant le 1 mai 2012.

Le prix J. Stan Rowe

Prix établi pour célébrer la vie et le travail de Stan Rowe, éminent écologiste canadien des plantes. La mise en candidature d'étudiants ayant publié un article en écologie végétale durant l'année précédente devrait être envoyée au co-président de la section écologie de l'ABC/CBA (Dr. Liette Vasseur et Dr. Art Fredeen, Brock University; e-mail: lvasseur@brocku.ca) avant le 1 mai 2012.

Le prix Taylor A. Steeves

Prix établi pour honorer les nombreuses contributions de Taylor Steeves à la botanique et à l'ABC/CBA. La mise en candidature d'étudiants ayant publié un article en 2008 en développement, structure ou morphologie végétales devrait être envoyée au président de la section développement végétal de l'ABC/CBA (Dr. Arunika Gunawardena, Dalhousie University, Halifax NS; e-mail: arunika.gunawardena@dal.ca) avant le 1 mai 2012.

Le prix commémoratif Luella K. Weresub

Prix établi en mémoire du Dr. Luella Kayla Weresub, une mycologue canadienne reconnue qui travailla à l'Institut de recherche en biosystématique d'Agriculture Canada. Cette compétition est ouverte à tous les étudiants de premier cycle ou diplômés qui travaillent sur les champignons. La mise en candidature d'étudiants ayant publié un article en mycologie devrait être envoyée au co-président de la section mycologie (Dr. Hugues Massicotte et Dr. Sahnnon Berch, University of Northern British Columbia; e-mail: hugues@unbc.ca) avant le 1 mai 2012.

ABC-CBA Prix de conférence

Bourse de Voyage John Macoun (étudiant gradué) et Keith Winterhalder (étudiant de premier cycle)

La bourse a été établie pour aider à défrayer une partie des coûts de déplacement à la réunion annuelle pour un(e) étudiant(e) (ou des étudiants) qui présentent une communication orale dans la compétition Cinq-Mars ou une affiche dans la compétition Taylor.

Eligibilité:

- Ouvert à tous les membres étudiants de l'ABC/CBA.
- Les étudiants doivent présenter une communication orale (compétition Cinq-Mars) ou une affiche (compétition Taylor) à la réunion annuelle de l'ABC/CBA.
- Aucun étudiant ne peut recevoir plus d'une bourse de voyage pendant qu'ils (elles) sont inscrit(es) au même programme d'étude.
- Les étudiants doivent soumettre leur candidature avant la date limite de soumission des résumés à la réunion annuelle.
- L'application doit contenir les documents suivants:
 - Une copie du résumé de la communication prévue à la réunion annuelle pour la compétition Cinq-Mars;
 - Une lettre de support du directeur de thèse de l'étudiant(e) qui inclue aussi une déclaration que l'étudiant est inscrit à un programme de maîtrise ou de doctorat;
 - Le curriculum vitae de l'étudiant (une page);
 - UNE lettre de support d'un membre du comité de direction de l'étudiant (autre que le directeur)
- Les demandes devraient être envoyées au président de l'ABC/CBA (Dr. Hugues Massicotte, University of Northern British Columbia; e-mail: hugues@unbc.ca) avant le 1 mai 2012.

Le prix Lionel Cinq-Mars

Décerné à un(e) étudiant(e) pour la meilleure présentation orale de son propre projet de recherche, présenté à la réunion annuelle.

Eligibilité:

Tout membre étudiant(e) de premier cycle ou diplômé inscrit(e) dans une institution canadienne d'études supérieures, ou membre étudiant(e) canadien(ne) d'une institutions étrangères, est éligible. Tous les moyens nécessaires seront employés afin d'assurer que chaque étudiant(e) participant à la compétition reçoive une évaluation juste et une chance égale de gagner la compétition.

La présentation orale sera évaluée par un comité de juges (au moins un représentant de chaque section de l'ABC/CBA) sous la direction du président élu. Le mérite de chaque communication sera jugé sur le contenu (60%) et la présentation (40%). Tous les étudiants qui souhaitent participer à cette compétition doivent indiquer leur intention en cochant la case appropriée sur le formulaire de soumission du résumé. Les résumés doivent être soumis pour la réunion annuelle à laquelle l'étudiant participera à la compétition.

Le prix Iain et Sylvia Taylor

Décerné à un(e) étudiant(e) pour la meilleure affiche présentée à la réunion annuelle.

Eligibilité:

Tout membre étudiant(e) canadien(ne) de premier cycle ou diplômé inscrit(e) dans une institution canadienne d'études supérieures, ou membre étudiant(e) canadien(ne) d'institutions étrangères, est éligible. Tous les moyens nécessaires seront employés afin d'assurer que chaque étudiant(e) participant à la compétition reçoive une évaluation juste et une chance égale de gagner la compétition.

Les affiches seront évaluées par un comité de juges sous la direction du vice-président de l'ABC/CBA. Tous les étudiants qui souhaitent participer à cette compétition doivent indiquer leur intention en cochant la case appropriée sur le formulaire de soumission du résumé. Les résumés doivent être soumis pour la réunion annuelle à laquelle l'étudiant participera à la compétition.

Obituary

Taylor Armstrong Steeves

Professor Emeritus Taylor A. Steeves of the Biology Department, University of Saskatchewan (U of S) passed away on September 6, 2011. Taylor was born on November 29, 1926 in Quincy, Massachusetts. He did his B.Sc. at the University of Massachusetts in Amherst, and in 1951 received his Ph.D. from Harvard University. During his graduate years at Harvard, Taylor spent a year as Sheldon Travelling Fellow at the University of Manchester and worked with the famous plant morphologist Prof. C.W. Wardlaw. After obtaining his Ph.D. he was appointed a Junior Fellow of the Society of Fellows at Harvard. In 1953, while a Fellow at Harvard, he was a Visiting Scientist at the Institut National de Recherches Agronomiques in Versailles, France. It was there that he acquired his lifelong interest in the language and culture of France that was to take on additional dimensions in later years of his life. In 1954 Taylor returned to Cambridge to join the faculty of Harvard University as an Assistant Professor.

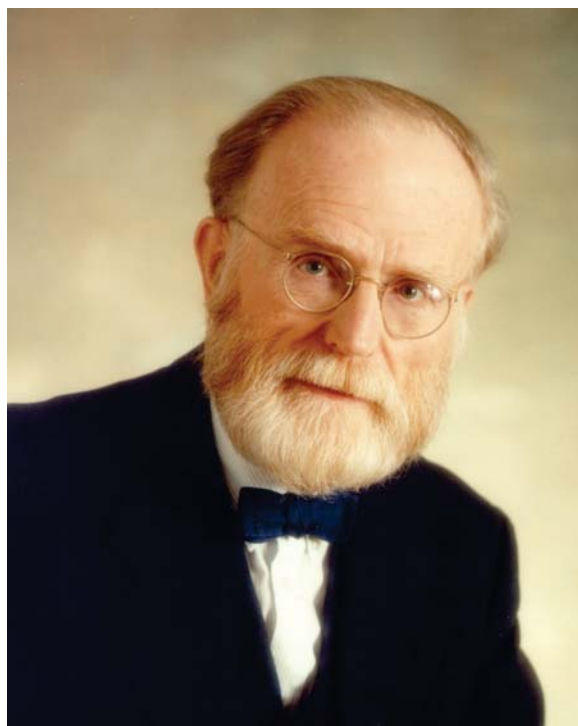
In 1959, after he had just finished a 5-year appointment as Assistant Professor at Harvard, Taylor was offered a position at the U of S as Associate Professor with tenure, and without an interview, by then Head of the Biology Dept., Prof. Rawson, an eminent biologist in his own right. Taylor had also received offers from Brown University and from Universities of California at Los Angeles, Texas, and Virginia.

After receiving the offer from the U of S, Taylor went to see the University and the city of Saskatoon. The Biology Dept. at Saskatoon had no building at that time but it was under construction and he was initially going to be housed in the basement of Physics building. Prof. Rawson offered Taylor to have his lab built in the new building the way he wanted it. Taylor was happy about that and saw a lot of potential at the place and liked the campus. He specially loved the city and its surroundings, the South Saskatchewan River, the vastness of the prairie land, and the accessibility to an off campus site, the Emma Lake campus. He accepted the job and then approached Prof. Rawson for travel expenses about his visit to the university. However, he was told that because he was not invited for an interview and came here on his own, there would be no reimbursement. Many years later when I was Department Head and we were inviting candidates for interviews, and in some cases for a subsequent visit, and we looked after their expenses, I was reminded repeatedly by Taylor that he never got paid to come here; I told him that is the price for being an exceptional candidate. Then, one year after joining the U of S, Taylor was offered the position of Associate Professor at Yale University with tenure, but he turned it down as he felt he had made a commitment to the U of S. This one act alone speaks volumes about the character of the man. Taylor stayed with the U of S Biology Department until his retirement in 1994. He was promoted to the rank of Professor in 1964 and served as the Department Head from 1976 to 1981, and then again from 1987 to 1988. He was named the Rawson Professor of Biology in 1985 for his distinguished service.

Taylor served the botanical community and his discipline in various capacities. He was the founding member of the Canadian Botanical Association/Association Botanique du Canada (CBA/ABC), and served as its President in 1973. He served the CBA/ABC in various other capacities including as chair of the Plant Structure and Development section, judge of Lionel Cinq Mars award and for hosting the annual meeting in 1975 in Saskatoon. Taylor and his wife, Dr. Margaret (Peggy) Steeves, a paleobotanist, regularly attended the CBA/ABC meetings. In 1993, the CBA/ABC established the Taylor A. Steeves award in Plant Development in his honour, and made him an Honorary Life Member in 1994. In 1978, the CBA/ABC awarded Taylor its highest honour, the Lawson medal, and in 1990 the Mary E. Elliott service award. Taylor was also the editor of the Botanical gazette (now the International Journal of Plant Sciences) from 1968 to 1974, and the editor of the Canadian Journal of Botany (now Botany) from 1979 to 1988. In 1996, the Botanical Society of America elected him a corresponding Member.

As a scientist, Taylor made enormous contributions to his field of plant morphology and development. His early research focused on several aspects of plant development including leaf and shoot development with particular emphasis on the use of plant tissue culture technique that he had acquired in France and introduced to his lab in Saskatoon. His research in later years involved native plants of the prairies and he and his students studied various aspects including, root growth, branching and vascular tissue differentiation. Taylor published numerous papers with his students and colleagues and was an invited speaker at many conferences and institutions in Canada and abroad. He co-authored an introductory text, Botany, which has been used by many institutions, and with his longtime friend, Ian Sussex, the book, Patterns in plant development, which became a standard text in his field. Taylor received several other awards including, Fellow of the Royal Society of Canada at the age of 45, an Earned D.Sc. from the U of S and an Honorary doctorate from the University of Guelph.

(Continued)



Dr. Taylor Steeves in a recent photo.

Perhaps Taylor's major contribution was in the area of teaching. He had an amazing wealth of knowledge which he transmitted to students with his wit, humor, enthusiasm, and storytelling. Students loved taking his courses and would come back for more. His style of teaching, his mannerism and persona were so powerful that many students actually changed the direction of their program and switched to studying plants. He was most proud of his students and their successes and was very caring of their welfare. When the U of S awarded him the Master Teacher Award, he treasured that more than any other award as teaching for him was of prime importance. Taylor was not only a great speaker but he also spoke very fast, and it was said that "Taylor could teach two classes at the same time by standing in between the doorway of two class rooms".

As a person Taylor was the kindest human being and a very compassionate and gentle soul. He was also very concerned about environmental issues and was a strong proponent of conservation. Throughout his stay at the U of S, he rode a bike during spring and summer, and walked in winter. I recall some Saskatoon winter days with temperatures hovering around -30°C , Taylor would arrive in the Department with his buffalo coat and a beard with icicles hanging down his face. He was very much into recycling materials, whether it was clothes or the use of office supplies; this was during the times when it was not fashionable to talk about conservation and going green, but Taylor practiced it all his life. He also had a great sense of humor and loved telling jokes and would start laughing before he would finish.

Taylor Steeves was an icon in the field of Botany. He will be sorely missed as a dear friend, wonderful colleague and mentor, outstanding scientist and teacher, and an exceptional human being. His passing is an end of an era.....

Vipen Sawhney
Biology Department
University of Saskatchewan
Saskatoon



Dr Taylor Steeves, working in a greenhouse at Harvard, around 1955.



Photo: C Maxwell

Plant Development Section: Research Profile Dr. Cynthia Ross Friedman and her students at Thompson Rivers University (TRU)

Dr. Cynthia Ross Friedman (Cindy) came to the Department of Biological Sciences at Thompson Rivers University (TRU) in August 2004. Having received her Ph.D. in 2002 under the excellent supervision of Dr. Michael J. Sumner and recently completed a stint as a sessional lecturer at the University of Manitoba, she arrived at TRU with the goal of being a teacher who is able to connect with her students through a shared joy of research. She never planned on having a “research lab” *per se*, but rather a mechanism for training students, primarily undergraduates, with skills not only in microscopy, development, and anatomy – Cindy’s personal passions – but also in writing and communicating findings to the broader scientific community. She strongly believes that students—undergraduate and graduate—should play a major role in the whole process of conducting research, from project conception through to dissemination in the peer-reviewed realm. This approach is working well for both her students and for Cindy, who was able to secure an NSERC Discovery Grant as well as a CFI – Leader’s Opportunity fund to establish a microscopy lab at TRU.

The main focal organisms Cindy and her students study are the enigmatic and problematic members of the genus *Arceuthobium*, the dwarf mistletoes, parasites of conifers and integral members of Canadian forests. While not traditional “model organisms”, *Arceuthobium* spp. are important plants due to their importance in the economy and ecology of forests, well deserving of study, and surprisingly versatile in the kinds and varieties of studies that the plant can offer. For example, Kathryn Pernitsky (B.Sc. Hons. 2007) along with Quinn Mason, Fawna More, Karl Koziura, and Charles Vaudry (all B.Sc. Hons. 2008) discovered that *A. americanum* contains an antimicrobial with properties of a biosurfactant and apoptotic agent.



Arvin Dwarka (Left) and Lyssa Martin (middle), two recent B.Sc. (Hons.) graduates from Thompson Rivers University, examine dwarf mistletoe “Up close and personal” along with supervisor Dr. Cindy Ross Friedman

Shannon Kelly (B.Sc. Hons. 2009) performed an elegant study of the dwarf mistletoe fruit, and both Aditya Chhikara (B.Sc. Hons. 2007) and Erin Littley (B.Sc. Hons. 2006) performed work regarding the effect of *A. americanum*

infection on pine needle anatomy. Cindy’s first B.Sc. (Hons.) student, Chad Stewart, who worked on an embryological comparison of *A. americanum* growing on two hosts, is now completing his Ph.D. at the University of Saskatchewan. All of Cindy’s undergraduate students listed above have published in peer-reviewed journals.

Most recently, Arvin Dwarka (B.Sc. Hons. 2010) published an intriguing study of DNA-level sex discrimination in *Arceuthobium americanum*, and Lyssa Martin (B.Sc. Hons. 2011) has published one paper on tissue culturing in *A. americanum* and has submitted a second to the *American Journal of Botany* on the discovery of endophytic fungi in the stems, fruits, and seeds. Current students are Kathryn Pernitsky, who has joined the new M.Sc. (Env. Sci.) at TRU to study male development in *A. americanum*, and Melissa Hardy, who, as an undergraduate, is working on the new Zeiss LS Evo “environmental” scanning electron microscope at TRU to study the fascinating process and structure of explosive seed discharge, which characterizes the genus.

Cindy was recently awarded with an Excellence in Teaching Award (2010) and an Excellence in Research Award (2011), both are institution-wide awards.



Cindy and her M.Sc. student, Kathryn Pernitsky (Right) examine dwarf mistletoe pollen with the new Zeiss LS Evo Scanning Electron Microscope.



What is new in Botany?

Graduate student news from across the country...and beyond.



Adrian Dauphinee

Adrian is a new graduate student under the supervision of Dr. Arunika Gunawardena at Dalhousie University, in Halifax, Nova Scotia. Adrian's research focuses on the lace plant (*Aponogeton madagascariensis*). The lace plant is an aquatic monocot that produces a mature complex leaf morphology through developmentally regulated programmed cell death (PCD). PCD deletes cells within areoles, found between longitudinal and transverse veins. The removal of cells through PCD begins in the center and expands outward, stopping only 4-5 cell layers before the vasculature. The result is a perforated leaf morphology that resembles a lace pattern, hence the common name. The lace plant provides an excellent system for studying PCD due to the predictability of perforation formation, established sterile cultures and thin transparent leaves that are ideal for live cell imaging. Adrian's project is investigating the early stages of development within the lace plant. Through the application of dissection techniques, he has been able to isolate the shoot apical meristem (SAM) of the lace plant with Dr. Christian Lacroix (co-supervisor) in his laboratory located at the University of Prince Edward Island. Adrian's dissections have been imaged using scanning electron microscopy to identify various stages of the lace plant's development. Laser scanning confocal microscopy has also been used to generate 3D models of the dissections. Adrian's future work will include the optimization of a protocol to regenerate lace plants from isolated SAMs, and the transformation of the lace plant to investigate KNOX gene expression.



Adrian Dauphinee

Gregory L. Owens



Greg is a PhD student, in Loren Rieseberg's lab at UBC
Research Summary:

Serpentine areas represents a severe edaphic environment while simultaneously hosting a disproportionately large number of endemic species. These species are adapted to the unique ionic and environment pressures presented by serpentine soils which prove lethal to most plants. Little is known about the genetics of the formation of these species. For example, does serpentine tolerance evolve through the cumulative action of many genes or is it a simple switch involving one gene? This has important implications in how plant communities form and change over time.

One of the more interesting serpentine endemics is *Layia discoidea*. This member of the tidytip group represents one lineage of the *Layia glandulosa* clade and is characterized by a loss of ray florets and strict serpentine endemism. I aim to understand how this species formed by using next-generation sequencing technology to model population history using markers across the entire genome. This vast increase in markers over traditional methods will allow me to determine the population history of specific genomic areas and identify genes favored by natural selection in the serpentine *L. discoidea* but not the non-serpentine *L. glandulosa*. This information can also be used to evaluate broad theories on how new species form, a fundamental process in biology.



Greg Owens in a field of sunflowers

David Garbary, at St. Francis Xavier University set a bonus question on a second year course exam a couple of years ago. The question was to write a poem on some aspect of plant biology. Hannah Buhariwalla answered with this poem!

Ethylene by Hannah Buhariwalla

Ethylene is very mean,
Do you know how mean it's been?
When the leaves fall to the ground . . .
And no scapegoat can be found . . .
There's a gas you cannot see
That makes the leaves fall off the tree.
When it's cold it has its fun
And when its evil deed is done . . .
It doesn't care how long it takes
And laughs above you as you rake.

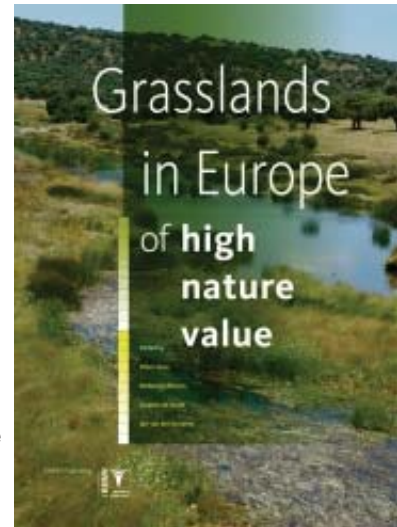
Book Review

Grasslands in Europe of high nature value.

Veen, P., Jefferson, R., de Smidt, J., van der Straaten, J. 2009.
(Eds.)

KNNV Publishing, Zeist (Netherlands). 320 pp.

Hardcover: ISBN 978-90-5011-316-8. Price: 69.95 €.



Grasslands and savannas are found in most terrestrial ecoregions of the world and they cover over 40% of the land surface. A long history of human use and abuse of grasslands has substantially shrunk their area around the world. On a European scale, grasslands are mostly of anthropogenic origin with the exceptions of the areas in alpine regions, along rivers and remnant fragments of steppe vegetation. Diversity is a key issue for grassland-based agricultural systems and remnant native grasslands in Europe. As it noted in the editorial foreword by M. Fisher Boel, EU Commissioner for Agriculture and Rural Development to this book, it intends to show that high nature value (HNV) grasslands are still present in the old world.

The book has an elegant design and is richly illustrated with high-quality colour photographs of landscape views and some characteristic plants and animals. Together with presented case studies of grassland conservation, it is an excellent guide to HNV grasslands in Europe. The fundamentals for the book had been established during the last one-and-a half decade by botanists involved in grassland mapping projects in Central and Eastern Europe initiated by the Royal Dutch Society for Nature Conservation with the financial support of the Government of the Netherlands.

The book is organised in three sections. Section 1 includes 6 introductory chapters. It covers the origin, development and use of grasslands in Europe; grasslands as habitats for butterflies and birds; lowland grasslands and climate; methodology for identification of HNV grassland. Section 2 has 24 chapters devoted to the regional studies. It begins with photographic session introducing all project areas. The regional case studies spread across most countries of European Union, as well as some non-EU member countries such as Belarus, Switzerland, Turkey, and Ukraine. These projects are scattered from lowland to mountains, and cover a wide array of different grassland types: dry grasslands, steppe grasslands, dry limestone grasslands (incl. alvars), mesic-dry acid grasslands, mesic-moisture meadows, mesic-dry and moisture pastures, mesic-wet grasslands and coastal grasslands. Section 3 has one chapter on farmer-centred policy outlook to managing and to maintaining HNV grasslands in Europe that includes recommendations for future progress. The book ends with biographical sketches of the 70 contributors and a glossary of basic geographical, ecological and pedological terms. Each chapter has its own references and each in the main section has the project location maps.

Overall, the book gives a very good overview of grasslands in Europe. It characterises not only HNV grasslands of Western European countries, but perhaps for the first time brings to the attention of Western readers an importance of vast grasslands areas of Eastern Europe, particularly dry grasslands that are among one of the most species-rich plant communities. Without any doubt this is an informative and useful book for grassland specialists, vegetation and wildlife ecologists, as well as wide circles of naturalists.

Grasslands in Europe characterize by multiply functions and have not only high biodiversity values, but also support rural economies and are a source of livelihood for local communities. Most grasslands were traditionally maintained through grazing or cutting during centuries. However, changes in agricultural practices in the last 50 years – intensification and land abandonment – caused grassland to disappear at an alarming rate. Nowadays grasslands are among most threatened ecosystems in Europe.

The European Commission does recognize multiply functions and values of grasslands and developed different tools to protect it. Of particular importance is the EU Rural Development Policy. It aims to reconcile agriculture with conservation through financing farming practices and agri-environment schemes for Natura 2000 habitats that have direct impact on grassland conservation. The recent reforms of the EU Common Agricultural Policy have also enabled further integration of biodiversity concerns into agricultural policy and further strengthened measures for farmland and biodiversity.

The book demonstrates existing social demand and political willingness to protect the environment, landscape and biodiversity of grasslands in Europe. Altogether, they can help build not only ecological resilience of grassland ecosystems, but also increase overall human well-being in rural areas. If carefully managed and planned, sustainable development and biodiversity conservation can go hand in hand and reinforce each other.

Dr. Vladimir Kricsfalussy
School of Environment and Sustainability
University of Saskatchewan



Position Posting

Plant Chemical Ecology (Assistant Professor)



UNIVERSITY OF ALBERTA, DEPARTMENT OF BIOLOGICAL SCIENCES – We invite applications for a tenure-track position at the Assistant Professor level in plant chemical ecology. We are interested in excellent plant ecologists who study fundamental aspects of chemically-mediated interactions (e.g. herbivory, pollination, competition, plant-microbe interactions). Preference will be given to applicants who incorporate both field and lab studies into their research program. The successful candidate must hold a PhD and have a strong record of plant-based research and demonstrated potential for excellence in teaching.

The Department of Biological Sciences (www.biology.ualberta.ca) consists of 70 faculty members (30 ecology) and 280 graduate students (100 ecology). This concentration of biologists offers a collegial environment for collaboration among ecologists, mathematical biologists, organismal biologists, molecular biologists, physiologists, and evolutionary biologists. Exceptional infrastructure includes field stations in Alberta and the Pacific Coast, plant growth facilities, museums, and access to service units in chemical instrumentation, molecular biology, plant/soil analysis, and microscopy. Members of Biological Sciences benefit from interdisciplinary connections with members of many other departments in the Faculty of Science, Faculty of Medicine and Dentistry, Faculty of Agriculture, Life, and Environmental Sciences, and the School of Public Health at the University of Alberta.

Candidates should submit curriculum vitae, a one-page summary of research plans, a one-page statement of teaching interests, and reprints of their three most significant publications **preferably** electronically to recruitment3@biology.ualberta.ca or by mail. Applicants must also arrange for three letters of reference to be sent to the attention of the Chair to recruitment3@biology.ualberta.ca.

Closing Date: **December 15, 2011**. The effective date of employment will be July 1, 2012.

Dr. Michael Caldwell, Chair
Department of Biological Sciences
CW405 Biological Sciences Bldg
University of Alberta
Edmonton, AB Canada T6G 2E9

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal peoples.

Announcement for a Tropical Ethnobotany Field Course

taught by Jillian DeGezelle this Winter in beautiful Bocas del Toro, Panama.
at the Institute for Tropical Ecology and Conservation (ITEC) Field Station.

The course runs from **December 20, 2011 - January 9, 2012**. Please forward this information on to any other students who may be interested! You can find additional details on the course website and the ITEC website.

COURSE WEBSITE: <https://sites.google.com/site/tropicaethnobotany/>

ITEC WEBSITE: <http://www.itec-edu.org/info.html>

COURSE DESCRIPTION: This 3 week course will emphasize tropical ethnobotany in the context of rainforest and island ecosystems. The material covered is equivalent to an upper level university course in ethnobotany. Readings and lectures will focus on the plant use and traditional cultures of Panama and the surrounding regions of Central and South America and the Caribbean, as well as innovative methodologies and current theory in the discipline. Much of the course will be spent learning field techniques and carrying out various class activities and exercises in the surrounding rainforest and local communities.

The course will include demonstrations by local healers, artisans and other specialists who utilize plants. Students will each complete a course research project, based on their individual interests, in local ethnobotany and ethnoecology. The field work for these projects will be carried out with a small group of other students, with each student having their own focus.

COURSE LOCATION: Institute for Tropical Ecology and Conservation (ITEC), Bocas del Toro Biological Station, Boca del Drago, Isla Colon, Republic of Panama. The biological station is located on a beach facing the Caribbean Sea. Coral reef and seagrass ecosystems lie out in front of the station and lowland tropical rainforests lie directly behind. This juxtaposition of the two most biologically diverse ecosystems provides tremendous opportunities for education and research. Panama's rich cultural diversity includes the Ng=Fbe and Teribe indigenous peoples of the Bocas del Toro region, the indigenous Kuna of the San Blas Islands, Afro-Caribbeans, Mestizos, and many other ethnic and cultural groups.

See <http://www.itec-edu.org/index.html> for more details and photos of the biological station and Isla Colon.

INSTRUCTOR: Jillian De Gezelle, PhD Candidate and Lecturer, The New York Botanical Garden & The City University of New York.

Email: Jdegezelle@nybg.org



MAJOR INVASIVE ALIEN PLANTS OF NATURAL HABITATS IN CANADA

Paul M. Catling and Gisèle Mitrow

2. Scotch broom or Common Broom, genêt à balais

Cytisus scoparius (L.) Link

Synonyms include: *Genista scoparius*, *Sarothamnus scoparius*, *Spartium scoparium*, *Sarothamnus bourgaei*, *Sarothamnus oxyphyllus*, *Sarothamnus vulgaris*.

The common name is derived from the use of the plant to make brooms. “*Cytisus*” is said to be derived from the Greek “kutisos” which refers to shrubby cover. The specific epithet “*scoparius*” is Latin for broom. Although we prefer “Scot’s Broom”, Scotch Broom is much more widely used.

Identification and Classification

There is actually little to confuse with Scotch Broom (Figure 1) where it grows in Canada. In British Columbia the invasive alien shrub, Gorse (*Ulex europaeus*, no.34) is of similar stature and also has yellow flowers, but it is spiny (Figure 2) and has a grey colour, unlike Scotch Broom which is without spines and is a bright green and yellow. The Golden Chain Tree (*Laburnum anagyroides*), a much less frequent escape from cultivation in south western B.C., has flowers in a drooping elongated cluster (a raceme), and it is a tree.

Several other species of *Cytisus* and its close relatives that are cultivated in Canada, rarely escape and are not yet well established. *Cytisus multiflorus* with relatively small (10 mm long), white flowers and hairy pods has escaped at

a few sites in the Victoria area and is also known in adjacent Washington. *Cytisus striatus*, Portugese Broom, from Spain and Portugal is locally abundant in California and western Oregon but has not been reported for Canada. It has pale yellow blossoms, hairs on the floral bracts and the inflated pods are silvery as a result of a dense covering of erect white hairs.

Genista monspessulana (*Teline monspessulanus*), French Broom, with relatively short pedicels 1-3 mm, light yellow flowers, pods covered with silky hair and somewhat evergreen leafy stems, is reported as an occasional escape in southern British Columbia. *Spartium junceum* L., Spanish Broom, with the calyx distinctively split to the base, has smooth waxy cylindrical branches and the elongated leaves are large and persistent. It is known from the Puget Sound area of adjacent Washington.

Cytisus scoparius subsp. *scoparius* var. *andreaeanus* with dark crimson to purplish-red wing petals (Figure 3) and subsp. *scoparius* forma *alba* with white flowers have both rarely escaped. *Cytisus scoparius* subsp. *maritimus* occurs on the maritime cliffs on the coasts of north western Europe and its status in North America is unclear.



Figure 2. Gorse (*Ulex europaeus*). a, branch with flowers above and thorns below. b, detail of the thorns which distinguishes it from Scotch Broom. Photo by P.M. Catling,



Figure 1. a, flowers of Scotch Broom. b, a landscape dominated by Scotch Broom. Previously the native white-flowered shrub, Puget Sound Saskatoon (*Amelanchier florida* var. *humptulipensis*) in the foreground, and other native species would have been dominant here. Photo by P.M. Catling, Victoria, British Columbia, 26 April 2010.

An Arsenal of Biological Features

A worldwide problem, Scotch Broom has an arsenal of biological features that have contributed to its success. They are very fast growth, ability to resprout from cut stems, prolific seed production, multi-faceted seed dispersal, nitrogen fixation by roots, stem photosynthesis, poisonous alkaloids, drought tolerance and longevity of seeds in the soil. The plant is damaging to biodiversity, agriculture, forestry, health and general economy. It was ranked as number 13 in the "Prioritized list of invasive alien plants of natural habitats of Canada" in 2005, but it may now to deserve a higher priority.

Key to escaped (and expected) species of *Cytisus* in Canada

- 1a. Flowers yellow, branches cylindrical; calyx split to the base ***Spartium junceum***
- 1b. Flowers yellow or not; branches angled; calyx not split to the base **2**
- 2a. Pods with hair all over **3**
- 2b. Pods with hair on the margins, otherwise smooth..... **5**
- 3a. Hair covering pods densely silky... ***Teline*** (also *Cytisus* or *Genista*) *monspessulana*
- 3b. Hair covering pods stiff and erect..... **4**
- 4a. Angles of stem T-shape in traverse section: corolla white ***Cytisus multiflorus***
- 4b. Angles of stem not T-shape: corolla yellow, sometimes pale..... ***Cytisus striatus***
- 5a. Branches procumbent, leaves and young twigs densely hairy subsp. ***maritimus***
- 5b. Branches erect, leaves and young twigs more or less glabrous subsp. ***scoparius***... **6**
- 6a. Flowers white..... subsp. ***scoparius*** forma ***alba***
- 6b. Flowers mostly yellow..... subsp. ***scoparius***..... **7**
- 7a. Wing petals purplish subsp. ***scoparius*** var. ***andreaeanus***
- 7b. Wing petals yellow subsp. ***scoparius*** var. ***scoparius***

Classification of many of the introduced brooms is poorly understood. Texts differ in diagnostic key characters and refer to some taxa as "extremely variable". The group requires taxonomic clarification in the native region before the North American introductions can be authoritatively identified. In California for example it is suspected that many plants identified as French broom may be hybrids of *Genista canariensis* and *Genista stenopetala*.

Canadian garden centers in British Columbia often do not know what they are offering for sale and list the cultivars under different species and hybrids. Some of the species sold are listed only by their cultivar names. Of 8 Vancouver and Victoria garden centers in British Columbia, 5 advertised both *Cytisus scoparius* and *C. X praecox*, 2 advertised *Cytisus* (*Argyrocytisus*) *battandieri*, and one nursery advertised *Cytisus nigricans* and *C. purgans*.

The Natural Resources of Canada plant hardiness zone project (Canada's Plant Hardiness Site - Going Beyond the Zones)
http://planthardiness.gc.ca/plant_chklist.pl?speciesid=10003

[98&lang=en](#), lists several taxa of *Cytisus* and relatives grown in Canada with a useful list of synonyms
C. X bearii (*C. ardoini* X *C. purgans*), *C. X kewensis* (*C. ardoini* X *C. multiflorus*), *C. procumbens*, *C. X praecox* (*C. multiflorus* X *purgans*), *C. decumbens*, *C. scoparius*, *Chamaecytisus hirsutus*, *Genista sagittatis* and *Argyrocytisus battandieri*. Of the 9 brooms on this list only *C. scoparius* has been known to escape at the present time.



Figure 3. Red-winged Scotch Broom (*Cytisus scoparius* var. *andreaeanus*) has rarely escaped. Photo by P.M. Catling, Victoria, British Columbia, 26 April 2010

Description (see Figures 4 and 5).

This deciduous shrub reaching 3 to 4 m tall is a perennial in the family Fabaceae (Leguminosae). It grows deep branching roots with nitrogen fixing bacteria. **Branches** are erect, ascending or procumbent, green, usually leafy, 5-angled, and smooth or sericeous when young. **Leaves** are alternate, stalked and compound with 3 leaflets on lower and older branches. On the upper branches they are often unstalked and simple, and pressed close to the stems. The leaflets are egg-shaped to oblong, pointed at the tip, hairy when young but soon smooth, 6-20 X 1.5-9 mm long, elliptic-oblong to obovate and stipules are lacking. **Inflorescences** are axillary with a solitary or sometimes 2 or 3 pea-like flowers. The pedicels are twice as long as calyx. **Flowers** are usually golden-yellow, sometimes with red, or pure white, 1-2.5 cm long, 2-lipped, the upper lip 2-toothed, the lower 3-toothed. The calyces are hairless and ½ the length of the corollas. styles are coiled and longer than the keel. **Fruits** are pods and are black when mature, flattened, 2.5-4 cm long, glabrous except along the hairy margins; mature pods split open and spiral as they dry, ejecting the 5 to 12 seeds which are 3-4 mm long. It has been suggested that the seeds from invasive populations may be larger than those from the native regions due to release from herbivory and increased seedling competition



Figure 4. Scotch Broom. a, flowering branch; b, frontal view of flowers; c, frontal view of flowers; d, branch with flowers in lateral view; e, flower from side and behind; f, leaf; g, branch showing erect branches; h, detail of branches showing branch angles; i, j, green immature and black mature pods with hair confined to the edges. Photos by Ben Legler, taken in Washington and Oregon.

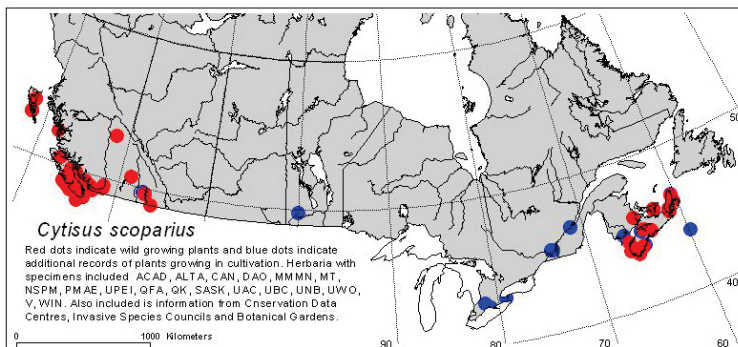


Figure 5. Scotch Broom plate from Koehler's "Medicinal Plants" (1837).

Distribution and History

The native range includes western, southern and central Europe northwards to southern Sweden and eastwards to the west central Ukraine. It is introduced around the world and occurs in southeastern and southwestern Canada (Figure 6). It is also naturalized in Australia, New Zealand, 27 states in the U.S.A. (including Alaska), the Chatham Islands, Hawaii, South America (Argentina, Bolivia and Chile), South Africa, Madagascar, India, the Canary Islands and Madeira. It is a problem in all of these areas and is one of the few invasive aliens in Canada that is considered a problem in parts of its native range.

The earliest introduction of Scotch Broom in North America was probably by the early west coast settlers since it was used in fresh cut bundles to package cases of imported whisky for gold camps along the Pacific Coast from California to British Columbia. As the packing material was discarded the seeds were likely spread throughout the coastal region. It was also used as a general packing material and was undoubtedly present in ship ballast. By the 1850s it was being used on both coasts of North America as



an ornamental and to control erosion and stabilize soil along roads. On account these uses the plant was popular until the 1950s. For example, it was deliberately and extensively planted by the British Columbia Ministry of Highways. The earliest collection in any Canadian herbarium is one collected by legendary John Macoun on Vancouver Island in 1875. It was likely not cultivated. The earliest non-cultivated collection on the east coast was from Nova Scotia in 1921. It has been cultivated in at a number of locations in Ontario beginning in 1913, but has not escaped in that province (Figure 6).

The Province of British Columbia has an online Oracle application that houses invasive plants records. This is used by regional districts, municipalities, public utilities, weed committees and other organizations involved in invasive plant management. The database, called the Invasive Alien Plant Program (IAPP) is connected to an online mapping application (IAPP Map Display). Spatial data is refreshed every 24 hours to ensure that it is up-to-date with the IAPP database. Scotch Broom records can be viewed at http://webmaps.gov.bc.ca/imf5/imf.jsp?site=mofo_iapp. There are 7900 locations where Scotch Broom has been surveyed at least once. It is possible to produce a high resolution and detailed map showing the distribution of Scotch Broom on a biogeoclimatic background. This may be some the best mapping of invasive species that is readily available in Canada (see also GBIF mapping of *Phragmites australis* subsp. *australis*, number 1 of this series).

Ecology

The flowers are produced from April to June or early July and pods mature in June and July. Scotch Broom is pollinated by larger bees (*Bombus*, *Apis*, *Osmia*, *Megachile*). When a bee lands on a flower that has not yet been visited, the stamens and style are released from the keel and spring upward. Five of the stamens are shorter and they dust the bee with pollen on the underside. The other five (or four) stamens are longer coming in contact with the upper side of the insect and depositing pollen there (Figure 7). The long style also contacts the bee on the upper surface and collects pollen already on the bees back from a flower previously visited.

The effect of introduced Honeybees on seed production of Scotch Broom, which is pollinator-limited, remains to be explored in Canada. The attention to Broom by native bumblebee pollinators may reduce pollination success of native Canadian flora, but this also remains to be investigated.

The seeds (Figure 8) are hard-coated and dispersed by water, with mud on vehicles or in tire treads, and by animals.

Figure 6. Distribution of Scotch Broom in Canada. The red dots are naturalized occurrences. Blue dots are cultivated plants. Derived from the DAO Invasive Alien Database Project.



Figure 7. A flower already visited by a bee and "tripped." The five reddish short stamens are to the left. Four yellow long stamens are to the right. The hairy style is curled between. Photos by Ben Legler, taken at in Washington.



Figure 8. Seeds of Scotch Broom. Photo by Steve Hurst. USDA-NRCS plants database.

Seeds in gravel may be moved along roads by graders and construction equipment. Ants, attracted by the oily seed appendage, are important dispersal agents over short distances. Birds and mammals may also be attracted to the oil and/or the seed contents and would disperse seeds over much greater distances. Seeds are also said to be able to be ejected up to 7 m by curling of a dried pod. This "ballistic" dispersal mechanism is a result of the pod producing a tension in each half as it dries and then the two sides splitting rapidly in different directions with an audible "snap." Plants are still sold and distributed by garden centres.

Seedlings can reach 2 m in 3 years, with a stem diameter of over 2 cm, and are bearing fruits by that time. A mature shrub can produce 2000-3500 pods each with 5-8 (10) seeds. Thus a mature shrub can produce approximately 28,000 seeds. Seeds have been reported to remain viable for 30 years, and even up to 80 years under ideal storage conditions. Although individual plants may survive only for 10-15 years (sometimes 20), old plants can be rapidly replaced by new one from the huge seed bank. Stands can thus be maintained much longer than the life of an individual plant.

Scotch broom has a very broad niche in Canada, being able to grow in a variety of conditions of soil moisture, pH (4.5-

7.5) and light. It is particularly likely to establish in open, periodically dry sites, especially in areas where forest has been recently cut, or where the substrate has been disturbed along new roads. With nitrogen fixation capability, it does well in low nutrient soils where there is less competition. Habitats include forest glades, open headlands, rocky slopes, semi-open forest, pastures, harvested timberlands, roadsides, riverbanks and vacant lots. The distribution of Scotch Broom in Canada suggests that it thrives in cool mesothermal climates with dry summers and cool, wet winters, but it can grow in areas of more extreme climates. Although its distribution in Canada may be climate limited, studies have suggested that it has not yet expanded to its full potential range under present conditions.

Like Lodgepole Pines, which have seeds with germination promoted by fire, so do the seeds of Scotch Broom in the soil seed bank. Their early growth following fire is so rapid that fires can make it easier for Scotch Broom to overwhelm other plants. The combustible dead material and flammable oil produced by Broom also promotes fire.

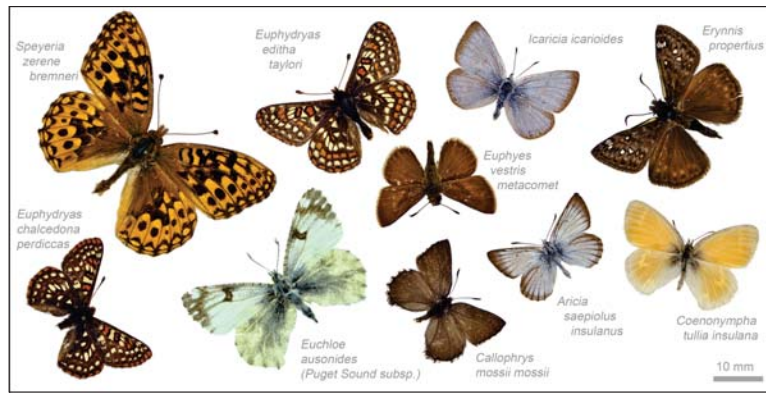
Damage

Biodiversity:

1. Broom crowds out native plants. The Garry Oak ecosystem (Figures 9 and 15) is one of the most severely threatened ecosystems in Canada. Although up to 10% remains as scattered remnants, those remnants are threatened by overgrowth of Scotch Broom which displaces and eliminates the native flora with a negative rippling effect throughout the ecosystem. More than 100 Garry Oak associated plants and animal species have been placed on the British Columbia's Species at Risk List including more than 75 plants (Figures 10 and 11), 2 reptiles, 14 birds, 3 mammals and 10-13 butterflies (see text box on the next page).
2. Broom changes soil chemistry at least through nitrogen fixation, resulting in a high nutrient soil environment to which native species are not well adapted. Recent studies have suggested that changes in nutrient pathways, increased organic matter and decrease in soil phosphorous are also major effects.
3. Broom develops dense thickets that shelter feral and pest animals.
4. Broom reduces food for native wildlife as a result of dominance and loss of native plant diversity. The plant is slightly toxic and unpalatable to many wildlife species.



Figure 9. The extent of the Garry Oak ecosystem in Canada as it was at the time of early settlement (approx. 1850).



Butterflies Swept Away by Scotch Broom

Sixty-four different kinds of butterflies once flourished on southern Vancouver Island, but in 1994 two butterfly biologists evaluated their status. They found that some were gone and others were seriously at risk. A number of factors were involved in the decline: urban development, over grazing, fire suppression and yes introduction of invasive plants. The article reads **“Of all the alien plant species that have been introduced to this region, the most detrimental for butterflies has been an invasive, yellow-flowered shrub called Scotch Broom.** The shrub crowds outs the native food plants that the butterflies depend on. Under **“what can we do?”** the text reads **“Control of Scotch broom in natural or rehabilitated habitats is essential”**. This well written and informative article is available on line www.env.gov.bc.ca/wld/documents/butterflies.pdf



Figure 10. Golden Paintbrush (*Castilleja levisecta*) is one of many native plants that are endangered in Canada with Scotch broom being one of the primary threats. This plant is also endangered in Washington and Oregon. It is only found in the Puget Sound region (one of a number of Puget Sound endemics). Photo with *Aquilegia formosa* on San Juan Island by Ted Thomas, United States Fish and Wildlife Service.

Agriculture:

5. Infestations make rangelands worthless and ultimately it threatens food security. In California a half million ha of rangeland have been infested resulting in loss of forage and leading to reports of livestock illness due to ingestion of toxic alkaloids. Scotch Broom overruns pastures eliminating valuable forage plants. Fields cannot be tilled. It causes livestock to trip. The costs of control are substantial.

Forestry:

6. Broom outcompetes young trees preventing both development of tree plantations and forest regrowth. It becomes established in young Douglas Fir plantations and quickly occupies up to 90% of the canopy and intercepts up to 70% of the light as well as competing with roots. It costs the state of Oregon 47 million dollars each year due to impact on timber production. Although mulch and landscape fabric around planted conifers may reduce Broom infestations to an acceptable level, this is costly for forestry operations.



Figure 11. Puget Sound Saskatoon (*Amelanchier florida* var. *humptulipensis*) is being overwhelmed by Scotch Broom. It is a very restricted relative of the rapidly growing Canadian crop. It is also one of a number of plants representing important Canadian germplasm for crop development that is declining due to Scotch Broom. Photo by P.M. Catling,

Health:

7. Many people are allergic to Scotch Broom. This reaction is probably most often a result of the pollen (Figure 12) being carried in the air by strong winds. Although the plants are adapted for pollination by insects, when there are millions of flowers in a few acres and billions on a landscape, it would not be surprising to find a lot of pollen in the air. Human reactions include headaches, breathing difficulties and burning eyes for a period of 2 months while the plants are in bloom.

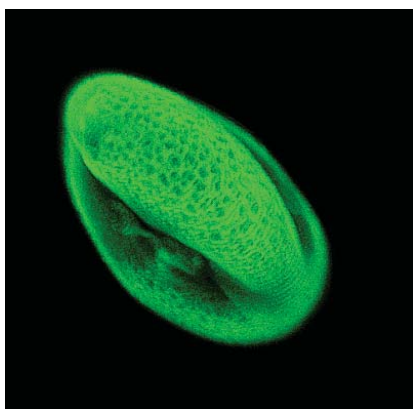


Figure 12. Pollen of Scotch Broom does not look especially irritating, but it has been implicated in extensive suffering for the two month period of heavy bloom. Photo by G. Mitrow from AAFC-DAO Pollen Collection.

8. Scotch Broom is poisonous to people and has been listed as an unsafe herb by the United States Food and Drug Administration.

Economy:

9. Broom blocks trails (Figure 13) and paths increasing trail maintenance costs.

10. Broom requires high costs to maintain roadside visibility

11. Broom increases the incidence of high heat fires because of accumulated dead material and high oil content. It is generally regarded as a fire hazard



Figure 13. A trail, formerly through an open area, is closed by Scotch Broom. Photo by P.M. Catling, Victoria, British Columbia, 26 April 2010.

Beneficial Aspects

1. Broom is a previously popular ornamental and is still for sale, but it has lost popularity due to environmental damage and as a result of being a cause of human discomfort.

2. Previously used to prevent erosion and stabilize highway verges, but now other methods are available and highway verges are known to be important opportunities to manage biodiversity.

3. In some places Broom has been used as a nursery cover for shade tolerant trees.

4. Other past uses such as manufacture of brooms, to make fences, use as packing material, use in brewing beer, roasting seeds to make coffee, medicinal use as a diuretic and cathartic, tanning leather, use of fibre for clothing, etc, are no longer important.

5. In some cases the flowers are an important source of pollen for beekeeping.

Management

In general, management may involve cutting, pulling, mowing, herbicide applications and biological methods, or some combination of these. All methods have advantages and disadvantages, and different methods often have to be applied to different sites. Early detection and elimination in new areas could result in huge savings and maintenance of existing control programs in areas of infestation is important. If a control effort is halted, even for a short period, much can be lost, damage may become irreversible and costs will definitely increase.

Chemical Methods: A large variety of herbicides have been applied with various application rates and results. There are number of articles on these methods and the extent of control. Although helpful in some situations, disadvantages include effects of poisons on other species, escape of the seed bank, costs, and temporary nature of the control.

Manual and Mechanical Methods: Pulling plants out of soil (uprooting), sometimes with the help of a weed wrench, works well in some situations. The difficulty with pulling is that it is labour intensive and creates disturbed soil conditions which facilitate development of Scotch Broom seedlings.

One study suggested that as much as 50% of young plants cut back will resprout, but another suggested a much lower percentage and found that much of the resprouting died within a year. Cutting should be done before Broom seed pods mature so as to limit seed development and dispersal. Cutting in July and August during periods of drought stress has proven particularly effective.

A study in Victoria found that trampling of native plants was greater where Broom had been pulled rather than cut. Pulling was more likely to impact invasives if done in July and more likely to affect native species if done in May.

These are the least expensive methods and minimum costs are \$ 100 per acre with chainsaws (10 person crew at \$ 250 per hour) and follow-up \$ 180 per acre weed eating that does not damage native plants. Damage to native vegetation is less after their seed dispersal.

Fire Control: Although fire was a natural process in the Garry Oak ecosystem, it benefits Scotch Broom so cannot be used for control in many situations. One of the best sources for fire control information is Zouhar (2005) from

which the following quote was taken. "The most effective removal treatment of Scotch broom on the El Dorado Forest in the Sierra Nevada foothills was cutting shrubs in September and October, allowing cut shrubs to dry on site, and then burning dried shrubs in late May and early June. This killed sprouts and most of the seed within the top 1 inch (2.5 cm) of soil. Seeds within 1.6 inches (2 cm) of the soil surface were scarified by heat, germinated within 2 weeks, and died during the summer drought period. This reduced the amount of seed in the soil by 97%, and although some seed remained below 2 inches (5 cm) in ant nests, the reduction in the seed bank decreased the need for chemical or hand removal of new seedlings in succeeding years."

Biological Methods: These methods, with lasting benefits and coupled with other techniques, are the most attractive to many biologists. They have been employed against Broom with variable results in many countries to date, but they may still not have realized their full potential, and in some places it is too early to fully assess the benefits. After introduction into a region, it may take at least 5-7 years for biocontrol agents to become effective. It has been estimated that a biocontrol agent would have to reduce Broom seed production by 70-99% to suppress invasion.

Biological control in North America began in 1960. Currently four biocontrol agents are established in California, Oregon and Washington: the Scotch Broom Bruchid (*Bruchidius villosus*), the Scotch Broom Seed Weevil (*Apion fuscirostre*), a Twig Miner (*Leucoptera spartifoliella*) and the accidentally introduced Broom Tip Moth (*Agonopterix nervosa*). A number of native insects also feed on the shrubs in California but damage has not been severe enough to control large scale infestations. However, in local areas of both California and Oregon, the biocontrol agents have reduced seed production by 60-85 %. In parts of Washington after 36 years, there has been up to 96% reduction in seed production. The impact of these biocontrol agents in BC is not clear. In 2010 a leafhopper (*Euscelis ohausi*) associated with Broom was found on the west coast including British Columbia. The Scotch Broom Bruchid (Figure 14a.) was first noticed in southwestern Nova Scotia in 2003 and the European Broom Psyllid (*Arytaina genistae*) was first noticed in the same region in 2004.

In Australia three biocontrol agents have been introduced including the broom twig-mining moth, the broom psyllid and broom seed beetle. In New Zealand the same three have been introduced as well as a gall mite Broom Psyllid, the Broom Leaf Beetle (*Gonioctena olivacea*) and the Broom Shoot Moth (*Agonopterix assimilella*, Figure 14b). Additionally the Broom Miner was introduced accidentally. As in North America, local success has been reported.

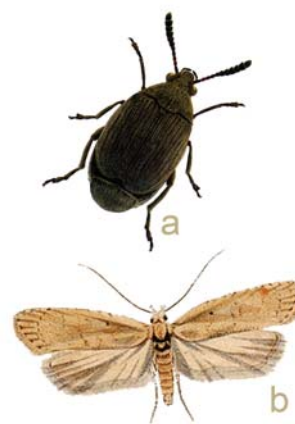


Figure 14. Two biocontrol agents of Scotch Broom a, Broom seed beetle (*Bruchidius villosus*). Photo from Udo Schmidt, Kafer der Welt, Selbitz, Germany. b, Broom shoot moth (*Agonopterix assimilella*). From Stainton 1861 in Watson, L., and M.J. Dallwitz. 2003 onwards. British insects: the families of Lepidoptera. Version: 16 July 2011.

Devil's Twine (*Cassutha pubescens*) is a common twining plant of the Laurel family, in southern and eastern Australia. Almost leafless, It is a partially parasitic on native legumes, but it has been found to have greater impact on introduced Scotch Broom than on the native species that are adapted to it. It has been recommended for exploitation as a control method for Broom. So far it has been found to reduce flowering by 50% and together with the Scotch Broom Bruchid, seed production can be reduced by 62%.

Although sheep did not eat Scotch Broom in a Canadian experiment, La Manchia Goats proved effective in a small plot on Vancouver Island. Some kinds of goats prefer woody vegetation over grasses and forbs. Angora Goats have proven effective in parts of California. The main problem with these animals is that, unlike the insects, they are not host specific.

The fungal bioherbicide *Fusarium tumidum* has proven effective on Scotch Broom in a Canadian study. Another fungal pathogen, *Selenophoma juncea*, has also been observed to cause extensive mortality

Prospects

Scotch Broom is likely to spread further north and become even more common in infested areas. It may become abundant in Waterton Lakes National Park threatening the

The Bradley Method of Control

The Bradley method, based on ecological principles, was specially designed for removal of Scotch Broom (and some other invasives) from nature reserves. The strategy is based on a gradual tipping of the ecological balance to the native plants. It is often a mistake to begin by clearing weeds out of the most heavily infested areas, since they will come right back. Instead, using hand weeding, work a little at a time from the strongholds of native vegetation. The natives will be favoured and their natural regenerative power will prevail over the weeds. After establishing native plant dominance in a few areas, work towards the stands with increasingly severe infestation. As the native population stabilizes in each cleared area, work deeper into the center of the most dense weed patches. The method has great promise on nature reserves with low budgets and with sensitive plant populations. See Fuller and Barbe

the remarkable biodiversity of that region. It may take over rocky coastal barrens and hilltops in the Maritime region and even Newfoundland (where current climate is suitable). A negative impact on blueberry cultivation in the Maritimes is a possibility. Application of climate change models has suggested potential occurrence throughout the Maritimes, in central British Columbia, in the foothills of Alberta, in southern Quebec and in southern, as well as parts of northern Ontario. Eventually natural enemies and biocontrol agents introduced in the US are likely to lead to some level of control in Canada. Scotch Broom may then decline, but when and if this will occur cannot be predicted with accuracy. In the interim it will be important to increase monitoring and management programs (Figure 15) and related research. This is an old suggestion that appears in reports a few decades ago, but it has become more important as economy is increasingly challenged with the cost of Broom control.

Believe it or not

- It is said that in 1849, a homesick Scotsman planted 12 Scotch broom plants around his home near Sooke, British Columbia. The three that survived led to the destruction of an ecosystem.
- Another explanation of its origin in British Columbia refers to the explorer Captain Walter Grant who in 1850 obtained seeds from the Sandwich Islands (Hawaii) and brought them to Vancouver Island to reduce erosion along roads. Again three plants were introduced in Sooke which led to the billions now growing on much of southern Vancouver Island.
- In Europe a few hundred different plant species have been used to make brooms. The most widespread brooms with a brush made of plant material are made from the panicles of the grass *Sorghum bicolor*.
- If a broom made of *Cytisus scoparius* was left outside a door it would prevent witches from entering since a witch had to count stems in the broom and since it was easy to make mistakes, this occupied her for so long that she eventually had to return home completely confused
- Broom Busters is an active group of local residents dedicated to clearing Scotch Broom from parts of southern Vancouver Island.

References

Among the references listed below, the annotated bibliography on the ecology and management by Judith Cullington & associates (2002), Peterson and Prasad's



Figure 15. Volunteers remove Scotch broom and other weeds in Garry Oak meadow in Victoria, B.C. Historic Elkhington House is in the background. Photo provided by the Nature Conservancy of Canada.

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Mite Help

In a very recent New Zealand study, it was found that the seed-feeding biocontrol agent, *Bruchidius villosus*, was not likely to be able to suppress Broom populations by itself. However, the invasive mite, *Varroa destructor*, which has caused Honeybee decline, may cause pollinator limitation. A population model suggested that together the biocontrol agent and the mite may cause extirpation of Broom. The only difficulty was that commercial beehives treat for the mite infestations so that pollinator limitation may not be realized everywhere. The information may be used as part of an integrated Broom control plan.

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TOP CANADIAN ORNAMENTAL PLANTS. 1. OVERVIEW (PART 2)

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TOP ORNAMENTAL PLANTS OF CANADA

The following lists the species (or genera in some cases) that are considered in this review to be the “top ornamental plants of Canada”. Brief taxonomic and geographical notes for the species are given. Christmas trees and lawn grasses are excluded from this list, but are dealt with separately below. The chief criterion for inclusion is that the species are sufficiently important economically that Statistics Canada issues annual production figures specifically for them (these figures are reported below). Almost everyone has a personal favourite ornamental, usually considers it the most beautiful of plants, and may be offended by its not being included here. There are also many ornamental plants that are very widely grown, but do not appear in the present list. To reiterate, the criterion for inclusion is simply the availability of statistical data on annual sales. In most cases a given species is included because its reported value is for a particular category of use (indoor potted plant production, bedding plants, or cut flowers), although some species (notably chrysanthemums, tulips, and roses are valuable for more than one category. Production statistics are not available for cedar, crabapple, lilac, and peony, which have been included on the basis that they are obviously among the most commonly cultivated ornamental plants in Canada. Trees not grown for floral display (except for cedar) have not been included, as information on the value of particular species for ornamental purposes is unavailable (probably the main expenditures for trees is based on arboriculture when they are mature, not on sales of young planting stock). No attempt is made here to rank order the importance of the top ornamentals, since data are not sufficient for this purpose. Roses (cumulatively) are the most important ornamental plants of Canada (indeed the world) from the point of view of sales. However, there are almost certainly more plants of Kentucky bluegrass in Canada than any other ornamental (indeed, possibly more than any other plant species), and given the widespread acreage of lawns in Canada, it may be the most important ornamental plant species economically.

African violet – *Saintpaulia* species, especially *S. ionantha* H. Wendl. (*S. kewensis* C.B. Clarke). [Native to East tropical Africa.]

Alstroemeria – *Alstroemeria* species and hybrids. Also known as Peruvian lily. [Native to South America.]

Argyranthemum – *Argyranthemum frutescens* (L.) Sch. Bip. (*Chrysanthemum frutescens* L.). Also known as marguerite. [Native to Canary Islands.]

Azalea – Potted plants for indoor display are *Rhododendron* hybrids, especially of *R. indicum* (L.)

Sweet, *R. mucronatum* (Blume) G. Don, and *R. simsii* Planch. [Potted plant cultivars are derived from Asian species.]

Begonia – *Begonia* species and hybrids, particularly *B. semperflorens-cultorum* hort.² (which includes many of the cultivars known as fibrous-rooted begonia and wax begonia) and *B. tuberhybrida* Voss (which includes many cultivars known as tuberous begonias). [Native to tropical and subtropical regions, especially in the Americas.]

Cedar – *Thuja occidentalis* L. Eastern white cedar is extensively employed for hedges. [Native to North America.]

Crabapple – *Malus* species and hybrids, especially involving *M. baccata* (L.) Borkh. [Ornamental crabapples have been derived from both Eurasian and North American species.]

Chrysanthemum – *Chrysanthemum*. The florist's chrysanthemum widely used as a potted plant is *Chrysanthemum morifolium* Ramat. (*C. morifolium* (Ramat.) Hemsl., *Dendranthema grandiflorum* Kitam.). [The florist's chrysanthemum is known only in cultivation, but probably was selected in China from *C. indicum* L.]

Cyclamen – *Cyclamen persicum* Mill., the florist's cyclamen, is widely grown for sale in pots for indoor display. [The florist's cyclamen is native to Eurasia and North Africa.]

Daffodil – *Narcissus* species and hybrids. [The 50 or so species are native to Eurasia and North Africa.]

Freesia – The florist's freesia is made up of several complex hybrids involving *Freesia alba* (G.L. Mey.) Gumbel., *F. corymbosa* (Burm. f.) N.E. Br., *F. refracta* (Jacq.) Klatt, and *F. leichtlinii* Klatt. These were collectively labelled *F. hybrida* by L.H. Bailey. [All of these species are native to South Africa.]

Geranium – *Pelargonium* species, especially *P. hortorum* L.H. Bailey, known as fish geranium and zonal geranium. The common name “geranium” is easily confused with the genus name *Geranium*, of which many species are also cultivated. [Fish geranium is known only in cultivation. Most geranium species are native to South Africa, a few are from tropical Africa, Australia, and the Middle East.]

Gerbera – Cultivars marketed in pots are mostly *Gerbera hybrida* hort. (*G. jamesonii* Bolus ex Hook. f. *G. viridifolia* (DC.) Schz. Bip.). [Gerbera species are from Africa and Asia; those mentioned here are from Africa.]

Hosta – *Hosta* is a genus of about 40 species, most of which are grown, with over 1,000 cultivars recognized. [The species are native to Japan, China, and Korea.]

Impatiens – *Impatiens* is a huge genus of over 800 species, but few are cultivated. The principal cultivated species are *I. walleriana* Hook. f., *I. balsamina* L., and *I. hawkeri* W. Bull (“New Guinea impatiens”) [*Impatiens walleriana* is from Africa, *I. balsamina* is from India and Myanmar, and *I. hawkeri* is from Papua New Guinea and the Solomon Islands.]

Iris – There are about 200 species of *Iris*. Dozens of these and numerous hybrids are cultivated. So-called “Dutch Irises” are the primary cut-flower irises, and are hybrids of *I. xiphium* L. and other species, particularly *I. filifolia* Boiss. and *I. tingitana* Boiss. & Reut. [Iris species are native to the northern hemisphere. *Iris xiphium* and *I. filifolia* are native to Europe and North Africa, and *I. tingitana* is native to North Africa.]

Kalanchoe – *Kalanchoe* species. *Kalanchoe blosfeldiana* Poelln. (*K. globulifera* var. *coccinea* Perr.) is especially used as a potted plant. [Most of the over 100 species are native to Madagascar and tropical Africa; *K. blosfeldiana* is native to Madagascar.]

Lilac – *Syringa* species, especially *S. vulgaris* L. [Lilac species

²“hort.” (with a lower case h), based on the Latin *hortulanorum* (“of gardeners”), is the conventional unofficial way of designating a widely used name of horticultural origin, but not traceable to an author; this is often given as “Hort.”, which could lead to confusion with F.J.A. Hort or several other botanists (Horton, etc.)

are native to Eurasia.]

Lily – Unqualified, “lily” refers to *Lilium*, but numerous genera also have lily in their names. Dozen of species and hybrids of *Lilium* are cultivated. The very popular “Easter lily” is *L. longiflorum* Thunb. The “florist’s lily” is usually a hybrid with *L. longiflorum* as one of the parents. [The 100 or so species of *Lilium* are native to the temperate northern hemisphere. *Lilium longiflorum* is native to Japan, Korea, and Taiwan.]

Lisianthus – The florist’s “lisianthus” is not a species of the genus *Lisianthus*; it is usually *Eustoma exaltatum* (L.) Salisb. ex G. Don (*E. grandiflorum* (Raf.) Shinn., *E. russellianum* (Hook.) G. Don ex Sweet). [*Eustoma exaltatum* is native to the Americas.]

Orchids – Commercial orchids include species and hybrids of *Brassavola*, *Calanthe*, *Cattleya*, *Coelogyne*, *Cymbidium*, *Dendrobium*, *Epidendrum*, *Laelia*, *Lycaste*, *Miltonia*, *Odontoglossum*, *Oncidium*, *Paphiopedilum*, *Phalaenopsis*, and *Vanda*. The most popular potted orchid is *Phalaenopsis*. *Cattleya* (the corsage orchid) is also widely grown as a house plant. [Orchids are native to many areas of the world. *Phalaenopsis* is native to Asia and Australasia, and *Cattleya* to Central and South America.]

Peony – Herbaceous garden peonies are mostly derived from *Paeonia lactiflora* Pall., and the tree (shrubby) peonies from *P. suffruticosa* Andr. [Both species are native to Asia.]

Petunia – *Petunia hybrida* hort. ex E. Vilm. (a complex group of hybrids of garden origin; postulated parents include *P. axillaris* (Lam.) Britton et al. and *P. integrifolia* (Hook.) Schintz & Thell.) [All species of the genus *Petunia* are native to South America.]

Poinsettia – *Euphorbia pulcherrima* Willd. ex Klotzsch; [Poinsettia is native from Mexico to Guatemala.]

Primula – *Primula* species. *Primula malacoides* Franch. and *P. praenitans* Ker. Gawl. (*P. sinensis* Sabine ex Lindl., *P. chinensis* hort.) are especially grown in pots for indoor display. [*Primula malacoides* is native to China and Indo-China; *P. praenitans* is native to China.]

Rose – *Rosa* species and hybrids. The “florist’s rose” employed for cut flowers is a hybrid tea rose, i.e. a hybrid of certain *Rosa* species, selected for large, single-stemmed flowers. “Miniature roses” commonly grown in pots as houseplants are dwarf cultivars of several of the species grown as shrubs. [*Rosa* species are native to temperate and subtropical regions of the Northern Hemisphere.]

Snapdragon – *Antirrhinum* species, mostly the garden snapdragon, *A. majus* L. [*Antirrhinum majus* is native to North Africa and Eurasia.]

Tulip – Over 100 species of *Tulipa* have been recognized, but most are not cultivated or are grown as rock garden specimens. The widely grown tulips are complex hybrids; taller forms have been assigned in the past to *T. gesneriana* L., while some dwarf forms have been assigned to *T. suaveolens* Roth, two species which have been thought to be ancestors of modern tulips. Also, some tulips were bred as hybrids with other *Tulipa* species. The scientific name *T. gesneriana* is generally used for the majority of cultivated tulips. [*Tulipa gesneriana* is a native of Eurasia, *T. suaveolens* is native to southern Russia and the Middle East.]

THE IMPRESSIVE SIZE OF THE ORNAMENTAL PLANT INDUSTRY OF CANADA

The ornamental horticulture sector represents a significant part of Canadian agriculture. Based on 2007 data (the last

comprehensive analysis), ornamental horticulture gross farm receipts totalled more than 2 billion dollars. About 65% of this was contributed by floriculture (including potted plants grown in greenhouses and (non-seed) propagating material sold for establishing outdoor plantings, whether established in greenhouses or outdoors); the remainder was contributed by plant nurseries (28%), the sod industry (6%), and the Christmas tree industry (3%).

The above data indicate the size of the ornamentals production industry at the wholesale or farm gate stage. However, the economic spinoff is much greater. Consumers spend over \$6 billion annually at the retail level on ornamental horticultural products, and about \$2 billion on landscaping services. The average Canadian household spends about \$700.00 annually on ornamental products and services. In addition, the Canadian economy benefits from manufacturing of horticultural equipment, as well as from trade and distribution of ornamentals and associated materials. Based on accepted economic multipliers, it has been estimated that the total economic contribution of the ornamental horticultural sector to Canada is about \$15 billion annually. The ornamental sector contributes to national tax income in a way unlike any other part of agricultural production: ornamental production is subject to GST/PST (or HST) taxes at point of production, i.e. at the first point of transfer in the value chain, as well as when consumers purchase the materials. When all taxes are considered, the ornamentals industry contributes close to a billion dollars in tax revenues annually. The ornamentals industry has been estimated to be responsible for about 6% of agricultural income generation in Canada. Ornamental plants collectively constitute Canada’s third largest crop after wheat and canola.

The ornamental horticulture industry of Canada employs the equivalent of close to 150,000 full time employees. Canada has over 3,000 commercial greenhouses, covering 20 million square metres, employing over 40,000 people. Floriculture represents 55% of this trade (the rest is dedicated to greenhouse vegetables). Canada also has over 1,000 sod and nursery producers, employing about 15,000. There are also about 3,000 Christmas tree farms. Slightly more than half of nursery and floriculture production occurs in Ontario, about 25% in British Columbia, and about 13% in Quebec. There are over 9,000 retail outlets (including florists) in Canada that sell ornamental products.

STATISTICAL ANALYSIS OF CANADIAN ORNAMENTAL PLANT PRODUCTION

The most current report of ornamental plant production in Canada is Statistics Canada (2011), which provides detailed information for 2009 and 2010. These data are summarized in the following.

In 2010, Canadian greenhouses produced 238 million potted ornamental plants (worth about \$700 million), 310 million cut flowers (\$133 million), 454 million ornamental bedding plants (\$181 million), and 101 million cuttings (\$63 million). Canadian nurseries additionally produced a variety of materials for ornamental planting (including both herbaceous and woody species) worth about \$500 million (including fruit shrubs). More precise data are given in Table 1.

(Continued)

Table 1. Comparative Values of Sectors of the Canadian Ornamental Plant Industry (based on Statistics Canada 2011; data for sod and Christmas tree production are reported separately in the discussions of these industries, below; the categories are mutually exclusive)

A. Greenhouse Sales (excluding vegetables and tree seedlings)

Category	2009 \$ wholesale	2010 \$ wholesale
Potted plants	670,128,340	701,340,625
Cuttings (for vegetative propagation)	64,631,528	62,992,480
Cut flowers	132,592,120	132,641,255
Bedding plants	175,255,085	180,722,750

B. Outdoor-Grown Plant Sales (includes shrubs & trees grown for fruit)

	481,897,010	510,992,660
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Total annual dollar values for production of individual plant species do not seem to be available for Canada (as noted below, they are for the United States). Instead, numbers of plants, or pots, or (numbers of cut flowers) are reported in Canada, and these statistics indicate comparative importance of at least the more important species. This information is indicated in Tables 2, 3, and 4, and information on categories of plants produced in nurseries is summarized in Table 5 (in all cases, empty cells indicate data were collected but were “too unreliable to be published”).

Table 2. Numbers of Indoor Potted Plants Produced in Canada³

Species or category	2009	2010
African violet		
Azalea		
Chrysanthemum	6,942,835	9,783,100
Cyclamen	2,145,555	1,803,125
Gerbera	3,469,270	2,789,950
Kalanchoe	4,783,525	5,792,150
Lily	3,362,675	4,716,425
Orchids	6,252,305	
Poinsettia	7,685,425	7,294,250
Primula	1,005,803	1,220,945
Rose (miniature)		
Tulip	1,996,270	
Indoor hanging plants	786,450	895,280
Other indoor plants	38,808,595	26,045,840
Tropical foliage and green plants	9,850,600	8,503,975

³ As noted above, over 200 million potted plants are grown in greenhouses annually, so that the above table only reports data for most of the leading species, representing about a third of total production.



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Plate 3. Principal indoor potted plants ("houseplants") produced in Canada. Fig. 13. African violet, photo by Wildeuer, online at Wikipedia [authorized for use under the GNU Free Documentation License]. Fig. 14. *Chrysanthemum morifolium*. Photo by M. Ikeda, online at Wikimedia. Fig. 15. *Cymbidium* orchid. Photo by Marlith, online at Wikimedia. Fig. 16. Poinsettia. Photo by P. Kratchovil, publicdomainpictures.net. Fig. 17. Primrose. Photo by Y. Ray, publicdomainpictures.net. Fig. 18. Easter lily (*Lilium longiflorum*). Photo by M.H. Wade, online at Wikipedia [authorized for use under Creative Commons Attribution-Share Alike License].



Plate 4. More principal indoor potted plants ("houseplants") produced in Canada. Fig. 19. Florist's azalea. Photo by E. Small & B. Brookes. Fig. 20. Miniature rose. Photo by E. Small & B. Brookes. Fig. 21. Tulips. Photo by V. Kratchovil publicdomainpictures.net. Fig. 22. Gerbera. Photo by 4028mdk09, online at Wikimedia [authorized for use under Creative Commons Attribution-Share Alike License]. Fig. 23. Florist's cyclamen (*C. persicum*). Photo by Fanghon, online at Wikipedia [authorized for use under the GNU Free Documentation License]. Fig. 24. Kalanchoe (*K. blossfeldiana* 'Flaming Katy'). Photo by F. & K. Starr, starrimages@hear.org [authorized for use under Creative Commons Attribution-Share Alike License].



Plate 5. Top florist's cut flowers. Fig. 25, Chrysanthemum. Photo by L. Jacobs, publicdomainpictures.net. Fig. 26. Gerbera. Photo by Ziko, online at Wikimedia [licensed for use under the GNU Free Documentation License]. Fig. 27. Bouquet of tulips. Photo by V. Kratchovil, publicdomainpictures.net. Fig. 28. Bouquets of roses. Photo by V. Kratchovil, publicdomainpictures.net. Fig. 29. *Alstroemeria aurantiaca* D. Don. Photo by J.J. Harrison, online at Wikipedia [licensed for use under the GNU Free Documentation License]. Fig. 30. Lisianthus (*Eustoma exaltatum*). Source: Curtis's Botanical Magazine, Vol. 65, Plate 3626 (1838).



Plate 6. More top florist's cut flowers. Fig. 31. Lily (note the tiny white flowers of gypsophila at right). Photo by S. Apted, publicdomainpictures.net. Fig. 32. Daffodil. Photo by Glenn Franco Harris [commercial use prohibited]. Fig. 33. Freesia. Photo by Glenn Franco Harris [commercial use prohibited]. Fig. 34. Snapdragon. Photo by Plane 777, online at Wikipedia. Fig. 35. Iris. Photo by Penubag, online at Wikipedia.

Table 3. Numbers of Greenhouse-grown cut flowers Produced in Canada⁴

Species or category	2009 (number of stems)	2010 (number of stems)
Alstroemeria	19,503,535	15,616,710
Chrysanthemum	20,107,860	27,531,280
Daffodil	12,826,820	
Freesia		
Gerbera	60,938,940	69,028,645
Iris		
Lily	16,049,375	19,777,870
Lisianthus		
Rose	11,482,530	12,046,655
Snapdragon	16,480,635	
Tulip	91,685,255	96,670,305
Other cut flowers	25,109,950	22,735,605

⁴ As noted above, about 300 million cut flowers are grown in greenhouses annually, so that the above table only reports data for some of the leading species.



Plate 7. Principal outdoor potted (bedding) plants produced in Canada. Fig. 36. Geranium. Photo by R. Focker, online at Wikipedia. Fig. 37. Petunia. Photo by R. Paprstein, online at Wikipedia. Fig. 38. Argyanthemum. Photo by Stickpen, online at Wikipedia. Fig. 39. Chrysanthemum. Photo by D. Wagner, publicdomainpictures.net. Fig. 40. Hosta. Photo by P. Henjum, online at Wikimedia. Fig. 41. Patience (Impatiens). Photo by Glenn Franco Harris [commercial use prohibited].



Plate 8. More popular outdoor potted (bedding) plants produced in Canada. Fig. 42. Tulips. Photo by Marmstrong21, online at Wikipedia. Fig. 43. peony (*P. lactiflora*). Photo by V.M. Vicente Selvas, online at Wikipedia. Fig. 44. Wax (fibrous-rooted) begonia. Photo by A. Schmidt, publicdomainpictures.net. Fig. 45. Peony (*Paeonia suffruticosa*). Photo by Charvex, online at Wikipedia. Figs. 46 & 47. Tuberous begonia. Photos by E. Small.

Table 4. Numbers of Outdoor Potted Plants Produced in Canada

Species or category	2009 (number of pots)	2010 (number of pots)
Argyranthemum	474,665	607,585
Begonia	5,102,385	6,357,740
Chrysanthemum	3,989,860	4,420,390
Geranium	18,948,495	19,492,085
Hosta		
Impatiens	8,119,585	8,878,845
Petunia	8,823,430	
Herbaceous perennials	8,836,485	14,847,445
Outdoor hanging pots	10,369,810	11,758,515
Other outdoor pots	57,574,195	57,226,310

Table 5. Numbers of Outdoor-grown Plants Produced in Canadian Nurseries (excluding tree seedlings produced for reforestation and fruit bushes and trees).

Category	2009		2010	
	Field-grown	Container-grown	Field-grown	Container-grown
Coniferous trees	4,567,970	10,073,620	2,827,810	2,382,190
Shade or ornamental trees	1,000,000	1,349,260		
Coniferous evergreen shrubs	1,045,210	3,937,330	1,184,965	4,248,225
Evergreen broadleaf shrubs	543,685	3,568,815	235,000	3,188,240
Deciduous shrubs including roses	2,756,650	8,360,025	1,960,175	9,422,275
Vines	1,741,850	750,155		687,605
Perennials & annuals		14,599,100	2,860,355	12,738,040
Other trees & plants	603,015	634,000		

The above tables highlight the species grown in greenhouses for sale as potted plants and cut flowers, and also the herbaceous species that are most important as bedding plants, but do not identify the particular woody species grown outdoors as shrubs and trees, except to indicate that roses are the predominant category of woody plant sold. Other outdoor plants in Canada that deserve mention include cedar (*Thuja occidentalis*, the principal hedge plant of Canada), lilac (*Syringa* species, especially *S. vulgaris*), crabapples (*Malus* species and hybrids), and peony (*Paeonia suffruticosa* and *P. lactiflora*).



Fig. 12. A commercial greenhouse dedicated to production of flowering potted plants. Photo by J. Locke, online at Wikipedia.



Plate 9. Roses, the top-selling outdoor woody plants in Canada. Fig. 48. *Rosa* 'Dream Carpet'. Photo by B. Brookes. Fig. 49. *Rosa* 'David Austin'. Photo by B. Brookes. Fig. 50. Rose bush. Photo by D. Wagner, publicdomainpictures.net. Fig. 51. Climbing rose. Photo by P. Greb, Bugwood Image Database.



Plate 10. Top-selling flowering trees grown for floral display in Canada. Fig. 52. Crabapple. Photo by J. LaForest, Bugwood Image Database. Fig. 53. Lilac. Photo by D. Bianco, online at Wikipedia

INTERNATIONAL TRADE IN ORNAMENTALS

Table 6. Top Ten Ornamental Plants in International Trade⁵

Alstroemeria	Gerbera
Carnation	Gypsophila
Chrysanthemum	Lily
Cymbidium	Rose
Freesia	Tulip

⁵ As recognized recently by the Dutch floral industry. While most of these plants have long-term popularity, trade statistics are variable from year to year, and some plants are much more popular in some countries than in others. Other plants that are very important internationally include gladiolus, orchids (other than cymbidium), anthurium, and aster. For a somewhat different list, see "the top 20 commercial cut flowers of the world" (which includes four *Lilium* species), in Maree and van Wyk (2010), who point out "It is impossible to be completely accurate about the best-selling flowers. These are constantly changing because production can be affected by adverse or favourable weather conditions...and because market forces control which products are imported from where and in what quantities."

The ten top-selling ornamental plants in international trade (Table 6) are all also top sellers in Canada, except for gypsophila. (Dozens of species of *Gypsophila* are cultivated in rock gardens and borders, and for bouquets; however, the florist's gypsophila (baby's breath) of commerce is usually *G. elegans* Bieb. or *G. paniculata* L., both native to Eurasia.) This impressive widespread popularity of a small number of plant species reflects two facts: (1) To be successful commercially, ornamental plants must be both attractive to consumers and have features that facilitate their efficient growth by producers and sale by retailers; plants that meet these criteria are likely to be successful everywhere, provided that marketplace features are comparable. (2) In fact, markets for many products have become very similar among countries purchasing ornamental plants. Most international trade is to well-off First-World consumers who live in an amazingly homogenous marketplace with the same products offered almost everywhere (for example, note the near-universal presence of the major fast-food chains).

Greenhouse cultivation of ornamentals in Canada during the winter is very challenging, especially in view of increasing costs for energy. Unfortunately, many ornamental plants are not well suited to grow in the low light levels of the Canadian winter, even with the use of high pressure sodium light supplementation. Until fairly recently, export trade in ornamental plants was mainly from Developed Nations, particularly including Europe, Japan, and North America. In recent decades, much of the trade has shifted to Third World areas with climates with very long growing seasons and cheap labour costs, notably Ecuador, Ethiopia, Kenya, Columbia, and India, and to a lesser extent South Africa, and Malaysia. Israel also accounts for a large proportion of the floral trade. China is expected to become a major player (it is one of the world's largest producers of flowers, but currently exports very little). Columbia is the major exporter of cut flowers to North America. The U.S. is the main exporter of ornamentals to Canada, especially from California, Washington, Florida, Hawaii, Oregon, and New Jersey. Canada also receives plants from Columbia, Mexico, Ecuador, Costa Rica, the Netherlands, Italy, Belgium, Denmark, Germany, and Spain.

There is concern about the extensive use of pesticides in many Third World nations now producing ornamental plants for international trade. This is not only an issue of human

health and environmental health, but also represents unfair competition. Integrated Pest Management principles, including the use of biological control agents, are now widely established in the ornamental plant industry in Canada, partly because of more stringent regulations regarding pesticides, partly due to increasing pesticide resistance in some pests, and partly due to regulations regarding exports to the U.S. While biological control is desirable, this necessitates additional expenses for Canadian producers.

The wealthy once maintained "cutting gardens" of plants that were intended to provide regular displays of cut flowers for the interiors of mansions. Today, stunningly attractive cut flowers are available from most supermarkets as well as florists and other outlets, and are in considerable demand. The most important sector of the international ornamental plant trade is cut flowers, because they are lighter than potted plants and so transportation costs are comparatively low. Cut flowers account for about 50% of worldwide trade in floriculture products, and cut foliage an additional 10%. Characteristics that make for good cut flower species include: ease of cultivation and handling; color (white and pink are popular for spring weddings, orange and copper are sometimes popular in the fall); fragrance; and stem length (long stems are often preferred). The cut flower industry is world-wide, and competition among nations is critical to determining the success of the domestic industry in Canada. Cut flowers are harvested both from outdoor and greenhouse-grown plants. In Canada, the cost of maintaining greenhouses in the cold part of the year is a considerable disadvantage. On the other hand, local production is advantageous where flowers do not ship well.

European consumers buy cut flowers and flowering potted plants almost weekly, and annually spend ten times more per person on such purchases than North Americans. However, there is very limited export of ornamentals from Canada to Europe. Almost all exports (worth about \$300 million annually) are to the United States, somewhat more than half originating from Ontario, with about a quarter from British Columbia. Imported ornamentals amount to about \$400 million annually, about half from the United States, much of the remainder from the Netherlands and Columbia. Table 7 provides details of Canadian international floricultural trade for 2009 and 2010.

Table 7. Canadian Floriculture Imports and Exports
(Value in \$millions; data from Agriculture Canada 2011)

Commodity	2009	2010		
	Exports	Imports	Exports	Imports
Bulbs, tubers, tuberous roots	13	50	15	52
Other live plants, including roots, cuttings, and slips	210	184	203	171
Cut flowers for bouquets or ornamental purposes	25	128	37	123
Foliage, branches, and other parts of plants ³	674	24	658	20
Totals	922	385	913	366

³ Unlike the other groupings of plant materials which represent cultivated plants, in Canada this category refers mainly to wildcrafted materials, particularly from forests (In the U.S., considerable “greenery” is grown). This is part of the “greens industry”, including for example evergreen branches for use in floral arrangements, basketry, and wreaths.

Part 3 of this overview will appear in the next issue of the Bulletin(45(1) which will be published in the Spring of 2012. A complete reference list will also be included.



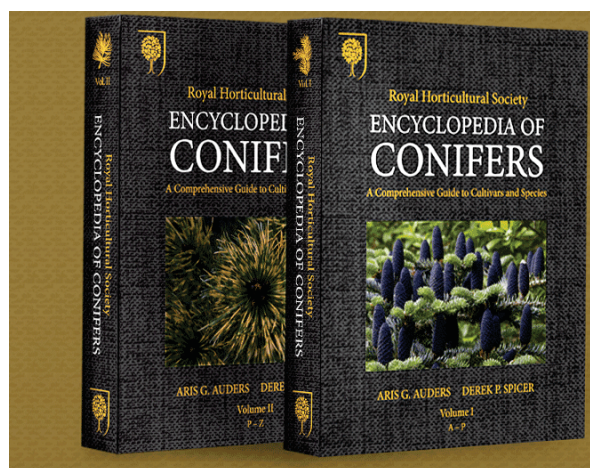
New Conifer Publication Announced!

A comprehensive guide to cultivars and species by Aris G. Auders and Derek P. Spicer.

Publication date: early 2012

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This two-volume, lavishly and extensively illustrated encyclopedia is a much needed, complete reference book covering all recognised conifer cultivars and species, both hardy and tropical. The 1,200-page work features names, synonyms, and brief descriptions, as well as information about height and spread after 10 years, where known, for over 8,000 cultivars and all 615 conifer species, plus their subspecies and varieties. Apart from the descriptive text, it is illustrated with more than 5,000 photographs, which have been taken especially for this encyclopedia.



The species and their descriptions follow the most recent botanical classification (Farjon, 2010) and the cultivar information has been compiled with reference to the RHS International Conifer Register and Checklist, including as yet unpublished data. There is unique appendix listing all the principle conifer collectors, nurseries, arboreta and individuals responsible for introducing new cultivars over the last three centuries. The book is designed to meet the needs of professional as well as amateur gardeners.

Aris G. Auders, a conifer collector and photographer from Latvia, and Derek P. Spicer, chairman of the British Conifer Society, have been working on this book for 7 years. The authors have been assisted by Lawrie Springate, RHS International Conifer Cultivar Registrar (2004–2009) and Victoria Matthews, RHS International Registrar.

Author and broadcaster Roy Lancaster states in the Foreword: The authors are committed and knowledgeable conifer enthusiasts who have been supported by a wealth of international expertise and experience. The book is claimed to be the most comprehensive account of its kind. Its authors and their helpers have delivered a truly monumental account of a major group of woody plants.

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