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The Canadian Botanical Association Bulletin

Bulletin de l'Association Botanique du Canada

March/Mars 2012. Volume 45 No.1/N°1

President's Message:
This is my scientific country, what's yours?[1]



Hugues Massicotte

The recent editorial "Frozen out" just published in Nature[2] had nothing to do with the winter we just had (which was rather tame by any La Niña standard) but rather compared the evolution of media interactions with government scientists over the last 6 years in Canada and in the United States. The article decries Canada's government media policies of micromanagement and control of the discourse made by their publicly funded scientists, thus showing a serious lack of understanding of the importance of free flow in scientific knowledge, at a time when our American neighbors have gone in the opposite direction with a more relaxed approach to media openness.

This fundamental issue of being able to speak knowledgeably when asked, got me thinking about the role of science and scientists in our modern society. As knowledge seekers and generators, scientists see their role, at least in part, as essential in providing public debates with 'the facts', hopefully governed ethically and with integrity. Society, it would seem, would welcome information that facilitates better decision making on what to do collectively with urgent and complex issues such as conservation and resource extraction, sustainable development, climate change, and water quality, to name a few. Ultimately, in my mind anyway, the flow of information could significantly impact "how the ship is steered" at the highest level and, importantly, steered in the best direction when all is considered.

The realm of science has become very politicized. Perhaps it was always thus, but certainly, within the current societal context, the research process is being seriously challenged financially as scientists compete for shrinking government (and other) dollars, but also challenged at the core, if discourse is not permitted. Those involved must continue to be active participants in public debates and, for this to happen, they must be able to speak freely about their scientific research, outcomes and consequences. We will need to sharpen our political and diplomatic pencils, otherwise science, as a whole, may rapidly become an historic relic in some political museum! I strongly recommend that interested members read the editorial Nature article and perhaps another recent article in The Guardian/The Observer[3] on "Attacks paid for by big business are driving science into a dark era", by Robin McKie.

Aside from public debate issues (although not entirely, as initiatives to revisit Charitable Organization status was recently introduced by government in 2011), your CBA executive has continued to be hard at work these last 6 months. An important committee has now been struck to 'refresh our constitution' for our continuance review as a Charitable Organization, and I am extremely grateful to Marian, Rodger, Frédérique and Jane who have kindly agreed to work on our behalf

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 natureconcernant 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(2)**, must be received **before August 6th 2012.**

La date de tombée des textes du prochain numero, le no **45(2)**, est **le 6 août 2012**

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in the next 12 months on this important task. In addition, preparations for Botany 2012 (Columbus, Ohio, July 7-11th) are shaping up nicely. The program is being fine-tuned and registration is now open at http://www.2012.botanyconference.org! As always, we are eagerly anticipating all nominations for CBA major awards (Lawson and Elliott), as well as all student and travel awards. I encourage you to put forth all eligible and deserving candidate names. I hope very much that many of you can join us and participate in what is certainly going to be a splendid opportunity to "peak into the future of botany" at Columbus, OH, this summer.
Sincerely,
Hugues Massicotte
(1) With apologies to Noah Richler, "This Is My Country, What's Yours?" (2006)
(2) Nature, March 1, 2012, Vol. 483: 6
(3) McKie, R. 2012, [http://www.guardian.co.uk/science/2012/feb/19]

Message du Président:
C'est mon pays scientifique, quel est le vôtre?[1]

Le récent éditorial «Frozen out» que vient de publier la revue Nature[2] n'avait rien à voir avec l'hiver que nous venons de subir (lequel était quand même très doux pour La Niña) mais plutôt avait rapport à l'évolution des interactions entre médias et chercheurs employés par le gouvernement fédéral au cours des 6 dernières années au Canada et aux États-Unis. L'article dénonce les politiques canadiennes de microgestion et contrôle du discours scientifique pour les chercheurs financés par Ottawa, démontrant ainsi une ignorance pitoyable de l'importance de la libre expression des connaissances scientifiques, à un moment où nos voisins américains profitent de plus en plus d'une approche détendue envers les médias. Ce débat fondamental, pouvoir parler en connaissance de cause, me fait réfléchir sur le rôle de la science et chercheurs dans notre société moderne. Comme intervenants responsables pour la recherche et génération du savoir, les scientifiques considèrent que leur rôle, au moins en partie, est essentiel pour soutenir les débats publics avec "les faits", régis nous l'espérons avec éthique et intégrité.
La société, il me semble, souhaite obtenir des informations qui faciliteront une meilleure prise de décision pour notre futur collectif en ce qui a trait aux questions urgentes et complexes telles la conservation et extraction des resources, le développement durable, le changement climatique, la qualité de l'eau, pour n'en nommer que quelques-unes. En fin de compte, j'espère toujours que ce flux d'information peut grandement influencer "la façon dont le navire est piloté" au plus haut niveau et, surtout, d'orienter le bâteau dans la bonne direction
Le domaine de la science est devenu très politisé. Peut-être était-ce toujours ainsi, mais il me semble que, dans le contexte sociétal actuel, le processus de recherche est sérieusement affecté, financièrement d'abord pour les subventions qui deviennent de plus en plus compétitives, mais aussi à sa base, si le discours essentiel n'est pas permis. Ceux et celles impliqué(e)s doivent continuer à être des participants actifs dans les débats de l'heure et, pour cela, ils doivent être en mesure de parler librement de leurs travaux de recherche, de leurs résultats et conséquences. Nous aurons besoin d'aiguiser nos crayons politiques et diplomatiques, sinon la science, dans son ensemble, va rapidement devenir une relique historique dans un musée politique! Je recommande fortement que les membres intéressés lisent cet éditorial et peut-être aussi un article récent dans le Guardian/The Observer[3] par Robin McKie qui décrit comment les attaques systématiques payées par les grandes entreprises peuvent contribuer à reléguer la science à un nouvel âge sombre.
Outre les questions de débat public (mais pas uniquement, comme l'initiative visant à revisiter le statut d'organisme de bienfaisance a été mis en place par le gouvernement en 2011), votre exécutif a continué à travailler fort ces 6 derniers mois. Un comité important a maintenant été mis en place pour «rafraîchir notre constitution» à titre d'organisme de bienfaisance, et je suis extrêmement reconnaissant à Marian, Rodger, Frédérique et Jane qui ont aimablement accepté de travailler en notre nom dans la prochaine année sur cette tâche importante. De plus, les préparatifs pour Botanique 2012 (Columbus, Ohio, du 7 au 11 Juillet) vont bon train. Le programme se raffine toujours et l'inscription est maintenant ouverte au http://www.2012.botanyconference.org! Comme toujours, nous attendons vos nominations avec impatience pour les grands prix de l'association (Lawson et Elliott), et autres récompenses pour étudiants et bourses de voyage. Je vous

encourage à soumettre tous les noms des candidats admissibles et méritants. J'espère aussi que plusieurs parmi vous pourrez nous rejoindre et participer à ce qui sera certainement une excellente occasion “d'explorer l'avenir de la botanique” à Columbus, Ohio.
Sincèrement,
Hugues Massicotte
(1) Avec nos excuses à Noah Richler, This is my country, what's yours? (2006)
(2) Nature, Mars 1, 2012, vol. 483: 6
(3) McKie, R. 2012,
[http://www.guardian.co.uk/science/2012/feb/19]

Future Meetings of CBA/ABC

2012: Joint with the BSA Columbus Ohio.July 7-11

2013: Thompson Rivers University Kamloops, BC June 1-5.

2014: CBA/ABC 50th Anniversary Meeting, Montreal. Date to be decided

2015: Plant Canada. In Ontario, final decision later.



Botany 2012



Abstract Deadline April 1st

July 7-11 2012
Columbus Convention Center
Columbus, Ohi





http://www.2012.botanyconference.org

Association News/ Nouvelles de l'association

Awards for Arunika.





Arunika Gunawardena with her daughter, Anisha Rajaselvam, herself a winner in an art competition with this button. Could she be an up and coming botanical artist?

Teaching Award

Dr. Arunika Gunawardena is the recipient of the Dalhousie Students Union 2010-2011 Teaching Excellence Award, presented annually by the Dalhousie Students Union. The award will be presented at a ceremony in April.
The letter that Arunika received notes, "We are so fortunate to have this opportunity to honour the dedication that you have given not only to our university, but to the students who have learned, grown, and excelled through your care and guidance",and also thanked her for the quality and passion that she shares with her students!

Killam Award

Arunika has also been awarded the Killam Prize in recognition of her exceptional research ability. The award carries a prize of $2000.00.

Congratulations on both of these awards!!

CBA/ABC Annual Meeting for 2013 at Thompson Rivers University.

Thompson Rivers University (Kamloops, British Columbia) will be hosting the CBA/ABC 49th Annual Meeting and Conference June 1 to 5, 2013. "Thinking Plants" will be the conference theme, and will focus on the importance of plants in society now and in the future. Confirmed keynote speaker is Dr. Diana Beresford-Kroeger, a botanist, medical biochemist and self-defined "renegade scientist" who brings together ethnobotany, horticulture, spirituality and alternative medicine to reveal a path toward better stewardship of the natural world. The CBA/ABC conference will also feature a unique "Art of Botany" Show that will highlight how art supports research and learning about plants (Botany).
Please see the article by Lyn Baldwin and Ila Crawford, on page 10 .
Contact botany@tru.ca for more information.

Regional Undergraduate Awards.

The **Science Atlantic Conference** was held in Sackville, New Brunswick, hosted by Mount Allison University on March 3rd and 4th. This used to be called the APICS Biology conference; however, now that it incorporates meetings for Environmental Science (also undergraduate) and Fisheries and Aquaculture (both graduate and undergraduate), the meeting title is now Science Atlantic. Christian Lacroix and David Garbary attended the meeting and evaluated the four botanically oriented oral presentations in the Biology Conference and the four botany posters (from Biology and Environmental Science) and decided to make an award for both an oral and poster presentation.
The winner of the oral presentation was:
Annie Livingstone, Department of Biology, St. Francis Xavier University, Antigonish, NS, B2G 2W5 for her presentation: "A sequence of events: Unravelling the story behind an algal-invertebrate symbiosis"



Annie Livingstone working in the lab at Bamfield Marine Station, Bamfied, BC. Summer 2011

The winner in the poster category was:
Kylie Tingley from the Biology Department at UPEI. Her poster was titled, "Dispersal and adaptation in a coastal beach plant"



Kylie Tingley receiving her award from David Garbary at the Science Atlantic conference.

Ontario Biology Day
This was held at Laurentian University on March 17th and 18th. Please see the report and winners on page 9.

The seventh annual **Irving K. Barber School Undergraduate Research Conference** (URC) is scheduled for Wednesday, April 4, 2012 from 11:00 a.m. to 4:00 p.m. at the University of British Columbia, Okanagan, in Kelowna. Students from Thompson Rivers University, University of the Fraser Valley, Trinity Western University, and the University of Northern British Columbia will be participating, with oral and poster presentations. Prizes will be awarded. More information is available from urc.info@ubc.ca or contact Hiltrud Volger directly: Hiltrud.Vogler@ubc.ca

Volunteers needed to serve on the CBA/ABC Board!

Please consider nominating someone or volunteering yourself to serve on the Board. The following positions will be available for the 2012-2013 year. All are for two year terms.

President Elect
Secretary
Directors from the west and the east.
Student representative.

If you are interested or know of someone who is please contact Rodger Evans at rodger.evans@acadiau.ca

CBA/ABC Gives Financial Support To Two Groups.

At a recent teleconference meeting, the executive voted to give financial support to the UBC Botany Graduate Students Symposium, and also to the Symposium for Women entering Ecology and Evolution Today. (SWEEET)

The Current State of Plant Science in Canada Today.

If you are interested in following up on Liette Vasseur's article in the Bulletin (Bulletin 44 No.2 page 51), please contact Liette at
LVASSEUR@BROCKU.CA

Sad News

Jim Soper (1916 – 2012) Passed away peacefully on February 16, 2012 in his 96th year after a brief illness. Beloved husband of Jean (Morgan) and loving father of Nancy (Richard Stoneman), Mary (David Gladwin), Daphne (James Boyce), and Ian (Nicole Ratté). Cherished Grandfather of Kathryn and John Stoneman. Born in Hamilton, Jim graduated from McMaster and Harvard (Ph.D 1943). He had a long career in botanical research as a professor of botany at University of Toronto and Chief Botanist, National Museums of Canada. In retirement, flowers and shrubs became the subject of his many paintings and drawings. A private memorial and cremation was held in accordance with his wishes.
Dr. Soper had served on the CBA/ABC executive as Treasurer in 1968-69 and as President in 1982-83.
If you wish to send a message of condolence, Jim's wife, Jean can be reached at the following address:
Jean Soper, Lord Lansdowne, 920 Bank Street (Room 505)
Ottawa, ON K1S 1M8
A full obituary will appear in the next issue of the Bulletin.

FEEDBACK NEEDED FROM MEMBERSHIP

At our last teleconference, a discussion took place on whether we should raise our membership fees in order to support more tangibly the journal "Botany" and Canadian Science Publishing (CSP). Given that CSP e-subcription mandatory rate would be $25.00 per person (see Bulletin 44(3):77), meaning that all members would automatically receive an e-subscription to "Botany", several options were discussed, including raising the regular member fee by $15.00, from $55.00 to $70.00 and subsidizing each membership by $10.00 (i.e. the CBA sponsors each member). Student and Retired member categories would remain unchanged.

This was seen as a compromise option, which could be brought to vote by the membership at the next AGM. A concern was that we could lose members if the membership fee is raised too much. Another problem is that some members already have access to Botany through academic or research institutions. Send your feedback on this issue to our Acting Secretary, Christine Maxwell, cba.abc.bulletin@gmail.com and we will compile the results before our AGM.

News from the Sections

Teaching Section

1. The Joint Teaching Symposium sponsored by CBA/ABC and BSA for the 2012 meeting in Columbus, Ohio.

The joint teaching symposium "Are we having a broader impact?" sponsored by the Teaching sections of CBA/ABC and BSA proposal for the 2012 meeting has been accepted. We have six invited speakers for this symposium. CBA/ABC is providing $1000 of support and has invited two speakers whereas BSA is providing $2000 of support and has invited four speakers. A copy of the symposium proposal abstract is given below.
Are We Having A Broader Impact? Stokes S. Baker (Bakerss@udmercy.edu), Santokh Singh, Phil Gibson
Sponsorship and Funding: Jointly sponsored by the Teaching Sections of the Botanical Society of America (BSA) and the Canadian Botanical Association/ Association botanique du Canada (CBA/ABC).
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. Jean Becker (Aboriginal education: Assessing the challenges and opportunities), Elder in Residence, Wilfrid Laurier University, Waterloo, Ontario, Canada. Santokh Singh (Three minute thesis: A rapid in-class instructional and assessment strategy – Tentative title): University of British Columbia, Vancouver, BC, Canada, and Teaching Section Chair, Canadian Botanical Association/ Association Botanique du Canada. Kimberly Tanner (Assessment of science programs – Tentative title), Director of The Science Education Partnership and Assessment Laboratory, San Francisco State University, San Francisco, California, United States. Jose Herrera (Amplifying the ripples: Broadening the effect of your educational projects), National Science Foundation, Washington D.C., United States. Phil Gibson (Evolution and assessment: Lessons from a tree-thinking curriculum), University of Oklahoma, Norman, Oklahoma, United States. Chris Haufler (Assessing content of a botany curriculum – Tentative title), Chair, Department of Ecology and Evolutionary Biology and Special Advisor to the Provost for Undergraduate Education, University of Kansas, Lawrence, Kansas, and At-large Director - Education, Botanical Society of America.

2. The University of British Columbia Botany Graduate Students Symposium.

The University of British Columbia (UBC) Botany Graduate Student's Association is organizing their annual symposium on April 5, 2012 in the Michael Smith Labs Auditorium in UBC, Vancouver, British Columbia. The CBA/ABC will continue its support for this symposium. I will be the CBA/ABC representative at the UBC Botany Graduate Students Association symposium.

3. The University of British Columbia Multidisciplinary Undergraduate Conference (MURC)

The annual University of British Columbia (UBC) Multidisciplinary Undergraduate Research Conference (MURC) will be held on March 24, 2012 at the I. K. Barber Learning Centre, UBC, Vancouver, British Columbia. The UBC Multidisciplinary Undergraduate Research Conference (MURC) celebrates the contributions of undergraduate scholarly inquiry and research at UBC.

Santokh Singh, Chair.

Development Section

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.

Our proposal for a joint symposium with the BSA development and structure section on "***From canonical to new model systems: The future of plant development***" has been officially accepted by the Botany 2012 organizing committee. This symposium will provide a valuable opportunity for researchers to present recent findings in plant development using model and non-model species. This symposium will be organized around different areas (e.g, epigenetics, reproductive biology, leaf development, programmed cell death, etc) that collectively, will identify approaches and methodologies used in plant development research. At the end, participants will be invited to share and discuss how model as well as non-model species can be used to further our understanding of plant development.
We have 6 confirmed invited speakers and 2-3 additional speakers will be selected from submitted abstracts. The conference web site is NOW ready for abstract submissions. Please visit: http://www.2012.botanyconference.org/.

Ecology and Conservation Section

Please see page 14 for a new conservation initiative.
Nominations for the Rowe Award are requested. The deadline is **May 1st 2012. Please send nominations to Liette Vasseur at lvasseur@brocku.ca**

Systematics and Phytogegraphy Section

Call for Nominations

Alf Erling Porsild Memorial Prize

Award honouring the memory of 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 Chair of the Systematics and Phytogeography Section of the CBA/ABC (Dr. Hugo Cota-Sánchez, Dept. of Biology, University of Saskatchewan; email: hugo.cota@usask.ca) **before May 15th, 2012.**

Le Prix Commémoratif Alf Erling Porsild

Prix honorant la mémoire de l'éminent botaniste 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 envoyé au president de la section systématique et phytogéographie des plantes de l'ACB/CBA (Dr. Hugo Cota-Sánchez, Dept. of Biology, University of Saskatchewan; email: hugo.cota@usask.ca) **avant le 15 mai 2012.**



Mycology Section News



At publishing time, the mycology section is still hard at work trying to secure our Weresub Memorial lecturer for this summer for BOTANY 2012 in Colombus, OH. The mycology section is also co-sponsoring a Symposium on 'The Root Microbiome' and, even though there are still some changes possible, Darlene Southworth and Ann Hirsch (both USA), as well as Hugues Massicotte and Shannon Berch (Canada) have hopefully secured 6 speakers (e.g. Martha Hawes, Marnie Rout, Ann Hirsch, Melanie Jones, Kari Dunfield, Charles Greer). The final details will be announced in the BOTANY 2012 program sometime early May.

In addition, a reminder to members to please consider forwarding names and dossiers of those students who may be eligible for the Luella K. Weresub Memorial Award 2012, for best published paper in mycology during the previous year. As always, we welcome all who might be interested in participating to the Mycology Section Meeting which will occur sometime during BOTANY 2012, as well as all mycology comments and (or) thoughts for our section and for the Bulletin!

Respectfully submitted,
Hugues Massicotte and Shannon Berch

Brooklyn Botanic Garden

Herbarium Techniques Course

Monday, August 20–Friday, August 31 2012

Offered by Brooklyn Botanic Garden and Royal Botanic Gardens, Kew

This two-week seminar is a collaboration between Brooklyn Botanic Garden and the Royal Botanic Gardens, Kew. Hosted by Brooklyn Botanic Garden and drawing much of its content from the Kew International Diploma Course in Herbarium Techniques, the course will also include input from SPECIFY and the US Fish & Wildlife Service and benefit from a visit to The New York Botanical Garden.

Registration Deadline: May 31, 2012

http://www.bbg.org/visit/event/herbarium_techniques/

Course details

With their wide-ranging collections of preserved plant specimens, well-curated herbaria represent a vital resource for plant diversity research, enabling the accurate identification and classification of plant materials that underpin any other botanical studies or conservation activities. Recognizing the key position that good curation plays in the ability of any herbarium to function at its fullest potential, we will review techniques employed and investigate possibilities to enhance our work, consider international standards and local practices, and investigate ideas to promote our collections to the wider audience beyond the scientific community.

Course venue: Brooklyn Botanic Garden
Fee: $600

Plant Development at St. Francis Xavier University

The second in a series of articles about plant development research in Canada.

David Garbary

While David's primary expertise has never been cell or developmental biology, the morphogenesis of seaweeds (mostly red and brown algae) has been a major theme throughout his research career. This departure from a taxonomic background arose from an interest in understanding the growth and life histories of these organisms. Early work on cell elongation and differential patterns of cell wall deposition raised questions about microfilament and microtubule organization and function in red algae. A desire to understand morphological patterns of growth and development, with an emphasis on structural and information complexity, led to the computer modeling of morphogenesis using Lindenmayer-systems in filamentous red algae, and studies on the changes in fractal dimension during ontogeny in fucoids. Some intriguing developmental discoveries include the reduction of ploidy levels during mitosis in kelp sporogenesis, and the occurrence of cell division in the absence of mitosis in *Ascophyllum*. A recent analysis of programmed cell death and its role in ontogeny and ecology of multicellular marine algae benefited from a collaboration with Arunika Gunawardena and her student Christina Lord (Dalhousie University). Indeed, David's research has involved many collaborations and interactions: with numerous undergraduates (and almost fifty honours students) who provide the research 'hands', with interested members of the general public, with departmental colleagues who provide missing expertise, and with numerous national and international collaborators including long-time collaborator Kwang Young Kim (Chonnam National University, Korea), and Elena Tarakhovskaya (St. Petersburg State University, Russia), who have contributed their expertise in plant physiology and specialized instrumentation to studies on whole-frond development and early morphogenesis in fucoids. This diverse and productive research program has been sustained by over 30 years of continuous funding from NSERC.



Graduate student, Leah Beveridge amidst a mass of Ascophyllum.

Moira Galway

Moira encountered the central mystery of morphogenesis (how does form come into being?) as an undergraduate in Margaret McCully's lab at Carleton University in Ottawa, and pursued this interest through graduate work with Adrienne Hardham at The Australian National University and two postdoctoral fellowships, first with Larry Fowke (University of Saskatchewan) and then with John Schiefelbein (University of Michigan). She hopes to evoke the same sense of wonder in her students, with many of whom she has had the pleasure of teaching through a three-year long sequence of courses in introductory genetics, cell biology, cancer biology, and genes and development. Sadly, her own research program has produced no new plant biologists, but has germinated a fine crop of doctors, teachers, lawyers, research technicians, a dentist, a neurobiologist, a cancer biologist, and a genetics counselor! Over the last decade, her interest in tubular shape formation (using the root hairs of *Arabidopsis thaliana*) has become focused on cell wall formation, involving a collaboration with her postdoctoral mentor John Schiefelbein and with Geoffrey Wasteneys (University of British Columbia), a colleague from graduate student days in Australia. Last year her honours student Sarah MacLellan won a CBA-sponsored prize for a poster on this theme at the Atlantic region's undergraduate biology conference. Intradepartmental collaborations are also proving fruitful. Moira, Cory and David all enjoyed the synergy arising from a recent joint review of convergent and divergent developmental mechanisms in plants and animals, and Moira and David hope to engage a student to continue probing the strange occurrence of cell division without mitosis in the fucoid alga *Ascophyllum nodosum*, which should be an intriguing return to Moira's graduate student roots in developmental phycology.

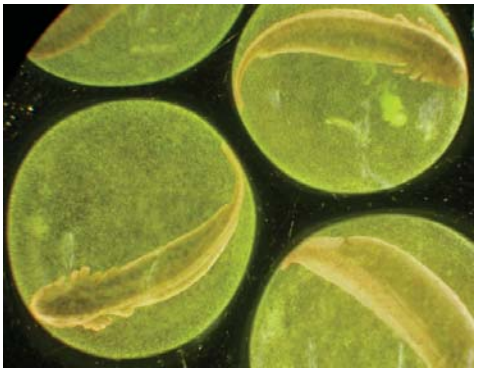
Cory Bishop: Zoologist or Botanist?

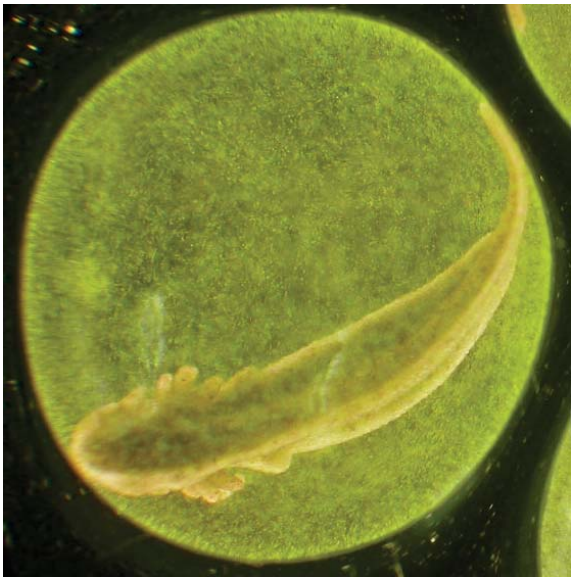
Cory completed his PhD in the department of Molecular Biology and Biochemistry (Simon Fraser University) with Bruce Brandhorst and completed two post-doctoral fellowships, with Mike Hadfield (Kewalo Marine Labs, Honolulu) and Brian Hall (Dalhousie University, Halifax). An animal evolutionary developmental biologist, his interests concern settlement and metamorphosis of marine invertebrate larvae, and in recent times has begun to explicitly incorporate ecological principles.

One long-term goal is to generate systematic comparative knowledge about the signaling systems that control the timing of metamorphosis and to understand how differences among taxa relate to the ecological context in which metamorphosis is occurring. Since arriving at StFX Bishop has acquired CFI and NSERC funding to continue this work and has overseen the construction of a common molecular biology space. So why include a zoologist here? In Brian Hall's lab, Bishop was privileged to work alongside another talented post-doc, Ryan Kerney who had noted an intriguing association between a unicellular alga and the embryos of the northeastern spotted salamander. Along with Aaron Heiss (Dalhousie), Eunsoo Kim (now at American Museum of Natural History, NY), and Roger Hangartner (Indiana University, IN) the group described the first known endosymbiotic interaction between a plant and an animal.

(Continued)

This discovery and its research potential are just too tantalizing to ignore, and will be pursued further in the Bishop lab. A major goal is to elucidate the biology of the symbiont: from animal metamorphosis to algal biology and taxonomy! This wouldn't be possible without the inherent flexibility of the NSERC Discovery Program. Bishop feels that the maintenance of a broadly-based research program is not only intellectually exciting but has the potential to attract a great diversity of students and collaborators, with very different talents, interests and skill sets.





Moira Galway took the above photo on behalf of Katelyn MacNeil, one of Cory's graduate students who collected the salamander eggs locally. The green algae are really vivid inside the eggs, and somehow they get into the developing embryo as well. The second image is a cropped version of the other.

Ontario Biology Day Awards.

The Ontario Biology Day was held at Laurentian University in Sudbury, Ontario, on the 17th and 18th of March 2012. The presentations were of high caliber and it was a pleasure to listen to some of them. As usual, our Society offered two monetary awards: one for the Best Oral Presentation for which 7 students competed, and one for the Best Poster Presentation which had 3 competitors. The winner for the Best Oral Presentation was Laura Borden, from the University of Western Ontario, who works under the supervision of Dr. Hugh Henry. Laura presented her work on the influence of nitrogen deposition in the restoration of tallgrass prairie in a changing environment. She delivered her talk in a relaxed but professional manner. The problem with global implications was well set, and her results should be taken into consideration when managing prairies. The winner for the Best Poster Presentation was Kurtis Baute, student at Wilfrid Laurier University under the supervision of Dr. Mihai Costea. Kurtis' poster was visually appealing, but more importantly, Kurtis provided detailed explanations in an engaging manner. His work was on the recognition of *Cuscuta pentagona* and *C. campestris* as distinct species of the genus *Cuscuta* subsection *arvensae.*
Both students received other awards. Kurtis received " Best Overall Poster" (competition of 20 students), and Laura was a runner up for the best oral presentation in the section, Environment and Restoration. Our congratulations to both!



Laura Borden



Kurtis Baute

Does the science of botany need art? Does art need the science of botany?

Lyn Baldwin, Department of Biological Sciences

Ila Crawford, Department of Visual and Performing Arts

Thompson Rivers University, Kamloops BC.

A century ago, or certainly two centuries ago, these would have been ridiculous questions, as science and art were not perceived as different endeavours. Instead both were understood to spring from deep-seated desires to apprehend reality (Stange 2010), albeit a reality that was believed to be the direct manifestation of creation. Noted art critic and theoretician of the late 1800's, John Ruskin stated that the measure of art was that it "declares the perfectness and eternal beauty of the work of God, and tests all work of man by concurrence with, or subjection to that" (Ruskin 1894, p.12). Nevertheless, as Stange (2010, p.2) eloquently argued "We get a deeper understanding of water from a Turner seascape *and* from understanding how the two gases, hydrogen and oxygen, can combine to form the curious liquid compound that is essential for life." Furthermore, art, in the guise of illustrations, played a critical role in establishing the identity of plants described in different languages from different regions (Pavord 2005). Many of those working during the Rennaissance, from Leonardo da Vinci to Maria Sibylla Merian, created a legacy that is now claimed by both artist and scientist. In the Age of Discovery, art was intricately entwined with the discovery of new plants. Plant hunters like Sir Joseph Banks took artists along with him on his voyages to help document and record his discoveries. However, by the mid-twentieth century, C.P. Snow (1993) argued that science and art had become deeply alienated from each other.

Snow (1993) simplistically described the two alienated cultures: science equals rationality and objectivity; art equals emotionality and creativity. Most importantly each culture was largely ignorant of the traditions and beliefs of the other. Snow, who was both a scientist and a writer, deplored artists' ignorance of the Second Law of Thermodynamics and scientists' ignorance of the great works of literature. Snow wrote, "The degree of incomprehension on both sides is the kind of joke which has gone sour" (Snow 1993, p.11). For many years, this split between the cultures was deemed almost a natural consequence of the different disciplines. This polarization is so ingrained into our thinking that if we want to capture the totality of a subject, we title a work, "The Art and Science of …." In our university library, we can find such titles ending in "Leadership," "Ecological Restoration," and "Branding," to name just a few. Yet today, for active practitioners within either science or the visual arts much has changed. In particular, the sciences and visual arts today are immersed in a "cross-disciplinary ferment, collaboration and intellectual confrontation"(Malina 2010). As artist and scientist, we, have different, yet complementary understandings of the way that science and arts interact. Below, we each articulate our perception of the dynamic ground between science and art and then come together with a description of a project that we believe will be of interest to both the members of the Canadian Botanical Association and artists.

Lyn—*Does the science of botany need art?*

As a science, botany can benefit from lessons learned from art. Ainsworth et al. (2011) argued in the journal *Science* that drawing increased student engagement, reasoning abilities, and communication abilities. Drawing has also been used as to diagnose student misconceptions of photosynthesis and respiration (Kose 2008). When Ila and I introduced illustrated learning journals into botany labs and supported this work with drawing tutorials, we found that drawing facilitated a different but legitimate route for students to interpret what they were observing (Baldwin & Crawford 2010). Artists like Galileo and da Vinci used drawing as a way of both observing and learning. In addition, the spatial visualization that occurs in map-making or drawing were critical for solving scientific problems such as the London cholera epidemic and plate tectonics (Rieber 1995). Recognition of drawing as a way of knowing has led to the development of non-profit groups such as The Campaign for Drawing sponsoring the annual UK Big Draw Event, a month-long series of workshops, that tries to teach people how to "see" through drawing (Whitely 2008).

But does art provide scientists with something more profound? I think it does. One of my favourite drawing exercises is blind contour drawing. Claire Walker Leslie, a well-known advocate for the use of drawing and field journaling as a way of knowing the natural world describes blind-contour drawing, "Imagine your eye is an ant crawling slowly over the whole shape. Either go from right to left or left to right. Using a continuous and careful line, draw the wanderings of the ant over the contours of the object, in and out of each part your eye follows" (Walker Leslie 1981, p.10). The line is drawn without looking at pencil or paper. In her tutorials with my botany students, Ila asks students to use both hands when doing blind contour: one hand keeps track of where the pencil was, while the other, holding the pencil, travels along surface of the form. Using both hands permits the drawer to estimate space without using sight. Not only does the drawer travel slowly along the form, but also physically measures distance by using knowledge embedded in their body.

As a quantitative field botanist, it took me years to learn the true seduction of this exercise. It took me years to stop cheating. But just recently when I made a series of blind contour drawings of a remnant hollyhock stem brought in from my winter garden, the drawings gave me both the specific details of the hollyhock—the arrangement of trichomes on the stem, the repeating pattern of star-shaped sepals subtending the seed capsules, the pattern of light and dark created by the seeds clustered within, the uniquely odd shape of the hollyhock seed—and something much less tangible, but no less necessary. By the eighth blind contour drawing of the same hollyhock stem, it felt like the marks on the page had moved beyond a visual image to a celebration of all that is "hollyhock." I think the science of botany needs the joy of art. I can count a moss, name a

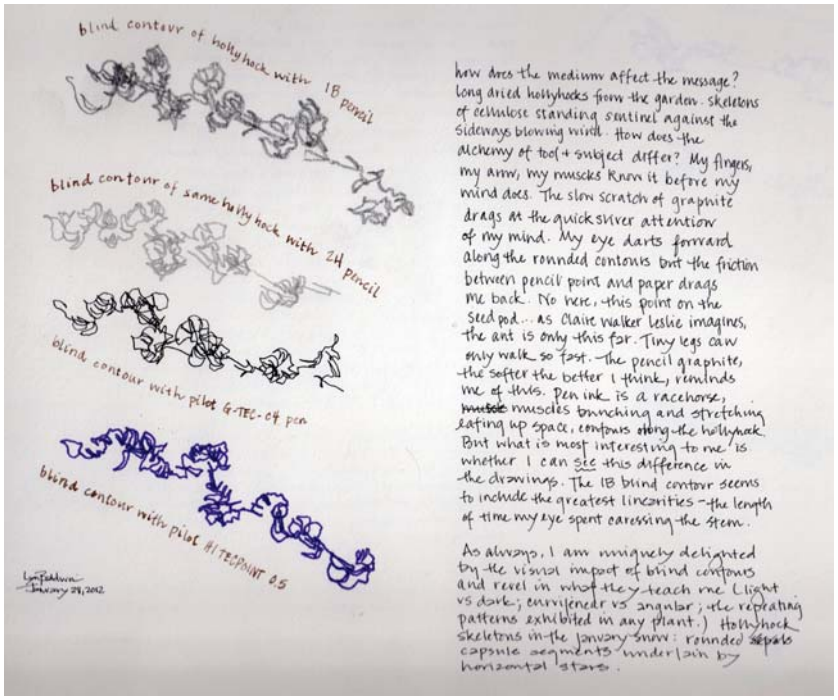


Figure 1. Blind contour drawings from Lyn's sketchbook

moss and there is praise. But when I draw a moss, it is not just my eyes, my mind, that know moss, it is also my hand, my arm, my heart.

IIa—*Does art need the science of botany?*

While plant blindness (Wandersee & Schussler 1999) is becoming more widespread in post secondary education, art education has always marginalized the use of plants in favor of other subjects, especially the human body (Efland 1990; Goldstein 1998; Macdonald 1970). The belief was that by understanding the human body the whole world was revealed. The French, Italian and English academies of art that developed following the Renaissance emphasized developing observational drawing skills by working in a studio, copying "master works," drawing from replicas of Greek and Roman sculptures, and from live male models. Studying plants as a way to teach drawing was, and is, not a usual activity in art schools.

Interestingly, the focus on the human body and social taboos regarding women drawing from the human body isolated women from historical art academies until the 1800's. However while not among the first botanical illustrators, women came to dominate botanical illustration after the 19th century (Saunders 1995).

Just as pre-Darwinian biology assumed that species were individually designed by God and therefore perfect, artists, following the Renaissance, proposed a reality that glorified and reflected God's intended perfection (Goldstein 1998). This approach can be seen in many early botanical drawings, where the role of art was to venerate the structure of the perfectly created world. Historically, botanical illustrations presented plants in studied perfection, amassing the best of each specimen, although exceptions do exist (Saunders 1995).

Since the Second World War, art has become a conflict "between those intent on teaching the content of art and those seeing it as self-expression (Efland 1990, p.263). All forms of realism have declined in importance leading to fewer representations of the human body and other recognizable subjects. Students no longer learn solely by copying "master" drawings; instead, emphasis is placed on the formal aspects of composition (line quality, darks and lights, compositional dynamism, etc.) using assignments that promote self-expression. However, even as art became more about ideas (as exemplified by cubism, abstract expressionism, etc.), students still had to learn how to draw from observation. Drawing is not about making pictures, but it is about learning to see through drawing. Typically, the drawing studio is a contained space where the same overused and worn objects are reconfigured time after time as subjects for drawing.

As an instructor in visual art, I can speak of my direct experience with students. I have taught first year courses in drawing and art foundations for twenty years. Year after year students report that their way of seeing the world changes significantly over the period of as little as one semester in a drawing class. I recall one student exclaiming that her world was suddenly full of the colours and shapes of shadows. Drawing is a way to see the world differently. Introducing plant studies in art classes focuses students' attention on a part of their world that is often missed.

Further considerations for incorporating the study of plants into art include:

Re-covering marginalized art practices and mediums as well as expanding into new ways of understanding subjects, such as using a scanner or satellite images to look at plants, falls neatly into a practice of teaching art that critiques a tradition of modernism along with the established and maintained hierarchies that theoretically no longer apply. Because botanical studies were often relegated to the domain of women, it is important to re-examine and include the study of plants, as much as it has been important to regard women as equally contributing members of society. Likewise, the media used for botanical studies (watercolour) could be included in mainstream art education.

Drawing from something real, such as plants, reveals that each individual is unique and that observation can lead to

further inquiry, for both artists and scientists. Art and science students learn to draw what they see rather than what they think they see, or have been conditioned to see. Drawing, in this context, is a way to learn and leads to inquiry arising from the process of drawing.

All of the elements of composition as they relate to drawing can be taught as easily using botanical subjects as using inanimate still-life objects. Plants are sometimes included as back-drops for still life or model studies but are not often used alone for analytical study. That is not to say that still-life and human figures should be replaced by plants, but that plants (live plants, cultivars, weeds, indigenous species, dried specimens, etc.) have a legitimate place in art education.

The trend to re-merging science and art is obvious in examples of contemporary art where botany and art practice overlap. Artist-in-residence programs currently exist in centres such as the Palo Alto Research Center, CSIRO, and Rothamsted Research, at science museums like the Exploratorium in San Francisco, and within universities such as the Massachusetts Institute of Technology or the University of Guelph's School of Environmental Science. Initiatives like these are working to "re-merge" the dichotomy between art and science. Both can benefit.

An invitation to submit to *Art and Science: Drawing and Botany*

Our collaboration began as a teaching initiative as we investigated how learning about drawing changes the way botany students learn. As of yet, we have not investigated the reverse. We think that introducing botany into a drawing class may have unexpected and desirable results for art students. Thus, over the next academic year, we plan to extend our collaboration. Lyn will introduce art students to the specifics of botany and Ila will return to the botany lab to not just draw but to do art. We don't have all the details of this collaboration worked out and much will be discovered over the next year through trial and error. It is clear to us that the project will *evolve*.

We would also love to see the results of other collaborations or work that blends the two cultures. We invite CBA/ABC members to consider integrating drawing and/or art into their plant classes over the upcoming academic year. We imagine that some members are already producing "art" as part of their own research. Thus, we invite students and practitioners of both art and botany to respond to our assertion that *"art has a place in both teaching and practicing botany; and botanical subjects and scientific methods have a place in teaching drawing and in art practice."* To facilitate an ongoing discussion of the re-merging of the "two cultures", the 2013 CBA/ABC Conference will include an art exhibit entitled, "*Art and Science: Drawing and Botany."* We hope that CBA/ABC members will begin to consider the collaborations that they might make or the work that they might submit. We will make a more formal call for work this coming summer. Specifically, we hope that this exhibit will include work that explores, in general, questions about the perceived boundaries between art and science, and will bring to bear the potential for synergy between art and botany.

For more information, don't hesitate to contact either of us lybaldwin@tru.ca or icrawford@tru.ca

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For more figures see the next page.



Figure 2. Field sketches from 2011 CBA field trip to coastal barrens and Peggy's Cove, Nova Scotia

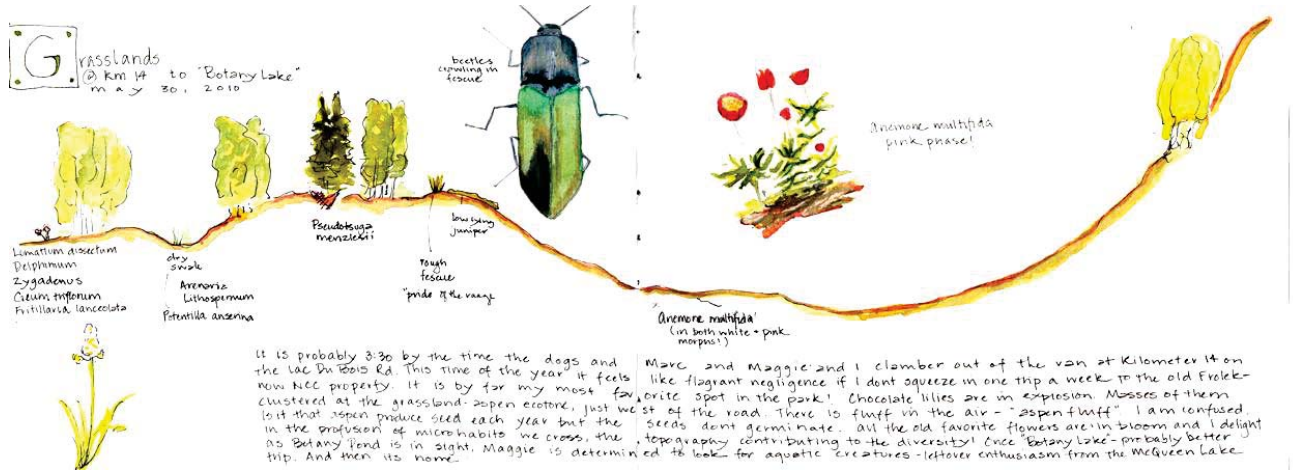


Figure 3. Field sketches from “Botany Pond,” Lac Du Bois Park, Kamloops BC

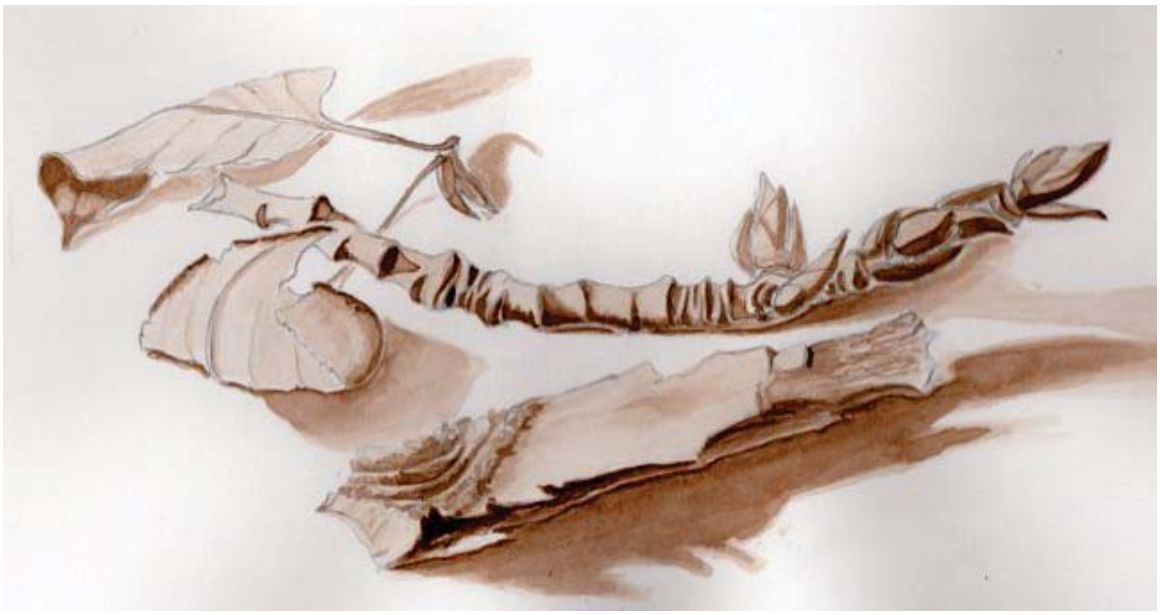


Figure 4. Cottonwood debris, inkwash from Lyn's sketchbook

A proposal and protocol to protect the Tusket River area in Nova Scotia

Dear members of the Systematics and Phytogeography Section and members of the CBA/ABC,
Last February 12, 2012, Dr. Paul Catling, contacted me to share the following information regarding an initiative to protect the Tusket River area in Nova Scotia.
In his communication, Paul indicated that he has helped Nova Scotia botanists to develop their idea of CBA/ABC providing profiles for conservation efforts of others by designating “Areas of Special Conservation Concern For Plants.” All of this is described in articles that follow.
As Chair of the Systematics and Phytogeography Section, I strongly advocate for biodiversity conservation-based efforts, and given the amazing rate at which the natural habitats are vanishing, proactive efforts should be prioritized to preserve the ecological and structural integrity of Canada's natural resources. Considering that this region includes a number of specialized plants and animals unique to these regions and is seen as a national and international hotspot area in Canada, preference for conservation should be given. I fully support the proposed initiative and protocol. Thanks to Paul, Liette, our Conservation Committee and Nova Scotia botanists for developing this idea, and others for doing this and bringing it to us.
I think that the time is right to adopt this proposal. I further suggest that if any of our members is conducting research in this area we should take advantage of this opportunity and showcase in the forthcoming meeting in Ohio ongoing studies in the areas of biodiversity conservation, plant biology, environmental impact, etc.
J. Hugo Cota-Sanchez, Ph.D.,Chair, Systematics and Phytogeography Section CBA / ABC, Associate Professor and Herbarium Curator, Department of Biology,University of Saskatchewan,112 Science Pl.,Saskatoon, SK S7N 5ETel. (306) 966-4405,Fax: (306) 966-4461Email: hugo.cota@usask.ca

AREAS OF SPECIAL CONSERVATION CONCERN
FOR PLANTS
– A NEW CBA/ABC INITIATIVE?

Paul Catling[1] and Liette Vasseur[2]

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CBA/ABC has a long history of interest in the protection of the Canadian flora (see text box). One of the ways in which CBA/ABC may be able to do more is by provinding the high profile needed to help local groups to protect the most important places for plant conservation in Canada. CBA/ABC has the expertise to do this through the Ecology and Conservation Section and the Systematics and Phytogeography Section. It can be done with a national conservation designation for special places with concentrations of plants that are at risk where threats are currently experienced and very high, or likely to be experienced within a few weeks or months. Such places could be designated as areas of "Special Conservation Concern" for plants. Following is a protocol for designation that we propose based on our own ideas and subsequent communication with the members of the Ecology and Conservation Section. After this is a proposal for the first CBA/ABC designation if the procedure is approved: The Tusket River in Nova Scotia. If this proceeds as a result of a vote at the Annual General Meeting (on the initiative and subsequently on the specific proposal), then the initiative will be underway and CBA/ABC will have started to focus increasing attention on Canadian Botanical treasures that are in danger. The purpose of this communication and the subsequent proposal is to put these ideas before the membership well in advance of a vote at the next AGM in Columbus, Ohio.

A concept

In this proposal, we focus on both risk and threat. These are already accounted for in the case of species that have been designated federally or provincially “at risk”. We have also suggested a methodology for calculating threat that helps to ensure that all threats are accounted for and appropriately weighted.
There are other considerations with respect to other kinds of designations for botanical landscapes such as how representative and pristine a landscape is, whether rare species and endemics occur there, whether important germplasm of crop relatives is present, whether or not there are lots of wild orchids, whether or not species richness is very high, etc. However, these aspects do not necessarily make a place “of special conservation concern.” We suggest

CBA/ABC IN CONSERVATION

CBA/ABC is a group largely based on scientific research and education. Through its work in conservation, it has addressed national and global conservation issues including those of the Global Strategy for Plant Conservation (http://www.cbd.int/gspc/intro.shtml), the Convention on Biological Diversity (http://www.cbd.int/convention/text/), and the Canadian Biodiversity Strategy (http://www.biodivcanada.ca/default.asp?lang=en&n=560ED58E-1). We have had numerous symposia on conservation topics, some published, such as “Man's Impact on the Canadian Flora” in 1976 and “Bioconservation and Systematics” in 2001, to mention only a few. For decades we have had an active Conservation Committee that has provided extensive advice on Conservation issues.

"SPECIAL CONSERVATION CONCERN" IS SPECIAL

Because of dependence on threat, urgency and risk, this is a different concept than that used to determine protected areas in parks, or to identify important plant areas (IPAs see http://www.plantlife.org.uk/international/wild_plants/IPA/ipa_criteria_and_methodology/

that the criteria are based on "at risk" species and threats as an element of urgency. We also think that a careful consideration of these will provide a clear and credible indication of what are the most important places for protection of plants across Canada. To get into this category, the situation has to be serious and to be in this category will therefore reflect a very serious situation.

Recommended Designation Protocol

The protocol would involve: (1) A local group making the suggestion in the form of a proposal to the Systematics and Phytogeography Section Chair, the Ecology and Conservation Section Chairs, and the CBA/ABC President; (2) With approval, the local group would make any appropriate changes to the proposal which would then be submitted to the Ecology and Conservation and/or Systematics and Phytogeography Section Chairs who would then send it to the section members for comment; (3) Following favourable comments, it would be published in the Bulletin so that all CBA members could learn about it; (4) Finally it would be submitted for approval of members by vote at the next annual general meeting to finalize the decision; (5) If adopted, the text would then be posted on the CBA website and a press release sent to the media for notification.

Criteria for designations

There should be flexibility in determining designations, but threats should be well-established (very high) and a process is available to evaluate threat (Master et al. 2009) using the the "Threats Assessment Worksheet" in Naturserve Conservation Status Assessments: Rank Calculator Version 2.0 Excel Worksheet available at http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.jsp. The use of the calculator is described in Master et al. (2009) and at the IUCN-CMP: The Conservation Measures Partnership website http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy/. Such designation by CBA/ABC will help to provide the profile needed for the protection of these special places.

Proposals

These should generally follow the outline of the following proposal for the Tusket River. This format may change in the future. The essential elements are: (1) An account of species at risk, threats and time period or urgency of threats; (2) References; (3) A map; and a few photographs of the habitat and the plants.

Reference:

Master, L., D. Faber-Langendoen, R. Bittman, G. A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. NatureServe Conservation Status Assessments: Factors for Assessing Extinction Risk. NatureServe, Arlington, VA. http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.jsp.

The Tusket River: An area of "Special Conservation Concern" for plants?

Paul Catling[1], Nick Hill[2], Sherman Boates[3] and Sean Blaney[4]

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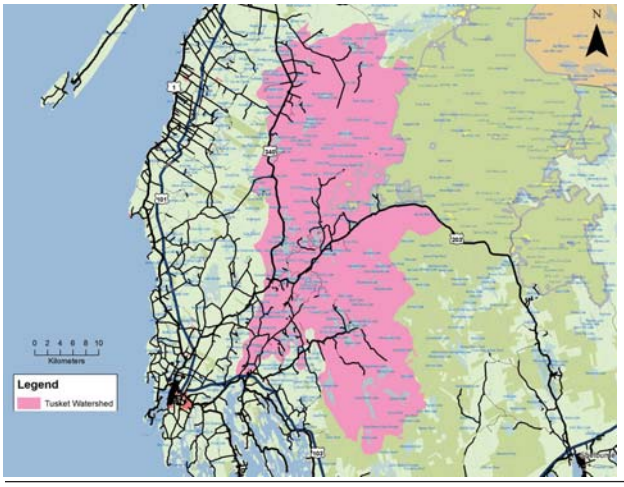


Figure 1. Southwestern Nova Scotia showing the Tusket watershed. Modified by P.M. Catling from a map on the Tusket River Environmental Protection Association website.

The Tusket watershed in southwest Nova Scotia (Figure 1) is home to a complex of nearly a hundred wetland plants with affinities to the Atlantic Coastal Plain. The Tusket, by virtue of its intact shoreline habitats, climate and great seasonal water level changes, is home to 8 of the 14 COSEWIC federally listed plant species at risk in Nova Scotia, including three that are also globally rare coastal plain species. Two of these are found nowhere else in Canada and are disjunct from wetlands in Massachusetts by more than 300 km. This is Canada's premier coastal plain river and it stands out in the Atlantic Coastal Plain Flora Recovery Strategy (Environment Canada and Parks Canada Agency 2010) as the area of concentration of species at risk. The guild of rare, stress tolerant coastal plain herbs with limited competitive ability is most diverse in wet meadows on ice scoured and flood prone lakeshores at downriver stations (Keddy, 2010), but nationally rare Atlantic Coastal Plain species occur throughout the watershed from the headwaters to the estuary. This past summer, a new shrub to Canada, *Lyonia ligustrina,* was discovered in swampy woods at the border of this watershed. Truly, this is both a national and international hotspot for rare plants adapted to infertile wetlands.

Special conservation concern is due because of the remarkable number of threats affecting the Tusket habitats, particularly the lakeshores along the main river channel that support the three global rarities. To a river that has lost the endemic Atlantic Whitefish and almost 50% of its best plant habitat because of the 1929 damming for hydroelectricity, were added losses to habitat associated with cottage development and off-road vehicle disturbance. Recently, water quality monitoring has confirmed that at least three lakes supporting globally rare plants have become eutrophic and a lengthy provincial investigation continues. Eutrophication is particularly serious for plants that evolved on the infertile sediments of the Atlantic Coastal Plain. The Tusket wetlands had been an internationally significant safe haven for these species until recently. Recognition by the CBA/ABC of the global importance of the Tusket River area, and our national responsibility to safeguard it, will help protect the following species. More information is available at the Species at Risk Public Registry (http://www.sararegistry.gc.ca/sar/index/default_e.cfm) and on the website for the coastal plain flora which gives details of the multispecies Recovery Plan and the Recovery Team (http://www.speciesatrisk.ca/coastalplainflora/)

Lilaeopsis chinensis, EASTERN LILAEOPSIS—"Special Concern". This species occurs in the Tusket estuary where plants have been destroyed by shoreline modifications and where the effect of dams and rising sea level is unclear.

Scirpus longii, LONG'S BULRUSH—"Special Concern" (G2/G3). This fire-barrens plant is at risk from long-term suppression of fire and other disturbances may lead to its genetic dilution through hybridization with the related, weedy *S. cyperinus.*

Coreopsis rosea, PINK COREOPSIS—"Endangered" (G3). Known in Canada only from the Tusket drainage, this species is subject to all threats related to shoreline modifications and pollution. (Figure 2).

Sabatia kennedyana, PLYMOUTH GENTIAN—"Threatened" (G3). In Canada, it occurs naturally only in the Tusket Watershed. Eutrophication stimulates lethal early development of its basal rosettes. (Figure 3).

Clethra alnifolia, SWEET PEPPERBUSH—"Special Concern". It rarely makes seed so survival is contingent on its persistence at seven known locations.

Hydrocotyleum umbellata, WATER PENNYWORT —"Threatened". Not known to produce viable seed and at greatest danger of competitive exclusion.

Eleocharis tuberculosa, TUBERCLED SPIKERUSH —"Special Concern". Slow-growing and particularly vulnerable to ATV disturbance.

Lyonia ligustrina, MALEBERRY— pending "Endangered", New to Canada 2011. A very small population discovered in a lake edge swamp.

Baccharis halimifolia, EASTERN BACCHARIS – "Threatened". In Canada, it occurs almost exclusively in saltmarshes of the Tusket estuary where it is threatened by shoreline development and potentially by sea-level rise.

Given the conservation value of the Tusket River wetland ecosystems, the designation of this area by the CBA/ABC will galvanize local and national conservation concern and give scientific validation for these concerns. Years of empirical study on these infertile wetlands made conservation of these wetland communities, a predictive science (in Keddy, 2010). Years of conservation effort and development and implementation of the Atlantic Coastal Plain Recovery Plan, led to the submission of this request for designation. It is fitting that the CBA/ABC "SPECIAL CONSERVATION CONCERN" initiative begins with these showcase wetlands of the Tusket River.

References

For more information on Nova Scotia's coastal plain flora see the Nova Scotia Coastal Plain Flora website at http://www.speciesatrisk.ca/coastalplainflora/?q=node/2, and for more on the Tusket Watershed see the Tusket River Environmental Protection Association website at http://www.trepa.com/our-watershed/ .

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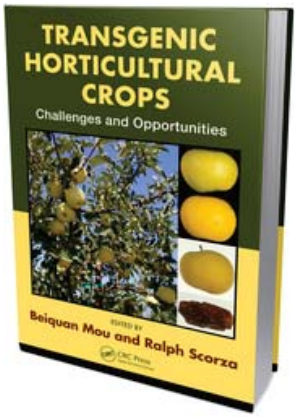


Figure 2. Pink Coreopsis (*Coreopsis rosea*), an endangered species growing in the Tusket River drainage. Left. Habitat by Martin Thomas. Right. Flower from above at Wilson's Lake by Mark F. Elderkin.

Figure 3. appears on the following page.

Book Review

Transgenic Horticultural Crops: challenges and opportunities
Edited by Beiquan Mou and Ralph Scorza, CRC Press (Taylor & Francis Group), Boca Raton, FL
xiii + 342 $129.55



The US Department of Agriculture recently approved (see Science, Oct 7th 2011, page 23) the release in the United States of the blue rose variety that was developed by Calgene, now known as Florigene. Interest in blue roses is almost as old as rose growing, hence it is no surprise that the hobby grower can see a blue rose, albeit with a non-rose pigment providing the elusive colour. This variety actually has been available in Japan since 2009, but is still restricted so that whole plants are not available to the general public…..but knowing gardeners and growers whom I know, don't hold your breath!

The editors of this book are to be congratulated on recruiting a strong panel of researchers from around the world, but as is so often the case with CRC books and any book in the field of plant transgenics, it is already out of date. This should not be a deterrent for anyone looking for comprehensive coverage of the field, but with the inevitable overstatements of potential.

The book opens with chapters on Nuts and Trees, Vegetables, Ornamentals and Pharmaceutical Proteins. The chapters with a geographic focus take us to where plant biotechnology has been led in almost all countries – the issues of public acceptance. It is encouraging to see that approximately half the pages in various chapters are devoted to acceptance, intellectual property, commercialization, and governance. Naturally the rewards of the basic research should go to those who are the 'discoverers/inventors/developers', call them what you will, but it would be naïve to think that the molecular biology industry has delivered those rewards. The big companies in the North America and Europe are long-standing major players, to the point where politicians and lobby groups have driven plant biotech governance, and have left the community of intellectual property lawyers wondering who is actually driving and in what direction. The future for horticultural innovation has always been more strongly in the hands of the consumer than has the future for agricultural developments. The international difficulties experienced in other controversial issues, such as climate change, see very spotty support for the Cartegena protocol and the Convention on Biodiversity (CBD). Each country wants its own control but the major players, particularly USA and its economic allies, want to impose some unification that always seems to fall back on US intellectual property and trade relations. Some of the problems in the book lie in the authorship list, because of a perceivable, but not necessarily real, bias to North America (28 out of 35 authors are listed with North American addresses). The Editors are to be congratulated on recruiting Alan Bennett and Steven Strauss to contribute very perceptive chapters on intellectual property and regulation.

One surprise for me was the absence of the emerging interests in the developed world for the so-called exotic food plants from the less-developed world. If the CBD can be given increased strength then issues of biopiracy may be reduced and non-compliant wealthy countries will understand that so-called free enterprise brings new obligations to ensure that many have-not, under-developed countries will become major contributors to development of new transgenics and will soon receive proper and real recognition as 'have' countries.

This book may be expensive, but understanding its content does not require familiarity with 'genomics-speak'. It should probably find its way to libraries that can still afford it, but above all it should be accessible through the world-wide web

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The Tusket River: An area of "Special Conservation Concern" for plants?
(Continued)



Figure 3. Plymouth Gentian (*Sabatia kennedyana*), a threatened species species growing in the Tusket drainage. Left. Habitat at Wilson's Lake by Sean Blaney. Right. Group of three flowering plants at Wilson's Lake by Megan Crowley

Pierre Dansereau, 1911-2011



L'écologiste québécois de réputation internationale, Pierre Dansereau, est décédé à Montréal le 28 septembre 2011, à l'âge de 99 ans, soit une semaine avant d'atteindre ses 100 ans. Son épouse centenaire, l'artiste-peintre Françoise Masson, lui survit, ainsi que son frère cadet Michel, qui a fait un brillant témoignage lors des funérailles.

Suite à son décès, de nombreux écrits ont été publiés dans les journaux[1] et les médias électroniques, documents toujours accessibles via le Web. Chacun y est allé de son témoignage, en tant qu'expert, ami, collègue, ancien étudiant ou collaborateur, administrateur, doyen, journaliste. On y retrouve plein de qualificatifs et de jugements sur cet éminent personnage et sur sa carrière. Il nous est difficile ici de résumer et d'apprécier ces textes car plusieurs ont été écrits sur le coup de l'émotion et l'on devra sans doute attendre un peu pour laisser retomber plus d'objectivité.

En raison de sa longévité et des nombreuses facettes de sa riche carrière, il est possible que l'on doive patienter avant la publication d'une biographie critique d'un tel personnage. En effet, comment peut-on résumer la vie d'un presque centenaire qui a enseigné dans une vingtaine d'universités sur cinq continents, obtenu plus d'une quinzaine de doctorats honorifiques, une soixantaine de décorations et de mérites de différents gouvernements et sociétés savantes, publié plus de 600 travaux scientifiques, comprenant près d'une dizaine de livres, et dirigé plus d'une cinquantaine d'étudiants gradués? Déjà en 1957, lorsque Pierre Dansereau avait été élu président de la Société de Géographie de Montréal, le géographe Camille Laverdière, qui devait présenter le nouveau président, trouvait très ardue la tâche de résumer sa carrière. Pierre Dansereau ne sera pas le seul dans cette situation. On attend encore une biographie critique de Marie-Victorin le botaniste, tout comme celles de Fernald, Stebbins et Cronquist, car de tels personnages sont plus grands que nature.

Il y a tout de même lieu de dresser ici les grandes lignes du parcours de Pierre Dansereau, botaniste, écologiste, biogéographe, écosociologue, éducateur, éthicien, humaniste, et même savant et philosophe, et d'insister sur les travaux faits au Québec et ailleurs au Canada. Le présent résumé de sa biographie s'inspire d'un écrit de l'un de ses proches, le sociologue Jean-Guy Vaillancourt, publié à la fin de la première partie de l'autobiographie inachevée de Pierre Dansereau: « *La lancée, 1911-1936. Autobiographie*. Éditions Multimondes. 2005 » (Vaillancourt: *Biographie*, pages 133-137).

Pierre Dansereau est né à Outremont, Montréal, en 1911. Il fréquente les institutions des Jésuites aux collèges Sainte-Marie (Montréal) et du Sacré-Coeur (Sudbury). Après l'obtention de son baccalauréat ès arts en 1932 à l'Université de Montréal, il étudie trois ans à l'Institut agricole d'Oka d'où il ressort avec une formation en sciences agronomiques. Il y découvre un intérêt marqué pour la botanique grâce aux enseignements dynamiques du Père Louis-Marie, trappiste, botaniste et auteur de la *Flore-Manuel de la Province de Québec* (1931). Durant ses vacances à Percé, en Gaspésie, il met en pratique ses connaissances acquises sur la flore. Ses premières observations portent sur la phénologie de la zigadène (*Zigadenus glaucus*, maintenant *Anticlea elegans*, 1934) et il est le premier à faire le point sur l'*Erigeron compositus* (1937), une espèce arctique-alpine disjointe toujours rare en Gaspésie.

Après un séjour à l'Université de Paris, il entreprend un doctorat ès Sciences à Genève (Suisse) qu'il termine en 1939 sous la direction de B.P.G. Hochreutiner. Il y étudie le genre *Cistus* en Méditerranée et intègre à ses travaux des disciplines et des aspects comme les campagnes d'herborisation, la méthode des collections massives, la systématique, la cytologie et les études d'hybrides. À la même époque, il fait un apprentissage en phytosociologie à Montpellier (France) à la Station Internationale de Géobotanique Méditerranéenne et Alpine (SIGMA) dont Josias Braun-Blanquet était le directeur.

À son retour à Montréal, de 1940 à 1942, il devient collaborateur du frère Marie-Victorin au Jardin Botanique de Montréal, et entretient des liens étroits avec Jacques Rousseau. Ces deux sommités sont parmi ses premiers mentors. Entre 1940 et 1950, comme chargé de cours, il enseigne l'écologie à l'Université de Montréal, une première pour cette discipline, et la taxonomie végétale au Collège Macdonald de l'Université McGill. Son expertise en agronomie et en phytosociologie lui permet d'accomplir des travaux innovateurs en agriculture, soit des études sur les pâturages (1947-9), les parasites (1957) et les mauvaises herbes du Québec (1947-8). Durant cette période, il dirige le Service de Biogéographie de la Province de Québec. Il étudie entre autre l'écologie des tourbières (1952) et ses travaux sur l'érablière laurentienne retiennent l'attention (1943-6). Il précise la nature et les caractéristiques de cet écosystème à sa limite d'aire en Gaspésie (1944). Il se préoccupe de l'avenir de l'acériculture (1945) et dirige des travaux sur la géographie et l'écologie du bouleau jaune (*Betula alleghaniensis*, 1959, 1966), sur l'introgression entre l'érable à sucre (*Acer saccharum*) et l'érable noir (*Acer nigrum*) (1941, 1947), et sur le complexe des violettes jaunes (*Viola pubescens*, 1957, 1966). Il s'intéresse à la classification de la végétation aquatique dans l'axe des Grands-Lacs et du Saint-Laurent (1945, 1959). Avec Doris Löve alors à l'Université de Montréal, il étudie le genre *Xanthium* (1959) et plus tard, avec une autre équipe, le genre *Alchemilla* (1964).

Grâce à l'*Arctic Institute of North America*, il participe, au début des années 1950, à l'expédition Baird sur l'île de Baffin. Il y fait entre autres des études sur les potentilles arctiques qui causent toujours des problèmes aux taxonomistes. Ses observations sur les modes de croissance des espèces du complexe du *Potentilla nivea* et du *Potentilla vahliana* (1954-56) sont encore très utiles aujourd'hui. Sur le plan de l'histoire de la botanique, il se

joint à ceux de son entourage qui rendent hommage à Marie-Victorin (1945) et présente sa propre synthèse sur ceux qui ont marqué la tradition botanique à Montréal (1956).
Il participe à la direction d'excursions botaniques en Gaspésie, autour de Montréal et en Montérégie lors de congrès internationaux de botanique qui se tiennent à Montréal: *Botanical Society of America*, en 1947 et *IXe Congrès International de Botanique*, en 1959. Plus tard en 1970, lors d'un congrès conjoint de l'ABC / CBA et de la Société canadienne de Physiologie végétale à l'Université Laval, Québec, il dirige la plupart des excursions qui se déroulent en Gaspésie.
Les sciences naturelles demeurent son pain et son beurre, et ses recherches sur la dynamique des forêts établissent sa réputation. Ses travaux l'amènent à développer un système qui décrit les structures végétales à partir de leur dimension spatiale, ce qui lui permettra d'élaborer des comparaisons à l'échelle mondiale. À cette époque, il subit les influences de plusieurs courants étrangers, en particulier des Américains Emma Lucy Braun, Henry S. Conard et Stanley A. Cain. Ne parvenant pas à décrocher un poste à plein temps dans une université du Québec, il va aux États-Unis et enseigne à l'Université du Michigan, Ann Arbor, de 1950 à 1955. De retour à Montréal, de 1955 à 1961, il dirige l'Institut botanique et devient doyen de la Faculté des Sciences de l'Université de Montréal. Ne se sentant jamais à l'aise dans des postes administratifs, et aussi en raison de ses idées progressistes et de son franc parler, il doit retourner aux États-Unis. Il enseigne alors à l'Université Columbia et devient aussi directeur adjoint et chef du département d'écologie du Jardin Botanique de New York.
C'est à cette époque qu'il publie son célèbre « *Biogeography, an Ecological Perspective* » (1957). Ses idées en écologie avaient évolué à ce point qu'il sera le premier à y intégrer des concepts d'écologie urbaine et humaine, ce qui constituera sa marque de commerce jusqu'à la fin de sa carrière. Cette publication charnière semble faire le pont entre la première étape de sa carrière où les sciences naturelles ont dominé, via la taxonomie, l'écologie végétale, la biosystématique et la biogéographie, et la suivante tournée vers la sociologie.
Selon Jean-Guy Vaillancourt, la deuxième étape de la carrière de Pierre Dansereau est plutôt axée sur les sciences sociales, via l'écologie humaine, l'écodéveloppement, la sociologie de l'environnement et l'écosociologie. Dans ce nouvel horizon, il subit plusieurs influences comme celles de la biologiste et environnementaliste Rachel Carson et du philosophe, théologien et paléontologue, le jésuite Pierre Teilhard de Chardin. Il s'intéresse non pas tant à l'influence de la nature sur les humains, mais plutôt à l'impact des humains sur la nature par l'entremise de l'agriculture, de l'urbanisation et de l'industrialisation. Il conçoit que toute démarche écologique doit être multidisciplinaire et avoir comme objectif l'écodéveloppement. Il s'agissait alors d'une sorte de développement durable avant même qu'on en parle. Ainsi, vers la fin des années 1960, il revient à l'Université de Montréal pour enseigner à l'Institut d'Urbanisme (1968-1971), puis à compter de 1971, à l'Université du Québec à Montréal (UQAM). Il appréciait l'ouverture d'esprit de cette jeune institution où les cloisons entre les départements n'étaient pas aussi étanches qu'ailleurs.
À cette époque, il dirige un projet majeur, une enquête d'intérêt public sur l'« *Étude écologique de la zone du futur aéroport international de Montréal (EZAIM)* » (1971 et suivantes). Il s'entoure de géographes, de géologues, de biologistes, d'ingénieurs et même d'un psychiatre social, et on produira une dizaine de rapports innovateurs. La politique étant ce qu'elle est, et Pierre Dansereau en était bien conscient, bien des décisions avaient cependant déjà été prises à l'avance. Malgré tout, ce sera pour lui l'occasion de mettre en oeuvre ses idées d'intégration de la nature et de l'humain. Il propose de remplacer le schéma de la chaîne alimentaire classique en forme de pyramide, par celui d'une sphère animée de flèches pointant dans tous les sens, sa célèbre « boule-de-flèches » en six niveaux trophiques: minérotrophique, phytotrophique, zootrophique herbivore, zootrophique carnivore, investissement et contrôle[2].
Il continue son oeuvre à l'UQAM où on le nommera professeur émérite en 1989. Il dirige le Laboratoire pour l'étude des écosystèmes et l'aménagement des territoires, jusqu'à l'âge de 94 ans. Durant cette période, les valeurs de l'humanisme et de l'éthique qui l'avaient suivi tout au long de sa carrière, priment sur celles de la recherche scientifique. En plus de diriger encore des thèses, il dispense ses cours, conférences et écrits à une audience élargie qui comprenait un public plus diversifié. Sa sagesse, ses idées philosophiques et son expertise sont sollicitées à divers niveaux consultatifs ou autres. Il signe les préfaces de nombreux livres de nature et de géographie publiés au Québec, dont l'Avant-Propos de la troisième édition de la *Flore Laurentienne* (1995), produite d'abord en 1935 par l'un de ses mentors, Marie-Victorin. Pendant ce temps, sa fidèle secrétaire Virginia Weadock, durant 48 ans, continue toujours à l'appuyer sans relâche. Éternel optimiste, il propose le concept d'« austérité joyeuse », soit l'idée de bien vivre mais avec moins. Une de ses dernières interventions faites au Québec marque son opposition en 2006 à la privatisation par le Gouvernement du Québec, du parc du mont Orford, dans les Cantons-de-l'Est.
Parmi les contrées étrangères qui l'ont accueilli, le Brésil constitue sans aucun doute sa deuxième patrie. Il y fit diverses études de terrain en forêt tropicale et y prodigua régulièrement ses enseignements. On l'avait gentiment surnommé *Pedro della Silva*. En 1998, on lui rendit un vibrant hommage, deux jours de colloque sur sa vie et sa carrière. Il en résulta une publication de plus de 700 pages comprenant les points marquants de son héritage intellectuel, des témoignages de gens d'ici et de là-bas, et sa bibliographie publiée la plus complète à ce jour: « *Ecologia humana, Ética e educação. A mensagem de Pierre Dansereau* » (1999), produite par Paulo Freire Vieira et Maurício Andrés Ribeiro. Aurait-on manqué le bateau ici pour lui offrir la pareille ou même aller plus loin?
Ainsi, dans cette bibliographie, retrouve-t-on les principaux ouvrages marquants de sa carrière, en plus de ceux déjà cités: *Biogeography* (1957) et son autobiographie (2005). Signalons entre autres: *Phytogeographica Laurentiana. II. The principal plant associations of the Saint Lawrence Valley* (1959), *Contradictions & biculture* (1964), *Dimensions of environmental quality* (1971), *La Terre des hommes et le paysage intérieur* (1973), *Inscape and Landscape* (1973, 1975), *The human perception of environment* (1975), *Harmony and Disorder in the Canadian Environment* (1975), *Harmonie et désordre dans l'environnement canadien* (1980), *Essai de classification et de cartographie écologique des espaces* (1985), *L'envers et l'endroit: le désir, le besoin et la capacité* (1991, 1994).
Il a contribué à des travaux encyclopédiques divers où il a établi la définition des termes de son domaine. On retient ses contributions aux *Encyclopedia Americana*, *Encyclopaedia Universalis*, *Encyclopedia McGraw-Hill of Science and Technology*, *The Canadian Encyclopedia* / *L'Encyclopédie du Canada*, et leurs diverses rééditions.

Pierre Dansereau a été beaucoup sollicité par les médias et il s'est volontairement prêté à l'exercice. En 1981, la journaliste Thérèse Dumesnil réalise plusieurs entretiens avec le célèbre écologiste et publiera « *Pierre Dansereau, l'écologiste aux pieds nus*. Éditions Nouvelle Optique ». En 2001, son cousin le cinéaste Fernand Dansereau réalise un magnifique documentaire sur son parcours exceptionnel: « *Quelques raisons d'espérer »* Office National du Film[3]. En 2002, les Productions Impex, grâce à André Larochelle, sortent le film « *L'homme de toute la terre* »[4] qui présente une autre version de son parcours scientifique. Depuis quelques années, le Service des Archives de l'UQAM a rendu disponible une exposition virtuelle sur Pierre Dansereau: http://www.archives-expopd.uqam.ca.
Même si l'*Encyclopedia Britannica* le présente comme l'un des fondateurs de l'écologie contemporaine et même si sa réputation s'étend sur plusieurs continents, Pierre Dansereau est toujours demeuré une personne très accueillante, reconnue pour son accessibilité, son amabilité, son charme, son empathie, son magnétisme, comme le soulignait à juste titre son assistant des vingt dernières années, le géocartographe Daniel Garneau de l'UQAM.
Pierre Dansereau n'avait pas suivi le virage spécialisé de la botanique dans les années 1960 et avait déploré auprès de l'auteur de ces lignes un délaissement des études de terrain et un certain abandon des connaissances taxonomiques de base portant sur les éléments de la biodiversité, alors que ce terme était utilisé à toutes les sauces en haut lieu. On n'était plus capable de nommer le vivant mais on voulait le protéger. Heureusement, les choses semblent vouloir changer de direction présentement.
Pierre Dansereau demeure un penseur d'envergure internationale et son décès marque encore une fois la disparition d'une personnalité inclassable aux allures encyclopédiques.

Jacques Cayouette
Mars 2012
1- Note de l'éditeur: Voir entre autre Globe and Mail, November 5, 2011, et plusieurs autres articles en français
2- Voir Noémie Mercier, Québec Science, Mars 2010, pages 38-43.
3- Note de l'éditeur: disponible au www.onf.ca/film/Quelques_raisons_desperer
4- Note de l'éditeur: voir www.the-mgc.com/Documentary/catalog/pdf/P_12_02.pdf



Pierre Dansereau. Photo: Daniel Garneau

Pierre Dansereau, 1911-2011

The internationally renowned Quebec ecologist, Pierre Dansereau, died in Montreal on September 28, 2011, at age 99, a week before reaching his 100th birthday. His centenarian wife, the painter Françoise Masson, survives him, as well as his younger brother Michel, who gave a brilliant testimony at the funeral.
Following his death, many written accounts have been published in newspapers[1] and electronic media, documents still accessible on the Web. Everyone provided testimonies as expert, friend, colleague, student, former employee, director, dean, journalist. These include descriptive accounts and judgments of this distinguished personage and his career. It is difficult to summarize and assess these since many were written on the spur of the moment and one should, perhaps, wait a while to reconsider them later, more objectively.
Because of his longevity and the many facets of his varied career, we may possibly have to wait until the publication of his critical biography. Indeed, how can one sum up the life of a nearly century-old man who has taught in twenty universities on five continents, received more than fifteen honorary degrees, sixty decorations and merits from various governments and learned societies, published more than 600 scientific works including nearly a dozen books, and directed over fifty graduate students? Already in 1957, when Pierre Dansereau had been elected president of the Geographical Society of Montreal, the geographer Camille Laverdière, who was to welcome the new president, was finding the task of summarizing his career very difficult.
Pierre Dansereau is not alone in this situation; we still await a critical biography of Marie-Victorin as a botanist, as well as those of Fernald, Stebbins and Cronquist, people often considered to be larger than life.
However, one can still sketch the main lines of the path taken by Pierre Dansereau, botanist, ecologist, biogeographer, ecosociologist, educator, ethicist, humanist, scholar and philosopher, and to emphasize the work done in Quebec and elsewhere in Canada. The following summary of his biography is based on an account written by a person close to him, the sociologist Jean-Guy Vaillancourt, published at the end of the first part of the unfinished autobiography of Pierre Dansereau: « *La lancée, 1911-1936. Autobiographie*. Éditions Multimondes. 2005 » (Vaillancourt: *Biographie*, pages 133-137).
Pierre Dansereau was born in Outremont, Montreal, in 1911. He attended the Jesuit Collèges of Sainte-Marie (Montreal) and Sacré-Cœur (Sudbury). After earning his BA in 1932 at the University of Montreal, he studied three years at l'Institut Agricole d'Oka, from which he emerged with training in agricultural sciences. He discovered an interest in botany, thanks to the dynamic teachings of Father Louis-Marie, a Trappist, botanist and author of *Flore-Manuel de la Province de Québec* (1931). During his vacation in Percé, Gaspé, he applied his knowledge of the flora. His first observations relate to the phenology of death camas (*Zigadenus glaucus*, now *Anticlea elegans*, 1934) and he is the first to comment on *Erigeron compositus* (1937), an arctic-alpine disjunct species still rare in Gaspésie.
After a term at the University of Paris, he began a Doctorate in Sciences in Geneva (Switzerland) which he completed in 1939 under the direction of B.P.G. Hochreutiner. He studied the Mediterranean genus *Cistus* and integrated into his work other aspects such as plant collecting campaigns, methods for massive collections, systematics, cytology and hybrid studies. At the same time, he did an apprenticeship in

phytosociology in Montpellier (France) at the Station Internationale de Géobotanique Méditerranéenne et Alpine (SIGMA) when Josias Braun-Blanquet was the director. Upon his return to Montreal, from 1940 to1942, he began work with Brother Marie-Victorin at the Montreal Botanical Garden, while keeping a close association with Jacques Rousseau. These two luminaries are among his early mentors. Between 1940-1950, as a lecturer, he taught ecology at the University of Montreal, a first for this discipline, and botanical taxonomy at Macdonald College, McGill University. His expertise in agronomy and phytosociology enabled him to do pioneering work in agriculture, pastures (1947-9), parasites (1957) and weeds in Quebec (1947-8). During this period, he headed the Service of Biogeography in the Province of Quebec. He studied among others the ecology of peatlands (1952) and his work on the Laurentian maple groves attracts attention (1943-46). He described the nature and characteristics of the sugar maple ecosystem to its limit in the Gaspé area (1944). He was concerned about the future of the sugar maple industry (1945) and conducted research on the geography and ecology of yellow birch (*Betula alleghaniensis*) (1959, 1966), the introgression between sugar maple (*Acer saccharum*) and black maple (*Acer nigrum*) (1941, 1947), and the complex of yellow violets (*Viola pubescens*) (1957, 1966). He was also interested in the classification of aquatic vegetation in the axis of the Great Lakes-St. Lawrence (1945, 1959). With Doris Löve, then at the University of Montreal, he studied the genus *Xanthium* (1959) and later with another team, the genus *Alchemilla* (1964).

Through the Arctic Institute of North America, he participated, in the early 1950s, to the Baird expedition on Baffin Island. He conducted, among others, studies on arctic *Potentilla*, a species that still causes problems for taxonomists. His observations on growth patterns of species of *Potentilla nivea* complex and *Potentilla vahliana* (1954-1956) continue to be very useful today. In terms of botanical history, he joins others in his entourage who pay homage to Marie-Victorin (1945) and presents his own synthesis of those who have influenced the botanical tradition in Montreal (1956).

He participated in organizing botanical excursions in the Gaspésie, Montreal area and Montérégie during International Botanical Congresses in Montreal: *Botanical Society of America* (1947) and *IX International Botanical Congress* (1959). Later in 1970, during a joint meeting of the CBA/ABC and the Canadian Society of Plant Physiology at l'Université Laval, Quebec, he directed most trips taking place in the Gaspésie vicinity.

Natural sciences remained his bread and butter, and research on forest dynamics consolidated his reputation. His work led him to develop a system that describes vegetation structure from a spatial perspective, which allowed him to further compare systems worldwide. During this time, he was influenced by numerous concurrent personages, in particular the Americans Emma Lucy Braun, Henry S. Conard and Stanley A. Cain. Unable to find a full-time position at any Quebec university, he went to the United States and taught at the University of Michigan, Ann Arbor, from 1950 to 1955. Back in Montreal from 1955 to 1961, he headed the “Institut Botanique” and became dean of the Faculty of Science, University of Montreal. However, never feeling comfortable in administrative positions, and also because of his progressive ideas and outspoken approach, he returned to the United States. He then taught at Columbia University and also became deputy director and head of the department of ecology of the New York Botanical Garden.

It was during this period that he published his famous *"Biogeography, an Ecological Perspective*" (1957). His ideas in ecology had evolved and he becomes the first to incorporate concepts of urban and human ecology, which would be his trademark until the end of his career. This seminal publication seems to bridge between the first stage of his career, when the natural sciences dominated via the taxonomy, plant ecology, biosystematics and biogeography, and the second stage that was devoted to sociology. According to Jean-Guy Vaillancourt, the second stage of Pierre Dansereau's career is more focused on social sciences, through human ecology, ecodevelopment, environmental sociology and ecosociology. In this new domain, he is influenced by many, including the biologist and environmentalist, Rachel Carson, and the philosopher, theologian, and paleontologist, Jesuit Pierre Teilhard de Chardin. He is interested not so much in the influence of nature on humans, but rather the human impact on nature through agriculture, urbanization and industrialization. He believed that any ecological approach must be multidisciplinary and have ecodevelopment as an objective. This concept was akin to sustainable development. In the late 1960s, he returned to the University of Montreal to teach in the Urban Institute (1968-1971), and, starting in 1971, at the Université du Québec à Montréal (UQAM). He appreciated the openness of this young institution where the “ walls between departments,” were not as rigid as elsewhere.

During that time, he led a major project, a public interest enquiry called "*Étude écologique de la zone du futur aéroport international de Montréal (EZAIM)*" (1971 onwards). He teamed up with geographers, geologists, biologists, engineers and even a social psychiatrist, and produced a dozen innovative reports. The political context being what it was, of which Pierre Dansereau was keenly aware, meant that many decisions had already been taken. Nevertheless, it was an opportunity for him to implement his ideas of integrating nature and humanity. He suggested replacing the pattern of the classic food chain pyramid, by that of a sphere with arrows pointing in all directions, his famous "ball-of-arrows" in six trophic levels: minerotrophic, phytotrophic, herbivore zootrophic, carnivore zootrophic, investment and control[2].

He continued his work at UQAM where he was named professor emeritus in 1989. He directed the Laboratory for the study of ecosystems and land use planning until the age of 94. During this period, the values of humanism and ethics that have followed him throughout his career, took precedence over those of scientific research. In addition to directing theses, he presents his classes, lectures and writings to a wider and more diverse audience. His wisdom, his philosophical ideas and expertise are sought at various advisory levels. He signed the prefaces of many books on nature and geography published in Quebec, including the foreword of the third edition of the Flore Laurentienne (1995), first produced in 1935 by one of his mentors, Marie-Victorin. Meanwhile, his faithful secretary during 48 years, Virginia Weadock, continued to support him tirelessly. An eternal optimist, he proposes the concept of "joyful austerity", the idea of living well with less. One of his last speeches made in 2006 witnessed his opposition to privatization by the Quebec Government of the park, Mount Orford, in the Eastern Townships.

Among the many foreign countries that hosted him, Brazil was, undoubtedly, his second home. He made several field

studies in the tropical forest and offered teaching. He was kindly nicknamed *Pedro della Silva*. In 1998, he was given a glowing tribute, two-day symposium on his life and career. The result was a 700 page publication including the highlights of his intellectual legacy, testimonials from people, and the most complete bibliography published to date: "*Ecologia Humana, Ética e educação. A mensagem de Pierre Dansereau* "(1999), produced by Paulo Freire Vieira and Andrés Mauricio Ribeiro. Have we missed the boat here by not giving him a similar tribute, or even to go further? Thus, in this bibliography, we find the principal works of his career highlights, in addition to those already cited: *Biogeography* (1957) and his autobiography (2005). Among these are: *Phytogeographica Laurentiana. II. The principal plant associations of the Saint Lawrence Valley* (1959), *Contradictions & biculture* (1964), *Dimensions of environmental quality* (1971), *La Terre des hommes et le paysage intérieur* (1973), *Inscape and Landscape* (1973, 1975), *The human perception of environment* (1975), *Harmony and Disorder in the Canadian Environment* (1975), *Harmonie et désordre dans l'environnement canadien* (1980), *Essai de classification et de cartographie écologique des espaces* (1985), *L'envers et l'endroit: le désir, le besoin et la capacité* (1991, 1994).

He has contributed to various encyclopedic works where he established the definition of his scientific domain. Noteworthy are contributions to the *Encyclopedia Americana*, *Encyclopaedia Universalis*, *Encyclopedia McGraw-Hill of Science and Technology*, *The Canadian Encyclopedia* / *L'Encyclopédie du Canada*, and their various editions.

Pierre Dansereau was much sought after by the media and he gracefully volunteered his time to them. In 1981, journalist Therese Dumesnil made several interviews with him and published "*Pierre Dansereau, l'écologiste aux pieds nus*. Editions Nouvelle Optique". In 2001, his cousin, the filmmaker, Fernand Dansereau, made a wonderful documentary about his exceptional career: "*An Ecology of Hope*" (National Film Board)[3]. In 2002, Productions Impex, directed by André Larochelle, produced a documentary "*A Man for the Whole World"* [4] giving another version of Dansereau's scientific career. In recent years, the Archives Department at UQAM has made available a virtual exhibition of Pierre Dansereau: http://www.archives-expopd.uqam.ca.

While the *Encyclopedia Britannica* describes him as a founder of contemporary ecology and although his reputation spread over several continents, Pierre Dansereau has always remained a very friendly person, known for his accessibility, his kindness, his charm, his empathy, and his magnetism, as rightly pointed out by his assistant of the past two decades, the cartographer Daniel Garneau, from UQAM. Pierre Dansereau did not follow the trend of specialized botany in the 1960s and complained to the author of the approaches, including a shift away from field studies and the abandoning of taxonomic knowledge as the fundamental element of biodiversity, while this term was being used indiscriminately in high places. One was no longer able to name the living, but wanted to protect it. Fortunately, things seem to be improving lately.

Pierre Dansereau remains a world-class thinker and his passing marks again the disappearance of a human being whose knowledge and scope remain incomparable.

Jacques Cayouette
(translated by Hugues Massicotte and Linda Tackaberry)
March 2012

1- Editor's note: Globe and Mail, November 5, 2011
2- See Noémie Mercier, Québec Science, March 2010, pages 38-43.
3- Editors' note: available at www.onf.ca/film/An_Ecology_of_Hope/
4- Editors' note: see www.the-mgc.com/Documentary/catalog/pdf/P_12_02.pdf

Memorial Plaque for John L. Harper, Plant Biologist.

The many Canadian botanists who were graduate students at Bangor, North Wales, with John Harper, will be interested to know that on March 17th there was a ceremony in Bangor, to unveil a block of local rough-hewn granite with the epitaph:

In memory of John L. Harper, CBE, FRS, Plant Biologist, Professor of Agricultural Botany, and later Botany, (1960-82) (in both Welsh and English)

The day was also marked with talks by Bob Whitbread (one of the first JLH appointees); Chris Gliddon (the joint last JLH appointee) and Mike Begon – co-author of the text 'Ecology'.



Photo courtesy of Chris Gliddon, one of the event organizers.

Obituary

Paul F. Maycock...his scientific contributions.

Dianne Fahselt

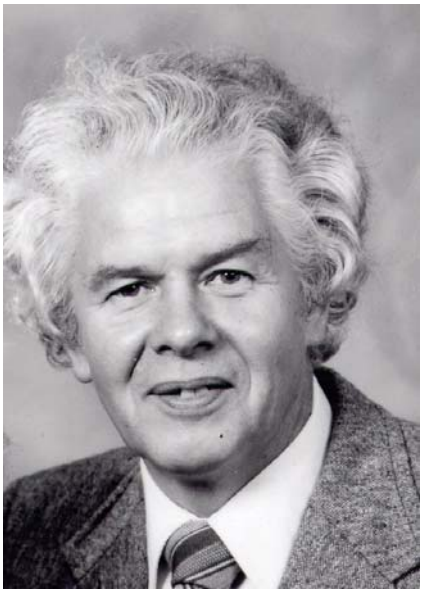


Paul Maycock, expedition to montane forest in Japan, 1989

A well known Canadian botanist and CBA member passed away on Feb. 23rd, 2012 at 81 years of age.
For decades Paul was the premier plant community ecologist of Ontario, having begun his work with Great Lake forests during his PhD program at University of Wisconsin. Through his graduate program and for at least five decades afterward he consistently used one standard method, the Point Quarter Method, of vegetational analysis to document the structure, composition and distribution of relatively undisturbed natural forests. With this method he investigated plant communities in thousands of locations in Wisconsin, Ontario and Quebec. In addition to forests in eastern Canada he also studied savannas, tall grass prairies, subarctic and high arctic communities and, further afield, vegetation of Poland, Japan, China, Chile and Slovakia, among others. In some cases he captured the character of stands that have already disappeared, and in every case he recorded quantitative baseline data against which future changes could be measured and against which attempts to restore damaged vegetation can be gauged. Coincidentally he contributed new information about plant distribution and species ecology.
The remarkable and unique extensive data base, built up by him and his students in Ontario-Quebec, has now been digitized, is probably unequalled in any other jurisdiction. It has unlimited applications to the understanding of plants and communities, of environment as well as environmental change, and is one of his main scientific legacies to future generations of ecologists and botanists. His field research was documented by 30,000 voucher specimens of plants which will also remain for posterity. His specimens were designated a Special Collection at the herbarium of the University of Toronto, Department of Biology, at Mississauga.
His meticulously documented scientific publications, such as the one on phytosociology of deciduous forests of Southern Ontario, have been regarded as authoritative since they were written. In addition to journal articles, he also contributed entries related to forests to the Canadian Encyclopedia and the WorldBook Multimedia encyclopedia.
He was a founding member of the Canadian Botanical Association and active in this association all his working life. In 1988-1990 he was Secretary General to an international organization of ecologists (Intecol) and helped to organize the fifth international Congress of Ecology, in Japan. Throughout his career Paul was always willing to jump into any conservation issue where his expertise and information could promote the cause. He was a key member of the Canadian Botanical Association Conservation Committee for many years, and before, after and during this time wrote numerous reports, attended many hearings and sent off countless letters appealing for preservation of natural ecosystems. For this work, he received numerous awards. In 1999 he received the Canadian Council of Ecological Areas Gold Leaf Award for long-standing contributions and personal dedication to enhancing Ontario's network of conservation areas and protecting ecosystems. In 2010, he was given the Goldie Award (2010) by the Field Botanists of Ontario to recognize his extensive studies of plant communities and his lifetime conservation efforts which culminated in the preservation of areas, such as the Ojibway Prairies at Windsor, Cawthra Woods and Creditview Bog, to name only a few.

The specimens in Paul's huge research collection are particularly significant because they are cross-referenced to the quantitative field data from Ontario, Quebec, Wisconsin, Poland, China, Japan, Chile, and other locations. These should be permanently housed in an active facility where curatorial staff will be available into perpetuity.
If CBA/ABC members are associated with, or could suggest, North American herbaria that would be appropriate for depositing the Maycock collection, would they kindly advise Dianne Fahselt (diannefahselt@gmail.com) as soon as is convenient please?
It appears also that, for scientific purposes, colleagues in the ecological and taxonomic fraternity of botanists may soon look forward to accessing 50 years of Paul's extensive field data.

As an expression of sympathy, and an acknowledgment of Paul's passion for botany and conservation, donations to the Royal Botanical Gardens, 680 Plains Rd. W, Burlington (www.rbg.ca)



MAJOR INVASIVE ALIEN PLANTS OF NATURAL HABITATS IN CANADA

Paul M. Catling and Gisèle Mitrow

3. Leafy Spurge, Wolf's-Milk, euphorbe ésule
Euphorbia esula L.
Synonym: *Galarrhoeus esula* (L.) Rydberg



Figure 1. Habitat of Leafy Spurge at it northernmost occurrence in Canada at Henderson Corners in Yukon. So far, attempts to remove this disjunct colony have failed. Photo used with permission of Bruce Bennett,. Yukon Conservation Data Centre, taken 8 July 2007.

The common name “spurge" is said to come from the Middle English/Old French “espurge” ("to purge"), resulting from the use of the plant's sap as a purgative. *Euphorbia* is said to be named for the Greek physician Euphorbus by the king of Numidia (who ruled present-day Tunisia and eastern Algeria, and who married the daughter of Mark Antony and Cleopatra). The king was interested in botany and decided to honour his physician by naming a plant after him, as Caesar had honoured his physician (but with a statue). The specific epithet “esula*”* is derived from an old Celtic name “esu” which refers to the acrid milky juice.
It was ranked as number 6 in the “Prioritized list of invasive alien plants of natural habitats of Canada” in 2005. It is unclear whether or not it now deserves a lower rank since it continues to spread despite the fact that biocontrol has been very effective in some areas.

What makes it a major problem?

(1) Effective dispersal
(2) Effective vegetative reproduction
(3) Poisonous latex
(4) Broad ecological niche
(5) Protective underground biomass
(6) Early rapid growth and tall stature
(7) Allelopathy

Identification and Classification
With its alternate, entire and linear or lanceolate leaves, *Euphorbia esula* is a relatively distinctive species (Figures 1 and 2). However, it is better referred to as a species complex that requires much more taxonomic work. There may be only one or a few taxa in North America. These may vary locally as a result of repeated introductions of different variants from different parts of Europe.
Leafy Spurge was once divided into more than 60 species as a result of taxonomists working independently in different countries. Recent studies have suggested several related species in the *E. esula* group and a recent Canadian study suggested that four taxa occur in North America: *E. agraria* Bieb., *E. cyparrisias* L., *E. esula* L., and the hybrid *E*. X *pseudoesula* Schur. The group is probably best conceived as about 7 species (*E. agraria*, *cyparissias*, *esula*, *lucida*, *nevadensis*, *salicifolia*, and *undulata*). There are also 3 hybrids and *E. boissieriana*, the relationships of which are unclear. This group of *7* and its close relatives (within section *Esula* Dumort.) is distinguished by smooth seeds, raylet leaves not joined at the base, capsules 4-5 mm wide, and leaves pinnately veined.
Leafy Spurge is most often confused with Cypress Spurge (*E. cyparissias* L.). The latter can be separated by having narrower leaves less than 2.6 (3) mm wide (compared to 3 – 15 mm wide in *E. esula*) and larger floral bracts 3-6 mm wide (instead of 8-16 mm wide in *E. esula*). Hybrids between the two cause some difficulty and are keyed below. Any of the Eurasian taxa may be introduced and some have been erroneously reported from Canada. All taxa in the group, including the Eurasian taxa, are in the provisional key that follows. Taxa not found in Canada are in square brackets.

1a. Leaf cordate (lobed) at the base ……..2
1b. Leaf base not cordate ……..3
2a. Leaves to 30 mm long ….. [*E. nevadensis*]
2b. Leaves to 80 mm long …… *E. agraria*
3a. Plants pubescent and with ovate or ovate-lanceolate leaves…..[*E. salicifolia*]
3b. Plants glabrous or if pubescent with linear to linear-lanceolate leaves ….4
4a. Leaves emarginate, oblanceolate or elliptic-obovate, with undulate margins; plants rhizomatous ….. [*E. undulata*]
4b. Lacking the combination of characters in 4a, leaves emarginate or not, oblanceolate or not, lacking undulate margins; plants rhizomatous or not ……5
5a. Leaves shiny ……[*E. lucida*]
5b. Leaves dull ….. 6
6a. Leaves lanceolate and acuminate …..[*E. boisseriana*]
6b. Leaves linerar, lanceolate, oblanceolate, broadly ovate, obovate, and acute or emarginate …..7
7a. Leaves lanceolate to broadly ovate, mostly more than 4 mm wide; lateral branches with few with scattered leaves ….. *E. esula sensu lato* (for notes on subspecies see below)
7b. Leaves linear, less than 4 mm wide; many lateral branches with crowded leaves …..7
8a. Cauline leaves less than 2.6 (3) mm wide; floral leaves 4-6 mm long …..*E. cyparissias* and [*E*. X *gayeri*]
8b. Cauline leaves more than 2.6 mm wide; floral leaves 10-13 mm long …..*E*. X *pseudoesula*

***Euphobia agraria* Bieb., URBAN SPURGE, (*E. podperae* Croizat)**. Widespread in southeastern Europe, introduced in North America. In Canada known only from Alberta, where collected at Edgerton and Lonely Lake on the Bow River. It is also known from the midwestern and northeastern U.S. A few varieties requiring more study have been described on the basis of leaf shape.

[*Euphorbia boissieriana* (Woronow) Prokh.]. Although sometimes considered a synonym of *E. esula,* this taxon was recognized as a species by some recent workers. It (and its putative hybrid with *E. esula*) are separated from subsp. *tommasiniana* by their slightly wider and more acuminate leaves.

***Euphorbia cyparissias* L., CYPRESS SPURGE (*Galarhoeus cyparrisias* (L.) Small ex Rydb.** This common introduced plant in Canada has both diploid and tetraploid races in North America, the former lacking viable pollen in some regions.

Euphorbia esula* L. *sensu lato. Having examined hundreds of specimens from across Canada, it is concluded that infrataxa should not be recognized as suggested by some recent authors. A single plant may often possess characters of both subspecies (see below). For example an individual plant may have both linear acute and oblanceolate obtuse leaves. Furthermore leaf shape and width appears to vary continuously among individuals and has a normal distribution. The number of rays is at least to some extent related to plant size. Although dubiously recognizable, the separation used by some authors is:

1a. Umbel with 5-9 rays; axillary rays 2-12; leaves linear to lanceolate and acute or subacute …..*E. esula* subsp. *tommasiniana* and *E*. X *pseudovirgata* and *E*. X *gayeri*]

1b. Umbel with 8-17 rays; axillary rays 8-20; leaves oblanceolate to broadly ovate or obovate and obtuse or emarginate …..*E. esula* var. *esula*

(1) **subsp. *esula***. (*E. borodinii* Sambuk, *E. filicina* Portenschl, *E. imperfoliata* Vis., *E. intercedens* Podp., *E. pancicii* G. Beck, *E. pseudoagraria* Smirnov, *E. pseudovirgata* (Schur) Soo, *Galarhoeus esula* (L.) Rydb., *Tithymalus esula* (L.) Hill). Plants of *E. esula* with lanceolate instead of oblanceolate leaves have sometimes been segregated as *E. waldsteinii* (e.g. Stace et al. 2005).

(2) **subsp. *tommasiniana*** (Bertol.) Kuzmanov, (*Euphorbia esula* L. var. *uralensis* (Fisch. ex Link) Dorn, *E. subcordata* Ledeb., *E. tenuifolia* Lam., *E. uralensis* Fisch. ex Link, *E. virgata* Waldst. & Kit., non Desf., *E. waldsteinii* (Soják) Radcl.-Sm., *Tithymalus uralensis* (Fisch. ex Link) Prokhanov). This taxon was reported for Saskatchewan erroneously (rejected afterward by the reporting author). Some European workers have recently recognized this taxon at the rank of species as *E. virgata.* It has most recently been recognized at the rank of subspecies (subsp. *tommasiniana* (Bertol.) Kuzmanov). In North America it has been treated at the rank of variety (*Euphorbia esula* L. var. *uralensis* (Fisch. ex Link) Dorn. Recognition appears unwarranted (see above) but if recognized, varietal rank seems most appropriate and it is desirable to maintain the name currently used in North America. However, it is treated as a subspecies in the recent world list of *Euphorbia* species. *Euphorbia* X *gayeri* Borbás & Soó, a hybrid of *E. cyparissias* and *E. esula* subsp. *tommasiniana* has been reported from from central Europe to Romania. It would be difficult to distinguish since subsp. *tommasiniana* closely resembles *E. cyparissias*. *Euphorbia* X *pseudovirgata* (Shur.) Soo, a putative hybrid of subsp. *esula* and ssp. *tommasiniana*, is treated as a synonym of *E. esula* var. *esula* by some recent authors. Since the subspecies intergrade, the recognition of this hybrid seems unwarranted.

[*E. lucida* Waldst. & Kit.] SHINING SPURGE, (*Galarhoeus lucidus* (L.) Rydb. Although *E. lucida* was reported for Canada (at Edgerton, Alberta), the report was later rejected since the specimen was misidentified as *E. agraria*. Reports for both Alberta and Saskatchewan based on plants with cordate leaves have also been discounted. Reports for Ontario are correctly assigned to *E. esula*.

[*E. nevadensis* Boiss. & Reuter]. A species closely related to *E. agraria* but smaller (leaves less than 30 mm long instead to 80 mm). It occurs in southern and eastern Spain.

***E*. X *pseudoesula* Schur, HYBRID CYPARISSIAS AND ESULA (?*E*. X *figertii* Dorfler).** This hybrid of *E. esula* var. *esula* and *E. cyparissias*, is well known in Europe. It was first reported from North America in 1969 from the counties of Huron, Bruce and Muskoka in Ontario. It is most easily recognized as a plant that appears to be *E. esula* but has unusually numerous and crowded, and small leaves (cauline leaves less than 4 cm long and less than 5 mm wide. Only hybrids between diploid *E. esula* and tetraploid *E. cyparissias* have been found, the hybrid having a chromosome number of 2n=50. Since two expressions of the hybrid occur in Europe, one possibly involving a diploid race of *E. cyparissias* with viable pollen, and since the Canadian hybrids form a small amount of seed, possibly allowing backcrossing, there may yet be more variation in this hybrid in Canada than has currently been noted.

[*E. salicifolia* Host], WILLOW-LEAVED SPURGE]. Known in Europe from Austria to Turkey.

[*E. undulata* Bieb.], UNDULATE-LEAVED SPURGE]. A native of S.E. Russia and W. Kazakhstan.

Description (see Figures 2, 3, 4, 5, 7, 11, 12).

This perennial is in the Euphorbiaceae (Spurge) family. All parts of the plant contain a milky white juice (Figure 3) generally referred to as “latex.” The plant reproduces by seed and also by underground roots on which new buds are produced. The stems are erect, glabrous, tough and woody reaching up to 10 dm high and are unbranched near the base. The stem is with or without non-flowering axillary branches, but with numerous axillary flowering rays near the summit. The leaves are mostly alternate, entire, glabrous, broadly linear to linear-lanceolate or narrowly oblanceolate with acute or obtuse tip, 2-8 cm long and 2-10 mm broad. Leaves (bracts) of the inflorescence are yellowish-green, broadly ovate to reniform, 10-13 mm long.

The flowers are inconspicuous, unisexual, and are borne in a hollowed-out cup-shaped structure called a cyathium. The margin of the cyathium (*plural* cyathia) usually bears four or more, two-horned, yellowish-green, nectariferous glands. Each cyathium includes several staminate flowers, each reduced to a single stamen, and a single pistillate flower with a 3-branched style. The ovary has 3 locules, each with a single seed. The seeds are smooth, grey to yellow or brown, usually mottled or flecked with brown, globose-ovoid with a yellow caruncle (oily gland) at one end. Seeds are 2.0-2.5(3) mm long and (1.1)1.3-1.5(1.8) mm wide. The cyathia are grouped in an umbellate cluster of seven or more rays at the summit of the stem, and additional cyathia develop from two opposite branches arising from the pair of bracts at the base of each ray.

A cyathium of Leafy Spurge is female first (protogynous) and the style, with stigmatic branches, protrudes from the cyathium (Figure 5a). A few days and after pollination, the pedicel of the ovary elongates and then hangs over the edge of the cyathium. At this point the male flowers, each a single stamen, begin to protrude and release pollen, two or three at a time (Figure 5b).

(Continued)

Far from milk
All species of *Euphorbia* contain a white milky sap, but it is far from milk. It is caustic and poisonous and likely evolved as a chemical defense against herbivores. It is usually referred to as "latex," which in fact refers to a stable dispersion of microparticles in an aqueous medium. The toxic compound in *Euphorbia esula* latex is euphorbon, but there are also glycosides, gums, resins and bitter principles. Only 10 % of all flowering plants have latex.



Figure 2. Plant of Leafy Spurge. USDA photo.

Two or three adventitious buds are usually present on the hypocotyl which is pale green above ground and dull reddish-brown at soil level. The cotyledons are 2-3 mm by 4-10 mm, becoming leaf-like, whitened by powdery granules above, pale and veiny beneath. The first two leaves are paired but the next two are not exactly paired. Subsequent early leaves are thin, bluish-green, have minute granules on the surface and are paler beneath. The first few pairs of leaves are folded tightly lengthwise whereas successive leaves are rolled up longitudinally. The chromosome number is 2n=60 based on 14 collections from Ontario and Saskatchewan.



Figure 3. A broken stem of Leafy Spurge with the white latex exuding. This sap, which is characteristic of the Euphorbiaceae family, can cause an allergic reaction. Photo reproduced with permission of the Stevens County (Washington) Noxious Weed Control Board.



Figure 4. Seeds of Leafy Spurge. From USDA in "Federal noxious weed disseminules of the United States." USDA photo.

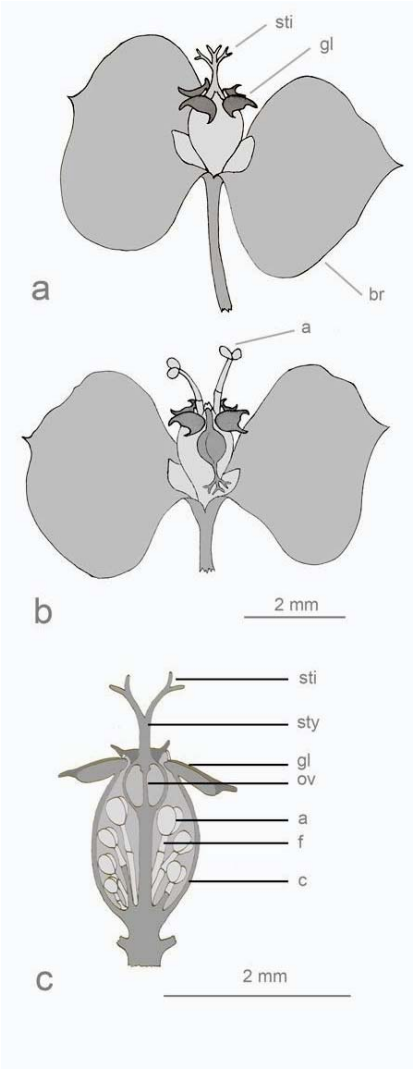


Figure 5. Inflorescences of Leafy Spurge. a, cyathium subtended by two bracts with female flower protruding. b, same as "a" but two days later with pedicel of female flower elongated and bent and two male flowers, each a single stamen, protruding. C, longitudinal section from a. a = anther; br = bract; c = cyathium; gl = gland attached to top of cyathium; f = filament; o = ovary; sti = stigmas; sty = style. Drawings by P.M. Catling

Distribution and History

The native range of Leafy Spurge includes much of Eurasia and it has been introduced into temperate regions worldwide. The first record in North America was from Newbury, Massachusetts in 1827. Leafy Spurge occurred across the northern US from Maine to Washington by 1933 but was well established and frequent in North Dakota and Wisconsin. It had a limited distribution in Canada at that time based on maps in White et al. (1993). By 1979 it was a major economic problem throughout much of the northern prairie region of the US. The oldest specimen seen from Canada was collected by John Dearness in 1889 at Bayfield in southern Ontario. There were nine other collections from southern Ontario until 1922 when it was first found in the prairie region in Manitoba. The first record for British Columbia was from Vernon in 1933. It was first recorded from Quebec in 1940. By 1980 it occurred across Canada and was frequent in much of the prairie region. Its apparent spread from east to west and north in Canada was likely a result of seed introduced with hay from the southeast.

Leafy Spurge now occurs across Canada (Figure 6) from Prince Edward Island and Nova Scotia west to British Columbia and Yukon. It is most common and continuously distributed in southern Ontario and in the western prairie region. It is also locally abundant in parts of central British Columbia where it occurs in the semi-arid areas of Cariboo, Boundary, East Kootenay, Nechako, and North Okanagan, it is a major concern in the Kootenay, Okanagan, Thompson, Cariboo and Omineca regions. Its occurrence near Dawson in Yukon, where it was first found in 1992, is a substantial disjunction from central Alberta, but it is well established there (Figure 1).

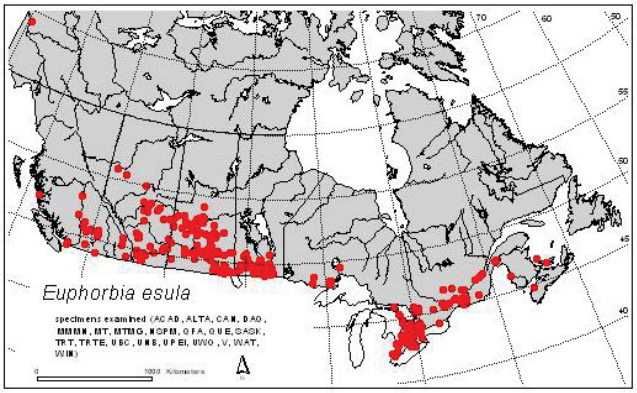


Figure 6. Distribution of Leafy Spurge in Canada based on specimens in Canadian herbaria. The species is likely still extending its range in the north. All locations are naturalized. Derived from the DAO Invasive Alien Database Project.

Ecology

Leafy Spurge can grow in moist, periodically flooded sites and in very xeric places. It occupies mostly open habitats but is also present in open woodland and scrub. The roots can extend to 10 m deep and 4.5 m wide and have abundant vegetative shoots, each of which can produce a new flowering stem. Vegetative reproduction from roots is the primary means of expansion of a patch. The huge underground biomass enables regrowth after above-ground damage and also enables drought resistance.

Leafy spurge is pollinated entirely by insects and over sixty species were recorded on flowers in a Saskatchewan study. Another study in the same province revealed 196 species. In both cases the insects were thought to be attracted by the glands on the cyathia. Flies and wasps were predominant in the observations and may be the main pollinators. A certain amount of self-pollination is possible and pseudogamy has been suggested as well.

The seeds are dispersed in a variety of ways. Long distance dispersal may occur: (1) when seeds lodge with soil and debris on farm equipment and vehicles; (2) when seed is transported in hay; (3) when seed is transported in gravel, sand or soil from infested sites; (4) by a variety of birds some of which digest some, but not all of the seed; (5) by mammals through ingestion and defecation or by adhesion to hair, in wool, etc. Seeds are dispersed over shorter distances by ants which collect them to feed on the oily gland. There is also an explosive dispersal mechanism that projects seeds up to 5 m. When the capsule matures, a row of columnar cells oriented toward the sutures, loose water and upon drying place a stress on the capsule tending to pull the edges of the locules together so that the capsule finally breaks with a very rapid explosive force. A box of mature capsules in the warm sun sounds like making popcorn. The seeds also float and can be dispersed by streams, during floods, and by irrigation systems.

Ant Dispersal

Leafy Spurge is one of many vascular plants that have evolved an oily seed appendage (a caruncle) to attract ants which carry the seeds, often to underground chambers. Other familiar plants that benefit from ant dispersal (called myrmechory) include some in the genera *Asarum, Carex, Viola, Sanguinaria, Hepatica, Trillium, Cytisus* (the last being number 2 in this series). Myrmechory, has evolved independently more than 100 times in angiosperms, and is present in 77 families and 11,000 species. It is a driver of plant diversity and a consistent example of the effect of mutualism.

The seeds mature thirty days after pollination. A stem produces ten to fifty capsules, and each capsule contains three seeds. Sixty to 80 percent of fresh seeds are viable. Seeds can remain viable in the soil for five to eight years. However, annual viability in the soil decreases by about 13 percent each year. Ninety-nine percent of viable seeds will germinate in the first two years. Temperatures between 68 and 85 degrees F (20-30 degrees C), alternating freezing and thawing, wet and dry periods, and shortened photoperiod promote germination.

Peak germination is from late May to early June. to develop two weeks later. The yellowish inflorescence bracts develop in May and often last through the season making the plants very conspicuous. Flowering ends in late June to mid-July or may continue throughout summer and into fall. Seed is produced from June to autumn frost.

Damage

Biodiversity:

Since Leafy Spurge completely dominates some Canadian ecosystems, its negative effect on diversity of plants and animals must be very great. There are many specific examples.

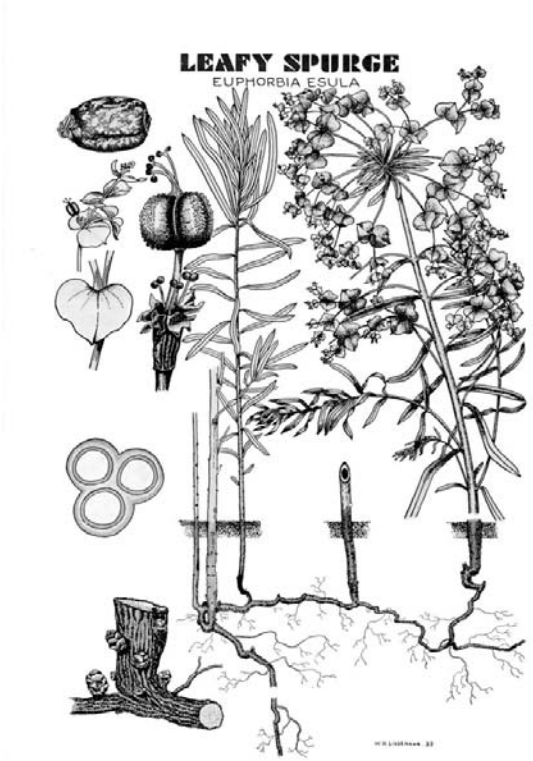


Figure 7. Leafy Spurge, drawings reproduced with permission of the Minnesota Agricultural Experiment Station.

1.Out-competes and replaces native plants. The endangered Western Spiderwort (*Tradescantia occidentalis*) is said to the threatened by Leafy Spurge at most Canadian sites. It is expected to lead to declines of the Prairie Fringed Orchid (*Platanthera praeclara*). There was no significant competition for pollinators in studies involving the native Prairie Violet (*Viola pedatifida*) and Blue-Eyed Grass (*Sisyrinchium campestre*) but other studies did suggest negative effects.
2. Reduces essential plant diversity. By reducing larval food plants and nectaring plants for adults, it has been implicated in the decline of three endangered prairie butterflies: Dakota Skipper, Poweshiek Skipper, and Ottoe Skipper. It is also involved in the loss of open sand habitat and sand stabilization that is associated with the decline of a number of endangered prairie insects.
3. Toxic to grazing mammals. It also reduces their native food supply. It has reduced habitat for bison, deer and elk.
4. Changes ecosystem composition. A recent study in North Dakota demonstrated that densities of Grasshopper Sparrows and Savannah Sparrows were significantly lower in areas with more dense infestation of Leafy Spurge.
5. A lizard? The invasion of leafy Spurge is one of the suspected causes of decline of the endangered Prairie Skink (*Plestiodon septenrionalis*) in Canada by eliminating areas of open sand.

$ 2 Billion and 100 Million ?
$ 2 Billion is the estimated cost of rangeland weeds in the United States annually. Most of this is due to less than 40 species although there are 400 rangeland weeds. One of the top 5 problems is Leafy Spurge. The problem species: (1) lower yield and quality of livestock forage; (2) interfere with grazing; (3) poison animals; (4) increase production costs; (5) reduce land values; and (6) incur high costs of wildlife management. Leafy Spurge infests 3 million acres in North America and sometimes stem densities are over 1000 per m^2. It is classified as a noxious weed in 19 states and most Canadian provinces. $ 100 Million is the estimated yearly cost of Leafy Spurge in Canada.

Agriculture:
6. Leafy Spurge displaces and sometimes eliminates valuable forage plants making rangelands and pastures useless.
7. It is toxic to livestock (excepting trained sheep and goats)
8. Reduces farmland values.
9. Competes with some crops including hay. Leafy Spurge does not usually persist in agricultural lands where conventional tillage practices are used but does occur in some crops and in reduced tillage systems.
10. Honey made from Leafy Spurge is bitter rarely sold for human consumption.

Health:
11. The milky sap can cause dermatitis in humans and use in excess as a purgative may be fatal.

Beneficial Aspects

1. Industrial. The seed oil has some industrial uses in China.
2. Pollination Service from a biocontrol agent. The Spurge Hawkmoth (*Hyles euphorbiae*) was introduced to control Leafy Spurge in western Canada in 1963. In 2006 it was found to be a pollinator of the endangered Western Prairie Fringed Orchid (*Platanthera leucophaea*) in the Sheyenne National Grassland in North Dakota.
3. Medicinal. It has been used medicinally to treat warts, as an emetic, anthelmintic, vasodilator and violent purgative. Large doses have a depressant effect and may be fatal.

Management

Biocontrol: Rangeland weeds are the ideal subjects for biocontrol and this method has been the subject of of extensive use and experimentation in the case of Leafy Spurge. At least 14 biocontrol insects have been introduced into North America to control Leafy Spruge (Table 1) and there are numerous local success stories. Most of these control insects are illustrated with extensive information on the “Montana War on Weeds”

Legislation
Leafy Spurge is one of the “Prohibited Noxious Weed Seeds” covered by the federal “Weed Seed Order 1986” under the federal “Seeds Act.” The seeds of these plants cannot be imported into Canada. It is illegal to sell or transport hay containing leafy spurge in some provinces (eg. Manitoba seed act and regulations). Special legislation in most Canadian provinces where leafy spurge occurs, enables control programs on infested lands.

Some Considerations for preventing infestations in special areas for biodiversity
(1) hay from contaminated areas may contain seed of Leafy Spurge.
(2) animals from infested areas may contain seeds inside or outside the body in wool, etc.
(3) seeds are readily transported in soil on the undercarriage of vehicles and farm machinery.
(4) soil and gravel from infested areas may contain seeds or rhizomes.
(5) grazing by livestock may increase leafy spurge in many situations by reducing competition with grasses which are favoured, the Leafy Spurge often being avoided.

website http://mtwow.org/Bio-Control-main.htm and the "Team Leafy Spurge" website http://www.team.ars.usda.gov/v2/publications/cdgallery/galleryintro.html .

The most effective biocontrol agents appear to be stem and root-boring and foliage-feeding flea beetles of the genus *Aphthona* and a species of stem and root boring beetle *Oberea erythrocephala*. In Wyoming three thousand black flea beetles (*Aphthona lacertosa*) and 3000 brown flea beetles (*A. nigriscutis*) were released in 1998 at 76 sites where leafy spurge had become the dominant ground cover and had greatly reduced rangeland productivity. These release sites and 33 control sites were monitored for six years after the release (Figure 9). The beetles reduced the average leafy spurge cover from 60% to less than 10% in three years. Over the next four years there was a steady recovery of the range as average leafy spurge cover continued to fluctuate between 8% and 22% and grass cover increased from 34% to over 80%. At a site in Montana 14 years after introduction of *A. nigriscutis,* Leafy Spurge was reduced by almost 70% and vascular plant diversity increased by 21%. In other situations *A. czwalinae* and *A. lacertosa* together have reduced Leafy Spurge density by over 95 %. Mixed populations of *A. lacertosa* and *A. czwaline* were released in over 50 locations in Alberta in 1997 and population reduction in *E. esula* were observed in following years with the highest reduction in areas of highest beetle density. The effectives of Leafy Spurge management with *Aphthona* beetles was found to last for 16 years in a North Dakota study. The reduction of Leafy Spurge was 95% after 6 years and that level was maintained for another 10 years. The authors summarized the results as "cost-free management for 16 years."



Figure 8. The Spurge Hawkmoth (*Hyles euphorbiae*). Adult above, larvae below. USDA photos.



Figure 9. Above, A landscape in Wyoming 6 years after biocontrol of Leafy Spurge with release of *Aphthona* beetles. Below, the same landscape before biocontrol. USDA photos.

Aphthona nigriscutis (Figure 10) is now established across Canada and is generally considered to be the most effective biocontrol agent. Although widely distributed, it has not yet spread to all places where Leafy Spurge occurs, so control is patchy. There have been releases of beetles to protect native plants in various parts of Canada; for example to protect Western Spiderwort (*Tradescantia occidentalis*) and Hairy Prairie Clover (Dalea villosa var. villosa). A combination of herbicide spraying and introduction of *A. nigriscutis* effectively controlled Leafy Spurge at a location of the endangered Small White Lady's-Slipper Orchid in Manitoda.
Some introductions have not been successful, as reported for the Canadian release of the aphid *Acrythosiphum neerlandicum.* Some biocontrol agents go through a lag phase prior to rapid population increases that vastly increase effectiveness. Although it may not yet have realized its full potential, biological control is already a major success story. A consideration of future impact of biocontrol in the northern plains states suggested that the target of 65% control by 2025 is progressing well and that the program is running successfully with $ 60 million in benefits annually.



Figure 10. A very effective biocontrol agent, the flea beetle *Aphthona nigriscutis*. USDA photo.

Although Leafy Spurge is poisonous to cattle, there are many reports of sheep being used effectively for control. Sheep may initially avoid it, but can be trained to eat it and may eventually prefer it. Leasing a herd of trained sheep has become a practice for cattle ranchers in some areas. Angora Goats have also been used for control.
Use of fungi and allopathic plants against Leafy Spurge has not yet become common. Planting of native bunchgrasses along with other methods has proven effective. It also prevents low quality introduced grasses and other weeds from colonizing spaces left by controlled Leafy Spurge. Some competitive grasses that have been recommended for Leafy Spurge reduction are non-native species that are inappropriate for use in protected natural landscapes.

Table 1. Biocontrol insects used for Leafy Spurge

Species name,	Common name
Acrythosiphum neerlandicum,	an aphid
Aphthona abdominalis,	Minute Spurge Flea Beetle
Aphthona cyparissiae,	Brown Dot Leafy Spurge Flea Beetle
Aphthona czwalinae,	Black Leafy Spurge Flea Beetle
Aphthona flava,	Copper Leafy Spurge Flea Beetle
Aphthona lacertosa,	Brown-Legged Leafy Spurge Flea Beetle
Aphthona nigriscutis,	Black Dot Leafy Spurge Flea Beetle
Chamaesphecia crassicornis,	None accepted
Chamaesphecia empiformis,	None accepted
Chamaesphecia hungarica,	Hungarian Cleawing Moth
Chamaesphecia tenthrediniformis,	Moth, None accepted
Dasineura sp. nr. *capsulae*,	None
Hyles euphorbiae,	Leafy Spurge Hawkmoth (Figure 8)
Oberea erythrocephala,	Red Headed Leafy Spurge Stem Borer
Pegomya curticornis,	an Anthomyiid fly
Spurgia esulae,	Leafy Spurge Tip Gall Midge

Chemical Methods: One study of the economics of leafy spurge control using herbicides concluded that: “for well established infestations on less productive land, the best alternative, from an individual landowner's perspective, is to not treat leafy spurge with herbicide and bear the increasing productivity losses.” The extensive root system results in high resilience, the root system maintaining a large pool of carbohydrates that allow for rapid shoot regeneration. A single herbicide application will not be enough and retreatment will have to continue for several years. Picloran is reported to be one of the most effective herbicides with 2 lb per acre applied in spring and again in fall for several years. A combination of chemical control and seeding/fertilizing may be necessary to produce improved pasture or it may prove impossible. A recent study in Montana has suggested that in grasslands where native plants have a long history of successful coexistence with leafy spurge, the sudden use of herbicides substantially reduced the natives and resulted in an increase in the Leafy Spurge population. It was concluded that “herbicide applications can be ill-advised.” Interestingly the cost of herbicide to control Leafy Spurge in northern prairie states in the 1980s was several million per state and was not far from the cost of the loss of beef cattle production.

Manual and Mechanical Methods: Again these methods may contribute to increased development from the root system and expansion of patches. Tilling 4 inches deep has been suggested every three week and or fall only cultivation for three years. Hand –pulling and mowing is effective only in the case of small, young infestations.

Fire Control: Fire is generally not effective due to rapid regerenatio from roots. It may favour native bunchgrass in native rangeland therefore reducing the effectiveness of spurge competition.

Integrated Pest Management: Although this sounds like a good idea, and has been reported to be effective in some cases, it has failed in others. Early applied herbicides removed the food source and prevented flea beetle establishment but fall applied treatments did not reduce flea beetle establishment or reproduction. In another case sheep or goat grazing as well as beetles resulted in a larger decline than either alone. In a three year study prescribed fall burns with spring herbicide treatments proved more advantageous than herbicides alone.

Prospects
At least 6 of the introduced biocontrol beetles are now well established and spreading in the prairie region of North America and it is anticipated that infestations of Leafy Spurge will decline in many areas. Restoration of native biodiversity and return to formerly productive forage lands may still be at least a decade away in some areas and will require continuing interventions. The fact that Leafy Spurge became established in cold climate of Dawson in Yukon suggests that it will expand throughout most regions of Canada where dry grasslands occur. In some cases decreases in abundance of perennial environmental weeds has resulted in an increase in other weeds. Managers may address this with the use of fire and planting desirable species. To some extent, the success of Leafy Spurge control depends on what replaces it.

Believe it or not

- Several years ago the U.S. Nature Conservancy sold one of its prairie preserves because the infestation of Leafy Spurge had left almost nothing else.
- Seeds of Sunn Hemp (*Crotalaria juncea*) contain a potent phtytotoxin that inhibits the growth of Leafy Spurge. Although economically valuable as a source of green manure, fodder and fibre, Sunn Hemp is largely a tropical plant of southeast Asia, so could not likely be used to replace a worthless infestation of Leafy Spurge.
- In Saskatchewan Leafy Spurge patches were found to produce 3400 lbs of seed per acre.
- Bad publicity for leafy spurge is 1000 times more than good publicity. All plants however have uses. If an extract of Leafy Spurge is rubbed on the human body we can only guarantee a severely irritating rash, but in shaved areas on rabbits it is said to produce thicker fur.
- Leafy Spurge is listed on the IUCN list of the 100 worst invasive species (all species, not just plants) worldwide. Few make this list (there are 300,000 species of higher plants). See the other 99 at http://www.issg.org/worst100_species.html



Figure 11. Leafy Spurge. From Deutschlands Flora 1796.



Figure 12. Leafy Spurge showing seed, seedlings, young plants, and part of a mature plant. From Wild Plants of the Canadian Prairies by A.C. Budd and K.F. Best. Drawn by K.F. Best, AAFC.

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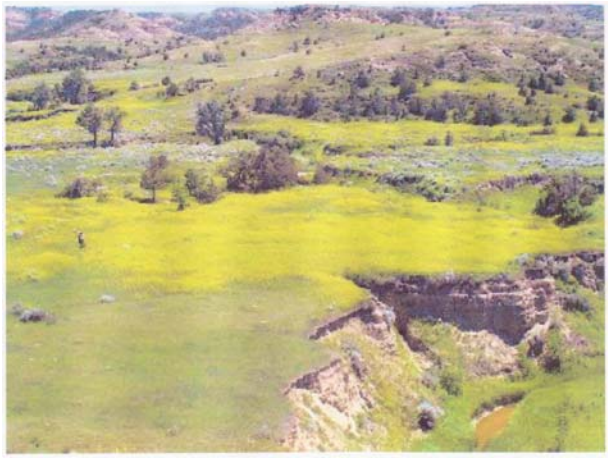
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NEXT DOOR



Across the border from Saskatchewan and Manitoba is North Dakota. Here Leafy Spurge costs farmers and ranchers $27 million in direct impacts every year and total cost to the state is estimated at $86 million annually. “In addition to the monetary loss is the loss of valuable and essential grasslands that puts the future of native wildlife in jeopardy.” The photo shows extensive yellowish-green areas dominated by Leafy Spurge in Theodore Roosevelt National Park, named after a popular president and one of the world's leading land conservationists. The park is less than 300 km south of Estevan , Saskatchewan. North Dakota, and especially this park, has been a major area for research on mapping vegetation using remote sensing and using leafy spurge as an example. These techniques allow large scale monitoring of the increase or decline of populations in response to biocontrol. Photo from: U.S. National Park Service Web Site.

TEAM Leafy Spurge
Working Together to Purge Spurge
USDA
ARS APHIS

TOP CANADIAN ORNAMENTAL PLANTS. 1. OVERVIEW (PART 3)

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A COMPARISON OF THE CANADIAN AND UNITED STATES COMMERCIAL ORNAMENTAL PLANT INDUSTRIES

Canada and the United States are each other's chief trading partners, and so it is important to understand the size and nature of the ornamental industries in the two countries. The United States is the world's largest producer of ornamental plants, and the Netherlands holds second place. By contrast, the Netherlands is the world's largest exporter, while the U.S. ranks quite low among the top ten exporters (the exact position fluctuates from year to year). The U.S. imports about half of its ornamentals, mostly from Columbia and Ecuador. For the most part, the top-selling ornamental plants of Canada are also top sellers in the U.S. The following five ornamental plants, however, are top sellers in the U.S. but not in Canada, although they are quite important in Canada:

Carnation – *Dianthus caryophyllus* L. [Probably native to the Mediterranean region.]
Delphinium (Larkspur) – *Delphinium* species and hybrids. *Delphinium grandiflorum* L. (*D. chinense* Fisch.) of Asia is often grown. [The more than 200 species of *Delphinium* are native to the North temperate zone, and cultivars have been selected from both American and Old World species.]
Gladiolus – *Gladiolus* hybrids. [*Gladiolus* is a genus of about 200 species of Africa and Eurasia. The cultivated hybrids are thought to be derived from just seven species, native to South Africa.]
Marigold – *Tagetes patula* L. (French marigold), *T. erecta* L. (African marigold); *Calendula officinalis* L. (pot marigold) is less often cultivated. [*Tagetes patula* L. is native to Mexico and Central America, *T. erecta* is native from Mexico to South America, and *C. officinalis* probably originated from the Mediterranean area.]
Pansy – Numerous species of *Viola*, known as violets, are cultivated. The most popular “pansies” are *V. tricolor*, L. and *V. wittrockiana* Gams (a hybrid of garden origin, probably with *V. tricolor* as one of the parents). [*V. tricolor* is native to Eurasia.]

Despite the much smaller population of Canada, the greenhouse production of potted plants and cut flowers in this country is proportionately much larger than the corresponding production in the U.S. (compare the total dollar figures in Table 1A for Canada with the total dollar figures for the U.S. in Tables 8 and 9), a reflection of the huge greenhouse industry in Canada. By contrast, the production of outdoor bedding plants is worth well over a billion dollars annually in the U.S. (Table 8), much larger than in Canada (although Table 1 for Canada does not separate the value of bedding plant production from that of shrub, ornamental tree, and fruiting woody plants, so only a collective value is available.). The U.S. greenhouse floriculture industry is valued at about 4 billion dollars annually, about four times the value of the corresponding industry in Canada, which has one-tenth the population.



Fig. 59. Vase with cut flowers. Photo by Rosendahl, publicdomainpictures.net.

Table 8. Top-selling Domestically Produced United States Outdoor (Flowering Bedding) Potted Plants (based on United States Department of Agriculture 2011)

Species or Category	Wholesale Value ($U.S.) in 2009	Wholesale Value ($U.S.) in 2010
Begonia	67,341,000	65,660,000
Chrysanthemum	110,747,000	116,063,000
Geranium	148,698,000	147,878,000
Hosta	34,283,000	27,583,000
Impatiens	160,727,000	161,591,000
Marigold	46,185,000	46,592,000
Pansy/viola	105,168,000	103,239,000
Petunia	126,329,000	136,366,000
Other flowering plants	911,221,000	975,159,000



Plate 11. Top-selling flowering ornamental plants produced in the United States that are not among the top-selling flowering ornamentals of Canada. Fig. 54. Carnation. Photo by J. Edwards, publicdomainpictures.net. Fig. 55. Pansy (violet). Photo by I. Savin, online at Wikipedia. Fig. 56. French marigold. Photo by Imcall, online at Wikipedia. Fig. 57. Gladiolus. Photo by M. Schmidt, publicdomainpictures.net. Fig. 58. Delphinium. Photo by M. Coates, publicdomainpictures.net.

Table 9. Top-selling Domestically Produced United States Indoor Potted Plants (based on United States Department of Agriculture 2011)

Species or Category	Wholesale Value ($U.S.) in 2009	Wholesale Value ($U.S.) in 2010
African violet	3,580,000	3,634,000
Azalea	31,044,000	26,197,000
Chrysanthemum	24,842,000	24,010,000
Lily (Easter)	27,405,000	26,831,000
Orchids[6]	161,208,000	170,774,000
Poinsettia	148,579,000	146,069,000
Rose	23,115,000	26,926,000
Other flowering plants	176,570,000	184,294,000
Potted foliage plants	557,029,000	571,110,000
Spring flowering bulbs	46,662,000	59,773,000

[6] Commercial orchid production in the U.S. is primarily in Hawaii and California.

Table 10. Top-selling Domestically Produced United States Cut Flowers (based on United States Department of Agriculture 2011)

Species or Category	Wholesale Value ($U.S.) in 2009	Wholesale Value ($U.S.) in 2010
Alstroemeria	1,629,000	1,650,000
Carnation	480,000	317,000
Chrysanthemum	11,298,000	11,769,000
Gerbera	33,027,000	32,737,000
Gladiolus	22,880,000	22,809,000
Iris	15,550,000	14,517,000
Larkspur (delphinium)	6,071,000	7,205,000
Lily	64,392,000	61,167,000
Lisianthus	3,327,000	2,973,000
Orchids	14,133,000	7,645,000
Rose	17,662,000	16,950,000
Snapdragon	10,118,000	8,531,000
Tulip	57,185,000	56,900,000
Other cut flowers	103,687,000	129,987,000

(Continued)

Extending the Vase Life of Cut Flowers

A gift of fresh cut flowers usually says “Congratulations”, “Thank you”, “I'm sorry”, “Get well”, “You're special”, or “I love you”. Unfortunately, cut flowers have a limited life span. Most freshly acquired cut flowers will last 5 to 7 days without care, but it is often possible to extend vase life, along with their message, for up to 2 weeks or more. Two factors cause cut flowers placed in water to wilt prematurely: (1) Air taken up by the stems blocks the uptake of water; (2) bacteria growing in the water clog the stems. To prevent air uptake, the cut stems should be placed in water as soon as possible, then recut underwater, at an angle (to prevent the stems from sitting flat on the bottom of the vase; an angled cut does not increase water uptake), using a sharp knife not scissors or a serrated knife (professionals will sometimes sterilize the blade with bleach or alcohol), removing about 2.5 cm (1 inch) from the stem (this procedure works because a film of water prevents air from entering the stem). Special tools are often used by florists for this task, and special “hydration” products are available to assist water to move up the stem. The second problem, microbial growth, is due to bacteria, yeasts, and other microorganisms growing on the sugars, amino acids, proteins, and other organic substances released by the cut stems. To control such growth, commercial preservatives with antimicrobials are added, commonly quaternary ammonium, hydroxyquinine salts, aluminum sulfate, and slow-release chlorine compounds. Both of the above problems can be exacerbated by the presence of excess foliage on the cut inflorescences: leaves above the water line can increase water loss, stressing the stem, and leaves below the water line will rot, increasing the bacterial problem. In addition to controlling wilting from lack of water, the life of some cut flowers (notably gladiolus) can be extended with “holding” solutions that provide carbohydrate (sugar) nutrition. Commercial solutions (often called “cut flower preservatives” and “cut flower food”) that both inhibit microorganisms and provide nutrition can be purchased from florists and supermarkets, and florists sometimes provide a package of chemicals to extend vase life along with the purchase of cut flowers. Controlling acidity of the water is important (pH 3.5 is good), but some specialists have warned that aspirin and vinegar, which have sometimes been recommended, should be avoided. Two simple home-made recipes are: (1) Combine a lemon-lime soda with three parts of water (do not employ diet drinks, which lack sugar, or colas, which can be too acidic) to make 1 L, and add 1/4 teaspoon household bleach (like Chlorox); or (2) Add 2 tablespoons of lemon juice (or the equivalent in bottled juice), 1 tablespoon of sugar, and 1/4 teaspoon of bleach in 1 L of water (for both alternatives, add 1/4 teaspoon of bleach to the vase every 4 days). Other practices for extending the life of cut flowers include: ensure the vase is clean to eliminate bacteria and fungi; add water daily if necessary to keep the water line above the bottom of the stems; avoid both softened water (which contains sodium) and hard water (use demineralized water if naturally soft water is unavailable); and keep the flowers cool – avoid sunny, warm, or drafty locations, especially windows and heat-generating appliances (notice that florists usually maintain their cut flowers in a cool display room). At the minimum, water should be changed if it becomes murky and the stems should be recut under water at that time. Not all techniques work ideally for all flowers. For some species, florists sometimes use commercial solutions that control ethylene, a gas which generally promotes ripening of fruit, but causes some flowers to look wilted or fail to open. Stems that ooze latex (poppies, poinsettia) can clog quickly when cut (one proposed solution is to remove the sealing latex by immersing the bottom 5 cm or 2 inches in boiling water for 10 to 30 seconds). Recommendations on which combinations of techniques are appropriate for given species can be found in the information resources cited below, but these are of interest mainly to specialists.

LAWN GRASSES

The Canadian sod industry is very large, employing about 2,000 workers. “Cool season grasses” (which start to grow as soon as temperatures rise somewhat above freezing in the spring) are cultivated in most of the country. Kentucky bluegrass (*Poa pratensis* L.) is the most widely utilized turfgrass, followed by red fescue (*Festuca rubra* L.), several other *Festuca* species, and bentgrasses (particularly *Agrostis stolonifera* L.). Sod is produced across Canada, except for northern regions. More than 40% of Canadian sod is produced in Ontario. The sod market is particularly dependent upon the housing market, but sod is also employed for business areas, golf courses, parks, and playing fields.

There are hundreds of books dedicated to the widespread obsession of “perfect lawns”, and many jurisdictions have bylaws requiring minimum care. Nevertheless, lawns have become a focus of criticism of many environmentalists. Lawns are monocultures (or nearly so), requiring enormous expenditures of energy in the form of fossil fuels, with resulting atmospheric pollution. Lawns are fertilized mostly with synthetic fertilizers, and pesticides are still widely used; the application of these chemicals tends to degrade ecosystems and destroy biodiversity. Lawns also require considerable water, an increasingly scarce resource. In much of the world, and particularly in the affluent areas of North America, lawns are viewed as very aesthetic, status symbols, functional (particularly as a surface for golf and other sports), and a normal, indeed almost indispensable part of life. Lawns are also profitable, providing employment for many. Lawns are unlikely to become obsolete in the near future, but the public and indeed the turf industry is becoming sensitized to the desirability of maintaining lawns in an ecologically responsible fashion. Botanists have an important role to play in providing research and guidance on how to maintain lawns with minimum resource inputs, and on appropriate lawn substitutes. (See Table 11 on page 37)

CHRISTMAS TREES

Once harvested from nature, Christmas trees in Canada are now mainly an agroforestry industry. Christmas tree farms are concentrated in Quebec and the Atlantic region, representing nearly 90% of Canadian sales. In Canada the most popular Christmas trees in decreasing order are: balsam fir (*Abies balsamea* (L.) Mill.), Fraser fir (*Abies fraseri* (Pursh) Poir.), Scots pine (*Pinus sylvestris* L.), and white spruce (*Picea glauca* (Moench) Voss). Forty million live Christmas trees are sold in North America every year, about six million of these grown in Canada. The value of farm cash receipts for Christmas trees in Canada is about $75 million annually. In 2010 Canada exported 1,764,000 trees valued at $28 million, most of these to the U.S. The largest producers are (in decreasing order) Quebec, Nova Scotia, New Brunswick and Ontario. The Christmas tree market is experiencing considerable competition from artificial Christmas trees, most of which are imported from China. Canadians spend about $50 million annually on artificial Christmas trees.

Table 11. Canadian Sod Production (based on Statistics Canada 2011; empty cells indicate that data were "too unreliable to be published")

Area	2009		2010	
	Hectares (grown for sale)	Value ($ wholesale)	Hectares (grown for sale)	Value ($ wholesale[7])
Newfoundland and Labrador	194	2,883,510	202	3,648,405
Prince Edward Island				
Nova Scotia			289	4,817,660
New Brunswick				
Quebec	2,398	28,183,500	2,244	27,014,175
Ontario	3,802	47,577,255	4,205	53,019,775
Manitoba	77	976,470	87	1,159,200
Saskatchewan			109	2,507,160
Alberta	1892	33,947,275	1,837	35,338,625
British Columbia	397	8,812,080	395	7,873,860
Canada	**9,391**	**132,510,370**	**9,514**	**136,882,740**

[7] Total sales of sod including resale activities: in 2009, $143 million; in 2010: $147 million.

ORNAMENTALS AS SOURCES OF ALIEN WEEDS

An analysis of the threat of ornamentals becoming new alien weeds in Canada is given in the Canadian Food Inspection Agency document cited below. There are an estimated 1,229 alien vascular plant species in Canada, representing about 24% of the total Canadian vascular flora, and 486 of these aliens are considered weedy or invasive. It has been estimated that 58% of Canada's alien plants were introduced intentionally (the rest were imported unintentionally), and that more than half of these deliberate introductions were for ornamental purposes. Accordingly, more than a quarter of Canada's alien species appear to be the result of attempts to introduce new ornamental plants. An alien or introduced species is not necessarily particularly harmful or "invasive", but some are. Some of the aliens introduced as ornamentals to Canada are quite toxic to humans (e.g. giant hogweed, *Heracleum mantegazzianum* Sommier & Levier) or very destructive of biodiversity (e.g. purple loosestrife, *Lythrum salicaria* L.). These facts indicate that introducing new ornamental plants to Canada requires careful screening to reduce the possibility of introducing new aliens. However, the fact that numerous ornamental plants originate from climates much hotter than Canada's does provide a measure of protection, since most cannot overwinter outdoors in this country. By contrast, in the hot climate of Australia, two-thirds of that continent's invasive plants originated from introduced ornamentals.

EDIBLE FLOWERS

Probably the most consumed flower is cauliflower, although it is not usually understood to represent floral tissue (the similar broccoli includes not just undifferentiated flowers but also the stalks of the inflorescence). The flowers of some other vegetables provide excellent culinary fare, particularly those of okra, pumpkins and squashes, and some chrysanthemums that are consumed in Japan. Herbal teas are frequently prepared with flowers, most notably those of chamomile species. Rose petals are widely used in jam, tea, and numerous other food preparations. Nasturtium (*Tropaeolum*, not the genus *Nasturtium*) flowers are often consumed. Violet (or pansy) flowers have frequently been candied in the past. Other species whose flowers have been consumed include begonia, carnation, gladiolus, lavender, lilac, and tulip (but note that certain of these have toxic organs, and this is sufficient for some to recommend against consumption of any parts of the plants). Often some species of a genus or some cultivars of a species are exceptionally tasty, whereas most are not. Usually advanced cultivars with doubled flowers are much less tasty than older forms with simpler, natural flowers. The edible flowers of most species that possess them are usually not outstandingly pleasant in taste, and flowers are often incorporated into meals simply because of their appearance and the allure of consuming exotic fare. Some greenhouse firms specialize in the production of edible flowers, especially for high-end restaurants. It is interesting to note that, like the use of parsley as a garnishment for meals, flowers seem to be incorporated into many meals more for their ornamental than their food value. There are dangers in consuming flowers: wrong identification (common names can be very misleading), allergies (particularly to pollen), and the fact that information on the toxicity of most flowers is extremely limited. "Lily" flowers require particular mention. Daylily (*Hemerocallis*) flowers are traditional in Chinese recipes. However, lily of the valley (*Convallaria majalis* L.), glory lily (*Gloriosa superba* L.), calla or arum lily (*Zantedeschia aethiopica* (L.) Spreng.), peace lily (*Spathiphyllum* spp.) and some other "lilies" are quite toxic. Tiger lily (*Lilium lancifolium* Thunb.) is sometimes recommended as an edible flower, but sometimes stated to be toxic. For extensive information on edible flowers, see Small (2006).

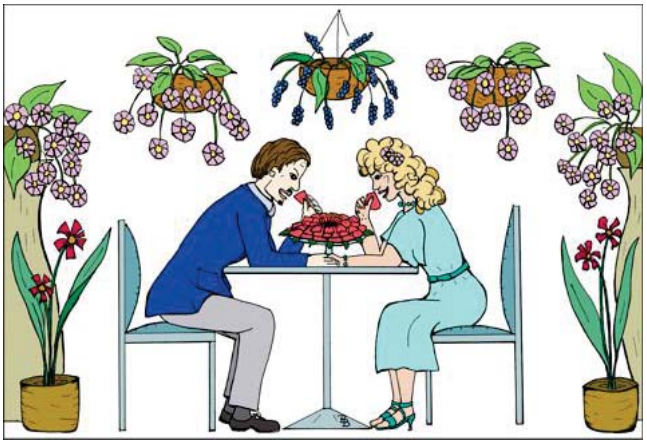


Fig. 60. A floral feast, by B. Brookes.



Plate 12. Examples of edible ornamental plants. Fig. 61. Ornamental cabbage. Photo by P. Griffin, publicdomainpictures.net. Fig. 62. A colourful cultivar of Swiss chard. Photo by Jonathuder, online at Wikipedia [licensed for use under the GNU Free Documentation License].

EDIBLE LANDSCAPING

In recent times, the phrase "edible landscaping" has acquired popularity. This is somewhat misleading, since it is mostly about edibility, not about landscaping. In practice, the phrase is usually understood to mean urban food production resulting from planting edible crops in situations where one usually plants ornamentals. Nevertheless, it is possible to cultivate edible plants in layouts that complement residences and (less frequently) public lands. One can simply interplant edible crops and ornamental plants, but some attractive plants are edible (including those with edible flowers, discussed above) and merit consideration for the dual purposes of providing food and attractive display. Certainly some vegetables, many culinary herbs, "small fruits" (such as shrubs producing berries and ever-bearing strawberries), and dwarf fruit trees are quite ornamental and represent a reasonable compromise between attractive appearance and urban food production. Ornamental cabbages (which are usually not cabbages, i.e. *Brassica oleracea* L. var. *capitata* L., but kales, i.e. *B. oleracea* var. *viridis* L.) are not only beautiful, but are suitable for consumption. Cultivars of Swiss chard (*Beta vulgaris* L. subsp. *cicla* (L.) Koch) that look like rhubarb with beautifully coloured leaf stalks are available, which are not only very tasty but are widely used as garden ornamentals. Generally, however, species that are grown for their appearance are not particularly edible, and ornamental cultivars of particular species are often insipid or unpleasant in taste compared to cultivars grown for food purposes. In most situations, different species and different locations are required for ornamental display and for growing food plants. Urban food production is well established in many developing nations, where poor families often reduce food costs by growing plants in almost every nook and cranny open to the sun, regardless of appearance. In richer nations such as Canada, the use of the phrase "edible landscaping" is useful, nevertheless, because people are naturally concerned with appearance, and educating citizens that edible plants can be grown in relatively attractive ways around the home is desirable.



Fig. 63. A green roof on a house built to demonstrate sustainable architecture in the Netherlands. Photo by Lamiot, online at Wikipedia [licensed for use under the GNU Free Documentation License].

GREEN ROOFS

"Green roofs" refers to rooftops covered with vegetation growing in a continuous layer of soil. These are of increasing interest, not particularly for yield of a crop or for ornament but rather for the insulation value that can reduce heating and cooling costs of buildings by about one-quarter. Green roofs also encourage biodiversity within cities. The idea is hardly new – sod roofs have long been popular in parts of Europe and were once frequent on the American prairies. Native plants adapted to the climate of Canada are ideal candidates for green roofs, and this is an interesting area of research with considerable potential benefit. Inevitably, the appearance of green roofs is a concern, so this special application of landscaping is allied to ornamental horticulture.

(Continued)



Plate 13. Castor bean (*Ricinus communis* L.), one of the world's most toxic plants. This plant is commercially grown for its very useful oil, but is also widely cultivated as an ornamental, especially outdoors but occasionally even as a houseplant. Touching the plant can result in an allergic reaction. More seriously, the seeds can be very poisonous (but intact seeds may pass through the digestive system without producing harm). The reddish fruits burst open at maturity, scattering the seeds. The plant should not be grown where there are children and pets (at least, it should not be allowed to go to seed). Fig. 64. Photo by Dezidor, online at Wikipedia [authorized for use under Creative Commons Attribution Share-Alike License]. Fig. 65. Photo by S. Hurst, U.S. Dept. Agriculture.

TOXICITY OF ORNAMENTAL PLANTS

Numerous plants can cause dermatitis from contact, poisoning from ingestion, and allergic reactions from either route. People differ greatly in their susceptibility, but many plants are especially dangerous, and this includes some grown as ornamentals in and around homes. On the whole, toxicity of ornamental plants is not a major issue, but it is one that bears mention because children and pets are especially at risk, and fatalities are possible. Most accidental human poisoning by ingestion of plants occurs in children under the age of five, but even in this age group poisoning from plants is rare compared to poisoning from common substances (such as drugs and cleaning materials) in and around the home

Ornamental plants with berries purchased for Christmas are a recurrent concern. The colourful fruits of some ornamental peppers (*Capsicum*) are attractive to small children (and pets as well), and are responsible for numerous calls to poison control centres; they can cause irritation (severe in some individuals), as well as vomiting and diarrhea in large doses, but the effects are usually of short duration. Similarly the bright red berries of holly (*Ilex*) are attractive to children and pets, and vomiting and diarrhea are usually the only result unless considerable quantities are consumed. The white berries of mistletoe (most commonly *Phoradendron leucarpum* (Raf.) Reveal & M.C. Johnst., often called *P. serotinum*) in North American households at Christmas time, are also of limited danger unless large amounts are eaten.

Table 12. Examples of Toxic Ornamental Plants That Can Affect Humans

Amaryllis (*Hippeastrum*; not *Amaryllis*, which is also toxic), bulb: gastric irritation.

Angel's trumpet (*Datura*, *Brugmansia*), all parts: delirium, convulsions.

Azalea (*Rhododendron*) all parts: nausea, vomiting, depression, difficult breathing, prostration, coma; potentially fatal.

Bleeding heart (*Dicenta formosa* (Andrews) Walp.), foliage, roots: may be poisonous in large amounts.

Caladium, elephant's ear (*Caladium bicolor* (Ait.) Vent.), all parts: gastric irritation; potentially fatal. (“Elephant's ear” refers to several unrelated plants, one of which is a food plant.)

Castor bean (*Ricinus communis* L.), seeds: one or two seeds can kill an adult.

Chinese evergreen (*Aglaeonema*), entire plant: mouth, throat, & gastric irritation.

Croton (*Codiaeum variegatum* (L.) A. Juss.), entire plant, especially sap: dermatitis, gastric irritation.

Cyclamen (*Cyclamen persicum* Mill.), corm: gastric irritation.

Daffodil (*Narcissus*), bulbs: nausea, vomiting, diarrhea; potentially fatal.

Daphne (*Daphne mezereum* L.), berries: several fruits can kill a small child.

Delphinium, larkspur (*Delphinium*), all parts: digestive upset, nervousness, depression; potentially fatal.

Dieffenbachia, dumb cane (*Dieffenbachia*), all parts: burning, irritation of mouth & tongue; asphyxiation is possible if base of tongue swells & blocks throat.

English ivy (*Hedera helix* L.), all parts: mouth, throat, &

gastric irritation.
Foxglove (*Digitalis purpurea* L.), leaves: dangerously irregular heartbeat and pulse, digestive upset, mental confusion; potentially fatal.
Hyacinth (*Hyacinthus orientalis* L.), bulbs: nausea, vomiting, diarrhea; potentially fatal.
Iris (*Iris*), bulbs: severe digestive upset.
Jasmine (*Jasminium*), berries: digestive disturbance, nervous symptoms; potentially fatal.
Lily-of-the-valley (*Convallaria majalis* L.), leaves, flowers: irregular heart beat and pulse, digestive upset, mental confusion.
Oleander (*Nerium oleander* L.), leaves, branches: affects heart; severe indigestion; potentially fatal.
Philodendron (*Philodendron*), entire plant: mouth & throat irritation, dermatitis.
Poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch), sap, leaves, stems: mild dermatitis in some people, slight potential for gastric irritation, but only if large amounts are consumed; reports of toxicity have been greatly exaggerated.
Pothos, devil's ivy (*Epipremnum aureum* (Linden & André) G.S. Bunting), entire plant: mouth, throat, & gastric irritation & swelling, dermatitis.
Sweet pea (*Lathyrus odoratus* L.), seeds, seedlings, and pods: slow pulse, respiratory distress, convulsions.
Tulip (*Tulipa*), bulbs: abdominal pain, sweating, nausea, vomiting, skin irritation; considered to have limited toxicity, but potentially fatal if large amounts are ingested.
Wisteria (*Wisteria*), all parts, especially seeds, pods: vomiting, diarrhea, gastric irritation.
Yew (*Taxus*), seeds, foliage: potentially fatal (reddish flesh of berries has been consumed, but seeds are very toxic).

Burrows and Tyrl (2001) is the most extensive analysis available of plants in North America that are toxic to animals. Table 13 presents information from this publication with regard to ornamental plants that are potentially dangerous to pets. Note that some common ornamental plant species are much more toxic to some animals than others. Azaleas (*Rhododendron*) may be the ornamental plants most frequently causing serious illness for dogs, which, however, are most often poisoned by consuming chocolate. Dogs are much less likely than cats to be poisoned by ornamental plants. A study of poison control reports in the United States found that of about 116,000 poison occurrences in dogs, about 11% were plant-based, while of about 19,500 poison incidents involving cats, more than 25% were plant based (see Knight 2006). Lilies (notably Easter lilies) are often considered to be the ornamental plants most frequently causing death or serious illness for cats. Cats eat a wider variety of plants than dogs, and when kept indoors most of the time they might find houseplants attractive.

Table 13. Partial List of Ornamental Plant Genera That Are Toxic to Dogs, Cats, and Other Pets, Showing Organ System Affected (after Burrows and Tyrl 2001)
Aloe (aloe): digestive
Allium (onion): blood
Amaryllis (amaryllis): digestive
Brugmansia (angel's-trumpet): nervous, ocular
Cycas (sago palm): hepatic
Cyclamen (cyclamen): digestive
Daphne (mezereon, spurge-laurel): digestive
Datura (thorn apple, jimson weed): nervous, ocular
Digitalis (foxglove): digestive, cardiac
Dieffenbachia (dieffenbachia): digestive
Epipremmum (pothos): digestive
Erythrina (coral bean): neuromuscular
Gladiolus (gladiolus): digestive
Gloriosa (glory lily): digestive
Hedera (English ivy): digestive
Hyacinthus (hyacinth): digestive
Ipomoea (morning glory, etc.): nervous
Iris (iris): digestive
Kalanchoe (kalanchoe): digestive, cardiac
Laburnum (golden chain tree): nervous
Lilium (lily): renal
Narcissus (daffodil): digestive
Nerium (oleander): digestive, cardiac
Nicotiana (tobacco) neuromuscular
Pieris (lily-of-the-valley bush, pieris): digestive, cardiac
Philodendron (philodendron) digestive, renal
Rhododendron (rhododendron): digestive, cardiac
Ricinus (castor bean): digestive
Taxus (yew): cardiac
Thevetia (yellow oleander): digestive, cardiac
Tulipa (tulip): digestive
Urginea (squill): digestive, cardiac
Zamia (coontie, Seminole bread)
Zantedeschia (calla lily): digestive

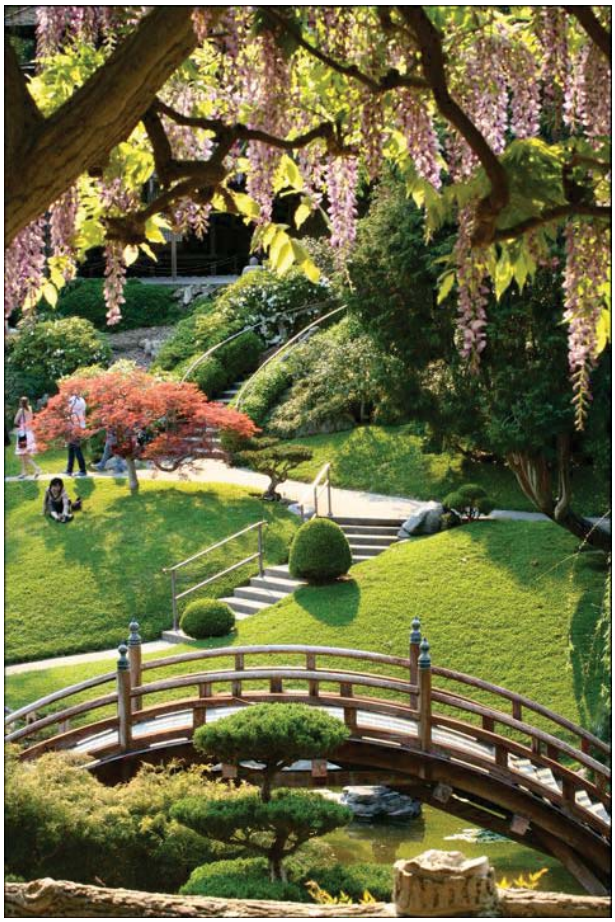


Fig. 66. Huntington Japanese Garden, San Marino, California. There are several classical Japanese gardening styles, this type showing “the best of nature's handiwork in a limited space”. Photo by Plane 777, online at Wikipedia

THE FUTURE

Several “macro trends” are expected to have major influences on the development of ornamental horticulture in Canada: (1) An aging population is expected to increase spending on garden and garden-related activities during retirement. (2) The generally poor economic outlook is expected to lead to retention of family homes and increasing investment in them, particularly with respect to ornamentals, which are well known to increase property values. (3) The generally increasing concern for the environment and for “green” values will also lead to increasing investment in ornamental plants, not just by individuals but by businesses and governments. (4) Competition from imported ornamental plants is likely to increase. (5) In common with agriculture generally, costs of production are increasing because of rising costs of energy and labour, and decreasing availability of water and suitable land for production. (6) Organic production is likely to increase, particularly in view of increasing concern about the high use of pesticides in the ornamentals industry. (7) Marketers have become very sensitive to the importance of impulse buying, and so sell plants in full floral display. (8) Increasingly, consumers are purchasing ornamental plants that are mature, to showcase homes and patios, rather than as planting stock to establish gardens or flower beds. This is consistent with the trends for “instant gratification” (compare microwave ovens, cell phones, and e-mail) and time constraints of modern life leaving little free time. (9) Also along the lines of instant gratification, online-ordered-delivery sales are progressively increasing. (10) Economies of scale and specialization are key drivers of market development generally, and these trends are strongly influencing ornamental plant development and marketing. Breeding and production are increasingly being carried out by large companies, often specializing in a limited number of ornamental crops; sales of ornamentals are increasingly being made by large chain stores. (11) In common with breeding of agricultural and horticultural crops generally, large investments are being made in breeding ornamental crops using advanced technologies (genetic engineering, tissue culture propagation, trait selection using marker genes, etc.), providing employment opportunities for biologists. (12) Plant breeder rights and patents are becoming more important as new varieties are being released; the associated legal issues, as well as the same moral and environmental issues that have become prominent for genetically engineered food and fibre plants, are likely to be raised for ornamental plants. (13) Top ornamental plant species have become staple offerings in large chain stores, which usually concentrate on sales of these high-volume commodities; however, a very large number of additional species are in demand by consumers, providing continued opportunities for smaller, specialized nurseries and greenhouses. (14) The world is an amazing source of new ornamentals, which are likely to continue to be discovered, developed, and introduced to the marketplace. This includes exotic introductions (of principal interest to greenhouse producers), and also local Canadian species that are likely to be especially suited to the climate and soils of Canada.

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

• A famous collection of over 3,000 astonishingly realistic models of painted glass flowers of 847 different plant species is housed in the Museum of Natural History at Harvard University. These were prepared as teaching models, but have become a major tourist attraction for those visiting the Boston area. The glass flowers were created by Leopold and Rudolf Blaschka from 1887 to 1935 in Germany.



Fig. 67. Part of the exhibit of glass flowers at Harvard's Museum of Natural History. Photo by Alcinoe, online at Wikipedia.

• The “language of flowers” was a coded, Victorian-era system of communicating private emotions by mentioning plants or flowers in letters, or placing them in small bouquets called tussie-mussies which were very fashionable at the time. For examples: red roses meant passionate, romantic love; white roses: virtue and chastity; yellow roses: friendship or devotion; gerbera: innocence or purity; daffodil: regard; and geranium: gentility. Most messages were positive or neutral, but some were negative, for examples lobelia meant malevolence; hydrangea: heartlessness; begonia: beware; and lime blossoms: illicit sex.
• Numerous superstitions are associated with flowers, for examples: stealing flowers from graves will result in an early grave for the thieves; bouquets of red and white flowers should be avoided because they are reminiscent of blood and bandages; drooping flowers are an omen of bad luck; bouquets should have an odd number of flowers, as even numbers are reserved for funerals; flowers are unlucky onboard a ship (because they could be used for a funeral); flowers are also unlucky aboard an airplane.
• The boutonnière is the only decorative floral apparel worn by men, the equivalent of a corsage for women. The word is French for “buttonhole” because the flower (usually a white carnation for formal occasions) is affixed by sticking the stem through a designated buttonhole on the left lapel (although today usually just pinned to the lapel, because modern jackets are often made without a loop on the back of the lapel to hold the flower, and sometimes even without a buttonhole). In ancient times, a flower worn on one's coat was viewed as a talisman protecting against evil spirits, odors and disease. In medicine, a “boutonniere deformity” refers to a finger bent down at the middle joint and bent back at the end joint, usually resulting from an injury, but sometimes from inflammatory disorders. When a finger is bent forcefully, the tendon tears away from the top of the finger bone, the tear resembling the buttonhole of a boutonnière.
• The “Dutch clock system” is widely employed in the world's large auctions of ornamental plants (the phrase

"Dutch auction" may refer to this system, but is also used for a quite different type of auction). A high price is first set for an allotment of plants, and the price is gradually reduced. The first bidder is awarded the plants at the price current at the time of the bid. Bidding too soon means that the bidder overpays; however, delaying one's bid too long means that a competitor is likely to get the flowers. The system today is computerized, and bids are automatically registered to authorized participants. Sellers generally obtain more money than they would with traditional, ascending-price bidding.

• Should flowering plants be in sick rooms? As noted above, beautiful flowers have the power to raise spirits. Plants can cleanse some pollutants out of the air, and generate oxygen during the day, but it is doubtful that there are significant benefits. On the negative side, highly scented plants could cause allergies. In theory, pollen from flowers could also cause allergies, but attractive flowers, if they even have pollen, are usually not wind-pollinated and the pollen is too heavy to be transported by wind currents in rooms. Summerbell et al. (1989) concluded that pathogenic fungi in indoor plant soils constitute a serious hazard for immunosuppressed patients. All things considered, for most people plants are welcome companions during periods of illness.

• Topiary is the horticultural practice of clipping the foliage and twigs of living perennial plants so that they develop into clearly defined shapes. A hedge so-manipulated is a simple form of topiary, but the practice has been elevated into a high art, with plants often trained to look like animals. "American Portable Style Topiary" uses steel wire frames within which plants are placed, and forced to conform to desired pre-determined shapes, rather than relying on the sculptural talents of the horticulturist. While purists may object to the technique, it has resulted in spectacular displays at the Disney resorts and parks, as well as other large theme parks throughout the world.

• Fractals are complex geometric figures containing smaller parts that are more or less identical to the larger parts. The repetitive shapes of many natural objects are often fractals, for example DNA, broccoli and cauliflower, and numerous trees and ferns. Many photographers have presented fascinating fractal figures generated by computer as art. The extraordinary beauty of many fractals is astonishingly reminiscent of flowers.



Fig. 68. Topiary at the Epcot Center, Orlando, Florida. Photo by B. Brookes

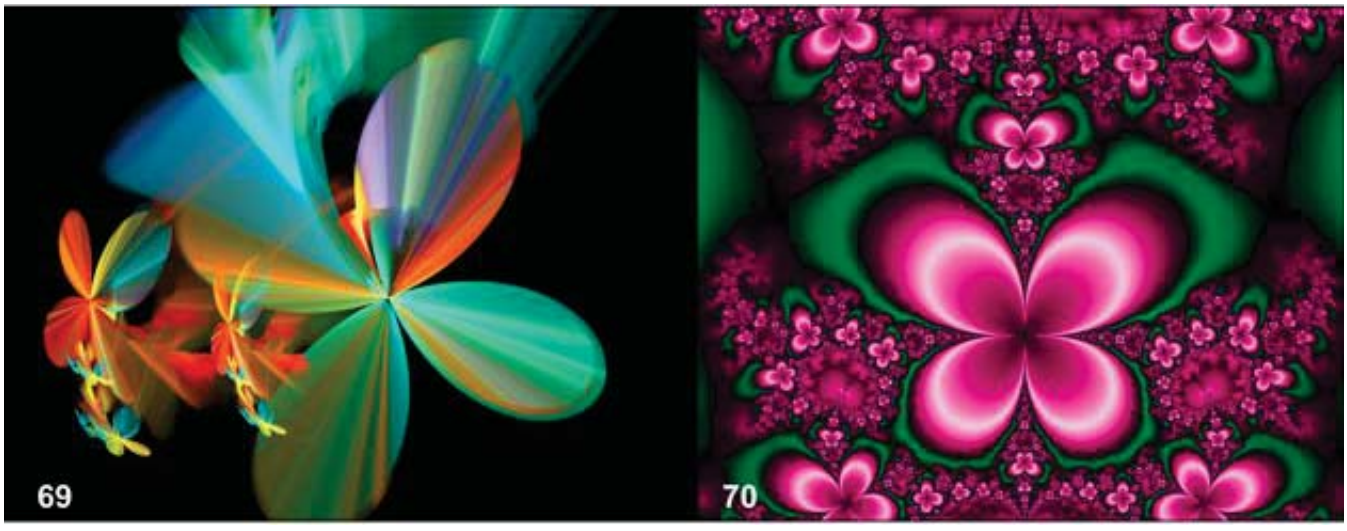


Plate 14. Flower-like fractal photographs. Fig. 69 by S. Apted; Fig. 70 by J. Schrader; both from publicdomainpictures.net.

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CANADIAN ORNAMENTAL PLANT ORGANIZATIONS

National Professional Organizations

The Canadian Ornamental Horticulture Alliance: represents the ornamental horticulture industry in Canada; an alliance of the Canadian Nursery Landscape Association, the Fédération Interdisciplinaire de l'Horticulture Ornementale du Québec, and Flowers Canada Growers; see www.coha-acho.ca.

Canadian Horticultural Council: a voluntary, not-for-profit, national association with the objective of advancing all matters tending towards the improvement of the horticultural and allied industries in Canada, including plant origination and recording, production, grading, packing, transportation, storage and marketing; see http://www.hortcouncil.ca/.

Canadian Nursery Landscape Association: a national trade association coordinating provincial member groups in the Canadian ornamental horticulture industry; see http://www.canadanursery.com/.

Canadian Ornamental Plant Foundation: a non-profit organization that helps to fund new ornamental plant development; see http://www.copf.org/.

Flowers Canada Growers: an organization representing floriculture greenhouse growers and industry partners in Canada; see http://www.flowerscanadagrowers.com/.

Provincial Professional Organizations: See Agriculture and Agri-Food Canada, Agri-Food Trade Service: Canadian Industry Associations; http://www.ats.agr.gc.ca/pro/asso-eng.htm.

Other Organizations: See Plants Galore: http://www.plantsgalore.com/ [A very informative site; choose "Plant Groups Galore"/Canada, which provides options for finding provincial organizations and clubs dedicated to particular species or ornamental plant topics.]



Fig. 71. Butchart Gardens near Victoria, British Columbia. The sunken garden shown here was constructed in an abandoned quarry. Photo by N.H. Myers, online at Wikipedia.

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This concludes the Overview. Forthcoming articles will feature specific genera of ornamental plants. Ed.