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The Canadian Botanical Association Bulletin

Bulletin de l'Association Botanique du Canada

December/Décembre 2006 • Volume 39 No.3 / N° 3

Plant Canada 2007

Saskatoon, June 10th-14th.

Arthur R. Davis, Vice President / Vice-présidente

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You are cordially invited to Saskatoon to attend the PLANT CANADA 2007 meeting which will be held from June 10-14, 2007. As well as the Canadian Botanical Association/L'Association Botanique du Canada, the other five member societies of Plant Canada (the Canadian Phytopathological Society, the Canadian Society of Horticultural Science, the Canadian Society of Plant Physiologists, the Canadian Society of Agronomy, and the Canadian Weed Science Society) will be well represented. Accordingly, this meeting will provide a significant opportunity for Canadian plant scientists from various disciplines, both pure and applied, to meet together and share their newest discoveries. Planning for next year's meeting continues to proceed, with regular meetings of the local organizing committee. The theme is "Growing for the Future" ("Le Végétal de Demain"), and plenary symposia include "Natural Plant Products: Biology, Chemistry and Application" and "Plant Health Network: Quarantine and Invasive Issues". Moreover, there are eleven (11) other symposia being organized by the various member societies. The CBA/ABC will be hosting three of these additional symposia, as follows: "Floristics for the Future" (organized by Tim Dickinson and Deborah Metsger); "Ontogeny of the Flower: The Next Generation" (Rodger Evans, Usher Posluszny); and "Plant Ecology and Invasive Species", a symposium jointly organized by CWSS (David Clements) and CBA/ABC (Paul Catling). Furthermore, delegates will also have the opportunity to attend a workshop on scientific manuscript preparation for publication, being organized by Larry Peterson and Iain Taylor of CBA/ABC.

Further details about registration, scientific presentations, accommodation, etc., for PLANT CANADA 2007 will be made available on the meeting website in the weeks and months ahead, and you are encouraged to visit "PLANT CANADA" (http://www.plantcanada.ca/)for the latest information updates.

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, **40(1)**, must be received before **February 12th, 2007.**

La date de tombée des textes du prochain numéro, le no **40(1)**, est le **12 fevrier 2007.**

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Visit the CBA/ABC Website
http://www.cba-abc.ca

CBA / ABC recognizes talent !

Dear members,
The CBA/ABC prides itself in being able to offer awards that recognize excellence in Plant Science in Canada. I urge you to consider nominating a deserving colleague or student for one of the awards listed below at your earliest convenience. If you think you don't have the time, contact your section Chair or ask a colleague in your department to assist you. The nomination process for any of the awards we offer is not onerous. Please don't hesitate to contact the members of the Executive if you need clarification on any of the eligibility criteria.

Help us identify those deserving scientists !

Chers membres,
L'ABC/CBA est fière de pouvoir reconnaître le succès des botanistes canadiens avec une variété de prix. Je vous encourage donc fortement de nommer un collègue ou un étudiant pour un des prix décrit ci-dessous dans les plus brefs délais. Si vous pensez ne pas avoir le temps de le faire vous-même, contactez le(la) responsable de votre section ou demandez à un(e) collègue de vous aider. Dans la plupart des cas, la préparation d'une nomination ne demande pas trop de votre temps . N'hésitez surtout pas à contacter un membre du comité exécutif si vous avez besoin de plus amples renseignements sur les critères d'éligibilité.

Aidez-nous à repérer ces scientifiques méritants !

Christian Lacroix, President.

The Lawson Medal. First awarded at the 1969 Annual Meeting, the Lawson Medal, the most prestigious award of the CBA/ABC, was established "to provide a collective, formal expression of the admiration and respect of botanists in Canada for excellence in the contribution of an individual to Canadian botany". It is named in honour of Dr. George Lawson, who is generally regarded as Canada's first professional botanist. Lawson was born in 1827 in Scotland and attended the University of Edinburgh. He obtained his Ph.D. from the University of Giessen in Germany in 1857, and accepted an appointment as Professor of Chemistry and Natural History at Queen's College (now University) in Kingston, Ontario. He was instrumental in establishing Canada's first botanical garden (1861) and the Botanical Society of Canada, which met from 1860 until 1862. In 1863 Lawson abruptly left Queen's for Dalhousie (we do not know precisely why). At Dalhousie he was active in the Nova Scotia Institute of Science and was a founding fellow of the Royal Society of Canada. From 1885-1895 he was Secretary of Agriculture for Nova Scotia (equivalent to a modern Deputy Minister). In 1891 he helped to establish the short-lived (1891-1910) Botanical Club of Club of Canada, and was its President until his death in 1895.

Lawson Medals may be awarded each year in two categories of eligibility:

(A) Recognition of a single outstanding contribution to botanical knowledge (monograph, book or series of papers) by a Canadian botanist at any stage of his career, and

(B) Recognition of cumulative, lifetime contributions to Canadian botany by a senior researcher, teacher or administrator.

Nominations should include the Curriculum Vitae of the nominee, a statement by the nominator concerning the nominee's contribution's to Canadian Botany, and at least three supporting letters from botanists who are familiar with the achievements of the nominee. Nominations for the Lawson Medal to be awarded at the next Annual Meeting, should be submitted to Christian Lacroix **before the end of January 2007**

Mary E. Elliott Service Award

The Mary Elliott Service Award is given to an individual for meritorious service to CBA/ABC. It was first awarded in 1978 in memory of Mary E. Elliott, who was a victim of homicide in September, 1976. She had just completed four consecutive years of service on the Board of Directors (as Secretary, Vice President and President), and was just at the beginning her term as Past President at the time of her death.

Mary Elliott was a plant pathologist and mycologist who spent 28 years with Agriculture Canada at the Central Experimental Farm in Ottawa. She was well known for her work on the taxonomy and biology of the Sclerotiniaceae. In 1975 she became Curator of the National Mycological Herbarium. Mary was also very active in identifying fungi for the public and in contributing to and editing (1970-71) a publication of the Biosystematics Research Institute for public information called Greenhouse-Garden-Grass.

Nominations: nominations should give an account of the contributions which the nominee has made to the Association in any capacity (e.g. Board of Directors, Executive Member, Editor, Committee member, etc.) which would make him/her a suitable candiate for receiving the Elliott Award. Nominations should be sent to Christian Lacroix **before the end of January 2007.**

Details of three other Association awards, the Lionel Cinq Mars award, the Iain and Sylvia Taylor award, and the John Macoun travel Bursary will appear in the next issue, or can be viewed on the CBA/ABC website.

Association news

CALL FOR NOMINATIONS

Nominations are invited for the position of Secretary of CBA/ABC for **two** years, starting from the end of the next AGM at the Plant Canada meeting in June 2007.
Please send your nominations to:

Vipen Sawhney,
Biology Department
University of Saskatchewn
Saskatoon SK S7N 5E2
email: sawhney@admin.usask.ca

RECENT BALLOT RESULT

As a result of the recent postal ballot, the following motions have been passed by the membership.

1. Motion "To amend the bylaws to allow for a "family membership to cost 1.5 times single, regular membership, rounded to the nearest dollar".
2. Motion: "To amend the Bylaws to allow a certified member of CSPP to pay half of regular or student membership fees to CBA/ABC".
3. Motion: "That the Bylaws be amended to allow the implementation of an Undergraduate Student Travel award."
4. Motion: "Award proposed above be named Keith Winterhalder Undergraduate Student Travel Award".

NEW CBA/ABC PUBLICATION

At the last annual meeting in Montreal, a new publication was launched: Dubé, M. 2006. The Canadian Botanical Association Bulletin: Electronic Version of Volumes 1(1)-39(1), 1968-2006. [CD-ROM] The Canadian Botanical Association Bulletin 39: Special Issue.

This CD contains all the 153 issues of the Bulletin since its creation in 1968 (plus some documents indicated as supplements to the Bulletin or otherwise linked to it). All this for a total of 2,184 pages transformed in pdf files fully searchable. An introduction explains the goals and the methods of the project and how to use the CD.

The CD is available from the Editor (Christine D. Maxwell) for a minimal cost of $5.00CDN.

WEBSITE MANAGER

The CBA is looking for a volunteer, proficient in web skills to maintain the CBA website on an ongoing basis. While the position is voluntary, a free membership will be offered. Contact the President of the Association,
Christian Lacroix at lacroix@upei.ca

Nouvelles de l'association

APPELS DE CANDIDATURES

Un appel de candidatures est lancé pour le poste de secrétaire pour le CBA/ABC pour une durée de deux ans, commençant à la fin de la prochaine assemblée générale annuelle à la réunion de Plant Canada en juin 2007.
Veuillez envoyer vos candidatures à

Vipen Sawhney,
Biology Department
University of Saskatchewn
Saskatoon SK S7N 5E2
email: sawhney@admin.usask.ca

RÉSULTAT DU DERNIER TOUR DE SCRUTIN:

À la suite du dernier vote par correspondance, les requêtes suivantes ont été acceptées par les me

1. Requête: « Modifier le règlement pour permettre à l'abonnement familial de coûter une fois et demie le prix de l'abonnement régulier, arrondi au dollar près
2. Requête: « Modifier les règlements pour permettre à un membre agréé de la SCPV de payer la moitié de la cotisation régulière ou du tarif étudiant pour adhérer au ABC/CBA
3. Requête: « Que les règlements soient modifiés afin de permettre la mise sur pied d'un prix de voyage pour étudiant du premier cycle
4. Requête: « Que le prix proposé ci-dessous soit nommé le Keith Winterhalder Prix de voyage pour étudiant du premier cycle».

Une formule de politesse

Chers (Chères) membres de l'ABC
Je m'excuse de ne pas avoir expédié par la poste un bulletin de vote bilingue. Il s'agissait d'une omission de ma part et je suis désolée pour cette erreur.
Sincèrement
Marian

NOUVELLE PUBLICATION DE L'ABC/CBA

Au cours du dernier congrès annuel à Montréal, une nouvelle publication a été lancée:

Dubé, M. 2006. Bulletin de l'Association botanique du Canada: version électronique des volumes 1(1) à 39(1), 1968-2006. [CDROM] Bulletin de l'Association botanique du Canada 39, numéro spécial.

Ce CD contient les 153 numéros du Bulletin publiés depuis sa création en 1968 (plus certains documents identifés comme suppléments au Bulletin et d'autres qui lui sont reliés). Tout ceci pour un total de 2 184 pages converties en fichiers pdf entièrement consultables par recherche de mots. Une introduction présente les objectifs du projet, la façon de procéder et explique comment se servir du CD.

Le CD est disponible auprès de la rédactrice (Christine D. Maxwell) au coût minime de $5,00CDN.

Martin Dubé
martin@umce.ca

Position volontaire

L'ABC recherche un volontaire, avec des compétences en création de sites web, pour maintenir le site web de l'ABC sur une base continue. C'est une position volontaire, mais une adhésion libre sera offerte.

Contactez le Président de l'Association, Christian Lacroix, à lacroix@upei.ca

News from the sections/Nouvelles des sections

Les conditions d'affectation de toutes les récompenses pour les travaux d'étudiants apparaissent à la page 54..
The terms of reference for all the student paper awards appears on page 54

Mycology section

Luella K. Weresub Memorial Award

Photo: M. Coleman

This award was established in the memory of Dr. Luella Kayla Weresub (1919-1979), a well-known Canadian mycologist who had worked at the Biosystematics Research Institute of Agriculture Canada since 1957. Dr Weresub was a very active member of CBA/ABC, serving as a Director from 1971 to 1973. The award is open to all undergraduate or graduate students working with fungi. Applications or nominations should be sent to Dr. Hugues Massicotte, Ecosystem Science and Management Program College of Science and Management, University of Northern British Columbia, Prince George, BC V2N 4Z9, **before April 12th 2007**.

We are preparing an email list for the members of the mycology who have given their permission and will use it for internal contact in the coming months.

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Ecology Section.

J. Stan Rowe Award

This award was established to celebrate the life and work of Stan Rowe, eminent Canadian Plant Ecologist. Applications from students who have published a paper in plant ecology last year are encouraged. They should be sent to the current Chair of the Ecology Section of the Canadian Botanical Association (Dr Paul Catling, Eastern Cereal and Oilseed Research Centre, Biological Resources Program, Agriculture and Agri-food Canada, Ottawa, Ontario K1A 0C6, catingp@agr.gc.ca) **before April 12th 2007.**

Systematics and Phytogeography Section.

Floristics for the Future

At the June 2007 Plant Canada meetings, the CBA/ABC Systematics and Phytogeography Section will sponsor a symposium, "Floristics for the Future," on Thursday, 14 June 2007, from 1030-1200h. Financial support for the symposium is generously being made available by the organizers of Plant Canada 2007. Details are still being worked out but plans are to combine presentations by invited speakers with a closing panel discussion of issues of importance concerning floristic studies in Canada. Organizers: Tim Dickinson and Deb Metsger, Department of Natural History, Royal Ontario Museum, 100 Queen's Park, Toronto ON M5S 2C6.

The section also calls for nominations or applications for the **Alf Erling Porsild Memorial Prize**. In 1990, the CBA/ABC established a fund to support the award of a prize for the best paper in the fields of plant systematics and/or phytogeographyby a student (as senior author) during the previous year. Applications or nominations should be sent to the current Chair of the Systematics and Phytogeography Section of the Canadian Botanical Association (Dr.Tim Dickinson, Dept. of Natural History, Royal Ontario Museum, 100 Queen's Park, Toronto ON M5S 2C6) **before April 12th 2007**.

Development Section

Taylor A. Steeves Award

This award was established to honour Taylor Steeves who has made numerous contributions to the CBA and to botany. Applications or nominations should be sent to the current chair of the Section of the Canadian Botanical Association (Dr. Usher Posluszny, Department of Molecular and Cellular Biology, University of Guelph, 50 Stone Rd. East, Guelph, ON N1G 2W1 before April 12th 2007

The Development Section is organizing a symposium..."**The Ontogeny of the Flower: The Next Generation**" for the 2007 Plant Canada meeting in Saskatoon. Organizers are Usher Posluszny and Rodger Evans. The keynote speaker will be Larry Hufford of Washington State University.

The Teaching Section

The teaching section website is currently being updated with links being restored and new material being added. We hope for completion in early January 2007.

Plans are also underway for a teaching section session at the 2007 Plant Canada meeting in Saskatoon.

The session will be held on Tuesday, June 12th 2007. The program for the first part of the morning from 8.30am-10.00am, will be arranged jointly by the CBA and CSPP. The second half is being planned by members of the Plant Canada team. Speakers will include Janet McVittie from the University of Saskatchewan Education Department, discussing issues related to improving the science background of our teachers; also a representative from AgWest Biotech will talk to scientists about communicating their science to the media; and they are also hoping to have a well-known science writer to address the effective communication of science.

Those of you who subscribe to Plant Education (Plant-ed) - a moderated BIOSCI newsgroup for plant educators, will have seen a recent, rather indignant, message from Dr David Hershey, a Biology education consultant and author of many articles in science education journals. His latest message was in response to a comment from another contributor, Monique Reed, who had found the following statement in a book published by The American Association for the Advancement of Science, called “ The Evolution Dialogues: Science, Christianity, and the Quest for Understanding". The statement reads, “The evolution of seeds enabled plants to spread rapidly and diversify into ferns, mosses, horsetails, cycads, and, later, conifers."

David Hershey comments on the large number of factual errors that appear in the science and science education literature, including biology textbooks and journals, and that in some cases his efforts to point out and change these errors have not been successful! He suggests that some of the more prestigious organizations, such as the Botanical Society of America, should produce a website called “Bad Botany” to draw attention to the large number of glaring errors that are appearing. There are two articles, which will be available on the Teaching website, in which Hershey elaborates on the misconceptions.

Avoid misconceptions when teaching about plants. Http://www.actionbioscience.org/education/hershey.html
And **More Misconceptions to Avoid When Teaching about Plants.**
http://www.actionbioscience.org/education/hershey.html
Hershey covers a wide range of factual errors and misconceptions, so they make interesting reading! There is an added bonus too. One can formulate exam questions such as “What is wrong with the following statement…….?”
Christine D. Mawell, Chair Teaching section.

Undergraduate Student Regional Awards

This program offers annually one award of $200.00 for one of the undergraduate conferences/meetings in Biology for each of the five (5) regions of Canada: Atlantic region, Québec, Ontario, Prairies and Territories, and British Columbia. The awards will be given for the best presentation by an undergraduate student in the discipline of Botany at one of the major regional undergraduate conferences. The purpose of this recognition is to encourage undergraduate students to pursue graduate research in botany and to enhance the visibility of the Association. If no presentation in Botany is scheduled, the money returns to the Association. Students cannot apply directly to the CBA/ABC for these awards.

Members are encouraged to attend or be involved:
APIC Undergraduate Biology Conference will be held at the University of New Brunswick, St John on March 2-4th 2007.
Ontario Biology Conference will be held March 17-18th 2007 at McMaster University.
If anyone is aware of similar conferences in the western provinces, please inform the President, Christian Lacroix.

Rejuvenation of the Conservation Committee.

Dianne Fahselt, Chair of the Conservation Committee
Department of Biology, University of Western Ontario
London, ON N6A 5B7 email dfahselt@uwo.ca

The conservation committee has just been re-established with some 22 members from across Canada. This means that no one will be over-worked and there should be projects of interest to everyone. The best news is that there are now some keen student members as well as many talented, high profile new members. This could perhaps help to increase CBA membership.

We hope that it will get us more exposure in any case, as enthusiasm seems to be running high. As you may know Marian Munro will be the chair next year, and her credentials are amazing. She is first of all very committed to conservation work, plus she has an exceptionally broad background, including academic, government, consultation experience as well as curatorial and educational work in a natural history museum. I will act as chair until she finishes her term as secretary.

The current membership list reads as follows: Gerry Allen, Rose Klinkenberg, Brian Klinkenberg, Adolph Ceska, Susan Robertson, Trevor Goward, Ellen McDonald, Scott Wilson, Richard Staniforth, David Punter, Liette Vasseur, Genevieve Duclos, Martha Gauthier, Dianne Fahselt, David Gailbraith, Daya Dayanandan, Kate McCarrie, Alex Mosseler, Ed Reekie, Marian Munro, Luise Hermanutz, Valerie Tomlinson, and Pippa Secombe-Hett.

The only large area for which we have no representative is the eastern Arctic. However,volunteers are welcome from anywhere.

Three position papers have been prepared in anticipation of conservation issues that might be encountered by the Conservation Committee. Also they are available for use by others outside of the association. Suggestions are invited for topics that could be developed as other position papers related to conservation. The papers that have already been prepared have been used on various occasions and one has apparently been involved in re-routing a pipeline in the north. To ensure they are concise and to encourage reading through to the end, the position papers are quite short, about a page in length, but we hope that cited backup papers with details of the rationale for each will be developed and published in refereed journals. This has so far been done for one. The newly re-constituted Conservation Committee will be involved. If anyone else is interested in being on the committee or participating in any other way please let us know.

The three papers appear below.

1. <u>Position Paper on Transplantation as a Means of Preservation</u>

Natural vegetation is being increasingly threatened by land development; such development is often opposed by conservationists because of the potential destruction of native species as well as habitat. Suggestions have been made that transplanting rare species from proposed development sites to other locations would eliminate conflict and, thus, tend to satisfy both developer and conservationist. The Canadian Botanical Association is strongly opposed to the idea that transplanting is a reliable method of conserving rare species. Ecosystem preservation is the only viable means of maintaining a full range of genetic diversity and thus removal of some elements from natural communities to other locations is not a desirable conservation alternative. Not only may transplantation fail to perpetuate species, but degradation of natural areas may be accelerated in the process.

This policy is based on the following rationale. A rare native species cannot be considered in isolation from its habitat. It is not simply the presence of rare plants that makes a site significant. Rather, rare species indicate that the habitat and, thus, the entire ecosystem is significant. Rare species may signify sites of phytogeographical importance, or unusual soil, microclimatic or other ecological conditions. In some cases, their presence may indicate a lack of disturbance. In all instances, the habitat is as important to scientific knowledge and our cultural heritage as the rare species itself. Thus, the transfer of rare species to a garden or a habitat where they did not occur naturally does not constitute a reasonable conservation alternative because the native habitat has been lost. Further, the extensive literature on ecological information needed to transplant rare species, methods of ascertaining whether transplanting has been successful, and schemes for expediting transplanting are largely irrelevant because transplanting does not preserve the native habitat.

Since any species taken from its native habitat no longer interacts with its natural suite of biological and physical environmental factors, the answers to many important questions dealing with its biology are lost along with the native habitat. For example, if plants are introduced to non-native site, it may be difficult, if not impossible, to discover how natural factors determined the native range of species or even what the original native range was. It will be impossible to probe physiological adaptations which have enabled plants to grow under specific natural conditions.

In parts of the world where the entire landscape has already been altered by man, and no other conservation alternatives exist, transplantation has been used to permit some genotypes to persist at least for some period of time. However, the success of a transplant cannot be predicted and the permanence of the protection available in cultivation is similarly uncertain – further reasons why transplantation is not a desirable alternative.

The propagation of rare plants in gardens may be aesthetically pleasing and indeed can be an important tool for scientific research. However, many desirable natural ecosystems could be destroyed of impoverished by collecting rare and uncommon plants for purposes of cultivation, and certainly, neither the plant community nor a reasonable range of genetic variability of a species will be preserved in most gardens.

Perhaps the most serious problem of all is the possibility that extensive, transplanting might become viewed as a standard way of resolving the preservation vs. development conflict. If transplanting is condoned as a standard conservation method, then uninformed decision-makers will feel no compunction about approving developments in any natural area. Attempts have been made to “recreate” natural ecosystems through transplantation and seeding. This has been generally undertaken in environments which were known to have formerly supported a similar community. Despite considerable expense, development of sophisticated techniques, and passage of time which might have allowed for establishment, such attempts can only be judged as partially successful. The best results have generally been obtained with simple grassland communities but even the most successful examples of these are not similar to natural communities. Attempts to re-create forest communities have only partly re-established the natural forest canopy and the understory in these cases is decidedly out of character. While attempts to re-establish a few of the commonest, least environmentally challenging elements such as trees, are fraught with difficulty, establishment of understory are rare species is even more problematical. It is quite a different matter simply to produce green vegetation cover over an eroding or unstable site; it is a worthwhile undertaking but not remotely equivalent to reconstituting a natural ecosystem – floristically, structurally or compositionally.

2.<u>Position paper on Planting to Complement Natural Area Protection</u>

All vegetation uses atmospheric CO_2 and gives off O_2, prevents erosion, humifies soil, enhances replenishment of ground water reserves and provides wildlife habitat. Artificial plantings, while lacking important characteristics of natural communities, confer many of these same benefits and could serve to extend total vegetation cover as well as provide connections between scattered remnant natural areas. This would allow native species to expand their presently limited habitat and would partially compensate for the extensive conversion of natural vegetation to agriculture, industry and urbanization.

The Canadian Botanical Association (CBA) advocates that only native species should be used for reclamation, and the following are CBA recommendations concerning the process.

1.Protection of remaining natural areas

Existing natural areas should be saved as examples of functioning ecosystems. They are irreplaceable as objects of scientific interest and a fundamental part of our natural heritage. They may also be a source of disseminules for natural recolonization of adjacent areas and for artificial revegetation.

Reserves should be protected from disturbances such as genetic contamination. Exotic species or inappropriate provenance should be controlled in adjacent areas since close proximity might permit hybridization and generate non-adaptive gene complexes. If aliens or their derivatives are successful and invasive, they could out-compete native species.

2.Reconnection of natural remnants

Spontaneous extensions may occur if "zones of opportunity" are established around existing natural areas. For example, unproductive or superfluous agricultural fields should be permitted to undergo succession, based on native species in the soil seed bank as well as adjacent natural communities, and to ultimately return to natural communities. In some cases, management techniques such as alteration of grazing regimes might facilitate revegetation. Removal of aliens or the use of controlled burns also may be effective.

Deliberate plantings could also be made to connect remnants and extend possibilities for populations which are presently isolated. These plantings could consist of extensive acreages, wide corridors or even narrow hedgerows, but ideally would form a continuous network of green areas. Local provenance should be used because particular physiological races may have evolved which are predisposed to existing local conditions, e.g., exposure, soil or moisture availability.

To broaden genetic representation somewhat, seeds or other propagules should be collected from several different plants, and only a small percentage of those produced in any one season should be taken. If massive plantings are planned, seeds should be propagated in gardens rather than removed from a natural area.

Initial planting of native trees, rather than only herbs or shrubs, may hasten the successional process. In this case, common pioneer tree species which grow in similar situations should be used. Inclusion of shrubs will not only diversify the habitat, but may provide cover for establishing trees. The art of revegetation is still poorly developed, however, and there are no established methods for producing even a close compositional facsimile of most kinds of natural communities.

To minimize confusion in future generations of botanists, the procedures followed and results achieved should be fully documented and a report deposited with a responsible person such as a regional ecologist or public institution such as a museum.

3.Enhancing survival of rare species.

The greatest advantage to rare plants can be provided by protecting their natural habitat. However, including some species in plantings might be beneficial, at least in the short term.

If stands including rare species are clearly under immediate threat of destruction and no remedy is possible, plants could be transferred to botanical gardens or areas being revegetated. However, the most effective way to establish them elsewhere is probably by seed. Experienced botanists are generally better equipped to assume responsibility for rare plants than amateurs, but the success rate may be very low, nevertheless.

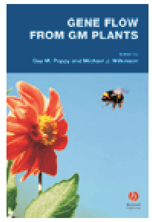
In no case should recovered plants be introduced into other natural areas. Besides the fact that particular microhabitat requirements or interactions with other species are poorly understood, there are many problems regarding the mechanics of transplantation. Introduction is itself a form of disturbance, and, as a result, communities could be altered compositionally and structurally. Component species could be atypical both physiologically and with respect to the degree of variation in each frustrating investigation which attempts to understand the functioning of natural ecosystems. Therefore, introduction is best done into peripheral plantings from which a species may gradually find

its own way into adjacent stands, if appropriate.
Disseminules of rare plants, such as seeds, might be taken for propagation from intact natural areas only if limited numbers are collected and only if it is clear that these are not required to maintain existing populations. No introductions, even by seeding, should be made into natural areas.
Records of stock source, storage and planting procedures as well as exact location of out-plantings should be maintained, and a copy placed with a reliable public agency.Co-ordination of regional efforts

Communications are essential among all land management agencies in order to achieve maximum effectiveness.

Continued on page 72

Book Review/ Revue de Livre



Gene flow from GM plants

Edited by Guy M. Poppy and Michael J. Wilkinson
Oxford: Blackwell Publishing. ppxiv + 241.
Price: US$179.99

This long overdue volume of 10 edited chapters arrived on my desk at the same time as a volume from the International Plant Genetics Resources Institute (IPGRI), entitled "Issues on gene flow and germplasm management", edited by M. Carmen de Vicente. The overlap is relatively small because the IPGRI volume devotes itself to crop systems while Poppy and Wilkinson have sought to link the realities of pollen dispersal to the biotechnology.
As one might expect from the author lists, Poppy and Wilkinson have drawn heavily on writers whose interest and research successes have been in understanding the positive impacts of genetic engineering. They are also to be congratulated on their success in persuading their authors to address the research progress that addresses the ecological concerns that have been raised. This is a valuable book for the expert and for an interested non-specialist. It is however not easy bedtime reading.
Any who have taught introductory higher plant botany have long bemoaned the paucity of information on how pollen gets where it goes. We know normal vectors and that each flower is more or less adapted to achieve gene transfer from male to female. The difficulty is that pollen transfer is required but gene penetration is not necessarily achieved. Development of sensitive DNA technology has led to substantial progress in understanding short term effects, but rigorous testing of gene penetration must await long term studies. GM technology now provides several new models but pollen biologists have a very difficult task to do more than deliver prognostications on the scale and impact of gene flow in natural, crop and biotechnological systems. Furthermore, we do not yet have an adequate theory base from which to develop sound risk and regulatory tools.
Philip Dale's opening chapter addresses the GM debate. He has written extensively on the benefits of GM technology, but falls yet again into an old trap, namely that we as scientists prefer to answer the questions that we want to answer rather than taking the public questions as bona fide statements of concern. Dale is obviously correct in seeing GM crops as "a lightning rod for a range of concerns", but it is odd that he sees the opposition in the UK in context of the Iraq invasion rather than further back in the public distrust that emerged after denials in the House of Commons that 'mad cow' disease posed no threat to the food chain. Dale does however, emphasize the critical point that Farm Scale Evaluations have to be rigorous and problems of containment resolved.
Thomas Nickson's chapter provides up-to-date coverage (as do all authors) although I think that he could have made a clearer break between issues of food and fibre crops.
Chapters by Ramsey, Richards, and by Jorgensen and Wilkinson give excellent, largely methodological explanations. The discussions of pollination vectors through hybrid formation and the assessment of rare hybrids are technical but bring together a substantial body of research that I have not seen covered effectively in recent years. I wonder if it is time to revisit earlier observations on heavy metal tolerance where penetration of one or two viable mutants changed population structure drastically in as few as 2 generations.
The most difficult parts of the book come in the final chapters. The ecologists have developed many tools to measure ecological fitness. Quantification of risk has always been a safety valve for those trying to convince others of benefits. The mathematics presented in these chapters (Weis, Raybould and Wilkinson, and Sutherland and Poppy) is tough going, but sound. I would have liked to see some consideration given to ensuring that risk is better understood by the interested public. This is never going to be easy, as long as the public (we are all public in issues that are beyond our expertise) remains oblivious to the small but real likelihood that scientists may not deliver a particular "good" all the time in all contexts.
The final chapters (Hill and Poppy and Wikinson) take us to the regulatory world. Unfortunately, careful analysis of the process by independent researchers in Canada and the United States has revealed cases that regulatory approval has been tainted by both bad science and regulator' failure to recognize major conflicts of interest when the advocate (industry) is charged with providing evidence to support regulatory approval. This is particularly problematic because attempts, using 'Freedom of Information' legislation, to obtain the original data submitted for regulatory approval have been blocked on the grounds of trade secrecy.
Bibliographies were certainly up-to-date, as one might expect for a book on a new technology. The index left a lot to be desired – no author index and no taxonomic index - I fear as a result of cost cutting. At US$179.99, this book is no bargain, but it is a must for any plant biotechnology company or researcher concerned with the real-life impact of GM crop development.
Reviewed by Iain E.P. Taylor, Editor, Davidsonia, Professor emeritus of Botany and Associate member W. Maurice Young Centre for Applied Ethics, University of British Columbia

Obituary

Dr George Ledingham 1911-2006

The Canadian Botanical Association was saddened to learn that an eminent botanist and CBA/ABC member, Dr George Ledingham had passed away on October 18th 2006 at the grand age of 95 years and 8 months. He was predeceased by his wife Marjorie,and is survived by his son Beattie, his grandsons and great granddaughters.
George Ledingham, was born in Moose Jaw in 1911, and graduated from the University of Saskatchewan, before obtaining a doctorate in plant genetics at the University of Wisconsin in 1939. He spent the war years working on the family farm and then moved to Regina College to teach Biology. The college then became the University of Regina and Dr Ledingham continued teaching for a total of forty years. He greatly influenced many of his students with his enthusiasm and interest in conservation and the environment.
Dr. Ledingham retired from fulltime teaching in 1978 and was named professor emeritus and curator of the herbarium at Regina, a herbarium which he had established.

He gained an international reputation over the years as a conservationist, a plant ecologist and an expert in prairie ecosystems. In 1986 the University of Regina conferred an honorary doctorate of laws on him and in 1990 named the George F. Ledingham Herbarium in his honour.
The herbarium, originally established at Regina College more than 60 yr ago by George Ledingham contains around 50,000 specimens, including 10,000 bryophytes and 10,000 lichens. Most of these specimens were his own. For a time he was head of Biology at the University of Regina, but he continuously curated the herbarium which now bears his name. He, in fact, attended to the herbarium well into his nineties and was still going in from time to time during his 94-95th years.

Much of his systematic work focused on *Astragalus* and over time he and his students studied chromosomes of hundreds of species and characterized the distinctive karyotypes of Old and New World species. Most of his travel was in search of *Astragalus* and in 1965 he discovered a new species on a dry hillside in Iran. Located 12 miles north of Shiraz, an ancient capital of Persia, it was named by R. C. Barneby as *A. ledinghamii*. A full page color photo of the holotype appears in the fall 2006 issue of the University of Regina magazine, Degrees, along with a few other specimens from his collection.

George contributed much to the accumulated knowledge of the flora of Saskatchewan and he was largely instrumental in establishing the Grasslands National Park in SW Saskatchewan. His conservation work was widely recognized and he received awards from Parks Canada, Environment Canada and the Canadian Nature Federation. He was also the recipient of a Canada 125 medal, the Saskatchewan Order of Merit and the Harkin Conservation Award, and was given an honorary membership in the Ottawa Field-Naturalists.

George Ledingham, working in the herbarium that bears his name. Photo courtesy of the Biology Department, University of Regina.

For about 10 years George was a member of the Core Conservation Committee of the Canadian Botanical Association. He also helped with the organization of Saskatchewan meetings of the CBA and led a field trip to the Big Muddy in the 1970's . He was an avid birder, seldom without binoculars, and one of the stalwarts of the Saskatchewan Natural History Society. He went out of his way to expose young people to nature, in and out of class, summer and winter, day and night. He included students of other disciplines, such as chemistry, as well as of biology and even members of their families on his outings around Saskatchewan. Summer was his favourite time and his home garden was glorious. Generous bunches of flowers were brought from there to the lab along, of course, with taxonomy lessons. He will be greatly missed by family, friends, students and colleagues, but he has left an enormous legacy.

Astragalus ledinghamii, Herbarium specimen prepared by George Ledingham. Photo courtesy Of the Biology Department, University of Regina.

Continued

Gwen Jones, a former student and colleague of George, wrote the following poem on the occasion of his retirement in 1978. We` present it here, as it sums up many of the characteristics which endeared him to his students and fellow botanists.

A is for Astragalus with flowers blue and pink!
B is for the brome grass which would drive a man to drink
C is for the cattle that around our station stand!
D is for the digger which is always in his hand!
E is for his energy that really makes us dizzy!
F is for the "Flora" which should keep him very busy!
G is for the Grasslands - he fought hard and long!
H is for the every hill he had to look beyond!
I is for the ideas in all the briefs he wrote!
J is for his joy on finding it's not brome! it's oats!
K is for the knowledge he imparts to all who seek!
L is for the logs we crossed on every creek!
M is for the miles he drives through mud and mire!
N is for the new plants he''ll find when he retires!
O is for his old friends who wish him joy, NO cares!
P is for the plant press that he carries everywhere!
Q is the Qu'Appelle in which he "birds" for fun!
R is for the rain and mud - what happened to the sun?
S is for the specimens he collects in early spring!
T is for Taxonomy - to him that's everything!
U is for the umbrella whose use he does disdain!
V is for the van, which he likes to drive in rain!
W is for the waxwings he looks for in December!
X is for his x-students he always does remember!
Y is for his yearning to hear the coyotes call!
Z is for his zest for life he's given to us all!

Field trip to Big Muddy,(Sask) led by Dr George Ledingham, as part of a CBA/ABC meeting, sometime in the 1970s. George Ledingham is wearing a plaid shirt, on the left. Keith Winterhalder is kneeling in the foreground. Perhaps other members are recognisable?

Dianne Fahselt
University of Western Ontario

Terms of Reference for Student Paper Awards

1.All students who have graduated from or are currently enrolled in a Canadian university, or Canadian students who have studied abroad are eligible

2. These awards are for work published while the author is still a student, or based on work done while a student and published within two year of graduation. This makes allowance for students who do not write until after thesis (graduate or undergraduate) completion and normal publication delays.

3. Students do not have to be CBA members to be eligible for Student Paper Awards.

4. No candidate may submit a paper for more than one award

5. The paper must have been published during 2006. Papers published in late 2006 but not available for reprint form for the 2007 deadline will be considered eligible

6. Joint papers must be accompanied by a statement on university letterhead, signed by all the authors, estimating responsibility of each author for:

a..the ideas that lead to the initiation of the project;

b.the actual research skill demonstrated

c. the writing of the manuscript

7. All application should include four copies of each of the following

. A. a reprint of the paper (or proof of the paper plus a letter from the editor of the journal stating that this paper is in press with a 2006 publication date;

. the candidates curriculum vitae including current address and e-mail information;

B. a statement indicating that this student is currently enrolled in a degree program, or has completed such a program during the calendar year for which the award is to be made (except for extenuating circumstances with respect to timing of publication as outlined above in (2).

C. a statement from the supervisor, the student and any co-author establishing responsibility for the paper as outlined above in (6)

8. Student award winners receive a one (1) year membership in the Canadian Botanical Association.

9. The judging committee reserves the right to make no award if submissions are not considered to of sufficiently high quality, or to share the award between two applicants if their papers appear to be of equal merit. The winner will be notified, and the award will be presented during the Annual Meeting of the Canadian Botanical Association.

10. The Treasurer of the CBA will be pleased to accept donations (which are tax-deductible) to the fund which finances these awards. Please publicize these awards as widely as possible, and please contribute to the capital fund if you can afford to do so

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11. Applications and supporting documents must be received, **before April 12th, 2007,** by the Section Chair (or Chair of the judging committee) responsible for the award. (see page 48)

Of Particular Interest to Graduate students (and their Supervisors!)

ESTABLISHING AGREEMENT ON EXPECTATIONS AND RESPONSIBILITIES BETWEEN GRADUATE STUDENT AND SUPERVISOR

Dr Kate Frego, University of New Brunswick at St. John.
Dept. of Biology, University of New Brunswick
P.O. Box 5050, Saint John, NB
Canada E2L 4L5

The relationship between faculty member and graduate student may be more complex that that with undergraduates – partly because there is a shift toward more equitable power. Especially for Masters students, who have not had previous graduate training, it is very useful to explicitly discuss expectations and responsibilities of both sides of the relationship, and to revisit these issues periodically throughout the graduate program. In my experience, many relationship issues result from initially insignificant misunderstandings. These are easier to prevent, through setting clear guidelines, than to "fix" once they arise.

The following items are meant as a starting point for discussion, and may be revised or reworded as appropriate. In order to avoid miscommunication, I believe it is worthwhile to summarize the resulting agreement in writing, with both student and supervisor(s) keeping a copy. I don't mean that this document constitutes a binding contract, however, the final version should be seen as an agreement to be honoured. Personally, I discuss these items with a potential graduate student well before we reach a decision on whether or not to work together.

Supervisor(s)'s commitment to the graduate student, i.e. what can the student expect from the supervisor, and with what degree of certainty?

Financial
- Subsistence:
  - Teaching Assistantships,
  - Research Assistantships,
  - stipend, and
  - duration and value of each
- Research expenses and access to equipment as required
  - chemicals and essential supplies
  - new equipment required
  - field expenses (accommodation, per diem, travel, vehicle use)
  - support for professional development, e.g. conference attendance (travel, registration, other); costs of presentation preparation (e.g. poster printing)

Space
- laboratory space
- office space
- experimental (lab, growth chamber, etc.)
- storage of samples (especially longterm)
- computer equipment (printer, etc.)

Scholarly assistance
- intellectual input and assistance
  - regular meetings
  - discussion opportunities (e.g. lab group, visiting scholars)
  - feedback on written work
- mutually-set deadlines met
- assistance with presentations (guidance, dry-run, etc.)

Professional acknowledgment
- authorship, e.g.
- first authorship on publications using data collected for thesis, assuming thesis is completed
- single authorship on projects done independently outside thesis
- second authorship, if thesis is not completed; student will have opportunity to comment on manuscript before submission.
- final word on additional co-authors
- use of data by others e.g. other students in subsequent studies; agreement that data will not be released to third parties before it has been published, and/or without the consent of the student
- acknowledgment of contributions, e.g. use of data collected by student, equipment designed and built by the student
  - in publications
  - in practice (i.e. access continuing after graduation)
- permanent access to data collected by student

General
- openness to discussion on research and academic matters
- fair warning of potential changes in plans (e.g. changes in supervisors funding or contract, sabbatical leaves)
- commitment for duration of research project and thesis, recognizing the student's career and financial investment

Graduate student's commitment to supervisor(s) i.e. what is expected of the graduate student?

Evidence of financial responsibility
- pro-active applications for additional funding (any source)
- input on grant proposals, as needed
- acceptance and fulfillment of TAships or equivalent
- responsible use of resources

Evidence of scholarship
- courses completed to acceptable standards and in timely fashion
- programme requirements met and on time
- creative thought in design, implementation, analysis and interpretation
- independent efforts to learn and apply theoretical and practical aspects

Evidence of scholarly productivity
- milestones of research effort (e.g. field season's goals) met within reason

Continued

interim reports on time
mutually-set deadlines met
preparation of manuscripts for publication, preferably before thesis completion

Academic/professional acknowledgment

collegial attitude to sharing data, e.g. supervisor has access to data used in thesis, in perpetuity;
clear and correct raw data and copies of all analyses to be provided before leaving
supervisor offered input into manuscripts and second authorship in publications directly resulting from thesis data
supervisor's support acknowledged in other papers or presentations where thesis work allowed collection of data outside thesis proper

General

effort to work with other graduate students on the "team"; collaboration, cooperation and contribution to consensus as required
openness to discussion on research and academic matters
fair warning of potential changes in plans (e.g. decision to switch to part-time, take a leave of absence, or drop programme)
commitment to development and completion of research project and thesis, recognizing the supervisor's career and financial investment
independent efforts to meet personal needs

Suggestions to avoid common pitfalls:

The items on this document are by no means exhaustive. Student and supervisor should add any other items or issues that come to mind.
Discussion of the nature and limits of the professional relationship are a good idea.
Any changes in commitment and/or expectations should be discussed as soon as they arise.
If the student is working with two or more co-supervisors, proportions of their individual commitments should be itemized in detail.

Activities at Plant Canada 2007

You may have heard that one of the events at Plant Canada 2007 will be a student journalism contest. The organizers are looking for scientists to act as volunteer interviewees for budding student journalists.. If you have questions or comments or are interested in participating contact Karen Bailey at 306-956-7260.

Scientific Manuscript Preparation Workshop

June 10th 2007

Plan to attend this workshop given by two experts, Iain Taylor, former editor of the Canadian Journal of Botany, and Larry Peterson, current co-editor of the same journal. Learn the techniques of abstract writing, correct referencing, data display and more!

The workshop will be held at 1.00pm until 4.00pm, at the Plant Canada 2007 conference location. More details will be available in the next issue of the Bulletin.

Botanical Research at Acadia University

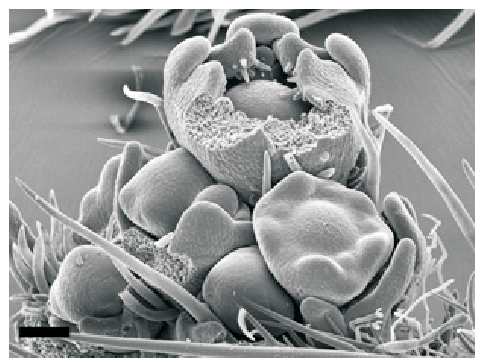
Rodger Evans, Sara V. Good-Avila,
Dave Kristie and Ed Reekie
Acadia University, 24 University Avenue, Wolfville, NS B4P 2R6

Nestled amongst the Minas Basin tides and Annapolis Valley apple orchards is a burgeoning botanical research group at Acadia University in Wolfville, Nova Scotia. Known in the past for excellence in plant taxonomy (EC Smith, Sam Vander Kloet) and mycology (Darryl Grund), plant biology at Acadia now includes four faculty members that have such varied interests as seed germination and plant development, effects of CO_2 levels on plant growth, the biology of rare and endangered flora, plant systematics and evolutionary floral development, as well as evolution of plant reproductive systems.

Rodger Evans (rodger.evans@acadiau.ca) – Plant Systematics and Floral Evolution

My research program uses various sources of molecular data and microscopic studies of comparative developmental morphology to infer relationships within the Rosaceae. These two seemingly disparate lines of evidence are used to hypothesize evolutionary changes in floral ontogenies that may have given rise to the wide variety of floral morphologies we see today. One of these projects involves a comparative analysis of floral development in various genera traditionally placed in subfamily Rosoideae (Rosaceae). Despite their economic and ecological significance, Rosoideae floral ontogeny has not been studied thoroughly. Molecular analyses of Rosaceae relationships demonstrate that Rosoideae are polyphyletic and that chromosome number is a better indicator of relationships amongst these genera. Results suggest a strongly supported clade of x=7 genera while x=9 genera are interspersed amongst other Rosaceae. Previous analyses of floral ontogeny in the Rosoideae either investigated a single species, or were only modestly comparative when more than one taxon was examined. Therefore, it is pertinent to investigate the ontogenetic basis for variation in mature morphology from a wide sampling of Rosoideae. (This project will involve field work in the SW USA – New Mexico, Arizona, and California).

As part of a new direction in my research program, I am in the process of organizing a sabbatical visit to the lab of Dr. Elena Kramer at Harvard University during the winter of 2007. While there I will learn *in situ* hybridization techniques to study floral development gene expression patterns in various Rosaceae flowers. One long-standing question in the Rosaceae is whether the hypanthium (floral tube) is of appendicular (phylogenetic fusion of sepal, petal and stamen bases), or receptacular (hypanthium is an extension of vegetative receptacle tissue) origin. Using *in situ* hybridization techniques to study expression patterns of class A, B, and C genes in thin sections of developing flowers may help resolve this question, as well as other Rosaceae floral evolution questions.



Scanning Electron Micrograph (SEM) of a developing *Potentilla* inflorescence. Scale bar = 100µm. (Photo by R. Evans)

Representative Publications:
Campbell, CS, RC Evans, MP Arsenault. In press. Phylogeny of Pyreae (Rosaceae): Limited resolution of a complex evolutionary history. Plant Systematics and Evolution.
Potter, D. T Eriksson, RC Evans, S-H Oh, J Smedmark, D Morgan, M Kerr, M Arsenault, and CS Campbell. In press. Phylogeny and Classification of Rosaceae. Plant Systematics and Evolution.
Evans RC and TA Dickinson. 2005. Floral Ontogeny and Morphology in *Gillenia* ("Spiraeoideae') and subfamily Maloideae C. Weber. (Rosaceae). The International Journal of Plant Sciences 166: 427-447.
Evans, RC and CS Campbell. 2002. The origin of the apple subfamily(Maloideae; Rosaceae) is clarified by DNA sequence data from duplicated GBSSI genes. American Journal of Botany 89: 1478-1484.

Sara V. Good-Avila (sara.good-avila@acadiau.ca) – Plant Reproductive Biology

My research focuses on the evolutionary genetics of plant reproduction. My main research interests concern the evolution and break down of self-incompatibility (SI) systems in flowering plants at both the micro- and macroevolutionary level. At the microevolutionary level, we have projects studying the effect of population isolation and fragmentation on reproductive success in self-incompatible species such as the endangered *Coreopsis rosea* (Asteraceae), and others looking at the effect of polyploidy on the expression of SI in species such as *Campanula rapunculoides* (Campanulaceae) or *Crataegus* spp. (Rosaceae). We have accumulated considerable evidence that individuals of *C. rapunculoides* vary in their degree of self-fertility (see my recent publications), and are now estimating rates of self-fertilization in colonizing and large populations of *C. rapunculoides* to assess whether partial SI is selected in colonizing populations. In addition, I am interested in the macroevolutionary patterns of the gain and loss of SI. Current projects include examining the impact of polyploidy, life history and flower structure on the gain and of loss of SI in the Asteraceae and Rosaceae. Further, it has been hypothesized that rates of speciation and extinction may be higher in self-compatible than self-incompatible families of plants. To test this, we are examining rates of diversification and species richness in angiosperm families that are predominantly self-incompatible, self-compatible or mixed using diverse analytical methods in phylogenetics and comparative methods. Thus research in the lab combines field data, molecular techniques and advanced methods in phylogenetics and population genetics to address diverse issue in the evolution of plant mating systems.

Coreopsis rosea (Asteraceae), the most endangered member of the Atlantic Coastal Plain Flora. (Photo by R. Evans)

Representative publications:

M. M. Ferrer and S. V. Good-Avila, 2006. Macroevolutionary analyses of the gain and loss of self-incompatibility in the Asteraceae. New Phytologist.. 172(4). (In press)
Good-Avila, S.V., Souza, V., Gaut, B. S. and L. E. Eguiarte. 2006. Timing and rate of speciation in *Agave* (Agavaceae), in press. The Proceedings of the National Academy of Sciences, USA. 24: 9124-9129.
Good-Avila, S.V., T. Nagel, D.W. Vogler and A.G. Stephenson, 2003. Effects of inbreeding on male function and self-fertility in the partially self-incompatible herb, *Campanula rapunculoides* (Campanulacaeae). American Journal of Botany 90:1736-1745..

Dave Kristie (dave.kristie@acadiau.ca) –Germination and Plant Growth Controls

Past research in my lab focused on two distinct areas: 1) Studies on the mechanism of photo-thermal control of germination and secondary dormancy induction in lettuce. 2) The use of high resolution growth measurement techniques to investigate the influence of photoperiod, light quality, thermoperiod and plant growth regulators on the circadian rhythm of stem and leaf elongation in floriculture and crop plants. More recently, because of industrial funding opportunities, we have also begun to develop bioassays to test the efficacy, and probe the mechanism of action, of commercial seaweed extracts on plant growth.

Representative Publications:

Kusakina, J., M.Snyder, D.Kristie and M.Dadswell. 2006. Morphological and molecular evidence for multiple invasions of *Codium fragile* in Atlantic Canada. Botanica Marina.49: 1-9.
Blom,T., D.Kerec, W.Brown, and D.Kristie. 2004. Temperature and irrigation water controls height of potted easter lilies. HortScience 39:71-74.
Neily,W.G., P.R.Hicklenton, and D.N.Kristie. 2000. Temperature, but not growth regulators influence diurnal stem elongation rhythms in zinnia. HortScience35:39-42.
Kristie,D. N. and A. Fielding. 1994. Influence of temperature on the Pfr level required for germination in lettuce cv. Grand Rapids. Seed Science Research 4: 19-25.

High resolution measurement of corn leaf extension in growth cabinets at KC Irving Environmental Science Centre. (Photo by D. Kristie)

Ed Reekie (ed.reekie@acadiau.ca)- Plant Ecophysiology at Acadia University

Research in our laboratory is currently focused on two areas: 1) the physiological basis for intra-specific variation in response to elevated atmospheric carbon dioxide levels, and 2) delineating the physiological and ecological tolerance limits of the rare elements of the Atlantic Coastal Plain flora in Nova Scotia. The first project uses the wide range of mutants available in *Arabidopsis* to probe the underlying mechanisms for differences among genotypes in their CO_2 response. In particular, we are attempting to explain the diverse effects of elevated CO_2 on developmental processes including flowering, stem elongation and leaf development. This work contributes to our understanding of how natural Populations will evolve, as well as what traits we should select for in managed Populations in a future high CO_2 world.

The Atlantic Coastal Plain flora contains many of Nova Scotia's rare and endangered species. The rarest of these species are limited to a small number of low nutrient wetlands. This habitat is under threat due to land use changes, cottage development, construction of dams, and eutrophication. The second project attempts to understand why the rare elements are so limited in their distribution. In particular, our focus has been on understanding the relationship between growth and hydrological regime using both correlative and experimental approaches. A detailed understanding of the impact of the hydrological regime on these species will allow us better predict the impacts of development on these species may allow us to ameliorate damage that has already occurred.

Representative publications:

1.Reekie, E.G. and F.A. Bazzaz. 2005. Reproductive Allocation in Plants. Elsevier, San Diego, CA.
2.Baltzer, J.L., E.G. Reekie, H.L. Hewlin, P.D. Taylor, and J.S. Boates. 2002. Impact of flower harvesting on the salt marsh plant *Limonium carolinianum*. Canadian Journal of Botany 80(8): 841-851.

Morris PA, Hill NM, Reekie EG, and Hewlin HL. 2002. Lakeshore diversity and rarity relationships along interacting disturbance gradients: catchment area, wave action and depth. Biological Conservation 106 (1): 79-90.

Why Study Botany at Acadia?

Picea glauca trees growing at various CO_2 levels and water regimes in KC Irving Centre phytotrons. (Photo by E. Mycroft)

A large part of the botanical renaissance at Acadia stems from the recent development of several research centres on campus. The largest, gifts from the Irving family in 2002, are the KC Irving Environmental Sciences Centre (http://kcirvingcentre.acadiau.ca) and Harriet Irving Botanical Gardens (http://botanicalgardens.acadiau.ca), the latter comprising six acres of gardens that feature a spectacular collection of native plants from the Acadian Forest Region. Botanical research spaces within the KC Irving Centre include public display greenhouses, a conservatory, several research greenhouses, and a bank of six state-of-the-art phytotrons. Within the research wing of the building is a large growth chamber room, darkrooms for plant growth experiments,and several research labs, one of which houses a DNA sequencing facility. The KC Irving Centre also includes the Irving Biodiversity Collection which is the new home of Acadia's ~200,000 specimen EC Smith Herbarium (http://herbarium.acadiau.ca), the largest herbarium in Atlantic Canada.

Another new centre, developed through funds from CFI and NSERC, is the Acadia Centre for Microstructural Analyses (ACMA:http://ace.acadiau.ca/science/biol/acma/home.html). Equipment within ACMA is shared by members of Biology, Chemistry and Physics. Equipment most beneficial to botanical research includes a JEOL JSM-5900LV Scanning Electron Microscope, Zeiss LSM 510 Confocal Laser Scanning Microscope, Zeiss Axioplan 2 Microscope, and Philips EM301 Transmission Electron Microscope.

Preparatory equipment (various microtomes, critical point dryer, sputter coater, etc.) for much of the equipment in ACMA is found within various labs in the Biology building, Patterson Hall.

Speaking of Patterson Hall… built in 1927 and last renovated in the 1970's, Biology's home is about to change dramatically. Currently there is a flurry of activity (http://131.162.129.149/view/index.shtml) behind Patterson Hall that will result in a brand new Biology building slated to open in early 2008. This building will house all the offices, special use teaching labs, and research labs for the 17 faculty that make up Acadia's Biology Department. This building will also be connected to the KC Irving Centre by an underground tunnel to allow for the movement of teaching and research materials between the buildings, particularly during the cold winter months. Patterson Hall will not be bulldozed for the sake of the new building, but will be renovated to hold a number of new spaces including a large dining area and meeting place, various sized lecture spaces, general use teaching labs, several ecology research labs, and offices of the Arthur Irving Academy for the Environment. This is certainly an exciting time to be a biologist, let alone a plant biologist, at Acadia University.

Position available: Trent University

Trent University invites applications for a tenure track appointment in the Department of Biology at the rank of Assistant Professor to start July 1, 2007, subject to budgetary approval. The applicant should have research expertise in a field of plant biology that addresses ecological, evolutionary or taxonomic principles at the whole plant, species, population, or community level. A completed Ph.D. is required, and preference will be given to applicants who have appropriate teaching and post-doctoral research experience. The successful candidate will contribute to teaching in plant biology, and will be expected to offer an upper year course in his/her area of specialization. The successful candidate is expected to establish an externally-funded research program, and to supervise graduate students within one of Trent's interdisciplinary graduate programs.

Trent is a growing and vital institution highly ranked among primarily undergraduate universities for its excellence in research as well as teaching. Research facilities include an Aurora high performance research greenhouse (Conviron), 270-acre field station (James Maclean Oliver Ecological Centre (http://www.trentu.ca/academic/oliver/), a DNA sequencing and profiling centre, a mass spectroscopy centre, and confocal and electron microscopes. Information about our program may be obtained on our web site (http://www.trentu.ca/academic/biology/).

Applications, including a curriculum vitae, statement of the applicant's research interests and teaching philosophy and the names, postal and e-mail addresses, and phone numbers of three referees who would be willing to write on the candidate's behalf should be sent to:

Dr. Carolyn Kapron, Chair, Department of Biology, Trent University,1600 West Bank Dr. Peterborough, Ontario, K9J 7B8. ckapron@trentu.ca, 705-748-1011, ext. 1641

The deadline for receipt of applications is **January 22, 2007**. All qualified candidates are encouraged to apply; however, Canadian and permanent residents will be given priority. Trent University is an employment equity employer and especially invites applications from women, Aboriginal people, visible minorities, and persons with disabilities.

NATIVE PLANT EMBLEMS OF CANADA - 2. NEWFOUNDLAND AND LABRADOR

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FLORAL EMBLEM: PITCHER PLANT
SYMBOLISM

A true carnivorous (meat-eating) plant, the floral emblem of Newfoundland and Labrador has remarkable leaves that trap and digest insect prey. The pitcher plant is an excellent choice as the provincial floral emblem, in view of the long historical association with the region, as pointed out below, but also in that it is superbly adapted to and abundant in the widespread bogs and barrens. It has a unique appearance that reflects well the unique character of the province. The fact that animal-eating plants are sometimes considered gruesome does not seem to have ever detracted from the favourable image of the plant. Figs. 1and 2.

LATIN NAMES
Sarracenia purpurea L.

The genus *Sarracenia* commemorates French naturalist and surgeon Michel Sarrazin (1659–1735), who has been called the “Founder of Canadian Science.” French botanist Joseph Pitton de Tournefort (1656–1708) coined the genus in recognition of Sarrazin after the latter sent him the first collections of *S. purpurea* from Quebec, where he held the post of surgeon-major. The specific epithet *purpurea*, purple, points out the strong anthocyanin colouration usually evident in the species. The name *Sarracenia purpurea* has been “conserved” (Taxon 49: 262. 2000; also see citations below).

ENGLISH NAMES

Common pitcher plant, pitcher plant, northern pitcher plant (in the Canadian and northern parts of its range), southern pitcher plant (in the southern part of the range), purple pitcher plant. Pitcher plants take their name from the pitcher-like shape of their leaves (some species have leaves shaped like urns or trumpets). Because the plants are so interesting, numerous names, now obsolete, were also employed, for example: Adam’s cup, devil’s cup, Dumbwatches (used in the New Jersey Pine Barrens, so-named because of the resemblance of the style and sepals to old-style watches with a star-shaped pattern on the cover, “dumb” because the flowers really couldn’t keep time), flytrap, forefather’s cup, frog’s britches, huntsman’s cap, sidesaddle flower and sidesaddle plant (“sidesaddle” is an apparent reference to the peculiar umbrella-liked expansion of the style), and whippoorwill’s boots.

FRENCH NAMES

Sarracénie pourpre. Archaic Quebec names include petits cochons (apparently based on the next name), oreille de

Fig.1 Pitcher plant (*Sarracenia purpurea*). Source: Canadian Heritage. 2002. Symbols of Canada (revised edition). Canadian Heritage, Ottawa, ON. Reproduced with permission of Canadian Heritage, as well as Public Works and Government Services Canada.

Cochon (pig’s ear,” for resemblance to the pitcher-leaf), and herbe-crapaud (“toad-herb,” based on the idea that this herb, like toads, eats insects).

HISTORY

a. Canada
The pitcher plant was adopted as the floral emblem of Newfoundland in 1954. Prior to 1947, it was depicted on the island’s one-cent coin, the choice having been made by Queen Victoria (from 1834 until Confederation in 1949, Newfoundland issued its own coinage and bank notes).

b. Foreign
No other political area on Earth appears to have employed the purple pitcher plant as an official emblem. In 2005, the Venus’ flytrap (= Venus flytrap, *Dionoea muscipula*) was proposed (Senate Bill 116) as North Carolina’s “Official Carnivorous Plant.

APPEARANCE

Pitcher plants are bizarre herbaceous perennials, individual plants living for up to 50 years. They produce a low rosette of unique, hollow, tubular, pitcher-shaped leaves, called “pitchers,” as well as leaves of more conventional appearance. Fig 3. The latter, called “phyllodia,” have much reduced pitchers and appear more leaf-like. The plants have a round, horizontal underground stem (rhizome or rootstock), and lack an above-ground stem (except for the flower/fruit stalk). Rhizome extension spreads the plant vegetatively.

Fig. 2 Painting of pitcher plants (*Sarracenia purpurea*) in their natural setting, from the Walter Coucill Canadian Centennial official flowers of Canada series (see Coucill 1966 cited in #1 of this series). Reproduced with the permission of the copyright holders, the Coucill family

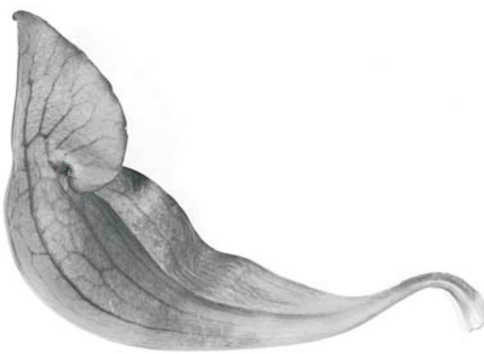


Fig. 3a Side view of pitcher-like leaf of the pitcher plant.
Fig. 3b Front view of pitcher-like leaf of the pitcher plant.
(Photos by P.M. Catling).

CLASSIFICATION

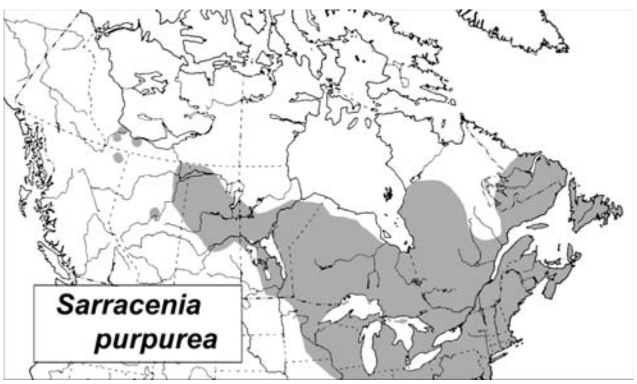
Family: Sarraceniaceae (pitcher plant family)

The pitcher plant family is a small group of low-growing perennial herbs of bogs and wet savannas of the New World (there is also an unrelated Old World pitcher plant family, the Nepenthaceae). The largest genus, *Sarracenia*, has eight or nine species, and these occur in the Atlantic coastal regions of North America. Species of *Sarracenia* hybridize freely, and natural hybrids between *S. purpurea* and *S. flava* (the yellow pitcher plant) are common where their ranges overlap.

There is considerable variation within *S. purpurea*, and disagreement about how infraspecific groupings should be accepted. Generally, two subspecies are recognized: subsp. *purpurea* which is found in Canada, the Midwestern states and the northeastern states, and subsp. *venosa* (Raf.) Wherry, which occupies the southern part of the distribution range. The geographical boundary between the two subspecies is in southern Delaware and northern Maryland, and reflects the southernmost extent of the Pleistocene glaciation. Subspecies *purpurea* grows in formerly glaciated areas whereas subspecies *venosa* grows only in unglaciated areas. The subspecies are distinguished by shape of the pitcher hood, ratio of pitcher length to diameter of pitcher opening, presence or absence of hairs on the outside of the pitcher, and flower colour. However, a recent paper by Ellison et al. (2004) concluded that “there is no obvious way to distinguish these subspecies on morphological grounds alone.” Alternative to treating the two groupings as subspecies, they have also been recognized as varieties: *S. purpurea var. purpurea* and *S. purpurea var.venosa* (a disconcerting technical difficulty with these names was circumvented in 2000; see Cheek et al. (1997) and Brummitt (2000)).

Subspecies *venosa* is often split into three varieties: var. *Montana* Schnell & Determann in the southern Appalachians of Georgia and the Carolinas; var. *venosa* on the Atlantic coastal plain from Delaware and Maryland through Virginia and into the Carolinas, as well as occasionally rare occurrences in southern Georgia; and var. *burkii* Schnell in the Gulf coastal plain from the Florida panhandle into Louisiana (this is increasingly being recognized as a separate species, *S. rosea* Naczi, Case & Case).

In the distribution range of subsp. *purpurea*, a variation of the pitcher plant that lacks red colouration is often recognized as forma *heterophylla* (Eaton) Fernald. Such plants have been collected in various parts of the range, and presumably are based on mutations that prevent accumulation of anthocyanin pigments as occurs in normal plants. Other variants have been proposed but not accepted. The forma *incisa* Rousseau and Rouleau, described from Lac Albanel in Quebec, has the pistil disc deeply 5-lobed. The var. *ripicola* Boivin, described from marly fens of the upper Great Lakes has numerous small , red pitchers but has been shown to develop fewer, larger green pitchers with red veins when transplanted to acid bog conditions, thus suggesting that its features are a consequence of habitat and unworthy of taxonomic recognition. The Nova Scotian forma *plena* Klawe was apparently based on a single floral freak and is also unworthy of recognition. Although several hybrids between *S. purpurea* and other species of Sarracenia have been recorded, none of these occurs in Canada; the parents of these hybrids occur further to the south.



GEOGRAPHY

-Fig. 4. Canadian distribution of the pitcher plant *(Sarracenia purpurea).*

Sarracenia purpurea is the most widespread species in the pitcher plant family. It occurs from the sub-Arctic to the subtropics, ranging from Labrador to Great Slave Lake, and southward to Georgia, Florida, Alabama, Mississippi, and possibly Louisiana. Its wide geographic range includes much of Canada east of the Continental Divide, the northern United States westward through the Great Lakes region, New England, and the entire coastal plain of the eastern United States. Fig 4.

ECOLOGY

Two Different Habitats: why?

In Canada, pitcher plants live in two very different kinds of habitats: acid, rain-fed ("ombrotrophic") bogs and alkaline groundwater-fed ("minerotrophic") fens. Bogs are dominated by sphagnum mosses and leathery-leaved shrubs of the heath family; they are fed by rainwater which is much like pure distilled water, i.e. without any nutrients, and they become progressively acidic. Fens are usually dominated by a sparse cover of grass-like plants; they are fed by ground water and often develop high concentrations of calcium and high alkalinity. These remarkably different habitats have one very important feature in common: low levels of macronutrients (nitrogen, phosphorus, potassium), so plants that capture and digest insects and other small organisms to supplement the few nutrients in their environment have an advantage. Indeed, both bogs and fens are host to a variety of other insectivorous plants.

HABITAT

Pitcher plants commonly occur in wet habitats, especially Sphagnum (peat moss) bogs in Canada and the northern part of its American range, but also in poor fens, seepage swamps and pine savannas, and even in the fast-flowing mountain streams of Geogia. The soils are saturated with water (acidic or alkaline as noted in the text box), and deficient in nitrates and phosphates. In sphagnum bogs, the base of the pitcher leaves are often buried in sphagnum. Fig 5.

INTERSPECIES RELATIONSHIPS

There are relatively few flowering plants that digest flesh. Since insects are the main prey, such plants used to be called "insectivorous," but "carnivorous" has become the term of choice, because animals other than insects are also consumed. Pitcher plant leaves are remarkably constructed passive pitfalls designed to entrap insects and other tiny prey that have been lured to the mouth of the leaf by a light-reflecting patch and a trail of nectar-secreting glands extending from the lip of the pitcher down into it. Downward-pointing (retrorse) hairs in the lip of the throat of the pitcher help to prevent climbing upward to escape. The hairs are too dense to crawl between and are like a wall of spears. A hairless polished area in the steepest part of the throat acts like a greased slide, causing the exhausted prey to fall into accumulated rainwater at the bottom of the pitcher, where they drown. Digestive enzymes secreted from the polished area of the throat occur in the liquid. Both the enzymes as well as bacteria serve to digest the trapped animals, and the odour of decay is often noticeable (it has been suggested that this may attract flies to the plants). Ants are the commonest insects trapped, but additionally there are often flies, wasps, spiders, crickets and, less commonly, frogs, salamanders, and lizards are trapped. In a Newfoundland

Fig.5. Boggy habitat of the pitcher plant (photo by P. M.Catling).

study, slugs and snails were 20% of the prey.
Indigestible parts of the animals accumulate in the pitchers, but older leaves eventually die and disintegrate.

The significance of the carnivorous habit in pitcher plants has been debated and there are several research studies, cited below, that deal with this. There is a general consensus that nitrogen compounds digested from the trapped animals are important to the plants which grow in habitats deficient in nitrogen. Trapped animals probably also serve as a source of phosphorus. While animals are a significant source of nitrogen, in some studies only about 10% of the plant's nitrogen budget comes from trapped animals. The roots are also quite inefficient at obtaining nitrogen from the substrate, obtaining as little as 5% of the plant's supply. Nitrogen-fixing bacteria have been found in the pitcher fluid, and these likely serve to increase the supply of nitrogen available to the plant. Rainwater (containing dust) and excretions from visiting (non-trapped) organisms that are present in the pitchers are also sources of nitrogen for the plants. As noted earlier, there are two kinds of leaves: insect-trapping pitchers and leaf-like phyllodia. Increased available nitrogen leads to fewer pitchers and more of the leaf-like phyllodia, thus supporting the interpretation that insect-trapping is important to supplement nitrogen.

Unlike the other species of the genus, the pitcher-leaves of *S. purpurea* do not have a hood that covers the opening, and this allows rain to freely enter the pitcher cavity. Also unlike most of the other species, the leaves of *S. purpurea* do not die back at the end of the growing season (i.e. they are evergreen), and can survive freezing of the liquid inside the pitcher cavities. Leaves that have turned red in the fall may become green in the spring. The leaves usually last only 1–2 years, but young (pitcher) leaves, no older than 1 month, are known to trap most of the animals caught by the plants, and pitcher leaves older than 1 year have very low rates of photosynthesis.

In addition to pollinators, some animals are adapted to using the pitchers of pitcher plants as sources of food and/or shelter. Some of these insects have become so adapted to life in pitcher plant leaves that they cannot survive elsewhere. Three kinds of flies occur commonly in pitcher plant leaves and they coexist by a spatial partitioning of the habitat and resources. Larvae of a midge fly (*Metriocnemus knabi*) feed on insect remains that accumulate at the bottom of the pitcher. Larvae of a sarcophagid fly (*Blaesoxipha fletcheri*) feed at the top of the pitchers on floating prey. Larvae of the pitcher plant mosquitoe (*Wyeomyia smithii*—see text box) live in the water, between the surface and the bottom. These inhabitants increase the rate of release of nitrogen from the decomposing prey and, to the benefit of the insects, the plant removes potentially toxic substances such as ammonia from the pitcher water and increases its oxygen content. The adults of these flies are able to fly in and out of the pitchers without being captured, and the larvae produce secretions that protect them against the digestive enzymes of the plant.
Several species of moths feed on pitcher plants. One of these (*Exyra fax*) eats a hole in the leaves, draining the pitcher contents. It then feeds on the leaf tissue and passes the winter in cocoons inside the empty pitcher. The caterpillars of another moth (*Papaipema appassionata*) bore down the flower stems to eat the rootstock, often killing the entire plant. Both of these moths are evidently unique to pitcher plants. Birds sometimes slit pitchers to get at the insects. In all, the pitchers are home to about 20 kinds of insects, several species of mites, at least 25 genera of algae, at least 40 species of protozoa, and numerous other microorganisms.

POLLINATION AND DISPERSAL

Pitcher plants produce flowers in early summer. The anthers shed their pollen onto the inverted umbrella-like style, where ants, beetles, and especially bees pick up the grains.

Living in a Plant's Stomach

While the leaf of the pitcher plant is a deadly trap for many insects, some species have adapted to it. The pitcher plant mosquito, *Wyeomyia smithii*, is one of the most interesting of 80 species of mosquitos found in Canada. It appears to be totally dependent on the pitcher plant for survival. All Canadian mosquitoes have their larval stages in water but the larvae of this one have only been found in the water-filled leaves of the pitcher plant. Here, with their very specialized mouth parts, they filter bacteria and protozoa from the water. They can be found in the leaves at all times of the year. They can even spend several months encased in the core of ice that develops in the leaves overwinter. Their closest relatives occur in tropical regions of Central and South America where the larvae live in the water that collects in the leaf bases of epiphytic bromeliads (pineapple relatives) of wet rainforest and high elevation cloud forest. The pitcher plant mosquito differs from all others in Canada in that the sexes cannot be readily distinguished by differences in the antennae. While females of most Canadian species require a blood meal in order to develop eggs, the females of the pitcher plant mosquito do not take blood. Males of all of the 80 kinds of Canadian mosquitoes feed only on nectar from flowers.

Although self-pollination can occur, the flowers are basically outcrossing, and the pollen matures first, so that fertilization occurs primarily when pollinators transfer the grains to an older flower of another plant. Seeds are produced late in the season, of the order of 1,000 seeds produced in a capsule. The seeds do not have specializations for distribution, but it has been suggested that seeds may be dispersed by flotation in water or by adhesion to wet fur or feathers.

USES

Pitcher plants are of minor economic importance. Indians in Newfoundland once used the roots to treat smallpox, a treatment that became popular for a brief period in the 19th century in England. A proprietary liquid extract of the roots was once used by physicians to treat neuralgia.

CULTIVATION

For centuries, pitcher plants have been cultivated as curiosities. They make interesting perennial ornamentals, both outdoors and indoors. As with most carnivorous plant species, growing conditions require acidic, wet soil (sphagnum peat and/or coarse sand should make up most of the substrate), good exposure to light is essential, and elevated humidity (60–90% has been recommended). Use of a loosely covered terrarium is one way to promote high humidity. Plastic pots are preferable to unglazed clay, and wide pots are best to accommodate the reclining pitchers. Fertilization should be avoided or at least extremely limited. Most people who have acquired carnivorous plants are tempted to feed them with leftover scraps of hamburger and the like—a mistake. Providing freshly killed insects in moderation is more likely to ensure survival.

NEGATIVE ASPECTS.

Pitcher plants are not known to have deleterious effects in any respect, except of course on the small animals that are trapped.

CONSERVATION STATUS

Although *S. purpurea* is so widespread that it is not endangered in most of its range, the area occupied is decreasing, due mostly to habitat destruction and changes in water table levels. In Georgia, *S. purpurea* is considered endangered. Several public and private organizations have attempted to restore a population of *S. purpurea subsp. venosa var. montana* in Georgia. Several southern U.S. endemic species of *Sarracenia* also have federal and/or state endangered status, and are protected by legislation. There is a large appetite for carnivorous plants in the horticultural trade, and unfortunately *Sarracenia* species are often simply collected from the wild and sold. Another factor that bears on conservation of *Sarracenia* is their restriction to wetlands, especially bogs, which are often the target of conversion for agriculture or other purposes.

Fig. 6 .Newfoundland coin showing pitcher plant. Queen Victoria chose the pitcher plant to be engraved on Newfoundland coins.

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

- A widespread myth about carnivorous plants is that, when grown in a house, they will catch all the flies present. They have also been recommended as a way of ridding a dwelling of cockroaches. However, it is mostly non-flying, small insects that are trapped, and carnivorous plants are not efficient enough to control household pests.

- Despite popular stories to the contrary, carnivorous plants are not capable of harming people. The largest prey— frogs, and rarely birds and small rodents such as rats—are sometimes captured by species of Southeast Asian *Nepenthes*, the vines sometimes reaching lengths of 15 m (50 feet), and the pitchers holding as much as 4 L (1 American gallon).
- The Sarraceniaceae family is considered native to the Americas. The first fossil plant belonging to the family, *Archaeamphora longicervia* Li, was very recently reported from northeastern China. The fossil is quite reminiscent of *S. purpurea*, and its discovery suggests that flowering plants may have evolved much earlier than commonly believed. [See: Li, H. 2005. Early Cretaceous sarraceniacean-like pitcher plants from China. Acta Botanica Gallica 152(2) 227–234. http://faculty.frostburg.edu/biol/hli/research/Archaeamphora.pdf. This website presents an artist's conception of the plant, in colour.]

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Fig. 7 Pitcher plant (*Sarracenia purpurea*). Source: Trail, C.P. and Fitzgibbon, A. 1868. Canadian WildFlowers. John Lovell, Montreal, Canada.

TREE: BLACK SPRUCE

SYMBOLISM

There are few parts of the province where black spruce is not a prominent feature of the landscape. It flourishes in the cool maritime climate. To those “from away” the pointed spires give a somewhat harsh look but to residents they represent home. In many parts of coastal regions the plants develop dense, low and virtually impenetrable thickets known locally as “tuckamore.” These low dense forests extend for miles over the coastal headlands and surround extensive boggy meadows with caribou and abundant moose. They offer valued shelter from strong coastal winds. Black Spruce has a history of economic and social importance to the province that makes it an excellent choice as the provincial tree.

LATIN NAMES

Picea mariana (Mill.) BSP.

The genus name *Picea* is based on the Latin word pix used for some species of pine and also for the “pitch” (resin). (The English word “pizza” comes from the Latin, picea, black ashes from the floor of the fireplace, which has nothing to do with the genus *Picea*.) *Mariana* in the scientific name *P. mariana* is Latin for “of Maryland.” Miller (the “Mill.” in the scientific name) considered “Maryland” to mean “North America.” Actually, black spruce is not native to the state of Maryland. (In some other scientific names, *mariana* refers to the virgin Mary, mother of Jesus Christ.)

ENGLISH NAMES

Black spruce is also known as bog spruce, swamp spruce, and shortleaf black spruce. While not actually “black” as the common name suggests, the twigs, cones, and bark are a darker brown than in related species. The word “spruce” has been explained as a modification of the old French Pruse (corresponding to the German Preussen), referring to Prussia, so named because in Europe spruces were associated with Prussia, particularly for making spruce beer. However, exactly the same explanation has been given for “spruce” in the sense of “neat and smart-looking” because, it has been argued, in the 16th century Prussian leather was used to make neat, smart-looking garments. An alternative explanation for the word spruce (as a tree) holds that the word comes from the German name of the tree, Sprossenfichte, literally “sprouts-fir.”Figs 8 and 9.

FRENCH NAMES

Épinette noire; also épicéa glauque, épicéa marial, épinette à bière

HISTORY

a. Canada
Black spruce was proclaimed to be the provincial tree of Newfoundland & Labrador in May of 1991.

Fig. 8 Silhouette of black spruce tree. Source: J.L. Farrar 1995. Trees in Canada. Canadian Forest Service and Fitzhenry and Whiteside, Markhan, ON, Canada. Reproduced with permission.

b. Foreign
Picea mariana does not appear to have official emblem status elsewhere, although species of *Picea* have been widely designated as official trees in northern areas. Red spruce (*P. rubens* Sarg.) will be discussed as the provincial tree of Nova Scotia, and white spruce (*P. glauca* (Moench) Voss) as the provincial tree of Manitoba. The blue spruce (*P. pungens* Engelm.) was made the state tree of Utah in 1933. Under the name Colorado blue spruce, it was proclaimed the state tree of Colorado in 1939. Alaska declared its state tree to be the Sitka spruce [*P. sitchensis* (Bong.) Carrière] in 1962.

Fig 9 Black spruce growing at Mer Bleu peat bog, Ottawa. Photo: P Catling.

APPEARANCE

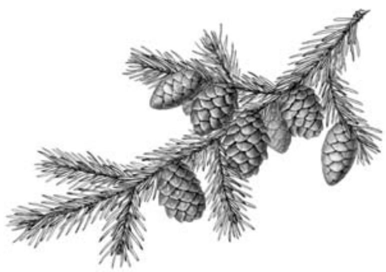

Fig. 10 Fruiting branch of black spruce. Source: Sargent, C.S. 1898. The silva of North America. Houghton, Mifflin and Company, Boston, MA. vol. 12, plate 596.

Fig. 11 Seedling and winged seed of black spruce. Source: Sargent 1898 (cited above).

Black spruce is a small to medium-sized evergreen tree. Especially near the tree line (alpine or boreal), black spruce grows as dwarf shrubs or stunted forest ("krummholz"). The dwarf shrubs have been named as varieties or forms (e.g. *P. mariana f. semiprostrata* (Peck) Blake). The trunk of the trees is characteristically straight, with limited taper. The bark is scaly, unlike that of the similar balsam fir (*Abies balsamea* (L.) Mill.). The branches are typically short, drooping, with upturned tips. Dead branches often remain on the tree for several years. The lower branches, frequently having been strongly depressed by snow, often layer (i.e. they take root and produce new plants), so that a ring of young plants may form around an established tree (an arrangement referred to as a "candelabrum"). Through much of its range black spruce averages 915 m (3050 feet) in height and 1525 cm (610 inches) in diameter, occasionally growing to 30 m (100 feet) and 1 m (3 feet) in diameter. The trees are smaller up to 20 m (66 feet) high and 30 cm (1 foot) in diameter on poorly drained sites. The roots are shallow and widespreading. The leaves are needle-like, stiff, and sharp-pointed, dark bluish-green, generally coated with a whitish powder, and spirally arranged on the twigs. They are square in cross section, rather than flat as in balsam fir and hemlock (*Tsuga canadensis* (L.) Carrière). When crushed, the fresh foliage produces a strong scent of balsam or lemon balm. The cones (fruits) are 1.53 cm (0.61.2 inches) long, smaller than most other spruce species, and persist in the upper crown for several years. Figs 10, 11 and 12.

Fig. 12 A black spruce (at left) with lower branches having layered to produce new young trees (at right).

Fig. 13 Characteristically persisting cones of black spruce.

In its range, black spruce could be mistaken for white spruce (*P. glauca*) or red spruce (*P. rubens*). The cones of white spruce are much longer (about 5 cm or 2 inches). Rarely, white spruce hybridizes with black spruce to produce plants called Rosendahl spruce. Red spruce, a native of eastern Canada and the eastern United States, frequently hybridizes with black spruce where their ranges overlap, and it is often very difficult to distinguish the two species. Fig 13. The following table (based on Morgenstern and Farrar 1964) points out key differences.

Character	Black spruce (*Picea mariana*)	Red spruce (*Picea rubens*)
Male flowers	Dark red, subglobose	Bright rced, oval
Immature cones	Purplish green to deep purple	Green to purplish green
Mature cones	Dull, gray-brown to brown, short-ovoid, persistent for 20–30 years, 2–4 cm long	Lustrous reddish brown, ovoid-oblong, falling within1 year, 3–5 cm long
Cone base	Gradually narrows to strongly incurved stalk	Narrows more abruptly to less incurved stalk
Cone scales	Irregularly toothed on margins	Entire or slightly toothed on margins
Seeds	Very dark brown, about 882,000 to the kg	Dark brown, about 309,000 to the kg
First season seedlings	Number of cotyledons 2–7, predominantly 4	Number of cotyledons 4–8, predominantly 6
Needle shape and length	Slightly incurved above middle, 6–12 mm long	More strongly incurved above middle, 10–16 mm long
Needle colour	Bluish green, dull	Dark yellowish green, shiny
Number of lines of stomata on one lower surface	Mostly 3–4	Mostly 1–2
Buds, old trees	Ovoid, minutely pubescent	Ovoid, acute; reddish brown
Bud colour, young trees	Dull, grayish brown	Shiny, dark reddish brown
Twig surface shape	Decurrent ridges to which needles are attached are flat	Decurrent ridges are round
Twig pubescence	Twigs pubescent; hairs tipped with glands, crooked	Twigs more or less pubescent; hairs without glands, straight and conical
Twig colour, mature trees	Cinnamon-brown or blackish-brown	Orange-brown
Twig colour, 4- to 10- year old open grown trees	Yellowish brown with a purplish tinge	Straw-yellow
Bark	Grayish brown, flaky scales; inner layers somewhat olive-green	Predominantly reddish brown, firm scales; inner layers reddish grown
Form of crown in older stands	Open, irregular-cylindrical; branches drooping, turning up at ends	Broadly conical; middle and upper branches at right angles to trunk, then turning up at ends, often giving a pagoda effect

CLASSIFICATION

Family: Pinaceae (pine family)

There are about 35 species of the genus *Picea,* including seven that are native to North America. The plants are evergreen, coniferous (cone-bearing) shrubs and trees with short (generally less than 2.5 cm or 1 inch), needle-like leaves.

GEOGRAPHY

Black spruce is widely distributed in North America, from Newfoundland to Alaska, north to the tree line, south to British Columbia and Minnesota, and east to Rhode Island and Massachusetts.Fig 14.

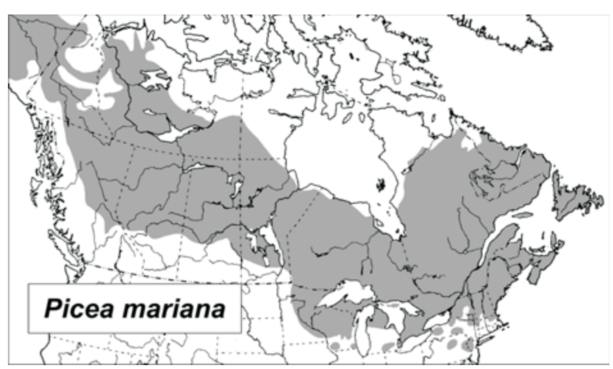

Fig. 14 Canadian distribution of black spruce.

Does Black Spruce Form the Canadian Polar Tree Line?

A frequently asked question is which tree extends the furthest north to form the "polar tree line." Throughout most of Canada the northern-most of the trees (even when they may not be more than several inches tall) is white spruce (*Picea glauca*) but black spruce does form the treeline in continental Nunavut and in parts of Ungava. In much of Europe, treeline is formed by Norway spruce (*Picea abies*) and Scots Pine (*Pinus sylvestris*), whereas in Siberia, Dahurian larch (*Larix dahurica*) and dwarf Siberian pine (*Pinus pumila*) form the polar treeline and no species of spruce comes close. For a more detailed discussion of treeline, see Hustich in Arctic 6(2): 149-162. 1953.

ECOLOGY

Habitat

Black spruce is a dominant component of boreal forests of North America, where it grows in a variety of climates, on both organic and mineral soils. It is most commonly found on poorly drained, acidic peatlands. The species does best in a cool, subhumid climate, and in the southern parts of its range it is restricted to cool swamps and subalpine forest zones of the higher mountains. Black spruce is moderately shade-tolerant. The tree usually produces pure stands only on shallow, poorly drained, cold, organic soils where competition is limited. On the thinner soils and where there is a high water table, black spruce is very susceptible to windthrow because of the shallow root system.

Inter-species Relationships

Since black spruce is a dominant species in much of the boreal forest region, it should not be surprising that many organisms depend upon it. The needles are a major food of the spruce grouse, especially during the winter months when the intestinal tract of the birds elongates to enable digestion of such tough food. Many birds including chickadees, nuthatches, crossbills, grosbeaks, and pine siskins eat the seeds as do a variety of mammals including red squirrels, snowshoe hares, mice, voles, shrews, and chipmunks. The dense growth provides cover for many species including moose, deer, and caribou. Numerous birds nest in the trees, among them the ruby-crowned kinglet, magnolia warbler, Cape May warbler, and ovenbird.

Among the many insects associated with black spruce, two are particularly noteworthy. Why the bog elfin (*Callophrys lanoraieensis*), a tiny brown butterfly, is rare and local is a mystery since the only food plant of the caterpillars is the widespread black spruce. The young caterpillars burrow in the spruce needles. The adult butterflies, with a wingspan of 2 cm, often fly among the tops of the spruces and are little larger than house flies. If not quite the smallest butterfly in Canada, this is certainly the most difficult to observe. Adults of the spruce budworm moth (*Choristoneura fumiferana*) are about the same size. The larvae actually feed more on balsam fir than spruce, but black spruce is particularly susceptible where it is mixed with the fir. Despite natural control by a number of tiny parasitic wasps and flies, spruce budworm can be devastating to large areas of forest. As a result, it is a target for control in areas of commercial black spruce harvest. Other insects that defoliate trees causing extensive damage include European, yellowheaded, and greenheaded spruce sawflies.

The crown of black spruce trees is often deformed near the top by red squirrels (*Tamiasciurus hudsonicus*). The tips of cone-bearing branches at the top are chewed off by the squirrels, resulting in a characteristic dense mass of small branches with many cones at the top of the tree (often called a "club" or a "crow's nest") and a bare portion of trunk just below.

Somewhat similar dense masses of branches called "witches' brooms" are formed where dwarf mistletoe (*Arceuthobium pusillum*), a parasitic flowering plant, grows on the branches. This parasite obtains most of its nutrients through root-like structures that penetrate the host branch. This particular species of mistletoe, the only one found in eastern Canada, is indeed tiny, with the leaves reduced to scales and the plant less than 2 cm in length. It is most often found on black spruce but also grows on white spruce, red spruce, blue spruce, balsam fir, tamarack, and on white, red and jack pine. Although these mistletoe plants are very small, they can discharge the seeds with an explosive mechanism up to 16.5 m (55 feet), but more often 1.5–6 m (5–20 feet) and at a speed of 80 kph (50 mph). The seeds are sticky and attach to whatever they hit. Birds may carry the seeds long distances on their feet. A fungus, spruce broom rust (*Chrysomyxa arctostaphylii*), also produces witches brooms in the trees but these lack the characteristic cups on the branches which indicate where the male flowers of mistletoe infection were shed. The mistletoe can do substantial damage, and is often subject to control in areas of commercial production.

With devastation by fire and infestations of insects, the boreal forest is subject to short-term, cyclical change, unlike some of the ecosystems further to the south that develop sustained climax forests. Although periodic fires and infestations are alarming, in fact they are to some extent natural processes, to which the flora and fauna are adapted.

Pollination & Dispersal

Pollen and seeds are both carried by the wind. The seeds are equipped with a prominent wing to assist in wind transport. The species reproduces both by seed and by layering following cutting or fire. The trees are easily killed by fire, but the cones are serotinous,adapted to releasing seeds following fire. (Most seeds are released from 2 months to 3 years following a fire, but viable seeds may be dispersed from a given cone for more than 25 years.) Because fire often occurs (every 50–150 years) in black spruce habitats, the stands are often made up of even-aged trees. However, ages up to 300 years have been recorded (ages of 500 years have been claimed).

Essence of the Boreal Forest

Black Spruce is the most prominent tree of the Boreal Forest, an ecosystem that extends as a nearly continuous subarctic belt across North America and Eurasia and represents one third of the planet's forests. The Canadian Boreal Forest is a recent development. It occupies a vast territory that was glaciated only 10,000 years ago and occurs in a cold continental climate where winters are severe. Black spruce is well adapted to these conditions. The narrowly conical shape of the tree allows snow to be shed without damage to branches. The needle-like leaves have a low surface area to volume ratio which dramatically reduces moisture loss when the ground is frozen and trees cannot replenish their water supply from the roots. The evergreen habit allows photosynthesis as soon as temperatures in the short growing season permit, thus avoiding delay for leaf growth.

The wilds of the Boreal Forest are home to fur-bearing animals that were the basis of early trade with Europe; beaver, muskrat, mink, ermine, fisher, marten, wolverine, lynx and others. They brought the voyageurs and the Hudson's Bay Company. Although the boreal forest region is almost uninhabited compared to the rest of Canada, it is no longer a pristine wilderness. To the contrary, it is riddled with development related to logging, mining, and hydroelectric development, that represent a threat to northern species, such as the woodland caribou. It is hoped that with a major planning effort, the biodiversity of the Boreal Forest and the associated traditional lifestyles of first nations such as the Cree, Innu, Métis, Dene, Gwich'in and Athabascan can be protected.

USES

The principal economic value of spruce is as north-temperate softwood trees used for construction lumber and paper pulp. Spruce trees are often used as Christmas trees, and while black spruce was often cut down for this purpose in the past, it is now rarely employed (the needles tend to fall off the cut tree fairly quickly). Most black spruce is used for pulpwood, and the species is highly valued by the pulp and paper industry, especially in Canada where it is the leading pulpwood source. Some black spruce is used for construction framing, general millwork, boxes, crates, and piano sounding boards (thin spruce boards have exceptional resonance qualities; see use in violins, below). Because of the relatively small size of the trees, spruce lumber is of secondary importance.

North American Indians prepared a string from the long roots and employed this to stitch together bark for canoes, to sew baskets, and for similar uses. They also used resin from the trunk to seal the hulls of their canoes. Pitch (resin) from the trunk or branches was used by Native Peoples for a variety of medical problems, both externally (for burns, wounds, and various skin conditions), as a gargle (for sore throats and toothaches), and internally (for coughs, diarrrhea, and other conditions). Spruce resin is used today to a very minor extent for medical salves.

Although not particularly appealing, some spruce trees have been used as food. It has been said (tongue in cheek) that Christmas trees are edible. Amerindians used the exuded resin of several North American spruce species as a chewing gum, and spruce gum was quite popular in the early 18th century among European settlers. The first commercial chewing gum in North America, manufactured in Maine about 1850, was made with spruce resin. Indians used the bark or twigs of several species to make tea or flavour other beverages. Black spruce was used to brew a beer by the Anticosti Indians of North America. The inner bark in the spring and early summer, and the stripped young shoots have been consumed as emergency food. “Spruce tips” is a phrase occasionally used in North America to refer to young branches of black or white spruce. These are used for ornamental purposes in bouquets and floral arrangements, but also for flavouring purposes, for examples: like capers in fish dishes, chopped fine into a sauce, or used directly in salads. Spruce wood is almost tasteless and odourless, and is the preferred wood for food containers.

CULTIVATION

Black spruce is easily grown in tree nurseries, and is often planted for harvest of timber and pulp.
Although not considered exceptional for ecological planting, black spruce is used in mixed plantings intended for erosion control and windbreaks. Breeding, or at least selection of superior genotypes, has been conducted in federal and provincial forestry departments. Black spruce is one of the main species used for reforestation in Canada.
Experimental plantations for timber have even been established in northern Europe. Although black spruce is rarely grown as an ornamental tree, there are several ornamental cultivars, including a dwarf form known as ‘Nana’.

CONSERVATION STATUS

Black spruce is one of the most widespread and abundant species in North America, and therefore there is little risk of its becoming endangered. Although there has been very limited taxonomic subdivision of *P. mariana*, it is possible that at its distribution limits in northern Canada the species has developed genes specialized for survival in extreme stress, and such unique plants may be useful in the future for forestry and agriculture. While black spruce is not in need of special conservation measures, because it is a principal forest resource for Canada and is quite slow-growing in its natural habitats, it requires wise management policies. The tree is intolerant of atmospheric pollution, and its health can be seriously affected by acid rain. The species is naturally adapted to the extremely widespread boreal regions of Canada, and climate change therefore represents a considerable potential future threat, especially to isolated occurrences near the southern range limit, such as in southern Ontario.

Spruce Beer

Spruce beer is manufactured in North America and Northern Europe. Now considered a weird beverage, it was popular in the United States and Canada during colonial times. Spruce leaves are rich in vitamin C, and spruce beer was a favoured remedy for scurvy, a common malady of the immigrants, soldiers, and sailors. Daily rations of spruce beer (typically a pint or a quart) were widely given to soldiers in Canada and the northern United States and to sailors until the value of citrus fruits to prevent scurvy became appreciated. “Chowder beer” is a beverage made by boiling black spruce twigs in water and mixing in molasses. This concoction is virtually unknown today, but in past times in the New World it was prepared as a palatable anti-scurvy drink (spruce providing the vitamin C). An alcoholic version of this, “callibogus” (calabogus, calibogus, calibougas; usually pronounced kahl-ee-boh-gahs), made of molasses, rum, and spruce beer, was a favourite drink of the admirals of North American colonial days. Today, it is essentially known only in Newfoundland, where it is also called “quick-call-an-ambulance!” Newfoundlanders make this brew with “screech” (a Newfoundland term for cheap, potent Jamaican rum, tracing to an early 20th century British term for harsh whiskey). Genuine spruce beer (as distinguished from soft drinks with this name) is beer flavoured with spruce twigs or spruce extract.

Recipe for spruce beer used in the 18Th century at the Fortress of Louisbourg
(from The Louisbourg Institute website)

Bring 4 gallons of water to a boil, add a bundle of spruce twigs (approximately 20" in diameter, using only the last 6" of the tips of the boughs) and bring to a boil again. Boil for one hour, longer for a stronger spruce flavour. Strain twice through a piece of fine (tightly woven, not cheesecloth) white cloth, into a container. When the liquid is lukewarm, add molasses (approximately 2 quarts, or to taste) and a package of dried yeast, proofed in ½ cup molasses and 3 cups warm (body temperature) water; mix well. Cover loosely with cloth and allow 34 days to ferment. Skim the foam lightly from the top frequently; do not stir or disturb the beer. When the bubbles cease to rise, strain through a cloth again. It can be bottled at this point or drunk immediately. If it is bottled, leave about 3" of space at the top of each bottle. Do not tighten the caps for at least 12 hours.

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

- French explorer and navigator Jacques Cartier (1491–1557) discovered the St. Lawrence River in 1535. During his second voyage in 1536, he decided to overwinter in the river, and his ship became frozen in the icy waters near Quebec City. By March, 25 of his crew had died of scurvy, and only a handful of healthy sailors were left. At the time, the need to supply vitamin C to prevent scurvy was unknown. Cartier then sought help from tribal chief Dom Agaya, who brought branches of an evergreen tree he called annedda, and instructed that the branches should be ground up, boiled into a tea, and drunk every 2 days. The cure worked, because conifer needles, including those of spruce, pine, balsam fir, hemlock and cedar, yield three to five times the vitamin C of oranges. Annedda has not been identified, but it would seem probable that it was spruce.
- The Italian Antonius Stradivarius (1644?–1682) is considered to be the greatest of all violin makers, and alpine spruce was one of the woods he favoured for his instruments. The rich resonance of his instruments remains a secret, but has often been attributed to some special varnish or wood treatment. An article by H. Grissino-Mayer and L. Burckle in the July 2003 issue of the scientific journal Dendrochronologia hypothesized that the superior sound was due to exceptionally dense wood developed in alpine spruce as it grew very slowly because of very cool conditions that prevailed in Europe before and during the time of Stradivarius.
- The chopsticks provided at fast food restaurants in the Far East are usually made of black spruce wood.

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Conservation Committee position papers (contd.)
3. Gardening with Wild Plants

The primary concern of the CBA is that remaining natural ecosystems, due to their scarcity and diminishing size, be as little disturbed as possible. Therefore, planting of wildflowers or native shrubs and trees must be done in such a way that it poses no threat to the integrity of natural communities. Nothing extraneous should be planted into natural communities and very close limits should be placed on what is taken out. Exotic genotypes of native plants should not be grown nearby because if they interbreed, locally adapted gene complexes might break down.

The preferred source of native plants for gardening is propagules which have been grown under culture. Commercial producers of seeds may take the pressure from natural areas as a source of stock for horticulture. Initially, seeds or cuttings (preferably not roots or rhizomes) must come from natural or semi-natural populations, but afterward should be generated in fields or gardens. A wild species which cannot be propagated in sufficient quantities this way should probably not be grown extensively in private gardens or offered for sale commercially.

Unfortunately, some nurseries offer mature plants which may have been taken directly from their natural habitats. This seems to be the case with certain orchids, known to require 10 years from seed to flowering, as some companies selling them are unable or unwilling to discuss source. Nurseries should provide information on the origin of their stocks, and customers must satisfy themselves that wild plants being sold were not removed from natural areas. If claims of being "nursery grown" are suspected to be false, companies should be challenged.

Exchanging cuttings, seeds or roots of wild plants among gardeners who have propagated them is a harmless way to stock a wildflower garden. Local genotypes, adapted to local climatic conditions are generally most successful, especially if sited according to known ecological requirements. While it may be reasonable for an individual to collect a limited number of seeds from a natural area, it must be remembered that each enthusiastic gardener could well be only one of several doing the same thing. A few collectors could remove most of the seed crop of a species for a given year. Taking plants and propagules from a natural area, which definitely will be destroyed, is a possibility, but wildflowers would benefit far more from active intervention at an earlier stage to ensure that destruction never happens. Long-term survival of native species is best in their natural habitat.

So that rare or endangered plants are not punished needlessly, amateurs should usually grow the more common and easily identifiable wild plant species. In a private garden, attractive but vigorous and easily propagated wild plants such as *Helianthus* (sunflowers), *Rudbeckia* (blackeyed susans), *Rhus* (sumac) and *Symphoricarpus* (snowberry) can be utilized very effectively. Species chosen depend, of course, on the region.