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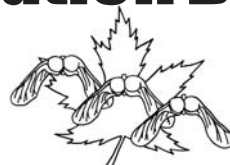
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The Canadian Botanical Association Bulletin



Bulletin de l'Association Botanique du Canada

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**Plant Canada 2007
Saskatoon
June 10th-14th**

PLANT CANADA 2007 will take place from June 10-14 at TCU Place in downtown Saskatoon, Saskatchewan. The six member societies of Plant Canada have been working diligently to prepare a scientific programme that promises to be diverse and interesting, and we look forward to offering you some warm western hospitality here this summer.

The CBA/ABC will be very well represented at this major event. Elsewhere in this Bulletin, you will find details about the Association's two stand-alone symposia "Floristics for the Future", and "Ontogeny of the Flower - The Next Generation". To encourage interactions among the various member societies, we are also a leader in co-hosting another symposium "Plant Ecology and Invasive Species" being prepared jointly with the Canadian Weed Science Society.

Delegates will also be interested in the workshop by current and past editors (Larry Peterson and Iain Taylor) of the Canadian Journal of Botany, where guidance toward the successful preparation of scientific publications will be provided.

The Teaching section of the CBA/ABC and the Education section of the CSPP have organised a session of three speakers, on Tuesday June 12th. For details see News from the Teaching section on page 11.

Owing to the wide participation anticipated from six societies of plant scientists, a decision was taken to schedule all talks by students intending to be considered for student presentation awards, on the afternoon of the first day. Thus, the CBA/ABC's Lionel Cinq Mars Award competition will be held on the afternoon of Monday, June 11. This will allow for judging to be completed, and final decisions made in time for the society luncheon and Annual General Meeting on Wednesday, June 13th, where the winners will be announced. As a result, if you are a student wishing to be considered for this year's Lionel Cinq Mars Award, please note that it will be necessary to submit your abstract early, in order to be scheduled into one of the 12 spots available. Such students will be sent a confirmation. The Iain & Sylvia Taylor Award will be available to students presenting a poster at the PLANT CANADA meeting. There is no such scheduling restriction for student posters.

(continued on next page)

Canadian Botanical Association Bulletin

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

Information for submitting texts

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

Association botanique du Canada Bulletin

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

Soumission de textes

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

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Next issue / Prochain numéro

Texts for the next issue, 40(2), must be received before **September 1st 2007**

La date de tombée des textes du prochain numéro, le no 40(2), est le **1 septembre 2007**.

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Please remember at the time of abstract submission, to indicate your intent to be considered for these competitions, so that your talk or poster will be attended by the CBA/ABC judging teams.

Specific details about the programme, registration, abstract submission and accommodations is available electronically on the PLANT CANADA 2007 website www.plantcanada.ca/2007.htm, which is regularly being updated. I recommend checking this website over the next few weeks, to obtain the latest information as it becomes available.

Briefly, here are the deadlines

* **Early Registration - April 5, 2007**

* **Abstract Submission - April 5, 2007**

* **Accommodations Deadline for Reduced Rates - April 30, 2007**

See you in Saskatoon in June!

Dr. Art Davis, Vice President, CBA/ABC

La conférence PLANT CANADA 2007 aura lieu du 10 au 14 juin à la place TCU au centre-ville de Saskatoon, en Saskatchewan. Les six sociétés membres de Plant Canada ont travaillé diligemment pour préparer un programme scientifique qui promet d'être diversifié et intéressant et seront heureuses de vous offrir un brin d'hospitalité chaude de l'Ouest cet été.

Le CBA/ABC sera très bien représenté à cet événement majeur. Plus loin dans ce bulletin, vous trouverez des détails sur les deux colloques différents (« Floristics for the Future », et « Ontogeny of the Flower The Next Generation »). Pour encourager les interactions entre les différentes sociétés membres, nous sommes également hôtes conjoints d'un autre colloque : « Plant Ecology and Invasive Species », que nous préparons de concert avec la Société canadienne de malherbologie.

Les délégués seront également intéressés par l'atelier de l'éditeur actuel et de l'ancien éditeur du Journal canadien de botanique (Larry Peterson and Iain Taylor), qui donneront des conseils sur la préparation réussie des publications scientifiques. La section de l'Enseignement du CBA/ABC et la section Éducation de la Société canadienne de physiologie végétale (SCPV) ont organisé une séance de trois conférences, le mardi 12 juin. Pour plus de détails, reportez-vous à la section Nouvelles de la section de l'Enseignement à la page...

En raison de la grande participation anticipée provenant des six sociétés de phytologues, nous avons décidé de programmer toutes les participations des étudiants qui sont inscrits au concours Lionel Cinq Mars lors du premier avant-midi (lundi 11 juin). Ceci permettra de terminer l'appréciation et de prendre les décisions finales à temps pour le dîner de la société et pour l'Assemblée générale annuelle qui se tiendra le 13 juin et lors duquel les gagnants seront annoncés.

Par conséquent, si vous êtes un étudiant qui désire être considéré pour le prix Lionel Cinq Mars de cette année, veuillez noter qu'il sera nécessaire de soumettre à l'avance votre résumé afin d'être inscrit au programme des 12 places disponibles. Ces 12 participants recevront une confirmation. Le Prix Iain & Sylvia Taylor sera disponible pour les étudiants qui présenteront une affiche à la conférence de PLANT CANADA. Il n'y aura pas de restriction de places pour les étudiants participant au concours d'affiche. Veuillez ne pas oublier, lors de la soumission de votre résumé, d'indiquer votre intention d'être considéré pour ces compétitions pour que votre allocution ou affiche soit jugée par les juges du CBA/ABC.

Des détails spécifiques sur le programme, l'inscription, la soumission des résumés et l'hébergement sont disponibles en ligne sur le site Web de PLANT CANADA 2007 au www.plantcanada.ca/2007.htm, mis à jour régulièrement. Je vous recommande de vérifier ce site lors des prochaines semaines pour être informé des dernières informations lorsqu'elles deviennent disponibles.

Voici, brièvement, les dates d'échéance :

* **Inscription hâtive- 5 avril 2007**

* **Soumission des résumés 5 avril 2007**

* **Date limite pour l'hébergement à tarif réduit 30 avril 2007**

En espérant vous voir à Saskatoon en juin!
Art Davis, Ph.D., vice-président, CBA/ABC

Association News.

President's message

Dear CBA members,

First of all, best wishes to all for 2007 !

Plans are well under way for the upcoming Plant Canada meeting in Saskatoon. Please visit the official web site at: www.plantcanada.ca for more information on the great diversity of symposia and activities planned for this conference.

I'm very pleased to let you know that **Dr. Daya Dayanandan (Concordia University)** will be our new webmaster. Please forward any suggestions or postings in electronic format to: daya@alcor.concordia.ca. I would also like to encourage you to consider nominating a colleague or student for the various awards we have. These are listed on our website (www.cba-abc.ca). Please act now, deadlines are fast approaching. I would like to draw your attention to the undergraduate and graduate travel awards. This is a wonderful opportunity to subsidize the travel costs of your students to CBA meetings.
Christian

Past president's message

I am delighted to inform you that Marian Munro has agreed to a 2-year term (until 2009) as secretary of CBA. We are still looking for student members of the board, especially representatives from the west. Any suggestions should be sent to Vipen Sawhney at sawhney@admin.usask.ca

The Keith Winterhalder undergraduate travel award.

This award is available for the first time, having been voted on by members of the Association in the fall of 2006. The award is named after Keith Winterhalder, a long time member and former president of the Association, for his outstanding contributions to the Association and for his never-failing interest and encouragement of the student members of the CBA/ABC. Donations may be made to the award fund, by sending a cheque, or using a credit card. See membership renewal form.

Sufficient funds are available to make an award this year.

Eligibility

1. The competition for the Keith Winterhalder Undergraduate Travel Award is open to student members of the CBA, who are in their fourth year of an undergraduate degree or who have completed an undergraduate degree in the past 6 months.
2. Students must present a paper in the Lionel Cinq-Mars Award competition or a poster in the Taylor Award competition at the Annual Meeting of CBA/ABC.
3. No student may receive more than one bursary while registered for the same degree

Procedures

1. Students applying for the Keith Winterhalder Undergraduate Travel Award must do so no later than the submission deadline for abstracts to the Annual Meeting **(This year the date is April 5th)**
2. The application must contain the following documents:
 - a. A copy of the abstract of the paper to be given at the Annual Meeting in the Cinq-Mars Competition or in the Iain and Sylvia Taylor Poster competition.
 - b. A supporting letter from the student's Honours thesis supervisor.
 - c. The student's curriculum vitae (one page);
 - d. A letter of recommendation from a member of the Biology/ Botany department of the University where the student is, or was, an undergraduate.
3. Applications should be sent to the President of CBA/ABC, Dr. Christian Lacroix, Dean of Science, University of P.E.I., Charlottetown PEI. C1A 4P3
Tel: 902-566-0320 Fax: 902-628-4303, Email: lacroix@upe.ca .

Nouvelles de L'association

Je vous souhaite mes meilleurs voeux pour l'année 2007! Les préparatifs pour le congrès de Plant Canada à Saskatoon sont déjà bien en marche. N'hésitez pas à visiter le site officiel de la société à: www.plantcanada.ca pour de plus amples renseignements sur la grande diversité de symposia et d'activités qui sont planifiés.

C'est avec plaisir que j'aimerais vous annoncer que le Dr. Daya Dayanandan (Université Concordia) sera notre nouveau webmaster. Veuillez lui faire parvenir vos suggestions ou matériel à télécharger à: daya@alcor.concordia.ca.

Je vous encourage également à nommer un collègue ou un étudiant pour un des nombreux prix offerts par l'ABC. Une liste des prix est disponible sur notre site web (www.cba-abc.ca).

Agissez dès aujourd'hui, les dates d'échéances approchent rapidement. J'aimerais particulièrement attirer votre attention aux prix Macoun et

Winterhalder qui subventionnent les frais de déplacement d'étudiants de deuxième et premier cycle aux conférences de l'ABC.

Christian

Message d'ancien président

Je suis heureux de vous apprendre que Marian Munro a accepté de continuer son mandat en tant que secrétaire du CBA/ABC pour deux ans, jusqu'en 2009.

Nous sommes toujours à la recherche de membres étudiants au sein du comité, notamment des représentants de l'ouest.

Toute suggestion doit être envoyée à Vipen Sawhney à l'adresse suivante : sawhney@admin.usask.ca

Le prix Keith Winterhalder de voyage pour étudiants de premier cycle.

Ce prix est disponible pour la première fois et les membres de l'Association ont voté pour sa remise à l'automne 2006. Le nom donné à ce prix rend honneur à Keith Winterhalder, un membre de longue date et ancien président de l'Association, pour ses

contributions remarquables à l'Association ainsi que pour son intérêt et son encouragement constants pour les membres étudiants du CBA/ABC. Des dons allant au fonds pour la récompense sont acceptés. Suffisamment de fonds cette année ont rendu possible la remise de ce prix.

Admissibilité

1. Le concours pour le prix Keith Winterhalder de voyage pour étudiants de premier cycle est ouvert aux membres étudiants du CBA/ABC qui sont dans leur quatrième année de leur premier cycle ou qui ont terminé leur diplôme de premier cycle au cours des six derniers mois.
2. Les étudiants doivent présenter un travail pour le Prix Lionel Cinq-Mars ou une affiche pour le Prix Iain et Sylvia Taylor à l'Assemblée annuelle du CBA/ABC.
3. Aucun étudiant ne peut recevoir plus d'une bourse de voyage dans le cadre du même diplôme.

Procédures

1. Les étudiants qui présentent une demande pour le prix Keith Winterhalder de voyage pour étudiants de premier cycle doivent le faire avant la date d'échéance de soumission des résumés à l'Assemblée annuelle.
2. La demande doit contenir les documents suivants :
 - a. Une copie du résumé du travail qui doit être remis à l'Assemblée annuelle pour le concours Cinq-Mars ou pour le concours d'affiches Iain et Sylvia Taylor.
 - b. Une lettre d'appui provenant du superviseur de thèse de l'étudiant;
 - c. Le *curriculum vitae* de l'étudiant (une page);
 - d. Une lettre de recommandation d'un membre du département de Biologie/Botanique de l'université où l'étudiant termine ou a terminé son premier cycle.
3. Les demandes doivent être envoyées au Président du CBA/ABC (D. Christian Lacroix, Doyen des sciences, University of P.E.I., Charlottetown, Î.-P.-E. C1A 4P3) Tél.: 902-566-0320 Téléc.: 902-628-4303, Courriel lacroix@upe.ca.

News from the sections.

Ecology section

J. Stan Rowe (1918-2004)

The 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 published a paper in plant ecology in 2006 are encouraged. They should be sent by email to the current Co-Chairs of the Ecology Section of the Canadian Botanical Association, Dr. Paul Catling (catlingp@agr.gc.ca) and Dr. Adrienne Sinclair (adrienne.sinclair@ec.gc.ca) **before April 12, 2007.**

The photo and information on Stan Rowe is available from

Saskatchewan's Environmental Champions website
(http://www.econet.sk.ca/sk_enviro_champions/rowe.html)

For the terms of reference for this award see page

Systematics and Phytogeography Section

Floristics for the Future

The CBA/ABC Systematics and Phytogeography Section symposium, "Floristics for the Future," will take place on Thursday, 14 June 2007, 1030-1200h as part of the June 2007 Plant Canada meetings. For details see page 6.

Alf Erling Porsild Memorial Prize

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 phytogeography by 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 (Tim Dickinson, Department of Natural History, Royal Ontario Museum, 100 Queen's Park, Toronto ON M5S 2C6) **before April 12th 2007**

Mycology section

Luella K. Weresub Memorial Award

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.**

Development section

Taylor A. Steeves Award

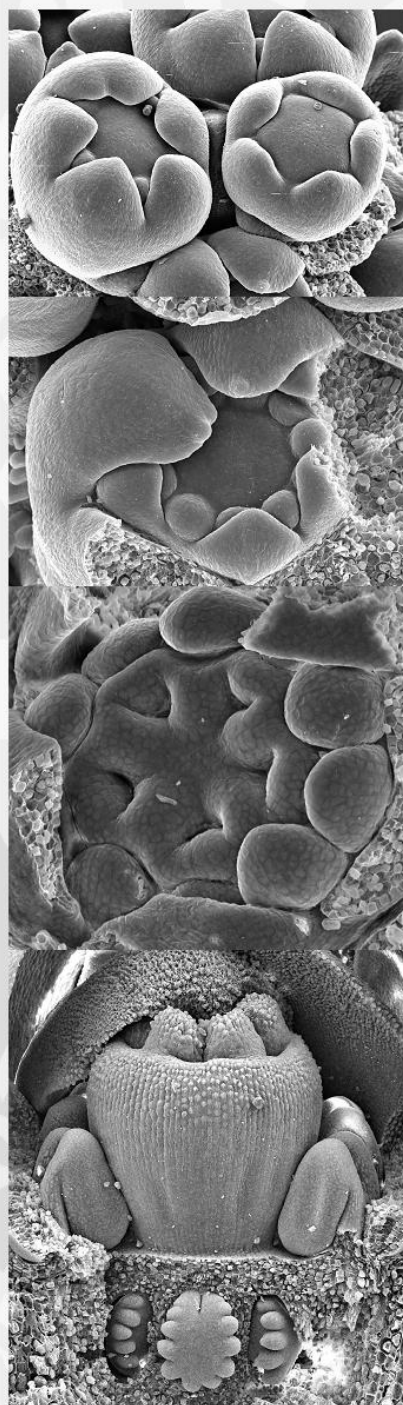
This award was established to honour Taylor Steeves who has made numerous contributions to the CBA and to botany. Applications or nominations should be sent to the current chair of the Section, Dr. Usher Posluszny, Department of Molecular and Cellular Biology, University of Guelph, 50 Stone Rd. East,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

The Development Section has organized 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. For details see page 5.

Teaching Section News See page 11.

ONTOGENY OF THE FLOWER: THE NEXT GENERATION

Plant Development Symposium
Organizers: Rodger Evans, Acadia University
Usher Posluszny, University of Guelph



INVITED SPEAKERS:

Dr. Larry Hufford, Washington State University

Keys to Innovation: Ontogenetic Avenues to Floral Specialization —

Dr. Hufford will discuss modes of ontogenetic evolution that have been implicated in morphological innovation and specialization in flowers. He will explore especially the alternatives of developmental integration and dissociation in the early ontogenies of flowers as keys to morphological innovation. Examples from Loasaceae subfamily Loasoideae, a largely South America clade characterized by complex floral forms, will serve as a case study for understanding the ontogenetic sources of morphological innovation.

Dr. Matyas Buzgo, University of Florida

Thinking Outside the MADS-box: Development of Inflorescence and Flower in an evolutionary perspective —

Dr. Buzgo will talk about how the ABC model of gene regulation of floral organ identity was tested in basal angiosperms. The results are that genes and features in basal angiosperms differ from model organisms ("Fading Borders"), and probably represent the early evolution of flowering plants. Further, the definition of the border of the flower is not clear-cut, and the only reliable clue is the absence of an axillary meristem in all floral organs. Nevertheless, this feature is absolutely stable in all flowering plants, only broken in mutations of genes like APETALA1, APETALA2 or AGL24 - the so called A class genes.

Dr. Rodger Evans, Acadia University

MADS-box Genes: A Key to Understanding Rosaceae Flowers? —

Dr. Evans will discuss using MADS-box gene expression patterns to expand our understanding of hypanthium and ovary development within the Rosaceae. MADS Box gene expression patterns are followed from floral apex initiation through ovule initiation. The primary goal of this research is to resolve whether the Rosaceae hypanthium is appendicular or receptacular in nature. He will also discuss results from comparative analyses of MADS Box gene expression patterns as tool for understanding the underlying developmental genetics associated with the change from perigyny to epigyny.

TUESDAY JUNE 12TH, 2007

8:30-10:00AM; TCU PLACE SALON 'C'

FLORISTICS FOR THE FUTURE

CBA/ABC Systematics and Phytogeography Section Symposium

Organizers: Tim Dickinson and Deb Metsger, Royal Ontario Museum

Invited Speakers:

Anne Bruneau, Université de Montréal

Biodiversity and Floristics: Gathering data to answer big questions

Brian Klinkenberg, University of British Columbia

Oil and water? Geospatial technologies, taxonomy, and collection databases: The case of E-Flora BC

Mary Barkworth, Utah State University

Building on existing resources: onwards, upwards, downwards, sideways

There will be a closing panel discussion moderated by Bruce Ford,
University of Manitoba, on the future of floristics in Canada.

Thursday, 14 June 2007
1030-1200h; TCU Place, Gallery A



Obituary

CBA Founder Passes Away

Dr. Paul Gorham



Paul R. Gorham (1999)

Dr. Paul R. Gorham, FRSC, one of Canada's eminent plant physiologists and a founder of the Canadian Botanical Association (CBA), passed away on November 9, 2006 in Edmonton, Alberta.

Paul Gorham's involvement with the CBA dates back to its very beginning in 1964. It was Paul who, as convener of the Royal Society's Plant Biology Subject Division, first invited Canadian botanists to meet at Queen's University to discuss the creation of a botanical society. This led to the founding of the Canadian Botanical Association at Carleton University in 1965. Paul went on to serve as president of the CBA in 1977-78 and to receive its Mary E. Elliott Service Award for meritorious service in 1979. In 1988, his contributions to Canadian botany were recognized with the CBA's prestigious Lawson Medal.

Paul was born in Fredericton, New Brunswick, and obtained his first degree there at the University of New Brunswick in 1938, followed by a Master of Science at the University of Maine (Orono, Maine) in 1940 and a PhD at Caltech (Pasadena, California) in 1943.

Returning to Canada in 1943, he began his scientific career with Agriculture Canada in Ottawa, Ontario, where he worked on the physiology of rubber-bearing plants as part of Canada's war effort. In 1945, he joined the National Research Council of Canada, also in Ottawa, to work on nutritional analyses of stored foods. In 1948, with the creation of NRC's new Plant Physiology section, he shifted his focus at first to the photosynthetic process and also later to the identification of toxins produced by cyanobacteria (blue-green algae). He took over as head of the Section in 1952. Pieter Trip (PhD Queen's, retired MD) who worked with him on translocation, photographed Paul hard at work in his third floor office in the Sussex Drive Building in 1966.



Paul Gorham in his office at the National Research Council Canada (1966) Photo: Pieter Trip

Paul was very active in the formation of several scientific societies in the 1950s and 60s. In addition to his role in founding the CBA, he played a major part in organizing a series of nine annual conferences on plant physiology hosted by different Canadian universities. These culminated in the creation of the Canadian Society of Plant Physiologists in 1958, with Paul serving as its first President. He was also instrumental in the creation of the International Association for Plant Physiology and served for ten years on the editorial board of the American Society of Plant Physiologist's internationally respected journal, *Plant Physiology*.

In the late 1960's, Paul became involved with the International Biological Program (IBP). While acting as Executive Secretary of the Canadian committee for the program in 1968-1969, Paul became interested in terrestrial ecosystem studies through the American plant ecologist Larry Bliss (Emeritus Professor, University of Washington). Larry writes "*One of the warmest memories I have of Paul is the very strong support that he gave us in the initial funding and then his professional advice in dealing with plant physiological aspects of an arctic ecosystem study. The National Research Council, with the help of Paul, provided an important component of the research funds for three years.*"

In 1969, Paul moved his family to Edmonton, Alberta to take up a position as professor of botany at the University of Alberta. There he continued his pioneering research on the translocation of photosynthetic assimilates and cyanobacterial toxins. He also took part in studies of submersed aquatic macrophytes in relation to thermal effluents from a pair of local power plants. In addition to developing his own research and group of graduate students, he helped advise the Devon Island ecosystem study (one of three Canadian terrestrial IBP projects) and

served on the graduate committees of many ecology students. He retired as emeritus professor in 1983.

Edwin A. Cossins, FRSC, Emeritus Professor of Biological Sciences (Plant Biochemistry), University of Alberta, recalls *"I remember our elation when Paul Gorham decided to join us in 1969. By then he was one of Canada's most distinguished plant physiologists and a Fellow of the Royal Society of Canada. We have to thank the special efforts of Don Ross, who was Dean of Science, and Bill Stewart our Chairman, for enticing Paul away from his senior position in Ottawa. Paul quickly adapted to his new academic environment and played a key role with Larry Bliss and Jim Mayo in setting up the controlled environmental facilities for the new Biological Sciences building. Paul served as Chairman of the Botany Department (1971-1979), a period when his heavy administrative load and teaching duties did not compromise his research program. He had an active research group and several very promising students received their graduate degrees under his able supervision."*

Wayne Carmichael, Professor of Aquatic Biology/Toxicology, Wright State University, completed both an MSc in 1972 and a PhD in 1974 with Paul Gorham. He remembers Paul's wit, engaging conversation and the speed with which he moved from place to place. *"I was put to work on his toxic algae cultures the one he brought from NRC and others collected from animal poisonings in Alberta and Saskatchewan. We easily fell into a routine of discussions, eventful field trips to Alberta lakes and algal bloom discoveries in Alberta and Saskatchewan. The years spent in Paul's labs were most enjoyable and scientifically worthwhile, and were instrumental in developing my professional career. Paul was always organized, engaging and detailed almost to a fault. He kept very meticulous notes of field trips on small Royal Bank booklets, in small and almost-legible writing. These booklets numbered in the dozens by the end of my stay in Edmonton and served as a wealth of material that I could count on for years to come. As late as 2005 I contacted Paul about a date and place from these notes only to get a very thorough and accurate reply within 24 hours!"*



Note taking in the field

Our research together generated about 20 papers and presentations that formed the basis of much of the



Paul Gorham and his graduate students, Dale Allen and Wayne Carmichael, collecting samples at Lake Wabamum, Alberta (1971)

research on toxic Cyanobacteria that has been published to this date." The spirit of Paul's outings with his graduate students is captured in a photograph taken in 1971.

Another graduate student, Dale Allen reports *"I talked Paul Gorham into supervising my Master's degree programme involving work on freshwater macrophyte physiology and ecology in 1971 and we remained good friends for the next 35 years. As Paul's student, I got to spend a lot of time with him both in the laboratory and in the field and thus received a lot of hands on experience. Even though he was Chairman of the Botany Department he usually had lunch in his own office (usually a single apple which he ate core and all) where we discussed our work. Paul liked to go on field trips to get out of the office and went with me many times. He took notes, labeled samples and ran equipment while I was under water (or ice). He introduced me to cross country skiing to collect material from lakes in the winter and in the summer we often went out in his Chestnut canoe. Writing papers with Paul could be very laborious as he chose every word carefully and the composition of some sentences could take a long time before the period was reached. Then followed revisions using scissors, glue and whiteout. He was also very generous with data and was quite willing to share it. My association with him had a great influence on my development as a scientist and it was a great honour to know him."*

Paul devoted a great deal of his time to community activities, serving on the boards of the Edmonton Art Gallery and Friends of the University of Alberta Devonian Botanic Garden for many years. In particular, he was a driving force behind the creation of the botanic garden's 5-acre, Kurimoto Japanese Garden. For these and other services to his country, he was awarded the Canadian Centennial Medal in 1967 and the Queen Elizabeth Silver Jubilee Medal in 1978. He also received a Certificate of Commendation from the Japanese Ministry of Foreign Affairs in 1991.

His scientific contributions, apart from a long list of publications in established journals, were recognized by his election as a Fellow of the Royal Society of Canada

in 1961, the bestowment of an honorary DSc by his alma mater, the University of New Brunswick in 1978, his election as a Fellow of the Rawson Academy of Aquatic Science in 1979 and the awarding by the CSPP of its Gold Medal in 1987.

Paul stayed active throughout his later years, continuing to serve on the Board of Trustees at the Botanic Garden until the time of his final illness. In 2005, at the request of Govindjee, he and Dr. C. Nozzolillo co-authored a historical review entitled, 'Photosynthesis Research in Canada from 1945 to the early 1970s'. The article appeared in *Photosynthesis Research* in 2006.

A generous and compassionate man, Paul and his wife opened their home to numerous graduate students, post

doctoral fellows and colleagues over the years. Many will remember him as an outstanding friend and mentor. Paul leaves his widow, Evelyn, three children (John, Arthur and Harriet) and five grandchildren (Katherine, Megan, Dan, Graeme and Hannah). A memorial service was held at the Westwood Unitarian Congregation in Edmonton on Thursday, November 23, 2006. Memorial donations can be made to the Edmonton Cardiac Institute (111 Avenue & Groat Road, Edmonton, Alberta, T5M 3L7) or the University of Alberta Devonian Botanic Garden (Edmonton, Alberta, T6G 2E1).

Harriet Gorham and Connie Nozzolillo
Photos provided by the authors.



The Graduate Student Perspective.

The Canadian Botanical Association / L'Association Botanique du Canada – an Essential Forum for Students in Botany

Martha Coleman

Department of Tropical Plant and Soil, University of Hawai'i at Manoa
3190 Maile Way, #117 St. John Honolulu, HI 96822

I have been a proud member of the Canadian Botanical Association / L'Association Botanique du Canada since 2005. I can remember the first conference I attended which was held in Edmonton, Alberta that year. There, I learned that there is nowhere else in the world that you can be completely submersed in Canadian botanical banter for an entire week! You are surrounded by Canada's best and brightest in botany and nearly every facet of botanical research is presented and discussed. Oral presentations may seem like a daunting task to some (and I won't lie my first one was a disaster!) however, they offer a perfect opportunity for students to talk about their research and it certainly becomes easier with each presentation. Attending oral presentations offers excellent insight into the work that is being done around the country. The research is fascinating and covers many areas. Attendees have no trouble finding something they are interested in; the trouble lies in trying to figure out which presentation to attend when there are three that you want to see and they all begin at the same time!

There are several symposia that take place throughout the course of the annual meeting and one of the highlights for me last year was a presentation given by Dr. Bryan Alters of McGill University. He spoke at the teaching symposium and addressed the concern of teaching evolution in the classroom. Other highlights included a field trip to the Gault Nature Reserve – Mont St. Hilaire and of course the auction. All auction items are generously donated by CBA/ABC members and the auction itself is run by quite a dynamic auctioneer! The auction is not to be missed and provides an ideal end to the week.

Attending the CBA/ABC annual meetings has proved to be beneficial to me in many ways. I have learned a great deal not only by attending presentations but from mingling with others during breaks and before and after the day's events. There is no shortage of interesting people to converse with and it is an excellent networking opportunity for students. This association is very generous and provides student members with the opportunity of being selected for several different awards and bursaries that are presented each year. There is a real sense of community at the annual meeting and I am grateful to the CBA/ABC for welcoming me with open arms. If you have not already, I strongly encourage you to book your flight to Saskatoon this summer and take part in Plant Canada 2007. Come and find out for yourself just what the CBA/ABC is all about. I am confident you will not be disappointed!

*Martha Coleman completed a Master of Science Degree in Molecular Ecology at Trent University. There she studied the genetic variability of two endangered plant species, *Cirsium pitcheri* and *Isoetes engelmannii*. She is continuing her education at the University of Hawai'i, where she is currently working alongside the USDA developing a database for identification of potentially invasive species to the Hawaiian Islands.*



Botany of the Ancients

Jim Ritchie. Pebbledash Cottage, Corfe, Somerset, UK TA3 7AJ
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After devoting much of my career to help work out the postglacial history of the plant cover of the immense landmass of Canada, I find myself, in advanced retirement, playing a very minor role in recording an aspect of the botanical history of a tiny corner of these small, over-crowded islands. UK's population is twice that of Canada, and its land area roughly one fortieth, and most of the population occupies the southern quarter of England.

Trees have become a topic of increased public interest, partly as a result of the growing urbanisation of the crowded south, partly as a response to the destructive effects of exceptional storms that hit parts of southern England in 1987 and 1990, destroying many fine trees, and spurred on more recently by the awareness of their important role in the changing global ecosystem. The Tree Council of the UK, an umbrella organization supported by government and other agencies, set up a network of volunteers in 1990, The Tree Warden Scheme. The aims of the scheme are to increase public awareness of the value and importance of trees, to develop projects of planting and maintenance, to provide early warning when existing trees are under threat, often by unscrupulous property developers, and to provide an inventory of ancient trees. Several thousand volunteer Tree Wardens are involved in these endeavours. When the Parish Council of Corfe asked me recently to serve as its Tree Warden, (probably as I seem to be the only botanist, retired or otherwise, in our village of about 200 residents!), I agreed with alacrity.

One of my current tasks and joys is taking part in a five-year national project to identify, record, map accurately, and describe the Ancient Trees in the parish. Individual trees or sites with several ancient trees are recorded on line. The resulting survey will provide an information base to enhance public awareness, and to facilitate action when protection or treatment of particular trees might be required. As Oliver Rackham puts it: "Ancient trees are not only objects of beauty, wonder and delight, they are historical monuments and witnesses to the past activities of plants, animals, and people; and they are the specific habitat of a large proportion of the animals and plants that depend on trees" (Rackham 2003, p 523).

How do we define ancient trees? Difficult question, and I will defer an attempt to answer it until the end of this article.

About 1 km from where I live, the distinctive specimen of English Oak (*Quercus robur*), pictured in Fig. 1, is a rare and cherished feature of the landscape. It displays some of the characteristics that comprise the concept 'ancient tree'. It consists of a large basal portion, 10.5 m in girth, and an upper canopy of large limbs, the product of previous pollarding, a spread of uppermost dead branches, and more recent lower regenerative branches that, this year, produced a profusion of acorns. The base is known as the bolling, and the whole tree is known as a pollard, defined as a tree that has been cut at 3-4 m. above ground to produce subsequent branching for use as timber (Rackham 1986 pp 65-7).

Three other venerable oaks grow in this field which has been intensively cultivated during the past two decades – the crop in Fig. 1 is turnips grown for cattle fodder – but before then it was pasture for sheep and cattle. As Rackham (1986 p 230) points out, isolated ancient trees in fields are rare, and are relics of a former land-use referred to as Wood-pasture – areas used primarily for grazing animals but with isolated trees, as in the example shown here. The Wood-pasture type of the cultural landscape of southern England is recorded as far back as at least Anglo-Saxon times and it is a distinctive, though not endemic element in parts of the rural landscape of UK. It is referred to by Rackham (1986) as Ancient Countryside, is confined to lowland England, and Corfe parish is included in the western segment, little changed in the past several centuries in the approximate proportions of woodland, wood pasture and farmland. He describes it "...a landscape of hamlets and scattered farmsteads linked by a network of lanes, deep holloways, ancient hedges and pollard trees" Holloways are former trackways, sunk below the level of the surrounding land by centuries of erosion, both human and natural. Of course features of 19-20th century culture have been superimposed across parts of this landscape, particularly a motorway and a major rail line, but the essential elements remain.

Early records show that in the 12th century an area of approximately 60 hectares, including the field shown in Fig. 1, was part of an Augustinian priory, and while the original buildings no longer exist, the ancient oaks are a likely remnant of a park and farm associated with the priory. The monks constructed fish ponds adjacent to the field, by damming a local stream, but now they are silted up and colonised by various aquatic and semi-aquatic plants.

Cores recovered from oaks in the parish, using a 50 cm Swedish increment borer, provide ring counts that can be used to



Dr. Jim Ritchie and friends. 2006



Fig 1. *Quercus robur*. Photo: Jim Ritchie

estimate ages, and my current preliminary suggestion is that we have three age-cohorts – the truly ancient few like that of Fig. 1 that are aged between 750 and 1000 years; a group scattered in the periphery of former minor estates planted in the early 18th century and potentially eligible as ‘ancients’; and individuals along lanes and field margins, roughly 100 years old, mere youths, centuries away from ‘ancient’ status.

So how do we define an ancient tree? *Quercus robur* is the only candidate in this parish as far as I am aware. Elsewhere in southern England, ancient specimens of beech, chestnut, hawthorn, holly, hornbeam and lime have been identified, but though all these species are represented in Corfe parish none is in the category ancient. Clearly the natural longevity of particular species, varying from relatively short-lived poplars and pines, intermediate types such as beech, and long-lived species of which oak is the oldest of UK’s native species, is directly relevant to how we use the term “ancient”. Obviously, while a 200 year old pine would be ancient an oak of that age has scarcely achieved middle age. In the current Ancient Tree Survey, tree girth at 1.5 m above ground level is recorded as the basic datum of relevance, and in the absence of ring counts or historical data, it serves as a very approximate indicator of age. An oak with a basal girth of 10 m, as the specimen in Fig. 1, qualifies as ancient, but the distinction becomes difficult to determine with diminishing girth!

Defining Ancient Woodland in Britain, on the other hand, is less imprecise. Peterken (1996) defines it as a site that has been continuously wooded for the last 400 years, and Corfe parish includes an area of woodland that fits this description in that, while it has been subject to management and exploitation in the past, it includes some elements of the pristine forests, so-called original-natural, that existed 5000 years ago. As Rackham has pointed out, ancient trees are rarely found in continuous woodland, but most are, as the oaks here in Corfe, isolated specimens that have survived in wood-pasture. The living oaks in Corfe’s ancient woodland are not older than about 200 years, while a scatter of stumps of felled trees are all that remains of individuals that would have been ‘ancient’ had they survived the woodman’s saw.

So you see why I have procrastinated over the definition of an ancient tree! On the other hand..... an easier definition might be that of an ancient botanist - an extant Founder Member of the CBA! How many are we these days, by the way?

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Rackham, O. (2003). Ancient Woodland, its history, vegetation and uses in England. New Edition, Castlepoint Press, Scotland UK



News from the Teaching section

The teaching section of the CBA/ABC and the Education section of the CSPP have arranged a session of speakers for the 2007 Plant Canada conference.

The session will take place on Tuesday June 12th from 8.30am to 10.00am in Salon D.

The speakers are Dr Malcolm Devine, Vice president of Performance Plants, Inc. whose title is “What will I do when I grow up?” This will be followed by presentations by two winners of several teaching awards. Dr Kate Frego (CBA/ABC) of the University of New Brunswick, St John. (Her title will be announced in the conference website) and Dr Sheila Macfie, (CSPP) University of Western Ontario, will give a talk on “Maximizing feedback and evaluation while minimizing time and red ink”

All are welcome to attend this session!

An item of interest, particularly to those who teach courses in Plant Anatomy and Morphology appeared on the Plant Education list recently. Dr David Hershey drew the attention of readers to an on-line article by A. E. Boyd, 2006. Plants & perpetrators: Forensic investigation in the biology classroom. American Biology Teacher online 68(9): 145-147. (Nov./Dec). <http://nabt.org/sites/S1/File/pdf/068-09-0025.pdf>

Students are asked to check the alibis of three murder suspects by examining the mud from their boots. There is a fairly complex scenario involving romantic liaisons, and in the conclusion we learn that the murderer and victim were zoologists and the two innocent parties were botanists! This might help to spice up otherwise rather dull lab exercises.



Winners at the APIC Undergraduate Biology Conference.

The Conference was held at the University of New Brunswick, St John on March 2nd-4th 2007. The CBA/ABC award was divided between a winner in the poster category and a winner in the oral presentation category. The winners were:

Poster

Caroline Tucker from Mount Saint Vincent University for her poster entitled, “Tolerance to herbivory in resistant and susceptible ecotypes of *Arabidopsis thaliana*.”

Oral presentation

Erin Mycroft of Acadia University for her presentation entitled: “Genotypic variation in growth response of white spruce (*Picea glauca*) to elevated carbon dioxide”.

Congratulations!

To contribute an article to this series please observe a limit of four pages, follow the format of recent issues (see the first in the series for an agreed upon format vol. 39(2): 28-30, profile students and their work as much as possible, and send the manuscript to the series editors (Ecology Section Co-chairs): Dr. A. Sinclair [adrienne.sinclair@ec.gc.ca] and Dr. P.M. Catling [catlingp@agr.gc.ca]. A few photos may be included. This series is an ongoing project of the CBA Ecology section.

Ecology in Canada: What's New and Who's Doing It?

3. Université Laval

Dr. Line Rochefort, Département de phytologie, Université Laval, Pavillon Paul-Comtois, Québec, Québec, G1K 7P4. Email : Line.Rochefort@fsaa.ulaval.ca. Phone: (418) 656-2131 ext. 2583.

The Lab

Since 1992, the team has been working with the Peatland Ecology Research Group (PERG) and has led many projects on peatlands dealing with:

- the development of peatland restoration techniques

- plant recolonisation after harvesting

- hydrology, geochemistry, microbiology of natural, harvested and restored peatlands

- peatland conservation strategies

- the peatland populations of birds, arthropods and mammals

- Sphagnum ecology and productivity

- Nordic peatland berries;

- Impact of snow goose grazing on peat polygons, Bylot Island, Canadian Arctic.



Dr Line Rochefort, in the field

Since 2003, the peatland projects have been carried out under the direction of the Industrial Research Chair in Peatland Management, with the support and the collaboration of the Canadian peat industry.

The research program of the Industrial Research Chair on Peatland Management aims to improve our knowledge of peatland restoration methods, to explore the potential for berry production and tree plantation, and to look into the cultivation of sphagnum fibers. The chair, led by Dr. Line Rochefort, continues a program based on 10 years of research carried out by the Peatland Ecology Research Group (PERG), in partnership with the Canadian peat industry.

The Research

Industrial Research Chair in Peatland Management

Research carried out by Line Rochefort and her team shows that regeneration of mined peatlands by natural processes is very slow and rarely tends toward a functional ecosystem. Therefore, the Peatland Ecology Research Group (PERG) has established a method for the re-establishment of vegetation on mined peatlands, dominated by Sphagnum mosses. This method consists of re-establishing the hydrological regime of undrained peatlands, harvesting plants in a peatland and spreading them as fragments in the mined sites, and covering them over with mulch to protect them. With this human intervention, a widespread peatland plant cover can be obtained within three to five years on abandoned peatland depending on site conditions. Moreover, research of the PERG has initiated the development of global peatland conservation strategies.



Bois-des-Bel research station, one year after peatland restoration works, October 2000 (Photo: S. Campeau).



Bois-des-Bel research station, four years after restoration works, October 2003 (Photo: PERG).

The Team

The research team is headed by Dr. Line Rochefort who supervises or co-supervises 15 graduate students: four Ph.D. candidates and 11 M.Sc. candidates. Dr. Rochefort is full professor, associate editor of the international journal *Mires and Peat*, and Chairman of the International Peat Society Commission V. Students and their subjects of study are listed below.

Roxane Andersen, Ph.D. candidate
Subject: Cycles biogéochimiques et interactions plantes-microbes dans les tourbières ombrotrophes : amélioration du suivi de la restauration écologique
E-mail: roxane.andersen.1@ulaval.ca

Mireille Bellemare, M.Sc. candidate
Subject: Effet des éricacées sur la croissance de la chicouté
E-mail: mireille.bellemare.1@ulaval.ca

Cillian Breathnach, M.Sc. candidate
Subject: Restauration de tourbières en zone côtière
E-mail: cillian.breathnach.1@ulaval.ca

Gabriel Caisse, M.Sc. candidate
Subject: Fertilisation et nutrition des plantations d'essences forestières sur les tourbières résiduelles
E-mail: gabriel.caisse.1@ulaval.ca

David Critchley, M.Sc. candidate, University of Alberta
Subject: Wet meadow creation: a reclamation option for Alberta's peatlands?
E-mail: DCRITCHL@nait.ca

Natacha Fontaine, M.Sc. candidate
Subject: La diversité végétale des mares de tourbières naturelles et exploitées
E-mail: natacha.fontaine.1@ulaval.ca

Louis Fortin, Ph.D. Candidate
Subject: Restauration de l'habitat forestier dans les tourbières en fin d'exploitation
E-mail: LFORTIN@umcs.ca

Martha-Darling Graf, Ph.D. Candidate
Subject: La restauration de fens
E-mail: martha-darling.graf.1@ulaval.ca

Josée Landry, M.Sc. candidate
Subject: Impact d'une nouvelle technique de récolte de tourbe sur la végétation et la qualité de l'eau
E-mail: josee.landry.1@ulaval.ca

Jacinthe Letendre, M.Sc. candidate
Subject: Évaluation de la production de CO₂ en surface d'une tourbière à l'aide de données spectrales
E-mail: jacinthe.letendre.1@ulaval.ca

Mylène Marchand-Roy, M.Sc. candidate
Subject: Recyclage des éléments minéraux et impact du broutement de la Grande Oie des neiges dans les milieux humides de l'île Bylot, Nunavut
E-mail: mylene.marchand-roy.1@ulaval.ca

Marilou Montemayor, M.Sc. candidate, University of Waterloo
Subject: Survival of plant species transplanted on a saline bog
E-mail: mariloubm@yahoo.com

Rémy Pouliot, Ph.D. candidate
Subject: Initiation de la structure présente dans les tourbières boréales : facteurs abiotiques et biotiques
E-mail: remy.pouliot.1@ulaval.ca

Claudia St-Arnaud, M.Sc. candidate
Subject: Drainage de deux types de tourbières caractéristiques du Sud du Québec comme simulation à une augmentation de deux fois la concentration en CO₂ atmosphérique actuelle et à un réchauffement climatique
E-mail: claudia.st-arnaud@fsaa.ulaval.ca

Guillaume Thérout Rancourt, M.Sc. candidate
Subject: Effet de la nappe phréatique sur la croissance de la chicouté (*Rubus chamaemorus* L.) en tourbière exploitée
E-mail: guillaume.theroux-rancourt.1@ulaval.ca

Future Plans

The restoration of peatland ecosystems is a lengthy process. Future plans include evaluation of the success of restoration by assessing the long-term evolution of plant communities and the return of other ecosystem functions (e.g. hydrology, C cycle, productivity, biogeochemistry, etc.).

Recently Published and Submitted Papers

Graf, M., L. Rochefort & M. Poulin. (Accepted) The spontaneous revegetation of abandoned fens of Canada and Minnesota, USA. *Wetlands*.

Groeneveld, E. V. G., A. Massé & L. Rochefort. (Accepted) *Polytrichum strictum* as a nurse-plant in boreal forest and peatland restoration. *Restoration Ecology*.

Sottocornola, M., S. Boudreau & L. Rochefort. (Accepted) Peat bog restoration: Effect of phosphorus on plant establishment. *Ecological Engineering*.

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NATIVE PLANT EMBLEMS OF CANADA

- 3. NOVA SCOTIA

E. Small and P.M. Catling, National Environmental Program, Biodiversity Section, Agriculture and Agri-Food Canada, Saunders Bldg., Central Experimental Farm, Ottawa ON K1A 0C6



FLORAL EMBLEM: MAYFLOWER



Fig. 1. Mayflower (*Epigaea repens*) from Canadian Heritage. 2002. Symbols of Canada (revised). Canadian Heritage, Ottawa, ON. Reproduced with permission of Canadian Heritage, Public works, and Government Services Canada.

SYMBOLISM

In the spring, the Mayflower produces delicate pink flowers in the forests and heathlands (open shrubby places) of Nova Scotia, signalling the retreat of winter and the promise of warmth. Not surprisingly, early residents of the province adopted the plant as a symbol suggesting high achievement in the face of adversity. As early as 1820, the Mayflower was employed as a native patriotic emblem. It was praised by songwriters and poets, showcased on early stamps and coins of the province before Confederation, and represented on the decorative brass of the militia and on the Lieutenant Governor's chain of state. The Mayflower also was adopted as the name of at least two Nova Scotian newspapers. While Nova Scotia was a colony of Great Britain, it was granted a Coat of Arms in 1625 (the oldest Coat of Arms outside of Great Britain), but this was not used after 1867 when Nova Scotia joined Confederation. In 1929 the original

Coat of Arms was re-adopted, with the addition of the Mayflower.



Fig. 2. Nova Scotia's Coat of Arms with Mayflower at the bottom.

LATIN NAMES

Epigaea repens L.

The genus name *Epigaea* is based on the Greek *epi* "upon" and *gaia* "the earth," referring to the creeping habit. The epithet *repens* is Greek for trailing or creeping, also referring to the habit.

ENGLISH NAMES

The name Mayflower is usually interpreted as being based on the early spring flowering of the plant (with this in mind, we capitalize the M in the name, although "mayflower" is also commonly found). It is often claimed that the name was given to the plant by the Pilgrims who emigrated to Massachusetts, who not only noticed that the plant flowered in the spring but were sensitized to the name Mayflower because it was the name of the ship that brought them to Plymouth Rock. However, this is likely a contrived explanation; the name Mayflower was applied by the English of then and now to species of hawthorn (*Crataegus*), as well as to a number of other plants. In fact, more than a dozen species are called Mayflower, and this name can be ambiguous. The famous Harvard botanist, M.L. Fernald (in the Preface of the 8th edition of Gray's Manual of Botany), commented "such a name as 'Mayflower' is used in so many senses as to be essentially meaningless outside restricted areas." The names "creeping Mayflower" and (rarely) "Plymouth Mayflower" are sometimes applied to *E. repens* to avoid ambiguity. "Canada Mayflower" is sometimes applied to *Maianthemum canadense*, a widespread herb in Canada. Another spring-flowering Canadian herb, *Cardamine pratensis*, is also sometimes known as Mayflower. *Epigaea repens* is also known as trailing arbutus, this name deriving from the small size in comparison with the trees and shrubs of the genus *Arbutus*. The latter, also in the heath family, has 14 species of which *A. menziesii* Pursh, called

O sacred flowers of faith and hope,
As sweetly now as then
Ye bloom on many a birchen slope,
In many a pine-dark glen.

Behind the sea-wall's rugged length,
Unchanged, your leaves unfold
Like love behind the manly strength
Of the brave hearts of old.

So live the fathers in their sons,
Their sturdy faith be ours,
And ours the love that overruns
Its rocky strength with flowers.

But warmer suns ere long shall bring
To life the frozen sod;
And, through dead leaves of hope,
shall spring
Afresh the flowers of God!

-Extracted from *The Mayflowers* by
John Greenleaf Whittier (1807-1892,
American poet).



Fig. 3. Painting of Mayflower (*Epigaea repens*) in its 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

arbutus and madrona, is a Canadian native, occurring in southwestern British Columbia. Obsolete names for Mayflower (which apply to other species as well) include gravel plant or gravel weed (so-named because of early medical use to treat "gravel," i.e. kidney stones), shadflower (shad are important food fishes of Europe and North America, especially the Atlantic coast; spring runs of the fish in North America have led to the application of "shad" to various spring-flowering plants), ground laurel, moss beauty, mountain pink, winter pink, and crocus.

FRENCH NAMES

Fleur de mai (fleur-de-mai), épigée rampante, épigée fleur de mai

HISTORY

a. Canada

The Mayflower was officially declared the Provincial Flower of Nova Scotia in 1901 (indeed, the Legislature stated that the flower has been the floral emblem of the province "from time immemorial").

b. Foreign

The Forest Potawatomi Indians of Wisconsin have long considered the Mayflower to be their tribal flower, and indeed believe that it is divine, having come directly from kitci' manitowiwin, their divinity. The state of Massachusetts declared the Mayflower to be its floral emblem in 1925.

Nova Scotia and Massachusetts have much more in common than the same floral symbol. The province and state share a great deal in terms of history, geography, and commercial and family ties (see red spruce, below).

APPEARANCE

The Mayflower is an exceptionally attractive flowering plant—"probably the best beloved of all the wild flowers of the eastern United States" according to Coville (1911). However, after flowering in the early spring it is inconspicuous and easily overlooked, despite the fact that it is a fairly common plant in much of its range. The Mayflower is a prostrate, sprawling, dwarf shrub that forms patches. It has scarcely woody, thin, vinelike branching stems up to 40 cm (16 inches) long (occasionally up a metre), the surface sometimes slightly shredded. The aboveground stems arise from a short (2–4 cm or about an inch in length, up to 1.5 cm (½ inch) in diameter) rhizome (underground stem) that is often twisted and knobby, and produces a strongly branching root. The above-ground stems bear evergreen, leathery, alternate leaves up to 7.5 cm (3 inches) long. Adventitious roots are developed at the nodes. Rusty-coloured hairs occur on the stems and petioles, and also often on the lower surfaces of the leaves. The flowers occur in groups of 3–5 (occasionally more) on the ends of branches. The trumpet-shaped flowers have a waxy appearance, and are about 12 mm (½ inch) long, with five white to pink or rose-coloured petals (the latter sometimes fading to white) and a spicy fragrance. Plants usually bear only male or only female flowers. Female flowers usually have stamens, but these are reduced in size compared to those of the male flowers, and do not produce functional pollen. The male flowers have abortive pistils so they cannot produce seeds. Depending on location, flowering occurs from March to May (in many places where it is found, the Mayflower is the earliest wildflower to bloom). The berry-like fruit is a small, globular capsule appearing like a large purple or pale yellow-orange pea (4–5.5 mm or about 1/4 inch in diameter). The five chambers are filled with numerous tiny dark brown seeds in a white pulp. The plant is often concealed by leaf litter, and often only its leaves are visible. The species can be easily identified by its prostrate growth habit; stems with brown hairs; leathery, ovate, often heart-shaped leaves; and white, fragrant flowers.



Fig. 4. Mayflower (*Epigaea repens*). Photographs supplied courtesy of M. Munro, Nova Scotia Museum.

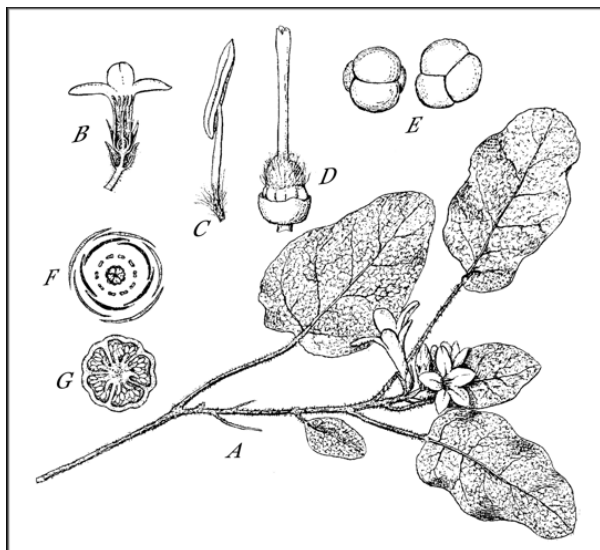


Fig. 5. Mayflower (*Epigaea repens*). A, lowering branch; B, flower cut longitudinally; C, anther viewed laterally; D, pistil; E, pollen grains; F, floral diagram; G, cross-section of ovary. From Bastin (1895).

CLASSIFICATION

Family: Ericaceae (heath family)

Epigaea repens is one of three species of *Epigaea*. *Epigaea asiatica* Maxim. occurs in Japan and Taiwan, and *E. gaultheriodes* (Boiss. & Bal.) Takht. is native to the Caucasus of Georgia and northwestern Turkey (Asia Minor).

Several varieties and/or forms of *E. repens* have been recognized on the basis of floral colour and presence of hairs on the foliage. Canadian plants are often assigned to var. *glabrifolia* Fern., which develops limited hairs on the leaves. Forma *plena* Rehd., a rare form, has doubled flowers.

GEOGRAPHY

Epigaea repens occurs from Newfoundland to Manitoba and Wisconsin, south to Kentucky and Florida. In the US, it has been recorded from 29 states, including all of those east of the Mississippi River. *Epigaea repens* is one of about 3 dozen herbaceous genera of plants that have one species in eastern North America and a very closely related species in eastern Asia. These plants are thought

to be survivors of an ancestral deciduous forest (the Arcto-Tertiary Forest) that formed a continuous band around the northern hemisphere 15 to 20 million years ago (see Li, H.-L. 1952. Floristic relationships between Eastern Asia and Eastern North America. Trans. Am. Phil. Soc. (N.S.) 42: 371–429.)

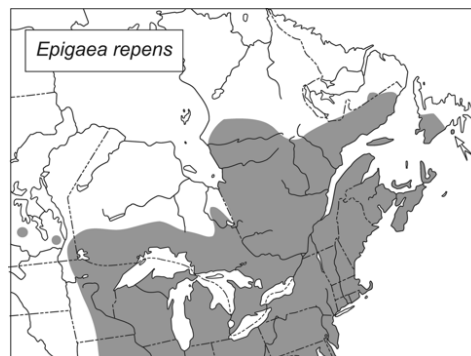


Fig. 6. Canadian distribution of Mayflower (*Epigaea repens*). Arrow indicates presence on the French islands of St. Pierre and Miquelon.

ECOLOGY

Habitat

In Nova Scotia and elsewhere, Mayflower occupies a moderately wide range of habitats. It is frequently found in open shrubby places, including barrens and bogs, as well as in deciduous and coniferous forests, and rocky pastures. Mayflower is adapted to shade, but does not flourish in deep shade, and is more common at the edge of forests. It is most common on acidic, dry, sandy and coarse well-drained soils, frequently on slopes. It occurs occasionally in rich woods or on pond margins in deeper, peaty soils. It is sometimes on cliffs and headlands where strong winds prevent the growth of taller plants. In Newfoundland, the Mayflower is a characteristic inhabitant of the Southern Long Range subregion, where it is a “snow-bed species.” Such species occur in areas where snow does not completely melt until late in the growing season (completion of melting does not occur until the middle of June in Newfoundland).

Inter-species Relationships

Chipmunks and small animals may eat the fruits of Mayflower, but the plant is not an important food source for wildlife.

Epigaea repens does not have root hairs, that in most plants absorb nutrients and water from the soil; instead, it has a mutualistic association with a mycorrhizal fungus that serves to increase absorption of nutrients to the plant.

Pollination & Dispersal

The flowers of Mayflower are pollinated by a variety of ants and flying insects (including bumblebees). Fruits ripen 4–5 weeks after pollination, turning from green to red or purple, then split open, exposing the seeds that are embedded in a sweet, sticky pulp. When the fruit splits open, the force may eject some of the seeds over short distances. Ants have been reported to be the principal distributors of the seeds. The ants gather the sugary pulp for food use and while transporting it back to their nest they drop seeds along the way in places that are often suitable for germination. The seeds also likely adhere to birds and mammal that come in contact with the fruit, and thus may

be distributed over great distances.

Ants Move Mayflowers

Seed dispersal by ants is called myrmecochory, and is widespread in northeastern North American woodlands. Plants that are assisted by ants in this way include many unrelated species (such as violets, goldenseal, bloodroot, sedges, claytonia, and seneca snakeroot), suggesting that the ant-plant relationship has evolved independently on many occasions. In most cases, ant-dispersed seeds are relatively large and have a nutritious (often oily) appendage usually called an elaisome. This contrasts to the tiny seeds of Mayflower, where the fruit pulp rather than any part of the seed is the attractant. Mayflower is the only ant-dispersed shrub in northeastern North America; the other ant-dispersed plants are all herbaceous perennials.



Fig. 7. Berry-like fruits of Mayflower (*Epigaea repens*). Top: closed; bottom: opened by separation of five valves to show numerous seeds imbedded in pulp. Prepared by B. Brookes.

USES

First Peoples of North America employed leaf infusions or decoctions of Mayflower for a variety of ailments, including diarrhea, indigestion, abdominal pains, labour pains during childbirth, rheumatism, and kidney problems. Some of these uses were adopted during colonial times in the US, but primarily the plant was used in remedies for urinary problems. The foliage contains the chemical arbutin that acts as a urinary antiseptic. However, the plant is now thought to have harmful properties, because arbutin hydrolyzes, i.e. reacts with water, to produce hydroquinone, which is toxic. Medical usage is considered obsolete today.

The spicy, aromatic flowers are sometimes eaten, and the fruits are said to be edible, but Mayflower is not considered to be a wild food plant. As noted below, Mayflower is sometimes cultivated as an ornamental, mostly in rockeries, and occasionally as a groundcover.



Fig. 8. Mayflower (*Epigaea repens*). Based on a postcard of a watercolour painted by Maria Morris Miller, supplied courtesy of M. Munro, Nova Scotia Museum.

CULTIVATION

Records show that the Mayflower has been cultivated for centuries in England and the US, but not frequently, because it is not an easy plant to grow. All three species of *Epigaea* are sometimes grown as ornamental plants in rockeries, where they require moist, acidic soil. A few named ornamental cultivars of Mayflower and *E. Hintertexta*, a hybrid between *E. repens* and *E. asiatica*, are marketed for cultivation. Detailed instructions on how to grow Mayflower, from former Central Experimental Farm horticulturalist and co-worker Larry Sherk, are reproduced below from his popular but out-of-print (1967) guide to growing Canada's floral emblems.

"It is very hard to reestablish plants taken from their native habitats. If possible, use only nursery-grown plants or those raised in pots from cuttings or seed.

Take cuttings 3 to 5 inches long either in spring soon after flowering or in early fall. In a large pot or flat, put a mixture of 1 part ground peat moss and 1 part sharp clean sand. Stick all of the cuttings except the top leaves into the mixture and keep them moist but not wet. Mist beds are not satisfactory for rooting this plant. Cuttings root in 2 or 3 months. Pot up spring cuttings in early fall if they are well rooted, but leave fall cuttings until the next spring, protecting them over the winter in a cold frame.

To raise plants from seeds, follow these directions carefully. Seed capsules ripen and start to split 40 to 55 days after flowering. Watch them closely because ants soon remove the seeds. You may sow the seeds at once or store them overwinter in sealed jars in a refrigerator. For sowing the seeds, use seed pans or other shallow pots containing 1 part peat moss, 2 parts well-rotted oak leaves rubbed through an eighth-inch screen, and 1 part sand. Screen a thin layer of finely sifted sphagnum moss over the mixture and scatter the seeds evenly over it. To keep the seeds moist after sowing, cover the seed pan with a sheet of glass and plunge the pan in a larger pan or flat filled with damp peat moss.

The seeds germinate in 5 to 6 weeks. When the seedlings are 2 to 3 months old, transplant them to 2- or 3-inch pots, using the same soil mixture. Sink the pots in a flat of moist peat moss

and keep them indoors until spring. The seedlings must be kept moist but not wet. In the spring, transfer the seedlings to a shaded cold frame. During the summer, transfer them to 3- or 4-inch pots or to their permanent location. If you leave young seedlings over the winter in a cold frame, mulch them with 3 or 4 inches of oak leaves.

The mayflower may be planted in a natural woodlot, or in an area in the garden that is shaded for part of the day. Because it is hard to keep the mayflower growing well in a garden, follow these recommendations carefully. Select a spot that will not be disturbed by the roots of aggressive trees and shrubs. Remove the soil to a depth of 18 inches and put down a 3-inch layer of small stones, cinders, or coarse sand. Then fill the hole to within 6 inches of the top with a mixture of equal parts of sand and peat moss. Fill the top 6 inches with a mixture of 2 parts oak-leaf mold, 1 part sand, and 1 part peat moss. If you have to keep out aggressive roots, sink a sheet metal or plastic barrier around the soil mixture. Water the plants well when you transplant them and often afterwards. A layer of pine needles also helps to keep the soil moist. Cover the plants with a 3- or 4-inch layer of oak leaves in the fall and remove the leaves gradually in the spring after danger of hard frosts is past. Plants may also be set out in the rock garden if the location is not too hot and dry in the summer."

The only aspects of cultivation to add to Sherk's very complete text, above, are: (1) Cold treatment improves germination. (2) Flowering tends to occur after rosettes have been exposed to cold (just above freezing suffices). (3) Using soil collected near well-established plants in soil mixtures is very desirable, as this introduces the mycorrhizal fungus that the plant needs for good growth (spores of the fungus also often appear to get attached to the seeds). The fungus appears to be essential for propagation from cuttings.

CONSERVATION STATUS

Although the Mayflower is considered common and secure through much of its range, there are many regions where it is rare. It is sometimes collected for winter decoration and wreaths, but because it is very slow growing, harvesting has eliminated or nearly eliminated it from some areas. It was extirpated from parts of Massachusetts, where it has been the floral emblem since 1925. A law dating from that time provides for a fine of up to \$50.00 for harvesting the plant from private land without permission, but if done "in disguise or secretly in the nighttime" the fine may be up to \$100.00. Once officially listed in Indiana as Threatened or Endangered, it is now ranked as a "Watch List species" there. The Mayflower is ranked as "Endangered" in Florida. In New York it has been listed as "exploitably vulnerable."

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

- According to legend of the forest Potawatomi Indians and the Ottawa Indians, an old man living alone prayed that he would not succumb to the harsh winter. A beautiful maiden then entered his lodge, breathing a warm, fragrance that put the man to sleep. The maiden then transformed the man into a Mayflower, and as she retreated through the woods

Mayflower plants grew in each of her footsteps.

- The "Victorian language of flowers" was a secret coded language in Victorian times, with flowers and plants symbolic of certain words or phrases, so when the flower or plant was mentioned in a letter those who knew the code could understand the hidden information. *Epigaea repens* stood for "budding."
- In 1959, Queen Elizabeth II conducted a 45-day tour of Canada. On Aug. 1 at a banquet in the Nova Scotian Hotel in Halifax, she wore a grey silk organdie evening dress designed by Hardy Amies, with pink and white floral embroidery that included Mayflowers for the occasion.
- Studies in Nova Scotia have shown first flowering dates of Mayflower to be significantly later than they were a century ago, perhaps as a response to a cooling trend in the Maritimes. (Vasseur, L., Guscott, R.L., and Mudie, P.J. 2001. Monitoring of spring flower phenology in Nova Scotia: comparison over the last century. *Northeastern Naturalist* 8: 402.)
- Colours are notoriously difficult to define. According to Webster's Third International Dictionary, the colour "Mayflower" is "a moderate red that is yellower and paler than cerise, claret, or average strawberry and bluer and paler than Turkey red."

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TREE: RED SPRUCE



Fig. 9. Silhouette of red spruce (*Picea rubens*) tree. Source: J.L. Farrar 1995. Trees in Canada. Canadian Forest Service and Fitzhenry and Whiteside, Markham, ON, Canada. Reproduced with permission.

SYMBOLISM

The red spruce has played an important role in the history of Nova Scotia. Red spruce tea, with its high content of vitamin C, helped the pioneers fight off scurvy. In the early days of shipbuilding when white pine was scarce, red spruce became an important mainstay of the industry. In justification of the choice of the red spruce as its provincial tree, the following admirable qualities have been cited to show that the tree represents the strength and versatility of the people of Nova Scotia: (1) The tree can thrive in a variety of places, from bogs to rocky shallow soils. (2) Red spruce can grow to an impressive height, sometimes more than 30 m (100 feet) in the province. (3) The tree is a remarkable survivor, capable of living for a century under dense shade and rebounding once it is provided with good light. (4) Red spruce is the leading sawn lumber species of the province, and second in pulpwood, hence a mainstay of the economy.

LATIN NAMES

Picea rubens Sarg.

The genus name *Picea* is derived from the Latin word *pix*, which refers to some species of pine, and also for the "pitch" (resin). *Rubens* in the scientific name is Latin for reddish. The bark is light reddish brown, and the cones and buds are also reddish-brown.

ENGLISH NAMES

Red spruce has also been called Adirondack spruce, Canadian spruce, Canadian red spruce, double spruce, Eastern spruce, he-balsam, West Virginia spruce, and yellow spruce. The curious name "he-balsam" was applied by residents of Appalachia to contrast the red spruce and Fraser fir, which often occur together in that region. Because of the red spruce's rough bark and prickly needles, like a man's beard, the tree was referred to as a

"he." By contrast, the smooth-barked Fraser fir [*Abies fraseri* (Pursh) Poir.] with its flat, less prickly needles, was called "she-balsam."

FRENCH NAMES

Épinette rouge (obsolete: épicéa rouge, épicéa rouge du Canada, épinette jaune, prusqueur rouge, sapinette rouge, sapinette rouge du Canada)

HISTORY

a. Canada

The red spruce was declared to be the provincial tree of Nova Scotia in 1988.

b. Foreign

Spruce tree species are widely employed as symbols of political regions, but the red spruce is officially recognized as a symbol only in Nova Scotia.



Fig10. A mature red spruce (*Picea rubens*) growing at Lays Lake, Halifax County, Nova Scotia. Photo provided by E. Gratton, Nova Scotia Department of Natural Resources.



Fig. 11. Fruiting branch of red spruce (*Picea rubens*). Inserts at upper right (left to right): branch with winter buds, winter buds showing bracts at base. Source: Sargent, C.S. 1898. The silva of North America. Houghton, Mifflin and Company, Boston, MA. Vol. 12, Tab. 597.

APPEARANCE

Red spruce is monoecious (male and female flowers occur on the same plant). Both male and female flowers are aggregated in separate strobili (cones). The male flowers are pendant and bright red, while female flowers are erect and bright red, pinkish-purple, or green tinged with purple. The cone buds form

in mid summer, but the male and female cones are difficult to distinguish until September, and pollination and fertilization do not occur until the following spring. The female cones are receptive to pollen when they are fully open, a period lasting only a few days. The female cones and their seeds mature in the fall and become pendent. At maturity, these are cylindrical with rounded ends, 2.3–5 cm (0.9–2 inches) long, light reddish brown (or orange-brown), glossy, with rigid, rounded scales that are frequently slightly toothed on the edges.

Under low light, red spruce can survive for more than a century as a dwarfed plant (growth may be as little as 2.5 cm (1 inch) annually), but once the canopy opens up the plant can develop into a substantial tree. Red spruce rarely, if ever, reproduces vegetatively by layering. The trees grow from 21–35 m (70–115 feet) in height (rarely as tall as 46 m or 151 feet), and develop trunk diameters of 3–60 cm (1–2 feet), rarely as thick as 1.3 m (4.3 feet). In stands, self-pruning occurs, with shedding of the lower branches that receive limited light. The crown of the tree is conical. The ends of the main branches are characteristically upturned. The root system is quite shallow, and subject to windthrow. The needle-like leaves are yellow-green to dark green (not glaucous), (8)12–15(30) mm (0.3–1.2 inches) long, four-sided, curved, with a sharp point, extending from all sides of the twig. The thin, scaly bark is gray-brown on the surface, red-brown on the inside. The trees are long-lived and, in the absence of fire or other catastrophe, often survive 250–350 years.

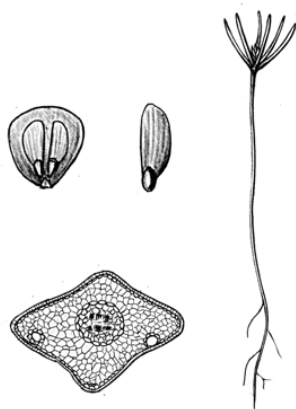


Fig. 12. Red spruce (*Picea rubens*). Upper left and centre: cone scale with seeds and seed with attached wing. right: seedling. Lower left: cross section of leaf. Source: same as Fig. 11

CLASSIFICATION

Family: Pinaceae (pine family)

Red and black spruces are closely related, and hybridize where their ranges overlap. In article #2 of this series, an extensive table is presented comparing the characteristics of the two species. At least ten other species of *Picea* have been crossed experimentally with red spruce in breeding studies, but in nature hybrids with these other species are uncommon. *Picea rubens* forma *virgata* (Rehd.) Fern. & Weath. has long, slender branches almost without branchlets, and is encountered most frequently in cultivation.

GEOGRAPHY

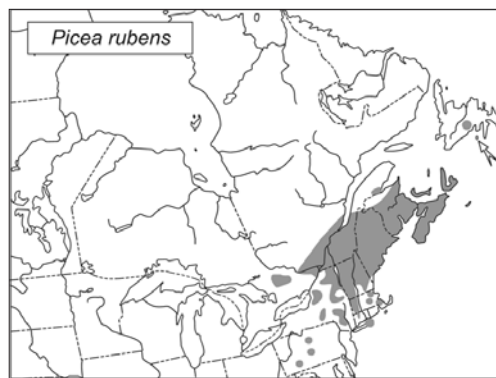


Fig. 13. Distribution of red spruce (*Picea rubens*). Arrow points to St. Pierre and Miquelon.

Red spruce is a native of eastern Canada and the eastern United States, as well as St. Pierre and Miquelon (France). It ranges from Newfoundland (an isolated population) west to Maine, southern Quebec and southern Ontario, south to New York, Pennsylvania, New Jersey, and Massachusetts. It also occurs south along the Appalachian Mountains to North Carolina, at higher elevations (2,000 m; 6,600 feet). Red spruce is common over much of the Maritime Provinces, but is uncommon in south-central Ontario and in Quebec north of the St. Lawrence River.

A Symbol of Hope and Sharing

Every December the people of Nova Scotia send a large Christmas tree to the City of Boston. The Nova Scotia Department of Natural Resources requires that the tree be a red spruce, white spruce, or balsam fir (all Canadian provincial trees), and at least 13.7 m (45 feet) high. The gift expresses gratitude for the assistance of Bostonians to Haligonians in the aftermath of a terrible explosion in Halifax Harbour in 1917. The yearly lighting of that tree in downtown Boston combines the symbolism of Christmas as a time of hope and sharing, with a reminder that neighbors working together can rise above extreme misfortune and adversity.

The Halifax explosion resulted from the collision of a French munitions ship with a Norwegian relief vessel. The munitions ship caught fire and exploded, killing an estimated 2,000 people and injuring over 9,000, many permanently blinded. The explosion caused a tsunami wave in the harbour, and a pressure wave of air that snapped trees, bent iron rails, demolished buildings, grounded vessels, and carried fragments of the ship for kilometres. It was the largest artificial explosion until the first atomic bomb test in 1945 and remains one of the largest artificial non-nuclear explosions. 1,630 homes were completely destroyed and over 6,000 people were left without shelter from the extremely cold weather that followed. The people of Halifax were destitute and in shock. The prompt and extremely generous assistance from Boston made a huge difference.

ECOLOGY

Habitat

Red spruce occurs as pure stands and in mixed forests along with other coniferous and deciduous trees. In its Appalachian range, it extends into montane and subalpine forests. Red spruce is adapted to a cool, moist climate. It grows on a wide variety of well-drained soils, including shallow till soils, and organic soils covering rocks, but usually the pH ranges from

4.0–5.5. Sites occupied include steep rocky slopes and wet bottomland; however, it does not thrive on poorly drained soils. It is susceptible to damage from air pollution, and this is believed to be a factor in its decline in the Appalachian region. In the northern part of the range the trees must withstand heavy snow cover. Along the Appalachian Mountains, red spruce occurs at higher elevations.

Red spruce seedlings can become established under light intensities as low as 10% of full sunlight, but require intensities of 50% or more for optimum growth. The species competes moderately well with other trees, but will be outcompeted by hardwoods that produce heavy shade, like beech and maple. Balsam fir, which is comparably shade-tolerant, is a major competitor.

THE IMPORTANCE OF NOVA SCOTIA'S FORESTS

Nova Scotia is situated in the Acadian Forest Region, that includes Prince Edward Island and much of New Brunswick, as well as Maine. The Acadian Forest is unique in its composition of softwood and hardwood species. Softwoods include red, white, and black spruce, balsam fir (the foundation of Nova Scotia's Christmas tree industry), eastern white and red pine, and eastern hemlock. Hardwoods include red and sugar maple, white and yellow birch, trembling and large tooth aspen, and beech. The adjoining Boreal Forest is dominated by fewer tree species, and softwoods are often predominant. Nova Scotia has been logged since the early 1600s, and forestry is still a key industry of the province, especially in rural areas, where nearly three quarters of the province's primary forest workers live, and where there are numerous sawmills and family-owned woodlots. Over 30,000 woodlot owners own almost half of Nova Scotia's productive forestland. Because the forests are essential for tourism, recreation, and clean air and water, and the habitat for considerable native biodiversity, sustainable management of the forest sector is essential.

Inter-species Relationships

Red spruce is a major component of many forests, and it provides important food and cover for numerous species.

Some of the insect species that consume it destroy the trees and are considered serious pests by the forest industry. The spruce budworm (*Choristoneura fumiferana*) is the most significant herbivore of red spruce. However, because it opens its buds later in the year than balsam fir or white spruce, the latter two species are more vulnerable. The eastern spruce beetle (*Dendroctonus rufipennis*) damages mature red spruce trees. The European spruce sawfly (*Diprion hercyniae*) and the native yellowheaded spruce sawfly (*Pikonema alaskensis*) cause severe defoliation in some areas. The eastern spruce gall adelgid (*Adelges abietis*) is sometimes also a serious pest on spruce. Eastern dwarf mistletoe (*Arceuthobium pusillum*), a parasitic plant, occasionally infects red spruce and causes reduction of growth, mortality, and degradation of wood quality. Mice and squirrels consume the seeds. Spruce grouse browse the twigs and leaves. Birds (especially crossbills or grosbeaks) eat the terminal buds of young trees, as do red squirrels, porcupines, bears, snowshoe hares, and rarely deer. Red spruce provides important winter cover for deer, moose to a lesser extent, snowshoe hare and

other furred animals, ruffed grouse, woodcock, and many song birds.

Pollination & Dispersal

Red spruce is wind-pollinated. The wind also distributes the seeds, the attached wings acting as sails. Seed production begins when the trees are about 15 years of age. Rodents (especially mice, voles, squirrels and chipmunks) and birds consume the seeds, and to some extent also serve as distribution agents.

As in numerous other trees, seed production varies from year to year, with very good seed crops occurring once every 3–8 years. These "mast years" of very high production have been interpreted as an adaptation against herbivores that consume the seeds. In a year of high production, herbivore populations are likely to be lower because the preceding years have provided only small amounts of seeds. In red spruce, good seed crops occur every 3 to 8 years, with light crops during intervening years. Most red spruce seeds germinate the spring following dispersal, and sometimes they germinate in the fall soon after dropping from the parent tree.

Have Seed, Will Travel

Stephen Hawking, one of the greatest physicists of all time, and author of the well-known (and occasionally read) book, *A Brief History of Time*, was warned by his publisher that every mathematical equation that he included would cut sales by half. However, this would never apply to people interested in plants! The following formula is useful in predicting dispersal distances of red spruce seeds. Knowing that red spruce seeds fall at a rate of 4.2 feet/sec in still air, the distance of travel can be calculated as follows:

$$D = S^2(1.47v)$$

where D = distance the seed will travel in feet, S = the time in seconds required for the seed to fall from height h (in feet) and v = the wind velocity in miles per hour.

Reference: Walter, L.C. 1967. Silviculture of the minor southern conifers. Stephen F. Austin State College School of Forestry, Bull. 15, Nacogdoches, TX. pp. 56-62.

USES

Red spruce is one of the most important commercially harvested coniferous trees of eastern Canada and the northeastern US. Its wood is soft, light in weight (with a specific gravity of 0.41, dry), straight-grained, and resilient. A pale yellowish-white colour is characteristic and the heartwood is similar to the sapwood. The wood is used to produce pulp for paper, construction lumber, and musical instruments (including pianos, guitars, mandolins, violins, and organ pipes; thin boards have exceptional resonance). It is easily worked, and has moderate shrinkage and moderate strength. The wood holds paint well but rates low in holding nails. It has limited decay resistance and is difficult to inject with preservatives. Red spruce is employed to a minor extent as a Christmas tree, but other species have proven to have better qualities for this purpose. White spruce is a more common Christmas tree, but all Canadian spruces tend to shed their needles a few weeks after being brought indoors.

CULTIVATION

Red spruce is a major silvicultural species, of special concern

to foresters. It is not usually cultivated as an ornamental tree, although a few horticultural varieties are available. For forestation purposes, there is considerable technical information available on seed collection, storage, and germination, and establishment and care of young trees. The species grows well in moist, acid, peaty or rocky soils.

CONSERVATION STATUS

Forest ecologists have noted a decline in red spruce throughout most of its geographic range. This decline has been attributed to: (1) Red spruce is a species adapted to late stages of succession; such plants have difficulty (in contrast to early-succession species like black spruce) in recovering from excessive harvesting, as has occurred.; and (2) Adverse environmental and climatic changes including warming over the last 2 centuries. (Projected increases of temperature from human activities may result in further decline, although parts of the range of red spruce may be less subject to increased temperature than other regions.) Increasing hybridization with black spruce may also result in the decline of red spruce. With extensive harvesting, the once continuous forests of red spruce become fragmented on the landscape, and black spruce becomes more abundant. "Genetic swamping" may then occur, i.e. the more frequent pollen of black spruce results in a reduction of pure red spruce seed.



Fig. 14. Cones of red spruce (*Picea rubens*). Photograph provided by M. Munro, Nova Scotia Museum of Science.

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

- Red spruce gum that exudes on trunk wounds was employed as a masticatory (gum) by native Americans. During the last half of the 19th and early 20th centuries, red spruce gum was the basis for a flourishing chewing-gum industry in Maine. (To make your own gum, collect the sap, boil it until completely dissolved, and pour it on to a greased cookie sheet.)
- The famous acoustic guitar manufacturer, Martin and Company, made most of its guitar tops from red spruce from about 1900 to the mid 1940s. Like high-elevation spruce of Europe, the wood from Adirondack red spruce is prized for its extraordinary tone, projection, and clarity. With the recent decline of Appalachian red spruce, a good supply of such wood is no longer available.

• In 2005, it was reported that Mount Allison student Ben Phillips found a 445-year-old red spruce tree, along the Bay of Fundy coast in New Brunswick (see January/February 2006 edition of Canadian Geographic). This is the oldest reported *Picea rubens* tree based on a tree ring count. Despite its venerable age, the tree is only 30 cm (1 foot) in diameter. The oldest authoritatively dated species of *Picea* is an Engelmann spruce (*P. engelmannii* Parry ex Engelm.) from Colorado that was felled about 1994, and was found to be 852 years old.

• Sometimes when a single seed of red spruce is planted, several plants emerge. How does this happen? Among living things, sexual combination of a single male gamete with a female gamete produces just one individual. Polyembryony is the production of more than one individual from a single fertilization, and it occurs occasionally among certain species, including animals such as the armadillo, and coniferous plants such as red spruce (Baldwin, H.I., and Percival, W.E. 1931. Polyembryony in red spruce. *Science* 74(1912): 203.). A polyembryonic seed produces several (usually genetically identical, or essentially so) independent plants. This may improve chances of germination and seedling establishment.

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PROVINCIAL BERRY: LOWBUSH BLUEBERRY

SYMBOLISM

The lowbush blueberry is an appropriate choice for Nova Scotia's provincial berry, given its importance to the province, its widespread occurrence, and its popularity. The area devoted to lowbush blueberry (13,355 ha; 33,000 acres) exceeds that of

any other crop in the province, and the value (farm gate: \$15,000,000.00; retail: \$35,000,000.00 annually) exceeds that of any other fruit crop. There are about 1,000 blueberry growers in the province.

LATIN NAMES

Vaccinium angustifolium Ait.
Synonyms include *V. lamarkii* Camp and *V. pennsylvanicum* Lam.

The genus name *Vaccinium* is the classical Latin name for the blueberry. It is said to derive from the Latin *vaccinus*, of cows. English navigator and explorer Captain James Cook (1728–1779) noted that cows love the berries. The genus name has also been interpreted as originating from *bacca*, berry, for the prominent, numerous berries. *Angustifolium* in the scientific name is Latin for narrow-leaved, describing the characteristically narrow leaves of the plant.



Fig. 15. Fruiting branches of lowbush blueberry (*Vaccinium angustifolium*). Source: S. Ferguson, Nova Scotia Department of Agriculture and Fisheries.

ENGLISH NAMES

The lowbush blueberry is also known as late lowbush blueberry, late sweet blueberry, low sweet blueberry, northern lowbush blueberry, sweet blueberry, and sweet-hurts [“hurts” is from the archaic West-Country (English) verb “to-go-a hurting,” i.e. collecting berries; “hurts” and “hurtleberries” are used in parts of England to designate the bilberry, *V. myrtillus* L.]

The English name blueberry is named for the blue (-black) color of the fruit, and originates from the Scottish “blaeberry,” used to denote related European species. The “blue” or “blae” traces to the Old High German word for blue, *blao*.

Blueberries (*Vaccinium* species) are known by many names, principally because early settlers noted that they resembled the European berries they knew as blaeberries, hurtleberries, trackleberries, whinberries, and whortleberries (the Scots associated them with the blaeberry, the Irish with whortleberries, the Danes with bilberries). “Whortleberry” is a dialectal variant of “hurtleberry,” derived from Middle English *hurtilberi*, and is perhaps based on *hurt*, an azure-colored ball (from Old French *heurte*) + *berye*, berry. Other interesting names for blueberry species include deerberries, farkleberries, southern gooseberries, and sparkleberries.

FRENCH NAMES

Airelle à feuilles étroites, bleuët à feuilles étroites, bleuët nain, bleuët sauvage nain

HISTORY

a. Canada

The “Nova Scotia wild blueberry” became Nova Scotia’s “Provincial Berry” in 1996.

b. Foreign

The lowbush blueberry has not specifically been adopted as an official emblem outside of Nova Scotia. However, “blueberries” in general and other species of *Vaccinium* have been chosen as official emblems. In 2001, the blueberry (no particular species) became the official State Blue Berry of North Carolina (its official State Red Berry is the strawberry; red and blue are the official state colours of North Carolina). The blueberry muffin was made Minnesota’s “State Muffin” in 1988. The “wild blueberry” (interpreted as *V. angustifolium*) was declared to be Maine’s “State Berry” in 1991. The province of Benguet of The Philippines adopted the “native highbush blueberry” (identified by the local names ayosi and alumani) as its Official Provincial Fruit in 1987. Web documents produced by the government of Benguet identify the species by the names highbush blueberry (*V. corymbosum*) and mountain blueberry (*V. membranaceum*), species that are not native to The Philippines. The species appears to be *V. myrtilloides* (Blume) Miq. (personal communication, D.A. Madulid, Philippines National Herbarium).



Fig. 16. Lowbush blueberry (*Vaccinium angustifolium*). Artist: B. Flahey, Agriculture & Agri-Food Canada.

APPEARANCE

The lowbush blueberry is a depressed shrub, varying from 5–90 cm (2–36 inches) in height, generally about 30 cm (1 foot) tall. It typically produces extensive, dense colonies. The root system is usually shallow and fibrous, although occasionally a tap root as deep as 1 m (39 inches) is formed. The plants spread by slim (about 5 mm or 0.2 inch in diameter) woody rhizomes (underground stems) growing about 5 cm (2 inches) below the surface. The white or pinkish-white, urn-shaped, small (4–6 mm or less than 1/4 inch long) flowers are borne in small clusters. The globular, bluish-black berries are 5–13 mm (7/32–1/2 inch), rarely 25 mm (1 inch) in diameter, and are sweet. The fruit contains up to several dozen tiny nutlets—so small that they are not objectionable to eat.

Fig. 17. Flowers of lowbush blueberry *Vaccinium angustifolium*.

Photo courtesy of D.L. Rubbelke.



CLASSIFICATION

Family: Ericaceae (heath family)

Lowbush blueberry is extremely variable, and several distinctive kinds of plants have been recognized by some taxonomists, especially the following two. Widespread plants with green leaves and blue berries have been called *V. lamarckii* and *V. angustifolium* var. *laevifolium* House; those wishing to recognize this taxonomically may call it forma *leucocarpum* (Deane) Rehder. Plants with whitish-green leaves and blackish fruit have been called *V. brittonii* and *V. angustifolium* var. *nigrum* (Wood) Dole; those wishing to recognize this taxonomically may call it forma *nigrum* (A.W. Wood) Boivin. There is some evidence that f. *nigrum* increases more rapidly in stands that are burned regularly, but these two kinds of plant show little if any ecological separation, they interbreed freely, and they have not been recognized as taxonomically distinct by most recent researchers. White fruit has been found to result from the expression of two independent genes when both are present in the homozygous recessive state. The characteristics associated with black (f. *nigrum*) fruit on the other hand are apparently influenced by a number of genetic factors.

Other minor variants have been recognized, including plants that have hairs on the veins of the lower surface of the leaves (var. *hypoplasium* Fern.) and plants with white berries (forma *leucocarpum* (Deane) Rehder).

Vaccinium angustifolium hybridizes with at least six other North American species, and hybrids are often difficult to identify. Cultivars Northblue and Northcountry are hybrids of *V. angustifolium* and *V. corymbosum*.

Lowbush blueberry is a distinctive species in northeastern North America, differing from the others as follows. It differs from cranberries (*V. oxycoccus*, *V. macrocarpon*) and northern mountain cranberry (*V. vitis-idaea*) in its erect (instead of prostrate) stems, blue (instead of red), berries and non-evergreen (instead of evergreen) leaves. Unlike the bilberry group (sometimes also called blueberries, including *V. cespitosum*, *uliginosum*, *ovalifolium* and *membranaceum*) the flowers and fruit are not single or in pairs in the leaf axils, but rather in crowded clusters. The highbush blueberry (*V. corymbosum*) has larger flowers, mostly over 6.5 mm long, is often taller, reaching 1 m, and does not form extensive low patches. The similar velvetleaf blueberry (*V. myrtilloides*) has densely hairy twigs and leaves that are very hairy below, unlike lowbush blueberry which lacks dense hair. The dryland blueberry (*V. pallidum*) has the leaf margins without teeth (instead of serrated as in lowbush blueberry) and it is more southern, reaching Canada only in southern Ontario. The boreal and high elevation northern blueberry (*V. boreale*) is similar but is a dwarf shrub, not reaching 10 cm in height, and has leaf blades 3–5 mm wide, whereas lowbush blueberry is

generally taller and has leaf blades 6–16 mm wide. Huckleberry (*Gaylussacia*) bushes differ from lowbush blueberry in their resinous leaves (shiny orange resin dots on the lower surface) and the fruits have much larger seeds, and are therefore less attractive to most people.

GEOGRAPHY

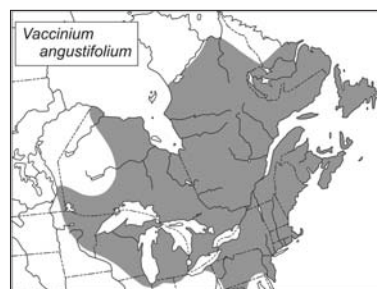


Fig. 18. Canadian distribution of lowbush blueberry (*Vaccinium angustifolium*).

The lowbush blueberry is native to eastern Canada and the northeastern United States. It grows from Newfoundland and Labrador west to southern Manitoba and Minnesota, and south to northern Illinois in the West and New England through the Appalachians to West Virginia and Virginia in the East.

ECOLOGY

Lowbush blueberry occurs typically in both evergreen and deciduous forests, often dominating the understory vegetation. It is an important recolonizer of clearcuts, burns, fields, and pastures. Lowbush blueberry's tolerance of shading allows it to thrive in forests, but when the trees are removed the bushes usually expand vigorously by their spreading rhizomes, and produce a much larger crop of berries. The species is also tolerant of acid rain, and it has been speculated that its presence could increase in boreal forests affected by acid rain.

Habitat

Lowbush blueberry grows in a wide range of habitats. It is found in mixed conifer and hardwood forests, bogs, along sandy riverbanks, on exposed rocky outcrops, in abandoned pastures and clearcuts, and along roadsides. Wet habitats occupied include bogs, swamps, wet depressions, seepage slopes, and the margins of ditches, rivers, and lakes. Dry sites occupied include granite outcrops, sand hills, headlands, meadows, and parklands. The species is most frequent on well-drained loam and clay loams, often with high levels of organic material. The soil pH range is 2.8–6.6, optimally 4.2–5.2. The species occurs from sea level to 1500 m (5000 feet).

Some of the exposed plant communities where lowbush blueberry is common, such as outcroppings of the Canadian Shield in the Thousand Island region of Ontario, appear to change little in species composition or in the amount of lowbush blueberry over a 10 year period. However, an interesting spatial relationship has been observed between blueberry and spreading juniper (*Juniperus communis*). The blueberry plants are displaced by circular patches of spreading juniper, but then the blueberry invades the empty centre of the juniper patches. In the maritime region lowbush blueberry is

more commonly encountered in rapidly changing plant communities, such as old fields where it reaches peak abundance 10–25 years after abandonment.

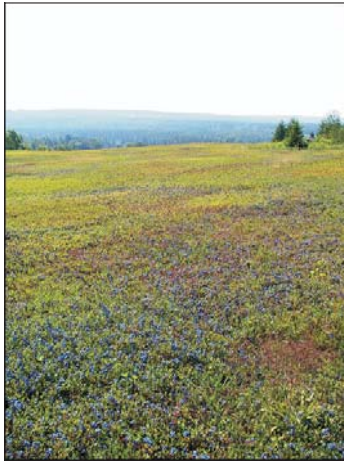


Fig. 19. Field of lowbush blueberry. Source: S. Ferguson, Nova Scotia Department of Agriculture and Fisheries.

Inter-species Relationships

Lowbush blueberry occurs in association with a large number of other plant species, that become significant competitors under certain conditions. Among the most important competitors are the bracken fern (*Pteridium aquilinum*) and sheep-laurel (*Kalmia angustifolia*). Stem growth of the latter after fire exceeds that of lowbush blueberry.

The berries are consumed by dozens of species of birds (including robin, crow, eastern bluebird, and wild turkey) and mammals (including black bear, red fox, raccoon, fox squirrel, red squirrel, eastern spotted skunk, gray fox, chipmunks, red-backed vole, and mice). So important are the berries to black bears that when the blueberry crop is poor, it has been found in some areas that the rate of survival of bear cubs decreases. Flower buds are eaten by ruffed grouse during the winter. The foliage of lowbush blueberry is browsed by white-tailed deer, black bear, and eastern cottontail. As far as growers and harvesters are concerned, the most objectionable feeder is the blueberry maggot (*Rhagoletis mendax*). The adult of this insect is a fly, slightly smaller than a house fly, with black bands across the wings and white lines on the abdomen. It lays eggs beneath the skin of the fruit, and the larvae feed on the fruit, making it unusable for commercial purposes. Regular burning helps to control populations in commercial fields. At least 15 other insects are regarded as important pests.



Fig. 20. Adult female and larva of the blueberry maggot (*Rhagoletis mendax*).

Pollination & Dispersal

Pollination by insects is essential for good fruit set (some clones are self-fertile, others require cross-pollination). Several species of *Andrena* (solitary bees) and *Bombus* (bumblebees) have been reported as important pollinators (e.g. *Bombus terricola*, *B. ternarius*, *Andrena lata*, *A. carlini*, and *Dialictus cressoni*). Most insects visit the flowers to collect nectar, although bumble bees collect pollen. In some areas, widespread use of insecticides has decimated the supply of wild bees, and blueberry growers employ honeybees and alfalfa leafcutter bees to effect pollination.

Wild bees do a better job of pollinating blueberry crops than managed bees (such as honey and leafcutter bees). They visit up to 6.5 times as many flowers in the time it takes a honey bee to visit one. They also carry more pollen and transfer more pollen. However they require adjacent natural habitats for nest sites and other food resources when crops are not available. Thus maintaining adjacent natural habitats not only protects biodiversity within an agricultural landscape; it puts money in the grower's pocket and helps the economy.



Fig. 21. A native andrenid bee visiting a blueberry blossom in a cultivated blueberry crop in the Annapolis valley of Nova Scotia. Photo by Agriculture & Agri-Food Canada biologist Steve Javorek.

The seeds are dispersed by birds and mammals. Deer, mice, chipmunks, and red-back vole have been found to be important short-distance dispersal agents, while the American robin and black bear are effective at long-distance distribution of the seeds. Seedlings are often observed in parts of the Maritime Provinces and in northern Maine, but are rare in eastern Ontario and other parts of the species' range. In many areas, reproduction is primarily vegetative. After fire or other disturbances, sprouts may appear from the stem base, from underground rhizomes, or from unburned belowground portions of aerial stems.

USES

Native North Americans in eastern Canada and the northeastern US were the first to realize the value of lowbush blueberry. The berries were consumed fresh, preserved by drying, baked, added to soups, or mixed with venison and other meats. European settlers also collected the fresh fruit, and used it extensively to prepare jams, jellies, and preserves. With increasing culinary technology, the berries are now also canned, frozen, used to make wine, juice, and incorporated into numerous processed foods, including pastry mixes, ice cream, and yogurt. Blueberries have become the second most popular berry in the United States (strawberries are first). The lowbush blueberry is the second most important commercial blueberry species in North America, after the highbush blueberry (*V. corymbosum* L.).

The colour pigments of blueberries are chemicals called anthocyanins, and these include antioxidants. Antioxidants are needed by the body to fight compounds called free radicals that are formed as a byproduct of breathing, digesting and exercising. Free radicals are believed to be harmful, increasing

the risk of cancer, heart disease, other diseases and premature aging. Blueberries were found to have the highest level of antioxidants in a study by the United States Department of Agriculture of 40 fruits and vegetables. Blueberries are very strongly recommended by nutrition experts.

In some parts of eastern Canada where wild blueberries are common, they are gathered by local people and sold at roadside stalls. The roadside vendors often also sell much larger (averaging twice the size) berries of the highbush blueberry, imported from New Jersey. Knowledgeable consumers will purchase the smaller and tastier wild berries, albeit at a higher price.

Blueberries ship well, and are a favourite fresh dessert eaten alone, topped with cream or liqueurs, mixed in fruits salads and cereals, and used as a topping for waffles and crêpes. As well, syrup, jams, jellies, ice cream, tarts, pies, muffins, cheesecakes, and dozens of other blueberry confections and breakfast pastries are widely enjoyed. Fungy (fungee) is a deep dish blueberry pie, popular for example in Nova Scotia. A “grunt” (also known as a slump) is a colonial American dessert, typically prepared with fresh fruit topped with biscuit dough and steamed in a closed container. Blueberry grunt is a specialty of Nova Scotia and adjacent regions, where wild blueberries grow. To prevent bleeding of the colour into other ingredients during cooking, blueberries should be added at the last minute, and stirred gently, to keep the skins from breaking. More than half of the commercial crop is processed by quick freezing. The fruit may also be canned and freeze-dried, and a pleasant wine can be manufactured. Blueberries are fragile and should be handled carefully. When purchased, they should be consumed promptly. If stored in a refrigerator, where they will keep for a few days, damaged berries should first be removed to prevent the spread of mould.

To a limited extent, lowbush blueberry is grown as an ornamental shrub and hedge. The cultivar Tophat is grown as an ornamental, sometimes as bonsai. Also to a small extent, the species has been used for land cover, notably to rehabilitate areas contaminated by mining and to prevent soil erosion on steep slopes.

CULTIVATION

Lowbush blueberry can be easily propagated using seeds, cuttings, and transplanted rhizomes. However, it is often managed in wild stands, rather than being planted as a horticultural crop like the highbush blueberry (*V. corymbosum*). Although yield may be less for a few years, the cost of planting seedlings may be less than the cost of planting rooted cuttings. Indians in Maine apparently realized that the wild blueberry does not bear fruit well when overgrown with brush and weeds, and burned the area to encourage vigorous regrowth. Commercial fields are burned every second year, thus maintaining high fruit productivity. Lowbush blueberry plants are managed much like garden plants—they are fertilized, and pests are controlled. Most lowbush blueberries are produced in Maine and eastern Canada (especially in Nova Scotia, but also in Ontario, New Brunswick, and Quebec). Only a few cultivated varieties are available. High-yielding clones of lowbush blueberry were developed by the Agriculture &

Agri-food Canada research station at Kentville, Nova Scotia, and by the University of Maine. Cultivars developed at Kentville include: Augusta, Brunswick, Chignecto, Blomidon, Cumberland, and Fundy.

Lowbush blueberries are often harvested in a single picking operation. They are picked by hand raking, using a metal rake that was invented by Abijah Tabutt of Maine in 1822. This looks like a dust pan, the bottom of which is made up of many close-set knitting needles. Most wild blueberries were hand picked using this device until recently, but mechanical pickers are now becoming popular.

A critical factor limiting flower and fruit development is late spring frosts. Temperatures cooler than -2.2°C (28 °F) for 6 hours will reduce flowering and fruiting. Frosts may also reduce fruit set by limiting pollinators.

CONSERVATION STATUS

Lowbush blueberry is a widespread species that is not currently considered in need of conservation protection. In some places, sandy barrens and open woodlands are special and restricted habitats that are home to rare species. Blueberry does well in these habitats, and they have been targeted for blueberry production. However, their conversion to commercial blueberry fields has threatened some of the rare species. For example, species of *Hudsonia* (sand heathers) have declined in the Annapolis Valley of Nova Scotia and in the Lac St. Jean area of Quebec.

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

- North American Indians preserved blueberries in various ways. In northern areas, the Inuit placed the berries in seal oil, or stored them in leather bags deposited in the permafrost. The berries were also dried in the sunshine or by a fire.
- Native peoples of North America used wild blueberries in spiritual ceremonies. The Maliseet valued the berries because they were believed to bring stamina, since they were the food of the bear. Native American Indians in what is now the northeastern United States observed that the stem end of the flower (the calyx) formed a perfect five-pointed star. These “star-berries” were said to have been sent to earth by the Great Spirit to relieve the children’s hunger during a famine.
- Native North Americans taught European settlers how to prepare various blueberry dishes. In 1615, the French explorer Champlain observed Native Americans gathering wild blueberries to make a dish called “Sautauthig.” The Native People would dry the wild blueberries and beat them into a powder that was added to parched meat.
- Native American peoples used blueberries as a source of dye for colouring clothing and basketry.
- Early American colonists made grey paint by boiling blueberries in milk
- The juice of blueberries is white.
- Blueberries will not ripen after they are picked.
- Blueberries are about 85% water.



Fig. 22A Using a blueberry rake to harvest lowbush blueberry (*Vaccinium angustifolium*)
 B. a blueberry harvester Source: S. Ferguson, Nova Scotia Department of Agriculture and Fisheries

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