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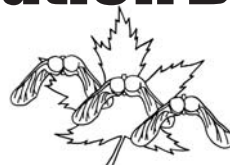
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The Canadian Botanical Association Bulletin



Bulletin de l'Association Botanique du Canada

March/Mars 2010. Volume 43 No.1/N°1



Society for the Preservation of Natural History Collections & Canadian Botanical Association Joint Conference

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

REGISTRATION AND CALL FOR PAPERS

Early bird registration ends March 31, 2010.

Full conference details:

<http://www.spnhc-cba2010.org/>

Keynote Address

Paul Hebert, University of Guelph *A Census of All Life*

Plenary Session

A Panel on Biodiversity Informatics Megastrategies: A Global Vision

Moderated by: James Macklin, Harvard University Herbaria

- Guy Baillargeon *Canadian Biodiversity Information Facility (CBIF)*
- Walter G. Berendsohn *European Biodiversity Informatics Initiatives*
- Penny Berents *Atlas of Living Australia*
- Anne Bruneau *Canadensys*
- John R. Wiczorek *American Bioinformatics Initiatives*

Scientific Symposia

- Dispersal in Fungi and Plants Co-sponsored by the CBA/ABC Mycology Section & Systematics and Phytogeography Section
- Roles and Status of Canadian Herbaria Co-sponsored by the CBA/ABC Mycology Section & Systematics and Phytogeography Section



SPNHC
ADVANCING COLLECTIONS CARE



Canadian Museum of
Musée canadien de la
NATURE

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, **43(2)**, must be received **before August 14th 2010**

La date de tombée des textes du prochain numéro, le no **43(2)**, est le **14 août 2010**

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Scientific Symposia (Continued)

- Plant-Insect Interactions Sponsored by the CBA/ABC Plant Development Section
- Data Recording: Legacy for Biodiversity Conservation Sponsored by the CBA/ABC Ecology and Conservation Section
- Is There a Future for Plants? The UN Biodiversity Convention's Global Strategy for Plant Conservation Organized by Danna Leaman & David A. Galbraith

Weresub Lecture

Irwin Brodo, Canadian Museum of Nature *Travels with a Lichenologist*

Special Lecture on Teaching

Kate Frego, University of New Brunswick *Calling or Culling: The Influence of our Teaching Metaphors*

Panel Discussion on Teaching:

Best Botanical Teaching Practices: Reaching Students in the Classroom, Lab, and Field. See details under the Teaching section news.

Workshops *Space is limited! Sign up now!*

- Lichen Identification Irwin Brodo & Pak Yau Wong (Canadian Museum of Nature)
- Georeferencing John R. Wieczorek, Carol Spencer, and Heather Constable (University of California, Berkeley) & Peter Desmet (Canadensys)
- Designing Facilities for Fluid Preserved Collections Walt Crimm (Ewing Cole-RDLA), Clare Valentine (Darwin Center, Natural History Museum, London) & Robert Waller (Canadian Museum of Nature)

Field Trips & Collections Tours. *Space is limited! Sign up now!*

- Five full-day field trips on Tuesday, June 1st.
- Two half-day collection tours on Tuesday, June 1st
- One full-day, post-conference field trip on Saturday, June 5th

Social Events

- Icebreaker Soirée
- CBA-ABC Mixer at the Canadian Museum of Nature's newly-renovated Victoria Memorial Building
- CBA Banquet Food, Society Awards, and a Dinner Lecture
Dr. Nancy Turner, University of Victoria *Lucille Clifton's Feasts: Reflections on Biocultural Diversity in Western Canada*

See you in Ottawa!

With 2010 declared "The International Year of Biodiversity" by the United Nations, this gathering of natural history collection professionals and botany specialists will offer many exciting opportunities for "cross-fertilization" of ideas and transfer of knowledge between participants.g

The Editor would like to thank Mr Jerry Gemakas, formerly of Custom Copy in Peterborough, for all his helpful comments over the past few years. His attention to detail has been remarkable, and I have learned a great deal from him. Thank you Jerry!

Association News

The CBA needs YOU ! Consider serving on our Board!

Nominations are invited for the following positions each of them for a 2 year term:

- Treasurer
- Two directors representing Eastern Canada
- Two directors representing Western Canada

These terms will begin at the end of our next AGM in June 2010.

Please send your nominations (or expression of interest) to: Christian Lacroix, Dean of Science, University of PEI

550 Univ. Ave, Charlottetown, PE C1A 4P3

E-mail: lacroix@upe.ca



I'ABC a besoin de VOUS ! Devenez un membre de notre conseil

D'administration. Un appel de candidatures est lancé pour les postes suivants, chacun d'une durée de deux ans:

- Trésorier
- Deux directeurs représentant l'est du Canada
- Deux directeurs représentant l'ouest du Canada

La période de service pour chaque poste débutera à la fin de la réunion annuelle générale en juin 2010.

Veuillez faire parvenir vos nominations (ou nous communiquer votre intérêt à soumettre votre candidature) à: Christian Lacroix, Dean of Science, University of PEI, 550 Univ. Ave, Charlottetown, PE C1A 4P3 e-mail: lacroix@upe.ca



Announcing the
Joint meeting of the
CSHS, CSA, CSPP, CWSS, CPS and CBA
Nova Scotia July 17-21 2011
www.plantcanada2011.ca



News from the sections

Mycology

Our section is collaborating with the Systematics and Phytogeography Section to co-sponsor two symposia at the Ottawa meeting. The symposium on 'Roles and Status of Canadian Herbaria;' will be held on the morning of June 3rd 2010 and is described under the Systematics and Phytogeography Section news. The other symposium, to be held on the afternoon of June 2nd 2010, is "**Dispersal in Fungi and Plants,**" and will feature four speakers:

Dispersal in Fungi and Plants

- 1) **Andre Lachance** - Floricolous yeasts and the microbial ubiquity model
- 2) **Keith Seifert** - The grey zones of microbial dispersal: The importance of collections, databases and taxonomists for understanding biological invasions
- 3) **Michael Windham** - A peek inside the black box: investigating factors affecting long-distance dispersal and sporophyte establishment in seed-free vascular plants
- 4) **Joe Ackerman** - The physical ecology of pollen dispersal



Photo: C Maxwell

We hope that you also come to the conference excited to attend the mycology section's annual meeting and lunch at noon on Wednesday June 2nd 2010.

Co-chairs Hugues Massicotte and Shannon Berch

The Systematics and Phylogeography Section

Our section, in collaboration with the Mycology Section, is co-sponsoring two symposia at the Ottawa meeting. By collaborating in this way the chairs of the two sections hope to provide fungal and plant systematists, and biologists generally, with stimulating presentations on important research areas common to both clades (plants and fungi, not systematists and biologists; the latter two form a single monophyletic group) and on important issues affecting systematic collections generally, and plant and fungal herbaria in particular.

The first of these, to be held on the afternoon of June 2nd 2010, is "Dispersal in Fungi and Plants," is featured on page 3. The second, to be held on the morning of June 3rd 2010, is "Roles and status of Canadian Herbaria," and features the following program:

- (1) **Mary Berbee** (UBC) - "Capturing the missing diversity among BC fungi and a plan to build understanding of fungal below ground ecology"
- (2) **Dan McDevit** (UNB) - "Acquiring DNA sequence data from dried archival (type) red algal collections for the purpose of applying specific epithets to contemporary molecular species: a critical assessment"
- (3) **Jacques Cayouette** (CMN) - "Changing values of Canadian herbaria from the 19th to the 21st century"
- (4) **Deb Metsger** (ROM) - "Tapping the international herbarium network to 'plant' Life in Crisis: the Schad Gallery of Biodiversity, at the ROM"
- (5) **Hugo Cota-Sanchez** (USASK) - "Herbarium data management and display using SPECIFY"
- (6) **Mary Barkworth** (Utah State University) - "Less commonly known uses of herbaria"
- (7) **Luc Brouillet** (IRBV) - "Assessing the state and trends of biodiversity sciences (taxonomy and collections) in Canada: An introduction to the Council of Canadian Academies' Expert Panel process"
- (8) **Chris Sears** (UBC) - "How Canadian herbaria are being utilized in the 21st century"
- (9) Questions and comments from the audience for the speakers

Section members should also mark their calendars so as to attend the section's annual meeting and lunch, to be held at noon on Wednesday 2 June 2010. We will need to discuss plans for future meetings, and ensure that we have judges for the next round of Cinq-Mars and Porsild competitions. Regarding the Porsild competition, I urge members to consider nominating graduate students (current and recently graduated) for the Porsild Award.

The Alf Erling Porsild Award is awarded annually, when suitable candidates are available, in recognition of the best paper published in the field of systematics and phylogeography that year by a graduate student in a Canadian university or a Canadian student in a foreign university; membership in the CBA/ABC is /not/ required. The work should be published while the author is still a graduate student or be based on work done while a graduate student, and published within two (2) years of graduating. Judges for this year's Porsild Prize will be Suzanne Warwick, Marian Munro, and Mihai Costea. Consideration for the 2010 Porsild prize will be given to papers published during the calendar year 2009 (papers appearing in 2010 should be nominated for the 2011 prize).

Nominations may originate with anyone (student, supervisor, co-author, etc.) but must conform to the terms of reference for CBA/ABC student awards, available online (www.cba-abc.ca/awards.htm) and modified as follows in order to make the nomination process as paperless as possible: - Submit the nomination by e-mail to the Chair of the CBA/ABC Systematics and Phylogeography Section (i.e. to tim.dickinson@utoronto.ca) by the 1 April 2010 deadline in the form of the following e-mail attachments:

- The paper in question, in the form of a .pdf file.
- A letter of nomination. If from the student's supervisor, or a co-author, then this letter must include an indication of the extent to which the paper is the student's own work, with an indication of the nature and extent of the contributions made by the supervisor or any co-authors.
- If the nomination originates with the student or someone other than the supervisor or a co-author, and is for a multi-authored paper, then the nomination should include a statement from a co-author or the supervisor indicating the extent to which the paper is the student's own work, with an indication of the nature and extent of the contributions made by the supervisor or any co-authors.

In all cases, the expectation is that the student should have done the majority of the research and the writing of the paper. Hardcopy will be accepted only in exceptional circumstances where a .pdf file of the paper is unavailable. In such cases the supporting documents should be submitted electronically, together with a brief explanation of why the .pdf file was unavailable. Last year by the time the deadline arrived there were only four nominations. This year I hope that we will have more than that.

Tim Dickinson, Section Chair

Ecology Section

The combined Ecology Section and Conservation committee has agreed for the 2010 conference to continue on some of the themes and activities that were initiated at the successful CBA 2009 meeting. Here are some of the elements:

1. Half day symposium on Data Recording : Legacy for Biodiversity Conservation. This symposium will examine the issues regarding data recording and information databases from the perspectives of field ecology to museum collection and information networks. We invite abstracts in these fields.
2. A follow up of the round table discussion on Species at Risk and Conservation. This year's discussion will address the question: Re-introduction - When, How and Where? with a focus on the issues and conditions when re-introduction is being considered in sites where a species has been extirpated. Stay tuned for the time and place. Come share your views and questions on this important topic.
3. A session for students... following the success of last year's session on "Life after graduation", a new panel will be organized for this 2010 meeting. We invite any suggestions on topics that students would like to discuss.

Liette Vasseur and Adrienne Sinclair

Development section

For the forthcoming SPNHC-CBA meeting in Ottawa, we are simply calling this symposium "Plant-Insect Interactions". It is being organized on behalf of the Development Section of the CBA, and is scheduled for the afternoon of Thursday, June 3rd.



Plant-Insect Interactions

Dr. Joseph Shorthouse, Laurentian University, Sudbury, ON - "Manipulation of plant development by cynipid wasps attacking Canada's wild roses"

Dr. Reinhard Jetter, University of British Columbia, Vancouver, BC - "Slippery plant surfaces: from chemistry to ecology"

Dr. Art Davis, University of Saskatchewan, Saskatoon, SK - "Flower development and nectar production in relation to insect pollination"
Photo: *Diplolepis bicolor* by Joe Shorthouse

Teaching section

The teaching section invites you to take part in the teaching-related activities planned for the upcoming conference.

Special Lecture on Teaching

Dr. Kate Frego of the University of New Brunswick, St John campus, and winner of a 3M Teaching fellowship in 2008 will be presenting a special lecture at the conference, hosted by the CBA-ABC Teaching Section. All are invited to attend!

Calling or Culling: The Influence of our Teaching Metaphors

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

***Please note** Kate would like to ask the botany educators to drop me a short email briefly describing their current metaphor for teaching, with a brief explanation of what that means (or why they chose it). Frego@unbsj.ca



Dr Kate Frego

Teaching Panel Discussion

The CBA-ABC Teaching Section is proud to host this Panel Discussion. The panelists from institutions across Canada, all of whom have been recognized for teaching excellence, will discuss aspects of teaching and learning as these processes occur in different settings and will engage the audience in discussion of ideas and technologies that work in three different teaching environments.

Best Botanical Teaching Practices: Reaching Students in the Classroom, Lab, and Field

The panel, moderated by Frédérique Guinel (Wilfrid Laurier University) and Vipen Sawhney (University of Saskatchewan):

- Mihai Costea, Wilfrid Laurier University
- Art Davis, University of Saskatchewan
- Kate Frego, University of New Brunswick
- Larry Peterson, University of Guelph
- Jane Young, University of Northern British Columbia

Please join us for the Teaching section meeting, scheduled for 5pm on Wednesday June 2.
Cindy Ross Friedman, Section Chair.

Regional Undergraduate Conferences.

The APICS (Atlantic Provinces Council on the Sciences) Undergraduate Biology Conference took place on March 5-7, 2010, at the University of New Brunswick in Fredericton, New Brunswick. See page 20 for winners. The 2010 Ontario Biology Day will be held at York University on March 13-14, 2010. The "British Columbia Regional University Science Undergraduate Conference" is going to be at the University of the Fraser Valley on Friday, March 26, 2010.

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

Carissa Brown
Northern Plant Ecology Lab
Department of Biology, University of Saskatchewan
112 Science Place
Saskatoon, SK S7N 5E2
[Http://www.usask.ca/biology/johnstone/](http://www.usask.ca/biology/johnstone/)

"...Above the level of organism extends a hierarchy of increasingly inclusive ecosystems, building from the local to the regional and on to the ultimate culmination in the all-encompassing world ecosystem..." J. Stan Rowe, 1961 (Ecology 42:420-27)

J. Stan Rowe was an eminent plant ecologist who spent the majority of his academic career at the University of Saskatchewan. A new plant ecology research lab has recently been set up at the University of Saskatchewan that is developing new research in topics that were of keen interest to Rowe, such as boreal forest dynamics and disturbance ecology. The Northern Plant Ecology Lab (NPEL) in the Department of Biology was started in 2006 by Dr. Jill Johnstone. Research in the NPEL is focused on the interacting roles of climate change and disturbance in driving the future dynamics of northern ecosystems. Our research emphasizes successional dynamics, landscape processes, and the critical role of initial community assembly in shaping subsequent successional pathways. New research in our lab includes investigating landscape patterns of resilience of the boreal forest as mediated by threshold changes in organic layer depths, soil thermal regime, and vegetation composition, and the role of plant-soil-disturbance interactions in limiting species range expansions from boreal into tundra plant communities. We have a number of projects in tundra and arctic systems that address these research interests:

1. The Effects of Soil Warming and Nutrient Increase on Plant Productivity in Alpine Tundra

Recently, Jill and her colleagues have been developing a new experiment to focus on plant-soil processes that may regulate invasion of boreal forest into tundra. This research will be investigated in part by Kirsten Allen as part of her M.Sc. degree. Kirsten will be quantifying the effects of soil warming and fertilization on nutrient cycling and plant growth to determine how soil processes may mediate future changes in northern plant communities. This research will be carried out in alpine habitat in south-central Yukon, near Whitehorse.

This is Jill's newest project in the NPEL, and one that she will be working on in the field this summer. Jill first developed an interest in northern ecosystems when studying at Middlebury College with Dr. Bill Howland. After completing a M.Sc. degree in arctic plant ecology at UBC with Dr. Greg Henry, Jill spent 10 years living and working in the North. During this time, she completed a Ph.D. at the University of Alaska Fairbanks (UAF) with Dr. F. Stuart (Terry) Chapin, III, studying fire effects on boreal forests. Jill began her position as assistant professor at the University of Saskatchewan in 2006. She is involved with research projects associated with the International Polar Year, US Joint Fire Science Program, and the Bonanza Creek Long Term Ecological Research program in Alaska.

Kirsten is the newest member of the NPEL, but is not a stranger to the University of Saskatchewan. Kirsten was raised on a bison ranch in Debden, SK, and completed her B.Sc. degree in biology with a minor in physical geography.

Right: Field work at the Arctic Circle.



Jill Johnstone with *Salix* plant and root.

She first became interested in northern ecosystems while working as an environmental technician in northern Saskatchewan.

2. Fire, climate, and black spruce regeneration in the forest-tundra

Fires in many areas of the boreal forest are expected to become more frequent as the climate warms. Northern black spruce require several decades to become reproductively mature; therefore a reduction in the fire return interval may interrupt the cycle of post-fire self-replacement for this dominant boreal conifer. The main objective of Carissa Brown's Ph.D. research is to investigate how an altered fire return interval can drive vegetation shifts in black spruce forests near treeline in northern Yukon. Preliminary results indicate that black spruce seedling recruitment was drastically reduced following two closely timed fires. Increases in fire activity may thus lead to a degradation of treeline forests in some areas, rather than the increased tree density and forest extent predicted with climate warming. As part of her M.Sc. degree, Jayme Viglas is studying the effects of stand age on seed production and potential post-fire recruitment of black spruce in the north Yukon and interior Alaska. Both projects are part of the International Polar Year Project PPS Arctic Canada (<http://pps-arctic.sres.management.dal.ca/index.html>). Before joining the NPEL, Carissa completed her B.Sc. degree at Lakehead University and her M.Sc. degree at Carleton University, in conjunction with the Canadian Wildlife Service. Carissa's interest in northern plant ecology began while growing up in Thunder Bay, Ontario, and has

grown to the point-of-no-return after three field seasons in northern Yukon. She plans to continue working in northern ecosystems during her post-doc research, and beyond. A native of Saskatchewan, Jayme became interested in northern treeline systems while working as an undergraduate research assistant on Carissa's project. Following her B.Sc., Jayme worked as a biologist for a local consulting company, conducting vegetation and fisheries surveys in the boreal forest of northern Saskatchewan. Jayme will be completing her black spruce germination trials and tree-ring analyses over the next term, and plans to finish her degree in the next year.



Nicole Wunderlich collecting treeline black spruce cones



Black Spruce seedling growing in a burned area

3. Coastal dune succession and forage quality on Sable Island, Nova Scotia

Not all research in the NPEL takes place in northern Canada. Emily Tissier, a M.Sc. student in the NPEL, is examining successional processes in the coastal dunes of Sable Island, Nova Scotia. She plans to associate particular vegetation traits to optimal forage for the feral horses on the

island. Linking vegetation patterns to succession will allow for predictions of how forage quality and habitat use may change with future disturbance on the island. This research is being conducted in conjunction with Dr. Phil McLoughlin, Emily's co-supervisor, who studies the feral horse populations on the island.

Emily is originally from France and completed her undergraduate studies at the University of Minnesota. She worked at the University of Alaska Fairbanks for several years as a Research Assistant, where she first became familiar with Jill's research. During this period, Emily was involved with several projects investigating the roles of fire and climate change on northern ecosystems. She is fascinated by disturbance ecology and succession, which are primary themes for her M.Sc. project. Emily will be heading back to Sable Island this summer for her second season of field work.

4. Recently completed projects

Two of Jill's M.Sc. students successfully defended their theses recently. Sara Pieper studied the response of alpine tundra vegetation to variations in climate in the mountains of south-central Yukon near Whitehorse. Sara now has a contract position with the Canadian Wildlife Service. Nicole Wunderlich's research looked at revegetation of industrial disturbances in the low arctic tundra of the Mackenzie Delta, NWT. Nicole is currently working as a Departmental Assistant for Biology at the University of Saskatchewan.

Recent and Upcoming Papers

- Johnstone, J.F., Hollingsworth, T.K.N., Chapin, F.S., III, and Mack, M.C. (2010) Changes in fire regime break the legacy lock on successional trajectories in Alaskan boreal forest. *Global Change Biology*, in press.
- Boby, L., Schuur, E.A., Mack, M. C., Verbyla, D., and Johnstone, J.F. (2010) Quantifying fire severity, carbon, and nitrogen emissions in Alaska's boreal forest: The adventitious root method. *Ecological Applications*, in press.
- Johnstone, J. F., Chapin, F.S., III, Hollingsworth, T. N., Mack, M. C., Romanovsky, V., and Turetsky, M. (2010) Fire, climate change, and forest resilience in interior Alaska. *Canadian Journal of Forest Research*, in press.
- Brown, C.D., and Boutin, C. (2009) Linking past land use, recent disturbance, and dispersal mechanism to forest composition. *Biological Conservation* 142: 1647-1656.
- Johnstone, J.F., Boby, L., Tissier, E., Mack, M.C., Verbyla, D.L., and Walker, X. (2009) Post-fire seed rain of black spruce, a semi-serotinous conifer, in forests of interior Alaska. *Canadian Journal of Forest Research* 39: 1575-1588.
- Brown, C.D., and Johnstone, J.F. Increased carbon losses from short interval fires in northern boreal forest. In preparation.

The Journal Botanica Serbica (eISSN: 1821-2638, ISSN: 1821-2158) is an open access journal that provides biannually publication of articles in all areas of the subject and easy access to your study. The latest issue is 33(2)!

The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. BS is dedicated to increasing the depth of the subject across disciplines with the ultimate aim of expanding knowledge of the subject. All articles published in BS will be peer-reviewed. Following acceptance, a paper will normally be published in the next available issue. Please, visit the Journal web page for more information at <http://botanicaserbica.bio.bg.ac.rs>

Botanica Serbica Editorial Team

NATIVE PLANT EMBLEMS OF CANADA

12. Yukon¹

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: Fireweed



Fig. 1. Fireweed (*Chamerion angustifolium*). Photo courtesy of Government of Yukon.

SYMBOLISM

The hardiness and attractiveness of the ubiquitous fireweed make it a natural botanical representative of Yukon. Dazzling blankets of magenta or pink flowers along the sides of roads and mountains always impress visitors to the territory, and the displays are evident for many weeks during the summer and fall, from June to August. The ability of the plant to beautify areas that have been denuded by natural disasters and man-made disturbances reflect well on the people who have chosen to live with the challenges of Canada's north.

Yukon is both tough and beautiful...like fireweed.

"This is the law of the Yukon, and ever she makes it plain:
Send not your foolish and feeble; send me your strong
and your sane ..."

Robert Service in The Law of the Yukon

"Some say God was tired when He made it,
Some say it's a fine land to shun;
Maybe; but there's some as would trade it
For no land on earth and I'm one."

Robert Service in The Spell of the Yukon



Fig. 2. The Yukon flag, showing fireweed at the base of the central, white vertical panel.

1 "Yukon" or "The Yukon"?

"When the Yukon Act came into effect in 2003, in legal documents references to the government, its departments and officials became 'Yukon'. It is no longer Yukon Territory or The Yukon Territory.

HOWEVER, and this is direct from the communications officer of the Executive council Office: 'in speech, correspondence and in media coverage, it is a matter of style and preference.' 'Yukon' or 'the Yukon' are both acceptable."

Ryerson Review of Journalism, Dec. 23, 2008: <http://www.rrj.ca/online/761/>

"In body text, either 'Yukon' or 'the Yukon' is acceptable. However, Yukon-specific article, category and list titles should always use the form *Yukon* **without** the word *the*. For the Northwest Territories, however, the preferred form is the *Northwest Territories* in article text and in the titles of list articles, but geographic articles about the Northwest Territories (e.g. Ukuhaktok, Northwest Territories) do *not* use the word *the* in the title."

Wikipedia Manual of Style: [http://en.wikipedia.org/wiki/Wikipedia:Manual_of_Style_\(Canada-related_articles\)](http://en.wikipedia.org/wiki/Wikipedia:Manual_of_Style_(Canada-related_articles))

LATIN NAMES

Chamerion angustifolium (L.) Holub is a name that has been adopted recently. The species is known in most of the North American literature as *Epilobium angustifolium* and in much of the European literature as *Chamaenerion angustifolium*. The reason for the name change is discussed below.

The genus name *Chamerion* is based on the Greek *chamai*, dwarf + *nerion*, oleander; fireweed does have narrow leaves like the ornamental oleander shrub. *Angustifolium* in the scientific name is from the Latin *angustus*, narrow + *folium*, leaf, indicating that the species has narrow leaves.

ENGLISH NAMES

Fireweed. Also: common fireweed, perennial fireweed, narrow-leaved fireweed, great willow-herb, spiked willow-herb, rosebay willow-herb, French willow, blooming Sally, wild asparagus, pink tops, purple rocket, wickup, wicopy.

The name fireweed usually refers to *Chamerion angustifolium* in North America, but in some parts of the world other species quickly colonize fire-ravaged areas, and are also known as fireweed. The name wild asparagus results from consumption of the young shoots which are sometimes eaten like asparagus. The willow in some variants of the name refers to the willow-like shape of the leaves; in Europe the plant has been called flowering willow, French willow, Persian willow, and rosebay willow. The name Sally is a corruption of *Salix* (the willow genus), still another reference to willow-like leaves. The name rosebay is a reference to the rosy flowers and the (allegedly) bay-like leaves (bay is the culinary plant *Laurus nobilis*).

FRENCH NAMES

Épilobe à feuilles étroites. Also: asperge, bouquet rouge, bouquets rouges, herbe à feu, lilas de montagne. In France: épilobe en épi, osier fleuri, laurier de Saint-Antoine.

HISTORY

a. Canada

Fireweed was chosen as the floral emblem of the Yukon Territory by members of the Yukon Territorial Government on March 27, 1957, and the choice was made official by an ordinance on Nov. 16, 1957. The prairie crocus had also been under consideration, but was rejected because it is the official flower of Manitoba (see #8 of this series).

b. Foreign

It appears that no other political region of the world has employed fireweed or any of its close relatives as an official symbol.

APPEARANCE

Fireweed is a robust perennial herb, 1-3 m (3-10 feet) tall, with erect, reddish stems which are somewhat stout and slightly woody. The plant is topped by a long inflorescence of very attractive purple or pink (rarely white) flowers with petals 1-2 cm (5/8-3/4 inch) long. The alternate, lance-shaped leaves are 3-20 cm (1-8 inches) long, and character



Fig. 3. Flowering and fruiting shoots and details of flower, fruit, and seed of fireweed (*Chamerion angustifolium*). Source: Hallier, E.H. 1885. Flora von Deutschland, edition 5 of D.F.L. von Schlechtendal et al. F.E. Köhler, Gera-Untermhaus, Germany. Vol. 22, plate 2256.

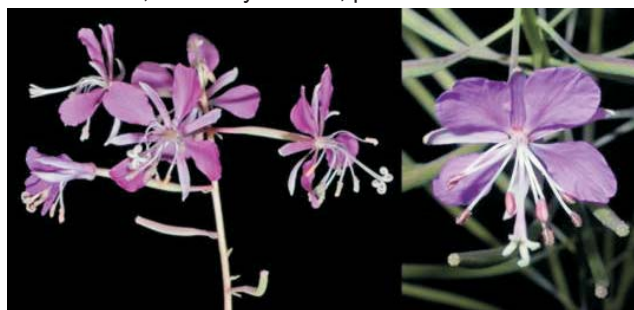


Fig. 4. Close-up photos of flowers of fireweed (*Chamerion angustifolium*), courtesy of G.D. Carr. The plants were growing near Cheney, Spokane Co., Washington State, on July 17, 2003.

characteristically reticulate-veiny on the lower surfaces. The flowers have four petals. The slender fruit is a linear capsule that splits from the apex. It is 5-8 cm (1-3 inches) long, and contains many brown seeds. The seeds are 1-1.3 mm (about 1/20 inch) long, and have a tuft of fine, white hairs at the apex.

CLASSIFICATION

Family: evening primrose family (Onagraceae). Until the early 1990s, the genus *Epilobium* was generally considered to comprise about 170 species, including fireweed. Molecular analysis (see Baum et al. 1994) showed that eight species now placed in *Chamerion* are well separated from the remaining species, now left in *Epilobium*.

All eight species of *Chamerion* are perennial herbs, restricted to the Northern Hemisphere, six of them native only to Eurasia. *Chamerion angustifolium* and the closely related *C. latifolium* (L.) Holub are circumboreal/circumarctic. The genus name *Chamaenerion*, which had also been employed, is not acceptable under the rules of nomenclature. For an authoritative review of the taxonomy of *Chamerion* and its relatives, see Wagner et al. (2007), cited below.

Chamerion angustifolium varies geographically in size and leaf shape, leading to past recognition of poorly defined varieties. In North America, *C. angustifolium* subsp. *angustifolium* Mosquin is characterized by small to medium-sized leaves lacking pubescence on the ribs of the lower side of the leaves, triplicate (3-pored) pollen grains, and a chromosome number of $2n = 36$. By contrast, subsp. *circumvagum* Mosquin has small to very large leaves with glabrous to densely pubescent leaf ribs, quadriplicate (4-pored) pollen as well as triplicate, and a chromosome number of $2n = 72$. Subspecies *angustifolium* occurs in the arctic, boreal, and cordilleran regions of Canada, south to the approximate southern border of the boreal forest, while subspecies *circumvagum* occupies the area to the south and east. Plants with white petals and sepals are occasionally seen and may occur together in numbers. They have been recognized as f. *albiflorum* (Domort.) Haussk. Another unusual color form is f. *spectabile* (Simmons) Fern. which has white petals with contrasting bright red sepals.

Chamaenerion latifolium is often called broad-leaved fireweed (also river-beauty). Natural hybridization between it and *C. angustifolium* has been reported but is apparently rare. The former is the only species likely to be confused with *E. angustifolium* in North America and they can be separated as follows:

- 1a. Stems solitary or few, erect 0.1-3 m (mostly 1-2 m) long (tall); leaves membranous, reticulate-veiny beneath; petals 1-2 cm long; style pilose at base, longer than stamens; seeds 1-1.3 mm long *C. angustifolium*
- 1b. Stems numerous, tufted, depressed or arched, less than 0.5 m long; leaves fleshy, not veiny; petals 1.8-3 cm; style glabrous at base, much shorter than stamens; seeds approx. 2 mm long *C. latifolium*

GEOGRAPHY

Fireweed occurs in all Canadian provinces and territories. It is also widely distributed in the U.S., except the southeastern states and Texas. The species is circumboreal, occurring widely in Eurasia.

ECOLOGY

Fireweed dominates many plant communities undergoing succession. It is common in streamside and upland habitats, and in logged and burned areas. This species is adapted to rapidly colonize newly disturbed habitats, especially where moist mineral soil is laid bare and considerable light is available.

Despite the "weed" in fireweed, this species is usually not a problem. Competition with conifer seedlings in revegetating burned land, and serving as the alternate host of conifer



Fig. 5. A rare white form of fireweed (*Chamerion angustifolium*), at Churchill, Manitoba. Photos courtesy of Joy Viola and Bugwood.org.



Fig. 6. Canadian and adjacent United States distribution of fireweed (*Chamerion angustifolium*).

rusts have been noted as potential difficulties for forest managers. Fireweed has also been observed as a weed of some vegetable crops in northern regions.

Habitat

Although fireweed can tolerate considerable shade, it grows well only in open locations. In North America it characteristically grows on gravelly, acidic soils, pH varying from as low as 3.5 to circumneutral, but the plant also tolerates somewhat basic soils. Favourite habitats include coniferous and mixed forests, aspen parklands, grasslands, and muskegs, disturbed regions such as cut-over or burned forests and swamps, avalanche zones, riverbars, embankments of highways, and railways, waste places, and old fields.

Inter-species Relationships

Numerous wild mammals (including moose, caribou, elk, deer, mountain goats, muskrats, and hares), and some wild birds graze on fireweed, which is moderately nutritious and

Behind the Beauty

Fireweed transforms a burned black and grey landscape into a rolling pinkish sea extending to the horizons. The visual impact and the strength of natural rejuvenation are compelling. But fireweed is also a key player in the dynamic rebirth of the boreal forest, which is forever locked in a cycle of destruction and regeneration. Fires are a natural process occurring in different places at different times. Fireweed is the first stage in a succession of habitat and vegetation changes that culminate in the restoration of the original forest. Mature boreal forests contain only a fraction of the biodiversity of the boreal forest ecosystem. Most biodiversity is distributed among the series of changing habitats that follow fires. Fireweed is the most important of many plants and animals that are uniquely adapted to early post-fire situations. Many of these are virtually absent from the mature forest. Without fire and the resulting gradient of habitats beginning with the fireweed community, biodiversity in the boreal forest would be greatly reduced.



Fig. 7. Fireweed (*Chamerion angustifolium*). Source: Canadian Heritage. 2002 (revised edition). Symbols of Canada. Canadian Heritage, Ottawa, ON. Reproduced with permission

palatable. Fireweed will also be consumed by domestic livestock, although it is considered only fair as forage. The seeds are eaten by small mammals such as chipmunks. Hummingbirds are attracted to the nectar. Butterflies and bees collect both the nectar and pollen. Hundreds of insect species have been documented feeding on fireweed.

Pollination & Dispersal

Inbreeding depression (reduced fitness following self-fertilization) is sometimes extreme in fireweed, making cross-pollination very important. Individual flowers mature their pollen before the stigma is receptive, to prevent selfing. Bees, moths, and butterflies are important pollinators of fireweed. They characteristically move from the bottom towards the top of the flowering stem. The insects first deposit pollen on the older, lower flowers, which have receptive stigmas, but receive no pollen from them since their pollen was released earlier. Then, they acquire pollen from the younger, upper flowers, which have not yet opened their stigmas.

The two North American subspecies sometimes grow together, and population biologists have been interested in

studying how they can coexist and remain distinct. Most hybrids are sterile. Hybridization between the two is difficult, partly because they differ in chromosome number, and partly because they differ in flowering time. Additionally, pollinators behave differently on the two subspecies.

The seeds have a tuft of long hairs at one end, which serves as a sail for wind distribution. The extremely numerous seeds produced can be carried by wind for hundreds of kilometers. A Swedish study revealed that up to half of the seed disperses over the landscape more than 100 m (328 feet) above the ground. Humidity expands the diameter of the seed hairs, decreasing loft, an adaptation which tends to deposit the seeds in humid areas and during wet periods, thus ensuring adequate moisture for germination. The seeds are non-dormant and short-lived, rarely remaining viable for more than 3 years, and generally germinating as soon as a suitable site is found. Although seeds account for the remarkable ability of fireweed to colonize new areas, once germination occurs, vegetative reproduction by rhizome spread becomes more important than sexual reproduction for propagating the plant at a given site. Fragmenting the rhizomes stimulates production of shoots, as with dandelions, contributing to the reputation of fireweed as a hard-to-eradicate weed. Most of the rhizomes and roots occur in the top 5 cm (2 inches) of mineral soils, and this underground portion can survive relatively intense fires. Indeed, the rhizomes sprout new shoots vigorously a few weeks following destruction of the old shoots. Young plants overwinter as rosettes. The aboveground shoots of older plants are killed by frost, but the plants overwinter as rhizomes.

USES

Food. The most important agricultural significance of fireweed is as a honey plant, providing considerable nectar to bees. Near Seattle, Washington, fireweed is common and beekeepers in the area market "fireweed honey" as a specialty item. Indeed, in the past, beekeepers in coastal Washington and Oregon often set up their hives in areas that were being colonized by fireweed. Indigenous people in both the Old and New Worlds have used fireweed as food, for example the young shoots consumed as greens, the leaves used to make tea, the petals made into jelly, and the roots eaten as a vegetable. In Russia, fireweed leaves are still used as a tea called "Kaporie tea". The Russian name *Ivans tea* also reflects the use of fireweed for tea in Russia. (The high tannin content suggests that consumption of fireweed tea should be limited. As is well-known, tannins in common tea are denatured by adding milk, a practice that is medically sensible.)

Fig. 8. Painting of the official flower of Yukon, fireweed (*Chamerion angustifolium*), 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.



Fibre. An antiquated use of the plant was the incorporation of the down of the seeds into cotton and fur to make clothing. Native Americans in the Pacific Northwest employed the stem fibres to make twine and fishnets.

Reclamation. The species is widely used for revegetation and soil stabilization of northern and alpine disturbed sites, such as mined lands, roadways, and logged areas. It is also useful for providing plant cover where oil spills have occurred, as well as for strip-mined areas and mine spoil deposits.

Medicines & Cosmetics. Native Americans employed fireweed juice to soothe skin irritation and burns, a practice also found in European herbal medicine. In both European and North American folk medicine, fireweed has been used as tea to relieve stomach upset, respiratory complaints (including whooping cough and asthma), and constipation. These uses could be explained by the high tannin content (and therefore astringency) of fireweed, or by the presence of antiseptic, healing compounds. Commercial creams, lotions, after-sun products, after-shave products, and baby care products that include fireweed extracts have been introduced to the marketplace in recent years

CULTIVATION

Fireweed is occasionally grown as an ornamental, admired for its easy cultivation, spectacular floral display, and deep red fall foliage, although its weedy, aggressive tendencies sometimes make it undesirable. Nevertheless, fireweed is an excellent addition to wildflower gardens in cold climates. The plants can grow in shade, but will develop best in sunny locations. They tolerate a variety of soils, but should not be drought-stressed, especially while being established. Instructions on how to grow fireweed, from former Central Experimental Farm horticulturalist and co-worker Larry Sherk, are reproduced below from his popular but out-of-print (1967) guide (cited in #1 of this series) to growing Canada's floral emblems:

"This plant will become weedy and take over large areas if you grow it in rich garden soil. It is best to plant it in dry, well-drained soil, preferably sterile and without any added nutrients. Choose a place where its vigorous suckers cannot encroach on other garden plants. The ripe seed pods should be cut off before they scatter the seeds, which self-sow



Fig. 9. Flowering top of fireweed (*Chamerion angustifolium*), photographed in south-central Colorado. Photo courtesy of Dave Powell (USDA Forest Service) and Bugwood.org.

readily. Seeds germinate quickly when they are scattered on the soil and lightly raked in. Or you can sow the seed in sandy, sterile soil in seed pans and transplant the seedlings when the first true leaves appear. Plants may also be propagated by suckers, root cuttings, or division of older crowns, in either early spring or early fall."

CONSERVATION STATUS

Fireweed is so widespread, and is often such an aggressive colonizer that it does not seem to be in any need of conservation. However, the pattern of genetic variability across its range is still not well documented. Areas of the Rockies in Alberta where both subspecies occur together are restricted and of interest from an evolutionary perspective.

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

- The Cree and Woodland Indians employed the time of flowering of fireweed as a seasonal indicator that moose

Prospecting with Plants ... and Plant Prospecting

Prospecting with plants (sometimes called geobotany) is the process of using the presence, appearance, or chemical content of plants to find mineral resources. Plants vary in their usefulness in this respect and different plants pick up different elements. The white-flowered forms of fireweed have been associated with uranium deposits after being found in abundance around the "Glory Hole" mine at Port Radium on Great Bear Lake. It has been suggested that mutations from the radiation near uranium deposits result in a relatively high frequency of white-flowered variants, and that this phenomenon can be used to find uranium. High positive correlations between soil uranium content and that in leaves of fireweed have been reported.

Plant prospecting is finding plants for the development of new foods, prescription drugs, dietary supplements, fragrances, flavours, cosmetics, industrial materials, pesticides, and other valuable products. A first step is the selection of plants for testing. In many cases plants like fireweed, which already have a history of use and are aggressive and easy to grow, are ideal candidates. In fact, there has been appreciable success in Canada in developing and marketing fireweed as a source of cosmetics and medicinal extracts.



Fig. 10. Fireweed (*Chamerion angustifolium*), at an elevation of 1,550 m (5100 feet) in the West Julian Alps, Italy, photographed Aug. 3, 2004. Photo courtesy of Amadej Trnkoczy.

were in their fattening stage.

- According to an old Alaska saying, the first snow will fall 6 weeks after the last fireweed flower on a plant opens and the first fruit releases its seeds to the wind (fireweed blooms mature sequentially from the bottom to the top of the floral stalk, the first seeds scattering from the lowest fruits).
- Fireweed sprouted quickly from surviving rhizomes, following the burning of the forest following the volcanic eruption on Mount St. Helens, Washington in 1980. One year after the explosion, 81% of all seedlings present were from fireweed.
- One fruit of fireweed can contain as many as 500 seeds. A single plant can produce as many as 80,000 seeds per year.

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Fig. 11. Young girl with an excavated plant of fireweed (*Chamerion angustifolium*). Photo taken July 3, 2002 in Benewah County, Idaho, courtesy of Richard Old (XID Services, Inc.) and Bugwood.org.

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TREE: Subalpine Fir



Fig. 12. Silhouette of subalpine fir (*Abies lasiocarpa*). Source: Farrar, J.L. 1995. *Trees in Canada*. Canadian Forest Service and Fitzhenry and Whiteside, Markham, ON, Canada. Reproduced with permission.

SYMBOLISM

The abilities of subalpine fir to withstand cold, heavy snows, and a short growing season all coincide with and symbolize the capacities of citizens of the Yukon to withstand the challenges of their northern climate. The strikingly symmetrical spire-like form of the trees is exceptionally attractive, reflective of the natural beauty of the territory. The traditional use of subalpine fir for food, medicine, shelter, and implements by indigenous people was also recognized

by Yukon in its choice of the tree as an emblem.

Tracing largely to the Old World, fir trees have long been respected, indeed often venerated. They have been associated with a winter solstice celebration since ancient pagan times in Europe, when the ritual of decorating a conifer represented tribute to the rebirth of the sun god. Gradually the custom was taken up by Christians, and at least since the 16th century in Europe small fir trees have been used to decorate houses at Christmas time. In Europe, the silver fir (*A. alba*) has long been the fir of choice for Christmas trees. In North America, the balsam fir, a close relative of the subalpine fir, has been the most desirable Christmas tree for many years. Subalpine fir is also used as a Christmas tree, but to a lesser extent. Fir trees have been a symbol of fertility in many cultures, for their ability to last through long winters, but the religious symbolism is now considered more important.

LATIN NAMES

Abies lasiocarpa (Hook.) Nutt.

The genus name *Abies* is based on the Latin *abed*, a word used by the classical Romans to refer to the silver fir of Europe (the word *abies* was also used in ancient Latin for the silver fir). Alternatively, the name is said to be based on the Latin *abire*, to rise up, referring to the great height of some of the species. *Lasiocarpa* in the scientific name is based on the Greek *lasios*, woolly, and *karpos*, fruit, a reference to the cone-scales which are covered with fine hairs.

ENGLISH NAMES

Subalpine fir. Also: alpine fir; uncommonly: caribou fir, mountain fir, sweet fir, sweet-pine.

The word "fir" in modern English traces back to Old English and Old High German words meaning fir forest and a Goth word meaning mountain. Today "fir" is usually restricted to the genera *Abies* and *Pseudotsuga*. The names alpine fir and subalpine fir indicate the frequent high-altitude habitat of the species. The names balsam, balsam fir, western balsam, mountain balsam fir, western balsam fir, and white balsam reflect the similarity with *A. balsamea*, the true balsam fir (treated in #5 of this series), which grows in eastern North America. (A few taxonomists have considered *A. balsamea* and *A. lasiocarpa* to be sufficiently close to merit placement in the same species.) The "white" in the name "white balsam" (and in "white fir", although this is the usual name of *A. concolor*) reflects the often almost-white wood and the occasionally whitish bark. "Sweet" in the names "sweet fir" and "sweet-pine" is based on the pleasant aroma. The name Rocky Mountain(s) subalpine fir (or Rocky Mountain alpine fir) is sometimes applied to the whole species, sometimes just to variety *bifolia*. The name Pacific subalpine fir (or Pacific alpine fir) is often restricted to variety *lasiocarpa*. The name corkbark fir is applied to variety *arizonica*. These varieties are discussed below. The name caribou fir reflects the attractiveness of the tree as browse for caribou and other large herbivores.

FRENCH NAMES

Sapin subalpin. Also: sapine concolore, sapin de l'Ouest, sapin des montagnes Rocheuses.



Fig. 13. Subalpine fir (*Abies lasiocarpa*), growing on southwest shore of Crystal Lake, Mount Rainier National Park, Washington State. Photo courtesy of Walter Siegmund.

HISTORY

a. Canada

Subalpine fir was chosen as the official tree of Yukon in 2001, the result of a contest held by the government that year. Most of the voters were students, of whom about one-third voted for the tree, the others for the other three choices: flatleaf willow, trembling aspen, and balsam poplar. One journalist reported "The willows are weeping, the aspens are trembling and the poplars are pleading, but no matter; the subalpine fir has been formally designated as the Yukon's official tree."

The closely related balsam fir, *A. balsamea* (L.) Mill., was adopted as the provincial tree of New Brunswick in 1987.

b. Foreign

North Carolina adopted the related Fraser fir (*A. fraseri* (Pursh) Poir.) as its "Official Christmas Tree" in 2005. The Fraser fir constitutes more than 90% of Christmas tree production in North Carolina and was chosen 10 times over the period 1971-2007 as the White House Christmas Tree. No species of *Abies* is an "official state tree" of any of the U.S. states, although Douglas fir (*Pseudotsuga menziesii*) is the official state tree of Oregon. Spanish fir (*A. pinsapo* Boiss.) has been called the national tree of the Andalusian region of Spain, but this is an unofficial designation.

APPEARANCE

The trees develop a narrow, dense crown that is spire-like at the top in open-grown trees, narrowly conical with a very elongated, extremely narrow top in trees growing in forests. Subalpine firs are typically 15-30 m (49-90 feet) in height,

rarely as tall as 45 m (148 feet), with a diameter at breast height up to 120 cm (4 feet), rarely 2 m (6.5 feet). The bark is grayish (sometimes reddish when young), covered with resin blisters, later becoming scaly (rough and fissured) and dark gray or whitish. The needles are mostly 1.5-2.5 cm (5/8-1 inch) long (sometimes as long as 4.5 cm or 1¾ inches), flattish, and grayish-green to bluish green. The needles are arranged spirally around the twigs, but twist at the leaf bases so that they are mostly above and at the sides of the twigs where they are exposed to the sun. Male and female flowers are produced on the same trees, in compact clusters called cones. The greenish or bluish male cones are 13-20 mm (1/2-3/4 inch) long and are borne in pendulous clusters on lower twigs of the tree, often abundantly. The seed cones are cylindrical or ovoid, borne upright on the twigs, singly or often in small clusters, in the upper part of the crown. The seed cones are usually less frequent than the male cones, and are 4-12 cm (1.6-4.7 inches) long and 2-4 cm (0.8-1.6 inches) wide. They are dull purple when young, purplish brown or brown at maturity, and often covered by resin. The cone scales disintegrate to release the ripe winged seeds in the fall. The bare axis of the cones may remain on the trees for years. The seeds are brown or purple, about 6 mm (1/4 inch) long, with a wing 10-18 mm (3/8-3/4 inch) long. Subalpine fir has a shallow, wide-spreading root system, and because the anchorage is often poor, the tree is occasionally toppled by wind. Frequently the plants are stunted or develop into shrubs on exposed ridges at tree line.

The oldest known tree is from Yukon and had 501 annual growth rings (subalpine firs rarely grow longer than 200 years). The tallest was from the Alpine Lakes Wilderness area in Washington and was 52 m (170 feet) in height. The tree with the broadest trunk had a diameter at breast height of 204 cm (6.7 feet) and was from Olympic National Park, Washington State.

CLASSIFICATION

Family: Pinaceae (pine family).

There are about 40 species of *Abies*, distributed in north temperate regions of the world, as well as in Mexico, Central America, and North Africa. Four species are native to Canada (five if *A. lasiocarpa* and *A. bifolia* are considered to be separate species). A key to the Canadian species of *Abies* is presented in #5 of this series. *Abies lasiocarpa* is known to hybridize with some other species, particularly the rather similar *A. balsamea*, where the two species overlap in central Alberta.

Across the continental divide in the northern Rocky Mountains, the western subalpine fir trees differ somewhat from the eastern trees, and the two kinds have been recognized by some taxonomists as different species. However, most authorities recognize them as different subspecies or varieties. *Abies lasiocarpa* var. *lasiocarpa*, known as Pacific alpine fir, occurs west of the continental divide, on the Pacific slope from eastern Alaska and the Yukon to northwestern California. *Abies lasiocarpa* var. *bifolia* (A. Murray) Eckenwalder (= *A. bifolia* A. Murray), known as Rocky Mountain subalpine fir, occurs east of the continental divide, from Yukon to Utah and central Colorado. The two are distinguished in the table on page 16..

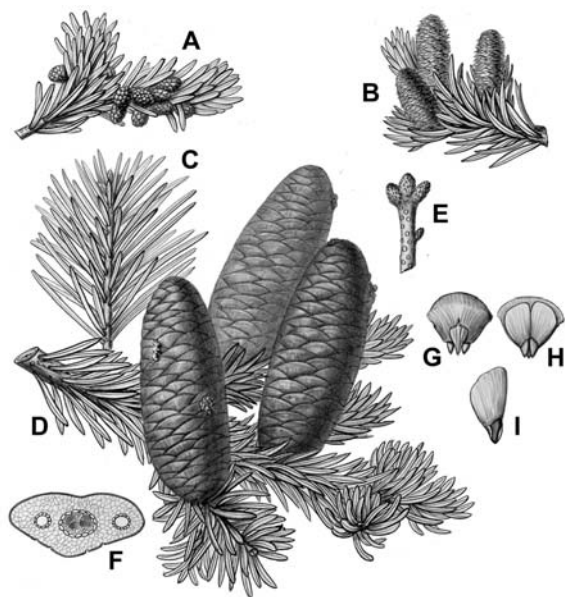


Fig. 14. Subalpine fir (*Abies lasiocarpa*). A, branch with male cones; B, branch with young female cones; C, end of a lateral branch; D, fruiting branch; E, winter buds; F, cross section of a leaf; G, lower side of a mature cone scale with its bract; H, upper side of a mature cone scale with its winged seeds; I, winged seed. Source: Sargent, C.S. 1898. *The silva of North America*. Houghton, Mifflin and Company, Boston, MA. Vol. 12, plate 611.

In southern Colorado through Arizona and New Mexico, there are trees known as corkbark fir, which have a thick, corky bark and especially glaucous foliage (i.e. bluish needles). These are often classified as *A. lasiocarpa* var. *arizonica* (Merriam) J. Lemmon, but are also considered by many authorities to simply be part of *A. lasiocarpa* var. *bifolia*.

Populational geneticists have been intrigued by the nature of genetic variation in subalpine fir, because some have discovered that it is very high among high elevation sites on different mountains, while others have found substantial genetic difference associated with different altitudinal growth forms on the same mountain.

GEOGRAPHY

Subalpine fir (including both varieties) is the most widely distributed of the western North American species of *Abies* and the second most widespread fir species in North America. It is found in the subalpine region, extending from



Fig. 15. Resin-blistered trunk of subalpine fir (*Abies lasiocarpa*) growing in south-central Colorado. Photo courtesy of Dave Powell (USDA Forest Service) and Bugwood.org.

southeastern Alaska east to central Yukon Territory, south through British Columbia and western Alberta to Colorado, southwestern New Mexico, northeastern Nevada, and southeastern Arizona. The species occurs in the Coast Mountains of British Columbia, the mountains of Alaska, Washington, Oregon, and California, frequently up to treeline. Scattered populations are distributed throughout the Rocky Mountains, more so in the north. The species extends east as far as the eastern margins of the Rocky Mountains. Towards its southern limit, it is found in scattered montane sites in Arizona, northwestern California, and New Mexico. Subalpine fir grows (rarely) down to sea level in the north of its range, and up to 3,650 m (12,000 feet) in altitude in the southernmost part of its range. The approximate distributions of the two varieties are separated by a dashed line in Fig. 16, on page 17.

Some ecologists have speculated that the isolated occurrences of the species are where the trees survived glaciation in refugia not covered with ice. However, in one region of isolated occurrences it was concluded that the trees are simply in areas with underlying limestone, which is presumably advantageous to the plants. Fossil pollen assemblages in lakebeds suggest that 200,000 years ago subalpine fir was more abundant in Yukon and grew as far north as Old Crow, which is 400 km (250 miles) north of the tree's present northern limit near Dawson. Interestingly lodgepole pine is a relative newcomer, having arrived in Yukon about 1,000 years ago.

A comparison of some key characters of the two varieties of *Abies lasiocarpa*.

	Var. <i>lasiocarpa</i>	Var. <i>bifolia</i>
Fresh leaf scars (evident upon pulling off a few needles)	Red periderm	Yellow or tan periderm
Foliar buds	Basal scales are equilaterally triangular with crenate or dentate margins	Basal bud scales are long, narrow-triangular to spatulate with crenate to entire margins
Leaf dimensions	18–31 mm × 1.5–2 mm	11–25 × 1.25–1.5 mm
Leaf odour	Sharp (from β-phellandrene)	Similar to camphor
Leaf color, upper surface	Blue-green, very glaucous	Light green to blue-green, usually glaucous



Fig. 16. Distribution of subalpine fir (*Abies lasiocarpa*). The variety *lasiocarpa* occurs west of the dashed line, variety *bifolia* to the east.

ECOLOGY

Abies lasiocarpa grows in pure stands in some places, more often in associations with other conifers, and sometimes with cold-hardy deciduous trees including aspen (*Populus*) and birch (*Betula*) species. Subalpine fir is a pioneer on severe and disturbed sites, but often becomes less competitive when forests approach maturity. The trees are slow-growing, and once stands are established they sometimes persist for a century or more, but are often replaced by other species. *Abies lasiocarpa* is common at and near the tree line, occurring in subalpine forests in mountainous regions, and in the northwestern part of North America's boreal forest, where it has a competitive advantage. The very narrow, spire-like crown is adaptive to the heavy snowfall often encountered in the subalpine zone, the trees shedding snow easily as the relatively short branches bend downward.

Habitat

The trees occur on a variety of soils, often colonizing newly exposed ground. They do best on deep, moist, well-drained, loamy soils, but are capable of growing on very poor, thin soils, sometimes acting as the main pioneer species in such sites. Subalpine fir is tolerant of semi-shade. The species is adapted to a short growing season associated with cold winters, cool summers, frequent summer frosts, and heavy snowpack. Although they can tolerate some drought, the trees are naturally adapted to moist environments.

Inter-species Relationships

Subalpine fir is an important source of browse for wildlife, including grouse, deer, elk, and bighorn sheep. The seeds are consumed by squirrels, chipmunks, mice, and several birds. The cones are a favourite food of squirrels, which tear the cones open to obtain the seeds. The trees also provide cover for both small and large mammals, such as bear, porcupine, pine marten, fisher, lynx, hares, mice, voles, chipmunks, and shrews, as well as numerous birds. Many kinds of insects feed on subalpine fir, and some (including the western spruce budworm, western balsam bark beetle, and balsam woolly aphid) are considered to be quite damaging.

Pollination & Dispersal

Subalpine fir is wind-pollinated, the male flowers shedding pollen in late spring and early summer. Although the trees are capable of self-pollination, a substantial degree of cross-pollination occurs. The female flowers (and consequently the seed cones) are predominantly at the top of the trees, a strategy for increasing reception of pollen from distant trees. The seeds ripen in late summer and early fall, and are wind-dispersed, the seed wings acting as sails. In open areas, most seeds fall within 30 m (100 feet) on the windward (upwind) side, and within 80 m (260 feet) on the leeward (downwind) side. Most seeds are distributed by the wind, but some are dispersed by squirrels as a result of being carried to and stored in caches; seeds that escape being eaten often germinate in clumps to produce a group of trees. As with many tree species, masting occurs, i.e. seed

Arctic and Alpine Tree-Lines

Subalpine fir is geographically limited by tree-lines. The term tree-line has sometimes been used loosely. The area in which a tree can grow can be limited by various factors, including cold (or heat), wind, soil features, water availability, herbivores, disease, and competitors. However, "tree-lines" are best known when they are latitudinal (such as the taiga-tundra boundary of northern Canada), or altitudinal (such as occurs on the side of a tall mountain, where subalpine communities are replaced by low-growing alpine plants). An "inverted treeline" can occur where cold air drains into a mountain basin, producing a tree-line based on a lower instead of an upper altitudinal limit. Some ecologists dislike the phrase tree-line, since frequently the "line" isn't sharp, and many prefer the phrase "tree zone". In any event, European ecologists often use three terms to specify more exactly the areal limits of tree growth. These terms are:

"Timber-line" (*waldgrenze*): upper limit of tall, erect tree growth at forest densities.

"Transition zone" (*rampfzone*): the area between the timber-line and the tree-line.

"Tree-line" (*baumgrenze*): the area where trees are often deformed, dwarfed, or prostrate because of the severe environment.

In North America and Europe, a community of dwarfed and deformed (usually coniferous) trees such as occur at tree-lines is often referred to as "*Krummholz*" or "*Krumholtz*" from the German *krumm* meaning crooked, bent, or twisted and *Holz* meaning wood. The term "elfin-wood" is also sometimes applied but is also used to describe many kinds of tropical and subtropical dwarf woody vegetation.

production is very high in one year, followed by several years of limited production, a strategy to prevent seed consumers from building up large populations in lean years, and to generate so many seeds in good years that there are too few animals to eat them all. In subalpine fir, abundant seed years occur about every 3 to 5 years.

The lower branches sometimes droop and touch the ground, where layering may occur, i.e. the branches take root, producing new plants. This is much more frequent at high elevations, where snow load increases the likelihood of branches contacting the ground, and because the plants are smaller, indeed often dwarfed, the branches are nearer to the ground.



Fig. 17. Subalpine fir (*Abies lasiocarpa*) growing in northeastern Oregon. Photo courtesy of Dave Powell (USDA Forest Service) and Bugwood.org.

USES

Lumber & Pulp. Subalpine fir is mainly employed for construction lumber (often included in shipments of spruce) and pulp, occasionally for other uses such as boxes, veneer, finish carpentry, and poles. The often inaccessible high-mountain and northern habitats, and small size often developed in much of the range of the species, limits the tree's economic importance. The trunk seems to be susceptible to interior defects from middle age onwards, decreasing the value of the wood. Subalpine fir is one of four species harvested together, by British Columbia and Western Alberta lumber manufacturers as part of the SPF (spruce-pine-fir) group. The other species are white spruce (*Picea glauca*), Engelmann spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta*). Of these species, subalpine fir is considered the most difficult to process and market because of its relatively low wood density, high moisture content, high presence of moisture pockets, and lower drying rate compared to the other species. In British Columbia, the four SPF species are processed together for dimension lumber, with the residuals used for pulp and paper.

Other. As noted elsewhere, the species is also used to a limited extent as a Christmas tree and as an ornamental. The resin (known commercially as Canada balsam and Strasbourg turpentine) from firs is employed as a cement for optical lenses and microscope slides, as a varnish, and for medicinal purposes. However, subalpine fir is a minor source of the resin.

Traditional. North American Indians chewed the resin of subalpine fir to clean their teeth, and also employed the resin as a topical antiseptic, and even for tea. The resin was also used to patch holes in canoes and preserve the strings of bows. Hair tonic was prepared by mixing powdered leaves with deer grease. All parts of the plant were used for a variety of medicinal purposes. Because the foliage has a pleasant aroma, it was employed to scent rooms, clothing, and even people. The wood, bark, and boughs were used for roofing.

TOXICITY

Working with subalpine fir lumber can cause dermatitis or eczema in some individuals, but the species is not considered to pose a significant health problem.

CULTIVATION

Abies lasiocarpa is planted to some extent in North America for landscape rehabilitation, and as an ornamental park or roadside tree in areas where it grows naturally, but is not grown much for agroforestry purposes. In Scandinavia, particularly in Norway, subalpine fir cultivation is expanding for production of Christmas trees.

Subalpine fir is adapted to high altitudes and cool, moist conditions, and so does not grow well in many areas outside its natural range. In low-elevation gardens, the trees often do not develop their characteristic spire-like form.

Nevertheless subalpine fir is very picturesque and symmetrical, and is grown as an ornamental to some extent. Seedlings grow very slowly in their first year (1-year-old seedlings are often less than 2.5 cm (1 inch) in height), and container nursery stock is usually employed for ornamental purposes. Dwarf cultivars are popular, especially of variety *arizonica*, which as noted earlier has attractively-bluish needles. Dwarf cultivars include: 'Argentea' ('Arizonica Glauca', noted for its silvery-blue foliage); 'Compacta' ('Glauc Compacta', with silvery-blue foliage and a conical shape); 'Mulligan's Dwarf', 'DuFlon', and 'Green Globe' (rounded and somewhat flat on top).

CONSERVATION STATUS

Subalpine fir is not thought to be in need of conservation measures, although curious forms have been described at the periphery of its range. These are not well understood at present, but some of them might merit conservation measures.

MYTHS, LEGENDS, TALES, FOLKLORE, AND INTERESTING FACTS

- The ancient Irish were Celts who had migrated to the Irish isles from Central Europe nearly two thousand years before the coming of Christianity to Ireland. Their unique language, Gaelic, was written in a special alphabet called the "Celtic Tree Alphabet", comprised of letters that signified trees found in abundance in Ireland. In "Ogham script", the lettering of old Gaelic, "A" (Ailm) stood for the fir tree (sometimes interpreted as a pine), and was represented by a cross with equidistant arms within a circle. This is sometimes displayed in Irish tattoos. The character indicates purity, as the fir tree was synonymous with purity and considered sacred. After the 16th century, Gaelic clans in Scotland frequently adopted tree symbols

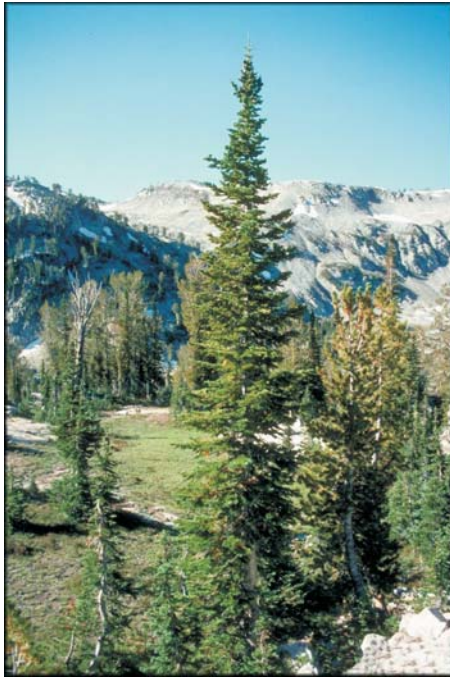


Fig. 18. Subalpine fir (*Abies lasiocarpa*) growing in southwestern Colorado. Photo courtesy of Dave Powell (USDA Forest Service) and Bugwood.org.

- as clan badges, and the fir was often chosen.
- Beginning about the 7th century, fir trees were hung upside down from ceilings in Central Europe as a symbol of Christianity at Christmas time. This practice (still sometimes encountered) seems curious, even sacrilegious today, although it appears to originally have been simply a way of giving the tree a lofty prominence in the home.
- Colours are often very difficult to characterize. "Fir green" is defined (Webster's Third New International Dictionary) as "a dark grayish green that is yellower and stronger than average ivy, yellower and deeper than Persian green, and yellower, lighter, and stronger than hemlock green."
- According to an old wives' tale, consumed fresh plant parts or seeds that aren't sufficiently chewed might grow inside a person. In 2009, Russian surgeons, operating on a 28-year-old man suspected of having a tumour in one of his lungs, discovered instead a fir sprig about 5 cm (2 inches) long. Newspapers subsequently published X-ray radiographs of what appeared to be a small fir plant inside the man's chest, with the suggestion that it had grown inside his lung. Botanists asked by journalists to comment on the report noted the unsuitability of the interior of the human body for plant growth.

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(Continued)

A Fir Poem

I remember, I remember
The fir-trees dark and high;
I used to think their slender tops
Were close against the sky:
It was a childish ignorance,
But now 'tis little joy
To know I'm farther off from heaven
Than when I was a boy.

-Thomas Hood (1799-1845; British poet)



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Project eligibility is very broad. In last two years, Accelerate has funded projects focused on controlling the biennial bearing of apple trees, investigating new ways to control the Canola flea beetle, understanding the importance of timing in pesticide application and researching the effect of plant condition on bumble bee pollination in greenhouse tomatoes.

Interested companies or individuals are encouraged to contact Alison Ewart at 416.650.8439 or visit www.mitacsaccelerate.ca. Accelerate is administered by MITACS, a national, not-for-profit research corporation which connects academia and industry through collaborative research projects. For more information, visit www.mitacs.ca.



Regional Undergraduate Awards at APICS.

Duncan MacGillivray (pictured above) from the University of New Brunswick (Fredericton) was the winner of the CBA 2010 Best Oral presentation for his talk on "Self-fertilization in lowbush blueberries: Does size matter?".

Kyle Roherty also from the University of New Brunswick (Fredericton) was deemed the winner of the CBA 2010 Best Poster presentation for his poster entitled "Examination of programmed cell death hallmarks in *Heterosigma akashiwo* during HaRNAV infection". (Photo not available)

