Fundy Model Forest

~Partners in Sustainability~

Report Title: Assessment of the Usefulness of Various Data Sets in Evaluating the Status of Trees and Shrub Species Possibly at Risk in New Brunswick

Author: N. Ives

Year of project: 1999

Principal contact information:

File Name:
Biodiversity_1999_Ives_Assessment_of_the_Usefulness_of_Various_Data_Sets_in_Evaluating_the_Status_of_Trees_and_Shrub_Species_Possibly_at_Risk_in_New_Brunswick

The Fundy Model Forest…
…Partners in Sustainability

"The Fundy Model Forest (FMF) is a partnership of 38 organizations that are promoting sustainable forest management practices in the Acadian Forest region."

Atlantic Society of Fish and Wildlife Biologists
Canadian Institute of Forestry
Canadian Forest Service
City of Moncton
Conservation Council of New Brunswick
Fisheries and Oceans Canada
Indian and Northern Affairs Canada
Eel Ground First Nation
Elgin Eco Association
Elmhurst Outdoors
Environment Canada
Fawcett Lumber Company
Fundy Environmental Action Group
Fundy National Park
Greater Fundy Ecosystem Research Group
INFOR, Inc.
J.D. Irving, Limited
KC Irving Chair for Sustainable Development
Maritime College of Forest Technology
NB Department of the Environment and Local Government
NB Department of Natural Resources
NB Federation of Naturalists
New Brunswick Federation of Woodlot Owners
NB Premier's Round Table on the Environment & Economy
New Brunswick School District 2
New Brunswick School District 6
Nova Forest Alliance
Petitcodiac Sportsman's Club
Red Bank First Nation
Remsoft Inc.
Southern New Brunswick Wood Cooperative Limited
Sussex and District Chamber of Commerce
Sussex Fish and Game Association
Town of Sussex
Université de Moncton
University of NB, Fredericton - Faculty of Forestry
University of NB - Saint John Campus
Village of Petitcodiac
Washademoak Environmentalists

56

Year End Report

Fiscal year 1998/99

Fundy Model Forest

Gene Conservation Strategy Development

Proponent: Judy Loo

Two contracts were administered to carry out separate parts of the Gene Conservation Strategy project. The first was an assessment of the availability of data on the tree species that have been identified as requiring additional information prior to assessing the need for conservation strategies, and those tree species for which we know conservation measures are needed. The second was assembling information and writing a guide for identification of species of trees and shrubs at risk. Deliverables from these two contracts are included in this report.

Assessment of the Usefulness of Various Data Sets
in Evaluating the Status of Tree and Shrub Species
Possibly at Risk in New Brunswick

submitted by
Nadine Ives

Introduction

This report describes the five major data sets available and assesses their usefulness in 1) evaluating the status of fourteen tree and shrub species possibly at risk in New Brunswick and 2) adding further information on six additional species known to be at risk. In addition to the five data sets originally discussed for this project (PSP's, SCP's, FDS, FIDS and ESA, defined below), a number of other data sets have been identified by various members of the Gene Conservation Working Group as possibly being of use. They are included in the following evaluation. Data sets are grouped according to where they are housed. For each data set, I have included a description of the data, why they were collected, my interpretation of their usefulness and the main contact person for the data.

Summary

One of the most useful sources of information will be the GIS maps for individual species provided by Vince Zelazny. These maps are based on information from the Dept. of Natural Resources and Enviroment (DNRE) Composite Data Set , which includes primarily Permanent Sample Plot (PSP), Site Classification Plot (SCP) and old Forest Development Survey (old FDS) data. Data from Dave MacLean are also included in the Composite Data Set and the new FDS data will be added before the final maps of our species are made. The maps are especially useful because in addition to showing locations where a species has been recorded, they also show all sample locations so one can determine whether a species absence from an area may be due to lack of sampling in that area. There are cases where sampling was done, but not for the particular species on the map; however, the sampling points will give us a good indication of geographic areas sampled. These maps are available for 11 species. Data from other sources which include geographic locations will be added to the DNRE GIS maps and can be used to create maps for some species not in the DNRE Composite data set.

There are more data available for some species than other. Beech and hemlock are included in all forestry data sets (being two of the standard 20 spp. surveyed) and, therefore, the information obtained should give a good idea of the current distributions of the species. However, specific information is also needed: for beech, the location of clear (disease-free) trees, especially in southern NB, and for hemlock, its regeneration status. In addition to beech and hemlock, the following species are included among the 268 spp. contained in the Site Classification books (and, therefore, in the DNRE Composite Data Set): Canada yew, witch hazel, alternate-leaved dogwood, squashberry, black ash, black cherry, elm, butternut, basswood

to be of importance as indicators. Some plots are in mature stands, some in plantations

Location: included in the DNRE Composite Data Set (see above)

4. FDS (Forest Development Survey) - older survey

Description: the largest data set available but the older survey included only 20 spp. (only hemlock and beech from our list of 20 spp.). Consists of cruise sheets only (which estimate volume); other DNRE sets also include site cards (soil data, etc.) and vegetation sheets (complete sample of vegetation in a 12 m^2 circle). The most recent full inventory (all of New Brunswick) was conducted in 1982-86 and consisted of photo interpretation then a ground check, a line cruise sampling every 50 m of the line within the stand. All private lands were cruised by the Marketing Boards, while the Licensees did all Crown land.

Purpose: to produce inventory of upper canopy species - timber resources (forecasting). Cruised mature timber (*c.f.* new FDS, which also includes 15-30 yr.-old stands).

Location: included in DNRE Composite data set (see above)

Contacts for additional information: Hilary Veen, John Upshall (collects and coordinates FDS and PSP data, which cover Crown Land and private woodlots (Marketing Boards))

5 FDS - new survey

Description: since the 1982-1986 survey, a different region has been sampled every year on a rotating basis (too expensive to do the whole province at once). The new survey starts with 1993-1994. Conducted by the Marketing Boards and Licensees. Has some understorey species. Density, merchantable volume, and basal area are recorded. John Upshall has the updated FDS Field Manual - consult this for the species list (which covers more than the 20 spp. in the original FDS), species ID #'s and sampling techniques - prism plots and circular subplots. In addition to hemlock and beech, this data set contains black cherry, basswood, black ash, butternut, elm. The format is somewhat different than the original FDS. Cruised 15-30 yr.-old stands as well as mature stands (2 data sets). More than 6000 stands; about 4000 stands linked to GIS. John has extracted the data with our species of interest: there are 2609 records of occurrence of our species (out of 57,888 species tallied) and at least one of our species occurs in 1741 out of 6869 stands sampled (J. Upshall, *pers. comm.*).

Assessment: a very useful addition to the DNRE Composite Data Set

Location: Vince will get the relevant data from John Upshall (both mature stands and 15-30 yr.-old stands); John has given me the mature stand data for our species.

Contact: John Upshall

Note: John will get clearance from Avenor for us to use the data

* These data should be added to the main GIS files for preparation of the final maps.

Upshot: We would have to sift through lots of data to get little information. Best bet is to stick with the Site Class Plots and PSP's (T. Ng, *pers. comm.*)

Contact: Thomas Ng (DNRE)

10. ELC FMF data (Ecological Land Classification - Fundy Model Fundy)

Comment: apparently FMF will call FDS when they are putting in cruise plots - I assume this means the whatever FMF data exist are compatible with the FDS (old or new?) and may already be included in the FDS data.

Location: some or all included in DNRE Composite Data Set

Contact: Bruce Matson, Hampton DNRE (832-6055)

B. Data Sets held at CFS

1 FIDS (Forest Insect and Disease Survey)

Description: a national data base established in 1936 with data collection ongoing. Sample plots are randomly located (with the aim of reflecting actual forest cover) and assigned to specific provincial and independent (or industrial?) cooperators for monitoring. The plots are sampled for disease organisms and the data base is set up with this focus, *i.e.* we may pull out tree or shrub species because they are host to disease organisms. Data include ground vegetation and tree-by-tree maps

Purpose: to monitor change in tree condition and to correlate this with the ground vegetation

Assessment: Could be quite useful for some species

Contacts: Ken Harrison - general info ; Sue Martin - to request data

Note: I have requested geographic locations for all trees species recorded in New Brunswick from 1970 to present. I need to check whether shrub species are also included as host species

Note: Apparently Wayne extracted the FIDS data on clear (disease-free) beech for Judy a year or two ago (where is this?). It may also be useful to request full information on other disease-infected species in order to determine the presence and location of any disease-free trees. I will follow up on this once I have seen the data from the initial request.

* Data should be added to the GIS files for the final maps

2 CAP (Condition Appraisal Point) data

Description: about 10-12 years of data for the Maritimes, collected from 1983-1985

Description: PSP's with Site Class data; New Brunswick PSP programme data Used by folks at DNRE to validate their forecasting models.

Note: Since this data is already in the DRNE Composite Data Set, I have not contacted Dave MacLean to acquire it separately

Contact: Dave MacLean (452-3580)

C. Data Sets held Elsewhere/Individuals with Information.

1 ESA (Environmentally Significant Areas)

Description: A compilation of notes on 910 sites throughout New Brunswick that have been deemed environmentally significant Some records include fairly comprehensive species lists, others are quite vague. Some include references to files held by the Nature Trust I will follow up on those files for the records mentioning our species.

Assessment: Quite useful for a number of species and very useful for a few species that I have not yet seen mentioned elsewhere. The quality of the data spans a broad range from quite thorough to too vague for our purposes (there may be sites I didn't extract because no species lists were given, although our species may, in fact, be present on the sites). The data are well-organized and easy to use. I have been through the data set and have the information (including geographic locations) on sites listing our species

Contact: Jane Tims, NB Dept of Environment (Argyle St.) (457-4846)
Or contact the Nature Trust - Hal Hinds, or Martha Gorman (367-9010)

* Add data to GIS map files

2 Samantha Hines (CFS) (452- 3735) - working on stewardship, meets with woodlot owners to conserve anything special they find Samantha has a list of our species and is checking for any information she may have or contacts that may be of use.

3 Tone Pronck (sp?) (DNRE) - worked with Andy MacDougall; knows location of a disjunct population of *Ulmus americana* near Upsalquitch (away from the river valley). Huge trees, found by miners/prospectors. I will contact him about this stand.

4 Donnie McPhee (CFS) - knows the location and status of pretty well every *Quercus macrocarpa* in the province Has manuscript with description of locations that will be ready soon

5 John Malcolm (Roger Cox) (CFS) - info in *Betula* spp John and Roger have passed me a reference and some information

6 Hal Hinds (UNB) - contact Biology Dept.

Location of information on tree and shrub species needing further research to determine their status in New Brunswick

I. Species lacking information (Rating 1)

Species	Gr. form.	Data sets
**Alnus serrulata*	shrub	ESA, NAIP(?)
Betula cordifolia	tree	R. Cox, E. Hurley, FIDS(?), NAIP(?)
Betula glandulosa	shrub	ESA, FIDS(?), NAIP(?)
Cephalanthus occidentalis	sm. tree/shrub	ESA, NAIP(?)
Cornus alternifolia	sm. tree/shrub	DNRE Comp., FIDS(?)
Fraxinus pennsylvanica	tree	ESA (?), FIDS & CAP
Hamamelis virginiana	shrub	DNRE Comp., ESA, FIDS(?)
Prunus nigra	sm. tree	Mktg. boards; FIDS(?), NAIP (?)
Prunus serotina	tree	DNRE Comp., FIDS & CAP
**Salix nigra*	sm. tree	DNRE Comp. (all *Salix* spp. lumped), FIDS(?)
Taxus canadensis	shrub	DNRE Comp., FIDS(?), Ron Smith (?)
Tilia americana	tree	DNRE Comp., ESA, FIDS(?)
Tsuga canadensis	tree	DNRE Comp., FIDS & CAP
Viburnum edule	shrub	DNRE Comp., ESA, FIDS(?)

II. Species at risk (Rating 3)

Fagus grandifolia	tree	DNRE Comp., ESA, FIDS & CAP
Fraxinus nigra	tree	DNRE Comp., FIDS & CAP, First Nations (?)
Juglans cinerea	tree	DRNE Comp., ESA, FIDS & CAP
Quercus macrocarpa	tree	Donnie, FIDS(?)
Ulmus americana	tree	DNRE Comp., ESA, FIDS & CAP
***Castanea dentata*	tree	Tannis (says there's none)

* *Alnus* and *Salix* are included in the DNRE Comp. data set, but not identified to species

** *Castanea dentata* is a special case. Its geographic range has never extended to New Brunswick, but a number of trees were planted in Nova Scotia long ago and continue to exist there disease-free. There are efforts ongoing to preserve these trees and their offspring and to test them for disease-resistance (contacts: Lee Corkum in NS and Rod Savidge at UNB). Although it is not a native of NB, because of the special status of this tree, I recommend that we continue to keep an eye out for records of its presence, which would be of use to those working in NB, NS and elsewhere to preserve this species and re-introduce disease-free individuals into its native range.

Acer saccharum Marsh. sugar maple

Habitat

Sugar maple is typically found on hillside and hilltop situations where soils are well-drained and reasonably fertile. It often grows in mixture with beech and yellow birch. As it is very shade-tolerant, it may be found in the understorey as well as the overstorey.

Form

Sugar maple is a tree that can grow up to 27 m in height with stem diameters up to 70 cm. The crowns of older trees are generally rounded in outline and occupy 30 to 40% of the tree height in a stand. In open situations, the broadly oval crowns may reach nearly to the ground.

Morphology

The **leaves** are simple and borne in pairs. Each is 10 - 25 cm long with a petiole (leaf stalk) about as long as the palmately 5-lobed blade (lamina). The sinuses between the lobes are rounded and the lobe margins are smooth. The outer three lobes tend to be parallel-sided below their two round-pointed side teeth from which the margins extend in a smooth concave manner to the longer, round-pointed lobe ending.

The shoots (twigs) are either fully preformed **short shoots**, usually with one or two pairs of leaves, or preformed, or partially preformed and partially neoformed **long shoots** with more than two pairs of leaves. On the long shoots, the neoformed leaves near the shoots' ends tend to have longer and narrower lobes than do the preformed leaves on short shoots or at the bases of long shoots.

Sharp-pointed **buds** with overlapping brown scales develop in each leaf axil, and, at each shoot end, a larger terminal bud forms. When the leaves fall they leave V-shaped leaf scars below each lateral bud. **Twig** surfaces are smooth and brown and slightly mottled by small pale brown lenticels.

The greenish-yellow **flowers** are each borne on a long, limp, stalk in hanging clusters, and they emerge just before the leaves expand. Male and female flowers are

Fagus grandifolia Ehrh. American beech

Habitat

Beech is a species of richer, moist, but well-drained sites, mostly on hillsides or hilltops. It is very shade-tolerant, and is frequently mixed with sugar maple and yellow birch.

Form

Beech is a tree that can grow up to 25 m in height (though it is often much shorter) and reaches a stem diameter of up to 60 cm. In a stand, the crown is small and oval, but in the open, the crown is broadly rounded and quite deep. Sometimes beech stems are clumped, signifying earlier vegetative reproduction.

Morphology

The beech is probably the easiest tree to recognize: it has several distinctive features. The **leaves** are borne alternately (or in a single spiral) along the shoots. Each leaf is 7 - 15 cm long, short-petioled, with an eliptical lamina that ends in a sharp point. The leaf margins have many small, outwardly pointing, teeth, each one at the end of a distinctive, almost straight, secondary vein, and separated from the next tooth by a short segment of straight leaf margin.

The longer, light brown, **twigs** tend to be slightly zigzagged with lateral buds carried at a wide angle at each twig bend. The **terminal bud** is 15 - 25 mm long, lance-shaped and sharp-pointed. The **lateral buds** are similarly shaped but smaller; those near the base of the twig or on short twigs are tiny. Each lateral bud tends to be offset from the small semicircular **leaf scar** on the twig below it.

Male flowers are carried clustered at the ends of long, hairy, drooping stems that are borne in groups at the bases of new shoots, as the leaves are expanding. These stems and flowers drop off after the blooming period. The **female flowers** are borne in small groups on short stems in axils of new leaves further out along the new shoots. These later develop into **bristly husks** that open into four parts to permit the two triangularly pyramidal **nuts** they enclose to be shed, when they are ripe in the fall. Each nut can contain a seed.

Juglans cinerea L. butternut

Habitat

Butternut occurs in central, western, and southwestern New Brunswick, mostly on deep rich soils on lower slopes of the valleys of the larger rivers. It grows scattered among other hardwoods, sometimes in small groups, but always with its crown exposed to light because it does not tolerate shade.

Form

Butternut is a relatively short-lived tree (60 to 70 years) with a broad spreading, irregularly rounded crown. It commonly reaches heights of 13 to 20 m and stem diameters of 30 to 60 cm. The thick twigs and sparse, uneven branching at the crown's periphery, help to distinguish this species through the winter.

Morphology

The large **leaves** are alternately arranged. They are 20 to 50 cm long, pinnately compound, with 11 to 17 finely toothed, broadly lance-shaped **leaflets** that have closely hairy undersides, the lateral leaflets are arranged more or less opposite one another along a glandularly hairy rachis that extends from a short petiole that has a broadened base.

The stout, strong, greenish-grey somewhat hairy new **twigs** carry large (12 to 18 mm long), closely downy terminal **buds**, and much smaller lateral buds, often two, one above the other, above each distinctive leaf scar. The **leaf scars** are large, broadly triangular, but with rounded edges, and carry three groups of vein scars, and a distinct hairy band, or lip, along the upper margin. The **pith** of a new twig is cinnamon-brown and as it ages (as in a two-year-old twig) it becomes chambered (so, if cut lengthwise it appears ladder-like).

The **male flowers** are produced in thick, green catkins 6 to 14 cm long, that arch out and down from lateral buds below the shoots and leaves beginning to grow out from the terminal buds above. The **female flowers** are much less conspicuous in small groups on short stems arising in axils of new leaves some distance along the stronger of the new shoots. The distinctive **fruits** develop from the female

Ostrya virginiana (Mill.) K.Koch ironwood

Habitat

Ironwood occurs naturally in the southern half of New Brunswick. It usually grows as scattered individuals among sugar maple, beech, yellow birch and white ash on rich, well-drained sites, and often in the understory as it is a relatively small, very shade-tolerant species.

Form

Ironwood rarely grows taller than 13 m or to stem diameters greater than 30 cm. It usually produces an upright stem that is visible almost to the top of the crown. The crown is rounded and the branches may spread widely, especially when more open-grown.

Morphology

The **leaves** are simple, alternately arranged, and tend to be larger nearer the ends of the shoots. Each leaf is short-petioled, oval to elliptic, tapered at both ends or sometimes narrowly rounded or indented at the base, sharply toothed around the margin with teeth at vein ends only slightly larger than intervening teeth. The secondary veins are nearly straight and parallel and some near the middle are distinctively forked. Undersurfaces are somewhat hairy, especially when the leaves are young.

The **twigs** are slender, slightly zigzagged, and reddish-brown with inconspicuous leticels. All **buds** are lateral, thus the end bud is a **pseudoterminal bud** with both a twig scar and a leaf scar at its base. The buds, except the end bud, are angled widely from the twig. They are greenish-brown, plump, pointed, and have overlapping scales each of which is striated along its length. **Leaf scars** are narrowly oval and each carries three vein scars. Many twigs carry preformed **male catkins** at their ends over winter. These are usually borne in threes, sideways, at an angle away from the direction in which the supporting shoot has grown, and each is 8 to 15 mm long.

In the spring, the male catkins elongate to 3 or 4 cm and hang down as their

Picea rubens Sarg. red spruce

Habitat

Red spruce occurs on well-drained sites in lowland and upland areas. It is a very shade-tolerant species that may be found in mixture with many species -- for example, as an understory species growing up beneath and later with aspens and birches, and as a companion species with balsam fir, eastern hemlock, and eastern white pine, and as a lesser component with sugar maple and beech. It is the predominant spruce species in western and central New Brunswick.

Form

Red spruce grows to heights of up to 26 m and to stem diameters of up to 60 cm. The crown is conical when young. It becomes broadly conical in older trees and made up of rather thinly foliated branches that are mostly horizontal and upturned at their ends. This gives a pagoda-like appearance to the crown, which in stand-grown situations occupies no more than about one-third of the height of the tree.

Morphology

The **leaves** are needlelike, 7 to 16 mm long, roundly four-sided, bluntly tipped, and shiny, yellowish-green. Each is borne on a brownish **pulvinus, or leaf cushion,** that projects from the shoot. The leaves occur in a series of long spirals around the shoot and tend to lie somewhat forward, or appressed, along the shoot with those attached on the underside being bent upwards a little.

The **twig** surfaces are made up of longitudinally arranged, small round-topped ridges, each one of which supports near its outer end a leaf cushion with its leaf. The twig surfaces become pale orange-brown by the end of the growing season. The round-topped ridges carry a few tiny steeple-shaped hairs on their surfaces, and many more in the valleys between the ridges. The **terminal bud** is surrounded by small, forward-pointing leaves that tend to obscure it. The bud has shiny reddish-brown outer scales that sometimes extend somewhat. Smaller, ovoid, **lateral buds** may occur in axils of leaves farther back along the shoot.

barrel than like the fingers on the back of one's hand, as are those of red and white spruce. Both the flat surfaces and the indentations between them are covered by short hairs, many of which have tiny swollen glands at their ends, so they look like little straight pins, and some are curled in various ways. Black spruce seed cones are darker, smaller, and more orbicular than those of red spruce. Most stay on the trees unopen for many years, but some, especially on younger trees, do open somewhat in the first fall. The bark of black spruce is dark and scaly.

They simplest and surest way to separate the three species is by use of the twig-surface features along with the leaves. The ridge features, the hair features, that require a hand lens for proper viewing, and the leaf colour and orientation, readily combine for positive identification. The best shoots to use for this are side shoots at the end of a branch, and the easiest viewing is of the undersurfaces of the shoots.

Red spruce and black spruce hybridise with each other when they grow in close proximity, and the offspring can cross back with either parent. As this sort of introgressive hybridisation goes on over time, populations can arise wherein individual trees may be of all shades of mixture of the two species. This has happened in the plateau area of central New Brunswick, where the typically upland red spruce grow on well-drained soils close to the typical lowland black spruce on poorly drained soils. Because there is only a few metres of difference in elevation beteen the two types of site, interbreeding has been possible, and offspring have been able to establish on intermediate sites. Nevertheless, it is usually feasible to identify hybrid individuals as "mostly black spruce" or "mostly red spruce". The problem, however, is that, gradually, the species are becoming less and less pure. This is more of a concern for red spruce than for black spruce because it has a much smaller range, and, in New Brunswick the ranges of the two species overlap entirely.

Red spruce is likely to suffer severe defoliation by spruce budworm. This will particularly be the case when it is growing in mixture with balsam fir, which suffers more. Red spruce/black spruce hybrids suffer less than do red spruce trees, so in spruce-budworm killed areas some hybrids may survive. This also serves to "dilute" the red spruce.

at the tips of more vigorous elongating long shoots. They are purple at first and grow in their first year to small brown cones 8 to 10 mm in diameter. The next season they become green and grow to full size when, as they ripen they become brown. They may open to release seeds in the second fall, or in the following early spring. The mature seed cones are 4 to 6 cm long, ovoid when closed and nearly orbicular when open, and have thickened brown scales that have paler smooth ends.

The **bark** is reddish or pinkish, and loosely scaly when young. It is thick and deeply furrowed between broad, flat, pale reddish-brown, scaly plates when old.

Notes

Red pine is easily distinguished from the other native pines by leaf length and number per microshoot. Jack pine also has two leaves per microshoot, but they are rarely more than 3 cm long. Eastern white pine has leaves 4 to 6 cm long, but they are produced five per microshoot. Red pine might be confused with the introduced Scots pine because the young bark is somewhat similarly coloured, but the leaves of Scots pine are much shorter. The introduced Austrian pine is less easy to separate because its leaves are of similar length to those of red pine, and it also has two leaves per microshoot. However, its leaves tend to be less brittle than those of red pine, so they tend not to break as cleanly when bent. Its buds are pale brown and usually whitened by resin, and its twig surfaces are yellowish-green to brown, and thus, quite different from red pine.

Red pine is used extensively for poles and piling. The wood is relatively hard and can be used for structural timbers. Red pine is often planted as an ornamental.

close-packed scales with extended tips that form a bur-like structure with a distinct fringe around the portion of the acorn that is exposed. The originally green acorn gradually changes to yellowish brown as it matures in the fall

The bark is smooth and light ashy grey when young. When older it is deeply dark-grey furrowed with light-grey flattened ridge tops.

Notes

Bur oak is in the "white oak" group of oaks that have round-lobed leaves and acorns that develop to maturity in one season. The "red oak" group, in contrast, have pointed-lobed leaves with bristle tips to the lobes and acorns that take two seasons to mature. Thus a red oak commonly has acorns of two sizes in the fall, one-season old, small ones, and two-season old, mature ones.

The wood of bur oak is hard and strong, and can be used for furniture, interior trim, boat building, and, because it is of the white-oak group, barrels for storing liquid (woods of the red-oak group cannot be used for storage containers for liquids).

Bur oak withstands city environments well, so is useful for streetside plantings and other ornamental uses.

new leaves and shoots start to form. Because there are no marks left on the shoots (no bud scars), it is not possible to determine how much of the shoot system grew in a given year. Eastern white cedar, does not produce buds, so, in consequence, all branching is neoformed.

At times, darkened tips to some of the tiny shoots look as though they may be buds, but these are either preformed **seed cones** or preformed **pollen cones**. Very early in the spring, these extend to either expose ovule tips for pollination or to shed pollen. The pollen cones then shrivel up and remain as deadened tips to the shoots for many months. The seed cones grow on, become green upright structures through the summer, and then change through greenish-yellow to orange-brown by October when the scales of the small (7 to 15 mm long), still-upright cones spread apart a little to permit seed to be shed. The **seeds** are not winged at one end as are those of the other conifer trees, but laterally winged with flat wings spread out on either side of the elongated seed.

The **bark** is reddish-brown, shiny and quickly becoming fibrous when young. With increasing age, it becomes separated into narrow, flat, greyish-brown, longitudinal strips. Sometimes the strips spiral slightly up the stem.

Notes

Eastern white cedar is a member of the cypress family (Cupressaceae), not the pine family (Pinaceae), as are our other coniferous trees. The name "cedar" is not really appropriate, as that is the name for trees of the *Cedrus* genus (in the Pinaceae), like "cedar of Lebanon" (*Cedrus libani* A. Rich.). Eastern white cedar has many other common names: among these, eastern thuja or eastern arbor-vitae, would be the preferred names.

Because the heartwood of eastern white cedar is extremely durable, tree stems are used for posts, poles, and fences. The wood is also used for fence boards, decks, shingles, siding, and boat-building, and because of its aroma and moth-detering properties, for cedar chests and closets.

The foliage of eastern white cedar is a favourite winter food for deer, so overwintering deer yards are frequently found in or near areas where the species is common.

true lateral buds. Most buds terminate shoots. The **buds** are small, conical to round, and greenish-brown. They develop late in the season and carry only a small amount of preformed content. When the new shoots grow out, much of their lengths are neoformed.

Pollen cones are borne along the undersides of weaker shoots, in axils of leaves. **Seed cones** hang at the tips of shoots of moderate vigour throughout their development, and are 12 to 20 mm long when they open to release seeds, starting in late October.

The **bark** is dark brown and scaly when young. It is thick and deeply furrowed, with dark greyish-brown flat-topped, slightly scaly ridges when old. If pieces of bark are broken off, purple flecking will show in the broken surfaces.

Notes

The wood of eastern hemlock is liable to have splits in it, even when still standing in the tree. This limits its usefulness, except as large-dimension lumber in general construction.

Because the bark has a high tannin content, eastern hemlock trees used to be cut for their bark. The tannin was used in the tanning of hides for leather.

The bark is smooth and grey when young, but quite quickly becomes greyish-brown with obliquely intersecting flat ridges. In old age, the broad ridge tops become ashy grey and scaly. Broken surfaces of outer bark frequently show alternating dark brown and orange-brown bands.

Notes

White elm was formerly a common tree in lowland areas and in towns and cities where it was often planted as a shade-tree. However, the species has largely succumbed to effects of Dutch elm disease, so is now seldom seen, except as dead standing monuments to its earlier prominence. It is still present where long-term sanitation programs have been in effect -- in fact, in such situations it regenerates readily, so young trees are encountered.

The fatal disease is caused by fungal infection. The responsible fungus is readily spread from infected trees by either of two species of beetle that construct feeding and breeding galleries under bark on branches. Sanitation programs, such as that used in Fredericton since 1949, involve systemmatically removing trees as soon as they show signs of infection, so that spread of the fugal spores is reduced.

Elms may be subject to defoliation by the elm leaf beetle. This, especially if it occurs in successive years, can weaken and even kill trees.

The yellowish-brown, hard wood of white elm has an attractive grain, making it suitable for panelling, furniture and veneer. It is also used for caskets and in boat-building.