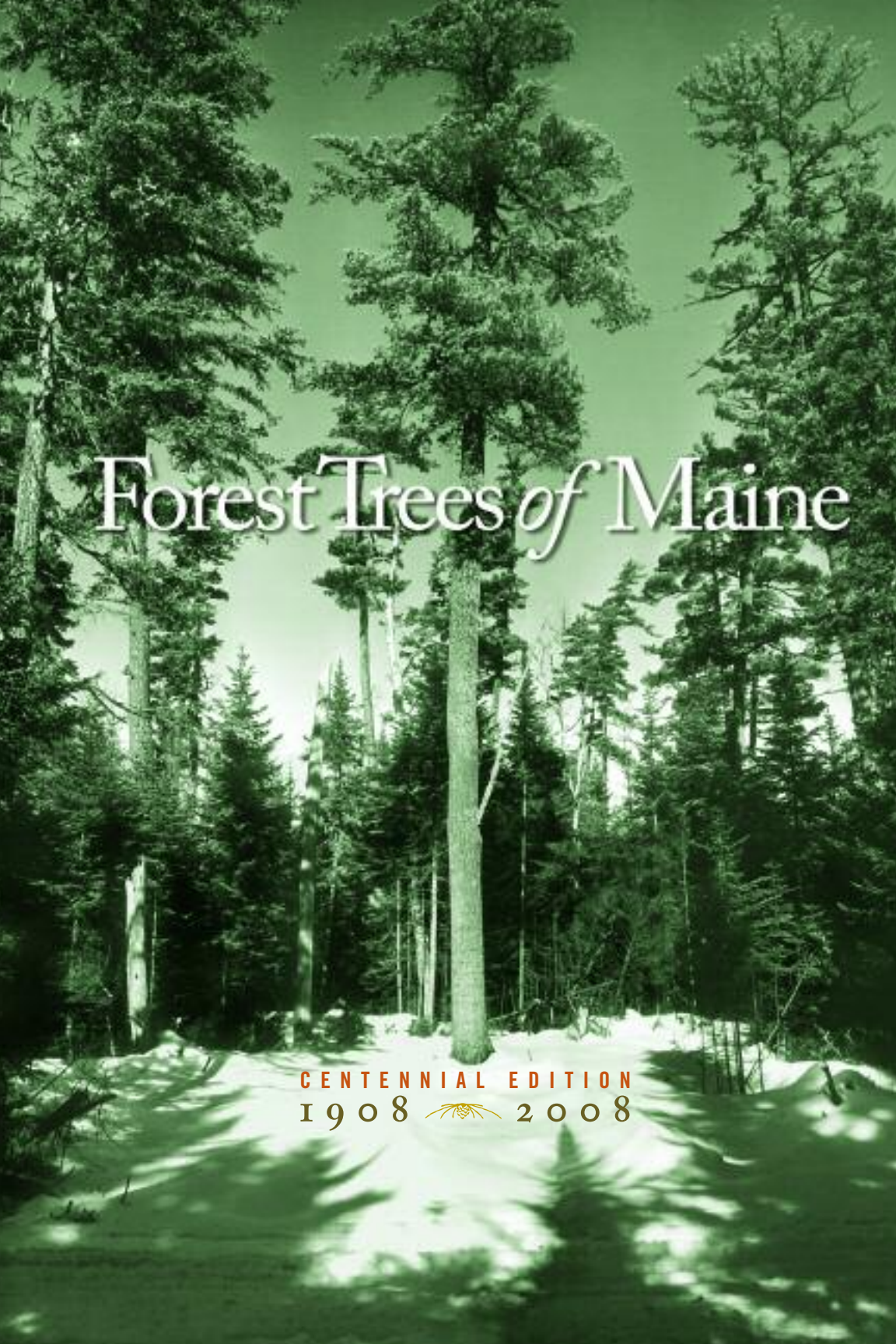

Forest Trees of Maine
CENTENNIAL EDITION
1908 2008

The Maine Forest Service

The Maine Forest Service was established in 1891 to ensure Maine's citizens the greatest economic and social benefits from trees and forestlands of the State.

Part of the Department of Conservation since 1973, the primary responsibilities of the Maine Forest Service include:

to develop through information, education, and formal publications a greater public awareness and appreciation of forests as Maine's basic economy and renewable resource;

to provide advice and assistance in forest management to woodland owners;

to maintain and improve the scenic beauty, wildlife habitat, and recreational values of Maine;

to encourage and promote appropriate forest land management practices; and...

to protect the forest resource from fire, insects, diseases, and other natural enemies.

Dedication

The Centennial Edition of the *Forest Trees of Maine* is dedicated to all the hardworking men and women who make their living in the Maine woods.

Forest Trees of Maine
First published in 1908 Revised 2008
(Fourteenth Edition)
Maine Forest Service
Department of Conservation
Maine Forest Service Phone: (207) 287-2791
E-mail: forestinfo@maine.gov
www.maineforestservice.gov

Printed in Maine on certified paper.

Table of Contents

Acknowledgements

A great many people contributed to the production of this publication. The *Forest Trees of Maine* Centennial Committee was instrumental in bringing this book into being. Members of the committee included Peter Lammert, Dan Jacobs, Merle Ring, Judy Tyler, Kevin Doran, Greg Miller, Jan Ames Santerre, Andy Shultz and Keith Kanoti. Special credit is due to Peter Lammert for updating the wood uses, Dan Jacobs for researching and writing the History section, and Greg Miller for producing the range maps. Others who contributed to the project include: Tom Whitworth, Scott Sawtelle, Tom Collins, Jen Wright, John Anastasio and Debbie Jacques.

Keith Kanoti revised the manuscript and acted as project manager.

The book was designed by David Deal and the manuscript was edited by Donna Stuart, both of Glen Group Inc.

Tom Rawinski, botanist with the US Forest Service Northern Research Station, reviewed the manuscript for technical accuracy.

Cover photo by Arthur Rogers, presented to Forest Commissioner Austin Wilkins by Governor Percival Baxter.

The glossary sketches were used with the generous permission of Dr. Michael A. Dirr.

The range maps are based on *Atlas of United States Trees* by the late Dr. Elbert L. Little.

The majority of the photographs were taken by the Maine Forest Service, Policy and Management Division field staff. Through bugwood.org, several photographers generously let us use images that we could not obtain ourselves. These include Paul Wray, Iowa State University (white oak acorns, swamp white oak acorns, northern red oak acorns, black oak acorns, butternut fruit, shagbark hickory fruit, bitternut hickory fruit, balsam fir cones, black willow leaves); The Dow Gardens Archives, Dow Gardens (mountain laurel flowers, rhododendron flowers, striped maple fruit); Chris Evans, River to River CWMA (bitternut hickory leaves); Bill Cook, Michigan State University Extension (beechnuts, American hornbeam fruit); and David J. Moorhead, University of Georgia (flowering dogwood flowers).

Other photography sources were obtained through USDA-NRCS PLANTS Database. These include Robert H. Mohlenbrock 1995, *Northeast wetland flora: Field office guide to plant species* (Atlantic white cedar cones); D.E. Herman, et al. 1996, *North Dakota tree handbook* (American basswood fruit, blue spruce cones/foliage, bur oak fruit, staghorn sumac fruit); and Steve Hurst (Sugar maple fruit, scarlet oak fruit, black ash fruit).

Introduction

In 1908 the Maine Forest Service released a booklet titled *Forest Trees of Maine*. In his 1910 Commissioner's report, Forest Commissioner Edgar Ring wrote of the popularity of the new publication: "For the *Forest Trees of Maine* there has been a large and constant demand which will very soon exhaust the edition. Possibly in order to meet the demands for this pamphlet it will be considered wise and money well spent to issue another edition." Now, 100 years later and in its 14th edition, *Forest Trees of Maine* remains the Maine Forest Service's most popular publication.

Since 1908, all editions of *Forest Trees of Maine* have had the same objective: to relate accurate information and to keep pace with new findings. As those who are familiar with *Forest Trees of Maine* will immediately notice, we have departed from the traditional format for this edition. This has allowed us to include color photographs, which have long been requested. For those who prefer the tried and true *Forest Trees of Maine* format, it will still be made available.

For the first time, range maps have been included. The maps are based on those of those of the legendary US Forest Service dendrologist, Dr. Elbert Little, who assisted with the 7th edition. The maps indicate the parts of the state where you are most likely to encounter each tree species. No map is perfect, and it is certainly possible to find a species outside of its indicated range.

The keys have been revised and, for the first time, a winter key has been included. To help you use the keys, sketches have been added to the glossary which illustrate many of the terms used. The keys are limited to the trees in the publication. For information on more complete keys, see Selected References on page 174.

The book contains information on 78 different tree species, including all of Maine's commercially important native tree species, as well as a few of the more common and important introduced trees. As with previous editions, no attempt has been made to include all the species in complicated groups, such as willows and hawthorns. When deciding which species to include in this edition, emphasis was placed on trees that occur in Maine's forests. With a few exceptions (e.g., horsechestnut, blue spruce, black walnut), species limited to ornamental plantings were excluded. Other introduced species were included if they have been commonly used in forest plantations (e.g., Norway spruce, Scots pine) or have escaped cultivation and are reproducing in forested areas (e.g., black locust, Norway maple). Several species are included that occasionally grow large enough to be considered small trees (e.g., bear oak, witch hazel, rhododendron, mountain laurel), but are more commonly found as shrubs.

Scientific names in this publication follow the Integrated Taxonomic Information System database: www.itis.gov.

Historic photographs found throughout the book are from the Maine Forest Service Archives and the Maine State Museum.

For more information about this publication or the Maine Forest Service, call 207-287-2791, e-mail us at: forestinfo@maine.gov or visit our website at: www.maineforestservice.gov

Foreword

I am privileged to be able to write a foreword for the centennial edition of *The Forest Trees of Maine*, this wonderful gift that the Maine Forest Service has provided for so long!

Suppose that someone invented a wonderful new machine. It can soak up the "greenhouse" gas carbon dioxide from the air and breathe out oxygen. It can pump huge amounts of water from the soil to reduce floods, while holding the soil together and helping to clean water that flows into streams and ponds. It can produce strong materials for building and fiber for paper. Pick up a stick of firewood. You hold the power of sunlight in your hands! This machine can store solar energy until we release it through fire. If we take care of the land where it grows, then our machine can be replaced by new machines just like it that will give us more of these wonderful things. Of course, the "machine" is not new at all—it is the tree—the tree that is beautiful in the forest and that forms beauty in the form of houses, furniture and the pages of a child's book.

Maine's forest trees are worth knowing. We don't have as many species as do some other states, but we have more acres of land covered with trees. Various sources estimate that we have nearly 96% as much forest as when Maine was first settled. More than in any other state, this great forest is privately owned, yet is more accessible to the public than is true in most areas.

Today too many children grow up in a world of television and computer games. They know little about where the food they eat, the clothing they wear, or the paper they write on comes from. Using this book to learn to identify trees, and to learn about trees and forests, can help to keep your children physically and mentally healthy and can be a great family activity. What fun it can be to explore the woods and see the diversity of trees! Can you identify one of the earliest to blossom in the spring—the serviceberry? Did you know that one shrub-like tree (witch hazel) does not blossom until the fall? Some—like the poplars (aspens), cherries, and white birch—are fast-growing "pioneers" that thrive in the full sun following a forest fire or timber harvest. Others, like sugar maple, can take root in deep shade and grow slowly for hundreds of years.

I hope that you will take the time to enjoy Maine's trees, and to use the wealth of information in this book to educate yourselves, your friends, and your children about this marvelous, renewable resource that is essential to Maine's quality of life.

—Dr. David Field, Professor Emeritus, School of Forest Resources, University of Maine

Logging crew, Upper Kennebec River, 1908

History Snapshot 1908

1908

The history of the most recognizable publication by the Maine Forest Service, *Forest Trees of Maine*, began in 1908.

While Mainers were enjoying the first edition of the *Forest Trees of Maine* that year, the nation as a whole was becoming increasingly hungry for forest resources. In the nation's capital, conservation issues and court rulings in Maine held the interest of the President.

In his 1908 State of the Union message, President Theodore Roosevelt declared, "Thanks to our own reckless use of our splendid forests, we have already crossed the verge of a timber famine in this country…"

In a speech at the White House that same year, the President applauded the State of Maine (particularly the Supreme Court of Maine) for an "exceedingly important judicial decision." The decision, which confirmed the legislature's authority to regulate timber harvesting, was viewed by President Roosevelt as a step towards "the wise utilization of forests....Such a policy will preserve soil, forests, waterpower as a heritage for the children and the children's children of the men and women of this generation."

In the conservation arena, 1908 was an important year: It marked the arrival of this great companion that has guided many people on journeys through the Maine woods.

Region II forest management and operations class, Dyer Brook 2008.

Then and Now

A tremendous number of changes have occurred throughout Maine since the first printing of the *Forest Trees of Maine* in 1908. These changes, too numerable to count, have impacted all our lives, as well as our forest products industry. The table below illustrates some of the changes that have occurred in Maine over the past century.

THEN AND NOW	1908	2008
Forested Area (%)	75[1]	89
Population of Maine	694,466[2]	1,274,923
Population of U.S.	92,228,496	281,421,906
Harvest Volume (cords)	2,879,807	6,742,351*
Stumpage Price of Spruce (MBF**)	$5.49[1]	$135.00
Forestry Students at UMO	31[3]	50
Students at UMO	884	11,800±
Cost of Bangor Daily (year)	$6.00	$180.00±
Most Harvested Hardwood	Aspens[3]	Red Maple
Primary Use of Paper Birch	Spools[3]	Pulp
Gypsy Moth Infested Area of Maine	York and Cumberland	All Counties
Maine Indian Basketmakers	400	100
Primary Use of Black Ash Indian Baskets	Agricultural & Industrial	Collectables & Art

1 Kellogg, R.S. 1909. The Timber Supply of the United States, USDA Forest Service, Circular 166.
2 1909. Maine Register, State Year Book and Legislative Manual 1909-1910, No. 40, G.M. Donham, Portland, 1051pp.
3 Ring, E.E. 1910. Report of the Forest Commissioner, Maine, Kennebec Journal Print, Augusta, 110 pp.
* Harvest volume listed is for 2005. **MBF: Thousand board feet. Note: All values listed in nominal dollars.

1917

1925

1932


1951

A Few Precautions

The Maine woods are a pretty safe place; however, there are a few hazards anyone who is learning to identify trees should be aware of.

POISONOUS PLANTS

Maine has two species of poisonous plants you should learn to identify: poison ivy and poison sumac. Severe dermatitis can result when skin comes in contact with roots, stems, leaves, flowers, fruit or with implements or clothing that have come in contact with plant parts of either poison ivy or poison sumac. Smoke resulting from the burning of plant parts of either species is also poisonous.

POISON IVY, or mercury, is widely distributed throughout the state. It grows as an aerially-rooted climbing vine on trees or as a smooth, trailing vine or erect shrub along stonewalls, fencerows, roadsides and near water bodies.

The **leaves** are alternate, compound, with 3 very shiny, dark green leaflets. Leaflet margins are lobed, wavy, toothed or entire. The stalk of the terminal leaflet is much longer than those of the 2 lateral leaflets. Fall color is often a fiery red.

The **fruit** is a creamy-white, ribbed, globular, BB-sized drupe that occurs in axillary clusters.

POISON SUMAC is an uncommon species that is found throughout the southern part of the state and as far north as Penobscot County. It occurs as a small tree in low, wet swamps. It is particularly common around Mt. Agamenticus in southern Maine.

The **leaves** are alternate, 7–14 inches long, consisting of 7–13 leaflets along a smooth greenish-red rachis. Leaflets have entire margins, short stalks, are dark green and lustrous above with scarlet midribs, and paler and glabrous below. Twigs are without hairs.

Poison ivy (above) and poison sumac (below) are two plants everyone going into the woods should know how to identify and avoid.

The **fruit** is a globose, slightly compressed, thin-fleshed, ivory white or tawny white berry, about 1/5 inch in diameter; it is borne in loose, pendent axillary clusters that ripen in September, but persist on the tree far into winter.

TICKS

About 13 different species of ticks live in Maine. One of these species, the deer tick (*Ixodes scapularis*) can transmit the bacterium that causes Lyme disease. Lyme disease frequently starts with a rash and flu-like symptoms, and if untreated may progress to neurological problems.

Ticks are most common in coastal and south-central Maine. When going into the woods in areas known to have high tick populations, it is wise to take some precautions to help avoid tick bites. For example:

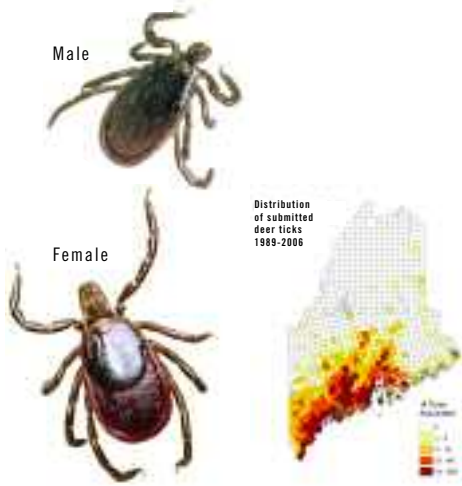
- Tuck your pant legs into your socks and your shirt into your pants.
- Wear light-colored clothing so ticks can be seen more easily.
- Use a repellent containing DEET according the label directions. Pay special attention to treating shoes, socks and pant legs. Use caution in applying high-concentration products to the skin, especially on children.
- To protect pets, consult your veterinarian about tick repellents.
- Inspect yourself, your clothing, your children, your companion and your pets when you get in from the field. Ticks often attach to body folds, behind the ears and in the hair. If possible, shower and wash clothes immediately. Heat drying is effective in killing ticks.

Prompt removal of ticks from skin is very important. To remove a tick, grasp it as close to the skin as possible, preferably with tweezers, and pull gently but firmly until the tick lets go. Do not handle the tick with bare hands. Apply antiseptic to the bite. You should consult your physician if you develop a large rash at the site of the tick bite or if you remove an engorged deer tick.

For more information on ticks, visit the Maine Medical Center Research Institute Vector-borne Disease Laboratory's Lyme disease research Website: www.mmcri.org/lyme/lymehome.html.

Dog Tick

Deer Tick



When supplies could not be brought to logging camps by water, they were transported over land on "tote" roads.

How to use the keys to identify a tree

This book contains keys to help you identify trees in both winter and summer. These are dichotomous keys; they work by giving you pairs of choices called couplets. Each couplet has the same number located on the left side of the key.

Begin at couplet number 1. Read both choices carefully to determine which matches the tree you are trying to identify. After you make your choice, the number at the right tells you which couplet to go to next. Go to that couplet and decide which choice matches your tree; repeat the process until you arrive at a name or species group for your tree. Turn to the page indicated and compare your tree to the species in the table to figure out the individual species.

The final step is to compare your tree to the pictures and drawings in the book. If they don't seem to match your specimen, don't be discouraged; return to the key and check to see if you made an error. Remember that leaves and bark can vary a lot even on the same tree, but the photograph can only show one example. To help you with the terms in the key, a glossary is provided on page 14.

Example: We want to identify the tree these needles came from. Starting at the first couplet, choose the descriptions that fit the specimen. The lines in red indicate the correct choices in the key.

	SEE GLOSSARY PAGE 14	GO TO
1.	Leaves are needle-, awl- or scale-like; conifers	2
1.	Leaves are broad and veined, not as above; hardwoods or broad-leaf trees	9
2.	Leaves needle-like	3
2.	Leaves awl- or scale-like, or both	7
3.	Leaves flat, tips blunt, and occur singly	4
3.	Leaves angular in cross section, tips pointed	5
4.	Leaves taper, twigs limber; cones shorter than 1 inch	**Eastern Hemlock p. 48**
4.	Leaves parallel-sided, twigs stiff; cones over 2 inches	**Balsam Fir p. 46**
5.	Leaves occur singly, never clustered	**Spruce p. 37**
5.	Leaves occur in clusters, also singly in larch	6
6.	Leaves in clusters of 2–5 with papery sheath at base[1]	**Pine p.25**
6.	Leaves in clusters[2] of 8 or more on spurs; papery sheath lacking	**Tamarack p. 50**

We now know the tree is a pine. We then go to the species table to figure out what species of pine it is.

Pines *The Important Distinctions*

	Eastern White Pine *Pinus strobus*	Red Pine *Pinus resinosa*	Pitch Pine *Pinus rigida*
NEEDLES			
NUMBER/ CLUSTER	5	2	3

The tree is Eastern white pine.

Winter Key

	SEE GLOSSARY PAGE 14	GO TO
1.	Leaves are evergreen	2
1.	Leaves are deciduous (dead leaves may remain attached)	10
2.	Leaves are needle- or scale-like; fruit is a cone; conifers	4
2.	Leaves are broad and flat, often curled in winter	3
3.	Leaves to 3 inches long	**Mountain laurel p. 169**
3.	Leaves 4–8 inches long	**Rhododendron p. 170**
4.	Leaves are needle-like	5
4.	Leaves are awl- or scale-like or both	8
5.	Leaves in clusters of 2, 3 or 5 with a papery sheath at the base (may be lacking in white pine)	**Pine p. 25-36**
5.	Leaves attached to the twig singly	6
6.	Leaves angular in cross section, will roll easily between the fingers	**Spruce p. 37-45**
6.	Leaves flat in cross section, will not roll easily between the fingers	7
7.	Leaves taper, attached to twig with tiny stem; bark thick, purple under scales	**Hemlock p. 48**
7.	Leaves parallel-sided, attached directly to twig with round base like tiny suction cup; bark thin with resin blisters	**Fir p. 46**
8.	Branchlets with awl-shaped leaves; leaves prickly	**Juniper, Red cedar p. 56-58**
8.	Branchlets with scale-like leaves; leaves not prickly	9
9.	Twigs flat; cones oblong, up to ½ inch; common statewide	**Northern white-cedar p. 54**
9.	Twigs slightly flattened; cones ¼ inch, rounded; rare tree of southern and midcoast Maine	**Atlantic white cedar p. 52**
10.	Older twigs with many short spur branches less than ¼ inch long; fruit a cone	**Tamarack p. 50**
10.	Spur branches lacking or if present are longer than ¼ inch; fruit not a cone	11
11.	Leaf scars are opposite	12
11.	Leaf scars are alternate	17
12.	3 bundle scars (may be obscured in flowering dogwood, see 15)	13
12.	More than 3 bundle scars	16
13.	More than 2 bud scales	**Maple p. 70-85**
13.	2 bud scales	14
14.	Buds long and narrow, base of terminal bud swollen; bud scales covered with minute, scale-like particles	**Nannyberry p. 166**
14.	Buds not long and narrow; bud scales not covered with minute, scale-like particles	15
15.	Lateral buds hidden; rare small tree of southwestern Maine	**Flowering dogwood p.171**
15.	Lateral buds conspicuous; common small trees	**Maple p. 70-85**
16.	Buds shiny and sticky in spring before flowering	**Horsechestnut p. 158**
16.	Buds not shiny; bud scales covered with minute, scale-like particles	**Ash p. 127-133**
17.	Twigs armed with spines, thorns or branches ending in a spine	18
17.	Twigs are unarmed	20
18.	Armed with paired spines less than 1 inch long	**Black locust p. 162**
18.	Armed with thorns or branches ending in a spine greater than 1 inch long	19
19.	Armed with thorns that occur just above the leaf scar	**Hawthorn p. 147**
19.	Armed with branches ending in a spine	**Canada plum p. 146**
20.	Buds not visible	**Black locust/Honey locust p. 162-164**
20.	Buds visible	21
21.	Leaf scar nearly encircling the bud	22
21.	Leaf scars extending less than ¾ of the way around the buds	23
22.	Buds covered by scales; twigs not hairy; bark mottled in color	**Sycamore p. 159**
22.	Buds naked; twigs very hairy; bark with prominent lenticels	**Staghorn sumac p. 168**
23.	Pith chambered or diaphragmed	24
23.	Pith solid	25
24.	Pith chambered	**Butternut or Walnut p. 155-157**
24.	Pith diaphragmed; uncommon tree of swamps in southern Maine.	**Black gum p. 160**

25.	Buds naked	26
25.	Buds covered by one or more scales	27
26.	Terminal buds scalpel-shaped	**Witch-hazel p. 167**
26.	**CAUTION POISONOUS** Terminal buds ovoid	**Poison sumac p. 6**
27.	Buds covered with a single cap-like scale	**Willow p. 68**
27.	Buds covered by 2 or more scales	28
28.	A single bundle scar; crushed twigs aromatic; rare tree of southwest Maine	**Sassafras p. 165**
28.	More than 1 bundle scar	29
29.	Catkins present	30
29.	Catkins absent	32
30.	Buds stalked; 2 types of catkins present	**Alder p. 102**
30.	Buds sessile; 1 type of catkin present	31
31.	Bud scales with tiny grooves; gray bark with loose vertical scales	**Eastern Hop-Hornbeam p. 98**
31.	Bud scales without grooves; bark peeling or blocky, not with loose vertical scales	**Birch p. 86-96**
32.	Terminal bud absent, the end bud is pseudo-terminal (except on spur shoots)	33
32.	Terminal bud present	38
33.	Up to 4 bud scales (except on spur shoots)	34
33.	5 or more bud scales	36
34.	Bud scales deep red; fruit hard and round, borne in cymes attached to a bract	**American basswood p. 134**
34.	Bud scales other than deep red; fruits not attached to a bract	35
35.	Pith star-shaped (rare tree)	**American chestnut p. 124**
35.	Pith round, fruit borne in catkin-like cones	**Birch p. 86-96**
36.	Buds four-angled, square in cross section; stem fluted, gun metal gray	**American Hornbeam p. 100**
36.	Buds not four-angled, trunk and bark not as above	37
37.	Buds with small vertical grooves, yellow-green, round in cross section; grayish-brown bark peeling into vertical scales	**Eastern Hop-Hornbeam p. 98**
37.	Buds without small vertical grooves, brown, often laterally flattened; bark corky, ridged, often with alternating light and dark layers in cross section	**Elm p. 136-137**
38.	Leaf scars very long and narrow, several times longer than broad	39
38.	Leaf scars broader, at most 3 times longer than broad.	40
39.	Second bud scale more than ½ the length of the bud; buds always uniformly colored	**Mountain ash p. 150**
39.	Second bud scale less than ½ the length of the bud; buds sometimes bi-colored—reddish and greenish	**Serviceberry p. 148**
40.	Pith star-shaped	41
40.	Pith round or if angled without 5 points.	45
41.	Buds clustered toward the tip of the twig	**Oak p. 106-123**
41.	Buds not clustered toward the tip of the twig	42
42.	Terminal bud more than ⅜ inch long; bud scales loose; older trees with gray shaggy bark	**Shagbark hickory p. 152**
42.	Terminal buds less than ⅜ inch long; bud scales not loose; bark of older trees fissured and ridged or smooth, not shaggy	43
43.	Buds sulfur yellow (rare tree of southwestern Maine)	**Bitternut hickory p. 154**
43.	Buds brown to reddish-brown	44
44.	Lowest bud scale centered over the leaf scar; wood diffuse porous	**Aspen/Poplar p. 61-67**
44.	Lowest bud scale not centered over the leaf scar; wood ring porous (rare tree)	**American chestnut p. 124**
45.	Buds long and narrow, several times longer than broad, diverge from the twig at a wide angle; bark smooth gray or often pockmarked with small cankers	**American beech p. 104**
45.	Buds not long and narrow, do not diverge from twig at wide angles.	46
46.	Nodes often clustered toward the ends of twig; bark of dead branchlets yellowish-orange	**Alternate-leaved dogwood p. 172**
46.	Nodes not clustered; dead branchlets not yellowish-orange	47
47.	Buds stalked; pith triangular	**Alder p. 102**
47.	Buds sessile; pith round	**Cherry p. 139-145**

Summer Key

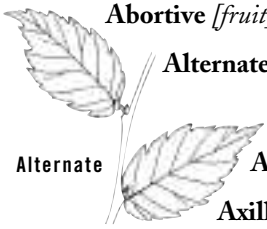
	SEE GLOSSARY PAGE 14	GO TO
1.	Leaves are needle-, awl- or scale-like; conifers	2
1.	Leaves are broad and veined, not as above; hardwoods or broad-leaf trees	9
2.	Leaves needle-like	3
2.	Leaves awl- or scale-like, or both	7
3.	Leaves flat, tips blunt, and occur singly	4
3.	Leaves angular in cross section, tips pointed	5
4.	Leaves taper, twigs limber; cones shorter than 1 inch	**Eastern Hemlock p. 48**
4.	Leaves parallel-sided, twigs stiff; cones over 2 inches and upright	**Balsam Fir p. 46**
5.	Leaves occur singly, never clustered	**Spruce p. 37-45**
5.	Leaves occur in clusters, also singly in larch	6
6.	Leaves in clusters of 2–5 with papery sheath at base[1]	**Pine p. 25-36**
6.	Leaves in clusters[2] of 8 or more on spurs; papery sheath lacking	**Tamarack p. 50**
7.	Branchlets with prickly, awl-shaped leaves; cones are berry-like	**Juniper/Eastern Redcedar p. 56-58**
7.	Branchlets with scale-like leaves; leaves not prickly; cones un-berry-like	8
8.	Twigs flat; cones oblong, woody, up to ½ inch; wood slightly aromatic	**Northern White Cedar p.54**
8.	Twigs slightly flattened; cones ¼ inch, rounded, leathery; wood strongly aromatic	**Atlantic White Cedar p. 52**
9.	Leaves opposite, trees only	10
9.	Leaves alternate	15
10.	Leaves simple	11
10.	Leaves compound	13
11.	Leaf margin serrate	**Nannyberry p. 166**
11.	Leaf margin lobed or entire	12
12.	Leaf margin lobed	**Maple p. 70-85**
12.	Leaf margin entire	**Flowering Dogwood p. 171**
13.	Leaves palmate	**Horsechestnut p. 158**
13.	Leaves pinnate	14
14.	3–5 leaflets, lobed, coarse teeth	**Boxelder p. 84**
14.	5–13 leaflets	**Ash p. 127-133**
15.	Leaves simple	16
15.	Leaves compound	36
16.	Leaf margin entire, wavy, or lobed	17
16.	Leaf margin toothed or serrate	24
17.	Leaf margin entire	18
17.	Leaf margin wavy or lobed	21
18.	Leaves thin, veins parallel	**Alternate Leaf Dogwood p. 172**
18.	Leaves thick and leathery, net-veined	19
19.	Pith diaphragmed; leaves 2–5 inches long	**Black Tupelo p. 160**
19.	Pith not diaphragmed	20
20.	Leaves to 3 inches long	**Mountain Laurel p. 169**
20.	Leaves 4–8 inches long	**Roseberry Rhododendron p. 170**
21.	Leaf margin wavy toward tip; base of leaf one-sided	**Witch-Hazel p. 167**
21.	Leaf margin lobed or wavy throughout	22
22.	Leaf petiole hollow and covers bud; numerous main leaf veins radiate from base	**American Sycamore p. 159**
22.	Leaf petiole neither swollen nor hollow; leaves with one main vein	23

[1] Papery sheath on white pine drops in late August
[2] Larch leaves are borne singly on elongating shoots

23.	Twigs angular; pith star-shaped	**Oak p. 106-123**
23.	Twigs round, spicy odor and taste; leaves 0–3 lobed	**Sassafras p.165**
24.	Leaf margin singly toothed or serrated	25
24.	Leaf margin doubly serrated	31
25.	Teeth hooked, prominent; fruit a bur	26
25.	Teeth not hooked, fruit not a bur	27
26.	Pith star-shaped; buds blunt; bark brown	**American Chestnut p. 124**
26.	Pith round; buds long, pointed; bark gray	**American Beech p. 104**
27.	Leaf base one-sided, leaf cordate; pith not symmetrical	**American Basswood p. 134**
27.	Leaf base even; pith symmetric in cross section	28
28.	Leaves long and narrow; petioles short without glands; buds with a single, cap-like scale	**Willows p. 68**
28.	Leaves broad, or if narrow with glands on petiole; buds with several scales	29
29.	Leaf petiole usually long, flat, except rounded in balsam poplar; pith star-shaped	**Aspen/Poplar p. 61-67**
29.	Leaf petiole short, not flat; pith round	30
30.	Twigs pungent when broken; glands on petiole	**Cherry, Plum p. 139-145**
30.	Twigs odorless; leaf petiole glandless; buds slender, twisted at tip, silky within	**Serviceberry p. 148**
31.	Leaf base one-sided, surface sand-papery	**Elm p. 136**
31.	Leaf base even, surface smooth	32
32.	Branches with thorns 1 inch or more long	**Hawthorn p. 147**
32.	Branches without thorns	33
33.	Pith triangular; buds stalked, smooth	**Speckled Alder p. 102**
33.	Pith not triangular; bud scales overlapping	34
34.	Leaves hairy on both surfaces; pith green	**Eastern Hop-Hornbeam p. 98**
34.	Leaves if hairy only so on one surface; bark smooth	35
35.	Stem fluted; bark smooth, gun-metal gray	**American Hornbeam p. 100**
35.	Stem not fluted; bark white, yellow, or red to dark brown	**Birch p. 87-96**
36.	Leaflets with margin entire	37
36.	Leaflets with serrated margin	38
37.	Twigs with paired spines; 7–19 leaflets	**Black Locust p. 162**
37.	Twigs spineless; 7–13 leaflets; leaflets poisonous	**Poison-Sumac** ** **p. 6**
38.	Leaflets ½ inch long with fine, rounded teeth	**Honeylocust p. 164**
38.	Leaflets over 1 inch long	39
39.	Pith chambered or diaphragmed	**Black Walnut/Butternut p. 155–157**
39.	Pith solid	40
40.	5–7 leaflets; pith star-shaped	**Shagbark/Bitternut Hickory p. 152–154**
40.	11–31 leaflets	41
41.	Twigs smooth; 11–17 leaflets; buds large	**Mountain Ash p. 150**
41.	Twigs densely hairy; 11–31 leaflets; buds small	**Staghorn Sumac p. 168**
	** See also Poison ivy, page 6	

Glossary

Structure in brackets indicates part to which the term applies.



Abortive *[fruit]* Not developed completely.

Alternate *[arrangement of leaves or buds]* Not opposite on sides of twig.

Appressed Pressed close or lying flat against something.

Awl-shaped *[leaf]* Narrow and tapering to a sharp point.

Axillary Growing from the Axil. The angle between the upper side of a leaf or stem and the supporting stem or branch.

Basal disc *[fruit]* A plate-like structure on the base of a fruit.

Bloom A whitish covering; usually on new shoot growth or fruit.

Bole The main stem of a tree; usually the part that is commercially useful for lumber or other wood products.

Bract A leaf-like structure which is attached to a flower, a fruit or to its stalk.

Branchlet Shoot growth of the latest growing season.

Broadleafed Having relatively broad rather than needle-like or scale-like leaves.

Bur *[fruit]* A prickly or spiny husk enclosing the seed.

Capsule *[fruit]* A dry fruit enclosing more than one seed and splitting freely at maturity.

Catkin A compact, cylindrical cluster of flowers of the same sex.

Chambered *[pith]* With hollow cavities separated by discs or plates.

Compound *[leaf]* A leaf composed of smaller leaf units or leaflets.

Conical Wide at the base and gradually tapering to a point; circular in cross section.

Conifer Cone-bearing trees; the "evergreens."

Cordate *[leaf]* Heart-shaped at the petiole end or base.

Corymb A flat-topped floral cluster with outer flowers opening first.

Cup *[fruit]* The scaled, concave basal portion of oak fruit.

Cyme A flattened flowering structure, center flowers bloom earliest.

Deciduous *[leaves]* All leaves drop in the autumn; not evergreen.

Diaphragmed *[pith]* Solid but divided into sections by firmer discs.

Drupe *[fruit]* Fleshy outside, hard and stone-like inside.

Ellipsoid Tapers equally at both ends; more than twice as long as broad.

Elliptical Like an ellipse; flat and tapering equally at both ends.

Entire *[leaf]* Margin of leaf without teeth, lobes, or divisions.

Fascicle *[leaf]* A cluster of conifer leaves.

Fluted *[stem]* With alternating, rounded depressions and ridges.

Fruit The seed-bearing part of a tree.

Glabrous Smooth, without hairs

Glands Generally raised structures at the tips of hairs, or on a leaf, petiole, or twig.

Globose Spherical or globe-shaped.

Habitat The place where a plant usually grows, e.g. rocky, moist, well-drained, etc.

Hardwood Term used to describe all broad-leaved trees. These tree species are typically deciduous, retaining their leaves only one growing season. Despite the term, some "hardwoods," such as the aspens, have wood that is relatively soft.

Head A compact aggregate of flowers or fruit on a common stalk.

Husk *[fruit]* The somewhat leathery, outer covering of a fruit sometimes capable of splitting along well-defined lines.

Invasive Not native to and tending to spread widely in a habitat or environment, sometimes displacing native species.

Lance-shaped Long and tapering; several times longer than broad; broadest at the base.

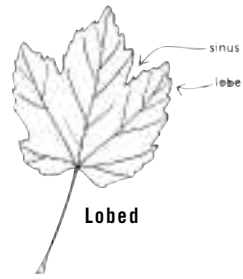
Leaf Stalk (petiole) and blade of hardwoods; needles and scales of conifers.

Leaflets Smaller leaf units which together form a compound leaf.

Lenticel *[bark]* Corky, raised pores on woody parts with openings for air-gas exchange.

Linear *[leaf]* Much longer than broad with parallel margins.

Lobed *[leaf]* With large, rounded or pointed projections along the leaf margin. Projection formed by indentations of the leaf margin.



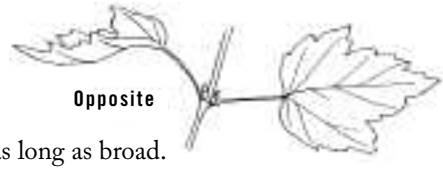
Margin *[leaf]* The edge, perimeter, or portion forming the outline.

Midrib *[leaf]* The large central vein.

Oblong Longer than wide with nearly parallel sides.

Obovate Egg-shaped in outline; broadest above the middle.

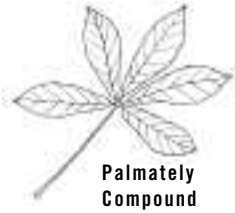
Opposite *[arrangement of leaves or buds]* Directly across from one another on a common axis, or twig.


Opposite

Oval Somewhat elliptical; less than twice as long as broad.

Ovate Egg-shaped in outline; broadest below the middle.

Ovoid An egg-shaped solid.


Palmately Compound

Palmate *[leaf or veins]* Compound, with leaflets originating at the same point on a common stalk. Veins originating at a common point at base of leaf blade.

Panicle A loosely branched, pyramidal cluster of flowers.

Pendulous Drooping or hanging downward.

Petiole *[leaf]* The stalk that supports the leaf blade.

Pinnate *[leaf or vein]* Compound, with leaflets along a common rachis or stalk. Veins originating along a common mid-vein.


Pinnate Veins

Pistillate Containing female portions of flowers, or the pistils.

Pith The central, soft part of the stem.

Prickle A small spine-like growth.

Pseudo-terminal *[bud]* When the bud on the end of a twig has a leaf scar located directly below.

Pubescent Covered with hairs.

Raceme Numerous stalked flowers or fruit along a common axis.

Rachis The common stalk in a compound leaf to which the leaflets are attached.

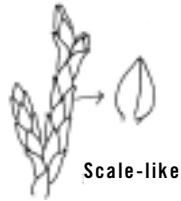
Ranked *[leaves]* Arranged in rows or files.

Samara A winged fruit, e.g. ash, maple.

Scales *[bud]* Small, modified leaves on the outer surface of buds.

Scales *[cone]* The basic structures that enclose the seeds.

Scale-like *[leaf]* Small, generally overlapping, triangular-shaped leaves of some conifers.


Scale-like

Seed That part of the fruit capable of germinating and producing a new plant.

Serrate *[leaf]* Margins with a saw-tooth outline. Doubly serrate: with small teeth on the larger teeth.

Sessile Attached directly by the base without an intervening stalk.

Shrub A woody, many-stemmed plant, usually under 15 feet in height at maturity, which branches from its base.

Simple *[leaf]* A single leaf composed of a single blade. Not compound.

Smooth Without hairs, glands, or any roughness.

Softwood Term used to describe all needle-leaved trees. These species are typically evergreen, retaining their leaves through two or more growing seasons. Larches, including tamarack, are exceptions, being deciduous "softwoods."

Solid *[pith]* Without cavities or sections separated by discs.

Spike A flower stalk.

Spinescent Having a spine or spines; or terminating in a spine.

Spur A short, extremely slow-growing, woody twig projection.

Staminate Containing male portions of flowers, or the stamens.

Stipule A tiny, leafy, sometimes spiny projection arising at the base of a petiole.

Stomate *Plural stomata* Small pore on a leaf used for gas exchange.

Stone The "bony" or stony pit of drupes.

Style The usually slender part of a pistil, situated between the ovary and the stigma.

Toothed *[leaf]* With moderate projections along the margin.

Tree A woody plant, generally single-stemmed, that reaches a height of more than 15 feet at maturity and a diameter of 3 inches or more measured at 4½ feet above the ground.

Umbel A group of flowers or fruit whose stalks have a common point of attachment.

Unequal *[leaf base]* Base parts of blade on either side of midrib are uneven.

Valve-like *[bud scales]* Meet at their margins and do not overlap.

Wavy *[leaf margin]* Undulating but smooth; not toothed nor lobed.

Whorl *[leaves or branches]* More than two originating at the same level on a common axis.

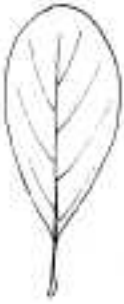
LEAF SHAPES

Ovate

Lanceolate
(Lance-shaped)

Cordate
(Heart-shaped)

Elliptical



Obovate

Oblong

Linear

MARGINS

Entire

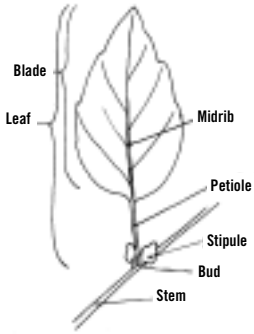
Serrate
(Toothed)

Crenate
(Round toothed)

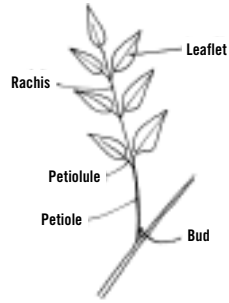
Doubly-Serrate
(Doubly toothed)

Dentate
(Coarsely toothed)

LEAF STRUCTURES



Simple Leaf



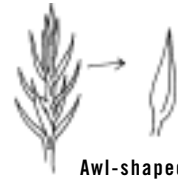
Pinnately Compound Leaf

Palmately Compound Leaf

NEEDLE TYPES

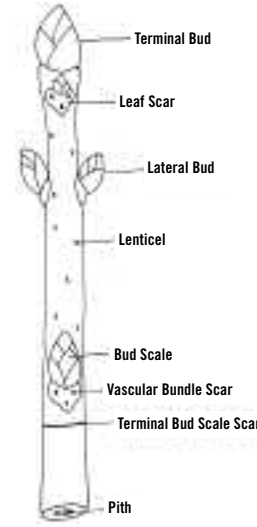
Needle-shaped

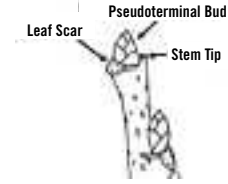
Scale-shaped



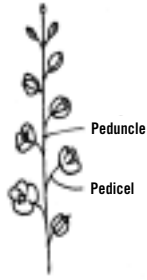
Awl-shaped

TWIG STRUCTURE





FLOWER TYPES

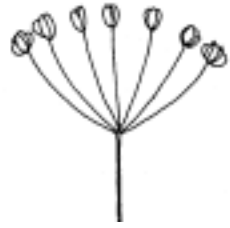


Raceme

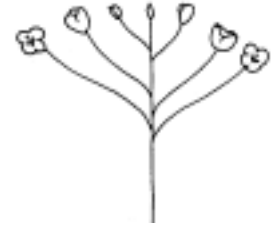
Spike

Panicle (of Racemes)

Cyme



Umbel



Corymb

Tree Parts and Functions

A tree has three major parts: **roots**, **trunk** and **crown**.

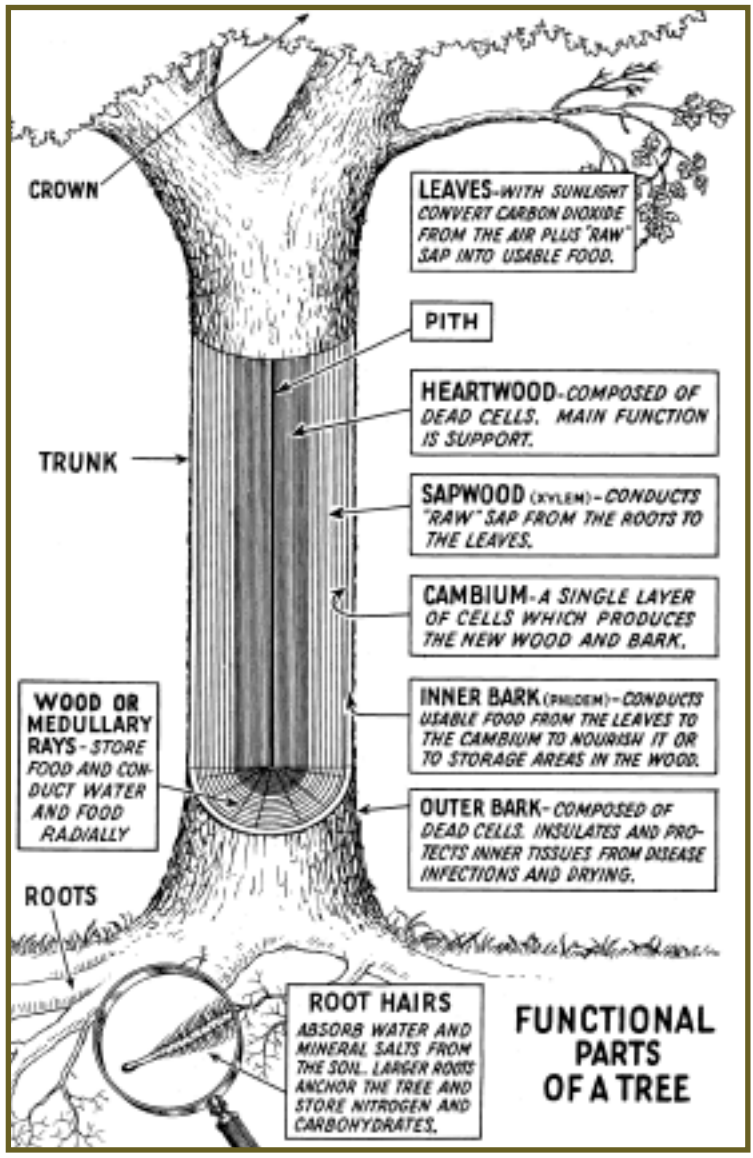
Large roots anchor the tree and store foods which are manufactured in the leaves. **Small roots** and **root hairs** absorb water and dissolved mineral salts from the soil. These raw materials are conducted upward to the leaves where they are utilized in the synthesis of necessary plant food. Air must be present in the soil for the roots to live, although some species can endure several months of flooding.

The **trunk** is the main body of the tree. In the center of the trunk is the pith. Next to the pith is the **heartwood** which is composed of dead cells and serves as support. On the outer side of the heartwood is the **sapwood**, which contains the sap conducting tubes. Sapwood is usually lighter in color, but it darkens with age and becomes heartwood. Heartwood and sapwood together comprise the **xylem**. Outside the sapwood is the **cambium**, a thin layer of cells, which annually produces new sapwood inwardly and new **inner bark** outwardly. The cambium produces diameter growth, and callus growth around open wounds. The **inner bark** or **phloem** is outside the cambium and carries food from the leaves downward to nourish the cambium and growing parts. The **outer bark** is the outer-most part of the tree. Essentially, it is composed of dead cork cells and protects the inner bark from mechanical injury, drying or disease; it also insulates the phloem from extremes of heat and cold. Damage to the phloem causes interference with food movement to growing parts below the injury. Girdling of a tree through its inner bark will kill the tree. **Wood or medullary rays** radiate out from the center, and serve in lateral conduction and as food storage areas. They are most conspicuous in a cross-sectional view.

The **crown** is composed of branches, twigs, buds, leaves, flowers and fruit. The process of **photosynthesis** occurs in the **leaves**. Using energy produced by sunlight, the leaves combine carbon dioxide from the air and water from the soil to produce **carbohydrates**. Oxygen is released in the process. Carbohydrates plus fats and proteins are the plant foods necessary for growth and respiration of the tree. **Flowers** and **fruit** are important in reproduction.

ANNUAL RINGS

The **yearly growth** of a tree can be compared to the annual placement of hollow wooden cones, one on top of the other. Each cone would represent a single year's growth over the entire stem. At the beginning of each new growth period, new wood cells are large and thin-walled, and form the **springwood** or **early wood**. As the growing season progresses, the smaller, thicker-walled cells of the **summerwood** or **late wood** are produced. The darker appearance of the late wood delineates the **annual ring** of growth put on by a tree. The age of a tree, at any desired point along the trunk, can be determined by counting these annual rings.



The relationship between tree age and size can be very deceptive. Many tree species can survive in a shaded understory for years, with nearly microscopic growth rings. These tree species are called shade tolerant. When the canopy is partially or wholly removed by harvest, mortality or weather, increased available sunlight allows accelerated growth. This process is known as release. Some long-lived species, such as red spruce, can survive for decades in the understory, then for centuries in the overstory. Others are shade tolerant but short lived; for example, balsam fir rarely exceeds 100 years in total age. Still other species such as quaking aspen and paper birch are intolerant of shade and relatively short-lived. An observer with knowledge of tree species and growth characteristics can deduce the history of a forest without cutting or boring holes in stems to count rings.

Autumn Coloration

Autumn foliage coloration, one of Maine's greatest aesthetic assets, is enjoyed every year, generally with little appreciation for the processes responsible for it. Most hardwoods produce dramatic leaf coloration if climactic conditions are favorable, while conifers usually produce only weak coloration of yellow and brown.

Hardwoods contain green, yellow and orange pigments in their leaves. Chlorophyll allows the green to be the most prominent of the pigments; however, the green pigment is also the least stable. It is repeatedly produced and destroyed throughout the summer and masks the carotenoid pigments (xanthophyll and carotene) which give the yellow and orange shades. As autumn approaches, chlorophyll is destroyed faster than it is produced. As the chlorophyll disappears, the carotenoid pigments begin to show. The purple and brilliant red shades become visible from the production of anthocyanin pigments, which are also capable of masking the carotenoids. Tannins cause brown shades in some species.

Certain conditions favor maximum autumn coloration. They include adequate summer rainfall, adequate sugar accumulations in the leaves and prolonged periods of cool, bright, sunny weather without severe frosts. Frost is not an essential element for leaf coloration. In fact, weakened trees occasionally color in mid-summer.

Although variations are numerous, a general guideline to autumn tree coloration is listed below.	
YELLOWS	tamarack, green ash, black ash, basswood, beech, birch, butternut, elm, boxelder, mountain maple, silver maple, striped maple, sugar maple, mountain-ash, poplar, serviceberry, willow, witch-hazel.
RED/SCARLET	hornbeam, red maple, mountain maple, sugar maple, black oak, red oak, scarlet oak, white oak, sumac, tupelo.
ORANGE	sugar maple.
BROWNS	black oak, beech.
PURPLE	white ash.

Although much less appreciated than fall color, the subtle color of Maine's trees in early spring can be just as dramatic.