

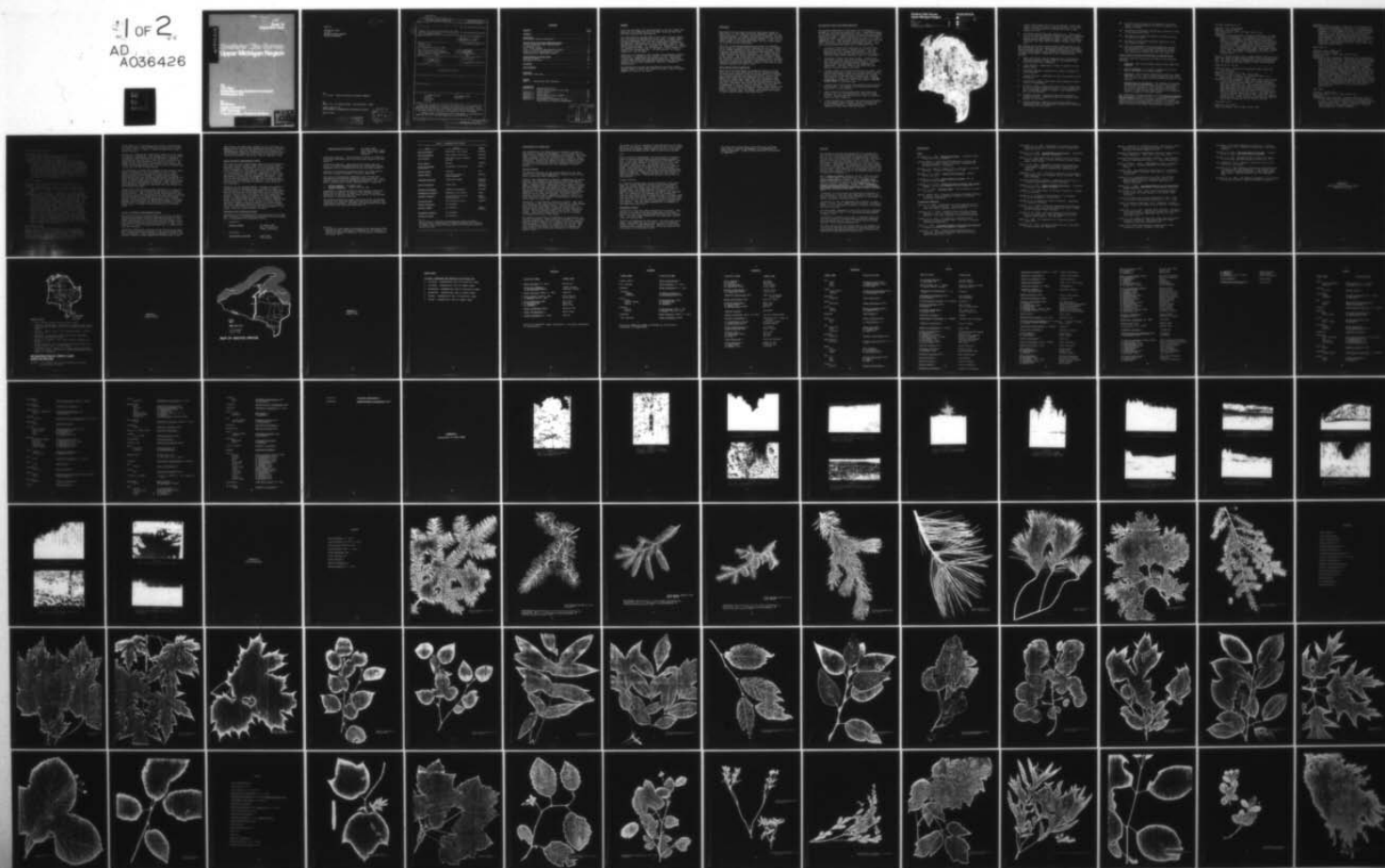
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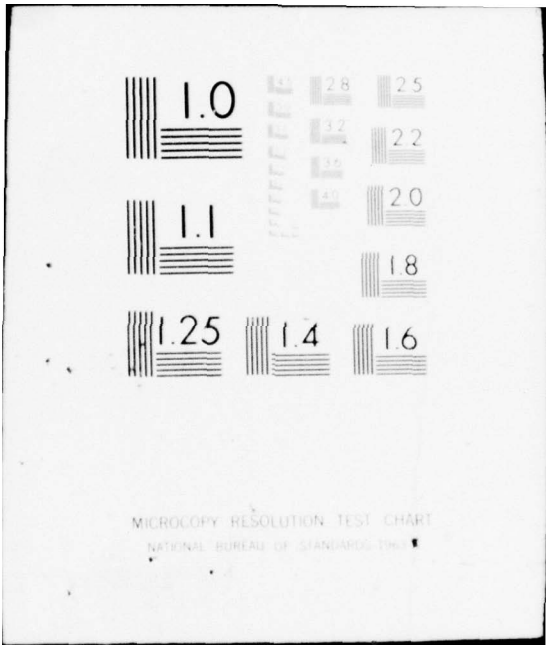
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Book 18
Vegetation Data

Seafarer Site Survey Upper Michigan Region

for
U.S. Navy
Naval Electronic Systems Command
Washington, D.C.

by
EDAW inc.
under contract to
GTE Sylvania
Communication Systems Division

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BOOK 18

VEGETATION DATA
of the
UPPER MICHIGAN REGION
PROJECT SEAFARER

for
U. S. Navy. Naval Electronic Systems Command

by
EDAW, Inc., 50 Green Street, San Francisco 94111

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Since the settlement of the area in the late 1820's, the vegetation has undergone major changes due to logging and clearing for agriculture. Originally the area was once the site of many large stands of white pine, but due to the lumber industry, the area is now covered by stands of hardwoods. A vegetation map, delineated from aerial photographs, is presented which summarizes data with a minimum mapped unit size of 160 acres.		

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SUMMARY

Since the settlement of the Study Area in the late 1820s the vegetation has undergone major changes resulting from logging and clearing for agriculture.

The classification system used in this report groups vegetation according to dominance of crown cover. Primary classification represents 50-95 percent ground space covered by the dominant vegetative unit, with secondary classification representing 5-49 percent of the ground space covered. Vegetative units include: (C) Conifers, (H) Hardwoods, (S) Shrubs, (G) Grasses and Forbs, and (W) Wetlands. Other classes of ground cover recognized are: (A) Agriculture, (U) Urban-Industrial, and (R) Rock.

Vegetation is related to both natural and managerial factors. Variations in vegetation are related to local differences in moisture, temperature and parent material. Regionally, climate along with soil patterns resulting from past glacial activity are the most significant factors in vegetation determination.

The Vegetation Data Map was delineated from aerial photographs, flown in July, 1973 (scale 1:82,800), with a minimum mapped unit size of 160 acres.

EVOLUTION

The Study Area was once the site of many large stands of White Pine. In the 1840s and 1850s commercial logging and lumbering began in the Upper Peninsula of Michigan. By 1905 the area had been so heavily cut and burned that few saw-log timber stands of pine and hardwoods remained. Pine is still being logged in the Study Area today, but will never regain its previous size and abundance.

The area is now covered primarily by stands of hardwoods. These stands of second-growth hardwoods are not as valuable to the lumber industry as were the original forests. Many areas are now dominated by an Aspen-Birch association with a Balsam Fir-White Spruce understory. The lumber and saw timber industry was closely related to the mining industry of the region. The mines used the timber for props. Wood for charcoal production played an important part in the manufacturing of pig iron, with well over 800,000 acres of land cleared to produce the necessary timber to keep the pig iron furnaces burning from 1860 to 1925.

Anticipated Future Conditions

With the virtual exclusion of extensive wild fire in the Study Area, on those areas which are not logged or burned the more shade-tolerant trees like Sugar Maple will succeed less tolerant species like aspen and birch. Most of the Aspen-Birch areas will be succeeded by a Spruce-Fir type before the climax Sugar Maple type (see Distinctive Units and Characteristics for a more detailed description of succession). The White Pine stands may eventually be replaced by hardwoods as long as fire is excluded. The lack of reproduction in Eastern Hemlock and Eastern White Cedar will cause a reduction in their numbers. The conifer bogs will remain as conifer bogs, and swamps and marshes will remain in their present state in the near future.

DISTINCTIVE UNITS AND CHARACTERISTICS

The present vegetation of the Study Area was mapped to a minimum of 160 acres per vegetative unit. Exceptions mapped to 40 acres were distinctive areas such as lakes and cleared agricultural lands. Classification is based on dominance of vegetative types. Primary classification (the "H" in "HC") represents 50-95 percent ground space covered by the dominant vegetative unit. The secondary classification (the "C" in "HC") represents 5-49 percent ground space covered. Vegetative units recognized singly or in combination are:

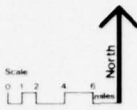
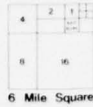
- C (conifers)--trees with needlelike or scalelike foliage and conelike fruits, typical trees in the area being pines, firs, spruces and Tamarack. All but Tamarack retain their foliage for two years or more and hence have become generally known as "evergreen."
- H (hardwoods)--trees with broad leaves. These trees lose their foliage each fall and develop a new canopy with the advent of another growing season. Those trees exhibiting this behavior are described as "deciduous." Typical trees of the Study Area are maples, birches, aspens, and elms.
- S (shrubs)--there are various definitions of shrub. Most sources agree that a shrub is a woody perennial generally having several stems from the same root crown. A mature shrub is smaller than a mature tree, usually less than 20' high. The distribution maps in Shrubs of Michigan, Billington (1943), were used to list the shrubs found in the Study Area.
- G (grass)--areas where grass and associated forb species are dominant. Dry meadows or abandoned agricultural lands are in this category.
- A (agriculture)--land cultivated for farm crops like potatoes and hay improved pasture land and fallow fields. Agricultural lands are not shown in combination with other elements.
- U (urban-industrial)--intensive use areas with buildings or structures, such as towns, cities, airports and mining developments. These areas are not shown in combination with other classifications.

Seafarer Site Survey Upper Michigan Region








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VEGETATION

- | | | | |
|---|--------------------------------|---|----------------------|
|  | Vegetation Types (See Text) |  | Urban and Industrial |
| GENERALIZED VEGETATION ZONES | |  | Lakes |
|  | Hardwood Dominant | | |
|  | Conifer Dominant | | |
|  | Wetland Dominant | | |
|  | Agriculture and Grass Dominant | | |



- R (rock)--areas where rock is at the surface. Rocks must occupy 5 percent or more of the ground space to be indicated. All rock areas are combined with one or more vegetative units.
- W (wetlands)--areas where the ground is wet. These areas can be occupied by conifers, hardwoods, shrubs, herbaceous plants, or any combination of these. These are poorly drained areas often bordering lakes, rivers, and streams. "Wetlands" are also known as swamps, marshes, bogs, and fens.

The combination of cover classification symbols used on the map are derived from the various individual cover classifications described earlier. The symbols representing the vegetation and other elements that characterize the area are listed in order of dominance. Examples of the classifications include:

- U towns and cities, such as Marquette and Iron Mountain, and also industrial areas, such as the National and Greenwood Mines near Ishpeming;
- G grass dominant, comprising at least 95 percent of the ground space;
- H hardwoods dominant, comprising at least 95 percent of the overstory;
- C conifer dominant, comprising at least 95 percent of the overstory;
- A agricultural lands, lands which show evidence of cultivation or improvement;
- W wetlands, swamp or marsh lands which are not dominated by any one single vegetative unit. It can contain conifers, hardwoods, shrubs, or grass in any combination with no one dominant;
- HC hardwood dominant, comprising from 50-95 percent of vegetative cover. Conifers occupy the remaining 5-49 percent of the cover;
- CH conifer dominant, comprising from 50-95 percent of vegetative cover, with hardwoods occupying the remaining 5-49 percent of the cover;

- WC wetlands with conifers as the dominant vegetative cover. Conifers comprise 50 percent or more of the vegetative cover;
- WH wetlands with hardwoods comprising 50 percent or more of the vegetative cover;
- WS wetlands with shrubs the dominant vegetative cover (50 percent or more);
- WG wetlands with grass the dominant vegetative cover (50 percent or more);
- HCR after the vegetative units characterizing the area are presented first in terms of dominance, areas with more than 5 percent but less than 50 percent rock showing are represented with the letter "R."

Forest Types and Their Relationship to Mapping Units

The major types are described in terms of the following features.

- o Rotation: The period between seedling and commercial maturity.
- o Size at maturity: The size at commercial maturity. DBH is the diameter at breast height.
- o Tolerance: The relative tolerance to shade on a scale from one to five. One is very tolerant of shade while five is very intolerant and will regenerate only in full sunlight.
- o Regeneration and succession: The problems and methods of regeneration and the stage the association represents in the succession of the forest. Succession is the natural sequence of types proceeding from less tolerant to more tolerant species which can regenerate under the shade of the forest canopy.

The information on shade tolerance is from The Timber Management Field Book, Northeast Area, U. S. Department of Agriculture Forest Service. The other information is from several sources, including Forest Service in Ironwood, The Department of Natural Resources in Lansing, Dr. Eric Bourdo, Dean of Forestry at Michigan Technological University.

Northern Hardwoods--H, HC

Dominant tree: Sugar Maple

Rotation: 120-140 years

Size of maturity: 24" - 36" DBH, 80-100' tall

Tolerance: 1

Regeneration and succession: Natural regeneration of Sugar Maple is widespread. The tolerance to shade and the ability of the seeds to penetrate layers of leaves enable it to regenerate in the shade of dense canopies. This ability makes it the climax species on those soils it finds favorable. Sugar Maple prefers well drained soils and occurs infrequently on wet and excessively drained soils. Although Sugar Maple forms pure stands, it is often associated with Basswood, Red Maple, Yellow Birch, Elm, and others. Tolerances (1.5, 2.5, 2, 3 respectively).

The U. S. Forest Service lists a Maple-Hemlock type which has been the climax as both trees are long lived and shade tolerant. The lack of hemlock regeneration and its desirability as a saw timber species may remove it from future forests.

Aspen-Birch--H, HC, WH

Dominant trees: Quaking and Largetooth Aspen, Paper and Yellow Birch

Rotation: 40 years

Size at maturity: 10-12" DBH, 50-70' tall

Tolerance: Quaking Aspen - 4, Largetooth Aspen - 3.5, Paper Birch - 5, Yellow Birch - 2

Regeneration and succession: The aspens form clones (groups of trees which share a common root system) and will sprout from their roots when cut. Birch will sprout from the stumps when cut. Both aspens and birches will seed when conditions are open with exposed soil. This type represents an early stage in succession and if left undisturbed it will be replaced by Spruce-Fir or maples on good soils and Jack Pine in the sandy plains. If cut or burned, aspen will return. The wider the clearing open to full sunlight, the better the regeneration will be. Aspen rarely survives for more than one generation without the aid of fire or cutting.

Red Pine--C, CH

Rotation: 140 years

Size at maturity: 24-36" DBH, 60-100' tall

Tolerance: 4.5

Regeneration and succession: Red Pine can be successfully regenerated by seeding or planting. Its relative intolerance to shade places it early in the successional sequence. It can replace Jack Pine by shade and root competition, and grows with Jack Pine on the better Jack Pine sites. It grows with White Pine on the poorer White Pine Sites but White and Jack Pine rarely grow together. On dry, sandy plains, fire is fairly common and this maintains the Jack Pine-Red Pine succession. Red Pine also grows on rocky ridges where there are shallow soils.

White Pine--C

Dominant trees: White Pine

Rotation: 100-140 years

Size at maturity: 36-48" DBH, 50-120' tall

Tolerance: 2.5

Regeneration and succession: White Pine will reproduce by seed and can be planted. Problems with a fungus (White Pine blister rust) are so severe that despite the high quality of its wood, it is not planted as much as it used to be and will not regain its previous abundance. It is the Michigan State tree because of its great importance to Michigan's lumber industry. Michigan led the country in lumber production from 1875 to 1900, mostly White Pine. It grows in nearly pure stands or mixed with hardwoods and hemlock. It will grow in the shade of other trees but it will become the tallest with maturity. Without fire it cannot maintain itself as maple will seed under the pine and the pine will not be able to regenerate in the shade of the maple. White Pine lives in more habitats than any other conifer in the Study Area--from wet to dry, and from deep to shallow soil.

Jack Pine

Rotation: 50-60 years

Size at maturity: 12-15: DBH, 40-60' tall

Tolerance: 5

Regeneration and succession: Although Jack Pine will grow in wet sites, its main habitat is on the dry sandy plains. It is easy to plant and will reproduce readily from seed after fire. Slash in Jack Pine clearings can be burned to stimulate regeneration. Its deep rooting protects it from windthrow.

White Spruce-Balsam Fir

Rotation: 45-80 years

Size at maturity: White Spruce 6-12" DBH, 40-50' tall,
Balsam Fir 12-18" DBH, 40-60' tall

Tolerance: White Spruce - 2, Balsam Fir - 2

Regeneration and succession: White Spruce and Balsam Fir with their tolerance for shade are capable of regenerating in the shade of other trees and they will also seed into clearing. They form a short-lived understory to the Aspen-Birch which will outlive the Aspen-Birch, but then will be followed by hardwoods. In some areas the Balsam Fir-White Spruce stands have been defoliated by insects and then replaced by aspen again. If it were not for their short lives, these trees would be part of the climax Maple-Hemlock forest.

Bog Conifers-WC

Dominant trees: Tamarack, Black Spruce, White Cedar

Rotation: 100 years

Size at maturity: Black Spruce 6-12" DBH, 40-50' tall;
Tamarack 12-24" DBH, 50-75' tall; White Cedar 24-28"
DBH

Tolerance: Black Spruce - 3.5, Tamarack - 5, White Cedar - 1

Regeneration and succession: These bog conifers represent a stage in a slow succession from water to marsh to bog, and eventually to forest. A small lake will be covered by a floating mat of sphagnum moss called a bog. On this bog Black Spruce, Tamarack, and White Cedar can become established. These swamp conifers are sensitive to changes in water level. Reproduction of cedar is rare and some experimental burning is being done to stimulate sprouting. Response to cutting is varied. Some sites will come back to alder or Balm-of-Gilead, while some will come back to conifers. It can be from 10 to 100 years before the conifers will get reestablished. Areas of wetland shrubs like alder, willow, Labrador Tea, and elderberry occupy many stream banks (WS). The bogs on which these conifers grow are often free of trees and have a covering of shrubs like Leather Leaf Cassandra and blueberries (W).

White Cedar Swamps

White cedar is commonly referred to as a swamp conifer because moisture is a critical factor in the regeneration of this tree in its typical swamp habitat. A high water table, slow moving groundwater, or stagnant water can inhibit growth and in some cases kill the entire stand. Any regeneration method must take this into account.

White cedar is a slow growing tree having a rotation age of 120-160 years. Seed production normally begins between the ages of 20 to 30 years. Maximum production is best after 75 years.

Because of a shallow root system any change in water table can result in mortality. Such changes are often the result of improper road construction and trenching. Improper trenching has been found to raise the water table on the upslope side, killing trees as far back as 1/2 mile. Because of their high value in providing winter shelter and browse for Michigan deer herds, such activities should give a wide berth to white cedar stands.

The importance of white cedar swamps as deer yards in some areas of Michigan is due to the ability of the cedar to shelter the white-tailed deer from the wind in severe winter weather and to provide a valuable winter browse. While White Cedar deer yards are not present throughout the Upper Peninsula, they are considered the nucleus of the yards in areas where cedar is numerous. White cedar swamps are generally contained within the deer yards located in lower Marquette, Menominee, Dickinson and Iron Counties on the Wildlife Data Map.

Managing the Northern White Cedar because of its value as winter cover is a joint effort of the district foresters and biologists. Some of the problems associated with this management include overbrowsing by both the white-tailed deer and the snowshoe hare, sensitivity to fluctuating water tables, and an extremely low germination rate. Methods of managing and maintaining the white cedar swamps in northern Michigan involve either not harvesting the cedar on state owned lands, or windrow cutting and burning of residual slash.

Cyrus H. McCormick Experimental Forest

The McCormick Forest, approximately 17,124 acres located in Marquette and Baraga Counties, represents one of the last large forested tracts in the eastern United States. Relatively undisturbed since 1906, the tract was donated to the USDA Forest Service by the McCormick family in 1968. The location of the tract within the Study Area is shown on the Land Use Data Map.

Vegetation communities occurring within the tract are similar to those originally existing in the central Upper Peninsula of Michigan. Virgin northern hardwood, white pine and northern hardwood climax communities becoming rare in the

lake states, are especially evident in the 3,675-acre research natural area in the northeastern corner of the tract (Appendix C of the Land Use Data narrative contains the "Establishment Report for McCormick Research Natural Area"). The wilderness character of the tract is continually utilized for ecological and social research (Metzger, 1976).

Upper Peninsula Experimental Forest

The Upper Peninsula Experimental Forest was established in 1926 and consists of over 5,000 acres located at Dukes, Marquette County, approximately 20 miles southeast of the City of Marquette. The tract was given National Forest status in 1935 and is maintained by the Forest Service, U. S. Department of Agriculture. Appendix D of the Land Use Data narrative contains a detailed description of the Experimental Forest and its management objectives. Location of the tract within the Study Area is shown on the Cultural and Recreational Data Map and a more detailed map of the forest is contained in Figure 1 of the Land Use Data narrative.

Forestry, in its broadest aspect, including all phases of forest production and forest use, is bound to occupy a leading place in the future development of the Upper Peninsula of Michigan and the northern Lake States in general, as very large areas in this region are best suited to that purpose. Forest lands in Michigan are being developed either as timber-producing units or as hunting reserves, parks, and recreational areas by all classes of owners--the Federal government, the State, counties, cities, school districts, lumber and paper companies and various others. The Forest Experiment Station's objective is to furnish a basis of sound scientific facts for the development of the forest lands for these different purposes.

Endangered and Threatened Plants

Endangered and threatened plants occurring within the Study Area included by the Smithsonian Institution on the National List of Endangered and Threatened Plants.

o Endangered

Woodsia abbeae

No common name
Rock crevices and
ledges, Marquette

o Threatened

Cypripedium arietinum

Ram's-head
Lady-slipper

Gymnocarpium heterosporum

No common name
Cool-rocky woods, limestone cliffs and ledges, Marquette

"Endangered Species: those species of plants in danger of extinction throughout all or a significant portion of their ranges."¹

"Threatened Species: those species of plants that are likely to become endangered within the foreseeable future, throughout all or a significant portion of their ranges."¹

Information regarding occurrence within the Study Area is from the Michigan Department of Natural Resources.

The State of Michigan has compiled a list of rare and endangered plant species occurring within the State. Sixteen of these plants are considered endangered. Two of the plants probably occur within the Study Area. These are:

- o Woodsia abbeae: no common name
- o Opuntia fragilis: fragile Prickly Pear

Information on the occurrence of these species within the Study Area is from Dr. W. Wagner & Dr. Ed Voss, of the University of Michigan and Dr. Ralph Blouch of the Michigan Department of Natural Resources.

One hundred ninety-five plants within the State of Michigan listed by the "Technical Advisory Committee for Plants" are considered threatened. Seventeen of those species have been found within the Study Area (see Table 1).

¹ Definitions from "Report on Endangered and Threatened Plant Species of the United States" presented to the Congress of the United States of America by the Secretary, Smithsonian Institute, 1975.

Table 1. THREATENED PLANT SPECIES*

<u>Name</u>	<u>Habitat</u>	<u>County</u>
<u>Carex atratifomis</u>	Wooded edges, rock outcrops	Marquette
<u>Carex Sychnocephala</u>	River bottoms, lake shores	Menominee
<u>Iris lacustris</u>	Moist sands, gravel, limestone crevices	Menominee
<u>Juncus stygius</u>	Peat Bog	Marquette
<u>Allium schoenoprasum</u> (native var.)	Stream banks, rock crevices	Baraga
<u>Disporum hookeri</u>	Woodlands	Iron
<u>Calypso bulbosa</u>	Moist conifer woods, or conifer-hardwoods	Marquette
<u>Cypripedium arietinum</u>	Dunes-conifer swamps	Marquette Menominee
<u>Orchis rotundifolia</u>	Conifer bogs	Marquette Dickinson
<u>Agropyron dasystachyum</u>	Sanddunes and lakeshores	Menominee
<u>Calamagrostis lacustris</u>	Lakeshores, rock crevices	Baraga
<u>Oryzopsis canadensis</u>	Sandy openings in jack pine and white spruce	Baraga Marquette
<u>Trisetum spicatum</u>	Rock crevices and shores	Marquette
<u>Arenaria macrophylla</u>	No information	
<u>Gentiana linearis</u>	No information	Baraga Marquette
<u>Myriophyllum farwellii</u>	No information	
<u>Pinguicula vulgaris</u>	No information	

* The occurrences of endangered and threatened plant species are based on herbarium records at the University of Michigan and Michigan State University. Dr. Edward G. Voss, Curator of Vascular Plants at the Univerisity of Michigan supplied these data.

RELATIONSHIP TO OTHER DATA

The vegetation of the Study Area is intimately related to both natural factors and management. This is made clear by observing the correlation of vegetative boundaries with topography, property lines, and boundaries of old burns. Man's land managerial activities have also been limited by natural boundaries. Despite the changes in species composition due to influence by settlers, the major large and small scale patterns of plant distribution are dependent on natural factors.

Natural Factors

The general character of the climate along with the character of the soil has determined the regional nature of the forest growth and other vegetation.

Locally, the differences in moisture, temperature and parent material have related to variations in native vegetation. They have also affected local variations in soil. For example, "Hardwood Land," dominated by maple, American Elm and American Basswood imply the better soil for general farming, and "Pine Land," Jack, Red and White Pine, the poorer soil. Veatch (Reconstruction of Forest Cover Based on Soil Maps-Appendix A) has made a fairly close correlation between the distribution of plant associations, the growth habit of species, and soil types. Appendix A contains a map of the Study Area which shows Veatch's reconstruction of the original forest or plant cover.

Vegetation is significantly related to climate. The interior regions of the Study Area are subjected to colder weather which shortens the growing season. Local water availability has the most effect on species composition. Willows and Alder prefer moist areas such as near streams and rivers. Red Pine prefers sandy plains and dry, gravelly ridges. Sugar Maple prefers moist rich soils in valleys and uplands and moist, rocky slopes.

The seasonal relationship of vegetation to construction is related to dormancy. Most shrubs and hardwoods in the Study Area are dormant from the first frost to the last (approximately October 20-March 20). Regrowth will be more rapid if disturbance to plants is confined to this period. However, construction during the winter will circumvent the possibility of identifying any endangered or threatened plants (forbs).

The effect of glacial activity is very prevalent on the vegetation of the region. Lowlands, carved by the glacial action, are occupied by swamps, bogs, marshes, and fens, with mixed hardwood and hardwood-conifer types occupying the uplands.

Fire

Before effective suppression, fire maintained the stands of pine by eliminating the shade-tolerant hardwood regeneration. Fires were common and occasionally disastrous in the days of the early settlers. Fires were set to clear land and remove logging slash. The present stands of aspen represent areas which have been burned within the last 100 years. Some burning is carried out by the Department of Natural Resources (DNR) to keep areas in early successional stages of aspen and brush, as this provides good habitat for deer and Sharptail. Blueberry patches are also burned to improve productivity. The Forest Service's use of fire is very limited.

Climate and Soil

In areas of hard pan soil or high watertable, where root depth is limited and where there are trees which extend above the general canopy, the likelihood of windthrow is the greatest. The trees which are able to grow above the general canopy and become exposed to windthrow are (C) Hemlock, White Pine, Red Pine; (H) Red Maple, Elm, Basswood, Ash. The probability of windthrow can be increased by clearing near large trees and exposing them to stronger winds than they faced previously. On well drained soil most roots will be within 2-3' of the surface. On poorly drained areas root depth is even less and the likelihood of windthrow is even greater. The tree least susceptible to windthrow is the deep-rooted Jack Pine.

Management Factors

Agricultural lands have been cleared from the forest. Agriculture is not one of the major industries in the Study Area due to the short growing season and extensive forested land. The major crops harvested in the Study Area include corn, hay and potatoes.

Wildlife are dependent on the forest. The deer seek forest edges. The amount and type of edge is one of the determining factors in game production. Openings in the forest provide a food source for the deer, while the adjacent forests remain as a protective cover.

The Study Area covers parts of two districts and eight areas used in forestry management by the Department of Natural Resources. A map of these divisions is contained in Appendix F.

VALIDITY

The Vegetation Data Map was delineated to a minimum unit size of 160 acres from stereoscopic color photos flown in July of 1973. The photo scale is approximately 1:82,800. The base map was planimetrically enlarged on clear film from a scale of 1:125,000 to the photo size of 1:82,800. The delineations were drawn directly onto the clear film from the photos. Adjustments for variation of the photo's scale were made as necessary. The delineations were then reduced to the original base map scale of 1:125,000 and drafted onto the base map. Field sampling was accomplished prior to and during the delineating. A map of the sampling routes driven is contained in Appendix B.

Gray's Manual of Botany (Fernald, 8th Ed., 1950) was used for all plant names. Information on rare plants is from Shrubs of Michigan (Billington, 1943). Michigan Trees (Otis, 1972) was also used as a reference guide. Information on evolution is mostly from The Lumbering Era in Michigan History (1860-1900), (Mason, 1956); Demographic Changes and Resource Use in the Western Counties of Michigan's Upper Peninsula (1860-1950), (Davis, 1961); and field work.

Information on associations and successional sequences of the vegetation is from the USFS Experimental Station, Marquette, Michigan, and Jerry Rose, Forester for Department of Natural Resources, Lansing, Michigan.

Information on rare and endangered plant species is from Ralph I. Blouch, Ph.D., MDNR, Lansing, Michigan, and Warren Wagner, Ph.D., Department of Botany, University of Michigan, Ann Arbor, Michigan.

The photographs (Appendix D) and plant collection (Appendix E) are from field work or from The Silva of North America, (Sargent, 1897).

Information on present use of fire is from Gene Gazlay of the Fire Division of the Department of Natural Resources, and from Marion True of the U. S. Forest Service, Ottawa National Forest Regional Headquarters.

The areas delineated with dotted lines at the southern tip of the Study Area were not covered by the photography and were mapped using the delineations in the Michigan Forest Survey by the Department of Conservation.

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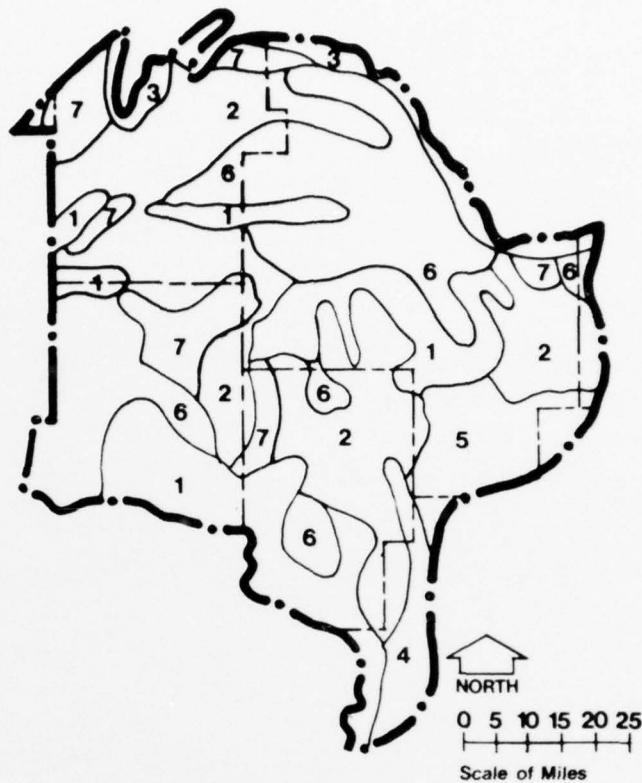
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APPENDIX A
RECONSTRUCTION OF FOREST COVER
BASED ON SOIL MAP



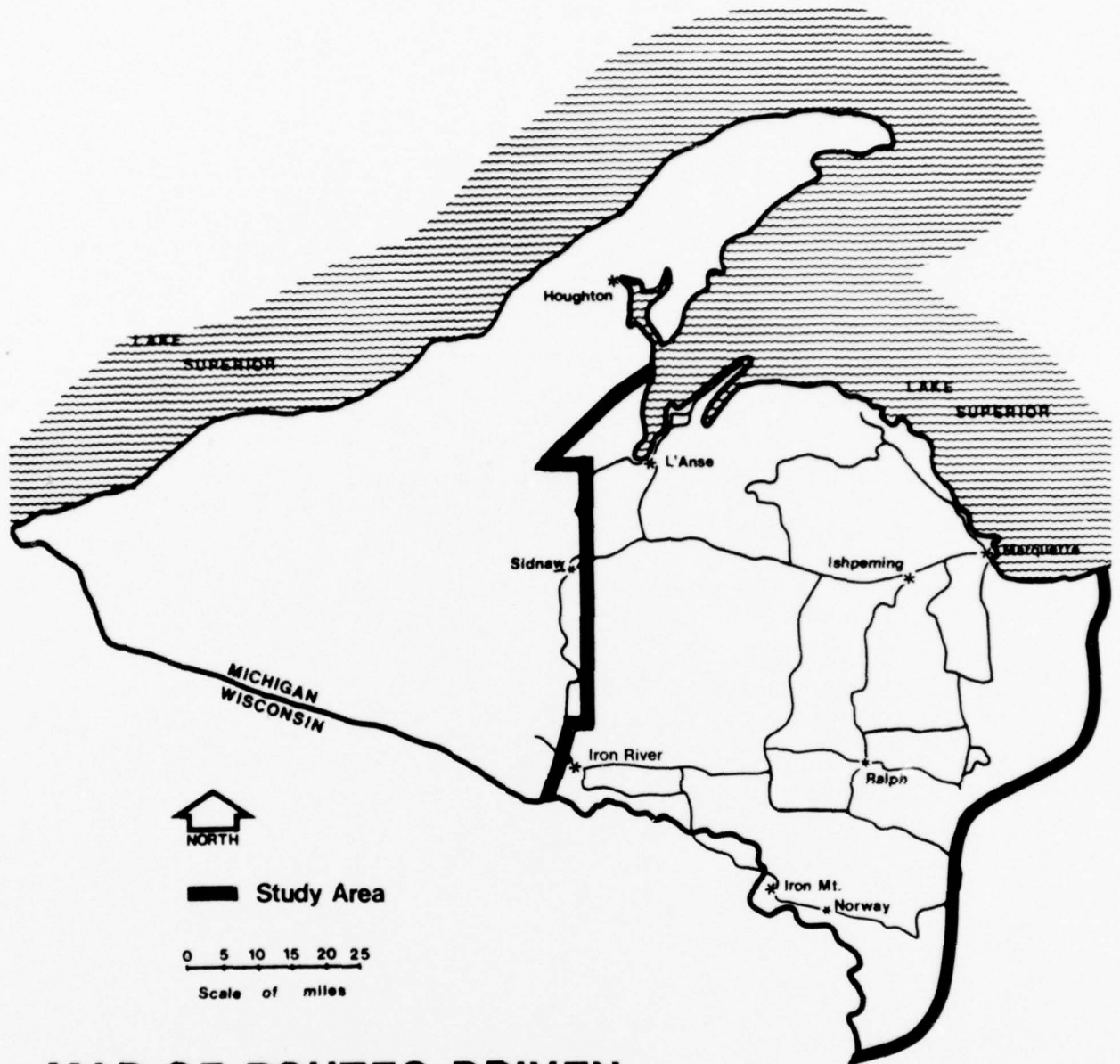
Number on Map

1. Pine. Norway, White, and Jack Pines; Oaks.
2. Hardwood. Sugar Maple, Yellow Birch, American Elm, Basswood, Eastern Hemlock, Balsam Fir, American Beech rare or absent.
3. Conifer. Cedar, Spruce, Fir, Tamarack swamps. Pines on dry soils.
4. Hardwood. Sugar Maple, Yellow Birch, Ash, Basswood, American Elm, American Beech.
5. White Pine abundant. Also Cedar, Spruce, Tamarack, Fir swamps.
6. Hardwood-Conifer. No. 5 hardwood, and mixed White Pine, Norway, Aspen, Oaks. Conifer swamps.
7. Hardwood-Conifer. Balsam Fir, Spruce, Eastern Hemlock, White Pine, Maple, Yellow Birch, Basswood mixture, Spruce, Cedar, Fir, Tamarack.

**RECONSTRUCTION OF FOREST COVER
BASED ON SOIL MAP**

Source: J. O. Veatch, Agricultural Experiment Station,
Michigan State College

APPENDIX B
ROUTES DRIVEN



MAP OF ROUTES DRIVEN

APPENDIX C
PLANT LISTS

PLANT LISTS

Conifers, Hardwoods and Shrubs of the Study Area

1. Conifers: alphabetical list of scientific names
2. Conifers: alphabetical list of common names
3. Hardwoods: alphabetical list of scientific names
4. Hardwoods: alphabetical list of common names
5. Shrubs: alphabetical list of scientific names
6. Shrubs: alphabetical list of common names

CONIFERS

<u>Scientific Name</u>	<u>Common Name</u>
* <u>Abies balsamea</u> (L.) Mill.	Balsam Fir
<u>Juniperus communis</u> L.	Common Juniper
<u>J. horizontalis</u> Moench	Creeping Juniper
* <u>Larix laricina</u> (DuRoi) K. Koch	Tamarack
* <u>Picea glauca</u> (Moench) Voss	White Spruce
* <u>P. mariana</u> (Mill.) BSP.	Black Spruce
* <u>Pinus Banksiana</u> Lamb.	Jack Pine
* <u>P. resinosa</u> Ait.	Red Pine
* <u>P. Strobus</u> L.	White Pine
<u>Taxus canadensis</u> Marsh.	American Yew
* <u>Thuja occidentalis</u> L.	White Cedar
* <u>Tsuga canadensis</u> (L.) Carr.	Hemlock
* Listed as commercial woods of Michigan by Michigan Department of Conservation	

CONIFERS

<u>Common Name</u>	<u>Scientific Name</u>
* Cedar, White	<u>Thuja occidentalis</u> L.
* Fir, Balsam	<u>Abies balsamea</u> (L.) Mill.
* Hemlock	<u>Tsuga canadensis</u> (L.) Carr.
Juniper	
Common	<u>Juniperus communis</u> L.
Creeping	<u>J. horizontalis</u> Moench
* Pine	
* Jack	<u>Pinus Banksiana</u> Lamb.
* Red or Norway	<u>P. resinosa</u> Ait.
* White	<u>P. Strobus</u> L.
* Spruce	
* Black	<u>Picea mariana</u> (Mill.) BSP.
* White	<u>P. glauca</u> (Moench) Voss
* Tamarack	<u>Larix laricina</u> (DuRoi) K. Koch
Yew, American	<u>Taxus canadensis</u> Marsh.

*Listed as commercial woods of Michigan by the Michigan Department of Conservation.

HARDWOODS

<u>Scientific Name</u>	<u>Common Name</u>
* <u>Acer negundo</u> L.	Boxelder
* <u>A. rubrum</u> L.	Red Maple
* <u>A. saccharinum</u> L.	Silver Maple
* <u>A. saccharum</u> Marsh.	Sugar Maple
* <u>Betula lutea</u> Michx. f.	Yellow Birch
* <u>B. papyrifera</u> Marsh.	Paper Birch
<u>Carpinus caroliniana</u> Walt.	American Hornbeam, Blue Beech
* <u>Fagus grandifolia</u> Ehrh.	American Beech
<u>Fraxinus americana</u> L.	White Ash
<u>F. nigra</u> Marsh.	Black Ash
<u>F. pennsylvanica</u> Marsh.	Red Ash
<u>Juglans cinerea</u> L.	Butternut
<u>Ostrya virginiana</u> (Mill.) K. Koch	American Hophornbeam
<u>Populus balsamifera</u> L.	Balsam Poplar or Balm of Gilead
<u>P. grandidentata</u> Michx.	Largetooth Aspen
<u>P. tremuloides</u> Michx.	Quaking Aspen
<u>Prunus pensylvanica</u> L.f.	Pin Cherry
<u>Prunus serotina</u> Ehrh.	Black Cherry
<u>Quercus alba</u> L.	White Oak
<u>Q. macrocarpa</u> Michx.	Bur Oak
<u>Q. rubra</u> L.	Red Oak
<u>Tilia americana</u> L.	American Basswood
<u>Ulmus americana</u> L.	American Elm
<u>U. rubra</u> Muhl.	Slippery Elm
<u>U. Thomasi</u> Sarg.	Rock Elm

HARDWOODS

<u>Common Name</u>	<u>Scientific Name</u>
Ash	
Black	<u>Fraxinus nigra</u> Marsh.
Red	<u>F. pennsylvanica</u> Marsh.
White	<u>F. americana</u> L.
Aspen	
Large Tooth	<u>Populus grandidentata</u> Michx.
Quaking	<u>P. tremuloides</u> Michx.
Basswood	
American	<u>Tilia americana</u> L.
Beech	
American	<u>Fagus grandifolia</u> Ehrh.
Birch	
Paper	<u>Betula papyifera</u> Marsh.
Yellow	<u>B. lutea</u> Michx. f.
Boxelder	<u>Acer negundo</u> L.
Cherry	
Black	<u>Prunus serotina</u> Ehrh.
Pin	<u>P. pensylvanica</u> L.f.
Elm	
American	<u>Ulmus americana</u> L.
Rock	<u>U. Thomasi</u> Sarg.
Slippery	<u>U. rubra</u> Muhl.
Hornbeam	
American	<u>Carpinus caroliniana</u> Walt.
Hophornbeam	
American	<u>Ostrya virginiana</u> (Mill.) K. Koch
Maple	
Red	<u>Acer rubrum</u> L.
Silver	<u>A. saccharinum</u> L.
Sugar	<u>A. saccharum</u> Marsh.
Oak	
Bur	<u>Quercus macrocarpa</u> Michx.
Red	<u>Q. rubra</u> L.
White	<u>Q. alba</u> L.
Poplar	
Balsam	<u>Populus balsamifera</u> L.

SHRUBS

<u>Specific Name</u>	<u>Common Name</u>
<u>Acer pensylvanicum</u> L.	Striped Maple
<u>A. spicatum</u> Lam	Mountain Maple
<u>Alnus crispa</u> (Ait.) Pursh	Green or Mountain Alder
<u>A. rugosa</u> (DuRoi) Spreng.	Speckled Alder
<u>Amelanchier oblongifolia</u> T. & G. Roem	Shadbush
<u>Andromeda glaucophylla</u> Link.	Bog Rosemary
<u>A. Polifolia</u> L.	Wild Rosemary
<u>Arctostaphylos Uva-ursi</u> (L.) Spreng.	Bearberry
<u>Betula glandulosa</u> Michx.	Dwarf Birch
<u>B. pumila</u> L.	Low or Swamp Birch
<u>Ceanothus americanus</u> L.	New Jersey Tea
<u>C. ovatus</u> Desf.	Inland Jersey Tea
<u>Celastrus scandens</u> L.	Waxwork
<u>Chamaedaphne calyculata</u> (L.) Moench	Leather-leaf Cassandra
<u>Elematis virginiana</u> L.	Virgin's Bower
<u>Comptonia peregrina</u> (L.) Coult.	Sweet Fern
<u>Cornus alternifolia</u> L.	Alternate-leaved Dogwood
<u>C. Amomum</u> Mill.	"Red Willow"
<u>C. asperifolia</u> Meyer	Rough-leaved Dogwood
<u>C. Baileye</u> Coult. & Evans	Bailey's Dogwood
<u>C. circinata</u> L'Her	Round-leaved Dogwood
<u>C. paniculata</u> L'Her	Panicled Dogwood
<u>C. stolonifera</u> Michx.	Red Osier
<u>Corylus rostrata</u> Ait.	Beaked Hazelnut
<u>Crataegus coccinea</u> L.	Scarlet Thorn
<u>C. punctata</u> Jacq.	Large-fruited Thorn
<u>Diervilla Lonicera</u> Mill.	Bush Honeysuckle
<u>Dirca palustris</u> L.	Leatherwood
<u>Empetrum nigrum</u> L.	Black Crowberry
<u>Epigaea repens</u> L.	Trailing Arbutus
<u>Gaultheria procumbens</u> L.	Aromatic Wintergreen

<u>Gaylussacia baccata</u> (Wang.) C. Koch.	Black Huckleberry
<u>Hamamelis virginiana</u> L.	Common Witch-hazel
<u>Hudsonia tomentosa</u> Nutt.	Wooly Hudsonia
<u>Hypericum Kalmianum</u> L.	Kalm's St. John's-wort
<u>Ilex verticillata</u> (L.) Gray	Winterberry
<u>Juniperus communis</u> L. Var. <u>depressa</u> Pursh	Prostrate Juniper
<u>Kalmia polifolia</u> Wang.	Pale or Bog Laurel
<u>Ledum groenlandicum</u> Oeder	Labrador Tea
<u>Lonicera canadensis</u> Bartr.	Fly Honeysuckle
<u>L. dioica</u> L.	Smooth-leaved Honeysuckle
<u>L. glaucescens</u> Rydb.	Douglas' Honeysuckle
<u>L. hirsuta</u> Eat.	Hairy Honeysuckle
<u>L. oblongifolia</u> (Goldie) Hook.	Swamp Fly Honeysuckle
<u>L. villosa</u> (Michx.) R. & S.	Mountain-Fly Honeysuckle
<u>Myrica Gale</u> L.	Sweet Gale
<u>Nemopanthus mucronata</u> (L.) Trel.	Mountain-Holly
<u>Parthenocissus quinquefolia</u> (L.) Planch.	Virginia Creeper
<u>P. vitacea</u> (Knerr) Hitchc.	False Grape
<u>Physocarpus opulifolius</u> (L.) Maxim.	Ninebark
<u>Potentilla fruticosa</u> L.	Shrubby Cinquefoil
<u>Prunus pumila</u> L.	Sand Cherry
<u>P. virginiana</u> L.	Choke Cherry
<u>Ptelea trifoliata</u> L.	Wafer Ash
<u>Pyrus melanocarpa</u> (Michx.) Willd.	Black Chokeberry
<u>Rhamnus alnifolia</u> L'Her.	Alder Buckthorn
<u>Rhus glabra</u> L.	Smooth Sumac
<u>R. Toxicodendron</u> L.	Poison Oak
<u>R. typhina</u> L.	Staghorn Sumac
<u>Ribes cynosbati</u> L.	Prickly Gooseberry
<u>R. floridum</u> L'Her.	Wild Black Currant
<u>R. lacustre</u> (Pers.) Poir.	Bristly Black Currant
<u>R. prostratum</u> L'Her.	Skunk Currant
<u>R. triste</u> Pall.	Red Currant

<u>Rosa acicularis</u> Lindl.	Prickly Wild Rose
<u>R. blanda</u> Ait.	Smooth Rose
<u>R. carolina</u> L.	Swamp Rose
<u>Rubus allegheniensis</u> Porter	Sow-Teat Blackberry
<u>R. canadensis</u> L.	Smooth Blackberry
<u>R. hispidus</u> L.	Hispid
<u>R. idaeus</u> L.	Raspberry
<u>R. parviflorus</u> Nutt.	Thimbleberry
<u>R. triflorus</u> Richards.	Dwarf Raspberry
<u>Salix balsamifera</u> Barratt.	Balsam Willow
<u>S. candida</u> Flugge	Hoary Willow
<u>S. cordata</u> Michx.	Heartleaf Willow
<u>S. discolor</u> Muhl.	Large Pussy Willow
<u>S. glaucophylla</u> Bebb	Broadleaf Willow
<u>S. humilis</u> Marsh.	Small Pussy Willow
<u>S. longifolia</u> Muhl.	Sandbar Willow
<u>S. lucida</u> Muhl.	Shining Willow
<u>S. pedicellaris</u> Pursh.	Bog Willow
<u>S. petiolaris</u> Sm.	Slender Willow
<u>S. rostrata</u> Richards.	Beaked Willow
<u>S. sericea</u> Marsh.	Silky Willow
<u>S. serissima</u> (Bailey) Fern.	Autumn Willow
<u>S. syrticola</u> Fern.	Sand-dune Willow
<u>Sambucus canadensis</u> L.	Common Elder
<u>S. pubens</u> Michx.	Red-berried Elder
<u>Shepherdia canadensis</u> (L.) Nutt.	Soapberry
<u>Spiraea alba</u> DuRoi	Meadow Sweet
<u>S. latifolia</u> (Ait.) Borku	Meadow Sweet
<u>Staphylea trifolia</u> L.	Bladdernut
<u>Symphoricarpos occidentalis</u> Hook.	Wolfberry
<u>S. racemosus</u> Michx.	Snowberry
<u>Vaccinium atrococcum</u> (Gray) Heller	Black Highbush Blueberry
<u>V. macrocarpon</u> Ait.	Large or American Cranberry
<u>V. membranaceum</u> Dougl.	Thin-leaved Bilberry
<u>V. myrtilloides</u> Michx.	Sour-top Blueberry
<u>V. ovalifolium</u> Sm.	Tall Bilberry
<u>V. Oxycoccus</u> L.	Small Cranberry
<u>V. pensylvanicum</u> Lam.	Low Sweet Blueberry
<u>V. vacillans</u> Torr.	Low Blueberry
<u>Viburnum acerifolium</u> L.	Mapleleaf Viburnum
<u>V. cassinoides</u> L.	Witherod
<u>V. dentatum</u> L.	Southern Arrow-wood

V. Lentago L.
V. Opulus L.
V. pubescens (Ait.) Pursh.

Vitis vulpina L.

Zanthoxylum americanum Mill.

Sweet Viburnum
Guelder-Rose
Downy Arrow-wood

Frost grape

Prickly Ash

SHRUBS

<u>Common Name</u>	<u>Scientific Name</u>
Alder Green, Mountain Speckled	<u>Alnus crispa</u> (Ait.) Pursh. <u>A. rugosa</u> (DuRoi) Sprang.
Arbutus Trailing	<u>Epigaea repens</u> L.
Arrow-wood Downy Southern	<u>Viburnum pubescens</u> (Ait.) Pursh. <u>V. dentatum</u> L.
Ash Prickly Wafer	<u>Zanthoxylum americanum</u> Mill. <u>Ptelea trifoliata</u> L.
Bearberry	<u>Arctostaphylos Uva-ursi</u> (L.) Spreng.
Bilberry Tall Thin-leaved	<u>Vaccinium ovalifolium</u> Sm. <u>V. membranaceum</u> Dougl.
Birch Dwarf Low or Swamp	<u>Betula glandulosa</u> Michx. <u>B. pumila</u> L.
Blackberry Smooth Sow-Teat	<u>Rubus canadensis</u> L. <u>R. allegheniensis</u> Porter
Bladdernut	<u>Staphylea trifolia</u> L.
Blueberry Black Highbush Low Low Sweet Velvet-leaf	<u>Vaccinium atrococcum</u> (Gray) Heller <u>V. vacillans</u> Torr. <u>V. pensylvanicum</u> Lam. <u>V. myrtilloides</u> Michx.
Buckthorn Alder	<u>Rhamnus alnifolia</u> L'Her
Cassandra Leather-leaf	<u>Chamaedaphne calyculata</u> (L.) Moench
Cherry Choke Sand	<u>Prunus virginiana</u> L. <u>P. pumila</u> L.

Chokeberry Black	<u>Pyrus melanocarpa</u> (Michx.) Willd.
Cinquefoil Shrubby	<u>Potentilla fruticosa</u> L.
Cranberry Large or American Small	<u>Vaccinium macrocarpon</u> Ait. <u>V. Oxycoccus</u> L.
Creeper Virginia	<u>Parthenocissus quinquefolia</u> (L.) Planch
Crowberry Black	<u>Empetrum nigrum</u> L.
Currant Black Bristly Black Wild Red Skunk	<u>Ribes lacustre</u> (Pers.) Poir. <u>R. floridum</u> L'Her <u>R. triste</u> Pall. <u>R. prostratum</u> L'Her
Dogwood Alternate-leaved Bailey's Panicked Rough-leaved Round-leaved	<u>Cornus alternifolia</u> L. <u>C. Baileyi</u> Coult. & Evans <u>C. paniculata</u> L'Her <u>C. asperifolia</u> Meyer <u>C. circinata</u> L'Her
Elder Common Red-berried	<u>Sambucus canadensis</u> L. <u>S. pubens</u> Michx.
Fern Sweet	<u>Comptonia peregrina</u> (L.) Coult.
Gale Sweet	<u>Myrica Gale</u> L.
Gooseberry Prickly	<u>Ribes cynosbati</u> L.
Grape False Frost	<u>Parthenocissus vitacea</u> (Knerr) Hitchc. <u>Vitus vulpina</u> L.
Hazelnut Beaked	<u>Corylus rostrata</u> Ait.
Hispid	<u>Rubus hispidus</u> L.

Holly	Mountain	<u>Nemopanthus mucronata</u> (L.) Trel.
Honeysuckle	Bush	<u>Diervilla Lonicera</u> Mill.
	Douglas'	<u>Lonicera glaucescens</u> Rydb.
	Fly	<u>L. canadensis</u> Bartr.
	Hairy	<u>L. hirsuta</u> Eat.
	Mountain-Fly	<u>L. villosa</u> (Michx.) R. & S.
	Smooth-leaved	<u>L. dioica</u> L.
	Swamp-Fly	<u>L. oblongifolia</u> (Goldie) Hook.
Huckleberry	Black	<u>Gaylussacia baccata</u> (Wang.) C. Koch.
Hudsonia	Wooly	<u>Hudsonia tomentosa</u> Nutt.
Kalm's St. John's-wort		<u>Hypericum Kalmianum</u> L.
Laurel	Bog or Pale	<u>Kalmia polifolia</u> Wang.
Leatherwood		<u>Dirca palustris</u> L.
Labrador Tea		<u>Ledum groenlandicum</u> Oeder.
Maple	Mountain	<u>Acer spicatum</u> Lam.
	Striped	<u>A. pennsylvanicum</u> L.
Meadow Sweet		<u>Spirea alba</u> DuRoi
		<u>S. latifolia</u> (Ait.) Borku
Ninebark		<u>Physocarpus opulifolius</u> (L.) Maxim.
Oak	Poison	<u>Rhus Toxicodendron</u> L.
Osier	Red	<u>Cornus stolonifera</u> Michx.
Prostrate Juniper		<u>Juniperus communis</u> L. Var. <u>depressa</u> pursh
Raspberry	Dwarf	<u>Rubus idaeus</u> L.
		<u>R. triflorus</u> Richards.
Rose	Guelder	<u>Viburnum Opulus</u> L.
	Prickly Wild	<u>Rosa acicularis</u> Lindl.
	Smooth	<u>R. blanda</u> Ait.
	Swamp	<u>R. carolina</u> L.

Rosemary		<u>Andromeda glaucophylla</u> Link.
Bog		<u>A. Polifolia</u> L.
Wild		
Snowberry		<u>Symphoricarpos occidentalis</u> Hook.
Soapberry		<u>Shepherdia canadensis</u> (L.) Nutt.
Sumac		
Smooth		<u>Rhus glabra</u> L.
Staghorn		<u>R. typhina</u> L.
Tea		
Inland Jersey		<u>Ceanothus ovatus</u> Desf.
New Jersey		<u>C. americanus</u> L.
Teaberry		<u>Gaultheria procumbens</u> L.
Thimbleberry		<u>Rubus parviflorus</u> Nutt.
Thorn		
Large-fruited		<u>Crataegus punctata</u> Jacq.
Scarlet		<u>C. coccinea</u> L.
Viburnum		
Mapleleaf		<u>Viburnum acerifolium</u>
Sweet		<u>V. Lentago</u>
Virgin's Bower		<u>Clematis virginiana</u> L.
Waxwork		<u>Celastrus scandens</u> L.
Willow		
Autumn		<u>Salix serissima</u> (Bailey) Fern.
Balsam		<u>S. balsamifera</u> Barrett.
Beaked		<u>S. rostrata</u> Richards.
Bog		<u>S. pedicellaris</u> Pursh.
Broad leaf		<u>S. glaucophylla</u> Bebb.
Heartleaf		<u>S. cordata</u> Michx.
Hoary		<u>S. candida</u> Flugge
Large Pussy		<u>S. discolor</u> Muhl.
"Red"		<u>Cornus Amomum</u> Mill.
Sandbar		<u>Salix longifolia</u> Muhl.
Sand-dune		<u>S. syrticola</u> Fern.
Shining		<u>S. lucida</u> Muhl.
Silky		<u>S. sericea</u> Marsh.
Slender		<u>S. petiolaris</u> Sm.
Small Pussy		<u>S. humilis</u> Marsh.
Winterberry		<u>Ilex verticillata</u> (L.) Gray
Witch-hazel		
Common		<u>Hamamelis virginiana</u> L.

Witherod

Viburnum cassinoides L.

Wolfberry

Symphoricarpos occidentalis Hook.

APPENDIX D
PHOTOGRAPHS OF COVER TYPES



Plate 1
Type (H), showing Sugar Maple
(Acer saccharum Marsh.).



Plate 2
Type (H), showing a typical
hardwood, Paper Birch (Betula
papyifera Marsh.).



Plate 3

Type (HC), the conifers are easily seen with their conical tops.



Plate 4

Type (HC), young hardwoods on the left with conifers on the right.



Plate 5

Type (CH), darker trees are conifers with hardwoods being lighter. This area is dominated by the conifers.



Plate 6

Type (G) foreground with conifers, type (C) in background. Photo taken at the Yellow Dog Plains.



Plate 7

Showing Tamarack, Larix laricina
(DuRoi) K. Koch, in a type (WC)
area.



Plate 8
Showing Black Spruce, Picea
mariana (Mill) BSP., which is
a typical species in type (WC).



Plate 9

Type (W) with type (WC) in background.



Plate 10

Shows type (W) in foreground with type (WS) in the middle-ground. Type (HC) covers the hills in the background.



Plate 11

Type (G) in the foreground with hardwoods,
type (H) in background.



Plate 12

Type (G), which is on an abandoned farm.
Shrubs and trees are now invading the area.

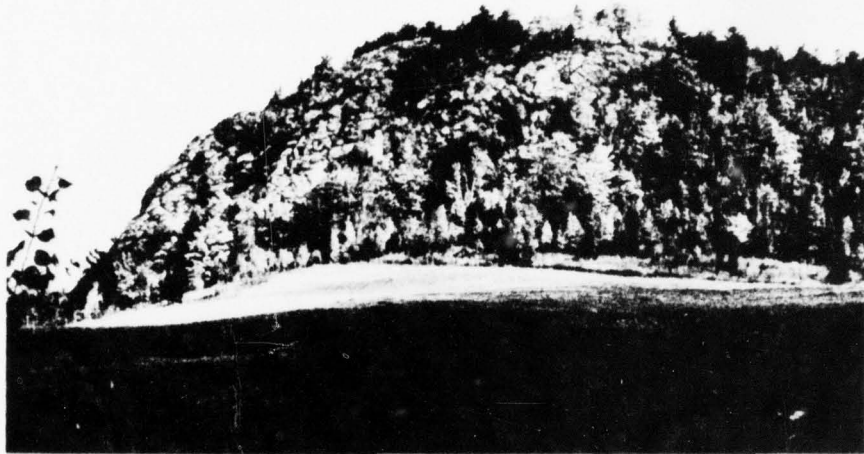


Plate 13

Type (HCR), with agriculture, type (A) in foreground.



Plate 14

Area cleared for underground pipeline. The area is in the middle of a hardwood stand, type (H).



Plate 15
Second-growth hardwood stand, type (H).

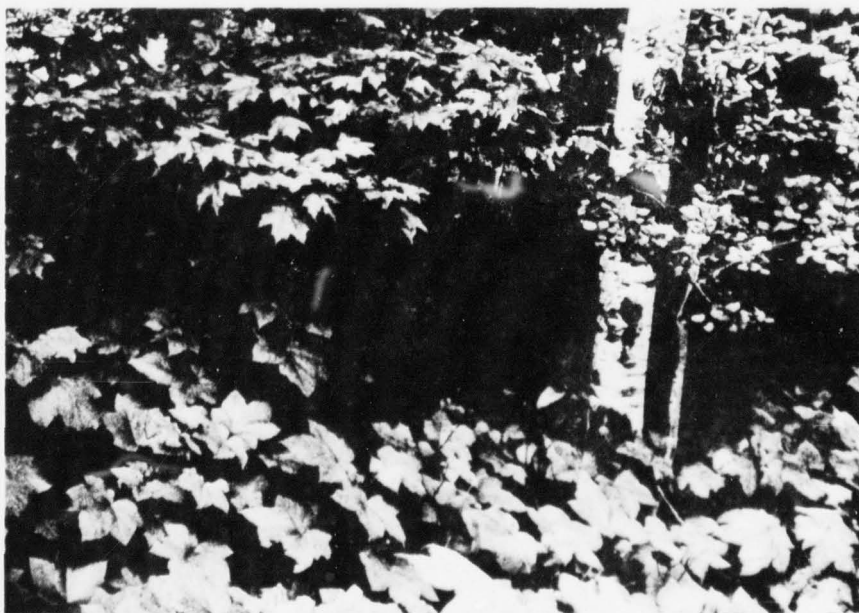


Plate 16
Understory of shrubs, Rubus parviflorus
Nutt. in a hardwood stand.



Plate 17
Lake, type (L), near Alberta, Michigan.



Plate 18
Type (W) in foreground, with conifers in
background.

APPENDIX E
PLANT COLLECTION

CONIFERS

Abies balsamea (L.) Mill.

Larix laricina (Du Roi) K. Koch

Picea glauca (Moench) Voss

Picea mariana (Mill.) B.S.P.

Pinus banksiana Lamb.

Pinus resinosa Ait.

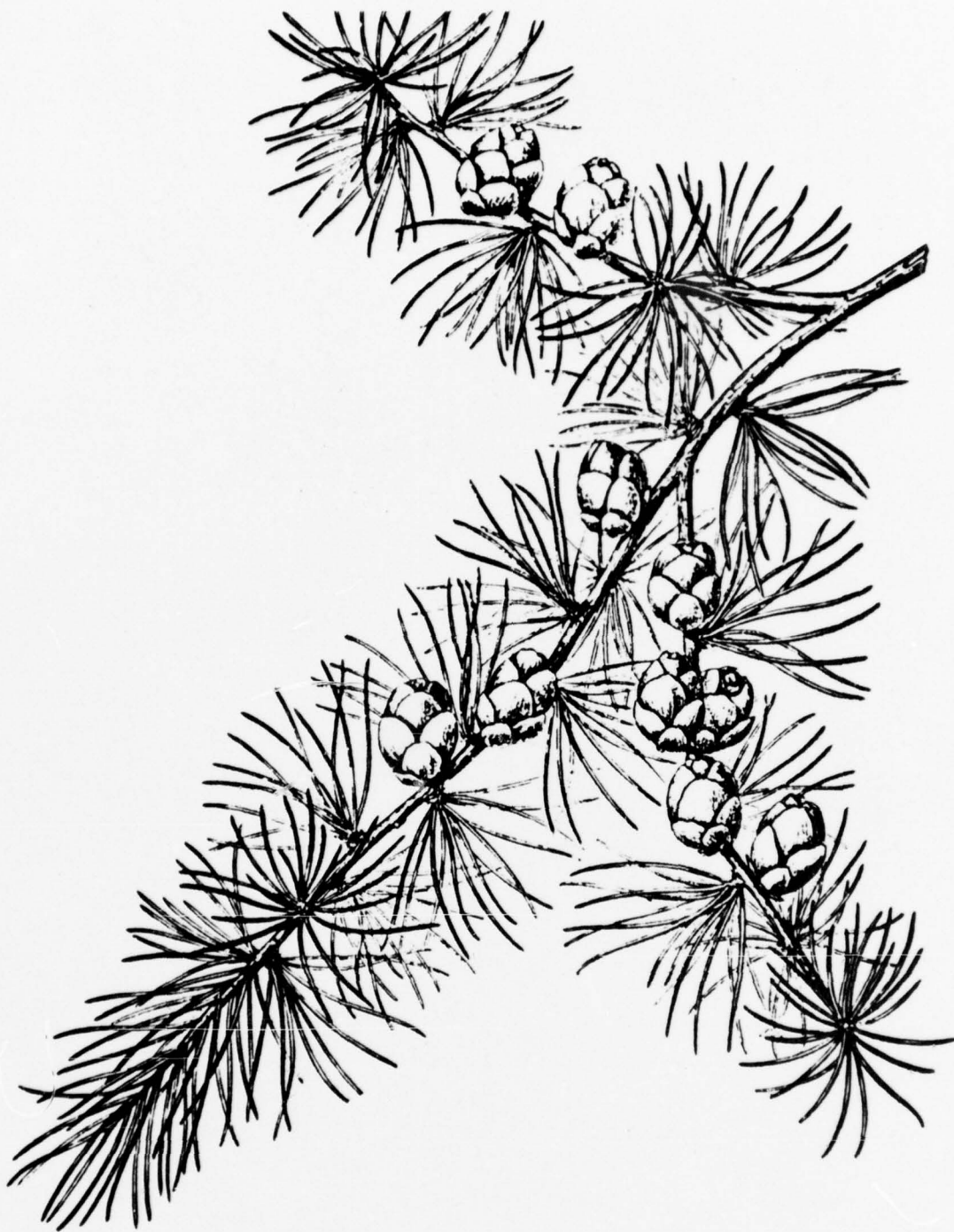
Pinus strobus L.

Thuja occidentalis L.

Tsuga canadensis (L.) Carr.

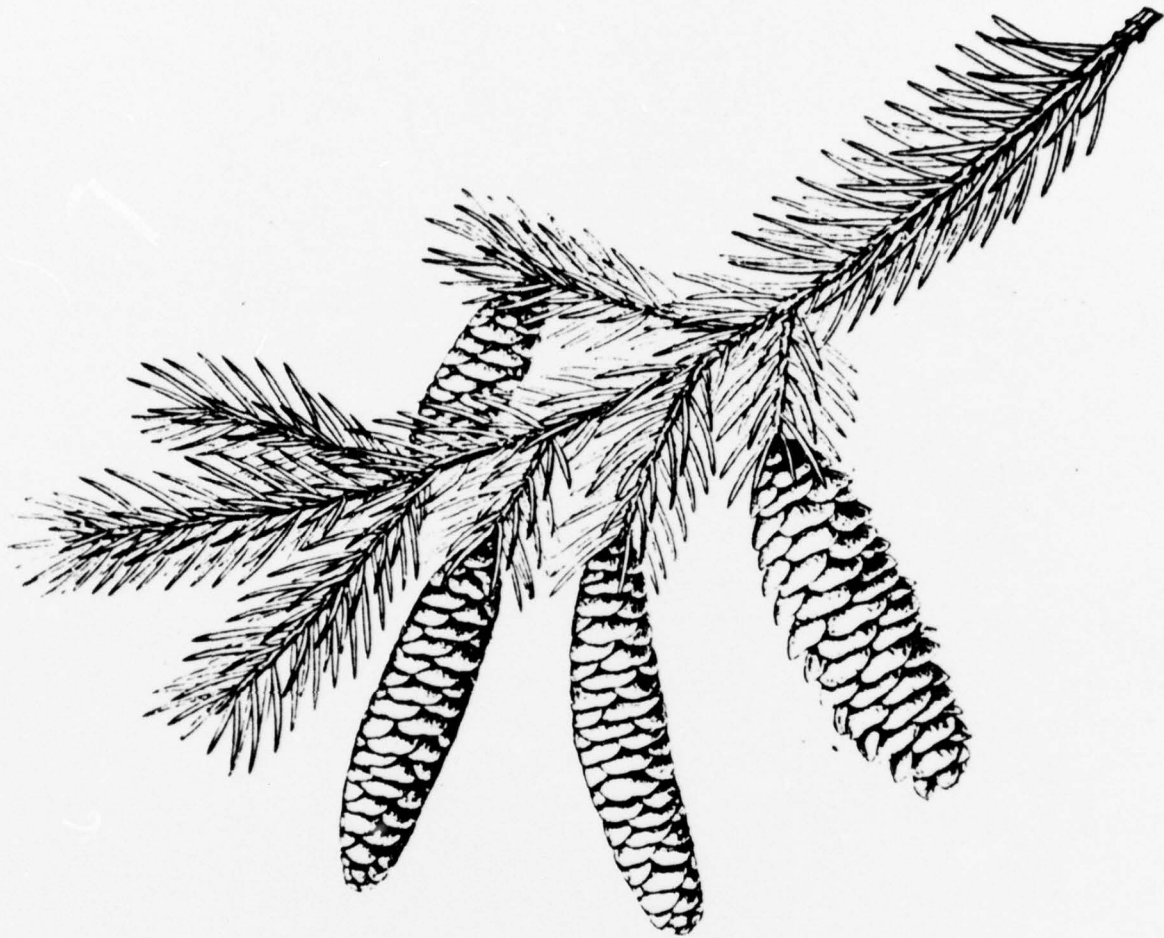


Abies balsamea (L.) Mill.
Balsam Fir



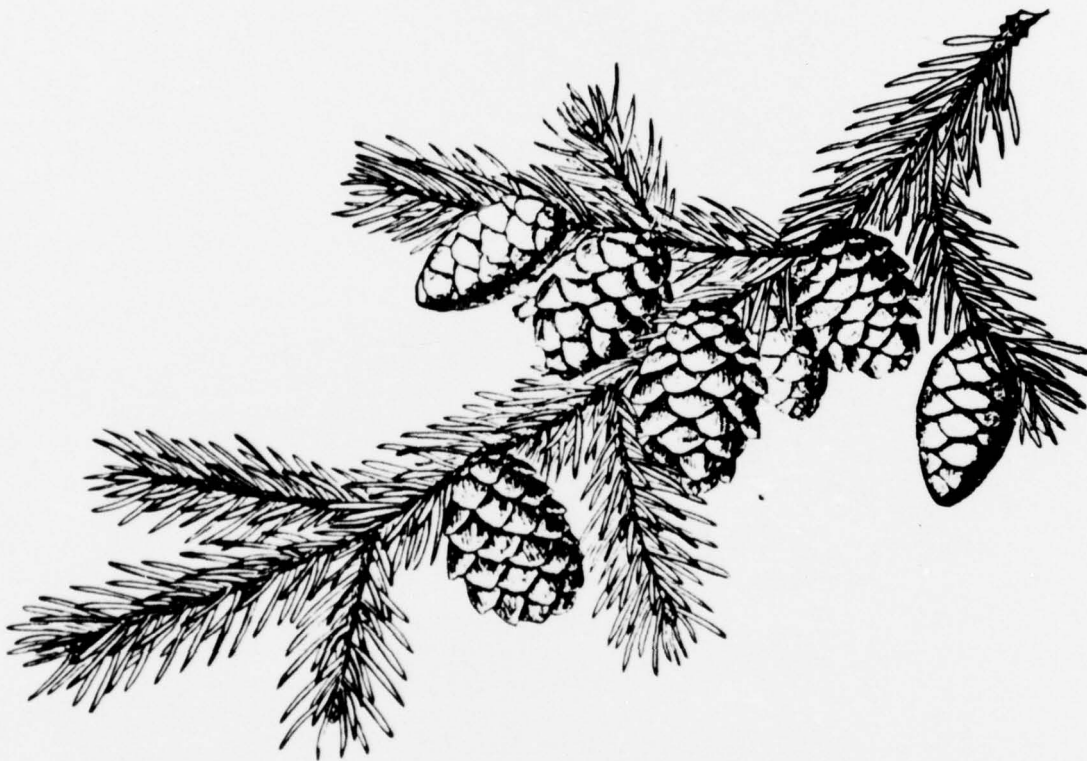
Larix laricina (Du Roi) K. Koch
Tamarack

Reproduced with permission of Peter Smith Publishing Co.,
Gloucester, Mass., in The Silva of North America, by
Charles Sprague Sargent, 1897.



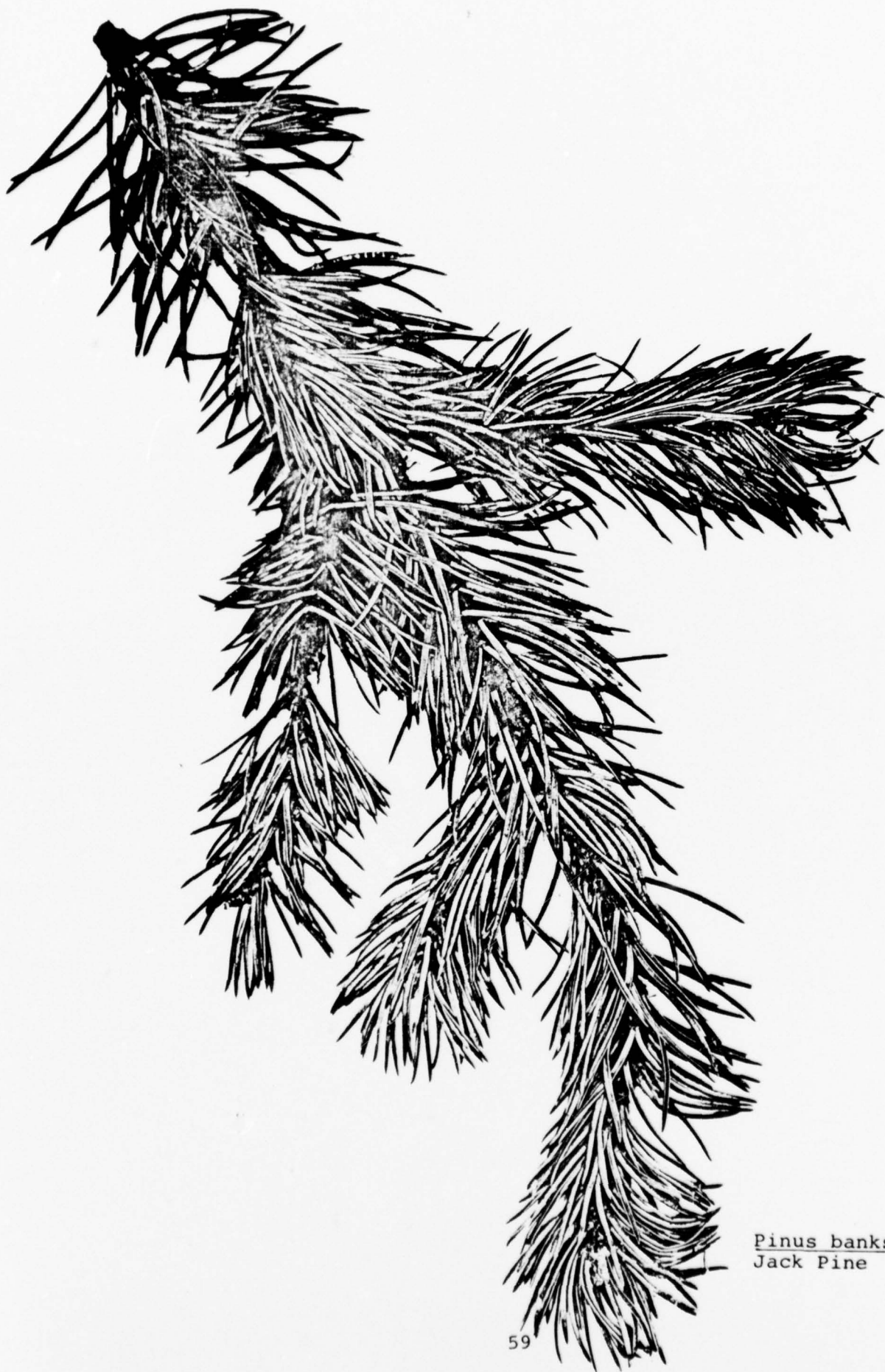
Picea glauca (Moench) Voss
White Spruce

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Gloucester, Mass., in The Silva of North America, by
Charles Sprague Sargent, 1897.

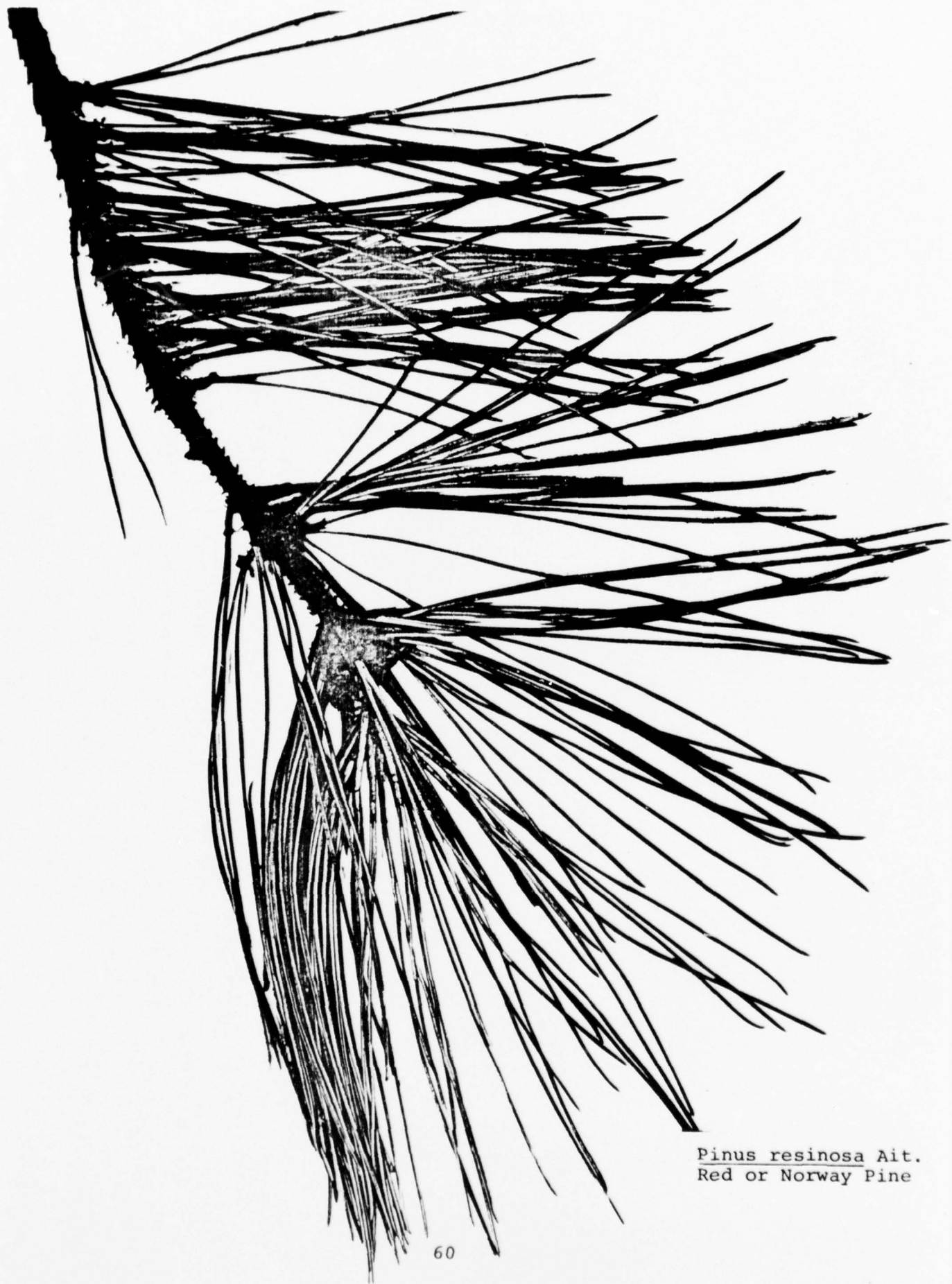


Picea mariana (Mill.) B.S.P.
Black Spruce

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Gloucester, Mass., in The Silva of North America, by
Charles Sprague Sargent, 1897.



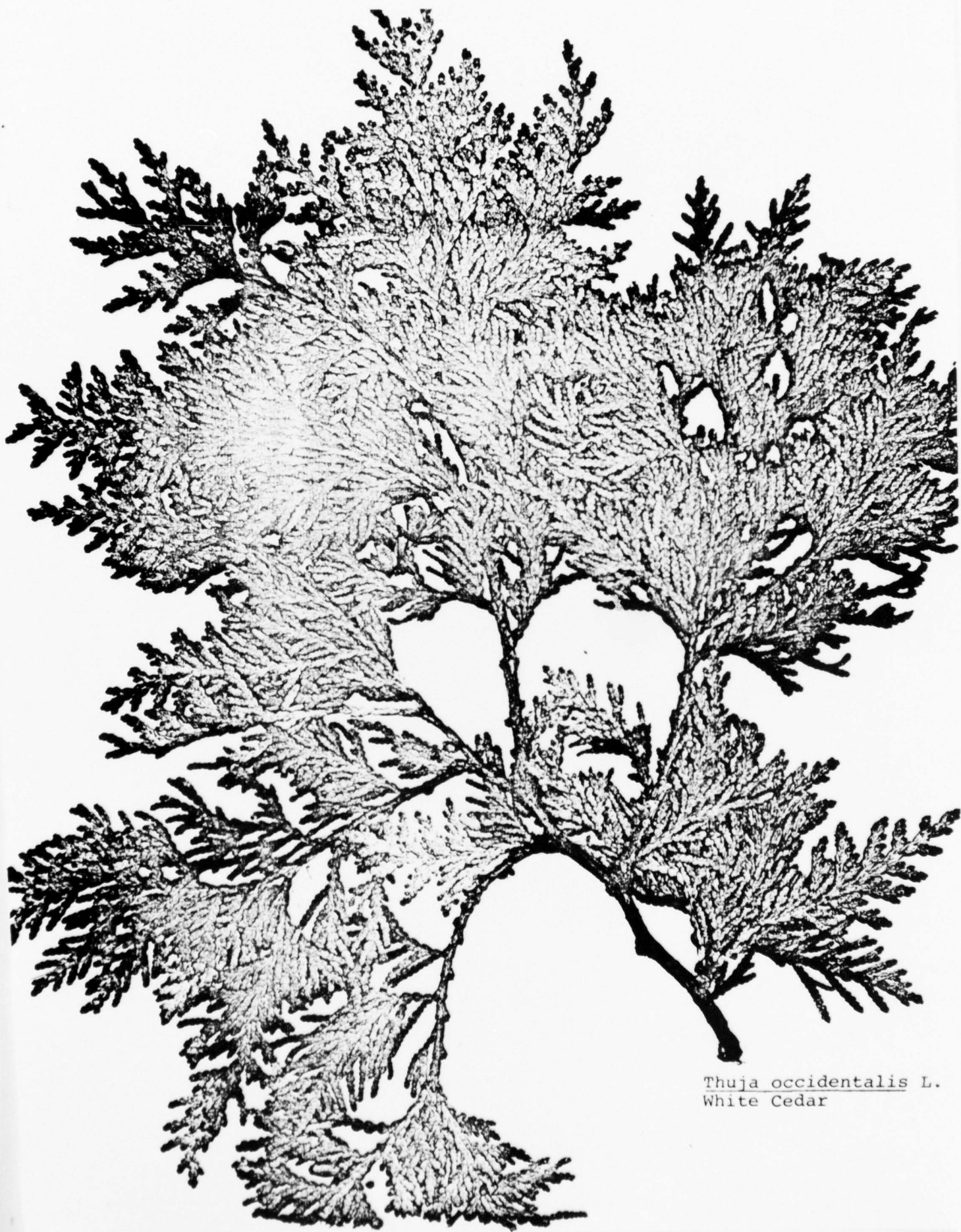
Pinus banksiana Lamb.
Jack Pine



Pinus resinosa Ait.
Red or Norway Pine



Pinus strobus L.
White Pine



Thuja occidentalis L.
White Cedar



Tsuga canadensis (L.) Carr.
Eastern Hemlock

HARDWOODS

Acer rubrum L.

Acer saccharinum L.

Acer saccharum Marsh.

Betula lutea Michx.

Betula papyrifera Marsh.

Fraxinus nigra Marsh.

Fraxinus pennsylvanica Marsh.

Ostrya virginiana (Mill.) K. Koch

Populus balsamifera L.

Populus grandidentata Michx.

Populus tremuloides Michx.

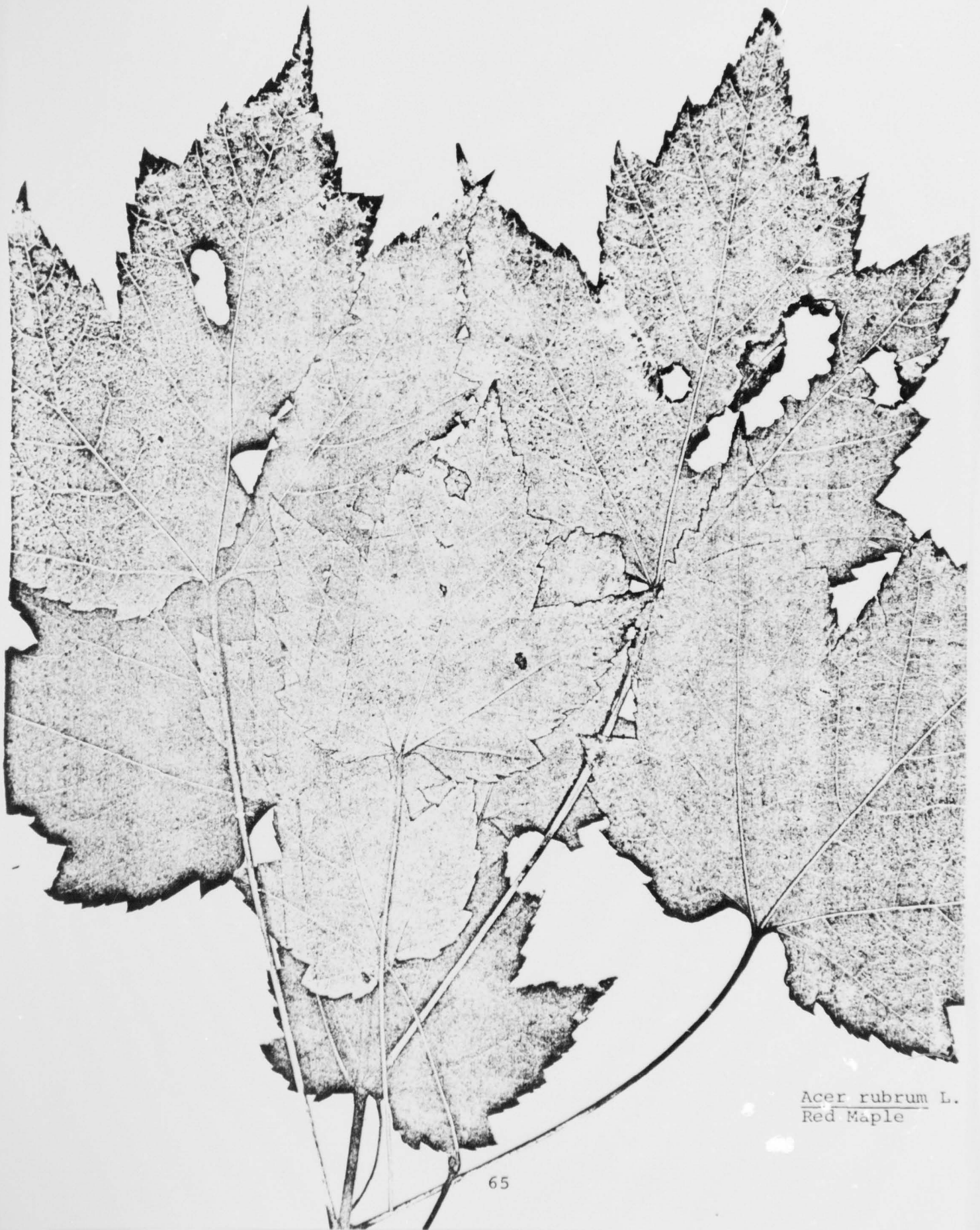
Prunus pensylvanica L.F.

Prunus serotina Ehrh.

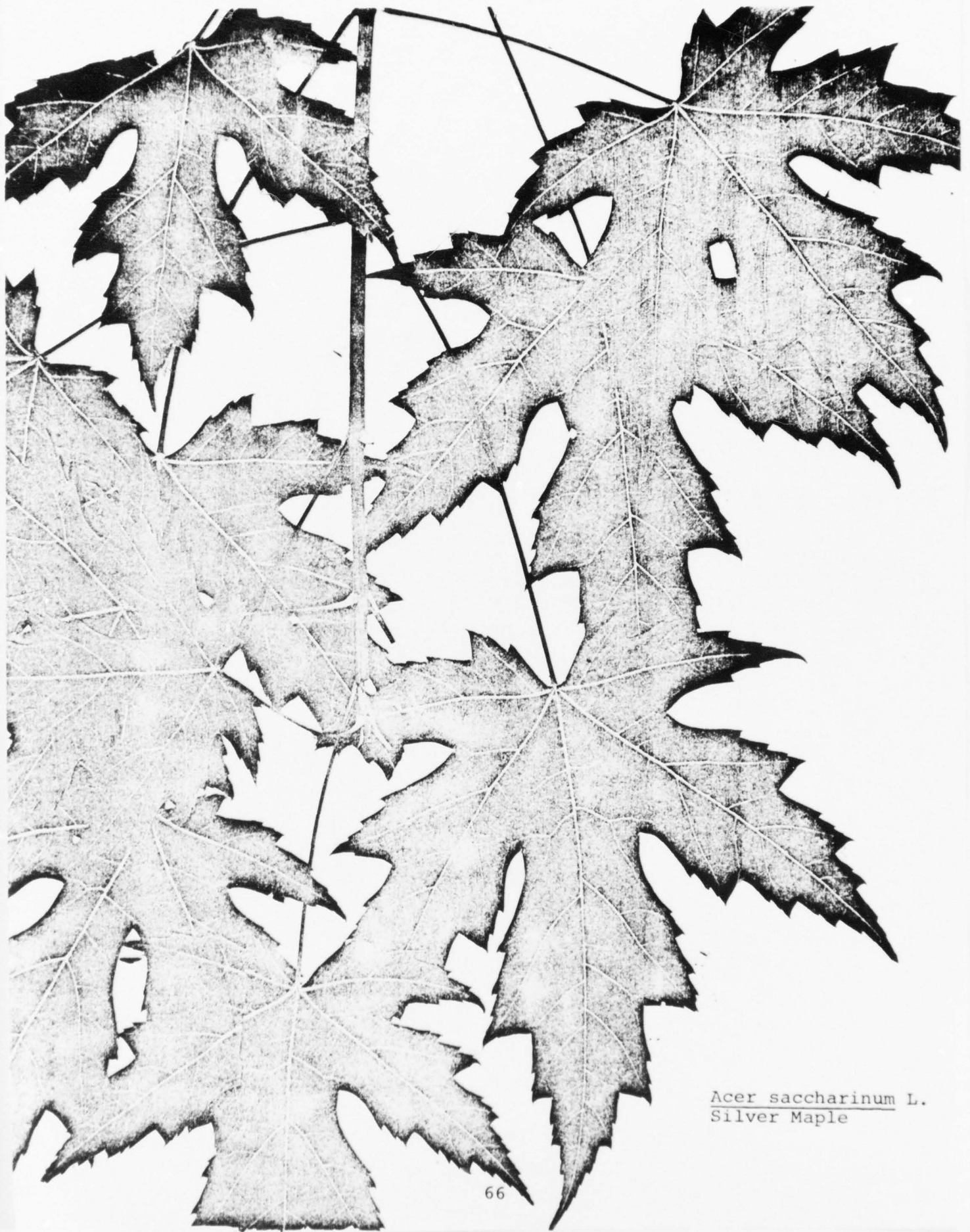
Quercus rubra L.

Tilia americana L.

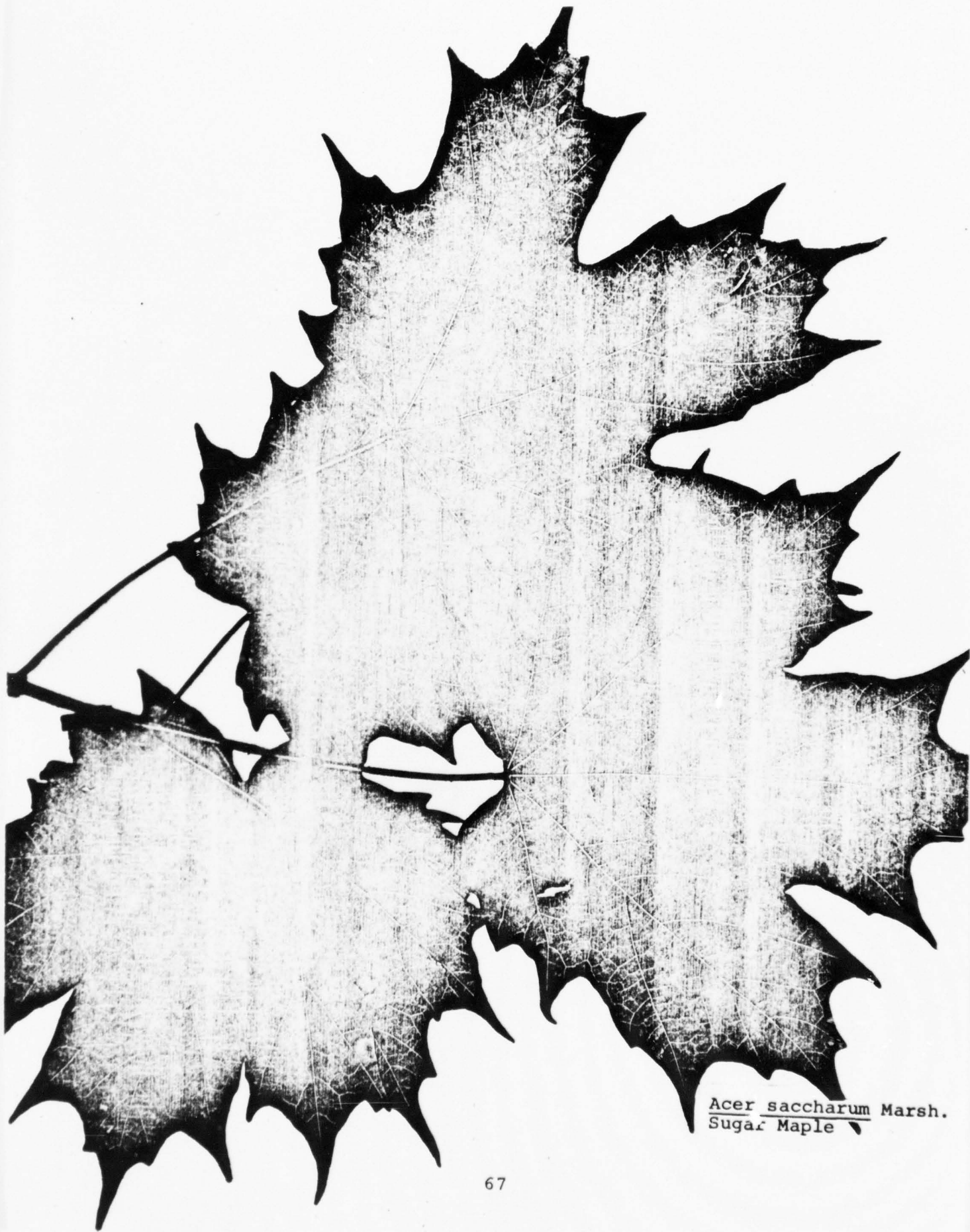
Ulmus americana L.



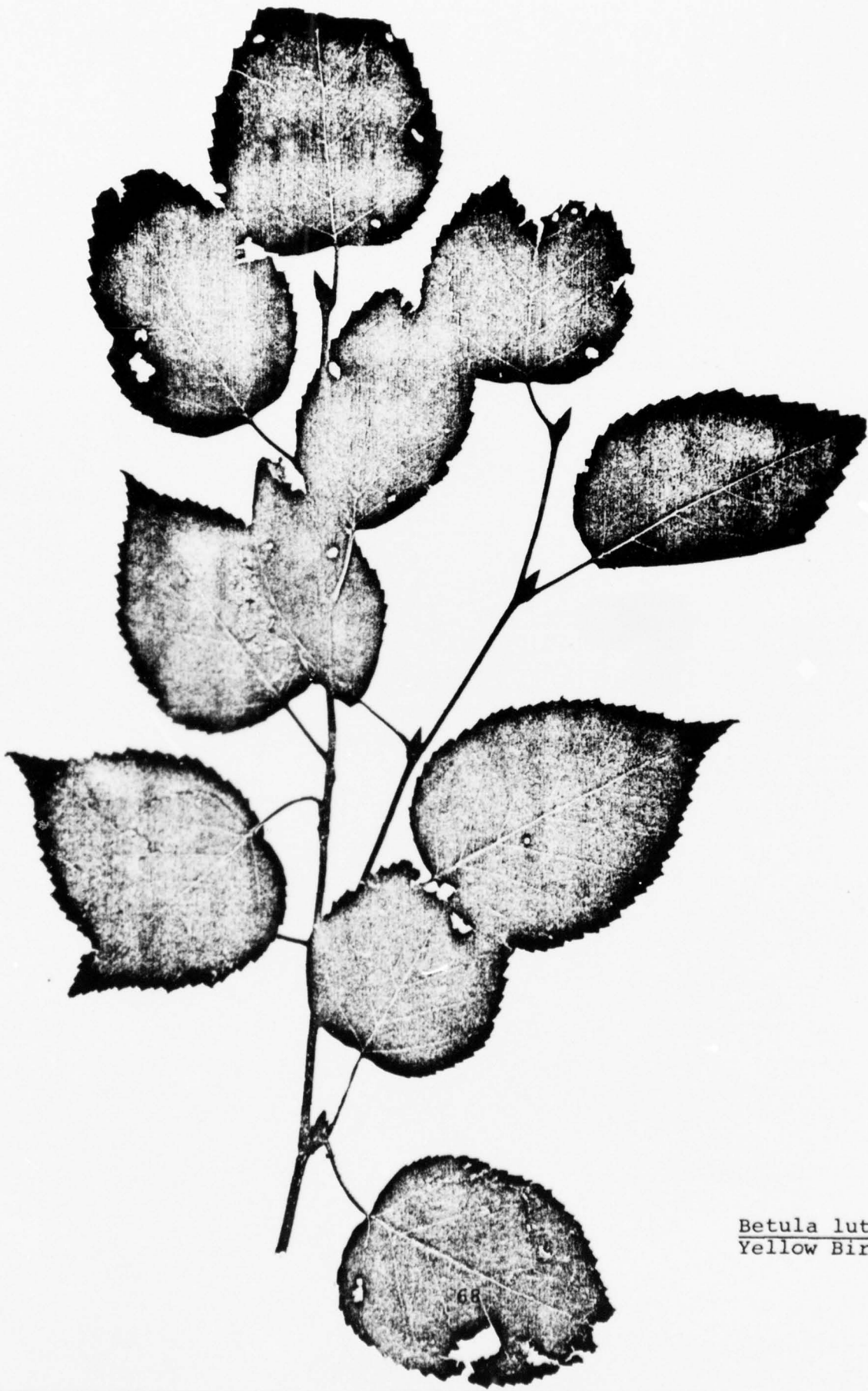
Acer rubrum L.
Red Maple



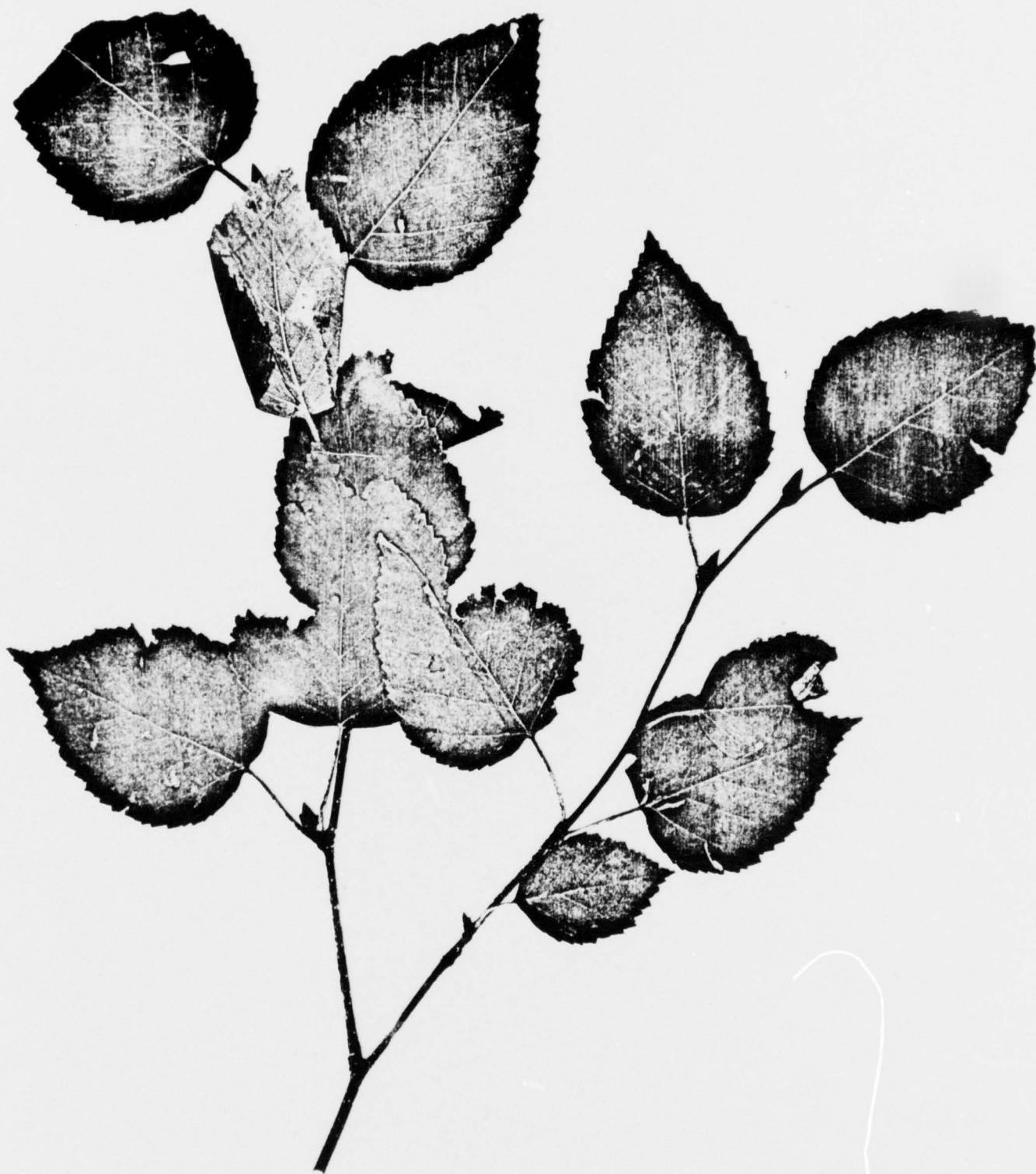
Acer saccharinum L.
Silver Maple



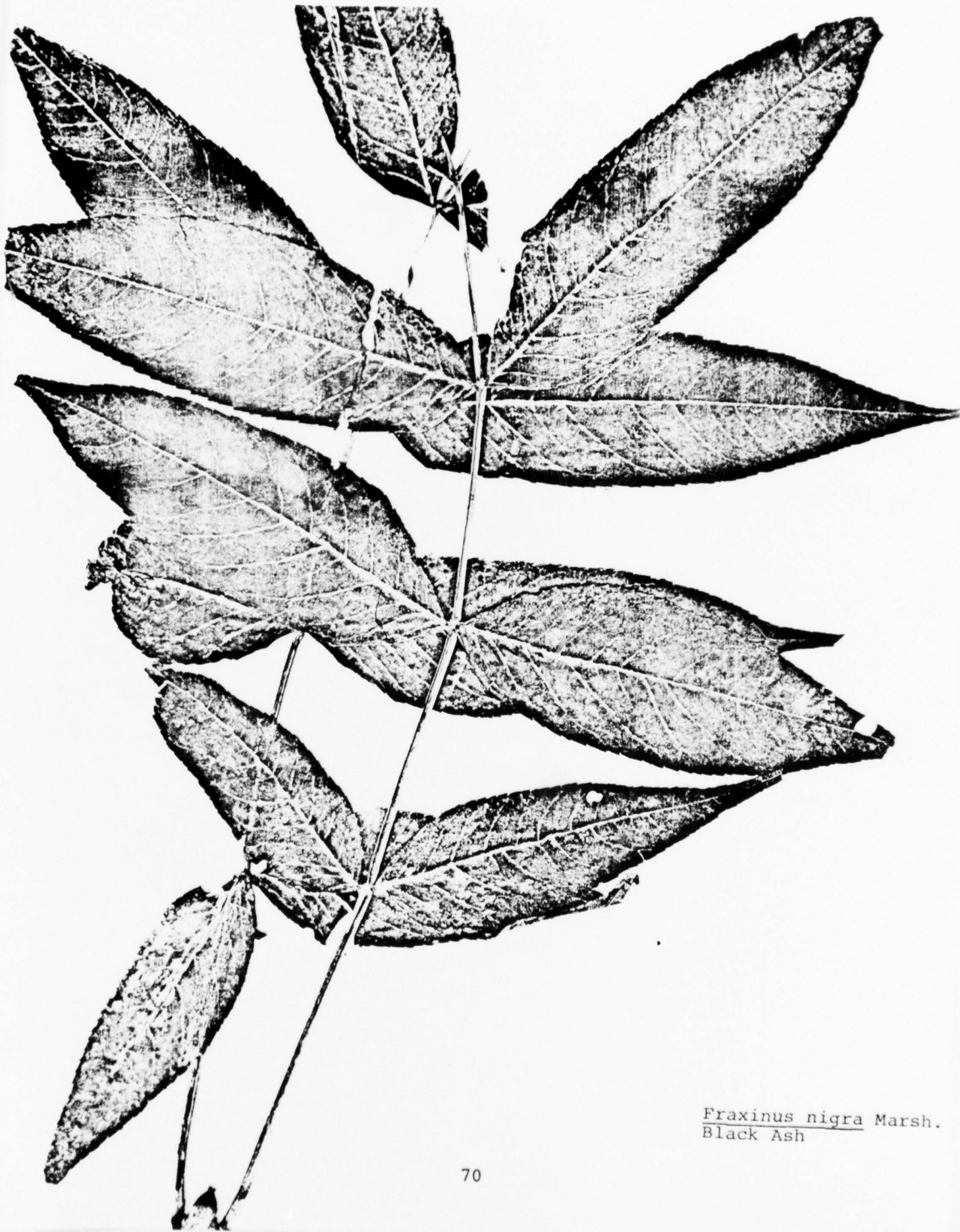
Acer saccharum Marsh.
Sugar Maple



Betula lutea Michx.
Yellow Birch



Betula papyrifera Marsh.
Paper Birch



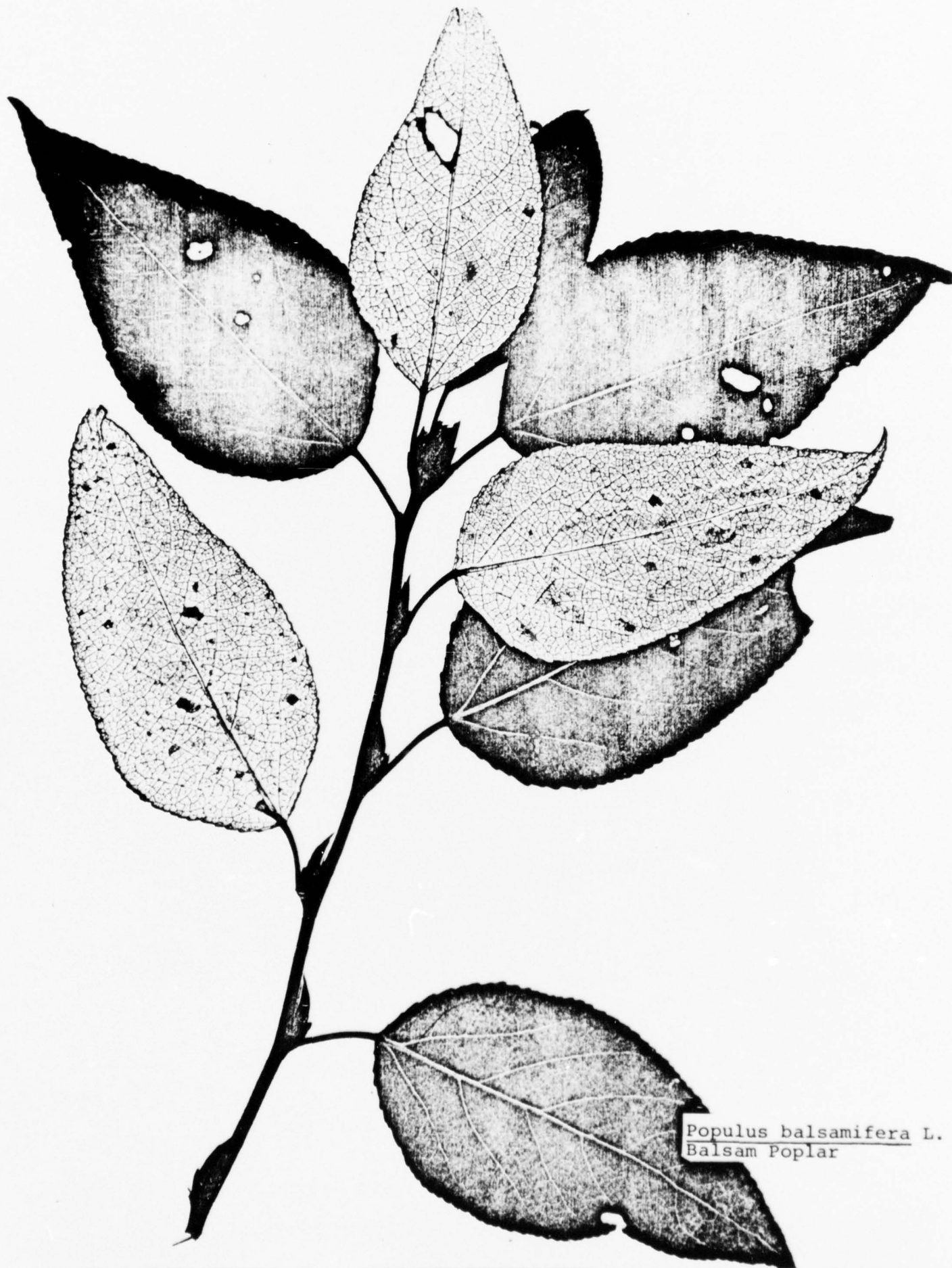
Fraxinus nigra Marsh.
Black Ash



Fraxinus pennsylvanica Marsh.
Red Ash



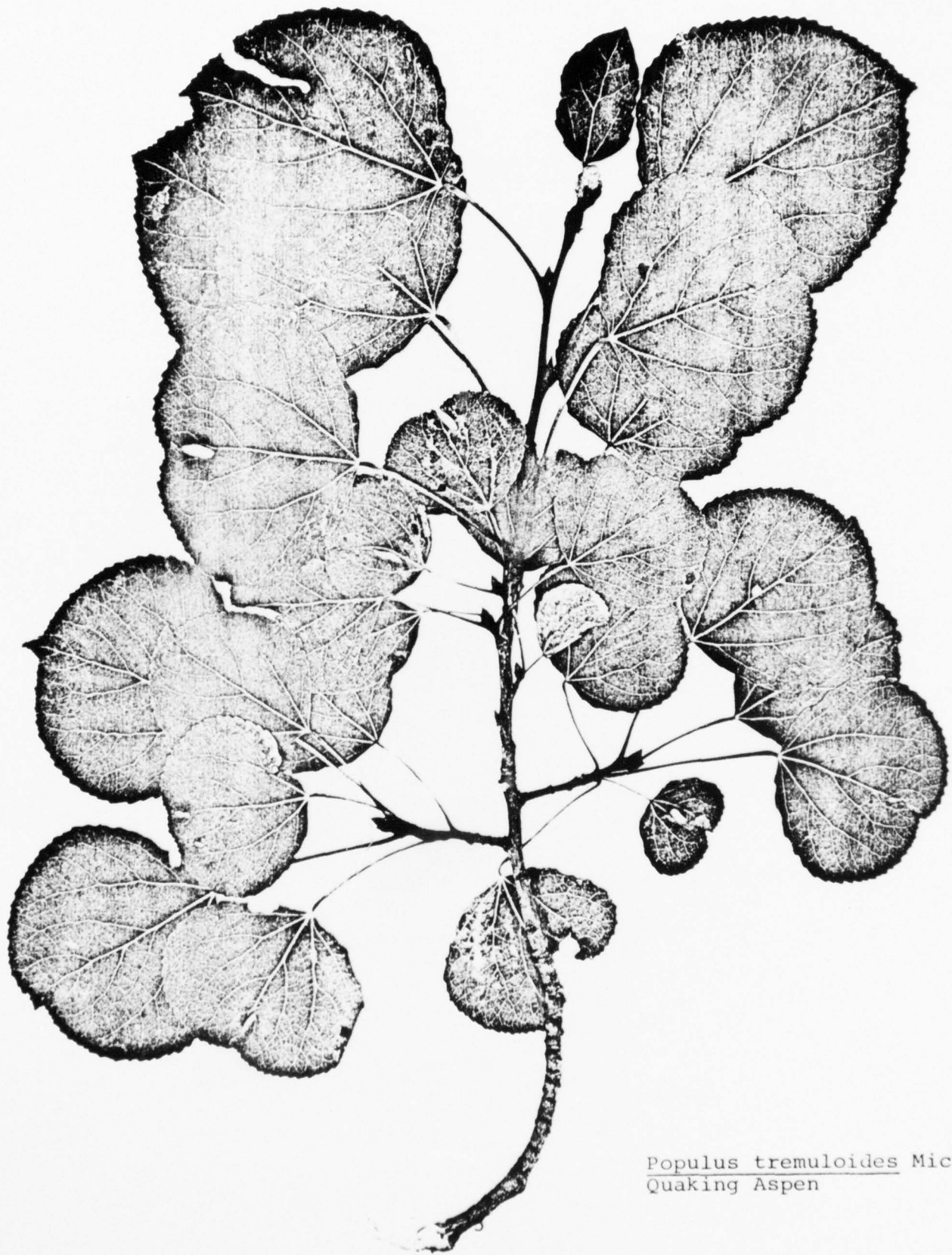
Ostrya virginiana (Mill.) K.Koch
Iron Wood



Populus balsamifera L.
Balsam Poplar



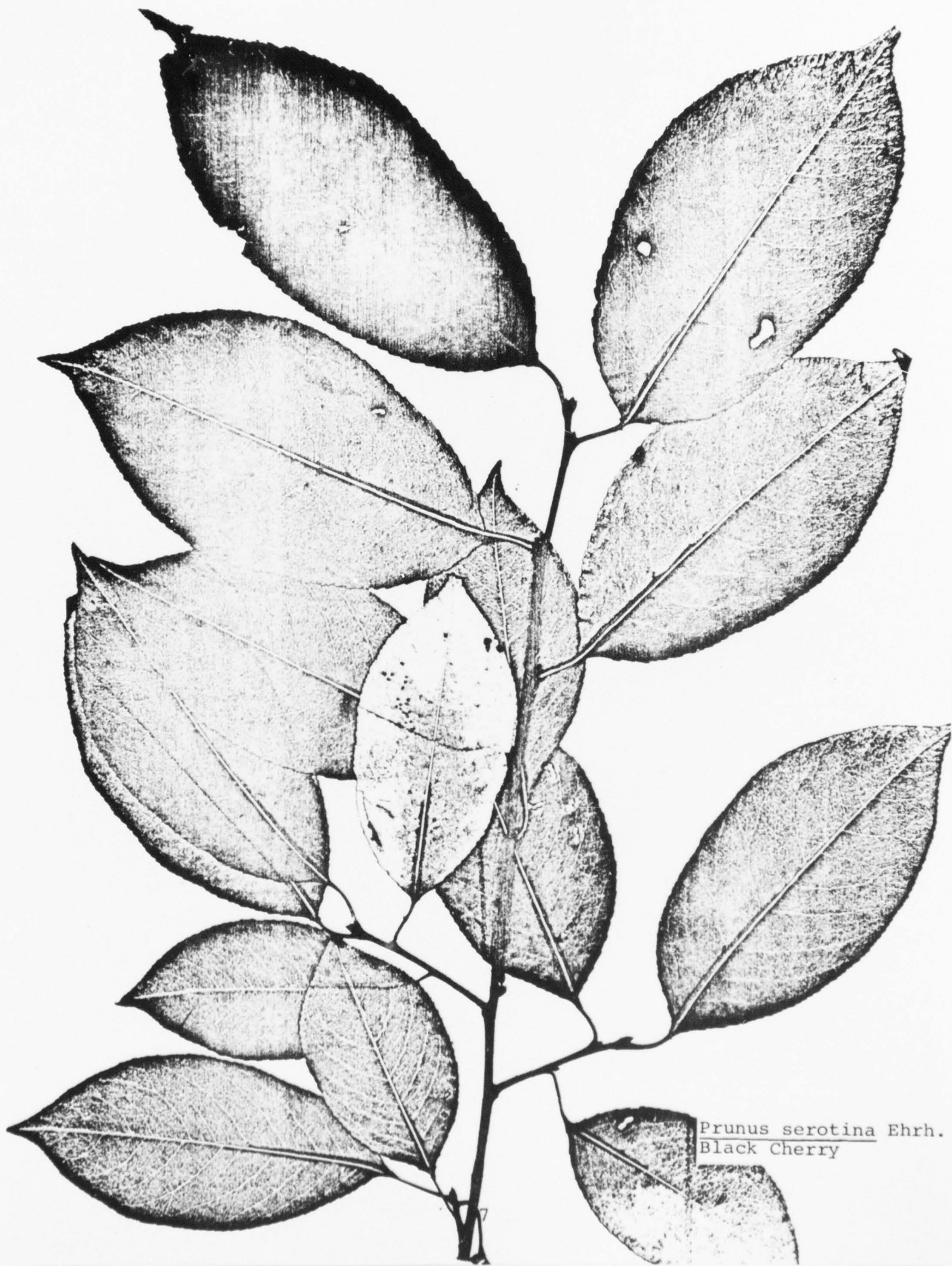
Populus grandidentata Michx.
Largetoothed Aspen



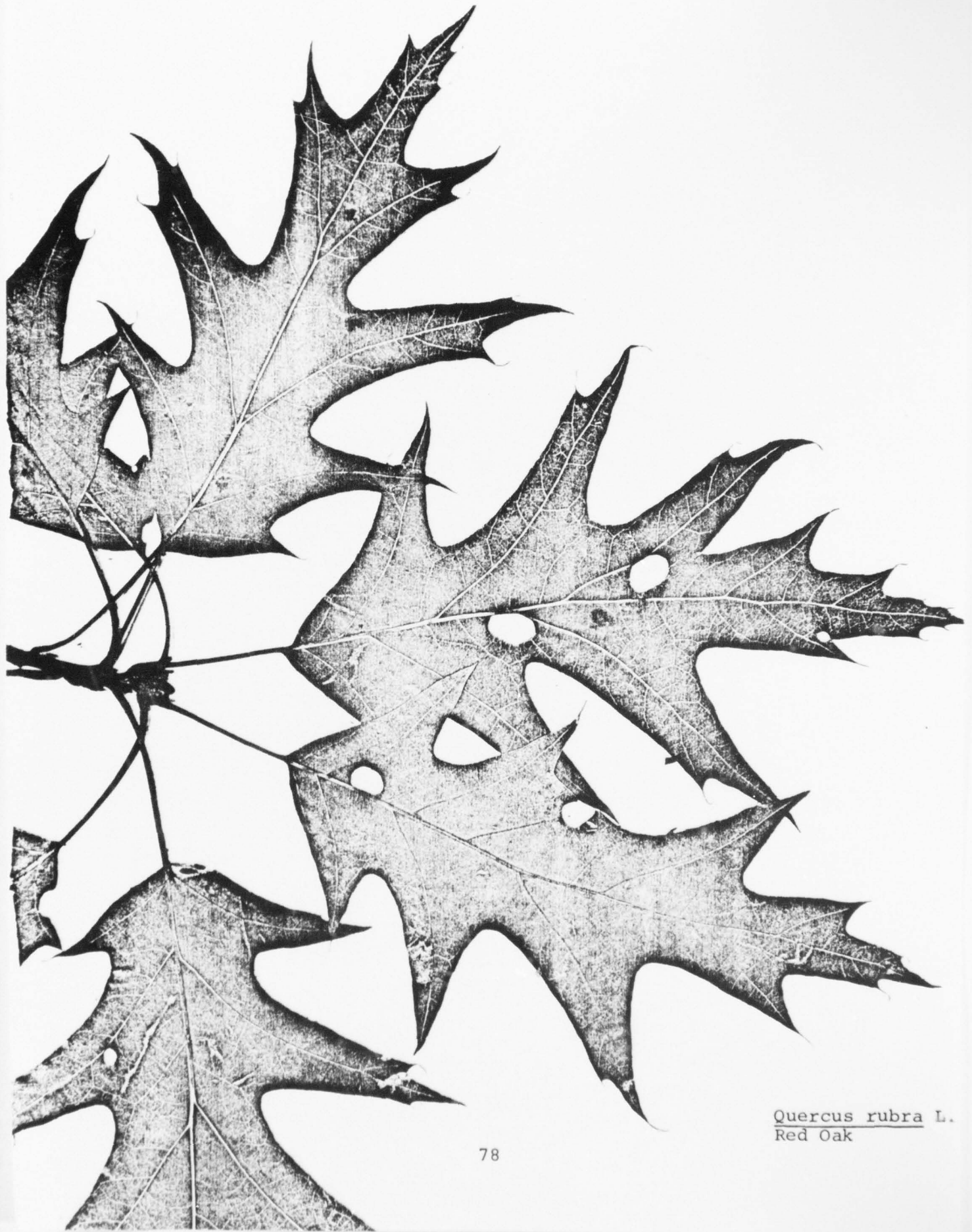
Populus tremuloides Michx.
Quaking Aspen



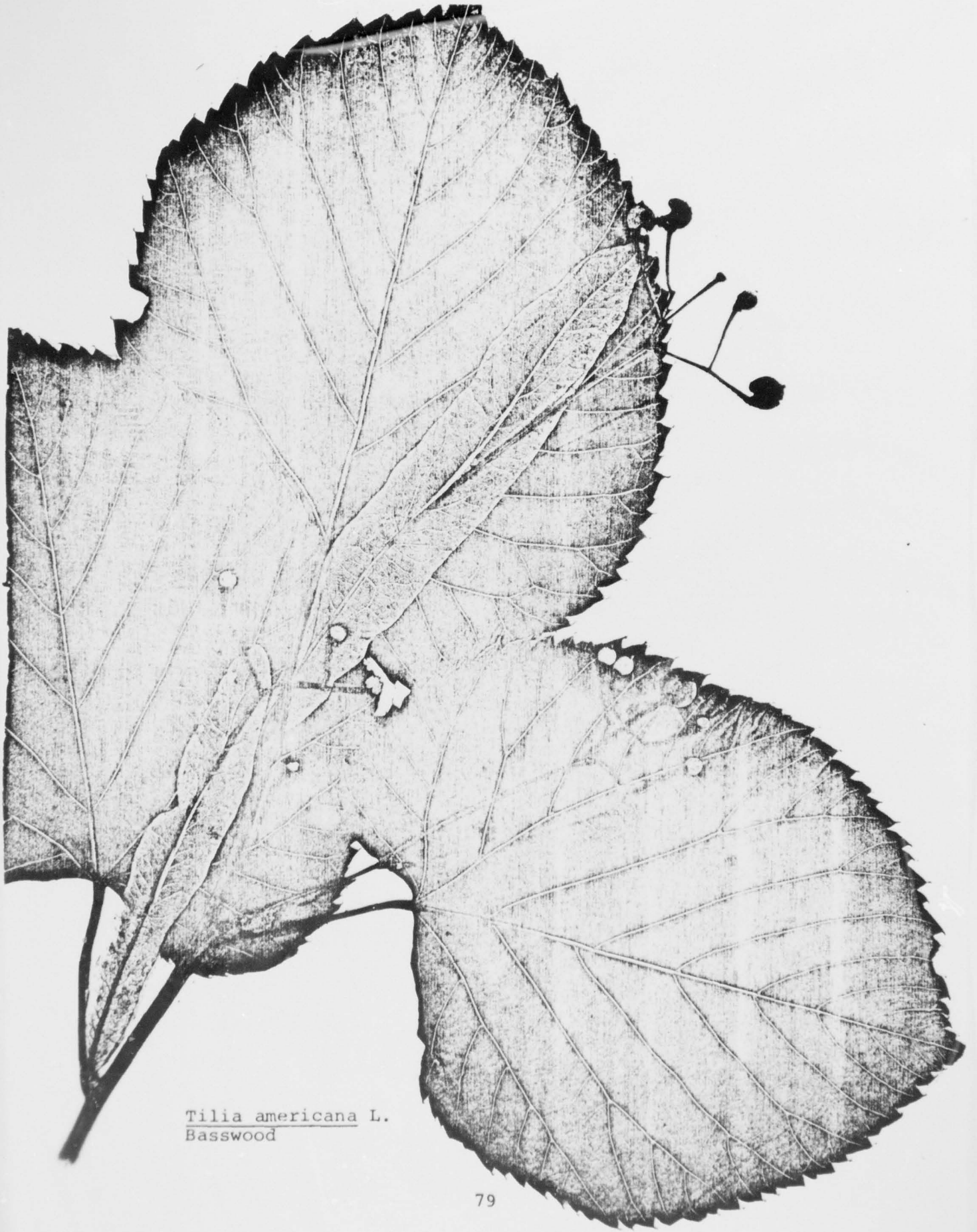
Prunus pensylvanica L.F.
Pin Cherry



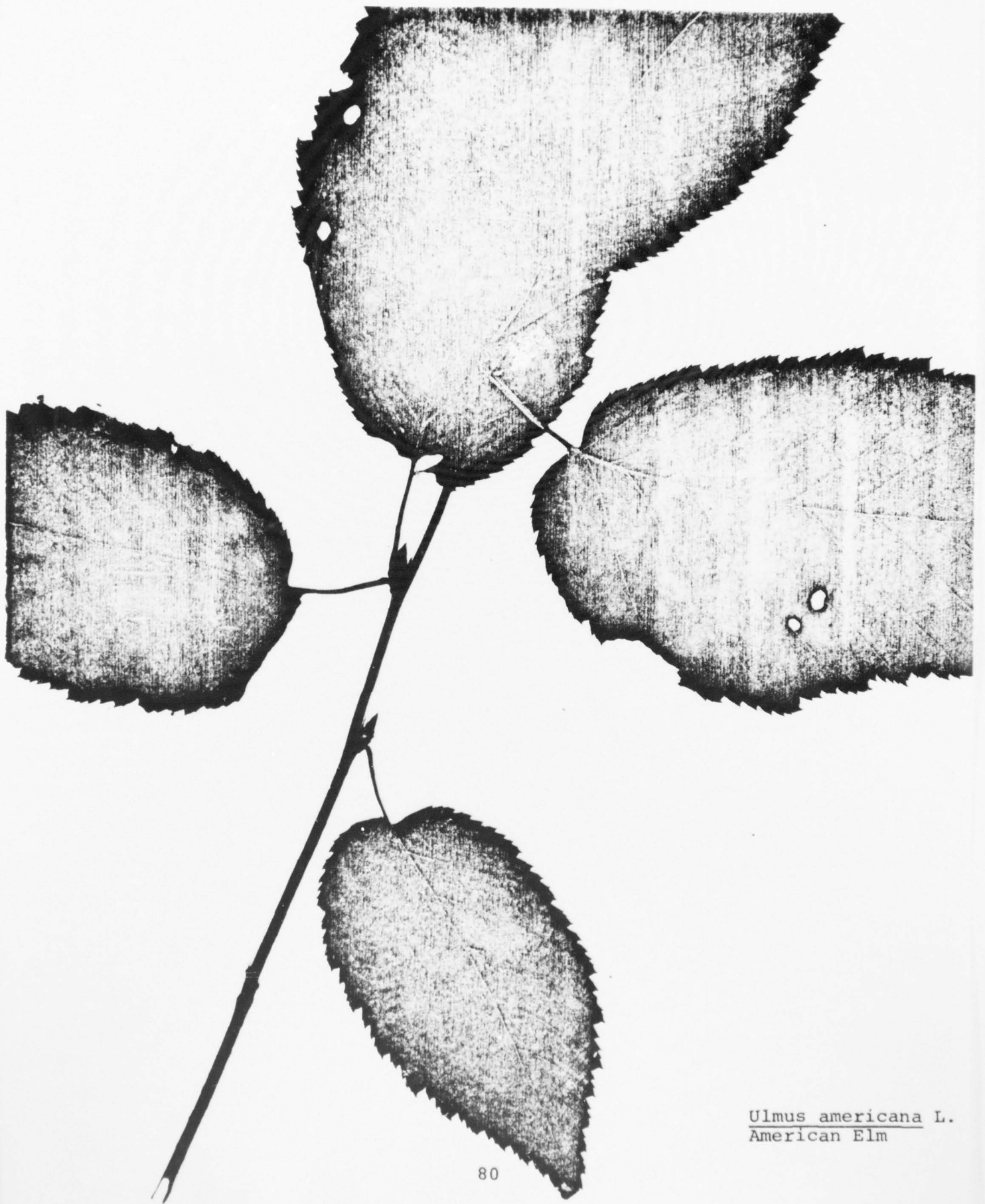
Prunus serotina Ehrh.
Black Cherry



Quercus rubra L.
Red Oak



Tilia americana L.
Basswood



Ulmus americana L.
American Elm

SHRUBS

Acer pensylvanicum L.

Acer spicatum Lam.

Alnus rugosa (Du Roi) Spreng

Amelanchier oblongifolia T. & G. Roem.

Andromeda glaucophylla Link. and Kalmia polifolia Wang.

Chamadaphne calyculata (L.) Moench.

Clematis virginiana L.

Comptonia perigrina Var. asplenifolia (L.) Fern.

Cornus stolonifera Michx.

Gaultheria procumbens L.

Juniperus communis L. Var. depressa Pursh.

Ledum groenlandicum Oeder

Myrica Gale L.

Rubus parviflorus Nutt.

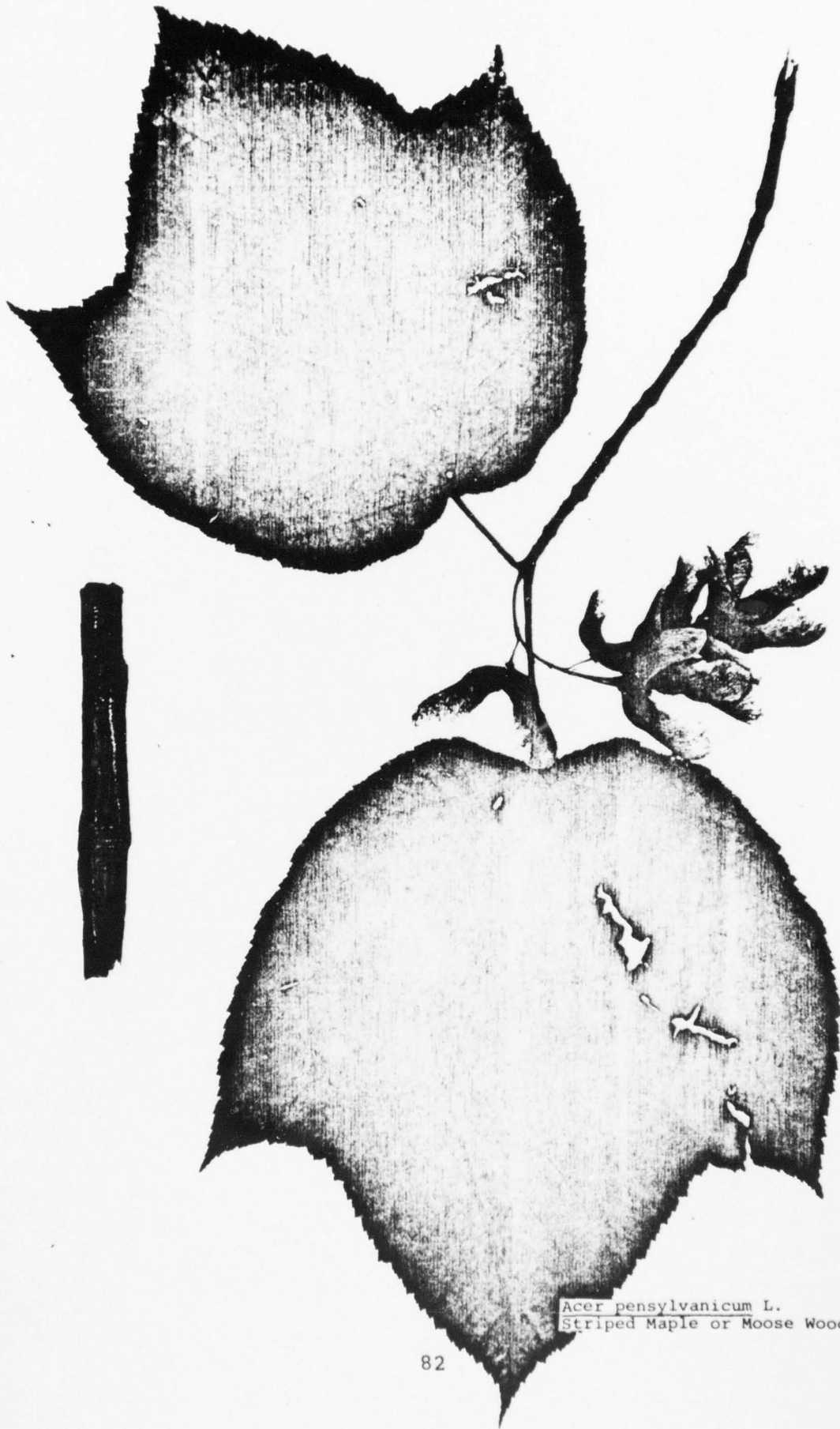
Salix sp.

Salix sp.

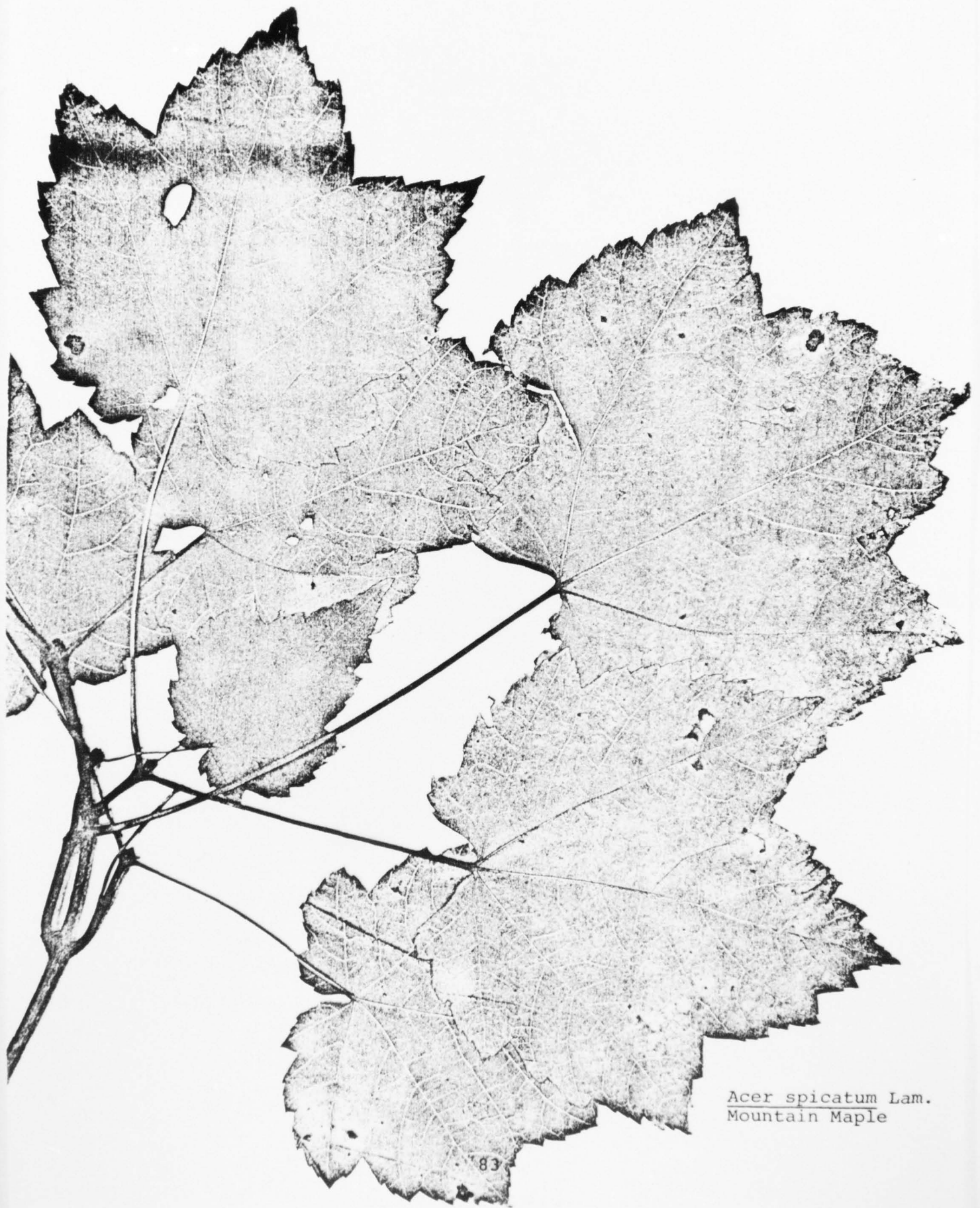
Sambucus canadensis L.

Spirea latifolia (Ait.) Borkh.

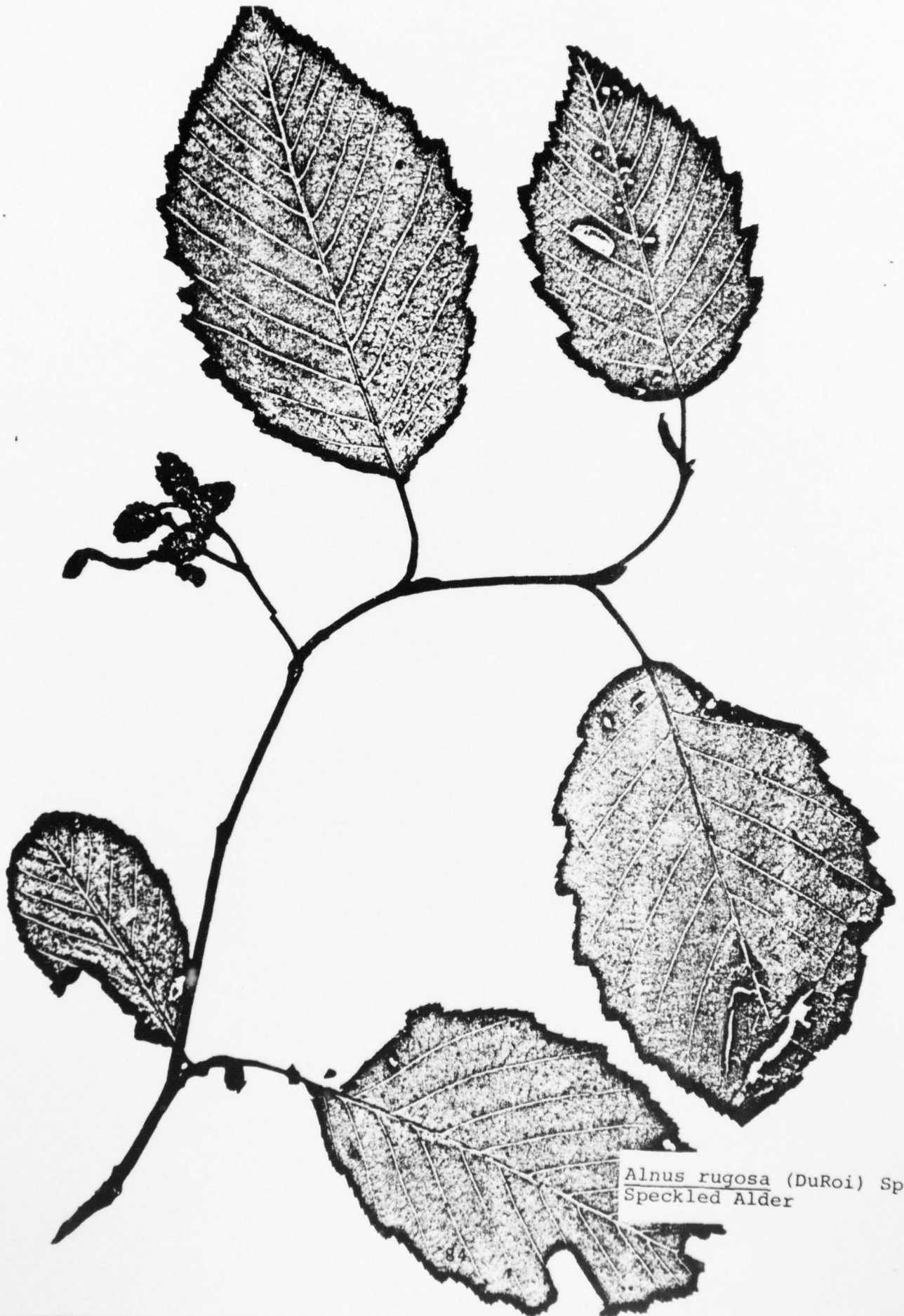
Vaccinium myrtilloides Michx.



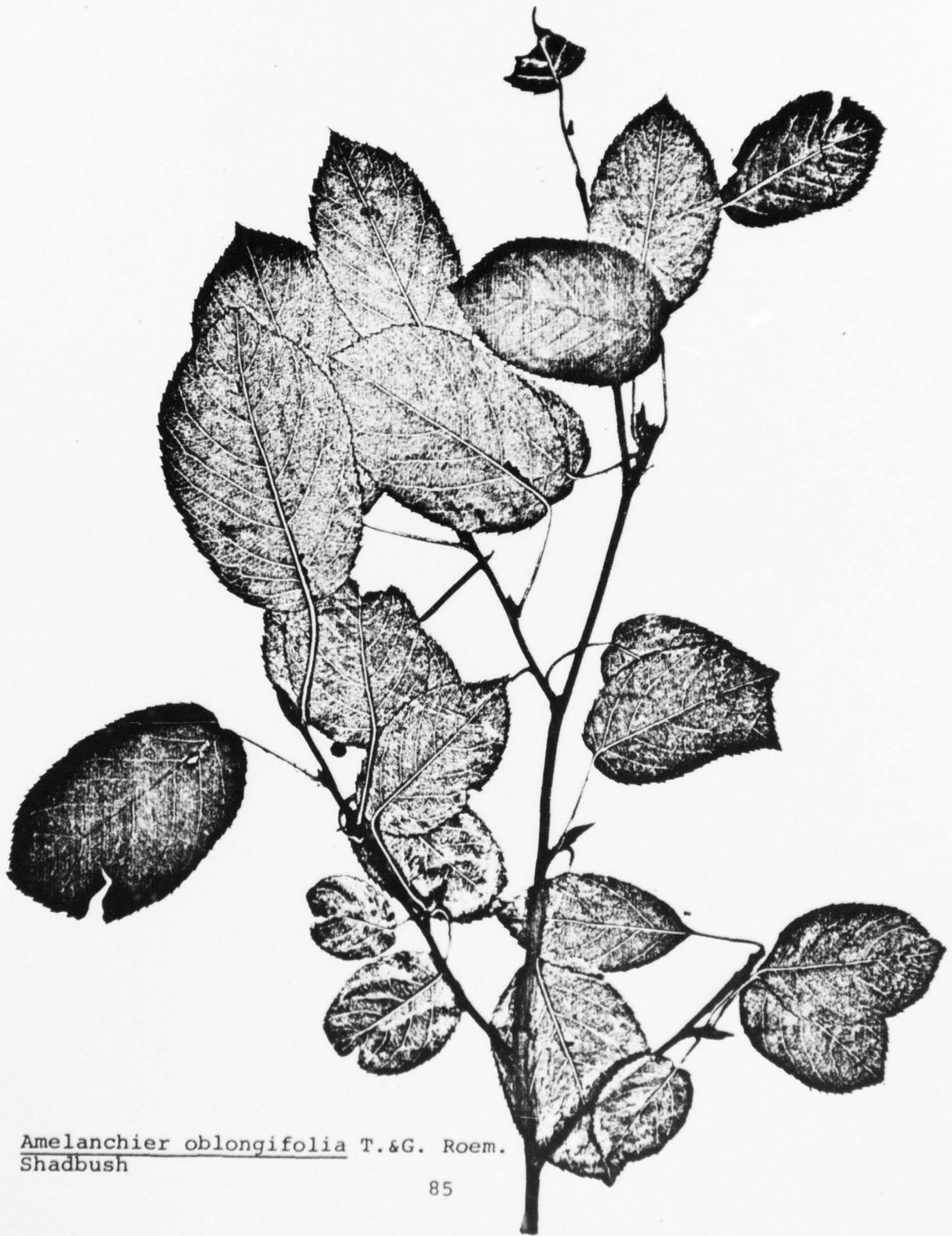
Acer pensylvanicum L.
Striped Maple or Moose Wood



Acer spicatum Lam.
Mountain Maple



Alnus rugosa (DuRoi) Spreng
Speckled Alder



Amelanchier oblongifolia T.&G. Roem.
Shadbush



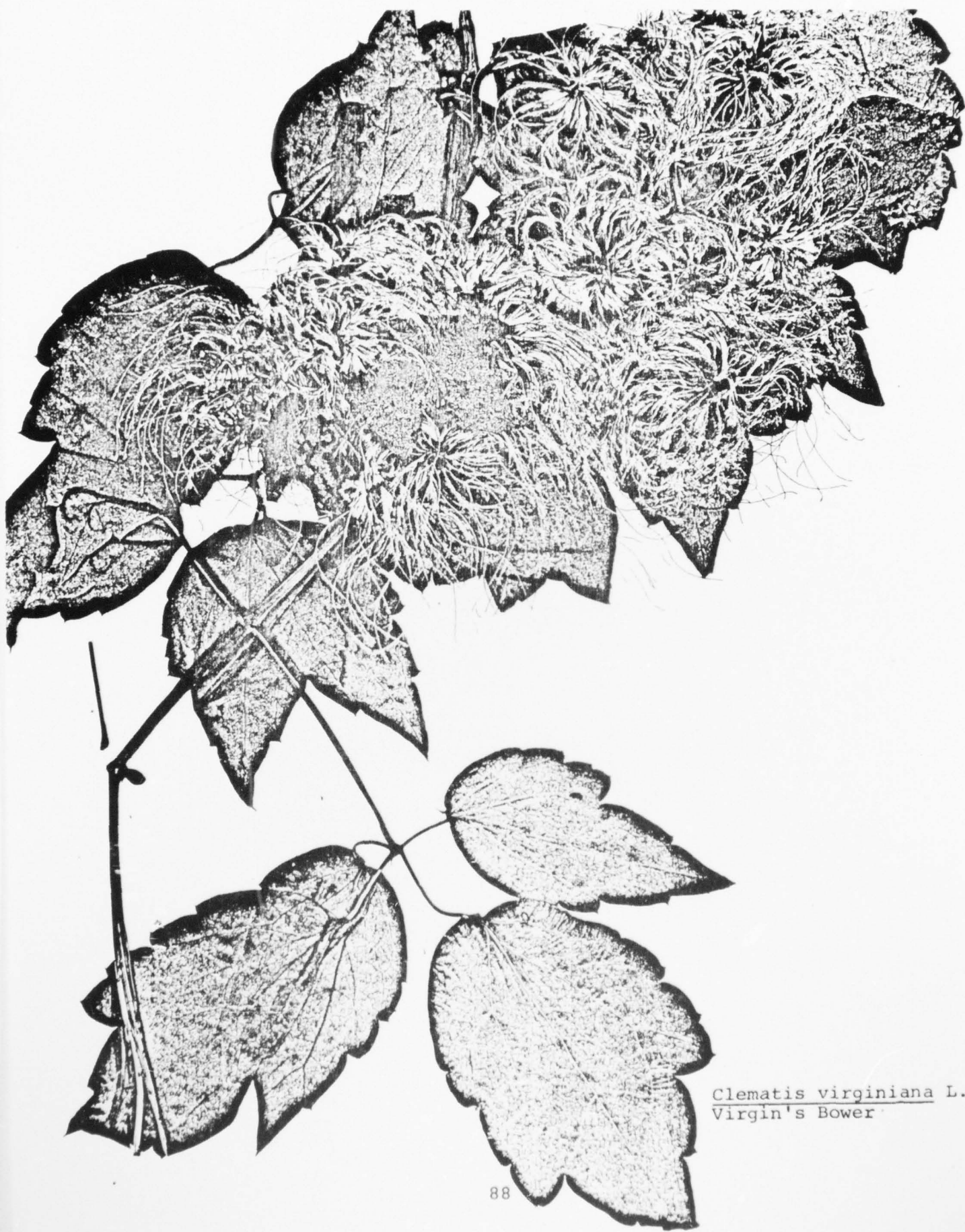
Kalmia polifolia Wang
Bog Laurel



Andromeda glaucophylla Link
Bee Rosemary



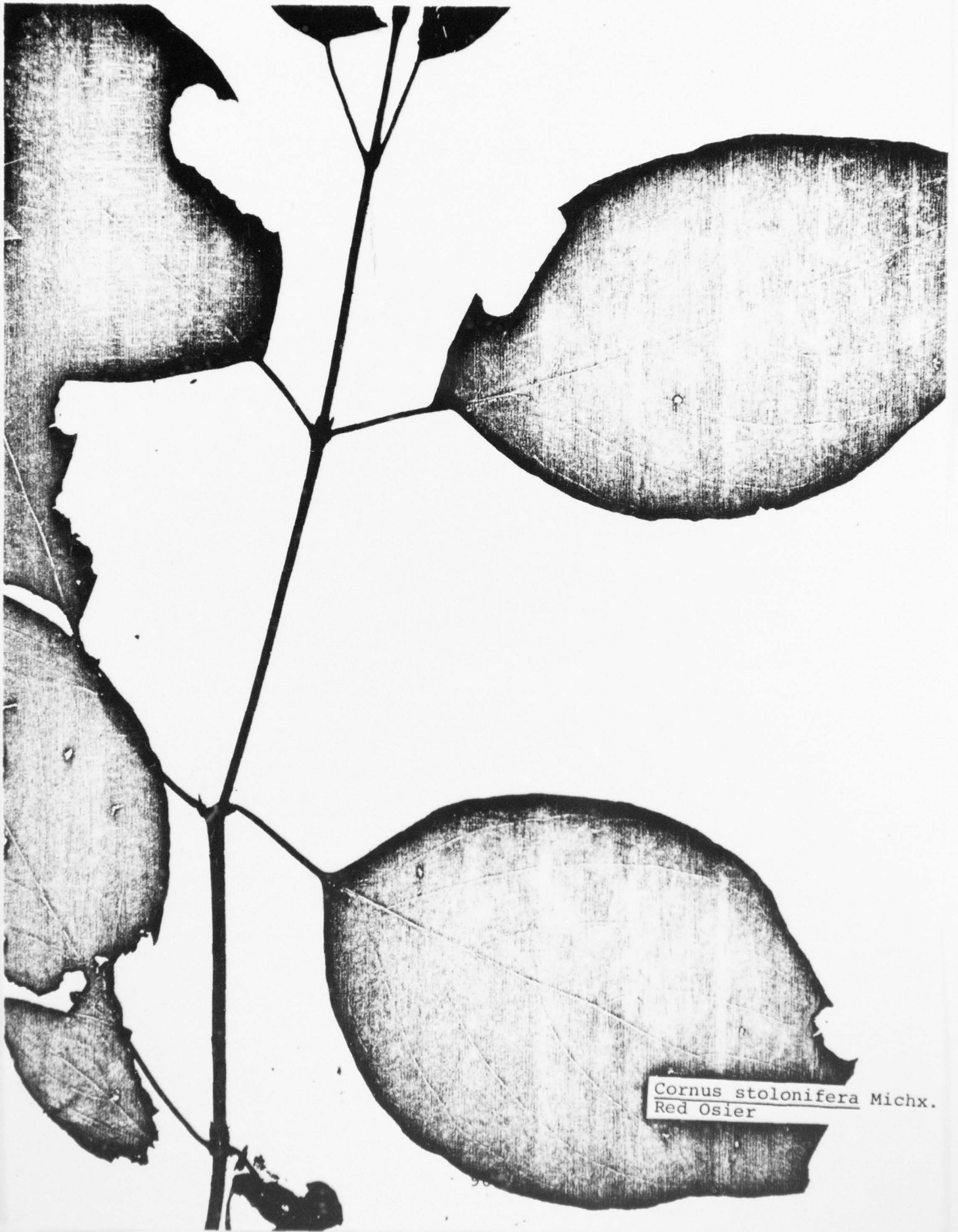
Chamadaphne calyculata (L.) Moench.
Leatherleaf Cassandra



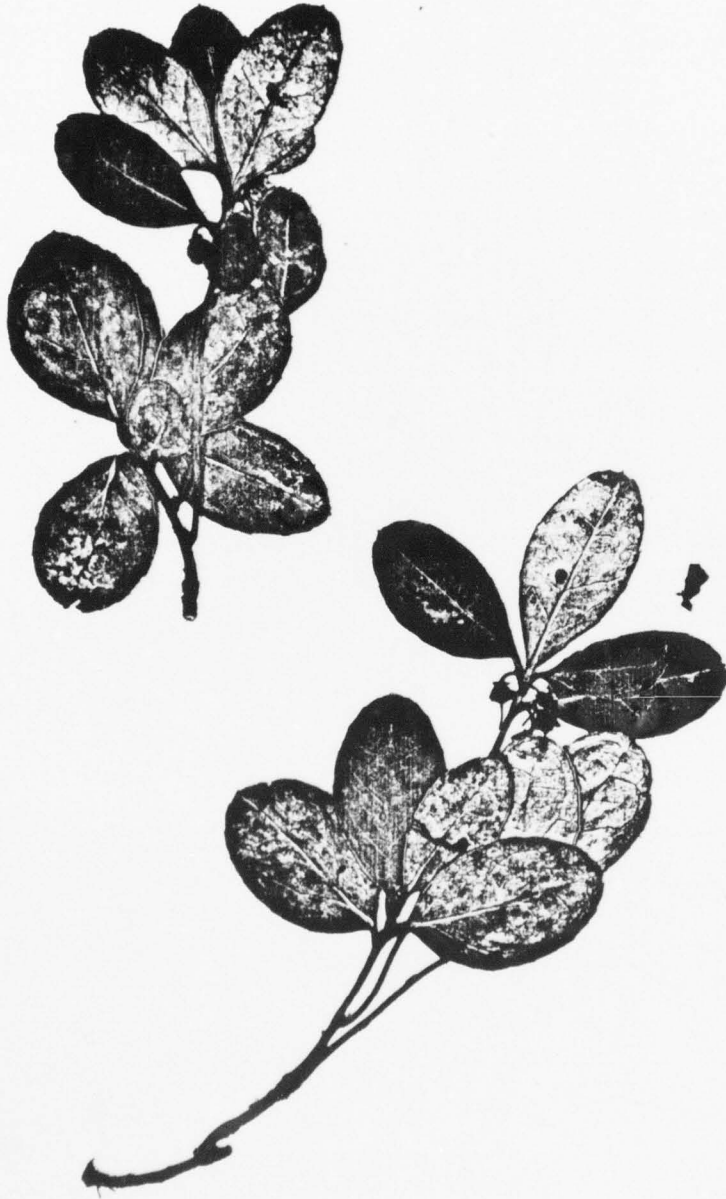
Clematis virginiana L.
Virgin's Bower



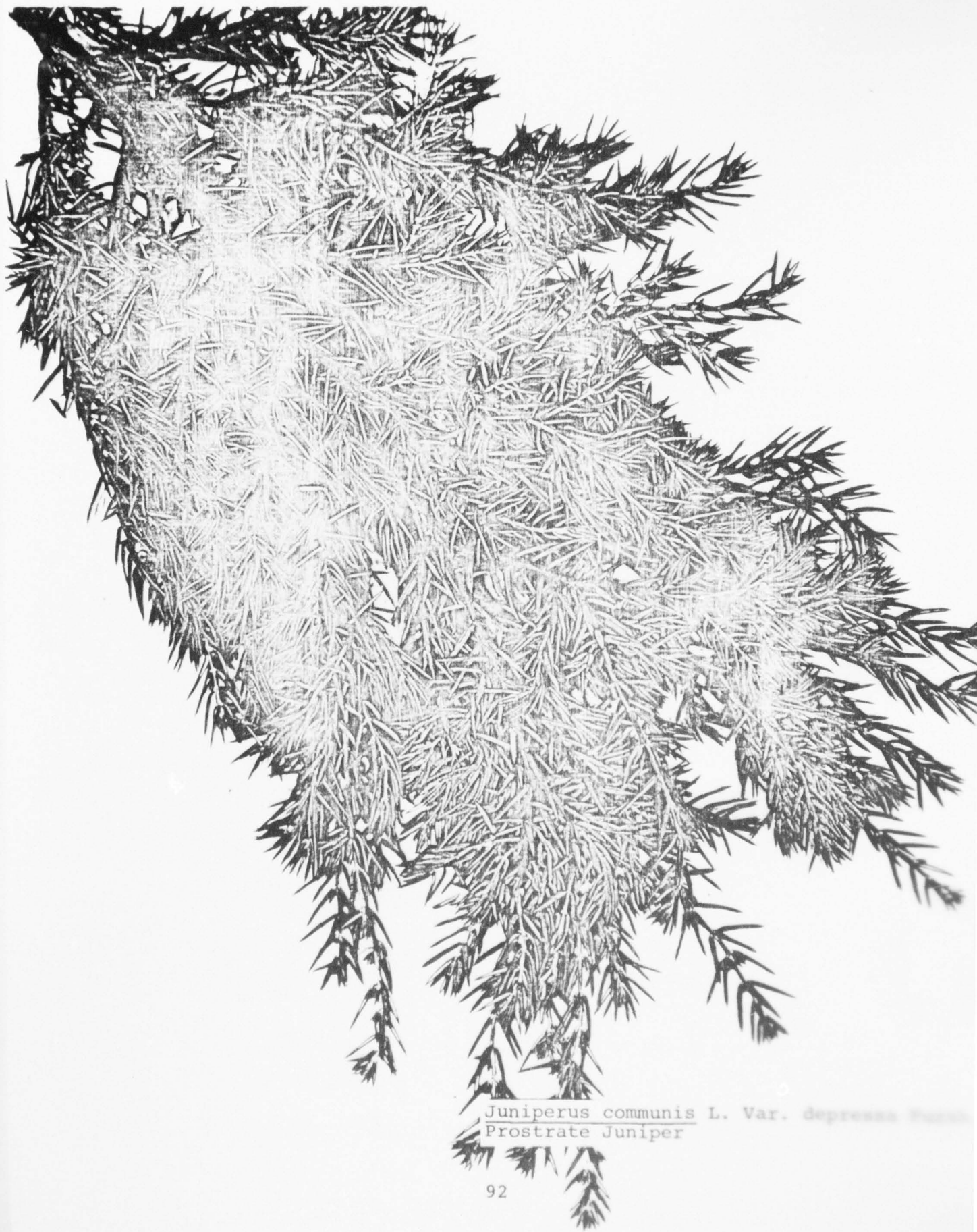
Comptonia perigrina Var. *asplenifolia* (L.) Fern.
Sweet Fern



Cornus stolonifera Michx.
Red Osier



Gaultheria procumbens L.
Aromatic Wintergreen



Juniperus communis L. Var. *depressa* Turcz.
Prostrate Juniper

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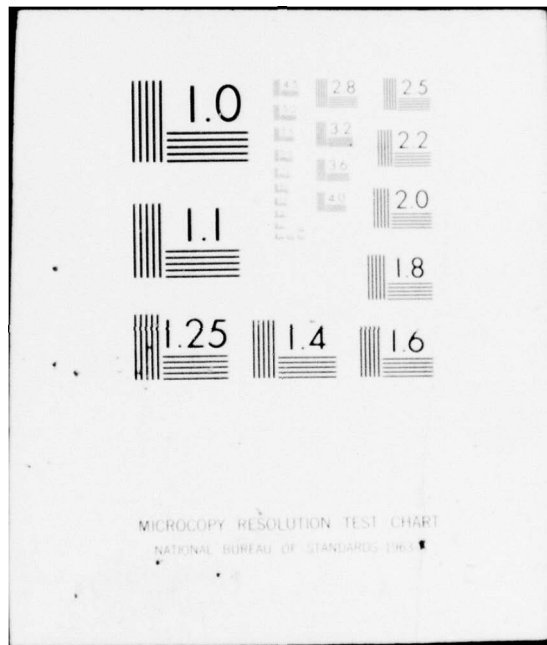
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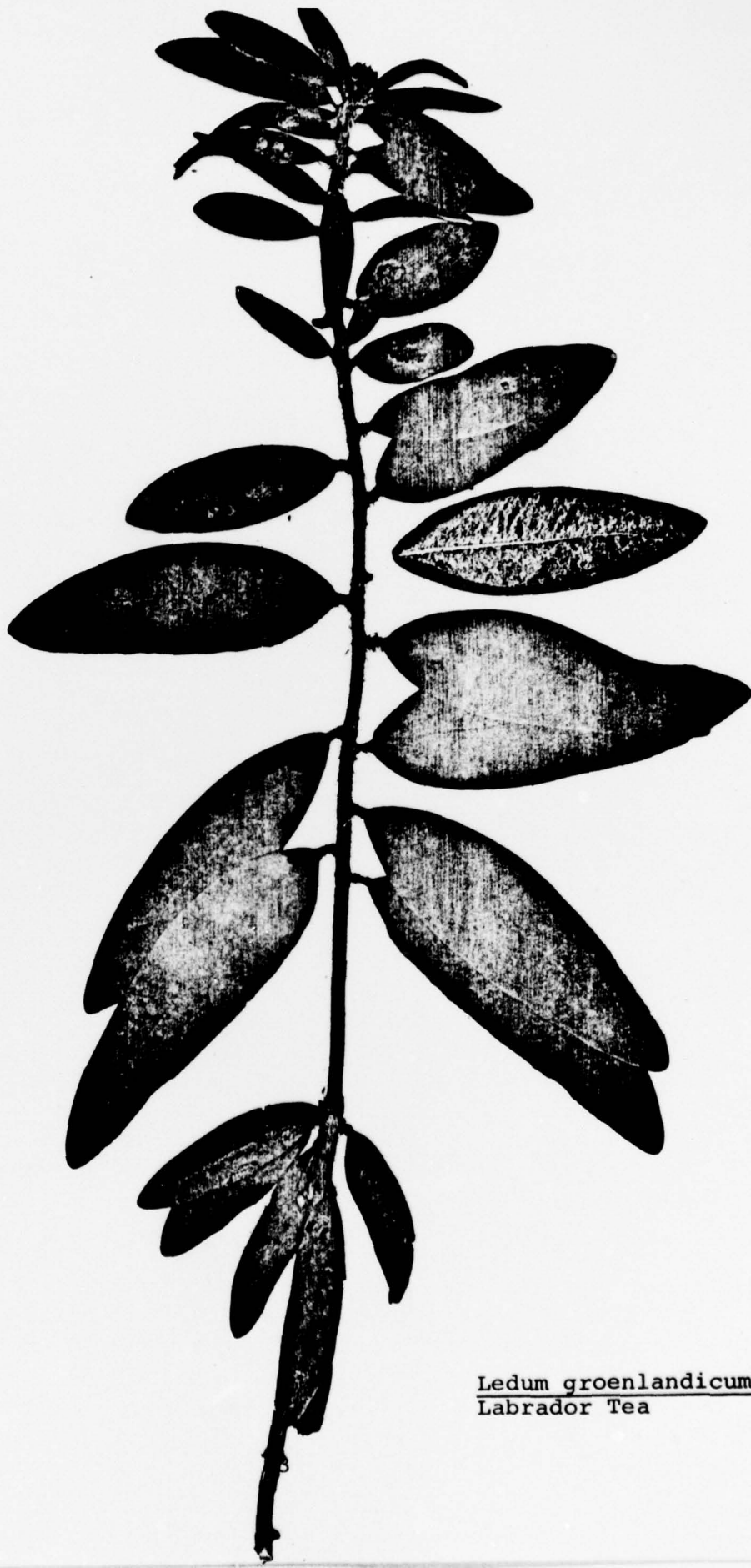


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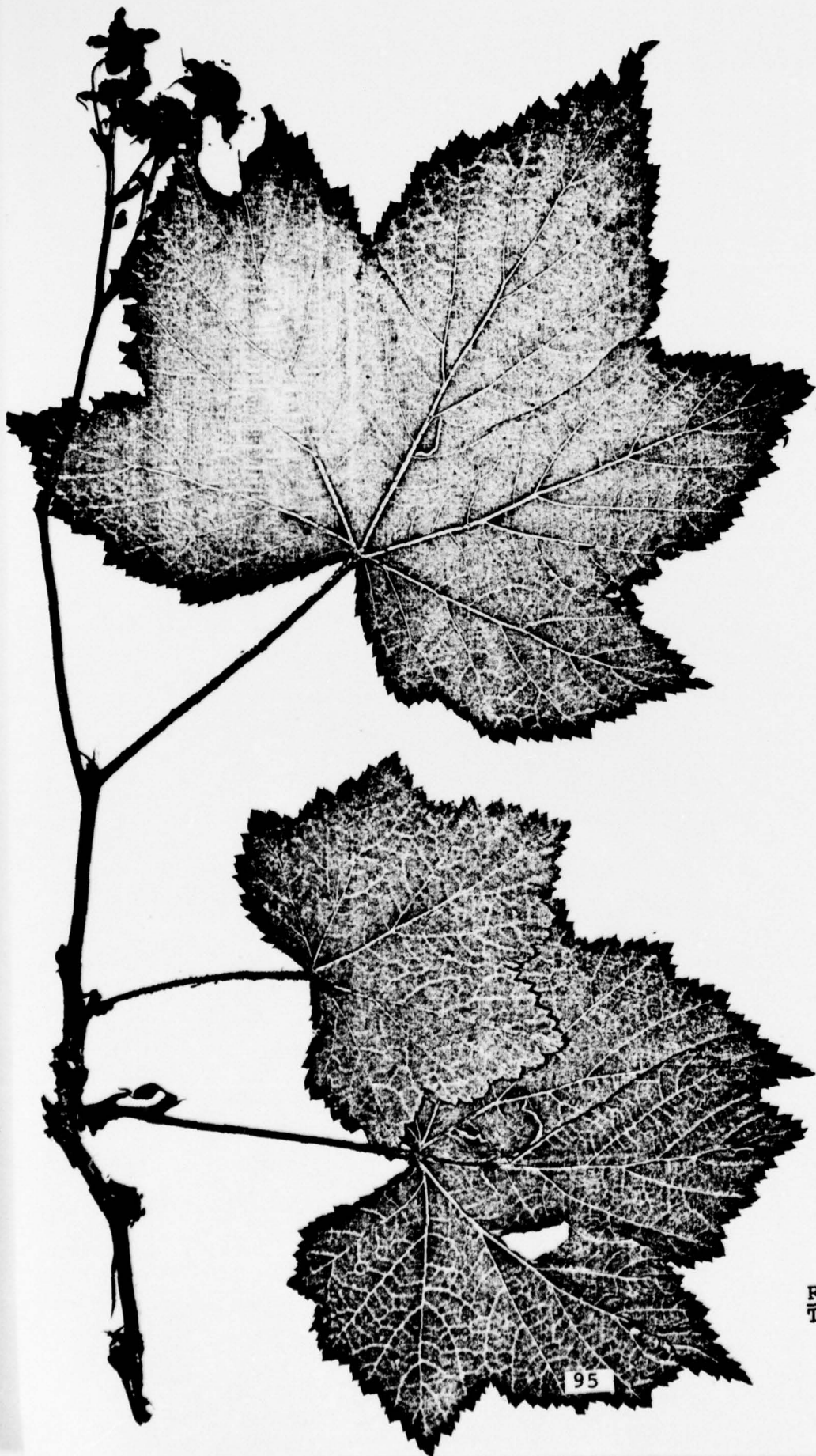
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



Ledum groenlandicum Oeder
Labrador Tea



Myrica Gale L.
Sweat Gale

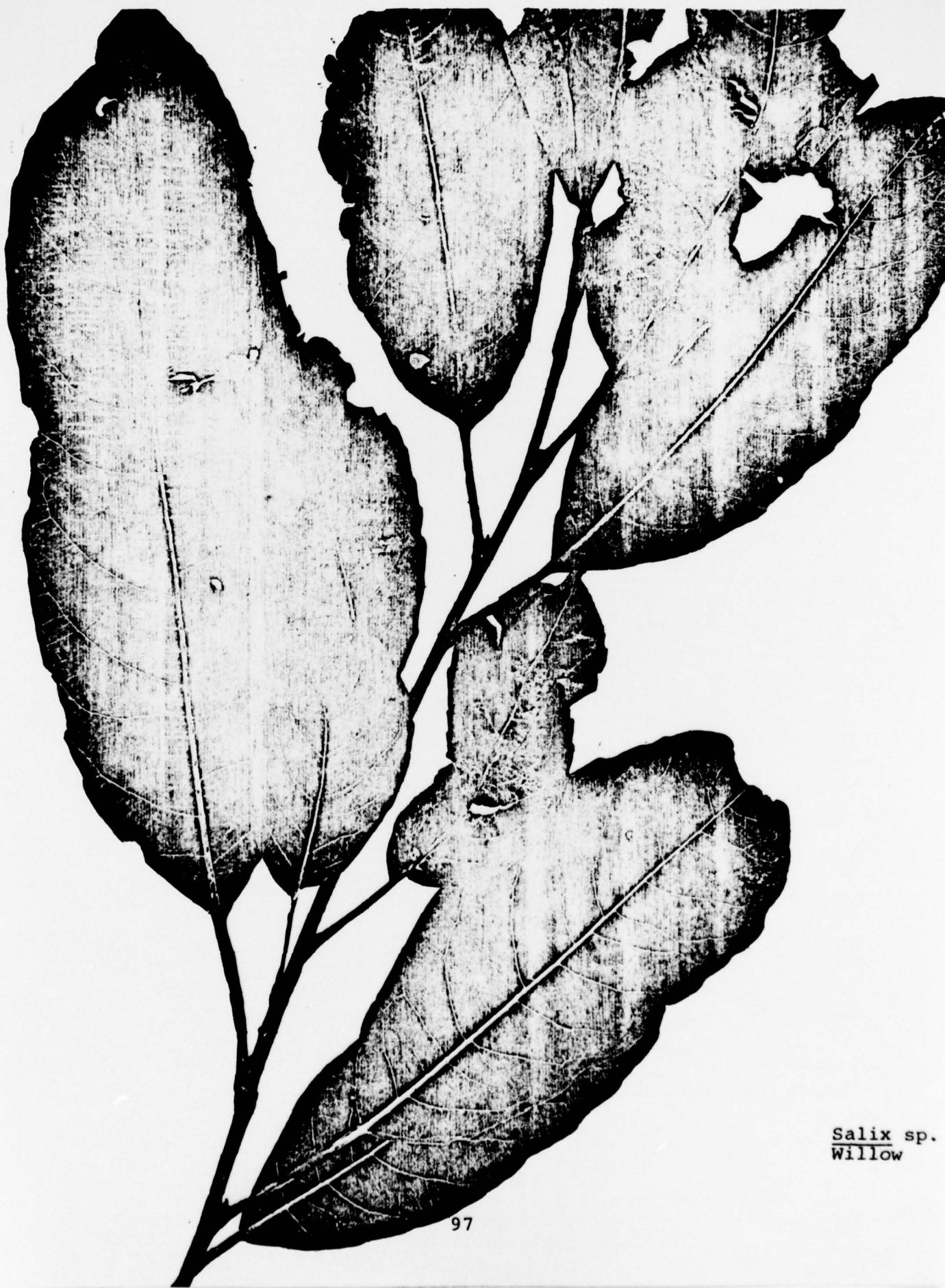


Rubus parviflorus Nutt.
Thimble Berry



Salix sp.
Willow

967



Salix sp.
Willow



Sambucus canadensis L.
Common Elderberry



Spirea latifolia (Ait.) Borkh.
Meadow-sweet



Vaccinium myrtilloides Michx.
Velvet Leaf Blueberry

100

HERBACEOUS PLANTS

Apocynum androsaemifolium L.

Aralia nudicaulis L.

Carex sp.

Clintonia borealis (Aiton.) Raf.

Cornus canadensis L.

Eriophorum sp.

Maianthemum canadense Desf.

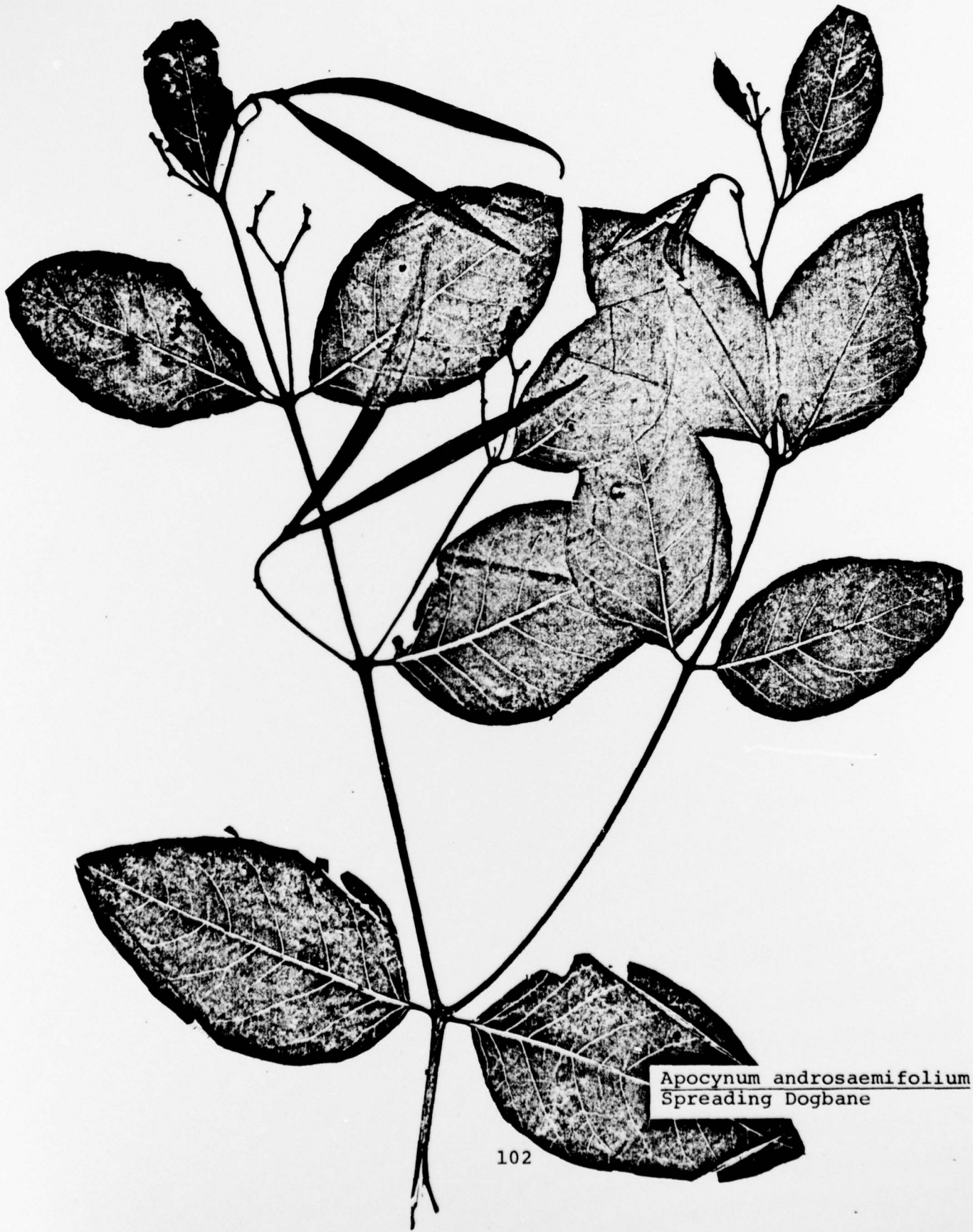
Phleum praetense L.

Pteridium aquilinum L. Kuhn

Smilacena racemosa (L.) Desf.

Solidago sp.

Sphagnum sp.



Apocynum androsaemifolium L.
Spreading Dogbane



Aralia nudicaulis L.
Wild Sarsparilla



104

Carex sp.
Sedge



Clintonia borealis (Aiton.) Raf.
Corn Lily





Eriophorum sp.
Cotton-grass



Maianthemum canadense Desf.
Wild Lily-of-the-Valley



Phleum pratense L.
Timothy



Pteridium aquilinum L. Kuhn
Bracken Fern



Smilacena racemosa (L.) Desf.
False Spikenard



Solidago sp.
Goldenrod

112



Sphagnum sp.
Sphagnum Moss

APPENDIX F
GOVERNMENTAL DIVISIONS
OF THE STUDY AREA
FOR FORESTRY MANAGEMENT

FORESTRY REGIONS, DISTRICTS AND AREAS

