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Conifer Forest



The University of Wisconsin Arboretum

This field book is dedicated to Mrs. Jean Otto who loved the Arboretum and visited it often.

Mrs. Otto had a deep appreciation and understanding for the natural world and readily transmitted it to those who knew her. For her each season brought its own delights; migrating birds, colors of fall, the stark beauty of bare branches against the winter sky, the tender wild flowers poking through soft earth in spring, and lush green of summer—all were part of the rhythm of her life.

We hope that those who use this booklet will gain a deeper feeling and understanding of the natural world thereby making this a suitable memorial for Jean Wilson Otto.

ARBORETUM CONIFER FORESTS

Leach

Conifers, modern editions of an ancient group, bear pollen and seeds in cones or open “berries” instead of flowers. A peculiarity of certain conifers—the pines, firs, spruces and tamaracks—is their paucity of growing points and the location of these growing points only at the branch tips. Each tip has a “leader” bud and a ring of buds around it. Thus the yearly growth additions enable ageing most of the trees by counting the rings of branches from any branch tip back to the ground. (A few, like jack pine, may grow twice or thrice in one year, however.) All our conifers except tamarack are evergreen because their leaves (needles) last from 2 to 10 years before falling. The needles survive the dry cold winters, apparently carrying on some photosynthesis in the late fall and early spring. The aromatic resins may help prevent drying, as well as trap attacking insects, but conifers do suffer from dry winds in late winter and from salt spray from highways. The cones, requiring two years to develop in pines, are especially abundant at irregular intervals. A big crop in August, 1967 resulted in many small white pine seedlings along our trails and openings in 1968-1969. We may expect these seedlings to die out soon where shaded by dense pine stands, since pines, like most conifers, require much light and their distributions generally form a reverse map of shading.

Some background will indicate the ultimate aim of our conifer forest restorations. The Lake States’ thirteen native conifers occur in six natural associations or communities, many of which have deciduous trees in addition to the conifers.

Conifer Associations

WET SITES:

Bog

Tamarack
Black Spruce

Swamp

White Cedar
Balsam Fir

MESIC SITES:

Boreal Forest

White Spruce
Balsam Fir
White Pine

Conifer-Hardwoods

Hemlock
Yew
White Pine
Red Pine

DRY SITES:

Barren Sands and Shores

Jack Pine
Red Pine

Hills and Dunes

Red Cedar
Common Juniper
Prostrate Juniper

These conifers, except the junipers, prefer cool summers and deep snow (fig. 1), and occur chiefly north of Curtis’ “Tension Zone.” The zone is a steep place in the gradient of the precipitation/evaporation ratio—delineating the prairie from the conifer forest—that runs roughly through Twin Cities and Milwaukee. Because conifer seedlings are small and require abundant light, their establishment is favored by an absence of fallen leaves and broad-leaved ground plants. Hence conifers usually get their start on cold or dry sites, on rotten logs and stumps, or on soil laid bare by grazing, roadside grading, timber dragging, plowing, erosion, tip-up mounds, or fire. Storms and natural forest fires aided their perpetuation in the past by creating openings. Hemlocks, balsams and yews are exceptional in their tolerance—their ability to hang on to life despite heavy shading for many years until opening of the canopy permits faster growth; but even they start chiefly on steep banks and fallen logs, as do the birches.

The complicated effects of site differences and disturbance factors result in the varied aspect of the natural forest. To replicate the complex accurately requires much understanding. Our attempts to replicate conifer forests at the south extremity of their natural range has already given much insight into their ecology. The Arboretum’s conifer plantings began with the CCC men in the early 1930’s and included much of our Leopold Pines area. It was known that the pines had maintained themselves to the present time as far south as Illinois on cliffs too dry and infertile for invasion of dense oak and maple forest and steep enough to stop prairie fires. Lacking such cliffs, the Madison area had prairie and oak savannah, but no pines; yet our “borderline” climate could permit their growth here.

Pines are not all alike in their adaptations to the environment. Jack pine is very intolerant of shade while white pine is the most tolerant of our pines. But although white pine is more tolerant than the other pines and some deciduous species, such as aspen and black oak, it is much less tolerant than sugar maple and basswood. Since there is a general correlation between the amount of shade a tree can grow under and the amount it casts, the intolerant species are "pioneers," growing only in places where no other trees exist. The shade they cast is relatively light, and other, more tolerant trees can get started under them. Thus there is a succession, over centuries of time, from intolerant to tolerant species. As this succession proceeds, the environment in the forest changes. The usual change in environment is toward more moderate conditions, with the soil getting richer in nutrients and organic matter, having a greater ability to hold water, thus being a better place for the more demanding species to grow.

In Northern Wisconsin it might be expected that the intolerant pines would have regenerated themselves after the logging that occurred shortly after settlement by the white man, but the destructive slash-fed crown fires following logging eliminated seed trees from large areas, so that the only returning pioneer trees were the windblown aspen and white birch. Efforts to bring pines back revealed that pines are easy to propagate and transplant, and much reforestation has been done with nursery-grown pines. It is too early to tell how successful these plantations will be in producing merchantable timber, but at least they have provided the environmental conditions and the seed source for future natural forests.

Pine plantings are too often made without full understanding of their ecology. Expecting them to grow well in the shade of other trees, as for instance white pine plantings in a maple forest, was only one of many errors. Species unsuited to the site were tried. Early-planted Scotch pines and Norway spruces became picturesque windbreaks on many prairie homesteads but proved to be of little timber value here. The root collar weevil became a pest, spreading from Scotch pine plantings to native red pines. White pine and white spruce were planted on very sandy sites to which jack pine and red pine were better suited.

Another common mistake, monotypic even-aged plantings regularly spaced and very close together, provides a situation that is very susceptible to infestation by diseases and pests. Insects and fungi can spread rapidly through these continuous plantings of a single species, just as they do in agricultural crops and unbroken rows of city elms. Natural forests usually have more than one species, and have openings to break the paths of migration. Such situations are not only esthetically pleasing, they are ecologically sound, hence of practical and economic merit. For example, the tip weevil will not attack white pine if it grows under a light canopy of slightly taller aspen or birch. Lacking deciduous intermixture and planted very closely, man's dense young plantations intercept so much rainfall and snow that the soil suffers from drouth. The combined shade and dryness prevent growth of the natural coniferous ground-cover flora, and the monotony excludes most animals and earns the name "biological desert" for pine farms.

To populate the "desert" we can let nature take its course, or take steps in this artificial situation to speed up the natural processes. One can make large openings in the plantings and introduce equally light-loving deciduous co-pioneers. In places, our plantings are too regular (i.e., on the corners of squares—a situation which arose because at the time of planting the attempt to make a random planting erred seriously in the direction of even spacing) and the trees tend all to grow at the same rate, thus not providing the natural situation where the more-favorably located trees grow faster and crowd out the less-favored trees. These areas will have to be thinned. Where the plantings are more random, natural thinning will gradually admit moisture and light and encourage the northern conifer-hardwood forest to work its way in. The northern ground-cover plants can then be expected to spread from the planted edges, especially along the conifer trails near posts 5, 6, 7 and 21 where a good flower show now extends throughout May. (See appended list of conifer flora.)

The present success with these ground-cover plantings results from their location downslope on the northeast side of the older pines under the open sky. Here they receive

maximum rain and snow, are cooled by protection from hot drying sun and winds from spring through fall, and receive runoff from soil being acidified by the accumulating mineral-deficient leaf litter produced by the pines. This acidification, most advanced under the oldest (Leopold) pines but now occurring most quickly under the Grady Tract plantings on their sandy soil, is attested to by the recent spread of the European orange hawkweed, which requires acid soil and cool summers. The effects of the conifers on the local environment (soil acidification and podzolization, late freezing and late thawing of soil, and cooler, moister air) will, we hope, enable the Arboretum to maintain its northern forest communities once they are established here. Replacement seedlings or plantings can occur in clearings protected by the surrounding conifers.

We hope to make all of the plantings look more natural by softening their edges, varying the tree spacing, and creating tree diversity by occasional culling and interplanting of the conifers with other species. Certain special management techniques offer possibilities. We may be able to use irrigation to advantage in dry summers to encourage the spread of northern ground-cover plants and podzolization of the soil. (Podzolization is the movement downward of small soil particles when water acidified by accumulated organic matter abundantly percolates through.) We could try chemicals to acidify the soil, or we could augment the litter until the conifers cool the soil sufficiently to retard oxidation of the litter by bacteria and fungi as is the case in the north. Acidification alone will retard the bacteria eventually but apparently not the fungi.

At present, wildlife use of our conifer plantings is limited to roosting by crows and migrant robins and blackbirds, and winter feeding by red-breasted nuthatches, crossbills, siskins and redpolls seeking insects and seeds of conifers and birches. Possibly the cone crops will be dependable enough from now on to justify introducing the red squirrel as the first northern mammal. Some day we hope to attract more of the conifer forest birds as nesters.

James H. Zimmerman
1970

TABLE 1: ARBORETUM CONIFER LOCATIONS—1970

The accompanying map indicates where to find the 35 conifer areas in the Arboretum outlined below.

G: Grady Tract: Sandy soil. The new beltline frontage road will take away a strip of conifers along the edge.

G1: Northwest Grady Pines—An extensive forest of variously aged red and white pine with some jack pine, black oak, red maple and white birch. Some new ground-cover plantings are thriving, especially along the fire lane north of post 21. Upslope to the west, under the pines, is a single old common juniper.

G2: Northeast Grady—White spruce-balsam-fir (low) and jack pine (higher slope); healthy young trees.

G3: Westcentral Grady—Experimental rows of medium-sized red, white and jack pines and red cedar. The jack pines are seeding in on the sandy burned prairie.

G4: Eastcentral Grady—Experimental young Rocky Mountain conifer plantings: ponderosa and limber pines, Colorado spruce, white and Douglas firs; others to come later.

M: West (Wingra) Marsh Section (along west border):

M1: Ho-nee-um Pond White Cedars—Abundant large trees with a few white birch. A few seedlings on the south shore of Lake Wingra may have come from these!

M2: Ho-nee-um Pond New Plantings—Various conifers along the teaching trail, from the springs to the meadow: red and white pine, hemlock, white cedar, white spruce, and tamarack.

M3: Spring Trail Pond Ornamentals—At present a few white spruces and white pines.

M4: Viburnum Garden—With 3 newly planted bald cypresses we hope will survive.

W: *Wingra and Gallistel Woods Section*: To become northern and southern climax forests respectively.

W1: Wingra Woods—Under the red oak canopy with a few white pine, abundant hemlock and yellow birch plantings (along with many sugar maple saplings) will soon create the mood of the conifer-hardwoods forest of northern Wisconsin. Some characteristic shrubs (mountain maple, witch hazel, leatherwood) are going in, and several American yew are doing very well near post 4.

W2: Wingra White Cedars—This recent planting is well hidden.

W3: Gallistel Southern Swamp—With two newly planted bald cypresses we hope will survive, along with other Ohio Valley forest trees.

S: *South Marsh and Springs Section*:

S1: Wingra Springs Tamaracks—These good-sized trees replace the last bog relic tamaracks cut near here just prior to Arboretum establishment, and add personality to the view out over the spring.

A: *Administration Area*:

A1: Hilltop Ornamentals—The good-sized Austrian and Scotch pines west of the parking lot are now seeding in under the white birch and cherry and sumac to give as natural an effect as the spontaneous red cedars. West of them, by the road, are a few red pines to compare with. Across the road, some fine white pines, beginning to show flagging, have become picturesque sentinels.

A2: Hilltop Spruces—Pyramidal silhouettes in contrast to the pines. Our only sizeable Colorado spruce is located nearest the road, with adjacent tall white spruces and young maples.

A3: West Spruce-Fir Area—This intimate northern spot has excellent northern skyline character, with brushy spaces between variously sized white spruce and the very narrow-spined balsam, including some big ones. Subtle contrasts in form are provided by a few interplanted Norway spruces and (by the road) several western Douglas firs. Underplantings have begun along the trail through the densest spruce-fir, and a few black spruce and hemlock are being tried out.

A4: White Pine Pioneers—These healthy natural seedlings from the adjacent golf course trees demonstrate the role pines play in plant succession—irregularly invading open land along with brush, giving the diversity in species height, and spacing so important to animal life.

A5: The Horticultural Gardens—Including a block of white and red pine and white spruce north of the parking lot and, westward, special uses of conifers, notably experimental low hedges of white and red pine, white cedar, and white spruce, as well as of Japanese yew. Here the naturally low mugho pines and Pfitzer junipers need little or no clipping, in contrast. To the east, behind the shop, new plantings compare arbor vitae with *Chamaecyparis* cedar. Upslope to the north, a variety of recent plantings include limber pine, Colorado and Serbian spruce, and varieties of red cedar (exhibiting shaping by deer browse!). Two fast-growing groves of European larch and some newly planted maidenhair trees near the parking lot will soon lend flavor to the skyscape.

A6: Woody Plant Nursery—Plantings awaiting setting out in 1970 include: white, red, jack, limber and ponderosa pine; white, Colorado and hybrid spruces; balsam, Fraser, white and Douglas firs; hemlock; American and Japanese yews; red cedar, Rocky Mountain juniper, prostrate and Eurasian junipers; arbor vitae and *Chamaecyparis* cedar; tamarack; bald cypress and metasequoia; and maidenhair tree. Several large columnar-form white cedars are conspicuous; one more marks a homestead south of the Beltline (G1).

A7: Administration Buildings Ornamentals—White pine, white cedar, mugho pine, Japanese yew.

- A8: The Strain Garden—A miniature arboretum designed to demonstrate the environmental effects of different plant communities (including effects on different strains of a single plant species). Balsam and tamarack about to be added; white cedar, black spruce, hemlock and jack pine newly planted; white and red pine and white spruce groves partly grown; red cedar seeding in from the cedar glade to the east.

P: Leopold Pines Section:

- P1: Leopold Pines—A block of our oldest white and red pines, with some younger ones to the north. Northern shrubs and ground-cover plantings are beginning to be successful along trails near posts 5-7, and in several fenced deer and rabbit enclosures and the ravine near P3, always in openings. Some aspen, white birch, and red maple occur along trails and at the Curtis Prairie edge, and a few hemlock and American yew are being introduced to join sugar maples spreading from an old tree to build the climax stage.
- P2: Beltline White Cedars—A young hedgerow due to be destroyed when the intersection at Seminole is reconstructed.
- P3: Beltline Spruce-Fir—A small low area with sizeable white spruce and balsam; erosion from culvert discharge to be corrected with a concrete flume in 1970.
- P4: Beltline Pine Shelterbelt—White and red pine, bordering the prairie eastward, gives the prairie a pine-sugar maple backdrop with northern autumnal color contrasts.
- P5: Southeast Spruce-Fir Area—A large area of variously aged white, black and Norway spruce, balsam and hemlock, much of it mixed with black oak, aspen, cherry, ash, red maple, basswood, and white birch, simulating nicely the natural start of conifers under a light overstory of deciduous pioneers. A serious fungus infection of white spruce needles here may require periodic control spraying.

T: Teal Pond Area: The center of deer activity, because of seclusion and presence of palatable white and red cedar.

- T1: Teal Pond Spruce-Fir—Continuing P5 northward along the low prairie, with the largest black spruce and some balsam. A few red cedar and jack pine are seeding into the prairie here.
- T2: Teal Pond Tamarack and White Cedar Swamp—Nearly full size now, as are the Ho-nee-um white cedars, Lost City jack pine, and Wingra Springs and East Marsh tamaracks, but with the advantage of additional more-recent peripheral conifer plantings for naturalness. Underplantings only begun. Much browsing by deer.
- T3: The Cedar Glade—Red cedars and white birches approaching full size and now spreading out by seed (cedar) and by newer plantings (birch) on a knoll designed to simulate the Sauk City river bluffs which have in this century become forested (for the first time?) as a result of grazing and fire stoppage. The three native junipers can be compared here: red cedar, trees; common juniper, shrubs; prostrate juniper, creeping mats. Spontaneous scattered red cedars now found all over the Arboretum may have come from this planting, although a few were also native in this area in 1930. Noteworthy on red cedar are the blue berries on female trees, April pollen from innumerable cones, winter deer browse, and orange horns on the cedar apple rust after a May rain.

L: Lost City Section: Extensive pine plantings with good age diversity and varied spacing merge with a young forest of oak, hickory, aspen and sumac and open fields and meadows.

- L1: Lost City Jack Pine—A healthy, dense, tall stand east of Teal Pond (T1) where humidity has prevented successful burning which we had hoped could bring about typical jack pine barren openness and Pennsylvania sedge understory. Some natural seeding is occurring in the low prairie (T1) and along fire lanes; not all the cones await the heat of fire to open.

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L2: The Lost City Pines—Our most expertly planted red, white and jack pine stands; extensive, on hilly terrain, of diverse ages and spacings, with some aspen and oak. Like G1, this area is secluded enough to be good territory in which to seek owls.

L3: Lost City Experimental Area—Trials of disease-resistant and hybrid trees are being tested, including some hybrid pines.

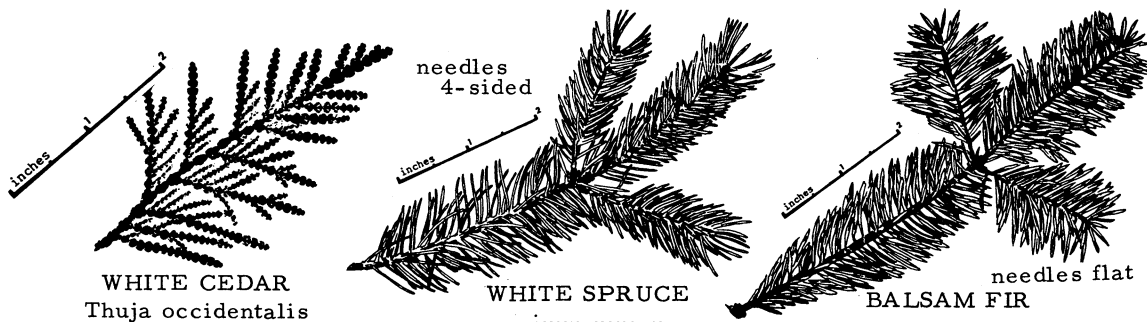
L4: Sensenbrenner Tract Pines—A small plantation of red pine.

E: *East (Gardner) Marsh Section*: On wet peat and marl soils.

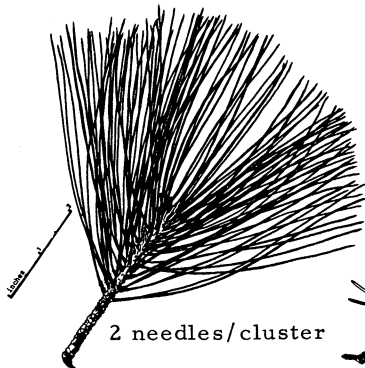
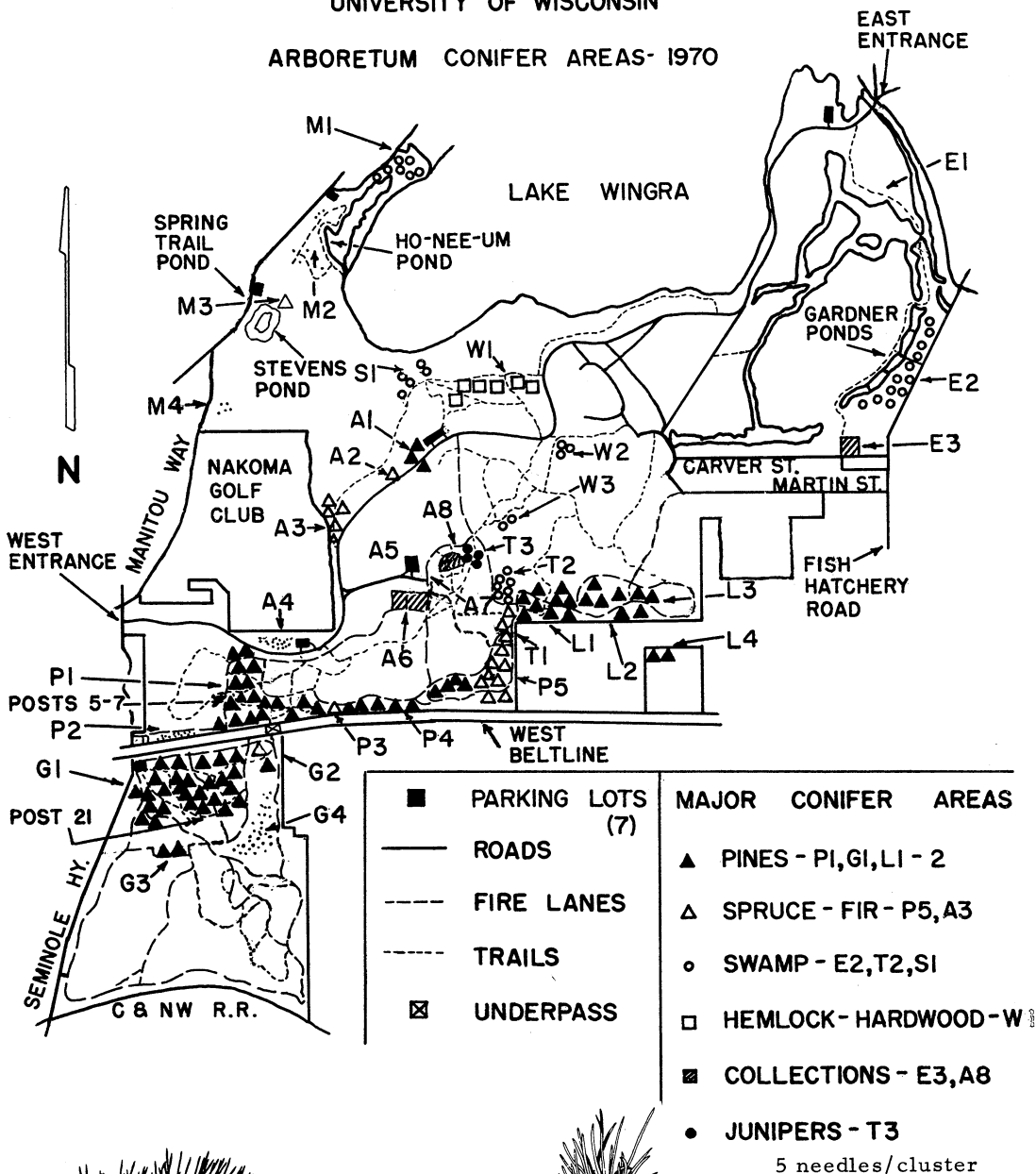
E1: Northern Gardner Marsh—A few young red cedars have come in on the wet marl meadow.

E2: East Marsh Tamaracks—Our most extensive and authentic bog skyline isolates the marsh and ponds from traffic. As at Teal Pond, alkalinity has so far thwarted attempts at establishing bog vegetation. Experimental plantings of other conifers occur toward Fish Hatchery Road.

E3: The Taxonomic Garden, where all 13 native conifers will be displayed together. Now present: white, red, jack pines; white, black spruces; balsam fir, hemlock; arbor vitae, red cedar, prostrate juniper; tamarack. American yew and common juniper still to be planted.



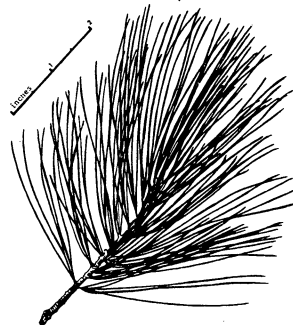
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ARBORETUM CONIFER AREAS- 1970



RED PINE
Pinus resinosa



JACK PINE
Pinus banksiana



WHITE PINE
Pinus strobus

Sketches by Wayne Westphal

TABLE II: THE CONIFER FLORA

Associates of the conifer forest now established in at least a few places in the Arboretum include the following:

DECIDUOUS TREES AND SHRUBS*¹

Catkin-bearers: Birches, Aspen, Poplar, Oak, Sweet Fern, Beaked Hazel, Alders, Willows

Rose Group: Thimbleberry, Mountain Ash, Cherries, Shadbush, Ninebark, Spireas

Tubular Flowers: Maples, Ash, Witch Hazel, Honeysuckle, Snowberry, Red Elderberry, Leatherwood, Dogwood, Sumac, Holly, Highbush Cranberry

HERBS AND SUBSHRUBS (evergreens starred)

Ferns and Monocots:

Ferns: Oak, Beech, Bracken, Spinulose Shield,* Marginal Shield,* Club Mosses,* Pedunculate Sedge,* Wood Rush

Monocots: Rattlesnake Plantain, Moccasin Flower, Canada Mayflower, Bluebead Lily, Small Bellwort, Nodding Trillium, Twisted Stalk, Starry Smilacina, Small Solomon's Seal

Buttercup-Rose Group: Roundleaf Hepatica,* Starflower, Goldthread,* Red Baneberry, Wood Anemone, Barren Strawberry,* Northern Dewberry,* Sweet White Violet, Crinkle-root,* White Wood Sorrel, Naked Miterwort, Wild Sarsaparilla

Ericads and Other Tubular Flowers:

Cowwheat, Bearberry,* Wintergreen,* Blueberries, Huckleberry, Pipsissewa,* Shinleaf,* Trailing Arbutus,* Bunchberry, Gaywings,* Partridgeberry,* Twinflower,* Big Leaf Aster

*¹Note: Berry plants abundantly brought by roosting itinerant birds and growing on the edges and openings include species that do not belong in northern conifer forest: poison ivy, black elderberry, grapevines, woodbine, bittersweet, black cherry, gray dogwood, nannyberry, and four Eurasians—bitter nightshade, Tatarian honeysuckle, and two buckthorns.

SELECTED REFERENCES

- Curtis, J. T., 1958. Native Woody Plants of the Arboretum. II. The Conifers, *Arboretum News* 7:2.
 Rees, C. P., 1967. Effects of Three Pine Stands on . . . the Underlying Soil. *Arboretum News* 16:3-4.
 Selleck, G. W., and K. Schuppert, 1957. Some Aspects of Microclimate in a Pine Forest and in an Adjacent Prairie. *Ecology* 38(4): 650-653 (studied in the Arboretum).

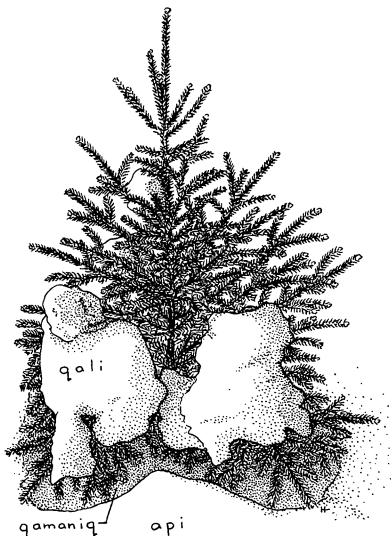


Fig. 1.

The Eskimos have a word for it. As reported by William O. Pruitt, Jr., in *Animals of the North* (Harper & Row, 1967), "api" is the snow on the ground, "qali" is the snow accumulating on branches, and "qamaniq" is the snow shadow under the tree—a safe, steep-walled hollow where animals may seek shelter. (Kobuk Valley, Alaska, Eskimo.)

Sketch by Elizabeth H. Zimmerman

