GYMNOSPERMS

One of the most interesting exotic gymnosperms is the famed maidenhair tree, *Ginkgo biloba* L., a native of China first introduced into the United States in 1784. The sexes are separate in *Ginkgo* and the "fruit" is a smelly plum-like seed so staminate plants are preferred for cultivation. Rarely, small seedlings may appear near planted trees, as in Kalamazoo Co. (McKenna, 2004). Many other gymnosperms are planted in quantity and may sporadically spread by seed, especially near plantings.

CUPRESSACEAE—CYPRESS FAMILY

1. Leaves alternate, needle-like but deciduous, soft and pliable in 2-ranked flattened sprays ..... *Taxodium*
1. Leaves opposite or whorled, evergreen, scale-like or if needle-like, then hard, sharply pointed, and not 2-ranked.
   2. Mature female cones fleshy and berry-like, up to 8 (–10) mm long, green or bluish; leaves opposite or whorled, needle-like, or if scale-like and appressed then quite uniform (none keeled) and ultimate branchlets ± quadrangular ..... *Juniperus*
   2. Mature female cones brown and ± woody, ca. 8–15 mm long, the elongate scales distinct; leaves all opposite and appressed, scale-like, dimorphic (a pair of opposite strongly keeled leaves at right angles to adjacent pair of flat leaves), ultimate branchlets strongly flattened..... *Thuja*

Juniperus

The female cones are berry-like and dark bluish, often glaucous. The volatile oil they contain is the source of the distinctive flavor of gin. One often sees on *Juniperus* colorful orange galls caused by rust fungi of the genus *Gymnosporangium*, a widespread disease of apples and related plants.

1. Leaves in whorls of 3, all awl-like, articulated at the base, not decurrent; female cones on very short, scale-covered peduncles in the axils of awl-like leaves ..... *J. communis*
1. Leaves mostly opposite, some or all scale-like (awl-like leaves when present often whorled but not articulated, decurrent at base); female cones apparently terminal on short, scale-covered peduncles borne on branchlets with scale-like leaves.
   2. Erect small tree with central trunk, growing in southern Michigan; fruit on ± straight, ascending peduncles (or branchlets) ..... *J. virginiana*
   2. Prostrate trailing shrub, growing in northern Michigan; fruit usually on ± arched or recurved peduncles ..... *J. horizontalis*

Juniperus communis L.—Common or Ground Juniper

Most widespread on or near sandy shores and dunes along the Great Lakes, often associated with pines; also inland and there occurring in a diversity of habitats: old fields and gravelly banks, usually with scattered red-cedar in characteristic "juniper savannas;" also occasionally in coniferous swamps (on hummocks in wet places); in oak-hickory forests and

northward scattered under jack pine and aspens; in the western Upper Peninsula in crevices of rock outcrops.

Our plants are var. *depressa* Pursh, a ± decumbent form; the large cup- or saucer-shaped mats are characteristic of dunes and sandy places. Various forms of this species are cultivated for ornament.

Juniperus horizontalis Moench—Creeping Juniper

On rock at Isle Royale and in Marquette and Keweenaw Cos. (including a very blue-glaucous form on Mt. Bohemia) and on dolomite pavement on Summer Island (Delta Co.) and Drummond Island (Chippewa Co.); elsewhere almost entirely confined to the sandy or gravelly shores and dunes of the Great Lakes, usually associated with pine and the common juniper, and relic on older shores and beach ridges among cedar and fir thickets; in peatlands in the Upper Peninsula. Often cultivated, and some southern collections on roadsides inland from the Great Lakes shores are not mapped as they were presumably from plantings.

Juniperus virginiana L.—Red-cedar

Stabilized sand dunes, lake shores, open deciduous forests, especially, oak-hickory, and even swamps and open wetlands; but most characteristic, especially in the southeastern Lower Peninsula, of old fields and hillsides in open juniper savannas with *J. communis.* It is not certain whether any of the collections north of Newaygo Co. represent native plants. Red-cedar is probably more common and widespread in Michigan now than it was before the clearing of the landscape. Both this species and *J. horizontalis* have sharp awl-like leaves on the young growth and seedlings (or sometimes after injury), while the leaves on old growth are scale-like and overlapping.

Taxodium

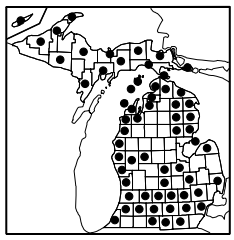
Taxodium distichum (L.) Rich.—Bald Cypress

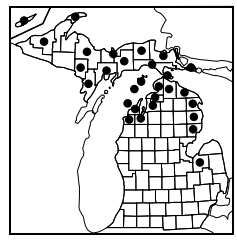
A major tree of the swamp forests of the southeastern States, though ranging north to southern Indiana; sparingly escaped to wet areas and along watercourses in southwestern Michigan, where first collected by W. S. Martinus in 2010 in Kalamazoo Co.

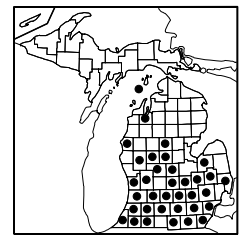
Thuja

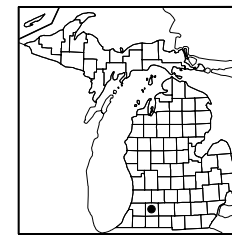
Thuja occidentalis L.—Arbor Vitae; White-cedar; "Cedar"

This is the characteristic tree of "cedar swamps" that occupy hundreds of thousands of hectares of wet ground in northern Michigan, much of it nearly impenetrable, except by the deer for which both shelter and a favorite food are provided. Cedar may be found at least sparsely in almost all kinds of forests, except the driest; on sand dunes, shores, and rock outcrops


Juniperus communis


Juniperus horizontalis


Juniperus virginiana


Taxodium distichum

(especially limestone); along streams, in springy areas. It thrives on calcareous gravelly shores and ridges near Lakes Michigan and Huron in the northern part of the state. Often cultivated, and sometimes spreading from plantings in southernmost Michigan.

The youngest seedlings have opposite or whorled flattened needle-like leaves, but the first branches have the characteristic scale-like leaves. The flat unkeeled leaves (i.e., those on top and bottom of twigs in contrast to the keeled leaves straddling the sides) have a ± prominent resin gland near the apex; this is especially evident on the lower leaf.

PINACEAE—PINE FAMILY

1. Leaves needle-like, all or mostly grouped in definite clusters on short shoots.
   2. Leaves deciduous, crowded and numerous on short lateral shoots (alternate leaves on new twigs); female cones less than 2 cm long.....*Larix*
   2. Leaves evergreen, in clusters of (normally) 2 or 5; female cones more than 2 cm long.....*Pinus*
1. Leaves flattened or 4-sided, alternate (spiraled), not in definite clusters.
   3. Leaves persistent on dry branches, sessile, separating cleanly from an orbicular leaf scar not or barely raised (on a low rounded ridge) above the surface of the twig.
      4. Terminal buds rounded, densely covered in resin; female cones erect, the scales falling from the persistent central axis at maturity; underside of leaves with two whitish bands (formed by whitish stomata) on either side of the midvein .....*Abies*
      4. Terminal buds ± pointed, the scales evident, not enclosed in resin; scales persistent, the female cones remaining intact, and eventually falling entire; undersides of leaves without whitish bands.....*Pseudotsuga*
   3. Leaves readily falling from dry branches, leaving persistent peg-like bases, the twig hence very rough.
      5. Leaves flattened, rounded at apex, distinctly short-stalked in addition to the persistent narrow peg-like base.....*Tsuga*
      5. Leaves ± 4-sided, acute or sharp-pointed, sessile on the persistent peg-like base.....*Picea*

Abies—Fir

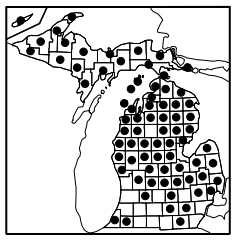
Abies balsamea (L.) Mill.—Balsam Fir

Coniferous and mixed forests, often with aspen or paper birch (especially in a rather characteristic association near the Great Lakes shores); cedar swamps, bogs, and spruce-fir stands.

Readily recognized by the smooth round leaf scars, this aromatic plant is a popular Christmas tree, since the needles do not fall readily as do those of the spruces. Resin-filled pustules are characteristic of the bark of this species, and the young female cones are often heavily resinous.

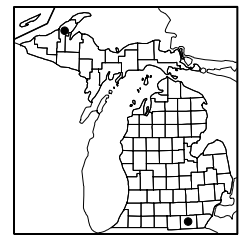
Larix—Larch

1. Female cone scales ca. 10–20, glabrous.....*L. laricina*
1. Female cone scales ca. 40–50, puberulent .....*L. decidua*

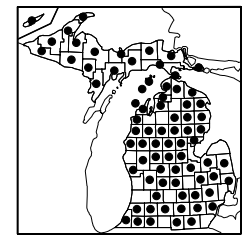


Thuja occidentalis

Abies balsamea



Larix decidua



Larix laricina

Larix decidua Mill.—European Larch

Sometimes planted, this European tree occasionally escapes in the vicinity of plantings. First collected as an escape by E. A. Bourdo in Houghton Co. in 1962. The leaves are often more than 2.5 cm long in this species and shorter than this in *L. laricina*.

Larix laricina (Du Roi) K. Koch—Larch; Tamarack

In almost all sorts of wet places, open or forested, shores, and sometimes on drier ground where there is not too much competition; especially characteristic of the older stages in peatland succession (and invading younger mats), sometimes with spruce and less often cedar. Also frequent in beach thickets and interdunal hollows. The young cones are normally a bright purple, but the striking gold-cone tamarack (f. *lutea* Jaurès) with clear yellow cones occurs rarely (see Naczi & Thieret, 1996).

Picea—Spruce

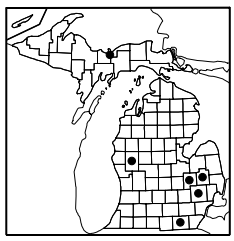
Spruce needles fall readily from a prominent peg-like projection on the twigs. Black spruce is the usual host of dwarf mistletoe, *Arceuthobium pusillum* Peck, although the parasite has occasionally been found on white spruce in the vicinity of the Straits of Mackinac (and rarely on *Larix* and 2-needled *Pinus* elsewhere in the Great Lakes region). The western *Picea pungens* Engelm., Colorado blue spruce, is commonly cultivated and persists on old homesites and roadsides. It has very stiff, sharp-pointed, spreading needles that are usually a distinctive blue-green, especially when young and cones somewhat longer than our native spruces (ca. 6–10 cm).

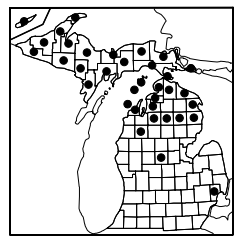
1. Young branchlets ± densely fine-pubescent; leaf bases below the peg-like projections ± obscure on 1-year-old twigs; female cones rather spherical, (1–) 1.5–2.8 (–3) cm long, the scales with slightly irregular or erose margins ..... *P. mariana*
1. Young branchlets glabrous; leaf bases prominent below the peg-like projections on 1-year-old twigs, appearing to cover them with ridges and grooves; female cones cylindrical, (2.5–) 3–18 cm long, the scales nearly or quite entire.
   2. Female cones (2.5–) 3–6 cm, leaves stiff, spreading, often somewhat glaucous, branchlets spreading. ..... *P. glauca*
   2. Female cones ca. 10–18 cm, leaves somewhat flexible when live, pointed forward along twigs, green, branchlets pendulous on mature trees ..... *P. abies*

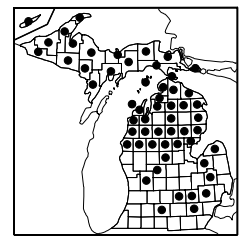
Picea abies (L.) H. Karst.—Norway Spruce

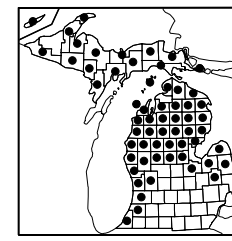
Fields and open forests, mostly near plantings.

Picea abies is the most commonly planted spruce and well known with its drooping branchlets and female cones more than twice as large as those of *P. glauca*. It occasionally escapes and has now been recorded as a wild plant from scattered stations throughout the state. First collected by D. Henson in Alger Co. in 1987 but noted as extensively naturalizing in the Lower Peninsula by Wade & Parfitt (2000).


Picea abies


Picea glauca


Picea mariana


Pinus banksiana

Picea glauca (Moench) Voss—White Spruce

Coniferous swamps, mixed forests, bogs, and stream borders, often seen in thickets and forests on dunes and gravelly shores along the Great Lakes.

Picea mariana (Mill.) Britton, Sterns & Poggenb.—Black Spruce

In the southern portion of its range in the state, almost entirely restricted to bogs; northward, found also in the same swamps, dune ridges, gravelly shores, etc., as *P. glauca*, but most often in bogs, usually with *Larix*, sometimes with *Thuja* or *Abies*. The peg-like projections tend to be widely spreading in this species, even at right angles to the twig, while in *P. glauca* they tend to be strongly ascending.

Pinus—Pine

The most prominent native conifers in Michigan are pines, and many species are cultivated. In addition to those noted below, *Pinus mugo* and *P. virginiana* are noted as escapes in Ontario. See Catling (2005) for keys to native and commonly cultivated 2-needled pines in our region. The spread of non-native species of *Pinus* beyond cultivation has been a relatively recent phenomenon, with almost all records being in the last couple decades.

1. Needles usually 5 in a cluster, ± triangular in cross-section; membranous sheath surrounding base of each cluster deciduous; female cones cylindrical, at least twice as long as wide.....*P. strobus*
1. Needles usually 2 or 3 in a cluster, ± semi-circular in cross-section; membranous sheath surrounding base of each needle cluster ± persistent; female cones short-ovoid, much less than twice as long as wide.
   2. Needles ca. (6–) 8–25 cm long, ± straight, not strongly spreading.
      3. Needles mostly 3 in a cluster, the longest 15–25 cm long.....*P. ponderosa*
      3. Needles mostly 2 in a cluster, the longest 8–15 cm long.
         4. Needles stiff and brittle, snapping when sharply bent; buds ± reddish brown; bark of upper trunk reddish.....*P. resinosa*
         4. Needles flexible, not snapping when sharply bent; buds whitish, resinous; bark of upper trunk gray to dark brown.....*P. nigra*
   2. Needles ca. 2–7.5 cm long, usually twisted or spreading apart.
      5. Twigs brown; female cones bent apically, upper bark of trees brown.....*P. banksiana*
      5. Twigs pale greenish yellow; female cones ± straight; upper bark of trunk orange.....*P. sylvestris*

Pinus banksiana Lamb.—Jack Pine

Most often a rather scrubby tree, often occurring mixed with some oak, in forests or savanna on dry sandy soil, as in the vast areas of jack pine plains in the north central Lower Peninsula. Locally it also occurs in boggy situations with leatherleaf (*Chamaedaphne*) as well as on barren rocky sites (e.g., Isle Royale).

It has been estimated that jack pine predominates on perhaps half a million hectares of forest in Michigan, over half of it in the northern Lower Peninsula, where certain restricted areas of young growth are the home of our most famous bird, the Kirtland's or "Jack Pine" Warbler, which breeds nowhere else in the world.

Pinus nigra J. F. Arnold—Black Pine; Austrian Pine

Commonly planted by residences and along roadsides, this introduced European tree has been recently documented to be spreading from plantings, especially along roadsides and dunes (Parfitt & Wade, 2000). In some areas, it has become a significant pest (Leege & Murphy 2001). First collected by A. Anderson in Muskegon Co. in 1974, though reported from Kalamazoo Co. in 1947 (see McKenna, 2004). *Pinus nigra* resembles *P. resinosa*, but is darker and denser in appearance, with the bark gray or darker in contrast to the very distinctive reddish

flaky bark of *P. resinosa*, and the stiff, needles do not break cleanly upon bending, compared to those of *P. resinosa*, which snap sharply.

Pinus ponderosa P. Lawson & C. Lawson—Ponderosa Pine

A tall, long-needled, western North American species sometimes planted in Michigan and rarely escaped into dry, sandy fields; collected by W. S. Martinus in Muskegon Co. in 2009. Our plants are var. *ponderosa*.

Pinus resinosa Aiton—Red Pine

Usually a tall straight tree of striking appearance when solitary or in groves on sand dunes, ridges through boggy ground, or rock outcrops; common on well-drained sandy plains, seldom on moist ground, sometimes with balsam fir, often with jack pine and oak.

Pinus strobus L.—White Pine

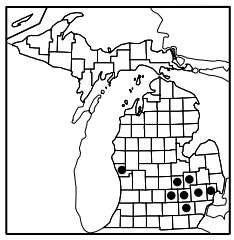
Often in mixed forests ("hemlock-white pine-northern hardwoods") but also on sandy plains and dunes with red and sometimes jack pine, bogs with tamarack, in swamps (mixed or on banks, rather than deciduous swamps or floodplains), on rock ridges, and even in cedar swamps.

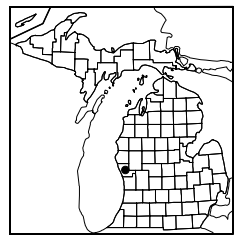
The familiar and important white pine is the official state tree of Michigan. It is a fitting designation, for this was the backbone of the lumber industry, particularly in the last quarter of the 19th century, when Michigan led the nation in lumber production. Here were the finest stands of this species in the world: trees attaining at their best 1.5–2.1 m in diameter and 45–60 m in height (although usually smaller). Branches at the top of tall trees in exposed situations are generally bent away from the direction of the prevailing winds, producing a characteristic and picturesque shape, which makes it possible to recognize white pine even at a distance or in silhouette along shores and dunes or towering above a forest canopy.

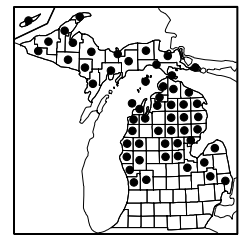
The needles of white pine are lighter in color, softer in texture, finer and less stiff than those of our other species.

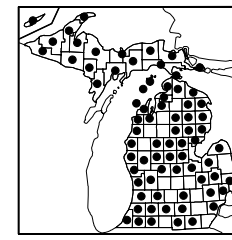
Pinus sylvestris L.—Scots Pine; Scotch Pine

Extensively, though unwisely, used for plantations in the past, the Eurasian *Pinus sylvestris* is increasingly spreading into successional habitats, especially on sandy soils. *Pinus banksiana* and *P. sylvestris* are similar and young plants without female cones or mature bark can be difficult to distinguish. The needles of jack pine are ± abruptly obtuse to acute but blunt at the apex. In *P. sylvestris* the needles average a bit longer than in *P. banksiana* and they often tend to taper to sharp tips as well as being more silvery in aspect. In more mature trees, the curved female cones of *P. banksiana* tend to point forward toward the ends of their branches and are


Pinus nigra


Pinus ponderosa


Pinus resinosa


Pinus strobus

long-persistent, while the more readily deciduous female cones of *P. sylvestris* are horizontal or reflexed, pointing toward the base of their branches. The bark of *P. sylvestris* is a distinctive orange-brown, noticeable especially on the upper part of the trunk. First collected by C. D. Richards in Houghton Co. in 1949.

Pseudotsuga

Pseudotsuga menziesii (Mirb.) Franco—Douglas-fir

Very locally spreading into fields and open forests. A native of western North America, but the var. *glauca* (Mayr) Franco of the Rocky Mountains is commonly planted in Michigan both for ornament and in plantations. First collected as an apparent escape in 1961 in Genesee Co.

Tsuga

Tsuga canadensis (L.) Carrière—Hemlock

Typically with beech, sugar maple, yellow birch, and often white pine, but also in coniferous swamps and on forested dunes; often on knolls, in small groves, or in ravines.

The short needles, mostly 6–13 (–16) mm long, in flat sprays, and the small female cones, mostly 13–22 mm long, are characteristic of this species. The needles of hemlock are minutely toothed toward the rounded apex and are on distinct, raised pegs ca. 0.5 mm long. The hemlock woolly adelgid (*Adelges tsugae*) has recently been discovered in Michigan and poses a serious threat. Lenawee Co. records are spread from cultivated trees.

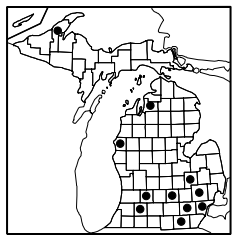
TAXACEAE—YEW FAMILY

Taxus

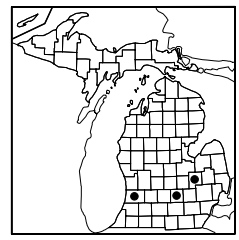
1. Plants spreading-ascending shrubs with decumbent bases; larger leaves 1.3–2 (–2.4) mm wide, mostly 0.8–2.2 cm long.....*T. canadensis*
1. Plants erect large shrubs or small trees, often with a single stem; larger leaves 2.2–3 mm wide, mostly 2–4 cm long.....*T. cuspidata*

Taxus canadensis Marshall—Ground-hemlock; Yew

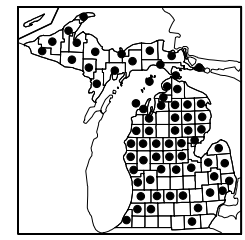
Rich often swampy forests: deciduous, mixed, or coniferous (hemlock, white pine, fir, and especially cedar), often thriving on banks and in ravines; favored by the moist winds from Lake Michigan and often luxuriant on forested dunes and in coniferous forests near the shore. It is heavily browsed by deer and moose in Michigan, and has become scarce in many parts of the state due to severe deer browsing.



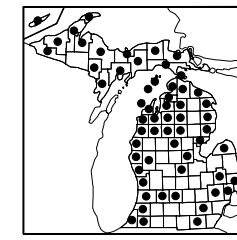
Pinus sylvestris



Pseudotsuga menziesii



Tsuga canadensis

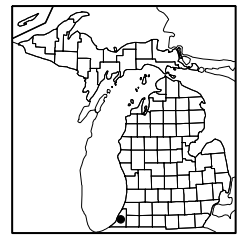


Taxus canadensis

Taxus cuspidata Siebold & Zucc.—Japanese Yew

A species of temperate eastern Asia, commonly cultivated and rarely escaped to conifer plantations and natural areas, usually in and near cities and towns. This can be a large tree in its native range, quite unlike our small, native understory species, but many cultivated forms are smaller selections. First collected by W. S. Martinus in Berrien Co. in 2003.

The European yew, *T. baccata* L., and the hybrid between it and *T. cuspidata* (*T.* ×*media* Rehder) are also commonly cultivated. Mature specimens of these can be distinguished from *T. canadensis* by their generally more upright habit, often wider leaves (> 2 mm), and from both *T. canadensis* and *T. cuspidata* by their obtuse and non-keeled bud scales (especially in *T. baccata*). Documentation of non-native *Taxus* is sparse, and juvenile specimens are not reliably identifiable.



Taxus cuspidata