Northern Dry-mesic Forest (Global Rank G4; State Rank S3)

Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Mature stands of Northern Dry-mesic Forest comprised the “pineries” for which parts of the Upper Midwest, including large areas in northern and central Wisconsin, were famed as Wisconsin was settled by Euro-American immigrants during the mid- and late 1800s. The dominant eastern white and red pines grew to very large sizes, and stands of pine were intensively sought as valuable commodities by lumber interests. Unlike hardwood timber, the eastern white and red pine logs could be floated across lakes and down rivers to sawmills—a key factor for those exploiting the pine forests. This is why stands growing close to the major rivers were among the first targeted for cutting. Promoted as a “limitless resource” to the early loggers and settlers, northern Wisconsin’s pineries lasted little more than a single human generation and were virtually gone by the end of the 19th century.

Forests dominated by large eastern white and red pines were formerly widely distributed across northern Wisconsin but were most abundant in areas with sandy soils, especially on terrain broken up by lakes, rivers, streams, wetlands, or other natural barriers that did not allow wildfires to advance unimpeded over vast areas at frequent intervals. Periodic wildfire was the dominant disturbance factor prior to Euro-American settlement. Severe, stand-replacing wildfires occurred infrequently at intervals of many decades to several centuries. More frequent fires of low intensity helped maintain stand structure and pine dominance by reducing the abundance of competing hardwoods in the understory.

The most extensive pineries occurred north of the Tension Zone, especially in north central Wisconsin within the Northern Highland Ecological Landscape. This is also the part of Wisconsin in which eastern white pine has made its greatest post-Cutover recovery. Marketable stands of eastern white and red pines also grew in the northeastern, northwestern, west central, and central regions of the state.

Landforms supporting Northern Dry-mesic Forest include pitted (collapsed) sandy outwash, uncollapsed outwash, sandy glacial lakebeds, coarse-textured end moraines, sandy river terraces, and bedrock outcrops. Soils are most often acid sands, loamy sands, or sandy loams of medium or low nutrient status. Stands sometimes occur on thin soils over sandstone or igneous bedrock.

The severe fires that occurred in the slash left behind by loggers in the late 19th and early 20th centuries often eliminated pockets of younger, uncut pine, leaving no seed source to repopulate the cut-over areas. In the Northern Highland region of north central Wisconsin, the rougher topography, pockets of loamier soils, extensive wetlands, and numerous lakes and streams created barriers to fire and allowed the development of more extensive areas of older pine forest compared to the drier and more level regions in the northwestern and northeastern parts of the state. Central Wisconsin’s vast peatlands afforded some protection to stands of older pine (Eswein 1995).

Stand of eastern white and red pine associated with sandstone bluffs in southwestern Wisconsin’s Driftless Area are often small and isolated or, when the type is associated with the bedrock exposures of an escarpment, linear. See the “Pine Relict” community description for additional information on these isolated Driftless Area stands in the Western Coulees and Ridges and Southwest Savanna ecological landscapes. Local but significant pineries also occurred in the Baraboo Hills (Lange 2014) and at several Driftless Area locations, for example, in south central Monroe and northeastern Vernon counties (Finley 1976).

Eastern white pine and, less commonly, red pine, were capable of reaching enormous stature in the mesic hemlock-hardwood forests that covered much of northern Wisconsin, but there the trees typically occurred at very low densities of only a few individuals per acre. Even so, stands containing only two or three of these giants per acre were profitable to log (Curtis 1959).

Areas with level or subdued topography, few lakes and wetlands to act as natural firebreaks, and low nutrient, drought-
Kingston Pines is one of the larger blocks of mature, dry-mesic, eastern white (and red) pine-dominated forest in central Wisconsin. This site supports a representative native flora for the community type and a diverse array of animals more commonly associated with conifer forests much farther north. Several rare species inhabit Kingston Pines. Meadow Valley Wildlife Area (federally owned, Wisconsin DNR managed), Juneau County, Central Sand Plains Ecological Landscape. Photo by Thomas Meyer, Wisconsin DNR.

prone sandy soils were more likely to support dry forests, with jack pine and red pine dominant. White birch was sometimes common on such sites as competition was reduced by site conditions and more frequent fires. In regions with many lakes and extensive wetlands, dry-mesic forests of eastern white pine, red pine, white birch, and sometimes northern red oak were likely to occur on the north and east sides of lakes. Sites with loamier soils and protection from wildfires supported more mesic forests of eastern hemlock, yellow birch, sugar maple, and red maple.

The heavy cutting of pine across northern Wisconsin in the late 1800s was often followed by severe slash fires. In many areas, these fires destroyed the pine seed source. In some regions, for example where lakes and streams were common, wetlands extensive, and the topography complex (e.g., on rough pitted outwash landforms), remnant stands of eastern white and red pines sometimes persisted. Islands within lakes, peninsulas bordered by wetlands or water, and steep slopes with relatively cool and moist northeastern exposures are examples of sites that offered some protection from the slash fires (R. Eckstein, Wisconsin DNR, personal communication).

**Community Description: Composition and Structure**

The dominant trees in mature stands of Northern Dry-mesic Forest are eastern white pine (*Pinus strobus*) and red pine (*P. resinosa*). The important canopy associates vary but may include northern red oak (*Quercus rubra*), red maple (*Acer rubrum*), big-tooth aspen (*Populus grandidentata*), quaking aspen (*P. tremuloides*), and white birch (*Betula papyrifera*). Black cherry (*Prunus serotina*), white oak (*Quercus alba*), northern pin oak (*Q. ellipsoidalis*), balsam fir (*Abies balsamea*), and jack pine (*Pinus banksiana*) occur in some stands but are uncommon or rare. Sapling eastern white pine may thrive beneath a canopy of red pine or below deciduous species such as white birch, quaking aspen, or oaks, although red maple is now a common sapling and small tree in many stands.

The shrub/sapling stratum may be composed of eastern white pine, red maple, balsam fir, beaked hazelnut (*Corylus cornuta*), mountain maple (*Acer spicatum*), northern bush-honeysuckle (*Diervilla lonicera*), and maple-leaved viburnum (*Viburnum acerifolium*). The density of tall shrubs and saplings can be very high in stands that have been protected from wildfire for several decades or longer.

Characteristic herbs and low shrubs include species such as Canada mayflower (*Maianthemum canadense*), wild sarsaparilla (*Aralia nudicaulis*), large-leaved aster (*Eurybia macrophylla*), American starflower (*Trientalis borealis*), bracken fern (*Pteridium aquilinum*), early low blueberry (*Vaccinium angustifolium*), velvet-leaf blueberry (*V. myrtilloides*), partridgeberry (*Mitchella repens*), pipsissewa (*Chimaphila umbellata*), wintergreen (*Gaultheria procumbens*), large-leaved shin-leaf (*Pyrola elliptica*), sessile-leaved bellwort (*Uvularia sessilifolia*), hairy Solomon’s-seal (*Polygonatum pubescens*), dwarf ginseng (*Panax trifolius*), and gay-wings (*Polygala paucifolia*). Toward the southern edge of this community’s Wisconsin range, the understory sometimes includes species associated with the dry and dry-mesic oak forests of southern Wisconsin.

Rare plants associated with Northern Dry-mesic Forest are Hooker’s orchid (*Platanthera hookeri*), large round-leaved orchid (*P. orbiculata*), western fescue (*Festuca occidentalis*), and giant pinedrops (*Pterospora andromedea*).

Mammals inhabiting dry-mesic pine forests include American marten (*Martes americana*), northern flying squirrel (*Glaucomys sabrinus*), red squirrel (*Tamiasciurus hudsonicus*), North American porcupine (*Erethizon dorsatum*), eastern red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*). Among birds using mature eastern white pine-red pine forests are raptors such as Bald Eagle (*Haliaeetus leucocephalus*), Northern Goshawk (*Accipiter gentilis*), and Red-shouldered Hawk (*Buteo lineatus*). Some of the representative birds breeding...
in this forest community include Blackburnian (Setophaga fusca), Black-throated Green (S. virens) and Pine (S. pinus) Warblers, Red-breasted Nuthatch (Sitta canadensis), Hermit Thrush (Catharus guttatus), Red Crossbill (Loxia curvirostra), Blue-headed Vireo (Vireo solitaries), Evening Grosbeak (Coccothraustes vespertinus), and Pine Siskin (Spinus pinus).

Along the margins of the Tension Zone, especially in central and northwestern Wisconsin, several of the “southern” oaks, especially white oak and black oak (Quercus velutina), may occur as associates in conifer-dominated or co-dominated dry-mesic or dry forests. Northern pin oak was sometimes present and could be quite common in second-growth stands. To a lesser extent, this also applies to northeastern Wisconsin, for example, in parts of Marinette and northern Oconto counties (Northeast Sands Ecological Landscape).

**Conservation and Management Considerations**

Catastrophic (stand-replacing) fires occurred infrequently in Northern Dry-mesic Forest at intervals of approximately 100–300 years. Light ground fires were more common, and these kept forest understories relatively open and free of competing deciduous shrubs and saplings. In the Northern Dry-mesic Forest community, the absence of periodic fire will make it difficult to maintain the pines over time, especially the more light-demanding red pine. The increase in deciduous undergrowth and species that cast deep shade, such as balsam fir and red maple, will alter stand structure and create potentially unfavorable conditions for future generations of pine, northern red oak, or white birch. Forest fragmentation, especially in northern Wisconsin’s lake districts, has increased because of population growth, home construction, and development of associated infrastructure. As Northern Dry-mesic Forests are ultimately fire-dependent natural communities, these changes in land use and the resulting vegetation patterns will make it more difficult, and in some places impossible, to use prescribed fire as a management tool.

Some second-growth Northern Dry-mesic Forests are now dominated by northern red oak. In at least some of these stands, the oaks have grown up from post-Cutover, post-slash fire stump sprouts. Reoccupancy by red or eastern white pine is unlikely in those occurrences lacking a nearby pine seed source without resorting to underplanting. Invasive plants are moving northward, and species detected recently in Northern Dry-mesic Forest include common buckthorn (Rhamnus cathartica), glossy buckthorn (R. frangula), Tartarian honeysuckle (Lonicera tatarica), garlic mustard (Alliaria petiolata), and common speedwell (Veronica officinalis).

Examples of old-growth eastern white- and red pine-dominated Northern Dry-mesic Forest are virtually nonexistent today, and the former pineries are now composed mostly of the early successional deciduous species that proliferated after the Cutover, especially quaking aspen and white birch. Much of the aspen that originated during or shortly

![Older red pines in the canopy of this dry-mesic forest now exceed 150 years in age. Small white pines are now growing vigorously beneath the red pine. Oneida County, Northern Highland Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.](image1)

![This aerial shot depicts a mature northern dry-mesic forest occupying an isthmus bordered by several undeveloped lakes. The canopy dominants are large eastern white pine and red oak. Note the golden needles of the tamaracks in the swamp surrounding the small seepage pond between the large lakes. Northern Highland-American Legion State Forest, Vilas County. Photo by Eric Epstein, Wisconsin DNR.](image2)
after the Cutover on the public and industrial forest lands in northern Wisconsin has been a priority for perpetuation for many decades. While there have been some economic and recreational benefits to maintaining such an abundance of aspen, at least in the short term and from some perspectives, this has been both one of the direct and indirect causes of some of the major problems facing forest management in northern Wisconsin recently, which include fragmentation, skewed size and age class representations, loss of conifers, loss of important structural components, and high populations of white-tailed deer (*Odocoileus virginiana*). This issue has also become a huge and highly politicized obstacle to the serious consideration of other management options, let alone their implementation. However, there are excellent opportunities to plan for and allow the development of pine-dominated dry-mesic forests in northern and central Wisconsin, especially in and around the Northern Highland Ecological Landscape and at scattered locations elsewhere.

Pinery restoration is a legitimate and apparently attainable ecological management opportunity in areas formerly dominated by eastern white and red pines where pine dominance in the canopy has been greatly reduced from its historical abundance. The identification of stands and landscapes in which pines were historically dominant and are currently important as saplings and small trees is an important early step in considering the appropriate and effective restoration of this greatly diminished natural resource. This can be accomplished through the combination of landscape-scale vegetation inventories, the public lands planning process, forest certification, and application of management techniques appropriate to a given site. Additional experimentation with prescribed fire as a forest management tool is needed in areas where that is feasible and can be accomplished safely.

Some of the oldest existing stands of Northern Dry-mesic Forest were apparently of fire origin. The trees in these stands

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*The canopy of this old-growth stand of northern dry-mesic forest on rolling glacial outwash is composed of large eastern white pine, red pine, northern red oak, and red maple. Older examples of this forest community are now rare. Northern Highland-American Legion State Forest, Vilas County, Northern Highland Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.*

*Older stands of red and white pines border this undeveloped soft-water seepage lake in eastern Iron County. Northern Highland-American Legion State Forest, Northern Highland Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.*

*A white pine-dominated dry-mesic forest grows on and above these basalt cliffs along the Lower St. Croix River. Polk County, Forest Transition Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.*
would have been too small to exploit profitably while the Cutover was in progress during the last half of the 19th century or early 20th century. As none of these older forests have been maintained by fire, the need remains to identify sites supporting dry-mesic pine forests where fire management can be safely implemented. This would reestablish the historical disturbance regime responsible for both the origin and maintenance of this iconic northern Wisconsin forest community and would provide areas enabling comparison with stands managed by today’s silvicultural methods.

**Additional Information**

For information on similar or related natural communities, see the descriptions for Northern Dry Forest, Northern Mesic Forest, Central Sands Pine-Oak Forest, Pine Relict, Boreal Forest, and Pine Barrens. This community corresponds most closely to the U.S. National Vegetation Classification type CEGL002480 Eastern White Pine - (Red Pine) - Northern Red Oak Forest (Faber-Langendoen 2001).

**Also see:**

- Anderson and Palik (2011)
- Heinselman (1973)
- McRae et al. (1994)
- Murphy and Nowacki (1997)
- Quinby (1991)
- Stearns and Likens (2002)
- White and Lloyd (1998)


For a list of terms used, please visit the [Glossary](#).

For a reference list, please see the [Literature Cited](#).