Managing Forest for Kirtland's Warbler Habitat in Ontario

Photo by P.Burke

The Kirtland’s Warbler (*Setophaga kirtlandii*) is a federally and provincially (Ontario) listed Endangered Species. Kirtland’s Warblers breed in young pine-oak forest, a habitat that is naturally created by stand replacing wildfire. The decline of this species to near-extinction is the result of forest cover loss, fire suppression, and forest management that does not emulate natural stand conditions.

The Kirtland’s Warbler has benefited from extensive habitat management efforts on Michigan’s managed forests where its population recovery led to its 2019 de-listing from the U.S Endangered Species Act. With its recovery, the population has expanded from northern Lower Michigan into Michigan’s Upper Peninsula as well as Wisconsin and Ontario. Ontario breeding records do pre-date this expansion but are sparse.

The goal of this booklet is to provide land managers with detailed guidance for creating and managing Kirtland's Warbler habitat. Using modifications to current management practices such as increasing tree density and including non-treed openings or purposeful habitat restoration, we can also steward Canada's Kirtland's Warbler population.

Ontario's Target Range

Lacking historic records, the Ontario breeding range is incompletely known with contemporary nesting in Simcoe County, Renfrew County and the District of Parry Sound. Based on breeding records, habitat associations, and the US geographic range it is expected that it could occupy an area extending north of Toronto to north of Sault Ste. Marie and across an area south of Temagami. This area is speculative and may change with greater information and modeling. Breeding evidence has been observed in Quebec, near the Ontario border and within similar latitudes, particularly near Petawawa, Ontario.

Map showing potential Kirtland's Warbler habitat area in Ontario. The boundary shown on this map are based on recent breeding records, associated plant and soil requirements and its US range. Revisions of the target habitat area are likely with greater habitat management efforts and research.

Minimum Stand Area

Patch sizes larger than 30 ha are most desirable, although research has shown that smaller patches (min. 12 ha) can be occupied.

Residency

Suitable habitat will be occupied when trees are between 1.5 and 6 m tall. Often this translates to a site being occupied from when the trees are 6 years old to 25 years old with peak Kirtland's Warbler densities between 8 and 15 years.

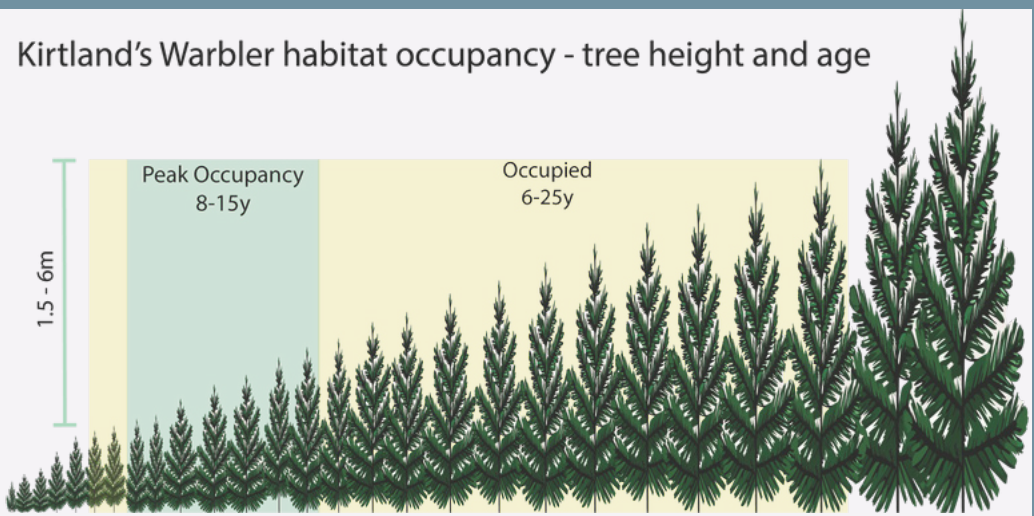


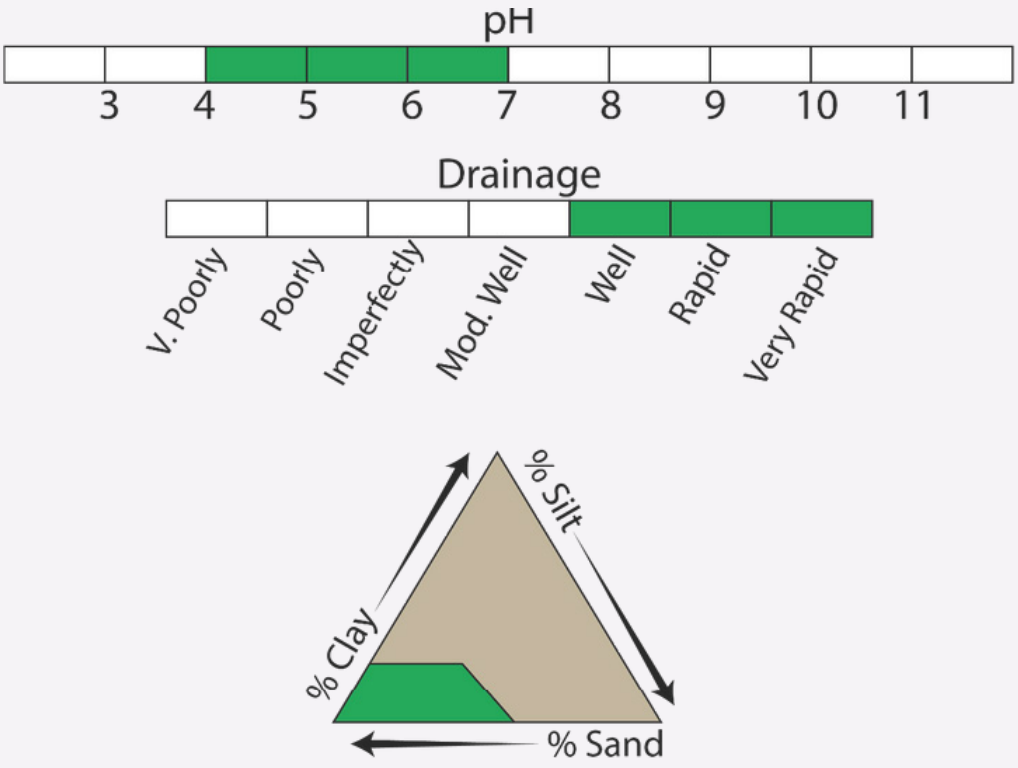
Diagram of Kirtland's Warbler habitat occupancy based on tree heights and tree ages. Factors such as climate and soil fertility can influence the amount of time that the habitat remains suitable.

Soils and Topography

Soil: Sand to Sandy Loam
Topography: Flat to Gently rolling
pH: Strongly Acidic to Neutral
Drainage: Well to Very Rapidly (Excessively)

Soils are a critical component of Kirtland's Warbler habitat as they are a ground-nesting bird, so they require dry, very well drained soils. Their habitat is dependent on these soils to support dry-adapted vegetation and facilitate wildfire renewal. More acidic soils are also preferred to support typical habitat vegetation like blueberries.

Soils and Topography



Soil conditions required for Kirtland's Warbler habitat creation. Preferred ranges are shown in green.

Forest Cover

Kirtland's Warbler habitat is high-density Jack Pine (*Pinus banksiana*) and/or Red Pine (*Pinus resinosa*) with a smaller proportion of other conifers and deciduous trees, particularly oaks such as Black (*Quercus velutina*) or Red Oak (*Q. rubra*). Whenever it is ecologically and management-appropriate, the highest composition of Jack Pine possible should be planted.

For tree density, a higher stems per hectare (SPH) such as >5000 SPH is preferred, but as low as 2500 SPH and lower may be occupied. Densities around 3600 SPH are commonly used in Michigan's managed sites.

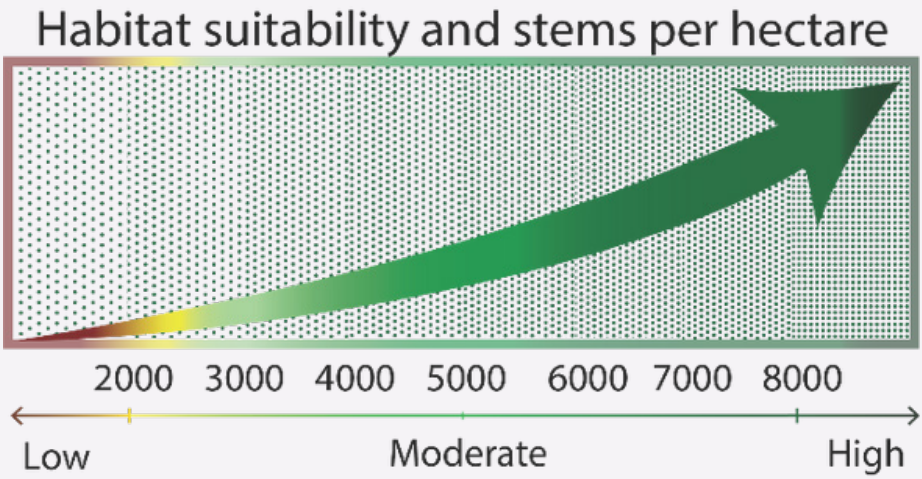
The following are some guidelines for achieving suitable forest cover:

- 3588 Stems per hectare
  - Achieved by planting using 5ft x 6ft spacing (1.5m x 1.8m)
- Dominantly Jack Pine, Red Pine, or a mix of these species
  - Minimum of 70% of total species composition
- Maximum of 30% other species, although between 10 and 20% is preferred
  - Most should be from Red Oak complex

Forest Cover

Note: Deer browsing on deciduous trees is not a problem for habitat as bushy oaks (often referred to as scrubby) are common within Kirtland's Warbler habitat.

White Pine (*Pinus strobus)*, Black and Fire Cherries (*Prunus serotina ad P. pensylvanica*), Poplars (*Populus sp.*), Serviceberries (*Amelanchier sp.*) and White Birch (*Betula papyrifera*) can occur in small amounts as would be natural after a forest fire.



Graphic representation of the positive relationship between Kirtland's Warbler habitat suitability and tree density (stems per hectare). Higher tree density typically results in greater occupancy rates and Kirtland's Warbler nesting densities.

Forest Openings

Among the dense forest, non-treed interior openings are a critical component of Kirtland's Warbler habitat. Nests are often placed near the edges of the openings. The conventional approach is to have 25% of the area in openings that are 0.1ha in size. This can uniformly be achieved by:

- 0.1 ha opening within every 0.4 ha of forest
  - i.e., 0.25 ac opening per 1 ac forest
  - 18 m radius circle (36 m diameter) = 0.1 ha

Some research suggests that smaller and more regularly occurring openings may create more desirable habitat. Naturally, there would likely be a mixture of opening sizes. The current use of 0.1 ha openings is based on a mechanical planting pattern referred to as the "opposing wave" traditionally used in Michigan management. When a site is being hand planted, smaller openings are easier to implement.

We recommend that managers default to 25% of the area having 0.1ha openings. If a manager desires smaller openings, 25% coverage should be maintained and openings should be at least 5m in width at their narrowest point.

Forest Openings

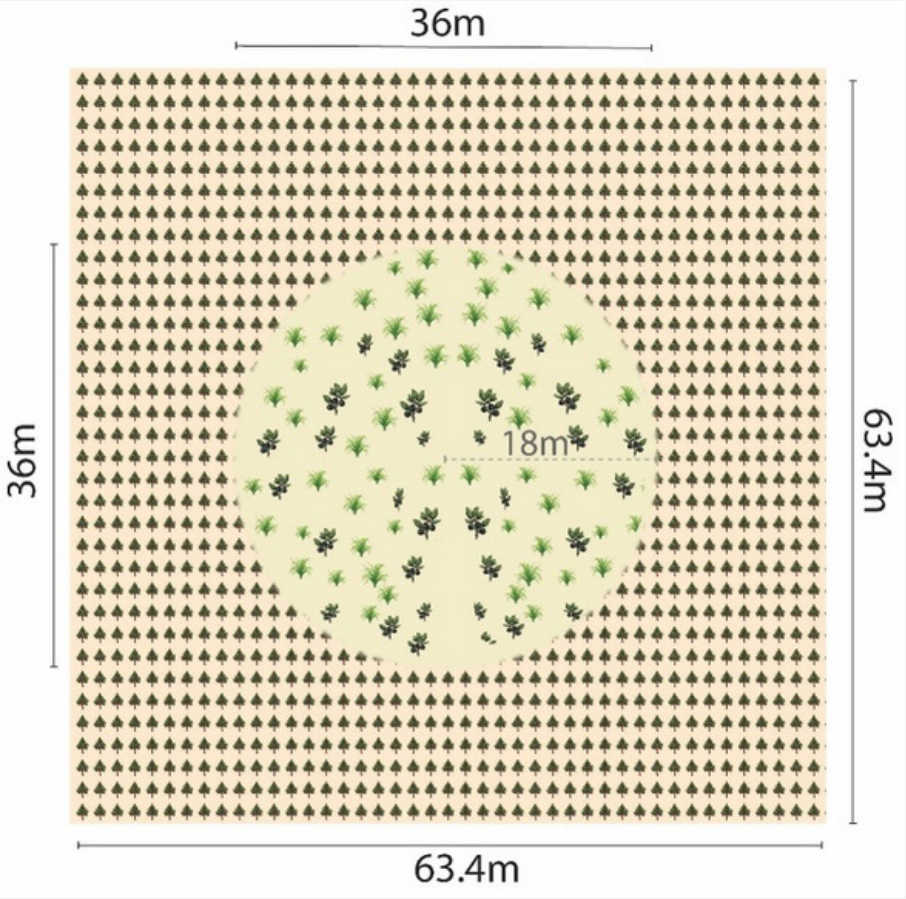


Diagram showing an 18m radius non-planted opening (0.1ha) within a 0.4ha forested block with trees planted at a 1.5m x 1.8m spacing.

Note: When ordering trees you will need to account for these openings. As they take up ¼ of the area, then you need to order ¾ of the trees per hectare. For example, if 3588 SPH is planned, then you would order 2691 trees for every hectare being planted. For details on machine planting using the opposing wave pattern, contact the authors.

Ground Cover

The vegetation community in Kirtland's Warbler habitat is often called a dry pine or a pine barren community. The non-tree layer cover, particularly in openings, should be high in shrubs (~25-50%), predominantly low (<30 cm tall) grasses, and sedges with few forbs (10-30%) and bare soil and woody debris (20-40%). Reindeer lichens (*Cladonia spp.*), Haircap mosses (*Polytrichum spp.*), and Feathermosses (*Pleurozium spp.*) are also found as major ground covers but are not easily managed. A species list of typical ground cover is shown in Appendix A.

Creating Habitats

After a Clearcut

If the site was a dry pine-oak forest that was clearcut, or had a similar stand replacing disturbance, the ground cover will likely be suitable.

Ideally after harvest, performing a prescribed burn would best facilitate regeneration from highly desirable pyrophytic species such as:

- Low Sweet Blueberry (*Vaccinium angustifolium*),
- Sweet Fern (*Comptonia peregrina*)
- Bearberry (*Arctostaphylos uva-ursi*)
- Sand Cherry (*Prunus pumila*)
- New Jersey Tea (*Ceanothus americanus*)

Creating Habitats

Conventional Management

Where a prescribed burn is not possible, conventional site preparation and planting is acceptable, but not optimal. Some areas may become dominated by sedge, raspberry, and Bracken Fern reducing overall habitat suitability.

Using Afforestation

If the land is not pine-oak forest or similar, but is anthropogenic such as cropland, then a restoration approach will be needed. Non-native or non-ecologically appropriate vegetation will need to be managed and replaced with appropriate ground cover through seeding, planting and other approaches. This will have ecological benefits that extend beyond replacing warbler habitat. A baseline recommended species list is shown in Appendix A and additional species may regionally vary.

Appendix A

Shrubs	
Serviceberries	*Amelanchier sp. (Multiple species)*
Bearberry	*Arctostaphylos uva-ursi*
New Jersey Tea	*Ceanothus americanus*
Sweet Fern	*Comptonia peregrina*
Teaberry	*Gaultheria procumbens*
Sand Cherry	*Prunus pumilasusquehanae*
Smooth rose	*Rosa blanda*
Prairie willow	*Salix humilis*
Snowberry	*Symphoricarpos albus*
Low sweet blueberry	*Vaccinium angustifolium*
Graminoids	
Wavy hair grass	*Avenella flexuosa*
Sedges	*Carex sp. (ex. C. pensylvanica)*
Poverty Oat grass	*Danthonia spicata*
Panic grasses	*Dichanthelium sp. (Many species)*
Slender Wheatgrass	*Elymus trachycaulus*
White-grained Mountain Ricegrass	*Oryzopsis asperifolia*
False melic grass	*Schizachne purpurascens*
Little Bluestem	*Schizachyrium scoparium*
Forbs	
Spreading Dogbane	*Apocynum androsaemifolium*
Long-branch frostweed	*Crocanthemum canadense*
Wild Strawberry	*Fragaria virginiana*
Canada mayflower	*Maianthemum canadense*
Narrowleaf Cow wheat	*Melampyrum lineare*
Goldenrods	*Solidago sp. (ex., hispida, nemoralis, ptarmicoides)*
Asters	*Symphyotrichum sp. (Multiple species)*
Ferns	
Bracken Fern	*Pteridium aquilinum*

Photo by L. Foerster

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