Kirtland's Warbler: An Assessment of the Availability of Potential Habitat in Minnesota

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Introduction

The Kirtland's Warbler is a federally endangered species that is known to breed in only a few counties in northern lower Michigan. Preferred breeding habitat is dense jack pine stands of wildfire origin in which trees are 1.7 to 5.0 m tall (Probst 1986). Dispersal of young birds is adaptive in species occupying such ephemeral habitat. The fate of dispersing birds is of interest; their failure to acquire mates might account for the failure of the population on the traditional nesting area in Michigan to grow despite high fledging success in recent years (Probst 1985).

Occasional singing males observed outside the traditional breeding area may represent dispersing individuals. The Kirtland's Warbler recovery plan (Byelich et. al 1985) recommends a search of adjacent states and Canada to locate, quantify, and band these "wanderers" in an attempt to determine their importance to the population biology of the species. Recent survey work in Wisconsin in 1988 yielded sightings of eight singing males in 3 counties, including Washburn and Douglas counties in the western part of the state (Anon. 1988). The proximity of these sightings to Minnesota prompted interest in conducting a similar survey in the east-central region. This report summarizes efforts to identify suitable habitat in Minnesota for field checking in 1989.

Summary of historical sightings in Minnesota

The bird collection at the Bell Museum of Natural History, University of Minnesota, contains one Minnesota specimen of a Kirtland's warbler, collected in May, 1892, in Hennepin Co. (Janssen 1987). The files of the Minnesota Ornithologists' Union (MOU) contain references to 8 sightings between 1944 and 1983 from various parts of the state (Minneapolis, St. Cloud, Dakota county, Cloquet, Duluth, and the Gunflint Trail). Only one of these sightings, from May, 1944, in St. Cloud (Stearns Co.) has been accepted by the MOU records committee (Heimenz 1980). This committee solicits detailed descriptions from individuals reporting rare species in Minnesota, evaluates the descriptions, and accepts only those that are adequately documented. Since there is little or no suitable breeding habitat in either Hennepin or Stearns counties, it is likely that both of the 2 accepted records represented vagrants. It is, of course, possible that some of the observations that were rejected because they did not provide enough detail to definitely discriminate Kirtland's from other species (such as Canada and Magnolia warblers with which they share some plumage characteristics), were indeed Kirtland's Warblers.

Criteria for identifying suitable habitat

The first step in the process of identifying suitable habitat in Minnesota was defining critical habitat variables. An analysis of habitat variables from 21 stands occupied by the

species in Michigan (Probst 1988) revealed the following range of characteristics:

1) Tree height: 1.7 to 5.0 m; trees of this height are usually 5 to 23 years old.
2) Tree density: initially 15-20% cover (more than 2000 stems/ha) up to 60% cover at peak occupancy; the latter translates to about 5000 stems/ha in fire regenerated stands and 3000 stems/ha in seeded areas.
3) Stand size: density in suitable habitat on the breeding grounds is 1 male/20 ha (50 acres). Stands less than 80 acres in size are rarely used by breeding birds (Byelich et al. 1985). This stand size limitation may not apply to extralimital wanderers, especially in landscape regions that contain many pines (Probst, pers. comm.).
4) Lower height of live foliage on the jack pine: less than 1 m off the ground.
5) Ground cover: low, light cover of shrubs and/or grass-sedge interspersed with moss, lichen and bare ground.
6) Soil: Grayling sands underlie the habitat in Michigan; these are deep, noncalcareous sands that are derived from former lake beds or sandy glacial outwash.
7) Fire history: In 1984, 73% of males censused in Michigan were in habitat regenerated from wildfire or prescribed burning.

The characteristics listed above define what might be considered "prime" habitat for the species. Birds actually occur

in stands that exhibit a more diverse array of size and density characteristics; for example, older, sparser stands that are adjacent to young, dense stands may be used. Densely stocked plantations with no recent fire history may be used. Norway pine may also be used. It seems reasonable to assume that dispersing birds, most or all of which are assumed to be unmated, may be particularly likely to be found in sub-optimal habitat.

Based on this information and discussions with John Probst, the variables deemed to be most important in identifying habitat with the highest likelihood of attracting Kirtland's Warblers were: tree species (jack pine), size (age) of trees (5-25 y.o.), tree density (minimum 2500 trees/ha, or 1000 trees/acre), stand size (greater than 50 acres), and soil type (deep, noncalcareous sand).

Sources of forest inventory information

1. Phase 2 forest inventory

Phase 2 forest inventory is a intensive inventory conducted by the MnDNR Division of Forestry on state-owned and county-owned forest land in Minnesota (excluding Itasca and St. Louis counties). The inventory involved vegetative cover-type mapping based on air photo interpretation, followed by ground reconnaissance to determine size and density of stands (Grand Rapids Forest inventory staff; work conducted in the late 70s and early 80s). Data were input into a computerized database, which is updated when stands are cut or destroyed by fire.

As a result of the considerations discussed above, an initial search of this database was done to identify jack pine stands (i.e. stands for which more than 40% of the volume was jack pine) state-wide that were 5-25 years old and greater than 50 acres in size. For each stand the following variables were requested: county, township, range, section, stand identifier number, acres, tree/acre, dbh, age, distance to nearest road, stand origin (natural or planted) and ownership (county or state). This print-out was used to select the 1989 study areas (see below).

The stand size variable is somewhat misleading because stands that are contiguous on the ground are subdivided in the database based factors such as ownership. Therefore, several adjacent stands that appear to be too small for consideration, when considered together would add up to more than 50 acres of contiguous habitat. These situations can be clarified only by consulting cover-type maps.

To make sure that all "prime" habitat, regardless of size, was identified in the target areas, a second print-out comprising the same variables was done to list all jack pine 5-25 years old in 6 counties (Pine, Carlton, Hubbard, Wadena, Cass, Becker). To include older, but still potentially suitable habitat, a print-out was done for all jack pine stands greater than 25 years old and 50 acres in size in the 6 target counties. Finally, a listing of red pine stands 5-25 years old and greater than 50 acres in size was obtained for the same counties.

The locations of the stands are listed in the database only to the nearest section. Precise locations can be determined only from cover-type maps that have been generated as part of Phase 2 inventory from air photo interpretation. Originally these maps were hand-drawn; digitizing is in progress to allow the production of computer generated maps. Copies of these cover types maps will be used by field personnel to locate stands, as well as to determine access points.

2. Other public lands

Because Itasca and St. Louis county lands were excluded from Phase 2 inventory, the land commissioners in those 2 counties were contacted for information on jack pine stands greater than 25 years old and 50 acres in size. Superior and Chippewa National Forest inventory staff were also asked to provide the same information.

3. Privately-owned lands

There is not an equivalent database of forest inventory information that is comprehensive of all privately-owned land in the state. After screening the information for public lands to identify regions of the state where survey might be the most profitable (see discussion below), letters were sent to 9 DNR area forest supervisors in 6 target counties, asking for their help in identifying dense jack pine stands on privately-owned lands that were 5-25 years old, and greater than 50 ac in size.

Computerized data based on air photo interpretation alone are available from DNR forest inventory for non-industrial privately owned lands in Carlton county. A print-out of these data was also obtained.

Potlatch Corporation was identified by forestry field staff as a major owner of potentially suitable land. Potlatch maintains their own database of forest inventory information for their lands. A print-out was obtained of jack pine stands 5-25 years old on Potlatch lands. Variables requested were stand location, size, age and tree density.

Selection of 1989 study areas

The initial Phase 2 printout listed 73 stands in 14 counties that were in the 5-25 year age range and larger than 50 acres in size (Table 1). These stands were clustered in five areas of the state (Fig. 1). They are as follows:

1) Pine county: 3 stands
2) So. Hubbard, Cass, Wadena and Becker counties: 12 stands
3) No. Hubbard, Beltrami, and Clearwater counties: 8 stands
4) Lake of the Woods and Roseau counties: 12 stands
5) No. St. Louis, Lake and Koochiching counties: 34 stands

Isolated stands were also located in Cook (2), southern St. Louis (1), and Aitkin (1) counties.

Funding constraints made it impossible to survey all these areas. It made sense logistically to choose the 2 areas that appeared to be the most promising and concentrate survey efforts

there. Several factors, including soils, proximity to Wisconsin, fire history, extent of potential habitat, and amount of pine in the general landscape resulted in the selection of the first 2 areas listed above for survey.

Soils appear to be a very good predictor of suitable habitat in Michigan (Probst, pers. comm.). The first 2 areas listed above appear to provide the most similar soils to the Grayling sands, being deep, noncalcareous sands of the Menahga series. Sandy soils that support jack pines in Beltrami and Clearwater counties tend to be more calcareous and support a denser understory (J. Almendinger, pers. comm.). Although there are scattered small patches of deep sandy soil in No. St. Louis and Koochiching counties, much of the jack pine there grows on shallow sand over bedrock. Lake of the Woods county appears to have some suitable soils, but was just too far away from the Wisconsin sightings to be considered among the likeliest possibilities.

Proximity to Wisconsin and suitable soils, as well as presence of some fire-regenerated stands made Pine county an obvious choice. Carlton county was also included in this group, even though no stands larger than 50 ac were identified there, because of the presence of suitable soils and proximity to Wisconsin. Of the other areas, Hubbard, Wadena and Cass counties had the most extensive areas of fire regenerated stands of suitable age, located on suitable soils, with a great deal of pine of various ages in the surrounding landscape.

Summary of stands identified

1. Stands outside the six target counties

No county-owned stands of suitable size and age were located in St. Louis or Itasca county. It should be noted that data-entry is not yet complete in these counties, and therefore the information received was not comprehensive.

No stands meeting the search criteria were located on the Chippewa National Forest. Superior National Forest inventory staff identified 146 stands 5-25 years old and greater than 50 acres in size (Table 2).

2. Phase 2 data for the target counties

The print-out of jack pine stands 5-25 years old of all sizes yielded 204 stands, 123 of which had tree densities greater than 1000 trees/acre (Tbs. 3, 4). In the over 25 year age range, 250 stands larger than 50 acres were identified; only 22 of these had tree densities greater than 1000 trees/acre (Tbs. 3, 4). In summarizing these data, I have divided them into two groups, those 26 to 40 years old, and those older than 40. I made an arbitrary decision to exclude from consideration all stands in the latter category. Seventeen stands were 26-40 years old and had tree densities greater than 1000 trees/acre. The total number of high density jack pine stands 40 years old or less was thus 140.

The red pine listing yielded 76 stands in 5 counties; 45 of

these had densities greater than 1000 trees/acre (Tb. 4).

3. Privately-owned lands in the 6 target counties

DNR area forestry staff identified only 1 stand that was 5-25 years old, larger than 50 acres and densely stocked. Several foresters referred me to Potlatch Corp. Several also provided information on the extent of the 1976 Huntersville fire that created a great deal of potential habitat in Hubbard and Wadena counties (Fig. 2).

Thirty-six jack pine stands greater than 10 acres in size were identified on private, nonindustrial land in Carlton county; none were larger than 50 acres and all had tree densities of 500 trees/acre or less. None were selected for survey.

Two hundred and fifty-five jack pine stands in the 5-25 year old age category were identified by Potlatch forest inventory staff (Tb. 6). Although density information was requested, it was available for only a small number of stands. Mark Jensen, a Potlatch land manager in Bemidji, provided information on 7 additional stands that were burned in a 1959 fire near Badoura.

Final site selection within the 2 survey areas

The inability to predict weather, logistical problems, and time needed to positively identify any birds located make it difficult to precisely define the number of sites that can be surveyed. From the group of 140 high density stands that were younger than 40 years old, I have selected 91 stands for survey

based on age, tree density, stand size, and fire history (Tb. 7). Of these, 68 are owned by the state or county, 22 are owned by Potlatch, and one is owned by a private individual. In case the scheduled survey period does not allow surveying all 91 stands, I have assigned priority ratings among the stands to assure that those that appear to provide the best habitat get surveyed.

All stands larger than 50 acres (N = 29) were included. Smaller stands in the 5-25 year old category were chosen if they were adjacent to one another, or were in sections with extensive older pines. From these two groups, 17 stands that appear to have regenerated after fire were assigned the highest priority for survey (F*). The rest of the larger stands (N = 21) were assigned to the next priority group (*). A third priority group (?*) is composed of stands that are located in the general area burned by the 1976 Hunterville's fire, but which are older than 13 years old (N = 5). Finally, all other stands, including a small number of stands from the low density group that were located in areas with extensive pine forests were assigned the lowest priority (N = 48).

In the case of stands owned by Potlatch, because of the absence of density information, I have ranked as high priority only those stands that appear to be within the area burned in the 1976 Huntersville fire (Fig. 2), and as lower priority those that appear to have resulted from the 1959 Badoura fire. Stands in the latter category would be 30 years old, a little too old to be considered "prime" habitat.

In Pine county, because of the relatively small number of suitable jack pine stands (N = 18), 4 red pine stands will also be surveyed. All are located in townships containing jack pine stands targeted for survey.

The sites marked by asterisks in the attached site logs will be surveyed earliest in the season. Field personnel will evaluate the suitability of each site based on ground cover, tree configuration, and live branches near the ground. Those stands judged to be most suitable will be scheduled for an additional survey 2-3 weeks later.

If time remains after the "prime" sites are surveyed, field personnel will begin to survey the smaller, older, or less dense stands. I considered the red pine stands to have a much lower probability of attracting Kirtland's Warblers, and therefore they are also ranked as low priority for survey. If there is time remaining after all stands are surveyed once, and prime sites are surveyed twice, field personnel will conduct road surveys of any other stands encountered during the course of their earlier survey work that they deem potentially suitable.

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Table 1. Numbers of state and county-owned jack pine stands in Minnesota that are 5-25 years old and greater than 50 acres in size by tree density class.[1]

County	≥ 1000 trees/ acre	< 1000 trees/ acre	Total
Aitkin	1	0	1
Becker	1	0	1
Beltrami	6	0	6
Cass	5	2	7
Clearwater	0	1	1
Cook	2	0	2
Hubbard	2	1	3
Koochiching	7	0	7
Lake	1	1	2
Lake of the Woods	5	3	8
Pine	3	0	3
Roseau	4	0	4
St. Louis	25	1	26
Wadena	1	1	2
Total	63	10	73

[1] Source: MnDNR Phase 2 forest inventory database

Table 2. Numbers of jack pine stands on the Superior National Forest that are 5-25 years old and larger than 50 ac, by county and stocking percentage.[2]

County	Stocking			Total
	> 70%	40-69%	16-39%	
St. Louis	43	27	7	77
Lake	28	7	13	48
Cook	10	4	7	21
Total	81	38	27	146

[2] Source: Superior National Forest Inventory data

Table 3. Numbers of high density (greater than 1000 trees/ac) jack pine stands on state and county land in the 6 target counties listed by age class and stand size. All stands older than 25 years old are larger than 50 acres.[3]

	5-25 y.o.				
County	≥ 50 ac	< 50 ac	26-40 y.o.	≥ 40 y.o.	Total
Becker	1	3	0	0	4
Cass	4	22	4	0	30
Hubbard	2	40	6	0	48
Wadena	1	31	6	5	43
Subtotal	8	96	16	5	125
Pine	3	13	1	0	17
Carlton	0	3	0	0	3
Subtotal	3	16	1	0	20
Total	11	112	17	5	145

[3] Source: MnDNR Phase 2 forest inventory data

Table 4. Numbers of low density (fewer than 1000 trees/ac) jack pine stands on state and county land in the 6 target counties by age class and stand size. All stands older than 25 years old are larger than 50 acres.[4]

	5-25 y.o.				
County	≥ 50 ac	< 50 ac	26-40 y.o.	≥ 40 y.o.	Total
Becker	0	4	1	23	28
Cass	2	14	3	41	60
Hubbard	1	28	3	97	129
Wadena	0	23	14	20	57
Subtotal	3	69	21	181	274
Pine	0	6	0	25	31
Carlton	0	3	1	0	4
Subtotal	0	9	1	25	35
Total	3	78	22	206	309

[4] Source: MnDNR Phase 2 forest inventory data

Table 5. Numbers of state and county-owned red pine stands 5-25 years old and greater than 50 acres in size in the 6 target counties by tree density class.[5]

County	≥ 1000 trees/ acre	< 1000 trees/ acre	Total
Becker	2	3	5
Cass	20	10	30
Hubbard	4	11	15
Pine	10	1	11
Wadena	9	6	15
Total	45	31	76

[5] Source: MnDNR Phase 2 forest inventory database

Table 6. Numbers of jack pine stands on Potlatch lands in the 6 target counties that are 5-25 years old by stand size class.[6]

County	≥ 50 acres	< 50 acres	Total
Becker	0	8	8
Cass	14	51	65
Hubbard	9	67	76
Wadena	6	73	79
Pine	0	4	4
Carlton	0	16	16
Total	29	226	255

[6] Source: Potlatch Corp. forest inventory, Cloquet

Table 7. Numbers of stands selected for survey in 1989, listed by county and survey priority. F* = top priority stands, * = second priority stands, ?* = third priority stands, low = lowest priority stands.[7]

County	F*	*	?*	low	Total
Becker	0	0	0	1	1
Cass	7	6	3	9	25
Hubbard	6	6	2	16	30
Wadena	4	0	0	9	13
Subtotal	17	12	5	35	69
Pine	0	9	0	13	22
Total	17	21	5	48	91

[7] The term "stand" is used here to indicate a survey unit; it may comprise several Phase 2 stands, as indicated on the site logs.