

WISCONSIN DEPARTMENT OF NATURAL RESOURCES  
Bureau of Wildlife Management  
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FINAL REPORT

State: Wisconsin Project Title: Endangered Species  
Cooperators: Michigan DNR Study Title: Range Determination and Study  
Project No.: E-1-2 of the Kirtland's Warbler  
Study No.: 204 in Wisconsin.  
Period Covered: January 1, 1978 - July 31, 1978

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Job 204.1: Determine Warbler Range  
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ABSTRACT

The Wisconsin Department of Natural Resources coordinated a search for the Kirtland's Warbler (*Dendroica kirtlandii*), a federally endangered species, to determine if this species is present and nesting in Wisconsin. Nearly 100 jack pine (*Pinus banksiana*) stands were surveyed in May and June 1978. Kirtland's Warblers were found in only one stand. Two unmated males had set up territories about 1/4 mile apart in a 90-acre jack pine stand in the Black River State Forest.

During the past 2 breeding seasons, 4 solitary male Kirtland's Warblers have been found outside their traditional exclusive nesting grounds in Michigan. The pioneering of new areas by Kirtland's Warblers may indicate a broader migration route than was previously known.

The recovery of the Kirtland's Warbler population may depend on its introduction into new areas of 8- to 20-year-old jackpine. If Wisconsin plans to take part in this transplant program, a habitat management plan must be initiated and sufficient time must be allotted for the growth of suitable nesting habitat.

JOB 204.1: DETERMINE WARBLER RANGE

OBJECTIVE

Determine suitable Kirtland's Warbler range by gathering data on climate, topography, forest fire history and other pertinent information using expertise from the State of Michigan and the U.S. Fish & Wildlife Service.

PROCEDURES

Since the first Kirtland's Warbler nest discovery in 1903, this federally endangered species has never been known to nest outside a 13-county area of the northern part of Michigan's lower peninsula. Prior to 1977, breeding season searches for the Kirtland's Warbler in Minnesota, Wisconsin, Michigan's upper peninsula, and Ontario had only turned up a single territorial male warbler in Ontario in 1958 (Mayfield 1960).

With a 60-percent decline in the Michigan nesting population from almost 1,000 Kirtland's Warblers in 1951 to a little over 400 warblers in 1971, chances were even smaller that this species might be found nesting in a neighboring state or province. Along with this decline, the distribution of the nesting areas in Michigan in recent years has shrunk, with most of the remaining warblers nesting in the 3 central-most counties. Nevertheless, in June 1977 a single male Kirtland's Warbler was found near Petawawa, Ontario. Chemical analysis of a feather clipped from this bird indicates that the warbler was from a "a distinct sub-population that (had) either wintered, summered, or both, in a region quite different from Michigan birds" (Aird and Hibbard 1978). This discovery suggests that Kirtland's Warblers may indeed be nesting in areas other than their known range in Michigan.

Several ornithologists have looked for the Kirtland's Warbler in jack pine stands in Wisconsin (Van Tyne 1951; Robbins pers. comm.; Walkinshaw pers. comm.). Since the mid-1880's there have been only 9 verified records of the Kirtland's Warbler in Wisconsin. All of these birds were observed in May and were probably migrants (Robbins in press). Encouraged by last year's discovery of the Kirtland's Warbler in Ontario, the Wisconsin Department of Natural Resources organized a survey from late May to late June 1978 to determine if any Kirtland's Warblers were breeding in the state. The results of this survey are included in this report.

Identifying general areas of Wisconsin similar to Michigan's Kirtland's Warbler nesting range was the first step in locating potential nesting areas in the state. We reorganized the methods suggested in the work plan for the actual study. Data on major forest types, soils, topography, climate and past sight records of this species in Wisconsin were used to identify those areas with potentially suitable Kirtland's Warbler nesting habitat.

## FINDINGS

### Forest Type

Nearly all Kirtland's Warbler nests found in Michigan were located in 8- to 20-year-old jack-pine stands of at least 80 acres in size. Major jack pine areas of Wisconsin are found north and east of the tension zone that separates the southwestern Prairie element from the northeastern Boreal element (Curtis 1959). These jackpine areas are largely located in Polk, Burnett, Washburn, Douglas and Bayfield Counties in the northwest; in Oneida, Vilas and Marinette Counties in the northeast; and in Portage, Wood, Adams, Waushara, Juneau, Monroe, Jackson and Eau Claire Counties in central Wisconsin (Fig. 1). Jackpine is often mixed with other tree species such as Hill's oak (*Quercus ellipsoidalis*), trembling aspen (*Populus tremuloides*), large-toothed aspen (*P. grandidentata*), and white oak (*Q. alba*) (Curtis 1959). Only 15 counties in Wisconsin have more than 1,000 acres of jackpine in the 10- to 20-year-old age class (Thorne, pers. comm.) (Table 1). Although the warblers utilize jackpine stands as young as 8 years old, state records of commercial forest land by stand-age class are grouped in 10-year intervals.

### Soils

Almost all Kirtland's Warbler nests found in Michigan have been located on Grayling sands. Grayling sands are extremely well-drained soils found on glacial outwashes or lake plains in Michigan. This sandy soil is ideal for the jack pine growth and sparse ground cover preferred by the warblers; its permeability also prevents Kirtland's Warbler ground nests from being destroyed in soaking rains.

The Wisconsin soil series most similar to the Grayling sands of Michigan are the Plainfield loamy sands of central Wisconsin; and the Vilas, Omega and Hiawatha sands of northern Wisconsin (Hole pers. comm.). For the most part, these soils were formed as bottom deposits of ancient glacial lakes or in adjacent outwashes (Fig. 2).

### Topography

Generally level to gently rolling topography characterizes the known Kirtland's Warbler nesting range of Michigan. The sandy soils which support the major jack pine forests of Wisconsin are also of a glacial lake origin, and are found on fairly level to gently rolling land.

### Climate

The climate of the Kirtland's Warbler nesting range in Michigan is "notable for extremes although the average temperature and rainfall are moderate" (Mayfield 1960). Extreme temperatures of up to 44°C (112°F) and down to -7°C (20°F) may occur during the warblers' 4-month stay on their Michigan nesting grounds (Mayfield 1960).

Major jackpine areas of Wisconsin also are marked by temperature extremes from mid-May to mid-September, but temperatures are not as severe as those recorded in Michigan. In the past 10 years during this breeding period, temperatures of up to 38°C (101°F) and down to -5°C (23°F) were recorded in these areas of Wisconsin. Spring frosts occurred as late as 24 June and fall frosts as early as 24 August (U.S. Department of Commerce, 1968-1977). In Wisconsin jackpine areas, the average July temperature is 20°-22°C (68°-71°F), with growing seasons of 120 days; annual rainfall averages 76 cm (30 inches) (Burley 1964).

### Past Sight Records

There have been 9 verified sightings of Kirtland's Warblers in Wisconsin in the past 125 years (Fig. 3). All of these sightings made in the last 2 weeks of May; none of these birds were ever observed for more than 2 days. Only 2 of the sightings were in counties with jackpine. All of these Kirtland's Warblers are thought to have been migrants (Van Tyne 1951; Robbins pers. comm.).

### DISCUSSION

Three major areas were located which met the nesting requirements of Kirtland's Warblers (Fig. 4). These areas constitute the range of suitable Kirtland's Warbler habitat in the state. The areas were identified using information on the distribution of major forest types, soil series and past Kirtland's sight records. Within the sandy jackpine regions of Wisconsin there are no great variations in either climate or topography. Therefore, these factors were not crucial in determining the range of Kirtland's Warbler nesting habitat in Wisconsin.

### JOB 204.2: DELINEATE HABITAT

#### OBJECTIVE

Delineate the most likely Kirtland's Warbler habitat and prepare maps using data on soils, vegetation, past site records and other necessary factors.

#### PROCEDURES

The procedures described in the original work plan were modified slightly to select specific jackpine stands which furnish possible nesting habitat for Kirtland's Warblers. Only those jackpine stands located within the 3 major areas identified as Wisconsin's Kirtland's Warbler range (Job 204.1) were considered as potential habitat for this species in Wisconsin. Historical information on forest fires and the physical character of forest stands within the range of Kirtland's Warbler habitat was used to identify which stands to survey. State, county and private forest reconnaissance records were used to locate these jackpine stands. The guidelines used to select survey stands were: (1) the dominant tree species had to be jackpine with any secondary tree species utilizing less than 40 percent of the growing space, (2) the jackpine trees had to be 6 to 18 feet tall or approximately 8 to 20 years old, and (3) stands had to be at least 80 acres in size.

I visited Michigan's known Kirtland's Warbler nesting areas in mid-March and again in mid-May. On these trips, I acquired a mental image of suitable nesting habitat. This was useful in judging the suitability of jackpine stands selected for the Kirtland's Warbler survey in Wisconsin.

#### FINDINGS

One hundred three stands of young jackpine were located which approached the requirements for Kirtland's Warbler nesting habitat (Figure 5; Appendix A). Both natural stands and plantations were among the stands selected. Some marginal warbler nesting habitat was incorporated in the survey due to the lack of any suitable nesting habitat in that county. This marginal habitat included jackpine stands with secondary tree species using nearly 40 percent of the growing space or with trees about 20 years old. Two-thirds of the stands were on publicly owned land; half of the stands were located in central Wisconsin.

## DISCUSSION

Only about 10 percent, or 70,000 acres, of the total jackpine acreage in Wisconsin is presently between 10 and 20 years old (Thorne pers. comm.). Many jackpine stands date back to the 1930's when fire control practices were improved. Of the 70,000 acres in the 10- to 20-year-old class, only about 14,000 acres (20 percent) were selected as possible Kirtland's Warbler nesting habitat following the guidelines listed above.

Of critical importance to the creation and maintenance of Kirtland's Warbler habitat is the treatment of sites once mature jackpine stands are harvested. If these areas are allowed to regenerate, suitable Kirtland's Warbler habitat may increase. Whether jackpine will regenerate depends on how the stands are treated after the harvest. In many instances, the jackpine stands selected in this study were heavily mixed with other pine species and hardwoods. The most successful Kirtland's Warbler nesting areas in Michigan are largely pure stands of jackpine. One area with a considerable amount of Hill's oak is among the favored nesting sites. Although Kirtland's Warblers tolerate other tree species mixed with jackpine, evidence indicates that efforts to create new nesting habitat should be geared towards fairly pure jackpine stands.

## JOB 204.3: ORGANIZE AND CONDUCT CENSUS

### OBJECTIVE

Conduct spring census by organizing and conducting a thorough census utilizing voluntary and/or professional people in order to determine the presence of Kirtland's Warblers.

### PROCEDURES

To complete the survey of 103 jackpine stands around the state, volunteers were needed. A network of 13 volunteer groups was set up with 2 to 5 people in each group. Leaders with experience in identifying bird songs were selected for each group. Most group leaders had participated in U.S. Fish & Wildlife Service Breeding Bird Surveys. Other volunteers included members of the Wisconsin Society for Ornithology, Department of Natural Resources personnel, and university faculty and students.

Volunteers surveyed 63 stands while I examined the remaining stands. The groups surveyed the stands at their convenience from late May to the end of June. Surveys were scheduled from sunrise to 11:00 a.m., if skies were clear and the winds did not exceed 12 m.p.h. Listening stations were set up near the center of every 40-acre block of habitat. A recording of the Kirtland's Warbler territorial song was played for 30 seconds at each station. Then surveyors listened for 2 minutes for an answering song. This procedure was done twice at each listening station. If a Kirtland's Warbler answered, 2 or more volunteers were to attempt to make a positive visual identification of the bird. Group sightings would add credibility to a Kirtland's Warbler discovery. The trees in the vicinity of a Kirtland's Warbler were to be marked with flagging tape and the approximate location noted on a cover map of the stand.

### FINDINGS

One hundred three jackpine stands were selected to be surveyed for Kirtland's Warblers. After closer examination, 4 of these stands proved to be unsuitable for Kirtland's Warblers, and were dropped from the survey. Kirtland's Warblers were found in only one stand. Two territorial males were discovered in a 90-acre block of young jackpine trees Black River State Forest in Jackson County. The trees are about 9 feet tall and fairly dense with scattered grassy openings throughout; these trees are the natural regeneration from a clear cut in 1962. The soil is Plainfield loamy sand. Other species of birds found in this area include Common Flickers (Colaptes auratus), Hairy Woodpeckers (Picooides villosus), Eastern Kingbirds (Tyrannus tyrannus), Great Crested Flycatchers (Myiarchus crinitus), Blue Jays (Cyanocitta cristata), Common Crows (Corvus brachyrhynchos), Black-capped Chickadees (Parus atricapillus), White-breasted Nuthatches (Sitta carolinensis), Brown Thrashers (Toxostoma rufum), Black-and-white Warblers (Mniotilta varia), Nashville Warblers (Vermivora ruficapilla), Ovenbirds (Seiurus aurocapillus), Chipping Sparrows (Spizella passerina), and Song Sparrows (Melospiza melodia). Brown-headed Cowbirds (Molothrus ater), the traditional brood parasite of Kirtland's Warblers, were never seen or heard in this stand.

The primary understory plants associated with this jackpine stand were poverty oat grass (Danthonia spicata), little bluestem grass (Andropogon scoparius), sedges (primarily Carex pensylvanica), and yellow puccon (Lithospermum carolinense).

The two male warblers had set up territories about 1/4 mile apart. Their behavior indicated that they were not mated. The males spent a great deal of time singing in the tree tops; they were never seen carrying food to a would-be mate or young. One male had been banded as a nestling in 1972 on the artillery range of Camp Grayling, Michigan. Efforts to capture the other male were unsuccessful. The birds maintained their territories from the date of discovery (10 June 1978) until the time of this report (Appendix B).

Volunteers from Necedah National Wildlife Refuge heard a bird answering the tape recording of the Kirtland's Warbler territorial song on 9 June 1978 near New Miner in Juneau County. They played the tape 5 times and heard 5 responses, however they were never able to see the bird. The group returned to the area several times throughout the rest of June, but never heard the bird again.

Although none of the other surveys revealed any Kirtland's Warblers, the surveys did produce a list of the birds which inhabit the jackpine barrens of Wisconsin (see Appendix C).

#### DISCUSSION

During the past 2 breeding seasons, 4 solitary male Kirtland's Warblers have been found outside of Michigan. The male found near Petawawa, Ontario in June 1977 returned to the same area again the next summer. In 1978, a single male was found in Quebec, 60 miles east of Petawawa; this warbler had been banded as a nestling in 1974 near Lovells, Michigan. The two males found in Wisconsin complete the list of Kirtland's Warblers pioneering new areas.

Active dispersal by an avian species from its historical breeding range may be due to competition for low food supplies, population pressure, or seasonal migrations (Welty 1975). Kirtland's Warblers pioneering new areas may result from long-distance migrations. The migration route of Kirtland's Warblers may well be broader than was previously suggested by Van Tyne (1951) who considered any recoveries of this species in Illinois, Wisconsin, Minnesota or Ontario "far outside of any probable migration route." If Kirtland's Warblers do have a broad migration route, then yearling males searching for an unoccupied nesting territory may choose young jackpine stands in Wisconsin, Ontario or Quebec.

Yearling male Kirtland's Warblers are generally more wide-ranging in their selection of a territory than are yearling females; females usually nest very close to where they were born (Walkinshaw pers. comm.). Most male Kirtland's Warblers arrive on the nesting grounds a week earlier than the females (Byelich pers. comm.). Because of these differences, there is only a small probability of a female Kirtland's Warbler finding pioneering males.

The discovery of the 2 male Kirtland's Warblers in west central Wisconsin indicates that suitable nesting habitat exists in Wisconsin. The Kirtland's Warbler Recovery Plan recommends introducing this species into suitable nesting areas outside of the Michigan nesting grounds. If such a plan is implemented, west central Wisconsin would be a likely area for introduction. Should the Wisconsin Department of Natural Resources become involved in the recovery efforts of this endangered species, it must maintain sufficient acreage of 8- to 20-year-old jack pine stands.

Jackpine management practices generally provide suitable nesting habitat for Kirtland's Warblers. If jackpine stands are managed for Kirtland's Warbler nesting habitat as well as for pulpwood, harvests of the mature jackpine should be done in blocks of at least 300 acres. If natural regeneration is poor, some treatment of the area such as seeding or prescribed burning may be necessary. In recent years, jackpine plantations in central Wisconsin have been attacked by root tip weevils (Hylobius rhizophagus); planting jackpine seedlings may not be a viable alternative in this portion of Wisconsin.

JOB 204.4: PREPARE REPORT

OBJECTIVE

Prepare report.

RECOMMENDATIONS

The above narrative for Jobs 204.1, 204.2, and 204.3 constitutes the final report for Study 204. Based on these findings, I would like to make the following recommendations:

1. Conduct Kirtland's Warbler surveys in young jackpine stands in west central Wisconsin, particularly in the Black River State Forest in June 1979.
2. Monitor the area where the 2 male Kirtland's Warblers were found to determine if and when the birds return in the spring of 1979. Throughout the breeding season, continue observations of these warblers and any others found in the area.
3. Examine the implications of habitat management for the Kirtland's Warbler in the Black River State Forest. Determine how such a program would affect other forest uses. Based on this information, decide what steps will be taken to protect and manage habitat for the Kirtland's Warblers. Include these steps in the master plan for the area.

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TABLE 1. Wisconsin counties with more than 1,000 acres of jackpine, 10 to 20 years old (Thorne, unpubl.).

County	No. Acres 10-to 20-year-old Jackpine
Douglas	9,500
Burnett	6,600
Adams	6,500
Bayfield	5,700
Jackson	5,200
Washburn	4,500
Poik	3,700
Juneau	3,600
Monroe	1,400
Marinette	1,300
Oneida	1,300
Waushara	1,300
Eau Claire	1,200
Iowa	1,200
Marquette	1,100



APPENDIX A

Jackpine stands included in the Kirtland's Warbler Survey.

County	Stand No.	Location	County	Stand No.	Location
Adams	1*	T17N R6E Sec. 8,17	Jackson(cont.)	52	T22N R3W Sec. 12,13
	2	T18N R7E Sec. 13		53*	T22N R2W Sec. 18
	3*	T19N R6E Sec. 15		54*	T22N R2W Sec. 17
	4	T19N R6E Sec. 21		55*	T22N R2W Sec. 20
	5*	T19N R5E Sec. 2		56	T22N R2W Sec. 29
	6*	T19N R5E Sec. 3		57*	T21N R2W Sec. 1,12
	7*	T20N R6E Sec. 29		58*	T21N R2W Sec. 33
	8*	T20N R6E Sec. 29		59*	T21N R2W Sec. 33
	9	T20N R6E Sec. 4,5,8		60	T20N R2W Sec. 20
Bayfield	10*	T48N R7W Sec. 26	61	T20N R2W Sec. 21	
	11	T48N R7W Sec. 25	62	T20N R2W Sec. 21	
	12*	T48N R8W Sec. 24	63*	T20N R2W Sec. 22	
	13	T46N R9W Sec. 30	64*	T20N R2W Sec. 16,21	
	14	T46N R9W Sec. 15,22	65*	T20N R2W Sec. 17	
	15*	T45N R9W Sec. 13	66	T20N R2W Sec. 17	
			67	T20N R2W Sec. 17	
Burnett	16	T41N R15W Sec. 1	68	T20N R2W Sec. 17	
	17	T41N R14W Sec. 6	69	T20N R2W Sec. 17	
	18	T42N R14W Sec. 31	70*	T20N R2W Sec. 8,9,16,17	
	19	T42N R15W Sec. 35,36	71*	T21N R4W Sec. 35	
	20	T41N R14W Sec. 11,14	72	T21N R4W Sec. 34	
	21	T41N R14W Sec. 12,13	73	T21N R4W Sec. 34	
	22*	T40N R17W Sec. 10,15	74	T20N R4W Sec. 4	
	23*	T41N R15W Sec. 28,29,33	75	T20N R4E Sec. 2	
	24*	T41N R15W Sec. 25,36	76*	T19N R4E Sec. 8	
	25	T41N R15W Sec. 10,15			
Clark	26	T41N R15W Sec. 12,13	Marinette	82*	T36N R18E Sec. 13,14,24
	30*	T23N R3W Sec. 17,18,19,20		83	T32N R18E Sec. 20,29
	31*	T24N R3W Sec. 21		84	T32N R18E Sec. 25
	32*	T24N R3W Sec. 15		85*	T33N R18E Sec. 12,13
Douglas			Monroe	77*	T19N R2W Sec. 29
	33	T45N R11W Sec. 28		78	T19N R2W Sec. 31,32
	34*	T45N R11W Sec. 13		79*	T17N R2W Sec. 20,21
	35	T45N R10W Sec. 19		80*	T17N R2W Sec. 17
	36*	T45N R10W Sec. 32		81*	T18N R2W Sec. 7
	37	T44N R10W Sec. 6,7			
	38	T43N R11W Sec. 16	Oneida	86	T36N R6E Sec. 29,32
	39	T43N R11W Sec. 17,18,19,20		87	T36N R6E Sec. 30
				88	T36N R5E Sec. 25
Eau Claire	27*	T26N R7W Sec. 12		89*	T36N R6E Sec. 20
	28*	T27N R6W Sec. 22		90*	T36N R6E Sec. 20,21
	29*	T27N R6W Sec. 27		91*	T36N R6E Sec. 17,18
Jackson	40*	T22N R2W Sec. 13,14,23,24		92*	T37N R6E Sec. 7
	41*	T22N R2W Sec. 15,16,21,22		93*	T37N R5E Sec. 26,35
	42	T22N R2W Sec. 11,12,13,14		94*	T37N R5E Sec. 26,35
	43	T22N R2W Sec. 15		95*	T37N R5E Sec. 36
	44*	T22N R2W Sec. 34,35	Vilas	96*	T37N R6E Sec. 33,34
	45	T22N R2W Sec. 19		97*	T42N R10E Sec. 27
		T22N R3W Sec. 24,25		98	T42N R10E Sec. 21
	46*	T22N R3W Sec. 14		99*	T41N R10E Sec. 10
	47	T22N R3W Sec. 14		100*	T41N R11E Sec. 13 or 14
	48*	T22N R3W Sec. 22,23	Washburn	101*	T41N R13W Sec. 31,32
	49	T22N R3W Sec. 33		102*	T41N R13W Sec. 31,32
	50*	T22N R3W Sec. 31		103*	T41N R13W Sec. 29
	51	T22N R3W Sec. 16			

\* Marginal Kirtland's Warbler nesting habitat.

APPENDIX B

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Chronology of visits to the survey stand in west central Wisconsin  
which contained 2 territorial male Kirtland's Warblers

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<u>Date</u>	<u>Comments</u>
10 June 1978	Randy Rodgers (UW-Madison) and I conducted a survey for Kirtland's Warblers and discovered 1 male at 9:45 a.m. We heard the bird singing before we reached the first listening station. Both of us were able to see the bird; I taped its song and Rodgers took several photographs. We flagged trees in the area before we left.
11 June 1978	I returned to make sure the bird was still in the area.
15 June 1978	While observing the first Kirtland's Warbler, I heard another male singing about 1/4 mile away (7:31 a.m.). I was able to locate the second bird (10:23 a.m.) which was banded with an aluminum leg band.
20 June 1978	I visited this area in the evening with John Byelich, leader of the Kirtland's Warbler Recovery Team, and Larry Walkinshaw, a temporary employee of the USFWS and expert on the Kirtland's Warbler. We looked over the area to decide where to set up the mist nets the next morning. Only one male was audible at this time.
21 June 1978	Byelich, Walkinshaw and I were able to mist net the banded Kirtland's Warbler at 8:00 a.m. This bird (band #81-58970) was six years old and had been banded as a nestling on the artillery range of Camp Grayling, Michigan. The male's measurements were: Wing = 71.7 mm, tail = 55.5 mm, tarsus = 24.4 mm, culmen = 11.0 mm. One centimeter of the first secondary on the right wing was clipped for chemical analysis. We added a yellow, plastic leg band above the aluminum one. We were unable to mist net the unbanded bird. This male was not attracted to the tape recording of the Kirtland's Warbler territorial song.
22 June 1978	We attempted to capture the unbanded warbler, but were unsuccessful again; both birds were singing.
6 July 1978	Ron Nicotera, WDNR Endangered Species Supervisor, and I visited the area about 11:30 a.m. We did not hear or see either male Kirtland's Warbler. We visited nearby jackpine stands, but could not locate the birds.
7 July 1978	Nicotera and I returned to the area at 6:30 a.m. as a light rain was falling. We were able to hear and see both males.
13 July 1978	I visited the area at 6:30 p.m. and was unable to hear or see either warbler.
14 July 1978	I returned to the area at 6:00 a.m. and could not locate either male. After examining nearby jack pine areas, I returned to the survey stand and heard and saw the unbanded male. This warbler sang for about 20 minutes and then was quiet. I never saw or heard the banded bird on this visit.
18 July 1978	Paul Kooiker, WDNR Wildlife Manager from Neillsville, visited the area and was not able to locate either bird. He spent approximately 2 hours in the area and neither saw nor heard the birds.
27 July 1978	Kooiker visited the stand again and was able to hear and see the banded male. He was not able to locate the unbanded Kirtland's Warbler.

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APPENDIX C

Species list of birds seen and/or heard while conducting Kirtland's Warbler surveys  
in young jackpine stands of Wisconsin.

<u>Common Name</u>	<u>Scientific Name</u>
Cooper's Hawk	<u>Accipiter cooperii</u>
Red-tailed Hawk	<u>Buteo jamaicensis</u>
Broad-winged Hawk	<u>Buteo platypterus</u>
Ruffed Grouse	<u>Bonasa umbellus</u>
American Woodcock	<u>Philohela minor</u>
Mourning Dove	<u>Zenaida macroura</u>
Yellow-billed Cuckoo	<u>Coccyzus americanus</u>
Common Nighthawk	<u>Chordeiles minor</u>
Common Flicker	<u>Colaptes auratus</u>
Pileated Woodpecker	<u>Dryocopus pileatus</u>
Red-headed Woodpecker	<u>Melanerpes erythrocephalus</u>
Hairy Woodpecker	<u>Picoides villosus</u>
Downy Woodpecker	<u>Picoides pubescens</u>
Eastern Kingbird	<u>Tyrannus tyrannus</u>
Great Crested Flycatcher	<u>Myiarchus crinitus</u>
*Yellow-bellied Flycatcher	<u>Empidonax flaviventris</u>
Acadian Flycatcher	<u>Empidonax virescens</u>
Least Flycatcher	<u>Empidonax minimus</u>
Eastern Wood Pewee	<u>Contopus virens</u>
*Olive-sided Flycatcher	<u>Nuttallornis borealis</u>
Tree Swallow	<u>Iridoprocne bicolor</u>
Barn Swallow	<u>Hirundo rustica</u>
Blue Jay	<u>Cyanocitta cristata</u>
Common Raven	<u>Corvus corax</u>
Common Crow	<u>Corvus brachyrhynchos</u>
Black-capped Chickadee	<u>Parus atricapillus</u>
White-breasted Nuthatch	<u>Sitta carolinensis</u>
House Wren	<u>Troglodytes aedon</u>
Gray Catbird	<u>Dumetella carolinensis</u>
Brown Thrasher	<u>Toxostoma rufum</u>
American Robin	<u>Turdus migratorius</u>
Hermit Thrush	<u>Catharus guttatus</u>
Veery	<u>Catharus fuscescens</u>
Eastern Bluebird	<u>Sialis sialis</u>
Ruby-crowned Kinglet	<u>Regulus calendula</u>
Cedar Waxwing	<u>Bombcilla cedrorum</u>
Yellow-throated Vireo	<u>Vireo flavifrons</u>
Red-eyed Vireo	<u>Vireo olivaceus</u>
Warbling Vireo	<u>Vireo gilvus</u>
Black-and-white Warbler	<u>Mniotilta varia</u>
Golden-winged Warbler	<u>Vermivora chrysoptera</u>
Nashville Warbler	<u>Vermivora ruficapilla</u>
Yellow-rumped Warbler	<u>Dendroica coronata</u>
Chestnut-sided Warbler	<u>Dendroica pensylvanica</u>
Pine Warbler	<u>Dendroica pinus</u>
Ovenbird	<u>Seiurus aurocapillus</u>
Connecticut Warbler	<u>Oporornis agilis</u>
Common Yellowthroat	<u>Geothlypis trichas</u>
American Redstart	<u>Setophaga ruticilla</u>
Northern Oriole	<u>Icterus galbula</u>
Common Grackle	<u>Quiscalus quiscula</u>
Brown-headed Cowbird	<u>Molothrus ater</u>
Scarlet Tanager	<u>Piranga olivacea</u>
Cardinal	<u>Cardinalis cardinalis</u>
Rose-breasted Grosbeak	<u>Phœucticus ludovicianus</u>
Indigo Bunting	<u>Passerina cyanea</u>
Pine Siskin	<u>Carduelis pinus</u>
American Goldfinch	<u>Carduelis tristis</u>
Rufous-sided Towhee	<u>Pipilo erythrophthalmus</u>
Vesper Sparrow	<u>Poœcetes gramineus</u>
Chipping Sparrow	<u>Spizella passerina</u>
Clay-colored Sparrow	<u>Spizella pallida</u>
Field Sparrow	<u>Spizella pusilla</u>
White-throated Sparrow	<u>Zonotrichia albicollis</u>
Song Sparrow	<u>Melospiza melodia</u>

\* Migrants.

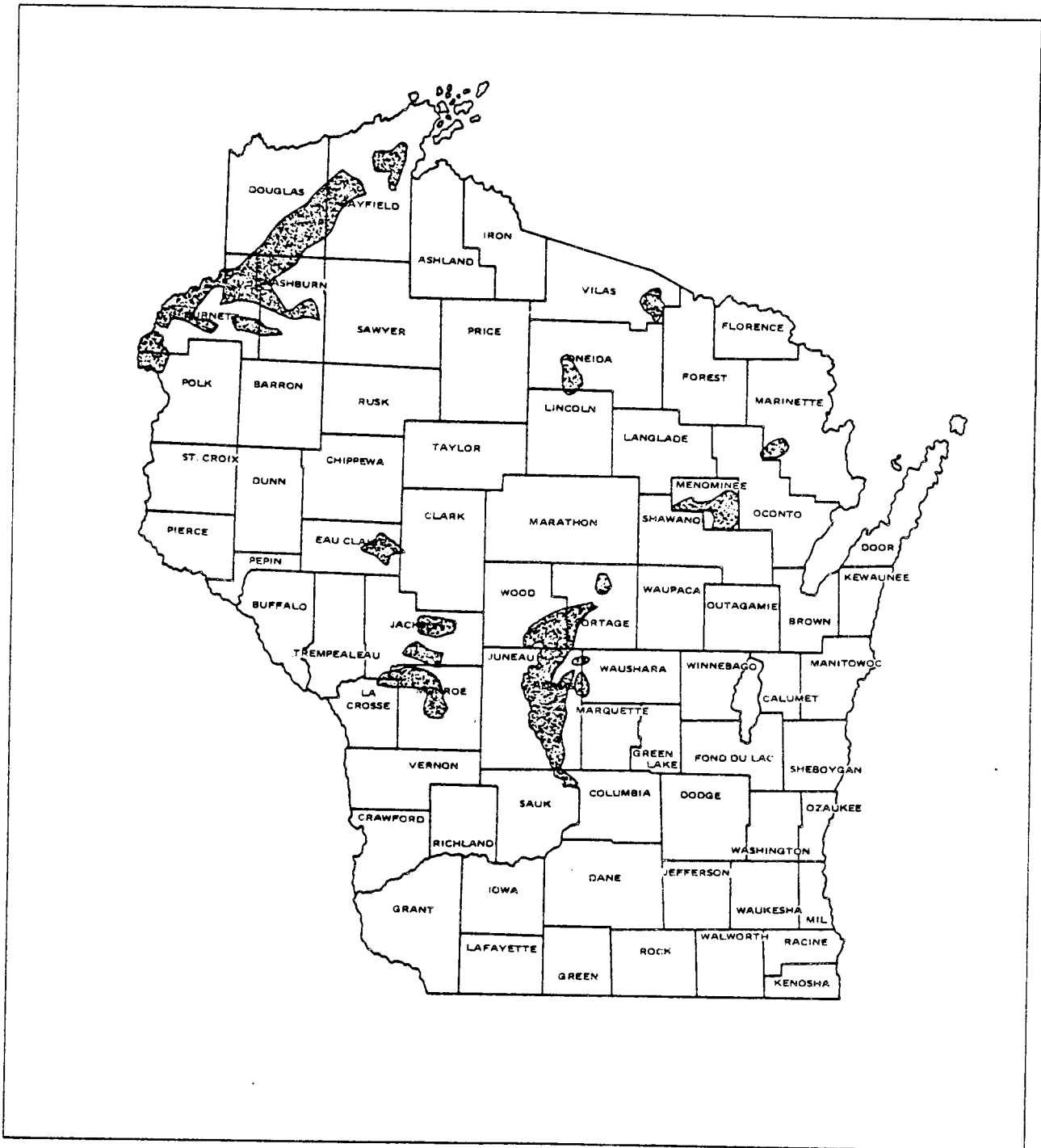


FIGURE 1. Major pine areas of Wisconsin (jack pine, red pine, white pine). After Spencer and Thorne 1972.

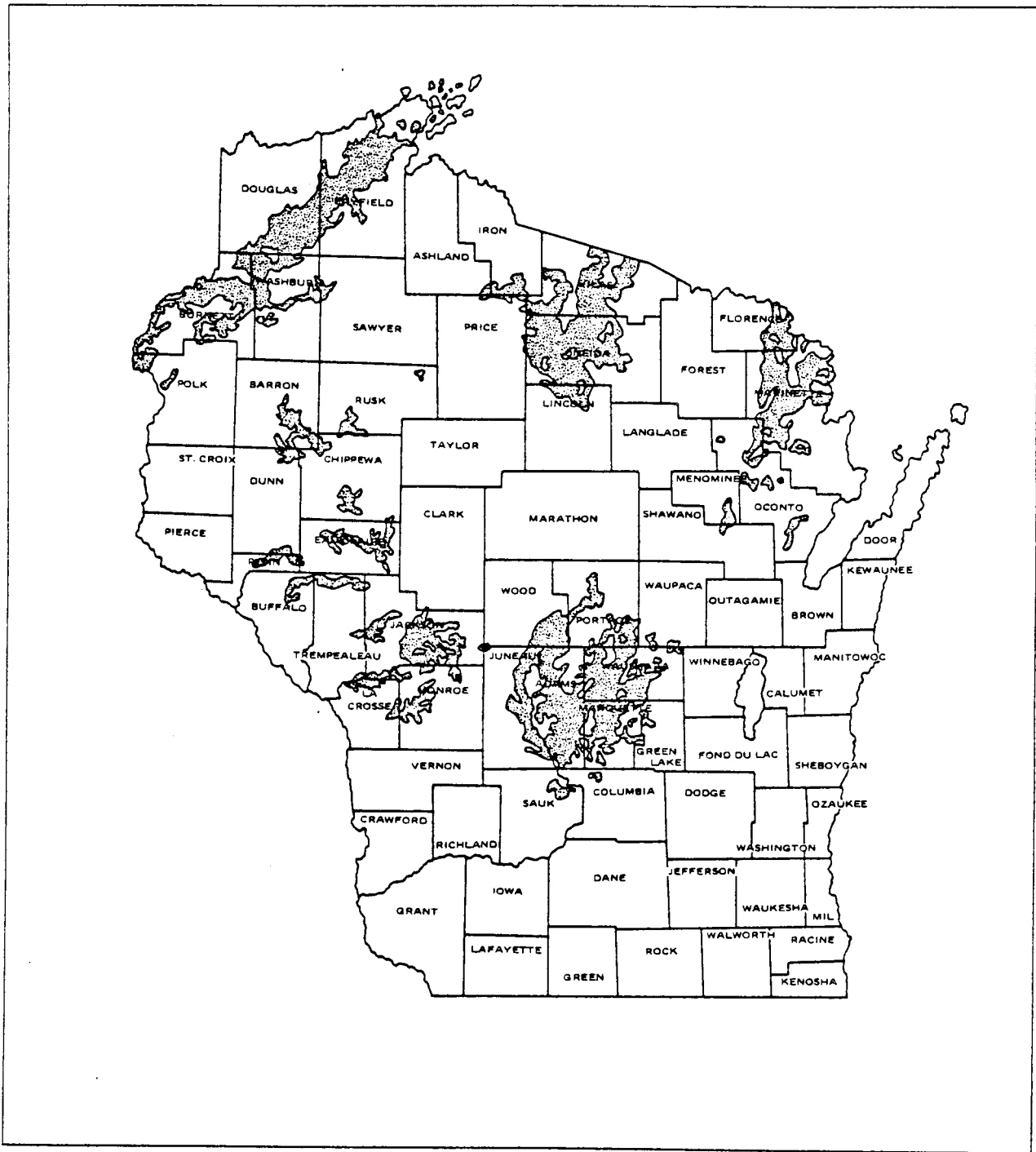


FIGURE 2. Location of sandy soils of Wisconsin which are similar to Grayling sands of Michigan. After Hole 1968.

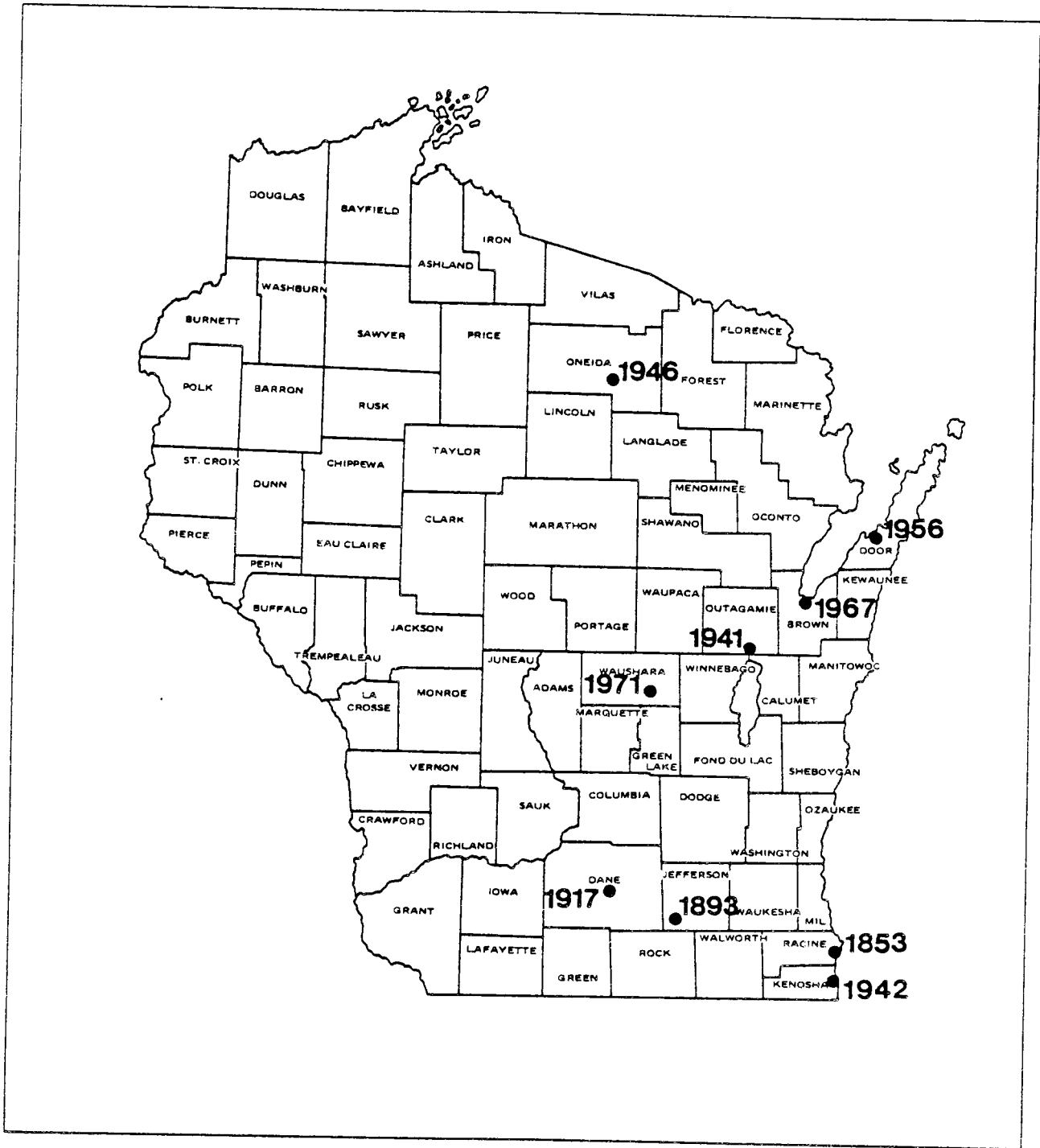


FIGURE 3. Verified sight records of Kirtland's Warblers in Wisconsin. All sightings were made in late May. Information from Robbins in press.

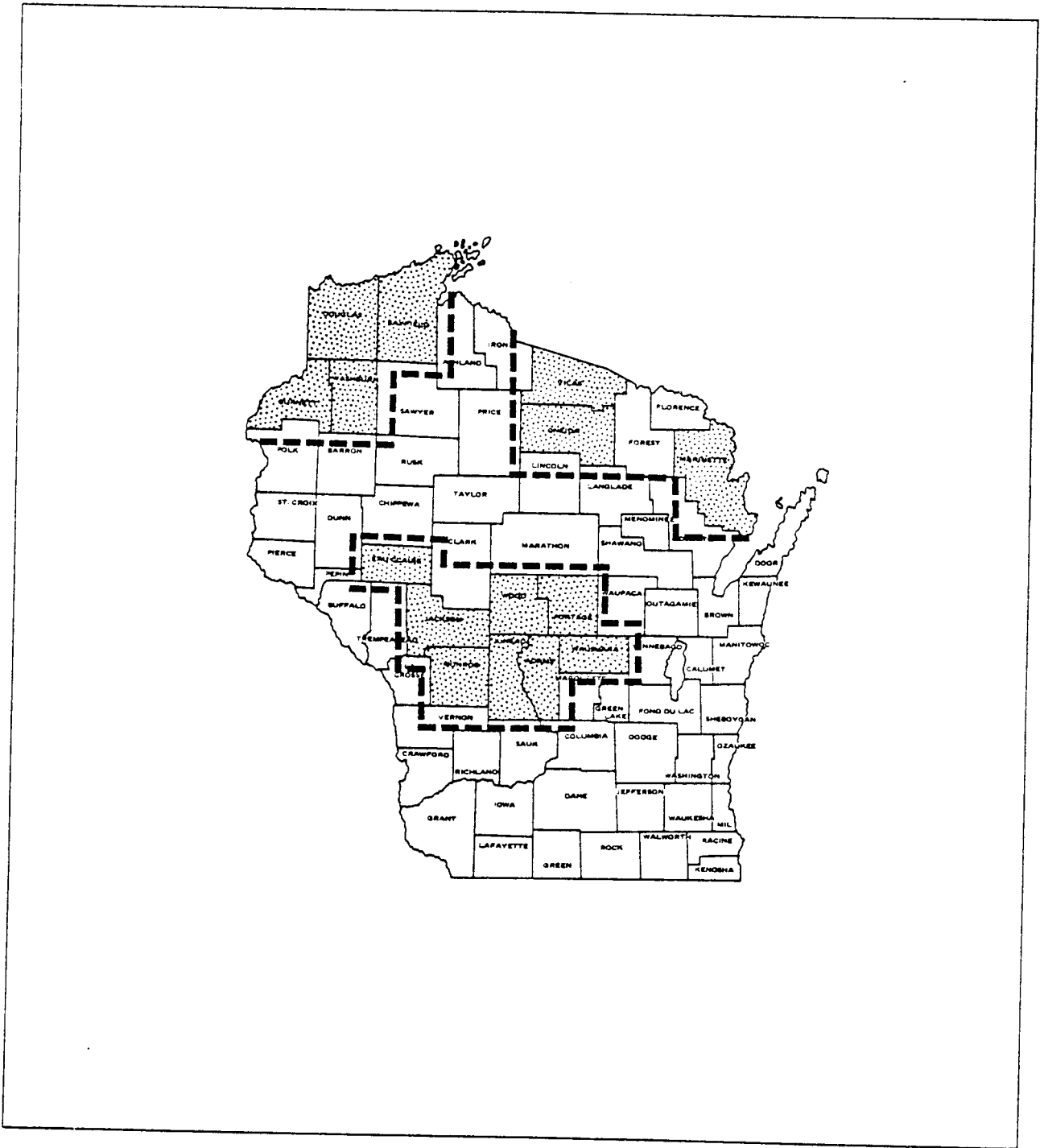


FIGURE 4. Range of potential nesting habitat for Kirtland's Warblers in Wisconsin. General outline indicates the 3 major habitat areas referred to in text.

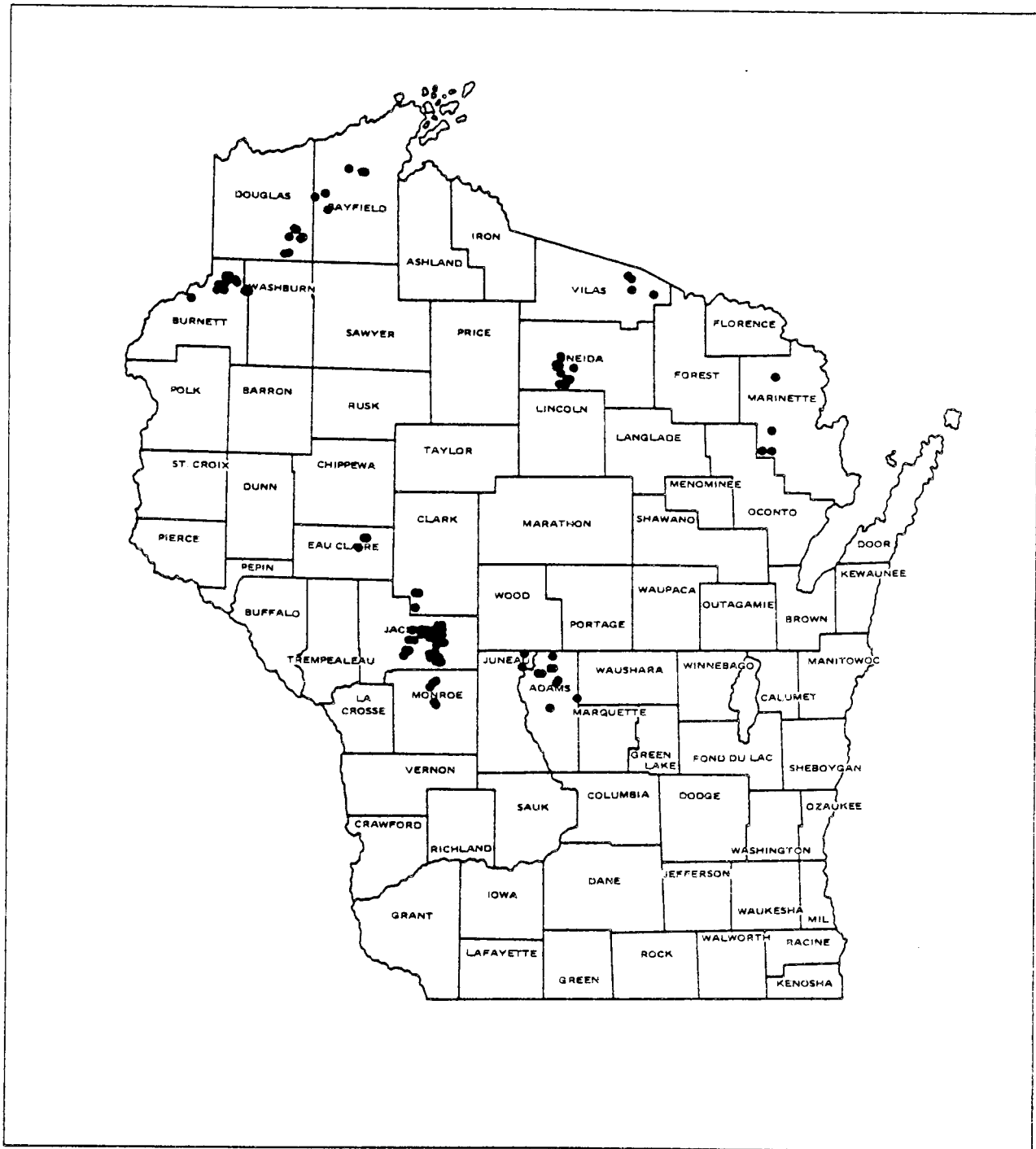


FIGURE 5. Location of jack pine stands selected for the 1978 Kirtland's Warbler survey in Wisconsin.