

The Kirtland's Warbler usually returns almost exactly to its former nesting site. It nests in "colonies", or assemblies of pairs; each pair having an exclusive territory within the colony. They tend to stay in this area even though the habitat may be declining. This characteristic may reduce its chances of exploiting new areas at any great distance from its former territory. An isolated pair in any area is usually an indication of a declining colony.

The Kirtland's Warbler is found only where the Jack-pine tracts occur most compactly and on the poorest soils where the warbler finds the ecological "niche" needed for survival.

These two aspects of the life history of this species make the establishment of a management area feasible and desirable as a means of preserving this bird.

There appears no immediate threat of extinction. Nevertheless the establishment of this management area (in conjunction with three 2560 acre areas set up outside the Forest by The Michigan Department of Conservation in 1957) will provide areas where the bird will be given special encouragement in the years ahead.

It is desirable to select a management area now inhabited by this bird to preserve existing colonies, as well as limiting the effort required to keep the habitat in a condition suitable to the warbler.

Valuable assistance in locating the area was obtained from John Byelich, District Game Supervisor, Michigan Department of Conservation, and Mr. Verne Dookham, retired conservation officer at Mio, Michigan, whose knowledge of Kirtland's Warbler range is unmatched.

U. S. F. S. R-9  
RECEIVED  
OCT 22 1962  
RECREATION & LANDS

MANAGEMENT PLAN  
for the  
KIRTLAND'S WARBLER  
MANAGEMENT AREA

Lower Michigan National Forest

*MC*

*25-25-10*

DRAFTED BY

H. O. Nixon, Lands  
R. E. Radtke, Wildlife  
W. B. Werthington, Recreation

APPROVED

*J. K. Adams*  
J. K. Adams  
District Ranger-Harrisville

APPROVED

DRAFTED FOR AND APPROVED BY

*L. Battey*  
L. Battey  
District Ranger-Mio

*L. A. Posmerening*  
L. A. Posmerening  
Forest Supervisor

*Mark H. Fire - 1944  
6470 acres*

*cc - M. R. Radtke*

MANAGEMENT PLAN

For The

KIRTLAND'S WARBLER  
MANAGEMENT AREA

Lower Michigan National Forest

## ABSTRACT

### KIRTLAND'S WARBLER MANAGEMENT AREA

#### INTRODUCTION

The Kirtland's Warbler, or the "Jack-Pine Warbler" as it is often called in Michigan, is a rare, and believed, vanishing species. This bird may be regarded as Michigan's special bird because its nesting habitat is restricted to the pine-type in the northeastern part of the Lower Peninsula of Michigan.

It can be extremely expensive to save a bird from extinction as shown by the efforts presently being put forth to preserve the whooping crane. However, it is felt that this warbler can be held in present numbers through continuous management.

The Huron National Forest is located in the center of the Kirtland's Warbler range. Since this bird is specific in its habitat, the Forest Service is in an excellent position to adjust forest management practices on portions of its area to maintain a relatively stable population.

#### Objectives:

The objective of this management plan is to establish and maintain an area for the continued development of Kirtland's Warbler nesting habitat, and to provide the necessary protection to nesting birds. This will require timber cutting cycles, planting, burning and protection which will maintain an ecological condition favorable to the creation of ideal nesting cover.

Establishment of an area dedicated to the preservation of this bird will not eliminate the production of other resources on this area. This area was established under the Multiple Use - Sustained Yield Act of June 12, 1960, and is a part of the multiple-use program of the Lower Michigan National Forest.

#### HISTORY

This song bird was first known in 1851. The species winters only in the Bahama Islands. Its nesting grounds were discovered in July 1903, near Red Oak, Oscoda County, Michigan. Every nest found subsequently has been within 60 miles of the first.

#### NESTING HABITAT AND POPULATION

##### Nesting Range:

The Kirtland's Warbler nests in scattered locations in some 12 counties, but not more than 9 at any one time. The center of the Kirtland's Warbler range and maximum population densities are reached in the Mio Ranger District of the Huron National Forest. Normally, its range is limited to extensive natural jack pine stands. In rare instances, it may inhabit mixed jack and red pine plantations. Where a pine overstory or numerous deciduous trees are present, the area is no longer acceptable to the warbler.

### Habitat Requirements:

Almost without exception, this bird can only be found in large, homogeneous, blocks of jack pine varying from 5 to 15 feet in height and occurring in a patchy condition of dense stands interspersed with nearly an equal area of small openings. The crucial requirement of the species appears to be the presence of living pine-branch thickets near the ground, together with numerous small openings. It is significant that Kirtland's Warblers have never been known to come in an area opened by lumbering.

To establish and manage an area for the preservation of this bird, involved the subdivision of a series of contiguous blocks on which even-aged jack pine stands can be managed on a 5 year cutting cycle and harvested as early a date as possible, consistent with minimum sacrifice of timber. Controlled burning and selective planting will be necessary to obtain the desired habitat where natural regeneration is inadequate.

### Tract Size:

Few, if any, warblers are found on tracts of less than 80 acres. The Kirtland's Warbler is most successful in the midst of very extensive homogeneous tracts where conditions are exactly to its liking, but rather unfavorable to nearly all other forms of life. This tends to preserve the Kirtland's Warbler, a comparatively unsuccessful species, by freeing it from heavy pressure of competition.

### Soils:

Nests of the Kirtland's Warbler, perhaps without exception, have been found on one podsol type: Grayling Sand. The soil is sandy and porous. It produces the vegetation required for nesting.

### The Role of Fire:

Under natural conditions, the habitat of the Kirtland's Warbler is produced only by forest fires. This bird, is, therefore, unusual among living creatures in being dependent upon fire.

### Census Data:

A census of this species was undertaken in 1951, and again in 1961, under the direction of Harold Mayfield. The entire population is believed to be between 800 and 1000 birds. The American Ornithologists' Union adopted a resolution in 1961, concerning this endangered species, requesting the U.S. Forest Service, ". . . to insure its continuance in an established location for the enjoyment of all people in the future."

## FOREST MANAGEMENT IN RELATION TO THE KIRTLAND'S WARBLER

### Fire Control:

Burned area objectives on the forest have been established. This acceptable acreage and size of fires are smaller than that capable of producing suitable warbler habitat.

### Planting:

Plantations are rarely used by this bird. Jack pine has not been planted on the forest for a number of years. Large, open areas, available for planting, no longer exist.

### Silviculture:

Selective cutting in pine stands until rotation age will not produce suitable habitat for this warbler. Natural red or jack pine stands do not provide the necessary habitat conditions to maintain this species. Therefore, some modifications of existing silvicultural practices are necessary to produce desirable habitat conditions.

Controlled burning, to obtain adequate reproduction of jack pine, and special planting requirements are necessary to provide habitat which will insure suitable nesting habitat.

### MORTALITY

The cowbird may be a major item in the survival of this species. Losses from parasitized nests are high. Ultimately, the survival of this species may depend on control of the cowbird.

Other major losses include nest desertion and predation.

### THE MANAGEMENT AREA

The area selected for management involves a portion of the Mack Lake Burn. This area now provides ideal habitat. Selecting an area inhabited by existing colonies will limit the effort required to keep the habitat in a condition suitable to the warbler. The Kirtland's Warbler Management Area contains 4010 acres of National Forest land, located 6 miles southeast of Mio, Michigan. The area is within the Huron National Forest.

### MANAGEMENT

Management blocks have been selected and a cutting sequence established which will provide the largest possible area, consistent with the overall management of the area. Management practices such as burning and planting will be undertaken, based on the ecological requirement of this bird, which will produce desirable nesting habitat.

### Signing:

Adequate signing of this area is necessary to inform the public of this project and to control use of the area during the nesting season. Signing the area to control use will have two objectives: (1) Minimum nesting losses, and (2) Obtaining fairly accurate data on the use of this area by the public. Controlled use of the management area will be from May 1 to August 15. It is not the intent of the U.S. Forest Service to prohibit access to the area, but to control situations which might be detrimental to this bird. Such restricted use will not interfere with the normal hunting seasons.

## CORRELATION WITH OTHER USES

### Timber:

The jack pine timber type is one of the dominant timber types on the Huron National Forest. This management plan correlates timber management with the primary objectives of this Management Area.

### Fire Control:

Prescribed or "controlled" burning will be necessary to create favorable warbler nesting habitat since, "under natural conditions the habitat of the Kirtland's Warbler is produced only by forest fires."

### Recreation:

Roadside zones will be eliminated within the Management Area. This is necessary to permit the homogeneous tracts necessary to the welfare of this bird.

### Wildlife"

Extensive homogeneous tracts necessary for the welfare of the bird are unfavorable to other forms of wildlife. Deer populations would not be greatly affected because of their mobility. Deer would benefit from the openings maintained in the area.

### Special Uses:

Mineral activity must necessarily be limited in this area. Warbler colonies have abandoned areas where such activities disturb the site.

Mineral rights, with the exception of one 160 acre parcel, are now vested in the United States. The exception is vested in the State of Michigan. Restrictions will be placed on all lands within the area. Subsurface deposits may be prospected and removed by means of directional drilling only.

## PROJECT FINANCING

### Cooperative Agreements:

Cooperative Agreements have been signed with various groups interested in the preservation of this bird. The Forest Service welcomes the assistance of these organizations. This help will accomplish several mutual objectives: (1) Development of an area for the continued protection of this endangered species; and (2) Provide a working relationship between the Forest Service and the various groups involved, for a mutual understanding of the objectives and aims of each.

### Forest Service:

Forest Service Wildlife funds (080) will be used for those projects which are not a part of normal timber management operations, or in conjunction with other project funds, such as fire control, where benefits are accrued to other resource activities.

## ACKNOWLEDGEMENT

Appreciation is expressed for the technical assistance given by the Michigan Department of Conservation; especially by John Byelich, District Game Supervisor for the Mio area, and Don Douglass, Game Division, Lansing.

Valued suggestions relating to the management area selected were received from Mr. Verne Dockham, retired State Conservation Officer and an authority on Kirtland's Warbler range.

Special mention is given to Harold Mayfield. In addition to conducting a census of the Kirtland's Warbler, his book, The Kirtland's Warbler, published by the Cranbrook Institute of Science in 1960, has provided much of the information upon which this management plan is based.

Dr. Andrew Burger, reviewed the Management Plan and was in charge of the 1961 Warbler Census for Southeastern Oscoda County, which includes the Management Area.

Technical data on the use of fire as a silvicultural tool in jack pine regeneration was obtained from Bill Beaufait.

Special appreciation is expressed to the various organizations which have entered into a Cooperative Agreement with the National Forest Service to help finance the development of this project.



TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT .....	iii
ACKNOWLEDGEMENT .....	vii
TABLE OF CONTENTS .....	viii
LIST OF FIGURES AND TABLES .....	x
INTRODUCTION .....	1
Objectives .....	1
Establishment .....	2
HISTORY .....	4
Winter Range .....	4
Summer Range .....	4
NESTING HABITAT AND POPULATION .....	5
Nesting Range .....	5
Habitat Requirements .....	5
Tract Size .....	9
Soils .....	10
Ground Cover .....	10
The Role of Fire .....	11
Census Data .....	12
BEHAVIOR PATTERNS .....	17
WINTERING GROUNDS AND MIGRATION .....	18
FOREST MANAGEMENT IN RELATION TO THE KIRTLANDS WARBLER .....	19
Fire Control .....	19
Planting .....	21
Silviculture .....	21
MORTALITY .....	25

TABLE OF CONTENTS (Cont'd)

THE MANAGEMENT AREA .....	25
Location .....	26
Cover Types .....	26
MANAGEMENT .....	34
Management Units .....	34
Timber Stand Improvement .....	35
Reforestation .....	35
Spraying .....	36
Controlled Burning .....	37
Signing - Visitor Information .....	43
Cowbird Control .....	50
COORDINATION WITH OTHER USES .....	52
PROJECT FINANCING .....	58
Cooperative Agreements .....	58
Cooperative Projects .....	58
Wildlife Project Funds .....	59
APPENDIX A Kirtland's Warbler Management Area	
B Cover Types - 1961	
C Resolution - American Ornithologists' Union	
D Soils of Michigan	
E Forest Fires - Huron National Forest	
F Prescribed Burning Unit Plan	
G Cooperative Agreements	

LIST OF FIGURES AND TABLES

FIGURES

		<u>Page</u>
Figure 1 -	Kirtland's Warbler Nesting Range	6
Figure 2 -	Management Area Sign	44
Figure 3 -	Major Site Sign	45
Figure 4 -	Special Area Signs	48
Figure 5 -	Access Permit	49

TABLES

Table 1 -	Kirtland's Warbler Census Data	16
Table 2 -	Acreage Burned-Huron National Forest	20
Table 3 -	Cover Types-1948	28
Table 4 -	Cover Types; Summary-1948	30
Table 5 -	Cover Types-1961	31

## KIRTLAND'S WARBLER MANAGEMENT AREA

### INTRODUCTION

The Kirtland's Warbler (Dendroica kirtlandii) or the "Jack-Pine Warbler" as it is often called in Michigan, is a rare, and perhaps, vanishing species. This bird may be regarded as Michigan's special bird because its nesting habitat is restricted to the pine types in the Northeast part of the Lower Peninsula of Michigan. Because it nests in only a few counties in Michigan, people from all over the country have come to observe this bird in its native habitat. It can be extremely expensive to save a bird from extinction as shown by the efforts presently being put forth to preserve the whooping crane. The Michigan Audubon Society feels that this warbler can be held in present numbers through continuous management.

The Huron National Forest is located in the center of the Warbler range. Since this bird is specific in its habitat, and at present some of its best habitat is found within the Huron National Forest, the U. S. Forest Service is in an excellent position to adjust forest management practices on portions of its area to maintain a relatively stable population.

#### Objectives;

The Kirtland's Warbler, like the California Condor or Ivory-billed Woodpecker, is a species that has become adapted to certain limited environmental conditions. It is rather intolerant of changes in its habitat and finds it difficult or impossible to adjust itself to the disturbances, changes, or pressures wrought by ecological changes. There is a possibility that the Kirtland's Warbler will disappear because of "biological eclipse", or natural extinction. Although this may be true, we are not thereby justified in assuming that they will of necessity disappear in a short

period of time. If given help by man this species could continue to exist for many years. There is no warrant for believing that we are wholly incapable of preserving this species from extinction.

The objective of this management plan is to establish and maintain an area for the continued development of Kirtland's Warbler nesting habitat. This will require timber cutting cycles, planting, thinning, or burning which, in turn, will maintain an ecological condition favorable to the creation of ideal nesting cover.

Establishment:

The establishment of a Kirtland's Warbler Management Area will not eliminate the production of other resources on this area. The area will be established with minimum sacrifice of existing or potential wood production. Recreational and wildlife values will be increased. Watershed values will be protected.

Although the bird is not now threatened with immediate extinction because of lack of suitable nesting territory, it is very rare. It is not inconceivable that better control of forest fires and improved forest management might reduce the suitable nesting areas toward the vanishing point at some time in the future. There are some counties in Michigan where the bird formerly nested, but which lack suitable habitat today. It is for these reasons that the establishment of an area dedicated to the preservation of the Kirtland's Warbler and its nesting habitat is justified and a part of the multiple use program of the Lower Michigan National Forest. Concern for this species is shown by the American Ornithologists' Union which passed a resolution (Appendix C) requesting

the U. S. Forest Service,----"to set aside and manage an area for the benefit of this endangered species, to insure its continuance in an established location for the enjoyment of all people in the future."

An analysis of the life history and habits of this song bird is presented by Mr. Harold Mayfield in the The Kirtland's Warbler, published by the Cranbrook Institute of Science. This book is the result of work conducted on this species by the late Jesselyn Van Tyne, Curator of Birds at the Museum of Zoology, University of Michigan, Harold Mayfield, Verne Dockham, and many others interested in the preservation of this species. The life history information, derived from this book, is presented in this report to serve as a basis for this management plan, and the establishment of an area dedicated to the preservation of this warbler.

The establishment of the Kirtland's Warbler Management Area is authorized under the Multiple Use-Sustained Yield Act of June 12, 1960, which authorizes and directs the administration of the various renewable resources of the National Forests for multiple-use benefits with due consideration being given to the relative values of the various resources in particular areas.

## HISTORY

The Kirtland's Warbler is a member of the family Parulidae, or wood warbler. A little smaller than an English Sparrow, this Warbler's best distinguishing features are its bright plumage, its loud song, and a habit of "wagging" its tail up and down.

### Winter Range:

This song bird was first made known from a specimen taken, on May 13, 1851, near Cleveland, Ohio. Its winter range was discovered in 1879 after several specimens were taken from the Bahamas. This bird had never been found outside the Bahamas in winter.

### Summer Range:

The Kirtland's Warbler was known for over 50 years before its nesting grounds were found. The first nest was discovered in July, 1903, near Red Oak, Osceola County, Michigan, by Norman A. Wood. The first nest was found in a tract of several hundred acres, swept by fire about 6 years previous. The area was covered with jack pines three to ten feet tall. Every nest found subsequently has been within 60 miles of the first.

## NESTING HABITAT AND POPULATION

### Nesting Range:

The Kirtland's Warbler nests in scattered locations in some 28 Townships of 12 counties, but not more than 9 at one time, in the Northeastern part of Michigan's Lower Peninsula (Figure 1). The majority of the birds, however, are found in Crawford and Oscoda Counties. The center of the Kirtland's Warbler range and maximum population densities are reached in the Mio Ranger District of the Huron National Forest. Normally, its range is limited to extensive natural jack pine (*Pinus banksiana*) stands. In rare instances it may inhabit mixed jack and red pine plantations. In 1951, several colonies of nesting Kirtland's Warblers were observed in red pine plantations. Among the natural jack pine areas there may be a few scattered red and white pine, scrub oak, aspen, cherry and juneberry. When deciduous trees are numerous, the area is no longer acceptable to the Kirtland's Warbler.

### Habitat Requirements:

Almost without exception this bird can only be found in large blocks of jack pine varying from 5 to 15 feet in height and occurring in a patchy condition of dense stands interspersed with nearly an equal area of small openings.

"Typically, the warblers first appear when the tallest trees of the young growth are about as tall as a man (Christmas tree size), with trunks one to two inches in diameter at the base. However, if the new growth is exceptionally dense ("as thick as timothy hay"), the warblers may appear when the trees are only waist high; and years later, if there are ample openings, the warblers may remain even though many trees have



become larger than the usual limit". (Mayfield, 1960: 14).

Mr. Mayfield goes on further to state that, "The crucial requirement appears to be, not the height of the trees, but the presence of living pine-branch thickets near the ground. Trees are not big enough to produce such thickets until adjacent trees touch each other, and they are too big when the lower limbs die; opening a gap between the foliage and the ground cover. It is characteristic of jack pines that the lower limbs die when shaded; thus, large jack pines close together have no foliage near the ground". (Mayfield, 1960: 14).

To establish and manage an area for the preservation of the Kirtland's Warbler as based on the life history of the bird, involves the selection of an area suitable for subdivision. This subdivision should be a series of contiguous blocks 160 to 320 acres in extent on which even-aged coniferous stands can be established and managed on a 50 to 60 year rotation with a 5 to 10 year cutting cycle at as early a date as possible and consistent with minimum sacrifice of timber. The number of blocks required is dependent on the age interval between blocks. A tolerance of from 5 to 10 years in the age interval would be satisfactory with the shorter interval being preferred.

It might appear that the bird has adequate habitat throughout the forest and that under sustained yield forest management the establishment of a special management area would not be consistent with multiple use management. Management of jack pines for maximum timber production, however, is based on selective cuts until rotation age (about 50-60 years), at which time the stand is clear cut. Where natural regeneration is inadequate, planting supplements the stand to obtain an adequate level of

stocking. Normally, these operations do not occur over large, solid blocks, but are distributed throughout the cutting compartment in blocks ranging in size from several acres to 40 to 80 acres. "It is significant that Kirtland's Warblers have never known to come in an area opened by lumbering". (Mayfield 1960: 23).

The Kirtland's Warbler has, at times, nested in extensive jack and red pine plantations. Their desirability, however, is limited. This can be explained as follows: Plantations at their normal spacing of 6 by 6 feet do not produce suitable thickets where branches touch until they are six to seven feet tall, or about 10 to 11 years old. Openings are likely to be few and small, even with natural mortality. In natural stands, dense thickets provide suitable habitat as early as 6 years.

Pine plantations become unsuitable after two to three years. Where natural mortality may be high, these plantations may last an additional year or two. They become unsuitable more quickly than natural stands because they become dense more quickly. As the lower branches begin dying, the warblers tend to disappear from the interior of the plantation. Where natural openings are numerous these lower branches persist for a number of years. The suitability of a natural tract is variable; it may be as few as six years or as many as 19, with a typical life of 10 to 12 years.

The Michigan Department of Conservation has planted several large areas to determine if planting configuration and densities can be altered to provide suitable habitat that will persist as long as a natural stand. Trees have been planted on a 2 by 2 foot spacing; 15 rows planted with an unplanted strip of equivalent size. This has been repeated throughout the entire plantation. Jack pine, Red pine, and White spruce are

being planted to determine if the birds will nest in red pine or spruce thickets as readily as jack pine. "It seems probably that plantings of other needle-bearing trees might be equally acceptable to the warbler. As Odum (1945: 197) has pointed out about birds in general, the requirement of the Kirtland's Warbler probably is a certain "life form," not a species of plant" (Mayfield, 1960: 16).

#### Tract Size:

On the basis of warbler census data, few, if any, warblers are found on tracts of less than 80 acres, even though birds are present in seemingly identical cover in the same township. Size of tract is an important consideration in the establishment of a nesting site even though the territories defended by the male are relatively small. The average size of the Kirtland's Warbler territory is about eight acres. However, this is more than twice the size of the territory reported for any other North American Warbler.

The Kirtland Warbler seldom occurs in tracts less than 80 acres. Why this occurs is not fully known. However, Mr. Mayfield as well as others working on the bird, believe that the Kirtland's Warbler may be most successful in the midst of very extensive homogeneous tracts where conditions are exactly to its liking, but rather unfavorable to nearly all other forms of bird or animal life. This, they believe, tends to preserve the Kirtland's Warbler, a comparatively unsuccessful species, by freeing it from heavy pressure of competition and predation. The warbler sometimes breeds in smaller tracts of the same habitat, but the spillover of other species from the surrounding mature forest probably operates to the disadvantage of this bird.

### Soils:

Soils of the area are largely podzols (Appendix D). Nests of the Kirtland's Warbler, perhaps without exception, have been found on one podsol type: Grayling Sand. The soil is sandy and porous. The humus layer is thin; or even entirely lacking in many places.

"The nature of the soil is significant to the Kirtland's Warbler in two ways: (1) it produces the vegetation required for the nesting habitat; and (2) it absorbs water so rapidly that rain seldom floods the nests, although they are usually indented into the ground". (Mayfield, 1960: 13). Soils on the Management Area are all classed as Grayling Sands.

Soil types were correlated with warbler populations during the 1961 census by Harold Wing. Only three colonies were found on soils other than Grayling Sand. All were planted with pine, and had other unusual features. One small colony was located in an area planted to jack pine in 1950 as a sand stabilization project. The trees were distorted, with exaggerated growth of the limbs near the ground, as a result of insect infestation.

The other two colonies were located on Rubicon Sand, which is only slightly more fertile than Grayling Sand. Both areas were planted to Red and Jack Pine. One area contained several open strips within the plantation. (Mayfield 1961: 7-8).

### Ground Cover:

The sandy soils, assisted by repeated fires, create a ground cover used for nesting. If the soils were rich, the ground cover would probably become too lush for the warbler.

Shadbush, cherry, bracken fern and sweetfern are characteristic of the plants over one foot in height. Of greater significance is the ground

layer of vegetation. Here, the most common genera, in order of abundance, are bluestem grass, Andropogon (A. Scoparius and A. gerardii); sedge, Carex; wild oat grass, Danthonia (D. Spicata) goldenrod, Solidago; blueberry, Vaccinium; reindeer moss, Cladonia (C. rangiferina); bearberry, Arctostaphylos (A. Uva-Ursi); cherry, Prunus (Chiefly P. pumila); blackberry, Rubus (Zimmerman, 1956: 216).

The Kirtland's Warbler nests in areas with abundant ground cover. A favorite site is under a tussock of dead grass, which forms a natural arch. Woody stems of low growing blueberry support the arch under which the nest is concealed. Perhaps the most distinguishing ground species noted by the casual observer is the blueberry.

#### The Role of Fire:

Forest fires have been an important factor in preserving this bird from extinction. "Under natural conditions, the habitat of the Kirtland's Warbler is produced only by forest fires. This bird is therefore unusual among living creatures in being dependant upon fire" (Mayfield, 1960: 23). Extensive fires have created large tracts of jack pine. Natural regeneration creates ideal habitat. It is in this type of stand that the majority of the warblers, as well as maximum density, has occurred. Fire assists in opening the serotinous cones of the jack pine; thus aiding in germination at the same time fire reduces competition from other plants. The jack pine "plains" of Northern Michigan were undoubtedly created by fire. "As railroads pushed into Michigan and lumbering was at its peak, extensive areas of slash from cutting operations were scattered throughout the peninsula. Fires swept through the slash. For many years the odor of burning wood and reddened sunsets from smoke were a normal feature of the region during the hot, dry months (Davis, 1936: 316-318).

"Without doubt the area in the stage of growth required by the Kirtland's Warbler was at its peak in that period. It seems reasonable to suppose that the area may have amounted to 200,000 acres, most of it in large tracts; that is, at least four times the minimum amount of pre-historic times". (Mayfield, 1960: 25).

Following the big lumber boom of the late 1800's, many of the jack pine "plains" were burned deliberately again and again to encourage the blueberry crop. As late as the 1920's, fires in the Huron National Forest burned an average of more than 5,000 acres per year.

In summary, Mr. Mayfield states that the Kirtland's Warbler is restricted to one small part of the vast range of the jack pine by a combination of three factors found uniquely in Northern Lower Michigan: (1) porous soils, (2) ample ground cover, and (3) unimpeded sweep of forest fires (Mayfield, 1960: 33).

#### Census Data:

Ideal habitat and greatest populations of this warbler are believed to have existed in the period 1880-1900, when lumbering and fires were at their height.

In the 100 years since its discovery, the Kirtland's Warbler has always been an extremely rare bird. Estimates are that only 800 to 1000 birds remain.

To census the total population of any song bird would be a formidable task. However, the Kirtland's Warbler is restrictive in its range as well as in its habitat.

In 1951, under the direction of Harold Mayfield (1953: 17-20), a census of this bird was undertaken. It covered some 1200 sections of land containing suitable habitat within a region about 90 miles square.

Almost all of the suitable habitat in this area is in a state or national forest. Planting records, type map, and forest fire records were available and provided a basis for selecting the most promising areas. All counts were made in June, 1951. Because of their loud, clear call, only singing males were recorded.

The total count was 432 males. The entire population was estimated to be less than 1,000 birds. The accuracy of this census is indicated by the fact that no warblers were found outside those sections reported in the census except for one short-lived "colony" of three pair found in 1952. These birds were located in an isolated area of the smallest size on record (32 acres).

A similar census was conducted during the spring of 1961. Because the nesting habitat remains suitable for only 10-15 years, while the trees are just the right size, the nesting localities are constantly shifting within the breeding range. "For example, among 91 sections with warblers in 1951, only 41 of these held warblers in 1961, and even here the portions occupied were often different in the second census" (Mayfield, 1961: 3).

The 1961 census indicates that the Kirtland's Warbler appears to be maintaining their numbers at present. However, the population is still in a precarious position. There are several factors which indicate that the 1961 population is at a high point, in a population that may be fluctuating considerably from year to year:

1. Distribution on the breeding ground is believed to be becoming more difficult because the special habitat required by the bird is increasingly to be found in pockets isolated from one another by miles of forest of a different type. Control of forest fires will reduce these areas still further. Serious efforts to control forest fires began in Michigan in 1927, and, whereas the average fire in the State burned more than 300 acres in the first quarter of the century, the average fire burned less than 15 acres in the 1940's (Mitchell and Robson, 1950: 20,28). An objective of the Management Area would be to provide continuity of nesting habitat in one area.
2. A large percentage of the birds recorded during the 1961 census were found in areas created by the 1946 burns. These areas are now at, or have passed their optimum, and will soon provide little habitat. Within the Huron National Forest there have been no large fires since 1946 which will create any amount of suitable habitat in the near future. Abnormally high population densities were recorded in an area in Oshtemo County, which contained no birds in the 1951 census. Although the total population in 1961 was about the same as recorded in 1951, the number of sections and townships in which these birds were found was less in 1961 than in 1951. A population which is declining in numbers, typically occupies less and less of its natural range until it is confined, to only those areas which provide the most ideal habitat. This may be occurring with this species.



3. In a species where the average life expectancy is about two years, a poor nesting season, or a period of two to five years in which suitable habitat was scarce or lacking, could prove disastrous.

The warbler population now occupying suitable habitat within the management area is estimated to be 68. The location of the singing males recorded is shown in Appendix B. A census of the management area should be made at least every 5 years to determine population trends, and the effect of the management measures undertaken. Census methods are outlined in Mayfield's 1961 Decennial Census of the Kirtland's Warbler.

TABLE 1  
KIRTLAND'S WARBLER CENSUS DATA

County	1951			1961		
	Males	Town- ships	Sec.	Males	Town- ships	Sec.
Alcona	4	1	1	0	0	0
Crawford	142	7	19	52	6	19
Iosco	74	8	20	30	2	6
Kalkaska	28	1	6	32	2	4
Montmorency	43	2	11	61	2	15
Ogemaw	0	0	0	114	1	5
Oscoda	103	6	19	152	5	22
Otsego	0	0	0	14	1	4
Presque Isle	34	2	13	34	2	9
Roscommon	4	1	2	13	1	2
Clare	0	0	0	0	0	0
Alpena	0	0	0	0	0	0
<b>TOTALS</b>	<b>432</b>	<b>28</b>	<b>91</b>	<b>502</b>	<b>22</b>	<b>86</b>

Mayfield, 1960 and 1961

## BEHAVIOR PATTERNS

The Kirtland's Warbler, while on its nesting grounds, is known for its tameness. It shows almost no fear of humans and has been known to eat out of a person's hand.

At the nesting site one can approach the female with ease. However, if danger is imminent, this warbler may either flee, threaten to attack, freeze, or put on a distraction display. Even though it is relatively tame, it is fully capable of escaping its enemies in its familiar habitat.

"At first glance, tameness would seem to be a disadvantage. It would appear to make the warblers easy to capture by predators, and yet losses of adults on the nesting ground are very low. Although tameness on the part of the female often seems to make nest finding easier for the human observer than it would be otherwise, the quietness and directness of the bird sometimes have the opposite effect". (Mayfield, 1960: 62).

Another characteristic of the Kirtland's Warbler, often used in field identification of this bird, is its habit of "wagging" its tail up and down. This action is more pronounced when the bird is agitated.

## WINTERING GROUNDS AND MIGRATION

"Little is known about the life of the Kirtland's Warbler except during the nesting season. Scant notes by collectors in the 19th Century suggest that the bird is a quiet inhabitant of deciduous brush throughout the Bahama Islands.

Specimens have been collected on most of the principal islands of this group, particularly in the '80s and '90s of the last century. No specimen has been taken there since 1915.

We know too little about the bird's requirements and behavior in winter to consider adequately the factors that may have tended to limit the population on the wintering ground. One variable that may have been important is the extent of land area in the Bahamas. This area was very much larger about 20,000 years ago than at present. At that time, it also had a much richer bird life; a condition that may have been unfavorable to the Kirtland's Warbler. However, the land area in the Bahamas seems to have been not significantly different from that of today during the 6,000 to 8,000 years that the Kirtland's Warbler has been nesting in Michigan.

The Kirtland's Warbler begins its fall migration in late August, and nearly all the birds have left the nesting grounds by September 15. Spring migrants begin entering the United States in April, and the first birds reach the nesting grounds between May 3 and May 20, with an average date of May 12", (Mayfield, 1960: 43).

## FOREST MANAGEMENT IN RELATION TO THE KIRTLAND'S WARBLER

The required habitat for the Kirtland's Warbler is almost entirely dependent upon forest fires and forest plantings. What is the future of this species in light of present and future management practices?

### Fire Control:

A new fire plan for the Forest is being written. This plan sets up objectives of control. The calculated burned area objective for the Mio, Ranger District is a maximum of 246 acres per year out of a total of 228,761 acres within the district's protection boundary. Objectives are established for various priorities of land. High value lands have a lower acreage objective than low value tracts. An objective of maximum allowable burned acreage in the type (priority 3) which, when burned, is likely to produce suitable warbler nesting habitat has been set at 116 acres per year. The majority of this burned acreage would occur in Class A, B, or C fires. These areas would be insufficient in size to provide warbler habitat.

The calculated burned area objective for the Huron National Forest protection area is 370 acres. This new fire plan is based on a program which would require approximately three times the financing outlay that is presently expended.

There have been no large fires on the Huron National Forest since 1946. Table 2 shows acreage burned on the Huron National Forest since 1911. The Mack Lake fire occurred in 1946 and was the last large fire on the forest. In a few years this area will no longer provide suitable warbler habitat unless the habitat is improved for this bird. Appendix E gives the location of all Class C, D, and E fires occurring on the Huron National Forest for the period 1942-1960.

TABLE 4  
 ACRES BURNED - HURON NATIONAL FOREST  
 (All Lands Within Protection Area)

<u>Year</u>	<u>Acres</u>	<u>Year</u>	<u>Acres</u>
1911	10,996	1935	175
1912	3,103	1936	314
1913	19,125	1937	1,783
1914	17,483	1938	184
1915	23,350	1939	67
1916	14,408	1940	76
1917	4,135	1941	474
1918	10,778	1942	1,075
1919	14,217	1943	266
1920	11,209	1944	289
1921	3,450	1945	4,238
1922	235	1946	17,066
1923	2,220	1947	155
1924	1,776	1948	387
1925	9,841	1949	209
1926	16,626	1950	28
1927	411	1951	12
1928	11	1952	127
1929	1,564	1953	201
1930	1,459	1954	62
1931	1,071	1955	338
1932	11,320	1956	28
1933	2,191	1957	1,030
1934	945	1958	244
		1959	177
		1960	14
		1961	298
		<b>TOTAL</b>	<b>201,228</b>

Along with more intensive forest management will come a need for greater fire protection. The possibility of a large fire always exists. However, an objective has been established to keep the size of fires below an acceptable acreage. This acceptable size is smaller than that capable of producing suitable warbler habitat.

#### Planting:

Jack and Red Pine plantations have been used by the Kirtland's Warbler, although not to any great extent. Jack Pine has not been planted on the Forest for a number of years. The existing plantations either no longer provide suitable habitat; or, will soon pass the stage of growth acceptable to the warbler.

Red pine plantations are no longer being planted in large, open, tracts, because such areas are non-existent. The planting program is now confined to smaller blocks, or to oak sites which are being underplanted to pine. This type of planting will not provide suitable warbler habitat.

#### Silviculture:

As previously stated, present sustained yield management in jack pine is aimed at <sup>a Regeneration cut followed by a Harvest cut at Present</sup> selective cutting until rotation age. More intensive management will require individual tree marking (which is being started now) to a given basal area <sup>30-40</sup> per acre. An objective of the final harvest cut will be an adequate <sup>uniform</sup> level of restocking <sup>over all zones</sup>. The possibility of controlled burning to obtain adequate reproduction may improve the habitat for this species. However, little has been done at present on using fire as a regular management tool in jack pine. It might be noted again that the Kirtland's Warbler has never been found in an area following timber cutting, and which has been kept free of fire.

## MORTALITY

### The Cowbird:

Why the Kirtland's Warbler is rare is not yet fully known. However, in addition to the factor of its very selective habitat, the Brown-headed Cowbird may be a major item in its survival.

The Cowbird is a parasite on other birds, including the Kirtland's Warbler. It lays its eggs in the nest of this warbler. Studies have shown that the warbler is particularly vulnerable; or, seen from the viewpoint of the cowbird, it is the perfect host (Mayfield, 1960: 144).

It is believed that the Kirtland's Warbler has felt the influence of the Cowbird only within the last 80 years. "The Brown-headed Cowbird, a native of the Western Plains, which was probably not present here until the forests were cleared for farming up to the nesting ground of the Kirtland's Warbler. This social parasite, which removes warbler eggs and places its own eggs in the warbler nest, takes a heavy toll of the reproductive potential of the warbler, already a marginal bird". (Mayfield, 1960: 3)

"The loss of warbler eggs in parasitized nests was 41 per cent of the eggs laid; the loss in all nests, 55 per cent of them parasitized, was 23 per cent of warbler eggs laid - these losses from egg removal alone.

The Cowbird takes a heavy toll at every step of the nesting process. The probability that eggs present at hatching time will hatch is 85 per cent among warbler eggs alone, but 75 per cent with cowbird eggs present; the rate is lower in nests with several cowbird eggs than in nests with only one. The presence of young cowbirds in the nest reduces by .55 the probability that warblers will be fledged. The presence of two or more cowbirds



hatched ahead of the warblers is lethal to the warbler nestlings". (Mayfield, 1960: 181).

Mr. Mayfield has further concluded that, with 55 per cent of the present nests parasitized, and with the success of eggs in nests not molested by cowbirds, the Kirtland's Warbler would produce 60 per cent more fledglings if there were no cowbird interference.

Ultimately, the survival of this species may depend on control of the cowbird. This problem is treated in the management portion of this Plan.

#### Predators:

Among Kirtland's Warbler nests lost, two-thirds are destroyed by predators. Most predation is believed to be done by birds, such as the Blue Jay, Crow and Cowbird. The Red Squirrel and thirteen-lined Ground Squirrel are believed to be the chief mammal predators.

One-third of those nests lost are through the female deserting the nest. This may be due to disturbance, flooding, death of the female, removal of eggs by the cowbird (the warbler does not often desert as a result of egg removal however), or long incubation.

Mayfield further states that, "---- the probability that eggs will survive from the start of incubation to hatching time is .54; the probability that eggs present at hatching time will produce live nestlings through the hatching period is .78; the probability that young birds will survive the nesting period to fledging is .76; the probability that eggs at the start of incubation will produce fledglings is .32 in the absence of cowbirds. However, with about half the nests parasitized by cowbirds, the probability that Kirtland's Warbler eggs will produce fledglings is reduced to about .19.

Thus, about 0.9 young are produced per nest at present, instead of about 1.5 per nest which would be produced without interference by cowbirds.

"The production of fledglings per pair of adult Kirtland's Warblers per season at present is about 1.4; without cowbird interference it would be about 2.2.

The survival of adult Kirtland's Warblers is about 60 per cent per year, and the life expectancy of an adult is about two years.

We have no direct evidence for calculating the survival rate of Kirtland's Warblers in their first year of life. Other data suggest it would have to be more than 50 per cent - an improbable figure - to maintain the population" (Mayfield, 1960: 208-209).

Mr. Mayfield then goes on to point out an important aspect of his study - one which is the basis of this management plan, and the basis for which this area should be established. That is, that, if the samples in his study are typical, the population of the Kirtland's Warbler has been declining. With the number estimated at less than 1000 - the number of birds remaining - and present management practices in effect which limit the habitat of this species, the establishment of a special management area, dedicated to the preservation of this species, is necessary to preserve this bird from eventual extinction.

## THE MANAGEMENT AREA

The Kirtland's Warbler usually returns almost exactly to its former nesting site. It nests in "colonies", or assemblies of pairs; each pair having an exclusive territory within the colony. They tend to stay in this area even though the habitat may be declining. This characteristic may reduce its chances of exploiting new areas at any great distance from its former territory. An isolated pair in any area is usually an indication of a declining colony.

The Kirtland's Warbler is found only where the Jack-pine tracts occur most compactly and on the poorest soils where the warbler finds the ecological "niche" needed for survival.

These two aspects of the life history of this species make the establishment of a management area feasible and desirable as a means of preserving this bird.

There appears no immediate threat of extinction. Nevertheless the establishment of this management area (in conjunction with three 2560 acre areas set up outside the Forest by The Michigan Department of Conservation in 1957) will provide areas where the bird will be given special encouragement in the years ahead.

It is desirable to select a management area now inhabited by this bird to preserve existing colonies, as well as limiting the effort required to keep the habitat in a condition suitable to the warbler.

Valuable assistance in locating the area was obtained from John Byelich, District Game Supervisor, Michigan Department of Conservation, and Mr. Verne Dookham, retired conservation officer at Mio, Michigan, whose knowledge of Kirtland's Warbler range is unmatched.

The area selected is a part of the Mack Lake Burn, which occurred in April 1946, covering approximately 6470 acres. Much of this burn now provides good warbler habitat, and holds a high percentage of the remaining population of this species. It can be expected that most of the Mack Lake Burn area will become unsuitable for this bird in the near future, much of it within five years. The area will reach a stage of growth unacceptable to the warbler unless special action is undertaken.

Location:

The Kirtland's Warbler Management Area is located in Sections 1, 2, 3, 11, 12, and 13 of Township 25 North, Range 3 East; and Sections 7, 18, and 19 of Township 25 North, Range 4 East, Michigan Meridian (Appendix A). It encompasses 4010 acres of national forest land in solid ownership.

The area is located 10 miles from Mio, Michigan, and within 6 miles of Highway M 33, an all weather asphalt road. One major consideration in selecting this area is the presence of a drivable road around the area. Individual sections or management blocks also have roads along all four sides. These will be necessary where prescribed burning is indicated.

Cover Types:

Cover types as of 1948 are shown on the 1948 Timber Survey Maps (Tables 3 and 4; and Appendix A. Since these maps are 12 years old, they have only been used as a base map, and to indicate trends in the ecological succession of the area.

A detailed cover type survey of the area was necessary to show the present cover types, age, height, and the suitability of the various types in relation to desired Kirtland's Warbler habitat (Appendix B). The various

types were correlated with the 1961 warbler census in this area to verify our conclusion about optimum warbler habitat.

This detailed cover map provides the basis for the Management Plan of this area. Tables 5 and 6 summarize the cover types and acreage mapped during 1961.

25-36

TABLE 3

KIRTLAND'S WARBLER MANAGEMENT AREA  
Timber Types - 1948

UNIT A (640 Acres)

Sec 1

<u>Block</u>	<u>0</u>	<u>5b'</u>	<u>5b''</u>	<u>5b'''</u>	<u>5c'</u>	<u>5c''</u>	<u>5c'''</u>	<u>5d'</u>	<u>5d''</u>
2		75	201	4	3	30		3	4
4	7	45	214		52	2			
<b>Total</b>	<u>7</u>	<u>120</u>	<u>415</u>	<u>4</u>	<u>55</u>	<u>32</u>		<u>3</u>	<u>4</u>

UNIT B (640 Acres)

28

Sec 2

<u>Block</u>	<u>0</u>	<u>5b'</u>	<u>5b''</u>	<u>5b'''</u>	<u>5c'</u>	<u>5c''</u>	<u>5c'''</u>	<u>5d'''</u>	<u>5e'</u>	<u>5e''</u>
1		57	148	88				10	5	12
3	98	54	133	10	1	5				19
<b>Total</b>	<u>98</u>	<u>111</u>	<u>281</u>	<u>98</u>	<u>1</u>	<u>5</u>		<u>10</u>	<u>5</u>	<u>31</u>

UNIT C (640 Acres)

Sec 11

<u>Block</u>	<u>0</u>	<u>Is</u>	<u>5b'</u>	<u>P5b'</u>	<u>P5b''</u>	<u>P5'''</u>	<u>5b''/P8b'</u>
5	188	4	3	26		89	10
7	38		3		24	158	27
<b>Total</b>	<u>226</u>	<u>4</u>	<u>6</u>	<u>26</u>	<u>24</u>	<u>247</u>	<u>107</u>

TABLE 3 (Cont'd)

UNIT D (754 Acres)

<u>Block</u>	<u>0</u>	<u>5b'</u>	<u>5b'''</u>	<u>5c'</u>	<u>5b'/P8b'</u>	<u>5b'''/P8b'</u>	<u>P5b'</u>	<u>Kb'</u>	<u>Ab'''</u>	<u>Kb'/P8b'</u>	<u>P8</u>
6	166	8		5	74	27	80	17	3	56	
8	12	24	41		23	63					38
<b>Total</b>	<u>178</u>	<u>32</u>	<u>41</u>	<u>5</u>	<u>23</u>	<u>90</u>	<u>30</u>	<u>17</u>	<u>3</u>	<u>56</u>	<u>38</u>

UNIT E (696 Acres)

<u>Block</u>	<u>0</u>	<u>5b'</u>	<u>5b'''</u>	<u>5c'</u>	<u>5b''/P8b'</u>	<u>5b'''/P8b'</u>	<u>Kb'</u>	<u>Kb''/P8b'</u>	<u>Ab'</u>	<u>5b'/P8b'</u>
9	106	55	9	1	48	9	19	17	50	1
10	133	23	17		61	58				49
<b>Total</b>	<u>239</u>	<u>78</u>	<u>26</u>	<u>1</u>	<u>109</u>	<u>67</u>	<u>19</u>	<u>17</u>	<u>50</u>	<u>90</u>

UNIT F (640 Acres)

<u>Block</u>	<u>5b'</u>	<u>5b''</u>	<u>5b'''</u>	<u>Kb'</u>	<u>Kc'''</u>	<u>0</u>	<u>5c'''</u>
11	38	65	192	16	9		
12	35	28	118			125	14
<b>Total</b>	<u>73</u>	<u>93</u>	<u>310</u>	<u>16</u>	<u>9</u>	<u>125</u>	<u>14</u>

*Sec 12 + 13*

29

*Sec 12*

*Sec 13*

TABLE 4

KIRTLAND'S WARBLER MANAGEMENT AREA

<u>TYPE</u>	<u>ACREAGE</u>	<u>PERCENT</u>
0	873	21.8
5b''	739	19.7
5b'''	479	12.0
5b'	420	10.5
5b''/P8b'	407	10.1
P5b'''	247	6.2
5b'''/P8b'	247	6.2
P5b'	106	2.6
Kb', Kb'''	65	1.6
5c'	61	1.5
Kb'/P8b'	56	1.4
Ab'	50	1.2
Kc', Kc'', Kc'''	49	1.2
P8b'	38	.9
5c''	33	.8
P5b''	24	.6
5b'/P8b'	23	.6
5c'''	19	.5
Kb''/P8b'	17	.4
Is, Ab'''	7	.2
	<u>4,010</u>	<u>100.0</u>



KIRTLAND'S WARBLER MANAGEMENT AREA  
Cover Types - 1962

TABLE 5

Management Area	Total Area	Nesting Area	Acres Avail- able habitat	GROWING STOCK				Other ox, etc.
				(By Age Class - Years)	30-40	25-29	20-24	
Unit A Block 2 (N <sub>2</sub> ) Block 1 (S <sub>2</sub> )	320 ac.	7	-	-	-	-	210	-
Unit B Block 1 (N <sub>1</sub> ) Block 3 (S <sub>1</sub> )	320 ac.	-	-	-	32	130	190	1
Unit C Block 5 (N <sub>1</sub> ) Block 7 (S <sub>1</sub> )	320 ac.	210	50	-	-	-	106	4
Unit D Block 6 (Sec. 12)	436 ac.	115	319	12	90	114	11	4
Unit E Block 8 (Sec. 12, 13)	318 ac.	42	42	-	130	144	-	2
Unit E - - - Block 9 (Sec. 7)	315 ac.	-	105	-	26	60	124	-
Sections 125N-R3E Block 10 (Sec. 13, 14) T25N R 3 E	381 ac.	-	-	-	137	215	29	-
Unit F Block 11 (N <sub>1</sub> ) Block 12 (S <sub>1</sub> )	320 ac.	-	115	-	-	-	320	-
Total	4010 ac.	629	938	-	352	906	1787	27

## MANAGEMENT

### Management Units:

The objective of the management system established for this area involves the selection of 12 management units (Appendix A), each approximately 320 acres in size. The long range objective of this management area will be to maintain at least one section (640 acres) of land in suitable condition to attract the Kirtland's Warbler.

The Kirtland's Warbler is most successful in the midst of very extensive homogeneous tracts where conditions are exactly to its liking, but rather unfavorable to nearly all other forms of life. Therefore, it is particularly desirable to establish tracts of such size that there is at least one area of large size at all times in the stage of tree growth suitable to this bird.

Cutting cycles have been set at five year intervals. The cutting sequence is such that the area suitable to the warbler is the largest possible, consistent with the overall management of the area.

The suitability of any natural tract may last as long as 20 years. Its typical life is 10 to 12 years. Under intensive management an objective of 15 years use would not be unreasonable. Using this as an objective, three 320 acre cutting blocks, or a total of 960 acres might provide Kirtland's Warbler habitat at any one time. To obtain the largest area possible, cutting blocks are contiguous to each other. In other words, any one block scheduled for cutting has been located adjacent to the block previously cut. Ultimate age class distribution within the cutting units might be as follows:

MANAGEMENT BLOCKAGE

2	0-5 - Young
4	6-10 - Just becoming suitable
5	11-15 - Prime warbler habitat
6	16-20 - Less suitable
1	21-25 - Not suitable-timber growth
3	26-30 - Timber growth
7	21-35 - Timber growth
8	36-40 - Timber growth
10	41-45 - Timber growth
9	46-50 - Timber growth
11	51-55 - Timber growth
12	56 -60 - Harvest, reproduction established

The establishment of this cutting sequence may involve cutting several blocks before the 55-60 year harvest age is reached. This is necessary because the present stand is composed primarily of two age groups, resulting from the Mack Lake Burn.

The Plan sets up suggested cutting blocks and management practices. However, it must be flexible to permit alterations based on current research on the Kirtland's Warbler, or silvicultural practices necessary to maintain the desired habitat.

Timber Stand Improvement:

Optimum warbler habitat contains numerous openings. These can be planted, after the management units no longer provide habitat for warbler nesting (about 20 years). A 55-60 year rotation age would allow sufficient time for these trees to reach harvest age. T.S.I. work, such as thinning, should be undertaken only on those areas which are no longer suitable as warbler habitat.

Reforestation:

Natural regeneration may be insufficient following cutting and burning, although with the amount of natural openings required this is believed not to be a major problem.

Where planting may be required, however, it will be in one-chain wide strips, separated by unplanted strips one-half chain in width, leaving a two-chain wide strip open at the stand edge. This is to limit the overflow of competitive species from the surrounding areas.

Heavy furrowing will be avoided to minimize the destruction of existing ground cover. Planting will be on a 3 x 3 foot spacing.

Species other than jack pine may be used. However, the dominant species in the stand will be jack pine. This may require planting jack pine if natural reproduction is lacking.

The selection of the species to plant will be somewhat dependent upon research being conducted on the bird's preference of the various conifers. It is hopeful that this study will show that birds may not have a preference among the various conifers, provided that the basic requirements (pine thickets interspersed with openings) are met in sufficient quantity on dry, sandy land. Red pine does not occur in this condition in natural stands.

Where good cover is lacking, a clear cut at rotation age will be the basis for creating the proper conditions where planting is employed. This will encourage a denser ground cover. Where ground cover is dense, prescribed or controlled burning will be employed to reduce excessive ground vegetation, which, in time, might become too rank for nesting cover.

#### Spraying:

The use of insecticides will not be permitted within the management area, unless selective chemicals are developed which are non-toxic to bird life. Careful attention will be given to any spray operation throughout the forest to ensure that these chemicals are not detrimental to wildlife. Specific attention must be given to those stands which provide suitable habitat for warbler nesting to protect this bird.

## Controlled Burning:

### 1. Introduction

Historically, fire has been the most important factor in the establishment of natural jack pine reproduction, and Kirtland's Warbler habitat. Although the use of "controlled" or "prescribed" burning is not new, there has been a reluctance to employ fire because of the potential hazards involved.

The use of controlled burning as a management tool in the regeneration, or modification, of forest types has become of increasing interest to forest managers and wildlife biologists. It is being used more and more in efforts to regenerate jack pine following harvest of mature stands. The Michigan Game Division has pioneered its use for the improvement of game habitat. A review of the characteristics of jack pine and recent research on controlled burning was made in order to develop management plans for obtaining optimum habitat.

Jack pine occupies nearly one million acres of forest land in Michigan. Many cut-over jack pine areas have failed to regenerate within a reasonable length of time. Although these sites can be planted, regeneration of jack pine by such artificial means is expensive (\$20.00-\$25.00/acre). The most economic solution lies in successful regeneration through improved silvicultural treatment.

### 2. Cone Serotiny

The primary reason for the failure of jack pine to regenerate itself is because the cones exhibit some measure of serotiny. Higher

than normal temperatures are required to open the cones and release their seed (Beaufait, W.R., 1960: 194). The advantages of controlled burning in Jack pine include the preparation of a mineral seedbed and exposure of the serotinous cones to temperatures likely to assist dispersal of the seed. To be a useful silvicultural tool, controlled burning must release the seeds from serotinous cones, but not destroy the viable seed. Studies have shown that only actual cone ignition appears to affect the viability of seeds. The interval between cone opening and ignition lies in a range of temperatures between 200°F and 1300°F. "Since the heat liberated by either surface fires or crown torching does not ash the cones of standing trees, and since very high temperatures are not likely to last as long as three minutes in the crowns of seed trees, it is logical to conclude that seed viability is not markedly affected by prescribed burning (Beaufait, W.R., 1960: 198).

Burning is not as severe a treatment as is often believed. With adequate precautions, controlled burning can be accomplished with safety to achieve regeneration.

### 3. Jack Pine Regeneration

Jack pine is an intolerant tree, but as a seedling, it will become established and grow under stands with crown closure up to 50 per cent. Seed germination occurs whenever 10-day average maximum air temperatures exceed 64°F, if given adequate moisture. On the proposed Management Area, the best conditions for germination will probably occur between the first and third weeks in June.

Perhaps the most important requirement for successful regeneration of jack pine is a desirable type and conditions of the seed bed. Mineral soil is the most favorable for germination and early survival.

#### 4. Seed Bed Preparation

There are two economically feasible methods of preparing an adequate seedbed - scarification and prescribed burning. Disking or scalping exposes mineral soil by removing the soil containing incorporated organic material. Although the displaced organic matter is still available to the trees at some time during their lives, the young seedlings have been deprived of this storehouse of nutrients as well as the more effective moisture holding capacity of this layer. Burring has no noticeable influence on soil nutrient levels, and is at least as favorable for germination and first year survival of jack pine as are untreated areas (Beaufait, W.R., 1960: 62).

#### 5. Effects of Shade

Temperature and soil moisture fluctuations effect regeneration and seedling growth. The greatest fluctuation appears in unshaded areas. This appears critical only when soil moisture is limiting. The beneficial sheltering effect of shade is more than off-set by its deleterious effect on intolerant second year jack pine seedlings (Beaufait, W.R., 1960: 38).

#### 6. Controlled Burning and Seedbed Preparation

Prescribed burns have demonstrated a capacity to prepare a mineral seedbed. Incomplete combustion of the fuels, however, combines the bad features of fire with the disadvantages of no site treatment.

The area is blackened to absorb more solar heat, yet the organic duff remains with all its tendency to reduce the amount of water available to germinating seeds. Complete combustion, on the other hand, results in a small amount of ash which rapidly loses its blackened appearance. Heavier fuels, such as large limbs, remain to provide the shade shown to be helpful to seedling establishment. Also, controlled burning releases a seed supply to the prepared site, while disking or other scarification techniques do not influence seed dispersal.

Seedbed preparation after seedling establishment also effects survival due to seedling competition with the other plants. The most vigorous seedlings occur on burned sites (Beaufait, W.R., 1960: 41).

#### 7. Controlled Burning Preparations

Controlled burning can be expected to produce the desired mineral soil exposure if sufficient dry fuel is present. However, regeneration depends upon an aerial source of seed, since all cones present in slash are burned, destroying all viable seed.

Recommendations for controlled burning include approximately 15 evenly distributed seed trees per acre marked to leave before cutting operations begin. This would amount to about 2-3 cords per acre.

During the cutting operation, all slash should be lopped and scattered. The slash should be drawn away from the base of each seed tree. Slash from the harvested trees, will provide a relatively



uniform fuel supply after a short curing period of 1-3 months. Even though the slash is withdrawn from seed trees, none can be expected to survive a controlled burn due to the high temperatures of the fire - ranging from 1400°F at one foot above the ground, to an average of 600°F at 17 feet. However, whether or not the seed tree crowns torch, the seeds from cones in these crowns remain viable - the brief period of intense heat being only sufficient to open the cones.

#### 8. Burning Operations

Whatever method of burning is employed, the objective must be to produce a hot fire. A backing fire is hotter, slower, and consumes a greater portion of the available fuel than does a head-fire, but factors such as wind and burning index will effect this. Where burning conditions and fuel supply are optional, combustion will be complete, and the resulting ash will soon be incorporated into the soil, preparing the seedbed for regeneration. Following adequate regeneration, the remaining seed trees should be cut to reduce this shade level as outlined under Section 5, "Effects of Shade".

#### 9. Seedling Failure

If seedbed or moisture factors adversely affect seedling survival, additional measures may be necessary to secure jack pine reproduction. However, many viable seeds remain on the ground at the end of a growing season. Seedlings often appear on burns during later years. Artificial regeneration should be accomplished only if natural regeneration does not occur in 3-5 years. The possibility of aerial seedling should also be investigated.

#### 10. Costs

The Michigan Department of Conservation has used controlled burning as a management tool to increase browse production and improve sharptail habitat. Over 6,000 acres have been burned since 1946 at an average cost of about \$ .040 per acre. Recently, off-site aspen stands were burned at a cost of \$1.40 per acre, including all labor. However, some prison-inmate labor was used on these projects. It might be expected that controlled burning on the Management Area could be accomplished for \$2.00 - \$3.00 per acre.

#### 11. The Management Area

The 12 cutting blocks were established to permit controlled burning, with minimum control effort, to insure jack pine reproduction and to reduce competition of ground species. Optimum Kirtland's Warbler habitat is found on old burns. Until studies show that burning is unnecessary, it should be undertaken on these areas.

Controlled burning to encourage jack pine reproduction is relatively new. Present research, however, indicates that spring burning would be more desirable than fall burning in terms of optimum stand composition. Management blocks cut at harvest age would not provide nesting habitat for a number of years and would, therefore, be suitable for spring burning without effecting nesting birds. Weather, an important factor in controlled burning, is more reliable during the spring. Fall burning may be necessary where there would be any chance of warbler nesting in progress.

Prescribed burning is a technical job requiring considerable knowledge and experience. Burning projects require a control plan. Unit burning plans will be prepared in accordance with the Forest Service Manual.

Signing--Visitor Information:

It is the responsibility of the Forest Service to keep the public informed of the activities of the Forest Service. One way this is accomplished is through adequate signing of the various multiple use activities of the Forest. Information signs, designating the Kirtland's Warbler Management Area are planned at four locations. These are along the major routes of travel bordering the area, as shown in Appendix A. Information signs<sup>3 ea</sup> will describe the area, list its objectives, and briefly describe the management measures being taken to preserve this bird (Figure 2). A rustic information sign listing the major cooperating agencies, and objectives of the area will be located near the center of the area along F.R. 4138 (Figure 3).

The question might arise concerning whether or not such dedication of an area might eventually create such public interest in this warbler, that excessive use of the area would be detrimental to the bird. However, we believe the kind of person who knows one songbird from another and is willing to make a special trip to see this warbler is likely to be fairly well informed about birds already and an ultra-conservationist in his viewpoint. The field-glass observer does little or no harm. Of major concern would be large groups or photographers, who, if not careful could cause the abandonment of a nest, or its eventual loss through predation. We believe that this can be easily curbed if the area is adequately signed and ground rules posted.

Use of the area should be controlled during the nesting season. Signing the area to limit or control its use will have two objectives:

# KIRTLAND'S WARBLER MANAGEMENT AREA

MANAGED IN COOPERATION WITH

PONTIAC AUDUBON CLUB

MICHIGAN AUDUBON SOCIETY

DETROIT AUDUBON SOCIETY

MICHIGAN NATURAL AREAS COUNCIL

THIS AREA OF 4010 ACRES IS MANAGED TO PRESERVE THE NESTING HABITAT OF THE KIRTLAND'S WARBLER, A RARE SONG BIRD, WHICH NESTS ONLY IN THIS GENERAL AREA OF MICHIGAN. CONTROLLED BURNING, TIMBER HARVESTING, AND SPECIAL PLANTINGS ARE MADE TO PRODUCE THE YOUNG PINE REQUIRED BY THE BIRD FOR NESTING. MULTIPLE USE PROVIDES FOR THE NEEDS OF WILDLIFE AS WELL AS FOR WOOD, RECREATION, AND WATER.

## HURON NATIONAL FOREST



*Construction sheet 3.*

**ACTION POSTER BOARDS (Small Size)**

Board Size: 12 x 16 ← *see figure 2 P. 44*

Mounting : 4 x 4 Post

Letters : Typed - Metal Sheet  
as follows:

**KIRTLAND'S WARBLER MANAGEMENT AREA**

(ENTER ONLY BY PERMISSION BETWEEN MAY 1 AND AUG. 15)

**OBJECTIVE**

This area protected and managed by the National Forest Service to preserve the nesting habitat of the Kirtland's Warbler.

**THE KIRTLAND'S WARBLER**

This rare song bird nests only in a small area of Lower Michigan. It can, therefore, be regarded as Michigan's bird. It is about the size of an English Sparrow; yellow and gray in color.

Almost without exception, this bird can only be found in large areas containing jack pine from 5 to 15 feet in height.

**MANAGEMENT**

To preserve this bird from extinction, areas are cut-over in order to obtain young jack pine. Controlled burning and special planting measures are also undertaken to provide this bird with a suitable place to nest. A total of 4,010 acres have been set up in this area. The timber is cut according to a prescribed management plan.

**RESTRICTIONS**

The Kirtland's Warbler is fully protected by State game laws. You may not enter this area between May 1 and August 15 without written approval from the District Ranger, U.S. Forest Service or the Michigan Department of Conservation, both located at Mio, Michigan.

BY ORDER OF

L.A. POMMERENING  
Forest Supervisor  
Lower Michigan N.F.

PLEASE HELP PROTECT THESE BIRDS.

- 13
1. Minimum nesting losses.
  2. Obtaining fairly accurate visitor-use data by persons interested in observing this bird.

Adequate signing will be necessary to accomplish these objectives. Controlled use of the Management Area will be from May 1 to August 15, a period of  $3\frac{1}{2}$  months. This interval will cover the period from when the birds arrive at their nesting grounds until most birds have left for their wintering grounds in the Bahamas. Such restricted use will not interfere with the normal hunting seasons, or with blueberry picking.

Signs prohibiting access between May 1 and August 15 will be required around only those management blocks which contain suitable habitat, as well as at several locations along the main gravel road running through the area. Signs should be 7 by 10 inches, black on yellow, and of standard gauge metal (Figure 4). Metal signs are required if the area is to be managed on a permanent basis.

Approximately one sign every 500 feet will be sufficient. This would require about 300 signs with 4" x 4" x 8' treated and stained posts.

Authorization to enter the Management Area can be obtained from any of the 3 District Rangers of the Huron National Forest, or from the Michigan Department of Conservation's field office located at Mio, Michigan. Mimeographed forms (Figure 5) will be sufficient. These will be prepared by the Lower Michigan National Forest.

Brochure:

A brochure will be prepared which will serve to acquaint the general public with the area, and serve as a guide for the many individuals who request information on where and when to see the bird.

Figure 4

300 metal signs  
7" x 10"

Note: Rectangular wooden  
backs will be  
slightly longer than  
7 x 10

**KIRTLAND'S WARBLER MANAGEMENT AREA**  
**NOTICE**  
**ENTER BY PERMIT ONLY**  
**BETWEEN MAY 1 AND AUG. 15**


Each sign will be  
erected on a  
4' x 4' post.



THIS AREA MANAGED TO PRESERVE THE NESTING HABITAT OF THE KIRTLAND'S  
 WARBLER, A RARE BIRD. ENTER BETWEEN MAY 1 AND AUGUST 15 BY PERMIT  
 ONLY. PERMITS OBTAINED FROM DISTRICT RANGER, U. S. FOREST SERVICE,  
 OR MICHIGAN DEPARTMENT OF CONSERVATION - MIO, MICHIGAN.

BY ORDER OF

**L.A. POMMERENING**  
**FOREST SUPERVISOR**  
**LOWER MICHIGAN NATIONAL FOREST**

No. _____	No. _____		
			
	is authorized to enter the Kirtland's Warbler Management Area subject to the following restrictions:		
	1. The Kirtland's Warbler is fully protected by Michigan and United States Laws.		
	2. Disturbance of trees, nest, nesting birds, etc., Prohibited. Photography of nests or nesting birds strictly prohibited.		
	3. For use on _____ date(s) only		
DATE	By order of Forest Supervisor, Lower Michigan National Forest under Regulation U-10, U. S. Department of Agriculture.		
NO. IN PARTY	ISSUED BY:		
VISITS			
MAN DAYS USE			
	Date- _____		
	Date- _____		
	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">MICHIGAN DEPT. OF CONSERVATION</td> <td style="width: 50%; text-align: center;">U.S. FOREST SERVICE</td> </tr> </table>	MICHIGAN DEPT. OF CONSERVATION	U.S. FOREST SERVICE
MICHIGAN DEPT. OF CONSERVATION	U.S. FOREST SERVICE		



### Cowbird Control

Cowbird parasitism is believed to be a major factor in the Warbler's survival. ". . ., as a direct result of the cowbird 73 per cent of warbler eggs in parasitized nests fail to produce fledglings. Some 55 per cent of all Kirtland's Warbler nests are parasitized, the cowbird causes the loss of about 43 per cent of all Kirtland's Warbler eggs between laying and fledging, in nests not destroyed or abandoned". (Mayfield, 1960: 177). Eliminating the cowbird would not bring to fledging all the young whose loss is statistically attributable to cowbirds, however, because other causes, such as destruction and desertion of nests would occur. Control of the cowbird would eliminate much of the loss that does occur. Control of the cowbird is now the subject of further study.

At present, there are several approaches which can be suggested to reduce the frequency of cowbird parasitism, and thereby increase the rate of survival of this species:

1. Controlled Hunting.

The cowbird normally arrives on the nesting grounds a week or two before the arrival of the Kirtland's Warbler. If the cowbirds have established a definite home range local control may be effective. Studies are needed to determine the rate at which natural repopulation of cowbirds occur following controlled hunting.

2. Egg Punctures.

Egg punctures are an effective way of eliminating the hatching success of the cowbird. However, this method requires that the nest be found - a time consuming job. It may also be that nests untouched by human beings may succeed better than those visited

by humans. Egg removal may cause nest desertion and is not recommended.

3. Trapping and Release.

To study the homing instincts of the cowbird as well as to learn more about home range and repopulation of the cowbird, a trapping and banding study should be initiated. This study might also have the effect of reducing the population of the cowbird within the warbler range. The study should be conducted by a University or individual in cooperation with the Forest Service.

Of the three methods mentioned above, the first, controlled hunting, appears to be the most feasible at present. Studies on controlled hunting should be attempted at an early date.

## CORRELATION WITH OTHER USES

### A. Timber

The jack pine timber type, as of July 1950, is one of the dominant timber types on the Huren National Forest. It occupies approximately 140,000 acres or 36 percent of the productive timber types on the forest. Of this, about 109,000 acres are classed as "re-stocking" or production. The estimated annual cut each year is about 16,000 acres.

A condition exists on the management area where remnants of older trees occur as small groups. These are remnants which have survived previous forest fires. The spread of spruce budworm in these old trees has caused insect damage to many of the younger stands. These older trees also limit warbler nesting. Cutting the older trees will limit budworm damage. In some areas it may increase the available habitat for this bird. The operation of the management area provides for the establishment of even aged stands of jack pine. This will reduce insect damage, promote better growth and provide for maximum timber products consistent with the objectives of the management area.

The Kirtland's Warbler area is comprised of compartments 143, 144, 169, 170 and approximately one-half of 172. Compartment summaries by timber types and condition classes have been prepared for use in correlating timber management plans with the objective of this Management Area.

At present, only the dense (5c''') jack pine stands on the forest have sufficient basal area in the 30-40 year age classes to permit an intermediate cut. This cut generally reduces the basal area to about 30 sq. ft. It is doubtful that an intermediate cut will be possible on the Management Area. Sufficient openings, necessary for warbler habitat, will not likely provide sufficient basal area for an economical cut unless the basal area is to be reduced below 70-30 sq. ft. For this reason a single harvest cut at age 60 is recommended.

B. Fire Control

Prescribed or "controlled" burning will be necessary to create favorable warbler nesting habitat, since, "under natural conditions the habitat of the Kirtland's Warbler is produced only by forest fire" (Mayfield, 1960). When planting will produce desirable habitat prescribed burning may not be necessary. All burning will be done in accordance with the requirements set forth in Forest Service Manual 5150 (Prescribed Burning and Fuel Treatment).

C. Recreation

Roadside zones, as established by the Forest Roadside and Waterfront Zone Policy, and included in the National Forest Recreation Survey, will be eliminated within the Management Area. This is necessary to permit the large, homogeneous tracts necessary to the welfare of this bird. A roadside zone, in effect, would break up the cutting blocks, encourage the distribution of other birds within the area, and limit

controlled burning, and other management practices necessary for optimum warbler habitat. Adequate signing planned for the area will limit any adverse criticism of the roadside strip.

Recreational activities, such as berry picking, hiking, etc., during the nesting season (May 1-August 15) will be controlled by limiting access to the nesting area. Hunting and other recreational use of the area between August 15 and May 1 will be unrestricted.

#### D. Wildlife

The Kirtland's Warbler is most successful in the midst of extensive homogeneous tracts where conditions are exactly to its liking, but rather unfavorable to nearly all other forms of life. This tends to preserve the Kirtland's Warbler, a comparatively unsuccessful species, by freeing it from heavy pressures of competition and predation. To the majority of <sup>Roadside?</sup> small mammals and other birds, these extensive stands of jack pine might act as a faunal desert. Deer populations would not be affected greatly, because of their mobility. Present indications are that a substantial number of deer are present in the Mack Lake area. This is especially noticeable during the spring of the year when deer use the openings to obtain grasses and other new plants following their confinement to the winter deer yards.

The establishment of the Kirtland's Warbler Area would undoubtedly limit wildlife populations, other than deer, in this area. However, this would be relatively unimportant to game species, such as grouse, since populations of these birds on the forest are not high. High

deer populations on the Huren are believed to be an important factor in keeping the grouse population at a comparatively low level.

The overall effect of the management area on wildlife would be negligible. Deer populations would benefit from the openings maintained in the area.

E. Special Uses

1. Mineral Development

Mineral activity must necessarily be limited in this area.

Warbler "colonies" have been known to abandon an area where such activities as pipe line construction, cutting, etc., disturb the site.

An examination of the status of all mineral rights within the Management Area has shown that mineral rights are now vested in the United States on all lands with the exception of the NW $\frac{1}{4}$ , Section 1, T25N-R3E. A breakdown of mineral rights is shown below:

T25N - R3E

Section 1

NE $\frac{1}{4}$ , SW $\frac{1}{4}$	Public Domain land
SE $\frac{1}{4}$	M/R in U.S. Michs. Exc. 172
NW $\frac{1}{4}$	M/R in State of Michigan under State Exchange #42

Section 2

NENE, NW $\frac{1}{4}$ , SW $\frac{1}{4}$ , NWSE	Public Domain land
S $\frac{1}{2}$ NE $\frac{1}{4}$ , NWNE, S $\frac{1}{2}$ SE $\frac{1}{4}$ , NESE	M/R in U.S. State Exchange 1 & 2

Section 3

SWNE	Public Domain land
E $\frac{1}{2}$ , SW $\frac{1}{4}$ , NWNW, E $\frac{1}{2}$ NW	M/R in U.S. Michigan Exchange 1 & 2

Section 11

SE $\frac{1}{4}$ , SWNE  
NW $\frac{1}{2}$ , SW $\frac{1}{2}$ , N $\frac{1}{2}$ NE, SENE      Public Domain land  
M/R in U.S. State Exchange 1&2

Section 12

E $\frac{1}{2}$   
W $\frac{1}{2}$       Public Domain land  
M/R in U.S. State Exchange 1&2

Section 13

Entire      Public Domain  
T25N - R4E

Section 7

W $\frac{1}{2}$       M/R in U.S. State Exchange 1&2

Section 18

W $\frac{1}{2}$       Public Domain land

Section 19

NW $\frac{1}{4}$       Public Domain land

The only parcel with mineral rights not vested in the United States is the NW frl.  $\frac{1}{4}$  of Section 1, T25N-R3E. Here mineral rights were retained by the State of Michigan in State Exchange #42.

A mineral lease (1034) for the 151.45 acres in this fractional quarter section was granted to B. G. Hilliard by the State of Michigan on September 14, 1960. The following restrictions were included:

All other provisions of this lease notwithstanding, it is understood that the land described in this lease shall not be entered for any purpose whatsoever without first contacting the U.S. Forest Supervisor, Lower Michigan National Forest, Cadillac, Michigan and securing detailed instructions as to cutting any forest growth for the purpose of making roadways or clearing

well locations or for any other purpose in order that the surface values may be properly protected and conserved. No drilling operations may be conducted within 200 feet of any road or highway.

Applications for mineral development on lands within the Management Area, and having mineral rights vested in the United States, should be rejected and recommendations sent to BLM stating that mineral leases should not be issued in his area. "irectional drilling would not conflict with the primary purpose for which this area is to be managed. The following clause will be inserted in all gas and oil lease application reports on lands within the management area.

"The leasee shall not occupy, use or otherwise disturb the surface of the following described land: (descriptions).  
Provided, however, that subsurface mineral deposits beneath these lands may be prospected for and removed by means of directional drilling."



## PROJECT FINANCING

### Cooperative Agreements:

The establishment of this management area is dependent upon funds to initiate and continue the necessary development work. A specialized project of this type should be assisted by groups interested in the survival of this bird. The Forest Service has encouraged and welcomes the assistance of various groups in the development of this area. This assistance will accomplish several mutual objectives:

1. Development of an area for the continued protection of this endangered species, under multiple use management.
2. Serve as an expression of interest that these various groups have in this project.
3. Provide a working relationship between the Forest Service and the various groups involved, for a mutual understanding of the objectives and aims of each.

Cooperative agreements have been signed by a number of Conservation groups (Appendix G ). It is expected that this project will receive continued public support.

### Cooperative Projects:

Those items which have been outlined in the management plan for this area, and which might be supported financially by a cooperative agency, include: Planting, cutting, burning, and possibly cowbird control (if this proves feasible). Other measures might be; the limited control of hardwoods through herbicide treatment; creating small openings in dense stands;

and minor signing for informational purposes. Normal signing will be accomplished with Forest Service funds.

Wildlife Project Funds:

Those projects which would require wildlife (030) financing are those items which are not a part of timber management or fire control operations. For example, because of special treatments required within the management area (close spacing), the cost of normal planting might be increased \$2.00 - \$3.00 per acre. This work would require wildlife financing.

Listed below are estimated project costs involved in the establishment and operation of this area during the first 5-year program as described in the Management Plan.

LITERATURE CITED

- Beaufait, W. R. 1960: Influences of Shade Level and Site Treatment, Including Fire, on Germination and Early Survival of Pinus Banksiana.  
Forestry Division, Department of Conservation  
79pp.
- Davis, Charles M. 1936: The High Plains of Michigan. Papers, Mich. Acad. Sci., Arts, & Letters, 21: 303-341.
- Odum, Eugene P. 1945: The Concept of the Biome as Applied to the Distribution of North American Birds.  
Wilson Bull., 57: 191-201.
- Mayfield, Harold. 1953: A Census of the Kirtland's Warbler.  
The Auk, 70: 17-20.
- Mayfield, Harold. 1960: The Kirtland's Warbler.  
Cranbrook Institute of Science  
Bloomfield Hills, Michigan. 242 pp.
- Mayfield, Harold. 1961: 1961 Bicennial Census of the Kirtland's Warbler.  
Unpublished report, 11 pp.
- Zimmerman, Dale A. 1956: The Jack Pine Association in the Lower Peninsula of Michigan.  
Its Structure and Composition  
Ph. D. Thesis, University of Michigan.