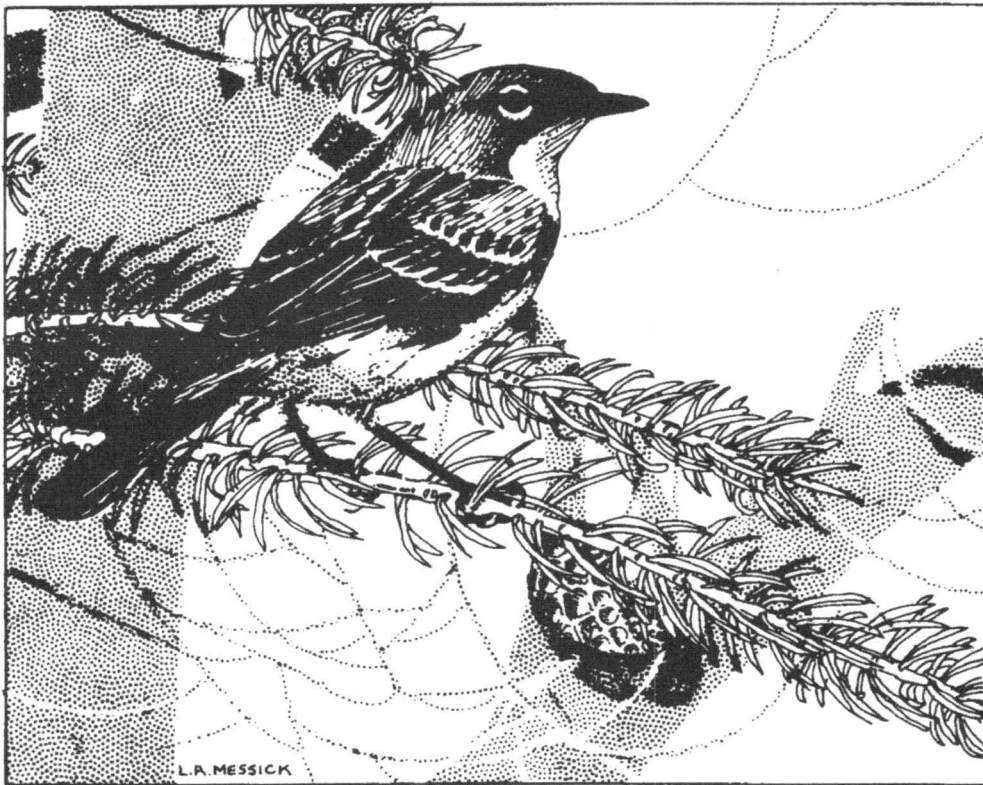


STRATEGY FOR KIRTLAND'S WARBLER HABITAT MANAGEMENT

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FOREWORD

In 1981, the Kirtland's Warbler Management Plan for Habitat in Michigan (1981 Management Plan) was set in motion under the direction of the Kirtland's Warbler Recovery Team. This plan described the action that was needed to maintain and develop nesting habitat for the Kirtland's warbler. Habitat management was one of the major objectives outlined in the Kirtland's Warbler Recovery Plan. Information, maps and guidelines were provided that coordinated timber management with known nesting requirements of the Kirtland's warbler.

Today, our task is one of reviewing, updating and revising this original plan. The Michigan Department of Natural Resources (MDNR), USDA Forest Service (USFS) and USDI Fish and Wildlife Service (USFWS) are the agencies responsible for habitat management oversight. The **STRATEGY FOR KIRTLAND'S WARBLER HABITAT MANAGEMENT** (Strategy) is intended for land managers and incorporates review of past practices and analysis of current conditions. Also included are changes based on new findings that will continue to conserve and enhance the status of this endangered songbird.

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INTRODUCTION

The Kirtland's warbler (*Dendroica kirtlandii*), a federally listed endangered species, was first discovered in 1851 when a spring migrant was taken near Cleveland, Ohio. Five more spring migrants, four in Ohio and one in southern Michigan, were collected before the first wintering bird was taken on January 9, 1879, on Andros Island, Bahamas. Between 1884 and 1897 there were 71 specimens collected throughout the Bahama islands. This species has never been adequately confirmed to occur outside the Bahamas archipelago in winter.

More than a half century after the species was first described, its nesting range was discovered. A specimen collected on June 13, 1903, near the AuSable River in western Oscoda County, Michigan, was taken to Norman A. Wood, curator of birds at the University of Michigan Museum of Zoology. He identified it as a Kirtland's warbler. Wood promptly set out on a trip to Oscoda County, traveling by rail, rowboat, buggy and foot to search for nesting birds. Between July 2 and 7, he discovered two small groups of warblers which he described as "colonies" near Butler Bridge (now Parmalee Bridge) in "jack pine plains". He found no nests. On July 8, 1903, Wood then moved to some jack pine (*Pinus banksiana*) farther to the west and in the western part of Section 31, T27N, R1E, Oscoda County, and discovered the first nest.

Singing males have been found in other parts of the Great Lakes Region. Except for two possible reports in Ontario, nowhere other than Michigan has a mated pair of Kirtland's warblers been found. Searches for nesting birds have been expanded into Wisconsin, Minnesota, Ontario and Quebec.

Modern wildfire suppression has reduced much of the natural disturbance factor that sustained Kirtland's warbler habitat for thousands of years. Without wildfire, land management agencies must take an active role in conserving and enhancing the jack pine ecosystem through active habitat management. **The Strategy provides guidelines for 1) managing summer range for the Kirtland's warbler, and 2) protecting individuals and their nesting habitat.**

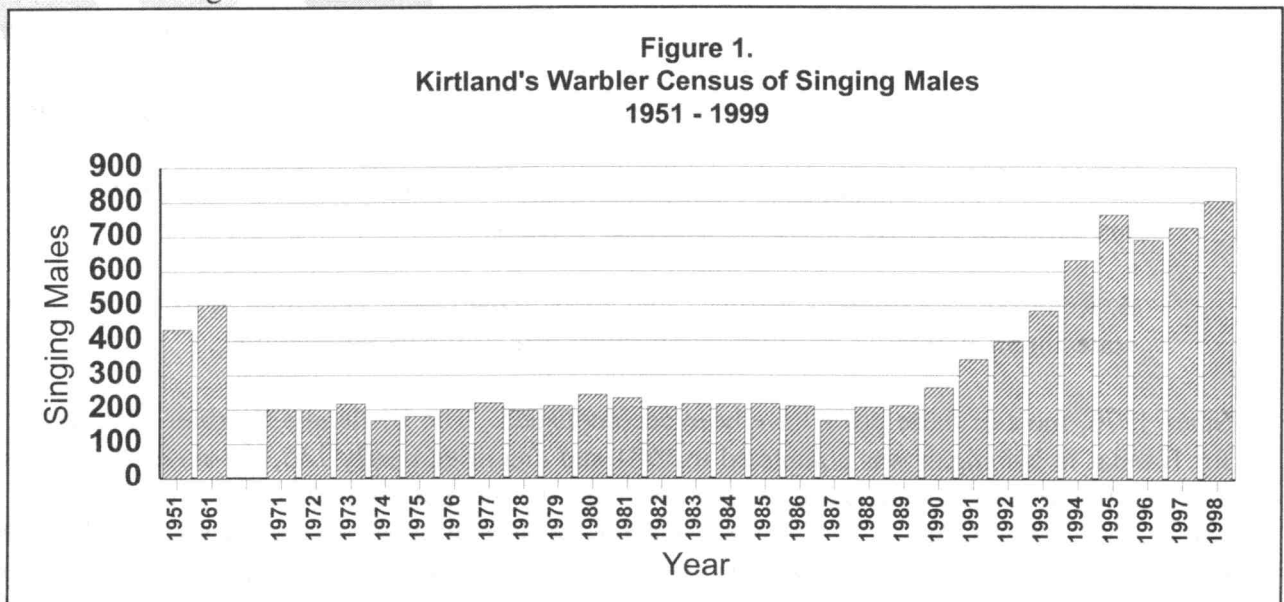
The maps, tables, charts and stand prescriptions in this strategy are intended to be dynamic. As we learn more about the Kirtland's warbler, jack pine ecosystem and needs of people, the products of this strategy should be continuously updated.

HISTORY OF ORGANIZED EFFORTS AT MANAGEMENT

In 1957, the first major effort was made at providing nesting habitat for the Kirtland's warbler. Three areas, each comprising roughly four square miles, were established specifically as warbler management areas on Michigan state forest lands in Ogemaw, Crawford and Oscoda counties. Portions of two of these areas were reforested with jack pine using a special configuration to provide openings within the stand. The intention was to maintain these tracts in three age classes, seven years apart, by burning and replanting the stands when they reached an age of 21 years. Planting of the third area in Oscoda County near Muskrat Lake was deferred because pines on that area were approaching a commercially harvestable age. However in 1964, almost one-third of this tract was burned by wildfire prior to harvest. The regeneration which resulted from that fire provided nesting habitat for Kirtland's warblers from 1972 to 1988 and is one of the longest occupied stands recorded to date. These three areas were later incorporated into the 1981 Management Plan.

In 1962, the Huron-Manistee National Forests approved the first management plan for the Kirtland's warbler. A 4,010-acre tract was dedicated for management in June 1963 near Mack Lake, Oscoda County. This plan established 12 management blocks of about 320 acres each. Ultimately, each block was to be grown on a 60-year commercial rotation with five years age difference between blocks. In 1973 and 1974, the Huron National Forest cut, burned and planted areas near Luzerne, Oscoda County, and Tawas, Iosco County, to benefit the warbler. These areas were later incorporated into the 1981 Management Plan.

In 1971, the third decennial census showed an alarming 60 percent decline in the population level of nesting warblers (Figure 1). This decline initiated a meeting jointly sponsored by the USDA Forest Service and Michigan Department of Natural Resources. One of the major outcomes of this meeting was the formation of an ad hoc steering committee whose responsibility was to outline needed habitat research, propose restrictions on human activity in nesting areas, initiate a cowbird control program and locate funding.



Through the efforts of committee members, both agencies established an official policy with specific points designed to improve the outlook for the warbler. This policy was to treat the best warbler jack pine stands for a period of not less than five years for the purpose of improving warbler habitat. Provisions of this policy included the use of clearcutting followed by prescribed burning.

Efforts to aid the Kirtland's warbler were given a step forward when the Endangered Species Act of 1973 became law. This act provided the means to have the Kirtland's warbler officially declared "endangered", provided for acquisition of land to increase available habitat, provided funding to carry out additional management programs, set up provisions for state cooperation with the federal government and established various legal protections for endangered species. Previous acts in 1966 and 1969 provided for endangered species listings, research and some habitat acquisition, but the 1973 law still stands as the most encompassing endangered species legislation to date.

The Federal Endangered Species Act was supplemented by the Michigan Endangered Species Act of 1974. This act added legal protection to listed species in the state.

Rules published in the Endangered Species Act of 1973 called for the establishment of recovery teams to assist the Fish and Wildlife Service in carrying out provisions in the act. In early 1975, a Kirtland's Warbler Recovery Team was named by the Secretary of the Interior to guide efforts in aiding the warbler. As a result of the team's efforts, a Kirtland's Warbler Recovery Plan (Recovery Plan) was prepared outlining steps designed to increase the population of the species. The primary objective of the Recovery Plan is to **"reestablish a self-sustaining wild Kirtland's warbler population throughout its known former range at a minimum level of 1,000 pairs."** Goals designed to accomplish the primary objective are as follows:

1. Maintain and develop 135,000 acres of suitable nesting habitat for the Kirtland's warbler throughout its former known range.
2. Protect the Kirtland's warbler on its wintering grounds and along the migration route.
3. Reduce key factors adversely affecting reproduction and survival of Kirtland's warbler.
4. Monitor breeding populations of the Kirtland's warbler to evaluate responses to management practices and environmental changes.
5. Reintroduce Kirtland's warblers into areas in the Upper Peninsula of Michigan or in other states in an attempt to establish independent self-sufficient populations.

Since 1976, most of these goals have been accomplished. The Kirtland's Warbler Management Plan for Habitat in Michigan was completed in 1981 and identified nearly 135,000 acres of essential habitat. For more than a decade, the agencies used this plan as a guide designed to direct management toward the achievement of the habitat goal with notable response from the Kirtland's warbler population (Figure 1). The Nature Conservancy is leading ongoing efforts to locate and protect Kirtland's warblers on their wintering grounds in cooperation with Bahamas Department of

Agriculture, Bahamas National Trust, North Carolina State Museum of Natural Sciences, US Fish & Wildlife Service, US Forest Service, Michigan Department of Natural Resources and others. Cowbird trapping has continued since 1972 and area closures of occupied habitat have been in effect for many years. The Kirtland's warbler population has been monitored since 1971 by conducting an annual census. Several banding projects and nesting success studies have provided valuable information about warbler population dynamics and the effectiveness of cowbird trapping. Cross fostering and captive rearing studies were completed. However, with the significant increase in Kirtland's warbler numbers, part of the population is now nesting and producing young in the Upper Peninsula.

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STRATEGY FOR HABITAT MANAGEMENT

The Jack Pine Ecosystem

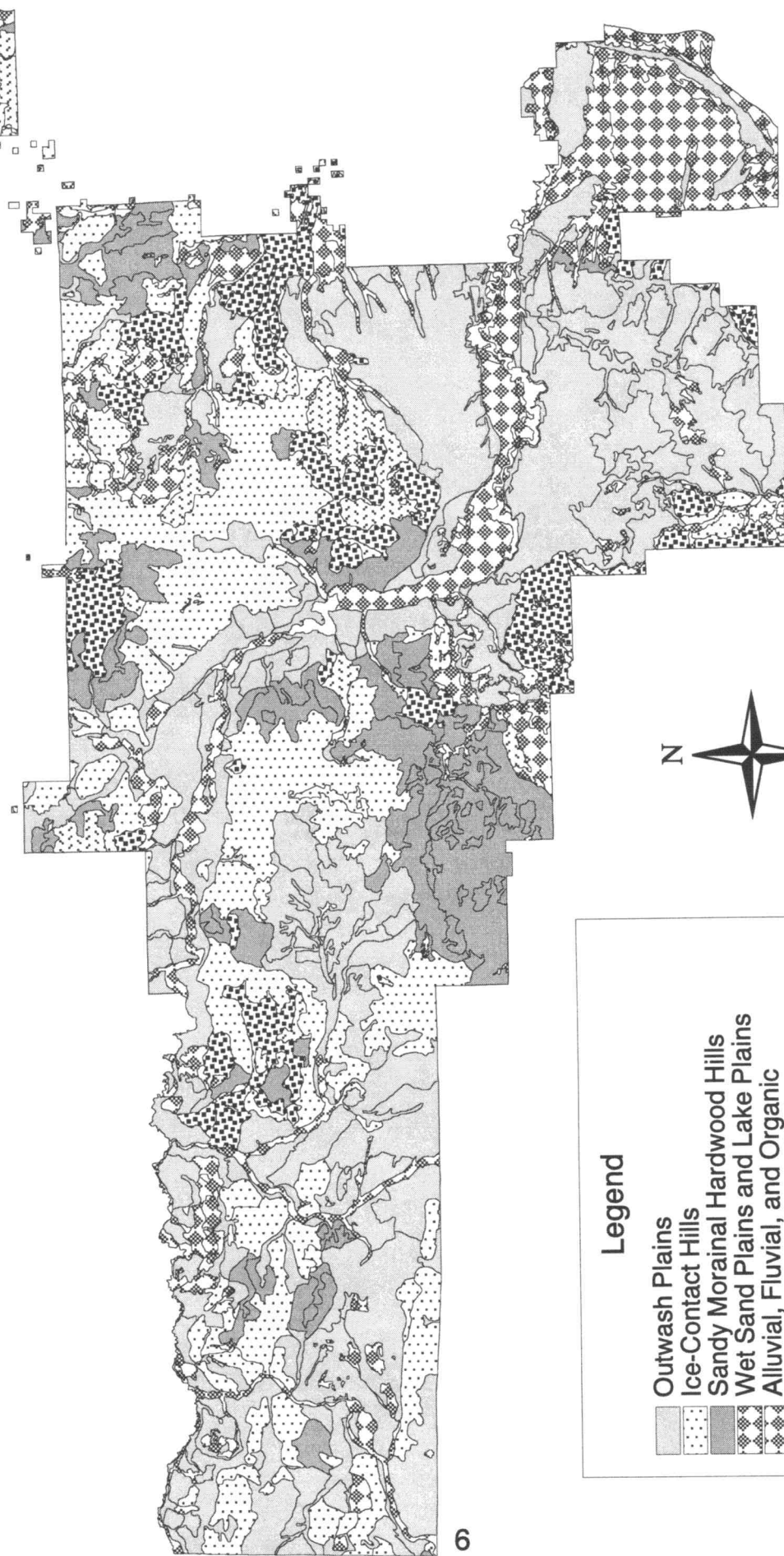
The dry-site jack pine forest associated with the Kirtland's warbler was recognized in the 1981 Habitat Management Plan as a life community. The plan also identified Kirtland's warbler management as management for a unique assemblage of species. Today, this approach provides a foundation for ecosystem management. With added knowledge and improved technology, we are able to integrate information such as cover type, species use, soils, topography and climate with spatial, temporal and historical factors. The result reveals a more comprehensive view of the landscape that focuses on the specific habitat requirements of this endangered species and provides a wealth of information to meet the challenges of changing environmental and social conditions.

To begin the integration process, an ecological classification and inventory system was developed by the Forest Service. The system attempts to develop a consistent approach to ecosystem classification and mapping at multiple geographic scales. A classification hierarchy divides the landscape into major climatic and physiographic divisions termed Provinces and Sections (Table 1). These are further defined into Landtype Associations (LTA) which are characterized by large-scale geologic features that have a somewhat consistent forest community and similar trends in soil parent material. At the next level, Ecological Landtypes (ELT) are groups of large ecosystems defined by particular soils and plants. It is here that managerial guidelines are suggested and planning efforts are initiated. Lastly, an Ecological Landtype Phase (ELTP) is the most site-specific category in the hierarchy.

Classification work to the LTA level has been completed on the Huron-Manistee National Forest (Figure 2) and the entire Upper Peninsula. In another classification scheme, Districts and Sub-districts have been recognized for the entire state and the process to further define these areas in state ownership has just been proposed.

Early observers of the Kirtland's warbler found the birds in what was then described as the "jack pine plains" of northern lower Michigan. While jack pine is found throughout Canada and from mid-Michigan and Wisconsin to the continental tree line, Kirtland's warblers occupy only a small portion of the extreme southern range. Almost all nesting has occurred on Grayling sands. Given the serotinous nature of jack pine cones and adaptations of associated plant species, fire has been assumed to play a long-term and dominant role in shaping the plains landscape. Using the terminology of the ecological classification system, Kirtland's warbler habitat would be assigned to the Province Laurentian Mixed Forest, Section Northern Great Lakes and then mostly to the LTA called outwash plains. Key elements of the latter association include deep, excessively drained sand soils and sites supporting jack pine, northern pin oak and red pine. This community is adapted to dry conditions and frequent fire disturbances. Further study has been made of these areas using presettlement maps, drawn from survey notes and analyzed by staff from the Michigan Natural Features Inventory. Results suggested that the abundance and distribution of jack pine and oak on these dry, sandy outwash plains was greater in the past than today.

**Figure 2.
Land Type Associations
on the Huron National Forest**



Legend

- Outwash Plains
- Ice-Contact Hills
- Sandy Morainal Hardwood Hills
- Wet Sand Plains and Lake Plains
- Alluvial, Fluvial, and Organic
- Clay Hills and Clayey Plains
- Loamy Outwash and Ground Moraines
- Dunes

Table 1. Hierarchical levels for ecological classification system.

Level	Factors	Scale
Province	Geomorphology, climate	Multi-State
Section	Geomorphology, Climate, vegetation	1000's square miles
Subsection	Climate, geomorphology, vegetation	10's to 100's of square miles
Landtype Association (LTA)	Landforms, natural overstory communities, soil associations	10's to 1000's of acres
Ecological Landtype (ELT)	Landform, natural vegetative communities, soils	10's to 100's of acres
Ecological Landtype Phase (ELTP)	Soils, landscape position, natural vegetative communities	1 to 10's of acres
Site	Soils, landscape position, natural vegetative community	

(From Field Guide Ecological Classification and Inventory System of the Huron-Manistee National Forests. USDA, Forest Service.)

As managers use the layers of information from this ecosystem approach, they are better able to predict the potential for a particular landscape to attract and hold Kirtland's warblers. With these predictions, managers are better able to evaluate specific management practices that impact the Kirtland's warbler population and justify the cost of this Strategy.

To create optimal habitat for the Kirtland's warbler, knowledge of its specific habitat requirements is necessary. In the classification scheme, these requirements would be defined at the ELTP level. Kirtland's warblers use of the jack pine ecosystem is restricted to a relatively young age structure. Initial use may start when tree height reaches 5 to 7 feet or at an age of 6 to 10 years old. Generally, occupancy is maintained as long as trees retain relatively dense living branches near the ground. This structure is often lost by the time the trees attain a height of 12 to 20 feet, or at an age of 18 to 21 years old.

Numerous other considerations are given to warbler breeding habitat. Stands of appropriate age but less than 80 acres in size are seldom occupied. Stands of 1000 acres and larger have been found to greatly improve occupancy by groups of warblers both in terms of nesting density and duration of use. Several studies of breeding habitat have shown that stocking density may be quite variable (at least 1200 to more than 10,000 stems/acre) but stems are usually distributed in dense patches of trees interspersed with small openings. Plantations with evenly spaced trees have attracted warblers; however, the presence of some openings in the plantations appears to be important in keeping warblers over time.

Ground vegetation in nesting habitat consists of plants adapted to survive fire, drought and temperature extremes. Low shrubs, deep-rooted perennial herbs, sedges and grasses form a mosaic that ranges from sparsely vegetated areas with bare ground to densely covered patches. The ground-nesting Kirtland's warbler appears to prefer dense patches of a blueberry (*Vaccinium* sp.), bearberry (*Arctostaphylos uva-ursi*), sweet fern (*Comptonia peregrina*) and grass/sedge mix for nest sites.

It is unlikely that Kirtland's warblers nested in naturally regenerated red pine areas but some birds have been found in red pine plantations. In most cases, the birds have moved from adjacent habitat of primarily jack pine. These instances have been rare and use has been of short duration. Warblers have also used areas of jack pine with a relatively high component (40%) of northern pin oak. Typically, occupancy of such sites occurs early in the use of the larger stand and may be associated with higher site index values for jack pine. Warblers will likely abandon areas with a significant hardwood component earlier, as trees on higher sites grow faster.

Kirtland's warblers evolved in an ecosystem where large and frequent wildfires occurred. Fire disturbance in some areas near Mack Lake in Oscoda County were found to have occurred about once every 28 years. Historically, fires burned vast areas and created very diverse vegetative conditions. Such varied conditions are extremely important to the Kirtland's warbler and other species of the jack pine ecosystem.

Over the life of a jack pine stand, many benefits to other species can be noted. Birds such as common nighthawks (*Chordeiles minor*), vesper sparrows (*Pooecetes gramineus*) and upland sandpipers (*Bartramia longicauda*), and plants such as harebell (*Campanula rotundifolia*) and Hill's thistle (*Cirsium hillii*) thrive on sites with very open conditions. Where snags persist, eastern bluebirds (*Sialia sialis*), American kestrels (*Falco sparverius*), common flickers (*Colaptes auratus*) and other cavity nesting birds are common. Remnant prairies, frost pockets and other openings include special plant species such as rough fescue (*Festuca scabrella*) and pale agoseris (*Agoseris glauca*). As a stand matures, hermit thrush (*Catharus guttatus*), spruce grouse (*Canachites canadensis*), saw-whet owls (*Aegolius acadicus*) and Nashville warblers (*Vermivora ruficapilla*) will be found. Mature stands are inhabited by pileated woodpeckers (*Dryocopus pileatus*) and pine warblers (*Dendroica pinus*). This species diversity over time should be a measurement of the success of this Strategy.

The outwash plains inhabited by the Kirtland's warbler support a rich array of plant and animal species that change in shape and kind over time and are specifically adapted to conditions in which fire plays a dominant role. Within this ecosystem, the influence of the human species must be recognized. The ability to understand the importance of the conservation and protection of endangered species, and the decision to do something about it, are parts of the human contribution to the process. This Strategy will provide sustained habitat conditions for a wide variety of plant and animal species, as well as opportunities for recreation and economic return from wood fiber resources. This ecosystem management approach will attempt to recognize the value of individual species, time, dynamic processes and economic considerations not only for Kirtland's warblers but for the sum of all the parts of these outwash plains.

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Framework For Developing Essential Habitat

Essential habitat is that land identified as biologically appropriate and necessary for the development of nesting habitat for the Kirtland's warbler. Essential habitat is designated by the Regional Forester from the USDA Forest Service and the Director of the Michigan Department of Natural Resources and occurs in significant acreages on both state and federal (USDA Forest Service, USDI Fish and Wildlife Service) lands. Each agency has individual land management functions and is responsible for developing habitat on the land with which it is entrusted. All agencies are working together, sharing information to coordinate habitat development on a statewide basis using a geographic information system (GIS).

All essential habitat originally identified on state and federal lands for the Kirtland's warbler was reevaluated in 1996 as potential nesting habitat. In addition, lands not previously identified as essential habitat and thought to be potential nesting habitat were identified. These additions include new habitat on Forest Service and Fish and Wildlife Service lands. After field examination and stand data analysis, those stands that were believed to be manageable for nesting habitat were identified as essential habitat. At present, Kirtland's warbler habitat is managed in 24 Management Areas; 17 on State Forests and 7 on the Huron National Forest.

Significant additional acreage of potential warbler nesting habitat exists on Michigan Department of Military Affairs (DMA) land at Camp Grayling. A Cooperative Agreement between the Michigan Departments of Military Affairs and Natural Resources dated 22 May 1986 addresses potential warbler habitat on Camp Grayling's Range 30. Lands in the North Down River Road Management Area, which are under long term lease to the DMA from the MDNR, were designated for Kirtland's warbler habitat management under this Cooperative Agreement. The Agreement also provided for protection of other areas of occupied or potential warbler habitat on Range 30. Efforts are ongoing between the two state agencies and USFWS to develop an agreement to cover additional potential nesting habitat in other parts of Camp Grayling.

Since 1981, the USFWS, USFS and MDNR have actively pursued acquisition of private inholdings identified in the original 1981 Habitat Management Plan. Although some 7500 acres have been acquired, a large number of these desirable parcels remain privately-owned. Efforts to acquire these parcels (listed on pages 21 and 22) will continue. The agencies will work closely with landowners whose property supports occupied or developing nesting habitat in order to provide protection for the warbler and its nesting habitat.

Recently, Kirtland's warblers have been found to be breeding in large areas of jack pine regeneration in the Upper Peninsula of Michigan. One of the goals of the Recovery Plan is to "reintroduce Kirtland's warblers into areas in the Upper Peninsula of Michigan or in other states in an attempt to establish independent self-sufficient populations". Land management agencies can contribute to the recovery of this species by applying the guidelines presented in this Strategy to the jack pine ecosystem in the Upper Peninsula.

In the 1981 Habitat Management Plan, each management area was divided into management units containing 1000 to 2000 acres of essential habitat. Most units were subdivided into five cutting

blocks, with each block containing 200 or more acres of contiguous stands of habitat. In theory, one block in each unit was to be developed as nesting habitat each decade. However after a number of years, managers found that this Strategy tended to fragment nesting habitat and provided a less than optimum landscape configuration for breeding warblers.

Recent examination of Kirtland's warbler biogeography suggests that the birds prefer to nest in large stands (1000 acres +) of young jack pine. It appears that birds nest in higher densities in larger stands, and these large stands are used for a longer period of time than smaller stands. Census results from the Mack Lake fire area and large plantations support these findings. As a result, a new habitat management framework was developed to better meet the warblers preference for large stands and mimic the effects of large wildfires, as follows:

Distribution of Nesting Habitat

Nesting habitat is distributed across the landscape to minimize the risk of catastrophic losses of Kirtland's warblers due to wildfire. On average, 2710 acres are developed into nesting habitat annually; 1560 acres on MDNR lands, 1070 acres on USFS lands and 80 acres on USFWS lands. At least 30,000 acres of occupiable nesting habitat is available at any time across the landscape.

REC PLAN
127,600

↑ 38,000 IN REC. PLAN! × 5 = 190,000
(Pg 18)

33 YR ROTATION

↳ 646 PAIRS (0.017 PAIRS/AC)

Habitat Regulation

Essential habitat in MDNR and USFS management areas is regulated for sustained yield of warbler nesting habitat and commercial timber production. Fifteen to 25 percent of each management area is developed into nesting habitat each decade on a 40 to 70 year rotation. Rotations will vary due to the variety of stand conditions within each area as a consequence of previous habitat development and wildfire. Essential habitat on USFWS lands may be managed on a shorter rotation.

Treatment Block Size

Treatment blocks of 300 acres or larger are proposed. Given the limits of existing stand conditions, visual considerations, and land ownership patterns, some blocks will be smaller. However, treatment blocks of 1000 acres or larger are desirable to optimize Kirtland's warbler productivity. Management units within management areas are eliminated which will help reduce fragmentation of nesting habitat.

Scheduling Treatment Blocks

Treatment blocks in each management area are sequentially scheduled for habitat development, starting with the first block and progressing to the last over the planning period. Treatment blocks are scheduled for regeneration close to other blocks in space and time. New blocks should be developed adjacent to, or in close proximity to recently developed blocks to better mimic the effects of large crown fires. Generally, smaller treatment blocks are developed adjacent to one another and regenerated no more than 5 years apart.

Wildfire

Some essential habitat is likely to be consumed by wildfire. Typically, larger wildfires create occupiable habitat for the Kirtland's warbler. The habitat development schedule in this Strategy will be adjusted accordingly to ensure a sustained supply of occupiable habitat over the long term as prescribed in the Recovery Plan.

Managing Other Areas

A substantial amount of potential Kirtland's warbler habitat has not been designated as essential habitat. This potential habitat is present in other areas of jack pine and red pine plantation in the jack pine ecosystem. Wildfires, insects, disease or other factors may offer an opportunity to manage some of these areas for jack pine. These areas could provide habitat for the Kirtland's warbler and other animal and plant species of the jack pine ecosystem. When these opportunities appear, each site should be evaluated and considered for management to provide Kirtland's warbler breeding habitat.

Strategy Updates

This Strategy will be frequently reviewed and updated based on changing conditions and the needs of the Kirtland's warbler and the jack pine ecosystem. Each agency is responsible for designating an individual to accomplish this task.

Harvest and Reforestation of the Jack Pine Ecosystem

The jack pine ecosystem has been historically maintained by naturally occurring wildfires, resulting in large tracts of even-aged trees. Silvicultural techniques that mimic this structure and condition should be employed when managing for Kirtland's warbler nesting habitat. The economic value of the standing timber and future timber harvest potential are also important considerations in warbler habitat management decisions. The multiple objectives of ecosystem management, endangered species enhancement and appropriate timber utilization will provide the necessary long-term support for and ultimate success of this Strategy.

The primary silvicultural tools used to recreate even-aged stands of jack pine for Kirtland's warblers are varied strategies of clearcutting and prescribed burning. Timber sale layout and site preparation are important silvicultural considerations. The following are general guidelines:

Clearcutting

Clearcutting is the most practical technique to remove standing jack pine. Some changes in the methods of commercial harvest have occurred since the 1981 Habitat Management Plan was written. The most common and efficient operation at present is whole tree chipping. Trees are cut full length and chipped, leaving few tops or limbs as slash. There are some advantages to a clean site, but modifications must be considered in order to use prescribed burning as a follow-up treatment. Other highly mechanized logging methods may also require particular timber contract specifications in order to meet warbler habitat objectives.

Seed Tree/Shelterwood

Seed tree or shelterwood cuts offer a variation from clearcutting where 20 or more mature jack pine trees per acre are left standing in patches or strips as seed sources. Prescribed burning of such areas is desirable and recommended. While this practice has had limited regeneration success, it has not been tried often. It should be encouraged and may best be employed in cooler, moister climate such as the northern reaches of warbler habitat in the Lower Peninsula or in the Lake Superior watershed of the Upper Peninsula. Supplemental seeding may augment or even replace seed tree cuts in some areas.

Prescribed Burning/Wildfire

The use of prescribed burning on standing jack pine for natural regeneration may best be used at present on those lands held by the U.S. Fish and Wildlife Service. However, as the element of fire is key to the jack pine ecosystem, it may be appropriate under certain circumstances to use wildfire as a tool to create warbler habitat. Decisions to alter fire suppression efforts must be weighed carefully and thoroughly.

Retention of Dead Trees

All dead trees should be left in the sale area. In those cases where fewer than 10 standing dead trees per acre are present, live trees greater than 6" dbh should be retained to be subsequently girdled. An overall objective of 15-25 dead trees per acre is desirable. The

added cost of marking and girdling may be offset by the gain in structural diversity on the site.

Visual Management

At the time of timber sale layout, considerations should be given for visual management. Preferred alterations for visual management will be those which mimic conditions naturally occurring in wildfire areas (narrow fingers of live trees to resemble skip areas in burns, occasional large oak or red pine, openings, snag and downed wood retention, scenic vistas, etc.). Irregular sale boundaries that follow natural features help to break up large blocks of cut-over areas. Existing openings should be incorporated into the planting scheme to create mixed patterns of tree cover and open space. Alterations which do not add to warbler habitat diversity, or which detract from warbler habitat quality such as buffer strips or significant areas of selective management for types other than jack pine, will be compensated for with at least equal additional acreage of jack pine essential habitat.

Site Preparation

Prescribed burning should be used to prepare sites for planting or seeding. Other methods include the use of rolling choppers, chain scarification and disking. However, since these mechanical operations do not provide consistent results in producing high quality warbler habitat, burning is the preferred method.

Following timber harvest and site preparation, the management objective is to regenerate the jack pine stand to create habitat for nesting Kirtland's warblers. The following are guidelines for planting, seeding and evaluating these efforts:

Planting

Generally, the spacing of planted jack pine trees will be 6' x 6' or less. The treatment block will be considered regenerated when 75% of the area has a stocking density of 1600 or more trees per acre. The use of bare root (2-0) stock with machine planting has produced the most consistent regeneration success but this method is a relatively expensive operation. Use of containerized stock and hand planting may have some advantages, such as a wider window of planting opportunity, and may be appropriate in certain areas.

Approximately 25% of the area to be regenerated should be left unplanted. About 1 to 5 well-dispersed openings per acre is desirable. This configuration has been achieved with an opposing wave planting scheme. Attempts have been made to provide a greater diversity in opening size by avoiding groups of dead trees, steep terrain, rare plants or other special features.

Seeding

Broadcast seeding has had very limited success, especially on dry, sandy sites most typical of warbler habitat. Other attempts to seed an area using different combinations of a trencher and a seeder apparatus pulled by a large bulldozer are more promising. A trench or furrow is cut and seed is deposited directly into the furrow. Seed can be sown through soft snow

and one type of machine can vary the seeding rate. This method is relatively cost effective. In case a site is understocked, it is easier to hand plant into existing furrows with some cost benefit over other replanting schemes. It is proposed to use this method on some of the more moist jack pine sites.

Stocking Surveys

Follow-up checks for survival of planting stock or success of seeding establishment are very important to evaluate management goals and options. These should be accomplished in the first and third years after regeneration attempts.

General Considerations

- Any intermediate treatments for overstory removal, girdling or thinning, should be accomplished in those years when stands are not occupied by warblers.
- Timber salvage harvesting activities in the aftermath of a wildfire shall not compromise the future habitat quality of this rare occurrence. In most cases, salvage operations would be inappropriate.
- Whole tree harvesting of jack pine should be accomplished in late winter, if possible. Seeds dispersed from the scattered cones may germinate in the favorable soil conditions of spring.
- Some jack pine regeneration efforts for Kirtland's warbler habitat have produced unsatisfactory results. The Brakē scarifier with hand planting had low seedling survival rates and consequently, most stands not dense enough for warblers. Areas where seed tree cuts were disked but not burned have had no warbler use, suggesting low overall tree densities as well. Strip cuts do regenerate jack pine but not necessarily the desirable configuration for warbler habitat.
- Silvicultural treatments should be sensitive to special habitats such as prairie remnants or areas containing rare or threatened plants, as these are integral components of the jack pine ecosystem. Maintenance or enhancement of some of these components may require burning or other active management efforts while a more passive approach may be needed in different situations. Land managers should continue to cooperate and communicate with individuals who may be participating in natural features inventories so that special concerns can be identified and proper management applied.

Habitat and Species Protection

The purpose of designating public lands as essential habitat is to provide quality nesting habitat for the Kirtland's warbler. Since warbler habitat management is usually based on a 50-year rotation, which for most stands represents maturity to over-maturity, warbler habitat management is also management for the perpetuation of the jack pine ecosystem, with all its component plant and animal species. Managing for this entire ecosystem is the underlying precept and ultimate goal of this Strategy.

The most common human use of these lands is hunting primarily for white-tailed deer, snowshoe hares, wild turkey, and to a lesser extent for bear, bobcat, wild turkey, ruffed grouse and squirrels. Other uses are berry-picking, wildlife viewing and timber harvesting. These uses are generally compatible with management for Kirtland's warbler habitat on a 50 year timber rotation, and will be encouraged on these lands with some restrictions.

Since warbler nesting habitat is the highest priority for these lands, measures must be taken to protect the Kirtland's warbler and its habitat from potentially harmful agents, events or human uses.

Fire Prevention and Control

Fire is an integral and important factor in the jack pine ecosystem. Prescribed burning will continue to be the preferred method for site preparation, prairie maintenance and other jack pine regeneration techniques unless it is demonstrated that high quality habitat can consistently be developed without its use. Nevertheless, fire can also be a threat to occupied or developing warbler habitat and to the homes and property of local residents. Therefore, fire prevention, presuppression and suppression plans should to the extent possible:

- Consider essential habitat as very high priority in prevention of fire losses where age of jack pine is from one to 21 years. When essential habitat has reached the stage where it no longer supports Kirtland's warblers, the priority for wildfire prevention will change to whatever is appropriate for the area.
- Employ compatible methods in hazard and risk reduction. Anything that alters vegetation or habitat should be done prior to or following occupancy by Kirtland's warblers. Where fuelbreaks are deemed necessary for hazard reduction and public safety, they should generally be no more than three chains wide with provisions included to minimize the appearance of a wide and open corridor. Acreage committed to fuelbreaks within essential habitat will be compensated for with at least equal acreage of essential habitat not previously designated as such.

Insect and Disease Control

Kirtland's warbler habitat could be affected by outbreaks of certain insects or diseases, especially some of foreign origin. In general, large-scale control of native insects and diseases will be avoided, since these organisms are also part of the jack pine ecosystem. Exceptions to this approach, such as the need to protect occupied or developing nesting

habitat, may occur, and will be handled on a case by case basis through the consultation process, if necessary. Outbreaks of certain nonnative insects or diseases could present a more serious dilemma. Measures used to control these insects or diseases must not be hazardous to the Kirtland's warbler. Should such an outbreak occur, the land manager shall request professional appraisal of the situation and its potential harmful effects. The consultation process (with involvement of the Recovery Team) will be used to determine the appropriate course of action.

Predator and Parasite Control

The Kirtland's warbler has not evolved defenses against nest parasitism by brown-headed cowbirds. Such parasitism has been shown to be especially damaging to the production of young warblers. Accordingly, the U.S. Fish and Wildlife Service has controlled cowbirds by trapping in warbler nesting habitat since 1972. This activity is prescribed in the Recovery Plan and it is coordinated through the Recovery Team. The need to control cowbirds on warbler nesting areas will not diminish in the foreseeable future.

Should future research document the need to control other predators or parasites, new efforts will be coordinated through the Recovery Team.

Land Uses and Potential Human Impacts

Certain uses may adversely affect the Kirtland's warbler or its essential habitat. The following actions will serve to minimize potentially detrimental effects of certain land uses:

- *Habitat closure* - Occupied habitats will continue to be closed to public entry during the breeding and nesting season, except through conducted tours. Areas with high and increasing concentrations of singing males will be closed from May 1 through September 10. Areas with low and declining concentrations will be closed from May 1 through August 15. Areas are to be adequately posted. Generally, two-track roads not on the county road system will be closed either permanently or at least during the posted closure period.
- *Recreational Trails and Associated Developments* - Trails, parking lots and campgrounds for off road vehicle (ORV) users, equestrian users, or hikers will not be constructed in Kirtland's warbler essential habitat.

Snowmobile trails are permitted in essential habitat. Snowmobile trails in essential habitat should be gated during the closure period if the habitat is occupiable by the Kirtland's warbler. Snowmobile parking lots should not be constructed in essential habitat.

ORV, equestrian and hiking trails will be relocated or buffered to prevent adverse effects to breeding Kirtland's warblers by recreational users. Trails in existing and proposed additional essential habitat will be relocated to areas outside of essential habitat where possible. New trails will not be constructed in Kirtland's

warbler essential habitat. Existing designated trails will remain in essential habitat only if they cannot be relocated outside of essential habitat without loss of recreational opportunity or experience. Kirtland's warbler nesting habitat will not be developed within 100 feet of trails that cannot be relocated.

Essential habitat acreage lost to the construction of recreational developments shall be compensated for with at least equal additional acreage of essential habitat.

Special Events (off-road vehicle events, equestrian trail rides, military training exercises, etc.) - Although each proposed event must be considered separately, these activities will be generally excluded from all occupiable habitat, and in most cases from all essential habitat.

Road, Pipeline, Powerline Construction and Other Structural Developments

When planning new roads, pipelines, powerlines and structures, essential habitat should be avoided. If this is not feasible, then a request for consultation with the Fish and Wildlife Service will be required if Federal lands or Federal project funds are involved. In most cases, such activities within or adjacent to occupied habitat will be conducted between October 1 and April 30.

Right-of-way Maintenance

Maintenance activities on road and utility rights-of-way must be performed for the safety and welfare of the general public. In most cases, such activities within or adjacent to occupied habitat will be conducted between October 1 and April 30.

Mineral Development

For all essential habitat where the State of Michigan owns the mineral rights, leasing of these rights shall be for non-development only. Limited oil and gas development may be allowed on areas of essential habitat for which the mineral rights are owned by the Federal Government, but with major restrictions on activities within occupied habitat (Appendix A). Extraction of all other minerals, including sand and gravel, shall not be allowed in essential habitat.

Timber Harvest Adjacent to Occupied Habitat

Timber harvest activities should not be allowed within one-quarter mile of occupied nesting habitat during the posted closure period. In most cases, timber hauling will be routed away from occupied habitat.

Planting Adjacent to Occupiable Habitat

Reforestation activities adjacent to occupiable habitat should be avoided during the nesting season. If planting cannot be completed before May 1, design operations so that portions immediately adjacent to occupiable habitat are planted first.

Wildfire Timber Salvage

Wildfire-killed trees are a natural and very important part of the jack pine ecosystem, and of high-quality natural Kirtland's warbler nesting habitat. In recognition of this, timber salvage harvesting activities shall not compromise the future quality of the habitat for warblers and other wildlife.

Rare and Threatened Plants

Unique prairie remnants and other areas containing rare or threatened plants are integral components of the jack pine ecosystem, and they will be perpetuated within essential habitat, but with minimal net loss of essential habitat acreage. At least equal additional acreage of essential habitat should be designated to compensate for significant areas left open for threatened plants.

Other

All proposals for any other activities within essential habitat not covered above are subject to the consultation process.

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Land Acquisition Priorities

Some private land inholdings in Kirtland's Warbler Management Areas are desirable for acquisition to improve federal and state ownership patterns thus improving habitat development for the Kirtland's warbler. Agencies will attempt to purchase private land inholdings provided owners wish to sell, funds are available for such purchases, and the parcels can be obtained at fair market value.

Private land inholdings are prioritized by the following criteria:

Highest Priority (A)

Private land within or adjacent to a Kirtland's Warbler Management Area that is 40 acres or larger, adjoins federal or state essential habitat and provides or is capable of providing quality breeding habitat.

High Priority (B)

Private land within or adjacent to a Kirtland's Warbler Management Area that is less than 40 acres, adjoins federal or state essential habitat and provides or is capable of providing quality breeding habitat.

Medium Priority (C)

Private land within or adjacent to a Kirtland's Warbler Management Area that would improve federal or state ownership pattern, but is not necessarily capable of providing quality breeding habitat. Acquisition of lands in this category is desirable because it would reduce landowner concerns and management constraints when prescribed burning, clearcutting and closing occupied habitat. If these lands remain in private ownership, they are likely to be developed. As a consequence, there is a significant increased risk of wildfire and catastrophic loss of Kirtland's warblers and their habitat.

The following lists include parcels within State and National Forest boundaries that are desirable for acquisition (Maps in Appendix B):

Parcels within State Forest Boundaries

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Parcels within National Forest Boundaries

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APPENDICES

APPENDIX A.

Mineral Development Standards and Guidelines for Kirtland's Warbler Essential Habitat on the Huron-Manistee National Forests

(Huron-Manistee NF's Land and Resource Management Plan, pp. IV-143 to 144)

I. Use of common variety mineral deposits will only be for use within the Management Prescription area.

II. Hydrocarbon Leasing

This stipulation will be put in Federal and requested in State oil and gas leases for National Forest System lands.

A. The following shall apply to any operations for which this lease is a part.

1. Essential Kirtland's warbler habitat, **except stands aged 26-40 years old**, will be available for limited development with 1 location per 640 acres.
 - a. First priority for site location being inclusions of non-essential habitat.
 - b. Second priority for site location being inclusions of essential habitat 26 years old plus.
 - c. Third priority for site location being the essential habitat 0-25 years old.
2. Essential Kirtland's warbler habitat **aged 26-40 years old** will be available for limited development with a maximum of 1 producing location per 160 acres.
 - a. First priority for site location being inclusions of non-essential habitat.
 - b. Second priority for site location being essential habitat 26 years old plus.
3. Exceptions may be granted through consultation with the USDA Forest Service and the USDI Fish and Wildlife Service.

III. Hydrocarbon Exploration and Development

- A. No drilling, exploration, construction, or maintenance involving the use of heavy equipment shall take place within one-half mile of or create noise greater than 85 decibels in occupied habitat, between May 1 and September 30.
- B. In occupiable habitat, proven wells can be operated between October 1 and April 30, but between May 1 and September 30 only if they are flowing or operated by a bottom-hole pump and:
 - 1. the product is transported by buried pipeline;
 - 2. collection and storage facilities are located off essential habitat where feasible;
 - 3. noise from production operations will be less than 85 decibels at 100 feet;
 - 4. access is limited to routine monitoring of the well.
- C. Any well emitting toxic or sour gases into the air within one-half mile of occupiable habitat may not be operated during May 1 to September 30.
- D. In all essential habitat, oil and gas development shall be done in such a manner that the management of this habitat through the use of prescribed burning and planting is not precluded.
- E. All access roads will be gated and locked.
- F. Location of well sites, roads, facilities, and pipelines will be approved by the Forest Officer in charge prior to construction.
- G. A reclamation plan for all wells, pipelines, production facilities, and access routes must be submitted to the Forest Officer in charge for approval. These plans will detail the replanting and restoration of these areas. Disturbed areas will be restored after completion of drilling and/or production operations.
 - 1. Those areas not scheduled for reforestation and all areas disturbed prior to reforestation will receive treatments to establish permanent vegetative cover. The permanent vegetative cover will consist of a mixture of native warm season grasses; i.e. Big Bluestem, Little Bluestem, Indiangrass, and a variety of annual forbs and legumes. These will be scheduled for establishment just prior to the next growing season, generally late April, May or early June. If an activity is completed before this time frame, an annual cover crop with adequate soil nutrients is required.
 - 2. All soil disturbance actions associated with the oil and gas exploration and development activity will receive similar treatments.

H. Upon the establishment of economically producible reserves, a general hydrocarbon development plan must be submitted. This plan will detail future oil and/or gas development of the newly established field.

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APPENDIX B.

Land Acquisition Priority Maps
for the
Huron National Forest

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HABITAT DEVELOPMENT SCHEDULE
