

Characterizing the Decision Process of Land Managers when Managing for
Endangered Species of Fire Dependent Ecosystems: The Case of the Kirtland's
warbler (*Septophaga kirtlandii* Baird)

Thesis

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Abstract

While the Endangered Species Act is generally viewed as a strong tool for environmental conservation, concerns have been raised over its effectiveness at recovering listed species. While every listed species requires the development of a plan to recover population levels, it has been argued that management activities to recover listed species have resulted in an overemphasis on individual species with detrimental impacts to other ecosystem components. For example, management for the Kirtland's warbler (*Septophaga kirtlandii* Baird), a neotropical bird with nesting grounds in the northern great lakes region, has led to questions regarding decreased biodiversity, homogenized landscapes, the displacement of rarer ecosystem types, and development of hazardous fire management conditions. Such potential conditions create a challenge for managers who are charged with preserving critical habitat for threatened and endangered species while also restoring ecosystem processes and conditions that may pose short-term risks to listed species. Drawing on the case of the Kirtland's warbler, this project examines the factors that influence management decisions regarding the development and preservation of habitat, the use of fire as a management tool, and restoration of ecosystem integrity. Twenty-five management personnel from federal and state government agencies and other key stakeholders involved in Kirtland's warbler recovery efforts participated in in-depth interviews where they were asked questions pertaining to Kirtland's warbler and

jack pine (*Pinus banksiana* Lamb.) ecosystem or habitat management. Results were then coded to determine the legal, psychological, and social factors influencing management decisions. Results indicate legal mandates and policies as the largest factor influencing management. Risk aversion was also predominant in affecting management decisions. Collaboration and information exchange were also central to management decisions. Desired management strategies were also identified along with obstacles to their achievement. Recommendations to overcome these obstacles include: broadening the stakeholders involved in the management, including specialists of varying backgrounds; using alternative management demonstration sites for learning as well as for public education; the use of a structured decision making process to accurately assess management alternatives and their tradeoffs; the inclusion of more researchers in the management decisions; and to draw on further social science research to develop an informed understanding of the decision process and public stakeholders.

Dedication

To Riana, who came into being and grew along with my research. This work is a great accomplishment for me, but you by far are the greatest thing I have ever created. Eres mi corazón.

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Fields of Study

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Chapter 1: Introduction

Threatened and endangered species recovery efforts have increased around the globe in an effort to combat predicted and observed biodiversity loss (Kerkvliet, 2007). While such efforts have been effective at recovering protected species, in some cases, they have also resulted in unintended consequences including the development of homogeneous landscapes with negative effects on overall biodiversity. With increasing emphasis of natural resource management agencies on landscape level restoration, traditional approaches to endangered species management and recovery are coming into question. Currently, little is known regarding the factors that influence the decision making for threatened and endangered species. This study provides an important contribution to the broader discussion of endangered species management by examining this knowledge gap to inform how management objectives can be met within the broader context of public resource management.

The Endangered Species Act, Fire Management, and Decision Making

The Endangered Species Act of 1973 (ESA) provides protection for species at risk of extinction. The goal of the ESA is to recover a listed species to the point where they are no longer threatened by extinction (Clark et al., 2002). As described in the legislation, the ESA has a strong focus on the habitat required by listed species; specifically, the ESA is “to provide a means whereby the ecosystems upon which endangered species and

threatened species depend may be conserved and to provide a program for the conservation of such endangered species and threatened species” (Endangered Species Act of 1973, p. 2).

The ESA seeks to preserve these ecosystems by designating habitat areas that are critical to the continued survival of listed species. Critical habitat is defined as "the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species at the time it is listed that are determined by the Secretary to be essential for the conservation of the species" according to the ESA (ESA section 3(5)(a)). Critical habitat areas are typically limited to federally owned lands (Hoekstra et al., 2002). Section 7 of the ESA requires federal agencies to ensure their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or degradation of designated critical habitat (O'Laughlin, 2005). Section 7 also requires resource management agencies to consult with the United States Fish and Wildlife Service (USFWS) about any proposed action that could impact threatened and endangered (T&E) species.

Once a species is listed, agencies are directed to develop a recovery plan that describes how the species will be recovered to enable delisting. Since 1988, all recovery plans must include a description of specific management actions necessary to achieve recovery, objective criteria by which recovery will be measured, and a time and cost estimate for plan implementation (Clark et al., 2002). There is tension between the time

and expense required to create individualized plans for species and a need to produce such plans in a timely and cost-effective manner (Clark et al., 2002).

Previous research has found that USFWS spending decisions do not always follow the guidelines established under the ESA, but, in many cases, may be influenced more by visceral rather than scientific qualities (Metrick, 1998; Simon, 1995). This suggests human values may supersede science in decision making for listed species. For example, charismatic animal species are disproportionately given more funding than uncharismatic or plant species. Tear et al. (1995) suggest the distinction between biology and politics has been blurred, which compromises a species' chance for recovery.

The ultimate goal of threatened and endangered species restoration programs is “to bring any endangered species or threatened species to the point at which the measures pursuant to...the Endangered Species Act are no longer necessary,” (Endangered Species Act of 1973, p. 4-5). However, since the inception of the ESA only 7 out of 1300 listed species have been successfully recovered (Walden, 2005). This perceived lack of success has diminished political and public support for the ESA (Kerkvliet, 2007). Moreover, the ESA does not necessarily require the conservation of natural ecosystems and habitats as a means to recover species (Noss, 1997), resulting in management that focuses on saving a species rather than its natural habitat. The ESA has been criticized by both biologists and legal experts for its single species approach to biodiversity conservation (Rohlf, 1991). Such an emphasis is likely at least in part due to the broader context that existed when the ESA was first passed. At that time, many threatened and endangered species were in peril due to overhunting or exploitation. However, this is markedly different from the situation today. Currently, most species are threatened or endangered due to habitat loss. It is

argued there is a greater need for conservation of ecosystems including the associated wildlife communities (Rohlf, 1991). While the ecological sciences have advanced substantially since the passage of the ESA, there are several challenges to incorporating ecological principles in management decisions, including 1) the existing framework of laws, regulations, and professional practice within which resource management is conducted and 2) the lack of scientists skilled at linking ecological theory to management alternatives (Clark et al., 2002).

Furthermore, endangered species regulations often impose restrictions on the specific management tools that can be used to accomplish resource objectives because of the risk of harming individuals of the listed species. One such tool is the use of fire to manage habitat conditions (Williamson, 2007). There are two main methods to using fire in land management: prescribed fire and wildland fire use (WFU). A prescribed fire is ignited by forest management personnel under pre-determined conditions to achieve a particular set of objectives (Cohan et al., 1984). Wildland fire use allows natural ignitions to burn in pre-determined locations under certain conditions. There is growing popularity behind the idea of using prescribed fire as a management tool. It plays an important ecological role and may provide a means to efficiently achieve a wide range of management objectives in forest and rangeland ecosystems (Cohan et al., 1984). However ecological knowledge of a forest ecosystem does not determine future management; the decision makers behind the management do.

Drawing on the case of the Kirtland's warbler (*Septophaga kirtlandii* Baird), this project examines the factors that influence management decisions regarding the conservation and management of habitat, the use of fire as a management tool, and

restoration of ecosystem integrity. Specifically, recovery actions that focus on the critical habitat of the endangered Kirtland's warbler, a neo-tropical bird which depends on young, dense stands of jack pine (*Pinus banksiana* Lamb.) traditionally created by wildfire on the breeding grounds in northern Lower Michigan, have had the unintended consequences of homogenizing landscapes and ecosystems (Spaulding & Rothstein, 2009), displacing rarer ecosystem types (Houseman & Anderson, 2002), and producing fuel conditions that complicate prescribed fire management activities for future habitat management. While the population size of Kirtland's warbler has increased and the breeding distribution has expanded to Upper Michigan, Wisconsin, and Ontario, the methods to reach these increases have resulted in development of unnatural habitat conditions and a decrease in biodiversity (Spaulding & Rothstein, 2009). Thus while some objectives were achieved (an increase in population) others were not met (habitat restoration and biodiversity protection).

Previous work by Wilson et al. (2009) in the study region examined land manager's objectives in the context of fire management and mixed-pine (*Pinus* spp.) restoration. The majority (62%) of the 13 land managers stated the most desired change in management was to incorporate more wildland fire use and prescribed fire for the ecological benefits derived. The key barriers to using fire were: mandates and statutes; uncertainty and a lack of ecosystem knowledge; a lack of resources; public perception and needs; and wildland-urban interface (WUI) constraints. In addition, concerns about risks to socio-economic management objectives seem to carry greater weight than risks to ecological objectives. This reflects the literature in the field of fire management, as most research has been about preventative fire management, and research in fire management

for ecological benefits is minimal. This example of meeting some objectives but not others coupled with barriers to desired management strategies makes the decision process behind the management for the Kirtland's warbler an interesting case to examine decision making for endangered species management.

An overview of the Kirtland's warbler and jack pine habitat management

The Kirtland's warbler is a ground-nesting, neo-tropical migratory songbird that breeds in the fire-dependent jack pine ecosystems (Probst, 1986). These ecosystems tend to be found on xeric, sandy soils in the northern Lower Peninsula of Michigan (Probst, 1986). The Kirtland's warbler prefers to breed in younger, seral stages of jack pine that are dense with patches throughout the stands (Probst, 1986), which were historically maintained by periodic large wildfires every 5-20 years (Kashian et al., 2001). During the 20th century, timber management coupled with fire suppression led to decreased disturbance on jack pine stands, and the Kirtland's warbler population drastically declined. They were listed as endangered in 1967 (Lantz, 2010). A recovery plan was written in 1985 outlining management objectives and the critical habitat areas (management units) for the Kirtland's warbler (see figure 1).

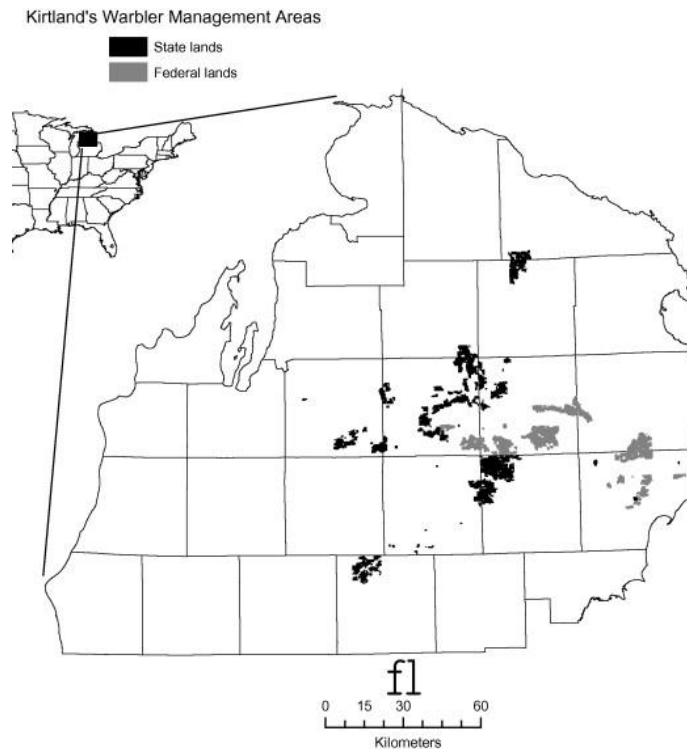


Figure 1. Kirtland's Warbler Management Areas within their primary breeding range, northern Lower Michigan. (Reproduced from Donner et al., 2010)

A history

The primary objective for management as outlined in the Kirtland's warbler Recovery Plan was the establishment of a self-sustaining population of Kirtland's warblers at a minimum of 1,000 nesting pairs (Kirtland's Warbler Recovery Team, 1985). Intensive efforts to manage breeding habitat through jack pine plantations began in the northern Lower Peninsula of Michigan by the Michigan Department of Natural Resources (DNR), the U.S. Forest Service (USFS), and the U.S. Fish and Wildlife Service (USFWS) (Kirtland's Warbler Recovery Team, 1985). Despite rapid management efforts toward Kirtland's warbler recovery in the 1970s and 1980s which

included annual censuses, control of brown-headed cowbirds (*Molothrus ater*) and increased habitat management it was not until 1990 that the population began increasing (Probst et al., 2003). This coincided with increases of primary habitat from two major wildfires: The Bald Hill fire of 1975 (600 ha) and the Mack Lake fire of 1980 (9,700 ha) (Walker et al., 2003). The Mack Lake burn nearly tripled the amount of suitable habitat available for the Kirtland's warbler (Walker et al., 2003). This prescribed fire was designed to improve wildlife habitat, including the Kirtland's warbler, but grew out of control ("Fire Spares Warbler," 1980). Upon escape, it eventually burned 25,000 acres, destroyed dozens of homes, and resulted in one human fatality ("Fire Spares Warbler," 1980). While such impacts were certainly undesirable, the fire did result in the development of a large amount of acreage of suitable habitat for the Kirtland's warbler. Subsequently, there was a rapid increase in the population (Miller & McGee, 2001). Prior to the Mack Lake fire, prescribed burns were used regularly to provide Kirtland's warbler habitat in Michigan's forests; however, after the 1980 Mack Lake fire escape, the use of fire was sharply curtailed and mechanical methods were increasingly used ("Fire Spares Warbler," 1980).

Until 1995, the only known nesting habitat for the Kirtland's warbler was in the Northern Lower Peninsula of Michigan. Today, Kirtland's warblers also nest in the Upper Peninsula of Michigan, Wisconsin, and Canada (see figure 2) (U.S. Fish and Wildlife Service, 2011). The recovery goal of 1,000 singing males (breeding pairs) has now been exceeded for the 11th year in a row, with 1828 singing males in 2011 (U.S. Fish and Wildlife Service, 2012).

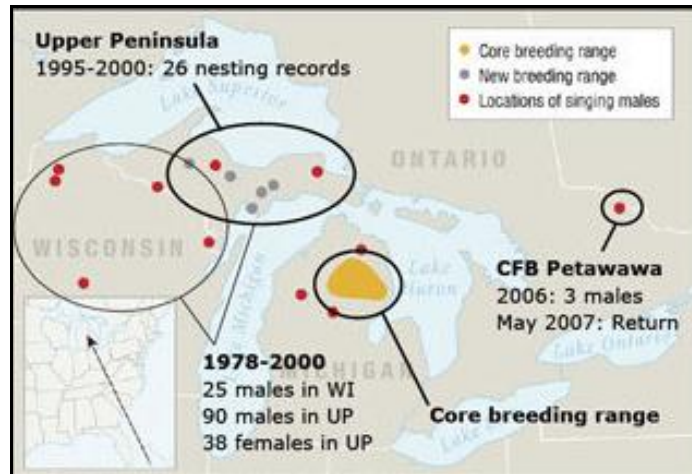


Figure 2. Population increase in Kirtland's warbler and summer range expansions to Wisconsin and Michigan's Upper Peninsula (reproduced from Probst et al., 2003)

Current Management

While multiple management approaches could potentially be applied to promote habitat development for the Kirtland's warbler, in the absence of fire, land managers have primarily come to rely on mechanical methods in recent years (Marshall et al., 1998; Probst et al., 2003). The most commonly used approach consists of the establishment of dense jack pine plantations, with bird use occurring when the plantations are between approximately 5 and 23 years old (Probst et al., 2003). Between 1980 and 1995, over 70% of Kirtland's warblers occupied habitat created by wildfire, however with wildfire habitat on the decline, jack pine plantations support nearly 95% of the Kirtland's warbler population (Walker et al., 2003). Typically the silvicultural treatments for these plantations involves clear-cutting mature jack pine stands, followed by trenching and then hand-planting 2 year old jack pine seedlings in an "opposing wave pattern", as demonstrated in figure 3 (Houseman & Anderson, 2002; Probst et al., 2003). This method

of planting creates small openings where adult birds can forage, surrounded by dense patches of jack pine which provide nesting habitat (Probst et al., 2003). These plantations were an attempt to mimic the dense, patchy pattern of natural regeneration produced by wildfire (Walker et al., 2003).



Figure 3. Opposing wave pattern used in jack pine plantations. Reproduced from US Forest Service (2010). Retrieved from http://nrs.fs.fed.us/sustaining_forests/conservation/biodiversity/Kirtlands_warbler/.

Intensive management intervention is required to maintain jack pine plantations. These methods have proven effective at not only increasing Kirtland's warbler habitat but also providing commercially valuable timber (Probst et al, 2003). In using the jack pine plantations, managers attempt to balance the development of habitat with the provision of commercially valuable forest products. The rotation length of harvests is shorter than

commercially optimal, while stands are maintained for a period of ten years beyond the amenable habitat to Kirtland's warbler nesting in order to increase timber profits (Marshall et al., 2000).

In locations outside of the Kirtland's Warbler Management Areas, agencies have conducted management for the regeneration of jack pine ecosystems using fire and adaptive management approaches on a small scale rather than the jack pine plantation management. These areas are not subject to the recovery plan as they are outside of the critical habitat. The results of these approaches are not yet fully understood as some of the approaches have been recently implemented.

Currently the DNR develops 1,560 acres of breeding habitat within designated Kirtland's Warbler Management Areas on DNR lands, according to their 2001 Strategy for Kirtland's Warbler Habitat Management (U.S. Fish and Wildlife Service et al., 2011). The USFS regenerates an average of 2,270 acres of breeding habitat per year and maintains at least 22, 660 acres of jack pine in the appropriate age class (U.S. Fish and Wildlife Service et al., 2011). According to the current Forest Plans (USFS and DNR) and the Comprehensive Conservation Plan (USFWS) at least 38,000 acres of Kirtland's warbler breeding habitat should be available at any time within the Kirtland's Warbler Management Areas (U.S. Fish and Wildlife Service et al., 2011). These are acreages of breeding habitat produced by using the jack pine plantation approach.

In April, 2011 the three managing agencies for the Kirtland's warbler (USFS, DNR, and USFWS) signed a memorandum of understanding (MOU) (U.S. Fish and Wildlife Service et al., 2011). This MOU is a written, nonbinding agreement that the

agencies will continue collaborative management for Kirtland's warbler habitat, brown headed cowbird control, monitoring, research and education in order to maintain the Kirtland's warbler population at or above the recovery goal of 1,000 breeding pairs, as appropriated funds are available. The MOU was written in preparation for the eventual delisting of the Kirtland's warbler. Recent language has termed the Kirtland's warbler as 'conservation reliant,' or a species that will always be dependent on annual habitat management and control of parasitic cowbirds (U.S. Fish and Wildlife Service, 2012), another reason for the need of the MOU. The MOU is expected to ensure management for the jack pine landscape in a way that "reduces wildfire danger, creates habitat for game and nongame species, provides timber products, and supports the local economy" (U.S. Fish and Wildlife Service et al., p. 3, 2011).

Objectives

This study is part of a larger research project that investigates historical patterns in the distribution of young jack pine across the northern Lower Peninsula landscape as well as the spatial patterns of jack pine regeneration in recent wildfires. The portion of this larger study reported here focuses on the human dimensions of Kirtland's warbler and jack pine habitat management.

The goal of this thesis is to characterize the factors that influence the decisions of managers engaged in the recovery of threatened and endangered species that traditionally rely on fire dependent ecosystems. Based on the limited prior research in the field, this study aims to identify the legal, social, and psychological factors that influence the decision process when managing for an endangered species that historically relied upon

fire for their habitat establishment. It also aims to identify desired management objectives and the obstacles to their achievement.

Plan for Thesis

This paper is organized in the traditional long thesis format including the following chapters: an introduction, literature review, methodology, results, discussion, and conclusion. The introduction provided the purpose of the research, background on the Endangered Species Act, and an overview of jack pine and Kirtland's warbler management. The literature review provides information from other studies examining contextual, social, and psychological factors influencing land management decisions. The methods chapter describes the methodologies employed to collect data, the selection of study participants, and the process used for data analysis. The results chapter provides the findings from the interviews, with a summary of the legal, social, and psychological factors found to affect management decisions. The discussion describes the most important components of the research findings and relates them to relevant literature, while the conclusion summarizes the lessons learned from this research and resulting implications.

Chapter 2: Literature Review

Decision making can be defined as the process of “selecting from several choices, products, or ideas, and then taking action in relation to this choice in order to bring about a desired result” (McDermott, 2006). A good decision making process consists of defining the situation, generating alternatives, gathering information, selecting an alternative, and implementation (McDermott, 2006). Developing a better understanding of the factors that influence this process, and examining whether a good decision making process is occurring, can help land managers avoid common shortcomings and improve their ability to make decisions that are aligned with their objectives.

A large body of literature examines decision making processes. A smaller, but growing number of studies specifically examine decision making in natural resource contexts. In this chapter, we review findings from this prior research that is relevant to this study. First, we review contextual factors that influence land management. Then we examine resource management decision making, specifically discussing prior research on psychological factors that have been shown to influence decision makers including groupthink, tradeoffs, value orientation, risk aversion, and decision heuristics.

Contextual factors influencing land management

Land and resource management by federal and state government agencies often emphasize multiple objectives including consumptive uses (e.g., timber harvest and oil

and gas), recreation opportunities, provision of wildlife habitat, maintenance of ecosystem services (e.g., drinking water) and mitigation of the risk of fire or other natural disasters (Hann & Bunnell, 2001). Public forests are increasingly being valued for a wide variety of potentially conflicting objectives that can be generally classified as economic (e.g., the production of timber) and non-economic (environmental protection) (Koontz, 2002). Demands for these benefits may be exerted on agency managers through a variety of methods including laws and legislation, pressure from interest groups, public involvement in decision processes, as well as the professional expertise and training of managers. In this section, we explore the contextual factors within which managers work as this broader context may have a substantial influence on the establishment of management objectives and selection of management approaches.

We begin with a discussion of the policy and legal framework that provides guidelines for natural resource management on public lands. While several such laws could be included in this discussion, we focus on two here given their relevance to our research questions. First, the National Environmental Policy Act (NEPA) of 1969 requires federal land managers to analyze environmental impacts of proposed actions and mandates public review of agency plans (O'Laughlin, 2005). For every proposed plan that meets the law's requirements, agency managers complete an environmental assessment and record of decision that describe the potential impacts of a range of alternative management approaches and provide the rationale for the selected alternative. Members of the public have the opportunity to review and comment on proposed plans as well as challenge them via an appeals process and litigation once a decision is made. NEPA is often cited as influencing agency decision making (Canton-Thompson et al., 2008,

Stankey et al., 2003). Due to the potential for public appeals and litigation, management strategies must be well documented, traceable, and defensible (Vining, 1992). Under such constraints, the ability to implement innovative management approaches is limited (Stankey et al., 2003).

Next, as described above, the Endangered Species Act (ESA) includes several guidelines that directly influence management decisions. For example, agencies must ensure management will not harm a listed species, even if the likelihood of harm is minimal or the consequences are short term and in the long term there may be greater benefit. This limits management options. While the ESA mandates protection for listed species, it provides limited guidance for maintenance of ecosystem structure, processes, or biodiversity (Rohlf, 1991; Noss, 1997). Thus, the focus of the law is on protection of listed species rather than protection of their natural ecosystem. This can result in a single species management focus.

In addition, funding and budget allocations can greatly influence management (Koontz, 2002; Stapp, 2003; Wilson et al., 2009; Canton-Thompson et al., 2008; Stankey et al., 2003). For federal agencies, these decisions are generally made by Congress and are influenced by political motivations and budget debates. The results can be very substantial. For example, the lack of long-term financial support has been cited as one of the major obstacles to prescribed fire use on public lands (Stapp, 2003). Moreover, as the number of wildfires have increased in recent years, government funding for wildfire suppression has also increased while funding for prescribed fire activities has declined, increasing the difficulty of using fire as a management tool to provide ecological benefits or reduce hazardous fuel levels (Stapp, 2003).

While contextual factors such as budget, time constraints, lack of staff, and others greatly affect management decisions, it is important to understand the factors influencing management decisions within this framework. These contextual factors within which managers must work also create challenges for using fire despite land managers understanding of fire's natural role in ecosystem functions (Wilson et al., 2009).

Public Perceptions of Agency Management

Public interest in the management of federal lands has increased considerably in recent decades, prompting passage of legislation (e.g. the National Environmental Policy Act, the National Forest Management Act) mandating public involvement in resource decision making and causing resource managers to pay greater attention to citizen concerns (Shindler et al., 2002). This increase in public interest has ensured that virtually all resource decisions will undergo critical scrutiny (Shindler et al., 1993). In order for a program to enjoy long-term success in this atmosphere, it must be socially acceptable (Shindler et al., 2002).

While the current management for the Kirtland's warbler includes jack pine plantations to ensure a timber product, management for timber has become increasingly controversial on forest lands as public concern for wildlife, wilderness, recreation, and other values from the forests has increased (Steel et al., 1994; Bengston & Xu, 2009). Several studies have found evidence of a shift from a commodity-based approach to managing public lands (e.g., timber production) to one focused more on provision of ecological goods and services (see summary in Shindler & Cramer, 1999).

While limited research examines public acceptance of Kirtland's warbler management, several studies have been completed on commonly-used practices including mechanized thinning and manager-ignited prescribed fire finding high levels of acceptance of some use of both prescribed fire and mechanized thinning treatments in several locations (e.g., Absher & Vaske 2006, McCaffrey 2006, Toman & Shindler 2006b, Vogt et al. 2007, Lim et al. 2009). This research finds the most common predictors of treatment acceptance include knowledge and familiarity with the practice and trust in agency managers (Winter et al., 2002, Shindler & Toman, 2003, Brunson & Shindler, 2004, McCaffrey, 2004). In a recent study by Toman et al. (2011) increased confidence in agency managers to effectively implement certain treatments on federal lands had the strongest impact on public acceptance of the treatment, even when accounting for other variables.

Ultimately, the long-term success of Kirtland's warbler recovery programs will be influenced by citizen support for management activities. As the findings reviewed here indicate, this support depends on the ability of agency managers to engage their local citizens to develop understanding of the rationale behind these practices and trust in their ability to accomplish their goals.

Groupthink

The USFWS is charged with creating a recovery plan in collaboration with other agencies (the "recovery team"). There are many benefits to working in groups. Some individuals are more likely to cooperate if they feel they are part of a group (Griffin, 2002). Group affiliation can increase communication, result in more frequent

interactions, and provide information on others' actions (Griffin, 2002). However, it is also important to raise some potential cautions with such groups that may negatively influence the group's ability to make effective decisions. One bias that occurs is called "groupthink." Groupthink occurs when cohesive groups tend to be insulated from external influences, and where members are pressured to conform (Plous, 1993). There are eight common symptoms of groupthink outlined by Janis Irving (1982), as shown in table 1.

<i>Type I. Overestimation of the group-its power and morality</i>
1. An illusion of invulnerability
2. An unquestioned belief in the group's inherent morality
<i>Type II. Close-mindedness</i>
3. Collective efforts to rationalize in order to discount warnings or other contradictory information to their assumptions
4. Stereotyped views of enemy leaders as too evil to warrant genuine attempts to negotiate, or as too weak and stupid to counter whatever risky attempts are made to defeat their purposes
<i>Type III. Pressures toward uniformity</i>
5. Self-censorship of deviations from the apparent group consensus
6. A shared illusion of unanimity
7. Direct pressure on any member who expresses strong arguments against any of the group's stereotypes, illusions or commitments
8. The emergence of self-appointed mindguards

Table 1. The Eight Symptoms of Groupthink. (Source: Janis, 1982, pg. 174-175).

When groupthink occurs, a critical evaluation of alternative ideas does not happen; rather the group cohesion becomes more important than the actual decision (Hathaway, 2008). While individuals may have concerns about the action proposed by

the group, they do not voice this opposition because they do not want to risk losing group cohesion (Hathaway, 2008). A rationalization to discount warnings prevents an accurate assessment of past decisions, leading to a justification that past decisions were correct, thus the current situation is also correct (Hathaway, 2008). This prevents questioning of the current situation. Furthermore, groupthink often involves limited or no use of outside experts in decision making (Krill, 2008).

Resource Management Decision Making

The complexity and uncertainty surrounding decisions for management of threatened and endangered species that traditionally rely on fire dependent ecosystems leaves decision makers susceptible to the use of heuristics, or mental shortcuts, that can influence how they make decisions. A substantial body of psychological research examines the factors and processes that influence decision making. We review those approaches here that are particularly relevant to our study area.

One well-known theory in the psychology of decision making is the Expected Utility Theory (EUT). This theory states that the decision maker chooses between risky or uncertain alternatives by comparing their expected utility values (the amount of satisfaction received from each alternative), or the weighted sums found by adding the utility values of different outcomes multiplied by their probabilities (Mongin, 1988). Decision makers are expected to select the alternative that provides the greatest utility value. However as uncertainty, risk, and/or complexity increase, taking such a rational approach to decision making is increasingly challenging. In such complex situations, a number of psychological variables, including personal values, “subjective” interpretations of probability, as well as uncertain outcomes and competing objectives can influence

people to stray from using EUT (Simon, 1959). Thus, in the realm of land management, which involves complex decisions with uncertain outcomes, managers are unlikely to follow a strictly empirical approach as suggested by EUT. In the following sections, we draw on the psychological literature to identify and describe those factors that influence decision making under the uncertainty common to resource management.

The Cognitive Hierarchy

Substantial prior research examines the factors that influence how humans view the world and the behaviors humans choose to adopt. One of the most commonly cited approaches, known as the cognitive hierarchy, postulates that the underlying concepts can be organized in a hierarchy of components consisting of values, value orientations, attitudes and norms/conventions, behavioral intentions, and behaviors. The cognitive hierarchy is represented by an inverted pyramid, with subsequent element building upon those below it within the hierarchy (Vaske & Donnelly, 1999) (see figure 5). According to the cognitive hierarchy, value orientations affect attitudes and behavioral intentions, thus influencing behavior (Fulton et al., 1996; Vaske & Donnelly, 1999). Value orientations can be defined as “patterns of basic beliefs relative to a particular topic” (Vaske & Donnelly, 1999).

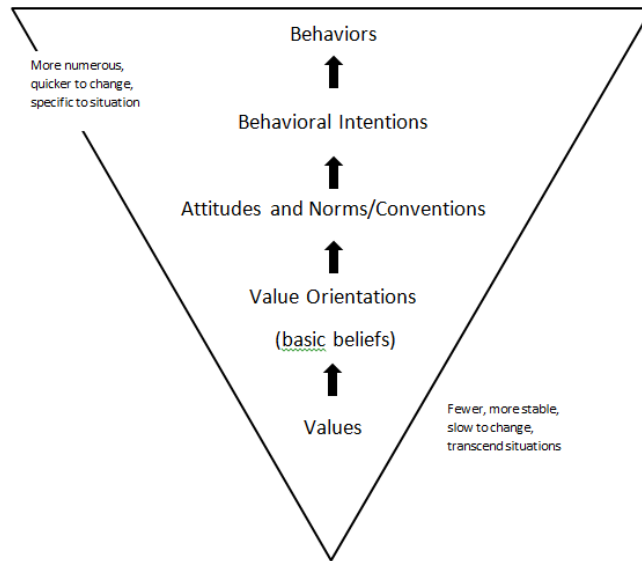


Figure 4. Cognitive Hierarchy model of human behavior. Adapted from Vaske & Donnelly (1999).

Agency officials' beliefs are important determinants of bureaucratic decisions according to previous research (Koontz, 2002), and beliefs stem from underlying values and value orientations (Fulton et al., 1996; Vaske & Donnelly, 1999). Agency community also creates a set of 'shared norms' or a socially constructed understanding among members of the agency, which can also influence behavior (Koontz, 2002). Previous research regarding natural resource management suggests that value orientations can range from anthropocentric to biocentric (Shindler et al., 1993; Thompson & Barton, 1994; Steel et al., 1994).

Those with anthropocentric value orientations value forests for their utility for human society, whereas those with a biocentric value orientation believe ecosystems, species, organisms, etc., as well as humans all have an inherent worth that should be

respected and preserved equally, even if they are in conflict with values for human society (Vaske & Donnelly, 1999). Traditionally, forests have been managed from an anthropocentric value orientation (Vaske & Donnelly, 1999), focusing on direct societal benefits. Value orientations can influence management through 1) the orientations held by managers that influence their perspectives on appropriate behavior, and 2) the value orientations of the public that influence the formation of legislation, agency missions, etc. and thus influence possible agency decisions. Individuals driven by a biocentric value orientation are more likely to adopt management decisions even if they lack clear socio-economic objectives, bring increased liability, have unknown risks, or have limited internal agency support (Williamson, 2007). For example, a recent study found that the decision to implement a Wildland Fire Use project was primarily influenced by managers' personal commitment to restoring fire for the good of the land despite multiple existing disincentives (Williamson, 2007).

Tradeoffs

Although land management decisions are said to be made on the basis of scientific evidence, there is an abundant literature demonstrating that underlying the science are several subjective choices (Gregory & Long, 2009). For example, an evaluation of what constitutes an impact, what constitutes evidence, and what analyses are appropriate can all be influenced by ascribed values (defined as the level of importance one places on a particular item or issue) (Gregory & Long, 2009). Although the literature on tradeoffs uses similar language as previously described in the cognitive hierarchy, "values" are used here to represent a different concept.

Tradeoffs occur whenever getting one thing of value requires giving up something else that also has a high level of importance, a situation common in land management decisions. Tradeoffs are challenging because they force people to weigh two or more items of importance and ultimately promote one item over another. In many cases the conflicting values are not easily comparable due to the multiple dimensions of the resulting outcomes (Maguire & Albright, 2005). For example, land management decisions may affect human safety, the economy, and ecological health, among others. Comparing potential gains and losses across these different categories can be challenging, such as weighing potential benefits to wildlife habitat against potential costs to economic revenue (Maguire & Albright, 2005). As the dimensions of value involved in any one decision increase, so does the difficulty in weighing potential outcomes in making a decision (Kleindorfer et al., 1999).

Gregory suggests one reason for the failure of local and national initiatives in environmental risk management policies is the inadequate attention paid to addressing the related value tradeoffs (Gregory & Long, 2009). Many tradeoffs are difficult to address because they raise emotional, moral, and/or ethical issues that are hard for individuals to consider and are not easily resolved. Individuals may experience cognitive dissonance, or an inability to acknowledge a tradeoff because it is uncomfortable to weigh impacts to different items of value, creating disharmony in cognitions. In order to achieve harmony individuals will ascribe more value to one item and less to another (McLeod, 2008). For example, if an individual values privacy, they may choose to keep trees close to their home even though it puts their home and family at a greater risk of fire. As this decision pits two values (privacy and safety) against each other, they may tell themselves that the

risk of fire really is not that great, diminishing the value they hold for safety and increasing their value of privacy. If these tradeoffs are not addressed, it creates challenges for decision making.

Tradeoffs often have multiple value dimensions, which can make the consequences of a decision uncertain or unclear if the tradeoffs are not explicitly addressed (Gregory, 2002). Furthermore, the evaluation contexts are often unfamiliar (Gregory, 2002), for example, how one would evaluate the value of clean water and the value of economic revenue would be difficult as one can be measured with dollars and the other has no definitive scale. If these tradeoffs are not addressed directly, with an accepted and understood scale of measurement for items of multiple dimensions of value, then the items of importance may not be accurately measured, negatively impacting decision making.

An additional challenge with public resource management is that these decisions include not only the values of land managers but a variety of public stakeholders, each with a potentially different interpretation of the tradeoffs involved. Moreover, as discussed above, these decisions are made within a complex web of sometimes conflicting policies that promote particular values over others. For example, endangered species protection involves balancing wildlife recovery goals, societal benefits (e.g., human health, property rights), and other management objectives (e.g., public health, economic revenue, etc.) and may require tradeoffs between protected values (values that certain stakeholders find difficult to tradeoff with other values) (Baron & Spranca, 1997).

The difficulty in negotiating these tradeoffs has been cited as a primary reason for the failure of many endangered species deliberations (Gregory & Long, 2009).

In this particular case, the Kirtland's warbler historically relied upon fire to create its breeding habitat. Given that fire can affect forest resources and habitats, air and water quality, structures, and the safety of human lives, the use of fire includes difficult tradeoffs across potentially protected values (Cohan et al., 1984). Moreover, given the uncertainty associated with fire behavior and outcomes, it is difficult to fully predict these impacts prior to implementing a project. These conditions increase the challenge with using fire in endangered species management.

Structured Decision Making

One approach to addressing tradeoffs between values that is being increasingly applied in environmental decision making is structured decision making, or decision aids. Incorporating value judgments in decision making can contribute to the development of alternatives that are likely to achieve greater public support and long term success (Gregory et al., 2001; Wilson et al., 2009). Using a structured decision making approach assists in a better evaluation of technical information and results in choices that better reflect prioritized objectives (Wilson & Arvai, 2006). Figure 4 provides an overview of the elements and benefits of a structured decision making process. In the traditional group decision setting, it is unlikely that the full range of objectives is defined (Wilson & Arvai, 2006). Currently, the Kirtland's warbler recovery team is not employing the use of such decision aiding tools.

Elements of a well-structured decision process	Benefits of a well-structured decision process
<ol style="list-style-type: none"> 1. Define the decision problem to be addressed 2. Identify key objectives to clarify what you want your decision to achieve 3. Define a rich set of alternatives 4. Describe consequences in terms of how each alternative meets the objectives 5. Focus on the tough tradeoffs that exist across objectives 6. Define how uncertainty affects your decision 7. Pay close attention to cognitive and emotional traps that could inadvertently bias your choices 8. Examine how the outcome of this decision will influence future decisions. 	<p>Facilitates the identification of concepts, alternatives, and information. In particular, stakeholders need not be concerned that they may inadvertently agree to something early that will prove problematic later.</p> <p>Saying “yes” to whatever one believes in is more positive and liberating than worrying about when to say “no.”</p> <p>Regulators are given more information about the decision to be made, and about stakeholders’ preferences, in the event consensus is not reached.</p> <p>There are repeated opportunities to explore divergent preferences, refine alternatives, and learn about others’ views. For example, stakeholders may find that they agree about a fundamental goal of the decision process even though they may disagree about the means by which it should be achieved.</p>

Figure 5: Elements and benefits of a well-structured decision process. Adapted from Gregory et al., 2001.

Risk Aversion and Decision Heuristics

Previous studies have found that, in some cases, forest managers may make decisions to avoid particular management approaches they view as risky even if doing so results in a failure to meet their management objectives (Christenson, 2003; Wilson et al.,

2009; Stankey et al., 2003). This suggests they are acting overly risk averse as the actions they are taking do not make good sense in relation to their stated goals (Maguire, 2005). Risk and uncertainty are inevitable in the management of biophysical and socio-economic systems (Stankey et al., 2003). When a decision maker believes a decision, such as the use of prescribed fire, could result in disciplinary action, job loss, or personal liability, it becomes rational to be risk-averse (Maguire & Albright, 2005; Stankey et al., 2003; Canton-Thompson et al., 2008). A fully objective analysis of the appropriateness of fire for a particular project would require objectively estimating the likelihood of prescribed fire to escape and cause harm against the benefits from successful treatment implementation. However, in the case of a failed fire project the use of heuristics can cause a focus on placing blame for bad outcomes rather than examining the quality of the decision itself (Maguire & Albright, 2005). While nearly all prescribed fires conducted by federal land management agencies are successful (only about 1% of them burn beyond the planned area) those that do escape can result in a sharp reduction in the use of prescribed fire (National Academy of Public Administration, 2000). Moreover, some escaped prescribed fires can result in substantial negative impacts. For example, the Cerro Grande Fire in Los Alamos, New Mexico burned over 47,000 acres and destroyed more than 225 structures and received considerable attention as an escaped, management-ignited prescribed burn (Stapp, 2003). Within the study region, the Mack Lake Fire began as a prescribed burn but eventually burned over 24,000 acres, destroyed more than 40 structures, and resulted in one fatality (Simard et al., 1983). It goes without saying that managers do not want to be responsible for the decision to implement a treatment that ultimately leads to such negative consequences.

Moreover, activities that are judged as high risk, (if the risk occurred it would have severe effects), have been shown to be perceived to have a low benefit, as it creates a mental conflict to have something be high risk and high benefit (or low risk and low benefit) (Alhakami & Slovic, 1994). In order to avoid this conflict, the brain uses a mental shortcut to assume an association of high risk with low benefit and vice versa (Alhakami & Slovic, 1994). Research has found that this heuristic results in overestimating negative results from the use of fire among fire managers (Wilson et al., 2010). For example, if a fire is seen to pose a high risk to safety, then it is hard to recognize potential benefits, such as habitat restoration.

This risk averse behavior is a major constraint to more experimental management approaches such as using fire to maintain or improve wildlife habitat. Respondents in a study conducted by Canton-Thompson et al. (2008) felt a growing number of incident commanders and other team members are becoming increasingly risk-averse due to an increase in agency safety concerns, and a perceived lack of agency support if something was to go wrong, increasing a risk to personal liability and excessive rules and regulations (Canton-Thompson et al., 2008). Observers of recent decisions have alleged that both the land management organizations and regulating agencies that review their decisions, such as the Environmental Protection Agency (EPA) and the US Fish and Wildlife Service (USFWS) have become overly risk-averse, in that the actions they take do not seem in good judgment in relation to their stated management goals (Maguire & Albright, 2005). Specific to the study region, managers indicated the uncertainty of potential risks to management objectives constrained their ability to use fire (Wilson et al., 2009).

Within the parameters of this study, this risk aversion is compounded by the fact that management decisions may affect endangered species habitat. In this case, the potential consequences involve not only those described above, but also the potential for species decline as well as lack of compliance with federal law. When the result of failing to meet objectives involves an irreversible process, such as extinction, there tends to be a shift to avoid risk and increase safety margins (Marshall et al., 1998). This tendency towards risk aversion is also encouraged by the need for the decision maker to present a defensible rationale for their choices and scientifically supported information that the choice will decrease risk to a T&E species (Gregory & Long, 2009).

When making complex decisions in an uncertain environment, such as land management, there are several psychological barriers to making good decisions (Maguire, 2005). These barriers can result in inaccurate estimates of the probability of events, erroneous assessments and identification of the values underlying decisions, and a failure to articulately combine information regarding probabilities and/or values (Maguire, 2005). This can hinder good decision making. Use of mental shortcuts, or decision heuristics, when making decisions for land management can lead to decisions that are overly risk-averse (Maguire, 2005). An individual's characterization of risk depends upon value judgments made about the probability of the event occurring as well as different perceptions on whether and how much an event poses danger or adverse impacts (O'Laughlin, 2005). When the decision problem involves something of high perceived importance and when the decision-maker may be held liable for the outcomes, individuals tend to adopt a risk averse approach (Wilpert et al., 1976). There are several

mental shortcuts which can result in risk aversion, threatening good decision making.

Table 2 reviews common decision heuristics which lead to risk aversion.

Decision Heuristic	Explanation	Potential Management Result
Certainty Bias	Frame decisions as a risky choice versus a low-risk ("certain") alternative, resulting in an inadequate assessment of the risk-risk tradeoffs	Prescribed fire management decisions are often framed as a risky choice (prescribed fire) vs. a certainty (status quo management), resulting in the 'certain' alternative being chosen
Status Quo Bias	When failing to take action results in negative consequences, decision makers feel less responsible than when taking action results in negative consequences, resulting in a preference for actions that prevent harm over those that could reap benefits	Status quo, or traditional management continues because it is seen as less risky
Reference Point Effect	Alternatives are evaluated relative to a reference point, which affects how a problem is framed and thus which alternatives are chosen	Management may be based off a recovery goal for a species, however a service biologist and a conservation biologist may have differing views on what an adequate recovery goal number would be
Availability Bias	Tendency for more recent, vivid, or personally experienced events to be overweighed when estimating probabilities or making decisions. Decision makers are affected more strongly by vivid information than statistical or abstract information	Previous escaped prescribed fires in the area can cause managers to overestimate the likelihood of escape of prescribed burns

Table 2. Decision heuristics which can lead to risk aversion

Continued

Table 2 continued

Affect	Feeling or state people experience in response to a stimulus, which in turn influences judgment	If a prescribed fire escapes and lives or property are lost, that creates a vivid and negative emotional attachment to prescribed fire and thus an aversion to its use in the future
Future Discounting	The immediate impacts are weighted more than the long-term benefits of risks. Thus potential future gains may be outweighed by possible short term losses	Rejecting the use of prescribed fire due to a fear of escaped fire in the short term could result in declining habitat and an increase in the probability of a future wildfire due to fuel buildup. When viewed from this perspective, the value of not using fire decreases over time; however, management decisions rarely include such an assessment

Certainty and Status Quo Biases

The way a decision problem is framed has a strong effect on decision making and preferred alternatives (Kleindorfer et al., 1999). Prior research indicates that people desire certainty, and accordingly may describe decisions in a way that makes one alternative look safe and neglects the associated risks. Doing so prevents an accurate assessment of the potential costs and benefits of the potential range of alternative actions (Maguire & Albright, 2005). This approach to framing decisions is a heuristic called the ‘*certainty bias*’ (Tversky & Kahneman, 1974). This heuristic can lead to a biased evaluation of

alternatives in favor of the “less risky” option. Often the “less risky” choice is perceived to be the alternative that has traditionally been used. Thus, the traditional responses or decisions continue, even if they result in suboptimal outcomes. This is an example of the ‘*status quo bias*.’

Prescribed fire decisions are often framed as a risky choice (prescribed fire) versus a certainty (status quo management) (Maguire & Albright, 2005). This may lead managers to reject the use of prescribed fire more often than would be justified by a true weighing of the costs and benefits of all alternatives (Maguire & Albright, 2005).

Decision makers feel less responsible for not taking action over taking action (Maguire & Albright, 2005). For example, fire damage to a species or property is seen as less serious if a wildfire caused it (i.e., not taking action) than if it results from an escaped management-ignited prescribed fire (i.e., taking action) (Maguire & Albright, 2005).

Availability Bias and Affect

Also potentially influential is the ‘availability bias’, which is the tendency for more recent, vivid, or personally experienced events to be predominant when estimating probabilities or making decisions (Kleindorfer et al., 1999). Decision makers are affected more strongly by vivid information than by statistical or abstract information (Plous, 1993). The availability bias also influences risk-aversion as previous catastrophic or escaped fires can cause managers to overestimate the likelihood of escape, thus prioritizing maximum safety and the limit of fire spread over ecological objectives (Canton-Thompson et al., 2008).

The availability bias often coincides with the affect heuristic. Affect, defined as the feeling or state people experience in response to a stimulus, may also influence judgment of the potential alternatives (Wilson & Arvai, 2006). For example, if a prescribed fire escapes and lives or property are lost, that creates a vivid and negative emotional attachment to prescribed fire by those who were affected by it. Thus individuals are susceptible to both the availability bias (from the vivid, emotional experience) and the affect heuristic (from the negative emotional association to prescribed fire).

Chapter 3: Research Methods

This study uses a qualitative analysis to examine the decision making environment of land managers and researchers directly involved in Kirtland's warbler recovery efforts. A qualitative approach is beneficial when variables are not clearly identified, theories need further development, and when a detailed description of a topic is needed (Creswell, 2007). Given the lack of prior data examining decision making for endangered species, we determined that a qualitative approach was most appropriate for this study. Through discussions with current members of the Kirtland's Warbler Recovery Team (KWRT), a list of 37 potential participants who were currently or formerly involved in Kirtland's warbler recovery efforts was developed. Each participant was then asked to identify others who they felt would be good representatives of the management and/or would have points of view pertinent to the research. This method, known as snowball sampling, draws on the knowledge of those directly engaged in the topic of interest to specify others with sufficient knowledge and experience to provide informed responses (Gold, 1997). These purposive sampling methods were appropriate given the exploratory nature of the study and to achieve an in-depth understanding of factors influencing decision making and fire management in this particular case. Study participants included a range of agency personnel and academic scientists that are

currently involved in or previously played a key role in the management and decision making for Kirtland's warbler recovery.

The research team developed an interview protocol based on prior research on risk and decision making. The semi-structured interview protocol consisted of open-ended questions, enabling the collection of in-depth responses. While this protocol was used to guide the interview and ensure coverage of topics pertinent to the research, the interviewer was flexible with the sequence and specific wording of the questions so as to maintain a conversational tone and allow interviewees to be able to respond in a way that made the most sense to them (See appendix A for the interview guide). This inductive approach enables collection of data to provide an in-depth description and understanding of the factors influencing decisions for Kirtland's Warbler Management Areas. Interviews were either conducted in person or if not possible, over the phone. All interviews were audiotaped with prior verbal consent of the respondents.

Agency/Organization	Number of Respondents
US Forest Service	11
MI Department of Natural Resources	7
US Fish and Wildlife Service	5
Academia	2

Table 3. Table of Participants, n = 25

Interviews were conducted until the point of saturation where subsequent interviews failed to provide new information (Creswell, 2007). A total of 25 interviews were completed. The number of interviews coincided with the acreage allotted to Kirtland's warbler management (i.e., the USFS manages the largest amount of Kirtland's warbler management areas, and had the most interviews). Participants included active and retired personnel with the USFS, USFWS, DNR, and academic institutions (see table 3). No members of the funded research team (which included USFWS personnel and academics) were part of the interview population. Positions included: wildlife biologists, research ecologists, fire and fuels specialists, stewardship coordinators, ecologists, foresters, and academics. Participants discussed the current and historical forest structure and the role of fire and its use (or lack thereof) in jack pine forests and Kirtland's warbler habitat. The roles of different agencies and stakeholders as well as policies and regulations were also discussed. Recovery objectives and factors influencing the decision making for management were identified and desired future management and barriers to those management strategies were discussed as well. In addition, communication techniques, Kirtland's warbler management decisions compared to other endangered species, and what a 'recovered' population is were also examined.

Interviews lasted from one-half to two hours. Each respondent could end the interview at any time or decline to answer any questions (none did). Each interview was then transcribed verbatim. Identification codes were used to protect the interviewees' confidentiality. Using a systematic approach, an initial coding of transcribed interviews was completed to reveal content categories and distinctive features to identify themes.

This was done by first coding four of the interviews with no existing codes, using the major themes that appeared across the responses. This was then cross referenced with components from the research proposal and information from the literature review to create a final coding scheme. Coding was completed using NVivo 9. This coding scheme contained several levels of nodes, beginning with parent nodes and additional description provided by underlying child nodes. The first level parent nodes included: Decision Factors (legal, social, and psychological), Current Management, Desired Management, Contextual factors influencing management, Use of Fire, and Use of Adaptive Management Strategies.

A fellow researcher was consulted to ensure inter-coder reliability. Interviews were selected that covered the widest range of codes, and then were analyzed and coded by an outside researcher. Findings and codes were then discussed. These discussions revealed agreement across the selected interviews. Qualitative methods such as those employed in this research provide the opportunity to explore a particular topic in-depth within its particular context. This approach is well suited to the nature of endangered species management (directed by relatively small recovery teams acting within a particular location). While the resulting data do not enable statistical generalization to other locations, findings can be compared through the development of additional cases in the future.

Chapter 4: Results

The following paragraphs describe the findings from the qualitative analysis of this research. Part of this analysis included comparing responses between the different agencies included in the study. Overall, responses were similar and no evidence was found of substantial differences among the legal, social, and psychological factors between organizations. We begin this chapter with a description of the legal, social, and psychological influences on management decisions (see figure 6) and then present current and desired management for the Kirtland's warbler. When appropriate, direct quotes from study participants are used to illustrate findings.

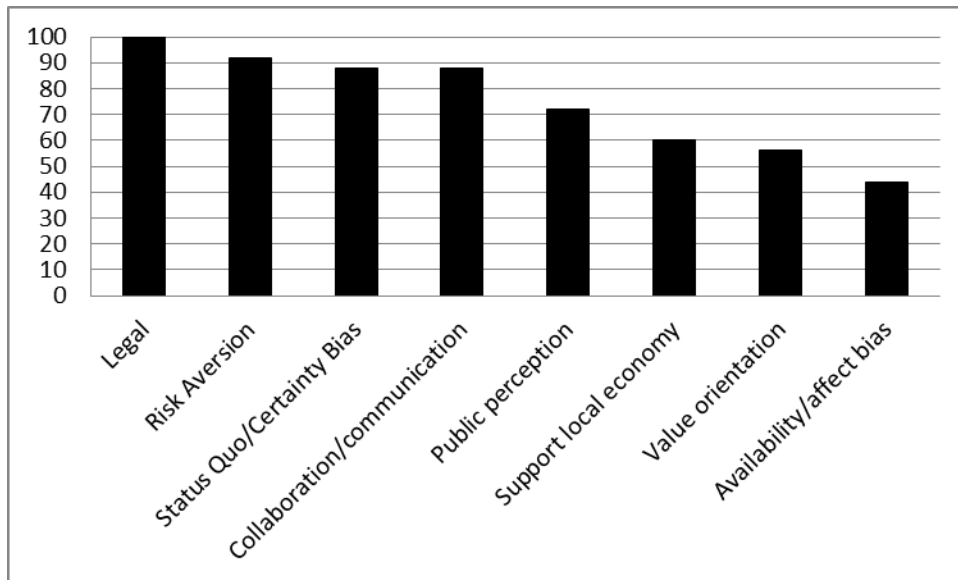


Figure 6. Factors characterizing the decision process of land managers

Legal Influences

All of the interview participants mentioned policies, laws, mandates or plans as influencing the decision process. In particular, the legal status of the Kirtland's warbler as a federally protected species influenced how management was carried out. Some cited the listing of the Kirtland's warbler prompted proactive management action that may not have been undertaken otherwise. As a USFWS employee stated, *"You know if you don't have a federal trust species, a federal species, or even a state species, if there's no legal mandate to do something, they don't."* However many respondents also indicated the legal status of the species constrained their ability to make management decisions. These participants indicated that the federal protections limited opportunities for experimentation and flexibility in management, and enforces a single species rather than

a multi-species, ecosystem focused approach. *“It (the ESA) was sort of written in a backward fashion anyway. They started with endangered species rather than biodiversity and this idea of dealing with species when they’re common was explicitly contradicted almost in dealing with endangered species. They do mention in the ESA the fact that oh by the way, helping endangered species will help other critters that are in the same habitat, but that was more of an aside than have it be a rare habitats type of thing, and in some of the early days of the ESA a lot of things just had to do with harvesting, poaching, and the like, so it was a protection deal, and that’s why some of the early KWRT members are so into protection” – USFS employee.*

It is important to note that the Endangered Species Act is only one of many laws that influence agency management decisions. Agency managers work to balance the multiple and sometimes competing demands created by the broad suite of laws. For the USFS and the DNR one such mandate that was often mentioned was the need to provide timber products from their lands. These participants indicated the adoption of intensive mechanical management of jack pine stands provided a means to both meet the warblers’ habitat requirements while also satisfying the need to provide timber products. However as one academic noted, *“a lot of agencies have a lot more latitude than they think to do certain things that doesn’t cost a lot of money and they don’t have a direct mandate to do it, but they also don’t have a prohibition against doing it.”*

Social Influences

The social factor most frequently mentioned to affect management was the collaboration and communication among individuals and between organizations and agencies (88%). This was stated as a positive factor, encouraging information exchange and collaborative learning. The KWRT meetings were often mentioned as a great

resource for this information exchange and communication to take place, as well as to build trust. Several respondents felt this was what made the Kirtland's warbler recovery so successful and unique; what sets it apart from other endangered species recovery programs. *"So the Kirtland's warbler project was a remarkable one because you had the Michigan DNR, you have the USFS, the USFWS, the USFS research station, and 3-4 or more universities involved from time to time to do projects, and so it was a multi-unit collaboration, which I thought was quite remarkable...and we'd have a get together after our meetings and everybody got to talk and they'd exchange ideas and things...so that interworking, interconnections of those organizations and the people from the University view points and the DNR and the USFS, I don't know another example in Michigan that matches that project"* –Forest Ecologist.

Respondents also commented on the consistency of the recovery team and those involved in the management as contributing to effective communication and relationship-building: *"The more time that you spend working on it, the easier the communication gets, and a lot of the people have been coming to the same meetings for twenty years and longer, so that just helps, it's been a very cohesive, consistent recovery team"* -USFS employee.

While the overall impact of the group gatherings was noted as positive, some responses indicated the possibility of groupthink. As one retiree stated: *"You tend to get a little bit insular and a little bit provincial."* A current member of KWRT also seemed to notice the possibility of groupthink occurring: *"From some individuals I've noticed this visceral sort of rejection or maybe threatened, or a concern that doing anything different is going to send the species back, and a lack of willingness to be open to*

thinking about the problem as a whole and thinking beyond what they've always done, and the dogma that they've sort of been operating under... I saw this firsthand [at a KWRT meeting]...where any new ideas were brought up or proposals to step outside of the box and rethink were sort of entertained but otherwise tabled or kind of shot down...it's kind of an obstacle towards future conservation in my mind.”

In addition, while many respondents felt the KWRT has traditionally blended science and management well, incorporating research, some respondents felt that currently that has diminished. *“My feeling of whoever’s making the decision now on the committees and on the KWRT is management oriented only. I think they do not have a large enough research capacity or research interest represented” –USFS Employee.*

Public perception and needs were mentioned by 72% of the participants as a limiting factor for management. Several participants indicated the public ‘just doesn’t understand’ why they manage how they do. *“They don’t understand why the clear cuts are necessary in the big picture because of jack pine management, and needing that habitat to be regenerated, just for the sake of jack pine and for fire management, but they don’t get that, so they want to see these big mature trees all the way around them, around their cabins, around their homes, when they’re driving out to their cabins, and so the local pressure can get strong enough to affect how the local land managers have to, you know, what they have to respond to as well” –USFWS employee.* Respondents discussed the need to accommodate public desires to maintain good relations as well as funding. However some noted that managing for public desires can result in decisions that may have negative economic consequences. *“That’s one thing I hate, when there’s a forest fire and then they go through and salvage all the trees and so they basically take away all*

that woody debris and now it's just left with bare ground because it looks better, and when the grass comes back in it looks better. Well, yeah, but c'mon. What's the long term ecological value of all that dead wood? So I think there's a lot more pressure of short term management to make that compatible with what people want"-USFWS employee.

As this quote illustrates, public perception and input was often characterized as limiting management approaches and interfering with objectives. However, as existing laws and regulations require these agencies to include public input and all of the agencies depend on the public for continued funding; participants were resigned to the need to consider public input in developing management plans. Moreover, some participants also noted the value of such input as described by one USFS employee: *"But society wants that. I don't think it's our job to put things back the way they were just because we think we're the know-it-all ecologists or whatever, because if society doesn't want that, we shouldn't do that."*

The need to support the local economy was mentioned by 60% of respondents as a reason for the current management. As noted above, intensive mechanical management was seen as a compromise of multiple objectives, not just for the Kirtland's warbler but to provide important economic returns as well. In addition to the legal mandates to provide timber products, there is also societal pressure for a local economic product. *"If this was solely about Kirtland's warbler, we could get by with a lot less acreage and we'd manage it a lot more intensively. So birds leave at age 20 [of jack pine], we'd clear cut it, we'd plant it, but there was a conscious decision not to do that because we wanted the support that would come and I think the benefits that would come by allowing the*

stands to grow to a marketable age, in providing a timber product that's then used locally, regionally, and then replanting" –USFWS employee.

Several participants noted the importance of providing these products for the continued ability to have the support necessary to provide warbler habitat. If this economic return was not realized, they indicated that management for the Kirtland's warbler would not be possible due to societal pressure and lack of funding for habitat management.

Psychological Influences

A tendency towards risk aversion was the most commonly observed psychological factor influencing participant responses (92%). Risk aversion was mentioned both in decision making with the use of fire, as well as decision making for an endangered species. Upon listing, many participants indicated that the low numbers of the Kirtland's warbler necessitated the need to be risk averse in order to ensure the species' recovery. In several cases, this tendency towards risk aversion continued even though population numbers had increased and currently exceed recovery goals. *"I think the composition of the KWRT is very protective in nature and rightly so, but it also limits being able to think beyond the conditions that were in place when the species first became listed and certainly it's good to celebrate success and consider these, but I think there's some resistance within the core KWRT to be more flexible and adaptive in management and minimizing threats because that's been the history with recovering a species from the brink of extinction."* Several decision heuristics were also identified by a majority of respondents, which can lead to or reinforce risk aversion.

Most participants (88%) also demonstrated a status quo and certainty bias in management decisions. In part this was due to risk aversion, but also because of the predictability and ‘success’ of the traditional management. *“And it’s been tried and true, and we’ve been using that for probably more than 30 years now. Which is kind of interesting, you know we haven’t changed at all. Just because it works. You know, when you got something that works you don’t change it” –USFS employee.* While these prior management approaches had proven effective, most participants acknowledged that this emphasis on continuing past practices could be a barrier to seeking alternative management approaches. *“The Forest Service tends to be a reactive agency. We don’t change, we don’t change, we don’t change, something blows up, and then woosh, big change. Instead of sort of measured, proactive, forward looking. I’m a little bit concerned about that. You know it takes a long time to steer a 30,000 person agency that manages 194 million acres. That’s not a nimble outfit” –USFS employee.*

Although it occurred in 1980, the Mack Lake fire remains vivid in the minds of both management personnel and the public. This emotional event has caused an availability bias in managers and the public, as many reflect on this event when considering the use of prescribed fire to manage habitat conditions. The feelings generated by this event result in a strongly negative affect. *“I can tell you there’s a reluctance in that system to light a match. Both from the agency side and from the public side. After Mack Lake, which was a huge black eye, in 1980, in the year 2000 we were still hearing from people like it happened yesterday... We were ready to start [burning], but some of the public, they will just never let us forget it” –USFS employee.*

Value orientations were identified as influencing decision making for 56% of study participants. A more biocentric value orientation would result in attitudes that the Kirtland's warbler should be preserved because of its inherent worth. Participant responses suggest that such a perspective can influence managers to persevere in their efforts despite low perceived likelihood of success and insufficient resources to recover the Kirtland's warbler population. This perspective was often raised by study participants as an integral piece to the 'success' of the program and recovery. *"Because someone could say, well why do you do all that work for that damn bird, if you get rid of that bird and put deer up there, more turkey, or more red pine so we can get more timber market off that land, or so that can go either way just depending on what you feel, and what's important to you. So, I'm on the end of...that's such a value to have that species in your community"* –USFWS Employee. However, agencies have traditionally managed lands with a more anthropocentric approach (Vaske & Donnelly, 1999). This traditional approach coupled with existing laws and regulations that represent this value orientation influence the current management practice of ensuring a product for economic return.

Current and Desired Management

Of participants who were directly involved with land management, 80% are using jack pine plantations or opposing wave management for the Kirtland's warbler, and 20% are also using alternative approaches that involve the use of fire. The use of these alternative methods was mainly limited to the Upper Peninsula where land managers indicated they had greater flexibility as the lands were not designated as critical habitat in the Recovery Plan thus avoiding the strictest restrictions of the ESA. In addition, some of

the lands were managed by the USFWS, and thus did not have a multiple use mandate to produce forest products.

When asked about the development of the current management approach, the most common responses were that it works, it is predictable, and it meets multiple objectives. *“We tend to harvest and manage our landscapes to some multiple benefits, one of them being economic, certainly another one being recreation, and the third is certainly wildlife habitat, and the fourth one has got ecosystem components written into it” –DNR employee.* Respondents mentioned various tradeoffs of the current management, including silvicultural, wildlife habitat, fire safety, and natural ecosystem processes. The respondents seem to share an understanding of the tradeoffs, and that compromises are necessary in management plans. *“You don’t get what you want, you get what you negotiate for. There’s always going to be a little bit of internal tension. The art is balancing it. Don’t sell out one resource to benefit another. You try to find the happy medium, the middle ground amongst the various resources”-USFS employee.*

While these compromises and tradeoffs to the current management of jack pine plantations are acknowledged, many respondents expressed an alternative desired management particularly now that the Kirtland’s warbler has exceeded the recovery goal for the eleventh year in a row (U.S. Fish and Wildlife Service, 2012). Reflecting on the management approach to date and looking ahead to future management decisions, one USFS employee noted, *“It was the right thing to do, I’m convinced of that for the Kirtland’s warbler at the time. We knew it would work, but I think it’s time now for us to think about some different strategies.”*

Of the desired management, 60% of respondents stated they would like to see the use of more adaptive, ecological and/or natural management that had a greater focus on multiple species. *“We understand what the ecological tradeoffs have been by managing an opposing wave and managing very intensively, and it’s time to recognize that there have been ecological tradeoffs and let’s manage towards some of the other ecological values associated with the jack pine outwash plain, and start to see how compatible, and what the range of tolerance is in Kirtland’s warblers in association with some of these other ecological values”-DNR employee.*

In addition to coding responses for various factors that might influence decision making, a separate line of questions focused specifically on barriers to desired management. When asked what obstacles prevented the desired management of the use of more alternative, adaptive management from taking place, obstacles that repeated codes included the largest constraint mentioned, which was legal constraints (the ESA status of the Kirtland’s warbler) (57%), this was followed by the related emphasis on a single species focus (50%), though this was a new obstacle not previously coded for. *“Ecologically I think that under the ESA we’re really charged to focus on Kirtland’s warbler and meet their needs, and there’s a reason for that obviously. Financially we’re funded to meet the needs of Kirtland’s warbler first, and then there’s, you know you can tweak the management to meet the needs of other species on the landscape” –USFS employee.* Other repeated obstacles mentioned were that you ‘don’t mess with success’ as the current strategies are bringing up the bird numbers (i.e., status quo) (14%). Other new obstacles mentioned were management objectives superseding science (29%), that it

takes time for change to happen, “it’s a big ship that’s hard to turn” (21%), and a need for additional research (7%) (See figure 7).

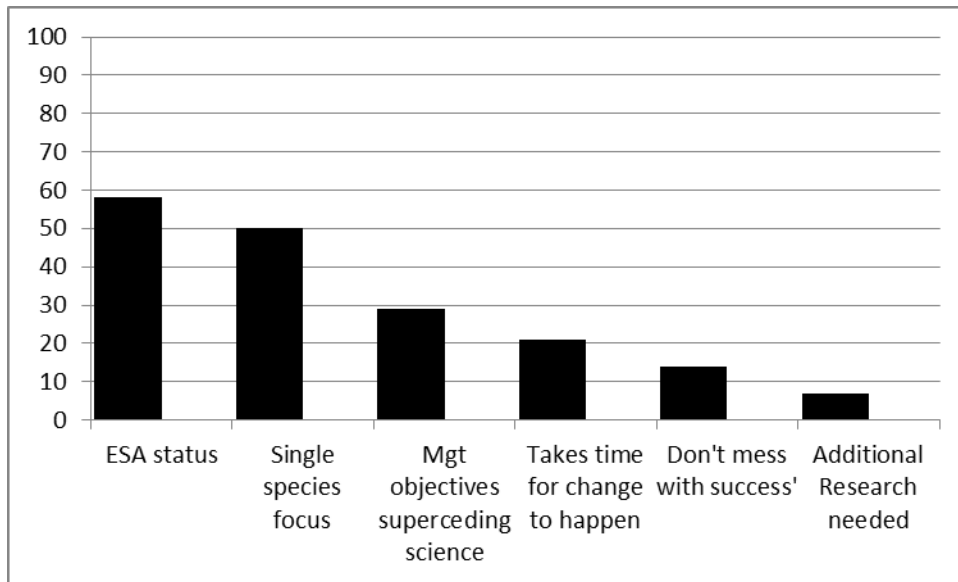


Figure 7. Obstacles to adaptive/alternative management

Over half of participants (52%) desired a greater use of fire in Kirtland’s warbler management and suggested that doing so would provide a number of benefits including ecological health, diversity and resilience, and the creation of habitat (64%), natural, successional regeneration (48%), and having another tool in the toolbox (40%). *“Oh gosh, we need fire back in that landscape bad. Really bad. It’s, we’ve lost a lot of process and function and we’re really going to, it’s, that mature canopy and the needle cast from*

the jack pine and the red pine, is just eliminating what would've been beautifully functioning systems" –USFS employee.

While the ESA was noted as the primary obstacle to adopting alternative management approaches regarding the use of fire, it was noted as only one of many obstacles (28%). This suggests there are barriers to fire management for ecological purposes regardless of species' status in the ecosystem. The primary obstacle to integrating more fire use was the time, planning, staff, and complexity of using fire (68%). *"We're going to have a hard time getting a burn window that we need, it's not too wet, it's not too hot, it's gotta be just right, and then when we get that, we've got to have enough dozers on hand, firefighters on hand, aircraft overhead, it's like a military operation to make that all happen. Before that we have to have the money sitting in a bank account someplace. It's going to be 100s of 1,000s of dollars to pull this off. So there's a good chance we're not going to be able to do it" –USFWS employee.*

Another obstacle mentioned by nearly an equal number of participants was the societal risks to human health, life and property (64%), and public resistance and perception (64%). *"If we stop putting out forest fires it (Kirtland's warbler) would probably be fine but we need to protect people's property and their lives and so as long as there's people within the ecosystem we'll always be putting out forest fires" –USFS employee.* Providing a timber product and the economy were also mentioned as obstacles by the majority of respondents (56%) as the use of fire was seen as relinquishing *"the economic value of those trees" – DNR employee.* Several other obstacles were also noted by a substantial number of participants. New obstacles mentioned were the intensity of fire needed for jack pine regeneration (40%), and lack of knowledge/experience/success

(40%), and the unpredictability of fire (40%). Repeated obstacles were external constraints such as weather, timeframe to burn, etc. (40%), the success of the current management was also mentioned as an obstacle (i.e., status quo) (36%), along with liability (no one wants to get blamed or be held responsible) (i.e., risk aversion) (36%) (See figure 8).

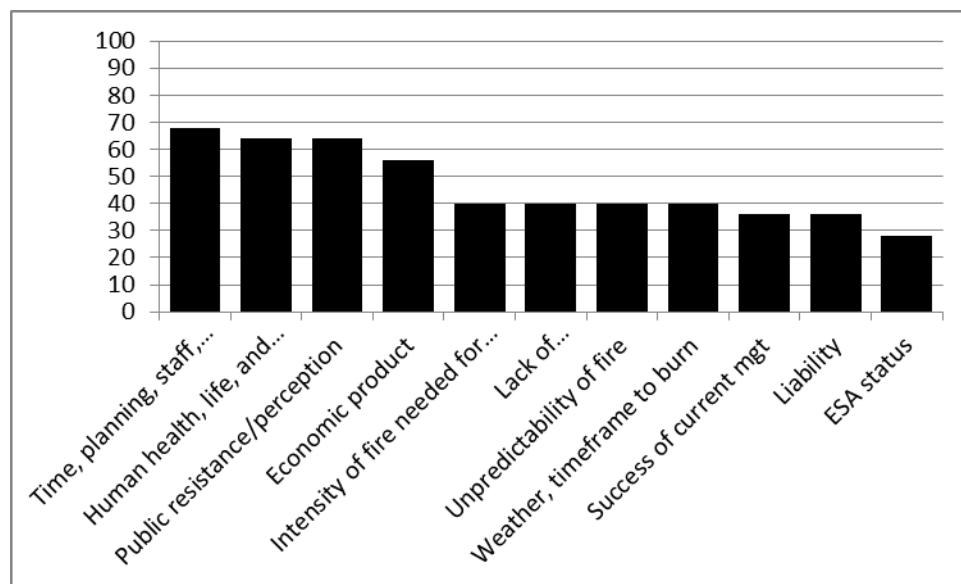


Figure 8. Obstacles to using fire for management

Forty-four percent of respondents felt that there needed to be more of a focus to ensure long-term recovery of the Kirtland's warbler. The biggest factor mentioned among participants to ensure that was an increase in public relations and outreach (32%). *“So obviously there's a community component we need to draw in and I think that gets to the*

information and education we've talked about, is that's really an integral piece into the future in making sure the community's aware of what's happening and why it's being done, and trying to garner their support for continued work because it will really have an impact, at least for the state and to some level to the federal lands and being able to continue doing the work" –USFWS employee. Also mentioned was looking at broader landscapes and outside of the critical habitat areas (16%) and involving more groups in the management (16%). "As we move forward and think about delisting and the fact the KWRT will be dissolved, I sort of feel like we've maybe not done ourselves the best service by not integrating some non-agency people in a more formal role because we've missed out on some opportunities to really get some stakeholder buy-in which I think we're going to have to make up for in the near term. We're going to have to engage with some groups that can reach out to some of those folks"-DNR employee.

The following chapter will discuss further these findings and their significance, recommendations for the management, and ways to improve the decision process.

Chapter 5: Discussion

This study is an exploratory attempt to examine the factors that influence the decision making of land managers and others involved in Kirtland's warbler recovery efforts. Findings identify not only the most influential factors but also describe how they influence decision making. While the efforts of the KWRT have brought a species back from the brink of extinction, which is a commendable feat, this study is aimed at better understanding the decision making process and offer suggestions to help the KWRT and other recovery teams make more effective decisions in the future. Several important findings emerge from this research. In this chapter we begin with a discussion of legacies of the past and how they have influenced agency norms and management decisions. Next, we discuss groupthink and strategies to curtail it. We then move on to discuss the expressed desire for adaptive management and constraints to its use. While several members of the recovery team expressed a desire for adaptive management strategies and increased use of fire for ecological purposes, these methods have not been consistently integrated into the management, with jack pine plantations remaining the dominant strategy. Finally, we examine the potential for structured decision making to address this disconnect as well as the psychological and social barriers to decision making found in this case study.

Legacies of the past

Previous value orientations and past management practices have resulted in several legacies that influence management decisions. The value orientations in place when the USFS, USFWS, and MI DNR were created resulted in an anthropocentric focus. Table 4 outlines the mission statements of these agencies. With a focus on the value of forests for human society, rather than an intrinsic value, these mission statements provide evidence of this anthropocentric approach (Vaske & Donnelly, 1999). Within this focus, with the exception of subsets such as the USFWS National Wildlife Refuge System, these agencies are charged with managing for the multiple uses and various values the public retains from the forests. In some cases such uses and values are complementary, but in many cases they may actually compete with one another. In such cases, agency managers must balance these competing objectives as they develop and implement plans. In particular, the DNR and USFS have a multitude of objectives to meet, as they must obtain forest products from the land as well as manage for recreation, ecosystem health, and other values. While many individual managers indicated a desire to adopt alternative approaches to restore Kirtland's warbler habitat, in many cases the dominant value orientations within their agencies appear to favor managing for human use values.

Agency	Mission Statement
Forest Service	The mission of the USDA Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations
Michigan Department of Natural Resources	The Michigan Department of Natural Resources is committed to the conservation, protection, management, use and enjoyment of the state's natural and cultural resources for current and future generations
U.S. Fish and Wildlife Service	The U.S. Fish and Wildlife Service's mission is, working with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people

Table 4. Mission statements of agencies

Currently, Kirtland's warbler recovery efforts by the USFS and DNR seek to produce a self-sustaining population of 1,000 singing males (breeding pairs) while still meeting timber production goals. While respondents acknowledged their desire to do more work toward ecological benefit, they indicated such mandates and their perception of the public's demands for other values as thwarting such efforts. Currently the value of

socio-economic benefits seems to outweigh those of ecological benefits (Wilson et al., 2009).

In addition, laws such as the ESA provide little flexibility for using adaptive management approaches (Stankey et al., 2003). Many respondents felt the ESA is outdated and leads to a single species focus that does not reflect current ecological understanding. Furthermore it includes strict guidelines and imposes constraints on decision-makers.

Thus, value orientations coupled with restrictions due to mandates and the overall anthropocentric approach to natural resource management results in a perception among managers of having limited options for potential management approaches (Stankey et al., 2003). The mechanized approach of jack pine plantations with the opposing wave was generally acknowledged to be the most efficient way to achieve the broad range of objectives.

There is also a legacy of risk aversion in land management agencies (Stankey et al., 2003; Wilson et al., 2009; Canton-Thompson et al., 2008; Stapp, 2003; Maguire & Albright, 2005), resulting in a tendency toward prescriptive, standardized management approaches (Stankey et al., 2003). This further constrains innovative, adaptive management actions. With emphasis on the mechanized approach to management, the KWRT is failing to embrace risk, which is a component of adaptive management. While the jack pine plantation approach has proven to bring up the Kirtland's warbler numbers, it is an intensive management strategy and requires continual management for Kirtland's warbler habitat. This prevents the Kirtland's warbler's ability to have a self-sustaining population (or a population that could survive without management). Thus, this failure to

embrace risk could threaten the survival of the species in the long term and results in lost opportunities to learn due to the lack of experimentation (Stankey et al., 2003).

Furthermore, the legacy of success of the jack pine plantation management in increasing the Kirtland's warbler population has led to a reliance on this technique. This tendency to rely on past practices results in limited opportunities to explore alternative management approaches. There is a resistance to try alternatives as the current management 'is a recipe that works,' regardless if it is the best recipe. In this case, the mechanized approach has resulted in successful recovery of the Kirtland's warbler; however, this success has become an obstacle to experimenting with new approaches that may provide additional benefits.

On the other hand, the Mack Lake fire of 1980 left a negative legacy regarding the use of prescribed fire. Escaped prescribed fires have historically resulted in substantial reduction in agency use of prescribed fire, even if prescribed fires are generally successful and burn within their prescription (Stapp, 2003). After the Mack Lake burn, the use of prescribed fire to create habitat for the Kirtland's warbler was sharply curtailed. This resulted in management with high risk aversion and the employment of decision heuristics such as the availability bias and a negative affect when considering management with prescribed fire for habitat creation. Even though the Mack Lake fire occurred more than 30 years ago, it still remains vivid in the memories of both community members and managers as demonstrated by findings here and other projects (Winter et al., 2002). Despite increased knowledge and experience with prescribed fire since 1980, as well as better technology and weather predictions for setting prescribed

fire, there is strong resistance to its use from both the public and management (Stapp, 2003).

Groupthink

While the KWRT meetings are important for information exchange and collaboration, responses here provide some evidence of groupthink among KWRT members. For example, while several participants indicated a desire to use fire to restore Kirtland's warbler habitat when speaking individually with the primary researcher, there appears to be a hesitancy, confirmed by some participants, to thoroughly discuss the use of fire as an alternative approach at KWRT meetings. Instead, group discussions largely stick with the topics and management approaches that have higher levels of group consensus (or perceived consensus at least) while potentially controversial topics are tabled. This is an indication of mind guards that protect the group from information that might challenge the group's complacency (Janis, 1982), resulting in an inadequate assessment of both past and present decisions.

In order to prevent groupthink, it is important to create an atmosphere where dissent is welcome (Janis, 1982). Currently, KWRT meetings follow a loose version of Robert's Rules of Orders. Group decisions are made when an individual proposes a motion; someone seconds said motion, and then a vote for the final decision. A more accurate assessment of risks and benefits may result from shifting from a process that seeks to identify which alternative everyone can agree upon to asking which alternatives each member can support (without limiting support to one alternative) and then asking why they do or do not support each alternative (Gregory & Long, 2009). Such an

approach could also contribute to increased discussion of potential areas of disagreement among group members. In addition, incorporating more time for interactive discussion at the KWRT meetings could be beneficial to prevent groupthink and to ensure all alternatives are brought forward and assessed by the group. Fresh ideas on management should be welcomed and discussed, not tabled as some respondents feel is what occurs. This can also help prevent risk aversion and status quo management.

Janis (1982) recommends group leaders explicitly encourage dissent and criticism, even of their own positions. One way to encourage this is to officially appoint a “devil’s advocate” at each meeting, changing the person each time (Janis, 1982). This enables one to explicitly critique and question the group’s decisions, without fear of disrupting group cohesion as it is their assignment to behave in such a manner. Currently there is no such ‘devil’s advocate’ at KWRT meetings, though this could serve an important role and is a quick and free method to help prevent groupthink.

In the current structure, the KWRT makes recommendations for Kirtland’s warbler management, which then are taken into consideration by the agencies, though several agency members also serve on the team itself. Another measure recommended by Janis (1982) to prevent groupthink is to set up other groups with other leaders to consider the same question or issue at hand, thus creating an opportunity to compare answers across the two groups (Plous, 1993). There are many interested parties in the Kirtland’s warbler recovery efforts that are not on the Recovery Team. These individuals could serve as the ‘other group’ with which the KWRT could compare results or management decisions.

Interaction with outside associates, experts, and colleagues that can freely critique the group's work should also be encouraged (Plous, 1993). This is one area that the KWRT has somewhat incorporated into their efforts. For example, this work along with other research from outside groups or universities has been conducted with permission of the KWRT. An important step in this process is that the group be receptive to findings and take recommendations into consideration, which groupthink can prevent.

In addition, some participants felt the current outreach efforts largely consisted of “singing to the choir” and primarily engaged those already interested in Kirtland's warbler recovery. This homogeneity in the public sector that is kept informed of Kirtland's warbler efforts can promulgate groupthink as dissenting opinions are less likely to occur in groups that have similar values or social norms. The participants indicated that future outreach efforts needed to find ways to broaden the audience to increase awareness and support for Kirtland's warbler recovery efforts. Education and outreach information should focus on not just the Kirtland's warbler, but jack pine ecosystems, fire management, and a diverse array of species as a means to prevent groupthink and encourage alternatives to the management. Respondents indicated funding was often garnered for land management through donations from groups such as deer hunters and recreational users. Providing tangible information (such as demonstration sites) on how different management strategies affect those items which the public value or utilize from the land (deer, blueberries, etc.), in a format where discussion is encouraged can engage more than ‘just the birders’ and create a forum where the public is able to understand and engage in the management decisions and provide ideas for alternative management strategies.

Previous research has shown that interactive, “hands on” learning is more effective at increasing knowledge and support for alternative forms of management than traditional, one way communication such as brochures or public meetings (Toman et al., 2008, Toman et.al, 2006, Parkinson et al, 2003). While brochures, websites, and other outreach materials are useful at building awareness and providing specific details, interactive approaches are more effective at enabling participants to develop a more in-depth knowledge, test out new ideas, develop trust, and provide differing opinions so as to minimize groupthink. Guided field trips and demonstration sites have been shown to increase understanding and support, reduce uncertainties, and enhance goodwill and relationships among stakeholders and agency personnel (Toman et al., 2008). Personal communications and informal interactions where citizens can ask questions and feel heard are also more effective at increasing trust (Toman et al., 2006, Parkinson et al., 2003). Collaborative efforts to test and validate assumptions are integral to combatting groupthink and the use of decision heuristics.

Adaptive management

The majority of respondents expressed a desire to see more adaptive, alternative types of management on the ground. Interestingly, many respondents remarked that the Kirtland’s warbler management is supposed to be using adaptive management principles, but it is not. A lack of consensus on what adaptive management means could be causing this paradox (Stankey et al., 2003). The adaptive management approach was developed to help environmental decision makers and managers “increase knowledge acquisition rates, facilitate information flow among policy actors, and create shared understanding among scientists, policy makers, and managers” (McLain & Lee, 1996, p. 439). In order to have

successful adaptive management, the management must be willing to take risks, be flexible, and encourage and integrate a variety of perspectives into the decision making process (McLain & Lee, 1996).

A consequence therefore of failing to act adaptively is a loss of potential learning that could better inform future actions and decisions (Stankey et al., 2003). Describing an approach to adaptive management, Gregory et al. (2001) suggest implementing multiple approaches on a small scale to yield experimental learning. Such an approach not only provides learning opportunities for the managers implementing the treatments, but can also be used as demonstration sites to allow others to examine the outcomes of alternative treatments. While there are some alternative management strategies occurring within the study region, these are happening on a very small scale, with the majority of these alternative approaches conducted by the USFWS National Wildlife Refuge System or outside the critical habitat area (in the Upper Peninsula of Michigan). These are not being done officially through the auspices of the KWRT, but rather by the agencies own volition.

Furthermore, some participants noted the lower human population density in the Upper Peninsula allowed for reduced public pressure and greater flexibility in selection of management approaches. This suggests perceived constraints of the ESA coupled with perceived public perceptions may have a strong influence on management decisions, as those outside of the critical habitat in less populated areas feel they have greater flexibility to implement alternative management techniques. Respondents also noted how field days to these alternative management sites were beneficial to achieve greater in-

depth knowledge of what others were doing for management strategies and for information sharing.

Moreover, in other locations, demonstration sites have been effective at providing an opportunity for those skeptical of prescribed fire use to better understand potential outcomes and gain confidence in the ability of agency managers to effectively use fire treatments (Toman et al., 2008). Such an approach may help to counter the availability bias and negative affect prevalent within the study location. Implementing such prescribed fire treatments on a small scale can also provide a means to reduce concerns regarding the risk of such treatments to the Kirtland's warbler as only small portions of habitat will be influenced by fire treatments.

While budget and time constraints can limit how often field visits can occur, these should be encouraged to provide opportunities to discuss and learn from ongoing management activities. In addition, land managers and their superiors in the management efforts should visit demonstration sites for the same reasons as the public: demonstration sites and field trips are beneficial for increasing understanding, support, and reducing uncertainties (Toman et al., 2008). The use of interactive, engaging communication and outreach activities with on the ground examples can have benefits for both society and management. This can be beneficial in particular in the case of the Kirtland's warbler management, where there is a desire to use adaptive and alternative management approaches, but they are not successfully being integrated into management activities.

Furthermore, respondents indicated that the public's lack of understanding or knowledge of the management and ecology results in a lack of support for management strategies. The give and take of these interactive exchanges not only provide useful

opportunities to build awareness of the rationale behind management activities, but can also allow managers to gain a better understanding of the public's values and preferred management approaches.

Structured decision making

The presence of psychological factors that may hinder decision making coupled with an expressed desire to try alternative management approaches suggest a structured decision making approach could be appropriate. In order to integrate alternative management strategies in recovery efforts, particularly the use of fire, there is a need for both institutional and public support. A structured decision making approach is a method that can help decision makers to achieve a more accurate assessment of the alternatives, allowing them to determine which alternative is the best option and the most likely to have success in the long term and garner public support (Wilson & Arvai, 2006; Gregory et al., 2001; Wilson et al., 2009). Using this approach can also provide decision makers with something tangible to demonstrate both to the public and the agency why the decision was chosen, and if something were to go wrong, that ultimately the decision itself was not a poor decision when the tradeoffs are properly analyzed.

A structured decision making approach can help to adequately assess alternatives and identify those most likely to meet specified objectives. Using the structured decision making process encourages participants to express and explore their values, refine information, and ultimately make informed judgments on which alternatives they support (Gregory et al., 2001). Explicitly incorporating affect and values into decision making can help to build trust and improve alternatives that are produced. Using a structured decision making process does this by starting with the values of participants and then

generating alternatives based on their expressed trade-offs and concerns (Gregory et al., 2001). Participants can assign weight to expressed values, enabling them to compare ethical, moral, and aesthetic concerns with other tangible items such as costs (Gregory et al., 2001).

Maguire & Albright (2005) stress the importance of assessing the tradeoffs of each alternative, rather than framing it as a certainty versus a risk (i.e., status quo management is predictable, and thus ‘certain’ while prescribed fire is uncertain and therefore a risky alternative). The current Kirtland’s warbler management strategy makes a tradeoff for socio-economic objectives over ecological objectives. Structured decision making is an approach that can be used to consider multiple objectives and facilitate tradeoffs when the objectives conflict (National Research Council, 1996). It can also aid in making an accurate assessment of both socio-economic and ecological risks as well, proportioning the proper weight to each value. Using a structured decision making approach or a similar process to accurately assess each alternative, their risks, and the management objectives has been shown to garner public support, prevent unintended consequences, and help managers to better meet multiple objectives (Wilson et al., 2009).

The endangered status of the Kirtland’s warbler contributes to adopting risk averse recovery decisions as any negative impact to the bird would diminish its small population and also likely negatively impact public confidence for the land managers given the high visibility of the bird in the region. Now that the bird population has exceeded the population goal for several years, several respondents feel this risk aversion should begin to dissipate; however, that has not yet been reflected in the current management or in KWRT discussions. This could be due to the presence of the

psychological factors mentioned in the findings, resulting in an inadequate assessment of the ability of current and alternative management approaches to achieve the desired goals.

In order to obtain an accurate assessment of risks and values, it is also important to diversify the recovery team. Clark et al. (2001) found recovery teams with a greater diversity of participants correlated with improved recovery plans (plans with a greater implementation of recovery tasks and improved status trends). In addition, risk aversion may diminish somewhat with the inclusion of more specialists, for example a specialist with a background in fire and fuels management on the team itself or in attendance of meetings could offer information needed for a more accurate assessment of the risk of fire. A specialist that can help measure the amount of risk and provide information to the group on alternatives can decrease the risk aversion in the group. This may be particularly useful for the KWRT as there is an expressed desire to incorporate more fire use, and risk aversion among land managers is heightened when using fire (Maguire, 2005; Wilson, 2009).

Successful risk management depends on a true integration of risk analysis into the decision making process. Risk management decisions are complex, and analysis can provide valuable insights to agencies as they develop and evaluate management alternatives. If values are incorporated into analyses, it can ease communication about why certain alternatives are chosen over others (O'Laughlin, 2005). This can also help to incorporate key uncertainties into the planning and decision process (Cohan et al., 1984).

Chapter 6: Conclusion

Natural resource management is inherently challenging as managers seek to balance a range of objectives. Such challenges are amplified in the case of endangered species management. Based on the goals outlined in the recovery plan, the KWRT has been successful at restoring the Kirtland's warbler back from the brink of extinction. This success is evidence of the knowledge, expertise, and hard work of the KWRT, additional managers, and others that have been committed to the Kirtland's warbler recovery. The findings presented here do not take away from this success; rather, they provide insight into a very challenging decision making process where decisions and resulting management actions can have serious and lasting consequences for a protected species. By identifying existing challenges in the management of the Kirtland's warbler, our goal in this study was to provide a means for managers to more effectively achieve their management objectives.

Now that the Kirtland's warbler population has appeared to stabilize above recovery goals, many KWRT members indicated it is time to explore alternatives to the management to create a more natural habitat for the Kirtland's warbler and other species that can be sustained by natural processes rather than continuous management intervention. As the KWRT considers future plans using a structured decision making approach or similar decision aid can assist the recovery team in avoiding groupthink, decision heuristics, and legacies of the past in influencing their decision making. This

strategy can also help to generate and more fully assess the ability of current and alternative management approaches to achieve the complete slate of managers' objectives. Furthermore, the optimal time to integrate an adaptive management approach is during plan revision; when lessons from prior decisions can be drawn on to inform future decisions (Clark et al., 2001). For the KWRT, this is the ideal time to take advantage of these strategies to make more informed decisions in the future that are more likely to reach desired outcomes and avoid unintended consequences.

Findings here also illustrate the value of social science research to better understand endangered species management. While recovery decisions are mandated to be based on the best available science, typically only the biophysical sciences are employed in developing recovery goals and management plans (Bruskotter et al., 2010). However, while such data is a necessary component for such plans, ultimately, recovery decisions and management plans are developed by management personnel and influenced by society. A greater understanding of the psychological and social factors that influence decision making is necessary to better understand the decision process and develop more effective recovery decisions.

Although we presented legal, social, and psychological factors separately in this discussion, results here suggest a high degree of interaction between these components. For example, legal factors were mentioned by all participants as predominant in influencing management, but laws and mandates are created by people, and the underlying psychological and social factors discussed in the literature review and findings therefore influence decision makers when creating and implementing laws, plans, and policies. In turn, the ways in which these laws, plans, and policies are

perceived then impact psychological and social factors when making decisions. Therefore when making land management decisions, all three must be considered and acknowledged for appropriate and good decision making to occur.

While the findings presented here are specific to one case study preventing generalizations to be drawn to other endangered species recovery efforts, they provide an important first step in characterizing endangered species management. We recommend the completion of additional case studies to further examine and build on the findings presented here.

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Appendix A: Interview Guide

Kirtland's warbler Interview Protocol

Date:

ID#:

Agency/organization:

Thank you for participating in this project. This project is designed to develop a better understanding of how Kirtland's warbler habitat management and jack pine barrens restoration might be integrated with landscape-level fuels treatments and fire management in northern Lower Michigan. Questions examine your specific objectives for managing Kirtland's warbler habitat, the strategies you use to achieve them, and potential risks and benefits of these approaches. There are no right or wrong answers; I am simply interested in your ideas.

This is meant to be informal, but I do have a list of questions that I need to ask each participant. If you feel like I am asking something you have already addressed, please do not hesitate to tell me to move on or to say that you have nothing additional to contribute. Do you have any questions?

If you agree to participate further, please indicate that you understand the purpose of this research and that you are willing to participate by answering "yes".

Is it okay if I audiotape this interview? If yes, please indicate consent by answering "yes."

1. Can you describe your job for me?
 - a. What is your job title?
 - b. How long have you been in this current position?
2. How would you describe the current forest structure of the lands you manage?
 - a. How is that structure similar or different from historical conditions?
 - b. What has contributed to these similarities and differences?
 - c. How do you think the landscape would be different if it hadn't been managed to provide Kirtland's warbler habitat?
3. Besides the Kirtland's warbler, how much experience do you have managing for endangered species?

If have other experiences continue with the following questions; if NO to Q3, skip to Q6

4. Can you tell me about your experience(s)?
 - a. How many recovery plans have you been involved in?
 - b. Do you draw from past experiences when making decisions?
 - c. How do you make decisions when managing for the Kirtland's warbler?
5. Is the decision process for managing for the Kirtland's warbler similar or different from the processes used for other endangered species?

Now I want to talk specifically about your objectives or goals for managing Kirtland's warbler habitat in your area...

6. What aspects of your job involve the Kirtland's warbler?
7. How are decisions made regarding Kirtland's warbler recovery?
 - a. How are goals determined for KW recovery?
 - b. What agencies/organizations are involved?
 - i. Role of KW Recovery Team, USFWS, and other agencies; how do these groups work together?
 - c. How is scientific and management input balanced in setting recovery goals?
 - d. What is the role of non-governmental organizations and the public in determining these goals?
8. After the broad goals for KW recovery have been determined, could you run me through the process of how management decisions are made for the KW in your management area?
 - a. Specifically, how are these goals translated into more specific objectives for KW management?
 - i. What factors influence these objectives?
 - ii. How are they measured?
 - iii. Are the multiple objectives compatible with one another?
 - iv. Is there a difference in your short-term vs. long-term objectives for managing habitat?
 - b. Where does management of Kirtland's warbler rank in relation to other management objectives in your area?
 - i. Are there any conflicts between KW recovery goals and your broader resource management objectives?
 - ii. Do you feel some objectives carry more weight than others? Why?
 - c. What are your current strategies for managing KW habitat in your area?
 - i. What factors influence your selection of the various potential management strategies? (perceived effectiveness, associated risk, local public, budgets, time, other agencies, NGO's, location/size of habitat area)
 - d. Does fire play a role in restoring ecosystem and function?

- i. How often do you use naturally ignited fires to achieve these objectives? Why do/don't you use fire and/or what influences the frequency of its use?
 - ii. How often do you use prescribed fire to achieve these objectives? Why do/don't you use prescribed fire and/or what influences the frequency of its use?
 - e. What are the expected benefits of your selected strategies?
 - i. Ecological
 - ii. Societal
 - iii. Economic
 - f. What are the expected risks?
 - i. Ecological
 - ii. Societal
 - iii. Economic
 - g. Do these benefits/risks differ between the short and long-term?
 - h. Are there any management strategies you would like to pursue to a greater extent than you currently are able?
 - i. What are the barriers that prevent you from using these approaches as much as you'd like?
 - i. What policies/regulations play a role in the decisions regarding objectives and management strategies?
 - i. Are the agency policies and procedures compatible and clear?
 - ii. Are the regulations compatible with the goals and objectives for KW recovery?
 - iii. Is there influence from external agencies or higher levels of hierarchy within agencies?
- 9. Given the goal of the Endangered Species Act is to achieve recovery of listed species, how would you define a recovered KW population?
 - a. How will you know when a recovered population is achieved?
 - b. If recovery is achieved, how would that influence your future management approaches?
- 10. What approaches are used to communicate regarding KW management?
 - a. Who is normally included (e.g., agencies, NGO's, general public)?
 - i. Is anyone not involved you feel should be?
 - ii. If someone disagrees with the decisions, what actions can they take (if any)?

We are wrapping things up now...before we close:

- 11. Is there anything else you feel is important that we haven't discussed?
- 12. Is there anyone else you feel would be a good person for me to interview, or that may be willing to be interviewed?

Thank you so much for your time, etc. (Closing up the interview, thanking, explaining how I will provide them with the results I find if they wish, etc).