

# INTEGRATING FUELS REDUCTION AND PINE BARRENS RESTORATION IN ENDANGERED KIRTLAND'S WARBLER HABITAT MANAGEMENT

## Annual Report (2011)

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## I. Overview

An important aspect of the Endangered Species Act (ESA) of 1973 is to “provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.” The endangered Kirtland’s warbler (*Dendroica kirtlandii*) is a neotropical migratory bird that utilizes young, dense stands of jack pine (*Pinus banksiana*) produced by stand-replacing wildfires. Unfortunately, habitat management for the warbler and other changes in land use have had the unintended consequences of homogenizing landscapes and ecosystems, displacing rarer ecosystem types and producing fuel conditions that complicate prescribed fire management activities for future habitat management. **These alterations, relative to the pre-EuroAmerican landscape, have led to the need for the development of novel, landscape to patch-scale research that guides future multi-agency planning and management and integrates restoration of ecosystems, Kirtland’s warbler habitat, and safe, effective fire management.**

## II. Project Justification & Expected Benefits

Historically, wildfires every 5-59 years maintained warbler habitat across glacial outwash-dominated landscapes of northern Lower Michigan. Fire exclusion has created the need for intensive habitat management to produce young (5-25 yr. old) jack pine for Kirtland’s warbler breeding habitat. Forest managers with the U. S. Forest Service (USFS), Michigan Department of Natural Resources (MDNR), and the U. S. Fish and Wildlife Service (USFWS) now intensively manage approximately 130,000 ac. with the primary objective of producing young jack pine plantations. Contemporary habitat management involves clearcutting mature (>40 year) jack pine, then trenching and planting these sites with 2-yr. jack pine seedlings in an “opposing wave” pattern whereby the pattern of densely (>1,000 stems ac<sup>-1</sup>) planted trees includes small openings in which birds forage. These plantations are typically occupied by warblers for only a narrow window of time (<20 yr.). At approximately 50 years of age (~30 years after their last use by warblers), these jack pine plantations are then clearcut and the management cycle begins again. At present, no intermediary silvicultural treatments are applied to reduce fuels or enhance stand structural components or landscape complexity following warbler occupancy and abandonment.

The focus on intensive jack pine plantation management has significantly increased the warbler population and has aided in breeding range expansion into the Upper Peninsula of Michigan, Wisconsin, and Ontario. A tradeoff, however, is that these plantations often fail to emulate the structure of young wildfire-generated stands. Although stand-replacing prescribed and managed wildfire would yield “natural” habitat, the large, homogenized fire-prone plantations along with housing developments, an abundance of natural gas wells, and other land use patterns makes broad-scale application of fire difficult. In particular, re-introducing prescribed fire is especially difficult without a spatial framework for establishing fire breaks and the management of other, less fire-prone (and rarer) ecosystem types, such as jack pine barrens. Moreover, existing habitat management for warblers in some areas likely exacerbates the issue of prescribed fire by producing larger, more homogenous blocks of highly combustible fuels (jack pine plantations). As the recovery of Kirtland’s warbler continues and management expands to newly occupied ecoregions, and as land managers work with more diverse groups of constituents to provide breeding habitat, integration of warbler management with forest ecosystem restoration and increased prescribed fire management is necessary. Specifically, we are examining whether future management actions can emulate spatial, compositional, and structural patterns of wildfire and pre-EuroAmerican forest ecosystems.

**Before prescribed fire is applied on the ground to produce landscapes similar to those historically characterized by wildfires, the following are needed: 1) examination of the fire management decision context across ownerships (e.g., objectives, challenges, perceived compatibility with other objectives), 2) development of a framework to emulate past spatial patterns of jack pine ecosystems, 3) development of a spatial framework for integrating #2, above, with fuel load reductions and existing and planned fuel breaks, 4) evaluation and integration of Kirtland's warbler habitat management with restoration of rarer jack pine barren ecosystems that have substantially reduced fire risks relative to jack pine plantations, 5) assessment of the role of wildfire in restoring ecosystem structure and function (with an emphasis on the spatial and temporal variability), and 6) development of silvicultural guidelines for reducing fuel loading and enhancing residual structure of jack pine plantations that have been abandoned by Kirtland's warbler due to their age.**

### **III. Accomplishments (As of September 2011)**

**Objective 1** –Working with the research team and past and current members of the Kirtland's Warbler Recovery Team, a list of 21 potential interviewees was created. This list was comprised of professionals across agencies and organizations associated with the management of habitat and/or the recovery of the species per ESA guidelines. To date, semi-structured interviews have been completed with 20 study participants. Interviews were conducted both in person and by phone. The research team is transcribing each interview and beginning data analysis using NVIVO qualitative analysis software. Additional interviews will be conducted and are scheduled for completion by December 2011. Presentations were made at multiple meetings (see below).

**Objectives 2 - 4** – We intend to investigate two distinct lines of inquiry that will examine historical patterns of young jack pine ecosystems. First, we will examine the impact of warbler management on landscape structure by estimating the range of variability of the amount and arrangement of young jack pine on the landscape within the warbler breeding area for comparison to current conditions. We will use a fire regime map of northern Lower Michigan developed by Dr. David Cleland of the US Forest Service to develop a data layer of young jack pine of the landscape prior to European settlement. Using GIS, we will develop a spatial model from Dr. Cleland's data that will simulate the amount and arrangement of young jack pine forests across the landscape during this period for comparison to the current period. Second, we will examine the effectiveness of historical pine barrens as natural fire breaks on the landscape. Using pre-settlement maps of the location, size, and shapes of historical pine barrens, we will use fire models to simulate fire spread; these modeling results will be compared to specific scenarios of human-created fuel breaks to determine whether treatments that simultaneously serve as barren restoration projects and fuel breaks are feasible under current landscape conditions. A Master's-level graduate student has been identified to complete this objective of the proposal, and has started her graduate program in September 2011. We have also investigated the natural variability of biological legacies in jack pine ecosystems following wildfires using GIS and field studies, and have submitted and had accepted a manuscript describing this variability. Presentations were made at multiple meetings (see below).

**Objective 5** – In our proposal, we planned to conduct retrospective studies to quantify the legacies of three different disturbances on stand composition and structure: 1) wildfire, 2) prescribed fire, and 3) clearcuts without artificial regeneration. However, following the publication of two recent studies (Spaulding and Rothstein 2009, Rothstein and Spaulding 2010) that addressed these topics, as well as discussions at Kirtland's Warbler Recovery Team Meetings about what were the most critical questions related to Kirtland's warbler (KW) habitat management, we shifted the focus of this objective to address the question: *How variable in both space and time are stand structure and composition (including fuels) in naturally regenerated jack pine stands following wildfire?* Our working hypothesis is that wildfire results in a heterogeneous landscape that varies across space and time. By understanding these patterns we propose to develop silvicultural treatments for abandoned warbler plantations (first on USFWS lands) in an effort to reduce fuel loads and fire hazards, while enhancing structure and habitat for not only KW, but also other important species of conservation concern. Working with the Michigan Department of Natural Resources and the U.S. Forest Service, we identified 20 wildfires in northern Lower Michigan > 200 ac in size (range 200 to 5,916 ac) and which were not currently occupied by KW. Wildfires were categorized as either pre-KW occupancy (< 8 years) or post-KW occupancy (> 23 years). Each area was visited to confirm no anthropogenic disturbances following the wildfire (e.g., planted jack pine or red pine, post-fire salvage harvests), and potential sample areas  $\geq$  200 ac in size identified and delineated within a geographic information system (GIS). Within each sample area, we randomly established 48 sample plots along 12 transects within a 100-acre window and collected information on the overstory and understory structure and composition, as well as fuels. Currently we have sampled six wildfires and will continue sampling through the fall of 2011 and spring of 2012. Once field

sampling is completed, we will examine the spatial variability in the structure and composition of the vegetation and fuels and how they differ over time. Presentations were made at multiple meetings (see below).

**Objective 6** – This objective primarily pertains to the management of U.S. Fish and Wildlife Service Kirtland's Warbler Wildlife Management Area, with potential application on other lands as lessons are learned. During the 2011 field season, baseline assessments have been completed on lands in Crawford and Clare Counties, MI that may be treated to provide enhanced structure-composition relative to typical plantations. Baseline information has been forwarded to Seney National Wildlife Refuge's Fire Management Officer for a potential prescribed fire in Clare County. This fire would promote structure-composition more typical of openland-dominated barrens, even though the treated area would be relatively small (~40 ac.). Nonetheless, potential conservation partners have shown interest in participating and providing expertise, and the area has been proposed as a demonstration site for the JFSP-funded Lake States Fire Science Consortium. Efforts have also been expended in integrating our past and ongoing studies regarding wildfire structural patterns with migratory bird research and ecological forestry (and restoration) principles. In this vein, a potential Master's student at Central Michigan University (CMU) has been identified and Co-PIs Corace and Kashian are in the early stages of working with this person and Dr. Nancy Seefelt (CMU) on study design. Presentations were made at multiple meetings (see below).

### III. Deliverables

#### Submitted Refereed Papers:

- Kashian, D.M., Corace, R.G. III, Shartell, L.M., Donner, D.M. and P.W. Huber. *In press*. Variability and persistence of post-fire biological legacies in jack pine-dominated ecosystems of northern Lower Michigan. *Forest Ecology and Management*.

#### Conference Presentations-Field Tours-etc. (updated as “deliverables” on JFSP website):

- Corace, R.G., III, Kashian, D.M., Goebel, P.C. and E. Toman. 2011. Integrating fuels reduction and pine barrens restoration in Endangered Kirtland's warbler habitat management: Overview. Kirtland Warbler Recovery Team Winter Meeting. March 8, 2011: Roscommon, MI.
- Corace, R.G., III, Kashian, D.M., Goebel, P.C. and E. Toman. 2011. Wildfire and structural and compositional patterns in jack pine ecosystems of the northern Lower Peninsula of Michigan: implications for restoration and ecological forestry. Fall Field Tour, Michigan Society of American Foresters, Lower Peninsula Chapter.
- Corace, R.G., III, Kashian, D.M., Goebel, P.C. and E. Toman. 2011. Beyond Kirtland's Warbler: Multi-species consequences to jack pine ecosystem management. Jack Pine Symposium, University of Minnesota Tree Improvement Center, Cloquet, MN.
- Kashian, D.M., Corace, R.G. III, Shartell, L.M., Donner, D.M. and P.W. Huber. 2011. Variability and persistence of post-fire biological legacies in jack pine-dominated ecosystems of northern Lower Michigan. Annual Meeting of the US Chapter of the International Association for Landscape Ecology, April 3-7, 2011: Portland, OR.
- Kashian, D.M., Corace, R.G. III, Shartell, L.M., Donner, D.M. and P.W. Huber. 2011. Variability and persistence of post-fire biological legacies in jack pine-dominated ecosystems of the northern Lower Peninsula of Michigan. Kirtland Warbler Recovery Team Summer Meeting. July 27, 2011: L'Anse, MI.
- Myer, G., E. Toman, G. Corace, P.C. Goebel, and D. Kashian. 2011. Integrating fuels reduction and pine barrens restoration in Endangered Kirtland's warbler habitat management. The human dimensions. Kirtland Warbler Recovery Team Summer Meeting. July 27, 2011: L'Anse, MI.
- Myer, G., E. Toman, G. Corace, P.C. Goebel, and D. Kashian. 2011. What Influences the decision process of land managers when managing for Endangered species? School of Environment and Natural Resources Graduate Student Seminar. June 6, 2011: Columbus, OH.