

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

Annual Report (2012)

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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 (*Setophaga 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⁻¹) 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 in 2011. 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. Semi-structured interviews were then completed with 20 study participants. Interviews were conducted both in person and by phone. Results were tabulated and presented to both the Kirtland's Warbler Recovery Team and to the broader community via a Master's thesis (see below).

Objectives 2 - 4 – Despite a slight delay in finding a graduate student at Wayne State University to undertake this portion of the proposal, a Master's student was identified and enrolled in the Department of Biological Sciences at Wayne State in September 2011. The student has now completed her first year of graduate-level coursework, and will transfer to the PhD program at the end of the 2012-13 academic year.

An extensive pre-settlement vegetation data set was obtained from Dr. David Cleland, who has re-located from his US Forest Service office in Rhinelander, Wisconsin, to an office in Washington, DC. The Cleland data includes digitized records of all trees and their respective diameters recorded in the original General Land Office (GLO) notes for northern Lower Michigan by species. The Cleland data was obtained as a supplement to the pre-settlement vegetation maps constructed by the Michigan Natural Features Inventory (MNFI) for two reasons. First, we noted multiple concerns with the MNFI maps cited by several federal and state land managers regarding accuracy and the scale of mapping. More importantly, the MNFI maps contain no information about tree size, such that the more detailed information in the Cleland data was necessary to construct jack pine age classes (rather than coverage alone) in order to address research questions. Unfortunately, the Cleland data is extremely extensive without being well documented, and it has taken a considerable amount of time to locate and document the proper spatial files and identify the appropriate fields within the databases. Currently, pre-settlement age classes have been created using this data set and preliminary on-screen digitizing; the graduate student is currently working to construct the maps using a more statistically rigorous set of techniques (kriging), and is gathering a database of current coverages of young jack pine on the landscape. A completed map and landscape analysis is expected by May 2013. We expect that the identification of natural and anthropogenic fuel breaks and the fire modeling that will answer other objectives/questions to be completed by August 2013.

In addition to the above two questions, we also instituted an abbreviated, 6-week field season for the graduate student during the summer of 2012. The field work addresses the potential importance of post-fire biological legacies in jack pine-dominated ecosystems (see Kashian et al. 2012) for plant biodiversity and post-fire succession and forest development. Field work was completed by the graduate student both to provide her with a graduate-level field experience and to address a relevant and important question for the current proposal. Between June and August 2012, nine "stringers" were extensively sampled using three evenly-spaced transects run perpendicular to the stringer to a distance of three times the height of the dominant trees beyond the stringer on each side (N = 27 transects). Stringers were sampled within a 1980, 2000, and 2006 wildfire, and sampled variables included tree density, diameter, age (using increment cores), height, coarse woody debris, and the percent coverage of all woody and herbaceous plants. The graduate student is expected to analyze these data prior to a second field season to be held in summer 2013.

The graduate student was assisted in the field by an undergraduate student who will complete a Wayne State University-funded undergraduate research project encouraged by a land manager (Philip Huber, US Forest Service) identified as an important collaborator on this proposal. The undergraduate student will intensively map post-fire jack pine regeneration

across the 2000 No Pablo Burn in northern Lower Michigan. Despite high deviation from conditions thought optimal for Kirtland's warbler nesting habitat, the No Pablo area has very successfully supported high densities of nesting warblers without additional post-fire silvicultural activities. The undergraduate student's project will therefore be an important example of both the natural variability in regeneration that exists following fires in this region and its potential usefulness as warbler habitat. The student is expected to complete the research and submit it for publication by May 2013.

Objective 5 – Following our revised study plan for this objective, we completed our field sampling in 2012. Working with the Michigan Department of Natural Resources and the U.S. Forest Service in 2011, 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 Kirtland's Warbler (KW). Wildfires were categorized as either pre-KW occupancy (< 8 years) or post-KW occupancy (> 23 years). Within each wildfire, 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. We completed field sampling in August 2011 with a total of 12 wildfires sampled, 6 classified as pre-KW occupancy and 6 classified as post-KW occupancy. These data have all been entered into the FIREMON/FEAT Data Management System and summarized, and we are will be analyzing the spatial variability in the structure and composition of the vegetation and fuels and how they differ over time during the fall of 2012 and winter of 2013. Preliminary data from a subset of the wildfires sampled in 2011 were summarized and presented at the 2012 Annual Meeting of the Ecological Society of America in Portland, Oregon.

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 2012 treatments were proposed for a property in Crawford County, MI. Using commercial logging equipment, the treatment was to create enhanced structure-composition relatively to typical plantations and based on published findings (Kashian et al. 2012). However, economic limitations (i.e., the timber could not be sold) stopped this from occurring; bids for the timber sale will go out again in 2013.

Additional Work – Efforts have also been expended in integrating our past and ongoing studies regarding wildfire structural patterns in jack pine ecosystems with migratory bird research and ecological forestry (and restoration) principles. In this vein, a Master's student at Central Michigan University (CMU, B. Cullinane-Anthony) has been working with Co-PIs Corace and Kashian and Dr. Nancy Seefelt (CMU) on data collection to characterize bird communities among post-fire biological legacy patches (stringers) and the surrounding jack pine stands/plantations. Presentations were made at multiple meetings (see below). Additional funding for this work comes from Seney National Wildlife Refuge.

III. Deliverables (including those shown in the 2011 report.)

Master's Thesis:

- Myer, M.G. 2012. Characterizing the decision process of land managers when managing for Endangered species of fire dependent ecosystems: the case of the Kirtland's warbler (*Setophaga kirtlandii* Baird). The Ohio State University, Columbus, OH. (M.S. Thesis)

Refereed Papers:

- Kashian, D.M., Corace, R.G. III, Shartell, L.M., Donner, D.M. and P.W. Huber. 2012. Variability and persistence of post-fire biological legacies in jack pine-dominated ecosystems of northern Lower Michigan. *Forest Ecology and Management* 263:148-158.

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

- Miesel, J.R., P.M. Nelson, P.C. Goebel, R.G. Corace III, and D.M. Kashian. 2012. Forest fuels and vegetation in wildfire-regenerated jack pine (*Pinus banksiana* Lamb.) forests: informing ecological forestry in the Lake States region. Poster presentation. 2012 Annual Meeting of the Ecological Society of America, Portland, OR.
- Corace, R.G. III, P.C. Goebel and D.M. Kashian. 2012. Snag management in pine forest types in northern Michigan. Society for Ecological Restoration-Midwest/Great Lakes Chapter Annual Meeting, Ann Arbor, MI.

- Kashian, D.M. and R.G. Corace III. 2012. Variability and persistence of post-fire biological legacies in jack pine-dominated ecosystems of northern Michigan. Webinar presented to the Lake States Fire Science Consortium.
- Corace, R.G. III, P.C. Goebel, D.M. Kashian and T. Pypker. 2012. Research-management partnerships and fire-dependent ecosystem restoration: case studies from Seney National Wildlife Refuge, Upper Michigan. Stewardship Network Conference, East Lansing, MI.
- Corace, R.G. III, Kashian, D.M., Goebel, P.C., E. Toman, N.E. Seefelt and B. Cullinane-Anthony. 2012. Integrating fuels reduction and pine barrens restoration in Endangered Kirtland's warbler habitat management: Overview. Kirtland Warbler Recovery Team Summer Meeting, St. Ignace, 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, 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, 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, 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: Columbus, OH.