

2009 Midwest Jack Pine Symposium

Poster Presentation Abstracts



Title: A Coarse Filter Approach to Identify Potential Kirtland's Warbler Habitat in Ontario

Author(s): Colin Bowling¹ and George Holborn²

Abstract: One of Canada's rarest birds, the Kirtland's Warbler, has been confirmed as nesting in Canada for the first time since 1945. Two adult birds were seen at Canadian Forces Base Petawawa, Ontario in the summer of 2006, successful breeding occurred during the summer of 2007, and the birds returned in 2008.

After the young left the nest (the first ever discovered in Canada) in 2007, the nest and unviable eggs were donated to the Royal Ontario Museum for study and display. These are the first Kirtland's Warbler eggs and nest to be included in the ROM's extensive bird collection.

Overlays of climatic, physiographic and tree cover information may provide a coarse filter approach to identify and evaluate potential Kirtland's Warbler habitat in Ontario east of its population core in northern Michigan.

¹Ontario Ministry of Natural Resources
Northwest Science and Information Section
Box 5080
Kenora, ON
P9N 3X9

²Ontario Ministry of Natural Resources
Northwest Science and Information Section
RR#1 25th Sideroad
Thunder Bay, ON
P7C 4T9

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Title: A Kirtland's Warbler Management at Regional, Landscape, and Local Scales

Author(s): Deahn M. Donner¹ and John R. Probst

Abstract: The Kirtland's Warbler breeds in young, densely-stocked jack pine forests of northern Lower Michigan, and more recently limited areas in the Upper Peninsula of Michigan, Wisconsin and Ontario. Because almost all the known population and potential nesting habitat can be surveyed and monitored, this species provides an outstanding opportunity for research on long-term dynamics. Historically, the necessary habitat conditions were provided by 5-23 yr-old wildfire-regenerated scrublands on sandy outwash areas. Plantations and unburned naturally-regenerated areas are used when jack pine stocking is greater than 1000 stems per acre, which is the case commonly found in the Lake States ecosystems where conditions are somewhat cooler and wetter than the core breeding range in Lower Michigan. When the Kirtland's Warbler population became protected under the Endangered Species Act, a habitat restoration program was started to reverse a declining to stable population. The immediate goal was to provide enough critical nesting habitat area to support over 1,000 males, and to increase productivity. Brown-headed Cowbird decoy trapping (designed by the late N. Cuthbert) implemented by USFWS was enormously successful at increasing productivity, yet the population did not increase leading USFWS to believe winter conditions were limiting the population. However, male density decreased within core breeding areas even though the amount of suitably-aged breeding habitat had increased suggesting habitat quality limitations. An opportunity to test this idea presented itself when a prescribed burn escaped (Mack Lake Fire) at the same time as plantations established specifically for the Kirtland's Warbler were becoming suitably-aged thereby greatly increasing the amount of suitable breeding habitat. We predicted a 3-fold population increase initially in response to the added habitat, but a five-fold increase in males was found due to greater total area and better quality habitat than predicted, and a favorable landscape structure of managed plantations. At the landscape scale, recommendations on chronology of stands helped overlap patches to reduce the need for male re-colonization and build-up. The regional habitat area targets were based initially on historical male densities found in high quality habitats, but were later found insufficient when more comprehensive occupancy patterns were examined at multiple scales. Specifically, we found only 30-50% of available habitat was occupied, especially by females, and these patterns varied temporally within the context of total habitat area and male population size. Further, at landscape and local scales, the duration of use for wildfire-regenerated and especially plantation habitat was shorter than expected in the initial Recovery Plan. Thus, approximately 50-60,000 acres has been added to habitat planning in recent years. Additionally, we found patch size, isolation, habitat type, and landscape factors such as rate of habitat creation and fraction of occupied patches influenced the timing of patch colonization and abandonment, thereby influencing the duration habitat areas are used. Recently, the majority of males (75 – 90%) are using plantation habitat that resembles larger wildfire-regenerated habitat due to landscape planning. At the local scale, oak coppice, snags and some residual trees was recommended to improve conditions, but management has been especially successful in increasing the stocking density of jack pine with or without fire for site preparation. Regenerating habitat without fire was critical to keeping habitat management plans on schedule following the Mack Lake Fire in the 1980s and 1990s such that enough suitably-aged habitat would be available once the wildfire-regenerated habitat became unsuitable. Current management emphases are on establishing habitat without expensive full-scale planting, especially outside the Lower Peninsula of Michigan. It is important to note that the Kirtland's Warbler research-management program was developed within the context of a Regional

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Openlands Program proposed in the early 1990's to benefit many rare or declining openland plants and animals, especially area-sensitive species such as Sharp-tailed Grouse and Upland Sandpiper. Indeed, managing for these other species on the Hiawatha and Wisconsin National Forests has created initial opportunities for Kirtland's Warblers in those places, and now Kirtland's Warbler habitat management is facilitating the return of Sharp-tailed Grouse and other area-sensitive species.

¹USFS Northern Research Station
5985 Hwy K
Rhineland, WI 54501

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Title: Baraga Plains Restoration Project Proposal

Author(s): Dave Steffensen, Gayle Sironen, Robert Wagner and Jeff Mell

Abstract: This set of five posters was created to help facilitate interagency and public comments for the Baraga Plains Restoration Project Proposal. The Ottawa National Forest is in the process of planning a project to enhance sand plains wildlife habitat by creating a large temporary opening in jack pine, managing the transportation network, improving recreation opportunities, and treating other vegetation types to maintain or develop structural and compositional diversity.

The first poster, “History of Fire on the Baraga Plains”, addresses the origins of this sand plain ecosystem and some historic information on the pre-European settlement conditions.

The second poster, “Managing Vegetation on the Baraga Plain”, shows some vegetation management projects that could be proposed with the project.

The third poster, “Baraga Plains Restoration Project”, focuses on some specific goals of the project.

The fourth poster, “Plains Boundary with General Land Office Data – Baraga IRP”, illustrates the different current and historical data sources used in the analysis of the Baraga Plains.

The final poster, “Recreation Improvements and Road Management for the Baraga Plains Project”, shows specific areas where improvement to the existing conditions is needed.

USDA Forest Service Ottawa National Forest

Ontonagon Ranger District

1209 Rockland Road

Ontonagon, MI 49953

(906)-884-2411

dsteffensen@fs.fed.us , gsironen@fs.fed.us , rwagner@fs.fed.us , or jeffmell@fs.fed.us

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Title: Bird Conservation in Jack Pine Forests: The WBCI All-bird Conservation Plan

Author(s): Andy Paulios

Abstract: Jack Pine forests and associated barrens and northern dry forests are important for the conservation of a number of high priority species including habitat specialists like Kirtland's Warbler and Connecticut Warbler and declining species of greatest conservation need. In addition, many open-country species and disturbance dependent species are found in this habitat during or after insect outbreaks, fires, or large even-aged management treatments. Management and restoration of this forest community is globally important for Wisconsin and will depend on improved landscape design and coordination across multiple ownerships.

Wisconsin Department of Natural Resources
101 South Webster St.
Madison, WI 53707-7921
608-264-6137
Andy.Paulios@wisconsin.gov

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Title: Brown-Headed Cowbird Control: Protecting Kirtland's Warbler for 38 Years

Author(s): Chris Mensing¹ and Jeremy Banfield²

Abstract: The federally endangered Kirtland's warbler (*Dendroica kirtlandii*) has made remarkable strides towards recovery because of intensive habitat management and brown-headed cowbird (*Molothrus ater*) control. The 2009 annual census counted over 1,800 singing males, sustaining a 20-year increasing trend and marking a dramatic increase from a low point of 167 singing males in 1987.

The brown-headed cowbird control project was initiated by the U.S. Fish and Wildlife Service in 1972 after researchers determined that nest parasitism by brown-headed cowbirds was severely limiting Kirtland's warbler fledge rates. Since then, this annual program has removed nearly 150,000 cowbirds and virtually eliminated Kirtland's warbler nest parasitism in the northern Lower Peninsula of Michigan.

¹U.S. Fish and Wildlife Service East Lansing Field Office
2651 Coolidge Road
Suite 101, East Lansing, MI 48823
517-351-8316
chris_mensing@fws.gov

²U.S. Fish and Wildlife Service East Lansing Field Office
2651 Coolidge Road
Suite 101, East Lansing, MI 48823
517-351-8318
jeremy_banfield@fws.gov

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Title: Comparative diversity and habitat relationships of avian and bat communities in managed pine stands of the Great Lakes.

Author(s): Kimberly M. Skahan¹ and Kevin R. Russell

Abstract: Most research investigating wildlife associations with jack pine forests has focused on early-successional and pine barrens specialists. However, contributions of older (i.e., mature) stands of jack pine to wildlife diversity in the Great Lakes remain poorly characterized. Because many managers consider jack pine to be less economically valuable than other tree species, existing stands continue to be converted to intensively managed stands of red pine (*P. resinosa*) and other species. Because the composition and structure of naturally-regenerated jack pine stands differ from those of red pine plantations, the continued loss of jack pine forests may have significant impacts on regional biodiversity. We present results from a two-year study comparing the diversity and habitat relationships of avian and bat communities within replicate stands of rotation age jack pine ($n = 12$) and plantations of red pine ($n = 12$) in Minnesota and Wisconsin. We will relate bird and bat metrics to a suite of compositional and structural habitat attributes measured within each stand and compare both wildlife and habitat metrics between stand types.

¹ College of Natural Resources
University of Wisconsin- Stevens Point
Stevens Point, WI 54481
715-572-0682
kimberly.m.skahan@uwsp.edu

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Title: Coordinated Bird Monitoring in the Midwest Region

Author(s): Katie Koch¹ and Tom Will²

Abstract: Monitoring for bird conservation assumes many auspices, ranging from status and trend measurement to setting population and conservation goals for species, determining the causes of population changes and ultimately informing management to make conservation decisions. For >1,000 bird monitoring programs in the United States, there has been little effort to share data, unify coverage, standardize protocols, or incorporate new and powerful techniques for managing and analyzing data until very recently. Midwest Coordinated Bird Monitoring partnerships are being forged to align various stakeholder groups to prioritize, set conservation and monitoring objectives, design regionally coordinated surveys, and clearly articulate a data management strategy. Coordinated bird monitoring isn't just about the monitoring itself, but rather placing that information in a conservation context such that it can INFORM management decisions. By developing a more efficient, strategic, cooperative and coordinated framework, we will demonstrate the utility of focused monitoring programs that address bird conservation issues.

¹US Fish and Wildlife Service Marquette Biological Station
3090 Wright St
Marquette, MI 49855
906-226-1249
katie_koch@fws.gov

² US Fish and Wildlife Service Midwest Regional Office
One Federal Drive
Fort Snelling, MN 55111
612-713-5362
tom_will@fws.gov

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Title: Deer repellent trials on jack pine seedlings at Brule River State Forest: Final Results 2005-2009

Author(s): David Harbec

Abstract: Two-year-old bare root jack pine seedlings, planted at Brule River State Forest in the spring of 2004, were treated with 6 different retail deer repellents in the falls of 2005, 2006, 2007 and 2008 (see Table 3 for list of products, active ingredients and costs). Observations of deer browse incidence were recorded and height measurements were taken in each spring (mid-June) following these treatments. Seedlings treated by any of the repellents were significantly taller and had lower incidence of deer browse damage than control (non-treated) seedlings. Plantskydd®, Thiram and Repellex™ treatments yielded the tallest trees. Likewise, observations of deer browse damage showed these same products (Plantskydd®, Thiram and Repellex™) had the greatest repelling effect. In this study a *browse height threshold* was identified at **20 inches**. Seedlings reaching this size were much less susceptible to browse damage on the leader and terminal bud. Average height measurements showed that the control seedlings were nearly **2 years-of-growth** behind the treated seedlings. Observational data was difficult to collect and not as reliable as the seedling height measurement. This was due to the difficulty in differentiating between cumulative years of browse damage and browse damage within individual years.

Table 1: Seedling Height Measurements by Treatment and Year

	<i>2007 – 1.5 years into study</i>	<i>2008 – 2.5 years into study</i>	<i>2009 - 3.5 years into study</i>
Deer Off®	24.5"	32.6"	41.5"
Repellex™	30.3"	37.2"	50.5"
Hinder®	19.5"	29.4"	39.5"
Plantskydd®	28.7"	39.3"	51.8"
Thiram	27.4"	35.2"	50.7"
Tree Guard®	19.2"	27.9"	38.3"
Avg. of all Repellents	24.9"	33.6"	47.3"
Control	13.7"	18.2"	27.6"

Table 2: Deer Browse Incidence by Treatment and Year

	<i>2006 - 0.5 yrs into study</i>	<i>2007 – 1.5 years into study</i>	<i>2008 – 2.5 yrs into study</i>	<i>2009 – 3.5 yrs into study</i>
Deer Off®	14.9%	13.8%	6.4%	4.5%
Repellex™	19.3%	1.3%	4.2%	6.5%
Hinder®	10.5%	67.1%	10.8%	12.8%
Plantskydd®	8.8%	10.4%	0.0%	9.1%
Thiram	11.2%	2.9%	8.6%	6.0%
Tree Guard®	10.6%	77.1%	19.5%	23.8%
Avg. of all Repellents	12.6%	28.7%	8.2%	10.5%
Control	48.2%	97.8%	67.5%	30.0%

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Title: Endangered Kirtland's Warbler Habitat Management and Multi-Species Bird Conservation

Author(s): R. Gregory Corace, III¹, P. Charles Goebel² and Damon L. McCormick³

Abstract: Intensive management of jack pine (*Pinus banksiana* Lamb.) plantations has led to a population increase and breeding range expansion of the endangered Kirtland's Warbler (*Dedroica kirtlandii* Baird). However, no study has quantified the different bird communities that are associated with Kirtland's Warbler habitat management. We examined bird species conservation scenarios of warbler habitat management by addressing the following: 1) how do bird community structure and conservation scenarios differ among jack pine habitats of three discrete age classes (YOUNG, <5 yr.; KW, 5-23 yr.; and OLD, >23 yr.), 2) what functional groups (e.g., nest placement groups, foraging groups) of bird species are represented among these three habitat types, and 3) what are the relationships between bird communities and the composition and structure of these habitat types? Sixty bird species were observed in 37 habitat patches across the three habitat types. Conservation metrics based upon the pooled species lists for each of the habitat types indicated no difference ($P>0.05$) among them. Nonetheless, five bird species of U. S. Fish and Wildlife Service Regional Conservation Priority were found among the habitat types, with all but Kirtland's Warbler most common in the YOUNG habitat. Five indicator species associated with the YOUNG and KW habitat types were observed, while nine species were associated with the OLD habitat. An analysis of bird species by functional group indicated that stand structure was important for breeding species across habitat types. We believe our results support increased ecologically-based planning and management across jack pine habitats for more than just Kirtland's Warbler.

¹Seney National Wildlife Refuge
US Fish and Wildlife Service
Seney, MI 49883
Greg_Corace@fws.gov

²School of Environment and Natural Resources
Ohio Agricultural Research and Development Center
The Ohio State University
Wooster, OH 44691
goebel.11@osu.edu

³Common Coast Research & Conservation
Germfask, MI 49836
dlvm@msn.com

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Title: Fiber, Feathers and Friends – An Integrated Approach to Managing Jack Pine to Benefit Kirtland's Warbler, Maintain Yields and Involve Partners

Author(s): Kirk Piehler, Wildlife Biologist, Hiawatha National Forest, Escanaba, MI
Jean Perkins, Silviculturist, Hiawatha National Forest, Escanaba, MI
Steve Sjogren, Wildlife Biologist, Hiawatha National Forest, St. Ignace, MI

Abstract: Jack pine (*Pinus banksiana*) is a common fiber producing tree in the Great Lakes states. Dense stands of young jack pine provide optimal nesting habitat for Kirtland's warbler (*Dendroica kirtlandii*) or "KW", a federally listed species. The species breeding range is primarily Michigan's northern Lower and eastern Upper Peninsulas. The Hiawatha National Forest's 2006 Forest Plan contains management direction, including goals for average annual acres of jack pine regeneration, designed to promote recovery of KW. On the Hiawatha National Forest (HNF), located in the eastern Upper Peninsula, young jack pine stands about 6-16 years of age (about 5-15 feet tall) are considered suitable for nesting. Jack pine is adapted to well drained and sandy soils (i.e. "barrens"), conditions that have been present since the retreat of the Wisconsin ice sheet about 14,000 years ago. Historically, vegetation on the jack pine barrens was maintained by natural wildfires that occurred frequently throughout the region. With the arrival of wildfire suppression, an emphasis on forest management practices to regenerate jack pine is required for the continued recovery and viability of the Kirtland's warbler.

Habitat standards suggest that jack pine stands less than 80 acres in size are seldom occupied. The highest potential for nesting will occur in stands or complexes greater than 1,100 acres with an average stocking density of about 1,100 trees per acre or more, including small non-forest inclusions (approximately 25 percent open area per acre), or approximately 5'x 6' spacing or less. Due to the open-land requirement, the actual tree density would be about 1,450 trees per acre in habitat outside of the open areas. Natural regeneration or planting can be used to regenerate jack pine for KW on the HNF.

Reforestation of jack pine for KW on the HNF emphasizes natural regeneration, which is less expensive than full planting. Site preparation consists of crisscross passes with a rollerchopper to crush jack pine slash remaining after a mature jack pine stand has been clearcut. Spiked anchor chains dragged behind the rollerchopper scarify the soil at the same time. Jack pine is extremely intolerant of shade, and cones are serotinous. Rollerchopping brings the cones on the slash close enough to the ground that radiant heat from the sun will open them. Site preparation takes place as soon as possible after harvest so seed viability will be at maximum, and so the soil will be scarified before the jack pine cones open (generally in July following harvest), so that seeds falling from cones in the logging slash germinate on mineral soil. Natural regeneration must sometimes be supplemented with additional seeding or planting to reach the stocking density needed to meet KW nesting requirements. Stocking density must also be kept below densities that might reduce later marketability. After stands grow out of the size that provides KW nesting habitat, they are managed conventionally for fiber production.

Partnerships are a promising means for funding KW habitat work if either full or supplemental planting of jack pine for KW is prescribed. The Hiawatha National Forest received grants from the National Arbor Day Foundation in 2006 and 2009. These grants were used to create and restore habitat for Kirtland's warbler through supplemental planting on more than 1,100 acres where natural regeneration of jack pine alone did not result in sufficiently dense stocking to meet KW habitat needs.

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Title: Forest Bird Habitat Matrix: Putting important bird - forest information at the tip of your fingers

Author(s): Andy Paulios

Abstract: The Wisconsin Bird Conservation Initiative (WBCI) in cooperation with the Wisconsin DNR is implementing Phase II of the Forest Bird Habitat Matrix. This project connects bird point count data to stand-level habitat information in an effort to compile and analyze information on bird populations relative to a common habitat language that ornithologists and habitat managers can understand. The output of this effort will be a web interface that allows managers to answer questions about bird occurrences and abundances in different habitat types and access to large bird point count datasets for ornithologists in the Midwest. In addition, WBCI hopes that this project can serve as a means for coordination to help address and guide ongoing and future bird monitoring efforts for forest birds.

Wisconsin Department of Natural Resources

101 South Webster St.

Madison, WI 53707-7921

608-264-6137

Andy.Paulios@wisconsin.gov

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Title: Identifying land manager objectives and alternatives for mixed-pine forest ecosystem management and restoration in eastern Upper Michigan

Author(s): R.S. Wilson¹, D. M. Hix², P.C. Goebel³, R.G. Corace, III⁴

Abstract: The increasing emphasis on developing a more holistic approach to forest ecosystem management and restoration presents many decision-making challenges. The study reported here was a first step in a structured decision-making approach aimed at encouraging more informed management choices in mixed-pine forest ecosystems in eastern Upper Michigan. The results of interviews with 13 land managers indicate that ecological objectives (e.g., restoring ecosystem integrity) take precedence over socio-economic objectives (e.g., providing forest products) for forest management. The reverse is true for fire management, where socio-economic objectives take precedence. Despite interest in using fire as one of many tools to help emulate natural disturbances, land managers felt their options were limited by uncertainty about the potential risks to their management objectives, and difficult tradeoffs between achieving short- versus long-term objectives. These results highlight the need for decision-support tools that will assist managers in balancing competing objectives and making difficult tradeoffs in this highly complex decision context.

¹The Ohio State University
The School of Environment and Natural Resources
2021 Coffey Road
Columbus, OH 43210
614.247.6169
Wilson.1376@osu.edu

²The Ohio State University
The School of Environment and Natural Resources
2021 Coffey Road
Columbus, OH 43210
614.292.1394
hix.6@osu.edu

³The Ohio State University
The School of Environment and Natural Resources
1680 Madison Avenue
Wooster, OH 44691
330.263.3789
Goebel.11@osu.edu

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⁴United States Fish and Wildlife Service
Seney National Wildlife Refuge
1674 Refuge Entrance Road
Seney, MI 49883
906.586.9851 ext 14
Greg_Corace@fws.gov

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Title: Jack Pine in Ontario

Author(s): Colin Bowling and Stacey Skene

Abstract: Jack pine (*Pinus banksiana* Lamb.) is the most widely distributed Canadian pine, and can typically be found growing in extensive, even-aged stands that have developed out of burned-over areas caused by forest fires. As such, the pattern that emerges for the jack pine forest is rapid establishment as a monoculture over fire-prone sites with subsequent invasion and establishment of black spruce (*Picea mariana* (Miller) B.S.P.) and balsam fir (*Abies balsamea* (L.) Miller) in later stages of succession.

A number of biogeographic features make jack pine suitable for intensive management for a range of objectives including:

1. high yields at early ages, thereby shortening rotation ages
2. a wide natural range extending across most of northern Ontario
3. a capability of growing on a wide range of soils and a tolerance for extreme climatic conditions
4. a natural occurrence in extensive, unfragmented stands, making the species suitable for large-patch management practices
5. an ability to produce large quantities of seed frequently and at early ages

Ontario Ministry of Natural Resources
Northwest Science and Information Section
Box 5080
Kenora, ON
P9N 3X9

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Title: Killer Hazel Jack Pine Regeneration Prescribed Burn

Author(s): Nichol Martin and Dave Schulz, Brule River State Forest, Brule, WI

Abstract: The purpose of this project on the Brule River State Forest was to use fire to naturally regenerate jack pine in a large block of natural jack pine originating from the large forest fires that burned through this area in 1936. Goals of the prescribed burn were to provide an adequate seed bed and open the serotinous jack pine cones; with a final goal of having a fully stocked jack pine seedling stand within 5 years of the harvest.

Results: The 112 acre site was burned on 5/22/06.

Discussion/Recommendations:

- Seed trees were left at about 6 trees per acre, but were clustered in groups of 3-4. This provided wind stability to the seed trees and virtually no seed trees were lost to wind throw between the harvest and burn.
- Slash was evenly scattered across the site during the timber harvest, our technicians pushed the slash away from the line and into the unit, giving at least a 50' buffer of slash free ground near the line. This did create somewhat of a windrow of slash 50' from the line that did burn intensely.
- The burn unit had a 90 degree jog in the line one side, which we had a plan to deal with. But once committed to the burn it compromised our ability to adapt as easily as we would have liked. Recommend to separate these from the main unit and use them as test burns.
- Mature standing red pine and pole sized white pine were left standing throughout the unit and next to the line. Most of the pine near the line torched out and caused concern for the holding units.
- As the fire spread it actually burned up the boles of the jack pine on the bark sometimes 30-40 feet up the tree.
- All standing seed tree jack pine did not survive the burn, but we did achieve the objective of opening the serotinous cones spreading the seed.
- The burn provided an excellent seed bed, only 1000-hr fuels remained on the site.
- Maximum flame lengths observed were 3-6' flanking, 10-20' head; note these were maximum and were not always present.
- Average rate of spread for the burn was 25 chains per hour.
- Instead of having type 7 engines to patrol consider pairing 2 or 3 firefighters with an ORV with water to patrol (minimizes firefighter fatigue). The type 7 engines were not as mobile patrolling back and forth as would have liked. A second similar burn done we used more people on foot and it was much better.
- Following the burn in May of 2006 the area is experiencing severe drought; precipitation in 2006 was short 10 inches for the year, 2007 had between 12-16 inches short, 2008 had between 4-6+ inches short. Seedling count done 2009.

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Title: Predator Surveillance of Brown-Headed Cowbird Traps

Author(s): Jeremy Banfield¹ and Chris Mensing²

Abstract: In an effort to reduce impacts to the federally endangered Kirtland's Warbler, the U.S. Fish and Wildlife Service traps brown-headed cowbirds, a brood parasite, in the jack pine forests of Michigan's northern Lower Peninsula. Capitalizing on the gregarious nature of the cowbird, traps are baited with live decoy cowbirds. However, a significant proportion of the decoys are lost to predation, reducing the overall effectiveness of the trap.

During the spring of 2009, the U.S. Fish and Wildlife Service initiated a small-scale research project examining the predation of decoy cowbirds. We used infrared cameras to determine what species were preying upon the cowbird decoys and examined the relationship between predation rates and the habitat surrounding the cowbird traps. Ultimately, we hope to modify traps in a way that limits predation or place future traps in locations less prone to predation.

¹U.S. Fish and Wildlife Service East Lansing Field Office
2651 Coolidge Road
Suite 101, East Lansing, MI 48823
517-351-8318
jeremy_banfield@fws.gov

²U.S. Fish and Wildlife Service East Lansing Field Office
2651 Coolidge Road
Suite 101, East Lansing, MI 48823
517-351-8316
chris_mensing@fws.gov

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Title: Public perspectives of fire, fuels and the Forest Service in the Great Lakes Region: A survey of residents in Michigan, Minnesota, and Wisconsin

Author(s): Eric Toman¹, Bruce Shindler² and Sarah McCaffrey³

Abstract: This poster describes public opinion research from counties surrounding National Forests in Wisconsin, Minnesota and Michigan. Data address citizen perspectives on (1) fuel reduction practices and related risks, (2) confidence in the US Forest Service to implement treatments, and (3) interactions between the agency and forest communities. A longitudinal (panel study) methodology was used to survey the same citizens in 2002 and again in 2008 at each location. This form of research is rare, but can yield important insights about influences on public opinion over time.

Findings demonstrate substantial support for prescribed fire and thinning treatments. While participants still expressed some concerns with treatment implementation, several concerns declined substantially across the study period. In particular, fewer participants were concerned about the threat of prescribed fires getting out of control and potential impacts to private property. Overall, Minnesota residents had fewer concerns whereas Michigan respondents were more cautious.

¹School of Environment and Natural Resources
Ohio State University

²College of Forestry
Oregon State University

³Northern Research Station
USDA Forest Service

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Title: Snag Management in Kirtland's Warbler Jack Pine Plantations

Author(s): R. Gregory Corace, III¹, Nancy E. Seefelt², P. Charles Goebel³ and Heather L. Shaw

Abstract: In many pine (*Pinus* spp.)-dominated stands in the northern Lake States, changes in land-use practices and altered fire regimes have produced structurally simplified conditions relative to stands which developed following natural disturbance events. In many intensively managed stands, important biological legacies either do not exist or are found at low abundance. To advance guidelines for snag management in Kirtland's Warbler (*Dendroica kirtlandii*) jack pine (*Pinus banksiana*) plantations, we conducted a post-clearcut retrospective study of the development of 335 natural and girdled snags of primarily jack pine and oak (*Quercus* spp.). Results indicated that most (84%) of the snag mortality (i.e., snags snapped to <6 m or uprooted) occurred within the first year after clearcut-girdling, and that after 2.5 yr., mortality of natural and girdled jack pine stems was greater than oak stems of either treatment type. Moreover, decay class development in girdled snags lagged >1 decay class behind natural snags, suggesting that different wildlife habitat types are provided by girdled snags. To provide more residual structure than would be provided by simply maintaining all natural snags post-harvest, we suggest that land managers place more emphasis on creating snags in intensively managed jack pine plantations.

¹Seney National Wildlife Refuge
US Fish and Wildlife Service
Seney, MI 49883
Greg_Corace@fws.gov

²Department of Biology
Central Michigan University
Mt. Pleasant, MI 48859
nancy.e.seefelt@cmich.edu

³School of Environment and Natural Resources
Ohio Agricultural Research and Development Center
The Ohio State University
Wooster, OH 44691
goebel.11@osu.edu

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Title: Thinning High-Density, Post-KW Jack Pine for Biomass

Author(s): James M. Schmierer and James C. Rivard

Abstract: We are investigating the potential for biomass removals in young stands of jack pine previously regenerated to high stand densities (1000 to 2000 trees per acre) suitable for Kirtland's warbler (KW), but by age 25 are generally unsuitable for KW habitat and significantly overstocked. In this condition, basal area growth and individual tree vigor is reduced. Thinning to a stand density of 400 to 600 trees per acre can yield up to 50 tons per acre of biomass at age 30, based on a local volume equation for pre-commercial jack pine developed at the Ford Forestry Center on the 25,000 acre Baraga Plains (Grayling sand, site index 55 ft at base age 50) in upper MI. This leaves a better-spaced residual stand that can fulfill timber production objectives since individual tree volume, and total yield is optimized at a density of 500 tpa and a rotation age of 50 years, according to density management diagrams for jack pine.

School of Forest Resources & Environmental Science
Michigan Technological University

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Title: Wisconsin's Forestland Woody Biomass Harvesting Guidelines

Author(s): Authors: Sarah Herrick¹, Eunice Padley, Joe Kovach, Carmen Wagner, and Darrel Zastrow

Abstract: Higher energy prices and incentives to produce renewable energy have increased the nationwide interest in bio-fuels, and expanded demand for sources of biomass. The potential expansion of a wood-based bio-energy industry could benefit Wisconsin's economy by expanding markets for forest products, creating jobs and reducing reliance on fossil fuels. However, concerns have been raised about the sustainability and environmental impacts of increased removal of woody biomass from Wisconsin's forests. The harvest of woody biomass for energy is not yet widespread in Wisconsin, but several bio-energy projects are developing which could quickly increase demand for the State's wood based resources. In response, the Wisconsin Council on Forestry sponsored the development of biomass harvesting guidelines designed to ensure that woody biomass is not only a sustainable forest product but that increased extraction does not harm the long-term sustainability or productivity of Wisconsin's forestland.

¹101 S. Webster St.
Madison, WI 53703
(608)267-7689
Sarah.Herrick@Wisconsin.gov