

Title

Assessing the demographic response of an early seral songbird to intensive forest management

Investigators

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Project duration

Our group initiated a two-year (2013-2014) landscape-scale manipulative experiment to assess how IFM impacts songbirds that require early seral forests. Funding from FWHMF funding was obtained to expand this work by supporting field operations scheduled for the 2015 field season (May-August).

Study objectives

1. Determine whether the intensity of herbicide application is linked to songbird nesting success.
2. Quantify juvenile survival during the critical period immediately after young fledge from the nest.
3. Assess survival of adults that depend on early seral habitats to raise their young.

Summary of accomplishments over past year

Good progress has been made on the avian demography study over the last year. As discussed in our November 2014 progress report, we did not conduct field work in 2015; however, we did undertake detailed data analysis on data collected during the 2013 and 2014 field seasons (>800 sparrow nests, >50 fledglings radio-tagged). That work has uncovered several important results regarding how herbicides impact songbird demography. Against our initial predictions, per capita daily nest survival rates did not differ statistically among treatments ($X^2 = 3.54$, $P = 0.316$); however, daily survival did differ between years ($X^2 = 12.59$, $P < 0.001$; Fig. 1A) with no year*treatment interaction ($X^2 = 0.40$, $P = 0.940$). Daily survival rate also varied with mean age of the nest ($X^2 = 7.30$, $P = 0.007$) and day of year ($X^2 = 9.80$, $P = 0.002$). When examining the number of fledglings produced per hectare we detected no significant effect of either treatment ($F_{3,9.72} = 0.79$, $P = 0.526$) or year ($F_{1,12.1} = 0.07$, $P = 0.803$), but we did detect a significant treatment*year interaction ($F_{3,11.4} = 11.4$, $P = 0.017$). For the two least intensive treatments (Control, Light) area-specific productivity decreased from 2013 to 2014, whereas the opposite pattern was found for the two most intensive treatments (Moderate, Intensive; Fig. 1B). This result reflects the “green-up” hypothesis, which posits that any negative effects of herbicide on songbird reproduction in the early stages of succession becomes dampened in later years once vegetation emerges in moderate and intensively managed stands. Our subsequent analysis will focus on identifying the vegetation and food attributes associated with management treatments to provide insight on potential mechanisms for this high degree of inter-annual variation in treatment response.

In addition to nest survival, we have also quantified post-fledgling survival of sparrow offspring (n=59) from nests located in Control and Moderate stands. Cox-proportional hazards modeling indicated that neither year ($X^2 = 2.20$, $P = 0.138$), date of fledging ($X^2 = 2.24$, $P = 0.135$), nor treatment ($X^2 = 1.72$, $P = 0.190$) had statistically significant effects on juvenile survival. However, the hazard rate to fledglings, which describes the instantaneous rate of death for a given time, increased by 49.6% in Control stands relative to Moderate stands. Thus, these results indicate that fledglings raised in Control stands survived approximately half as long as those in Moderate stands after leaving the nest. What is responsible for this pattern is unclear, but one hypothesis is that the greater vegetative cover on control stands may have provided more hiding cover for predators of fledglings (e.g., snakes, small mammals) that are themselves preyed upon by higher-level predators present on stands (e.g., owls, hawks).

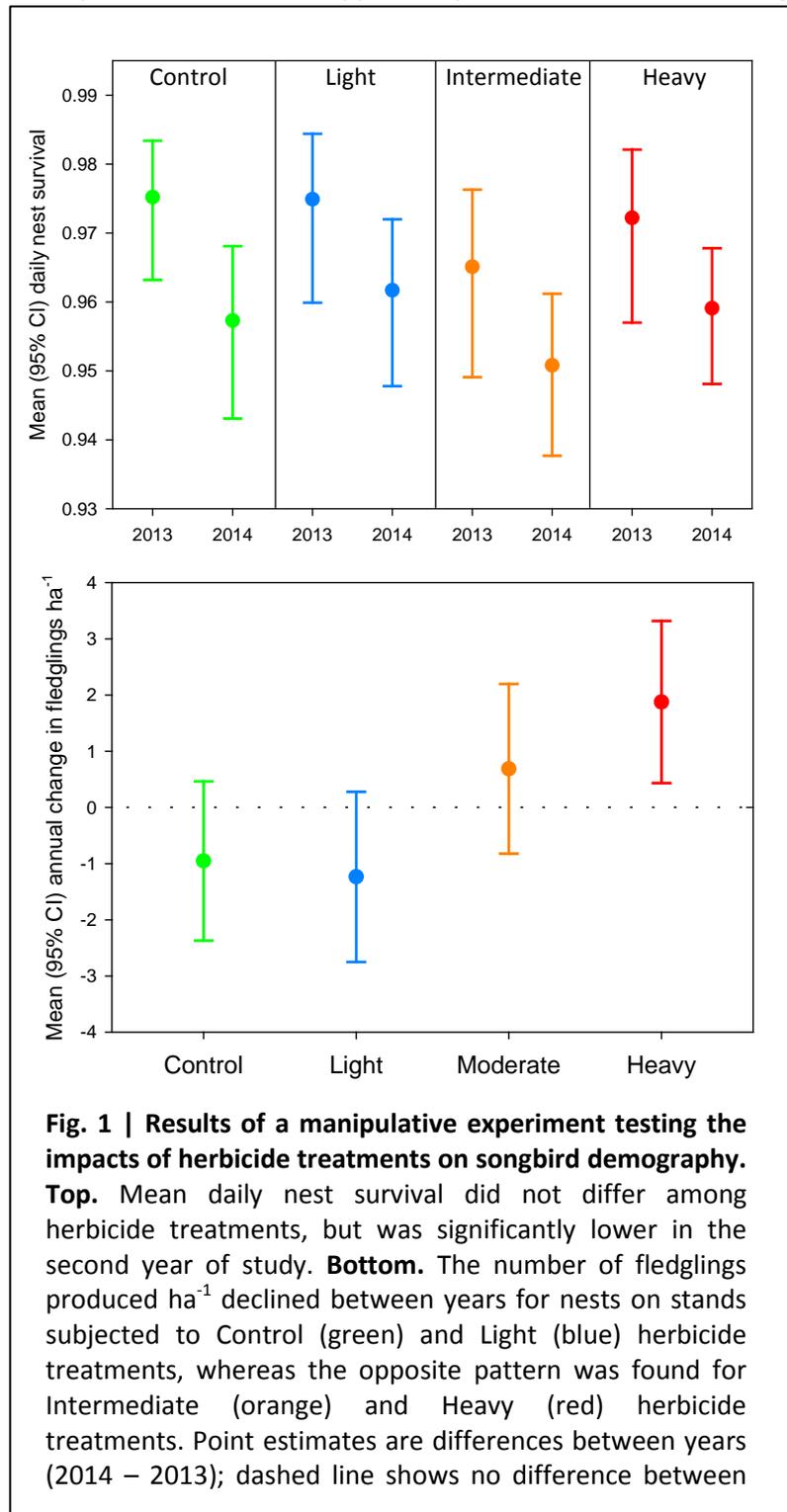
Problems, barriers, proposed changes to objectives

Observations made during summer 2014 indicated that the expected post-herbicide vegetation response had not advanced at the rate initially expected for all treatments. Because of this, we shifted our investigation of this response so that field work will be conducted during the 2016 breeding season (May-August). This change was adopted to provide us with best opportunity to detect the effect of long-term herbicide treatments on demographic measures and, in particular, the vegetation response that occurs after chemical control of broadleaved hardwood plants is terminated.

Observations conducted during summer 2015 indicated that the density of White-crowned Sparrows was markedly reduced on stands subjected to Control and Light herbicide treatments. This pattern may be due to changes in the amount of vegetative cover on stands, as sparrows require areas with bare ground for foraging during the breeding season. We hypothesize that documented increases in the amount of vegetation on Control and Light stands has led to a reduction in the amount of this critical habitat component and, in turn, led to a reduction in breeding density. Based on observations during the 2015 season, the decrease in sparrow density suggests that sparrow abundance in Control stands is so low that will be unable to collect sufficient data across all treatments during the 2016 field season. Thus, our group will explore bird point data collected during 2015, as part of a related study, to determine whether field work should be undertaken in 2016 as planned, or if a modified approach should be adopted.

Planned work

We are currently working on the final steps for analysis of the 2013-2014 data. Once this is completed, we will use those results and couple them with point count data



collected during summer 2015 to determine whether field work should take place in 2016. Given the large and extensive dataset we have already collected and the clear change in response to herbicide treatments we have already detected (Fig. 1B), it may be that we have already have adequate data for rigorously testing our hypotheses about the impact of herbicides on demographic rates. Regardless of whether field work will be undertaken in 2016, however, we will continue to evaluate and refine our modeling approach, present our results at scientific conferences, and submit our findings to a peer reviewed journal.

List of names and brief overview of graduate and/or undergraduate engagement in project

Kristin Jones (Department Forest Ecosystems and Society, Oregon State University) is involved with the project as a graduate student and is finalizing her M.S. thesis (November 20, 2015 defense date) by investigating the interactive effects of intensive forest management and temperature on offspring production in the House Wren.

Jonah Powell (Department of Fisheries and Wildlife Science, Oregon State University) was involved with the project as an undergraduate student and collected towards an independent study assessing how food provisioning of the House Wren is influenced by the intensity of forest management practices.

During summer 2014, 10 enrolled and recent graduates from colleges and universities across the United States were hired to undertaken field data collection for project objectives. Additionally, 17 undergraduate students from Oregon State University obtained research experience on the project by collecting House Wren adult provisioning data from videos during eh 2014-2015 academic year.

List of presentations, posters

Jones, K. N., J. W. Rivers, and M. G. Betts. 2015. Effects of intensive forest management on reproductive success in a cavity-nesting songbird. Oral presentation for the Bird Nerds Student Club, Corvallis, Oregon.

Jones, K. N., J. W. Rivers, and M. G. Betts. 2015. Effects of intensive forest management on reproductive success in a cavity-nesting songbird. Oral presentation at the first annual Willamette Valley Bird Symposium, Corvallis, Oregon.

Rivers, J. W., M. G. Betts, A. J. Kroll, C. J. Schwarz, and J. Verschuyt. 2015. Songbird demographic response to herbicide application in early-seral forest. Oral presentation at the 133rd meeting of the American Ornithologists' Union, Norman, OK.

Rivers, J. W., J. Verschuyt, A. J. Kroll, and M. G. Betts. 2015. The influence of intensive forest management practices on breeding success of the White-crowned Sparrow, an early-seral songbird. Oral presentation at the Oregon Chapter of The Wildlife Society, Eugene, OR.

Rivers, J. W., J. Verschuyt, A. J. Kroll, and M. G. Betts. 2015. Influence of intensive forest management on the breeding success of an early-seral songbird. Oral presentation at the Washington Chapter of The Wildlife Society, Grand Mound, WA.

Rivers, J. W., J. Verschuyt, A. J. Kroll, and M. G. Betts. 2015. Quantifying tradeoffs between biodiversity and timber production in western Oregon. Oral presentation at the Washington Chapter of The Wildlife Society, Grand Mound, WA.

- Betts, M. G. 2014. Introduction to the Intensive Management Study. Invited oral presentation at the Wildlife in Managed Forests: Songbirds and Early Seral Habitats Symposium, Oregon Forest Resources Institute, Albany, Oregon.
- Betts, M. G. 2014. Are changes in bird abundance likely to influence insect abundance and herbivory on trees? Invited oral presentation at the Wildlife in Managed Forests: Songbirds and Early Seral Habitats Symposium, Oregon Forest Resources Institute, Albany, Oregon.
- Jones, K. N., J. W. Rivers, and M. G. Betts. 2014. Investigating the effects of intensive forest management on reproductive success in a cavity-nesting songbird: preliminary results and future directions. Seminar given to the Oregon State University AVES group, Corvallis, OR.
- Jones, K. N., J. W. Rivers, and M. G. Betts. 2014. Effects of intensive forest management on reproductive success in a cavity-nesting songbird. Poster presentation at the 132nd meeting of the American Ornithologists' Union, Estes Park, Colorado.
- Rivers, J. W. 2014. Songbird demography in early seral habitats. Invited oral presentation at the Wildlife in Managed Forests: Songbirds and Early Seral Habitats Symposium, Oregon Forest Resources Institute, Albany, Oregon.
- Rivers, J. W., J. Verschuyf, A. J. Kroll, and M. G. Betts. 2014. Quantifying the demographic consequences of intensive management practices on breeding birds in early seral plantation forests. Invited oral presentation at the 2014 Annual Meeting of the Oregon Chapter of The Wildlife Society, Bend, OR.
- Rivers, J. W., and M. G. Betts. 2014. Intensive forest management practices reduce nest survival and offspring production: evidence from a landscape-scale experiment. Oral presentation at the 132nd meeting of the American Ornithologists' Union, Estes Park, Colorado.
- Verschuyf, J., A. J. Kroll, J. W. Rivers, K. Jones, and M. G. Betts. 2014. A manipulative study of the effects of forest herbicide use on nest success of early seral birds. Oral presentation at the 2014 Annual Meeting of the Washington Chapter of The Wildlife Society, Pasco, WA.

List of publications, thesis citations

- Jones, K. N. 2015. Effects of intensive forest management on air temperature and reproductive success in a cavity-nesting songbird. M.S. thesis, Department of Forest Ecosystems and Society, Oregon State University. Anticipated December 2015.
- Jones, K. N., J. W. Rivers, and M. G. Betts. Intensive forest management exerts weak and variable influences on microclimate in early-seral forest. Anticipated for submission to *Forest Ecology and Management*.
- Jones, K. N., M. G. Betts, and J. W. Rivers. Intensive forest management and local microclimate exert negligible effects on reproductive success in a cavity-nesting songbird. Anticipated for submission to *Canadian Journal of Forest Research*.
- Rivers, J. W., M. G. Betts, A. J. Kroll, C. J. Schwarz, and J. Verschuyf. Demographic response of an early successional songbird along a gradient of herbicide intensity in regenerating forests. Anticipated for submission to *Ecological Applications*.