2006 Progress Report
Birds and Burns Network
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Examining the Influence of Post-wildfire Timber Harvest on Sensitive Woodpecker Reproduction

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Project Description

Post-fire timber harvest practices on public lands are a highly contentious issue in the western United States. Plans for salvage logging are often challenged in court, with plaintiffs frequently citing the detrimental effects of salvage harvest on wildlife populations. Despite this controversy, few studies have investigated the connection between burned tree removal and its influence on wildlife reproduction. The objective of this study is to assess whether postfire timber harvest influences black-backed (*Picoides arcticus*), Lewis's (*Melanerpes lewis*), and white-headed (*Picoides albolarvatus*) woodpecker nest survival, productivity, and distribution within burned, mixed conifer forests. This research is unique in that it focuses on little-known, sensitive species and their relationship to salvage logging using a before and after experimental approach.

While it is well known that most woodpecker species rely exclusively on snags for nest cavities, their dependence upon dead trees in regards to nest success and productivity has not been thoroughly explored. This study will quantify the effects of salvage logging on three woodpecker species by monitoring nest survival, productivity, and occurrence in multiple treatment (harvested) and control (unharvested) plots of various sizes. Plots have been surveyed and nests observed four years - two years pre-treatment (2003, 2004) and two years post-treatment (2005, 2006). Black-backed, Lewis's, and white-headed woodpecker nest survival, productivity, and distribution will be analyzed in respect to logged or unlogged sites at multiple spatial scales. Although three species have been monitored, this project primarily focuses on black-backed woodpeckers to address the question of salvage harvesting effects. The life history characteristics of black-backed woodpeckers indicate that these birds may be especially vulnerable to salvage harvest activities due to their preference for early post-fire habitats and areas of high snag densities (Hutto 1995, Murphy and Lehnhausen 1998, Saab and Dudley 1998, Dixon and Saab 2000, Saab et al. 2002).

Upon completion, this project will supply agencies and managers with scientific data regarding post-fire habitat conservation for sensitive woodpecker species. This study is one of several projects in the "Birds and Burns Network" (see web page http://www.rmrs.nau.edu/lab/4251/birdsnburns/), a research network directed by the Rocky Mountain Research Station to conduct studies on the influence of fire on habitats and populations of birds within ponderosa pine ecosystems of the western United States. The information provided by this study should fill an important gap in the literature; thus moving land management agencies and conservation groups closer towards balancing the demands of the timber industry with the needs of wildlife using post-burn habitats.

Partners
Collaborators for FY 2003, 2004, 2005, and 2006 are the Fremont-Winema National Forest (FRNF), the Rocky Mountain Research Station (RMRS), and Montana State University (MSU) Ecology Department. Their respective contributions are as follows:

FRNF (Amy Markus, North Zone Wildlife Biologist)
- Assisted with study design and provides majority of funding for the project, including vehicles, equipment, field housing, and wages for field assistants and crew leader/supervisor. Also supplies additional logistical support in the field (data entry and preliminary analysis).

RMRS (Dr. Vicki Saab, Research Wildlife Biologist)
-Responsible for the design and implementation of the study, analyzing field data, supervision and advising of the crew leader, and composing technical reports and publications. Provided funding for crew leader/supervisor in 2006. Also supplying full project funding for 2007 season.

MSU (Chris Forristal, Master's Candidate & Dr. Jay Rotella, Professor)
- Supplies instruction and facilities for graduate student, peer review, and technical advice regarding data analysis and publications.

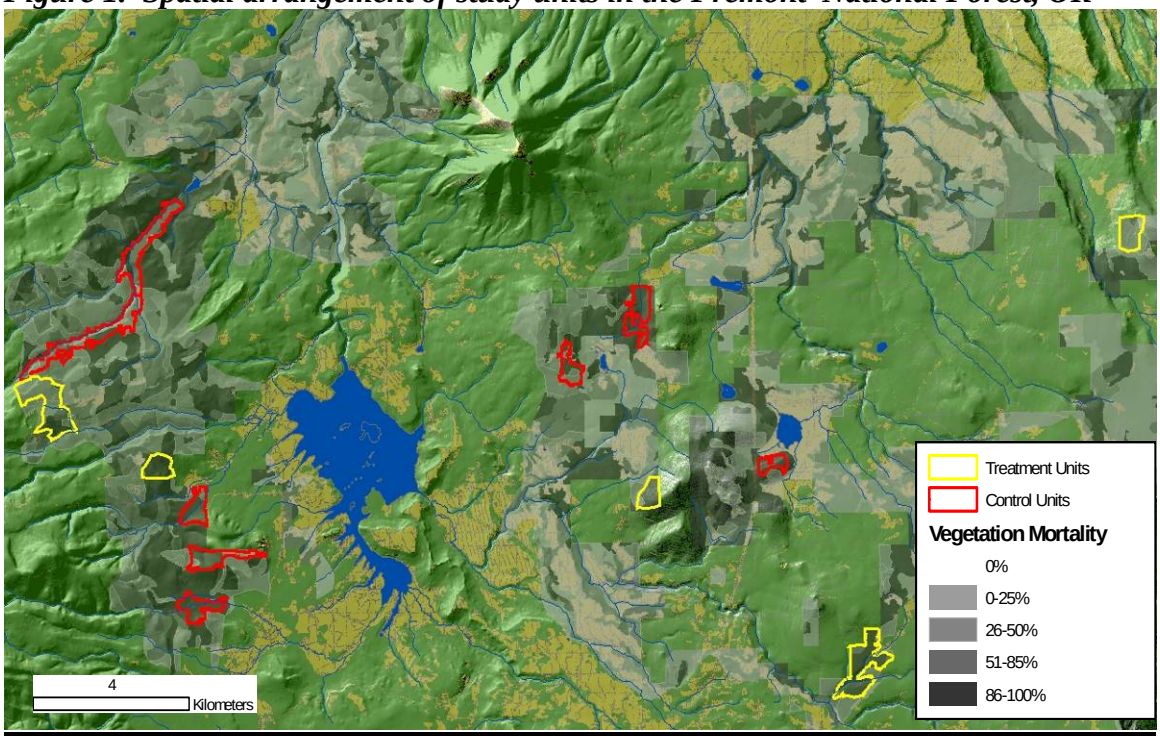
Study Sites

This research is being conducted on the Fremont-Winema National Forest of south-central Oregon. The Fremont-Winema occupies 480,000 hectares of mostly coniferous forests combined with intermittent scab-rock flats. Dominant tree species in the study area consist of ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), and white fire (*Abies concolor*). In late summer of 2002, the Toolbox and Silver Fires burned approximately 34,398 hectares at elevation ranges from 1,500 to 1,800 meters. Both fires were of mixed-severity, resulting in a mosaic pattern across the landscape. The burned forest is characterized by patches of completely charred trees next to relatively green, unburned woodland. This burned/green mosaic offered a unique opportunity to conduct field experiments in conjunction with plans for post-fire timber harvest.

Portions of all study sites within the Toolbox and Silver fires underwent stand-replacement wildfire with high levels of tree mortality (see figure 1). Study sites were selected using pre-fire and post-fire Landsat TM imagery in conjunction with the outlined plans for salvage logging sale units (Johnson et al. 2000). Replicates were paired based upon size, pre-fire canopy closure, and vegetation mortality and type, respectively. Intensity of planned harvest within 500 meters of the site boundaries was also considered when matching replicates. Control sites are those untouched by logging, whereas treatments were salvage logged in the autumn of 2004. Treatment sites were logged with a retention of 25 snags/hectare. The resulting prescription was clumps of approximately 100 leave trees every 4 hectares (see photo on page 4). Diameters of leave trees were planned to be evenly distributed across the gradient of present trunk diameters at breast height (dbh).

A number of "Lewis's areas" were selected for monitoring in addition to the above plots. These sites are small in area (<25 ha) and were chosen because they contained burned ponderosa pine snags of large (>50 cm dbh) sizes, the preferable size of nesting tree for Lewis's woodpeckers (Saab and Dudley 1998). The Lewis's sites were also surveyed and monitored for all three species using standardized methods. They are not displayed in Figure 1 due to their small size.

Figure 1. Spatial arrangement of study units in the Fremont National Forest, OR



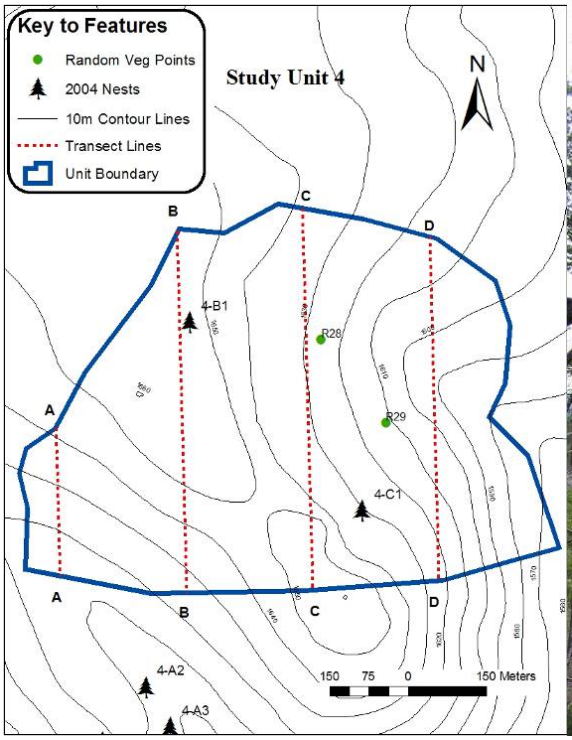
Methods

Bird survey and monitoring methods used by this study are shared by many projects within the Birds and Burns Network (BBN) (Dudley and Saab 2003). Methods for habitat measurements are found on our BBN website (http://www.rmrs.nau.edu/lab/4251/birdsnburns/info_partic.shtml)

Nest Searching and Monitoring

Woodpecker nests were located using systematic searching and playback surveys along belt transects (0.4 x 1.0 km) during April, May, and early June (see Figure 2). This technique provides a relatively complete census of nest cavities (Dudley and Saab 2003). Nest cavities from the previous year are also visited to determine current use and detect potential returning pairs. Birds were audibly or visibly detected and followed back to cavities, where the location was recorded via a field maps and GPS unit. Cavities were not considered active until they were found to contain eggs or young. A nest's detailed reproductive data was collected every 3-4 days using an electronic camera mounted to a telescoping pole (TreeTop II; Sandpiper Technologies, Inc.).

Figure 2. Example study unit with transects



Holly Marchman monitoring a BBWO cavity.

Habitat Measurements

Habitat components were measured for both nest sites and random points within study sites. Forty random vegetation points were generated by GIS and proportionally distributed across all sites (except Lewis's) based upon size of the plot. The same random point locations were monitored in 2003 and 2004, and a new set was generated for the 2005 – 2006 field seasons. Vegetation characteristics surrounding nest trees and random points within sites were recorded through two intersecting 20 m x 100 m rectangular plots (Fig. 3). Detailed nest, snag, live tree, and shrub variables were also collected with this protocol (Bate et al. 1999). Our vegetation measurements differed slightly from the standard BBN protocol in that ground cover and fine fuels were not recorded, as the majority of these items had already been consumed in the wildfire.

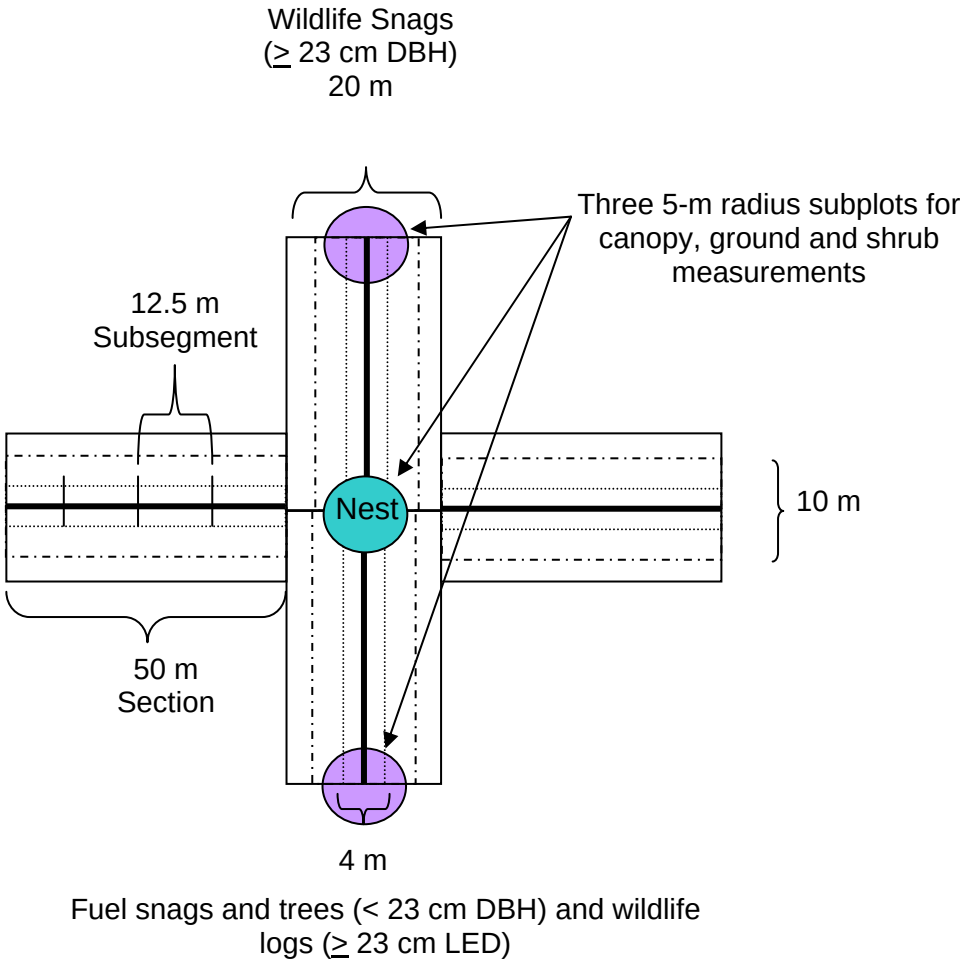


Figure 3. Belt Transect sample design surrounding nest and random trees

Remaining "leave" trees clumped after salvage logging and fuels treatment.
(http://www.rmrs.nau.edu/lab/4251/birdsnburns/info_partic.shtml

Preliminary Results for 2006

The 2006 field season was conducted from May – August with a field crew of 4 full-time employees and a budget of approximately $50,000.

Postfire salvage logging was completed in late summer/autumn of 2004, leaving our control units unlogged and our treatment units logged at varying intensities. Logging

activities, combined with postfire fuels reduction projects, left our control sites as patches of relatively unlogged, burned forest in three size classes:

1. Large (85-110 hectares)
2. Medium (40-60 hectares)
3. Small (25-40 hectares)

Woodpeckers

A total of 66 nests of three species were monitored in 2006 (see Table 1). Total numbers of black-backed woodpecker nests decreased between 2005 (yr. 3 postfire) and 2006 (yr. 4 postfire) from 64 to 47 nests. White-headed woodpecker nest numbers remained similar (11 to 9) and Lewis's woodpeckers increased slightly, from 4 to 10 nests.

Table 1. Woodpecker nest numbers by species, year and unit type. BBWO = black-backed woodpecker, WHWO = white-headed woodpecker, LEWO = Lewis's woodpecker.

Species	**Year**	**Unit Type**			
		Total	Control	Treatment*	Lewis's
BBWO	2003	32	24	3	5
	2004	69	44	18	7
	2005	64	41	16	7
	2006	47	30	11	6
		Total	Control	Treatment	Lewis's
WHWO	2003	7	6	1	0
	2004	13	6	3	4
	2005	11	6	2	3
	2006	9	3	2	4
		Total	Control	Treatment	Lewis's
LEWO	2003	0	0	0	0
	2004	6	4	0	2
	2005	4	1	1	2
	2006	10	6	2	2

* Additional treatment unit added in 2004

Black-backed woodpecker nest survival was high overall, and shows variation (but not a clear trend) in relation to year postfire (Table 2). These nest survival percentages are only general estimates; nest survival will be modeled and compared in greater detail in future publications.

Table 2. BBWO nest survival estimates (with 95% CIs) by Year, and Site Type.

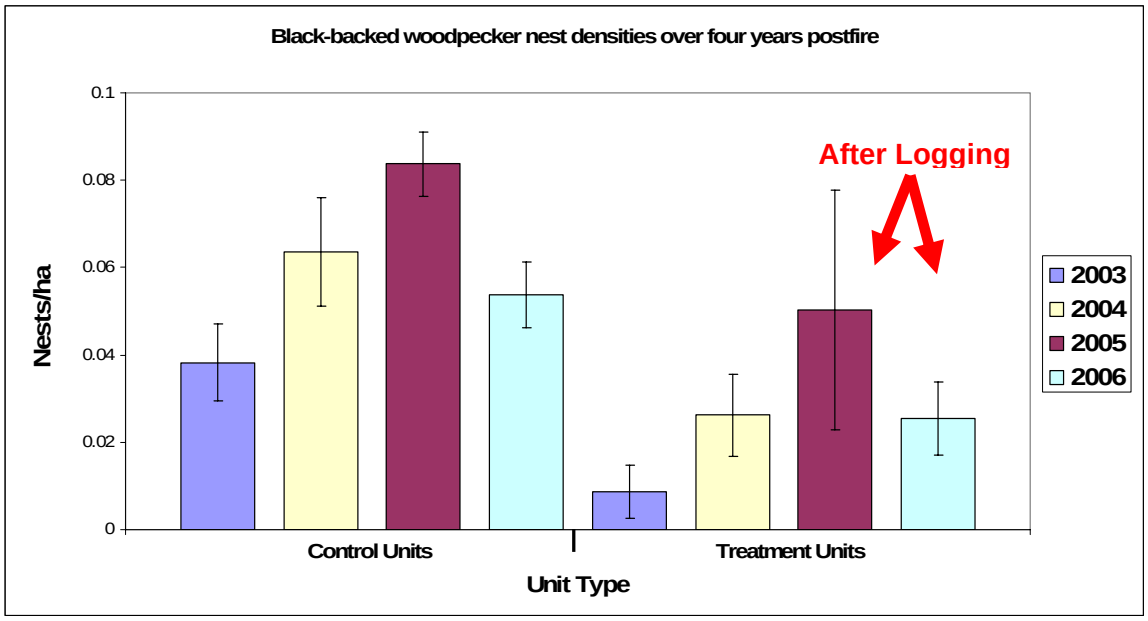
Year	Site Type		
	Total	Control	Treatment
2003	**69.75% (38.40-87.38) N=32**	67.50% (35.20-86.31) N=29	100% N=3
2004	**88.72% (72.72-95.61) N=69**	84.49% (63.87-93.88) N=51	100% N=18
2005 (Post-logging)	**72.88% (55.57-84.35) N=64**	72.30% (50.69-85.69) N=41	74.13% (39.66-90.81) N=16
2006 (Post-logging)	**66.51% (44.29-81.57) N=46**	68.75% (40.72-85.58) N=29	71.60% (26.52-92.01) N=11

Of the three focal species, black-backed woodpeckers exhibited the highest nesting densities. Nests found outside our study unit boundaries were not used in the nest density estimations but were used to calculate nest survival. Nest densities in logged units were extremely variable (see Table 3, Fig. 4), with some units gaining nests and others losing nests after treatment in 2004. When averaged together, logged unit nest densities did not decrease in response to salvage harvest, contrary to our hypothesis. Much of this density increase appears to originate from a single treatment unit, which gained five nests between pre and post-logging years. Speculating on the cause, a significant portion of the burned landscape surrounding this unit received logging and fuels treatment more severe than within the actual unit. As a result, displaced BBWOs seeking better habitat may have relocated inside the unit. We do not report nest numbers in relation to area surveyed for White-headed and Lewis's woodpeckers because of low sample sizes.

Table 3. Number of black-backed woodpecker nests in relation to area surveyed and year.

Unit Type C=unlogged T=logged	Size (hectares)	Number of BBWO nests			
		2003	2004	2005	2006
C	86.2011	2	3	5	4
C	102.389	3	10	9	5
T	111.293	1	2	3	3
T	104.413	N/A	6	5	2
C	40.47	3	2	4	2
C	53.0157	1	1	4	2
T	38.4465	1	1	6	2
C	44.517	3	4	4	1
C	58.2768	3	7	7	5
T	33.9948	0	1	0	1
C	36.0183	0	2	2	2
C	23.8773	1	1	2	2
T	48.564	0	0	1	0

Figure 4. **Mean nest densities for control and treatment study units (± 1 SE)**



Vegetation

A total of 113 vegetation plots were completed in 2006 (66 nest, 47 random). Vegetation data for nest and random plots is summarized below. For purposes of this analysis, a "snag" is considered any dead tree ≥23 cm diameter at breast height (DBH).

Table 4. Average # of snags per a hectare for nest and random plots within each site type. Standard errors are in parenthesis (none for LEWO because of low sample sizes).

Species	**2006**		
	Control	Treatment	Lewis's
BBWO	134 (±11.90)	81 (±18.87)	98 (±11.41)
WHWO	75 (±19.42)	39 (±13.75)	89 (±26.52)
LEWO	72 (±17.42)	76 (±48.75)	99 (±46.25)
Random	105 (±10.56)	68 (±13.24)	N/A

Figure 5 suggests that in 2006 black-backed woodpeckers tended to nest in areas with higher snag densities than randomly distributed non-nest plots within the same study sites. In Fig. 5, treatment sites were logged. Error bars are plus or minus one standard error.

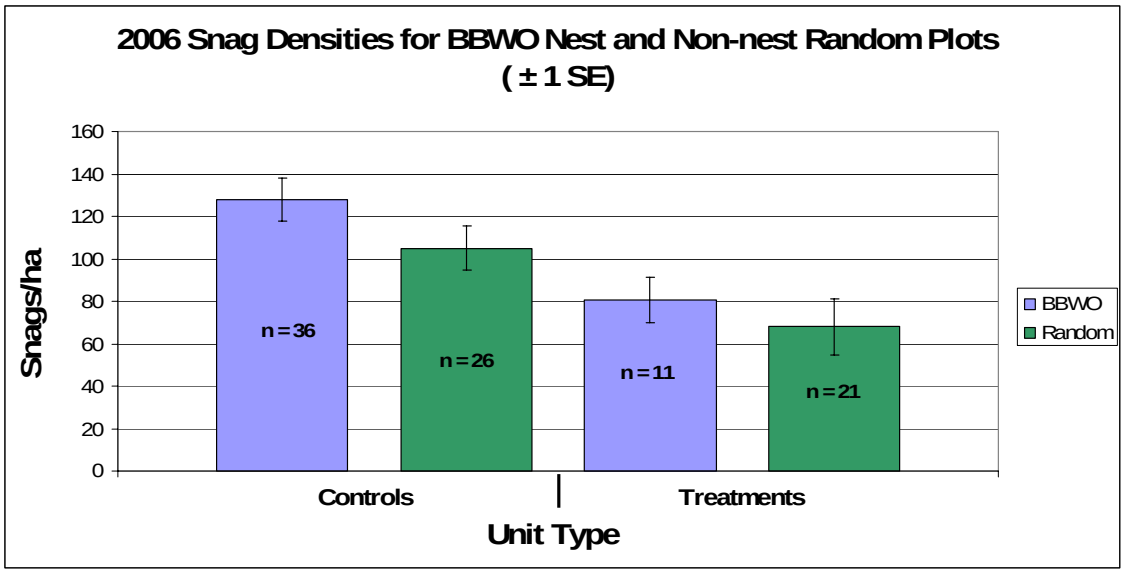


Figure 5. 2006 average # of snags per hectare for BBWO nest and random non-nest plots. Error bars are ± 1 SE.

Future Plans

Funding has been secured for a fifth year of nest searching, monitoring, and vegetation sampling within our study units. Past studies suggest that black-backed woodpecker numbers will continue to decline whereas Lewis's woodpeckers should increase in numbers (Saab et al. 2007). We predict a decreasing trend in nest survival as nest predators recolonize and propagate in these severely burned areas (Saab and Vierling 2001).

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