Final Report – Joint Fire Science Program, 30 October 2007

Project Title: Understanding the influence of local and landscape conditions on the occurrence and abundance of Black-backed Woodpeckers in burned forest patches

JFSP Project No. 04-2-1-106

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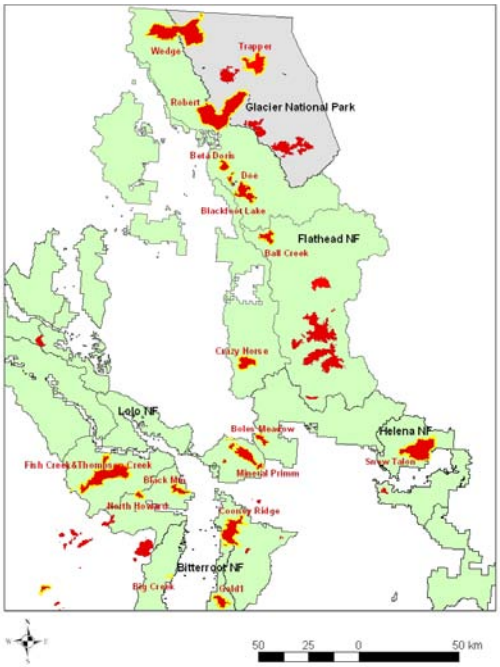
Synopsis of results related to stated Objective 1—*To conduct an extensive survey of Black-backed Woodpecker occurrence across burned forests within three classes of fire severity and within burned forest patches that had undergone various levels of fuel reduction logging before and/or after the fires of 2003 in western Montana:*

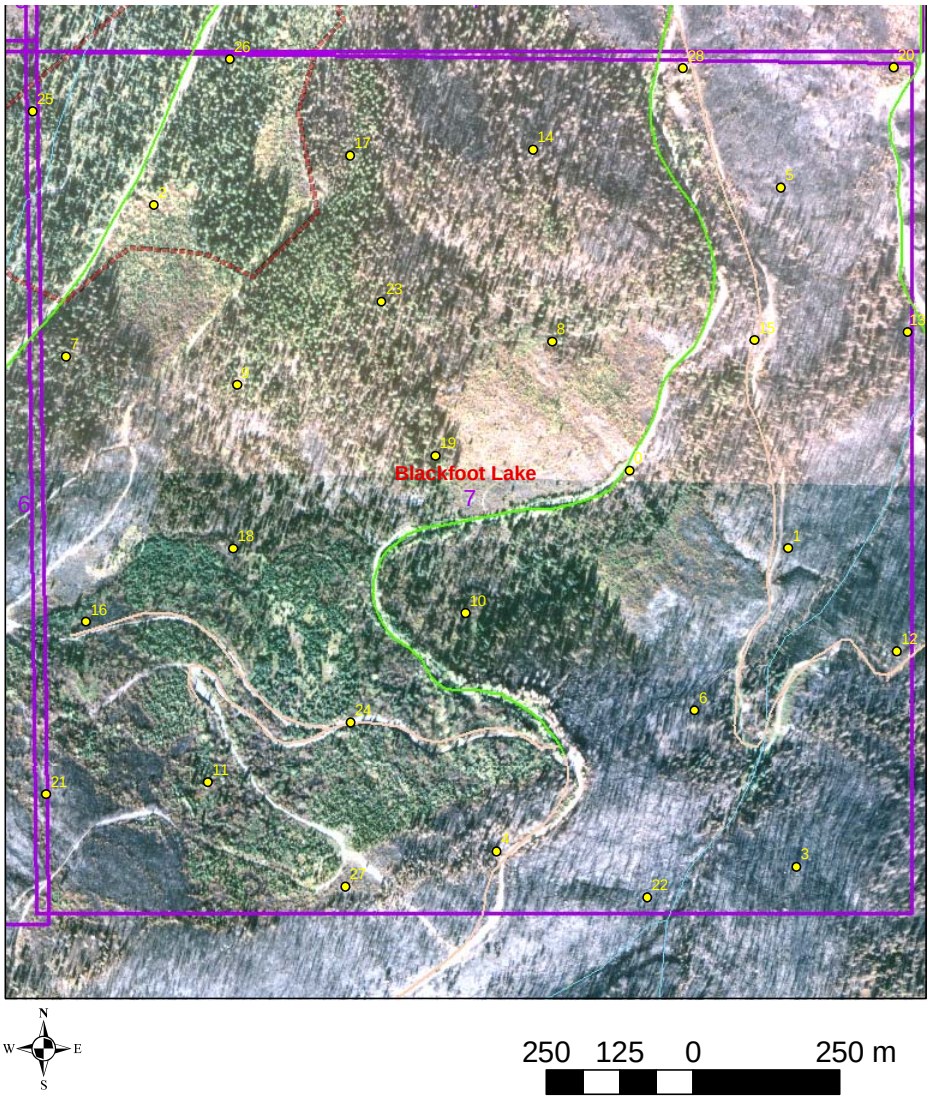
1. The extreme geographic extent of this study

This study is probably one of the most geographically extensive studies of fire effects ever conducted. We collected bird survey data from within in each of 17 separate fires in western Montana (see figure to right) in each of the 4 years following the fires of 2003. The logistics involved with our annual efforts included advertising, hiring, and training a field crew, acquiring permission from all landowners, coordination with logging operations, acquiring access through locked gates, maintaining field equipment, defensive driver's training sessions, participation in field safety courses required by Glacier National Park, and daily check-ins. The level of cooperation needed to conduct a study involving multiple land owners, forests and districts was extreme, and logistic support from numerous cooperators was absolutely necessary to get needed survey data in a timely fashion. I am especially grateful for the dedication and effort provided by my field coordinator, Kristina Smucker, and by the 18 field assistants who worked on this project.



2. Study design

To assure coverage across a variety of pre-fire forest conditions, four categories of fire severity, and two categories of post-fire activity (salvage or no salvage), we spent several months each year planning our sampling effort by using available GIS data layers that were developed before and after the fires of 2003 to position multiple 2.25-ha survey blocks in each of the 17 fires outlined in yellow above. We then positioned survey points randomly within each block, with the constraint that no point fell closer than 250 m from another point (see Figure below for an example target plot within the Blackfoot Lake fire). For each target site, we attempted to include a mix of fire severity (apparent in the photo below), a mix of relatively large (> 23-cm mean dbh) and small (< 23-cm mean dbh) trees, a mix of relatively high and low tree densities for each size class, and some post-fire salvage logging activity (if postfire logging had occurred subsequent to the fire).



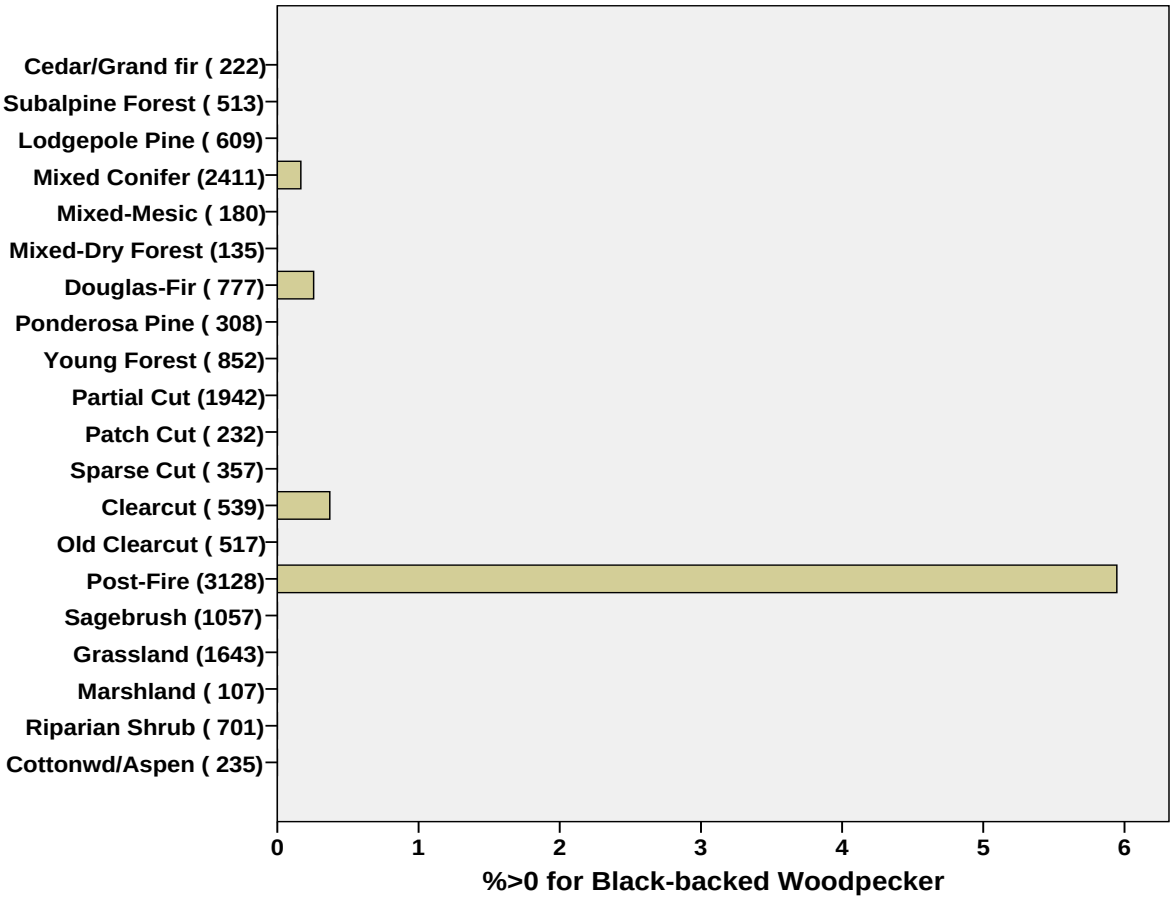
3. Sampling effort achieved

During the first field season immediately following the fires of 2003, we managed (through additional funding from the USFS) to organize our field effort for the future and to conduct 465 point counts in 10 different fires. Since that initial year's effort (2004), we used JFSP support to conduct standard point-count surveys at more than 900 points in each subsequent year (2005-2007). Survey points were located through a stratified random sampling scheme that was developed using GIS data layers during the winter of each year. A number of points were visited twice each year in the latter two years to enable us to better estimate probabilities of detection, and a subset of points was revisited from one year to the next to better control for location in analyses of year-to-year changes in detection. All fire severities were sampled in each of the 17 fires, so the level of true replication attained in this study for numerous variables is noteworthy. The table below provides a breakdown of the distribution of sampling effort among fires across years and by management agency:

Agency/Forest	**Fire Name**	**Total Point Count/Playback stations**			
		2004	**2005**	**2006**	**2007**
Bitterroot NF	Big Creek	15	24	17	0
Bitterroot NF	Gold 1	11	1	0	0
Flathead NF	Ball Creek	0	66	23	33
Flathead NF	Beta Doris	0	53	63	80
Flathead NF	Blackfoot Lake	0	92	62	72
Flathead NF	Crazy Horse	0	33	47	48
Flathead NF	Robert	0	45	78	111
Flathead NF	Wedge Canyon	0	52	80	139
Glacier NP	Robert	0	88	66	70
Glacier NP	Wedge Canyon	104	56	78	107
Glacier NP	Trapper Creek	0	18	16	66
Helena NF	Snow Talon	59	48	33	0
Lolo NF	Black Mountain	121	141	102	115
Lolo NF	Boles Meadow	33	45	60	54
Lolo NF	Cooney Ridge	36	59	99	51
Lolo NF	N. Howard Creek	9	13	12	0
Lolo NF	Mineral Peak	28	62	21	57
Lolo NF	Thompson Creek	49	86	51	62
Totals		**465**	**982**	**908**	**1065**

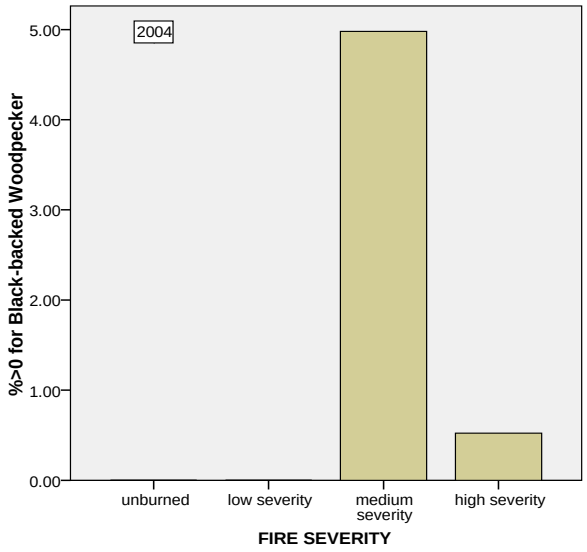
4. Burned forests are not only biologically rich, but they are biologically unique as well.

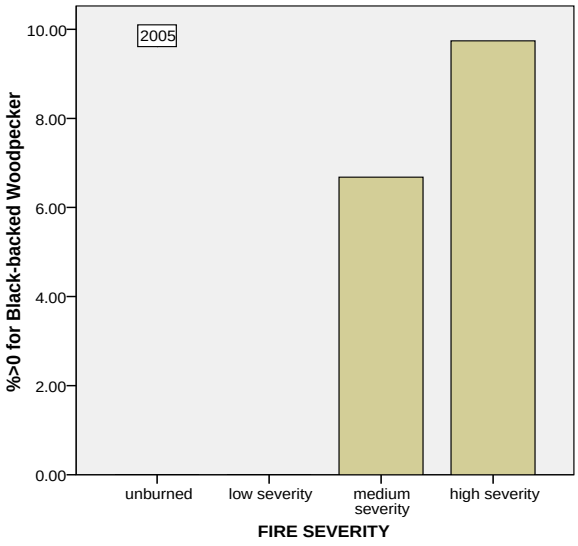
Because the point-count protocol we used was identical to the sampling protocol used by the Northern Region Landbird Monitoring Program (see methods manual at http://avianscience.dbs.umt.edu/research_landbird_methodsmanual.htm, we were able to amass the largest comparative database of its kind in the world. The landbird data (which have been collected from all major vegetation types in the Northern Rockies over a period of 12 years), in combination with the thousands of burned forest sample points visited as part of this research project, enabled us to combine data from more than 50,000 point counts (16,465 separate locations—see sample sizes in parentheses in figure below) to verify that burned forest conditions are, indeed, unique. Many bird species are relatively common in burned forests, and some are relatively restricted to such conditions, with the Black-backed Woodpecker being more restricted to burned forest conditions than any of more than 100 other bird species for which we have sufficient data (see figure below). These results will be submitted to *Science* for publication.

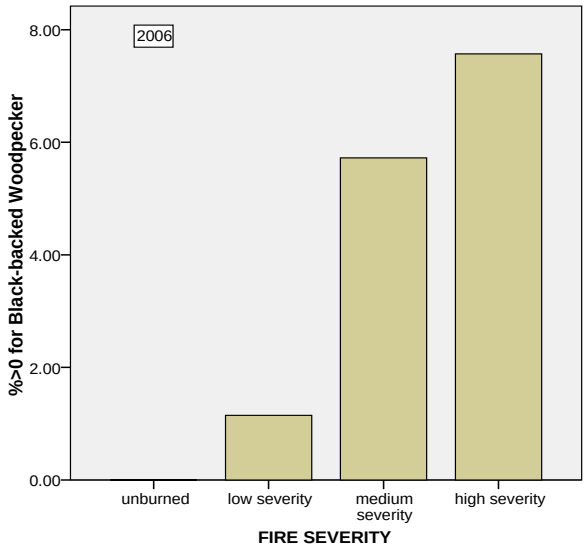


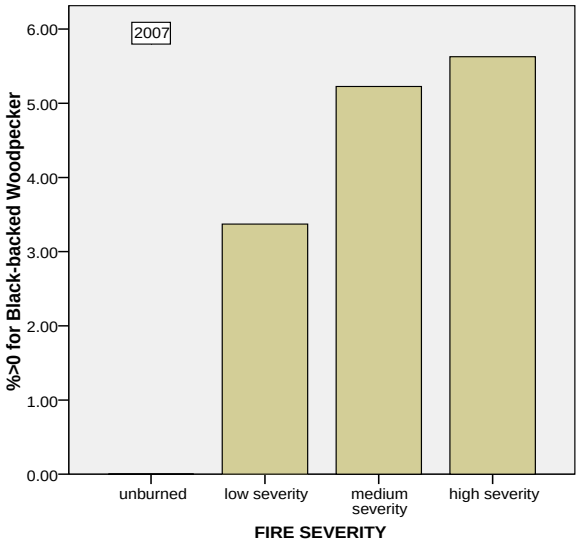
5. Bird distribution is not uniform across burn severity, and, importantly—some like it hot!

Of all the patterns that have emerged so far from preliminary data analyses of bird distribution **within** burned forests, there is one variable that exerts an influence that outstrips the influence of any other variable on the distribution of birds, and that is fire severity. Not only do some bird species clearly benefit from fire, as evidenced by their abundance in burned vs. unburned forest of the same habitat type, but some species are relatively abundant only in the lower severity patches, while others (in general, the species most restricted to burned forests) are relatively abundant only in the high-severity patches. This result is profound because the kinds of fires that have been suggested to be "unprecedented," "catastrophic," "beyond the range of natural variation," are precisely those that provide the most suitable habitat for a number of bird species. The distribution of the Black-backed Woodpecker across more than 1000 survey points distributed within burned forest perimeters illustrates this pattern well in each of the four years following fire (below):



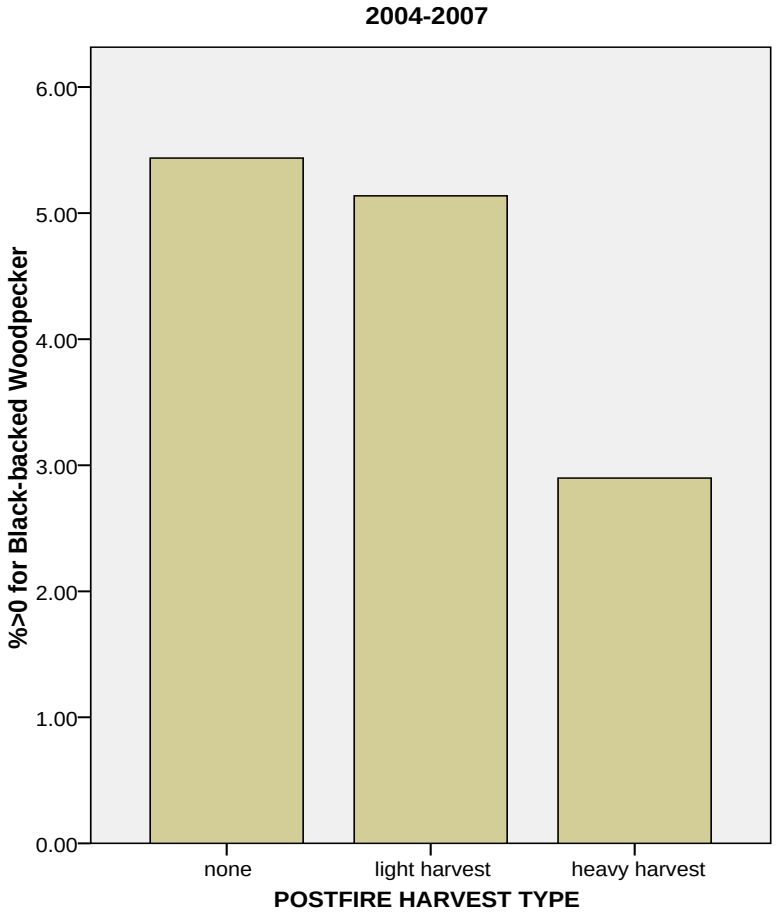






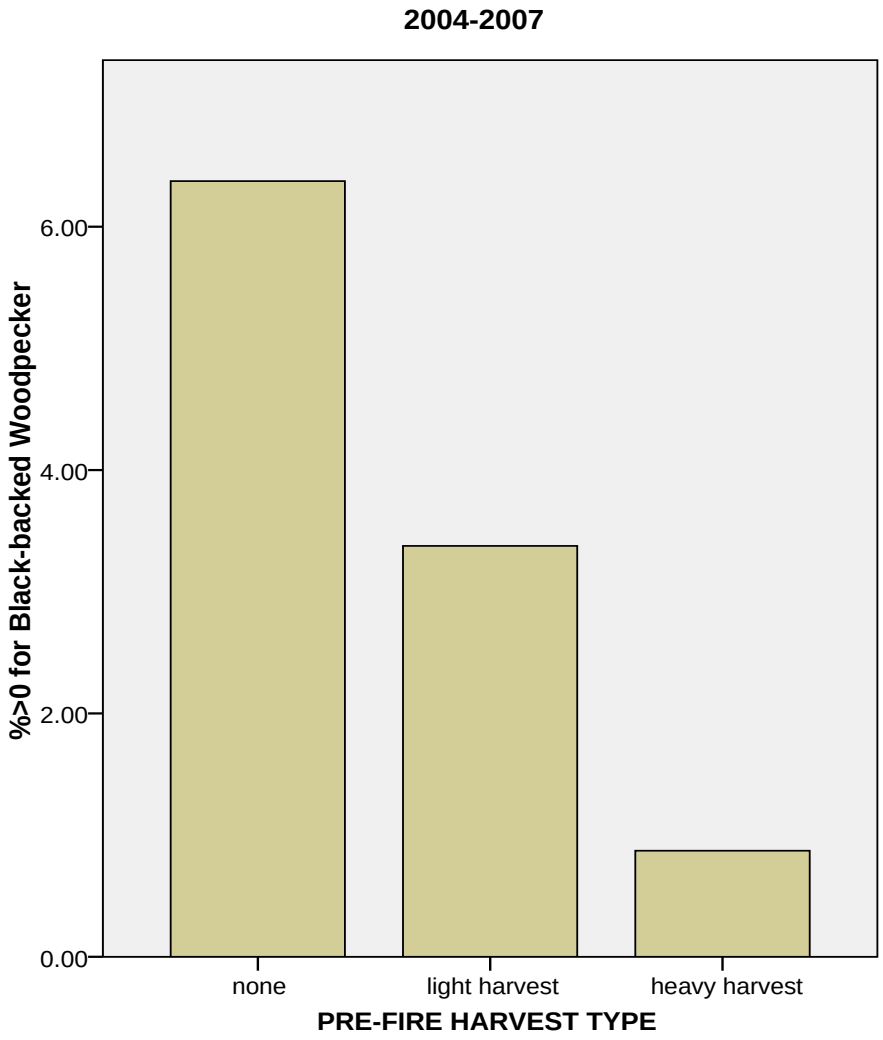
6. Timber harvest immediately after fire (salvage logging) has a negative effect on the Black-backed Woodpecker and other fire-dependent bird species, but the effect varies with intensity of timber harvesting.

As outlined later, the lack of detailed information about the nature of timber harvesting operations (how trees were removed, how much volume was removed, when the trees were removed, what was done after logging) greatly impairs our ability to make definitive statements about salvage logging. Nonetheless, the two broad categories of salvage logging methods that we included in our study (partial and more complete harvests) clearly reveal that when levels of harvest are relatively heavy, there are strong negative effects of that kind of land use activity on the Black-backed Woodpecker and every other bird species for which we have adequate data (see figure below). Nonetheless, less severe harvest methods seem to have little or no negative effect on the more fire dependent species. We have not yet divided the data by year after fire that trees were harvested, which could be an important variable because birds may never colonize if timber is removed early, but may colonize and make the best of a bad situation if harvest is delayed until two years after fire. Results are based on sample sizes that were obtained on a catch-as-catch-can basis from 2004-2007 (n = 2097, 292, 207 for no postfire harvest, light postfire harvest, and heavy postfire harvest).



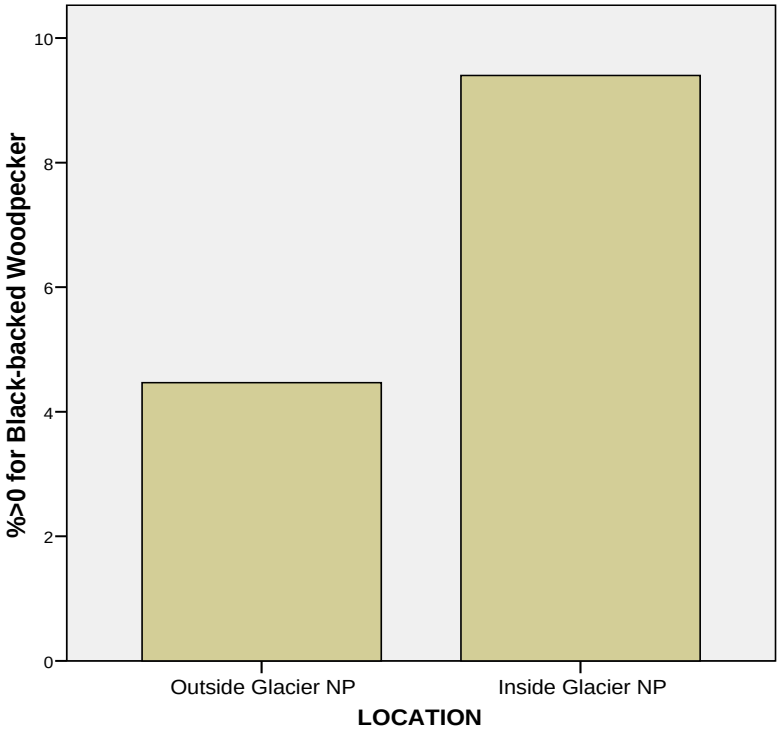
7. Timber harvest within a decade or two prior to fire also affects the postfire response of the more fire-dependent bird species.

This finding carries huge implications. If we are going to conduct "forest restoration" logging on public lands, we must understand what the effects of that logging are going to be on organisms that depend on the presence of disturbance events like beetle outbreaks and fire. Our preliminary results suggest that burned forests that were harvested fairly intensively (seed tree cuts, shelterwood cuts) within a decade or two prior to the fires of 2003 were much less suitable as postfire forests to the Black-backed Woodpecker (see figure below) and other fire dependent bird species. Even forests that were harvested more selectively within a decade or two prior to fire were less likely to be occupied by Black-backed Woodpeckers. As with the salvage logging data, these data were collected on a catch-as-catch-can basis from 2004-2007 (n = 1867, 385, 344 for no pre-fire harvest, light pre-fire harvest, and heavy pre-fire harvest).



8. Relatively unmanaged lands, such as those in Glacier National Park, are clearly refuges in a sea of less suitable lands surrounding the park, especially for the most fire dependent bird species.

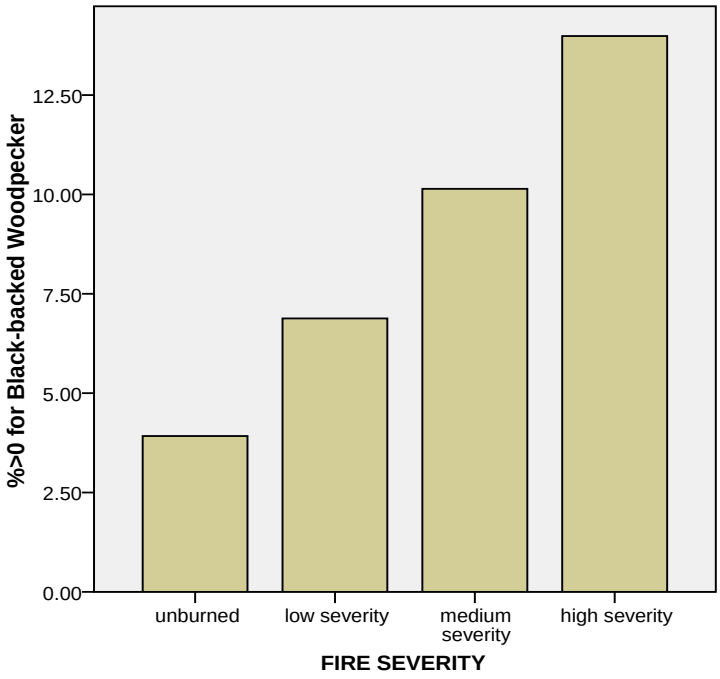
The probability of detecting a Black-backed Woodpecker in Glacier National Park is nearly 10% (compared with an average elsewhere across the region of about 4.5%). Clearly, there is something special about the Park, and the "unmanaged" nature of lands within the Park suggests strongly that what we do to the land BEFORE a fire affects the suitability of those lands to the most fire dependent species after a fire occurs.



9. Woodpecker playbacks can improve one's ability to detect birds that are present but, more importantly, they verify that patterns of distribution from point-count data alone are not biased by bird detectability differences among treatment categories.

In each of the 4 years of study, we conducted 5-min Black-backed Woodpecker playback calls either entirely independently of formal point counts or during the 5 min period after a formal point count. One reason for conducting playback experiments was to determine whether responses to recorded drumming patterns would increase detection rates beyond what we would achieve through point count alone. We have not completed this analysis, but preliminary results confirm that we can detect as much as 1.5 times more woodpeckers through the use of recordings. The other reason we wanted to use playbacks was to test whether our habitat relationships might be biased because bird are detected more readily in some habitat conditions then in others. The graph below shows that the pattern of woodpecker occurrence among

categories of fire severity, for example, is very similar to the pattern obtained on the basis of point-count data alone. Thus, the patterns of habitat distribution for the sensitive Black-backed Woodpecker that we obtain from point-count data are probably reliable. In fact, the slightly broader distribution of woodpeckers among categories of fire severity that we obtain from playback data is probably less accurate than information derived from point-count data alone because playbacks can "draw" birds from more typical haunts into places that they may not otherwise frequent (unburned forests).



10. Important lesson from this study, and a plea for help from land management agencies

The nearly infinite combination of fire characteristics, forest conditions, and management activities prior to and following soon after wildfire serves to underscore the importance of (a) carefully documenting past land-use activities and (b) achieving meaningful levels of replication to understand the effects of fire on ecosystems. Forest conditions and management activities conducted prior to and immediately following wildfire are extremely diverse. The distributions of a variety of bird species, including our focal species (Black-backed Woodpecker) are clearly related to (and independently affected by) each of these factors, which complicates one's ability to make simple definitive statements about the independent effects of, say, fire severity or forest structure on the integrity of the natural biological system. To make matters worse, an important impediment to our ability to understand the effects of diverse forest conditions on biological communities is the availability of an accurate database on the history of land use. A veritable gold mine of opportunity to learn about land management effects is lost without careful documentation of land use activity (When was this forest cut? How was it cut? Were trees planted afterward? Was the soil scarified? Was the slash burned? What forms of recreation

have been allowed since the fire?) We had a devil of a time trying to determine whether and how a burned forest had been cut before (and even in same cases after) the fire. Without such information, the effects of management are difficult to discern from what could otherwise be extremely powerful scientific studies.

Synopsis of results related to stated Objective 2—*To conduct intensive mapping and monitoring of nests within uncut and cut portions of six, 150-ha burned forest patches as a complement to the more extensive survey work:*

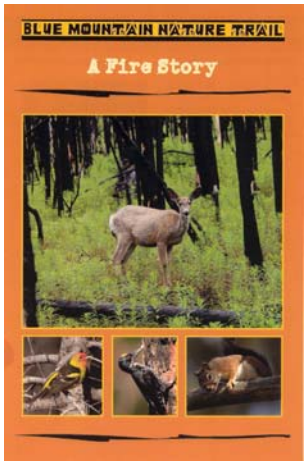
1. Limitations associated with sparse population sizes

We conducted a pilot effort to locate and monitor all Black-backed Woodpecker nests on three 150-ha plots in Glacier National Park in 2004, but the woodpecker densities were simply too low to allow for meaningful assessment of nesting conditions favored by, or influencing success of, woodpeckers as originally proposed. Instead, we chose to approach the study of nest site characteristics by capitalizing on the relatively large number of nests (now totaling more than 100) that we and another researcher (Jenny Woolf) located across all study areas in all years of the study. We are currently collecting remotely sensed information surrounding nest sites, which we will use to compare with the same kind of information surrounding all point-count locations to tease apart the importance of fire severity, pre-fire and post-fire forest conditions on the presence and (in a smaller subset of the data) success of nests.

Synopsis of results related to stated Objective 3—*To establish interpretive trails and demonstration sites in the Black Mountain Fire near Missoula and in the Robert Fire in Glacier National Park:*

1. New demonstration sites are now in place

Sue Reel completed writing and publishing interpretive material for an existing nature trail on the Lolo National Forest that burned in 2003. The site is now used as a demonstration site to illustrate the effects of fire severity on ecological systems (see photo of interpretive sign; the brochure pictured to the right is also included as a hard copy for this final report). Sallie Hejl also finished overseeing the creation of a new interpretive trail in Glacier National Park, and it, too, serves as a demonstration site for illustrating the effects of fire severity on ecological systems (see photo of



interpretive sign and trail below).

2. Other information transfer and education efforts were a huge success

We conducted 12 field demonstrations and made 16 presentations at professional meetings and workshops, including the organization of a special fire symposium at the annual meeting of the American Ornithologists' Union in Laramie, WY, in August 2007. We published several papers and have several more in progress. Our web interface is also progressing nicely, and we should be well poised to have predictive bird distribution maps up and running in the next year. See the crosswalk table below for a complete listing of education products.

Deliverables Crosswalk Table:

Proposed	**Delivered/Status**
(1) scientific papers publishable in *Ecological Applications, Conservation Biology* or equivalent journals;	Papers published: • Hutto, R. L. 2006. Toward meaningful snag-management guidelines for postfire salvage logging in North American conifer forests. Conservation Biology 20:984-993. • DellaSala, D. A., J. R. Karr, T. Schoennagel, D. Perry, R. F. Noss, D. Lindenmayer, R. Beschta, R. L. Hutto, M. E. Swanson, J. Evans. 2006. Postfire logging debate ignores many issues. Science 314:51-52. • Robertson, B. A. 2006. The roles of food and predation in shaping adaptive and maladaptive behaviors in postfire bird species," Ph.D. dissertation, University of Montana, December 2006. Papers currently in progress: • Hutto traveled to Portland, OR, to meet with PNW scientists from 17-18 October 2006 to work on a draft of a paper on the importance of early postdisturbance environments to the maintenance of the ecological integrity of forest systems. • Hutto, R. L. 2007. On the importance of 'catastrophic' wildfires: some like it hot. Science, in prep. • Hutto, R. L., et al. 2007. Symposium speakers are preparing a paper for a special section on biological effects of fire to appear in Fire Ecology.
(2) Park Service and Forest Service workshops	• April 2004—Richard Hutto participated in Crown of the Continent workshop for Glacier National Park managers. • June 2005—Richard Hutto was an invited speaker at the Glacier National Park Interpreters training session, West Glacier, MT.

Proposed	Delivered/Status
	• Fall, 2005—ASC staff conducted a series of regionally based workshops for USFS biologists to learn how to make use of our web-based resources • July 2006—Richard Hutto was an invited panelist on the biology and conservation of black-backed woodpeckers at the USFS Northern Region Wildlife Council meeting, Missoula, MT. • 1 May 2007—Richard Hutto gave a presentation on the naturalness of severe fire to 30 fire managers at a national Wildland Fire Use workshop hosted by the Aldo Leopold Wilderness Institute, Montana. • 13 June 2007—Richard Hutto gave a presentation on "The naturalness of severe fire, and the challenge of educating the public" at the Glacier National Park interpreter's training workshop, Many Glacier, MT.
(3) presentations	• August 2005—Richard Hutto was an invited speaker at the Waterton-Glacier Science History Conference, Lake McDonald Lodge, Glacier National Park, MT. • August 2005—Richard Hutto (speaker) and Kristina Smucker presented a talk entitled "Changes in bird abundance after wildfire: importance of fire severity and time since fire" at the American Ornithologists' Union annual meeting, Santa Barbara, CA. • February 2006—Richard Hutto and Smucker (speaker) presented a talk entitled "Results from passive and broadcast surveys for Black-backed and Three-toed woodpeckers" at the Montana Chapter of the Wildlife Society annual meeting in Helena, MT. • February 2006—Richard Hutto was a designated speaker on telephone press conference call regarding Medford field hearings surrounding HR4200 • March 2006—Richard Hutto presented testimony at Congressman Tom Udall's science forum, Washington, D.C. • March 2006—Richard Hutto was a designated speaker in telephone press conference organized by Congressman Tom Udall (NM). • September 2006—Richard Hutto was an invited panelist for Northern Rockies Nature Forum, Fall 2006 Series on *Salvaging Science: A look at fire and post-fire management in the Northern Rockies*, Missoula, MT.

Proposed	Delivered/Status
	• October 2006—Richard Hutto presented a talk entitled "Fire research results: hard science, soft delivery" at the Organismal Biology and Ecology seminar series, Missoula, MT, 11 October 2006. • October 2006—Bruce Robertson presented a talk entitled "Food and predation shape the evolution of plastic life history traits in Dark-eyed Junco" at the North American Ornithological Congress, Veracruz, Mexico. • 12 October 2006—Richard Hutto presented a slide show on fire effects at the President's Club Dinner, University of Montana, Missoula. • 13-17 November 2006—Richard Hutto presented a talk entitled "Plant and animal species closely associated with severely burned conifer forests: are we managing for their maintenance?" at the 3rd International Fire Ecology and Management Congress, San Diego, CA. • January 2007—Bruce Robertson presented a talk entitled "Nest microclimate and the evolution of avian nest site preference" presented at the Annual Meeting of the Society of Integrative and Comparative Biology, Phoenix, AZ. • 6-9 February 2007—Amy Cilimburg (speaker) and Richard Hutto presented a talk entitled "The bird community in beetle outbreak areas: surveying for Black-backed Woodpeckers and other species" at the Wildlife Society Montana Chapter meetings, Bozeman, MT. • 15 March 2007—Richard Hutto presented a talk entitled "Using the distribution patterns and adaptations of plants and animals to learn about the kinds of fires that occurred naturally in the past" to the USFS Fire Laboratory, Missoula, MT. • 14 April 2007—Richard Hutto was an invited panelist discussing "Fire effects in the West" at the 2007 University of Montana Graduate Student and Faculty Research Conference, Missoula, MT. • 8-11 August 2007—Richard Hutto was symposium organizer and speaker at the American Ornithologists' Union meeting, Laramie, WY. "Using the spatial distribution of Black-backed Woodpeckers to reconstruct historically natural fire regimes in the northern Rockies" presented as part of a symposium entitled "A bird's-eye view of natural fire regimes"

Proposed	Delivered/Status
(4) a web-based interface to disseminate results	The web page for information dissemination related to this fire research is http://avianscience.dbs.umt.edu/research_avianfire.htm. The page includes: • A powerpoint presentation of "A bird's-eye view of severe fires" • A downloadable slide show called "Portraits in Black" (with Marc Cohn music accompaniment) • Field methods manuals and field playback protocols (at http://avianscience.dbs.umt.edu/research_landbird_methodsmanual.htm) • High school fire curriculum (at http://avianscience.dbs.umt.edu/education_k-12_sib.htm)
(5) field trips to demonstration sites on the Lolo National Forest and in Glacier National Park for professional land managers, biologists, schoolchildren, and the public-at-large	• April 2004—Richard Hutto and Amy Cilimburg led public field trip to Black Mountain. • July 2004—Richard Hutto and Sue Reel led public field trip to Black Mountain. • June 2005—*Ecology of the Black Mountain Fire* (with Sue Reel) offered as part of the Bitterroot Birding and Nature Festival, Stevensville, MT. • 3 October 2005—field trip with Lolo and Bitterroot National Forest personnel to explain management implications of our JFSP-supported fire research. • May 2004, October 2005, May 2005—ASC staff conducted fire ecology module in the field with Big Sky High School students. Some of the curricular materials are available at http://avianscience.dbs.umt.edu/education_k-12_sib.htm • May 2005—Sussex School field trip to Black Mountain. • 24-25 May 2006—Sussex School field trip on fire ecology in Glacier National Park. • 16 June 2006—Field demonstration for USFS biologists, FMOs, and line officers at Black Mountain, MT. • 17 June 2006—Field trip to Black Mountain for public, in collaboration with the Montana Natural History Center and USFS.

Proposed	Delivered/Status
	• 30 June 2007—Field trip to Black Mountain for public, in collaboration with the Montana Natural History Center and USFS. • 26 October 2007—fire ecology data collection field trip with Sussex middle-school science class. • 25 July 2007—Richard Hutto met in the field with the University of West Virginia Law Seminar to discuss postfire land management from a bird's perspective.
(6a) Lolo NF and NPS interpretive specialists will produce interpretive signs and brochures for self-guided trails	Products are pictured above on pages 10 and 11. These were outstanding accomplishments by collaborators and partners.
(6b) we will synthesize scientific and interpretive information for the Lolo NF, GNP, and ASC websites, and several existing websites will be enhanced to include the Black Mountain interpretive trail	Our main web page for fire results is located at http://avianscience.dbs.umt.edu/research_avianfire.htm We are currently modifying the Northern Rockies Fire web page to include recent literature at http://www.northernrockiesfire.org/effects.htm Sue Reel completed construction of a "Life after fire" for the Lolo National Forest web page at http://www.fs.fed.us/r1/lolo/resources-natural/wildlife/after-fire/index.htm We included the Blue Mountain Nature Trail on the Montana Birding and Nature Trail web site at http://www.montanabirdingtrail.org/maps/r1/t1/s1/r1t1s1.php#content
Other accomplishments	• Fall 2004—Richard Hutto offered a graduate-level fire ecology class at the University of Montana. • August 2005—ASC co-lead 2-week institute on improving science inquiry teaching in Montana using fire as a focus (UM Department of Educational Research and Service Summer Fire Ecology Institute). • June 2007—Richard Hutto and Amy Cilimburg participated in GTEC Montana K-12 teacher education workshop in Missoula, MT, using bird distribution data in relation to fire severity.

Proposed	Delivered/Status
Press releases about our fire research	• August 2004—Missoulian article about our fire research at Black Mountain http://www.missoulian.com/articles/2004/08/01/news/top/news01.txt • Kurz, C. 2004. Celebration or wake? Montana Naturalist, Fall 2004. • Kurz, C. 2004. Real world research: how fire shapes forests in the Northern Rockies. Montana Naturalist, Fall 2004. • Fall 2004—Vision magazine article about our fire research at Black Mountain http://www.umt.edu/urelations/vision/2004/14black.htm • July 2005—article about our bird banding operation in Seeley Lake http://www.dailyinterlake.com/articles/2005/07/14/lifestyle/lifestyle01.txt • July 2005—KPAX television interview about our fire work for evening Outdoor feature. • August 2005—Missoulian article about our fire research http://www.missoulian.com/articles/2005/08/11/outdoors/od01.txt • August 2005—Helena Independent Republic article about our fire research http://www.helenair.com/articles/2005/08/21/sunday/c01082105_03.txt • August 2005—Daily Interlake article about talk at the science and history conference in Glacier National Park http://www.dailyinterlake.com/articles/2005/08/29/news/news02.txt • June 2006—Bitterroot Birding and Nature Trail featured as one of nation's top 10 trails in National Wildlife magazine http://www.nwf.org/nationalwildlife/article.cfm?issueID=107&articleID=1339 • June 2006—Missoula Independent article "Still life, with woodpeckers" covers our research on postfire ecology (http://www.missoulanews.com/Archives/News.asp?no=5791) • August 2006—Missoulian article "Scientists concerned over forest legislation: group says bill may lead to poor logging practices" http://www.missoulian.com/articles/2006/08/02/news/local/news07.txt