

Implications of a recent mountain pine beetle epidemic for habitat and populations of birds

Elkhorn Mountains, Helena National Forest

2012 Annual Progress Report

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Purpose: This project is a continuation of the original Birds and Burns Project (Joint Fires Sciences Program Proposal # 01-1-3-25) investigating the effects of prescribed fire strategies to restore wildlife habitat in ponderosa pine forests of the interior west (<http://www.rmrs.nau.edu/wildlife/birdsnburns/>). Thinning and prescribed fire treatments were not implemented on the Helena National Forest due to litigation but pre-treatment data were collected during 2002-2006. In 2007, a mountain pine beetle (*Dendroctonus ponderosae* [MPB]) outbreak began. By 2009 and 2010, the outbreak was widespread and mortality of ponderosa and lodgepole pine ranged from 50-90%. During 2009-2012 the Helena National Forest and Rocky Mountain Research Station remeasured the vegetation at 76 random points and monitor avian populations for comparison with pre-outbreak conditions and to evaluate the influence of a MPB outbreak on habitat and populations of birds. For an ongoing snag persistence study, Douglas-fir (*Pseudotsuga menzeisii*), ponderosa (*Pinus ponderosa*) and lodgepole pines (*Pinus contorta*) (live trees 23 cm dbh or greater) were resampled in 2012 to determine live or dead status and to evaluate if trees had been impacted by Western spruce budworm (*Choristoneura occidentalis*) (i.e. Douglas-fir) or MPB (*Pinus spp.*) killed by MPB.

Partners: Partners include the U.S. Department of Agriculture, Forest Service, Helena National Forest and Rocky Mountain Research Station (RMRS); Montana State University, Montana State Department of Fish, Wildlife, and Parks; Montana Audubon; and Bureau of Land Management.

Preliminary Results: Four study units are located southeast of Helena, Montana in the Elkhorn Mountain range. Two units, Strawberry Treatment (ST) and Maupin Treatment (MT), were originally proposed for mechanical and prescribed fire treatments and paired with control units (Strawberry Control [SC] and Maupin Control [MC]) where no mechanical or prescribed fire treatments would occur. Data were collected in 2002-2006, and in 2006 litigation halted the planned fire treatments. In 2006 a MPB epidemic began, which continued into 2010. Since the outbreak, the goal of the project is to evaluate the impacts of the recent mountain pine beetle epidemic on habitat and populations of birds, and to evaluate snag persistence. The overstory vegetation in the study units is dominated by a mixture of ponderosa pine and Douglas-fir. A smaller portion of the landscape is composed of lodgepole pine and quaking aspen (*Populus tremuloides*). The understory vegetation varies with sparse grass cover dominated by bluebunch wheatgrass (*Pseudoroegneria spicatus*) and Idaho fescue (*Festuca idahoensis*). The most common

shrubs are snowberry (*Symphoricarpos albus*), Oregon grape (*Berberis repens*) and kinnickinnick (*Arctostaphylos uva-ursi*). The noxious weeds dalmation toadflax (*Linaria dalmatica*), hound's tongue (*Cynoglossum officinale*), and Canada thistle (*Cirsium arvense*) occur in some areas.

The four study units range in size from 135 to 270 ha and in elevation from about 1500 m to about 1700 m. In 2002, the vegetation was surveyed at 40 random points on the ST and MT units. In 2003, the vegetation was surveyed at 19 random points on the MC unit and 17 random points on the SC unit. This completed our vegetation sampling at all 76 random points prior to the beetle epidemic. The vegetation was also surveyed at all 76 random points in 2009, 2010, and again in 2012 after the epidemic. We relocated and tagged ponderosa pine and lodgepole pine in 2011 that were originally surveyed as live trees in 2002 and 2003, and assessed their condition in an ongoing effort to determine snag persistence of these species following a MPB outbreak. Additionally in 2012 we tagged Douglas-fir trees that were alive in the initial 2002 and 2003 random vegetation surveys and assessed their condition as to the degree they were affected by Western spruce budworm. We have also surveyed vegetation characteristics at 305 nest trees since 2003. Appendix 1 lists the common and scientific names of the woody vegetation recorded within the four study units since 2002.

In 2012, we successfully visited each random point three different times to survey birds. A list of species observed during the counts can be found in Appendix 2. These data will be used in an ongoing analysis of point count data to assess avian community responses to the MPB outbreak.

To aid in finding woodpecker nests, we established a total of 41 transects on the four survey sites in 2003. These were systematically placed 200 m apart on the four study sites. These same transects were used again in 2004-2006 and 2009-2012 to search for woodpeckers and their nests. Each transect was visited a minimum of one time (two times each in 2011 and 2012). This included using a play-back device to increase the probability of encountering a woodpecker. Transects where we detected woodpeckers were repeatedly visited to locate woodpecker nests. Nests were then monitored throughout the season to determine nest fate.

We located and monitored 83 confirmed nests (those that contained at least one egg) in the 2012 field season (Appendix 3). We found 22 nests on the MC unit, 31 on the MT unit, 11 on the SC unit, and 19 on the ST unit. Species for which nests were found included the Williamson's sapsucker (*Sphyrapicus thyroideus* [2]), red-naped sapsucker (*Sphyrapicus nuchalis* [16]), downy woodpecker (*Picoides pubescens* [27]), hairy woodpecker (*Picoides villosus* [15]), American three-toed woodpecker (*Picoides tridactylus* [11]), northern flicker (*Colaptes auratus* [10]), and mountain bluebird (*Sialia currucoides* [2]). This represents an almost 1.5 fold increase in nests compared to 2011 (59) and can be explained almost entirely by a more than threefold increase in downy woodpecker nests from 2011 (8). Nest numbers for the six other species were similar to those reported in 2011.

In 2012, 34% of the nests found were in ponderosa pine (compared with 27% in 2011), with the remaining 66% being in quaking aspen. Eighty-two percent of American three-toed woodpecker nests were in ponderosa pine (9), as well as 53% hairy woodpecker nests (7), 26% of downy woodpecker nests, 30% of northern flicker nests (3), and 50% of Williamson's sapsucker nests (1). All other nests were found in quaking aspen.

Apparent nest success (percentage of nests that successfully fledged at least one young) for all species 2012 was 82% with 68 of 83 nests fledging at least one chick (Appendix 3). Species specific apparent nest success (# successful nests and total # of nests in parentheses) include Williamson's sapsucker 100% (2 of 2), red-naped sapsucker 94% (15 of 16), downy woodpecker 93% (25 of 27), hairy woodpecker 40% (6 of 15), American three-toed woodpecker 91% (10 of 11), northern flicker 90% (9 of 10), and mountain bluebird 50% (1 of 2).

Constant daily nest survival (the probability that a nest will survive for one day during the nesting period [DSR]) was calculated for five species (red-naped sapsucker, northern flicker, American three-toed, hairy, and downy woodpeckers) for the pre-MPB (2003-2006) and post-MPB (2009-2011) periods using the Mayfield method (Mayfield 1961). None of the species nest survival rates (DSR raised to the number of days in each species respective nesting period [NSR]) showed a statistically significant response to the MPB outbreak. A trend of higher NSR, however, was observed for American three-toed and hairy woodpeckers during post-outbreak years (Appendix 4).

Future: Field data collection will continue in 2013. Data analysis is ongoing for the point count data to assess avian community responses to the outbreak, and development of habitat suitability models for nesting woodpeckers during the outbreak. Preliminary results on these data should be completed by August 2012. Additionally, in the future we will be applying simulation modeling to assess how changes in fuels after a beetle outbreak may affect fire dynamics under different environmental conditions (with Rachel Loehman [RMRS]), and our habitat suitability models will incorporate information on insect population trends (with Barbara Bentz [RMRS]), vegetation change, and projected fire behavior after a beetle outbreak under different climate and management scenarios (with Rachel Loehman [RMRS]). Further analysis will investigate the influence of several abiotic, biotic, and spatiotemporal variables on the nest survival of five woodpecker species (red-naped sapsucker, northern flicker, American three-toed, hairy, and downy woodpeckers).

Literature Cited:

Mayfield, H. 1961. Nesting success calculated from exposure. *The Wilson Bulletin* 73:255–261.

Appendix 1. Common and scientific names of woody vegetation recorded at random points within the four study units during the 2002-2003, 2009, 2010, and 2012 field seasons in Elkhorn Mountains on the Helena National Forest.

Common name	Scientific name
Mountain Alder	<i>Alnus incana</i>
Western Serviceberry	<i>Amelanchier alnifolia</i>
Bearberry, Kinnikinnick	<i>Arctostaphylos uva-ursi</i>
Creeping Oregon grape	<i>Berberis repens</i>
Princes pine	<i>Chimaphila umbellifera</i>
Red-osier Dogwood	<i>Cornus stolonifera</i>
Common juniper	<i>Juniperus communis</i>
Rocky Mountain juniper	<i>Juniperus scopulorum</i>
Twinflower	<i>Linnaea borealis</i>
Lodgepole Pine	<i>Pinus contorta</i>
Ponderosa Pine	<i>Pinus ponderosa</i>
Quaking-aspen	<i>Populus tremuloides</i>
Common Chokecherry	<i>Prunus virginiana</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>
Bitterbrush	<i>Purshia tridentate</i>
Currant	<i>Ribes spp</i>
Prickly Rose	<i>Rosa Acicularis</i>
Wood's Rose	<i>Rosa woodsii</i>
Wild raspberry	<i>Rubus idaeus</i>
Thimbleberry	<i>Rubus parviflorus</i>
Scouler's Willow	<i>Salix scouleriana</i>
Buffaloberry	<i>Shepherdia Canadensis</i>
White Spirea	<i>Spirea betulifolia</i>
Common Snowberry	<i>Symphoricarpos albus</i>

Appendix 2. List of species detected on four study units during 2012 bird surveys in the Elkhorn Mountains on the Helena National Forest.

Species Common Name
Ruffed Grouse
Northern Goshawk
Red-tailed Hawk
Killdeer
Mourning Dove
Great Horned Owl
Great Gray Owl
Red-naped Sapsucker
Downy Woodpecker
Hairy Woodpecker
American Three-toed Woodpecker
Northern Flicker
Pileated Woodpecker
Western Wood-Pewee
Hammond's Flycatcher
Dusky Flycatcher
Cassin's Vireo
Warbling Vireo
Gray Jay
Clark's Nutcracker
Common Raven
Tree Swallow
Black-capped Chickadee
Mountain Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
Brown Creeper
House Wren
Ruby-crowned Kinglet
Townsend's Solitaire
Swainson's Thrush
Hermit Thrush
American Robin
Cedar Waxwing
Yellow-rumped Warbler
MacGillivray's Warbler
Chipping Sparrow
Lincoln's Sparrow
Dark-eyed Junco
Western Tanager
Lazuli Bunting
Brown-headed Cowbird
Cassin's Finch
Red Crossbill
Pine Siskin
Evening Grosbeak
Red Tree Squirrel

Appendix 3. Number of nests monitored, and the number that successfully fledged at least one young, for each bird species on four study units during the 2012 field season in the Elkhorn Mountains on the Helena National Forest in Montana.

		Unit ¹				All units combined
		MT	MC	ST	SC	
Williamson's Sapsucker	Number of nests monitored	1	1	0	0	2
	Number of nests that successfully fledged young	1	1	0	0	2
Red-naped Sapsucker	Number of nests monitored	9	5	1	1	16
	Number of nests that successfully fledged young	9	4	1	1	15
Downy Woodpecker	Number of nests monitored	11	9	4	3	27
	Number of nests that successfully fledged young	11	8	4	2	25
Hairy Woodpecker	Number of nests monitored	4	2	5	4	15
	Number of nests that successfully fledged young	1	1	2	2	6
American Three-toed Woodpecker	Number of nests monitored	2	1	6	2	11
	Number of nests that successfully fledged young	2	1	6	1	10
Northern Flicker	Number of nests monitored	3	4	2	1	10
	Number of nests that successfully fledged young	2	4	2	1	9
Mountain Bluebird	Number of nests monitored	1	0	1	0	2
	Number of nests that successfully fledged young	1	0	0	0	1
Totals	Number of nests monitored	31	22	19	11	83
	Number of nests that successfully fledged young	27	19	15	7	68

¹ MC = Maupin control; MT = Maupin treatment; SC = Strawberry control; ST = Strawberry Treatment

Appendix 4. Nest survival rates with 95% confidence intervals, calculated using the Mayfield method, for five cavity-nesting species before (2003-2006) and after (2009-2011) a MPB outbreak in the Elkhorn Mountains on the Helena National Forest, Montana.

