Annotated Bibliography of Recently Published Literature on the Black-backed Woodpecker

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Literature summarized by Julia Polasik, The Institute for Bird Populations

This document summarizes scientific literature on Black-Backed Woodpecker that was not yet available when Version 1.0 of the Conservation Strategy for Black-backed Woodpecker in California (Bond et al. 2012) was published. The papers listed here are primarily from 2012-2015, as well as a dissertation from 2009. An annotated bibliography of 42 additional papers and reports that were available in 2012 is provided in Appendix D of Version 1.0 of the Conservation Strategy for Black-backed Woodpecker in California (available from http://www.birdpop.org/pages/blackBackedWoodpecker.php).

Suggested citation for this Annotated bibliography of recent literature:

Polasik, J. S. 2015. Annotated bibliography of recently published literature on the Black-backed Woodpecker. The Institute for Bird Populations, Point Reyes Station, California.

Dudley, J. G., V. A. Saab, and J. P. Hollenbeck. 2012. Foraging-habitat selection of Black-backed Woodpeckers in forest burns of Southwestern Idaho. The Condor 114:348-357.

Location: Southwestern Idaho

Focus: Foraging Habitat, Burned (Salvage Logging)

Synopsis: Modeled foraging habitat selection of Black-backed Woodpeckers at fine and coarse scales 6 – 8 years post fire using radio-telemetry data of four males collected in 2000 and 2002 in burned forests of southwestern Idaho (Dudley and Saab 2007). The best model for foraging habitat was a multi-scale model that included foraging tree diameter, the density of trees within a 0.04 ha plot, and the interaction of the two. Black-backed Woodpeckers also selected for larger diameter trees and high densities of trees in a comparison to available habitat within their home-ranges. These results suggest that retaining patches of burned forest with high densities of larger diameter trees may support beetles and thus provide important foraging habitat for Black-backed Woodpeckers within the first 8 years after a wildfire.

Fogg, A. M., L. J. Roberts, and R. D. Burnett. 2014. Occurrence patterns of Black-backed Woodpeckers in green forest of the Sierra Nevada Mountains, California, USA. Avian Conservation and Ecology 9:3.

Location: Sierra Nevada, California

Focus: Occupancy, Unburned

Synopsis: Used passive point counts and call playbacks to assess Black-backed Woodpecker occupancy across 386 sites in green forests of the Sierra Nevada from to 2011 to 2013. Black-backed Woodpeckers were detected at 75 sites (29% naïve detection rate) with 31% of detections occurring at the same site during more than 1 year. Estimated occupancy in green forest was 0.21, colonization probability was 0.05, and extinction probability was 0.19. Black-backed Woodpecker occupancy was positively correlated with elevation, latitude, northern aspects, number of snags, tree diameter, and lodgepole pine forests but negatively correlated with slope within a 0.79 ha plot. From 2003 – 2014, 19 Black-backed Woodpecker nests were also found within green forests and 7 of those were within live trees. Observed occurrence rates of Black-backed Woodpeckers was found to be higher than previously suggested, but still lower than occupancy in burned forests. Green forests with higher snag densities (27 per ha) than current snag retention guidelines (9.9 per ha) may provide important secondary habitat for Black-backed Woodpeckers. Black-backed Woodpecker use of green trees for nests may also help provide snag resources for other cavity nesting species.

Latif, Q. S., V. A. Saab, J. G. Dudley, and J. P. Hollenbeck. 2013. Ensemble modeling to predict habitat suitability for a large-scale disturbance specialist. Ecology and Evolution 3:4348-4364.

Location: Montana, Oregon, Idaho, and Washington

Focus: Nesting Habitat, Habitat Suitability Modeling, Burned

Synopsis: Developed habitat suitability models for Black-backed Woodpeckers in 20 recently burned (≤ 6 years) areas of Montana using nest locations from fires in Idaho, Oregon, and Washington. Compared 8 models created using 108 pixels of Black-backed Woodpecker nest locations and three modeling methods to assess model agreement. Found complete agreement in high suitability and low suitability for 40% of pixels in eastside Montana fires and 52.8% of all pixels outside of nest survey units. Burn severity and pre fire canopy cover were consistently important across the habitat suitability models but their relationship with predicted suitable habitat varied slightly. These ensemble habitat suitability predictions could be used to guide management efforts for Black-backed Woodpeckers related to post-fire salvage logging. The authors suggest that these ensemble predictions are most applicable to dry mixed-conifer forests but that nest data from other forests could be used to test the applicability of the model in other locations.

Manley, P. N., and G. Tarbill. 2012. Ecological succession in the Angora fire: The role of woodpeckers as keystone species. U. S. Forest Service, Pacific Southwest Research Station, Davis, California.

Location: Sierra Nevada, California

Focus: Nesting Habitat, Secondary Cavity Use, Burned (Salvage Logging)

Synopsis: Located nests of three species of *Picoides* woodpeckers (Black-backed Woodpeckers, Hairy Woodpeckers, and White-headed Woodpeckers) in the Angora fire near South Lake Tahoe. Modeled characteristics of nest trees and nest sites by species and assessed use of nest cavities by secondary cavity users 2 – 3 years post fire. Found 158 nests in 2009 and 2010: 39 Black-backed Woodpecker, 78 Hairy Woodpecker, and 41 White-headed Woodpecker. Black-backed Woodpecker nest trees were positively associated with the density of decay, scorch, and tree height, and negatively associated with tree diameter. The density of snags was important at nest site scale with ≥ 260 stems/ ha necessary for a 0.75 probability of Black-backed Woodpecker nesting. Of the nest cavities monitored for secondary cavity users in 2010 and 2011, 86% of them had detections of at least one secondary cavity user. White-headed Woodpeckers nest cavities had the highest mean species richness for secondary cavity users (1.41 ± 0.98), followed by Black-backed Woodpeckers (0.94 ± 0.54), and Hairy Woodpeckers (0.88 ± 0.71); however, Hairy Woodpecker nest cavities supported species complementary to those supported by Black-backed Woodpecker nest cavities. Based on nesting habitat characteristics of the three *Picoides* species in burned habitat, management for high densities of small diameter snags and some large diameter snags in open areas may help provide suitable nesting habitat and help support secondary cavity users in recently burned areas.

Odion, D. C., and C. T. Hanson. 2013. Projecting impacts of fire management on a biodiversity indicator in the Sierra Nevada and Cascades, USA: the Black-backed Woodpecker. The Open Forest Science Journal 6:14.

Location: Sierra Nevada and Cascades

Focus: Fire and Forest Management, Burned

Synopsis: Modeled the amount of primary Black-backed Woodpecker habitat (> 20 m^2 basal area/ha following high severity fire) that would be available 27 years in the future in the Sierra Nevada and Cascades in relation to fire and forest management scenarios. Determined that with current fire regimes of high severity fire moving through areas every 625 years, 0.66% of the public land on the landscape would be available primary habitat for Black-backed Woodpeckers. With 20% pre-fire thinning of forests, 33% post-fire clear cutting of burned forests, or both methods, 0.56%, 0.50%, and 0.37%, respectively, of the public land on the landscape would be primary habitat for Black-backed Woodpeckers. These results suggest that management for burned habitat with > 20m^2 basal area/ha and restoration of a historical fire regime may increase the amount of primary habitat for Black-backed Woodpeckers in the Sierra Nevada and Cascades.

Pierson, J. C. 2009. Genetic population structure and dispersal of two North American woodpeckers in ephemeral habitats. Ph.D. Dissertation, University of Montana, Missoula, Montana.

Location: North America

Focus: Genetics, Dispersal, Burned

Synopsis: Assessed genetic connectivity, genetic structure, and genetic based dispersal characteristics of Black-backed Woodpeckers and compared genetic characteristics to Hairy Woodpeckers. Determined there were three genetic groups of Black-backed Woodpeckers, one in South Dakota, one from the Rocky Mountains to Quebec, and one in Oregon. Found that there was positive genetic spatial structure at a larger scale in Black-backed Woodpeckers (90 km) than Hairy Woodpeckers (45 km) potentially due to longer dispersal distances of Black-backed Woodpeckers. Dispersal in Black-backed Woodpeckers was found to be male-biased and a temporal increase in genetic structure suggests that Black-backed Woodpecker juveniles delay dispersal to utilize abundant resources in recent fires. Large gaps in forested habitat also reduced genetic connectivity suggesting that they are a movement barrier for Black-backed Woodpeckers.

Pierson, J. C., F. W. Allendorf, P. Drapeau, and M. K. Schwartz. 2013. Breed locally, disperse globally: fine-scale genetic structure despite landscape-scale panmixia in a fire-specialist. PLoS ONE 8:1-8.

Location: Montana and North America

Focus: Genetics, Dispersal, Burned

Synopsis: Assessed genetic structure of Black-backed Woodpeckers in burned areas of western Montana and across North America from 2004 – 2007. Found that there was little genetic differentiation for Black-backed Woodpeckers at a large scale suggesting essentially random mating among the boreal forest population. However, based on estimates of spatial autocorrelation and genetic relatedness they also found a signal of fine-scale genetic structure, which is expected when dispersal is limited. The authors determined that female Black-backed Woodpeckers likely disperse less than 110 km, and suggest that dispersal of Black-backed Woodpeckers is male biased with males dispersing further than females. An increase in genetic relatedness over time in 86% of burned areas suggests that juvenile dispersal may be delayed as juveniles stay in those areas while resources are abundant, providing an explanation for burned areas acting as source habitats for Black-backed Woodpeckers.

Rota, C. T. 2013. Not all forests are disturbed equally: population dynamics and resource selection of Black-backed Woodpeckers in the Black Hills, South Dakota. Ph.D. Dissertation, University of Missouri-Columbia, Columbia, Missouri.

Location: Black Hills, South Dakota

Focus: Nesting Habitat, Population Dynamics, Home-range Size, Foraging Habitat, Dispersal, Burned, Beetle-killed

Synopsis: Assessed Black-backed Woodpecker survival, home-range size, nest site selection, foraging behavior, and dispersal between habitat created by summer wildfire, fall prescribed fire, and mountain pine beetle infestations in the Black Hills of South Dakota from 2008 – 2012. Found that adult, juvenile, and nest survival were highest in summer wildfire created habitat, intermediate in mountain pine beetle infestations, and lowest in fall prescribed burns. Home-range sizes were smallest for 1 – 2 year post wildfire habitat, intermediate for 2 year post

prescribed fire and mountain pine beetle habitat and largest for 3 – 4 year post fire habitat. They also observed greater foraging success for wood-boring beetles in summer wildfire habitat compared to mountain pine beetle infestations, while apparent foraging success of small prey was greater in mountain pine beetle infestations than summer wildfire habitat. Foraging success was also positively associated with tree diameter but negatively associated with time since fire. Dispersal distances of 18 dispersal events ranged from 4 – 60 km and woodpeckers were 46 times more likely to transition to burned habitat relative to its availability but only 14 times more likely to transition to mountain pine beetle habitat relative to its availability. Nest failure in the previous time step as well as an increase in the age of the fire both increased the probability of dispersal. These results suggest that 1 – 2 year post summer wildfire is important for Black-backed Woodpeckers, but that when it is limited (such as in the Black Hills) mountain pine beetle infestations can also provide nesting and foraging habitat for Black-backed Woodpeckers.

Rota, C. T., M. A. Rumble, J. J. Millspaugh, C. P. Lehman, and D. C. Kesler. 2014. Space-use and habitat associations of Black-backed Woodpeckers (*Picoides arcticus*) occupying recently disturbed forests in the Black Hills, South Dakota. Forest Ecology and Management 313:161-168.

Location: Black Hills, South Dakota

Focus: Nesting Habitat, Home-range Size, Burned, Beetle-killed

Synopsis: Evaluated home-range size and resource selection of Black-backed Woodpeckers in wildfire, prescribed burn, and mountain pine beetle infested habitats in the Black Hills of South Dakota. Collected woodpecker locations from April 2008 – August 2011 and May 2012 – August 2012 for a total of 74 woodpecker home-ranges. The average 99% kernel density home-range contour was smallest in 1 – 2 year post wildfire habitat (79 ha) and largest in fall prescribed burn habitat (460 ha) but varied from 20 – 1248 ha. In both wildfire and prescribed burn habitats there was a higher probability of Black-backed Woodpeckers using burned trees when they were also infested with mountain pine beetles. Resource selection of Black-backed Woodpeckers was based on 29 woodpeckers and vegetation data collected 3 – 4 years post wildfire and 2 – 4 years post prescribed fire. Black-backed Woodpeckers showed a higher probability of using a trees with a greater surrounding basal area (average 27.8 m^2/ ha), tree diameters $\geq$ 27 cm, and moderate to high burn severity, thus, those conditions in patches of $\geq$ 200 ha are suggested for management of Black-backed Woodpecker habitat. Summer wildfires are also suggested as the most efficient disturbance for management of Black-backed Woodpecker habitat in the Black Hills based on the smaller home-range size and success with supporting woodpeckers over a longer time period post disturbance.

Rota, C. T., J. J. Millspaugh, M. A. Rumble, C. P. Lehman, and D. C. Kesler. 2014. The role of wildfire, prescribed fire, and mountain pine beetle infestations on the population dynamics of Black-backed Woodpeckers in the Black Hills, South Dakota. PLoS ONE 9:1-10.

Location: Black Hills, South Dakota

Focus: Nesting Habitat, Population Dynamics, Burned, Beetle-killed

Synopsis: Evaluated survival and population dynamics of Black-backed Woodpeckers in habitat created by summer wildfire, fall prescribed fire, and mountain pine beetle infestations. Found that adult (n = 140), juvenile (n = 72), and nest survival (n = 95) were all highest in the habitat created by summer wildfire, followed by mountain pine beetle infestations, and lowest in fall prescribed fire habitat. Population growth rates were positive in habitats created by summer wildfire but negative in both mountain pine beetle infestations and fall prescribed burn habitats. In all habitats growth rates were most sensitive to adult (r^2 = 0.34 – 0.80) and juvenile survival (r^2 = 0.17 – 0.48) probabilities. The authors suggest the differences in Black-backed Woodpecker survival between wildfire and prescribed burn habitat may be due to the timing of fire that could be influencing prey availability or fire intensity differences potentially influencing predator presence. Summer wildfires are suggested for management of Black-backed Woodpecker habitat but mountain pine beetle infestations may increase the amount of time those habitats are used by Black-backed Woodpeckers following a fire.

Seavy, N. E., R. D. Burnett, and P. J. Taille. 2012. Black-backed Woodpecker nest-tree preference in burned forests of the Sierra Nevada, California. Wildlife Society Bulletin 36:722-728.

Location: Northern Sierra Nevada, California

Focus: Nesting Habitat, Burned

Synopsis: Located 31 Black-backed Woodpecker nests in the Moonlight (n = 16) and Cub fires (n = 15) in the northern Sierra Nevada from 2009 – 2011. Habitat characteristics of nest trees and the number of snags within a 0.04 ha plot around nest trees were compared to random tree and plot characteristics to assess preference. Black-backed Woodpecker nest trees had a mean diameter (33 cm) that was smaller than that of random trees (40 cm), thus woodpeckers preferentially chose moderate diameter trees (29 – 61 cm) rather than the largest snags for nesting. There was no indication of a preference of trees with broken or unbroken tops. However, there was a higher average snag density around nest trees (13.3 per plot) than random trees (5.0 per plot) indicating a preference for areas with high snag densities (> 200 snags/ha). This suggests that management for large patches of high snag densities may provide important nesting habitat for Black-backed Woodpeckers in burned habitats of the northern Sierra Nevada.

Siegel, R. B., R. L. Wilkerson, M. W. Tingley, and C. A. Howell. 2014. Roost sites of the Black-backed Woodpecker in burned forest. Western Birds 45:296-303.

Location: Northern Sierra Nevada, California

Focus: Nesting Habitat, Burned

Synopsis: Located roosting Black-backed Woodpeckers via radio-tracking and described roost sites in the Wheeler fire of the northern Sierra Nevada in 2013. Other than within nests (where males are known to roost during the nesting season) 14 unique roost sites were located, and 11 of those were in dead trees. Of the 9 roost sites that were visually confirmed 5 were in burned out

hollows of trees, 1 was in a forked tree, 1 was wedged between the trunks of two closely spaced trees, 1 was in a deep natural bark furrow, and 1 was clinging to truck above a horizontal branch. All sites were within moderate to high burn severity areas and an average distance of 428 m (± 241 m) from the nesting site. The average tree diameter of roost sites was 37.0 cm (± 16.1 cm) and the average height was 12.3 m (± 5.5 m). Retention of large trees and "defect" snags during salvage logging may benefit Black-backed Woodpeckers by providing roosting locations during the nesting season.

Tarbill, G. L., P. N. Manley, and A. M. White. 2015. Drill, baby, drill: the influence of woodpeckers on post-fire vertebrate communities through cavity excavation. Journal of Zoology.

Location: Sierra Nevada, California

Focus: Nesting Habiat, Secondary Cavity Use, Burned

Synopsis: Monitored 77 nest cavities of Black-backed Woodpeckers, White-headed Woodpeckers, and Hairy Woodpeckers for secondary cavity users at the Angora fire along the shore of Lake Tahoe. Detected 111 secondary cavity users of 10 species in 86% of *Picoides* woodpecker excavated cavities 2 – 3 years post fire. Fifty two of secondary cavity use detections were breeding attempts by other cavity nesting birds. The highest diversity of secondary cavity use as measured by effective species number was in White-headed Woodpecker nest cavities (8), followed by Black-backed Woodpeckers (6), and Hairy Woodpecker (4). Nest and site characteristics of White-headed Woodpeckers were also the most different of the three species with nest cavities tending towards larger diameter, shorter trees, and more decayed snags in lower density stands. White-headed Woodpeckers also had the lowest snag loss in second year post-fire. Overall snag loss was 51% across species indicating a potential limitation of snags even if snag densities are high. The high rate of secondary cavity use observed in this study suggests that *Picoides* woodpeckers like the Black-backed Woodpecker serve an important role in providing habitat for secondary cavity users in recently burned stands.

Tingley, M. W., R. L. Wilkerson, M. L. Bond, C. A. Howell, and R. B. Siegel. 2014. Variation in home-range size of Black-backed Woodpeckers. The Condor 116:325-340.

Location: Northern Sierra Nevada, California

Focus: Home-range Size, Burned

Synopsis: Radio-tracked and estimated the home-range size and the relationship between home-range size and snag basal area for Black-backed Woodpeckers nesting on the Peterson, Sugarloaf, and Wheeler fires in 2011 and 2012. Of the 15 woodpeckers with a large enough sample size of locations to estimate home-range size, the average home-range was 89 ha (24 – 304 ha) using a full (95%) kernel method and 204 ha (33 – 796 ha) using a minimum convex polygon method. The median of the average snag basal area of full kernel home-ranges was 20.1 m^2 (3.2 – 35.7 m^2). Three woodpeckers that foraged in primarily unburned forest had larger home-range sizes and travelled further on average (167 m vs. 74 m) than the 12 woodpeckers that foraged primarily within burned forest. With an increase in snag basal area there was a decrease in a woodpecker's home-range size, even with removal of the three birds that foraged primarily in green forest. Models of snag basal area also explained 54 – 62% of the variation in

Black-backed Woodpecker home-range size while covariates (age of fire, age and sex of bird) were not competitive predictors of home-range size. These results suggest that a minimum snag basal area of 17 m^2/ha may be an appropriate guideline for management of recently burned forests for Black-backed Woodpeckers. Recently burned stands with a greater snag basal area may also support more Black-backed Woodpeckers because of smaller home-range sizes than in areas with a lower snag basal area.