White-headed woodpecker space use in central Washington

2011 annual report

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Introduction

The white-headed woodpecker (*Picoides albolarvatus*) is a species of concern in Washington and Oregon where it occurs primarily in lowland forests dominated by ponderosa pine (*Pinus ponderosa*). White-headed woodpeckers are primary cavity excavators and therefore members of a keystone guild that excavate cavities for many secondary cavity users. Early telemetry studies concluded that they prefer, and may even require, old-growth ponderosa pine stands for population persistence (Dixon 1995a, 1995b). Consequently, the harvest of old-growth pine by early settlers is thought to have caused widespread declines in this species (Dixon 1995a). However, more recent studies of white-headed woodpecker nesting ecology have found them nesting in other forest types, including young and recently thinned and burned stands (Kozma 2009, 2011; Wightman et al. 2009). This suggests that they are more plastic in their habitat requirements while nesting than originally thought. Yet information is still lacking on their ecology in managed stands during the non-breeding season, and on their use of space when away from the nest site. To address some of these information gaps we undertook a pilot study in 2011 to examine space use by white-headed woodpeckers in stands representing a range of management histories.

Study Objectives

Within this broad objective, our study questions included:

1. What features within the landscape affect spacing and home range size, and thus density of white-headed woodpeckers?

2. What substrates are used by white-headed woodpeckers for foraging and nesting in stands dominated by young trees versus stands dominated by older trees?

3. To what extent are current models of nest-site selection (Wightman et al. 2009) and nest success (Hollenbeck et al. 2011) from central Oregon accurate in other regions? Do they accurately predict occupancy and reproductive success in our study population?

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4. How are populations structured genetically? Are pairs monogamous within and among breeding seasons, and to what extent does juvenile dispersal affect gene flow within populations?

Methods

We initiated this study in spring 2011 at study sites in central Washington, and focused on four primary study areas: Mission Creek, Wenas Creek, Nile, and Rimrock (Figure 1; see appendix available on-line at: http://host119.yakama.com/TFW/Wildlife/cavity/cavity.html). Although each study area contained stands of different management history, in general, stands in the Nile and Wenas Creek Study Areas were more uniform and composed of younger trees with smaller diameters, whereas the stands in the Mission Creek and Rimrock Study Areas contained older trees with larger diameters.

We used three primary methods to address our study objectives: (1) **nest searching/monitoring**, (2) c**olor-banding/genetic sampling**, and (3) **radio telemetry**.

(1) **Nest searching and monitoring** during the breeding season (April-July) provided the starting point for all our study objectives. We revisited the locations of historic territories and searched new locations for breeding pairs and their nest cavities. This will provide information on nest-site selection and reproductive success across a range of forest types. With our nest-site selection analysis, we will also be able to validate models of nest-site selection published in other regions, and determine the extent to which populations differ in regard to habitat features used during nesting. Such model validation has not been previously attempted.

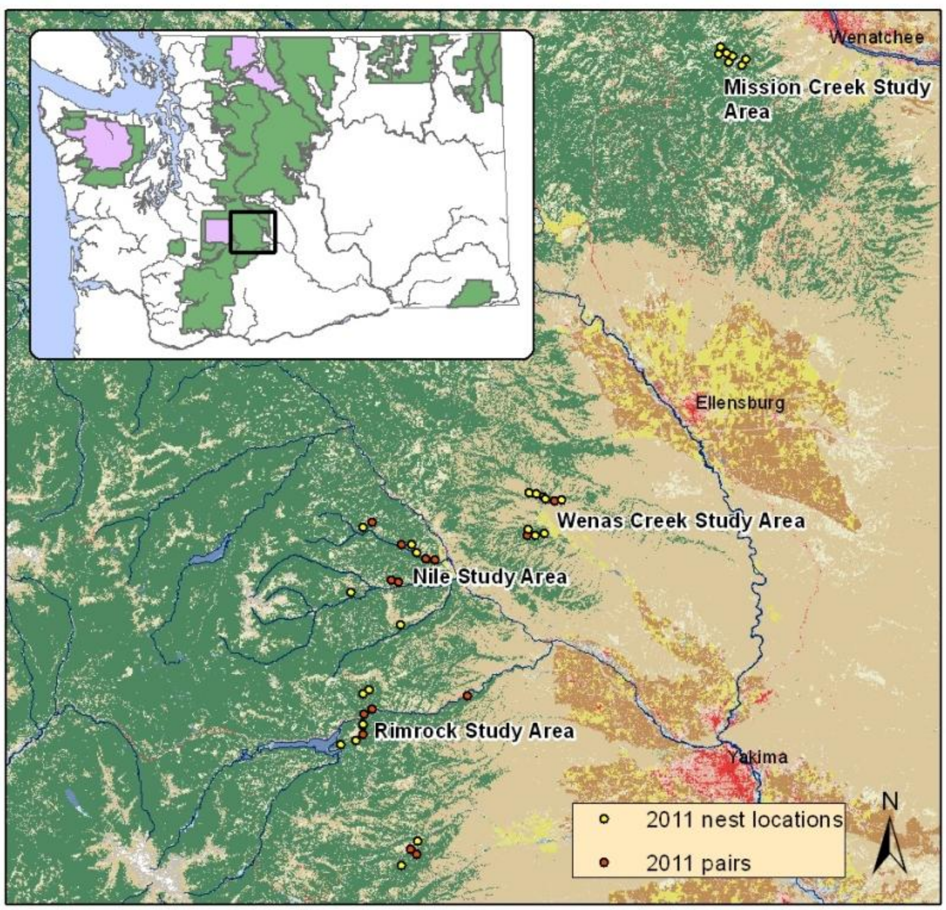

Figure 1. Locations of major study areas for color-banding white-headed woodpeckers in central Washington, and 2011 nest sites and breeding pairs.

(2) **Color-banding** occurred primarily during the breeding season, since birds are most easily captured at their nest sites (Figure 2). Our goal was to color band all individuals (adults and nestlings) nesting in two primary study

areas: Rimrock Study Area (Naches Ranger District, Okanogan-Wenatchee National Forest) and Wenas Study Area (Wenas Creek Wildlife Area, Washington Department of Fish and Wildlife) (Figure 1). If possible we hope to add the Mission Creek Study Area (Wenatchee River Ranger District, Okanogan-Wenatchee National Forest) as a primary study area for color-banding in 2012. Resightings of color-banded woodpeckers in future years will provide insights into survivorship, site fidelity, mate fidelity, and juvenile dispersal. **Genetic samples** from all captured woodpeckers will enable us to examine the population genetic structure, as well as provide much-needed information on dispersal and mating systems. Color-banding of nestlings and intensive genetic sampling within a single population has not occurred for white-headed woodpeckers anywhere in their range.

Figure 2. Color-banded white-headed woodpecker nestling from the Rimrock Study Area.

(3) We are tracking woodpecker space use using **radio telemetry.** Woodpeckers are captured for telemetry at nest sites and at water and feeding stations during the day, and at roost sites at night using mist-nets, hoop-nets, and noose carpet traps. The transmitters used in this study are supplied with batteries that last 200 days. Thus, each individual needs to be captured multiple times over the course of the study to enable year-round tracking. Transmitters are either glued to the tail (tail-mount transmitters) or fitted to the back of woodpeckers with an elastic leg-harness (backpack transmitters). We are visiting each individual at least once weekly from spring through autumn, and twice monthly in winter. We track woodpeckers for one continuous hour and record all foraging behavior, as well as characteristics of the foraging substrate. This will be the first study to examine space use by white-headed woodpeckers in heavily managed and recently thinned and burned pine stands.

Results and Discussion

Nest searching

We located 28 nests on 47 white-headed woodpecker breeding territories in 2011. Of the 28 nests we monitored, 19 (68%) were successful (i.e., fledged at least one young) and nine (32%) were unsuccessful. Nearest neighbor distances between nest sites of adjacent pairs ranged from 198–1492 m (*n* = 20 nests; Table 1), which is comparable to the range of 194–2378 m reported in Oregon by Frenzel (2003). Frenzel (2003) also reported that nests were often located near nests from past years, and distances between nests from consecutive years averaged 227 m. This distance is similar to the average distance between consecutive nest sites for our study areas; for territories where we found a nest site in both 2010 and 2011, distance between nests averaged 208 m (range 0–600 m, *n* = 11 nests).

Table 1. Number of white-headed woodpecker nests, and number of woodpeckers banded and radio-tracked by watershed for the four primary study areas in central Washington in 2011.

Watershed	Location	Nests found[1]	Mean (range) distance between nests (m)	Woodpeckers color-banded	Woodpeckers radio-tracked[1]
Wenas	WDFW Wenas Wildlife Area	7	890 (403–1376)	17	3
Nile	USFS, Naches RD	3	1081	4	3
Rattlesnake	USFS, Naches RD	2	-	1	1
Tieton	USFS, Naches RD	6	582 (198–966)	20	4
Mission	USFS, Wenatchee River RD	7	1002 (813–1492)	3	1

[1] Numbers do not account for all nests or banded and radio-tagged woodpeckers since some nests were found in areas outside of the primary study areas, and some birds were fitted with transmitters but were not tracked.

We were surprised to find some localized patterns of nest-site selection, where individuals in a small area selected nest sites that were similar to each other, but very different from those of the larger population (Figure 3). For example, although white-headed woodpeckers rarely nest high above ground or in live ponderosa pine trees, three nests in adjacent territories in the Mission Creek Study Area occurred high in a live ponderosa pine tree, despite an abundance of more typical nest snags. The similarity of these three nest sites and their contrast to the majority of nest sites reported for white-headed woodpeckers (e.g., low height and in moderately decayed dead trees; Raphael and White (1984), Kozma (2009)) suggest that these three pairs may have acquired their unusual nest-site preferences either from copying the behavior of their neighbors, or from similar and localized natal or personal experiences (e.g., Valone 2007). The importance of such non-habitat 'social' factors on nest site selection has not been studied for any North American woodpecker and we suggest that future studies of white-headed woodpecker nesting ecology consider the potential influence of such factors on nest-site selection.

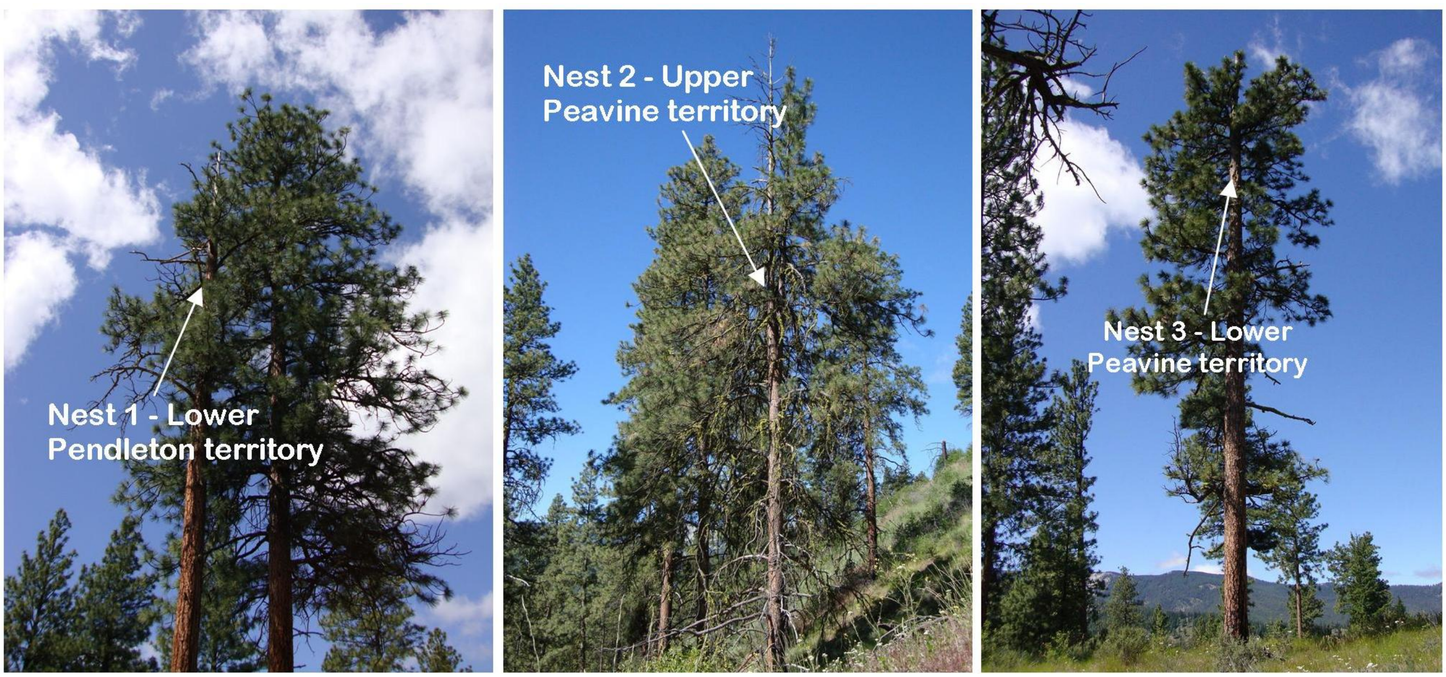

Figure 3. These three nest cavities are unusual nest sites for white-headed woodpeckers, being both higher than average and in live ponderosa pine trees. The three pairs that created these nests inhabited the same watershed in the Mission Creek Study Area, and were also neighbors, occuring within a 70 ha block of land. Given the uniqueness of these sites and their close proximity, factors besides habitat features, such as natal experience or habitat copying, may have influenced the selection of nest sites by these three pairs.

Color-banding and radio telemetry

We captured and color-banded 27 adults from 17 nests and 20 nestlings from nine nests in summer 2011 (Table 1, Figure 4). We obtained feather samples from all captured woodpeckers. Twenty-four adults were resighted since they were banded, and 11 nestlings were resighted since they fledged.

We radio-tagged eight female and nine male white-headed woodpeckers. Four individuals shed their transmitter within weeks of capture and were not tracked. Among the remaining birds, we obtained over 500 telemetry relocations and 2000 minutes of behavior observations, and estimated post-nesting home range size (July-September) for nine individuals. Seven of these woodpeckers successfully nested, and two failed in their nesting attempt, allowing us to compare space use by successful and unsuccessful breeders.

Figure 4. Measuring culmen length on a radio-tagged adult female white-headed woodpecker at Rimrock Lake, WA.

Home range size

We estimated home range size using three methods: minimum convex polygons (MCP), 85% adaptive kernels, and 95% fixed kernels. We chose the first two methods in order to directly compare our results with Dixon (1995a), but considered the third method, 95% fixed kernels, as the most accurate depiction of home range size.

The median post-nesting MCP (July-September) for white-headed woodpeckers in this study was 38 ha (94 acres) (Table 2), which is considerably smaller than the median home range size of 64 ha (158 acres) reported in Oregon for woodpeckers inhabiting old-growth ponderosa pine stands (Dixon 1995a). Many factors can affect home range size, although smaller home ranges are generally associated with higher quality habitat. Eighty-five percent adaptive kernel estimates, which depict intensity of use within ranges, were comparable with those reported in Dixon (1995a); the median 85% kernel was 56 ha (138 acres) in our study and 53 ha (131 acres) on old-growth sites in Dixon (1995a). Thus, woodpeckers in this study used a similar sized core area to woodpeckers in old-growth stands in Oregon, but ranged less widely from that core area. From 95% fixed kernel estimates, the median home range size was 71 ha (175 acres) (mean of 73 ha (180 acres)) which is slightly larger than the estimates of home range size for 85% adaptive kernel estimates (Table 2).

We found overlap in space use by neighboring pairs, where some radio-tagged woodpeckers foraged or roosted within the home ranges of their neighbors (Figure 5). We were also surprised to find that after nests fledged in July, many radio-tagged woodpeckers shifted their activities to other portions of the home range, to the extent that some post-nesting home ranges did not even include the spring nest site (Figure 5). In fact, the nest snags for three individuals were located between 150 and 350 m outside the boundary of the post-nesting home range, and only two radio-tagged woodpeckers placed their nest centrally within the post-nesting home range; the remaining birds had nests either outside their post-nesting home range, or closer to the edge than to the center. Thus, for most birds in this study, space use in the post-nesting, fledgling season was concentrated in areas relatively far from the nest snag. Additionally, it appears that during the summer and early-autumn, white-headed woodpeckers are not strictly territorial, and they can cross the home range boundary of neighboring pairs.

Table 2. Minimum convex polygon (MCP) and kernel estimates of home range size for nine radio-tagged white-headed woodpeckers from July through September 2011 in central Washington.

Territory name	**Watershed**	**Sex**	***n*[1]**	**100% MCP (ha)**	**85% adaptive kernel (ha)**	**95% fixed kernel (ha)**
E-pass Back	Wenas	male	51	94	69	116
Little Rattlesnake	Rattlesnake	female	49	107	98	111
Rag Canyon	Mission	female	49	80	77	96
Nile 5	Nile	male	39	90	103	94
Upper Nile Burn	Nile	female	41	29	37	49
Goose Egg Lower	Tieton	female	49	38	54	45
Bethel Fork Burn	Tieton	male	50	23	37	40
Goose Egg Meadow	Tieton	male	39	20	34	33
Milk Canyon[2]	Wenas	female	33	21	-	-

[1] *n* is the sample size of temporally independent telemetry points used in home range analysis
[2] kernel home ranges were not calculated for Milk Canyon because of inadequate sample size

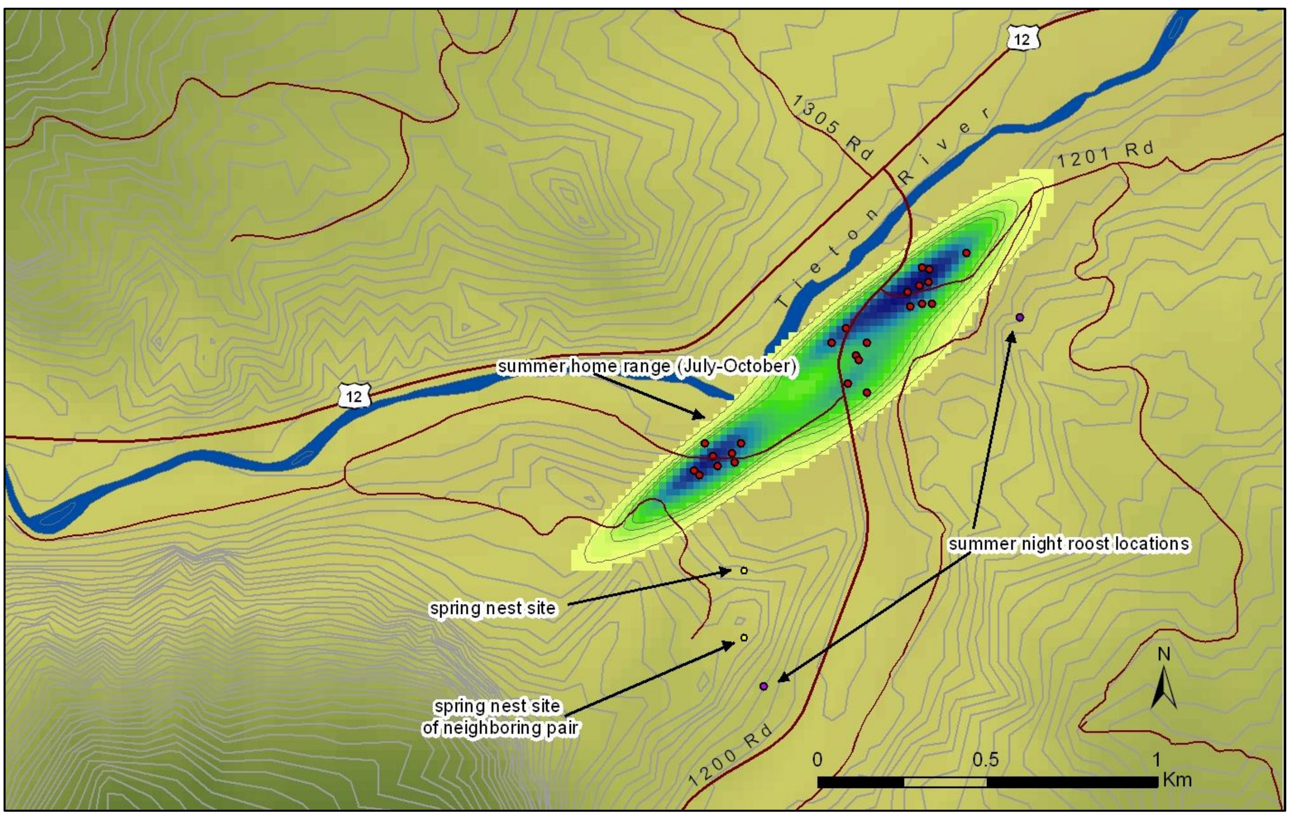

Figure 5. Kernel home range for a female white-headed woodpecker in the Tieton watershed, WA, from July through September 2011. Dark blue shading represents areas of intense use, and yellow represents areas of infrequent use. As this map shows, this individual concentrated her summer foraging and daytime activities in locations far from the nest site and summer roosts, even going so far as to roost in a snag nearly 1 km from the center of her home range and near her neighbor's nest snag.

Foraging behavior

Radio-tagged white-headed woodpeckers in this study foraged on a wider variety of trees than those reported in old-growth stands in Oregon (Dixon 1995a). Dixon (1995a) reported that white-headed woodpeckers in Oregon foraged nearly exclusively on ponderosa pine (98% of observations; Table 3), whereas birds in our study foraged approximately 25% of the time on Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*) trees, especially those infected with western spruce budworm (*Choristoneura occidentalis*). This is more similar to foraging by white-headed woodpeckers reported by Raphael and White (1984) in California, who found them foraging on firs (*Abies* spp.) 44% of the time. Interestingly, in our study a wider variety of trees were used by birds feeding fledglings (0.29% of time on non-pine species) compared to adults without young (0.06% of time on non-pine species) (Figure 6). Birds with fledglings may select a wider variety of foraging substrates because of the higher demands placed on them by dependent young.

Figure 6. Radio-tagged white-headed woodpecker foraging on a ponderosa pine on Bethel Ridge, WA. Woodpeckers in this study consistently foraged on smaller diameter trees than reported by Dixon (1995a), suggesting greater plasticity in their foraging behavior (photo courtesy of M. Charest).

Woodpeckers in this study also foraged on smaller-sized trees compared to that reported by Dixon (1995a, 1995b; Table 3); average diameter of forage trees was 52 cm, which is smaller than the averages of 68 and 72 cm reported by Dixon (1995a, 1995b) for woodpeckers foraging in Oregon. Again, our results are more similar to those reported for white-headed woodpeckers by Raphael and White (1984) who observed them foraging on trees smaller than 50 cm the majority of the time. This finding was not very surprising, given that few old trees are present in many of our study areas (Kozma 2011). Although we need larger samples sizes, it appears that young stands can provide adequate foraging habitat to support breeding populations of white-headed woodpeckers, at least during the post-nesting and fledgling period.

Table 3. Substrates used by white-headed woodpeckers for foraging in the current study, compared to woodpeckers foraging in old-growth ponderosa pine stands in central Oregon (Dixon 1995a).

Species	Proportion of time in current study	Average dbh in current study (cm) (SD)[2]	Proportion of time in Dixon (1995a)	Average dbh (cm) in Dixon (1995a) (SD)[2]
ponderosa pine	0.74	51.6 (7.8)	0.98	68.6 (0.5)
Douglas-fir	0.14	46.3 (7.8)	0.01	90.8 (9.9)
fir[1]	0.04	41.5 (5.6)	0.01	39.4 (4.3)
snags/stumps	0.06	59.2 (3.4)	0.00	0 (0)
western larch	0.01	26.3 (0.9)	0.00	0 (0)

[1] Grand fir in the current study and white fir (*Abies concolor*) in Dixon (1995a)
[2] SD = standard deviation

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