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CHARACTERISTICS OF NEST CAVITIES AND NEST TREES OF THE RED-BREASTED SAPSUCKER IN COASTAL MONTANE FORESTS

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Abstract.—From May through July 1997 and 1998, I quantified nest tree and cavity characteristics of 32 Red-breasted Sapsucker (*Sphyrapicus ruber*) nests in the high-elevation coastal forests of northern Vancouver Island, British Columbia. Nests were located in western white pine (*Pinus monticola*), hemlock (*Tsuga sp.*), and Douglas-fir (*Pseudotsuga menziesii*) snags. Nest trees were significantly taller and had a greater DBH than random snags. Nest height was positively correlated with tree height. All nests were in dead trees. The orientation of nest cavity entrances did not differ from random orientations. When choosing nest sites, Red-breasted Sapsuckers are likely balancing predation risk (decreasing at higher nest heights) and adequate nest space and insulation (greater with increasing diameter at lower nest heights).

CARACTERÍSTICAS DE LA CAVIDAD Y EL ÁRBOL UTILIZADO PARA ANIDAR POR PARTE DE *SPHYRAPICUS RUBER* EN BOSQUES MONTANOS COSTANEROS

Sinopsis.—De mayo a julio de 1997 y 1998, cuantifigué las características de la cavidad y el árbol utilizado para anidar por parte de 32 parejas de *Sphyrapicus ruber* en bosques montanos costaneros de Vancouver, Columbia Británica. Los nidos fueron localizados en arboles de *Pinus monticula, Tsuga* sp. y troncos partidos de *Pseudotsuga menziesii*. Los árboles utilizados para anidar resultaron significativamente más altos y con mayor DBH que los troncos partidos tomados al azar. La altura del nido estuvo positivamente correlacionada con la altura del árbol. Todos los nidos fueron encontrados en vegetación muerta. La orientación de la entrada de la cavidad del nido no resultó diferente a orientaciones al azar. Cuando las aves están seleccionando el lugar para anidar parecen poner en balance el riesgo de depredación (disminuye con la altura a que se construye el nido) con la insulación y el espacio adecuado para la construcción del nido (mayor con el incremento en el diámetro del tronco a menor altura).

The Red-breasted Sapsucker (*Sphyrapicus ruber*) is the most common primary cavity excavator in coastal montane forests of the Pacific Northwest (Bryant 1995). Because sapsucker excavations can provide important nesting and feeding opportunities for other bird species (Daily 1993, Walters 1996), the Red-breasted Sapsucker may be a critical component of coastal montane forest bird communities. Unfortunately, little is known about how timber harvesting, which reduces availability of suitable nest trees (Zarnowitz and Manuwal 1985, Martin and Eadie 1999), might impact this important species.

Because timber removal at higher elevations in coastal British Columbia is increasing (Whitehead 1995), a study of nest site selection by Red-breasted Sapsuckers in this region was needed. Therefore, the specific objectives of my study were to quantify Red-breasted Sapsucker nest-tree and cavity-site dimensions in coastal montane forests.

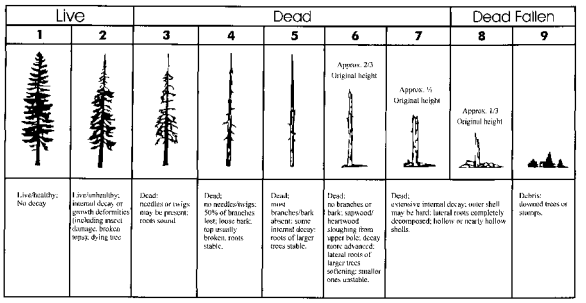

FIGURE 1. Wildlife tree classification system used to describe nest and non-nest trees. Numbers 1 through 9 denote decay classes the characteristics of which are pictured and described beneath.

METHODS

This study took place on Mt. Cain and Maquilla Peak (50°13′N, 126°18′W), Vancouver Island, British Columbia. The study area encompassed 11,800 ha of coastal montane forest. The landscape consists of managed and unmanaged stands of coastal montane forest, 600–1650 m in elevation. The dominant tree species included mountain hemlock (*Tsuga mertensiana*), western hemlock (*T. heterophylla*), yellow cedar (*Chamaecyparis nootkatensis*), and amabilis fir (*Abies amabilis*).

I searched for active Red-breasted Sapsucker nests between May and July, 1997 and 1998. Nests were considered active when nestlings could be heard. If adult birds were observed entering a cavity it was revisited until nestlings were heard or until it was clearly not an active nest. After the young had fledged in late July and early August, I quantified characteristics of the active nest trees and nest cavities. I recorded tree species based on remnant bark, wood condition, and tree form. Internal tree decay was evaluated from increment bore samples of heartwood and sapwood. Wildlife tree class from 1 (live, healthy) to 9 (very rotten) was assigned based on tree decay characteristics (Guy and Manning 1994, Fig. 1). Tree height was measured using a clinometer and tape measure.

I reached cavity nests using nearby live trees and climbing equipment. From each active nest I obtained the following data: entrance vertical and horizontal diameter, cavity depth, cavity orientation, cavity height, and diameter at cavity height. Cavity depth was measured using a plumb bob lowered into the cavity.

Comparative data were gathered from 135 10 × 10-m plots, systematically distributed at 300-m intervals throughout unmanaged forests in the study area. At each plot, I obtained the following data for all trees >2 cm dbh: tree species, DBH, tree height, bark retention characteristics, and stage of decay. For comparative purposes random samples of trees >17 cm DBH were drawn from these data since Crockett and Hadow (1975) found that this is the minimum diameter that could provide adequate space for a nesting sapsucker.

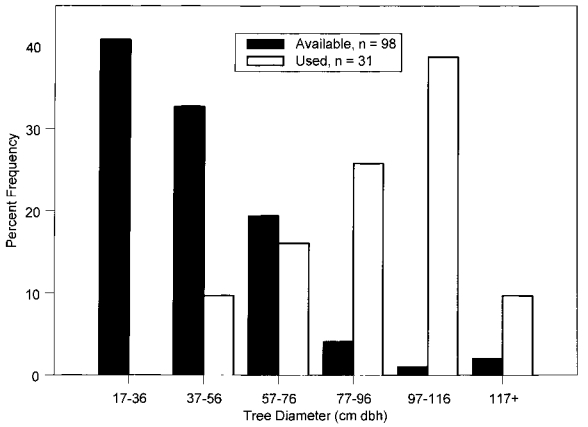

FIGURE 2. Diameter classes of trees used for nesting by Red-breasted Sapsuckers and of trees available in the Mt. Cain and Maquilla Peak study area of British Columbia, 1997 and 1998. Mean dbh of nest trees ($\bar{x}$ = 93.3 cm ± 4.6 SE, n = 31) was significantly greater than non-nest trees ($\bar{x}$ = 32.02 cm ± 2.2 SE, n = 98).

RESULTS

I located 32 active Red-breasted Sapsucker nests in 31 snags (17 in 1997 and 15 in 1998). No nest cavities were reused in the second year. Nests were located in western white pine (*Pinus monticola*) (n = 7), hemlock (n = 6), Douglas fir (*Pseudotsuga menziesii*) (n = 1), and unidentified snags (n = 17). Mean DBH of nest trees was significantly greater than that of non-nest trees >17 cm dbh (t = 10.54, df = 125, $P < 0.001$, Fig. 2.). Mean nest tree height ($\bar{x}$ = 32.5 m ± 2.4 SE, n = 31, range 16.8–47.1) was also significantly greater than the mean height of random trees ($\bar{x}$ = 14.75 m ± 0.81 SE, n = 88, t = 10.45, df = 118, $P < 0.001$). The distribution of wildlife tree classes differed significantly from expected (G = 23.95, df = 6, $P < 0.05$, Fig. 3). Sapsuckers selected only dead trees. I measured the cavity entrance dimensions and depth of 22 of the 32 active sapsucker nests (Table 1). Nest cavity orientation did not differ significantly from a random distribution (Rayleigh's test; R = 9.752, $P < 0.05$, n = 32). Nest height averaged 17.2 m and was positively correlated with tree height (r = 0.55, df = 30, $P < 0.001$).

DISCUSSION

In the coastal montane forests of Northern Vancouver Island, Red-breasted Sapsuckers consistently chose nest trees of larger diameter than non-nest trees, as has been found with other sapsuckers (Dobkin et al. 1995) and other small woodpeckers (Lundquist and Mariani 1991). The choice of large diameter nest trees may reflect an attempt by this species to maximize nest space, thermal insulation, and/or protection from predation. Red-breasted Sapsuckers require large nest cavities to accommodate large clutches and up to six nestlings (Campbell et al. 1990). The

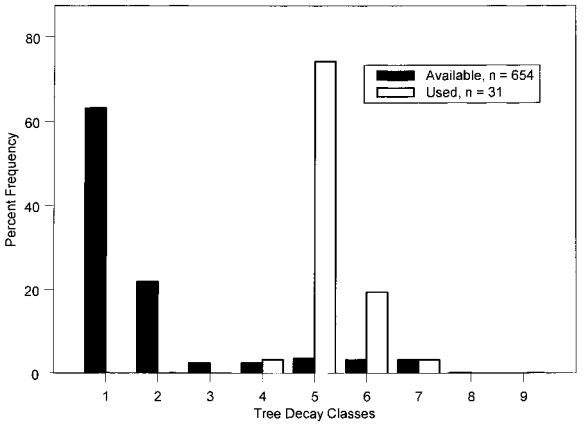

FIGURE 3. Wildlife tree classes of trees used for nesting by the Red-breasted Sapsucker and of a random selection of non-nest trees in the Mt. Cain and Maquilla Peak study area of British Columbia, 1997 and 1998.

greater insulation provided by larger snags may be beneficial to cavity nesting birds in high elevation forests where night temperatures can be below freezing well into the breeding season (pers. obs.). Additionally, large diameter nest trees may prohibit predators from reaching the nest by allowing cavities to have thicker walls (cf. Kilham 1971, Harestad and Keisker 1989). The preference for tall trees and high nest placement exhibited by Red-breasted Sapsuckers and other sapsuckers (Dobkin et al. 1995) likely reflects an adaptation to avoid predation by terrestial predators. Rates of predation and nest failure decrease among cavity nesters with increasing nest height (Nilsson 1984, Li and Martin 1991). Overall, Red-breasted Sapsuckers likely choose nest sites that balance predation risk (which decreases at greater nest heights) and the availability of adequate nest space and insulation (greater at lower nest heights). Red-breasted Sapsuckers chose to nest in dead trees with internal decay. Decayed heartwood is essential for most primary cavity nesting birds to excavate nest holes (Harestad and Keisker 1989).

As mature forests are logged, the population sizes of the cavity nesting

TABLE 1. Means, standard errors, and ranges of nest-cavity attributes of Red-breasted Sapsuckers from the coastal montane forests of northern Vancouver Island, British Columbia, Canada.

Nest tree or cavity variable	*n*	$\bar{x}$	SE	Range
Diameter at cavity height (cm)	22	75.0	5.0	32.9–124.8
Cavity vertical diameter (cm)	22	4.7	0.1	4.3–5.4
Cavity horizontal diameter (cm)	22	4.6	0.1	3.9–5.7
Cavity depth (cm)	22	24.8	9.6	14.1–34.2
Cavity height (m)	32	17.2	1.5	5.8–31.7

species that inhabit them are reduced, particularly those species which prefer large trees for nesting such as the Red-breasted Sapsucker. It is therefore important that snag retention is used to create some suitable habitat for such species in regenerating forests. It is now clear that primary cavity nesting species serve as a keystone group in northern forests (Daily et al. 1993, Walters 1996). My data suggest that in designing wildlife tree patches foresters should include tall large diameter snags and nearly dead trees to ensure suitable nest sites are available for Red-breasted Sapsuckers.

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