THE ASSOCIATION BETWEEN VAUX'S SWIFTS AND OLD GROWTH FORESTS IN NORTHEASTERN OREGON

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The Vaux's Swift (*Chaetura vauxi*) is a neotropical migrant that visits the Pacific Northwest long enough to nest and then returns to warmer climates for the winter. The interest in this species is two-fold. First, in the eastern United States neotropical migrants have undergone a general population decline that may be related to deforestation, habitat degradation, and forest fragmentation. Because the Vaux's Swift nests primarily in large hollow trees (Taylor 1905, Baldwin and Zaczkowski 1963, Bull and Cooper 1991), it could be affected by these factors. Second, in the Washington Cascade Range this species seems to be associated with old growth in Douglas-fir (*Pseudotsuga menziesii*) forests (Manuwal and Huff 1987), which is rapidly being logged. Our objective in this study was to determine if Vaux's Swifts are positively associated with old-growth forests in northeastern Oregon.

STUDY AREA AND METHODS

In 1991, we surveyed 160 stands for Vaux's Swifts on the Umatilla and Wallowa–Whitman national forests in Baker, Umatilla, Union, and Wallowa counties in northeastern Oregon. Half the stands selected were old growth and half had been logged in some way. We selected old-growth stands from maps provided by the Forest Service that delineated the location of these stands. We only used stands that were within 150 km of Wallowa or La Grande, within 1 km of a road, and > 5 ha in size. In addition, the stand had to meet the following conditions: >12 trees/ha ≥51 cm diameter at breast height (dbh), ≥2 canopy layers, ≥60% canopy closure, and little or no logging. In this study we did not use any old-growth stands where we had found swift nests previously (Bull and Cooper 1991).

Once an old-growth stand was located, we selected a logged stand at a random direction and at a random distance between 1 and 3 km away. If the randomly selected point fell in an old-growth stand, we repeated the process until the point fell in a logged stand. Logged stands were classified as partial overstory removals or harvest regeneration cuts. The partial overstory removals were stands where the large overstory trees had been cut; most of the trees that remained were <51 cm dbh. The regeneration cuts included clearcuts, seed tree cuts, and shelterwood cuts where all the old trees were removed eventually after young trees became established. These stands were usually dominated by young trees <6 m tall.

We recorded habitat characteristics in each stand in a transect 83.5 m long and 30 m wide and surveyed for swifts along the same transect. The transect was placed in the middle of the stand, and swifts were not counted if they were seen over a different stand. The habitat characteristics recorded were canopy closure, slope aspect and gradient, proximity to water (measured in the field or from aerial photographs), canopy height, number of canopy layers, stand size, landform (ridge, slope, draw), type of logging (none, partial overstory removal, or regeneration harvest), and forest type [ponderosa pine (*Pinus ponderosa*) series, Douglas-fir series, or grand fir (*Abies grandis*) series; Johnson and Hall 1990).

Within the transect area of 0.25 hectare we also recorded the number of hollow trees with broken tops, number of trees with conks of Indian paint fungus (*Echinodontium tinctorium*), number of live and dead trees ≥51 cm dbh, and number of potential nest trees for swifts. Potential nest trees were trees that appeared to be hollow with either a broken top or a hole in the side of the tree that swifts could enter. We recorded the density of these trees because swifts typically nest in large decayed trees (Bull and Cooper 1991).

From 1 to 30 June 1991, we surveyed each of the 160 stands once for swifts by walking slowly along the transect for a total of 20 minutes. We recorded the maximum number of swifts seen at any one time. We surveyed between 0900 and 1900 hours when the temperature was >55° F and when there was no precipitation. We surveyed in June because the birds were obvious as they performed extensive courtship flights prior to nesting.

In July and August we returned to the stands where we had observed swifts in June to search for nests. We searched each stand within 200 m of the transect by looking for trees with broken-off tops or with cavities and then watching them for 10 minutes to see if swifts entered. Each stand was searched for at least 1 hour and up to 4 hours if numerous potential nest trees were located. If we saw swifts enter or leave a tree at least three times during the day, we classified it as a nest. We climbed 19 such prospective nest trees in 1990 to verify that there was a nest in each tree (Bull and Cooper 1991).

We compared swift abundance with stand characteristics using multiple linear regression and Spearman's correlation analysis. Significance was defined as $P < 0.05$.

RESULTS AND DISCUSSION

Swifts were seen in 39 of the 160 stands. Forty-one percent of the old growth stands had swifts, while only 8% of the logged stands had swifts (Table 1). The greatest number of swifts seen in any stand was five.

The multiple linear regression showed that the number of swifts was significantly different in old growth and logged stands ($F = 23.14$; 1, 79 df; $P < 0.01$). We attempted to devise a mathematical model that could predict the number of swifts from the habitat characteristics. The best two-variable model for predicting the occurrence of swifts contained the number of dead trees ≥51 cm dbh (x_1) and number of trees with conks of Indian paint fungus (x_2) ($R^2 = 0.27$, $P < 0.01$). The R^2 value indicates the proportion of variability in abundance of swifts (27%) that can be explained by the number of large, dead trees and the number of trees with conks. The equation using these variables to predict number of swifts (y) was

$$y = 0.26 + 0.01x_1 + 0.09x_2$$

Table 1 Numbers of Vaux's Swifts Encountered in Stands of Old Growth, Partial Overstory Removals, and Regeneration Harvests in Northeastern Oregon, 1991

		Logged stands	
	Old growth	Partial	Regeneration
No. stands surveyed	80	42	38
No. stands with swifts	33	2	4
No. swifts/stand	1.0	0.1	0.3
Standard deviation	1.34	0.34	0.87
Range	0–5	0–2	0–3

The prediction equation containing only two variables predicted y almost as well as an equation using 12 variables ($R^2 = 0.36$). The Spearman's correlations showed that the number of swifts was correlated with many habitat variables but because these variables were also correlated with each other, only a few of these variables were needed to predict the number of swifts.

We searched the 39 stands where swifts were observed during surveys and found 13 nests in 9 stands. Eleven of the nests were in old-growth stands; two nests were in a regeneration harvest where >20 large-diameter dead trees had been left adjacent to an old-growth stand. An additional 11 nests were found in old-growth stands not surveyed for swifts but where we found swift nests in 1990.

The occurrence of two nests in regeneration harvests suggests that swifts nest in logged areas if hollow trees are left. In addition, one nest tree found in 1990 (Bull and Cooper 1991) was in a regeneration harvest. Dawson (1923) reported a nest tree in a burn in California. These nests provide some justification for retaining live and dead hollow trees in logged stands for swift nesting habitat. However, when these trees fall, it will take 100–200 years in northeastern Oregon for trees large enough and with the appropriate amount of decay to replace them. Over the long-term, suitable nest trees are most logically provided in old-growth stands.

All the nests were in large, hollow grand firs; tree dbh averaged 83 cm (standard deviation 26.61). Fifteen of the nests were in live trees, and nine were in dead trees. At nine nests, swifts entered the trees through the opening where the top had broken off. At the remaining nests, swifts entered the trees through holes along the trunk that had been excavated by Pileated Woodpeckers (*Dryocopus pileatus*), as described by Bull and Cooper (1991).

We think the association observed between swifts and old growth was due partly to the availability of suitable nest trees. The density of live and dead trees ≥51 cm dbh, of hollow trees, and of decayed trees was higher in old-growth stands than in logged stands, which typically lacked such potential nest trees (Figure 1). The density of these trees was higher in stands with swifts than in stands without swifts (Figure 2). Stands with swifts typically

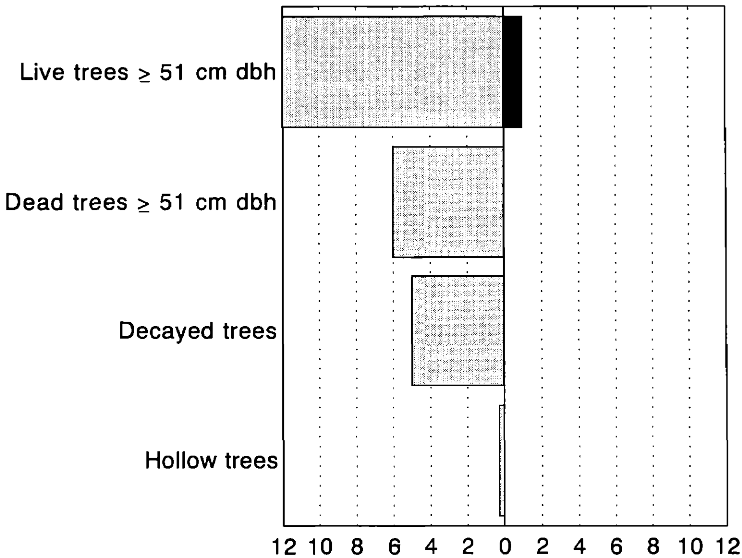

Figure 1. Habitat characteristics (mean number of trees/0.25 ha) of old-growth stands (shaded) and logged stands (black).

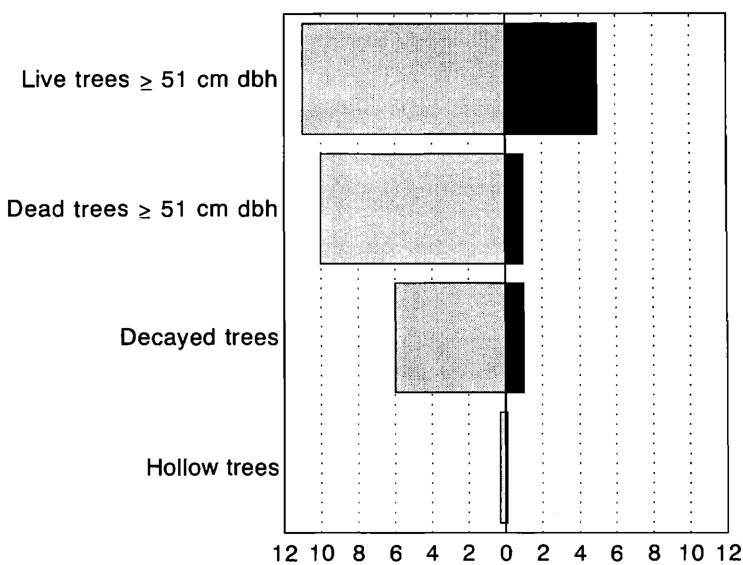

Figure 2. Habitat characteristics (mean number of trees/0.25 ha) of stands with swifts (shaded) and stands without swifts (black).

were in forests dominated by grand fir (92%), with a dense (73% canopy closure) and tall multi-layered canopy, and with little or no logging.

SUMMARY

We surveyed 160 forested stands in June 1991 for Vaux's Swifts; half the stands were old growth and half had been logged. Forty-one percent of the old-growth stands had swifts, while only 8% of the logged stand had swifts. The number of swifts was significantly higher in old growth than in logged stands, and the variables best able to predict swift occurrence were number of dead trees ≥51 cm dbh and number of trees with conks of Indian paint fungus. We think the association between swifts and old growth was partly due to the greater availability of suitable nest trees in old growth.

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