

## Population Ecology

# BREEDING BIOLOGY OF NORTHERN GOSHAWKS IN NORTHEASTERN OREGON

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**Abstract.** Ten of 25 historical Northern Goshawk (*Accipiter gentilis*) nest stands in Wallowa County had active nests in 1992. Young fledged at 10 of 12 nests at an average of 1.4 young per successful nesting attempt, or 1.2 young for all nests. Incubation occurred in late April and May, and nestlings were present in June and July. The earliest and latest fledging dates were 22 June and 27 July; the mean fledging date was 8 July. All nests were in old growth or remnant old-growth stands; however, most of the stands searched were old growth. Nest trees averaged 65 cm diameter at breast height and 34 m tall. Diet determined from prey remains consisted of 58.5% birds and 41.5% mammals.

**Key Words:** *Accipiter gentilis*; breeding biology; Northern Goshawk; northeastern Oregon.

The Northern Goshawk (*Accipiter gentilis*) has generated interest throughout the western United States because there is concern that populations and reproduction of this species are declining (Reynolds et al. 1992). In addition, the Northern Goshawk has been designated as a Management Indicator Species, and the National Forest Management Act regulations require that such species be monitored. Therefore, site specific information on breeding biology is needed to monitor populations of this species. Our objectives were (1) to search historical goshawk nest sites to ascertain how many still had active goshawk nests, and (2) to determine nesting chronology, nest habitat characteristics, and diet during the breeding season.

## METHODS

### STUDY AREA

The study was concentrated in 42 stands that ranged in size from 10 to 109 ha; these stands were contained within a 350,000-ha area on the Wallowa Valley Ranger District and adjacent portions of the Eagle Cap Ranger District and Hells Canyon Natural Recreation Area, Wallowa County, northeastern Oregon. The study areas were a mixture of stands including ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta*), grand fir (*Abies grandis*), and Engelmann spruce (*Picea engelmannii*). Elevations within the study areas range from 1200 m to 1800 m, and topography varies from flat to steep canyons.

### NEST LOCATION AND HABITAT

To locate active Northern Goshawk nests, we searched 25 historical goshawk nest stands and 17 additional stands containing old growth. A historical nest stand was one where goshawks had nested at least once in the last 20 years based on records kept by the Wallowa Valley Ranger District. Additional sites were selected on the basis of having a stand with >12 trees/ha that were >50 cm dbh, with >60% canopy closure,

and >10 ha in size. Stand boundaries were delineated by changes in successional stages. Only the blocks of forest that met the criteria listed above were searched.

Searches for nests were conducted between 16 April and 17 July 1992; however, the majority of the search effort occurred in May and June. We used a silent search and a broadcast of taped calls to search for nests. We searched 75% of the stands with the silent search technique where we walked through the stand looking for nest platforms, white-wash, prey remains, and goshawks. Approximately one person-day was spent searching stands >40 ha in size, and one-half a person-day was spent in smaller stands.

In the remainder of the stands we broadcast adult alarm calls (Kennedy and Stahlecker 1993) at stations about 400 m apart. This distance was used because we determined that the tape could be heard 200 m away. At each station, three calls were broadcast; each call was 10-sec long and 1-min apart. The speaker was oriented at 60°, 180°, and 300° during the calls. We did not use broadcast calls more extensively because the majority of our searching was done when the birds were presumed to be incubating, and birds are not likely to respond to calls during this period (Kennedy and Stahlecker 1993).

Active nest trees (terms defined in Reynolds et al. 1992) were revisited every 1–2 weeks to determine nesting chronology. If there was evidence of occupancy by goshawks (e.g., birds seen, prey remains, white-wash) but no nest was found, the stand was revisited in 2–4 weeks.

At each active nest tree, we recorded tree species, condition (live or dead), diameter at breast height (dbh), and height; exposure of nest (north = 316–45°, east = 46–135°, south = 136–225°, west = 226–315°); and height of nest above ground. In 1 ha around the nest tree, forest type, logging activity, successional stage, canopy closure, landform, slope aspect, and gradient were measured. We climbed seven of the nest trees and recorded: length, width, and depth of the nest structure; depth of the nest cup; and distance of the nest from the bole of the tree.

Forest type was classified using Johnson and Clausnitzer (1992): (1) ponderosa pine, (2) Douglas-fir, or (3) grand fir. Logging activity was classified as high-

graded (logging where only the valuable trees are removed, but the majority of the stand is left), selective (partial overstory removal), and clearcuts and shelterwoods. Clearcuts and shelterwood harvests were combined because neither silvicultural technique leaves habitat structure usable for nesting for many decades. Successional stages were defined as (1) young, trees <30 cm dbh; (2) mature, most trees 30–50 cm dbh; (3) old growth, >12 trees/ha that were >50 cm dbh, >60% canopy closure, and >1 canopy layer; and (4) remnant, some trees >50 cm dbh in the stand but not enough to classify as old growth. Canopy closure was measured with a spherical densiometer. Slope gradient was measured with a clinometer.

#### DIET AND PLUCKING POSTS

We searched for prey remains and pellets within 0.3 km of each nest. All prey remains found in one day of searching at each nest were combined to reduce the chance of counting the same prey item twice (Reynolds and Meslow 1984); however, this method may underestimate common prey types relative to rare prey types (C. Zabel, pers. comm.). Prey remains were identified later with the assistance of skull keys and museum collections.

Places where prey remains were found were called plucking posts. We recorded type of perch (e.g., log, stump, branch), perch height, distance from the nest, tree species, dbh, and condition (live or dead) at each plucking post.

## RESULTS

### NESTING

Of 25 historical sites searched, 23 had suitable habitat and two had been logged. Ten of the 25 sites had active nests in 1992. Two other active nests were found in the additional 17 stands searched.

The 12 active nests were located between 10 April and 15 July. Five nests were found with defensive adults, three with incubating females, three with nestlings, and one with fledglings. The two nests that failed were found when adults were defensive, and incubating females were seen on the nests before they failed.

Incubation typically started in late April and early May. Nestlings were present in June and early July. The mean fledging date was 8 July among five nests where we knew approximate dates. The earliest fledging date was about 22 June, and the latest was 27 July.

Juveniles fledged from 83% of the nests. Fourteen young fledged from the 10 nests, for an average of 1.4 young produced per successful nest or 1.2 young per nesting attempt. At least two young died before fledging; we could not determine if additional young died because we did not climb to the nests until young were ready to fledge.

Ten of the 12 nest trees were in old-growth stands that either had not been logged or had been high-graded in the past. The remaining two

nest trees were in stands that had only remnants of old growth because they had been partially logged. Nine nest trees were in a grand fir forest type, two were in a Douglas-fir type, and one was in a western larch-lodgepole pine-spruce type. The average canopy closure was 81% (SD = 6.9%). Nine nest trees were on the lower third of a slope, and the remainder were at midslope. Slope gradient averaged 31% (SD = 21.2%). Nine nest trees were on a north- or east-facing slope. The average distance from the nest to the nearest water was 70 m (SD = 72.0). None of the nests were >200 m from water. Stands containing an active nest averaged 43 ha (SD = 34.0) in size.

Seven nest trees were Douglas-fir, three were western larch, and two were grand fir. All but two of the trees were alive. Average dbh and height of the nest trees were 65 cm (SD = 23.5) and 34 m (SD = 7.3), respectively. Average nest height was 15 m (SD = 3.3). Aspect of the nest on the tree was south or west at 10 nests and north or east at two nests.

The actual nest platform averaged 94 cm (SD = 18.5) in length, 66 cm (SD = 20.3) in width, and 36 cm (SD = 12.4) in depth. The depression inside the nest averaged 24 cm (SD = 7.0) in length, 21 cm (SD = 4.0) in width, and 8 cm (SD = 7.6) in depth.

### DIET AND PLUCKING POSTS

We identified 94 prey items collected at nine nests; 58.5% were birds and 41.5% were mammals (Table 1). We collected between one and 32 prey items at each nest. American Robins comprised the majority (29%) of the birds found, and snowshoe hares comprised the majority (33%) of the mammals.

Forty-three plucking posts were found around nest sites; 51% were in trees, 33% on logs, 14% on stumps, and 2% on rocks. Of the standing trees, 63% were live and the remainder dead. Mean dbh and perch height of the standing trees were 32 cm (range = 8–75 cm) and 2.1 m (range = 0.8–4 m), respectively. The type of perch at these trees was a leaning tree trunk (55%), a branch (32%), or the top of the trunk where it had broken off (13%). Logs used as plucking posts averaged 59 cm in diameter (range = 16–110 cm). Perching height on logs averaged 0.5 m (range = 0.2–1.0 m) above the ground because logs were elevated. Three of the plucking posts on stumps were western larch; the remainder could not be identified. Mean diameter and perching height of stumps were 67 cm (range = 40–90 cm) and 0.6 m (range = 0.3–1.0 m), respectively.

Plucking posts typically were clustered around the nest tree, although we did not search >0.3 km from the nest. The distance between nests

TABLE 1. PREY REMAINS AND FREQUENCY (%) COLLECTED AT NINE NORTHERN GOSHAWK NEST SITES IN WALLOWA COUNTY, OREGON, 1992

Prey	N <sup>1</sup>	Birds or mammals (%)	Total (%)
<b>Birds</b>			
American Robin ( <i>Turdus migratorius</i> ) <sup>2</sup>	16	29.0	17.0
Northern Flicker ( <i>Colaptes auratus</i> )	8	14.6	8.5
Western Meadowlark ( <i>Sturnella neglecta</i> )	7	12.7	7.5
Western Tanager ( <i>Piranga ludoviciana</i> )	4	7.3	4.3
Clark's Nutcracker ( <i>Nucifraga columbiana</i> )	4	7.3	4.3
Steller's Jay ( <i>Cyanocitta stelleri</i> )	3	5.5	3.2
Gray Jay ( <i>Perisoreus canadensis</i> )	3	5.5	3.2
Hairy Woodpecker ( <i>Picoides villosus</i> ) <sup>3</sup>	3	5.5	3.2
Ruffed Grouse ( <i>Bonasa umbellus</i> )	2	3.6	2.0
Dark-eyed Junco ( <i>Junco hyemalis</i> )	2	3.6	2.0
Long-eared Owl ( <i>Asio otus</i> )	1	1.8	1.1
Black-headed Grosbeak ( <i>Pheucticus melanocephalus</i> )	1	1.8	1.1
Northern Goshawk ( <i>Accipiter gentilis</i> ) <sup>4</sup>	1	1.8	1.1
Total	55	100.0	58.5
<b>Mammals</b>			
Snowshoe hare ( <i>Lepus americanus</i> )	13	33.3	13.8
Ground squirrels <sup>5</sup>	12	30.8	12.8
Red squirrel ( <i>Tamiasciurus hudsonicus</i> )	11	28.2	11.7
Yellow pine chipmunk ( <i>Tamius amoenus</i> )	3	7.7	3.2
Total	39	100.0	41.5

<sup>1</sup> Represents number of individuals.

<sup>2</sup> Also may have included Varied Thrush (*Ixoreus naevius*).

<sup>3</sup> Also may have included sapsuckers.

<sup>4</sup> Remains of a nestling were found in pellets at the base of a nest.

<sup>5</sup> Columbian ground squirrels (*Spermophilus columbianus*) comprised 33% of these; the remainder could not be identified to species.

and plucking posts averaged 42 m (range = 7–200 m).

## DISCUSSION

We found active nests in ten of the 23 historical nest stands that we considered still suitable. Adult Northern Goshawks were seen in two suitable stands where we did not find nests. Consequently, about half the suitable stands we searched had nests or adults. Because we subjectively selected our stands, our findings do not necessarily indicate a preference for old growth. However, all the goshawk nests we located were in large-diameter trees, which are characteristic of old-growth stands.

The nesting pairs were productive with 83% of the nests successful and an average of 1.2 young fledged per nesting attempt. Similarly, Reynolds and Wight (1978) reported 1.7 young fledged per nesting attempt in Oregon during 1969–1974. The diet we determined from prey remains was similar to that reported by Reynolds and Meslow (1984) in Oregon (55% birds and 45% mammals).

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