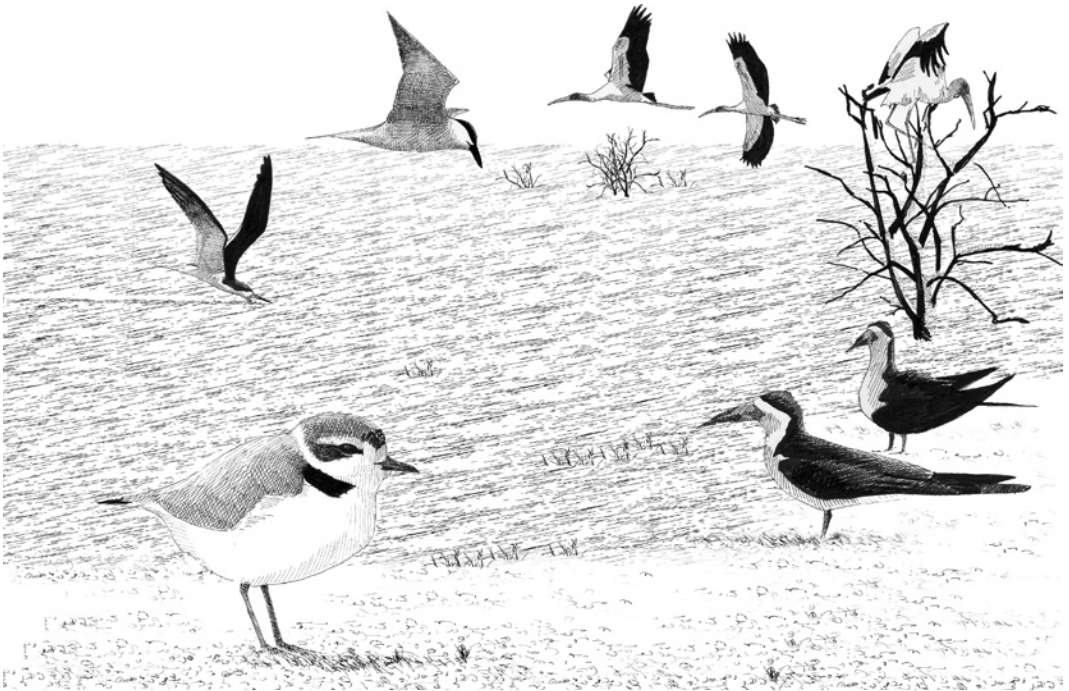


II

SPECIES ACCOUNTS



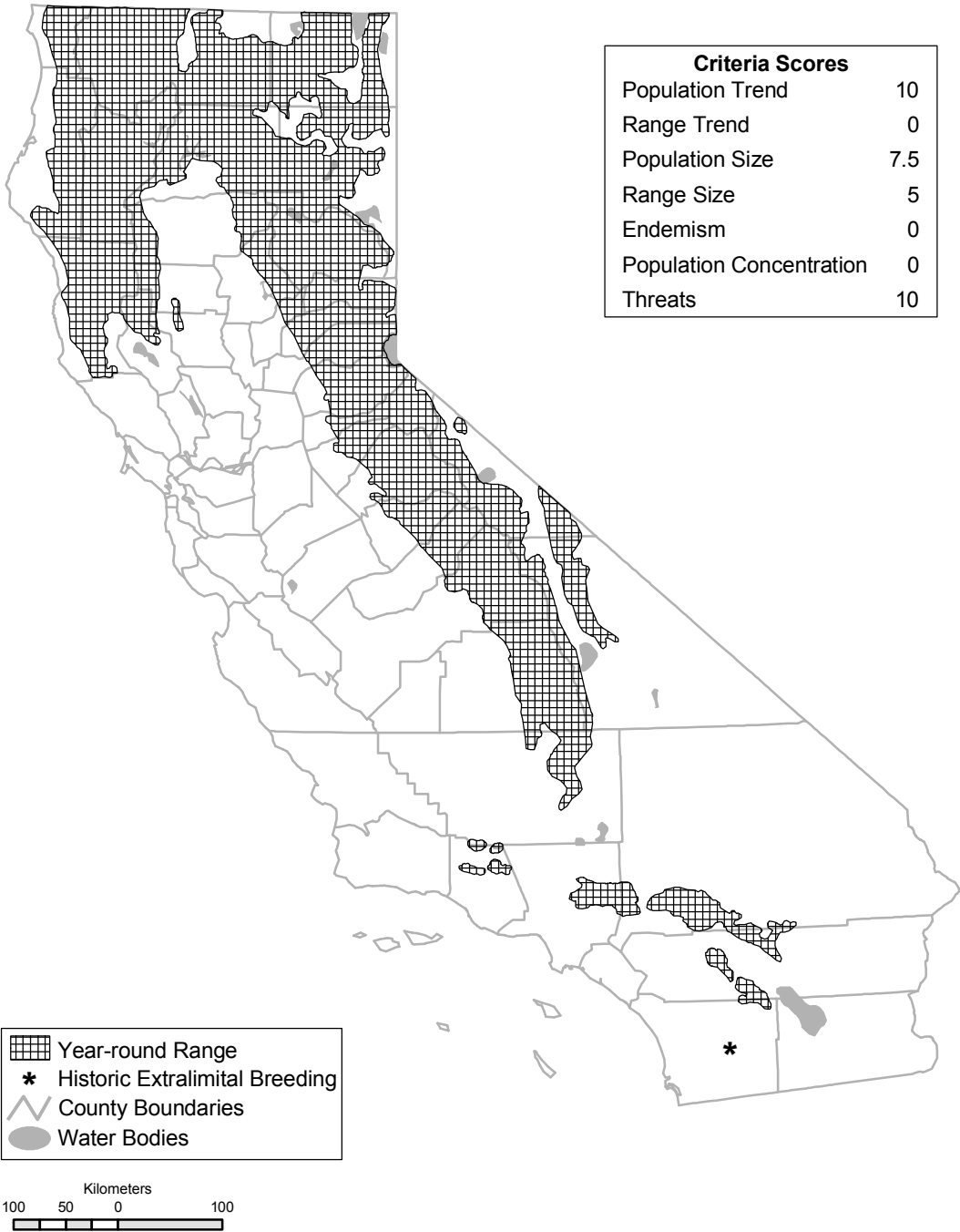
Andy Birch

PDF of Northern Goshawk account from:

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NORTHERN GOSHAWK (*Accipiter gentilis*)

JOHN J. KEANE



Year-round range of the Northern Goshawk in California; numbers have declined at least moderately. Small numbers of migrants or dispersing birds occur outside known breeding areas in the nonbreeding season.

SPECIAL CONCERN PRIORITY

Currently considered a Bird Species of Special Concern (year round), priority 3. Included on the list since its inception (Remsen 1978, 3rd priority; CDFG 1992).

BREEDING BIRD SURVEY STATISTICS FOR CALIFORNIA

Data inadequate for trend assessment (Sauer et al. 2005).

GENERAL RANGE AND ABUNDANCE

Holarctic distribution (Brown and Amadon 1968, Squires and Reynolds 1997). In North America, breeds from boreal Alaska and Canada south in the East as far as Pennsylvania and New York and in the West to the mountains of southern Arizona and New Mexico; disjunct populations occur in the mountains of western Mexico as far south as Jalisco and southern Guerrero (Howell and Webb 1995, Squires and Reynolds 1997). During winter, some birds are resident, whereas others are facultative migrants exhibiting short-distance elevational or latitudinal movements. During irruption years, northern populations can exhibit long-distance migrations in response to large cyclic fluctuations in prey populations (Squires and Reynolds 1997, Doyle and Smith 2001).

The AOU (1957) recognized two subspecies: *A. g. atricapillus* breeds throughout most of the North American range except where *A. g. laingi* occurs. The latter was originally described from the Queen Charlotte Islands and Vancouver Island but is now considered to extend north through insular British Columbia and insular and coastal mainland Alaska to Icy Strait and Lynn Canal (Squires and Reynolds 1997). Recognition of a third subspecies, *A. g. apache*, resident from southern Arizona through Mexico, is currently debated (Squires and Reynolds 1997).

SEASONAL STATUS IN CALIFORNIA

Year-round resident throughout all or most of the California range, though in winter some individuals remain on or close to breeding territories while others migrate short distances to winter elsewhere (Hargis et al. 1994, Keane 1999, D. J. Richter and R. Callas unpubl. data). Migrants from northern populations likely occur in California during some winters; irruptive movements into the state are rare, but considerable numbers occurred across southern California in the winter of 1916–17, an invasion year (Grinnell and Miller 1944).

HISTORIC RANGE AND ABUNDANCE IN CALIFORNIA

Grinnell and Miller (1944) described the species as “not common” in its breeding range in the higher altitudes in the northern third of the state—south in the Coast Ranges to the vicinity of Laytonville and Mount Sanhedrin, Mendocino County, and in the Cascades and Warner Mountains—and further south in the Sierra Nevada to Kings Canyon National Park and Whitaker’s Forest, Tulare County. Information available to Grinnell and Miller was incomplete. In Ventura County, egg sets were collected from Mount Pinos in 1904 (Kiff and Paulson 1997) and at an unspecified site in 1919 (Delaware Mus. Nat. Hist. egg set). Also, two egg sets were collected from the Cuyamaca Mountains, San Diego County, in 1937, and two young birds were seen at one locality there in 1938 (Kiff and Paulson 1997, Delaware Mus. Nat. Hist. egg set). In winter, individuals were recorded from lower elevations and the southern part of California from near the coast to the lower Colorado River valley (Grinnell and Miller 1944).

RECENT RANGE AND ABUNDANCE IN CALIFORNIA

A synthesis of historical and current breeding and distributional records from federal and state agencies, private land management companies, museums, and published literature indicates that Northern Goshawks are still well distributed across their core breeding range in most of the northern Coast Ranges, the Klamath and Siskiyou mountains, across the Cascades, Modoc Plateau, and Warner Mountains, and south through the Sierra Nevada (see map; J. Keane and B. Woodbridge unpubl. data). The compilation of records and additional fieldwork have extended the known range (likely mostly occupied prior to 1944) south to southern Mendocino County in the Coast Ranges, south past the Sierra Nevada to the Tehachapi Mountains, east to the Glass Mountain region and White-Inyo ranges, and sparsely south to the Mount Pinos–Frazier Mountain area and the San Gabriel, San Bernardino, San Jacinto, and Cuyamaca mountains of southern California (Garrett and Dunn 1981, Bloom et al. 1986, Lentz 1993, Kiff and Paulson 1997, J. Keane and B. Woodbridge unpubl. data). Breeding in the Cuyamacas is best considered extralimital, as there are no other breeding season records for San Diego County, even of just adults, despite the extensive fieldwork in 1997–2001 for the bird atlas (Unitt 2004). Breeding within the California range

extends from about 1000 to 10,800 ft (305–3290 m) in elevation.

Population trends of Northern Goshawks in California are poorly known. Distributional changes and loss of breeding territories from timber harvest and wildfire across their range suggests that population size has been reduced. Bloom et al. (1986) estimated a statewide population of approximately 1300 breeding territories. Recent synthesis of existing breeding territory records documented approximately 1000 known territories statewide between 1970 and 2001 (J. Keane and B. Woodbridge unpubl. data). That the majority of nest territory records were reported from the previous 12 years reflects an increased conservation focus and development of specialized survey procedures and efforts targeting Northern Goshawks. Christmas Bird Count data for California suggest a stable population between 1959 and 1988, although estimates are of questionable reliability because of small sample sizes and low abundance (Sauer et al. 1996).

Concern exists for potential range contraction, reductions in breeding densities, and generally low breeding densities in five areas of California as outlined below.

Coastal Redwood zone. Concern exists for potential extirpations in the Redwood (*Sequoia sempervirens*) zone along the north coast, where there are very few current breeding records. In 2001–2002, Weber (2006) conducted surveys at eight locations with prior nesting evidence and at many other sites with potential nesting habitat of mature or old-growth forest on public and private lands in the coastal Redwood region from Del Norte to Sonoma counties. No nesting was documented within the Redwood zone proper, though an active nest was found about 33 km inland at Angelo Coast Range Reserve, Mendocino County (nesting known since 1977, B. Woodbridge pers. comm.), at the transition from Redwood to more xeric Douglas-fir (*Pseudotsuga menziesii*) and mixed-oak habitat (Weber 2006). Current records indicate that Northern Goshawks do not breed in pure stands of Redwood, but that they do nest within stands of conifer-hardwood and mixed Redwood-conifer-hardwood within and immediately adjacent to the broader coastal Redwood vegetation zone.

Eastside pine zone. Northern Goshawks no longer occur in extensive areas of eastside pine forest, mainly Pacific Ponderosa (*Pinus ponderosa*) and Jeffrey (*P. jeffreyi*) pines, of northeastern California, where extensive railroad logging eliminated habitat (B. Woodbridge pers. comm.).

Westside Ponderosa Pine zone. Likewise, extensive logging on the entire lower west slope of the Sierra Nevada has eliminated 95% to 99% of the original old-growth Pacific Ponderosa Pine forests (Franklin and Fites-Kaufmann 1996). Goshawks are known to nest down to about 2500 ft (750 m) on the west slope, so it is likely that reductions in mature and old-growth pine has resulted in reductions in goshawk numbers in these forests.

Southern Sierra Nevada. There have been only about 25–30 recent nest records for the southern Sierra Nevada south of Yosemite National Park (Sierra and Sequoia national forests, Sequoia–Kings Canyon National Parks). It is uncertain whether this represents the limited survey effort expended in these areas, low breeding densities/suboptimal habitat conditions near the southern edge of goshawk distribution in the southern Sierra Nevada, or potential reductions in densities or distribution at the edge of the species' range.

Southern California mountains. The historic and current distribution of Northern Goshawks in these mountains is uncertain because of limited information. The few nest records—only seven confirmed and one suspected—suggest that goshawks likely bred and continue to breed across this region, although it is unknown how commonly or regularly. In addition to the historical nest records described above for Ventura and San Diego counties, there are records of active nests on Mt. Abel (1989–1990), Mount Pinos (1989), and the Tecuya Range (1991) in northern Ventura County and reports of an active nest at one site and an aggressive pair of adults during the breeding period (1990–1991) at another site in the San Jacinto Mountains, Riverside County (Kiff and Paulson 1997, J. Keane and B. Woodbridge unpubl. data). Of the approximately 25 breeding-period sight records of adult goshawks from the mountains of southern California over the past 50 years reported in *Audubon Field Notes* and its successors, about half were from the San Jacinto Mountains. Biologists conducting extensive surveys for California Spotted Owls (*Strix occidentalis occidentalis*) in the San Bernardino, San Gabriel, and San Jacinto mountains from 1987 to 2003 did not record Northern Goshawks, with the exception of one nesting pair in the San Jacintos in one year (W. La Haye pers. comm.), mentioned above.

ECOLOGICAL REQUIREMENTS

Key ecological requirements for Northern Goshawks are suitable nesting and foraging habi-

tat, including adequate prey. Northern Goshawks nest in mature and old-growth forest stands over much of their California range. Suitable stands occur in a broad range of conifer and conifer-hardwood types, including Pacific Ponderosa, Jeffrey, and Lodgepole (*P. contorta*) pine, mixed conifer, White (*Abies concolor*) and California Red (*A. magnifica*) fir, Douglas-fir, mixed Redwood–Douglas-fir–hardwood, and (rarely) pinyon-juniper (*P. monopylla*, *Juniperus* spp.), as well as in mature Quaking Aspen (*Populus tremuloides*) stands within aspen–shrub steppe vegetation east of the Cascade-Sierra axis. Nest stands have consistently larger trees, greater canopy cover, and relatively more open understories than stands lacking nests (Saunders 1982, Hall 1984, Hargis et al. 1994, Keane 1999, Maurer 2000). In most forest types, canopy cover around the nest tree is usually >60%–100%, although it is about 25%–40% in the naturally more open Pacific Ponderosa and Jeffrey pine forests east of the Cascade-Sierra axis. Goshawks usually place their stick nests in some of the larger available trees or, rarely, in snags. Nests are constructed mainly in the lower one-third of nest trees or just below the forest canopy, with nest heights varying with tree species and regional tree-height characteristics (Squires and Reynolds 1997). Of a sample of 157 nests in the southern Cascades and western Sierra Nevada of California, 45% were placed in a deformed top or mistletoe clump, 43% against the trunk, and 12% out on a limb (Richter 2005). The diameter of trees in which nests were placed in deformities averaged smaller than those where nests were against the trunk or on a limb.

Woodbridge and Detrich (1994) reported that annual territory reoccupancy rates approached 100% when approximately 80 ha of suitable nest-stand habitat was available. These rates decrease with smaller stand sizes indicative of forest fragmentation or management for limited buffers around nests (Woodbridge and Detrich 1994, Richter 2005).

Breeding-period home ranges of individuals in the Sierra Nevada averaged about 1800–2600 ha (range = about 800–6200 ha: 95% adaptive kernel; Hargis et al. 1994, Keane 1999). Nonbreeding-period home ranges averaged about 5500 ha (range = 1400–12,100 ha) for females and 8200 ha (range = 1500–15,000 ha: 95% adaptive kernel) for males (Keane 1999). In the southern Cascades, breeding-period home ranges averaged about 2400 ha (range = 1000–3900 ha) for males and about 3800 ha (range = 2000–6900 ha: 100% minimum convex polygon) for females (Austin 1993).

Northern Goshawk populations exhibit high annual variation in reproduction, with 30%–90% of pairs breeding in any year. Variation in reproduction is associated with annual variation in weather and prey abundance (Keane 1999, Keane et al. 2006). Although Northern Goshawks will prey on a large number of species, several important species and species groups dominate the majority of prey items and biomass in California (Keane 1999, McCoy 1999, Maurer 2000, Keane et al. 2006). These are the Douglas Squirrel (*Tamiasciurus douglasii*), Golden-mantled Ground Squirrel (*Spermophilus lateralis*), Belding Ground Squirrel (*S. beldingi*), Western Gray Squirrel (*Sciurus griseus*), hares and rabbits (*Lepus* spp., *Sylvilagus* spp.), chipmunks (*Tamias* spp.), American Robin (*Turdus migratorius*), Northern Flicker (*Colaptes auratus*), and Steller's Jay (*Cyanocitta stelleri*). In the Lake Tahoe region of the Sierra Nevada, annual variation in goshawk reproduction is associated with late winter and early spring temperatures and abundance of Douglas Squirrels, which vary annually in concordance with cone crop production (Keane 1999, Keane et al. 2006).

Goshawks forage in mature and old-growth forests that have relatively dense canopies (Widen 1989, Austin 1993, Bright-Smith and Mannan 1994, Hargis et al. 1994, Iverson et al. 1996, Beier and Drennan 1997), but also capture prey in a variety of vegetative cover, including meadow edges and open sagebrush (Younk and Bechard 1994). Foraging habitat use probably varies seasonally in response to prey availability.

Northern Goshawks are top-trophic-level predators that have relatively large spatial requirements and occur at relatively low breeding densities. Populations are likely regulated by a combination of territorial behavior, available prey, and suitability of nesting habitat. Although breeding pairs are more or less regularly distributed within appropriate habitat, breeding densities appear to vary with patterns of habitat quality across the landscape (Newton 1979, Joy 2002). Thus, landscapes can support only a certain, limited number of territories, and the spatial distribution of habitat is important for maintaining Northern Goshawk populations.

THREATS

Habitat loss and degradation are the primary known threats to Northern Goshawks (Squires and Kennedy 2006). As a result of timber harvest and fire suppression policies over the past century,

contemporary California forests are strikingly different in structure, composition, and function compared to the range of forest conditions resulting from the historic, natural disturbance regime. These recent management policies have likely degraded goshawk habitat quality by fragmenting forests, reducing the amount and distribution of mature and old-growth forest stands and large trees, increasing understory tree density, and changing tree species composition, resulting in broad-scale reduction of the proportion of pine in forest stands. Nest sites and territories have been lost from logging in nest stands and from stand-replacement fires. There is also increased risk of loss of habitat to such fires because past management policies have increased fuel loads.

Past and current management standards and guidelines for goshawks focus on protecting habitat at nest sites during project implementation. Management practices for nest territories on private forestlands in California range from protection of the nest tree and a few shade trees in the general area of the nest tree to protection of 2–8 ha around the nest tree. Little or no protection was directed at goshawk nest sites on U.S. Forest Service lands until 20–25 years ago. Since then, management has varied among individual national forests, with a focus on protection of 20–80 ha around known goshawk nest sites. It is likely that many of these management practices are inadequate for maintaining long-term site occupancy (see Richter 2005 on private timberlands). Woodbridge and Detrich (1994) reported that short-term reoccupancy rates approached 100% for core areas that had approximately 80 ha of suitable nesting habitat. Standards and guidelines adopted for Sierra Nevada forests as part of the Sierra Nevada Framework Project amend existing land management plans and require protection of the best available 80 ha of suitable nesting habitat around occupied nest sites. Northwest Forest Plan reserves provide protection for additional territories in limited areas of northern California. Uncertainty exists regarding the effects of proposed timber harvest and fuels management strategies on goshawk habitat quality at the home range and landscape scales.

Ongoing human population growth and associated development and recreational activity, particularly on the west slope of the Sierra Nevada (see Stein et al. 2005), may result in further degradation of goshawk habitat quality through direct loss of habitat, increased disturbance from recreational activities, and elevated fire risk from human ignitions. Goshawks are harvested for fal-

conry in California. Current harvest levels do not affect statewide population numbers, although negative effects may occur locally if specific breeding territories or areas, such as those on the Inyo National Forest in the eastern Sierra Nevada, are repeatedly harvested. Pesticides are not known to have negatively affected Northern Goshawk populations (Snyder et al. 1973, Squires and Reynolds 1997), and no information is available to suggest current problems with contaminants (see summary in Squires and Kennedy 2006). The spread of West Nile virus to California in 2003, and the susceptibility of other raptors to its effects, suggests goshawks may be at risk; still, there is no strong evidence indicating any diseases are significant factors limiting goshawk populations (Reynolds et al. 2006b).

MANAGEMENT AND RESEARCH RECOMMENDATIONS

- Regarding private and state lands, consult with the Department of Fish and Game to develop site-specific protection measures around nest trees, including maintenance of alternative nest trees. Restrict activities during the critical nesting and fledgling periods (1 Mar–15 Aug).
- Review private and public land management standards and guidelines to incorporate new information and evaluate their adequacy as applied to these lands.
- Establish, annually update, and manage a statewide nesting record database for tracking distributional patterns and assessing conservation status across state, federal, and privately managed lands.
- Conduct specialized inventories to assess distributional status in poorly known areas, such as the mountains of southern California.
- Conduct radiotelemetry studies to increase understanding of foraging habitat and prey use in both the breeding and winter periods.
- Conduct basic demographic research to understand how survival and reproduction are affected by interactions among habitat, prey, weather, and, possibly, disease such as West Nile virus.
- Initiate collaboration between research and management in an adaptive management framework to assess the effects of forest and fuels management policies on Northern Goshawk territory occupancy, demograph-

ics, and habitat quality, placing questions within the larger context of the restoration of California forests and natural disturbance regimes. Variation across major California forest types in terms of forest structure, composition, function, patch size and distribution, prey populations, and natural disturbance regimes dictates that management and conservation efforts be developed at appropriate spatial scales. (See Reynolds et al. 2006a for recommendations for developing ecosystem-based conservation strategies for goshawks.)

MONITORING NEEDS

The Breeding Bird Survey and Christmas Bird Count are inadequate for monitoring population trends of goshawks (Squires and Kennedy 2006). Monitoring of Northern Goshawks in California will require the use of standardized protocols to assess population distribution, status, and trends at appropriate spatial scales (e.g., Sierra Nevada bioregion). If feasible, monitoring in California should follow the U.S. Forest Service's recently developed design for bioregional monitoring of population trends and their association, if any, with broad-scale habitat changes (Hargis and Woodbridge 2006). Empirically derived habitat models should be used to monitor change in habitat distribution and quality at home-range and landscape scales. Monitoring project-level responses of nesting goshawks to management treatments would also be valuable.

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LITERATURE CITED

- American Ornithologists' Union (AOU). 1957. Checklist of North American Birds, 5th ed. Am. Ornithol. Union, Baltimore.
- Austin, K. K. 1993. Habitat use and home range size of breeding Northern Goshawks in the southern Cascades. M.S. thesis, Oregon State Univ., Corvallis.
- Beier, P., and Drennan, J. E. 1997. Forest structure and prey abundance in foraging areas of Northern Goshawks. *Ecol. Applications* 7:564–571.
- Bloom, P. H., Stuart, G. R., and Walton, B. J. 1986. The status of the Northern Goshawk in California, 1981–1983. Wildl. Mgmt. Branch Admin. Rep. 85-1, Calif. Dept. Fish & Game, Sacramento.
- Bright-Smith, D. J., and Mannan, R. W. 1994. Habitat use by breeding male Northern Goshawks in northern Arizona. *Studies Avian Biol.* 16:58–65.
- Brown, L., and Amadon, D. 1968. *Eagles, Hawks and Falcons of the World*. McGraw-Hill, New York.
- California Department of Fish and Game (CDFG). 1992. Bird species of special concern. Unpublished list, July 1992, Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.
- Doyle, F. I., and Smith, J. M. N. 2001. Raptors and scavengers, in *Ecosystem Dynamics of the Boreal Forest: The Kluane Project* (C. J. Krebs, S. Boutin, and R. Bostra, eds.), pp. 377–404. Oxford Univ. Press, New York.
- Franklin, J. F., and Fites-Kaufmann, J. A. 1996. Assessment of late-successional forests of the Sierra Nevada, in *Sierra Nevada Ecosystem Project, final report to Congress, vol. II, Assessments and scientific basis for management options*, pp. 627–669. Univ. Calif. Davis, Centers for Water and Wildland Resources. Available at <http://ceres.ca.gov/snep/pubs/>.
- Garrett, K., and Dunn, J. 1981. *Birds of Southern California: Status and Distribution*. Los Angeles Audubon Soc., Los Angeles.
- Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. *Pac. Coast Avifauna* 27.
- Hall, P. A. 1984. Characterization of nesting habitat of Goshawks (*Accipiter gentilis*) in northwestern California. M.S. thesis, Humboldt State Univ., Arcata, CA.
- Hargis, C. D., McCarthy, C., and Perloff, R. D. 1994. Home ranges and habitats of Northern Goshawk in eastern California. *Studies Avian Biol.* 16:66–74.
- Hargis, C. D., and Woodbridge, B. 2006. A design for monitoring Northern Goshawks at the bioregional scale. *Studies Avian Biol.* 31:274–287.
- Howell, S. N. G., and Webb, S. 1995. *A Guide to the Birds of Mexico and Northern Central America*. Oxford Univ. Press, Oxford.
- Iverson, G. C., Hayward, G. D., Titus, K., DeGayner, E., Lowell, R. E., Crocker-Bedford, D. C., Schempf, P. E., and Lindell, J. 1996. Conservation assessment for the Northern Goshawk in southeast Alaska. Gen. Tech. Rep. PNW-GTR-387, U.S. Forest Serv., Pac. Northwest Res. Station, Portland, OR.
- Joy, S. M. 2002. Northern Goshawk habitat on the Kaibab National Forest in Arizona: Factors affecting nest locations and territory quality. Ph.D. dissertation, Colorado State Univ., Fort Collins.
- Keane, J. J. 1999. Ecology of the Northern Goshawk in the Sierra Nevada, California. Ph.D. dissertation, Univ. Calif., Davis.
- Keane, J. J., Morrison, M. L., and Fry, D. M. 2006. Prey and weather factors associated with temporal variation in Northern Goshawk reproduction in the Sierra Nevada, California. *Studies Avian Biol.* 31:85–99.
- Kiff, L. F., and Paulson, D. R. 1997. Northern Goshawk breeding records from San Diego County, California. *W. Birds* 28:113–114.

- Lentz, J. E. 1993. Breeding birds of four isolated mountains in southern California. *W. Birds* 24:201–234.
- Maurer, J. R. 2000. Nesting habitat and prey relations of the Northern Goshawk in Yosemite National Park, California. M.S. thesis, Univ. Calif., Davis.
- McCoy, R. H. 1999. Effects of prey delivery on the fledgling success of Northern Goshawks. M.S. thesis, Humboldt State Univ., Arcata, CA.
- Newton, I. 1979. *Population Ecology of Raptors*. Buteo Books, Vermillion, SD.
- Remsen, J. V., Jr. 1978. Bird species of special concern in California: An annotated list of declining or vulnerable bird species. Nongame Wildl. Invest., Wildl. Mgmt. Branch Admin. Rep. 78-1, Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.
- Reynolds, R. T., Graham, R. T., and Boyce, D. A., Jr. 2006a. An ecosystem-based conservation strategy for the Northern Goshawk. *Studies Avian Biol.* 31:299–311.
- Reynolds, R. T., Wiens, J. D., and Salafsky, S. R. 2006b. A review and evaluation of factors limiting Northern Goshawk populations. *Studies Avian Biol.* 31:260–273.
- Richter, D. J. 2005. Territory occupancy, reproductive success, and nest site characteristics of goshawks on managed timberlands in central and northern California 1993–2000. *Calif. Fish Game* 91:100–118.
- Sauer, J. R., Hines, J. E., and Fallon, J. 2005. The North American Breeding Bird Survey, results and analysis 1966–2004, version 2005.2. USGS Patuxent Wildl. Res. Ctr., Laurel, MD. Available at www.mbr-pwrc.usgs.gov/bbs/bbs.html.
- Sauer, J. R., Schwartz, S., and Hoover, B. 1996. The Christmas Bird Count home page, version 95.1. USGS Patuxent Wildl. Res. Ctr., Laurel, MD. Available at www.mbr.nbs.gov/bbs/cbc.html.
- Saunders, L. B. 1982. Essential nesting habitat of the Goshawk (*Accipiter gentilis*) on the Shasta-Trinity National Forest, McCloud District. M.S. thesis., Calif. State Univ., Chico.
- Snyder, N. F. R., Snyder, H. A., Lincer, J. L., and Reynolds, R. T. 1973. Organochlorines, heavy metals, and the biology of North American accipiters. *BioScience* 23:300–305.
- Squires, J. R., and Kennedy, P. L. 2006. Northern Goshawk ecology: An assessment of current knowledge and information needs for conservation and management. *Studies Avian Biol.* 31:8–62.
- Squires, J. R., and Reynolds, R. T. 1997. Northern Goshawk (*Accipiter gentilis*), in *The Birds of North America* (A. Poole and F. Gill, eds.), no. 298. *Birds N. Am.*, Philadelphia.
- Stein, S. M., McRoberts, R. E., Alig, R. J., Nelson, M. D., Theobald, D. M., Eley, M., Dechter, M., and Carr, M. 2005. Forests on the edge: Housing development on America's private forests. Gen. Tech. Rep. PNW-GTR-636, U.S. Forest Serv., Pac. Northwest Res. Station, Portland, OR. Available at www.fs.fed.us/projects/fote/reports/fote-6-9-05.pdf.
- Unitt, P. 2004. San Diego County bird atlas. *Proc. San Diego Soc. Nat. Hist.* 39.
- Weber, T. T. 2006. Northern Goshawk (*Accipiter gentilis*) nesting habitat in northwestern California. An examination of three spatial scales: The nest area, the post-fledging area, and the home range. M.S. thesis, Humboldt State Univ., Arcata, CA. Available at <http://dscholar.humboldt.edu:8080/dspace/bitstream/2148/145/1/Final+draft5.pdf>.
- Widen, P. 1989. The hunting habitats of Goshawks *Accipiter gentilis* in boreal forests of central Sweden. *Ibis* 131:205–213.
- Woodbridge, B., and Detrich, P. J. 1994. Territory occupancy and habitat patch size of Northern Goshawks in the southern Cascades of California. *Studies Avian Biol.* 16:83–87.
- Younk, J. V., and Bechard, M. J. 1994. Breeding ecology of the Northern Goshawk in high-elevation aspen forests of northern Nevada. *Studies Avian Biol.* 16:119–121.