Golden Eagle (*Aquila chrysaetos*)

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Status

State: Fully Protected species

Federal: Protected under the Bald Eagle and Golden Eagle Protection Act

Population Trend

Global: Apparently stable in most areas of western U.S.; unknown elsewhere

State: Declining in southern California; common and presumably stable elsewhere in California

Within Inventory Area: Unknown

Data Characterization

Extensive long-term studies have been conducted on the distribution, demographics, and general biology of golden eagles (*Aquila chrysaetos*) in the vicinity of the ECCC HCP/NCCP inventory area as part of investigations on the impact of wind turbine operation on this species (see Hunt et al. 1998). These studies provide detailed information on the distribution and habitat-use patterns of resident and non-resident golden eagles, population structure, reproductive rates, survival rates, and population equilibrium dynamics.

A moderate amount of additional literature is available for the golden eagle outside the inventory area because it is a highly visible, fully protected bird of prey and top avian predator within its range. Most of the literature pertains to general natural history, behavior, distribution, and population changes in the past 30 to 40 years. Some information is available on demographics and population trends. Limited species-specific management information is available.

Range

The golden eagle is Holarctic in distribution. In North America, it breeds from northern and western Alaska east to the Northwest Territories, Canada, and south to southern Alaska, Baja California, the highlands of northern Mexico, west-central Texas, western portions of Oklahoma, Nebraska, and the Dakotas, and irregularly in eastern North America. The golden eagle winters in North America from south-central Alaska and the southern portions of the Canadian provinces south throughout the western breeding range and more rarely eastward (Johnsgard 1990).

Occurrences within the ECCC HCP/NCCP Inventory Area

The golden eagle is a resident breeder and migrant within the ECCC HCP/NCCP inventory area. The reproductive status of numerous nesting pairs has been monitored regularly within this general area (Hunt et al. 1998). The Contra Costa County Breeding Bird Atlas (http://www.flyingemu.com/ccosta/) shows additional breeding locations east and north of these areas.

Biology

Habitat

Golden eagles use nearly all terrestrial habitats of the western states except densely forested areas. In the interior central Coast Ranges of California, golden eagles favor open grasslands and oak savanna, with lesser numbers in oak woodland and open shrublands (Hunt et al. 1998). Secluded cliffs with overhanging ledges and large trees are used for nesting and cover. Nest trees include several species of oak (*Quercus* spp.), foothill pine (*Pinus sabianiana* and *P. coulteri*), California bay laurel (*Umbellularia californica*), eucalyptus (*Eucalyptus* spp.), and western sycamore (*Plantanus racemosa*) (Hunt et al. 1998). Preferred territory sites include those that have a favorable nest site, a dependable food supply (medium to large mammals and birds), and broad expanses of open country for foraging. Hilly or mountainous country where takeoff and soaring are supported by updrafts is generally preferred to flat habitats (Johnsgard 1990). Deeply cut canyons rising to open mountain slopes and crags are ideal habitat (Beebe 1974).

Breeding densities are directly related to territorial spacing and foraging requirements for the species. Territory size has been estimated to average 124 square kilometers (sq km) in northern California (Smith and Murphy 1973), but can vary largely with habitat conditions. Hunt et al. (1998) report an 820-sq-km area near Livermore supported at least 44 pairs of golden eagles in 1997, with a density of 1 pair per 19 sq km. This density is among the highest reported for the species.

Foraging

Golden eagles prey mostly on rabbits, hares, and rodents, but also take other mammals, birds, reptiles, and some carrion (Olendorff 1976, Hunt et al. 1998). California ground squirrels (*Spermophilus beecheyii*) and black-tailed jackrabbits (*Lepus californicus*) are the 2 most important prey species for the golden eagle within the inventory area (Hunt et al. 1998). Eagles typically hunt by using favorite perches located near areas that have regular updrafts to facilitate soaring to heights from which they can scan their hunting areas (Johnsgard 1990).

Reproduction

Nest building can occur almost any time of year (Brown 1976). Golden eagles prefer to locate their nests on cliffs or trees near forest edges or in small stands near open fields (Bruce et al. 1982, Hunt et al. 1995, 1998). Mating occurs from late January through August, with peak activity in March through July. Eggs are laid from early February to mid-May. Clutch size varies from 1 to 4 eggs, but 2 is the most common size (Brown 1976, Johnsgard 1990, Hunt et al. 1995). Incubation lasts 43–45 days (Beebe 1974), and the fledging period is about 72–84 days (Johnsgard 1990). The young usually remain dependent on their parents for as long as 11 weeks afterward. Breeding success tends to be variable depending upon local prey abundance. In a 15-year study of golden eagles in Oregon, Thompson et al. (1982) calculated a mean of 1.08 young fledged per breeding territory, 1.7 young fledged per successful nest, and 51% overall nesting success. Beecham and Kochert (1975) showed a similar average of 1.1 young fledged per nesting attempt, 1.8 young fledged per successful nest, and 65% overall nesting success in Idaho. More recently, Hunt et al. (1998) reported natality estimates of 0.64 and 0.58 young per pair for 57 and 59 pairs, respectively, in 1996 and 1997, within a 190-sq km wind resource area, a portion of which is within the ECCC HCP/NCCP inventory area. Brood sizes for this study varied from 1.44 to 1.62 fledglings per nest.

Demography

There are no published reports of the longevity of golden eagles in the wild. Captive golden eagles have lived to 48 years, but it is not likely that they live that long in the wild (Brown and Amadon 1968).

Behavior

Movement and Dispersal

Breeding golden eagles in the central Coast Ranges of California are mostly resident; juveniles may remain in the vicinity of their natal area until evicted by the parents. Floater non-breeding birds (adults without breeding territories) commonly move about regionally until they find a suitable vacant territory or are able to evict a territorial owner (Brown 1969, Hunt et al. 1995, 1998). Some migrants may temporarily move into areas used by resident birds during the winter.

Social

Healthy golden eagle populations include 4 population segments: breeders, juveniles, subadults, and floaters (Hunt et al. 1998). Breeders are individuals 4 years old or older that defend territories containing a potentially successful nest. Breeding pairs partition the landscape into a mosaic of territories that define the population density and size. Territorial boundaries tend to remain fairly stable from year to year (Marzluff et al. 1997). The size and density of territories is a function of either food or nest-site availability. During years of low prey

availability, eagles may forgo breeding but still occupy and maintain their territories.

Juveniles are eagles less than 1 year old; subadults are 1, 2, and 3 years of age. The existence of floaters is an indication that all habitat suitable for breeding is occupied by territorial pairs (Hunt et a1. 995, 1998). Floaters act to maintain the breeding segment of the population by replacing breeders that have died. However, if the number of floaters is large relative to the number of breeders, floater competition for nesting territories may reduce the reproductive rate (Hansen 1987).

Ecological Relationships

Golden eagles are the top avian predator in the grassland/savanna ecosystem of the central Coast Range in California. They may directly compete with ferruginous and other smaller hawks for small mammals, and with California condors (*Gymnogyps californianus*) for carrion. Territorial interactions with other golden eagles may result in some fatalities.

Threats

Existing threats to golden eagle survival in the central Coast Ranges of California include both foraging- and nesting-habitat loss; human disturbance of nesting birds; and direct fatalities from wind turbine strikes, electrocution, and poisoning. An analysis of the causes of fatalities of 61 golden eagles radio-tagged and recovered in the Diablo Range from January 1994 to December 1997 (Hunt et al. 1998) showed that 37% were killed by turbine strikes, 16% by electrocution, and 5% by lead poisoning (Hunt et al. 1998). The remaining birds were lost due to shootings (2%), car strikes (5%), botulism (2%), territorial fights with other eagles (5%), collision with fences (3%), fledging mishaps (10%), and other unknown factors (15%)

Conservation and Management

Golden eagle management and conservation generally includes habitat management, population enhancement, hazard management, controlling human activity in sensitive raptor areas, and education. Cattle ranching throughout the central Coastal Ranges can benefit and be beneficial to the golden eagle if grazing is maintained at moderate levels that stimulate growth of herbaceous foods used by primary prey species, including ground squirrels and rabbits (Hunt et al. 1995). In this area, ground squirrel populations are reported to reach their highest densities in areas of low grass height typical of grazed lands. Cattle ranching also provides eagles a source of carrion from dead cows, stillborn calves, and placentas.

Hazard management efforts that are being implemented to reduce wind turbine strikes include replacement of turbine models with fewer larger, but slower, ones that are less likely to strike soaring or hunting eagles.

Modeled Species Distribution

Model Description

Assumptions

1. Foraging habitat: All land cover areas except urban, aqueduct, aquatic, turf, orchards and vineyards.

2. Nesting habitat: Traditional nesting sites identified by researchers. Secluded cliffs with overhanging ledges and large trees adjacent to suitable foraging habitat. (not mapped)

Rationale

In the interior central Coast Ranges of California, Golden eagles use nearly all terrestrial habitats except urban, aquatic, turf, orchards, vineyards, and densely forested areas. Golden eagles favor open grasslands and oak savanna, with lesser numbers in oak woodland and open shrublands (Hunt et al. 1998). In Contra Costa County, there are numerous traditional and stable nesting sites and territories of Golden eagles (T. Hunt, pers. comm.).

Results

Figure 2 shows the modeled potential habitat of the golden within the inventory area. The habitat is very large, encompassing most of the inventory area. The documented occurrences of golden eagle include both verified nesting sites and estimated territory areas. Foraging ranges greatly exceed these areas. The known occurrences of golden eagles in east Contra Costa County fall within the modeled habitat.

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