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### Distribution and Density of Prairie Falcons Nesting in California During the 1970s

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The Prairie Falcon (*Falco mexicanus*) is endemic to western North America, and although extensively studied, questions still remain regarding distribution of nesting territories and density throughout its range. Information on Prairie Falcon nest site distribution and densities in California was limited prior to 1970. Grinnell and Miller (1944:108) stated that Prairie Falcons were "extensive throughout the state save in northwest humid coast belt. Metropolis appears to lie in southeastern desert and thence northwest along inner coast ranges." Miller (1951) used 3 methods to analyze California avifaunal distribution — life zone, biome, and biotic province — but did not specifically examine the distribution of Prairie Falcons statewide based on vegetational schemes. In 1971 the California Department of Fish and Game began a two-year statewide survey of Prairie Falcon nesting sites (Garrett and Mitchell 1972) that yielded comprehensive distribution data and provided impetus for more surveys. Here we report on Prairie Falcon nesting distribution and densities in California, and on the unusually low nesting density in northwestern California that *may be* the result of (1) interspecific competition with increasing numbers of Peregrine Falcons (*Falco peregrinus*), and/or (2) the presence of unsuitable foraging habitat.

Garrett and Mitchell (1973) provided us with 256 nesting territory locations that were originally obtained from ornithologists, egg collectors, museums, falconers, state and federal biologists and personal records. A territory was defined as an area 1 km in diameter that may have one or more alternate nest sites located within it. The existence of a territory was confirmed when (1) a pair of adults was found defending a specific location during the nesting season, (2) adults were observed incubating or brooding young in or on a ledge-pothole-cavity-or stick nest, (3)

when young were observed at a nesting site or (4) when recently fledged young in family groups were located. A territory was "active" when any of the aforementioned criteria were observed in subsequent years and inactive if falcons were not found. Visits to territories in following years revealed that alternate nest locations were sometimes used. When Prairie Falcons shifted nest site locations within the original 1 km diameter area of the territory we treated the nest as being within the same territory if no other Prairie Falcons were present within 1 km of the nest. Infrequently, two or more pairs of Prairie Falcons nested simultaneously within 1 km of each other and 1 km territories overlapped.

We added to Garrett and Mitchell's data base during the 1970s by conducting surveys, during the nesting season, of potential nesting areas using helicopters (after 1976), automobiles, motorcycles and by searching on foot. Additional records of Prairie Falcon nesting territories were obtained from the California Department of Fish and Game and other biologists working for state and federal agencies. Territories were plotted on U.S.G.S. topographical maps (1:64,000) and deposited with the Western Foundation of Vertebrate Zoology, Los Angeles, California.

The entire state was examined during the 1970s (1970-1979) for nesting Prairie Falcons. Our original intent was never to locate every single territory in the state. However, as we worked during the 1970s we were able to cover the entire state in great depth. We were not able to examine (in depth) the entire state in any single year and we did not have the manpower to visit all known territories in a single year. Furthermore, even with the use of helicopters, we could not be certain that we located all territories within every habitat type visited as Prairie Fal-

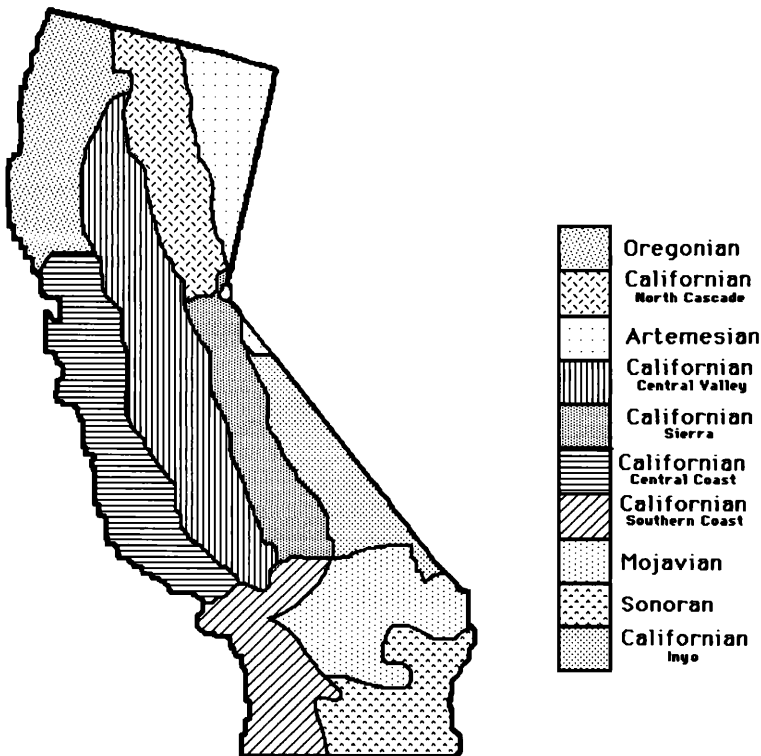


Figure 1. Biotic provinces of California (after Dice 1943). Within the Californian Province floristic regions are designated (after Stebbins and Major 1965).

cons were not always present at each territory every year. Although our nesting densities were not absolute (i.e., conservative estimates because of variable sampling intensities), they do provide for meaningful density comparisons by biotic province. We examined new areas each year and reexamined areas previously covered until the end of the 1970s. Our search image for nests was biased in that we examined only geologic formations for nesting pairs. We did not attempt to locate tree-nesting falcons (MacLaren et al. 1984) or falcons nesting on man-made structures (Boyce et al. 1980). We examined all territories reported on here at least once during the 1970s.

We report our findings by biotic province (Dice 1943, Fig. 1), which is similar to the U.S. Forest Service's ecoregions of the United States (Bailey 1980). Biotic provinces are delineated for all of North America and provide a means for researchers to report future comparative densities for the remaining biotic provinces. We subdivided the California Province, because of its recognized floristic heterogeneity, and reported nesting densities within it by floristic region (Stebbins and Major 1965). The number of territories reported for each area is the maximum count made during the entire study period.

Prairie Falcon nesting territories were distributed unevenly throughout California, but the mechanism(s)

causing the uneven distribution remains unknown (Table 1). More than 1,250 nesting attempts were observed at 520 nesting territories during the 1970s. The greatest number of active territories observed in a single year was 300 in 1977. During 1977, only 60% of the known territories were visited. Based on the number of territories found active in 1977, we estimate between 300-500 breeding attempts may occur annually within the state. Garrett and Mitchell (1973) provide data that showed an average of 2.18 fledglings were produced per pair studied statewide for a 3-year period. Based on 300-500 pairs of falcons attempting to nest each year, we estimate that between 650 and 1,100 fledgling falcons may be produced annually in California.

Greatest densities of nesting Prairie Falcons were found in the Mojavian Province (Mojave Desert) and central coast of the Californian Province (Table 1). During the latter part of the 1970s, historical nesting territory occupancy rates and fledgling productivity rates for the Mojave Desert were down (Boyce 1982) from those observed earlier by Garrett and Mitchell (1973). In contrast, the central coast population experienced an increase in number of occupied territories during the 1970s (Garrett and Walton unpub. data). The major difference between the two areas was that the Mojave Desert remained in

Table 1. The distribution and density of Prairie Falcon nesting territories in California by biotic province (shown bold; Dice 1943). Distribution and density of nesting territories by floristic region (Stebbins and Major 1965) within the Californian province are given.

BIOTIC PROVINCE	NESTING TERRITORIES (PER BIOTIC PROVINCE)	AREA (KM <sup>2</sup> )	KM <sup>2</sup> /TERRITORY
<b>Mojavian</b>	<b>91</b>	<b>23,210</b>	<b>255</b>
<b>Artemisian</b>	<b>63</b>	<b>22,600</b>	<b>359</b>
<b>Californian</b>	<b>332</b>	<b>267,080</b>	<b>804</b>
Central Coast	136	47,920	352
Central Valley	78	59,390	761
Inyo	39	34,520	885
Southern Coast	44	47,500	1,080
Cascade/N.Coast	30	34,370	1,146
Sierra	5	43,380	8,676
<b>Sonoran</b>	<b>25</b>	<b>29,450</b>	<b>1,178</b>
<b>Oregonian</b>	<b>9</b>	<b>55,000</b>	<b>6,111</b>
<b>TOTALS</b>	<b>520</b>	<b>397,340</b>	<b>764</b>

public ownership (U.S. Bureau of Land Management) while the central coast remained in private ownership. Land use policies differ drastically between the two areas. Private land owners in the central coast prevented high levels of human disturbance from occurring. In contrast, the Bureau of Land Management's multiple land use philosophy for the Mojave Desert resulted in nesting Prairie Falcons being subjected to tremendous human disturbance, and fledgling productivity rates were significantly lower for nests located near roads versus nests away from roads (Boyce 1982).

Northwestern California (west of longitude 123) had the lowest nesting density within the state despite an abundance of cliffs. Data suggest their absence in northwestern California *may be* due in part to interspecific competition with Peregrine Falcons for nest sites and lack of suitable foraging habitat. Walton (1978) observed two adult peregrines attack and apparently kill a Prairie Falcon flying near the peregrines' nest site in northwestern California. Northwestern California contained the greatest density of nesting peregrines remaining in the state and, during our study, their density slowly increased as the population recovered from presumed DDE poisoning (Monk 1981). However, interspecific competition for nest sites may not be important throughout the state. Dixon and Bond (1937) reported that Prairie and Peregrine Falcons nested concurrently on the same cliff near Tule Lake in northeastern California. We have also observed both species nesting in close proximity in other areas of the state. Presence of nesting peregrines and Prairie Falcons on the same cliff may be understood in

terms of habitat (no trees in sagebrush habitat) that apparently was conducive to hunting success of both species. At Tule Lake, Prairie Falcons primarily hunt ground squirrels (Haak 1983) while Peregrine Falcons probably captured exclusively birds.

Even where Peregrine Falcons were not occupying suitable cliffs (cliffs having ledges or potholes available) in northwestern California, Prairie Falcons were still absent. Unsuitable hunting habitat, in addition to interspecific competition, may have been a factor limiting Prairie Falcon densities since northwestern California is primarily forested with scattered open meadows. In northwestern California Peregrine Falcons often forage over forested valleys (Enderson and Kirven 1983) and river systems for avian prey that is attacked and captured in air (Hoddy pers. comm.). Prairie Falcons, on the other hand, generally hunt over unforested habitats for birds, mammals and reptiles, capturing prey mostly on or near the ground (15-100 m; Brown and Amadon 1968). In the Mojave Desert, Prairie Falcons have been observed to hunt, attack, and capture prey while within 10 m of the ground (Harmata et al. 1978; Boyce pers. obs.). The greatest nesting density of Prairie Falcons within California occurs in areas having few trees. Prairie Falcons, therefore, may be maladapted for exclusive predation on birds in forested habitat types.

Nesting densities and productivity rates have been reduced by urban sprawl in some areas (Boyce and Garrett 1977). Prairie Falcon distribution statewide, however, did not appear to be seriously affected during the 1970s, because (1) Prairie Falcons continued to occupy territories

that had a history of use in the last 30 years, (2) most territories studied by Garrett and Mitchell (1973) remained active until the end of the 1970s and, (3) during the later part of the 1970s we found additional territories in the same areas that had previously been examined.

Newton (1979) stated food or nest site availability set the upper limit of raptor pairs in an area. Undoubtedly, suitable habitat (unforested) with adequate nesting cliffs and ample vulnerable prey were fundamental factors involved in determining distribution and density of Prairie Falcons in California during the 1970s. Other factors possibly influencing Prairie Falcon distribution and abundance between and within biotic provinces were rainfall pattern and human population levels. We did not attempt to quantify cliff availability, prey availability or rainfall pattern and these were undoubtedly ultimate factors affecting distribution. There were definite differences in density of human populations in different areas. Northwestern California has few nesting Prairie Falcons and relatively low numbers of people. The Mojave Desert had high numbers of nesting falcons and low numbers of resident humans. However, an incredible number of recreationalists poured out of the megalopolis of Los Angeles and inundated the Mojave Desert during weekends, holidays and summer vacations. Lowered fledgling productivity in the Mojave Desert is attributed to high levels of human disturbance (Boyce 1982).

Prairie Falcons will occupy the same nesting territory year after year (not necessarily the same pair), but nest locations within territories may change. In some cases territories will remain unoccupied for 4-5 yrs in a row and then be reused. Data on nesting territory use through the years is important for: (1) determining the potential quality of individual territories by examining occupancy rates of territories between and within provinces, (2) examining use of alternate nests within the territory over time to determine critical habitat, (3) observing fledgling production through a series of years to determine levels of harvest or accessing population health, (4) observing how varying levels of human disturbance influence occupancy and reproduction and (5) assisting land managers in making informed decisions regarding land use practices.

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