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ELEVATIONAL DISTRIBUTION OF CALIFORNIA GNATCATCHERS IN THE UNITED STATES

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Abstract.—Known occurrences of California Gnatcatchers (*Polioptila californica*) in the United States were mapped relative to the 250-m, 500-m and 750-m elevation contours of southern California. Of 324 sites where this seriously threatened species was recorded from 1960 to 1990, 84% were located below 250 m elevation, and 97% occurred below 500 m. A total of 69 historic (pre-1960) sites showed a similar elevational pattern. These results indicate that previous estimates of the range of the northern, nominate subspecies were probably excessive, and that protection of coastal sage scrub habitat located above 250 m (in regions within 35 km of the coast) or 500 m (inland regions) may not significantly contribute to California Gnatcatcher conservation efforts. Furthermore, using the 250-m and 500-m elevation contours as approximate indices of the potential extent of the species' range in northwestern Baja California, approximately 65–70% of the historic distribution of *P. c. californica* may have been located in the United States.

DISTRIBUCIÓN ALTITUDINAL DE *POLIOPTILA CALIFORNICA* EN LOS ESTADOS UNIDOS

Sinopsis.—Se localizaron en mapas los lugares en donde ha sido informada en territorio de los Estados Unidos la Perlita de California (*Polioptila californica*) en relación a los contornos de elevación de 250 m, 500 m, y 750 m en el sur de California. De los 324 sitios en donde esta especie (seriamente amenazada) fue encontrada entre 1960 y 1990, el 84% correspondió a localidades por debajo de los 250 m de elevación, y el 97% por debajo de los 500 m. Un total de 69 registros históricos (antes de 1960) muestran un patrón similar. Estos resultados indican que los estimados de la distribución de la subespecie nominal (del norte), fueron probablemente excesivos, y que la protección del habitat de matorral costero localizado por debajo de los 250 m (en regiones dentro de un radio menor a los 35 km de la costa), o 500 m (en regiones interiores) no contribuirán significativamente a los esfuerzos de conservación de esta especie. Además, usando los contornos de 250 mm y 500 m como indicadores potenciales de la distribución de esta especie en el noroeste de Baja California, aproximadamente el 65–70% de la distribución histórica de *P. c. californica* probablemente ha estado localizada en los Estados Unidos.

The California Gnatcatcher (*Polioptila californica*) was recently recognized as specifically distinct from the Black-tailed Gnatcatcher (*P. melanura*) of the Sonoran and Chihuahuan deserts of North America (American Ornithologists' Union 1989, Atwood 1988). Although commonly and widely distributed in many of the lowland, arid regions of Baja California, the current United States range of the species is extremely localized, being entirely restricted to small fragments of coastal sage scrub that occur in the increasingly urbanized southern California counties of Los Angeles, Orange, Riverside and San Diego (Atwood 1980, 1990). Kirkpatrick and Hutchinson (1977:21) described coastal sage scrub as "one of the least known and fastest disappearing types of vegetation in California," and Westman (1987:134) believed it to be "one of the most endangered habitat types in the nation." Federal and State endangered

species listing of the California Gnatcatcher's northern subspecies has been recently petitioned by the Natural Resources Defense Council and Manomet Bird Observatory.

The California Gnatcatcher's northern, nominate subspecies, which occurs from coastal southern California south to 30°N latitude in Baja California (American Ornithologists' Union 1957, Atwood 1991), is similarly threatened in its Mexican range by habitat loss caused by agriculture, grazing and urban development (Best 1983, P. A. Bowler, pers. comm.). Michael Brandman Associates (1991) reported that no California Gnatcatchers were found in 1990 between Tijuana and Santo Tomas, a region of northwestern Baja California that represents approximately 40% of *P. c. californica*'s historic, latitudinal range in Mexico.

Atwood (1980, 1988) previously stated that *P. c. californica* was distributed mainly below elevations of 600 or 1000 m. These values, however, were based on the general limits of coastal sage scrub vegetation as defined by plant ecologists (Munz and Keck 1959), and failed to consider the possibility that California Gnatcatchers might not occur throughout all portions of this floristically variable (DeSimone 1989, O'Leary 1990, Westman 1983) plant community. In the present study we use current distributional information to examine the elevational limits of California Gnatcatcher distribution in the United States. Also, we apply these results to the question of whether the historic range of *P. c. californica* was located primarily in southern California or in Baja California, a potentially important issue in future discussions of whether this subspecies should be granted protection under the United States Endangered Species Act.

METHODS

Data concerning historic (pre-1960) and recent (1960–1990) records of California Gnatcatchers in southern California were obtained from museum specimens, literature accounts, public environmental review documents, field notes of ornithologists currently active in southern California, and the Natural Diversity Data Base of the California Department of Fish and Game (Atwood 1990). These data permit a more extensive analysis of California Gnatcatcher distribution in the United States than that provided by Atwood (1980). Observations were located to the nearest 1-min block of latitude and longitude, hereafter referred to as a "site." Latitude-longitude coordinates for historic records, which generally lacked precise locality data, could in most cases only be approximated.

Visual presentation of data and calculation of land areas were accomplished using the geographic information system CAMRIS (Computer Aided Mapping and Resource Inventory System; Ecological Consulting, Inc., Portland, Oregon). The 250-m, 500-m, and 750-m elevational contours were digitized from United States Geological Survey (USGS) 1:100,000 scale topographic maps; vegetation data for southern Orange County were based on the 1:125,000 scale Corona Quadrangle map prepared by the United States Forest Service (1940).

Unpublished documents cited in the text have been deposited in the

Wilson Ornithological Society's Josselyn Van Tyne Memorial Library, University of Michigan Museum of Zoology, Ann Arbor, Michigan 48109.

RESULTS AND DISCUSSION

The distribution of California Gnatcatchers in the United States is defined by relatively narrow elevational limits (Fig. 1). Of 324 sites of recent occurrence, 272 (84%) were located below 250 m elevation, 315 (97%) below 500 m, and 324 (100%) below 750 m (Table 1). The elevations of 69 approximately-located records of historic occurrence were consistent with those of recent observations; 65 (94%) of these sites occurred at elevations <500 m.

In areas of Los Angeles County, Orange County, and San Diego County located <35 km from the coast, 269 of 289 recent sites (93%) occurred at elevations <250 m. In Riverside County, located >35 km inland, 24 of 32 recent sites (75%) occurred at <500 m elevation, but only 1 (3%) occurred below 250 m. Destruction of coastal sage scrub vegetation from most lowland portions of this county has probably biased recent observations of California Gnatcatchers in this area toward elevations >250 m; nonetheless, the distribution of historic records from Riverside County suggests that the upper elevational limit of *P. c. californica* in inland areas is higher than in coastal regions (Table 1).

The exact ecological factors controlling the distribution of the California Gnatcatcher's northernmost, nominate subspecies are presntly unknown. Throughout its range *P. c. californica* is obligately associated with coastal sage scrub (Atwood 1980, 1988). Many areas of coastal sage scrub do not support California Gnatcatchers, however, and the range of *P. c. californica* is dramatically smaller than might be predicted from maps delimiting the distribution of this vegetation type (e.g., Mooney 1977). For example, the Venturan coastal sage scrub association (Kirkpatrick and Hutchinson 1977; Westman 1983), although including areas of known California Gnatcatcher occurrence in southern Ventura County and coastal Los Angeles County, was also described as extending north into Santa Barbara and San Luis Obispo counties, well beyond the northernmost limit of *P. c. californica* (American Ornithologists' Union 1957, Atwood 1991).

Even within the subspecies' range, not all areas of coastal sage scrub are occupied by gnatcatchers. For example, sizable portions of coastal sage scrub exist in southern Orange County at elevations >250 m; however, few California Gnatcatcher records are known from most of these areas (Fig. 2), despite considerable effort to locate the species (D. R. Bontrager, pers. comm.).

Nonetheless, elevation appears to be at least one factor that may serve to crudely evaluate gnatcatcher habitat suitability. We suspect that some type of transition in the structure and/or species composition of coastal sage scrub occurs near 250 m elevation in regions located <35 km from the coast, and that areas of this vegetation type that are located above this elevation are generally unsuitable for California Gnatcatchers. In

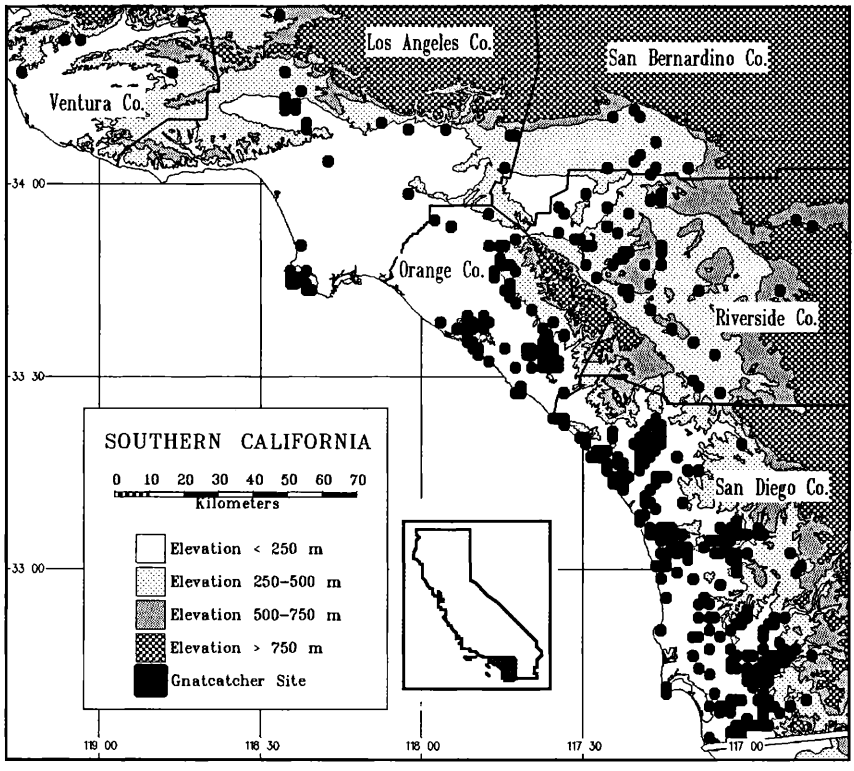

FIGURE 1. Distribution of recent and historic California Gnatcatcher records relative to three major elevation contours. Sites are mapped to the nearest 1-min block of latitude-longitude.

more inland regions this postulated habitat change occurs near 500 m elevation.

Further study of the precise ecological requirements of *P. c. californica* is needed, including possible floristic changes that may occur in coastal sage scrub at different elevations. Kirkpatrick and Hutchinson (1977, 1980) and Westman (1981) did not identify elevation as a significant predictor of most dominant plant species in the coastal sage scrub community. Many of the sampling localities used by these authors were not within the range of the California Gnatcatcher, however, and these analyses may have failed to detect ecological patterns relevant to the distribution of *P. c. californica.* Furthermore, although elevation may provide a broad index of habitat suitability, many areas of coastal sage scrub that are located below the 250 m or 500 m "limits" are also not occupied by gnatcatchers. Reasons for the species' absence from such sites are presently unknown, but may include a variety of factors such as slope, isolation

TABLE 1. Elevational distribution of recent and historic sites of California Gnatcatcher occurrence in southern California.

County	Type[a]	Elevation[b]		
		<250 m	250–500 m	500–750 m
Los Angeles	Recent (n = 11)	91	9	0
	Historic (n = 19)	63	32	5
Orange	Recent (n = 68)	88	12	0
	Historic (n = 2)	100	0	0
Riverside	Recent (n = 32)	3	72	25
	Historic (n = 11)	45	27	27
San Bernardino	Recent	—	—	—
	Historic (n = 9)	0	100	0
San Diego	Recent (n = 213)	94	5	1
	Historic (n = 23)	91	9	0
Ventura	Recent	—	—	—
	Historic (n = 5)	60	40	0
Total	Recent (n = 324)	84	13	2
	Historic (n = 69)	62	32	6

[a] Recent (1960–1990) and Historic (pre-1960) sites of California Gnatcatcher occurrence. Total number of 1-min blocks of latitude-longitude (n) given in parentheses. Locations of historic sites are approximate; all recent sites were exactly located on USGS topographic maps.

[b] Percent of total sites (n).

from adjacent patches of coastal sage scrub, fire history, bordering habitat type, or Brown-headed Cowbird (*Molothrus ater*) abundance.

Despite the fact that questions remain regarding the details of California Gnatcatcher habitat requirements, available data nonetheless have important implications for conservation planning efforts in southern California. In Orange County and the coastal areas of Los Angeles and San Diego counties, coastal sage scrub located above 250 m is unlikely to support populations of *P. c. californica*. In Riverside County and inland portions of Los Angeles and San Diego counties, California Gnatcatchers generally do not occur higher than approximately 500 m. Protection of coastal sage scrub above these elevations, although potentially valuable from the standpoint of maintaining connective corridors between otherwise isolated patches of lower elevation habitat, may contribute little to the long-term maintenance of viable gnatcatcher populations.

Much of southern California's remaining coastal sage scrub, especially that occurring at low elevations, is privately owned and subject to intense development pressures (Atwood 1990). Although a growing awareness of the conservation needs of the coastal sage scrub ecosystem has prompted increasingly frequent attempts to mitigate for habitat loss caused by construction activities, such efforts have often failed to protect adequately

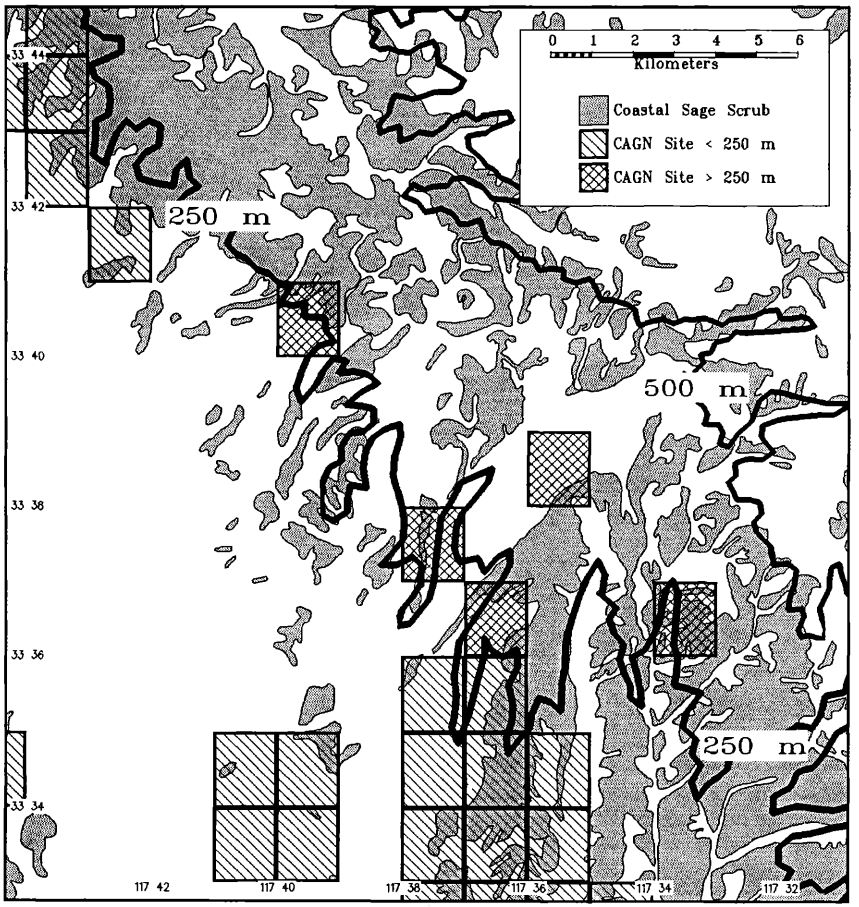

FIGURE 2. Distribution of coastal sage scrub in southern Orange County relative to elevation. Bold lines indicate 250-m and 500-m elevation contours. Vegetation map based on United States Forest Service (1940), with coastal sage scrub defined as areas dominated by *Artemisia californica, Salvia mellifera, Salvia apiana* or *Eriogonum fasciculatum*. Known sites of California Gnatcatcher (CAGN) occurrence mapped as 1-min blocks of latitude-longitude.

known gnatcatcher populations (Atwood 1990). Housing construction in southern California is generally focused in lowland areas, whereas sites designated for mitigation are often situated in areas of higher elevation that are more costly to develop, and less suitable for gnatcatchers. Consequently, areas of low elevation coastal sage scrub that are likely to support California Gnatcatchers are often destroyed during development projects, while areas of coastal sage scrub located at higher elevations, which are occupied by few, if any, gnatcatchers, are preserved (Atwood 1990).

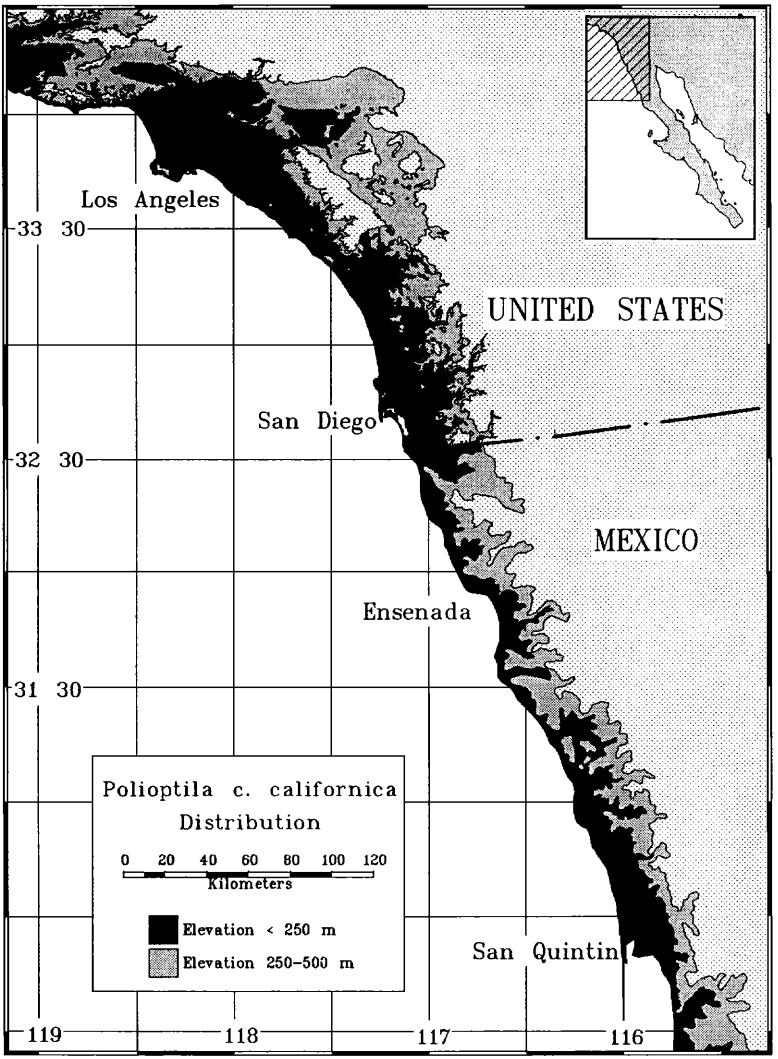

FIGURE 3. Maximum historic distribution of *Polioptila californica californica,* based on the 250-m and 500-m elevation contours and range descriptions provided by Grinnell and Miller (1944), American Ornithologists' Union (1957) and Atwood (1991). See text for further discussion.

The broad elevational patterns of California Gnatcatcher distribution also provide a method of addressing an issue of relevance to the proposed endangered species listing of the northern, nominate subspecies. The United States Endangered Species Act is seldom applied to species or subspecies that occur only marginally in the United States but which have

widespread, stable distributions in other countries. Should *P. c. californica* be considered a Mexican subspecies that only marginally extends into the United States, or vice versa?

California Gnatcatchers in northwestern Baja California are, like those of southern California, obligately associated with coastal sage scrub (Atwood 1980, 1988); the southern distributional limit of *P. c. californica* (American Ornithologists' Union 1957, Atwood 1991) is coincident with the southern terminus of this vegetation type (O'Leary 1990). Although the distribution of coastal sage scrub in Mexico is characteristically patchy and fragmented, there are no data to suggest that the degree of patchiness of this habitat differed historically between the United States and Mexico (Kirkpatrick and Hutchinson 1980; Atwood, unpubl. data; P. A. Bowler, pers. comm.). In fact, Mooney and Harrison's (1972) descriptions of coastal sage scrub near San Telmo, Baja California (31°N latitude) suggest that the distribution of this vegetation type in Mexico is controlled by similar ecological factors as in the United States. Therefore, we used the elevational characteristics of *P. c. californica*'s distribution in southern California to estimate the maximum, historic extent of the subspecies' range in Baja California, and to compare this value with a similar estimate from the species' range in the United States (Fig. 3). Calculations of land areas that have been defined by elevation contours obviously overestimate the extent of coastal sage scrub. Nonetheless, we believe that such measurements provide an index of the relative historic abundance of this habitat type, and probably of *P. c. californica,* in the United States vs. Mexico.

Geographic information system analysis indicated that approximately 6898 km^2 of low elevation (<250 m) land exists in the southern California range of *P. c. californica,* defined by Grinnell and Miller (1944) as "coastal southern California from the Mexican line northwest to the lower Santa Clara Valley, Ventura County, and eastward to San Gorgonio Pass." From the Mexican border south to the subspecies' southern limit at 30°N latitude (American Ornithologists' Union 1957, Atwood 1991), approximately 2869 km^2 of land <250 m elevation is present west of the Sierra San Pedro Martir. Using a more liberal definition of the California Gnatcatcher's elevational limits, approximately 12,930 km^2 of land <500 m elevation was calculated as occurring within the range of *P. c. californica* in the United States, as opposed to 6934 km^2 within the subspecies' Mexican range.

These results are consistent with Kirkpatrick and Hutchinson's (1977: 21) statement that coastal sage scrub covers "its largest area between San Diego and Ventura where it extends inland as far as San Gorgonio Pass." In northwestern Baja California, low elevation land that is most likely to support California Gnatcatcher populations is restricted to a narrow coastal strip that is bordered to the east by the abruptly-rising Sierra San Pedro Martir. In conjunction with Atwood's (1991) recommendation that the presently accepted (American Ornithologists' Union 1957) distributional limits of *P. c. californica* be maintained, these data indicate that

65–70% of the historic range of the California Gnatcatcher's nominate subspecies occurred north of Mexico.

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LITERATURE CITED

AMERICAN ORNITHOLOGISTS' UNION. 1957. Check-list of North American birds. 5th ed. American Ornithologists' Union, Washington, D.C. 691 pp.

———. 1989. Thirty-seventh supplement to the American Ornithologists' Union Check-list of North American birds. Auk 106:532–538.

ATWOOD, J. L. 1980. The United States distribution of the California Black-tailed Gnatcatcher. Western Birds 11:65–78.

———. 1988. Speciation and geographic variation in black-tailed gnatcatchers. Ornithol. Monogr. 42:1–74.

———. 1990. Status review of the California gnatcatcher (*Polioptila californica*). Unpublished technical report, Manomet Bird Observatory, Manomet, Massachusetts. 79 pp.

———. 1991. Subspecies limits and geographic patterns of morphological variation in California Gnatcatchers (*Polioptila californica*). Bull. S. Calif. Acad. Sci. 90:118–133.

BEST, T. L. 1983. Morphologic variation in the San Quintin Kangaroo Rat (*Dipodomys gravipes* Huey 1925). Am. Midl. Natur. 109:409–413.

DESIMONE, S. A. 1989. Classification and environmental relationships of coastal sage scrub at Starr Ranch Sanctuary, Orange County, California. M.A. thesis, California State Univ., Fullerton, California.

GRINNELL, J., AND A. H. MILLER. 1944. The distribution of the birds of California. Pac. Coast Avif. 27:1–608.

KIRKPATRICK, J. B., AND C. F. HUTCHINSON. 1977. The community composition of California coastal sage scrub. Vegetatio 35:21–33.

———, AND ———. 1980. The environmental relationships of Californian coastal sage scrub and some of its component communities and species. J. Biogeog. 7:23–38.

MICHAEL BRANDMAN ASSOCIATES. 1991. Unpublished job report: A rangewide assessment of the California Gnatcatcher (*Polioptila californica*). Prepared for the Building Industry Association of Southern California, Santa Ana, California; July, 1991.

MOONEY, H. A. 1977. Southern coastal scrub. Pp. 471–489, *in* M. G. Barbour and J. Major, eds. Terrestrial vegetation of California. Wiley, New York, New York.

———, AND A. T. HARRISON. 1972. The vegetational gradient on the lower slopes of the Sierra San Pedro Martir in northwest Baja California. Madroño 21:439–445.

MUNZ, P. A., AND D. D. KECK. 1959. A California flora. Univ. California Press, Berkeley, California. 1681 pp.

O'LEARY, J. F. 1990. Californian coastal sage scrub: general characteristics and considerations for biological conservation. Pp. 24–41, *in* A. A. Schoenherr, ed. Endangered plant communities of Southern California, Southern California Botanists Spec. Publ. No. 3. Rancho Santa Ana Botanic Garden, Claremont, California.

UNITED STATES FOREST SERVICE. 1940. Map of the vegetation types of California, Corona Quadrangle. Calif. Forest and Range Exp. Station, Cleveland Natl. Forest, California.

WESTMAN, W. E. 1981. Factors influencing the distribution of species of Californian coastal sage scrub. Ecology 62:439–455.

———. 1983. Xeric Mediterranean-type shrubland associations of Alta and Baja California and the community/continuum debate. Vegetatio 52:3–19.

———. 1987. Implications of ecological theory for rare plant conservation in coastal sage scrub. Pp. 133–140, *in* T. S. Elias, ed. Proceedings of the Conference on Conservation and Management of Rare and Endangered Plants. California Native Plant Society, Sacramento, California.

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INTERNATIONAL CRANE SYMPOSIUM

The National Audubon Society is sponsoring an international symposium entitled "People, Water and Wildlife: Human Population Impacts on Cranes" on March 23–24 in Kearney, Nebraska. The symposium will highlight crane and water experts from the U.S. and Asia, including Dr. Jim Lewis, National Whooping Crane Coordinator for the U.S. Fish and Wildlife Service, Ken Strom, Manager of Audubon's Rowe Sanctuary, Dr. Jonathan Cole, researcher for the Institute for Ecosystem Studies, Bijay Malla from Nepal's King Mahendra Trust for Nature Conservation, Dave Ferguson of the U.S.F.W.S. International Office, Gary Lingle of the Platte River Whooping Crane Critical Habitat Maintenance Trust, Jim Harris of the International Crane Foundation, Ross Lock of Nebraska Game and Fish Department, and crane experts from Russia, India and Pakistan. Audubon staff members will also discuss the issue of demographic pressures on wildlife and identify sustainable solutions. For additional information, contact Jim Connolly, National Audubon Society, 666 Pennsylvania Avenue, S.E., Washington, D.C., 20003. Telephone: (202) 547-9009. Fax: (202) 547-9022.