

THE MIDWINTER DISTRIBUTION OF THE CROW IN CALIFORNIA

WITH TWO ILLUSTRATIONS

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Crow distribution is a matter of both practical and scientific interest. Accordingly a survey of wintering crows in California was conducted during the years 1935-40, patterned after the New York State survey of 1932-33 (Emlen, 1938). Much information was obtained from the literature, from conversation and correspondence with field workers and from personal field observation. The main basis for the present report, however, is a state-wide survey conducted during the winter of 1937-38 with the cooperation of game wardens, county agricultural agents, farm advisers, high school instructors in vocational agriculture and many independent individuals. Each co-operator was presented with a questionnaire covering the midwinter (December-February) occurrence, distribution, flights, roosts, numbers and history of crows in his district. The response was generous: observations from over 1000 persons were incorporated in the 393 reports received; the 23 counties which contained more than a thousand wintering crows averaged 11.7 reports each. Grateful acknowledgment is hereby extended to members of the California Division of Fish and Game, the California State Department of Agriculture, the University of California Extension Service, the California Department of Education, and all independent observers who cooperated in supplying information.

Regardless of the experience and reliability of the observer, estimates of numbers in crow flocks are always susceptible to the "human factor," and no claims are made here for great accuracy in all figures presented. Areas from which seriously conflicting reports were received were rechecked by direct correspondence.

Summary of data.—The Western Crow (*Corvus brachyrhynchos hesperis*) ranges in suitable situations through western North America from central British Columbia, southern Saskatchewan and Montana, south to northern Lower California and central New Mexico. In winter, certain of the colder and more heavily forested parts of this range are evacuated in favor of lowland agricultural areas and river bottoms from southern British Columbia to the Mexican border. California, although it lies entirely within the boundaries of this winter range, supports a rather sparse population of crows which, in the 1937-38 survey, totaled about 82,000 individuals. These were distributed among 68 population units or centers with from 50 to 20,000 birds in each (fig. 79). Each unit had one or more roosting sites which the birds used habitually or with but slight local shifts, and from which they foraged during the day for distances of up to 25 miles.

Population densities on these wintering territories varied from about 5 to 25 crows per square mile. Comparable density figures for New York State territories in 1932-33, ranged from 20 to 79 per square mile (Emlen, *loc. cit.*). Taking the state as a whole, California held only .52 crows to the square mile whereas New York had 4.6 and Connecticut about 16.0 (R. P. Allen, MS).

Geographic analysis.—The wintering territories of the crow in California may, for purposes of analysis, be grouped into five geographic regions: north coast, central coast, south coast, the Sacramento Valley, and the San Joaquin Valley.

The northern coastal region, extending for 300 miles from San Francisco Bay to the Oregon boundary, is more or less mountainous, and generally well forested with coast redwood, Douglas fir, yellow pine and incense cedar. About 6700 crows in 16 population centers (27 known roosts) were reported along the narrow alluvial valleys

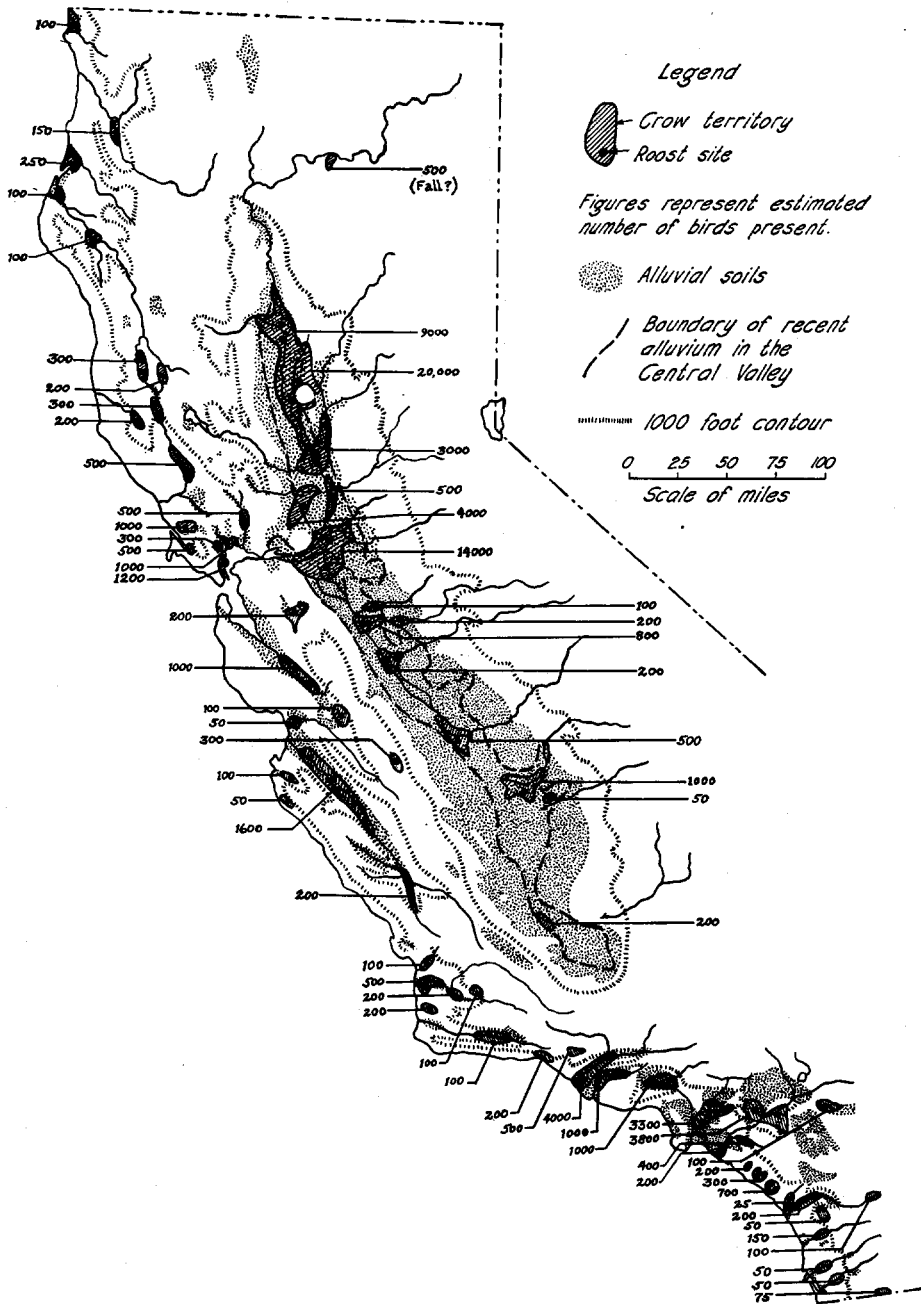


Fig. 79. Territories and populations of wintering crows in California, 1937-1938.

of coastal creeks and rivers. The heaviest concentrations were in Marin County at the southern end of the region (fig. 79).

The central portion of the coast, from San Francisco Bay to San Luis Obispo County, is 200 miles long. The terrain is hilly save for the Santa Clara and Salinas valleys. Total

annual precipitation is less than to the north, and the upland vegetation is largely chaparral (brush) and open oak groves. About 3600 crows were reported in 9 population centers (14 roosts) in this region. Three-fourths of these birds were located on the agricultural lands of the Salinas and upper Santa Clara valleys. Crows are absent from the northern part of this region which borders San Francisco Bay although they are quite numerous, as already pointed out, on the opposing Marin County shores just to the north.

The southern coastal strip of 300 miles, from southern San Luis Obispo County to the Mexican line, has a mountainous interior in which chaparral is the dominant vegetation type, and a coastal lowland, originally grass covered but now largely under cultivation. A total of 17,600 crows was reported from 27 population centers (44 known roosts) in this region, with the largest concentrations in the valleys of the Santa Clara, San Gabriel and Santa Ana rivers in Ventura and Los Angeles counties. The eight most southerly centers constituting the outposts of the winter range for the species, were all small, aggregating about 700 birds.

The Sacramento Valley is an almost uninterrupted lowland plain in the interior, 150 miles in length and 35 miles in width. Unlike the irregular and discontinuous habitat of the coast regions, the Valley provides a rather monotonous sweep of terrain, primitively in grass, now largely under cultivation. Crow flocks are larger there than elsewhere in California, and the roosting behavior is more like that to be seen in eastern and midwestern parts of the United States. About 50,000 crows, well over half of the State's total, were reported from 6 more or less confluent territories (8 roosts) in this region. One small group was reported to have remained in the Fall River Valley, Shasta County, at least into December.

The San Joaquin Valley is the southern portion of the great interior lowland. The natural vegetation does not differ markedly from that to the north, but there is less land under cultivation, precipitation is lighter, and surface water is inferior both in quantity and quality. The area is nearly half again as large as the Sacramento Valley, but only about 6 per cent as many crows were reported. These 3050 birds were found in 7 small population centers (8 roosts), mostly at the junctions of major rivers.

Historical record.—The locations and boundaries of winter crow territories in New York State in 1932 were essentially the same as those reported 25, 50, and, in one case, 125 years before (Emlen, *loc. cit.*). A similar permanency of range is indicated in the present California survey, although definite information in the literature is comparatively scarce. Of the 75 observers who commented on past conditions, 73 had noted a striking stability in local distribution winter after winter as far back as their recollections extended, which was from 5 to 50 years. Only two changes were reported: one roost near Long Beach, Los Angeles County, was abandoned about 1920 (Robertson, *corresp.*; also Robertson, 1931); another near Arlington, Riverside County, failed to form in 1937-38 (Gyger, *corresp.*). In both of these cases other roosts were situated within 12 to 15 miles so that the territorial changes were small. Thus, with the limited information in hand it appears that the midwinter range of the crow in California is essentially stable, and that the distribution as outlined in the present survey is typical of any winter season with but slight modification.

Statistics on crow numbers in the past are not available. In their absence we are obliged to refer to old-timers for comparative statements based on recollection. Such data are of dubious value in most instances, but collectively they may have some significance. Fluctuations from year to year were reported by a few of the 186 observers who commented on population changes, but most of the reports were concerned with comparisons of present and past (5 to 50 years ago) abundance. Of these, 67 reported

an increase, 27 a decrease, and 92 no change. A summary and evaluation of all these comments points to a general increase in the Sacramento Valley and the north coast region, particularly in Marin County, but little or no change in other parts of the State.

DISCUSSION

It is not possible to make a complete survey of the environmental factors which might influence the winter distribution of crows. A few of the more obvious items may, however, be considered in the light of information obtained in the present survey.

Climate.—Although climate probably plays a part in limiting the ultimate northward and southward dispersal of the crow as a species, it seems to have very little bearing on the location and conformation of the occupied range in California. The Lower Sonoran, Upper Sonoran and Transition life-zones, as mapped by Grinnell (1935), all contain crows in winter, yet in each of these the distribution is extremely patchy. It is barely possible that winter temperatures account for the absence of crows in the north-eastern (average 25° F.) and southeastern (average 55° F.) corners of the state, but they cannot explain the irregular distribution elsewhere, for the species is quite eurythermic. There seems to be even less correlation with climatic factors other than temperature. Crows winter in places having a variety of atmospheric conditions, from the coastal areas of high humidity and precipitation to the arid plains of the San Joaquin Valley, and from the fog bound north coast where the sun shines for an average of only 4 hours per day in winter, to the valleys of San Diego County which at the same season receive 7.5 hours of sunshine per day (Kincer, 1928).

Altitude.—Of the 68 wintering territories in California, 60, including all of the larger ones, are situated below the 1000-foot contour. This restriction to low altitudes is probably a secondary relationship. Barometric pressure, *per se*, is not likely to be a factor (see Moreau, 1934, p. 53) and definitely cannot explain the irregularities of distribution in the lowlands. The small temperature differences between the "crowless" foothills and the inhabited valleys cannot be considered significant. Topographical and soil differences in hill and valley lands are probably more directly concerned with crow distribution and will be discussed presently.

Water.—Crows have access to fresh water in natural streams, rivers or sloughs in each of the 68 territories of the State. All sizable rivers have crow territories scattered along them in the lower altitudes and where the water is fresh. The absence of crows from the Suisun area is possibly attributable to the brackishness of the water there, for crows abound along the Sacramento River down to this point. High alkalinity of the water may possibly account in part for the absence of crows along the west side of the San Joaquin Valley.

Fresh water is probably an essential element of crow habitat. Such water, however, is available widely beyond the crow's range. The absence of the birds from all water courses on shallow soils and rocky areas suggests that the primary relationship is with the alluvium found in association with streams and rivers on the lowland plains rather than with the water itself.

Soils.—Crow distribution shows a significant correlation with the areas of deep alluvial soils of recent geological origin which cover only about one-tenth of the total surface of the State (fig. 79). The largest winter flocks are located on the broader expanses of soil of this description, and every territory reported has at least some of it. In many places the boundary line of crow range coincides with that of this soil type. The correlation, however, is far from complete, for there are large areas of deep alluvium on which there are no crows in winter.

Vegetation.—It is improbable that soil type in itself has any great significance to the crow except as it influences the vegetation. Recent alluvium of deep profile in California naturally produces a grassland association with open stands or widely scattered groves of oak trees, and with rows of cottonwoods and willows along the water courses. Just such an open country with a scattering of timber appears to be the natural winter habitat of the crow in California. The lack of trees on alluvium along the western side of the Sacramento Valley may account for the absence of crows there. The abundance of trees on the well watered alluvium of the north coast may explain the narrow restriction of crows in that region to the vicinity of clearings. "Parkland" associations containing what appears to be a suitable interspersion of trees and grass occur beyond the winter range of the crow in the shallow-soiled foothills and on many tracts of valley alluvium. Whether the absence of the birds on such areas is attributable to soil, water, a qualitative character of the vegetation, or some other factor is open to conjecture.

Vegetation probably exerts its greatest influence on a bird population through the food and cover facilities which it affords. Crows are notably adaptable with respect to both these factors, and it is difficult to see how either could be responsible for the restriction of the birds to a single more or less uniform habitat type. Perhaps this relation to the vegetation is due not to environmental pressures acting on the toleration limits of the species, but to an innate preference for a special habitat type such as has been described for certain British birds by Lack (1933, 1934, 1937). Elton (1930, p. 51) has indicated that a sense of "awareness of environmental harmony" probably has a wide application in the animal kingdom.

The relationship of the crow to vegetation in California has been immeasurably complicated by the drastic environmental disturbances produced by civilized man during the past hundred years of agricultural development and expansion.

Agriculture.—The close correlation of crow distribution with agriculture has been noted and discussed by numerous observers. Agricultural crops are extensively utilized by crows and, in fact, provide more than half of the food supply for the species (Kalmbach, 1939). Every crow territory in California includes some cultivated land; the largest ones are found on areas which are extensively cultivated (fig. 80C).

It is often assumed that this close relationship with agriculture is the result of a direct adaptation by the bird to the food supply provided by farm products. There is considerable reason to believe, however, that such is not the case, and that the fundamental relationship is with the land itself. The first line of evidence for this statement comes from the historical record which, as we have seen, points to a stable winter range extending back as far as the records go—5 to 50 years in California and up to 125 years in New York State. This covers a period during which agricultural developments have been extensive.

More definite evidence for the absence of any direct relationship of crow distribution with agriculture, is provided by statistics on the geography of important food materials. Grain, which today forms the largest item in the food of the species, is grown extensively on shallow-soiled foothill lands and on many alluvial areas which still remain untenanted by crows (fig. 80B). Nuts are eagerly taken by crows when available in their winter territories, but are untouched in the large orchards that lie beyond the limits of crow range, as in San Luis Obispo, Colusa, Contra Costa, and other counties (fig. 80A). Crows have benefited and, in certain areas, have increased under man's improvement of the natural range. They have, however, apparently failed to take advantage of new food supplies opened up for them during the past hundred years outside of this range.

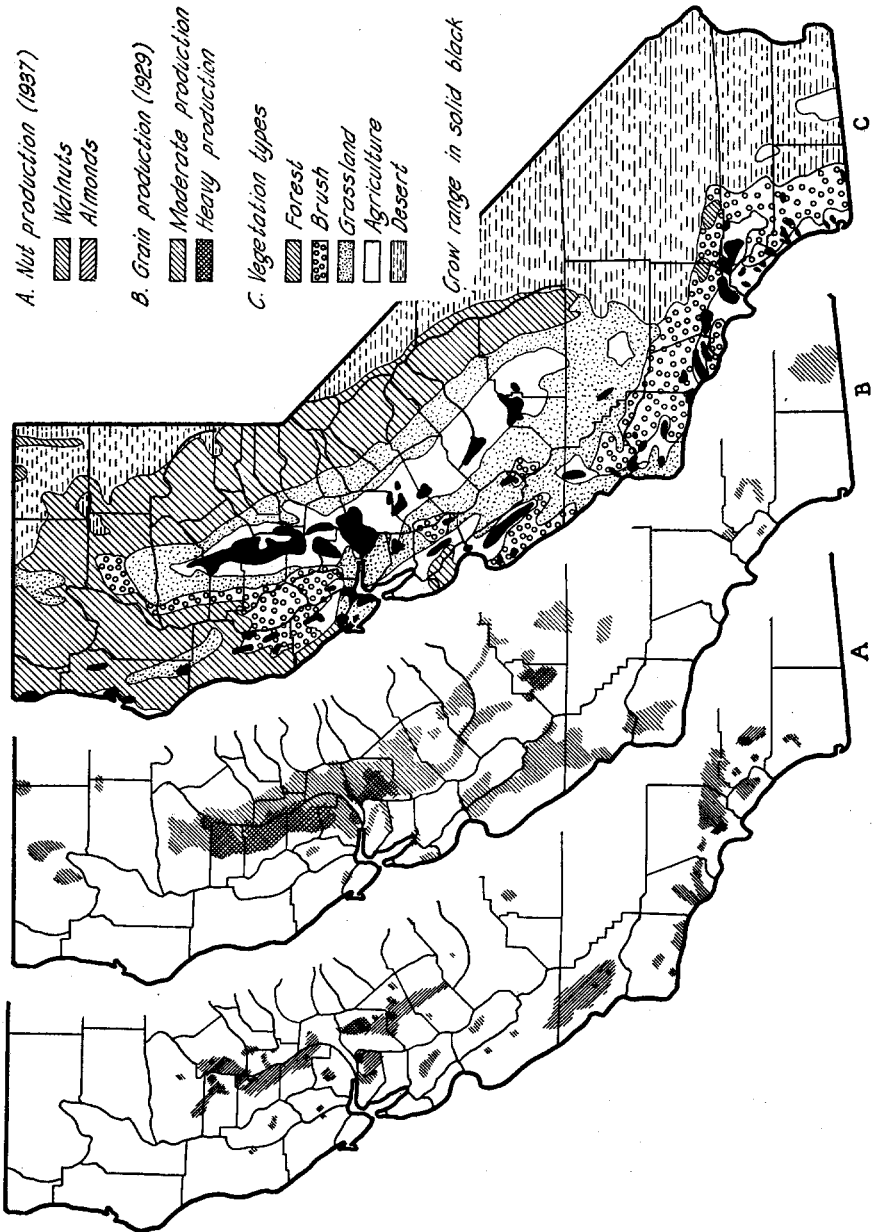


Fig. 80. Winter distribution of crows in California in relation to certain aspects of the vegetation.

Along with food-producing crops, agriculture has introduced broad irrigation ditches and scattered groups of shade trees into formerly arid and treeless plains, thereby creating a supply of water and arboreal cover as well as of food. There are numerous reclaimed areas of this type on good alluvial soils in the Great Central Valley, the Imperial Valley and elsewhere which, to the human eye, appear to afford the requisites of crow habitat, yet no birds are there. This might be more understandable in the case of a less adaptable species, but the crow has shown itself to be highly adaptable to environmental changes within the confines of its range.

Subjective factors.—From the foregoing account it appears that wintering crows adhere year after year to a rather definitely prescribed range despite the presence of preferred foods, cover, water and other attractive environmental features elsewhere. It is not likely that the birds have simply failed to discover these apparently suitable areas beyond their range, for crows migrate through and even nest on many of them. Some definite restraining factor seems to be involved. It is conjectured that this factor is an innate drive to return each winter to established (familiar) territory.

For many years it has been recognized that animal distribution is a dynamic and not a static phenomenon. Grinnell (1914, 1917, 1928), Howell (1922, 1924) and others have pictured the centrifugal pressure by a species on the boundaries of its range, and the counter role of retaining barriers, either of the rigid physical type or of the more elastic climatic, associational and competition types. To this barrier concept Elton (1927) has added an innate factor acting in restraint of dispersal, a power of selection of attractive environment which tends to restrict the animal to areas in which optimum or at least favorable conditions prevail. The innate drive to return to traditional winter territories which we have just postulated for the crow is similar to this last-named "exercise of choice" factor proposed by Elton, but differs from it in emphasizing familiarity with territory as the principal objective rather than attractiveness of habitat.

Support for a non-environmental factor in bird distribution is provided by studies of the homing instinct in pigeons, and by demonstrations in recent years of the wide occurrence of the homing drive in wild birds. These studies have shown that strangeness of surroundings, such as would be encountered by a straggler beyond the boundaries of the familiar home range, is a prime incentive to homing flight (Whitman, 1919, p. 136), and that a particular locality implanted in the bird's nervous mechanism, not a habitat, is the goal. Schmidt (1930, p. 287) has postulated the importance of homing phenomena in the endemism of island avifaunas, stating that the homing instinct "may condition the return of wandering individuals and thus increase the effectiveness of their insular isolation" (Hesse, Allee and Schmidt, 1937, p. 126). This concept of a homing factor acting in restraint of territorial expansion should also be applicable to distributional problems on the continental mainlands where barriers are only slightly less definite to highly mobile animals. It should apply particularly to flocking species like the crow in which social bonds are highly developed.

SUMMARY

1. A survey of the midwinter crow population of California was conducted during the winter of 1937-38 with the cooperation of various state agencies. A total of 82,000 crows in 68 population centers was reported.
2. Population densities on California crow territories were low as compared with those recorded in the eastern states; they varied from 5 to 25 birds per square mile.
3. Territories were largest and populations heaviest in the Sacramento Valley. Flocks in the coastal regions were small and scattered except in the lowlands of Los Angeles and Ventura counties.

4. Crow populations have apparently increased in the north coast region and in the Sacramento Valley during the past 5 to 50 years but have not changed appreciably in other parts of California.

5. No appreciable changes in the location or conformation of the winter territories of crows have been noted in the past 5 to 50 years.

6. Climate apparently plays only a minor role in delimiting crow distribution in California.

7. Crow distribution shows definite but incomplete correlation with factors of altitude, water, soils, land cover and agriculture.

8. Crows have adapted themselves to environmental changes on their established winter territories, but have failed to extend their range on to areas supplied by agriculture with preferred foods, water and scattered timber.

9. Evidence is presented for the existence of an innate affinity or homing reaction to established territory which, independent of environmental factors, acts in delimiting the winter distribution of the crow in California.

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