

*Range Expansion and Population Increase
in North and Middle America
of the White-tailed Kite (Elanus leucurus)*

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Various human activities have had a drastically injurious effect on many birds of prey. It is therefore gratifying to observe a very recent and dramatic increase of a raptor which, not many years ago, was considered on the verge of extirpation in North America. May, "Hawks of North America" (1935: 7-11), wrote: "The White-tailed Kite . . . is today in very real danger of complete extirpation in the United States, where it is now very rare and local. *An earnest and immediate effort should be made to arouse public opinion, through education, to save the pitiful remnant of this beautiful species before it has completely vanished.*"

Status Before the 1960s

The entire breeding range of the North American population, *E. l. majusculus*, as given by May (1935), was reduced to w. California (from the Sacramento Valley to the San Diego region), the coast of extreme s. Texas, and the Gulf coast of Mexico. Formerly it had had a wider range in s. United States; several nestings were on record for Florida (the latest in 1910; see Sprunt, 1954), and one in 1860 for Oklahoma (Sutton, 1964). The A.O.U. Check-list (1957) included British Honduras (see also Russell, 1964) in the range of the kite, and stated that it occurred occasionally in Guatemala (actually there was only one record, dating back to the 1850's; see Land, 1970).

The Mexican check-list (Friedmann, Griscom and Moore, 1950) mentioned occurrences

for Mexico in "Baja California (no record since 1903), Nuevo León, Tamaulipas, Veracruz (breeding) Tabasco, Campeche (breeding)." Paynter (1955) included a record from Quintana Roo. In adjacent British Honduras, in addition to earlier records, the species was observed frequently from 1956 on (S. M. Russell *in litt.*). For Central America south of Guatemala there was not a single specimen record or reported sighting, nor any for Panama (Friedmann, 1950; Eisenmann, 1955; Wetmore, 1965).

The White-tailed Kite had been considered common and widespread in the lowlands of California prior to about 1895, but was "now rare or entirely gone from many sections," (Grinnell and Miller, 1944). Hoffman (1927) had expressed the opinion that no more than fifty pairs survived in California. By the 1940s a slight trend towards recovery in area and numbers had been observed, and increasing numbers were observed during the 1950s. For Texas, Wolfe (1956) reported no improvement, considering the kite restricted as a breeder to the extreme southeast.

In South America the population called *E. l. leucurus* (subspective division of the American birds has recently been questioned), has long been known to breed in the warmer parts of the temperate southern half. The many scattered records from tropical n. and e. South America were regarded by Hellmayr and Conover (1949: 15-15) as probably involving migrants from either south or north. However, the kite has been found to nest in Venezuela

(Schäfer and Phelps, 1954) and in Surinam (Haverschmidt, 1959). In Trinidad it is apparently an occasional wanderer from the mainland (R.P. French *in litt.*).

Status from the 1960s to the Present

By the 1960s, a very great population increase and range expansion had become apparent in California, (Fry, 1966; see *Audubon Field Notes* Vol. 21, No. 2). Even more startling was the extension of range (including the breeding range) through the Central American countries and Panama, where the species historically had been unknown. This increase is worth documenting, both for its speed and the sudden appearance southward. Panama, however, (despite resident bird students and numerous visiting ornithologists and birdwatchers almost continuously since early in this century), was the last of the Middle American countries in which the White-tailed Kite was noted (1967). In view of studies in progress, and the availability of literature commenting on the increase in California, I shall mention the situation in the United States in less detail, mainly with the purpose of shedding light on possible causes of range extension elsewhere.

United States. Today in California the White-tailed Kite is, for a raptor, a common species of open and cultivated bottomland with scattered trees, and on grassy foothill slopes interspersed with oaks (or their cultivated equivalents). A useful summary of the changing status there is provided by Waian and Stendall (1970). In their study, relating to the Santa Barbara area, they effectively used the 1961-67 Christmas Bird Counts (*infra* "CBCs") published in *Audubon Field Notes* for that locality. As this kite is regarded as essentially a resident species, a careful analysis of the CBCs from California and Texas (and any other area from which the kite may be reported) would be revealing as to population trends, and suggestive of future range extensions. Recent White-tailed Kite sightings (Mallette, mimeographed maps by Calif. Fish and Game Dept., 1967-70), as well as a hasty glance through the CBCs, suggest that the White-tailed Kite range is still expanding. In the 1970-71 CBCs a total of 626 were reported from California; these kites were observed in 27 of 52 California CBCs (R. S. Arbib, *in litt.*). The species has now been noted, at least occasionally, in most California counties, except where unsuitable mountain forest or desert prevail. Nesting occurred in

1969 even in the extreme northwestern Del Norte County (Hehnke, 1970), and during the period from May 1969–April 1970 personnel of the Calif. Fish & Game Dept., in the course of their routine work afield, came across 21 nests and reported 1499 sightings. Neither the CBCs nor these reports reflect total population (R. D. Mallette, *in litt.*), but indicate the increasing ease with which the kite can now be found in California.

Comparable data from Texas are not presently available to me. Davis (1966) considered the species extirpated by hunters as a breeder in the coastal part of the Rio Grande Delta Region, but said that it bred irregularly inland "in such remnant wooded spots as the Santa Ana Wildlife Refuge." CBC data and personal communications (L. R. Wolfe, J. J. Morony) do suggest some increase during the past few years in southern Texas. Of 51 Texas CBCs in 1970-71, seven reported a total of 49 individuals (*Am. Birds* 25: 417-45). For the 1969-70 CBC period, only three of 50 counts reported the species, for a total of 15 individuals. (*Aud. Field Notes* 24: 373-99). Farther east, there have been a number of recent sightings in Florida (Hendrickson *et al.*, 1967) and one each for Georgia and Alabama (Miles, 1964).

Mexico. The kite is now commonly seen along the Gulf coast (where it has bred in the past), including eastern San Luis Potosí; recently it has been observed with increasing frequency in the more humid lowlands of the s.e. Pacific slope of Oaxaca and Chiapas, and has also been noted again in Baja California.

On trips along the Gulf coast in August 1966 and May 1967, Guy Tudor and his companions frequently saw White-tailed Kites along the highway from extreme s.e. San Luis Potosí, through Veracruz, to w. Tabasco; on August 9 at least 20 were observed (mostly in pairs) between Minatitlán and Cárdenas. While still unreported for most of the Pacific slope, it was observed in April 1947 in n.w. Baja California (Short and Crossin, 1967), has been repeatedly noted in Oaxaca since March 28, 1960 [dates ranging from August 1 to March 28 (Binford, 1968)], and although not recorded in the Chiapas check-list (Alvarez del Toro, 1964), now occurs there (Alvarez, *in litt.* 1966, Edwards, 1968).

British Honduras. Russell (1964) knew of only two specimen records prior to 1963, one of which was a female taken April 24, 1935, with ovary much enlarged, indicative of probable breeding. Since early 1956 the species has been reported seen regularly.

Russell (*in litt.*) had notes of observations for most months, starting with February 1956; he did not see this kite during his first trip in the spring of 1955. The *Belize Audubon Society Bulletin* indicates that observations of this species on field trips is usual, for it is listed, without comment, among species seen not far from Belize City on November 22, 1970, and six were reported on the CBC of January 9, 1971 (Young, 1971). Russell, (*in litt.*) mentions a number of sightings in the early 20th century.

Guatemala. The first record since the mid-19th century was of a female with enlarged ovary, taken by Kiff in July 1963 on the Pacific coastal plain; thereafter one was noted in Petén in May (Land, 1970). The Florida Audubon Society noted it at Sayaxche, Rio Pasión in February 1967 (M. H. Hundley). The scattered dates suggest a resident population.

Honduras. The first known sighting was on February 22, 1962; the first specimen was taken on September 19, 1962. Since the "fall" and "winter" of 1962-63 the species has been observed regularly in open country of both slopes; judging by dates of observation the kite is probably breeding (Monroe, 1968).

Extensive collecting was done by C. F. Underwood, resident from 1931-38, and by A. C. Twomey (1947-51). Other collectors and bird observers were in Honduras from the late 1940s into the 1960s. This kite was first noted by K. S. Hamilton in February 1962 at Liberia on the Caribbean slope, and collected there in September 1962. At this very locality, a bird student, M. Trafton, Jr., had been stationed from 1949 through 1961, without seeing the species (Monroe, 1968).

El Salvador. The first record was of a specimen taken on April 30, 1963 (Miles, 1964). Probably the species had appeared a year or two earlier, for P. Slud writes me that he saw one on February 3, 1962 while "travelling along the Pan American Highway from El Salvador to Honduras beside the Bay of Fonseca." It has been observed repeatedly during the late 1960s.

Exhaustive field work was done in this small country from 1925 to the early 1950s; but the published accounts do not mention this kite (Dickey and van Rossem, 1938; Rand and Traylor, 1954).

Nicaragua. The first record was of a specimen taken on February 23, 1961, at San Isidro, Matagalpa, by General M. Biddle (Bond, 1964). Since the "fall" months of 1961 the species has been regularly observed on both slopes (T. R. Howell, *in litt.*). Davis and Davis (1962) reported in *Audubon Field*

Notes a nest with young on March 5, 1962—the first definite breeding record for Central America.

During the 1920s W. de W. Miller and L. Griscom worked on the birds of Nicaragua. T. R. Howell has been visiting that country since the early 1950s, in connection with a projected distributional work. Howell's first personal observation was in late 1961. By April of the following year the species seemed more numerous, and he noted four in the Río Frío region near the Costa Rican border, and saw foraging birds cross the boundary.

Costa Rica. Slud (1964) believes that he saw a migrating flock as early as September 1, 1958 (see discussion below). He next noted foraging birds on April 6 and 7, 1962 in the Río Frío region, well inland, but on the Caribbean watershed. Wolf (1966) collected specimens and saw others in 1965 on the Pacific coastal region. Today the species is likely to occur anywhere in open or widely cleared lowlands, and has even been noted in the mainly forested n.e. Caribbean coast at Río Sarapiquí (Slud *in litt.*). Definite breeding data exist for the Pacific slope, with reproductive behavior observed as early as January 1965 (Slud).

Carriker's distributional book (1910), based on many years afield, and on collections by his many predecessors, does not mention this kite. On April 6 and 7, 1962, when Slud saw two or three in the Río Frío area, there were indications that the species was already locally established, for he was told by a Costa Rican that the species was regular in the San Carlos region to the east. In the Pacific northwest, at Tobago, Guanacaste, copulation was seen on January 26, 1965 (Slud), a recently fledged juvenal was found on January 1, 1967 (Orians and Paulson, 1969), and "courting" was noted on February 13 (J. R. Jehl, Jr. *in litt.*). In the Pacific southwest near Puerto Dominical, two fledglings were observed near a nest on April 27, 1970 (G. S. Keith and A. R. Keith, oral comm.).

Slud's (1964) report of a group of 30 "migrating individuals, both adults and immatures" on September 1, 1958 at Finca "La Selva" is intriguing, both because if correct it is the century's earliest sighting for a Central American republic, and because the species has not been reported to migrate (although it roosts in winter) in flocks. Omitted from Slud's earlier (1960) book because it was an unverified first record for Costa Rica, it raises interesting questions. Slud (*in litt.*) mentions seeing all the adult field marks except the shoulder patches, not visible because the kites were overhead, but his contemporaneous notes indicate the tails of the immatures as "many-banded." This description fits no specimen in the

series in the Am. Mus. of Nat. Hist., and suggests that White-tailed Kites might have joined a flock largely of *Ictinia* kites, possibly Mississippi Kites (*Ictinia mississippiensis*), a species which does migrate in flocks, but whose occurrence in Costa Rica was unrecorded until Slud provided the information (Eisenmann, 1963; Slud, 1964). The White-tailed Kite is certainly a wanderer, and pioneers probably find breeding grounds long distances from their place of origin, but it is not generally regarded as a migrant. However, it would not come as a surprise if part of the population, particularly some younger birds without established nesting territories, were migratory in a true sense; but this remains to be demonstrated.

Panama. The first reports, at opposite ends of the Pacific slope, were early in 1967: two at Finca San José (La Jagua marshes), east of Panama City, on January 11 (N. G. Smith), and two in w. Chiriquí near Concepción, on March 6 (Florida Audubon Society tour group; *vide* M. H. Hundley *in litt.*, C. H. Blake orally). The species was not noted again until the "fall" months of 1967, when it was repeatedly seen in the Pacific lowlands of w. Chiriquí, and in w. Bocas del Toro on the Caribbean slope (H. Loftin *in litt.*, based on reports of his banders; also V. H. Kleen). Since 1968 this kite has been widely distributed throughout extensively cleared areas and savanna grassland in the lowlands; in 1968 it was observed every month of the year. Breeding evidence: on July 14, 1970, in eastern Chiriquí, two full-grown immatures were perched giving food-begging calls, while below them in the same tree was an adult (E. Eisenmann, J. Gwynne, R. S. Ridgely, Mr. and Mrs. R. Sharp). Nest-building was observed near Aguadulce, Coclé, in February 1971 (R. Cooke; *vide* J. Pujals).

Most reports are from the Pacific lowlands of Chiriquí (once at 4200 ft.), Veraguas, Herrera, Coclé, and Panama provinces, as well as the Canal Zone, chiefly in cleared areas along the highways. Recent observations exist from the Caribbean coast of the Canal Zone and adjacent Colón province.

The situation in Panama is of special interest because the sudden appearance and extremely rapid increase are demonstrated not observational artifacts. The White-tailed Kite is conspicuous, unwary, and readily recognized; it frequents the open habitats regularly travelled by bird students. Since the Panama Canal opened in 1914, probably no neotropical area of comparable size has been more consistently worked by bird students. Let me comment only on the past twenty-five years. From the mid-1940s through the mid-1960s A. Wetmore and I visited Panama, usually at different seasons, almost

annually, and I have continued to do so. Many other persons interested in birds have been stationed in Panama for fairly lengthy periods, and there have been a number of ornithological visitors every year since at least the mid-1950s. Most people interested in birds who believed they had observed some unrecorded species have communicated with me, because of my Middle American list (1955), or, if not with me, with Wetmore. The organizations now called Smithsonian Tropical Research Institute and Florida State University Center for Tropical Studies have had on their staffs ornithologists resident in Panama, and since the early 1960s have brought down ornithological students acquainted with North American birds. Had this kite been resident in Panama before the mid-1960s it could not have been overlooked.

The kite is most often noted along the Inter-American Highway from east of Panama city, beyond the airport at Tocumen, westward to w. Chiriquí, a road used for many years by those going to the Chiriquí highlands in search of birds. Many bird students, watching for raptors en route, had travelled part or all of this road every year since the 1950s to 1967 without seeing the kite. As recently (before the first 1967 observations) as July 1964 and September 1965, N. G. Smith and I drove along this entire route both ways. The same bird-watching journey was made in November 1965 by E. S. Morton and P. A. Buckley. H. Loftin had bird banders in western Bocas del Toro during spring and fall migration from 1963 to 1965, and in October 1965 I passed a week there devoting much time to raptor migration. Yet from October 1967 White-tailed Kites were observed repeatedly in Bocas del Toro in the same areas where students in earlier years had spent months without seeing them.

I suspect that the kites entered Panama late in 1966. Neither Wetmore nor I visited that country in 1966, but ornithological trips, without seeing the kite, were made to w. Chiriquí and back in April by Morton, and in July by S. Olson; Loftin and G. V. N. Powell drove in September from the Canal Zone through Coclé to Herrera in the Azuero Peninsula; Smith and Morton also visited the grasslands east of Panama city in the first part of 1966. Although observations of two birds were made in the first quarter of 1967 at two places, both localities were visited by various observers (including myself) from February to May of that year without another White-tailed Kite report. Evidently the birds were scarce, if still present. It was not until early October 1967 that the species began to be reported regularly. An indication of the rapid increase thereafter is suggested by my experience on afternoon journeys from El Hato del Volcan, Chiriquí to the Canal Zone, on March 15, 1968 and on July 14, 1970, both times accompanied by R. S. Ridgely, and

specially watching for kites. On the earlier date we noted four, on the latter date nine or ten. Along a much shorter stretch of road, traversing in part rather marshy pasturelands, from Penonomé, Coclé to Santa María, Herrera, Ridgely counted 11 birds on August 2, 1968. N. G. Smith and I had spent two days in this area in 1964, H. Loftin and I had been there in 1965, Loftin and Powell in 1966, and Wetmore had collected in the area in 1948 and 1957—without seeing a single White-tailed Kite. At present writing (1971) this kite is one of the most widely distributed and conspicuous raptors of extensive semi-open and savanna country in Panama.

Possible Causes of the Increase

What caused the rapid buildup and range extension is a matter of speculation. In Middle America the effect is of a sudden population explosion. One might ask what caused the species almost to disappear from the United States, during the first quarter of the 20th century, after being fairly common in California until the 1890s (Grinnell and Miller, 1944). For much information and several ideas as to the species in California I am indebted to Peter L. Ames, who studied the kite in the San Joaquin River Delta during 1957 and 1968.

Improved Habitat

Ames (*in litt.*) believes that in the San Joaquin Delta of California the kite benefited greatly from the "fragmented agricultural pattern" and from year-round irrigation, which not only provided new habitat, but maintained through the winter a high mouse level in lush pasturage. Superficial examination of CBCs in *Audubon Field Notes* indicates an upward trend in California during the 1950s, but a possibly downward trend in Texas. During the 1960s the trend in both states was upward. For example, in the 1950-51 CBCs 9 kites were observed in Texas (in two counts out of 17), while only 8 were seen in California in four counts out of 19; in the 1959-60 CBCs none was reported from the 38 Texas counts, but in California 118 were totalled in 15 counts out of 33. The next two years CBCs are of interest because it was in these years that the species was first noted in many Central American countries. CBCs for 1960-61: Texas—11 kites in 3 counts out of 36; California—81 kites in 14 counts out of 36. CBCs for 1961-62: Texas—8 kites in one

count out of 37; California—154 kites in 14 counts out of 38.

In Middle America human activity during the years following World War II produced a great expansion in habitat suitable for the White-tailed Kite. Perhaps the most significant change resulted from the building during the 1950s and 1960s of the Inter-American Highway, and of tributary roads. These roads facilitated agriculture and their construction was followed or accompanied by extensive clearing of forest and woodland. The kite avoids areas that are excessively dry; in some comparatively arid areas, there has been irrigation, beneficial to the mouse population (and thus to the kite). While the White-tailed Kite needs trees for nesting and roosting, its hunting method requires at least partly open areas. Today road-building and clearing have provided the kite with practically continuous habitat from the United States well into e. Panama.

Growth of Public Sentiment Reducing Persecution

Although in many areas the habitat was greatly improved for this kite after World War II, it seems unlikely that in the early 1930s the habitats were less favorable in California than they were in the 1890s. Why did the kite population fall so drastically? I suspect as primary cause direct persecution by man. The species is notably unsuspecting and conspicuous—a tempting target for a country boy or man with a gun. California was being developed rapidly for agriculture during this period. Bird protection sentiment did not then embrace predators. Education in favor of raptors was a rather recent development. Until well into the 20th century hawks were generally regarded as inimical to man; they were not included in the protection of the Federal migratory bird laws nor of most state conservation laws. It has been suggested that taking of eggs by oologists may have played a part in reducing the kite population; I doubt its significance. Ames (*in litt.*) writes that when he was in California (during the late 1960s) the kite was rarely shot. Actually since 1957 California law has given strict protection to this species. The fact that it is shot at all now suggests what may have been the situation near the turn of the century, before there was extensive education to preserve the kite. During the second quarter of the century the rarity of the kite and its usefulness to man as a

rodent predator were well publicized. These factors, together with its beauty and ease of identification, helped it gain public sympathy. Reduction of human persecution, which had preceded legal protection, combined with "built in" adaptations for rapid increase, enabled the kite to take advantage of the habitat improvement.

Behavioral and Physiological Potential for Rapid Increase

Among American raptors the White-tailed Kite is exceptionally endowed for rapid population growth.¹

a. *Reduced territoriality.* In favorable situations the kite may breed semi-colonally. Ames in California found 6 nesting pairs in an almond-walnut orchard of 40-odd acres, and 18 pairs on a San Joaquin Delta island of 3 sq. m. which had been diked and drained, and was being farmed. He found more than 80 pairs in an area of ca. 50 sq. m. The orchard birds shared hunting areas; the island birds, confined to willows for nesting, were more territorial. Social tolerance increases after the breeding season. Young birds may feed together in numbers in mouse-rich localities. Roosts of over 100 individuals in winter are reported in California.

b. *High reproductive potential.* The clutch may run to four or five eggs; two clutches in one season may be reared; the incubation and fledgling period together require only about two and a half months (Brown and Amadon, 1968). As the species breeds in tropical and warm temperate regions the rearing successfully of two broods should often be possible. Available evidence indicates that north of the Equator the first clutch is laid early, often in February. Although proof is lacking, it seems likely that birds may reproduce the year following hatching, for the juvenal plumage is replaced by one similar to that of adults within a few months after fledgling.

c. *Tendency to wander.* As rodent populations fluctuate locally and seasonally, the kite is adapted to wander far in search of food. This is necessary for an essentially resident predator with a tendency to aggregate when conditions are highly favorable.

In any case immature birds must disperse to find breeding territory. In times of rapid population increase the surplus can be expected to go considerable distances and establish new breeding areas. Under natural conditions good habitat was probably widely scattered, so wide dispersal ability evolved.

d. *Immunity from the worst effects of pesticides.* The populations of some raptors have been drastically reduced by insecticides like DDT. The raptors most injured are those high on the "food chain," such as those eating birds, which in turn feed on insects—thus accumulating large quantities of poison. This kite feeds chiefly on herbivorous rodents. In this kind of raptor a poison such as DDT is not likely to accumulate in lethal quantities. A question arises as to whether such pesticides may even be indirectly beneficial to this kite by eliminating or reducing competitors; but there is no evidence to support this. An important competitor, for food at least, is likely to be a species similarly unaffected because of its diet.

Source of the Middle American Populations

The kite's sudden appearance in the early 1960s in Central American countries where previously unknown, and its rapid establishment as a breeder suggests an overflow from an area like California, where it had become abundant, and where, perhaps, there was already some population pressure. The data seem more consistent with such a push than with gradual range extension, or with migration and failure to return. Lacking banding data, I do not know whether California birds do go to the tropics. That they would have to cross unsuitable country in western or central Mexico would not be a problem for this species. All specimens taken in Central America have been identified as of the northern population, on the basis of tail length. It would be simpler zoogeographically if the overflow came from breeding populations of the Texas or Mexican Gulf coast, but the limited evidence available to me for this area does not indicate any substantial increase until after the first appearance of the kite in the Central American countries. Perhaps some student who has consistently worked e. Mexico through the 1950s and early 1960s can contribute information. One of the surprising aspects is that, south of British Honduras

¹ The situation of the Mississippi Kite is similar in many respects.

and Guatemala, the first observations as a resident in all Middle American countries (except Panama) were in 1961 or 1962. I suspect that an overflow must have entered Central America in 1960 or 1961. Curiously, the first 20th century record for Guatemala was in 1963, although Land (170: 22-24) indicates that there were a number of bird students visiting that country every year from 1958-62. This suggests that the extension of range was not a gradual north-to-south progression. The species reached Panama years after it was well-established in Costa Rica. Panama birds might have come from Costa Rica, or possibly from Colombia, but no specimen has yet been taken in Panama, so the race is undetermined. On the other hand, it seems to me not unlikely, because of the very considerable increase in the "fall" of 1967, that at least some of the birds derived from much farther north. The 1967-68 C B C s included 342 kites reported in 15 of 42 counts in California (158 on the Sacramento C B C alone).

Possible Resettlement of Former Range

The speed with which White-tailed Kites became breeders in s. Middle America leads one to wonder why they were not present all along in open or semi-open areas. That the South American population, widely separated until the 1960s from the North American population, differs so slightly that they may actually be a single form, suggests that at a time not far distant in the past they were in genetic contact. I have pointed out (Eisenmann, 1955: 7 and elaborated in a paper delivered at an A.O.U. meeting in 1966), that there are a number of species of semi-open or semi-arid habitat which have variously interrupted ranges ending somewhere in Central America and reappearing in South America; all are (or until recently were) absent from Panama and at least parts of s. Costa Rica. The White-tailed Kite belongs to this group. My thesis was that these species at one time had a more or less continuous range through Middle America to South America when the climate was drier and that in a more humid climatic cycle, growth of forest in southern Middle America made their range discontinuous. Haffer (1967) independently developed and provided evidence of repeated climatic fluctuations both in the Pleistocene and post-Pleistocene to explain the distribution and speciation of certain forest birds. C. F. Bennett

(1968) contends that when Panama was discovered and conquered by the Spaniards much more of the country was open and devoted to agriculture by the indigenous population than was the case when canal building was resumed by the United States and road building begun after 1903. He contends that with the destruction of the native culture and the decimation of the native population subsequent to the conquest, the Spaniards, not being interested in agriculture, allowed most of Panama to revert to forest. It is only in recent decades that forest clearing has approximated the situation at the start of the 16th century. Judging by bird distribution, Bennett's views seem basically correct. Probably, in varying degree, the same situation prevailed elsewhere in Middle America. However, I believe that cyclical climatic change played a part in forest regrowth. Man (especially primitive man), like other animals, is affected in his distribution and numbers by climate. The failure of the surviving Amerindians and their mestizo descendants to revive agriculture extensively in the centuries that followed the Conquest suggests that there had been a climatic change towards heavier rainfall, making it difficult to maintain cultivation with the available primitive equipment, and less healthful to live in the more humid areas. Modern mechanization, plus financing from the United States, has worked a drastic change in the Middle American environment since World War II. Forest destruction is more complete and extensive than prevailed with the Amerindian style of shifting agriculture, so that the potentiality for recurrent regrowth and soil enrichment is greatly reduced. Some species like the White-tailed Kite may be enabled to repopulate a probable prehistoric range, but it should not be overlooked that many tropical animals are imperiled to the point of possible extinction.

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(some of whom included observations of others), but with notably faithful frequency from H. Lof-tin, E. S. Morton, and R. S. Ridgely, the latter even sending a color slide as proof of the kite's presence in the Canal Zone.

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