

HABITAT USE BY WINTERING BIRDS OF PREY IN SOUTHEASTERN ARIZONA

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Habitat alteration by man has resulted in population declines in a number of raptor species in North America (Hickey 1969). Breeding raptor studies have long dominated the literature but few studies have been devoted to the winter ecology of raptors (Craighead and Craighead 1956, Southern 1963, Weller 1964, Schnell 1968, Edwards 1969, Koplín 1973, Mills 1975, Page and Whitacre 1975, Wilkinson and Debban 1980). However, data on preferred wintering habitats and relative abundance of each raptor species is required to evaluate the impacts of land management practices and proposals (i.e., transmission lines, oil and gas drilling, geothermal development) upon the birds and their habitat. This study examines the preferred wintering habitats and relative abundances of diurnal raptors, Loggerhead Shrikes (*Lanius ludovicianus*) and Greater Roadrunners (*Geococcyx californianus*) in southeastern Arizona.

STUDY AREA

The study area comprised the Bureau of Land Management administered public lands and adjacent private and state lands in Cochise, Graham, Greenlee and Pinal counties in southeastern Arizona (Figure 1). The 23,826 km² study area is predominantly a transition zone between the Sonoran Desert, Chihuahuan Desert, Sierra Madrean and Rocky Mountain vegetation complexes (Table 1). Vegetation was classified as to type according to the Office of Arid Lands Studies (1976) and Brown et al. (1980).

Average winter temperatures in the study area range from 7° to 13°C, with freezing temperatures occurring between October and April. Forty-five percent of the area's rainfall occurs during this period. Unlike summer rainfall, which is typically monsoon-like, winter rains are gentle and may last for several days.

METHODS

Automobile surveys for raptors have proven to be effective for collecting data on distribution and relative abundance (Craighead and Craighead 1956, Johnson and Enderson 1972, Koplín 1973, Woffinden and Murphy 1977, Craig 1978, Wilkinson and Debban 1980, Millsap 1981).

From November through March 1978-1980, we traversed 17 routes three times each at approximately 48 kph. Speeds were somewhat slower in the denser habitats such as pinyon-juniper (*Pinus monophylla-Juniperus monosperma*). We reversed the direction of travel on each successive trip to decrease any bias due to variable daily rhythms and detectability of any given species. The census routes totaled 2187 km; we drove each three times for a total of 6386 km during the study and considered a lateral distance of 150 m on each side of the census route to be thoroughly censused. We noted species, sex and age (if possible), and position for each bird observed.

WINTERING BIRDS OF PREY IN ARIZONA

Table 1. Habitat type prevalence on the study area and total length of census routes conducted, southeastern Arizona, November 1978-March 1980.

HABITAT TYPE		OCCURRENCE*	Census
Office of Arid Lands Study Classification	Corresponding Brown, Lowe and Pase Classification	% Total Area	# km Traveled
Desert Scrub	Chihuahuan Deserts scrub Sonoran Deserts scrub Disclimax Grassland	43.5	1833
Creosotebush	Chihuahuan Deserts scrub Sonoran Deserts scrub	23.3	1205
Mesquite	Shrub-scrub Disclimax Grassland Chihuahuan Deserts scrub Sonoran Deserts scrub	4.5	973
Grassland	Scrub-grassland	6.1	726
Agricultural Land	Agricultural Land	4.1	701
Mountain Shrub	Encinal	8.0	429
Saltbush	Chihuahuan Saltbush Sonoran Saltbush	2.2	195
Broadleaf Riparian	Broadleaf Riparian	0.1	143
Half-shrub	Disclimax Grassland	6.6	123
Pinyon-Juniper	Pinyon-Juniper	0.4	23
Barren Ground	Barren Ground	1.2	35
Total		100.0	6386

*Planimetered from Office of Arid Lands Studies. 1976. Vegetation map of the Upper Gila-San Simon grazing environmental statement area. Univ. Arizona, Tucson.

Table 2. Number of raptors sighted in selected habitats in southeastern Arizona, November 1978-March 1980.

Habitat	Species observed	Individuals observed	Relative abundance index	Relative abundance index exclusive of roadrunners and shrikes
Agricultural Land	12	217	310	203
Grassland	11	146	201	126
Broadleaf Riparian	7	22	154	126
Mesquite	9	114	117	69
Desert Scrub	10	190	104	62
Half-shrub	5	12	98	41
Saltbush	6	18	92	66
Pinyon-Juniper	2	2	87	87
Creosotebush	9	85	71	36
Mountain Shrub	4	7	16	9

WINTERING BIRDS OF PREY IN ARIZONA

Duplication of sightings was minimized by noting peculiar characteristics and direction of flight. We believe the relative error factors were relatively constant, thus allowing between-habitat comparisons to be made.

A relative abundance index was generated according to Woffinden and Murphy (1977) as follows:

$$\frac{\text{Total number of a species observed}}{\text{Total number of km traveled}} \times 1000 = \text{relative abundance index}$$

RESULTS AND DISCUSSION

We identified a total of 813 birds to species and classified them by habitat occupied. Golden Eagles (*Aquila chrysaetos*), Red-tailed Hawks (*Buteo jamaicensis*), Cooper's Hawks (*Accipiter cooperii*), Sharp-shinned Hawks (*Accipiter striatus*), Prairie Falcons (*Falco mexicanus*), American Kestrels (*Falco sparverius*), Great Horned Owls (*Bubo virginianus*) and Loggerhead Shrikes are yearlong residents in the study area. Their numbers probably increase during winter with the influx of migratory northern birds, although a portion of the resident population may migrate southward due to displacement by winter residents from the north or in avoidance of winter environmental stresses. The Bald Eagle (*Haliaeetus leucocephalus*), Ferruginous Hawk (*Buteo regalis*), Rough-legged Hawk (*Buteo lagopus*), Northern Harrier (*Circus cyaneus*) and Merlin (*Falco columbarius*) occur only as winter visitors. The Greater Roadrunner is resident.

Habitat Use

Agricultural lands—including irrigated pasture and fallow cotton and corn fields—had the highest relative abundance index and the greatest species diversity of all habitats (Table 2). This finding was true whether or not roadrunners and shrikes were included. This situation is somewhat surprising as agricultural lands in southeastern Arizona are often considered to be

Figure 1. Wintering birds of prey study area, Safford District, U.S. Bureau of Land Management, Arizona.



“biological deserts.” We believe that the high use of agricultural lands was due to the large number of available perches (i.e., telephone poles and fences), ease of sighting existing prey, and presence of edges and fence rows. Red-tailed Hawks, Northern Harriers, American Kestrels and shrikes were the most commonly observed species in agricultural lands (Table 3).

Grasslands ranked second in terms of both relative abundance index and species diversity. Predominate species were similar to those in agricultural lands. Exclusive of roadrunners and shrikes, broadleaf riparian habitats had an equivalent relative abundance index, but fewer species. Broadleaf riparian habitats predominately supported Bald Eagles, Golden Eagles, Red-tailed Hawks and American Kestrels.

Mesquite (*Prosopis juliflora*), saltbush (*Atriplex* spp.), desert scrub, half-shrub and pinyon-juniper had similar relative abundance indices. Half-shrub was the only habitat in this group that had significantly fewer raptors when roadrunners and shrikes were excluded from the total. Desert scrub and mesquite supported considerably more species than did saltbush, half-shrub and pinyon-juniper habitats.

Raptor abundances were lowest in Creosotebush (*Larrea tridentata*), mountain shrub, and barren ground habitats (in descending order). Creosotebush supported twice as many species as did mountain shrub. No raptors, shrikes or roadrunners were observed in barren ground (which was thus excluded from Table 3).

Birds were more difficult to observe as structural diversity—i.e., layers or tiers of vegetation—increased within plant communities. Agricultural lands, grasslands, desert scrub, half-shrub, saltbush, Creosotebush and mountain shrub were accurately censused; whereas, raptor populations in broadleaf riparian, mesquite and pinyon-juniper were undoubtedly underestimated.

Species Accounts

Bald Eagles were not encountered on any census route but were seen elsewhere in the area during the study. Due to the importance of the Bald Eagle, we systematically inventoried all potential wintering habitat to ascertain the number and locations of all individuals within the District. Fifteen individuals (8 adults, 7 immatures) were observed, all in broadleaf riparian habitat. In previous winters, Bald Eagles have been sighted in arid uplands. Apparently they prefer, but are not dependent upon, broadleaf riparian habitat.

We observed Golden Eagles in 6 of the 12 habitat types (Table 3). Relative abundance indices indicated that they preferred, in decreasing order, broadleaf riparian, grassland, mesquite, desert scrub, Creosotebush and agricultural habitats. The preference of broadleaf riparian habitat may be misleading as the habitat is of a linear nature and the eagles may have been foraging along the ecotone. Craig (1978) observed a similar preference for native vegetation over agricultural land in Idaho. Millsap (1981) found that in central Arizona Golden Eagles overwhelmingly preferred desert grasslands and did not occur in broadleaf riparian habitat.

Red-tailed Hawks occurred in all 10 habitats. In decreasing order, they preferred broadleaf riparian, agricultural, pinyon-juniper and grassland

habitats. Red-tailed Hawks in this study and in Millsap (1981) used a broad spectrum of habitats and were the most adaptable raptor studied. The ratio of adults to immatures was approximately 3:1. Adult to juvenile comparisons were pinyon-juniper (100% vs 0%), mountain shrub (100% vs 0%), riparian (100% vs 0%), desert scrub (84% vs 16%), mesquite (78% vs 22%), agricultural land (72% vs 28%), Creosotebush (63% vs 37%), and grassland (61% vs 39%). Immatures predominated only in saltbush (100%) and half-shrub (100%).

Ferruginous and Rough-legged hawks occurred in only three habitats. Both species occurred in agricultural land and grassland. Ferruginous Hawks were observed twice in mesquite, and a Rough-legged Hawk was once seen in the half-shrub habitat. Both species in this study and in Millsap (1981) preferred open agricultural land and grasslands to more structurally-complex habitats. Craig (1978) and Millsap (1981) observed the Rough-legged Hawk to use similar habitat in Idaho and Arizona, respectively. Wakely (1978) found that Ferruginous Hawk habitat preference was correlated with lack of vegetative cover and not prey densities.

Cooper's Hawks were observed in all habitats except half-shrub. Relative abundance indices indicated that it preferred those habitats with more layers or tiers of vegetation such as pinyon-juniper, desert scrub, broadleaf riparian, Creosotebush and mesquite. Millsap (1981) observed similar preferences for mesquite-saltcedar (*Tamarix chinensis*) and cottonwood (*Populus fremontii*-willow (*Salix* spp.) in central Arizona.

Sharp-shinned Hawks occurred in four habitats. Relative abundance indices were highest for the broadleaf riparian and agricultural habitats and considerably lower for Creosotebush and desert scrub. Sharp-shinned Hawks in central Arizona were much more common in the mesquite-saltcedar and cottonwood-willow habitats, which were more structurally diverse (Millsap 1981).

Northern Harriers and Prairie Falcons were observed in seven of the habitats. Of the 79 harrier sightings, 24% were males, 46% females or immatures, and 30% unidentified. Relative abundance indices indicated Northern Harriers preferred agricultural lands, saltbush and grasslands over the other habitats. Similarly, harriers used agricultural lands in Idaho (Craig 1978). Harriers and Prairie Falcons in central Arizona also preferred low structurally-complex vegetation communities, primarily Creosotebush-Bursage (*Ambrosia dumosa*) and desert grasslands (Millsap 1981). Prairie Falcons were abundant in grasslands, agricultural lands and half-shrub in this study (Table 3). Prairie Falcons preferred native vegetation in Idaho (Craig 1978); whereas, this study demonstrated that they used habitats with low structural diversity (i.e., native vegetative types and agricultural lands) regardless of origin.

A solitary Merlin was observed in agricultural land. The only Merlin seen by Millsap (1981) in central Arizona was in a structurally similar habitat, desert grassland.

American Kestrels were observed in 6 of the 10 habitats. Relative abundance indices indicated an overwhelming preference for agricultural lands and a secondary preference for grasslands. Millsap (1981), however, found kestrels in central Arizona primarily in cottonwood-willow habitat and second-

Table 3. Number of raptors sighted and relative abundance indices (R.A.I.) by selected habitats in southeastern Arizona, November 1978-March 1980.

SPECIES	Agricultural Land		Grassland		Broadleaf Riparian		Mesquite		Desert Scrub	
	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.
Bald Eagle	1	1.4	6	8.3	15*		4	4.1	4	2.2
Golden Eagle	37	52.8	30	41.3	3	21.0	30	30.8	62	33.8
Red-tailed Hawk	6	8.6	4	5.5	11	76.9	2	2.1		
Ferruginous Hawk	2	2.9	3	4.1						
Rough-legged Hawk	1	1.4	1	1.4	1	7.0	6	6.2	13	7.1
Cooper's Hawk	3	4.3			1	7.0			2	1.1
Sharp-shinned Hawk	29	41.4	17	23.4			14	14.4	6	3.3
Northern Harrier	5	7.1	8	11.0			5	5.1	4	2.2
Prairie Falcon	1	1.4								
Merlin	57	81.3	22	30.3	2	14.0	6	6.2	22	12.0
American Kestrel			1	1.4					1	0.5
Great Horned Owl	8	11.4	2	2.8	4	28.0	4	4.1	3	1.6
Greater Roadrunner	67	95.6	52	71.6	22	153.9	43	44.2	73	39.8
Loggerhead Shrike	217	309.6	146	201.1			114	117.2	190	103.6
Total										

*Represents Bald Eagles sighted during a separate inventory effort.

Table 3 (Cont.)

SPECIES	Half-shrub		Saltbush		Pinyon-Juniper		Creosotebush		Mountain Shrub	
	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.
Bald Eagle	2	16.3	5	25.6	1	43.5	2	1.7	3	7.0
Golden Eagle							19	15.8		
Red-tailed Hawk										
Ferruginous Hawk	1	8.1	1	5.1	1	43.5	8	6.6	1	2.3
Rough-legged Hawk										
Cooper's Hawk										
Sharp-shinned Hawk										
Northern Harrier	1	8.1	6	30.8			4	3.3		
Prairie Falcon	1	8.1	1	5.1			3	2.5		
Merlin										
American Kestrel							2	1.7		
Great Horned Owl										
Greater Roadrunner	7	56.9	1	5.1			3	2.5	1	2.3
Loggerhead Shrike			4	20.5			38	31.5	2	4.7
Total	12	97.5	18	92.2	2	87.0	85	70.6	7	16.3

WINTERING BIRDS OF PREY IN ARIZONA

daily in desert grasslands. Craig (1978) recorded similar habitat utilization in Idaho. Of the 110 kestrels observed in this study, 56 (50%) were males and 54 (50%) were females. This even sex ratio differs from the preponderance of females reported by Koplín (1973), Mills (1975, 1976), and Wilkinson and Debban (1980). Female kestrels preferred grassland (55% female vs 45% male), Creosotebush (67% vs 33%), and agricultural lands (53% vs 47%). Males predominated in mesquite (75% males vs 25% females), saltbush (100% vs 0%), and desert scrub (62% vs 38%). Female kestrels, presumably dominant, occupied the preferred habitat types; whereas, males were displaced to marginal habitats.

We encountered Great Horned Owls, which are primarily nocturnal, in desert grasslands and desert scrub. We do not believe that this finding accurately reflects their habitat utilization or preference.

Roadrunners occurred in seven of the habitats. Relative abundance indices indicated a preference for agricultural lands, saltbush and mesquite.

We observed Loggerhead Shrikes in every habitat, except pinyon-juniper. Relative abundance indices indicated a preference for agricultural land, grassland, half-shrub and mesquite.

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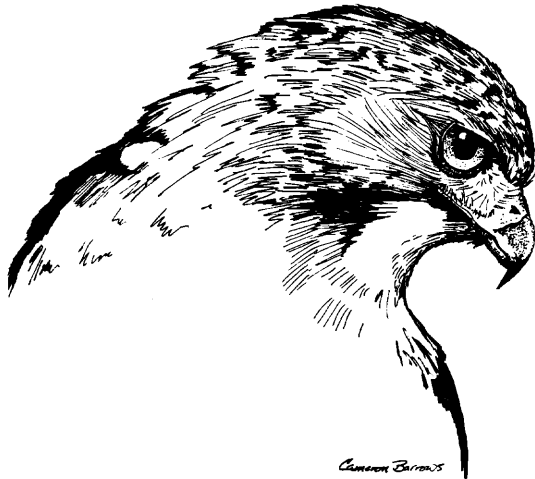
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Red-tailed Hawk

Sketch by Cameron Barrows

BULLETIN BOARD

GRASSHOPPER SPARROW STATUS IN SOUTHERN CALIFORNIA

Information on the past and present status of the Grasshopper Sparrow (*Ammodramus savannarum*) as a breeding species in southern California (south of Monterey—Inyo counties) is needed, for a preliminary study on the current population status and possible decline of this species in recent years. Please include the following information:

1) exact location of breeding birds; 2) date of observation; 3) number of birds; 4) evidence of breeding; 5) current status of site, if known; 6) habitat type, if known. All contributors will be gratefully acknowledged. Robert L. McKernan, Section of Ornithology, Los Angeles County Museum of Natural History, 900 Exposition Blvd., Los Angeles, California 90007.

RAPTOR RESEARCH FOUNDATION CONFERENCE—NOVEMBER 1985 ANNOUNCEMENT AND FIRST CALL FOR PAPERS

The 1985 Raptor Research Foundation (RRF) International Meeting and Symposium on the Management of Birds of Prey will be held at the Capitol Plaza Holiday Inn in Sacramento, California, 2-10 November 1985. Highlights of the meeting will include 1) the Second RRF Conference on Raptor Conservation Techniques—Twelve Years of Progress, 1973-1985; 2) a Western Hemisphere Meeting of the World Working Group on Birds of Prey (ICBP); 3) the Second International Vulture Symposium; 4) A Western North American Osprey Symposium; 5) a Workshop on North American Candidate Endangered Raptors; 6) an International Symposium on Raptor Reintroduction; and 7) a Symposium on Raptor Rehabilitation, Captive Breeding, and Public Education. For more information or if you are interested in presenting a paper, please contact Dr. Richard R. Olendorff, U.S. Bureau of Land Management, 2800 Cottage Way, Sacramento, California 95825, or Nancy Venizelos, San Francisco Zoological Society, Sloat Blvd. at the Pacific Ocean, San Francisco, California 94132.

WESTERN BIRD BANDING ASSOCIATION ANNUAL MEETING

The Western Bird Banding Association will hold its annual meeting 3-5 June 1985, prior to the joint meeting of the Wilson and Cooper ornithological societies to be held in nearby Boulder, Colorado. The WBBA meeting, at YMCA of the Rockies, Estes Park (adjacent to Rocky Mountain National Park), will include paper sessions, informal workshops and demonstrations, and field trips. Planned owlng trips(s) will provide a chance of hearing or seeing Boreal Owls.—*Ronald A. Ryder*, Dept. of Fishery and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523.