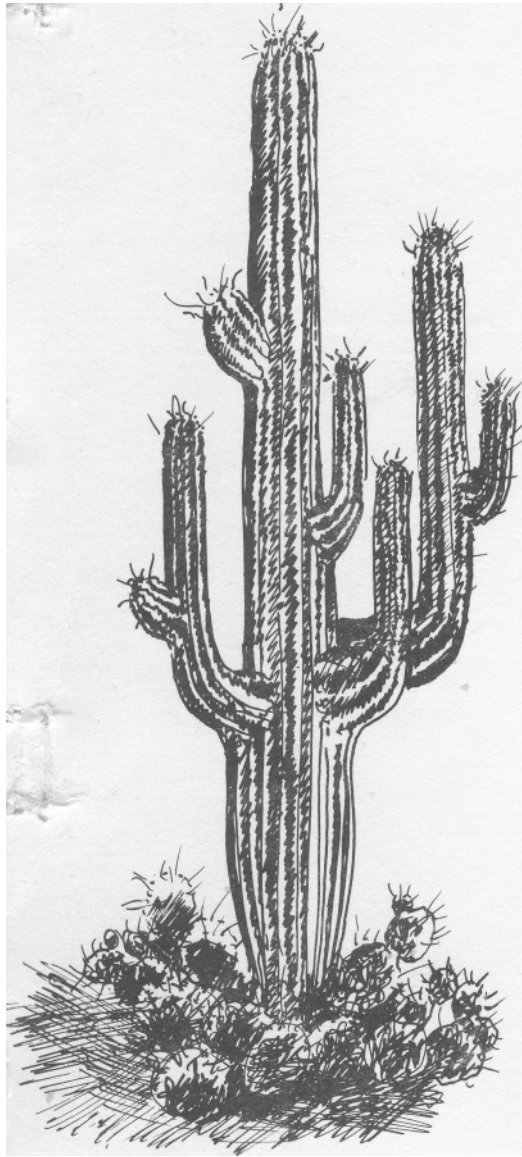




**Cooperative National Park
RESOURCES STUDIES UNIT**

University of Arizona
Tucson, Arizona 85721

Western Region
National Park Service
Department of the Interior
San Francisco, Ca. 94102

COOPERATIVE NATIONAL PARK RESOURCES STUDIES UNIT**University of Arizona/Tucson - National Park Service**

The National Park Service and the University of Arizona, Tucson, Arizona, signed a Master Memorandum of Understanding on August 16, 1973 that provided for the establishment and operation of this Unit. The Unit, although located in the Department of Ecology and Evolutionary Biology, is geared to provide a multidisciplinary approach that utilizes all talents on the University Campus to natural resources studies in areas administered by the National Park Service. Primary attention is directed to the park areas within the Southern Arizona Group.

Through the direction and coordination of the Unit Leader, projects are undertaken in these areas that are designed to provide scientific facts upon which the park managers may make appropriate decisions and formulate and implement effective management action plans. Through close association with faculty members and through guidance of graduate students, a greater awareness of problems and needs of the Service are recognized and academic interests are channelized to participate with the National Park Service in studies of mutual interest and concern.

NOTICE:

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TECHNICAL REPORT NO. 5
SURVEY OF THE VERTEBRATE FAUNA
CORONADO NATIONAL MEMORIAL

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SURVEY OF THE VERTEBRATE FAUNA OF CORONADO NATIONAL MEMORIAL

This final report is presented in three parts,
representing the results and conclusions for each of
the major vertebrate groups.

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A SURVEY OF THE AMPHIBIANS AND REPTILES

OF

CORONADO NATIONAL MEMORIAL

by

Terry B. Johnson

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Tucson

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Amphibians and Reptiles of the
Coronado National Memorial, Arizona

Terry B. Johnson and Charles H. Lowe
University of Arizona, Tucson

Abstract

Habitats in the four major biotic communities of the Coronado National Memorial and its environs were surveyed for amphibians and reptiles. Six species of amphibians and 16 species of reptiles were confirmed as occurring within the Memorial bounds; seasonal observed relative abundances for each are presented. An additional 14 species (one amphibian, 13 reptiles) were found in or have previously been reported for the area but were not confirmed for the Memorial itself. All 36 species, confirmed or hypothetically occurring, are included in an annotated checklist for the Memorial. Management and future research recommendations are included.

Introduction

Populations of amphibians and reptiles in the Coronado National Memorial and environs (Fig. 1) occupy habitats in four major biotic communities: (1) Semidesert Grassland, (2) Evergreen Oak Woodland, (3) Evergreen Pine-Oak Woodland and (4) Riparian Forest, Woodland and Scrub. Edificarian habitats within the Memorial area (e.g. residential, visitor-center and picnic areas) are primarily within Evergreen Woodland.

Personnel of the University of Arizona have worked for many years on the amphibians and reptiles of the Huachuca Mountains, including the Montezuma Canyon area (see Gloyd 1937). Our field work for the Memorial survey was conducted from

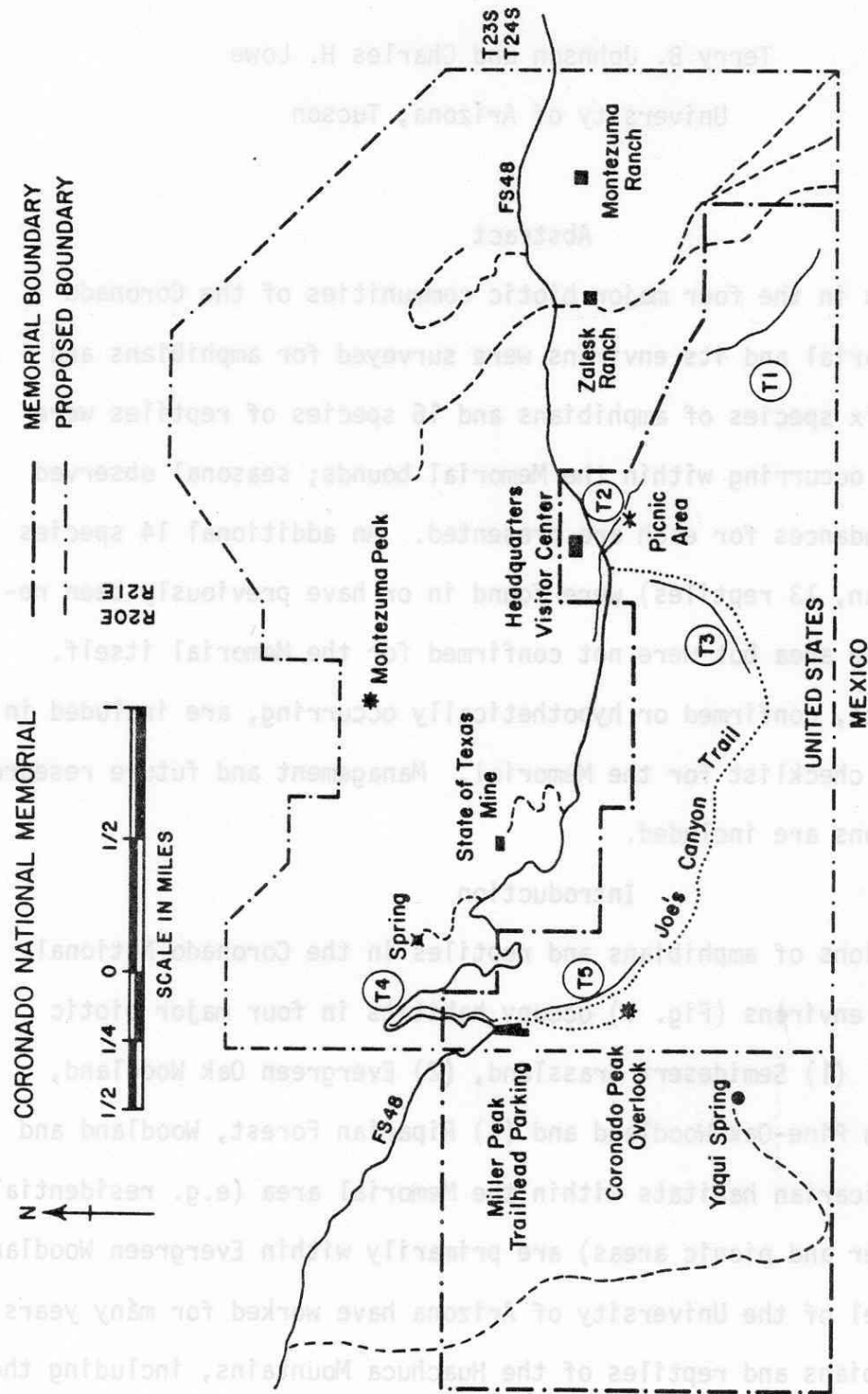


Fig. 1. Map of the Coronado National Memorial area. T1 through T5 = transects for censusing amphibians and reptiles.

August 1977 through October 1978. Observations were made in spring (May-June) summer (July-August), autumn (September-October) and winter (January).

The objectives of the vertebrate faunal survey of the Coronado National Memorial include (1) a list of all species known to occur within the park boundaries, (2) estimates of relative abundance, (3) estimates of probable seasonal fluctuations in numbers, (4) habitat preferences in terms of major biotic communities, and (5) management recommendations. Findings relevant to each objective are reported below.

We thank Superintendent Laurel Dale and Paul Thompson of the Coronado National Memorial and Barry Spicer and James Hudnall of the University of Arizona for their assistance during our field work.

Methods

The Coronado National Memorial presently consists of 1134 ha on the southeast side of the Huachuca Mountains. A proposed land exchange with the U.S. Forest Service would result in the gain of 1215 ha north and east of the present Memorial bounds east of Montezuma Pass and the loss of 479 ha west of Montezuma Pass (Fig. 1). We have essentially confined our studies to the part of the Memorial that is not included in the land-exchange proposal, but with the addition of the Zalesk and Montezuma Ranch areas.¹

Field work consisted of sampling populations in the herpetofauna of each of the major biotic communities and habitats described below. Methods included (1) seasonally repeated censuses of five 1 km transects established in natural areas in each biotic community, (2) spot sampling of selected habitats within each biotic community, and (3) an extensive

1. The area for principal field study was determined through discussions with Superintendent Laurel Dale,

road census during evening to daylight hours on the major roads (parts of which are paved) in the Memorial area. A total of 37 field man-days were spent on site during the survey period.

Species vouchers for the Memorial herpetofauna were collected on site or in nearby off-site areas as noted below. Voucher specimens are deposited in the Amphibian and Reptile (Herpetology) Collection of the Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona, 85721. Nomenclature in this report departs from that of Stebbins (1954, 1966) and Lowe (1964).

Biotic Communities and Habitats

The Coronado National Memorial is located in a semi-arid foothill situation on the southeast side of the Huachuca Mountains. Climatic survey for the Memorial Headquarters (1592 m) gives mean annual rainfall of 52.6 cm, mean monthly minimum temperature of -0.3°C (January) to 16.6°C (August), and mean monthly maximum temperature of 11.8°C (January) to 32.6°C (August) (unpublished data from CNM files, 1956, 1971).

The elevation of the area varies on a decreasing gradient from 2092 m on Coronado Peak to 1478 m in the southeast corner of the ranch acquisition area (see Fig. 1). Permanent surface water within the principal area studied is located only in mine shafts. Small washes in upper Montezuma Canyon run intermittently during and/or shortly after winter and summer rains.

Evergreen Woodland (332.2) ¹. In the Coronado National Memorial there is a gradual shift in dominance among the evergreen trees, as on other mountain gradients of

1. Brown and Lowe (1974a,b) digital system.

modest elevation in southeastern Arizona. In Montezuma Canyon the change is from an oak-grass landscape below into oak-juniper-grass communities at middle elevations, into pinyon-juniper-oak woodland above. There is insufficient elevation within the present-day Memorial, however, for full development of Mexican pine-oak woodland and for the Ponderosa Pine Forest that comes in above it on similar gradients elsewhere in southern Arizona.

Madrean woodland is well developed in Montezuma Canyon. At higher elevations in the Memorial, as on Coronado Peak, communities on north-facing slopes (pinyon-juniper-oak woodland) are dominated by Mexican pinyon pine (*Pinus cembroides*; see Figs. 2, 3). In the vicinity of the Memorial Headquarters there is an especially dense oak-dominated woodland on north-facing slopes and in canyon bottoms (Fig. 4). On opposite south-facing slopes, vegetation varies from that of Semidesert Grassland and mixed open-encinal to oak savanna at higher elevations (Fig. 5).

Riparian Forest, Woodland and Scrub (333.1, 342.4 and others). Diverse riparian communities are found along drainage paths in the Memorial area. The middle to upper reaches of Montezuma Canyon include riparian forest stands of broadleaf deciduous and evergreen trees (Figs. 6, 7) and various riparian scrub communities of shrubby species characteristic of chaparral, woodland, Semidesert Grassland and riparian desertscrub. The greatest structural diversity of riparian vegetation is in the middle to lower reaches of the Canyon, from the Memorial Headquarters toward the International Boundary. There the wash broadens, with sandy and rocky areas forming an extensive mosaic in which the lowermost



Fig. 2. North-facing slopes at 1768-2012 m on the east side of Coronado Peak (2092 m): Looking southerly. Pine-Oak Woodland. The principal woodland trees are Mexican pinyon pine (*Pinus cembroides*), alligator-bark juniper (*Juniperus deppeana*), Arizona oak (*Quercus arizonica*), and Emory oak (*Q. emoryi*).

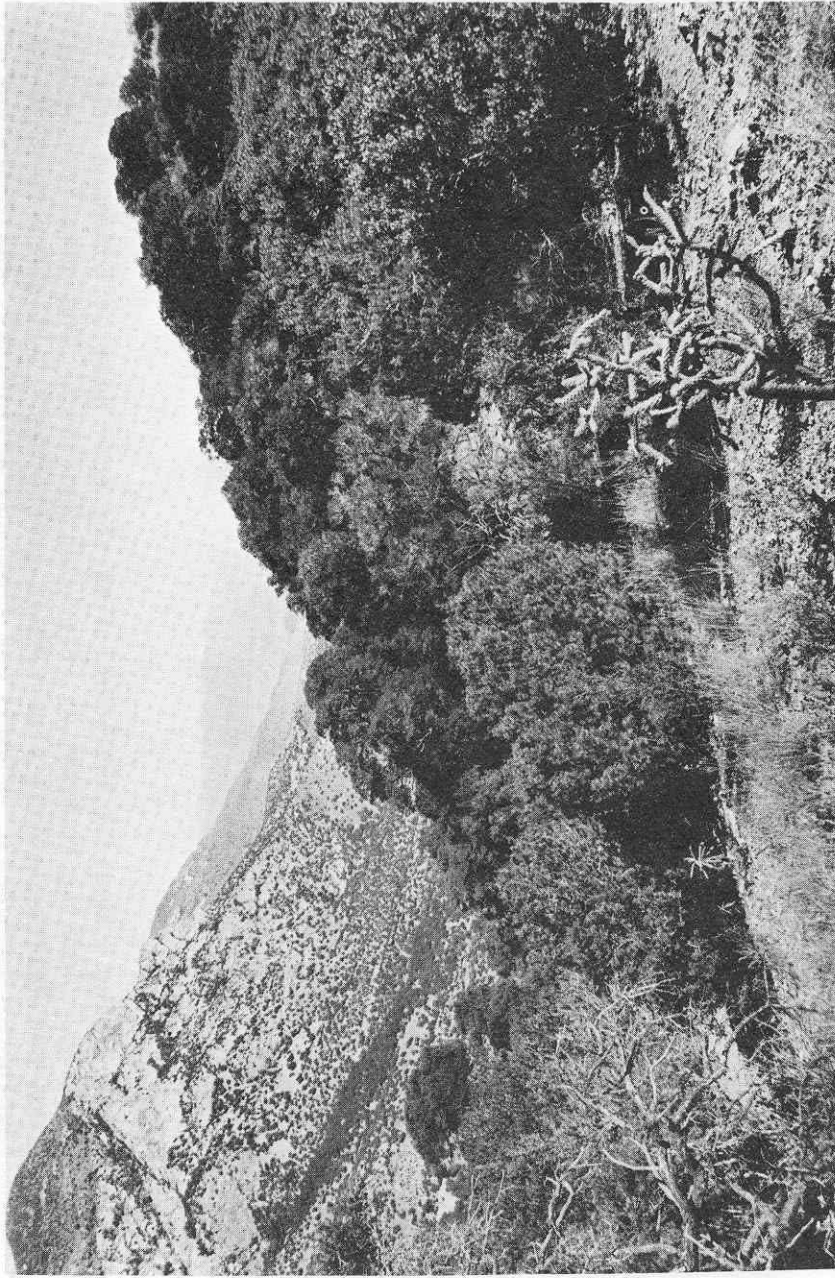


Fig. 3. North-facing slopes at 1950-2012 m on the east side of Coronado Peak (2092 m); looking easterly. Pine-Oak Woodland. Principal trees as in Fig. 2.

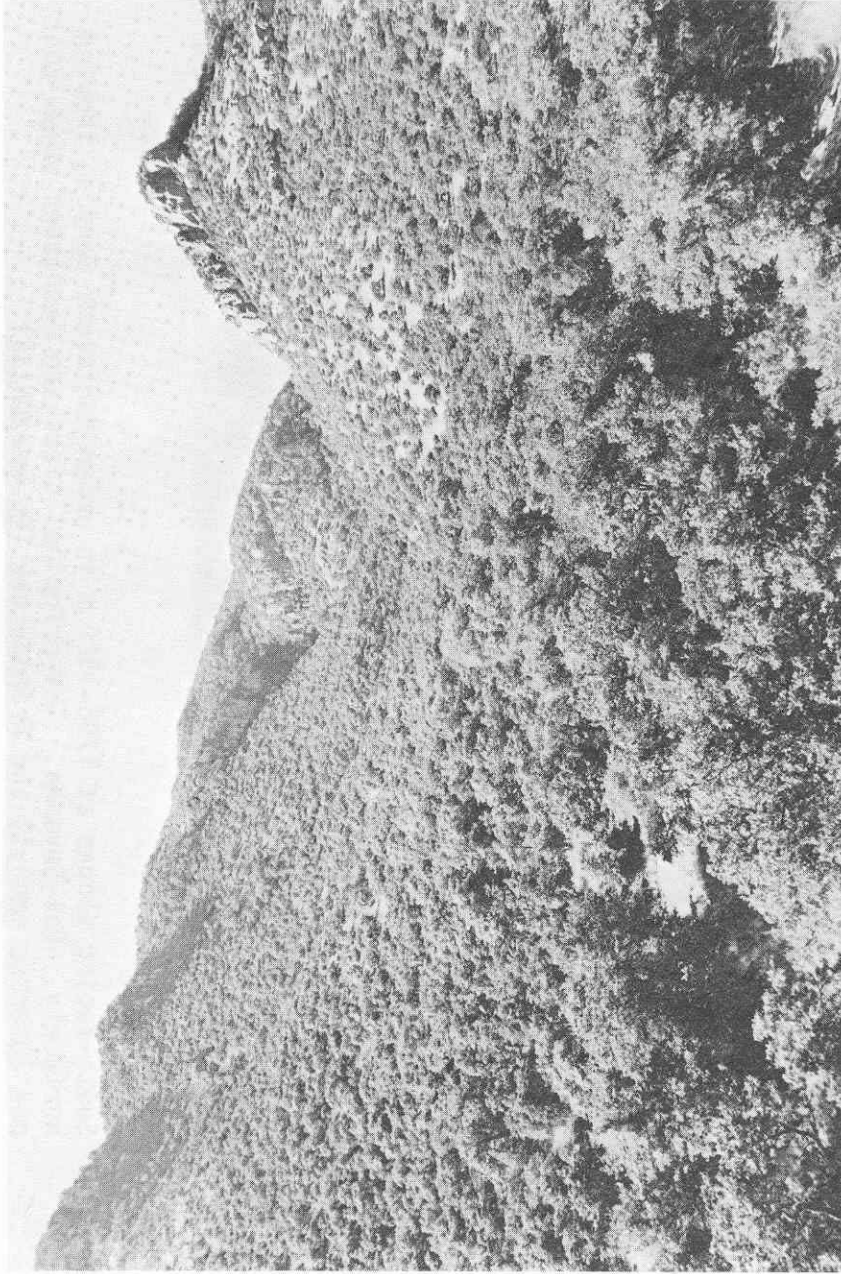


Fig. 4. North-facing slopes at 1615-1981 m in middle Montezuma Canyon; looking southerly. Evergreen Oak Woodland. The principal trees are evergreen oaks and Madroan juniper--Emory Oak (Quercus emoryi), Mexican blue oak (Q. oblongifolia), Arizona oak (Q. arizonica), and alligator-bark juniper (Juniperus deppeana).

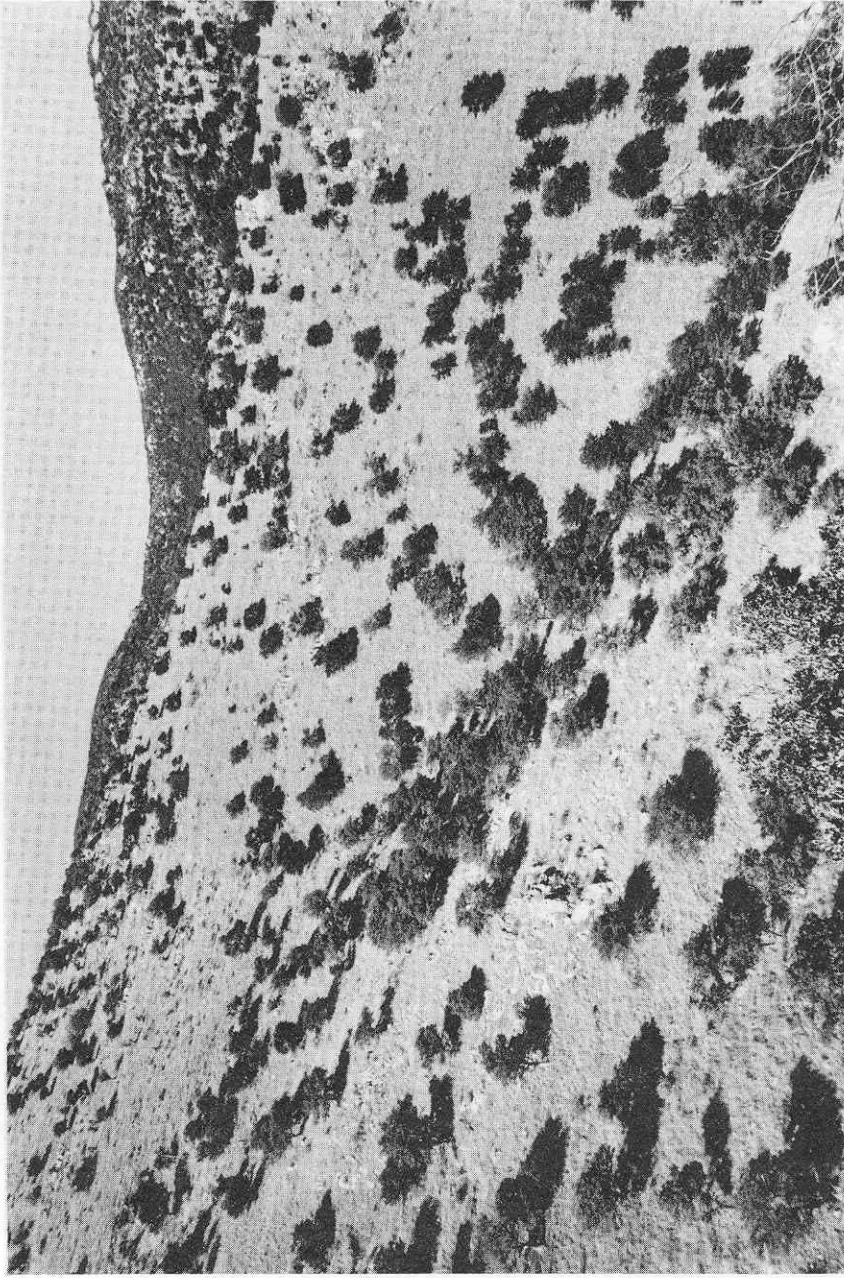


Fig. 5. South-facing slopes at 1798-1920 m in upper Montezuma Canyon, looking northerly. Oak-Savanna. The principal trees are evergreen oaks--Emory oak (Quercus emoryi) and Arizona oak (Q. arizonica).



Fig. 6. Upper Riparian Woodland and Forest at 1707 m in middle Montezuma Canyon, looking easterly. Sycamores (Platanus racemosa wrightii), walnuts (Juglans rupestris major), and live oaks are the riparian trees on drainageways in the Evergreen Woodland. Compare with Figs. 7, 8, and 9.

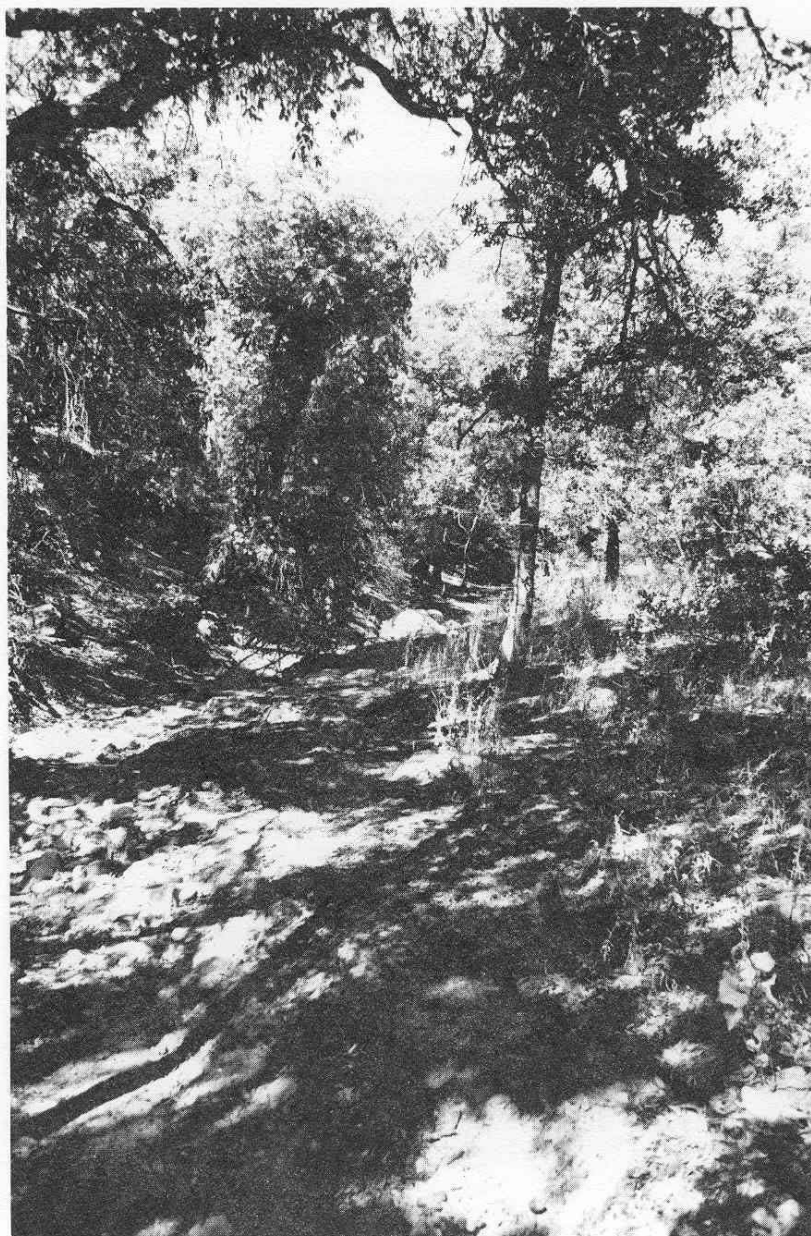


Fig. 7. Upper Riparian Woodland and Forest at 1722 m in middle Montezuma Canyon, looking westerly. Principal trees as in Fig. 6. Note canopy and shading effect. Also see Figs. 6, 8, and 9.

Evergreen (Oak) Woodland mixes with Riparian Woodland and Scrub in the Semidesert grassland (Figs. 8, 9).

Semidesert Grassland (352.3). Within the present-day Memorial bounds, Semidesert Grassland occurs on southerly-facing sides and slopes of the Coronado Peak area (Figs. 10, 11) and on its adjacent ridges, downward to extreme lower Montezuma Canyon near the International Boundary (Figs. 12, 13). Much of the proposed ranch acquisition area (i.e. Zalesk and Montezuma ranches) and the off-site area from the south to the northeast of the Memorial are also grasslands (mesquite-savanna; Fig. 14) or oak-grass ecotone (Fig. 15). Thus we extensively surveyed the Semidesert Grassland biotic community, in part compensating for the deletion of lands west of Montezuma Pass (as per discussion with Superintendent Dale, noted above).

Summary.-- The major biotic communities identified within and bordering the Memorial are as follows:

- (1) Semidesert Grassland
- (2) Evergreen Oak Woodland (oak-juniper)
- (3) Evergreen Pine-Oak Woodland (pinyon-juniper-oak)
- (4) Riparian Habitats
 - Forest
 - Woodland
 - Scrub

Results

The data for amphibians and for reptiles are given separately in Tables 1-3. These data reflect the situation that obtained in the Memorial during the survey period, unless otherwise specified.



Fig. 8. Lower Riparian Woodland and Scrub at 1501 m in lower Montezuma Canyon adjacent to semidesert grassland study area shown in Fig. 12; looking southeasterly. Desert willow (Chilopsis linearis), western soapberry (Sapindus saponaria drummondii), ash (Fraxinus pennsylvanica), and occasional evergreen oaks are the principal riparian trees.

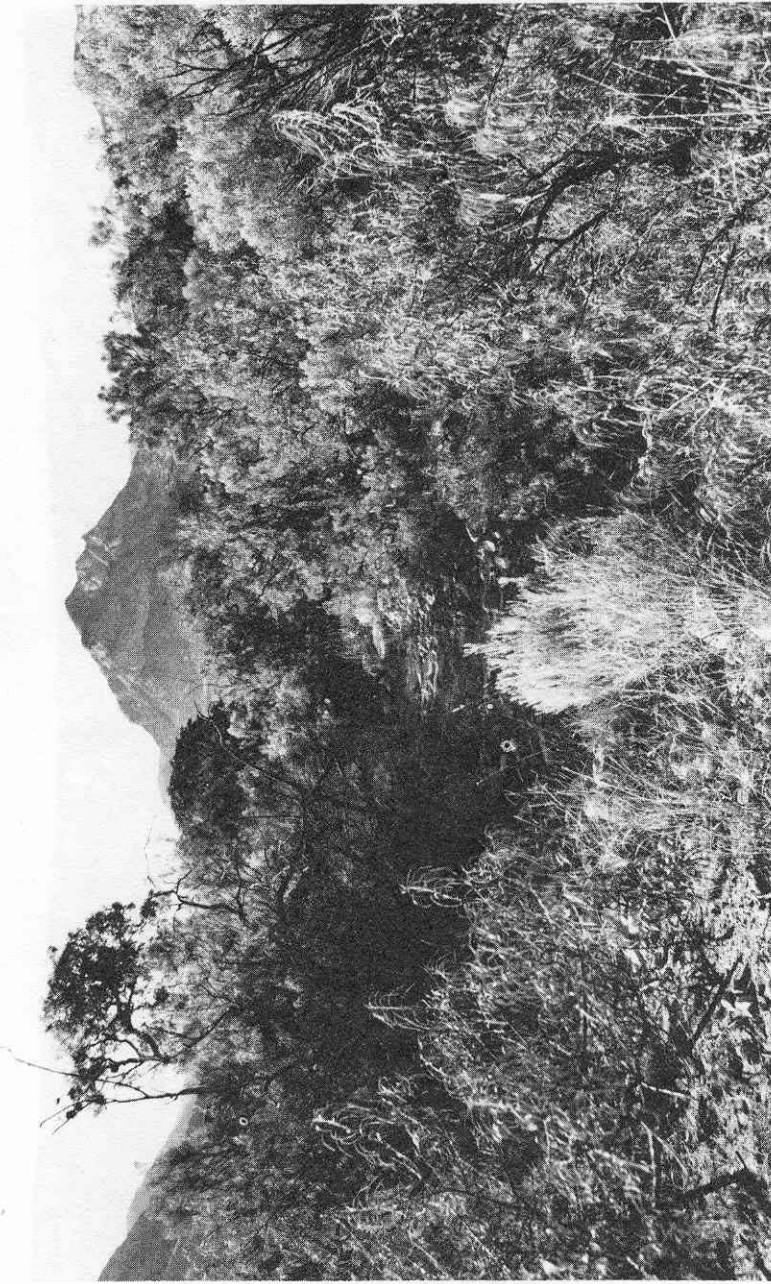


Fig. 9. Lower Riparian Woodland and Scrub at 1509 m in lower Montezuma Canyon adjacent to semidesert grassland study area shown in Fig. 12; looking north-westerly. Principal trees as in Fig. 8.

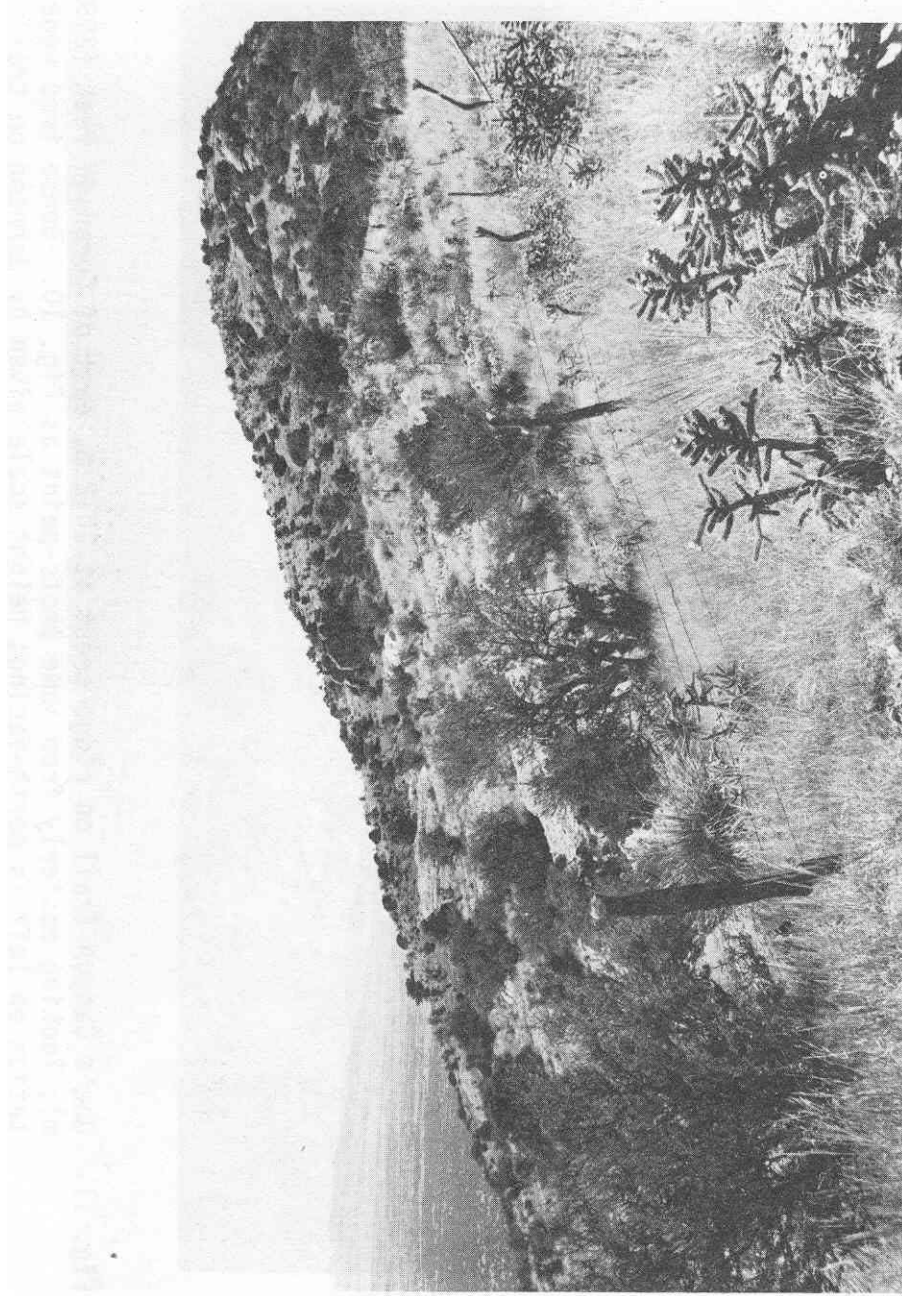


Fig. 10. Southeastly-facing slopes of Coronado Peak (2092 m, upper right) as viewed from Joe's Canyon Trail east of the Peak (see Fig. 11). Open vegetation of scrubby oaks, junipers, pinyons and chaparral species mixed with dry-tropic shrubs and grasses of the semidesert grassland.

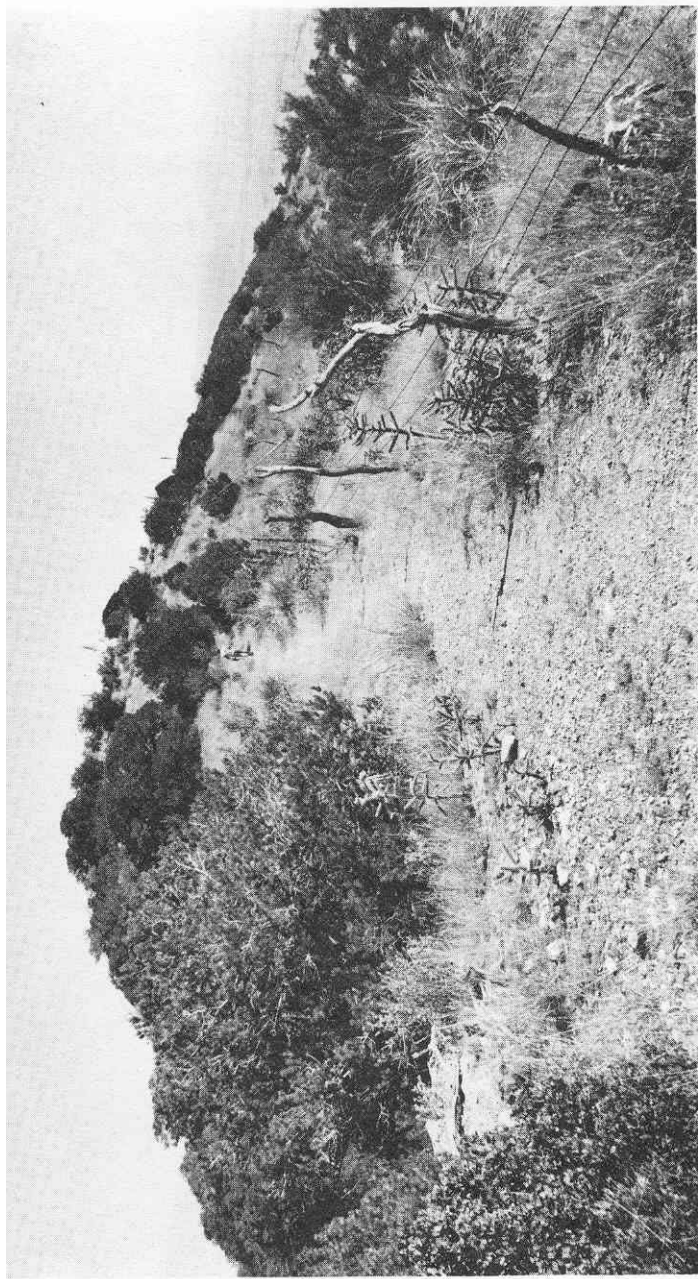


Fig. 11. Joe's Canyon Trail on ridge crest at 2012 m, east of Coronado Peak (2092 m); looking easterly from same photo-point as Fig. 10. Dense tree vegetation on left is north-facing; height scale given by Johnson on trail in distant center of photo.

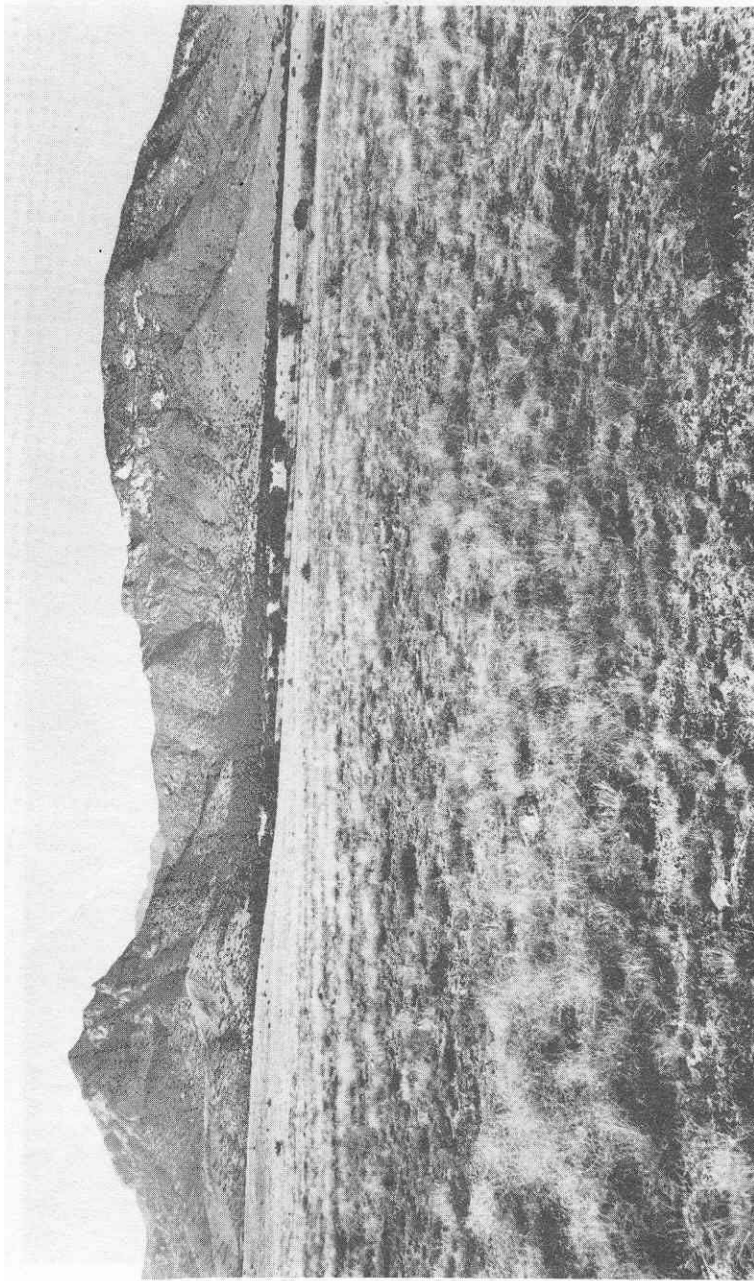


Fig. 12. Semidesert Grassland at 1486 m bordering riparian drainage in lower Montezuma Canyon; looking north-westerly toward Montezuma Canyon from near the International Boundary.

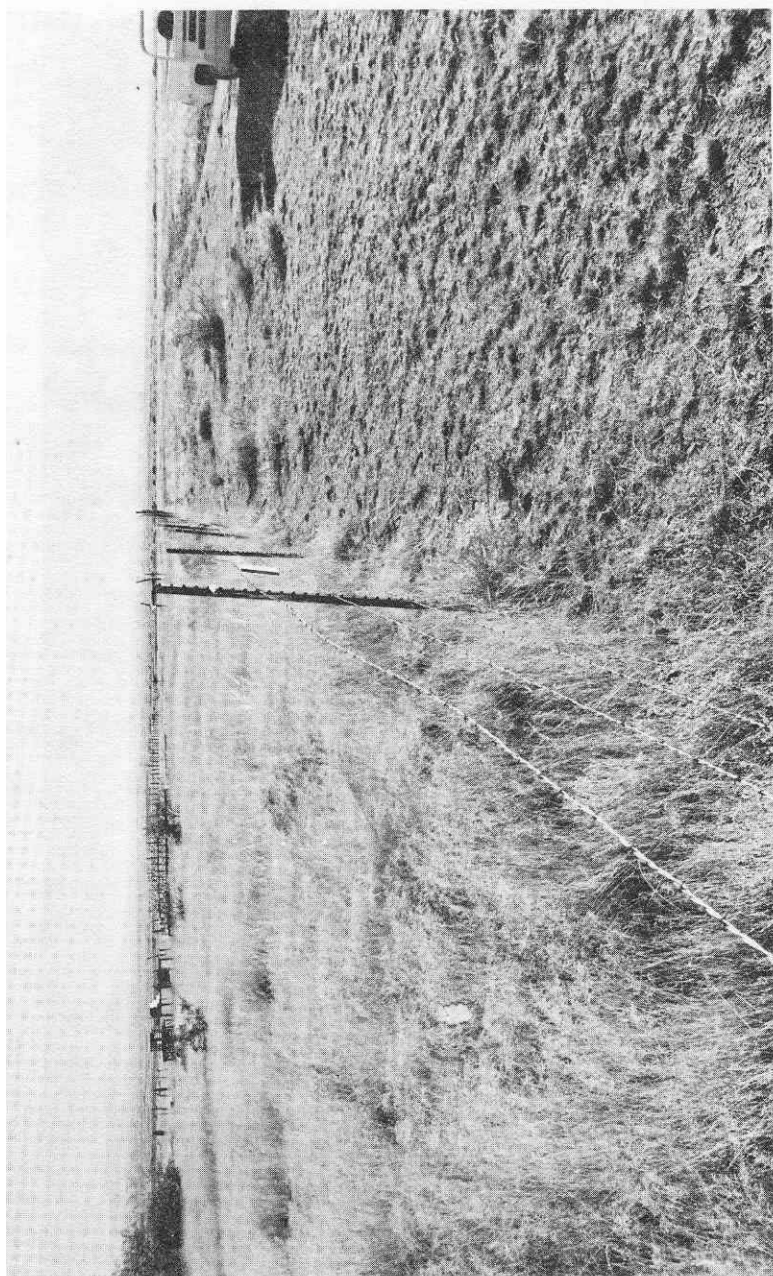


Fig. 13. Semidesert Grassland at 1486 m bordering riparian drainage in Lower Montezuma Canyon; looking south-easterly towards Mexico from same photo-point as in Fig. 12. USNPS equipment "exclosure"; note graze-line.

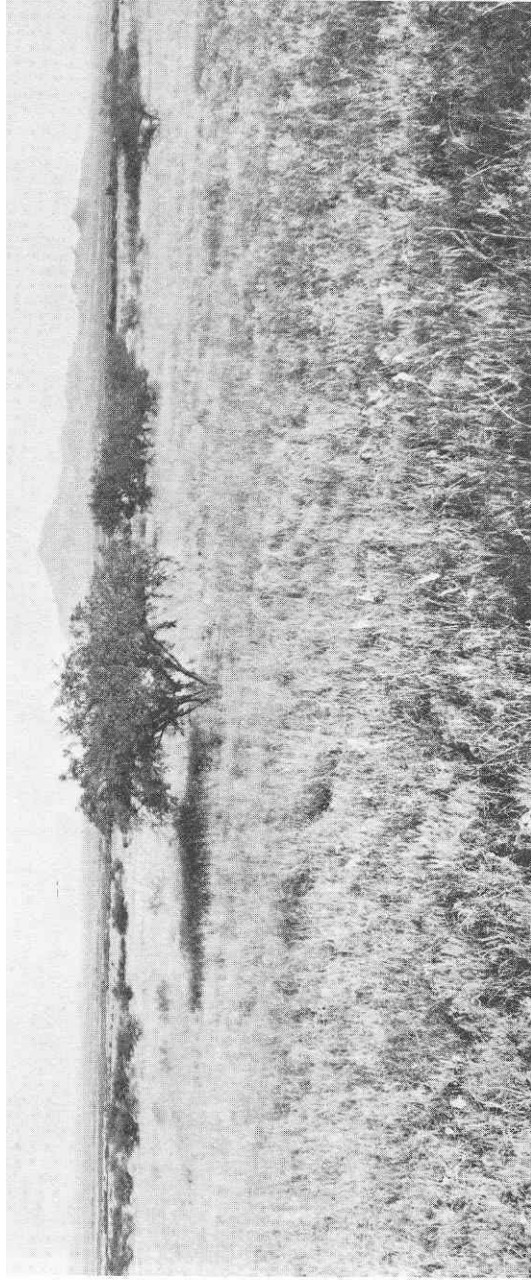


Fig. 14. Mesquite-Savanna in the San Pedro Grasslands at 1420 m, looking easterly toward the San Pedro River from about 4.0 km east of the Memorial boundary.

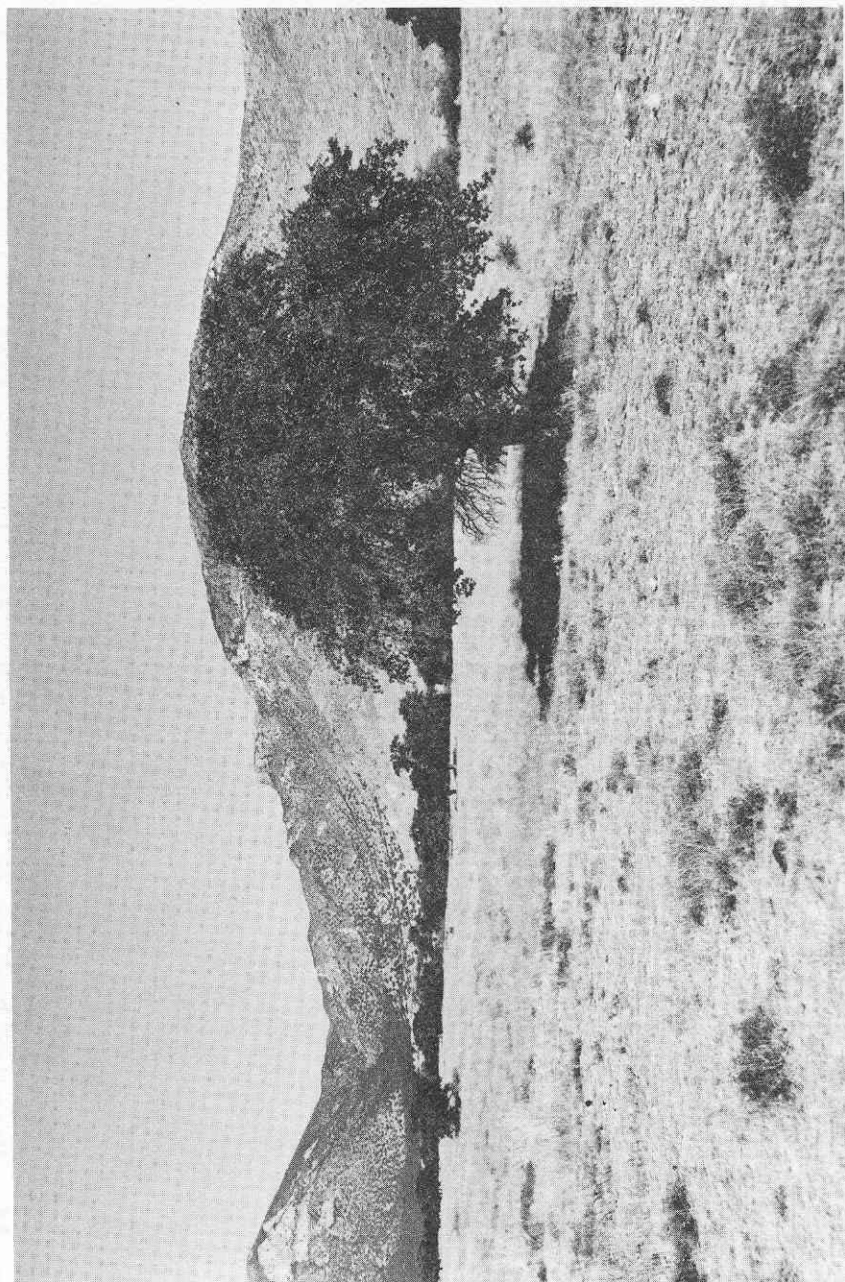


Fig. 15. Oak-Savanna at 1615 m near the eastern Memorial boundary; Looking north-westerly. Principal oaks are Emory oak (Quercus emoryi) and Mexican blue oak (Q. oblongifolia).

Ranking of Relative Abundance. Data were obtained by transect and other counts for estimates of relative abundance (= relative density) of each species of amphibian, lizard and snake observed on site. Relative abundances are reported in Tables 1-3. "Hypothetical" species (see below) are deferred to the "Accounts of Species." The five-category system used by Lowe and Johnson (1976) and in general application by other workers in the field is used herein. Ranking terms (Abundant, Very Common, Common, Uncommon, and Rare) refer only to the observed relative abundance. For example, a "Rare" species such as the Arizona Alligator Lizard is only rarely observed in the Memorial area but may be locally common in terms of its actual density. In tabular compilation of data, rank numbers (1-5) substitute for relative abundance categories (see below).

In this paper "Hypothetical" describes those species for which on-site presence has not yet been confirmed. Hypothetical occurrence on-site is based on sight records or other records and most importantly on our knowledge of the amphibians and reptiles of the region. Hypothetical species generally fall into one of two groups. For some species the on-site habitat may be marginal. These species may not occur on-site as established, stable populations. For species in the other group, the on-site habitat may be suitable but they may be present in populations that are too small and/or too local for individuals to be encountered during field work of short duration; snakes are typical of this group.

Amphibians.--Peak activity of amphibians occurs on warm, wet mid-summer nights. Relative abundance categories below are based on, and indicate, what an observer might expect to see during a nocturnal visit to a particular habitat on site during the mid-summer rainy period (late June-August).

Rank No.	Rank	Abbr.	Interval ¹
1	Abundant	A	$X > 20$
2	Very Common	VC	$20 > X > 10$
3	Common	C	$10 > X > 3$
4	Uncommon	UC	$3 > X > 1$
5	Rare	R	$1 > X$

All amphibian species on-site are anurans (toads and frogs). No population of the Tiger Salamander (*Ambystoma tigrinum*), native or introduced, has been observed yet on-site. Discussion of hypothetically occurring species is deferred to the "Accounts of Species."

Data by species of amphibians are given in Table 1, by season and by habitat (= biotic community, as used here). No amphibian was observed in winter. For all species observed, activity began with the onset of mid-summer rains in late June. Heavy rains normally do not occur until July.

Local weather conditions can greatly affect short-term herpetofaunal investigations. This is especially true in the arid southwest. Sparser than normal rainfall in July and early August 1978 in the Huachuca Mountains area was not favorable for amphibians and, to a lesser extent, reptiles. Reduced rainfall and elevated temperatures significantly affected microhabitat conditions throughout the area, and undoubtedly reduced the probability of field contact with several species during the survey period.

1. Observation of fewer than 1 ($1 \geq X$) individual animal results from averaging observation data.

Table 1. Estimated relative abundance of species of amphibians observed in the major biotic communities and habitats of the Coronado National Memorial during the seasons of activity in 1977-1978. Biotic communities: DG = Semidesert Grassland, OW = Oak Woodland, PO = Pine-Oak Woodland, RH = Riparian habitats. Relative abundance categories: 1 = Abundant, 2 = Very Common, 3 = Common, 4 = Uncommon, and 5 = Rare. See text "Results" for relative abundance category intervals.

Species	Spring				Summer				Autumn			
	DG	OW	PO	RH	DG	OW	PO	RH	DG	OW	PO	RH
<u>Scaphiopus hammondi</u>	1	3		4	1	3		4	4			
<u>Hylactophryne augusti</u>						5						
<u>Bufo woodhousei</u>	4	4		4	4	4		4				
<u>Bufo cognatus</u>	5	3		3	4	3		3				
<u>Bufo punctatus</u>	5	4		4	4	3		4				
<u>Rana catesbeiana</u>						5						

The Memorial is primarily a day-use area, open only to through-traffic during evening and night hours. Thus most visitors probably do not often encounter any toads and frogs. Absence of permanent surface water in the more frequently visited on-site areas also reduces encounter probabilities. Nevertheless, anurans comprise an especially interesting and important portion of the Memorial biota.

Reptiles. -- All species of reptiles known from the Memorial are lizards and snakes; results for each group are given separately below. No species of turtles or tortoises are known to occur in the Memorial. However, the Western Box Turtle (Terrapene ornata) occurs regularly in adjacent off-site grassland habitat; one or more local populations may occur in the eastern portions of the Memorial.

Lizards. The peak surface activity of lizards usually occurs during morning hours on warm-season days. A second and lesser peak may occur in mid- to late afternoon. In spring and autumn, diurnal lizard activity may begin later in the morning and extend more or less evenly through late afternoon. During any season, daily activity is affected by rain and/or cold weather on preceding days or nights.

Relative abundance categories below are based on, and indicate, what an observer might expect to see during an activity peak for a particular species of lizard. Note that intervals for lizards differ from those for amphibians (see above).

<u>Rank No.</u>	<u>Rank</u>	<u>Abbr.</u>	<u>Interval</u>
1	Abundant	A	$X > 25$
2	Very Common	VC	$25 > X > 15$
3	Common	C	$15 > X > 5$
4	Uncommon	UC	$5 > X > 1$
5	Rare	R	$1 > X$

Seasonal relative abundances of all species of lizards observed on-site during the survey period are given in Table 2, tabulated by habitat (= biotic community). Discussion of hypothetically occurring species is deferred to the "Accounts of Species."

As noted above under "Amphibians," local weather conditions govern and may cause changes in reptile behavior and activity in all seasons. Major activity by lizard species other than whiptails (Cnemidophorus spp.) begins in April-May in the Memorial area and lasts through October. Whiptail activity begins in May-June and lasts into early October. Only the Mountain Spiny Lizard (Sceloporus jarrovi) is winter-active in the Memorial area, and then only on warm, sunny days.

The slightly drier-than-normal rainy season of 1978 did not significantly affect most species of lizards. The numbers of juveniles appearing after mid-August were about as expected, considering the geographic and ecological situation of the Memorial. However, numbers of juvenile Sonora Whiptails (Cnemidophorus sonorae) were somewhat lower than expected.

Because of their diurnal activity patterns, most species of lizards are far more conspicuous to the usual Memorial visitor than are amphibians or snakes. Three species are evident to even the most casual mid-summer visitor: Mountain Spiny Lizard - on rocky road-cuts near Montezuma Pass; Sonora Spiny Lizard - large adults bask on warm, paved roads throughout the area; and Sonora Whiptail - adults scamper noisily around the Memorial Headquarters, in leaf litter in Oak Woodland and riparian habitats throughout, and occur all along Joe's Canyon Trail. Because of their smaller size and/or less conspicuous activity

Table 2. Estimated relative abundance of species of lizards observed in the major biotic communities and habitats of the Coronado National Memorial during the seasons of activity in 1977-1978. Biotic communities and habitats as in Table 1. See text (Results) for relative abundance categories, intervals, and rank numbers.

Species	Spring				Summer				Autumn			
	DG	OW	PO	RH	DG	OW	PO	RH	DG	OW	PO	RH
<u>Holbrookia maculata</u>	3	3	4	3	2	3	4	3	3	3	4	3
<u>Sceloporus jarrovi</u>		3	4			1	3			2	3	
<u>Sceloporus clarki</u>	4	2	4	2	3	1	4	1	3	3	4	3
<u>Urosaurus ornatus</u>	1	3	4	2	1	3	4	1	2	3	4	3
<u>Phrynosoma douglassi</u>	4				4	4			4			
<u>Cnemidophorus sonora</u>		3	4	3		1	3	2		3		4
<u>Cnemidophorus uniparens</u>	3				2				4			
<u>Gerrhonotus kingi</u>						5		5				

patterns, other lizard species (and juvenile lizards in general) are more frequently overlooked by visitors.

Snakes. As is usually the case, snakes were not encountered frequently enough to allow the construction of a relative abundance category system empirically equivalent to those used for amphibians and lizards. No species of snake was encountered often enough to be considered truly "common" in the sense in which some amphibians and lizards are "common." Thus snakes were ranked within-group from most to least commonly encountered species in the Memorial (Table 3). Such rankings are not intended to reflect actual population density relationships, especially among the more secretive, smaller and/or nocturnal species. Discussion of hypothetically occurring species of snakes is given in the "Accounts of Species."

Because of their retiring habits, snakes are not often noticed by the usual Memorial visitor. Both poisonous and non-poisonous species are found in the Memorial. Non-poisonous species are far more frequently encountered but do not leave so lasting an impression on visitors. The only poisonous species potentially dangerous to man that is known to occur on site is the Black-tailed Rattlesnake (Crotalus molossus). The Mohave Rattlesnake (C. scutulatus) occurs in adjacent and continuous grassland habitat off site; it may occur in the eastern Memorial grasslands.

Accounts of Species

Described below in the species accounts is the on-site (Coronado National Memorial) status of each species of amphibian or reptile that we encountered during the survey period or that has otherwise been reported to be in the area. Immediately following the species name is an estimate of relative abundance within the Memorial bounds.

Table 3. Species of snakes observed in major biotic communities and habitats of the Coronado National Memorial during 1977-1978. Estimated overall relative abundance rankings, from most commonly observed species (1) to least commonly observed species (1) to least commonly observed species (8). Biotic communities and habitats as in Table 1.

Species	DG	OW	PO	RH	RANK
<u>Masticophis bilineatus</u>	x	x			1
<u>Masticophis flagellum</u>	x	x			2
<u>Elaphe triaspis</u>				x	7
<u>Diadophis punctatus</u>		x			6
<u>Pituophis melanoleucus</u>	x	x		x	4
<u>Lampropeltis pyromelana</u>				x	8
<u>Trimorphodon lyrophanes</u>		x			5
<u>Crotalus molossus</u>		x	x	x	3

Observed relative abundance categories are defined in "results," above. "Hypothetical" species are those whose presence within the Memorial bounds or in adjacent and continuous habitat has not yet been verified by us or published by other workers.

San Pedro Grasslands. -- The grasslands (mesquite-savanna) extending easterly from the eastern Memorial bounds downward to the San Pedro River are continuous with the memorial's grassland habitats and form an ecotone with its Oak Woodland. Species of amphibians and reptiles inhabiting the San Pedro Grasslands may be expected in the

Memorial, occasionally or regularly, even though the grassland area within the present Memorial bounds may be too limited or otherwise marginal to support large and stable populations of such species. Thus we have included in this report information gathered on species occurring in the adjacent and confluent San Pedro Grasslands. Such potentially present or immigration populations must be considered in evaluating the biota of the Montezuma Canyon watershed.

Amphibians--Toads and Frogs

1. Scaphiopus couchi. Desert Spadefoot Toad. On-site relative abundance: Hypothetical; found in adjacent but dissimilar off-site habitat. Voucher: off-site, from T23S, R21E, S34. Increasingly common from the San Pedro Grasslands north and east into creosotebush desertscrub. If it does occur on-site, it is in lower Montezuma Canyon in the ranch acquisition area.
2. Scaphiopus hammondi. Western Spadefoot Toad. On-site relative abundance: Abundant in Semidesert Grassland, Common in lower Oak Woodland. Voucher: off-site, from T24S, R21E, S4. Decreases in abundance from lower to middle Montezuma Canyon. Has not yet been found in the upper Canyon, above 3093 m. Breeds in temporary pools in the Gravel Pit area (see Fig. 1) and in stock tanks in the San Pedro Grasslands. This is the most frequently seen anuran on roads on rainy evenings during the spring and summer.
3. Hylactophryne augusti. Barking Frog. On-site relative abundance: Rare and local in Evergreen Woodland. No voucher. On 10 July 1978 at 2242 h, in a light rain shower, we heard Barking Frogs calling from rocky clefts in the limestone ridge immediately north of the Memorial maintenance buildings (Fig. 16). The calls were given for about 90

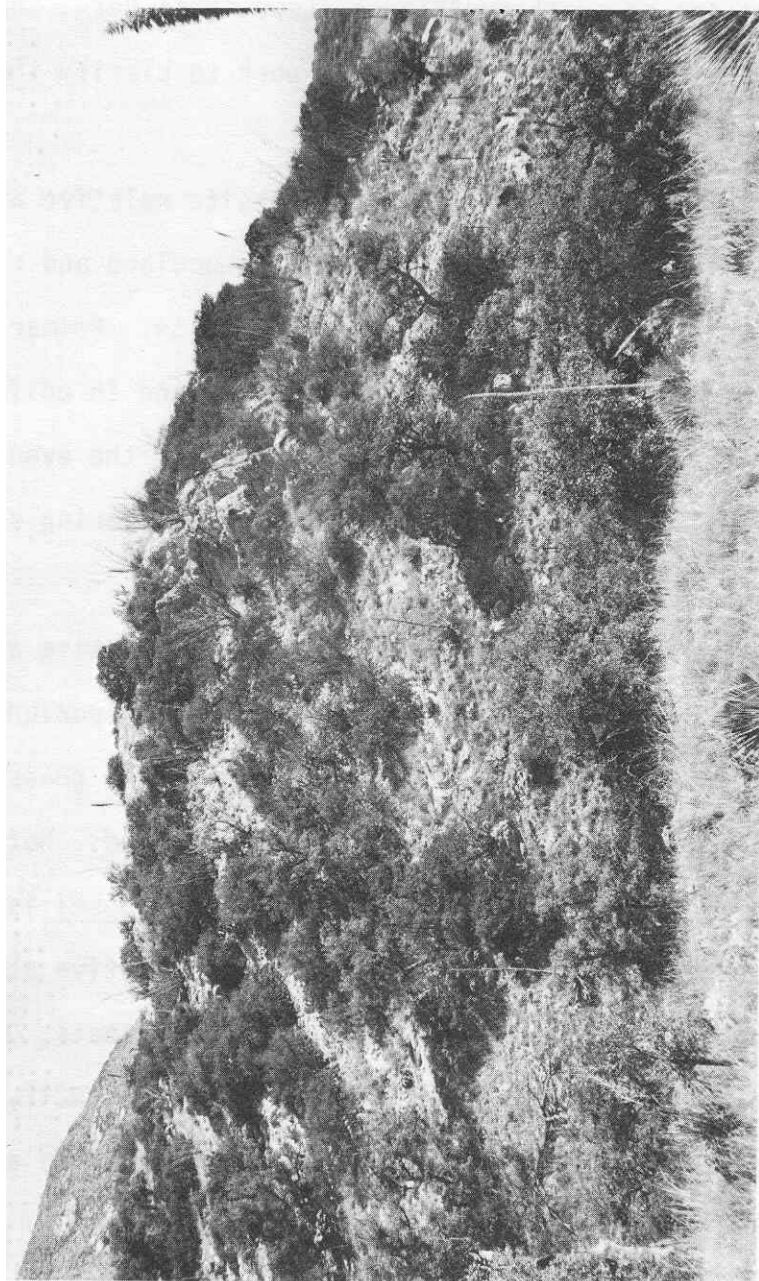


Fig. 16. Habitat of the Barking Frog (Eleutherodactylus augusti). Southerly exposure on limestone hill at 1692 m; looking easterly from the Memorial Residential Area. Aspect open with scrubby oaks, junipers, manzanita (Arctostaphylos pungens), sumac (Rhus choriophylla), sotol (Dasylirion wheeleri), beargrass (Nolina microcarpa), and golden-flowered agave (Agave palmeri).

minutes, but no specimens could be located before calling stopped completely.

Movement. of rocks during the search partially disturbed the microhabitat. No such calls were heard again during the summer. Barking Frogs are known from similar habitats in the Santa Rita and Pajarito mountains of southern Arizona (Lowe 1964; Bezy, Sherbrooke, and Lowe 1966). We encourage subsequent work to clarify the on-site distribution of this species

4. Bufo woodhousei. Woodhouse's Toad. On-site relative abundance: Uncommon in Semidesert Grassland washes, Oak Woodland and riparian habitats. Voucher: off-site, from T24S, R21E, S4. Primarily a riparian species, generally seen on roads throughout and in edificarian habitats of its biotic communities. Usually active in the evening or at night. Apparently more common on-site than the following species (B. cognatus).

5. Bufo cognatus. Great Plains Toad. On-site relative abundance: Uncommon in Semidesert Grassland, Oak Woodland and riparian habitats. Voucher: off-site, from T24S, R21E, S4. Primarily a grassland species in the Huachuca Mountains area. Marginal in woodland. Not primarily a riparian species, as the similarly-sized B. woodhousei is (see above).

6. Bufo punctatus. Red-spotted Toad. On-site relative abundance: Very common in Oak Woodland, Common in riparian habitats, Uncommon in Semidesert Grassland. Voucher: off-site, from T24S, R21E, S18. Found in rock crevices in canyons or on hillsides in grasslands and oaks. Breeds in standing water in cattleguards near the Memorial Headquarters, around which it can be heard calling loudly on rainy nights.

7. Rana catesbeiana. Bullfrog. On-site relative abundance: Rare and local in Oak Woodland. No voucher. We found a single large individual in a spring-fed (via pipeline) stock tank 2.2 km west of Montezuma Pass in the proposed exchange lands (T24S, R20E, S10). Lack of

permanent surface water within the proposed Memorial bounds precludes the continued presence of this non-native species that is widely introduced in Arizona.

Reptiles - Turtles.

1. Terrapene ornata. Western Box Turtle. On-site relative abundance: Hypothetical; found off-site in adjacent, continuous Semidesert Grassland. Voucher: off-site, from T24S, R21E, S3. Found regularly in the San Pedro Grasslands. On-site occurrence (Uncommon or Rare) expected in Semidesert Grassland in the ranch acquisition area.

Reptiles - Lizards.

1. Heloderma suspectum. Gila Monster. On-site relative abundance: Hypothetical; status in area requires clarification. A single sight-record by Rita Felix, Park Ranger Interpreter at the Memorial, along F.S. 48 near the Memorial's east boundary in oak-savanna. The habitat is atypical to marginal for this species; the elevation (ca. 1585 m) is roughly 305 m higher than its usual upper limit. Gila Monsters have been seen by Memorial personnel in creosotebush desertscrub about 20 km ENE of the Memorial. They may occur in the ranch acquisition area on-site.

2. Holbrookia maculata. Lesser Earless Lizard. On-site relative abundance: Very Common in Semidesert Grassland, Common locally in Oak Woodland. Voucher: on-site, from T24S, R20E, NE¼ of SE¼ of S14. Frequently seen in open, barren, often rocky, areas throughout the Memorial. Less common in the upper parts. Rare to absent on well-shaded north-facing slopes. Commonly seen off-site on F.S. 48 in the San Pedro Grasslands.

3. Sceloporus jarrovi. Mountain Spiny Lizard. On-site relative abundance: Abundant but very local in Evergreen Woodland. Voucher: offsite, from T24S, R20E, SE¼ of SE¼ of S11. Only in rocky habitats, such as talus slopes and road-cuts, with southerly

exposure (Fig. 12). A large population is found on the road-cut east of Montezuma Pass, down to a switchback at 0.75 km below. Occurs as low as 1707 m on the rocky canyon walls at Geronimo Cave (.8 km NW of Memorial Headquarters). An individual on a brick fireplace in the Picnic Area was presumably man-transported and was not seen on subsequent visits to the area.

4. Sceloporus undulatus. Eastern Fence Swift. On-site relative abundance: Hypothetical; known from adjacent and continuous habitat. Voucher: off-site specimen collected by Gloyd (1937), who reported it from "Montezuma Canyon." May be Rare and local in Semidesert Grassland in the ranch-acquisition area.

5. Sceloporus clarki. Sonora Spiny Lizard. On-site relative abundance: Abundant in Oak Woodland and riparian habitats, Common in Semidesert Grassland, Uncommon in Pine-Oak Woodland. Voucher: on-site, from T24S, R20E, NE¼ of SE¼ of S14. Conspicuous throughout the Memorial, especially in edificarian habitats. In the Semidesert Grassland it is found on trees or rocks in washes. Generally found on large oaks but smaller individuals are often seen on small oaks or desert willows. Large adults are frequently seen basking on warm, paved roads, especially after mid-day rains. This results in heavy mortality, as 3-4 per day can be found squashed on the roads, when proper weather conditions coincide with heavy traffic.

6. Urosaurus ornatus. On-site relative abundance: Abundant in Semidesert Grassland and riparian habitats, Common in Oak Woodland, Uncommon in Pine-Oak Woodland. Voucher: on-site, from T24S, R20E, NE¼ of SE¼ of S14. Concealingly bark-colored; encountered throughout the Memorial by the careful observer. Much less common on north-facing slopes. Along the upper end of Joe's Canyon Trail it is very numerous on small rock piles on open,

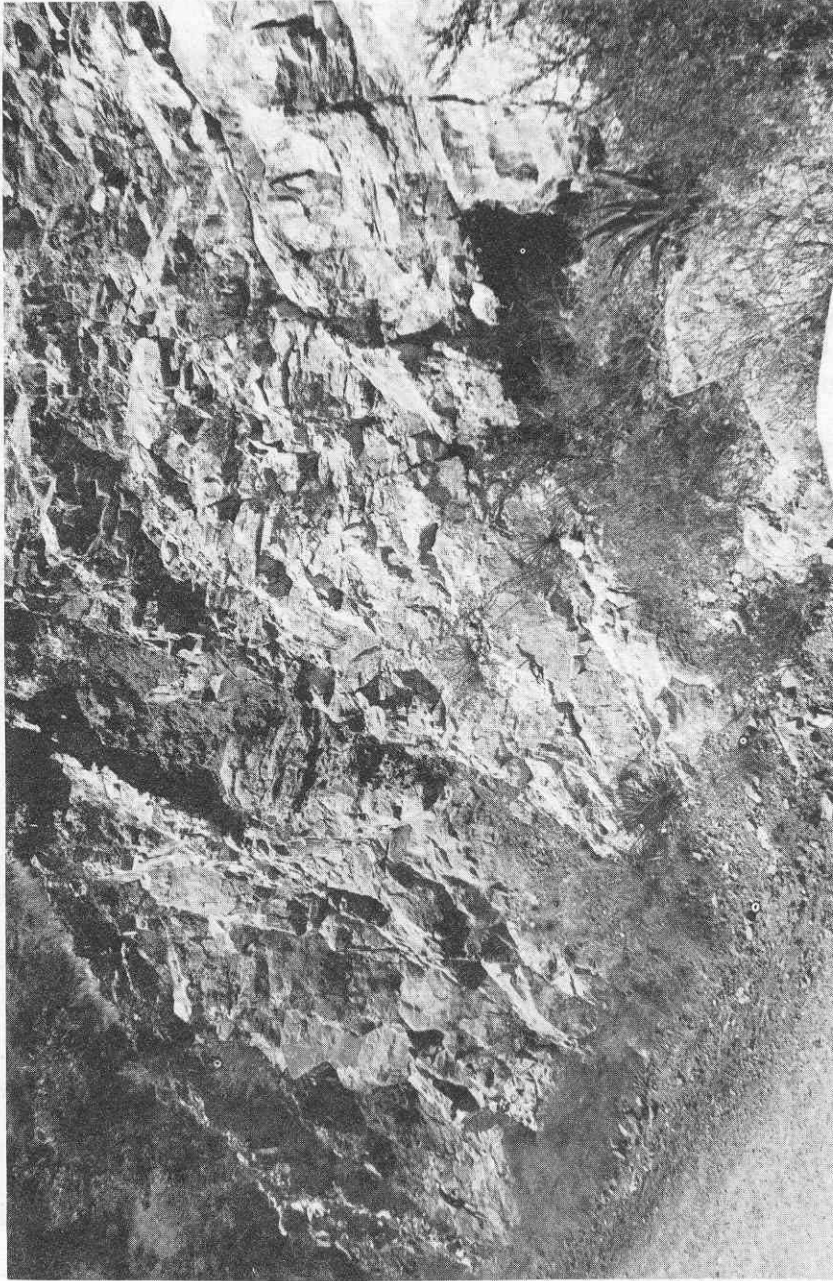


Fig. 17. Rock-face habitat of the Mountain Spiny Lizard (*Sceloporus jarrovi*) on road-cut at 1958 m in evergreen woodland, 7 km below Montezuma Pass; south-facing.

southerly slopes and hillsides. Elsewhere it is more commonly seen perched on trees, especially smaller oaks, willows and other trees in riparian situations.

7. Phrynosoma douglassi. Short-horned Lizard. On-site relative abundance: Uncommon in Semidesert Grassland and Oak Woodland. Voucher: on-site, from T24S, R20E, NE¼ of SE¼ of S14. Found throughout the Memorial but most numerous in the lower Canyon reaches and in open upland areas with southerly exposure. In low numbers and local in woodlands on north-facing slopes. Often found near ant-nests. The frequency of road-kills in the San Pedro Grasslands indicates a status of Common may be warranted for the Semidesert Grassland on site. Due to its concealing coloration and cautious activity pattern this species is probably overlooked by most visitors.

8. Phrynosoma cornutum. Texas Horned Lizard. On-site relative abundance: Hypothetical; found off-site in adjacent habitat. Voucher: off-site, from T24S, R22S, S33. Fairly common in creosotebush desert scrub and in the San Pedro Grasslands. If it occurs on-site, it should be in grasslands in the ranch-acquisition area and lower Montezuma Canyon.

9. Cnemidophorus sonorae. Sonora Whiptail. On-site relative abundance: Abundant in Oak Woodland, Very Common in Riparian Scrub, Common in Pine-Oak Woodland. Voucher: on-site, from T24S, R20E, NE¼ of SE¼ of S14. Abundance greatly drops on shaded north-facing slopes; otherwise found throughout the Memorial, but in Semidesert Grassland it is only in Riparian Scrub. For the visitor walking Joe's Canyon Trail on a hot day from June through early August, this is the most abundant reptile seen. As many as 60-70 adults may be seen on a one-way walk down the Trail from 0900-1100 on a sunny July morning. Juveniles are numerous in mid-August and into October. This is an all-female (parthenogenetic) species.

10. Cnemidophorus uniparens. Desert-grassland Whiptail. On-site relative abundance: Very Common in Semidesert Grassland. Voucher: off-site, from T24S, R21E, NE¼ of SE¼ of S4. Generally found away from riparian habitats in the ranch-acquisition area and eastward into the San Pedro Grasslands. Parthenogenetic.

11. Gerrhonotus kingi. Arizona Alligator Lizard. On-site relative abundance: Rare and local in Oak Woodland and riparian habitats. Voucher: on-site, from T24S, R21E, NW corner of S20. Found in riparian situations in Semidesert Grassland and in oak-grass habitats throughout the Evergreen Woodland. Often locally abundant, this species is usually seen only when rocks, logs, and dead agaves or yuccas on damp soil are turned over.

Reptiles - Snakes.

1. Thamnophis cyrtopsis. Black-necked Garter Snake. On-site relative abundance: Hypothetical; found off site in similar but discontinuous habitat. Voucher: off-site, from T24S, R21E, S9. Uncommon in the San Pedro Grasslands in riparian situations. Probably occurs at most stock tanks in the Memorial area and may occasionally be found in the washes of lower Montezuma Canyon.

2. Thamnophis marcianus. Checkered Garter Snake. On-site relative abundance: Hypothetical; found off-site in similar but discontinuous habitat. Voucher: off-site, from T24S, R22E, S4. Common in the San Pedro Grasslands, especially near the San Pedro River. In the Colorado River Basin, strictly riparian on the major rivers. Not expected to occur regularly in the Riparian Scrub or Semidesert Grassland in the eastern parts of the Memorial area.

3. Masticophis bilineatus. Sonora Whipsnake. On-site relative abundance: Very Common in Semidesert Grassland and Common in open Oak Woodland. Voucher: off-site, from T24S,

R21E, S4. Found throughout the lower and middle reaches of Montezuma Canyon. Not yet seen above about 1707 m or on shaded, north-facing slopes. From early August through mid-September this is the most commonly encountered snake in the area. Often during that period 5-6 hatchlings can be found per morning on the roads in the Memorial area.

4. Masticophis flagellum. Red Racer (Coachwhip). On-site relative abundance: Common in Semidesert Grassland and Uncommon in Oak Woodland. Voucher: off-site, from T24S, R20E, S13. Not as common nor as widespread as the previous species (M. bilineatus). Large individuals are most often seen in or near the San Pedro Grasslands. The Memorial is at the upper elevational limit of the species' distribution.

5. Salvadora hexalepis. Desert Patch-nosed Snake. On-site relative abundance: Hypothetical; found off-site in adjacent and continuous habitat. Voucher: off-site, from T24S, R21E, S9. Occurs in the San Pedro Grasslands and probably in the-lower reaches of Montezuma Canyon in the ranch-acquisition area. Most common in grassland but occasionally into the lower edge of woodland.

6. Elaphe triaspis. Green Rat Snake. On-site relative abundance: Rare and local in Riparian Woodland. No voucher. Several sight-records by Memorial personnel in the immediate area of the Memorial Headquarters. A voucher specimen should be obtained.

7. Diadophis punctatus. Ringneck Snake. On-site relative abundance: Uncommon in Oak Woodland and Semidesert Grassland. Voucher: off-site, from T24S, R20E, NE¼ of S14. This secretive species is rarely encountered except by turning rocks, logs and other surface cover on damp soil. Dry soil conditions during the survey period, resulting from sparse rainfall, greatly hindered search for this species.

8. Pituophis melanoleucus. Gopher Snake. On-site relative abundance: Uncommon in Semidesert Grassland and Oak Woodland. Voucher: on-site, from T24S, R21E, S18. Surprisingly low numbers in the Memorial area, but occurs throughout. Quite often seen during the day as well as at night.
9. Rhinocheilus lecontei. Long-nosed Snake. On-site relative abundance: Hypothetical; found off-site in adjacent habitat. Voucher: off-site, from T23S, R22E, S33. Found in desertscrub and in Semidesert Grassland, especially near the San Pedro River. Likely to be Rare in the Semidesert Grassland in the ranch-acquisition area of the Memorial.
10. Lampropeltis getulus. Common Kingsnake. On-site relative abundance: Hypothetical; found off site in similar but discontinuous habitat. Voucher: off-site, from T24S, R22E, S4. Found in riparian desertscrub and in Semidesert Grassland, especially along the San Pedro River. If found in the Memorial, it will be in lower Montezuma Canyon in the ranch-acquisition area or elsewhere along the eastern boundaries.
11. Lampropeltis pyromelana. Sonora Mountain Kingsnake. On-site relative abundance: Rare in Oak Woodland and Riparian Forest and Woodland. Voucher: off-site, from T24S, R20E, SE¼ of S11. This beautiful snake is found in montane woodland, especially in canyons. It is highly prized by collectors.
12. Trimorphodon lyrophanes. Sonora Lyre Snake. On-site relative abundance: Uncommon in Semidesert Grassland, Evergreen Woodland and riparian habitats. Voucher: on-site, from T24S, R21E, S18. Probably found throughout the Memorial. A rear-fanged poisonous snake that is harmless to man.
13. Micruroides euryxanthus. Arizona Coral Snake. On-site relative abundance: Hypothetical; reported from adjacent and similar off-site habitat. No voucher or sight-

record from the Memorial. Reported from Copper Canyon in mine shafts a few miles west of Montezuma Pass. Often confused with the Sonora Mountain Kingsnake and the Long-nosed Snake. Rare and local in Semidesert Grassland and Evergreen Woodland below 1684 m. Fossorial, extremely secretive, and difficult to locate. Poisonous and potentially dangerous to man.

14. Sistrurus catenatus. Massasauga. On-site relative abundance: Hypothetical; known from adjacent and similar Semidesert Grassland. No voucher or sight-record from the Memorial. A specimen reported from "Fort Huachuca" in the late 1800s. Rare in the San Pedro Grasslands and may reach the lower Montezuma Canyon area.

15. Crotalus molossus. Black-tailed Rattlesnake. On-site relative abundance: Uncommon in Evergreen Woodland and riparian habitats. Voucher: off-site, from T24S, R21E, S18. Usually found in rocky canyon areas. This is the woodland rattlesnake encountered by Memorial visitors, occasionally in the Picnic Area.

16. Crotalus scutulatus. Mohave Rattlesnake. On-site relative abundance: Hypothetical; found off-site in adjacent and continuous habitat. Voucher: off-site, from T23S, R21E, S34. Uncommon to Common in the San Pedro Grasslands. Expected in Semidesert Grassland in the ranch-acquisition area of the Memorial. This is the grassland rattlesnake that visitors are likely to see on F.S. 48 from the eastern Memorial boundaries to Arizona 92.

17. Crotalus lepidus. Banded Rock Rattlesnake. On-site relative abundance: Hypothetical; known from similar but discontinuous off-site habitat. No vouchers or sight-records from the Memorial. A common woodland species on south-facing talus slopes in the Huachuca Mountains. Expected to be Rare to locally Common in rocky situations with southerly exposure in the Evergreen Woodland in Montezuma Canyon.

Additional Species.--Given the short-term nature of this survey, entirely" several species of amphibians and reptiles that may occur in the area. Typically such species are small, surface-active only for brief periods during the year. There are no on-site records for this type of hypothetically occurring species, nor are there any immediate-area records as there are for the 14 "Hypothetical" species included in the "Accounts of Species." The species in question are known, however, from the Huachuca Mountains area, and one or more habitats on-site or in the acquisition-lands may be marginal to suitable for each species. Twenty-one such species (1 salamander, 2 anurans, r lizards, and 14 snakes) are listed in Table 4. For each species the probable availability of marginal or suitable habitat in the Memorial area is evaluated. It is important to note that our habitat evaluation is based on a cursory survey of the acquisition-lands and is not intended to be definitive. From Table 4 it is obvious that, in remarkable contrast to the reported situation for mammals (Petryszyn and Cockrum 1978), acquisition of the highlands north of the present-day Memorial will have a significant effect on the number of species included in the Coronado National Memorial herpetofauna. As many as 14 species presently unknown from the Memorial are likely to occur within the proposed acquisition lands (see Table 4). Also, several of the more uncommon or "Hypothetical" on- site species – Barking Frog, Sonora Mountain Kingsnake, Banded Rock Rattlesnake – may be present in larger populations there than within the present bounds.

Table 4. Additional species of amphibians and reptiles potentially occurring in the Coronado National Memorial and availability of on-site habitat for each. Species are known from the Huachuca Mountains area but were not encountered during this survey or are not known from the Memorial or its immediately adjacent area. Habitat suitability based on preliminary and cursory survey by the authors.

Species	Habitat Suitability			
	<u>Present Memorial</u>		<u>Acquisition Lands</u>	
	Suitable	Marginal	Suitable	Marginal
Tiger Salamander (<u>Ambystoma tigrinum</u>)	x		x	
Arizona Treefrog (<u>Hyla wrightorum</u>)			x	
Canyon Treefrog (<u>H. arenicolor</u>)		x	x	
Banded Gecko (<u>Coleonyx variegatus</u>)	x		x	
Bunch Grass Lizard (<u>Sceloporus scalaris</u>)		x	x	
Mountain Skink (<u>Eumeces callicephalus</u>)		x	x	
Great Plains Skink (<u>E. obsoletus</u>)	x		x	
Texas Blind Snake (<u>Leptotyphlops dulcis</u>)	x			x
Western Blind Snake (<u>L. humilis</u>)	x			x
Mexican Garter Snake (<u>Thamnophis eques</u>)		x		x

Table 4. continued

Species	Habitat Suitability			
	Present	Memorial	Acquisition	Lands
	Suitable	Marginal	Suitable	Marginal
Western Hognose Snake (<u>Heterodon nasicus</u>)		x		x
Mountain Patch-nosed Snake (<u>Salvadora grahamiae</u>)	x		x	
Glossy Snake (<u>Arizona elegans</u>)		x		x
Western Hook-nosed Snake (<u>Ficimia cana</u>)	x		x	
Western Ground Snake (<u>Sonora semiannulata</u>)	x		x	
Night Snake (<u>Hypsiglena torquata</u>)	x		x	
Mexican Black-headed Snake (<u>Tantilla atriceps</u>)	x		x	
Huachuca Black-headed Snake (<u>T. wilcoxi</u>)	x		x	
Western Diamondback Rattlesnake (<u>Crotalus atrox</u>)		x		x
Twin-spotted Rattlesnake (<u>C. pricei</u>)		x		x
Ridge-nosed Rattlesnake (<u>C. willardi</u>)		x	x	

Summary and Conclusions

The biological significance of the Coronado National Memorial is entirely disproportionate to its small size. The area is a transition zone from grasslands along the San Pedro River to coniferous forest at higher elevations in the Huachuca Mountains, one of the "Mexican Mountains" southeastern Arizona that is a northern outlyer of the Sierra Madre Occidental of Northern Mexico.

Within the present-day Memorial bounds there are four principal natural biotic communities: (1) Semidesert Grassland, (2) Evergreen Oak Woodland, (3) Evergreen Pine-Oak Woodland, and (4) Riparian Forest, Woodland, and Scrub. All major biotic communities and habitats within them were carefully examined during this survey for the presence of amphibians and reptiles. Areas adjacent to the Memorial were also surveyed. Field work was conducted from August 1977 through October 1978; a total of 37 field man-days were spent on site. Species vouchers are deposited at the University of Arizona, Tucson.

A total of six species of amphibians and 16 species of reptiles are known to occur in the Memorial (preliminary data). An additional 14 "Hypothetical" species (1 amphibian, 13 reptiles) are known to occur in the area, and one or more of these may also be found in the Memorial. All 36 of these on-site or "Hypothetical" species are discussed in the "Accounts of Species".

All six species of amphibians known from the Memorial are anurans (toads and frogs); only the Bullfrog is non-native. Anurans are most active on warm, rainy nights in mid-summer. The Memorial, however, is a day--use park and is open only to through-traffic at night. Thus amphibians are not frequently encountered by visitors. Nevertheless, four of the five native species are rather widely distributed, both ecologically and in visitor-contact areas. They are the most often encountered anurans: (1) Western Spadefoot Toad, (2)

Woodhouse's Toad, (3) Great Plains Toad, and (4) Red-spotted Toad. The fifth native species, the Barking Frog, apparently is restricted to clefts in the limestone ridge north of the Memorial maintenance buildings. It is unlikely to be encountered by visitors. The sixth on-site species of amphibian, the Bullfrog, is found only in a permanent stock tank west of Montezuma Pass. The proposed deletion of these lands from the Memorial would eliminate this non-native, introduced species from the Memorial checklist of amphibians.

The hypothetical occurrence on site of the Desert Spadefoot Toad is based on its known presence in adjacent grasslands. Marginal habitat is available in the ranch acquisition area of the Memorial.

No species of turtles or tortoises are known from the Memorial. The hypothetical occurrence on site of the Western Box Turtle is based on its known presence in adjacent grasslands. Habitat suitable for this species is found in the ranch-acquisition area of the Memorial. Box turtles are easily seen and identified; on-site occurrence of this species is expected to be confirmed.

There are eight species of lizards known from the Memorial; all are native species. The species form three groups in terms of their on-site abundance and the rate of encounter with visitors. In general, the more abundant species are more frequently encountered by visitors. In the first group are the five more abundant species, in decreasing order: (1) Tree Lizard, (2) Sonora Spiny Lizard, (3) Sonora Whiptail, (4) Lesser Earless Lizard, and (5) Mountain Spiny Lizard. Ordered by decreasing rate of encounter with visitors they are (1) Sonora Spiny Lizard, (2) Sonora Whiptail, (3) Mountain Spiny Lizard, (4) Lesser Earless Lizard, and (5) Tree Lizard. The small size, retiring habits and concealing bark-coloration of the Tree Lizard make it far less conspicuous to the usual visitor than its large population size alone would indicate.

In a group by itself is the Desert Grassland Whiptail. It is very common in the grassland habitats at lower elevations in the eastern parts of the Memorial, but very few visitors walk that area. Thus, while it may be at least as numerous in the Memorial as the Mountain Spiny Lizard--which is very local but found in high visitor-impact areas--it is far less frequently encountered by visitors.

The third group of on-site species is composed of the (1) Shorthorned Lizard and (2) Arizona Alligator Lizard. Both are local, uncommon and/or inconspicuous and are not seen by most visitors.

The hypothetical on-site occurrence of three additional species of lizards is based on: (1) Gila Monster--an unconfirmed sight-record in the Memorial, known presence 20 km ENE of the Memorial; (2) Texas Horned Lizard--known presence in adjacent and similar habitat; and (3) Eastern Fence Swift--known presence in adjacent grasslands. Habitats on the Memorial are atypical to marginal for these species. None of the three are expected to occur on-site as large, stable populations,

Eight species of snakes are known from the Memorial; all are native species. No species is frequently encountered by visitors in the sense that the more common lizards are. The following are the more often encountered snakes, in decreasing order: (1) Sonora Whipsnake, (2) Red Racer, (3) Black-tailed Rattlesnake, and (4) Gopher Snake. The preceding species are much more frequently encountered than the following, in decreasing order: (1) Sonora Lyre Snake, (2) Ringneck Snake, (3) Green Rat Snake, and (4) Sonora Mountain Kingsnake.

The Black-tailed Rattlesnake, poisonous and potentially dangerous to man, has been confirmed as occurring on-site. It occurs throughout the Memorial, except in grasslands where it is probably replaced by the Mohave Rattlesnake ("Hypothetical"). Black-tailed

Rattlesnakes are occasionally encountered by hikers in the Picnic Area and in wooded, rocky canyons.

There are nine species of snakes listed as "Hypothetical" for the Memorial: (1) Black-necked Garter Snake, (2) Checkered Garter Snake, (3) Desert Patch-nosed Snake, (4) Long-nosed Snake, (5) Common Kingsnake, (6) Arizona Coral Snake, (7) Massasauga, (8) Mohave Rattlesnake, and (9) Banded Rock Rattlesnake. The hypothetical occurrence on site of each species is based on known presence in the area and the existence on-site of suitable to marginal habitat for each. Note that the last four of these species are poisonous and potentially dangerous to man.

None of the species of the amphibians or reptiles discussed herein are on the Federal Endangered or Threatened Species lists; eight are included on the "Threatened and Unique Wildlife of Arizona" list approved by the Arizona Game and Fish Commission (1978):

- | | |
|------------|---|
| Group I. | Species or subspecies extirpated from Arizona that may possibly be re-established - none. |
| Group II. | Species or subspecies in danger of being eliminated from Arizona
- Tiger Salamander, Western Massasauga. |
| Group III. | Species or subspecies whose status in Arizona may be in jeopardy
in the foreseeable future - Gila Monster. |

Group IV. Species or subspecies of special interest because of limited distribution in Arizona - Western Barking Frog, Arizona Tree Frog, Arizona (Sonora) Mountain Kingsnake, Rock Rattlesnake, Ridge-nosed Rattlesnake.

Of these species only two (Western Barking Frog, Arizona Mountain Kingsnake) have been confirmed as occurring on-site. The other six species are known from elsewhere in the Huachuca Mountains or in their immediate environs and are listed as "Hypothetical" for the Memorial.

Recommendations

There are three primary recommendations to be made for resource management in the Memorial: (1) continued and rigorous restriction of off-road vehicular traffic, (2) continued enforcement of regulations governing habitat disturbance and collecting activities, and (3) immediate acquisition of lands north and east of the present-day Memorial bounds.

1. Access remains the single greatest catalyst for negative impact on the Memorial. Restrict off-road and access-road travel to a minimum that is not subject to periodic increase. Do not substantially improve the Memorial's trail system (e.g. Joe's Canyon and Coronado Peak trails) for other than walking as at the present time. Further expansion of the Picnic and Residential areas should be minimized. Expansion or other activity should not be allowed to affect the limestone hill immediately north of the maintenance buildings.

2. Rigorously enforce, in the field, existing National Park Service regulations that prohibit (1) on-site collection of plants, animals and other objects without prior, written permission, and (2) destructive or potentially destructive acts, including off-road vehicles and spraypainting of rocks (e.g. at Geronimo Cave).

3. Immediate acquisition of lands north and east of the present day Memorial bounds is encouraged. Protection of the entire Montezuma Canyon watershed is of considerable importance to both the present and potential Memorial vertebrate fauna.

4. We strongly recommend that similar field research projects for investigation of animal groups be funded for two year rather than one year periods.

Recommendations for further research to resolve management problems:

- (1) Extend survey of present-day (1978) Memorial lands for one year to clarify status of known and hypothetically occurring species. Emphasize monitoring talus slopes.
- (2) Survey acquisition-lands for 2 year period, concomittant with extended survey of present-day lands.
- (3) Establish population size and range of rare Barking Frog population on and in immediate area of the Memorial.

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A SURVEY OF THE BIRDS
OF
CORONADO NATIONAL MEMORIAL

by

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ABSTRACT

Field studies were conducted at the Coronado National Memorial in 1977 and 1978 in order to inventory the bird species and report their current status. Although the area lacks open water and high elevations, 119 species of birds were found. Of this total, probably 53 species breed there. None are described as rare or endangered by the U.S. Fish and Wildlife Service but the Lucifer Hummingbird and the Coppery-tailed Trogon are in the Arizona Game and Fish Department's Group IV list, implying that these species have limited distribution in Arizona and may be in jeopardy. The presence of these two species imposes no immediate management problems. Four other species found regularly in the Memorial are not common or widespread in the United States.

The transfer of a portion of the western part of the Memorial to the Forest Service should not result in the loss of any bird species but it would result in the loss of representative oak savanna habitat. The addition of new land to the north and east of the present boundary will substantially enhance the diversity of birds.

Four management recommendations are made: 1) the western section of the Memorial (proposed for transfer) should be retained in order to include an additional habitat (oak savanna) that complements other areas of the Memorial, 2) grazing pressure appears excessive and should be evaluated to determine future practices, 3) the status of the rare Lucifer Hummingbird needs to be more precisely defined, and 4) the birds of mountains and grassland of the proposed addition should be surveyed.

INTRODUCTION

The objectives of this study were to inventory the bird species on the Coronado National Memorial and to report on the current status of each species in the Memorial. The birds identified and counted on six transect lines in different habitats provide the basis for this report. Other observations are supplemental.

At the recommendation of Superintendent Dale, we did not survey the portion of the Memorial west of Montezuma Pass, (Figure 1) since much of that area is proposed for transfer to the Forest Service (National Park Service, 1976). Instead, we established routes in Montezuma Wash presently outside the Memorial but destined to be acquired at a future date.

The Huachuca Mountains have long been noted for their diversity of bird life. Swarth (1904) wrote on "The Birds of the Huachuca Mountains, Arizona," but included no mention of birds in the area at the present Memorial. Ornithological studies of these mountains have centered on the higher peaks and deeper, more moist canyons. The more exotic birds (generally of southern origin) were not likely to be found in Montezuma Canyon and this area was equally ignored by the earlier naturalists.

Park personnel with a special interest in birds are often significant contributors to a knowledge of the bird life of Park Service lands. Laurel Dale has searched Memorial records and provided me with the few recorded observations. Unfortunately, little useful information was available.

This report includes only species known to have been recorded in the Memorial. Many additional species are cited by Swarth (1904) and by Phillips, Marshall, and Monson (1964) for the Huachuca Mountains.

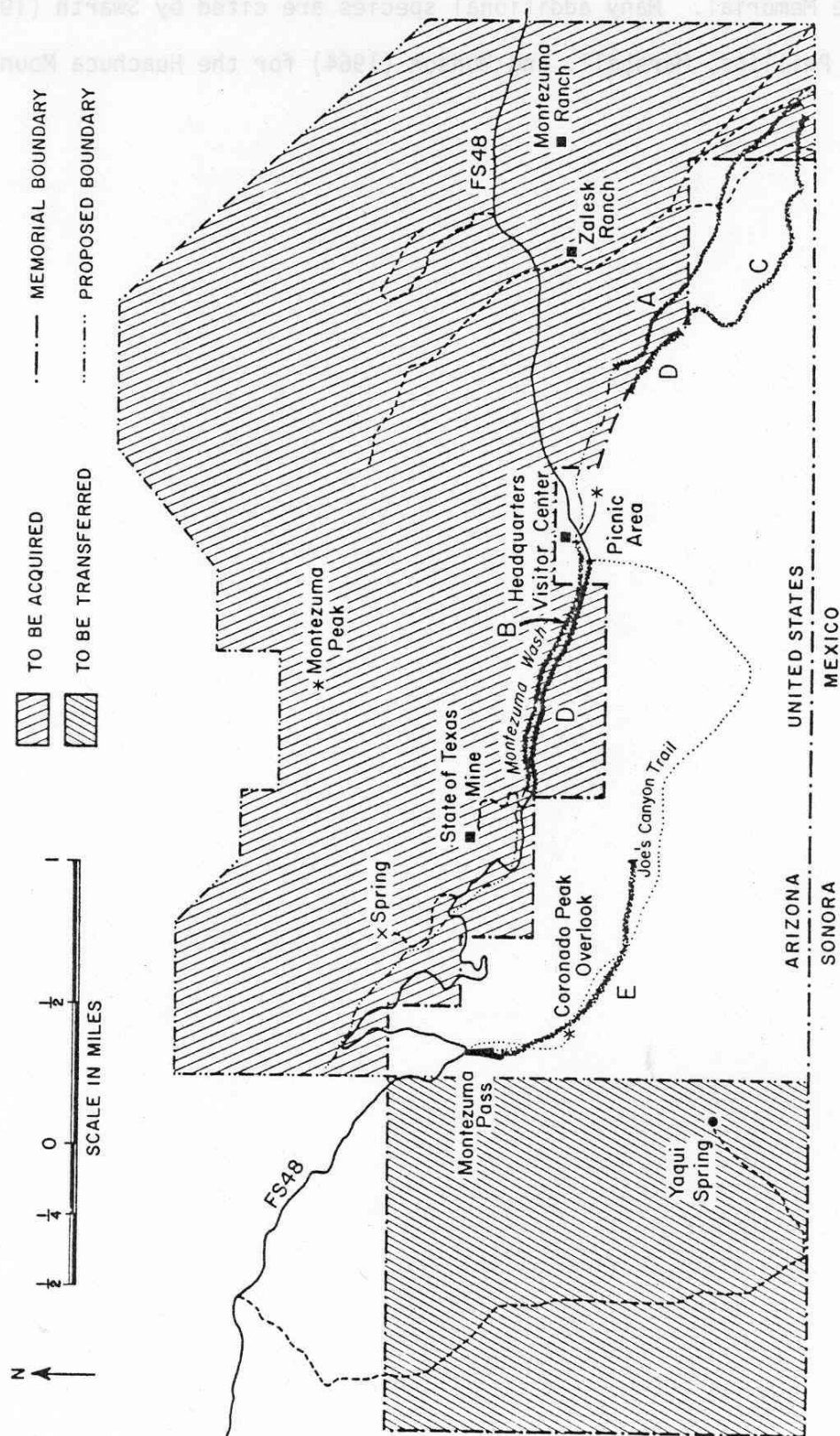


Fig. 1. Map of Coronado National Memorial. Routes utilized to obtain counts of individuals of birds per transect kilometer are: A = Lower Wash, B = Upper Wash, C = Grassland, D = Woodland, E = Ridge.

METHODS

Birds counted on transects provide the basis for this report. Table 1 summarizes numbers of counts, transect kilometers, and dates. Table 2 is a tabulation of all species of birds noted on transects and their relative abundance expressed as birds per kilometer in each of several habitats.

An annotated list of all species recorded from the Memorial is a concise summary of the status of each bird species. The list is based on the transect counts and supplemented by our few additional observations and those of Memorial personnel and visitors.

Six transects were established in the major habitats at locations illustrated in Figure 1. Two transects were in riparian communities. The Lower Wash route extended from about 0.2 km (650 ft) south of the lower end of the picnic area near the headquarters southeast 2.0 km (1.25 mi) along Montezuma Wash to within 100 m of the Mexican boundary. The upper portion of this route is dominated by oaks, most only 4-6 m (13-20 ft) tall. Farther east, there are fewer oaks and Chilopsis, Prosopis, and ash become dominant. Near the border, the wash is in a broad flood plain with grasslands on each side; it is in this area that many grassland birds were counted on the transect.

The Upper Wash route follows Montezuma Wash from its crossing of the highway at headquarters west 1.6 km (1.0 mi) to a point just below the group of houses on the State of Texas mining claim. This part of the canyon is narrow, but dominated by oaks, with some walnuts and juniper. Grape vines abound and a few sycamores occur in the upper part of this transect.

TABLE 1.

Dates of counts on transects, number of counts, and total kilometers of transects counted. In the lower part of the table, the total number of counts precedes the colon. This multiplied by the transect length provides the total length (kilometers) of transects counted (following colon). All dates are within the period from 8 July 1977 to 7 August 1978.

FALL: Sept. 24, 25; Oct. 29, 1977

WINTER: Nov. 19, Dec. 10, 1977; Jan. 29, Feb. 25, 1978

SPRING: Mar. 30, Apr. 22, 23, 30, May 13, 20, 21, 1978

SUMMER: Jul. 8, 9, Aug. 15, 17, 1977; Jul. 18, Aug. 7, 1978

	Lower Wash	Upper Wash	Grass- land	Wood- land	Ridge
TRANSECT LENGTH	2.0	1.6	1.7	2.1	1.5
FALL	3:6.0	3:4.8	3:5.1	3:6.3	6:9.0
WINTER	4:8.0	4:6.4	4:6.8	4:8.4	8:12.0
SPRING	7:14.0	7:11.2	7:11.9	7:14.7	14:21.0
SUMMER	5:10.0	6:9.6	5:10.2	5:10.5	6:9.0

TABLE 2. Occurrence of bird species (individuals per transect kilometer) in different habitats on the Coronado National Memorial.

F = fall W = winter Sp = spring S = summer

Numbers in brackets are total counts of individuals in coverage during that season.

See map and text for further explanation.

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Vulture,	F	(1)				0.9
Turkey	W					
	Sp			(1)	(1)	0.8
	S			(1)		(2)
Hawk,	F					
Sharp-shinned	W					
	Sp				(1)	(2)
	S					
Hawk, Cooper's	F				(1)	
	W					
	Sp		(2)		(2)	
	S	(1)	0.4			
Hawk,	F	(1)	(2)		(1)	(1)
Red-tailed	W	(1)	(2)		(1)	(1)
	Sp	(1)				0.2
	S					
Eagle, Golden	F					
	W					
	Sp				(2)	
	S					
Hawk, Marsh	F	(1)				
	W					
	Sp					
	S					

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Falcon, Prairie	F					
	W	(1)				
	SP					
	S					
Kestrel,	F			0.6	(1)	
American	W					(2)
	Sp	(1)		(1)		
	S	(2)		0.7		
Quail, Scaled	F					
	W					
	Sp					
	S	(1)				
Quail, Gambel's	F	2.5				
	W					
	Sp					
	S					
Quail, Monte-	F			2.0		
zuma	W					
	Sp	0.6		0.3	(2)	(2)
	S		(2)			
Pigeon, Band-	F					
tailed	W					
	Sp					(1)
	S		(1)			1.4
Dove,	F					
White-winged	W					
	Sp	(1)	(2)		0.3	0.4
	S	0.4	(1)	(1)	(2)	(2)
Dove, Mourning	F	2.5		(1)	(2)	(1)
	W	0.5			(1)	(1)
	Sp	1.6		(1)		
	S	3.1		0.7	0.3	

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Roadrunner	F					
	W	(1)	(1)			
	Sp	0.9			0.3	(1)
	S	0.8	(2)	(1)		(2)
Owl,	F	(1)				
Great-horned	W					
	Sp					
	S					
Swift,	F					
White-throated	W				0.7	
	Sp		(2)		0.8	3.0
	S		0.6			3.1
Hummingbird,	F					
Lucifer	W					(2)
	Sp					
	S					(2)
Hummingbird,	F					
Black-chinned	W					
	SP	0.6	1.2	(1)	(2)	
	S	0.4	0.3	0.3	1.0	0.7
Hummingbird,	F		(1)			
Anna's	W					
	SP					
	S					
Hummingbird,	F					
Broad-tailed	W					
	SP	(1)		(1)	(1)	(2)
	S		(2)		(1)	0.3
Hummingbird,	F					
Rufous	W					
	Sp					
	S				(1)	0.6

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Hummingbird,	F					
Rivoli's	W					
	SP					
	S					(1)
Trogon,	F					
Coppery-tailed	W					
	SP					
	S				(1)	
Flicker, Common	F	(2)	0.8		1.9	(1)
	W	(1)	0.5		0.4	0.7
	SP				(1)	
	S					
Woodpecker, Gila	F	(2)				
	W	(1)				
	SP	(1)			(1)	
	S	(1)				
Woodpecker, Acorn	F					
	W					
	Sp		1.1		(1)	
	S					(2)
Sapsucker,	F		(2)		(1)	
Yellow-bellied	W					
	SP					(2)
	S					
Woodpecker,	F	0.5			(1)	
Ladder-backed	W	0.4	(2)	(2)		
	Sp	0.4	0.3	0.3	0.3	
	S	0.3	(1)	(1)		0.3

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Woodpecker,	F				1.0	
Arizona	W		0.5		(1)	(2)
	Sp		(2)		0.3	(1)
	S		0.5		1.0	0.3
Kingbird,	F	0.7				
Western	W					
	Sp			(1)		
	S	0.3				
Kingbird,	F	(1)				
Cassin's	W					
	Sp	(2)	(1)		0.3	0.5
	S	0.4			0.3	0.3
Flycatcher,	F					
Sulphur-bellied	W					
	Sp					
	S		(2)			
Flycatcher,	F					
Wied's-crested	W					
	Sp					
	S		(2)			
Flycatcher,	F					
Ash-throated	W					
	Sp	2.1	1.8	0.3	1.2	0.8
	S	0.6	1.7		(2)	
Flycatcher,	F		(1)		0.6	
Olivaceous	W					
	Sp	(1)	1.5		1.0	0.2
	S		0.4		(2)	(1)
Phoebe, Say's	F	(1)		(2)		
	W	(2)	(2)	(2)	0.5	(1)
	Sp	(1)	0.3		(2)	0.4
	S					

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Flycatcher,	F					
Hammond' s	W					
	Sp	0.4	1.1		0.4	0.2
	S					
Flycatcher,	F					
Dusky	W		(1)			
	Sp	(1)	(1)			
	S					
Flycatcher,	F					
Gray	W					
	Sp	(1)				
	S					
Flycatcher,	F	(1)			(1)	
Western	W					
	Sp		(1)			
	S		(1)			(1)
Peewee, Western	F					
Wood	W					
	Sp	(2)				0.3
	S	(2)	(1)			
Lark, Horned	F			9.2		
	W			10.1		
	Sp			9.1		
	S			7.3		
Swallow,	F					
Violet-green	W					
	Sp					1.8
	S					(1)
Jay, Steller's	F					0.3
	W					
	Sp					
	S					

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Jay, Scrub	F					1.1
	W					1.3
	Sp					2.0
	S					1.7
Jay, Mexican	F	3.0	3.5	0.6	4.8	0.9
	W	2.0	5.6		3.3	3.6
	Sp	5.1	5.8		6.6	2.1
	S	8.2	12.1	0.9	5.7	3.1
Raven, Common	F			(1)	(1)	(2)
	W		(1)		0.6	0.3
	Sp	0.2	0.4	0.3	0.5	(2)
	S		0.4		0.4	
Raven, White-necked	F	(2)				10.2
	W		0.4			
	Sp					0.4
	S	(1)				
Titmouse, Bridled	F		1.3		5.2	
	W		3.0		2.1	
	SP	(2)	2.9		3.2	
	S	(2)	6.6		5.6	
Verdin	F	(1)				
	W	(3)				
	SP					
	S					
Bushtit	F		3.1		0.8	1.7
	W	5.0	4.8		2.1	8.3
	Sp	3.6	2.1		3.0	3.1
	S	1.4	3.3		3.2	3.6
Nuthatch, White-breasted	F		(1)		0.5	0.6
	W		0.5			(2)
	SP				(1)	(2)
	S		0.4		(1)	0.9

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Wren, House	F	(2)	(1)			
	W					
	SP		(1)			
	S					
Wren, Bewick's	F	2.0	2.5		3.7	1.2
	W	1.1	3.6		3.8	2.0
	SP	1.8	4.3		3.7	2.1
	S	2.8	4.6		2.5	2.2
Wren, Cactus	F					
	W					
	SP			(1)		0.3
	S	(1)				0.4
Wren, Canon	F				(2)	(1)
	W					
	SP		(1)		(2)	0.2
	S		0.3		0.6	0.3
Wren, Rock	F			(2)		0.6
	W	(1)	(1)			(1)
	SP				(2)	(2)
	S					(2)
Mockingbird	F					
	W				(1)	
	Sp	(2)			0.2	(1)
	S	0.5		(2)		
Thrasher,	F					0.3
Curve-billed	W					(1)
	Sp					0.2
	S					1.1
Thrasher	F				0.6	(1)
Crissal	W				0.4	0.4
	Sp				(1)	0.3
	S					0.7

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Robin,	F					(1)
American	W					(2)
	Sp					
	S					
Thrush,	F		0.8		(2)	
Hermit	W	(2)	0.8		(2)	(1)
	Sp		0.4			
	S					
	F					
Thrush,	W					
Swainson's	Sp		(1)			
	S					
Bluebird,	F					
Eastern	W		4.1			
	Sp					
	S					
Bluebird,	F					
Western	W					(2)
	Sp					
	S					
Gnatcatcher,	F					0.4
Blue-gray	W					(1)
	Sp					(1)
	S					

Species	Season	Lower Wash	Upper Wash	Grassland	Woodland	Ridge
Kinglet,	F					
Ruby-crowned	W					
	Sp					
	S					
Waxwing, Cedar	F		1.7			
	W					
	Sp					
	S					
Phainopepla	F				(2)	
	W	(2)				
	Sp	(2)			(2)	
	S	0.5	(1)			
Shrike,	F	(1)		0.6		
Loggerhead	W	(1)		(1)		
	Sp	(1)		(2)		
	S	0.6		0.7		
Vireo, Hutton's	F				(2)	(1)
	W		0.8		(2)	
	Sp		0.4		0.5	
	S		(2)		(2)	
Vireo, Solitary	F				(1)	
	W					(1)
	Sp	(1)	(2)			(2)
	S					

Species	Season	Lower Wash	Upper Wash	Grass-Land	Wood Land	Ridge
Vireo, Warbler	F		(1)			
	W					
	Sp					
	S	(2)	(1)		(2)	
Warbler, Orange crowned	F					
	W					
	Sp	(2)	(1)			(1)
	S	(1)			(1)	
Warbler, Nashville	F					
	W					
	Sp					
	S		(1)		(1)	
Warbler, Virginia's	F					
	W					
	Sp	(2)			(2)	
	S	(2)	0.6		0.5	
Warbler, Lucy's	F					
	W					
	Sp	0.4				
	S					
Warbler, Yellow-rumped	F					0.4
	W	(2)				
	Sp	(2)	0.5		0.3	(2)
	S					
Warbler, Black-throated Gray	F	(2)	1.3		0.8	(1)
	W					
	Sp	0.4	2.5		2.6	(1)
	S					

Species	Season	Lower Wash	Upper Wash	Grass-Land	Wood Land	Ridge
Warbler,	F				(1)	(1)
Townsend's	W					
	Sp	(1)	0.4		(2)	(1)
	S					
Warbler,	F	(1)				
Hermit	W					
	Sp	(1)	(2)			(1)
	S		(2)			
Meadowlark,	F	(1)	1.2			
Eastern	W		(1)			
	Sp		1.1			
	S	1.5	1.1			
Meadowlark,	F					
Western	W					
	Sp	(1)				
	S					
Oriole, Scott's	F		(2)		1.0	0.3
	W					
	Sp	(2)	1.2		1.7	0.3
	S	0.4	0.6	(2)	0.5	(1)
Oriole,	F					
Northern	W					
	Sp	(2)				
	S	(1)				
Cowbird,	F					
Brown-headed	W					
	Sp	0.7	1.0		1.3	(2)
	S	0.5	0.3			
Cowbird,	F					
Bronzed	W					
	Sp		(1)			
	S	0.3				

Species	Season	Lower Wash	Upper Wash	Grass-Land	Wood Land	Ridge
Tanager,	F					
Western	W					
	Sp	3.3	(1)		0.7	
	S					
Tanager,	F		(1)			
Hepatic	W		(1)			0.4
	Sp					(1)
	S					
Tanager	F				(1)	
Summer	W					
	Sp					
	S					
Pyrrhuloxia	F					
	W	0.8	(2)		(1)	
	Sp	(2)				
	S					
Grosbeak,	F					
Black-headed	W					
	Sp	0.7	(2)		(1)	(2)
	S	(2)	0.5			
Grosbeak, Blue	F				(1)	
	W					
	Sp					
	S	1.1				
Finch, House	F	1.0	(2)	(2)	0.6	0.4
	W	1.0	0.5			0.8
	Sp	0.5	1.6		1.0	1.3
	S	1.2	0.4	0.4	(1)	0.2

Species	Season	Lower Wash	Upper Wash	Grass-Land	Wood Land	Ridge
Siskin, Pine	F	(1)				(2)
	W					4.6
	Sp	0.4				
	S					
Goldfinch,	F		(2)		(2)	(2)
Lesser	W		0.9			
	Sp					(1)
	S		(2)		(2)	(2)
Towhee,	F	1.0				
Green-tailed	W					
	Sp	(1)				
	S					
Towhee,	F		(1)		0.3	
Rufous-sided	W		0.8		2.7	
	Sp		(1)		1.2	
	S				2.3	
Towhee, Brown	F	3.3				(1)
	W	3.8				0.5
	Sp	1.9				0.8
	S	4.7	(2)			1.2
Bunting, Lark	F					
	W					
	Sp	0.8			42.5	
	S					
Sparrow,	F			1.2		
Grasshopper	W	(1)		1.9		
	Sp			0.3		
	S	0.4				

Species	Season	Lower Wash	Upper Wash	Grass-Land	Wood Land	Ridge
Sparrow, Vesper	F	0.8		0.6		
	W	5.4		1.2		
	SP			1.7		
	S					
Sparrow, Lark	F					
	W					
	Sp			0.6		
	S	2.3		0.4		
Sparrow,	F	(1)	2.5		3.3	0.8
Rufous-crowned	W	(1)	0.9		0.5	1.8
	Sp	0.4	2.5		1.7	2.1
	S	0.4	1.6	0.6	2.7	4.9
Sparrow,	F	2.8	(2)			
Cassin's	W	2.8				
	SP	0.3		0.4	(2)	
	S	2.6		(1)		
Sparrow,	F					
Black-throated	W					
	Sp	0.4		0.3		
	S	1.4		(2)		
Junco, Dark-eyed	F					(2)
	W		(1)		1.0	6.3
	Sp		0.3			0.2
	S					
Junco, Gray-headed	F		2.1			2.2
	W		5.8		1.3	15.9
	SP					0.1
	S					
Sparrow, Chip-ping	F	13.5	7.1	1.0	6.3	4.7
	W	75.6	25.6		10.0	4.9
	Sp	5.6	2.1		2.6	
	S		0.4		(1)	0.6

Species	Season	Lower Wash	Upper Wash	Grass- Land	Wood Land	Ridge
Longspur,	F			1.2		
Chestnut-	W			8.8		
collared	Sp					
	S	(2)				

Grassland was sampled on a route beginning 100 m (328 ft) west of the point where Montezuma Wash leaves Arizona. The route roughly parallels the border to the west about 900 m before veering to the northwest 800 m (0.5 mi), to end near the south bank of Montezuma Wash at the edge of oaks.

Two short routes were combined to provide data on oak woodlands. A 0.5 km (0.3 mi) route through oaks connected the west end of the grassland route to the picnic area at headquarters. The main Montezuma Wash road served as the second woodland transect where it paralleled the Upper Wash route. Although the road passes through oak dominated woodlands, it is close to the wash and several typically riparian species were consequently counted.

The "Ridge" transect extended from the fence on the Joe's Canyon Trail above Montezuma Pass east along the trail 1.5 km (0.9 mi). The trail is on the ridge for much of the distance, and pinon-oak-juniper vegetation dominates the more moist north facing slope. A more open oak-grassland prevails on south facing slopes. Birds were counted on this route as it was covered from west to east and also on the return trip.

RESULTS

Results are presented in an Annotated List of species and as birds counted per transect kilometer in various habitats (Table 2). The Annotated List provides a concise statement for each bird species on relative abundance, seasonal distribution, habitat preference, and breeding status (if it is known to nest) on the Memorial. Relative abundance is expressed in terms adapted from Phillips et al. (1964). A species is described as abundant if it is highly predictable in its occurrence and is found in large numbers. Common denotes bird species seen in moderate numbers at any time in the appropriate season. Fairly common suggests lower predictability and very small numbers; on some days in the field the species will not be seen. Uncommon implies the species is infrequently seen but is expected occasionally. Rare is applied to species within their range but unexpected. Since field work for this report is based on only one year's study, the authors have had to draw upon their several years' experience in southeastern Arizona to reflect the probable abundance of some species.

The expressions fall (September, October), winter (November through February), spring (March through May), and summer (June through August) are used to describe seasonal distribution. A resident is a species present on the Memorial throughout the year; it would be expected to nest there. A summer resident is present and breeding in summer (and sometimes in late spring) but spends the remainder of the year elsewhere. The expressions migrant and transient are descriptive of species that move through the Memorial seasonally. Winter or summer visitants are present without nesting. Some migrants move south through Arizona as early as late July and August and others may linger into November. Occasionally, late spring migrants are found in June.

The terminology applied to habitats is broadly descriptive. The expression riparian is used for the alluvial plain of Montezuma Wash; a distinction is sometimes made between the upper portion dominated by oak, walnut, and juniper and the lower wash which is broader and more open and dominated by oak, mesquite and desert willow. Woodland refers to oak or oak-juniper communities. The grassland is ecotonal between open grassland and shrub grassland and is limited in extent on the Memorial. Ridge applies to the mixed communities at about 2000 m elevation southeast of Montezuma Pass (see comments in Methods).

DISCUSSION

The Huachuca Mountains are noted for their great diversity of bird species, a distinction shared with other high mountain ranges in southeastern Arizona. The variety of species is a consequence of the extreme altitudinal range combined with geographic position. Plant associations are diverse and include northern elements from the Arcto-Tertiary Geoflora and southern elements from the Madre-Tertiary Geoflora. The birds that are present are from northern and southern origins.

In the course of this survey of the Coronado National Memorial, 119 species of birds were recorded. Memorial files contain virtually no notes on birds and contributed no information on any additional species. In comparison with the diversity of the Huachuca Mountains, the Memorial species total is low. But bird species diversity is a function of the habitat diversity and when the total area (1134 ha, 2835 acres) and variety of habitats in the Memorial are considered, the number of birds is substantial.

Present Memorial boundaries are within the elevational range of 1494 to 2092 m (4900-6863 ft) and include only four major habitat types. There are no permanent streams or even large springs or stock tanks. The Memorial bird-list lacks waterfowl and shorebirds; even the ubiquitous Killdeer has yet to be recorded! The general location of the Memorial on the southeastern portion of the mountain range precludes moist canyons with their substantial variety of plants and animals.

Several Lucifer Hummingbirds were found on the rather open slopes of the ridge south of the Joe's Canyon Trail. The species rarely reaches the United States (from Mexico) and may be more frequent in the Memorial than anywhere else in the Southwest (it occurs in Big Bend National Park). Other birds found in this study were not unexpected. Coppery-tailed Trogons and Sulphur-bellied Flycatchers nest regularly in the Huachuca Mountains

but only where large sycamores are abundant. Sycamores are virtually absent in the Memorial. Several grassland species have been found on the Memorial only because its boundaries extend into this habitat adjacent to the Montezuma Wash at the eastern boundary.

Species that occur more or less regularly in the Memorial but are not geographically widespread in the United States (or are low in numbers elsewhere) are Montezuma Quail, Whiskered Owl, Lucifer Hummingbird, Arizona Woodpecker and Olivaceous Flycatcher.

The survey did not attempt to identify all breeding species but 38 species undoubtedly nest on the Memorial and another 15 probably nest there. None of these species are unusual enough to require any special management practice.

The western area of the Memorial that is to be transferred to the Forest Service (Figure 1) includes open oak-grass woodland (savanna) a spring, and a usually dry drainage. In terms of bird species, this area is not critical, i.e., its transfer would not result in a decrease of bird species in the Memorial. But the oak savanna habitat of this portion of the Memorial does not occur elsewhere in its boundaries.

The area proposed as an addition to the Memorial (Figure 1) includes the upper part of Montezuma Wash, elevations to 2340 m (7676 ft) on Montezuma Peak, and a substantial increase in the amount of grassland. Much of each of the Montezuma Wash routes is situated outside current boundaries (Figure 1) but no surveys were made in other proposed additions. The greatest variety of birds in the Memorial occurs along Montezuma Wash (96 of the total of 119 species recorded) and its inclusion in the planned addition is significant. Without this addition, the richest (in species diversity) area of Montezuma Canyon is outside the Memorial. Additions to the eastern part of the Memorial will greatly increase the extent of grassland, which is at present limited to a small area near the border.

A number of bird species were not found on this survey but are to be expected. Probably no species that may breed on the Memorial were overlooked. A number of transient or wintering species were not seen but occur regularly in the general area. Among those not found during the survey but expected to occur are Swainson's, Zone-tailed, and Rough-legged Hawks, Pygmy Owl, other hummingbirds (especially Broad-billed), several swallows, Brown Creeper, other warblers, Hooded Oriole, Cardinal, buntings, Brewer's and White-crowned Sparrows.

RARE AND ENDANGERED SPECIES

No bird species found on the Memorial are considered rare or endangered by the U.S. Fish and Wildlife Service (1978).

The Lucifer Hummingbird and Coppery-tailed Trogon are in Group IV of the Arizona Game and Fish Department list (1978) of "Threatened and Unique Wildlife of Arizona". This designation is applied to species "... of interest primarily because of limited distribution. They are not species in a lesser degree of jeopardy than those in Group III" (wording as approved by the Arizona Game and Fish Commission, October 21, 1978). Group III Species correspond closely to Federal "Threatened" categories. By implication, Group IV Species may also be "Threatened" but are restricted in their distribution in Arizona. The Coppery-tailed Trogon does not breed in the Memorial and the two on-site records of the species suggest its occurrence there is only casual. No special management practices should be necessary. The status of the Lucifer Hummingbird should be resolved; it may breed on the Memorial. All four observations of this bird were on the steep south-facing slope below the Joe's Canyon Trail in open agave-oak grassland. It is unlikely that its habitat will be altered through present Memorial practices but the presence of this species should be considered in future planning.

ANNOTATED LIST OF SPECIES

- Turkey Vulture (Cathartes aura): Uncommon; spring, summer, fall; could breed. A conspicuous species, in all habitats; most often seen over ridges.
- Sharp-shinned Hawk (Accipiter striatus): Rare; recorded only in spring, but to be expected in fall and winter.
- Coopers Hawk (Accipiter cooperi): Uncommon; spring, summer, fall; wooded habitats. Nests near the visitor center and perhaps elsewhere in the upper wash. May be expected occasionally in winter.
- Red-tailed Hawk (Buteo jamaicensis): Uncommon; all seasons. May forage over all habitats. Some individuals may be residents; breeding likely in area.
- Golden Eagle (Aquila chrysaetos): Rare; observed only on 8 July 1977 over ridge, and two on 30 April 1978 over Montezuma Wash. The species nests in the Huachuca Mountains.
- Marsh Hawk (Circus cyaneus): Rare; seen once, on 29 October 1977. Prefers grasslands and should be expected there during migration and winter.
- Prairie Falcon (Falco mexicanus): Rare; recorded only on 19 November 1977 over lower Montezuma Wash.
- American Kestrel (Falco sparverius): Uncommon; most frequently encountered in lower wash and grassland; perhaps nests in the lower wash-grassland ecotone.
- Scaled Quail (Callipepla squamata): Rare; grassland. One record of a calling male, 18 July 1978.
- Gambel's Quail (Lophortyx gambeli): Rare; found only in fall in lower wash area.
- Montezuma Quail (Crytonyx montezuma): Fairly common and probably resident, although not reported in winter. Easily overlooked. In all habitats but usually near oaks.
- Band-tailed Pigeon (Columba fasciata): Uncommon; spring and summer in oaks and on ridge. Should be expected in other seasons; may sometimes be abundant.
- White-winged Dove (Zenaida asiatica): Fairly common; in all habitats except grassland; spring and summer resident.
- Mourning Dove (Zenaida macroura): Common in all seasons in lower wash, where it nests. Uncommon and occasionally nesting in other habitats.
- Roadrunner (Geococcyx californianus): Fairly common resident in all habitats.
- Common Screech Owl (Otus asio): Common in lower Montezuma Wash in July; probably resident.
- Whiskered Owl (Otus trichopsis): Recorded only on 8 July 1977 about 1 km west of Visitors Center. Probably common resident in woodlands and upper riparian community.
- Great-horned Owl (Bubo virginianus): Found only in summer and fall in lower wash, but is probably resident there. Likely resident in higher habitats also.

- Elf Owl (Micrathene whitneyi): A few observations suggest it is a common summer resident in riparian and lower woodland communities but rarely seen.
- Whip-poor-will (Caprimulgus vociferus): Common summer resident in upper riparian communities and probably on higher slopes.
- Poor-will (Phalaenoptilus nuttalli): Common summer resident in lower, more open portions of Memorial. May occur in all habitats and some individuals may be resident.
- Common Nighthawk (Chordeiles minor): Found over shrub grasslands on 8 July 1977 where it may breed.
- White-throated Swift (Aeronautes saxatalis): Fairly common; generally at higher elevation but occasionally wanders over lowlands. Probably nests in Huachuca Mountains.
- Lucifer Hummingbird (Calothorax lucifer): Four observations, all on southfacing slope of ridge: female, 15 August 1977; male, 17 August 1977; two, 25 February 1978. A rare species that may be more common than believed in agave-studded oak-grasslands.
- Black-chinned Hummingbird (Archilochus alexandri): Common summer resident; in all habitats but least numerous in grassland.
- Anna's Hummingbird (Calypte anna): The only record is of a male on 24 September 1977 in Montezuma Wash above the Visitor's Center.
- Broad-tailed Hummingbird (Selasphorus platycercus): An uncommon transient through all habitats in spring and late summer. Common nesting species at higher elevations of Huachuca Mountains.
- Rufous Hummingbird (Selasphorus rufus): Common late summer and early fall migrant at higher elevations ridge.
- Rivoli's Hummingbird (Eugenes fulgens): One record: one on the south-facing slope of the ridge on 17 August 1977. Common summer resident in the moist canyons of the Huachuca's.
- Coppery-tailed Trogon (Trogon elegans): There are two records on the Memorial. Cora Thompson saw a male in the residence area 23 December 1975. Danforth found one on 17 August 1977 in the oaks in upper Montezuma Wash. The species nests and occasionally winters in more moist canyons of the Huachuca Mountains.
- Common Flicker (Colaptes auratus): Fairly common fall migrant and winter visitant in wooded communities. All flickers were the red-shafted form.
- Gila Woodpecker (Centurus uropygialis): Rare; recorded in all seasons in lower wash area and once in spring in oak-woodlands.
- Acorn Woodpecker (Centurus formicivorus): Uncommon in oak communities where it may breed. Recorded only in spring and summer.
- Yellow-bellied Sapsucker (Sphyrapicus varius): Uncommon fall transient and rare winter visitant in wooded areas.

- Ladder-backed Woodpecker (Dendrocopos scalaris): Common (or fairly common) resident in all habitats. This is the most frequently seen woodpecker.
- Arizona Woodpecker (Dendrocopos arizonae): Fairly common resident of upper portion of Montezuma Wash and the adjacent oak woodlands.
- Western Kingbird (Tyrannus verticalis): Uncommon summer resident in lower Montezuma Waste
- Cassin's Kingbird (Tyrannus vociferans): Uncommon summer resident in Montezuma Wash and south-facing slope of ridge.
- Sulphur-bellied Flycatcher (Myiodynastes luteiventris): On 9 July 1977, a pair may have been nesting in a cavity in a sycamore in Montezuma Wash a mile above the headquarters. No others have been recorded.
- Wied's-crested Flycatcher (Myiarchus tyrannulus): The only record is that of a pair near the headquarters on 9 July 1977.
- Ash-throated Flycatcher (Myiarchus cinerascens): A common late spring and summer resident in all habitats.
- Olivaceous Flycatcher (Myiarchus tuberculifer): Fairly common summer resident in upper part of Montezuma Wash and adjacent slopes: occasional in other habitats, probably as transient.
- Say's Phoebe (Sayornis saya): Uncommon winter resident and migrant in open habitats.
- Empidonax Flycatchers: collectively these are fairly common spring transients. Most are probably Hammond's Flycatcher (E. hammondi) and some Dusky Flycatchers (E. oberholseri). One observed 23 April 1978 appeared to be a Gray Flycatcher (E. wrightii). Identification of these three species listed in Table 2 must be considered somewhat tenuous.
- Western Flycatcher (Empidonax difficilis): Uncommon spring and fall migrant in wooded areas.
- Western Wood Peewee (Contopus sordidulus): Uncommon spring transient in Montezuma Wash and on ridge. Should be expected as breeding bird.
- Horned Lark (Eremophila alpestris): Abundant resident of grasslands.
- Violet-green Swallow (Tachycineta thalassina): Uncommon in spring and summer on ridge. The species breeds at higher elevations of the Huachuca Mountains and undoubtedly wanders over the Memorial.
- Steller's Jay (Cyanocitta stelleri): Recorded only on 24 and 25 September 1977, when single birds were observed on the ridge. The species breeds at higher elevations in the Huachuca Mountains.
- Scrub Jay (Aphelocoma coerulescens): Fairly common in wooded habitats on ridge, where it is resident.
- Mexican Jay (Aphelocoma ultramarina): Abundant resident of all wooded habitats; in flocks all year.

Common Raven (Corvus corax): Observed in flight in small numbers over all areas throughout year. The two raven species are difficult to distinguish. This species is probably more regularly seen than the White-necked Raven.

White-necked Raven (Corvus cryptoleucus): Uncommon over all habitats in all seasons. A flock of 92 ravens flying over the ridge on 25 September 1977 was probably of this species.

Bridled Titmouse (Parus wollweberi): Common resident where oaks are dominant.

Verdin (Auriparus flaviceps): Uncommon; found only in fall and winter in lower Montezuma Wash.

Bushtit (Psaltiriparus minimus): Common resident of all wooded areas. Flocks when not breeding.

White-breasted Nuthatch (Sitta carolinensis): Fairly common but perhaps resident in upper Montezuma Wash and woodland on north-facing slope of ridge.

House Wren (Troglodytes aedon): Rare fall and spring migrant in Montezuma Wash.

Bewick's Wren (Thyromanes bewickii): Common resident in all wooded habitats.

Cactus Wren (Campylorhynchus brunneicapillus): Uncommon. Found in spring and summer on south-facing slope of ridge, once in spring in grassland, and once in summer in lower wash.

Cañon Wren (Catherpes mexicanus): Uncommon. Sings from steep rocky slopes of Montezuma Wash in spring and summer. Not recorded in winter.

Rock Wren (Salpinctes obsoletus): Uncommon, probably resident on slopes of Montezuma Wash, but records inadequate to define status. Winter visitants likely.

Mockingbird (Mimus polyglottos): Uncommon. May occur as spring migrant in any open area. Summer breeding bird in lower Montezuma Wash near border.

Curve-billed Thrasher (Toxostoma curvirostre): Uncommon resident of southfacing slope of ridge.

Crissal Thrasher (Toxostoma dorsale): Uncommon resident in thickets on ridge and on slopes of Montezuma Wash.

American Robin (Turdus migratorius): Three individuals in fall and winter on ridge constitute the only record. Robins nest in the Huachuca Mountains and frequently move about in flocks when not breeding. Probably common in some years in winter.

Hermit Thrush (Catharus guttatus): Fairly common migrant and uncommon winter visitant in wooded habitats, especially riparian communities.

Swainson's Thrush (Catharus ustalatus): The only record is that of one bird on 13 May 1978 in Montezuma Wash above the visitors' center.

Eastern Bluebird (Sialia sialis): Fairly common winter visitant in upper Montezuma Wash. To be expected in winter in open areas.

Western Bluebird (Sialia mexicana): Two birds 10 December 1977 on the ridge constitute the only record.

Blue-gray Gnatcatcher (Poliophtila caerulea): Uncommon or rare transient and winter visitant in open scrubby areas on ridge.

Ruby-crowned Kinglet (Regulus calendula): Common transient and winter visitant in all wooded habitats.

Cedar Waxwing (Bombycilla cedrorum): The only record is that of a flock of 11 birds on 25 February 1978 in Montezuma Wash above the visitor's center. In some winters waxwings may be common.

Phainopepla (Phainopepla nitens): Uncommon in lower wash from August until March; occasional elsewhere where mistletoe berries are present. Not known to nest in Memorial.

Loggerhead Shrike (Lanius ludovicianus): Fairly common residents in grasslands and open portions of lower Montezuma Wash.

Hutton's Vireo (Vireo huttoni): Fairly common year around in wooded portions of upper Montezuma Wash and its slopes; occasionally on ridge. Probably breeds in the Memorial.

Solitary Vireo (Vireo solitarius): Uncommon spring and fall transient in wooded areas.

Warbling Vireo (Vireo gilvus): Uncommon spring and fall transient in woodlands at lower elevations.

Orange-crowned Warbler (Vermivora celata): Uncommon spring and early fall migrant in wooded areas.

Nashville Warbler (Vermivora ruficapilla): Two records: 15 and 17 August 1977 in upper Montezuma Wash.

Virginia's Warbler (Vermivora virginiae): Fairly common spring and early fall migrant in wooded habitats at lower elevations.

Lucy's Warbler (Vermivora luciae): Uncommon spring migrant in lower Montezuma Wash near the border; may possibly breed there.

Yellow-rumped Warbler (Dendroica coronata): Fairly common spring migrant and uncommon fall migrant and winter visitant in wooded areas.

Black-throated Gray Warbler (Dendroica nigrescens): Fairly common transient and summer visitant in wooded habitats of Montezuma Wash. This is the most frequently encountered warbler.

Townsend's Warbler (Dendroica townsendi): Uncommon transient in wooded habitats.

Hermit Warbler (Dendroica occidentalis): Uncommon transient in wooded areas of ridge.

Wilson's Warbler (Wilsonia citrina): Uncommon transient in Montezuma Canyon; recorded once in spring on ridge. Probably more common than records suggest.

Painted Redstart (Setophaga picta): One record: a bird foraging in the picnic area near the headquarters on 7 August 1978.

Eastern Meadowlark (*Sturnella magna*): Fairly common year around in grasslands; probably breeds there.

Western Meadowlark (*Sturnella neglecta*): Recorded only on 23 April 1978 in open portion of lower wash.

Scott's Oriole (*Icterus parisorum*): Fairly common summer resident (present from early spring into fall in more open woodlands. Some individuals may winter in Memorial.

Northern Oriole (*Icterus galbula*): Two birds on 21 May 1978 and one on 18 July 1977 (all in lower wash) constitute the only records from the Memorial.

Brown-headed Cowbird (*Molothrus ater*): Fairly common spring and summer resident except in grassland where it was not seen.

Bronzed Cowbird (*Tangavicus aeneus*): Uncommon; recorded only in Montezuma Wash in spring and summer.

Western Tanager (*Piranga ludoviciana*): Fairly common spring and uncommon early fall migrant except in grassland and on ridge (where not recorded).

Hepatic Tanager (*Piranga flava*): Uncommon summer resident in wooded areas at higher elevations.

Summer Tanager (*Piranga rubra*): One bird on 24 September 1977 in the oaks of lower Montezuma Wash constitutes the only record.

Pyrrhuloxia (*Pyrrhuloxia sinuata*): Uncommon winter visitant in thickets of lower portions of Montezuma Wash.

Black-headed Grosbeak (*Pheucticus melanocephalus*): Uncommon spring and early fall migrant in wooded areas.

Blue Grosbeak (*Guiraca coerulea*): Fairly common summer breeding bird in open areas of lower Montezuma Wash.

House Finch (*Carpodacus mexicanus*): Fairly common resident in all areas.

Pine Siskin (*Spinus pinus*): Fairly common winter visitant on ridge; occasional in lower wash. Present from October through March.

Lesser Goldfinch (*Spinus psaltria*): Uncommon in upper Montezuma Wash and on ridge from summer into winter; not known to breed on Memorial

Green-tailed Towhee (*Chlorura chlorura*): Fairly common fall migrant in lower Montezuma Wash; rare in spring.

Rufous-sided Towhee (*Pipilo erythrophthalmus*): Common resident on north slope of ridge; uncommon transient and winter visitant in other wooded habitats.

Brown Towhee (*Pipilo fuscus*): Common resident in lower Montezuma Wash; fairly common resident on slopes of upper Montezuma Canyon and on ridge.

Lark Bunting (*Calamospiza melanocorys*): The only record is that of a flock of 434 birds in the grassland on 15 August 1977.

Grasshopper Sparrow (Ammodramus savannarum): Fairly common winter visitant in grasslands; May and August records suggest the species may be resident.

Vesper Sparrow (Pooecetes gramineus): Common transient and winter visitant in grasslands and open areas of lower Montezuma Wash.

Lark Sparrow (Chondestes grammacus): Fairly common summer resident in thickets at edge of grassland and lower Montezuma Wash.

Rufous-crowned Sparrow (Aimophila ruficeps): Common resident of wooded, rocky slopes.

Cassin's Sparrow (Aimophila cassinii): Common from August 1977 to August 1978 in grass adjacent to lower portion of Montezuma Wash. May not be present (except in summer) every year.

Black-throated Sparrow (Amphispiza bilineata): Fairly common summer resident of grasslands and open areas of lower wash.

Dark-eyed Junco (Junco hyemalis): Common winter visitant on ridge and in upper Montezuma Wash.

Gray-headed Junco (Junco caniceps): Abundant winter visitant on ridge and in upper Montezuma Wash.

Chipping Sparrow (Spizella passerina): Abundant transient and winter visitant in all habitats except grassland.

Chestnut-collared Longspur (Calcarius ornatus): Abundant winter visitant in grasslands.

MANAGEMENT RECOMMENDATIONS

Although the Memorial was established because of the historical significance of the area, the fauna includes a number of bird species that are not widely distributed in the United States. These species are in no jeopardy and management practices that avoid any large scale habitat alterations will insure their continued presence.

The quality of the grassland community and its adjacent riparian woodlands has been reduced through excessive cattle grazing. Densities of a number of bird species are lower than would be expected in less disturbed habitats and possibly some species are not present due to recent grazing effects. The grassland community and the riparian association of the large wash (Montezuma) that traverses it constitute biotic communities that are not well established in National Park Service holdings in this part of the Southwest. Careful management of cattle grazing, perhaps even elimination of it, would lead to the re-establishment of a representative grassland community. The resulting increase in bird species diversity and numbers of individuals would be a valuable asset of the Memorial. It would be appropriate for the vegetation of the Memorial to be representative of the time of the events the Memorial commemorates. The land had not been overgrazed during the time of Coronado.

We make four recommendations for future management of the Memorial. 1) Not only should the Memorial be expanded as has been proposed but efforts should be made to retain the western section that has been scheduled for transfer. Retention of this area will add a fine sample of oak savanna to the National Park Service. 2) If the natural (as opposed to the historical) aspects are to be assigned the significance they deserve, it may well be practical to review grazing practices and evaluate the current impact more precisely. 3) the unexpected finding of the Lucifer Hummingbird merits research on its actual status. The species is rare enough to warrant special study. 4) The mountains and grasslands in the proposed addition

to the Memorial should receive a survey of their avifauna. The grasslands, as already noted, are a significant biotic community in the Memorial. The addition of grasslands may include species not occurring within the present boundaries. It is also possible that additional species may occur on the higher elevations of Montezuma Peak.

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A SURVEY OF THE MAMMALS
OF
CORONADO NATIONAL MEMEORIAL

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I.

ABSTRACT

Between June 1977 and October 1978 an inventory of the mammals of the Coronado National Memorial was conducted. A total of 1895 trap nights produced twelve species of rodents. Placement of nets over water sources yielded six species of bats. Sight observations added eight more species of mammals.

From this and additional data, recommendations were made concerning acquisition and transferal of lands, management, and possible future studies on the Memorial.

II. Introduction

The Coronado National Memorial consists of 2834 acres (1147 h). Various proposals for enlarging the Memorial have been made, one of which would result in an area of about 5220 acres (2113 h) (National Park Service, 1976). It is the latter area that has been examined during this preliminary survey (Fig. 1). The present Memorial ranges from 1486 m to 2093 m elevation. The proposed additions result in an altitudinal range of 1471 m to 2340 m (National Park Service, 1976),

The Memorial is in southeastern Arizona at the southern tip of the Huachuca Mountains, just north of the United States-Mexico International Boundary. As envisioned by Hoffmeister and Goodpaster (1954) the Huachuca Mountains comprise approximately 100 square miles (259 sq. km,) and range from 5000 feet (1924 m) on the eastern slope and 5700 feet (1738 m) on the western slope to heights approaching 9500 feet (2896 m) at the tops of Miller (9495 ft. = 2880 m) and Carr (9214 ft. = 2809 m) peaks. These mountains include desert grasslands, riparian situations, as well as oak and higher coniferous woodland situations. As indicated in Table 1 the diversity of mammalian species in this mountain range is large, especially when compared with much larger, more homogeneous areas such as Florida or Maine, but is much less than that found in a large heterogeneous area such as Arizona.

The present Coronado National Memorial consists primarily of southfacing slopes of oak-woodland vegetation ranging from 1524 m to 1830 m in elevation. The limited north-facing slope area is just east of Montezuma Pass. Here exists a limited area of oak-pinon-juniper vegetation as a result of the combined effects of higher elevation and north-facing slopes. The diversity of mammals associated with the limited diversity of vegetation types on the Memorial is low in comparison with that of the whole mountain. The proposed inclusion of the Zaleck and Montezuma ranches and adjacent areas to the east of the present Memorial

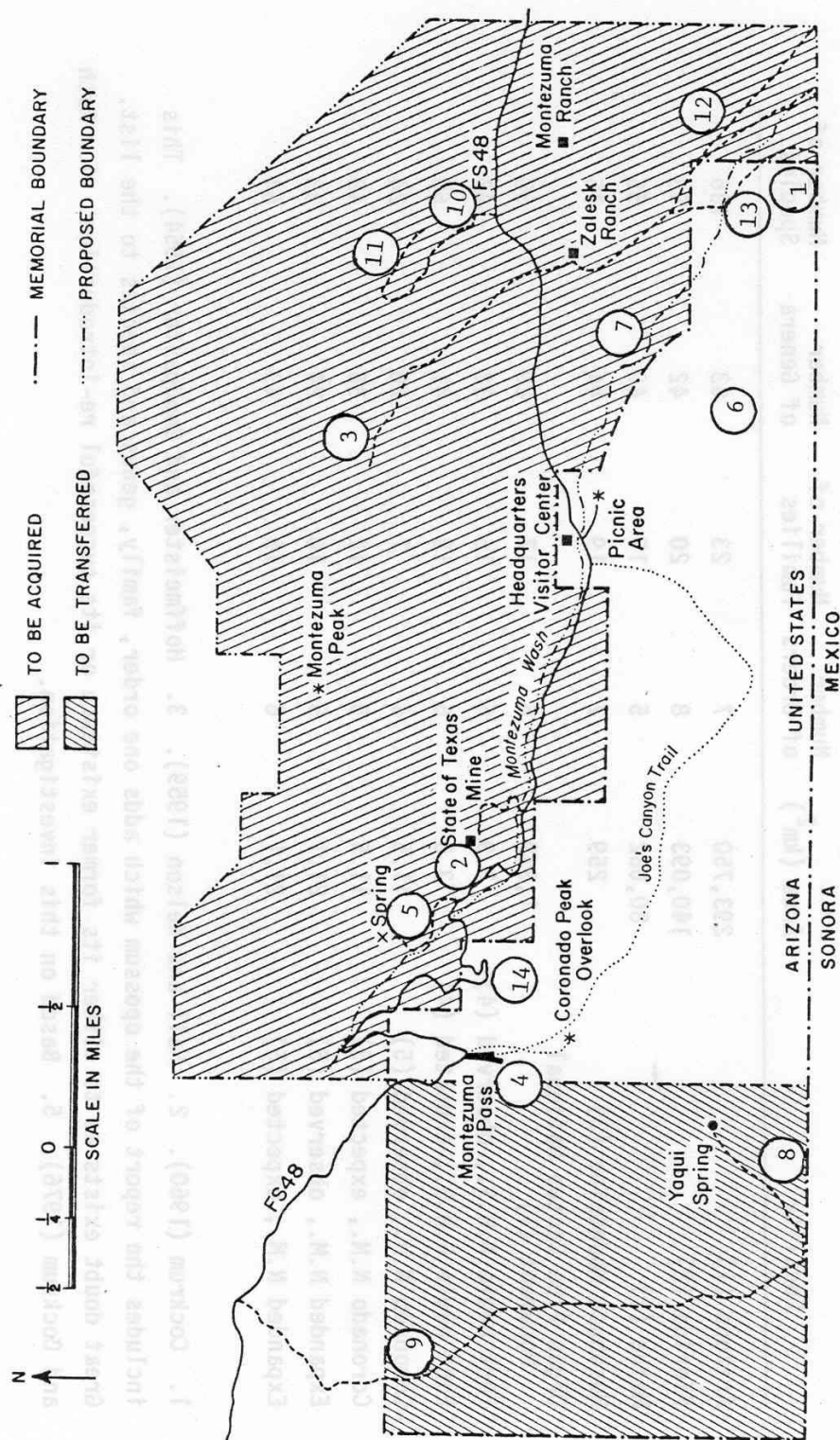


Figure # 1. Coronado National Memorial and adjacent areas. Circled numbers represent validation sites.

Table 1. Diversity of Mammalian species in selected areas of the United States.

Locality	Area (km ²)	Number of Orders	Number of Families	Number of Genera	Number of species
Arizona (1)	293,750	7	23	63	136
Florida (2)	140,093	8	20	42	53
Maine (2)	80,082	5	15	40	55
Huachuca Mountains (3)	259	7	19	44	75
Organ Pipe Cactus National Monument (1)	1,339	6	17	29	38
Fort Bowie N.H.S., observed (4)	3.9	6	16	32	47
Fort Bowie N.H.S., expected (4)	3.9	6	18	41	65
Coronado N.M., observed (5)	11.5	4	7	20	24
Coronado N.M., expected (5)	11.5	5	12	36	48
Expanded N.M., observed (5)	21.1	5	10	24	33
Expanded N.M., expected (5)	21.1	6	15	43	64

1. Cockrum (1960). 2. Hall and Kelson (1959). 3. Hoffmeister and Goodpaster (1954). This includes the report of the opossum which adds one order, family, genus and species to the list. Great doubt exists as to either its former existence or its successful re-introduction. 4. Roth and Cockrum (1976). 5. Based on this investigation.

would add limited areas of atypical desert grassland (most are simply ecotonal areas) and some limited riparian situations along the major washes. This would increase the diversity of mammals that would be expected to occur on the Memorial (Table 1).

Proposed additions in the higher elevations, such as the inclusion of the Montezuma Canyon watershed (National Park Service, 1976) do result in some increase in north-facing slopes. However, this would result in little or no increase in the diversity of mammalian species present.

There is no permanent flowing water in the area. Only during the summer rainy seasons (July-August) and in rare rainy winters and springs does water flow intermittently in the higher reaches of Montezuma Canyon. As far as we know, this increase in moisture is not adequate to support populations of Sorex arizonae Hoffmeister, or other hydrophylic species. No beaver, muskrats or otter have ever been recorded in the area. Two mine shafts (one of the State of Texas mine shafts and one on the Pruitt-Wray holding) do have permanent standing water that is presumably available at least to bats. However, both are at such high elevations that relatively few bats ever visit the area. The subterranean nature of these water sources markedly limits its utilization by deer, javelina or carnivores. A natural cave about 1 km northwest of the visitor center is dry, about 9 m high and approximately 300 m deep. No bats have been observed in this cave by us. However it may occasionally serve as a temporary roost, especially during the summer. Collecting sites 8 and 11 (Fig. I) are stocktanks that are supplied with water by windmills pumping from underground sources. Site 9 is a small pond supplied with water piped from springs high in Copper Canyon.

III. Species Accounts

During this survey of the mammals of the Memorial no large traps were utilized nor were any animals killed by guns. Only small traps suitable for capturing small rodents and a limited number of mist nets suitable for capturing bats were utilized. The traps utilized were mainly the "Museum Special" type of kill trap but some slightly larger "rat traps" of various trade names, Macabee type gopher traps and some small live traps including National, Sherman and Havahart designs were also used.

As a result of the restricted sampling methods utilized, several species native to the region were not captured. However, any direct evidence (sightings, identified tracks, others) of occurrence, obtained during the study, resulted in the species being included in the list of species actually observed.

Species known to occur in the region and expected to occur at least transiently on the Memorial are listed in section B (species probably present).

Section C is a list of species that formerly occurred on the Memorial but are now probably extinct in the area.

No subspecific names are included even though such assignments might be useful to some vertebrate zoologists utilizing this study. The subspecific identifications are being eliminated from this report primarily because too many non-systematists do not understand the limited meaning of the taxonomic category of subspecies. Scientific and common names (including the utilization of capital letters in the components of the common name of a species) are those utilized by Jones et al. (1975).

A. Species actually observed. See Appendix B for lists of localities from which each species was recorded.

1. Townsend's Big-eared Bat. Plecotus townsendi.

This species, characteristic of oak-woodland areas of southern Arizona, is probably resident on the Memorial throughout the year. It probably has day roosts in various mine shafts and rock crevices.

2. Southwestern Myotis. Myotis auriculus.

This species, also an inhabitant of oak-woodland areas, is probably resident throughout the year.

3. Fringed Myotis. Myotis thysanodes.

Habits similar to those of the Southwestern Myotis.

4. Small-footed Myotis. Myotis leibii.

This is another montane dweller that is probably resident throughout the year.

5. California Myotis. Myotis californicus.

A resident of desert and desert, grasslands, it occurs in the lower parts of the Memorial.

6. Hoary Bat. Lasiurus cinereus.

This large bat is found in a wide diversity of habitats. A single individual may feed over several dozens of square miles during a single night. Some perform major north-south migrations (summers either in Canada or montane regions of the western United States, winters in southern United States and in Mexico). Others perform seasonal local vertical movements (summers in mountains, winters in surrounding foothills or deserts).

7. Black-tailed Jack Rabbit. Lepus californicus.

Jack rabbits occur in limited numbers throughout the Memorial, but are more numerous at lower elevations.

8. Desert Cottontail. Sylvilagus auduboni.

This species also occurs throughout the Memorial, but is more common at lower elevations.

9. Rock Squirrel. Spermophilus variegatus.

Rock squirrels occur in rocky situations throughout the Memorial.

10. Arizona Gray Squirrel. Sciurus arizonensis.

This tree squirrel is essentially a resident of the oak-woodlands.

11. Botta's Pocket Gopher. Thomomys bottae.

Botta's pocket gophers occur in areas of deeper soils in flood plains in most parts of the Memorial.

12. Southern Pocket Gopher. Thomomys umbrinus.

This smaller, darker gopher is restricted to shallow soils, and is often associated with the scattered oaks along hillsides.

13. Hispid Pocket Mouse. Perognathus hispidus.

Essentially an inhabitant of grasslands, this pocket mouse was taken only in the eastern portion of the Memorial.

14. Desert Pocket Mouse. Perognathus penicillatus.

Smaller than the hispid pocket mouse, this pocket mouse is found in shrubby areas on the coarse, sandy soils of the Memorial.

15. Rock Pocket Mouse. Perognathus intermedius.

In size and general appearance this species resembles the desert pocket mouse.

However, its distribution is restricted to rocky microhabitats at lower elevations.

16. Western Harvest Mouse. Reithrodontomys megalotis.

Primarily a grassland inhabitant, this species may be found throughout the heavier grass areas of the Memorial.

17. Fulvous Harvest Mouse. Reithrodontomys fulvescens.

More restricted in its range than the Western Harvest Mouse, this species is found most frequently in riparian microhabitats.

18. Deer Mouse. Peromyscus maniculatus.

One of the most wide ranging species of rodents in the United States, this mouse is apparently rare throughout the Memorial. When present, it seems to be restricted to grassy areas.

19. White-footed Mouse. Peromyscus leucopus.

This species, when found in association with other species of Peromyscus, seems to prefer wooded areas. It was trapped in a riparian community in the SE corner and in a woodland in the SW corner of the Memorial.

20. Brush Mouse. Peromyscus boylii.

Primarily an inhabitant of Southwestern oak-woodland regions, this species is frequently found in most of the Memorial. It is probably the most common small rodent present.

21. Southern Grasshopper Mouse. Onychomys torridus.

Essentially a Lower Sonoran life zone inhabitant, this carnivorous mouse occurs only in the lower, grassier areas of the Memorial.

22. White-throated Woodrat. Neotoma albigula,

A dweller of arid and semi-arid regions of the southwest, this species probably occurs throughout the Memorial. It utilizes materials such as sticks and cactus pads to construct a den, or a rocky crevice to provide shelter.

23. Coyote. Canis latrans.

This carnivore can be heard howling almost every night, It probably feeds throughout the Memorial.

24. Gray Fox. Urocyon cinereoargenteus.

Few in number, gray foxes probably occur throughout the Memorial.

25. Kit Fox. Vulpes macrotis.

This secretive small fox, is seen periodically by residents of the area. Although essentially a desert dweller it may occur at times on the Memorial.

26. Raccoon. Procyon lotor.

Raccoons have been observed to the east of the Memorial in recent years and are transients over most of the Memorial from the riparian community of the San Pedro River.

27. Coati. Nasua nasua.

We observed no coati. Residents of the area have few sightings to report and state that several years ago a fairly large population occurred in the area. In the past major variations in populations in the Huachucas and elsewhere have been documented.

Probably a few are still present and, in the next few years, populations will again increase to the point that coatis will be "common".

28. Badger. Taxidea taxus.

More an open area inhabitant, the badger has been reported in the lower reaches of the Memorial in recent years.

29. Western Spotted Skunk. Spilogale gracilis.

Both local residents and Memorial personnel report seeing this species occasionally. Since elsewhere it exhibits wide ecological tolerances, it probably occurs in small numbers throughout the Memorial.

30. Striped Skunk. Mephitis mephitis.

Elsewhere, this skunk inhabits a wide spectrum of habitats. (In Arizona from the desert floor to montane areas). Several scattered observations on the Memorial lead to the conclusion that the species occurs throughout the Memorial.

31. Bobcat. Felis rufus.

This versatile and secretive cat, probably occurs in limited numbers throughout the Memorial.

32. Collared Peccary. Dicotyles tajacu.

Residents of the area report seeing several every year. A group of nine was observed above Pruitt's place in 1976. Preferring some cover, most peccary avoid the open grassy areas east and south of the Memorial.

33. White-tailed Deer. Odocoileus virginianus.

Observed at scattered sites throughout the Memorial, this species prefers higher elevations. The desert mule deer (O. hemionus), occurs along the San Pedro River a few miles to the east of this area and may occasionally wander into the lower elevations of the Memorial.

B. Species not observed but probably present.

The following species were not collected or observed on the Memorial nor on its proposed increased area during the course of this study. They have, however, been taken at similar elevations elsewhere in the Huachuca Mountains in the past. Species, mostly smaller rodents, that are marked (**) are primarily residents of grasslands.

1. Desert shrew. Notiosorex crawfordi.
2. Long-tongued Bat. Choeronycteris mexicana.
3. Ghost-faced Bat. Mormoops megalophylla.
4. Sanborn's Long-nosed Bat. Leptonycteris sanborni.
5. Cave myotis. Myotis velifer.
6. Long-legged Myotis. Myotis volans.
7. Silver-haired Bat. Lasionycteris noctivagans.
8. Western Pipistrelle. Pipistrellus hesperus.
9. Big Brown Bat. Eptesicus fuscus.
10. Red Bat. Lasiurus borealis.
11. Southern Yellow Bat. Lasiurus ega.
12. Spotted Bat. Euderma maculatum.
13. Allen's Big-eared Bat. Idionycteris phyllotis.

14. Pallid Bat. Antrozous pallidus.
15. Brazilian Free-tailed Bat. Tadarida brasiliensis.
16. Pocketed Free-tailed Bat. Tadarida femorosacca.
17. Big Free-tailed Bat. Tadarida macrotis.
18. Western Mastiff Bat. Eumops perotis.

Bats may cover areas larger than the total area of the Memorial during a single night's feeding flight. Thus, although the above 14 species have not yet been recorded on the Memorial, they probably occur, at least as transients during some part of the year. Some may occupy day roosts on the area only further study will clarify their status.

19. Spotted Ground Squirrel. Spermophilus spilosoma. (**)
20. Silky Pocket Mouse. Perognathus flavus. (**)
21. Ord's Kangaroo Rat. Dipodomys ordii. (**)
22. Merriam's Kangaroo Rat. Dipodomys merriami. (**)
23. Plains Harvest Mouse. Reithrodontomys montanus. (**)
24. Northern Pygmy Mouse. Baiomys taylori. (**)
25. Northern Grasshopper Mouse. Onychomys lucogaster. (**)
26. Arizona Cotton Rat. Sigmodon arizonae

Grass clippings, perhaps of this species, were seen on site no. 9.

27. House Mouse. Mus musculus.
28. Porcupine. Erethizon dorsatum.
29. Hooded Skunk. Mephitis macroura.
30. Hog-nosed Skunk. Conepatus mesoleucus.

31. Mountain Lion. Felis concolor.

May rarely be present in the area. Most have been eliminated by man.

C. Species probably extinct in the area.

The following may have occasionally roamed over the area now occupied by the Memorial but appear to be at least locally extinct.

1. Black-tailed Prairie Dog. Cynomys ludovicianus.
2. Wolf. Canis lupus.
3. Black Bear. Ursus americanus.
4. Grizzly Bear. Ursus arctos.
5. Jaguar. Felis onca.
6. Ocelot. Felis pardalis.
7. Jaguarundi. Felis yagouaroundi.
8. Pronghorn. Antilocapra americana.
9. Mountain Sheep. Ovis canadensis.

IV. Historical changes.

Many effects of human activity on mammals on populations can be seen at the Memorial. Self-evident are such improvements as roads, pavement, picnic areas, fences, buildings, mine tunnels, and stock tanks. All have local effects on mammalian habitat, habits and populations. Not so evident are the changes in water flow patterns resulting from mining activities, lumber cutting and the effects of grazing by domestic animals.

Effects on mammals have been varied, ranging from extermination to probable increase in populations. Both the Black and the Grizzly Bear formerly ranged over the whole Memorial. For example, the type locality for the Grizzly Bear, Ursus kennerleyi Merriam, is

"mountains near Los Nogales, Sonora." This specimen in the United States National Museum, was collected in June 1855 by Dr. C. B. Kennerly. Although grizzlies have been extinct throughout the region for years, they obviously ranged across the Memorial on many occasions in the past 100 to 150 years.

Black bears have been reported much more recently (see Hoffmeister and Goodpaster 1956). Mountain sheep formerly ranged through the area and Pronghorn, grazed in the grasslands on the eastern edge perhaps as recently as less than a century ago. Black-tailed prairie dogs may have occurred in the grasslands areas of the eastern border of the proposed expansion as recently as 1930.

The various large cats (jaguar, ocelot and jaguarundi) were probably never numerous and only rarely strayed through the area.

Not all species in the, general area of the Memorial have suffered reduced populations as the result of increase human utilization of the area.

For example, the abandoned mine tunnels and the various water tanks and ponds in the region have increased the available roosts and watering places for bats. As a result, total bat populations have probably increased in this general region in the past century.

Man induced habitat modifications have probably resulted in increased populations of skunks, coyotes, various rodents, and, perhaps, deer. As indicated below, further studies are needed to clarify and quantify these judgments.

V. Recommendations

As far as mammals are concerned, the enlargement of the Memorial, especially to the more grassy areas to the east, would increase the diversity of species present (see especially the species marked ** in III B). Note that most of these are small, grassland

inhabiting rodents. However, the total area of the Memorial is too small to support breeding populations of any but the smallest of the mammalian species. In other words, if the whole Memorial were to be suddenly transported to a climatically identical place surrounded by many miles of water, an obvious island would exist. This island would not be large enough to support breeding populations of any of the larger mammals (e.g. deer, coyote, or peccary). Even various smaller species, as the result of diseases or food shortages (drought, cold period or otherwise induced) might soon become extinct. This so called insular effect might well occur if the human use of all surrounding areas were to shift drastically.

An examination of the current patterns of distribution of mammals reveals that nonhuman factors have resulted in marked discontinuities in distributions of montane species. For example, no chipmunks (e.g. Eutamias dorsalis) occur in the Huachuca mountains although the species does occur in the Santa Catalinas and Santa Ritas to the north as well as the Chiricahuas to the east and in various Sierra Madre localities to the southeast. Further, even though Arizona grey squirrels (Sciurus arizonensis) are common in the Huachucas, they are absent in the Chiricahuas to the east.

At one extreme might be the paving and molding into city sub-divisions of all surrounding lands. The impact of the resulting gene pools, as well as the effects of dogs, cats, humans, English sparrows, house mice, etc. is hard to envision, let alone quantify. Lesser, and more probable, changes that may occur within the next few decades are increased utilization of the surrounding lands for grazing by domestic animals.

If any of these existing factors becomes dominant, further simplifications of mammalian faunas of the Memorial [a small island] will become evident.

Based upon these observations, we recommend:

a) That the size of the Memorial be increased as much as possible. The proposed increases to the eastward are certainly needed. However the abandoning of the area to the west is biologically counterproductive unless meaningful agreements recommended (in b) below can be accomplished.

b) Cooperative agreements with the U. S. Forest Service designed to insure the survival of carnivores (especially mountain lions, bob cats, other cats, coyotes, foxes) and larger herbivores would help counteract the insular effect of the small size of the Memorial. Long term agreements for limited use (grazing, hunting, etc.) of areas adjacent to the Memorial would insure larger areas and better chances of survival.

c) Past and current patterns of land use to the south of the international border make the expectation of insular enlargement by utilization of adjacent areas in Mexico highly improbable. When one considers the multitude of problems raised by any attempted international agreements, the expectation of any biologically meaningful arrangements practically disappear.

d) The proposed deletion simply results in a smaller island. If the western deletion reverts to U. S. Forest Service land and if biologically meaningful programs -- especially for the survival of the carnivores and larger herbivores -- can be insured, then the western area deletion will have little effect.

e) Further research needs, as far as mammals are concerned, appear to fall into two categories: (1) determination of conditions and populations within the historic past and (2) clarification of certain present problems. Details are:

1. Historic past.

A review of past records to determine the history and importance of the species listed in III C appears necessary. This is needed not only for the Memorial proper but for southern Arizona in general, in order to provide meaningful evaluations of probable past population densities as well as estimates of pre- and post-Coronado effects of interactions of these species with man and his domestic animals. This study should probably be a team effort, involving both a historian and a mammalogist.

2. Present Problems.

(1) An intensive study of the pocket gopher populations of the Memorial, utilizing modern karyotypic, serological and electrophoretic techniques as well as statistical analyses of classically evaluated morphological features should be done. Even though the Coronado National Memorial was chosen on strictly non-biological grounds[to commemorate a historic occurrence in the settlement of North America by Europeans], this small area is the only place within the current United States National Park holdings wherein Bottae's (Thomomys bottae) and southern (Thomomys umbrinus) pocket gophers both occur. As a result of studies by Patton and Dingman (1968), and others, these two species of fossorial rodents, each with narrow environmental parameters in areas of sympatric (or rather, microhabitably allopatric) distribution, are becoming classical examples of speciation in progress. Although none of the published studies have involved populations on the Memorial, intensive studies here are necessary to define the micro environmental (or other) factors that appear to maintain the genetic separation between the two species as well as quantify the details of their present distribution on the Memorial. Such a detailed study, if properly done, could become a minor landmark in modern evolutionary studies.

(2) Additional studies are needed to determine the status of a number of bats known to occur in the Memorial region but have not yet been recorded there (see section III B above).

VI. Acknowledgements

We want to express our special thanks to several people. Their cooperation greatly contributed to this report. First among these is Mr. William Sparks, who allowed us to explore the mineshafts on his property for bats and provided a great amount of information concerning the wildlife and history of the area.

Mr. Ben Pruitt also graciously allowed us on his property to sample the mammalian fauna. The personnel of the Coronado National Memorial, especially Mr. Paul Thompson and Mr. George Brown, deserve our thanks for the consideration and help they provided during the field work phase of this study. Mr. Brown, a life-time resident of the area, spent a considerable amount of time sharing his familiarity with the wildlife, habitats, and history of the areas; this was greatly appreciated.

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Appendix A. Summary of trapping sites.

- Site 1 (325 trap nights) location: R21E, T24S, Sec. 20, NW 1/4, NE 1/4, el 4900 ft. (1493 m), June 10-14, 1977. Habitat: Large wash surrounded by grassland. Wash is rocky and sandy with many desert willows and few large oaks. Soil is rocky and thin. Some dense stands of grass in area. Much of the area is exposed soil with clumps of short cropped grass.
- Site 2 (202 trap nights, bat net) location: R20E, T24S, Sec. 12, SW 1/4, el. 5800 ft. (1768 m). June 10-14, 1977. Habitat: Rugged oak-pinon. Rocky.
- Site 3 (211 trap nights) location: R21E, T23S, Sec. 7, SE 1/4, el. 5300 ft. (1616 m). June 10-14, 1977. Habitat: Rolling hills. Primarily oaks with grass cover.
- Site 4 (100 trap nights) location: R20E, T24S, Sec. 14, NW 1/4, el. 6600 ft. (2012 m). June 15-16, 1977. Habitat: Steep, cover of oak, pinon and juniper. Some bear grass and cholla.
- Site 5 (200 trap nights, bat net) location: R20E, T24S, Sec. 11, SE 1/4, el. 6000 ft. (1829 m). June 17-21, 1977. Habitat: Hilly, steep, and rocky. Mainly oaks, some junipers. Many large oaks in the narrow canyon. Deep mineshaft present.

- Site 6 (108 trap nights) location: R21E, T24S, Sec. 17, SW 1/4, el. 5000 ft. (1524 m). June 17-21, 1977.
Habitat: Grassy slopes, sparse riparian, very rocky. Heavily grazed.
- Site 7 (160 trap nights) location: R21E, T24S, Sec. 18, NE 1/4, el. 5100 ft. (1555 m). June 17-21, 1977.
Habitat: Flat meadow with sandy soil, on edge of oak woodland. Bench area of main drainage of Montezuma Canyon.
- Site 8 (100 trap nights, bat net) location: R20E, T24S, Sec. 24, SE 1/4, el. 5400 ft. (1646 m). June 16-17, 1978. Habitat: Rolling oak woodland, short cropped grassy meadows. Few riparian washes in area. Rocky thin soil.
- Site 9 (150 trap nights, bat net) location: R20E, T24S, Sec. 10, NW 1/4, SW 1/4, el. 5700 ft. (1759 m). June 18-19, 1978. Habitat: Rolling oak woodland with open meadows of grass. Most of area grazed. Stock pond present,
- Site 10 (100 trap nights) location: R21E, T23S, Sec. 8, SW 1/4, el. 5100 ft. (1555 m). June 20-21, 1978.
Habitat: Ecotone between oak woodland and grassland. Flat with small washes.
- Site 11 (100 trap nights, bat net) location: R21E, T23S, Sec. 8, SW 1/4, el. 5200 ft. (1586 m). June 21-23, 1978. Habitat: Ecotone area of oaks and grass. More ravines than site 10. Stock tank present.
- Site 12 (150 trap nights) location: R21E, T24S, Sec. 17, SE 1/4, el. 4920 ft. (1500 m). June 27-30, 1978.

Habitat: Primary grassland with riparian wash.
 Some large area of grass with grass up to 0.6 meters high.
 Site 13 (200 trap nights) location: R21E, T24S, Sec. 17, SW 1/4,
 el. 4980 ft. (1518 m). June 27-30, 1978.
 Habitat: Relatively barren, Growth low, no more than 5 inches high.
 Rocky, shallow soil. Some short cropped clumps of grass. A few agaves
 are present.

Site 14 Location: R20E, T24S, Sec. 14, NE 1/4, el. 600 ft (1829 m). June 27-30,
 1978.

Habitat: Dense oak-pinon-juniper. Steep.

Appendix B. Records of Occurrence in Memorial.

1. Plecotus townsendii 4 observed in mineshaft at Site 2; 6
at Site 5 in mineshaft.
2. Myotis auriculus 4 observed in mineshaft at Site 5
(1 in collection); 3 netted at Site 8
(2 in collection).
3. Myotis thysanodes 1 observed in mineshaft at Site 2; 12
at Site 5 (1 in collection); 1 netted
at Site 3 (in collection).
4. Myotis leibii 1 netted at Site 11 (in collection).
5. Myotis californicus 1 netted at Site 8 (in collection).
6. Lasiurus cinereus 1 netted at Site 9 (in collection).
7. Lepus californicus Several observed. 1 each at Site 3;
Site 6; and Site 7.
8. Sylvilagus audubonii Observed at Sites 5, 9, 10 and 8.
9. Spermophilus variegatus 2 observed at Site 4; 2 observed at
Site 7.

10. Sciurus arizonensis 1 observed on Site 2; 2 on Site 14;
1 near visitor center.
11. Thomomys bottae 1 collected at Site 7 (in collection).
12. Thomomys umbrinus 1 collected at Site 11 (in collection).
13. Perognathus hispidus 4 collected at Site 1 (1 in collection); 1 collected at Site 3; 1 collected at Site 12 (in collection).
14. Perognathus penicillatus 2 collected at Site 8 (1 in collection).
15. Perognathus intermedius 1 collected at Site 3; 1 at Site 11 (in collection).
16. Reithrodontomys megalotis 1 collected at Site 9 (in collection).
17. Reithrodontomys fulvescens 1 collected at Site 12 (skull in collection).
18. Peromyscus maniculatus 4 collected at Site 1 (1 in collection); 1 collected at Site 6 (in collection).
19. Peromyscus leucopus 1 collected at Site 1; 2 at Site 8 (1 in collection).
20. Peromyscus boylii 7 collected at Site 2 (1 in collection); 2 collected at Site 3; 18 collected at Site 4 (4 in collection); 4 collected at Site 5.
21. Onychomys torridus 2 collected at Site 1 (1 in collection); 1 collected at Site 6 (in collection); 1 collected at Site 11 (in collection).
22. Neotoma albigula 2 collected at Site 4; 1 collected at Site 5 (in collection); 1 collected at Site 11 (in collection).
23. Canis latrans Heard on Sites 1,3,8; seen on Site 11.

- | | | |
|-----|---------------------------------|--|
| 24. | <u>Urocyon cinereoargenteus</u> | Observed by C. H. Lane, 4 miles west of visitors center, |
| 25. | <u>Dicotyles tajacu</u> | Observed 9 on Site 5. |
| 26. | <u>Odocoileus Virginianus</u> | Observed 1 on Site 2; 3 observed on Site 5. |

Appendix C.

The following species is currently listed on the Federal Endangered species list.

Mexican Wolf. (Canis lupus mexicanus).

Listed on the Federal Threatened species list is:

Grizzly Bear. (Ursus arctos).

As already indicated, both of these appear to be extinct in the immediate region of the Coronado National Memorial.

The Arizona Game and Fish Department lists the following groups and species in its list of threatened wildlife species of Arizona (only species thought to occur in the region of the Memorial are here listed).

Group I. Species or subspecies extirpated from Arizona that may possibly be re-established.

Black-tailed Prairie Dog. (Cynomys ludovicianus arizonensis).

Grizzly Bear. (Ursus arctos).

Group II. Species or subspecies in danger of being eliminated from Arizona.

Mexican Wolf. (Canis lupus baileyi).

Group III. Species or subspecies whose status in Arizona may be in jeopardy in the foreseeable future.

Spotted Bat. (Euderma maculata).

Desert Bighorn. (Ovis canadensis mexicana).

Group IV. Species or subspecies of special interest because of limited distribution in Arizona.

Coati. (Nasua narica).

Appendix D. Subspecies names.

Based upon a preliminary evaluation of morphological features and geographic probabilities, the following are the subspecific assignments for the various mammals listed for species actually observed. Subspecies names are not assigned to those listed in Sections III B and III C. The common names are the same as those given in text. Most modern mammalogists do not use separate common names for different subspecies.

1. Plecotus townsendi pallescens Miller.
2. Myotis auriculus Baker and Stains.
3. Myotis thysanodes thysanodes Miller.
4. Myotis leibii melanorhinus (Merriam).
5. Myotis californicus californicus (Audubon and Bachman).
6. Lasiurus cinereus cinereus (Beauvois).
7. Lupus californicus eremicus J.A. Allen.
8. Sylvilagus auduboni arizonae (J.A. Allen).
9. Spermophilis variegatus grammurus (Say).
10. Sciurus arizonensis huachuca Allen.
11. Thomomys bottae collinus Goldman
12. Thomomys umbrinus cf. burti Huey
13. Perognathus hispidus conditi Allen.
14. Perognathus penicillatus pricei Allen

15. Perognathus intermedius intermedius Merriam.
16. Reithrodontomys megalotis megalotis (Baird).
17. Reithrodontomys fulvescens fulvescens Allen.
18. Peromyscus maniculatus sonoriensis (LeConte).
19. Peromyscus leucopus arizonae (Allen).
20. Peromyscus boylii rowleyi (Allen).
21. Onychomys torridus torridus (Cones).
22. Neotoma albigula albigula Hartley. 2
23. Canis latrans mearnsi Merriam.
24. Urocyon cinereoargenteus scotti Mearns.
25. Vulpes macrotis arsipus Elliot.
26. Procyon lotor mexicanus Baird.
27. Nasua nasus pallida Allen.
28. Taxidea taxus sonoriensis Goldman.
29. Spilogale gracilis gracilis Merriam.
30. Mephitis mephitis estor Merriam.
31. Felis rufus baileyi Merriam.
32. Dicotyles tajacu sonoriensis (Mearns).
33. Odocoileus virginianus couesi (Cones and Yarrow).