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Landbird Monitoring in the Sonoran Desert Network

Status Report 2008

Natural Resource Report NPS/SODN/NRR–2009/079

ON THE COVER

Greater roadrunner (*Geococcyx californianus*). Photo ©Greg Lavaty.

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Author
Aaron Flesch
University of Arizona
School of Natural Resources
325 Biological Sciences East
Tucson, Arizona 85721

Editing and Design
Alice Wondrak Biel
Sonoran Desert Network
7660 E. Broadway Blvd, Suite 303
Tucson, Arizona 85710

February 2009

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

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Please cite this publication as:

Flesch, A. 2009. Landbird monitoring in the Sonoran Desert Network: Status report 2008. Natural Resource Report NPS/SODN/NRR–2009/079. National Park Service, Fort Collins, Colorado.

NPS D-98, February 2009

Landbird Monitoring

Status Report 2008

Aaron Flesch, University of Arizona

U.S. FISH AND WILDLIFE SERVICE/KARNEY

Gambel's quail (*Callipepla gambelii*).

Introduction

Background

The primary mission of the National Park Service (NPS) is to protect and preserve natural and cultural resources for future generations. Responding to criticism that it lacked basic information on the condition of natural resources within national parks, the NPS initiated a servicewide Inventory and Monitoring (I&M) Program to determine status and trends in ecological resources (NPS 1992).

Established in 2001, the Sonoran Desert Network (SODN) Inventory and Monitoring Program includes 11 parks in southern Arizona and New Mexico that range in size from 356 (Tumacácori National Historical Park) to 133,882 hectares (Organ Pipe Cactus National Monument). Collectively, these parks are representative of most of the ecological communities present within the Sonoran Desert and Apache Highlands Ecoregions (NPS 2005).

Birds as a focus for monitoring

In 2005, SODN staff completed a monitoring plan that identified "vital signs," or parameters, representing a diverse range of natural resources including air, water, climate, soils, plants, invertebrates, and vertebrates (NPS 2005). During this process, population parameters of landbirds were considered among the most feasible vertebrate parameters for long-term monitoring, in part because birds are highly detectable, easy to survey, and because they are good indicators of the environmental conditions upon which they depend.

Goal and parameters

The overall goal of the SODN landbird monitoring program is to detect biologically significant changes in bird populations over time. To achieve this goal, we are monitoring for *density* of the most-common species in SODN parks, and estimating the *proportion of sites occupied* for most species in most parks.[1] These parameters focus on trend information. Detailed data exploration (including external data sources) and trend analysis of landbird data and will be explored in detail in the network's comprehensive Synthesis and Trends reports, to be released at five-year intervals (Powell et al. 2007).

In the meantime, parameters to be reported in annual status reports, such as this one, include (1) total detections by species, park, and habitat type; (2) community composition, (3) observations of breeding behaviors; and (4) notable observations and species additions. This annual status report provides a brief summary of SODN landbird monitoring efforts and results during the 2008 field season. This report also outlines changes made to the network's landbird monitoring protocol and provides additional background and recommendations to aid future implementation.

Methods

Sampling design

In 2008, we surveyed landbirds within all seven parks that were sampled in 2007 (CAGR, FOBO, ORPI, MOCC/MOWE, SAGE/SAGW, TUMA, and TUZI), and one additional park (TONT), where we surveyed three transects (Table 1; all tables appear after main text. See box, next page, for park acronyms). We also added a riparian transect (Rip-2) at ORPI in 2008. We surveyed a total of 34 transects, with the number

[1]The advantages and limitations of monitoring for density and proportion of sites occupied are discussed in detail in the SODN Landbird Monitoring Protocol (Powell et al. 2007).

Park acronyms used in this document

CAGR	Casa Grande Ruins National Monument
CHIR	Chiricahua National Monument
CORO	Coronado National Memorial
FOBO	Fort Bowie National Historic Site
GICL	Gila Cliff Dwellings National Monument
MOCC	Montezuma Castle National Monument (Castle Unit)
MOWE	Montezuma Castle National Monument (Well Unit)
ORPI	Organ Pipe Cactus National Monument
SAGE	Saguaro National Park (Rincon Mountain Unit)
SAGW	Saguaro National Park (Tucson Mountain District)
TONT	Tonto National Monument
TUMA	Tumacácori National Historical Park
TUZI	Tuzigoot National Monument

of transects per park ranging from 1 at CAGR to 6 at SAGE. Sites in each park were classified as either riparian or upland; we classified these sites separately because of variation in bird communities and because we wanted to focus some survey effort in riparian communities (see Powell et al. 2007).

Site establishment

In most parks, we used sites selected with methodology outlined in Powell et al. (2007) (see Appendix A). Exceptions occurred at Organ Pipe Cactus NM and Saguaro NP. In 2007, safety concerns related to undocumented immigration and smuggling at ORPI led park managers to institute travel restrictions that created significant obstacles for monitoring staff attempting to incoporate a random component to site selection. As a result of those concerns, only eight of the approximately 40 sites proposed for monitoring proved acceptable to park staff; all sites in the southern and western portions of the park were excluded from sampling. After some safety restrictions were lifted in 2008, those same eight transects were re-sampled by single observers and an additional transect was added.

Field methods

We surveyed transects located in riparian areas four times and transects located in upland areas three times each. We reduced survey effort in upland areas in 2008, due to budget constraints and because sample-size information and power analyses suggested that three visits facilitated monitoring of nearly as many species over time as four visits.

We maintained four visits in riparian areas because higher encounter rates in these vegetation communities made monitoring more efficient. Seasonal timing of surveys varied among parks. Timing of initial surveys was earlier in low-elevation parks (CAGR, ORPI, and SAGW) and later in mid-elevation parks (SAGE, FOBO, TUMA) and those in the Verde Valley (MOCC/MOWE and TUZI). Variation in timing was intended to account for differences in the onset of breeding for most species in each park. We spaced surveys a minimum of 1.5 weeks apart and completed all surveys by July 3 (see Table 1).

We used the point-transect survey method (Nelson and Fancy 1999, Buckland et al. 2001), which is the most widespread and accepted method for estimating landbird density (Rosenstock et al. 2002). Details on how to conduct point-transect surveys are provided in Powell and others (2007) and briefly outlined here.

We spent eight minutes at each station and used a rangefinder to estimate the linear distance to each bird detected. We recorded all birds, regardless of detection distance from the surveyor, including birds flying over observers. After counts were completed, observers located successive survey points with use of a handheld GPS. While walking between points, observers searched for species not recorded during the count period. Although monitoring staff deviated from the published protocol at ORPI in 2007, by working in groups of two, we surveyed transects independently in 2008.

Changes to the protocol

We made a few small changes to the SODN landbird monitoring protocol in 2008. First, we differentiated auditory detections with use of three classifications: singing (S), calling (C), and sounds made by birds' wings (W), whereas in the past all

The house finch (*Carpodacus mexicanus*) was among the most-commonly detected species in each park, including parks with only riparian and only upland transects.

A calling clapper rail (*Rallus longirostris*) was detected in the marsh at Tuzigoot National Monument.

of these cues were simply classified as auditory (A). We considered singing birds to be those that were delivering territorial vocalizations made only by males (e.g., flycatchers were not considered), which in the SODN region are predominantly perching birds (Passeriformes). We added these additional codes to facilitate trend estimation for singing males, which could vary less across time than estimations for all individuals combined.

We also noted initial detection distances of birds that were in flight if these species were aerial foragers (e.g., swallows) or hoverers (e.g., hummingbirds).

All data upon which this report is based were subject to SODN I&M QA/QC procedures and certification. These processes enabled us to identify and correct numerous errors created during the data-entry process.

Species accounts refined

In 2008, we reviewed species lists for each park in the NP-Species database. As part of this task, we noted species that may require additional documentation before they are included on park lists, as well as species already on the lists that are rare or unlikely to occur. Some species that are on park lists may have sufficient documentation for inclusion, but were noted as "need documentation" if we did not review the evidence.

Results and Discussion

The results summarized in this report represent an initial summary of bird data collected by field personnel in SODN parks in 2008. More focused and detailed reviews of these data and assessments of temporal trends in populations of landbirds will be completed after additional seasons of data are available.

Total detections

We recorded a total of 18,428 observations of 167 species during point counts (Table 2). Of these, 1,663 observations (e.g., individuals or groups) were flyovers and 12 species were detected only as flyovers. The greatest number of observations occurred at SAGE (n = 3,395); the fewest number occurred at CAGR (n = 468). We observed the greatest number of species at FOBO (n = 93), SAGE (n = 88), and TUZI (n = 88), and the least at CAGR (n = 40).

Community composition

Species richness and community composition varied widely among all eight parks surveyed. The 10 most frequently detected species in each park also varied among parks, although parks that supported large riparian areas often had similar composition to parks that were predominantly uplands (Table 3). Among the most frequently detected species in each park (Tables 3–4) were house finch, Gila woodpecker, verdin, cactus wren, white-winged dove, brown-crested and ash-throated flycatchers, and black-throated sparrow.

Breeding activity

We made total of 134 observations of confirmed breeding activity, including 11 behaviors or observation types (Table 5). In comparison, only 42 observations of confirmed breeding activity were obtained in 2007. Most breeding observations were in SAGE (n = 32) and MOCC (n = 24). Notable observations included nesting common black hawk at MOCC and MOWE and zone-tailed hawk and gray vireo at FOBO. Breeding records provided by the SODN augment known records across the network.

Species additions and species of interest

We added 18 new species to park lists in 2008, two of which were added to more than one park list (Table 6). We added the greatest number of new species to the TONT park list (n = 6) and the fewest to the park lists of TUZI (n = 1), CAGR (n = 1), and ORPI (n = 0). Notable new species included American redstart (TUZI) and northern parula (SAGE, along Rincon Creek). Additionally, a calling adult elegant trogon was detected incidentally in riparian forest at MOCC on the mornings of June 17 and 18, but was not relocated on July 1–2. Also of note was a calling clapper rail in the marsh at TUZI on May 6, and a soaring gray hawk above TONT on April 23.

Recommendations for future efforts

Overall, implementation of bird monitoring in SODN parks during 2008 was remarkably successful. The relatively minor

changes made to the existing protocol indicate the protocol's substantial utility for sampling bird communities. However, several recommendations should aid implementation during future years. When checking and certifying data from 2008, we found that the errors made most frequently were incorrect visit numbers and use of bird codes for the wrong species for some detections (<0.1%). To ameliorate the former problem, we suggest preparing and carefully checking the data that comprise Table 2 of this report before certifying data. To minimize the latter issue, we suggest preparing and carefully checking the data that comprise Table 3 of this report before certifying data; observers should focus on identifying entries of species that do not occur in a given park or of rare species that seem potentially out of place. Additionally, modifying the database so that only codes for species that have been detected within a park are acceptable values in the species field will help reduce these hard-to-find errors.

Perhaps our greatest limitation during the 2008 field season was insufficient time during which to complete vegetation measurements. These basic vegetation characterizations were designed to aid in the detailed explorations of bird population and community trends to be reported in the Synthesis and Trends reports (Powell et al. 2007). However, the vegetation surveys proved to be more time-consuming than predicted, which constrained the time allotted to database quality assurance/quality control (QA/QC). As SODN vegetation monitoring and mapping should provide similar data that would exceed our needs during the synthesis and trends analyses for birds, we recommend dropping all of the vegetation sampling from the bird protocol. The savings in staff time could be better spent on additional database QA/QC and perhaps adding additional sites in high-elevation habitats. Sampling of these habitats (at CHIR, CORO, GICL, and high-elevation SAGE) were initially restricted to five-year intervals due to increased access costs and lower detectability. However, bird communities at high elevation may be at greater risk from climate change than those at low- and mid-elevations. We recommend exploring the efficacy of annual surveys at high-elevation sites in 2009.

Acknowledgements

Moez Ali and Jon Green collected a wealth of data for this project and performed these duties with remarkable skill and dedication. Jon Green assisted in preparing several tables in this report and with the data certification process; both Moez and Jon entered all data and implemented SODN QA/QC procedures on data collected during the 2007 field season. Glenn Johnson also assisted with data collection. SODN park staff provided essential guidance and assistance during this field season. Specifically, thanks go to Tim Tibbitts, of ORPI, for completing two surveys and helping with safety issues. At other SODN parks, thanks to Dennis Casper, Jeremy Moss, Duane Hubbard, Don Swann, Natasha Kline, Larry Ludwig, Danielle Foster, Carol West, and others for assisting with access, permits, housing, and other logistics. Andy Hubbard, Kristen Beaupre, Debbie Angell, and the rest of the staff at the SODN I&M office supported our work; without their assistance, our efforts would not have been possible. I also thank Brian Powell for providing a wealth of guidance on numerous issues related to program implementation.

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Project contact

Andy Hubbard, Program Manager
Andy_Hubbard@nps.gov
Sonoran Desert Network
National Park Service
7660 E. Broadway Blvd., Suite #303
Tucson, Arizona 85710
Phone: 1+520-546-1607x1
http://www.nature.nps.gov/im/units/sodn/

Table 1. 2008 sampling dates by park and site.

Park unit	Site	Visit 1	Visit 2	Visit 3	Visit 4
CAGR	U	April 15	April 25	May 19	--
FOBO	SPN	April 28	May 27	June 12	June 26
	UpE	April 29	May 27	June 13	--
	UpW	April 29	June 12	June 25	--
MOCC	R1	May 8	May 28	June 17	July1
	R2	May 9	May 28	June 18	--
	Up1	May 8	June 17	July 1	--
	Up2	May 9	June 18	July 2	--
MOWE	R	May 7	May 30	June 20	July 3
	Up	May 7	May 30	June 20	--
ORPI	R1	April 11	May 22	May 30	--
	R2	April 10	May 1	May 21	--
	U1	April 11	May 2	May 22	--
	U12	April 10	May 1	May 21	--
	U4	April 9	May 1	May 21	--
	U5	April 9	May 2	May 29	--
SAGE	008	April 21	May 18	June 4	--
	009	April18	May 16	June 2	--
	112	April 17	May 13	June 6	--
	115	April 22	May 19	June 3	--
	139	April 22	May 14	June 3	--
	LRC	April 21	May 17	June 4	June 16
SAGW	204	April 16	May 12	June 5	--
	212	April 9	April 23	May 15	--
	213	April 16	May 12	June 5	--
	238	April 17	May 15	June16	--
	239	April 25	May 13	June 6	--
TONT	Rip*	April 23	May 14	June 11	July 4
	UpE*	April 24	May 15	June 10	--
	UpW*	April 24	June 10	July 4	--
TUMA	East	April 30	May 20	June 9	June 24
	West	May 5	May 20	June 9	June 23
TUZI	East	May 6	May 29	June 19	July 2
	West	May 6	May 29	June 19	--

See Appendix A for site locations.

Table 2. Bird detections by park and site.

Park unit	Site	Type	Survey points	Detections	Detections + Flyovers
CAGR	U	Upland	9	268	468
FOBO	SPN	Riparian	8	701	761
	UpE	Upland	8	441	483
	UpW	Upland	7	283	331
MOCC	R1	Riparian	6	664	690
	R2	Riparian	6	430	462
	Up1	Upland	8	526	563
	Up2	Upland	8	359	410
MOWE	R	Riparian	7	649	686
	Up	Upland	9	513	587
ORPI	R1	Riparian	7	402	416
	R2	Riparian	7	407	410
	U1	Upland	9	273	307
	U12	Upland	7	368	395
	U4	Upland	7	294	315
	U5	Upland	7	499	508
SAGE	008	Upland	7	448	473
	009	Upland	7	501	542
	112	Upland	7	363	404
	115	Upland	8	495	547
	139	Upland	8	350	364
	LRC	Riparian	8	1013	1065
SAGW	204	Upland	7	516	549
	212	Upland	6	269	285
	213	Upland	8	379	403
	238	Upland	6	398	461
	239	Upland	8	535	586
TONT	Rip*	Riparian	6**	759	823
	UpE*	Upland	10**	542	614
	UpW*	Upland	8**	373	424
TUMA	East	Riparian	7	826	873
	West	Riparian	7	691	787
TUZI	East	Riparian	7	770	849
	West	Riparian	7	132	162

* New transect in 2008

** Six points were surveyed during initial visit to “Rip” and 10 points each in “UpE” and “UpW”. Subsequently, two points from “UpE” were counted with “Rip” and two points from “UpW” were eliminated due to difficult terrain.

Table 3. Ten most common species in parks with only upland or riparian habitats, ranked by total detections.

Rank	Only upland	Only riparian
	CAGR	**TUMA**
1	**Mourning dove**	Lucy’s warbler
2	**Gambel’s quail**	**Gila woodpecker**
3	Great-tailed grackle	Bewick’s wren
4	European starling	Yellow warbler
5	**Red-winged blackbird**	**White-winged dove**
6	**House finch**	Yellow-breasted chat
7	**White-winged dove**	Brown-crested flycatcher
8	Cliff swallow	Bell’s vireo
9	Ash-throated flycatcher	Phainopepla
10	House sparrow	Summer tanager
	SAGW	**TUZI**
1	**Gila woodpecker**	**Red-winged blackbird**
2	**White-winged dove**	**House finch**
3	**Gambel’s quail**	**Mourning dove**
4	Verdin	**Gambel’s quail**
5	Ash-throated flycatcher	Common yellowthroat
6	Curve-billed thrasher	Phainopepla
7	Cactus wren	**Mourning dove**
8	**Mourning dove**	Lucy’s warbler
9	**House finch**	Brown-headed cowbird
10	Gilded flicker	Song sparrow

Species common across parks with only upland and only riparian transects are shown in bold.

Table 4. Ten most common species in SODN parks, by the habitat types (riparian vs. upland) in which they were detected.

Rank	Species	% in riparian	% in upland
Fort Bowie NHS			
1	House finch	54%	46%
2	Cactus wren	42%	58%
3	Ash-throated flycatcher	33%	67%
4	Bewick's wren	51%	49%
5	Canyon towhee	43%	57%
6	House finch	29%	71%
7	Scott's oriole	35%	65%
8	Common raven	57%	43%
9	Mourning dove	35%	65%
10	Gambel's quail	37%	63%
Montezuma Castle NM (Castle Unit)			
1	House finch	44%	56%
2	Lucy's warbler	61%	39%
3	Gambel's quail	39%	61%
4	Brown-crested flycatcher	35%	65%
5	Mourning dove	55%	45%
6	Bewick's wren	30%	70%
7	Phainopepla	46%	54%
8	Ash-throated flycatcher	23%	77%
9	Black-throated sparrow	--	100%
10	Brown-headed cowbird	59%	41%
Montezuma Castle NM (Well Unit)			
1	Mourning dove	47%	53%
2	House finch	34%	66%
3	Northern mockingbird	3%	97%
4	Yellow warbler	83%	17%
5	Bewick's wren	66%	34%
6	Lesser goldfinch	53%	47%
7	Gila woodpecker	82%	18%
8	Black-throated sparrow	---	100%
9	Brown-crested flycatcher	75%	25%
10	Brown-headed cowbird	82%	18%

Rank	Species	% in riparian	% in upland
Organ Pipe Cactus NM			
1	Gambel's quail	34%	66%
2	Ash-throated flycatcher	29%	71%
3	House finch	32%	68%
4	Mourning dove	35%	65%
5	Gila woodpecker	33%	67%
6	Verdin	39%	61%
7	Black-tailed gnatcatcher	28%	72%
8	Cactus wren	42%	58%
9	Gilded flicker	42%	58%
10	Black-throated sparrow	25%	75%
Saguaro NP (Rincon Mountain Unit)			
1	House finch	20%	80%
2	Gila woodpecker	19%	81%
3	Gambel's quail	27%	73%
4	Cactus wren	19%	81%
5	Ash-throated flycatcher	12%	88%
6	Black-throated sparrow	10%	90%
7	Mourning dove	21%	79%
8	House finch	30%	70%
9	Curve-billed thrasher	16%	84%
10	Lucy's warbler	71%	29%
Tonto NM			
1	Mourning dove	33%	67%
2	Black-throated sparrow	30%	70%
3	Gambel's quail	31%	69%
4	Ash-throated flycatcher	35%	65%
5	Gila woodpecker	47%	53%
6	Bell's vireo	67%	33%
7	Northern mockingbird	22%	78%
8	Cactus wren	45%	55%
9	Verdin	37%	63%
10	Brown-crested flycatcher	47%	53%

Species are ranked by total detections for 2008.

Table 5. Breeding observations in SODN parks, 2008.

Park unit Species	Carrying food	Carrying nest material	Nest building	Distraction display	Fledged young	Feeding young	Fecal sac	Used nest	Occupied nest	Nest with egg	Nest with young
Casa Grande Ruins NM											
American kestrel					1	1					
European starling	2						1		1		
Fort Bowie NHS											
Black-throated sparrow		1									
Common raven									2		
Gray vireo									1		
Zone-tailed hawk									3		1
Montezuma Castle NM (Castle Unit)											
Cooper's hawk	1								1		
Gila woodpecker											1
Lucy's warbler	1				1	1					
Cliff swallow									1		
Common black-hawk									2		
Hooded oriole	1								2		
Mourning dove		1	1						2		
Northern mockingbird					1	1					
Northern rough-winged											
Swallow									1		
Rock wren					2	2					
Summer tanager		1									
Montezuma Castle NM (Well Unit)											
Anna's hummingbird									1		
Lucy's warbler	1										
Common black-hawk									1		1
Song sparrow	1								1		
Yellow warbler					1						
Organ Pipe Cactus NM											
Gila woodpecker									1		
Ash-throated flycatcher					1	1					
Black-throated sparrow					1						
Cactus wren											1
Mourning dove									2	1	
Red-tailed hawk									3		
Verdin					2						
Saguaro NP (Rincon Mountain District)											
Abert's towhee					3						
Gila woodpecker	2								1		1
Black-tailed gnatcatcher	1				1				1	1	

Table 5. Breeding observations in SODN parks, 2008, cont.

Park unit Species	Carrying food	Carrying nest material	Nest building	Distraction display	Fledged young	Feeding young	Fecal sac	Used nest	Occupied nest	Nest with egg	Nest with young
Saguaro NP (Rincon Mountain District), cont.											
Black-throated sparrow	1										1
Cactus wren	1	1	1			1					
Gilded flicker	1								2		1
Great horned owl					2						
House finch						1					
Lesser goldfinch						1					
Northern cardinal		1									
Verdin					1						
Vermilion flycatcher					1	1			1		
Western kingbird		1									
White-winged dove									1		
Saguaro NP (Tucson Mountain District)											
Gila woodpecker									1		4
Brown-crested flycatcher											
Canyon towhee									1		
Common raven	1								1		1
Mourning dove				1							
Red-tailed hawk									1		
Rock wren	1										1
Tonto NM											
American kestrel	1										
Cooper's hawk									1		
Say's phoebe	1										1
Ash-throated flycatcher	1										
Black-throated sparrow					1						
Common raven	1								2		2
Curve-billed thrasher	1										
Mourning dove				1					1		
Northern mockingbird						1					
Western kingbird					1			1	1		
White-winged dove									1	1	
Tumacácori NHP											
Cassin's kingbird									1		
Lucy's warbler						1					
Gilded flicker	1										

Table 5. Breeding observations in SODN parks, 2008, cont.

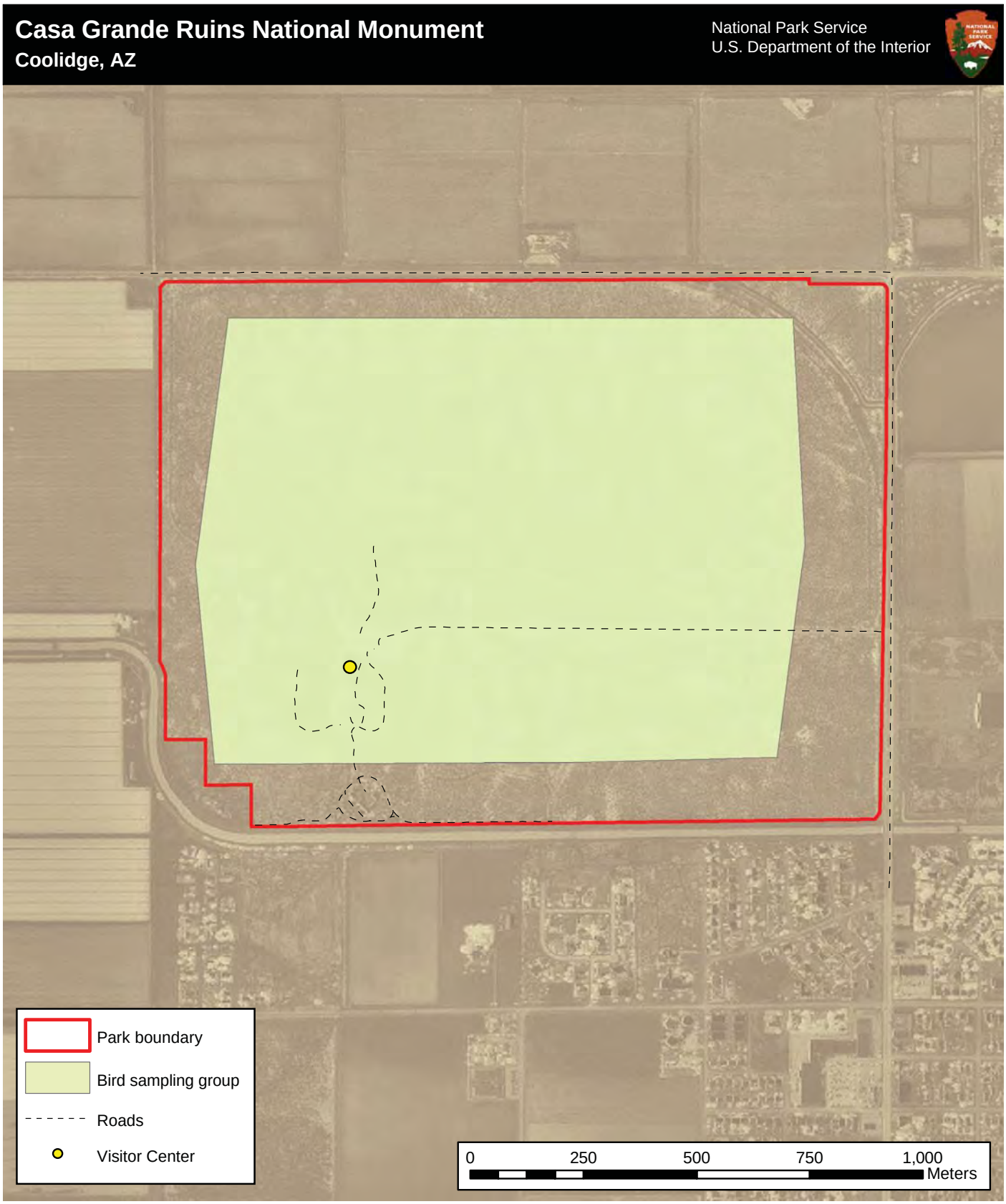
Park unit Species	Carrying food	Carrying nest material	Nest building	Distraction display	Fledged young	Feeding young	Fecal sac	Used nest	Occupied nest	Nest with egg	Nest with young
Tuzigoot NM											
Blue grosbeak		1									
Mourning dove		1									
Northern cardinal											1
Northern mockingbird	1										
Red-winged blackbird	1	1									

Table 6. New bird species added to park lists in 2008.

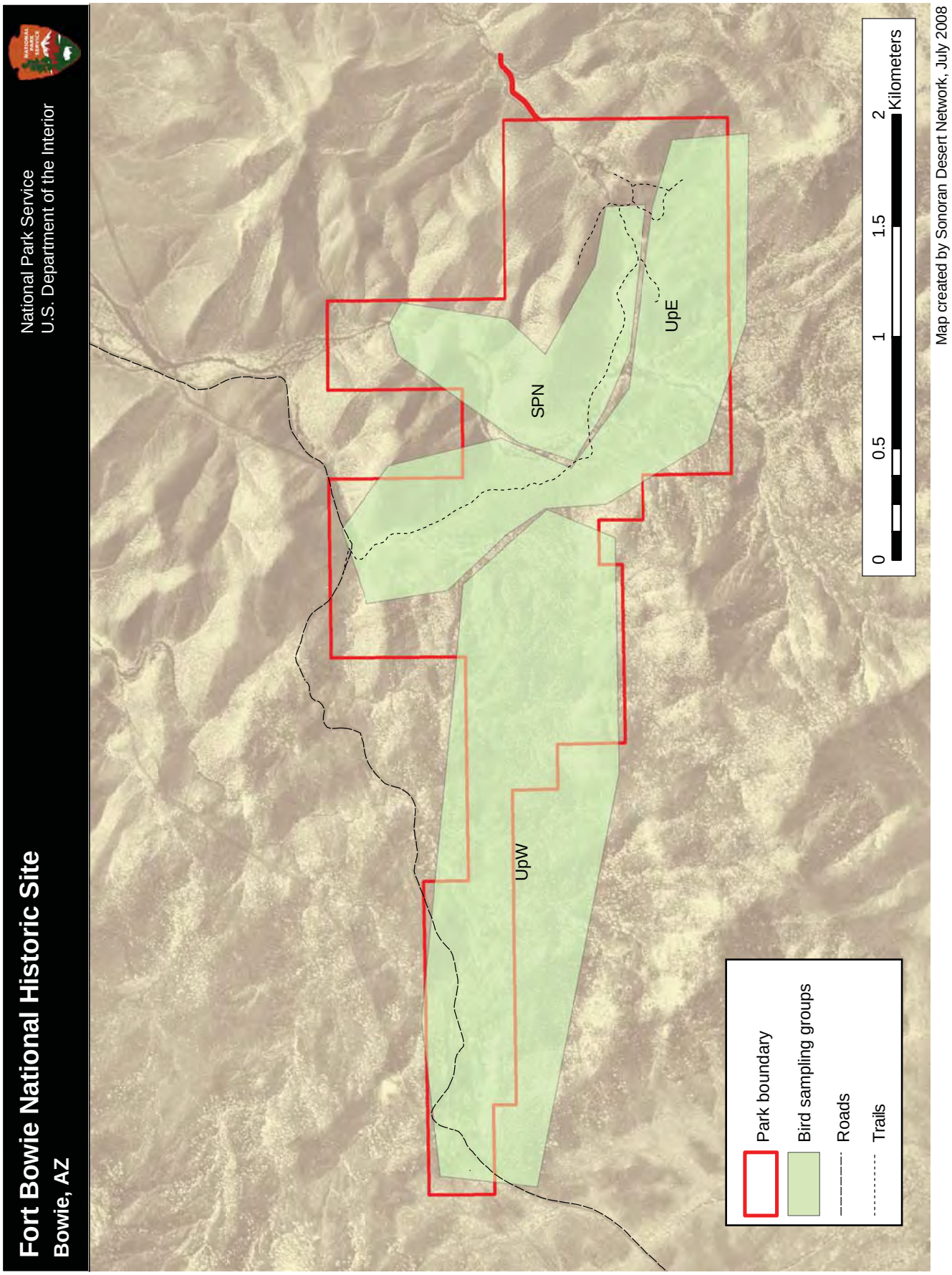
Species	CAGR	FOBO	MOCC	SAGE	TONT	TUMA	TUZI
Eurasian collard-dove			X				
American redstart							X
Cassin's finch		X					
Cassin's vireo		X		X			
Clapper rail							X
Blue grosbeak					X		
Common black-hawk						X	
Common nighthawk				X			
Double-crested cormorant					X		
Elegant trogon*			X				
Gray hawk*					X		
Gray vireo						X	
Gray-headed junco		X					
Great blue heron				X			
Northern beardless-tyrannulet					X		
Northern parula				X			
Purple martin						X	
Pyrrhuloxia					X		
Rufous-winged sparrow	X	X			X		

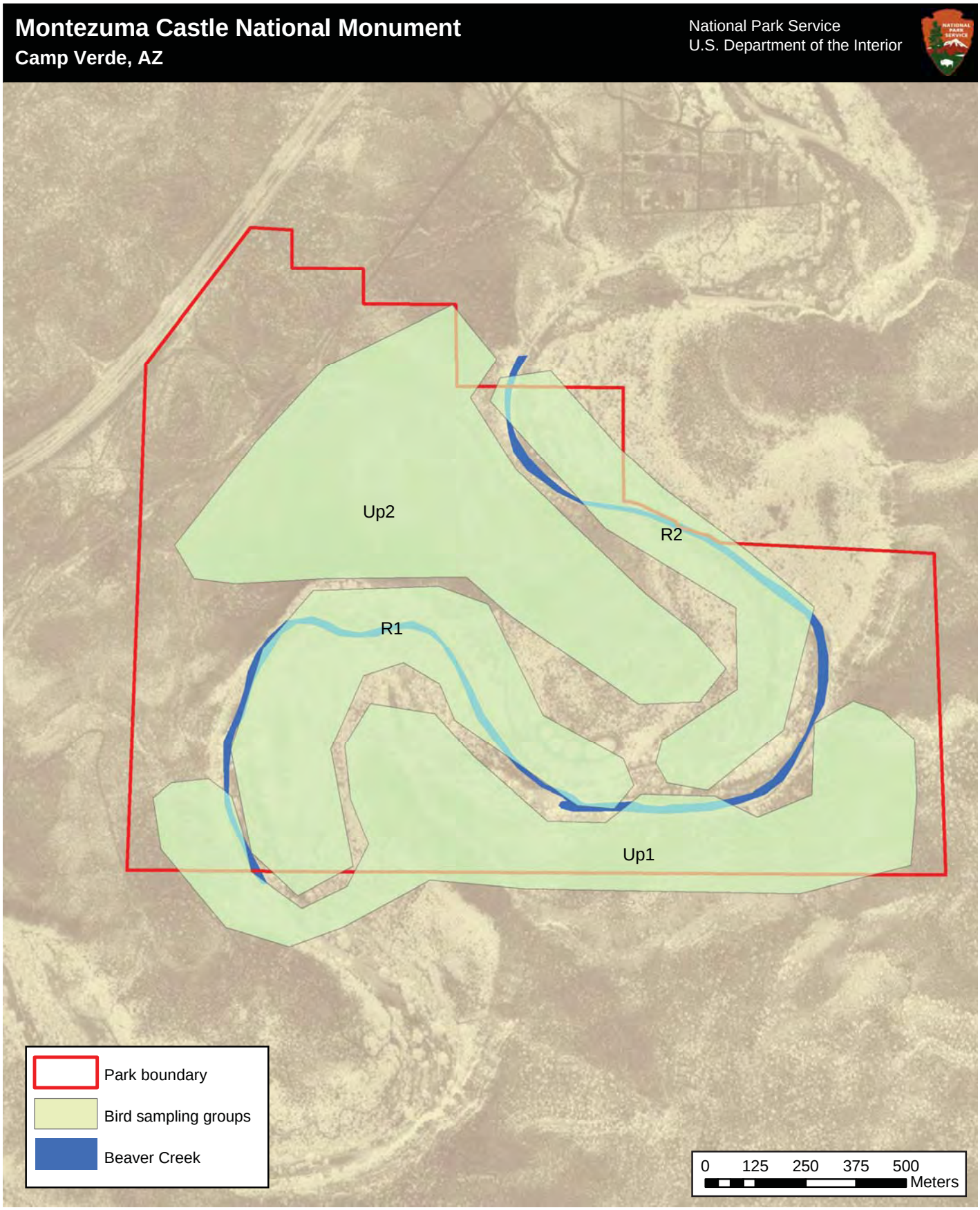
*Incidental detection.
No new species were added at Organ Pipe Cactus National Monument.

Appendix A. Landbird Sampling Locations in Sonoran Desert Network Parks

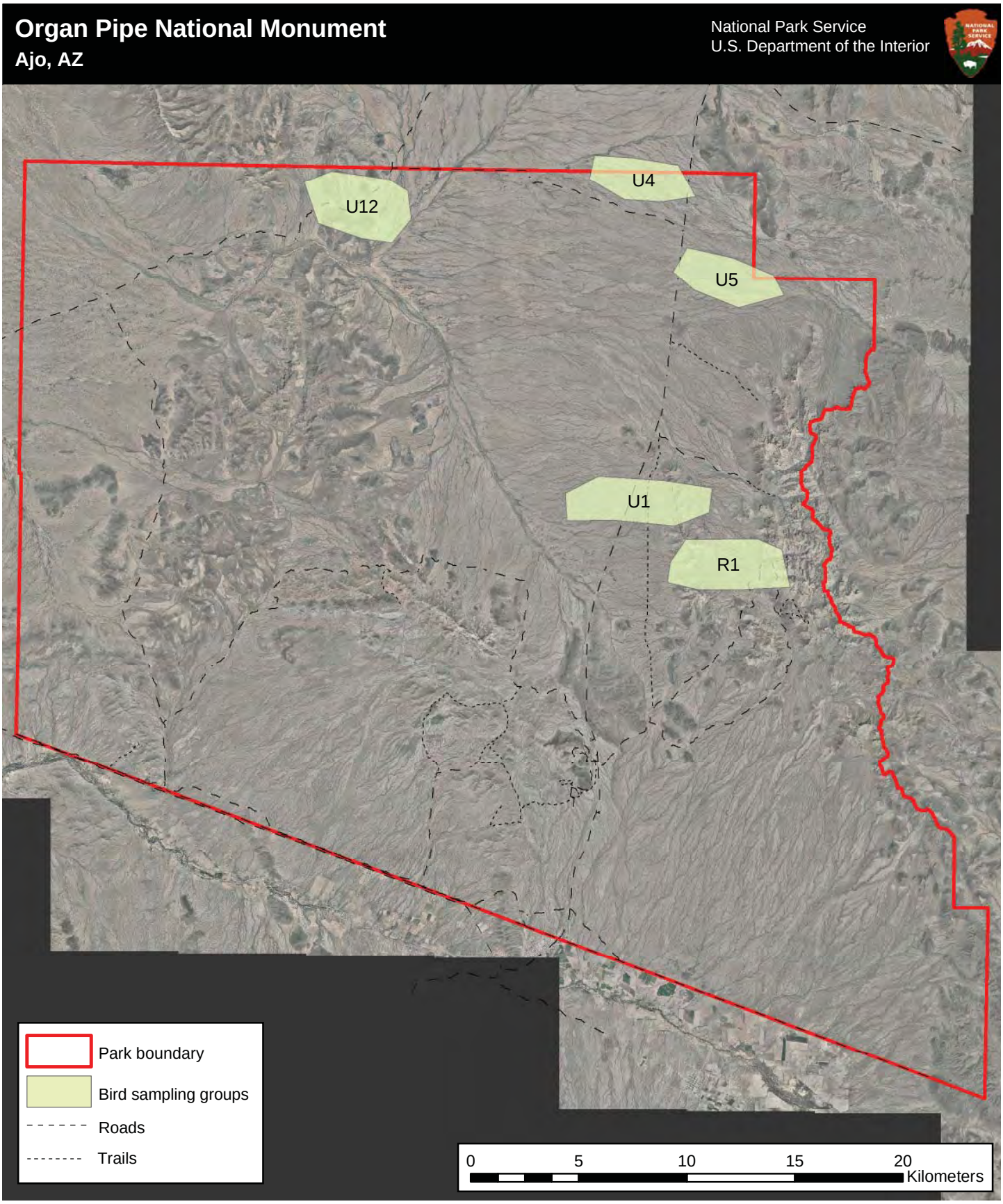


Map created by Sonoran Desert Network, August 2008

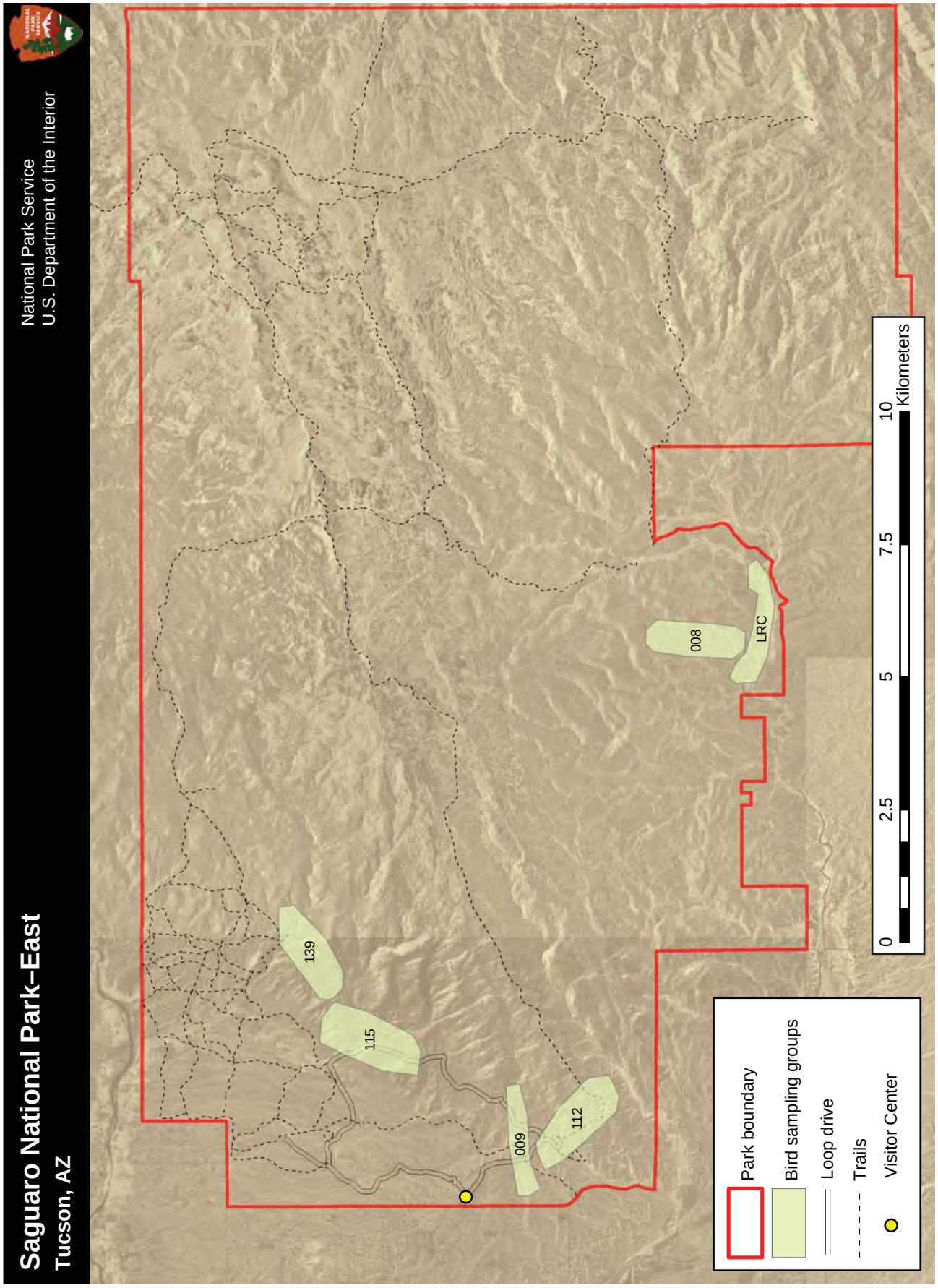

Fort Bowie National Historic Site
Bowie, AZ
National Park Service
U.S. Department of the Interior
SPN
UpE
UpW
Park boundary
Bird sampling groups
Roads
Trails
0
0.5
1
1.5
2
Kilometers
Map created by Sonoran Desert Network, July 2008



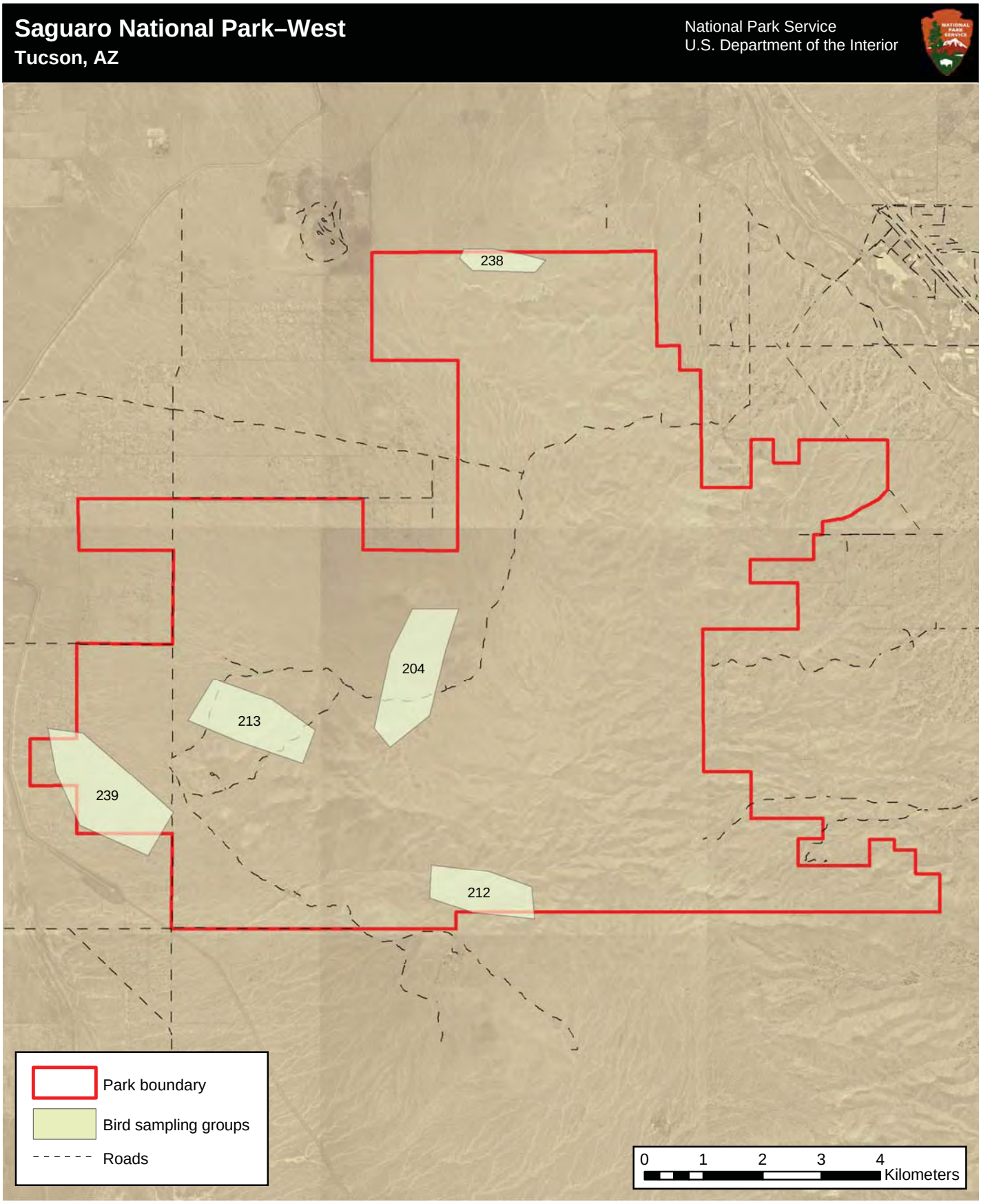
Map created by Sonoran Desert Network, July 2008



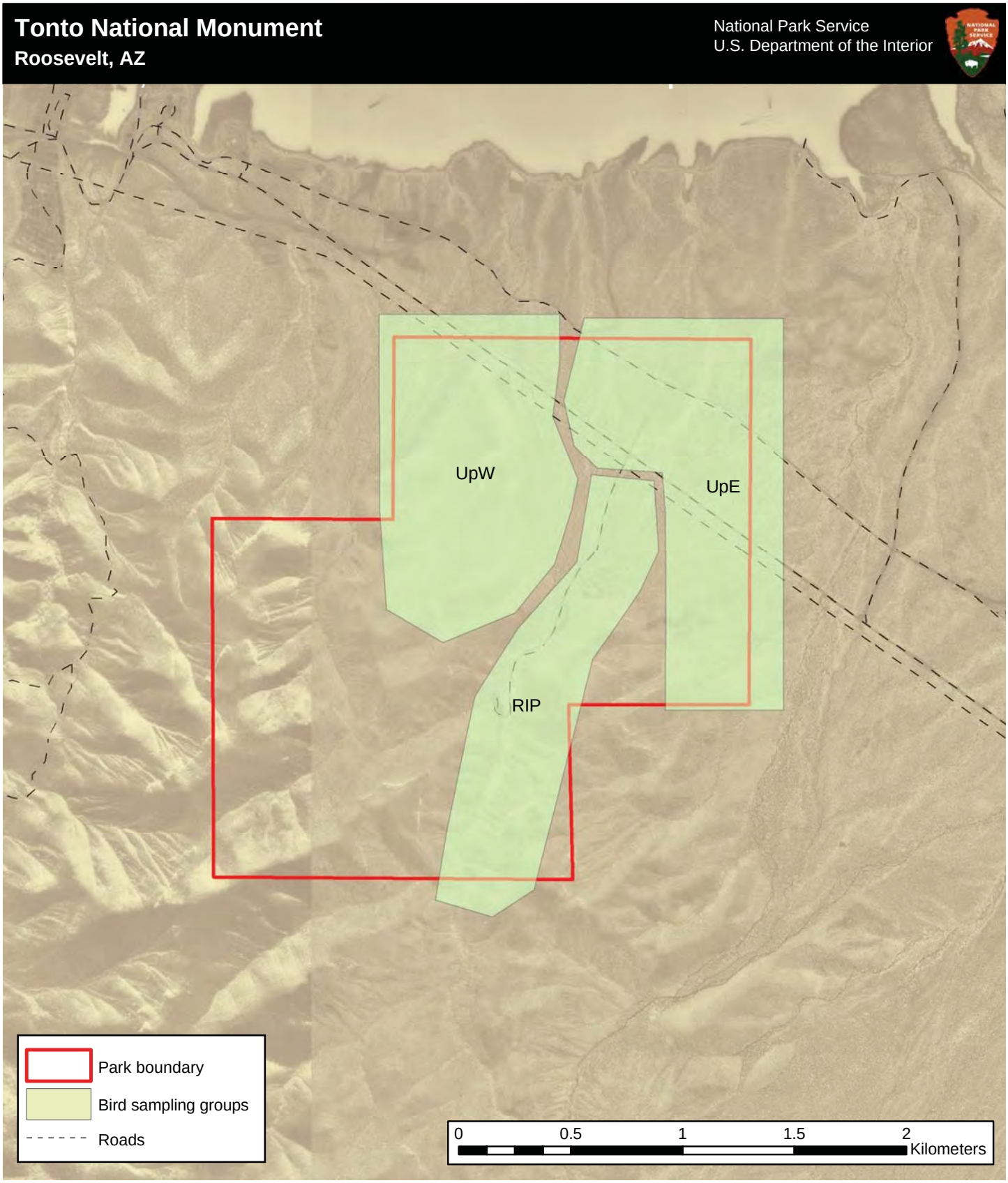
Map created by Sonoran Desert Network, July 2008



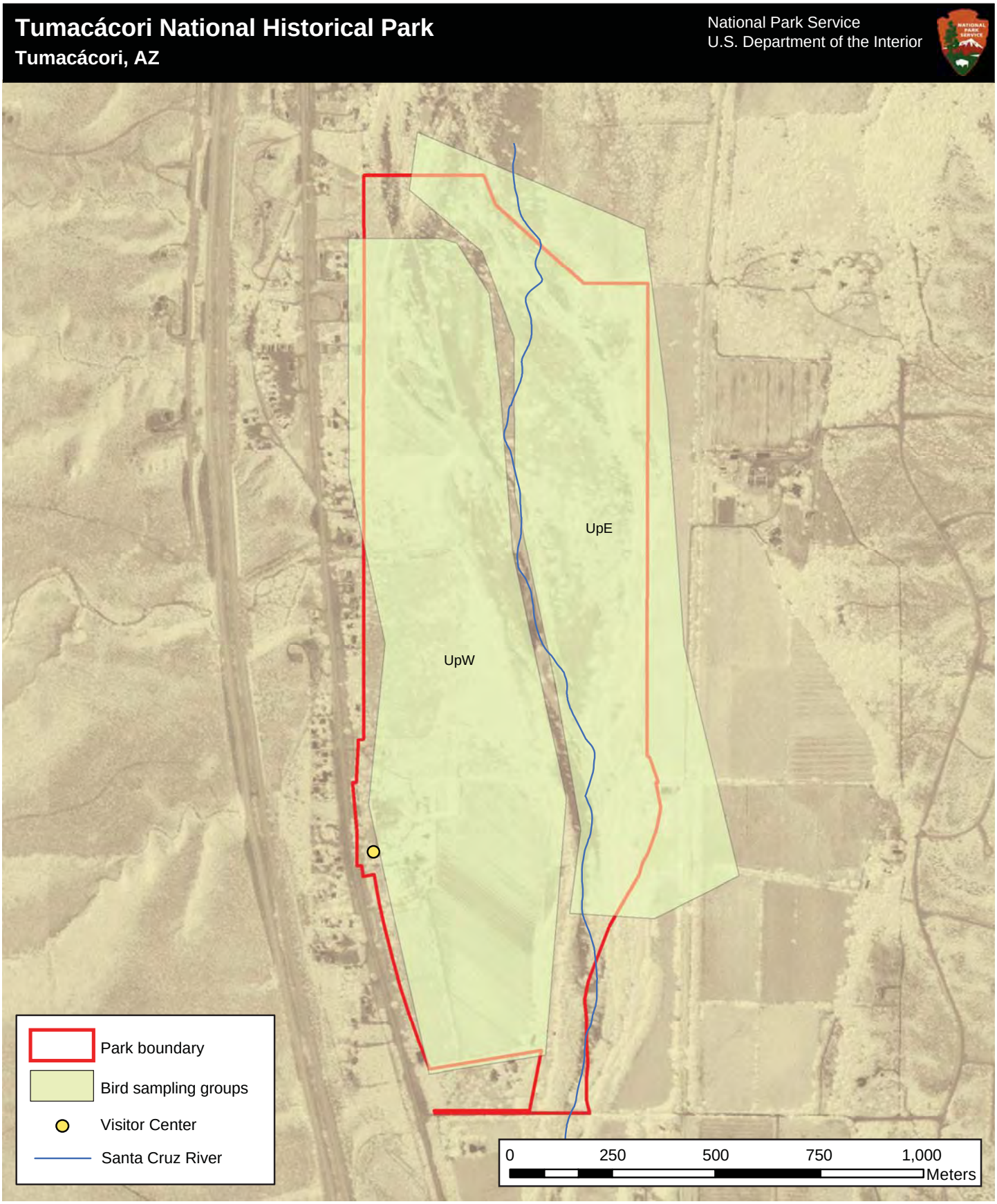
Map created by Sonoran Desert Network, July 2008



Map created by Sonoran Desert Network, July 2008



Map created by Sonoran Desert Network, August 2008

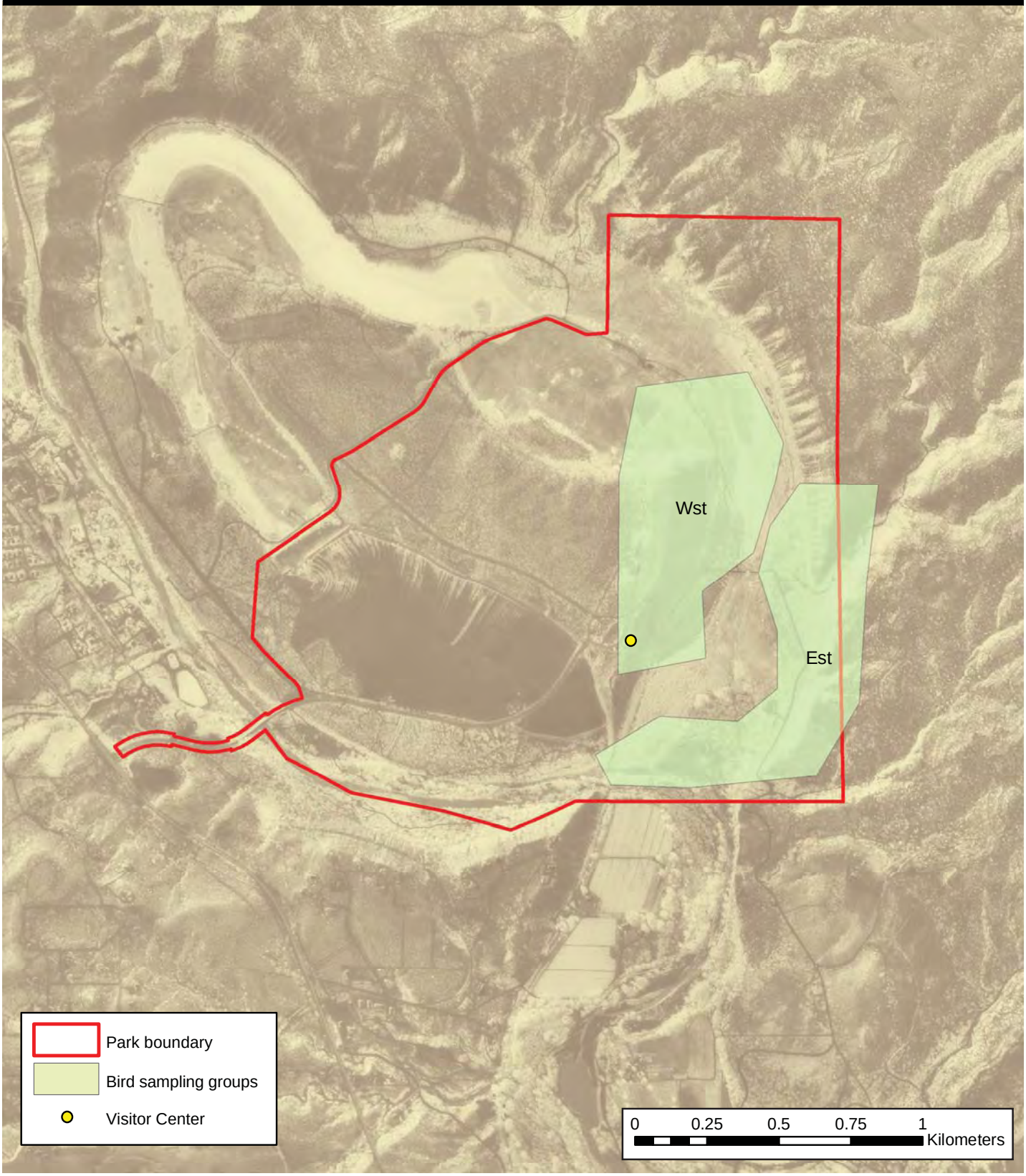


Map created by Sonoran Desert Network, August 2008

Tuzigoot National Monument

Clarkdale, AZ

National Park Service
U.S. Department of the Interior



Map created by Sonoran Desert Network, August 2008

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS D-98, February 2009

National Park Service
U.S. Department of the Interior

Natural Resource Program Center
1201 Oak Ridge Drive, Suite 150
Fort Collins, Colorado 80525

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