Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Yellow-billed Cuckoo Surveys in Conservation Areas on the Lower Colorado River and Bill Williams River

2021 Annual Report

May 2022

Work conducted under LCR MSCP Work Task F10

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

Federal Participant Group

Bureau of Reclamation
U.S. Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

Arizona Participant Group

Arizona Department of Water Resources
Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
Central Arizona Water Conservation District
Cibola Valley Irrigation and Drainage District
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City of Lake Havasu City
City of Mesa
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City of Yuma
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Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
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Unit "B" Irrigation and Drainage District
Wellton-Mohawk Irrigation and Drainage District
Yuma County Water Users' Association
Yuma Irrigation District
Yuma Mesa Irrigation and Drainage District

Other Interested Parties Participant Group

QuadState Local Governments Authority
Desert Wildlife Unlimited

California Participant Group

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City of Needles
Coachella Valley Water District
Colorado River Board of California
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Imperial Irrigation District
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Colorado River Commission of Nevada
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Native American Participant Group

Hualapai Tribe
Colorado River Indian Tribes
Chemehuevi Indian Tribe

Conservation Participant Group

Lower Colorado River RC&D Area, Inc.
The Nature Conservancy

Lower Colorado River Multi-Species Conservation Program

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2021 Annual Report

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Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
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ACRONYMS AND ABBREVIATIONS

ac	acre(s)
AOU	American Ornithologists' Union
Bill Williams River NWR	Bill Williams River National Wildlife Refuge
BLCA	Beal Lake Conservation Area
CDFW	California Department of Fish and Wildlife
Cibola NWR Unit #1	Cibola National Wildlife Refuge Unit #1 Conservation Area
CO	confirmed breeding territory
cuckoo	western distinct population segment of yellow-billed cuckoo (*Coccyzus americanus occidentalis*, western cuckoo)
CVCA	Cibola Valley Conservation Area
DNA	deoxyribonucleic acid
DPS	distinct population segment
ft	foot/feet
FR	Federal Register
ft^3/s	cubic foot/feet per second
GPS	Global Positioning System
ha	hectare(s)
HCP	Habitat Conservation Plan
km	kilometer(s)
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LDCA	Laguna Division Conservation Area
m	meter(s)
m^3/s	cubic meters per second
mi	mile(s)
MP3	MPEG-3 coding format for digital audio
n =	number equals (sample size)
Nature Trail	Cibola National Wildlife Refuge Unit #1 Conservation Area Nature Trail

Parametrix	Parametrix, Inc.
PO	possible breeding territory
PR	probable breeding territory
PVER	Palo Verde Ecological Reserve
Reclamation	Bureau of Reclamation
sp.	species (single)
spp.	species (plural)
SSRS	Southern Sierra Research Station
USFWS	U.S. Fish and Wildlife Service
western cuckoo	western distinct population segment of yellow-billed cuckoo (*Coccyzus americanus*, cuckoo; referred to as *Coccyzus americanus occidentalis* in LCR MSCP regulatory documents)
YEW	Yuma East Wetlands

Symbols

°C	degrees Celsius
°F	degrees Fahrenheit
>	greater than
<	less than
≤	less than or equal to
#	number
%	percent
®	registered trademark
™	trademark

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EXECUTIVE SUMMARY

Following large-scale water diversions and subsequent loss of riparian ecosystems over the previous century, the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was created in 2005, in compliance with the Endangered Species Act, to balance legal water resource use and the conservation of threatened and endangered species and their habitats along the lower Colorado River. The western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*, western cuckoo, cuckoo) was listed as threatened under the Endangered Species Act in 2014 and is 1 of 27 species covered under the program (referred to as yellow-billed cuckoo, western yellow-billed cuckoo, and *Coccyzus americanus occidentalis* in the LCR MSCP's regulatory documents). The Bureau of Reclamation (Reclamation) contracted the Southern Sierra Research Station to continue surveys and determine the breeding status of cuckoos in conservation areas along the lower Colorado River from Needles, California, to Yuma, Arizona, and along the Bill Williams River between Planet Ranch and Lake Havasu (the study area) from 2019 to 2022.

Five conservation areas managed by the LCR MSCP were surveyed in 2021, including the Palo Verde Ecological Reserve (PVER), Cibola Valley Conservation Area, Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), Laguna Division Conservation Area (LDCA), and Yuma East Wetlands (YEW). A stretch of suitable habitat within the Bill Williams River National Wildlife Refuge comprising Bill Williams River East (Bill Williams River-East) and Bill Williams River West (Bill Williams River-West) was also surveyed. Reclamation partially surveyed two other LCR MSCP conservation areas, the Beal Lake Conservation Area and Hunters Hole, which are reported separately. Another LCR MSCP conservation area, the Dennis Underwood Conservation Area, will not reach 2 years post-planting under this contract. The same sites were surveyed for cuckoos in 2021 as in 2020, except as follows. At the Bill Williams River, Planet Ranch was not surveyed due to backwater construction for native fishes, and Sandy Wash was surveyed just once before a 510-hectare (ha) (1,260-acre [ac]) wildfire burned most of the riparian vegetation in the area. One new site (Eastside), was added at Cibola NWR Unit #1 in between Cibola NWR Unit #1 Nature Trail and Cibola NWR North.

From June 14 to August 5, 2021, the Southern Sierra Research Station conducted standard cuckoo surveys at 41 sites ranging from 9 ha (22 ac) to 112 ha (277 ac), totaling approximately 1,729 ha (4,272 ac). Four surveys at each site resulted in 249 survey detections, including 8 at Bill Williams River-East, 1 at Bill Williams River-West, 92 at the PVER, 29 at the Cibola Valley Conservation Area, 70 at Cibola NWR Unit #1, 39 at the LDCA, and 10 at YEW.

After or between surveys, 267 followup visits were conducted in areas of activity to determine breeding status and to resight previously banded birds. Sixty-four breeding territories were estimated in the study area, including 32 possible (PO), 23 probable (PR), and 9 confirmed (CO) territories.

The main objective of resighting was to locate up to seven cuckoos fitted with Lotek PinPoint-10 Global Positioning System (GPS) tags in 2014 and 2015 that have not yet been recaptured. If a GPS-tagged bird was resighted, two capture attempts were permitted to recapture the bird. If no GPS-tagged cuckoos were resighted, an alternate option was to capture two cuckoos at a site where no previous capture attempts have occurred to provide information on site fidelity and dispersal in the study area. In 2021, surveyors positively resighted three cuckoos banded in previous years; none were previously GPS tagged. In lieu of resighting and capturing any GPS-tagged birds, at the request of Reclamation, one adult was captured and banded at YEW, and another attempt was made at the LDCA without success. Two other adults were captured and banded at Cibola NWR Unit #1, under a separate Smithsonian-funded satellite tracking project, after a surveyor resighted a cuckoo that had been previously satellite tagged on that project. Additionally, five chicks were opportunistically banded from two low nests: two at YEW and three at Cibola NWR Unit #1 Eastside.

Nest searching and monitoring were not part of the project scope of work in 2021, but field activities such as surveys and followup visits to determine breeding status or to resight banded adults sometimes led to the discovery of nests. Nine nests were found in the study area during followup visits in 2021: five at the PVER (Phases 5, 6, and 7), three at Cibola NWR Unit #1 (Upper Hippy Fire and Eastside), and one at YEW. The nest at Eastside, planted in 2019, confirmed breeding at this site in its first survey year. Nests were not typically monitored; however, some monitoring occurred to learn the banded status of adults.
The fates of seven nests were discovered during resight attempts: four nests successfully fledged at least one young, and three nests failed (two depredated and one abandoned after a normal incubation period).

Chapter 1 – Introduction and Project Background

YELLOW-BILLED CUCKOO HISTORY ON THE LOWER COLORADO RIVER

Since 1998, the Bureau of Reclamation (Reclamation) has been conducting surveys along the lower Colorado River (LCR) for the western distinct population segment (DPS) of yellow-billed cuckoos (*Coccyzus americanus*, western cuckoo, cuckoo – referred to as yellow-billed cuckoo, western yellow-billed cuckoo, and *Coccyzus americanus occidentalis* in Lower Colorado River Multi-Species Conservation Program [LCR MSCP] regulatory documents]). From 1975 to 1979, 242 cuckoos were estimated along the LCR, with an additional 208 at the Bill Williams River delta (Rosenberg et al. 1991). By 1986, the estimate for the LCR had declined to 18 cuckoos and 50–60 at the Bill Williams River delta (Rosenberg et al. 1991). Other reports describe population changes based on surveys conducted annually since 2006 (Halterman et al. 2009; Johnson et al. 2008; McNeil and Tracy 2013; McNeil et al. 2010, 2011, 2012, 2013a, 2013b, 2020; Parametrix, Inc. [Parametrix], and the Southern Sierra Research Station [SSRS] 2015, 2016a, 2016b, 2018, 2019; Tracy et al. 2021). Most cuckoos on the LCR are currently located in conservation areas managed by the LCR MSCP (Tracy et al. 2021; McNeil et al. 2020; Parametrix and SSRS 2019).

A major factor in the decline of cuckoos in the West, including along the LCR, is the loss of habitat within riparian systems (Gaines and Laymon 1984; Rosenberg 1991). The Proposed Rule for Threatened Status for the western DPS occurred on October 3, 2013 (78 FR 61621) (figure 1). The western cuckoo was listed as threatened under the Endangered Species Act on November 3, 2014 (79 FR 59992). A Proposed Rule to Designate Critical Habitat for the western cuckoo was published August 15, 2014 (79 FR 48547). A Revised Designation of Critical Habitat for the western cuckoo was listed on February 27, 2020 (85 FR 11458). In 2017, the U.S. Fish and Wildlife Service (USFWS) received a petition to delist the western cuckoo, purportedly due to an error in the DPS analysis, as well as documented use of additional habitat by the cuckoos. On September 16, 2020, the USFWS issued a 12-month finding that delisting was not warranted at this time (85 FR 57816). A draft cuckoo survey protocol (the protocol) and survey detection forms, with revised instructions, were issued by the USFWS (Halterman et al. 2016, USFWS and Reclamation 2019), with additional revisions to appendices 1 and 3 in 2021 (USFWS and Reclamation 2021).

Figure 1.—Boundary of the western DPS of yellow-billed cuckoos.
From figure 2 in 79 FR 59992.

LOWER COLORADO RIVER MULTI-SPECIES CONSERVATION PROGRAM

The LCR MSCP is a multi-stakeholder Federal and non-Federal partnership responding to the need to balance the use of water resources and conservation of native species and their habitats in compliance with the Endangered Species Act. The LCR MSCP is a 50-year plan to conserve at least 27 species along the LCR from Lake Mead to the Southerly International Boundary with Mexico through the implementation of a Habitat Conservation Plan (HCP) (LCR MSCP 2004a).

Past reports on cuckoo monitoring in the study area since 2006 are found on the LCR MSCP website (www.lcrmscp.gov). They provide information on sites previously surveyed under contract with Reclamation. Locations to be surveyed under this contract may include the Beal Lake Conservation Area (BLCA) (surveyed by Reclamation in 2020 and 2021), Bill Williams River National Wildlife Refuge (Bill Williams River NWR) (middle section of the refuge), Planet Ranch, Cibola National Wildlife Refuge Unit #1 Conservation Area

(Cibola NWR Unit #1), Cibola Valley Conservation Area (CVCA), Palo Verde Ecological Reserve (PVER), Dennis Underwood Conservation Area, Laguna Division Conservation Area (LDCA), and Yuma East Wetlands (YEW) (figure 2; also see table 1 in chapter 2).

PROJECT SCOPE OF WORK

The purpose of the current study is to monitor the status of cuckoos in LCR MSCP conservation areas from 2019 to 2022. The objectives are to conduct presence surveys and determine the breeding status of cuckoos at LCR MSCP conservation areas along the LCR between Needles, California, and Yuma, Arizona, including a stretch of the Bill Williams River between Planet Ranch and Lake Havasu (see figure 3 in chapter 2). Surveys and followup visits will be conducted for 4 years (2019–2022). In 2023, a summary report will be prepared showing results of the previous 4 years. All services will be conducted in accordance with the HCP (LCR MSCP 2004a), the associated biological opinion (File Number: 02-21-04-F-0161) (USFWS 2005a), the Section10(a)(1)(B) permit (TE-086834-0) (USFWS 2005b), and the LCR MSCP biological assessment (LCR MSCP 2004b).

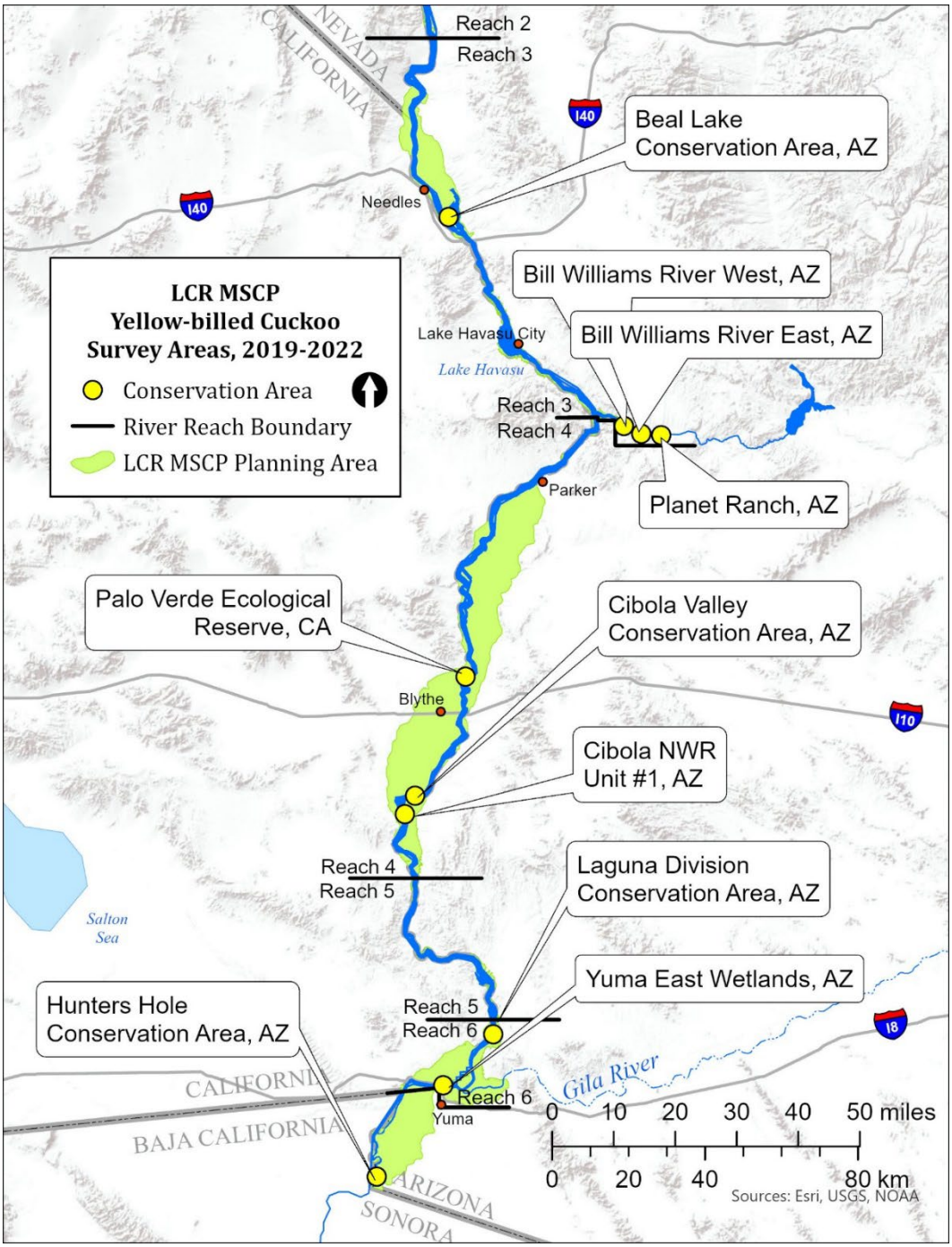

Figure 2.—LCR MSCP yellow-billed cuckoo survey areas, 2019–2022.

Chapter 2 – Study Area and Site Descriptions

STUDY AREA AND SITE SELECTION

Surveys of potential and previously occupied cuckoo habitat were conducted at sites spanning 300 kilometers (km) (186 river miles) of the LCR and tributaries, from the Havasu National Wildlife Refuge near Needles, California, to Yuma, Arizona (the study area; see figure 1 in chapter 1). Sites that a cuckoo would potentially use are defined in the HCP as at least 10 hectares (ha) (25 ac]) of contiguous riparian vegetation containing Fremont cottonwood-Goodding's willow (*Populus fremontii-Salix gooddingii*) (hereafter cottonwood-willow) of structural types I–III (an overstory averaging > 4.6 meters [m] or 15 feet [ft] tall) (Anderson and Ohmart 1984; LCR MSCP 2004a). Occasionally, smaller patches of habitat were surveyed depending on their location, perceived quality, and survey history; however, most nesting occurs in patches of at least 20 ha (50 ac) (Halterman et al. 2016), similar to the average territory size (95% kernel density estimate) in the study area of 70 radio-tracked cuckoos (19.6 ha; McNeil et al. 2013b) and matching the smallest patch size in the study area with confirmed breeding (BLCA). Thus, most small, isolated patches are unlikely to support breeding.

In 2021 the SSRS surveyed all LCR MSCP conservation areas at least 2 years old with suitable habitat, except for the BLCA and Hunters Hole, which Reclamation surveyed in 2020 and 2021 (Raulston 2021, personal communication); the results are reported separately. All sites surveyed in 2020 were surveyed again in 2021, except for Planet Ranch, which was surveyed by Reclamation in 2019 (LCR MSCP 2020) and by the SSRS in 2020 (Tracy et al. 2021). Planet Ranch was not surveyed in 2021 due to the construction of backwaters for native fishes (Brooks et al. 2019). Additionally, Sandy Wash in Bill Williams River-East was surveyed just once in 2021 before a wildfire burned around 510 ha (1,260 ac) from Sandy Wash to the I-95 bridge across the Bill Williams River delta. One recently planted site within Cibola NWR Unit #1, Eastside, was added due to becoming suitable for cuckoos. Forty-one sites were surveyed in 2021 (table 1).

Within each site, hand-held Global Navigating and Satellite System units and georeferenced aerial imagery were used to determine the boundaries of potential breeding habitat within each site. Survey transects were then established (described in chapter 3).

Table 1.—Sites surveyed for cuckoos in the LCR MSCP study area, 2021

Area	Site	Hectares	Acres
Bill Williams River-East	Esquerra Ranch	73.9	182.6
	Mineral Wash	41.0	101.2
	Kohen Ranch	68.5	169.3
Bill Williams River-West	Sandy Wash	80.8	199.6
PVER	Phase 1	8.9	21.9
	Phase 2	31.6	77.9
	Phase 3	34	84.0
	Phase 4 North	28.4	70.2
	Phase 4 South	12.8	70.3
	Phase 5 North	33.7	83.3
	Phase 5 Triangle	28.3	70.2
	Phase 5 West	25.3	62.5
	Phase 6 North	46.7	115.5
	Phase 6 South	42.2	104.3
	Phase 7 North	45.5	112.6
	Phase 7 South	45.0	111.2
	Phase 8	44.7	110.5
CVCA	Phase 1 North	17.7	43.8
	Phase 1 South	19.5	48.0
	Phase 2	27.5	67.9
	Phase 3 North	21.9	54.3
	Phase 3 South	21.8	54.0
	Phase 7	29.3	72.3
	Phase 8	44.7	111.5
	Phase 9	31.2	77.2
Cibola NWR Unit #1	Mass Transplanting/Nature Trail	22.7	55.9
	Cottonwood Genetics/CW-North	24.6	60.9
	Crane Roost North	29.9	74.0
	Crane Roost South	27.3	67.6
	Eastside	15.1	37.3
	Lower Hippy Fire	49.6	122.6
	Middle Hippy Fire	49.3	121.7
	Upper Hippy Fire	37.8	93.5
	North 160	63.9	158.0
LDCA	Reach 1 North	65.0	160.8
	Reach 1 East	78.1	193.0
	Reach 1 West	82.6	204.2
	Reach 2 North	112.9	279.1
	Reach 2 South	98.8	244.0
YEW	YEW North	26.8	66.2
	YEW South	40.6	100.3

SITE DESCRIPTIONS

Sites surveyed in 2021 are described by geographic area from north to south and alphabetically within each area. Some adjacent sites are presented together as one survey site, such as Mass Transplanting/Cibola NWR Unit #1 Nature Trail (Nature Trail) and Cottonwood Genetics/CW-North/Eastside.

The conservation areas are described in more detail in annual reports and restoration development plans that are available at https://lcrmscp.gov/steer_committee/technical_reports.html. Survey detections and estimated territories are included here for each site surveyed in 2021 (also see table 5 in chapter 3).

All detections summarized in the following section were assessed by spatial location, observed behaviors, and associated dates, and used to categorize the breeding status for each occupied patch as a PO, PR, or CO breeding territory (Halterman et al. 2016; USFWS and Reclamation 2019; USFWS and Reclamation 2021) (see table 4 in chapter 3). Due to the Federal listing of this species, and for the protection of nesting birds, site maps showing specific nesting locations are not included in this report. The results of all detections are listed in table 5 in chapter 3.

Bill Williams River National Wildlife Refuge

La Paz and Mohave Counties, Arizona

The Bill Williams River-East and Bill Williams River-West areas are within the Bill Williams River NWR (figure 3). This refuge was established in 1993 and is part of the Havasu National Wildlife Refuge Complex. It is located 14.3 km (8.9 miles [mi]) south of Lake Havasu City, Arizona, and consists of 2,430 ha (6,000 ac) of river drainage managed by the USFWS. The refuge extends from Lake Havasu upstream along the Bill Williams River for approximately 16 km (10 mi) and has historically supported some of the most extensive and productive cuckoo breeding habitat in the watershed (Johnson et al. 2008; Rosenberg et al. 1991). Portions of the river contain perennial surface water. Prior to the completion of Alamo Dam in 1968, the historical hydrologic regime enabled overbank flooding necessary for natural regeneration of native vegetation and persistence of cottonwood-willow forest. In the more recent past, occasional winter releases from Alamo Dam resulted in some natural riparian forest regeneration. The last significant flood releases were in the winter of 2004–2005 and March 2018 (Central Arizona Project 2018). On March 17, 2020, the U.S. Army Corps of Engineers began releasing water from Alamo Dam to conduct maintenance and repairs to the 50-year-old, 86.26-m (283-ft) earthen structure (U.S. Army Corps of Engineers 2018). Unlike previous releases

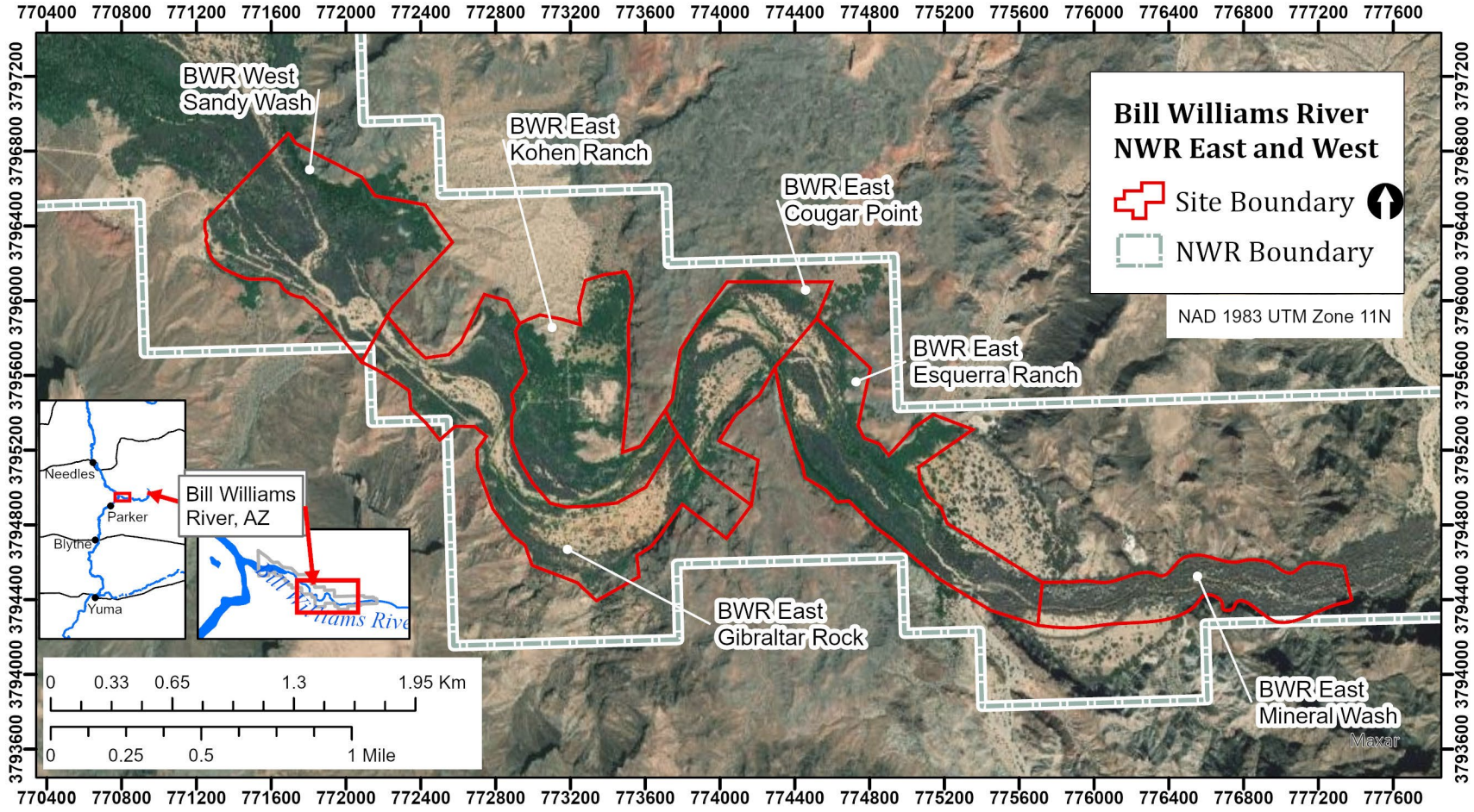

Figure 3.—Bill Williams River-East and Bill Williams River-West, showing sites surveyed 2019–2021.

designed to mimic a late winter storm, water was discharged as needed for dam repairs and diver safety. The flow started at 14.16 cubic meters per second (m^3/s) (500 cubic feet per second [ft^3/s]) and varied throughout the breeding season from 0.71 m^3/s (25 ft^3/s) to a maximum of 19.82 m^3/s (700 ft^3/s), with several high flows occurring in August and more frequent releases in September (Sweeten 2020, personal communication). More details are available at https://nwis.waterdata.usgs.gov.

Drone video footage of the refuge recorded in April 2018 (Brennan 2018) showed that most sites along the river were parched, with extreme die-off of riparian trees likely due to drought and more recent tamarisk (*Tamarix* spp.) defoliation by tamarisk beetles (*Diorhabda* spp.) (Parametrix and SSRS 2019). Notable regeneration of new cottonwoods and willows has occurred since 2018. The flood release in spring 2020 cleared much of the dead understory and cottonwood logs out of the channels, creating new areas for natural regeneration as well as a small seedling planting project along a 2.4-km (1.5-mi) stretch in the Mineral Wash vicinity (Shafroth 2020, personal communication). Continual water released throughout the 2020 season may have helped recharge the aquifer.

The vegetation composition and structure in the eastern half of the refuge significantly differs downstream from Gibraltar Rock. East of Gibraltar Rock, shallow underground bedrock and cliffs bordering the riparian corridor increase perennial flows and surface water. West of Gibraltar Rock, the underground bedrock is deeper, and the river channel widens into a sandy, broad floodplain that persists to the western edge of the refuge at its interface with Lake Havasu.

Sites previously surveyed in the Bill Williams River-East and Bill Williams River-West areas were removed from the study area after 2015 due to a reduced scope of work, with Bill Williams River sites falling outside of LCR MSCP conservation areas. With the addition of Planet Ranch to the LCR MSCP in 2016, the middle section of the Bill Williams River NWR became creditable acres under the program (Brooks et al. 2019), and in 2017, the riparian forest between Mineral Wash (Bill Williams River-East) and Sandy Wash (Bill Williams River-West) was included in annual surveys through 2020. Planet Ranch was surveyed by Reclamation in 2019 and by the SSRS in 2020, and in 2021, Reclamation temporarily suspended surveys due to construction at the site.

Surveys were impacted by two natural events in 2021 (also see site descriptions for Sandy Wash, Kohen Ranch, Esquerra Ranch, and Mineral Wash). On June 24, a 3:00 a.m., a lightning strike in the refuge around Sandy Wash sparked the Planet Ranch Fire. It was contained by July 3 and controlled by July 30 after burning around 510 ha (1,260 ac) from Sandy Wash west to the bridge at Hwy 95 (Fire Weather & Avalanche Center 2021, figure 4). Burned fuels included tamarisk, mesquite (*Prosopis* spp.), cottonwood, and brush.

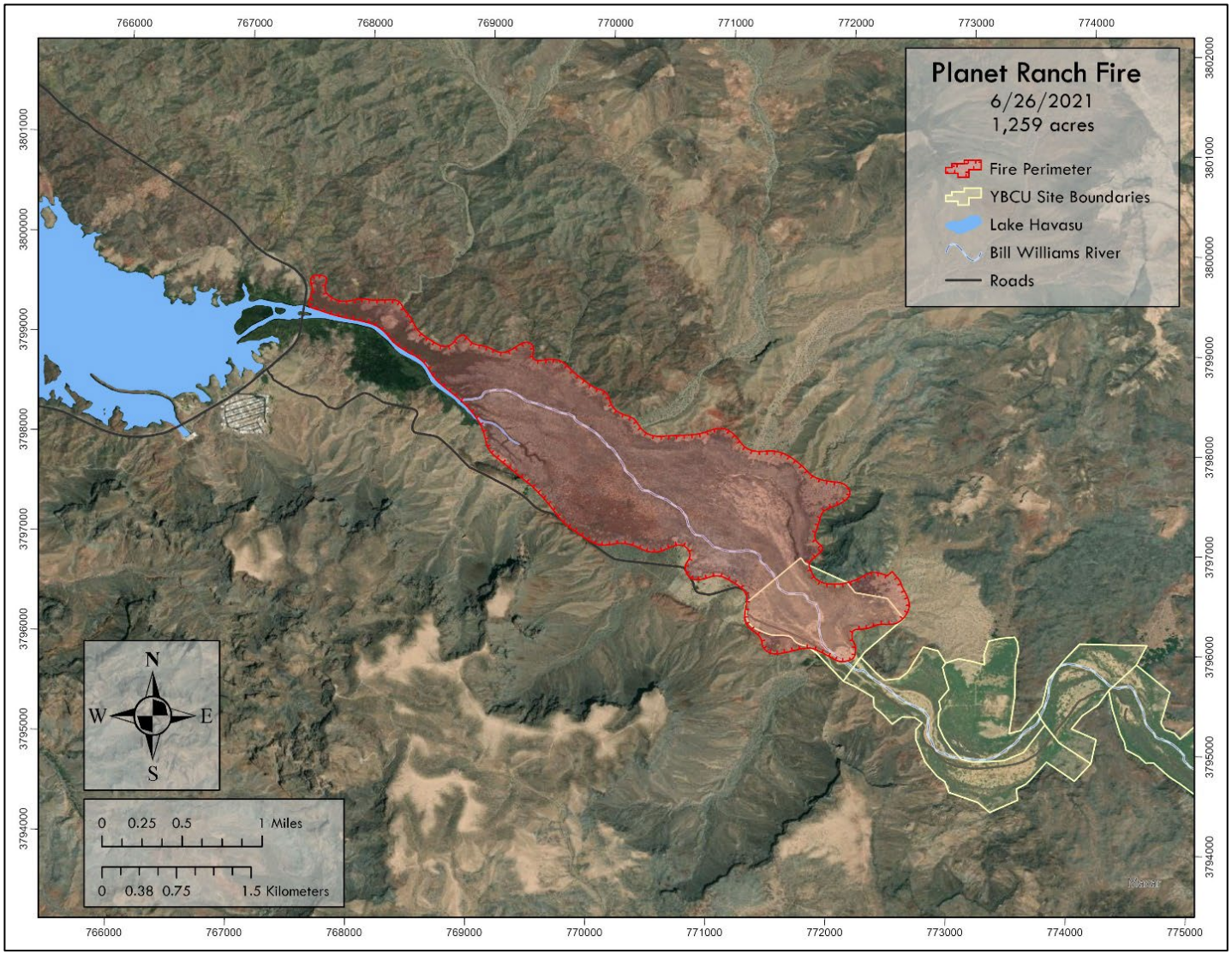

Figure 4.—Planet Ranch Fire perimeter, June 26, 2021.

July monsoon rains helped to extinguish the fire but also brought flash floods, which delayed the mid-July surveys several days. The late July surveys were impacted by extreme weather, which washed out and closed the road to Mineral Wash and Planet Ranch (see site descriptions).

Changes such as dropped or added transects are discussed in each site description below. Four sites at the Bill Williams River NWR were surveyed in 2021. Some areas of previously suitable habitat became unsuitable due to long-term drought or fire (Sandy Wash). In other areas, changes in vegetation caused by flooding required rerouting or clearing. Before surveys began, crews spent several days evaluating sites and clearing or modifying trails and survey routes.

Area: Bill Williams River East

Mohave and La Paz Counties, Arizona

Site: Esquerra Ranch

73.9 ha (182.6 ac)
Section: C1935

Esquerra Ranch is a 1.8 km (1.1-mi) section in the middle of the Bill Williams River NWR approximately 39 km (24.2 mi) west of Alamo Lake. The site lies between the Mineral Wash and Cougar Point survey sites and begins near the confluence of Mineral Wash and the Bill Williams River (see figure 3 in this chapter). The transect runs along the river channel to a bend known as Cougar Point. It is bounded by a steep cliff on the southwest and broad, dry uplands (the site of the historical Esquerra Ranch house) to the northeast. It is currently open, with many fallen cottonwoods and Goodding's willow snags, and scattered live tamarisk creating a tangled understory. Over the previous 4 years, the understory became dominated by dead tamarisk, cottonwood, and willow. After the release of dam water 3 years ago, some cottonwoods and willows are now thriving. Sections are lush with cattails (*Typha* spp.) and marsh vegetation growing along the central river corridor. To the east and west are mixed native-exotic forest, a continuation of the habitat of Esquerra Ranch.

In 2021, there were five survey detections and two PO territories at this site.

Site: Kohen Ranch

68.5 ha (169.3 ac)
Section: C1937

Kohen Ranch is a 2-km (1.2-mi) section of the refuge 38 km (23.6 mi) west of Alamo Lake. Kohen Ranch covers areas of natural regeneration that occurred following prolonged flooding in 2005, plus a restored honey mesquite (*Prosopis*

glandulosa) bosque area added to the survey site in 2019 (see figure 2 in chapter 1). This restored area north and east of the original site boundary includes 15 ha (37 ac) of abandoned agricultural fields planted by the USFWS in 2009 to increase the honey mesquite bosque habitat and to enhance riparian upper terrace avian communities (USFWS 2011). The route begins at the historical Kohen Ranch and heads northeast following the northern edge of the riparian corridor paralleling the Gibraltar Rock route. The route passes through senescent cottonwood forest with a honey mesquite bosque edge and an understory of honey mesquite, tamarisk, and seep willow (*Baccharis salicifolia*). The route then extends north to cover the restored mesquite bosque. A transect previously following the main river channel to the south was removed in 2019 due to the death of most riparian trees there. In the previous 4 years, the understory became thick with dead tamarisk and the demise of more than half the cottonwood-willow forest due to drought and the lack of water released from Alamo Dam. After a release 3 years ago, new cohorts of cottonwood and willow can be seen along the riverbed. After the large release in 2020, dead understory brush had been cleared by flooding, allowing for some new growth. A small spur was added to the transect in 2020 to cover an area with high cuckoo detections in 2019.

Surveys were delayed in 2021 due to the Planet Ranch Fire. The second survey was scheduled for June 30; however, on June 24, the refuge asked surveyors not to enter the site until further notice, and on June 28 advised entry would be allowed after July 3. The second survey was conducted on July 5, and the remaining surveys were conducted as scheduled. The fire did not reach Kohen Ranch, though smoke and fire crews may have impacted any cuckoos there.

In 2021, there were no survey detections at this site.

Site: Mineral Wash

41 ha (101.3 ac)
Section: C1901

Mineral Wash is a 1.7 km (1.1-mi) section of the Bill Williams River NWR 38 km (23.6 mi) west of Alamo Lake. This linear site is located toward the eastern end of the Bill Williams River NWR between Honeycomb Bend and Esquerra Ranch, following the river channel from a restricted canyon bordered by cliffs to an open floodplain (see figure 2 in chapter 1). It is comprised of a cottonwood-willow overstory with a honey mesquite bosque edge and an understory of mesquite and tamarisk. Arborescent Sonoran Desert scrub line the cliffs to the north and south, where saguaro (*Carnegiea gigantea*) and creosote bush (*Larrea tridentata*) are common. Seasonal flooding typically occurs during winter and summer rains. A public access road follows Mineral Wash, and there is some recreational activity where the road terminates at the river. The densest and tallest forest exists in the immediate Bill Williams River corridor. The river flowed during spring and summer in 2018, and during cuckoo surveys from 2019

to 2021. The eastern edge also appears most impacted from prior drought, and some of the older cottonwood-willow forest is dying or dead. The surveys planned for July 13 were delayed by a flash flood warning until July 14. The July 27 surveys were delayed by extreme weather, which washed out and closed the road to Mineral Wash and Planet Ranch. Surveyors accessed the two sites on August 2 by taking the longer Swansea Rd and hiking from Planet Ranch downstream to the sites.

In 2021, there were three survey detections and one PO territory at this site.

Area: Bill Williams River West

Mohave and La Paz Counties, Arizona

Site: Sandy Wash

80.8 ha (199.6 ac)
Section: C1938

Sandy Wash is a 2-km (1.2-mi) section of the Bill Williams River NWR 38 km (23.6 mi) west of Alamo Lake. The site connects Gibraltar Rock to the southeast, Fox Wash to the north, and Cross River to the northwest (the latter two sites last surveyed in 2015; Parametrix and SSRS 2019) (see figure 2 in chapter 1). This section gradually widens into a floodplain laced with dry river channels. Pre-fire, the area had a cottonwood-willow overstory, a mesquite and tamarisk understory, and a honey mesquite bosque edge. Arborescent Sonoran Desert scrub line the cliffs to the north and south. In 2019, a transect was added in the northeast to cover an area where a higher water table supports a sizeable patch of cottonwood-willow forest. By 2020, the western section of the site comprised mostly dead cottonwood-willow and tamarisk, and most trees along the old road appeared dead or dying due to prolonged drought; these provided fuels for the June wildfire (figure 5).

Figure 5.—Sandy Wash (left) pre-fire and (right) post-fire, June 2021.
Photos by C.L. Squibb.

Surveys were impacted in 2021 due to the Planet Ranch Fire. On June 17, the first survey was conducted at Sandy Wash, with survey 2 scheduled for June 30. On June 24, refuge staff asked surveyors to avoid the site until further notice due to hazardous conditions. On June 28, the SSRS was advised the site could be visited after July 3. On July 5, with extreme caution, surveyors entered the burned area to survey Kohen Ranch. They evaluated habitat, took photos of the fire damage, and determined that Sandy Wash no longer contained suitable cuckoo habitat. Sandy Wash was only surveyed during the first survey period. No other surveys were conducted at this site in 2021.

In 2021, only the first survey was conducted, with one survey detection and no territories.

Palo Verde Valley

Riverside County, California

Area: Palo Verde Ecological Reserve

The PVER is located 12 km (7.5 mi) north of Blythe, California (figure 6). The 547-ha (1,352-ac) area was acquired by the State of California in 2004. Reclamation implemented riparian restoration within former agricultural fields in eight phases, with public use and hunting managed by the California Department of Fish and Wildlife (CDFW). Public use includes jogging, dog walking, hunting, fishing, boating, swimming, and wildlife viewing. Each phase of the PVER is described in annual reports and restoration development plans that are available at https://lcrmscp.gov/steer_committee/technical_reports.html.

The main goal for the PVER is to create and manage habitat for southwestern willow flycatchers (*Empidonax traillii extimus*), cuckoos, and other covered LCR MSCP species over a 50-year period. The species composition and density were planted to mimic a natural riparian landscape when fully mature. Over 1.8 million riparian trees and shrubs were planted over an 8-year period, concluding in 2013 with the planting of Phase 8. The area surveyed for cuckoos included 427 ha (1,055 ac) of near-contiguous irrigated riparian forest spanning 5 linear km (3.1 mi) adjacent to the river. The phases were surveyed as they became suitable breeding habitat, with Phase 1 first surveyed in 2008 and Phase 8 first surveyed in 2016. Changes to survey sites in 2019 included the division of larger sites into smaller survey Sites: Phase 5 is surveyed as North, Triangle, and West; Phases 4, 6, and 7 are each surveyed and reported as two sites, North and South. All eight phases were surveyed in 2021.

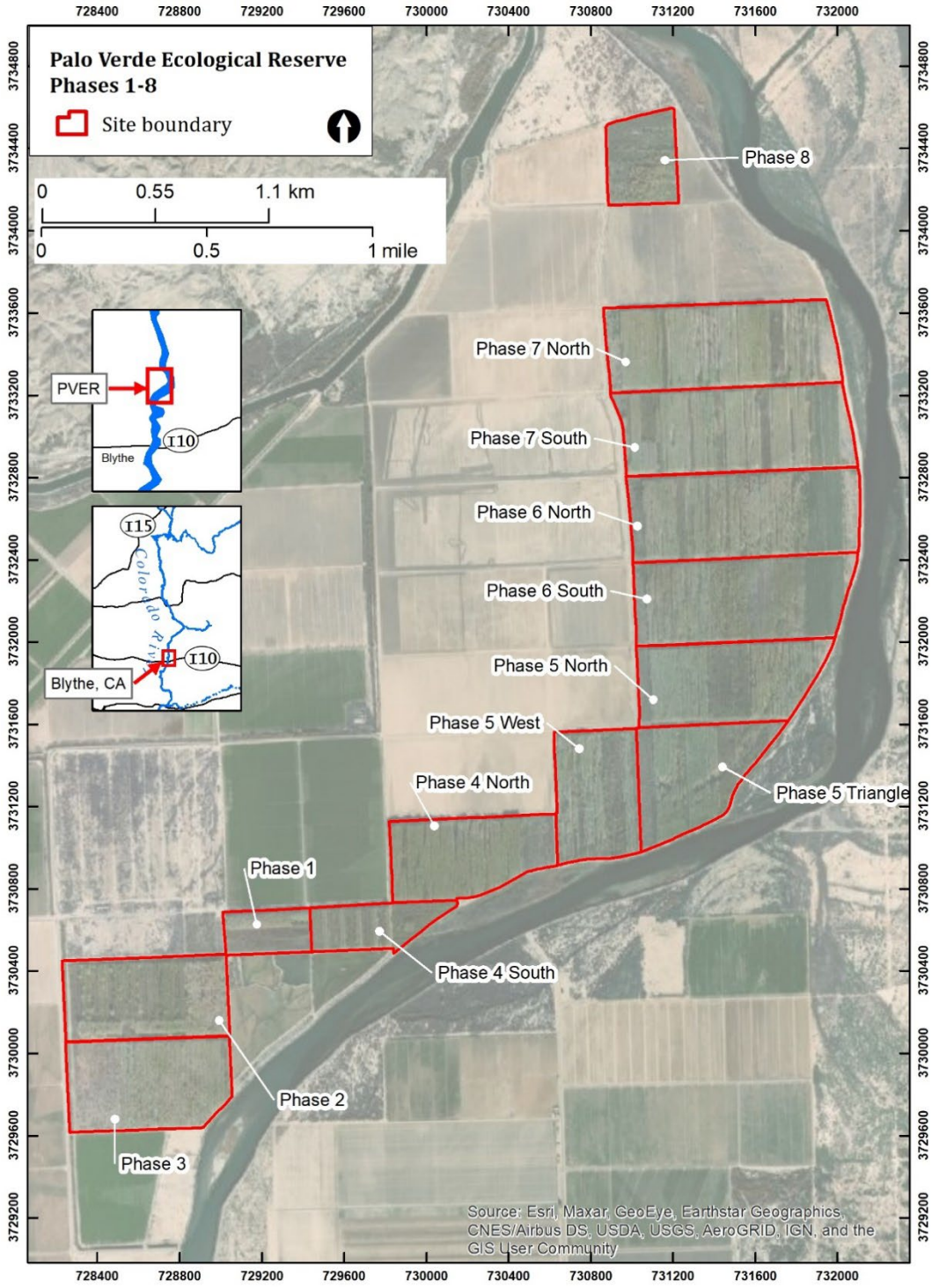

Figure 6.—PVER Phases 1–8, showing sites surveyed in 2021.

Adjacent farming activity that may negatively affect breeding cuckoos includes regular overhead crop dusting as well as noisy tractors and harvesting equipment. The edges receive overspray of chemicals from the crop dusting as well as applications from tractor spray. During the breeding season, farm equipment travels along the main road and in some perimeter and interior roads night and day. During the first session of dove hunting from September 1 to 15, all PVER phases experience hunting-related disturbance from increased road traffic, people, dogs, and gun shots.

Many trees throughout the PVER weep reddish streaks, previously reported in 2019 (McNeil et al. 2020) and 2020 (Tracy et al. 2021). Liquid may ooze from boring insect holes or other open wounds in the bark, resulting from wetwood disease or other bacterial growth deep within the tree trunk (Hofstra et al. 1999). The disease causes stress, leaf loss, branch die back, and canopy decline, and it may ultimately lead to tree death (Hofstra et al. 1999). All sites contain stressed or dead trees.

Site: Phase 1

25.0 ha (61.8 ac)
Section: C2363

The eastern section of Phase 1 was planted in 2006 (LCR MSCP 2006a, 2006b) (see figure 6 in this chapter). Mature cottonwoods and Goodding's willows are present, and at the southern edge is a dense patch of senescing coyote willows (*Salix exigua*). The western section was sparsely planted with honey mesquite, and cuckoos have not been documented using it. The site is bordered by dirt access roads on all sides. An agricultural field borders the north, and an open area managed by the CDFW lies to the south. During the early years after planting, the tree canopy was dense, with a wide-spreading canopy (LCR MSCP 2006b). The trees in this area are now tall, of large diameter and low canopy cover. Many downed branches litter the understory. Most baccharis (*Baccharis* spp.) and coyote willow understory present in past years has been shaded out, except along the road edges. The adjacent coyote willow area has always attracted many nesting birds, including red-winged blackbirds (*Agelaius phoeniceus*), which has made surveying this area difficult in the past due to the raucous noise.

In 2021, there were no survey detections at this site.

Site: Phase 2

31.6 ha (78.0 ac)
Section: C2361

Phase 2 was planted in 2007 (LCR MSCP 2006c, 2009a) (see figure 6 in this chapter). The eastern third contains a small field of seeded cottonwoods. The

understory in this plot is now dense, with many tall dead or dying trees. The remaining area of Phase 2 now has large-diameter trees present. The entire site is difficult to move through due to fallen trees and limbs. The site is bordered on all sides by dirt access roads and irrigation canals on the west, north, and south.

In 2021, there were five survey detections and one PO territory at this site.

Site: Phase 3
34.0 ha (84.0 ac)
Section: C2362

Phase 3 was planted in 2008 and 2009 (LCR MSCP 2007a, 2010a, 2013) (see figure 6 in this chapter). The site now consists of tall, large-diameter cottonwood and Goodding's willow trees. Fallen trees and branches make this site difficult to walk and approach birds stealthily for observation. The site is bordered by dirt access roads on all sides and to the east by the LCR and an open area managed by the CDFW. The southern edge is bordered by a large agriculture field and partially constructed housing development.

In 2021, there were seven survey detections and one PO territory and one PR territory at this site.

Sites: Phase 4 North and Phase 4 South
41.2 ha (101.8 ac)
Sections: C2372, C2371

Phase 4 was planted in 2009 (LCR MSCP 2009b, 2013) (see figure 6 in this chapter). It is bordered by actively farmed agriculture fields to the north and west. Dirt access roads surround the perimeter, and irrigation canals are present on the north and west edges. Both sections east and west of the road now contain large-diameter trees, with many dead or downed trees and limbs. The saltbush (*Atriplex* spp.) on the edges is large and dense, but many large honey mesquites are now dead or dying, as are the cottonwoods bordering this area to the south. Due to its large size, this phase is surveyed as two Sites: Phase 4 North and Phase 4 South, with the south site surveyed along with Phase 1.

In 2021, there were three detections and two PO territories in Phase 4 North, and two detections and no territories in Phase 4 South.

Sites: Phase 5 North, Phase 5 Triangle, and Phase 5 West
87.4 ha (216.1 ac)
Sections: C2366, C2364, C2365

Phase 5 was planted in 2010 (LCR MSCP 2009c, 2010b) (see figure 6 in this chapter) and differs from other nearby phases due to a more open canopy, several meadows, grassy ground cover, and a shorter average height of cottonwoods and

Goodding's willows. The Phase 5 North, West, and Triangle sites are all similar in species composition. The phase is bordered by agricultural fields to the north and west and the LCR to the east. Dirt roads surround the perimeter, and an irrigation canal is on the western boundary.

In 2021, there were 8 survey detections, 1 PO, and 1 CO territory (nest) in Phase 5 North; 7 detections, 1 PO, and 1 PR territory in Phase 5 Triangle; and 10 detections, 1 PO, and 1 CO territory (nest) in Phase 5 West.

Sites: Phase 6 North and Phase 6 South

89.0 ha (219.9 ac)
Sections: C2369, C2368

Phase 6 was planted in 2011 (LCR MSCP 2010c, 2019) (see figure 6 in this chapter). The phase is surveyed as Phase 6 North and Phase 6 South due to its large size, but both sites are similar in plant composition. The sites are bordered by agricultural fields, an irrigation canal to the west, and the LCR to the east. Dirt access roads surround the perimeter. Small areas of native grasses and honey mesquite plots on the southern and northern boundary appear stressed, yellowing, and dying.

In 2021, there were 12 survey detections, 1 PO territory, 2 PR territories, and 1 CO territory (nest) in Phase 6 North and 22 detections, 1 PO territory, 5 PR territories, and 1 CO territory (nest) in Phase 6 South.

Sites: Phase 7 North and Phase 7 South

91.6 ha (226.3 ac)
Sections: C2369, C2370

Phase 7 was planted in 2012 (see figure 6 in this chapter). The sites are bordered by agricultural fields to the west and north, the LCR to the east, and Phase 6 to the south. Dirt access roads surround the perimeters. Phase 7 shows similar vegetation changes as PVER Phase 6, with the mesquite planted along the eastern and western borders (LCR MSCP 2011, 2012a) yellowing and appearing stressed. Due to its large size, the phase is surveyed as two Sites: Phase 7 North and Phase 7 South.

In 2021, there were 4 detections and 1 PR territory in Phase 7 North and 10 detections, 2 PO territories, and 1 CO territory (nest) in Phase 7 South.

Site: Phase 8
14.6 ha (36.1 ac)
Section: C2335

Phase 8 is 500 m (1,640 ft) north of Phase 7 and separated by an agricultural field (see figure 6 in this chapter). It was planted with honey mesquite and alkali sacaton (*Sporobolus airoides*) in 2013, and scattered cottonwoods have naturally colonized (LCR MSCP 2012b). Most cottonwood trees are growing well and appeared healthy and green during the cuckoo breeding season, though some trees appear stressed, and many have died. The site is bordered by agricultural fields to the south, the LCR to the east, and disturbed scrubland to the north and west. Dirt access roads surround the perimeter.

In 2021, there were two survey detections and one PO territory at this site.

Cibola Valley
La Paz County, Arizona

Area: Cibola Valley Conservation Area

The CVCA is located 24.2 km (15 mi) south of Blythe, California, south and east of the LCR and the California State line, and immediately north of Cibola NWR Unit #1 (figure 7). Each phase of the CVCA is described in annual reports and restoration development plans that are available at https://lcrmscp.gov/steer_committee/technical_reports.html. Reclamation has implemented restoration activities on 412.4 ha (1,019 ac) of land, with hunting and public access managed by the Arizona Game and Fish Department. A mosaic of cottonwoods, Goodding's willows, and honey mesquite was planted to mimic the riparian communities historically present. Trees were planted in nine phases from 2006 to 2017; six of these phases were surveyed for cuckoos in 2021.

Sites: Phase 1 North and Phase 1 South
37.2 ha (91.9 ac)
Sections: C2547, C2548

CVCA Phase 1 consists of six fields planted in 2006 (LCR MSCP 2007b, 2008) (figure 7) and is surveyed as two survey Sites: Phase 1 North and Phase 1 South. The LCR flows approximately 100 m (328 ft) from the northern edge of the site. The dominant tree species include cottonwoods, Goodding's willows, and coyote willows. River Road, Highway 78, and several dirt access roads define the perimeter of Phase 1, and additional interior dirt roads cross the site. The northern, southern, and western boundaries have cement-lined irrigation

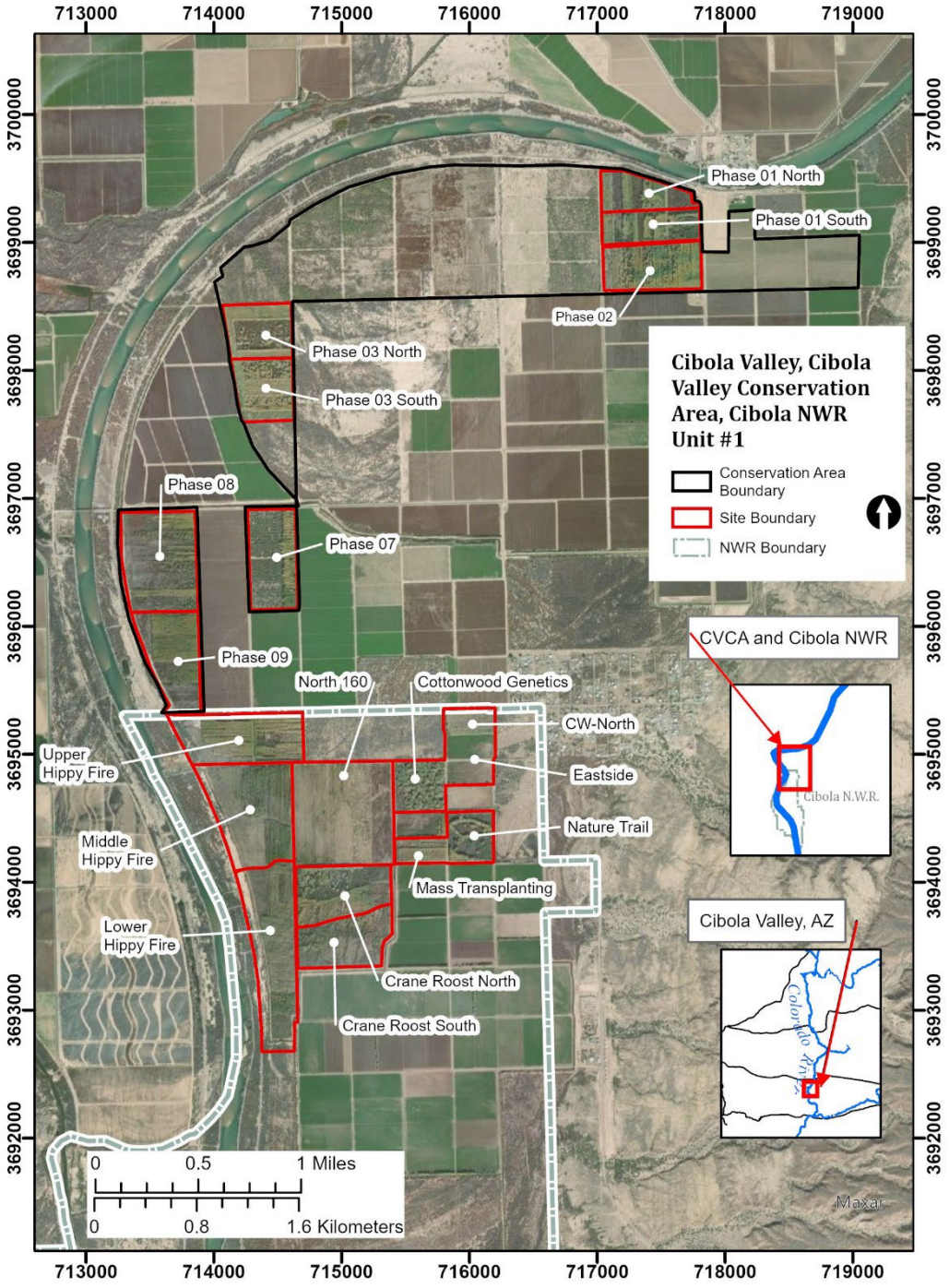

Figure 7.—The CVCA and Cibola NWR Unit #1, showing sites surveyed in 2021.

canals. In 2021, the site had many dying, downed, and stressed trees. Most interspersed stands of coyote willows are dead, as is a large patch once popular with cuckoos in the northeast corner of the site. The southeast corner of this plot experienced a fire in 2014, which impacted much of the prime cottonwood and willow habitat. Many Goodding's willows are now resprouting from burned trunks, but none have regained their former canopy spread. The middle access road is usually blocked by fallen trees or vegetative growth. In 2020, there were no survey detections in either Phase 1 North or Phase 1 South. That was the first year since 2008 when surveys began that no detections had occurred.

In 2021, there was one detection each on survey 1 in Phase 1 North and South and no territories found. Detections only on the first survey often indicate birds passing through a site.

Site: Phase 2

27.5 ha (67.9 ac)
Section: C2528

CVCA Phase 2 was planted in 2008 (LCR MSCP 2007c, 2010d) (see figure 7 in this chapter) to create 32 ha (80 ac) (approximate) of additional riparian habitat that shall be managed for covered species listed in the LCR MSCP Habitat Conservation Plan. The site is immediately south of Phase 1, separated by a dirt access road and a concrete-lined irrigation ditch. Cottonwoods and Goodding's willows are the co-dominant trees. As in Phase 1, trees appear stressed, with many downed trees and limbs. The dense cottonwoods bordering the road, east and south of the site, still appear green and healthy. Farm fields are located to the east and south, and Highway 78 is directly east. A regularly visited fenced yard used to store farm equipment is located just south of the southeast corner.

In 2021, there were two survey detections at this site, both during the first period, and no territories found.

Site: Phase 3 North and Phase 3 South

43.9 ha (108.4 ac)
Sections: C2529, C2530 CVCA

Phase 3 is located 2.6 km (1.6 mi) west of Phases 1 and 2, 670 m (2,198 ft) north of Phase 7, and 0.4 km (0.25 mi) east of the LCR (see figure 7 in this chapter). The site was planted in 2007 (LCR MSCP 2007d, 2010e). The site has low canopy cover, except for the dense plantings of cottonwoods along the western border, which appear healthy. Most patches of coyote willows appeared water stressed and were dying or dead. Dirt access roads line the perimeter and bisect the plantings, agricultural fields are located to the west, and restored or native vegetation surround the other three sides. In 2019, this phase was divided into the Phase 3 North and Phase 3 South survey sites.

In 2021, there was one survey detection in Phase 3 North and four detections and one PR territory in Phase 3 South.

Site: Phase 7
29.3 ha (72.3 ac)
Section: C2539

CVCA Phase 7 is located 692 m (2,270 ft) south of Phase 3 South, 400 m (1,312 ft) east of Phase 8, and 1.2 km (0.75 mi) east of the Colorado River (see figure 7 in this chapter). Plantings in 2015 converted the area from active agricultural fields to honey mesquite and cottonwoods which, along with earlier phases, were designed to create a mosaic of native vegetation (Stegmeier et al. 2018a, 2018b).

In 2021, there were six survey detections and one PR territory at this site.\

Site: Phase 8
46.6 ha (115.2 ac)
Section: C2542

CVCA Phase 8 is located 795 m (2,608 ft) south of Phase 3 South, 400 m (1,312 ft) west of Phase 7 across from a farm field, just north of Phase 9, and 200 m (656 ft) east of the LCR (see figure 7 in this chapter). Plantings in 2016 converted the area from farm fields to low- to high-density cottonwood-willow and honey mesquite. The plantings were designed to recreate historical plant and insect communities for birds and bats covered by the LCR MSCP (Stegmeier et al. 2018c, 2018d). Phase 8 was first surveyed in 2018.

In 2021, there were 11 survey detections and 1 PO territory and 1 PR territory at this site.

Site: Phase 9
31.2 ha (77.2 ac)
Section: C2546

CVCA Phase 9 is just south of Phase 8 (see figure 7 in this chapter) and was planted in 2017 (Stegmeier et al. 2018c, 2018d) with honey mesquite in sinuous rows as well as cottonwoods, coyote willows, and baccharis. Breeding at the site was first confirmed in 2018, when surveyors found a cuckoo nest in a small patch of suitable habitat in the northeast corner of the site. The entire phase was first surveyed in 2019.

In 2021, there were three survey detections and one PR territory at this site.

Area: Cibola National Wildlife Refuge Unit #1 Conservation Area

La Paz County, California

Cibola NWR Unit #1 is located 29.8 km (18.5 mi) south of Blythe, California, in the historical floodplain of the Colorado River (see figure 7 in this chapter). The refuge, created in 1964, spans over 6,475 ha (16,000 ac), including both the historical river channel and another channel constructed in the late 1960s. The historical channel receives irrigation, with parts maintained for wildlife, while the new highly levied channel carries the main riverflow. Most cuckoo habitat in the refuge is in conservation areas receiving varying irrigation. Nine sites were surveyed in 2021, including Eastside, that became suitable habitat at 2 years of age. Each phase of Cibola NWR Unit #1 is described in annual reports and restoration development plans available at https://lcrmscp.gov/steer_committee/technical_reports.html.

Sites: Cottonwood Genetics/CW-North, Eastside

24.6 ha (60.9 ac)
Section: C2741

This section consists of three plots planted over different years and later incorporated into Cibola NWR Unit #1 (LCR MSCP 2009d, 2009e; Stegmeier et al. 2018e). It is now surveyed as one survey site. Cottonwood Genetics was planted in 2005 with 1,000 trees propagated at a research greenhouse at Northern Arizona University for a joint university-Reclamation project (Nelson 2007) (see figure 7 in this chapter). Researchers used the plantings to assess the influence of stand-level genetic diversity on communities and ecosystem processes. The site is now a park-like grove of mature cottonwoods with an open understory. It is bordered by Eastside to the east, North 160 to the west, and Mass Transplanting to the south.

CW-North is a small, open, structurally homogeneous plot planted in 2002 (see figure 7 in this chapter). It consists of a mostly cottonwood overstory and ground cover dominated by Bermuda grass (*Cynodon dactylon*). Mesquite trees planted in the interior now form a small subcanopy. The plot is bordered on the north by Baseline Road and agricultural fields. Fallow fields of sparse tamarisk, arrow weed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*) extend east and west. The new Eastside plot is directly south.

Eastside is a formerly fallow 15-ha (37-ac) field planted in 2019 with a mosaic of high-density cottonwoods, willows, and baccharis (Stegmeier et al. 2020) (see figure 7 in this chapter). It links the previously disjunct CW-North to Cottonwood Genetics to create a larger contiguous patch important for breeding cuckoos. Previously CW-North was separated from Cottonwood Genetics to the

southwest by 200 m (656 ft) and from the Nature Trail to the south by 580 m (1,903 ft). Eastside was first surveyed in 2021 when it became suitable for breeding.

In 2021, there were five survey detections and one PR territory in Cottonwood Genetics, no survey detections in CW-North, and nine survey detections, one PR territory, and one CO territory (nest) in Eastside, confirming breeding in this section for the first time. Altogether there were 14 survey detections, 2 PR territories, and 1 CO territory over this greater survey site.

Site: Crane Roost North

30.0 ha (74.0 ac)
Section: C2744

Crane Roost is surveyed as two sites, Cranes Roost North and Crane Roost South (see figure 7 in this chapter). The North site incorporates an older established plot of 15.4 ha (38 ac) originally planted in 2005, consisting of tall, emergent cottonwoods and a dense grove of honey mesquite, seep willow, and tamarisk. In 2021, many of the cottonwood trees were bending over, touching, and blocking the road. Several large torqued branches eventually broke, blocking the main access. To the south is a younger plot planted in 2009 consisting of cottonwoods, Goodding's willows, and coyote willows (LCR MSCP 2009f). Most coyote and seep willows are stressed, dying, or dead in both sections.

In 2021, there were four survey detections and one PR territory at this site.

Site: Crane Roost South

27.4 ha (67.6 ac)
Section: C2743

Crane Roost South comprises fields planted in 2009. Plantings from west to east, as in Crane Roost North, include coyote willows, Goodding's willows, cottonwoods, and honey mesquite (LCR MSCP 2009f) (see figure 7 in this chapter). The site contains surface salt deposits, resulting in shorter, more sparsely distributed trees, with several grassy meadows. The site is bordered by agricultural fields to the east, scrub vegetation to the south, and Lower Hippy Fire to the west. Trees in this area appear stressed, with many willows having defoliated tops and resprouting from the base.

In 2021, there were nine survey detections and two PO territories at this site.

Site: Upper Hippy Fire
37.9 ha (93.5 ac)
Section: C2745

Hippy Fire was developed in 2013 to create habitat for southwestern willow flycatchers, cuckoos, and other LCR MSCP covered species (LCR MSCP 2012c; Miller et al. 2017) (see figure 7 in this chapter). This site grew rapidly and was intermittently checked for cuckoos in 2014. It was first surveyed in 2015. A nesting female cuckoo (MAC banded 2019) and a newly banded cuckoo (ZOT), whose nest (see chapter 4) was adjacent to Middle Hippie Fire, were observed using both sites during the nesting period.

In 2021, there were six survey detections, one PO territory, and one CO territory (nest).

Site: Middle Hippy Fire
49.3 ha (121.7 ac)
Section: C2746

In 2017, this site was converted from active agricultural land to riparian forest to benefit LCR MSCP covered species (Stegmeier et al. 2018f, 2019) (see figure 7 in this chapter). This site is bordered by Upper Hippy Fire to the north, Lower Hippy Fire to the south, and North 160 to the east. Several gravel and dirt roads surround the site, and an irrigation ditch borders the site to the east and north, with honey mesquite plantings and the LCR on the western border. The site was first surveyed for cuckoos in 2019.

In 2021, there were 14 survey detections, 2 PO territories, and 1 PR territory at this site.

Site: Lower Hippy Fire
49.6 ha (122.6 ac)
Section: C2747

Planted in 2016, the development of Lower Hippy Fire resulted in additional habitat to benefit southwestern willow flycatchers, cuckoos, and other species covered in the HCP (Stegmeier et al. 2018g) (see figure 7 in this chapter). The site is bordered by dirt and gravel access roads, an irrigation canal, and Crane Roost to the east, a levied road and the LCR to the west, and Middle Hippy Fire to the north.

In 2021, there were four survey detections and two PO territories at this site.

Site: Mass Transplanting/Nature Trail

22.7 ha (56 ac)
Section: C2742

This site combines two areas previously treated as two sites but typically surveyed by one surveyor in the same morning. Mass Transplanting, west of and adjacent to the Nature Trail, was planted in 2005 and 2006 and consists of cottonwoods and Goodding's willow, with open grassy areas (LCR MSCP 2007e) (see figure 7 in this chapter). Some open areas are invaded by non-native Johnsongrass (*Sorghum halepense)*. The Nature Trail was first planted in 1999 (LCR MSCP 2007b) (see figure 7 in this chapter). The transect follows a gravel trail winding through the habitat. Species composition and height vary across the site, creating structural diversity. Cottonwoods dominate the higher canopy across 30% of the site. The understory includes Goodding's willow, honey mesquite, and screwbean mesquite (*Prosopis pubescens*). Much of the surrounding area is agricultural, and bordering the site north and east are seasonally flooded fields for wintering waterfowl. Many of the willows and understory trees are dead or stressed as are the large canopy cottonwoods.

In 2021, there were no survey detections at Mass Transplanting. At the Nature Trail, there were six detections and one CO territory (nest).

Site: North 160

63.9 ha (158 ac)
Section: C2742

North 160 is designated as Area Number 4 of 5 areas in Cibola NWR Unit #1 set aside for restoration. North 160 borders some older plantings, including Mass Transplanting and Cottonwood Genetics to the east, Crane Roost to the south, and Hippy Fire to the west (see figure 7 in this chapter). Once a fallowed agricultural field, it was planted in 2018 (Stegmeier et al. 2018h). In 2019, at 1 year of age, surveyors noticed cuckoos from adjacent sites Crane Roost and Hippy Fire foraging in this site. Nesting in Mass Transplanting in 2019 may have been spurred by this new planting, as cuckoos seen foraging here in 2019 were suspected to be from the nearby nest. This site was first surveyed in 2020.

In 2021, there were 13 survey detections and 4 PR territories at this site.

Yuma

Yuma County, Arizona

Area: Laguna Division Conservation Area

Yuma County, Arizona

The LDCA is on Reclamation withdrawn lands along the LCR within the Laguna Division section of Reach 6 (see figure 2 in chapter 1; figure 8). The LDCA is downstream from Imperial Dam and upstream of Laguna Dam and encompasses around 585 ha (1,200 ac). Each phase is described in annual reports and plans available at https://lcrmscp.gov/steer_committee/technical_reports.html. Prior to restoration, the area consisted of a mix of saltcedar and mesquite and wetlands along the abandoned river channel between the Laguna Settling Basin and the Mittry Lake Wildlife Area. Baseline surveys in the remnant riparian areas from 2009 through 2012 (McNeil et al. 2013b) detected a few migrant cuckoos using the area.

Restoration has created a mosaic of riparian vegetation types consisting of open water/marsh and trees planted from 2013 to 2015 (Chavez et al. 2019). Several constructed channels meander through the area, and the hydrology is managed to sustain the cottonwood-willow and honey mesquite land cover types to meet LCR MSCP conservation criteria for target species (LCR MSCP 2004a). The area can be challenging to move through due to varying water levels, mud, and dense vegetation. Reach 1 was first surveyed in 2016, with Reach 2 added in 2018.

Sites: Reach 1 East, Reach 1 North, Reach 1 West

225.8 ha (558.0 ac)
Sections: C4965, C4964, C4966

All planting in Reach 1 of the LDCA (see figure 8 in this chapter) was completed in April 2014. The plantings were stratified along a flowing channel to represent wetland, wetland transition, and upland riparian species (LCR MSCP 2012d). In 2021, the 6-year-old planted cottonwoods, Goodding's willows, and coyote willows in Reach 1 were still generally sparse and spindly, with intermittent dense and healthier patches. Several larger healthy patches skirt the open marsh areas. Cuckoos have been observed foraging in both the tall, denser cottonwoods and large honey mesquite plots. The site is difficult to survey due to dense marsh vegetation, islands, changing water levels, and tributaries of deep marsh and open water areas. The first nest was found at this site in 2020. This site is divided into three survey routes, Reach 1 East, Reach 1 West, and Reach 1 North, to ensure full survey coverage.

In 2021, there were nine detections, one PO territory, and one PR territory at Reach 1 East; six detections, one PO territory, and one PR territory at Reach 1 North; and eight detections and one PO territory at Reach 1 West.

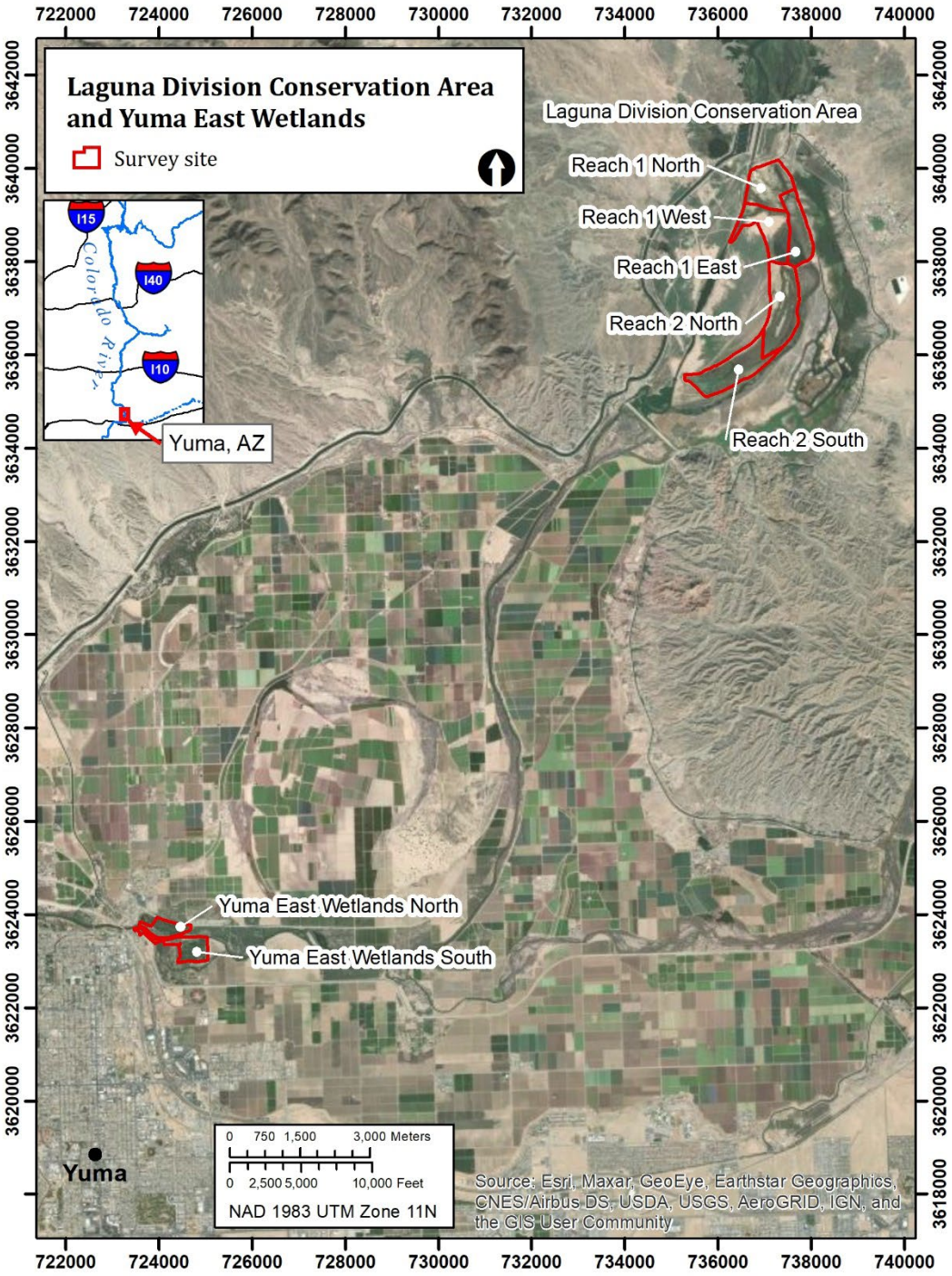

Figure 8.—The LDCA and YEW, showing sites surveyed in 2021.

Site: Reach 2 North and South
211.7 ha (523.1 ac)
Section: C4963

Reach 2, planted in 2015 (LCR MSCP 2012d) is at an earlier successional stage than Reach 1 (see figure 8 in this chapter). The site is long and linear, and a thin ring of short cottonwoods abuts the marshes. Some interior areas that line the deeper internal waterway contain taller and healthier-appearing cottonwoods and Goodding's willows. This site is difficult to survey due to changing water levels, marsh vegetation, and deep-water channels. It was previously surveyed from the road only, and in 2019, a second transect was added in the wet interior along a line of larger trees. The site was divided into two survey sites, Reach 2 North (interior transect) and Reach 2 South (road transect). In 2020, the first nest was found at this site in the interior transect.

In 2021, there were seven survey detections and two PO territories in Reach 2 North and nine survey detections and two PO territories in Reach 2 South.

Area: Yuma East Wetlands

Yuma County, Arizona

The YEW area is located along the banks of the LCR in the city of Yuma, Arizona (see figure 8 in this chapter). Until planting began in 2003, the area was a mix of exotic vegetation, trash dumps, and squatter camps. YEW is part of the Yuma Crossing Natural Heritage Area and is jointly managed by the city of Yuma, the Quechan Tribe, the Arizona Game and Fish Department, and private ownership. A mosaic of the marsh, cottonwood-willow, and honey mesquite land cover types were created from 2001 to 2014 (Brooks et al. 2018). Each Phase of YEW is described in annual reports and restoration development plans that are available at https://lcrmscp.gov/steer_committee/technical_reports.html.

The Colorado River divides the area from east to west with YEW North and YEW South sites, which are surveyed separately. It is promoted as a recreation area with trails, a swimming area, picnic tables, and restrooms. The area is highly managed, with new plantings, vegetation clearing, and frequent irrigation. Site workers, vehicles, joggers, cyclists, and dog walkers are regular visitors. Noise disturbance can be high due to a diesel irrigation system, associated vegetation management, railroad traffic, and vehicular traffic on Interstate 8 to the west. This site is managed for LCR MSCP covered species, including riparian and marsh birds.

Site: YEW North
26.8 ha (66.2 ac)
Sections: C4713

This site is immediately east of the Ocean-to-Ocean Bridge north of the LCR (see figure 8 in this chapter). This cottonwood-dominated area (previously Site J) to the north parallels the river and is connected to a small wetland area and Sunrise Park to the west. A large concrete drainage ditch runs through the mostly cottonwood and honey mesquite plantings. The irrigation system is powered by a loud diesel irrigation pump. The site is bounded by a tall leveed graveled road to the north and Quechan Tribal lands containing mixed exotic species. During surveys, evidence of heavy use was visible (trash, fire pits, fishing line) as well as people crossing over the gate barrier and fishing early in the morning at the site.

In 2021, there were two survey detections and no territories at this site.

Site: YEW South
40.6 ha (100.3 ac)
Section: C4714

The YEW South site is east of the Ocean-to-Ocean Bridge and south of the LCR (see figure 8 in this chapter) and consists of a mosaic of cottonwoods, Goodding's willows, and honey mesquite mixed with open areas and restored wetlands. It is promoted as a recreation area with several trails, a swimming area, picnic tables, and restrooms. It is popular with families, bicyclists, dog walkers, and birders. The site can be extremely noisy, as trains frequently cross over the historic bridge, and there is noise from the engine-driven irrigation pumps.

In 2021, there were eight survey detections and one CO territory (nest).

Chapter 3 – Surveys

INTRODUCTION

Objectives of this project include documenting the presence of yellow-billed cuckoos in suitable habitat within the LCR MSCP study area, determining breeding status in areas of activity, and trying to resight cuckoos previously fitted with Global Positioning System (GPS) tags in the study area that may still be wearing their harness with attached GPS tag (see Parametrix and SSRS 2019). Standardized surveys and territory estimates continued in 2021 in five LCR MSCP conservation areas and areas of the Bill Williams River NWR comprising Bill Williams River-East and Bill Williams River-West. The surveyed conservation areas described in chapter 2 include the PVER, the CVCA, Cibola NWR Unit #1, the LDCA, and YEW.

METHODS

Survey Sites

Sites surveyed in 2021 included all sites surveyed in 2020, except Planet Ranch, which was not surveyed due to construction onsite, and the BLCA, where Reclamation now conducts cuckoo surveys. One new site in Cibola NWR Unit #1, Eastside, was added in 2021 after becoming suitable habitat at 2 years post-planting (see table 1 and text in chapter 2 for detailed descriptions). In 2019, some large sites were divided into smaller sites to reflect what can be surveyed by an individual in a morning (i.e., PVER Phases 4–7, CVCA Phases 1 and 3, Crane Roost North and South, Hippy Fire [Upper, Middle and Lower], and LDCA Reach 1 [North, East, and West] were each divided into two or three sites (see McNeil et al. 2020). Additional survey transects were added in 2020 to Bill Williams River-East Kohen Ranch, Sandy Wash, and CVCA Phases 7, 8, and 9 to increase habitat coverage. One more site, LDCA Reach 2, was divided into two survey sites in 2020, becoming Reach 2 North and Reach 2 South (see 2020 annual report) (Tracy et al. 2021).

Surveys

Four surveys were conducted per site in 2021 following the standard cuckoo survey protocol (Halterman et al. 2016) from mid-June to early August (table 2). Surveys were conducted on foot between sunrise and 11:00 a.m. or until temperatures reached 40 degrees Celsius (°C) (104 degrees Fahrenheit [°F]).

Table 2.—Cuckoo survey dates for the LCR MSCP study area, 2021

Survey period	Survey number	Survey dates
1	1	June 14 – June 25
2	2	June 28 – July 11
2	3	July 12 – July 23
3	4	July 26 – August 5

When possible, adjacent sites were surveyed on the same day to minimize double counting of individuals. Radios were used to communicate among surveyors when adjacent patches were surveyed concurrently.

Surveys were conducted along one or more parallel transects approximately 200 m (650 ft) apart, with survey points spaced every 100 m (328 ft) along transects. Survey points were assumed to cover 100 to 125 m (328 to 410 ft) of habitat on either side of each transect. Most transects traversed through the habitat; however, some ran along edges such as adjacent roads for greater visual detectability or if the interior was inaccessible. Surveyors used Samsung Galaxy S8+ phones (Android operating system) with ArcGIS Field Maps ™ version 21.3.0 (Esri) to locate survey points and record data. During all field work, surveyors also recorded other LCR MSCP avian focal species detected (table 3). After data collection each morning, data were synchronized to ArcGIS Online for processing.

Table 3.—Avian species monitored during field work in the LCR MSCP study area, 2021

Scientific name	Common name	AOU code[1]
Empidonax traillii extimus	Southwestern willow flycatcher	WIFL
Coccyzus americanus[2]	Yellow-billed cuckoo	YBCU
Colaptes chrysoides	Gilded flicker	GIFL
Melanerpes uropygialis	Gila woodpecker	GIWO
Pyrocephalus rubinus	Vermilion flycatcher	VEFL
Vireo bellii arizonae	Arizona Bell's vireo	BEVI
Setophaga petechia sonorana[3]	Sonoran yellow warbler	YEWA[3]
Piranga rubra	Summer tanager	SUTA
Rallus obsoletus yumanensis	Ridgway's rail[4]	CLRA
Laterallus jamaicensis coturniculus	California black rail	BLRA
Ixobrychus exilis hesperis	Western least bittern	LEBI
Micrathene whitneyi	Elf owl	ELOW

[1] American Ornithologists' Union (AOU) nomenclature.
[2] Referred to *as Coccyzus americanus occidentalis* in the HCP (LCR MSCP 2004a).
[3] Referred to as *Dendroica petechia sonorana* (YWAR) in the HCP (LCR MSCP 2004a).
[4] Referred to as Yuma clapper rail in the HCP (LCR MSCP 2004a).

At each survey point, surveyors recorded the location, time, and presence of live cicadas (McNeil et al. 2013b). They then listened and watched for cuckoos for 1 minute. If a cuckoo was not detected, surveyors used an MP3 player and hand-held speaker to broadcast a 5-second cuckoo contact call (the "kowlp" call [Hughes 2015]) at approximately 70 decibels calibrated with a decibel meter before each survey, once per minute for 5 minutes. During the 5-minute period, each 5-second call was followed by 55 seconds of active listening. If a cuckoo was detected, surveyors immediately discontinued playback, and recorded the true bearing and estimated distance from the surveyor to the bird in meters, time of detection, number of calls broadcast, response type, behaviors, vocalizations, and presence and color combinations of any leg bands observed. Surveyors closely watched for breeding evidence, including carrying food or nesting material, copulations, juveniles, or nests. Surveyors then progressed along the transect 300 m (984 ft) from the estimated location of the detected bird to avoid additional disturbance and the potential for repeat detections of the same individual.

An individual cuckoo visually observed or heard during a survey, including any detected while traveling between survey points, was recorded as a new survey detection. If the same individual was presumed to have been detected more than once during a single survey (such as when an individual appeared to follow a surveyor), only the initial detection was counted toward the detection total.

Detections > 300 m (984 ft) apart during a single survey were generally counted as separate individuals, although surveyors used their judgment to determine whether multiple detections within 300 m (984 ft) were of the same individual. It is usually difficult to tell individual cuckoos apart by call or appearance; however, individuals exhibiting unique calls or behaviors can sometimes be recognized.

The distance between separate individuals of 300 m (984 ft) is somewhat arbitrary; however, it is reasonable for most areas because it corresponds to the typical minimum distance found between active nests based on previous field data collected. In recent years, using 300 m (984 ft) to separate territories in high- density nesting areas has resulted in undercounting individuals and territories (Parametrix and SSRS 2015). To compensate for this undercounting, the distance used to separate individuals and territories was reduced to approximately 200 m (656 ft) at known high-density sites, confirmed by active nests found ≤ 200 m (656 ft) apart during the season. Individuals detected more than once were considered repeat detections, and detections occurring before or after surveys were classified as incidental survey detections. Data collected for repeat detections were the same as that collected for survey detections.

Breeding Territories

Habitat patches were considered occupied if detections occurred in an area (generally < 100 m [328 ft] apart) during two or more surveys (i.e., at least 12 days apart). All survey detections were assessed by location, observed behaviors, and dates to estimate territories and to categorize the status for each as a PO, PR, or CO breeding territory (Halterman et al. 2016; USFWS and Reclamation 2021) (table 4). Fledglings or juveniles detected that could have come from a territory already counted were not counted as new territories.

Table 4.—Definitions for cuckoo breeding territory estimation

Term	Definition
Possible breeding territory (PO)	Detections within a 300- to 500-m (984- to 1,640-ft) area during at least two surveys and 12–14 days apart.
Probable breeding territory (PR)	Detections within a 300- to 500-m (984- to 1,640-ft) area during at least three surveys and 12–14 days apart, or PO territory plus purposeful food carry (single observation, bird does not eat food), stick carry (single observation), multiple incidents of alarm call in same area, or PO territory plus pair exchanging multiple kowlp or alarm calls (not coos) within 100 m (328 ft) of one another.
Confirmed breeding territory (CO)	Observation of active nest (or multiple stick carries to nest being built), copulation, fledgling (unable to fly) with adult, or PR plus multiple food carries to same area, or distraction display (dropped wing).

Note that PO, PR, and CO counts estimate the number of breeding territories and not the number of breeding pairs, with each territory representing two adults typically associated with a single nest. Apart from the fact that many nests are missed due to the cryptic nature and rapid nesting cycle of the species, other factors that complicate pair estimation include polyandrous females renesting with another male after leaving an active nest (Halterman 2009), polygyny/ multiple maternity of nests (McNeil 2015), and one or both adults renesting following a successful or failed nest. The number of actual territories represents the number of pairs assuming two birds tend each nest and all pairs nest exactly once in a season. The true breeding population will be less than twice the number of territories if individuals nest more than once per season. The CO territory count is the most conservative estimate of breeding territories. PR territories are

based on solid observations and a sound definition (Halterman et al. 2016; McNeil et al. 2013b) and, when summed with CO territories, provides a reasonable estimate of breeding territories. The sum of all PO, PR, and CO territories provides the maximum estimate and likely overestimates the true number of breeding territories.

Followup Visits

After surveys, and on days between survey visits, followup visits were conducted in areas of previous activity, both to determine breeding status, and to resight seven cuckoos previously GPS-tagged in the study area that may still be wearing their harness with attached GPS tag (see Parametrix and SSRS 2019). Detections during these visits were used to refine the breeding status of estimated territories, such as upgrading a PO or PR to a CO territory if breeding evidence was observed. Followup visits were focused in areas where no previous breeding evidence has been recorded.

RESULTS

Surveys

From June 14 to August 5, 2021, surveyors recorded 1,681 survey points across 157 survey visits to 41 sites, yielding 249 survey detections (table 5). Survey detections peaked during surveys 1 (mid- to late June, n = 74) and 2 (early to mid-July, n = 73) (table 5). By survey area, detections peaked on survey 1 at Bill Williams River-West, the PVER, and the CVCA, and peaked on survey 2 at the LDCA and YEW. Detections at the Cibola NWR remained consistent across surveys 2–4 (n = 20, 18, and 21, respectively). The fourth surveys had the fewest detections in all areas except for the Cibola NWR. Detections per hectare were highest in Eastside at 0.60 (11.91 per 20 ha) and PVER 6 South (0.52 [10.43 per 20 ha]) (table 5).

Breeding Territories

Sixty-four potential breeding territories were estimated in the study area, including 32 PO, 23 PR, and 9 CO territories. Followup visits led to the confirmed resighting of three previously banded adults and the discovery of nine nests (discussed in chapter 4). Maps showing survey detections, estimated territories, and nests are in a separate document due to the confidentiality of breeding location data related to federally listed species.

Table 5.—Survey detections, estimated territories, and detections per hectare, 2021

Area	Site	Detections by survey					Territories			Size (ha)	Detections per ha / 20 ha
		1	2	3	4	Total	PO	PR	CO		
Bill Williams River- East	Esquerra Ranch	1	2	1	1	5	2	0	0	73.9	0.07 / 1.35
	Kohen Ranch	0	0	0	0	0	0	0	0	68.5	0 / 0
	Mineral Wash	2	0	1	0	3	1	0	0	41.0	0.07 / 1.46
	Bill Williams River-East total	**3**	**2**	**2**	**1**	**8**	**3**	**0**	**0**	**183.4**	**0.04 / 0.87**
Bill Williams River-West	Sandy Wash	1	-	-	-	1	0	0	0	80.8	0.01 / 0.25
	Bill Williams River-West total	**1**	**-**	**-**	**-**	**1**	**0**	**0**	**0**	**80.8**	**0.01 / 0.25**
PVER	Phase 1	0	0	0	0	0	0	0	0	8.9	0 / 0
	Phase 2	4	1	0	0	5	1	0	0	31.6	0.16 / 3.16
	Phase 3	0	3	2	2	7	1	1	0	34	0.21 / 4.12
	Phase 4 North	2	0	1	0	3	2	0	0	28.4	0.11 / 2.11
	Phase 4 South	1	1	0	0	2	0	0	0	12.8	0.15 / 3.13
	Phase 5 North	4	2	2	0	8	1	0	1	33.7	0.24 / 4.75
	Phase 5 Triangle	3	2	1	1	7	1	1	0	28.3	0.25 / 4.95
	Phase 5 West	1	1	3	5	10	1	0	1	25.3	0.40 / 7.91
	Phase 6 North	5	3	2	2	12	1	2	1	46.7	0.26 / 5.14
	Phase 6 South	7	4	5	6	22	1	5	1	42.2	0.52 / 10.43
	Phase 7 North	1	3	0	0	4	0	1	0	45.5	0.09 / 1.76
	Phase 7 South	5	3	2	0	10	2	0	1	45.0	0.22 / 4.44
	Phase 8	1	1	0	0	2	1	0	0	44.7	0.04 / 0.89
	PVER total	**34**	**24**	**18**	**16**	**92**	**12**	**10**	**5**	**427.1**	**0.22 / 4.31**

Table 5.—Survey detections, estimated territories, and detections per hectare, 2021

Area	Site	Detections by survey					Territories			Size (ha)	Detections per ha / 20 ha
		1	2	3	4	Total	PO	PR	CO		
CVCA	Phase 1 North	1	0	0	0	1	0	0	0	17.7	0.06 / 1.13
	Phase 1 South	1	0	0	0	1	0	0	0	19.5	0.05 / 1.03
	Phase 2	2	0	0	0	2	0	0	0	27.5	0.07 / 1.46
	Phase 3 North	1	0	0	0	1	0	0	0	21.9	0.05 / 0.91
	Phase 3 South	2	1	1	0	4	0	1	0	21.8	0.18 / 3.67
	Phase 7	1	2	2	1	6	0	1	0	29.3	0.20 / 4.10
	Phase 8	2	4	4	1	11	1	1	0	44.7	0.25 / 4.92
	Phase 9	0	1	1	1	3	0	1	0	31.2	0.10 / 1.92
	CVCA total	**10**	**8**	**8**	**3**	**29**	**1**	**4**	**0**	**213.6**	**0.14 / 2.72**
Cibola NWR Unit #1	Cottonwood Genetics/CW-North[2]	1	1	2	1	5	0	1	0	24.6	0.20 / 4.06
	Crane Roost North	1	0	2	1	4	0	1	0	29.9	0.13 / 2.68
	Crane Roost South	3	2	0	4	9	2	0	0	27.3	0.33 / 6.59
	Eastside[1]	0	2	3	4	9	0	1	1	15.1	0.60 / 11.91
	Lower Hippy Fire	1	2	0	1	4	2	0	0	49.6	0.08 / 1.61
	Middle Hippy Fire	2	4	4	4	14	2	1	0	49.3	0.28 / 5.68
	Mass Transplanting/Nature Trail	1	2	2	1	6	0	0	1	22.7	0.26 / 5.30
	North 160	2	4	4	3	13	2	2	0	63.9	0.20 / 4.07
	Upper Hippy Fire	0	3	1	2	6	1	0	1	37.8	0.16 / 3.17
	Cibola NWR Unit #1 total	**11**	**20**	**18**	**21**	**70**	**9**	**6**	**3**	**320.2**	**0.22 / 4.37**

Table 5.—Survey detections, estimated territories, and detections per hectare, 2021

Area	Site	Detections by survey					Territories			Size (ha)	Detections per ha / 20 ha
		1	2	3	4	Total	PO	PR	CO		
LDCA	Reach 1 East	4	2	3	0	9	1	2	0	78.1	0.12 / 2.30
	Reach 1 North	2	3	1	0	6	1	1	0	65.0	0.09 / 1.85
	Reach 1 West	2	1	3	2	8	1	0	0	82.6	0.10 / 1.94
	Reach 2 North	3	4	0	0	7	2	0	0	112.9	0.06 / 1.24
	Reach 2 South	2	5	2	0	9	2	0	0	98.8	0.09 / 1.82
	LDCA total	**13**	**15**	**9**	**2**	**39**	**7**	**3**	**0**	**437.4**	**0.09 / 1.78**
YEW	YEW North	1	1	0	0	2	0	0	0	26.8	0.07 / 1.49
	YEW South	1	3	2	2	8	0	0	1	40.6	0.20 / 3.94
	YEW total	**2**	**4**	**2**	**2**	**10**	**0**	**0**	**1**	**67.4**	**0.15 / 2.97**
All sites	**Grand total**	**74**	**73**	**57**	**45**	**249**	**32**	**23**	**9**	**1,729.9**	**0.14 / 2.88**

[1] Eastside is a new plot that is surveyed as part of the greater Cottonwood Genetics/CW-North survey site but is reported here separately to enable comparisons across year.

Chapter 4 – Nests, Resights, and Banding

INTRODUCTION

Prior to 2016, intensive nest searching and monitoring were included in the scope of work to detect changes in reproductive performance, assess population health, and create solutions to species decline (DeSante et al. 2005; Hemmings et al. 2012a, 2012b). After 2015, nest searching and monitoring were removed from the project, although field activities, such as surveys and followup visits to determine breeding status or to resight adults, sometimes leads to nests being found. These nests are not typically monitored; however, some monitoring occurs to determine the banded status of adults, and at nests of conservation interest. Similarly, banding has largely been removed from the scope of this project, though minimal banding still occurs and is reported here.

METHODS

Nests

All field work adhered to the Ornithological Council's Guidelines to the Use of Wild Birds in Research (Fair et al. 2010). Field personnel were trained in safe and effective techniques for approaching potential cuckoo nests, emphasizing safety and minimization of disturbance to breeding birds. Yellow-billed cuckoos may be subtle in their distress signals and can abandon nests if disturbed (Halterman 2000). If a bird showed repeated alarm calls for > 5 minutes, observers moved at least 100 m (328 ft) away and waited 30 minutes minimum before cautiously returning to revisit the site. Observers checked for predators before visiting a potential nest and minimized time spent at nests. Flagging may increase predation risk and was used sparingly, placed at least 10 m (32.8 ft) away from nests when possible. To confirm breeding evidence, followup visits occurred in areas with survey detections on the same or another day.

Using a variety of techniques, field crews searched for nests at sites where breeding had not previously been documented. During or after surveys, the vegetation surrounding all survey detections was searched (following Martin and Geupel 1993), as cuckoos may respond to broadcast survey calls from the nest. Searchers also targeted dawn vocal exchanges nesting cuckoos often give when trading incubation duties (Halterman 2009; Hughes 2015; Potter 1980). Surveyors also followed up on localized activity or behavioral clues (e.g., food/ stick carries and alarm calls). Cuckoo nests were confirmed if stick nests contained one or more bluish eggs or cuckoo chicks. Recently used cuckoo nests were identified by the presence of small bluish egg fragments in or below the

nest. After locating a nest, flagging was placed at least 10 m (32.8 ft) away so observers could relocate or avoid the nest, and a Global Navigating and Satellite System location was recorded with distance and bearing to the nest. A more accurate position was sometimes recorded after nesting activity had ceased. Nest site characteristics, such as nest substrate species and height, nest height, stage, and the banded status of adults were also recorded if known. All observations made near active nests were completed as quickly as possible to limit disturbance to nesting birds.

Because banded cuckoos are typically easiest to resight while feeding nestlings, observers sometimes monitored nests to determine the nest stage and resight banded adults. To determine stage, observers watched nests through binoculars or a spotting scope. If nests were low enough (< 7 m [23 ft]), experienced personnel sometimes used a telescoping mirror pole to check nest contents. Most contents were not observed, and nests were typically not monitored to determine fate. Nestlings were banded opportunistically at 3–6 days if accessible (see below, "Banding"). Nests were judged successful if at least one young fledged, determined by detecting an adult or fledgling near the nest ≤ 2 days from the estimated fledge date (approximately 6 days after hatching). Nests were considered failed if found damaged or destroyed, with large eggshell fragments or remains, or empty before the earliest possible fledge date with no further activity detected nearby. Nests were considered deserted or abandoned if intact eggs or live chicks were present with no further parental activity detected. Multiple females' eggs in one nest were suggested by the appearance of two eggs in one 24-hour period during laying, or the appearance of a new egg > 2 days after laying had apparently ceased (MacWhirter 1989), based on cuckoos typically laying one egg per day until clutch completion (Jay 1911; Potter 1980).

Resights

Field crews attempted to resight previously banded cuckoos by observing with binoculars or photographing the legs of cuckoos detected during field work. The main objective was to resight up to seven cuckoos previously fitted with GPS tags in 2014 and 2015 and not yet recaptured (Parametrix and SSRS 2019). If a band color combination suggested a GPS-tagged bird, a crew immediately visited the area to relocate the bird. If a GPS-tagged bird were positively resighted, a banding crew would visit the area as soon as possible to attempt to recapture it (see below).

Banding

In 2021, if a cuckoo previously fitted with a GPS tag was resighted, up to two attempts would be made to recapture the bird to remove the tag and download the

data. If no birds carrying GPS tags were resighted or captured, other options were proposed, one being the capture of two birds at a site with no previous capture attempts. If no capture attempts were made, these attempts would carry over into upcoming years. For example, two unused capture attempts in 2021 would carry over into 2022, when four attempts could be made.

To capture adult cuckoos, a banding crew found or created a suitable net lane, such as a gap in the vegetation, and used a modified target mist net technique (Sogge et al. 2001). Three stacked nets 7.8 to 15 m (25.6 to 49.2 ft) high, ranging in length from 9 to 18 m (29.5 to 59 ft) were attached between two canopy poles (Bat Conservation and Management, Inc., Pennsylvania). Speakers placed on either side of the net broadcast recorded vocalizations to lure cuckoos into the net. Capture attempts ceased when temperatures reached 40 °C (104 °F) or when cuckoos became unresponsive.

Unbanded cuckoos newly captured in 2021 were banded with a silver Federal band on one leg and a pinstriped (two or three-striped color) aluminum band on the other leg to form a unique color combination. Non-targeted species were immediately released from nets without being banded. A stopped wing rule was used to measure wing and tail length, calipers were used to measure bill length, and a 100-gram (3.5-ounce) Pesola® or 400-gram (14.1-ounce) Acculab digital scale was used to weigh the birds. For adults, molt, feather wear, orbital ring color, cloacal protuberance score, and brood patch score were also recorded following the Monitoring Avian Productivity and Survivorship protocol (DeSante et al. 2015). For future sexing, a small amount of blood was extracted from the brachial vein of each newly captured cuckoo, placed on filter paper, and dried.

RESULTS

Nests

Between July 8 and August 2, 2021, nine nests were found in the study area, including five nests at the PVER (two in Phase 5, two in Phase 6, and one in Phase 7), three at Cibola NWR Unit #1 (one in Upper Hippy Fire, one in Nature Trail, and one in Eastside), and one at the YEW (South) (table 6). All nests were found during followup visits while attempting to resight GPS-tagged birds or determine breeding status.

Known nesting activity began July 8 at Cibola NWR Eastside and ended August 9 at PVER Phase 5. The nests were found in Fremont cottonwoods (n = 5), Goodding's willows (n = 2), and honey mesquite (n = 2). Nest tree heights ranged from 4 m (13 ft) to 18 m (59 ft), with an average of 10.8 m (35.4 ft). Nest heights ranged from 1.8 m (5.9 ft) to 13 m (43 ft) and averaged 7.2 m (23.6 ft).

Table 6.—Nests found in the LCR MSCP study area in 2021

Area	Site	Nest #	Date found	Tree sp.[1]	Tree height (m)	Nest height (m)
Cibola NWR Unit #1	Eastside	1	July 8	POPFRE	8	1.8
Cibola NWR Unit #1	Upper Hippy Fire	1	July 8	SALGOO	13	9.2
Cibola NWR Unit #1	Nature Trail	1	July 15	POPFRE	16	13
PVER	Phase 6	1	July 15	PROGLA	4.2	2
PVER	Phase 5	1	July 20	POPFRE	12	7.8
PVER	Phase 7	1	July 20	POPFRE	12.9	10
YEW	YEW S	1	July 29	PROGLA	4	2.5
PVER	Phase 6	2	July 31	POPFRE	18	15
PVER	Phase 5	2	August 2	SALGOO	9.4	4.3

[1] POPFRE = Fremont cottonwood, PROGLA = honey mesquite, and SALGOO = Goodding's willow.

The fates of some nests were discovered during attempts to resight nesting adults. Four of the nine nests successfully fledged at least one young, two nests were depredated, and one nest was abandoned after the incubation period of normally 10 days reached over 15 days. The fates of the other two nests are unknown. The four successful nests included PVER Phase 6 Nest 1 and Cibola NWR Unit #1 (Middle Hippy Fire Nest 1, Eastside Nest 1, and YEW Nest 1). Five young were opportunistically banded from two of the successful low nests: Eastside Nest 1 (three chicks) and YEW Nest 1 (two chicks, see "Banding" below). Two relatively high nests, PVER7 Nest 1 and Nature Trail Nest 1, had unknown fates with no evidence of hatching or feeding.

Resights

Three cuckoos banded in previous years were positively resighted in 2021 (table 7). One was satellite tagged in 2019 under a separate Smithsonian funded study and resighted at Hippy Fire Nest 1. Surveyors caught glimpses of other banded cuckoos that were not identified to individual. No GPS-tagged birds were positively resighted in 2021.

Table 7.—Cuckoos resighted in the LCR MSCP study area in 2021

Resight site	Resight date	Bird ID[1]	Color Bands[2]	Age[3]	Sex[4]	Original capture site	Original capture date
Upper Hippy Fire	July 17	MAC	R/mB-Lv-mB	ATY	F	Upper Hippy Fire	July 7, 2019[5]
PVER 6S	June 29	SER	S/W-Lv-W	A9Y	M	PVER 5N	July 12, 2013
PVER 6S	July 18	TAS	S/W-G-W	A7Y	M	PVER 6S	June 19, 2016

[1] Bird ID: unique three-character identifier of the individual cuckoo.
[2] Color bands (left/right, top to bottom): G = green, Lv = lavender, mB = mid- blue, R = red, S = silver, and W = white; hyphen (-) indicates a split band consisting of two or three colors.
[3] Age: ATY = after third year, A7Y = after seventh year, and A9Y = after ninth year (9+ years old).
[4] Sex (confirmed by deoxyribonucleic acid [DNA] test): F = female, and M = male.
[5] Banded under a separate Smithsonian-funded study.

Banding

As no GPS-tagged cuckoos were resighted in 2021, the option was exercised to band birds at the LDCA or YEW. One bird was successfully captured at YEW South (TUM; table 8). Additionally, five chicks were opportunistically banded from low nests (table 8).

Table 8.—Cuckoos newly banded in the LCR MSCP study area in 2021

Date banded	Site	Age[1]	Band number	Bird ID[2]	Color bands[3]
July 24	YEW South	AHY	1713-67999	TUM	S/Lv-O
July 9	Eastside	L	1212-27584	N1 C1	W-Y/S
July 9	Eastside	L	1212-27585	N1 C2	Ag-O-Ag/S
July 9	Eastside	L	1212-27586	N1 C3	W-Lv/S
July 31	YEW South	L	1212-27588	N1 C1	R-lB/S
July 31	YEW South	L	1212-27589	N1 C2	R-Ag/S

[1] Age: AHY = after hatching year (adult at least 1 year old), and L = locally hatched young of the year.
[2] Bird ID: unique three-character identifier of adult or nest (N) and chick (C) number of young.
[3] Color bands (left/right, top to bottom): Ag = gold, lB = light blue, Lv = lavender, O = orange, R = red, S = silver, W = white, and Y = yellow; hyphen (-) indicates a split band consisting of two or three colors.

DISCUSSION

Survey detections in 2021 were down from the previous year across the study area, including the Bill Williams River NWR and all LCR MSCP conservation areas. Likewise, breeding evidence was also down in all areas compared to 2020. In recent years, the PVER has supported the largest known breeding population in California, and the highest productivity in the study area, from 2011 (McNeil et al. 2013b) to 2021. Survey detections and estimated territories have been trending downward there since a high of 204 detections in 2014 (Parametrix and SSRS 2019), falling to 122 in 2020 and 92 in 2021. The Cibola NWR, the second most productive area on the river in recent years, also had fewer detections in 2021, though individual sites saw local increases, such as the 2-year-old Eastside plot. This area had higher-than-average detections and confirmed breeding, corresponding with the finding that nesting cuckoos favor dense patches of young native riparian forest (Stanek et al. 2021; Wohner et al. 2021).

The June wildfire at the eastern end of the Bill Williams River NWR was unsurprising given its recent history and current conditions. Until 2021, the area had seen increased cuckoo activity after 2017 when no cuckoos were detected on surveys (Parametrix and SSRS 2018, 2019; Tracy et al. 2021). The large areas of riparian forest dominated by tamarisk and dead woody debris, combined with ongoing regional drought, created conditions favoring the spread of the > 500-ha (1,260-ac) Planet Ranch Fire. Cottonwoods and willows can regenerate post-fire; however, increasing fire intensity or frequency reduces their resilience in favor of non-native species such as tamarisk (Webb et al. 2019). Wildfire and the loss of vegetative cover may also reduce the emergence and number of cicadas that breeding cuckoos depend on (Smith et al. 2006). With the last wildfire in the refuge occurring 14 years ago in 2007, the 2021 wildfire may portend a shift to a shorter fire return interval. Longer fire return intervals of > 35 to > 200 years are more typical in unregulated rivers in the Southwestern United States, where scouring floods limit the buildup of highly combustible fine fuels and litter in the understory (Webb et al. 2019). In the short term, fire may benefit the area by clearing out the large amounts of woody debris and enabling native seeds to germinate; the refuge is currently preparing a Burned Area Emergency Response proposal for funding to rehabilitate the area (Seavey 2021, personal communication). However, frequent fire tends to benefit tamarisk, which further promotes frequent fire (Busch 1995; Stromberg 2001; Webb et al. 2019). Burning of tamarisk and willow associations along the LCR was found to favor tamarisk, with impacts ranging from direct mortality to reduced propagule spread and willow establishment (Busch and Smith 1992). Riparian vegetation here increased since 1968, but most new vegetation biomass was tamarisk (Stromberg 2001). Since 2000, riparian health and its water use have been declining along the LCR based on remotely sensed data, representing a loss of green vegetation

over the last two decades (Nagler et al. 2021). These results suggest further deterioration of biodiversity, wildlife habitat, and other key ecosystem services in this region.

Cuckoo surveyors in southeast Arizona, which supports the largest population of cuckoos in the Southwestern United States, also found fewer detections and little breeding evidence in 2021 (Sferra 2021, personal communication). Monsoon storms were late, and even after they arrived, cuckoos were not found in areas of previous nesting. It is unknown if the low numbers were driven by late monsoon arrival or other factors facing cuckoos on their wintering grounds or migration routes. A range-wide western cuckoo occupancy assessment in 2022 led by the Arizona Game and Fish Department (Juárez 2021, personal communication) could add valuable information on breeding locations and a better count of their current numbers.

In 2021, as in previous years (McNeil et al. 2020; Parametrix and SSRS 2018, 2019), a pair at the PVER abandoned a nest containing one egg after 15+ days of incubation. It is unusual for just one egg to be laid in a nest (Laymon 1998), so something may have caused one or more eggs to be removed from the nest before it was found, such as extreme weather or predation. It is unknown if an event drove one parent to abandon the nest, leaving the egg exposed, or if the egg was infertile.

Presence surveys for yellow-billed cuckoos cannot detect trends in survivorship, movement by individuals between occupied conservation areas, or measure nest success and productivity. The method has limited inference to identify detailed aspects of habitat that are associated with increases in productivity of yellow-billed cuckoo populations. Additional data would need to be collected to provide this information. Reduced banding and nest monitoring since 2016 have led to fewer yearly resights, an ageing cohort of banded cuckoos in the study area, and only estimated territory numbers and incidental detections of nests. The limited banding and nest monitoring that have continued throughout the project, despite the variable annual effort, may still be informative (e.g., a 9+ year cuckoo resighted in 2021 is now the oldest cuckoo on record). In the Yuma area, the banding of three chicks in 2018 at YEW, one adult in 2019 at YEW, an adult and two chicks in 2020 at the LDCA, and an adult and two chicks in 2021 at YEW, may help add to current knowledge of dispersal and site fidelity in future years.

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ATTACHMENT 1

Maps of Survey Sites and Transects, Lower Colorado River Multi-Species Conservation Area (LCR MSCP) Study Area, 2021

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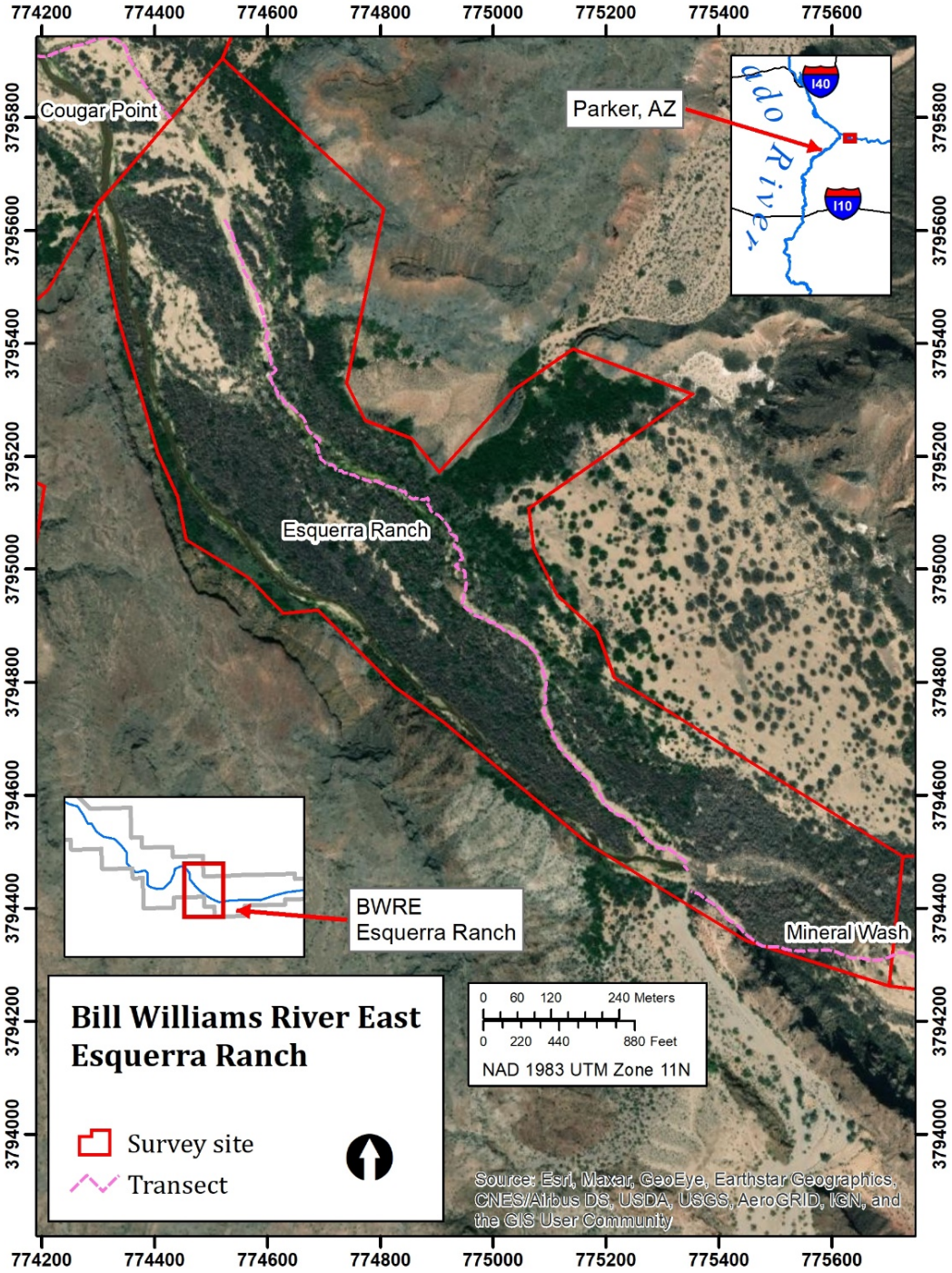

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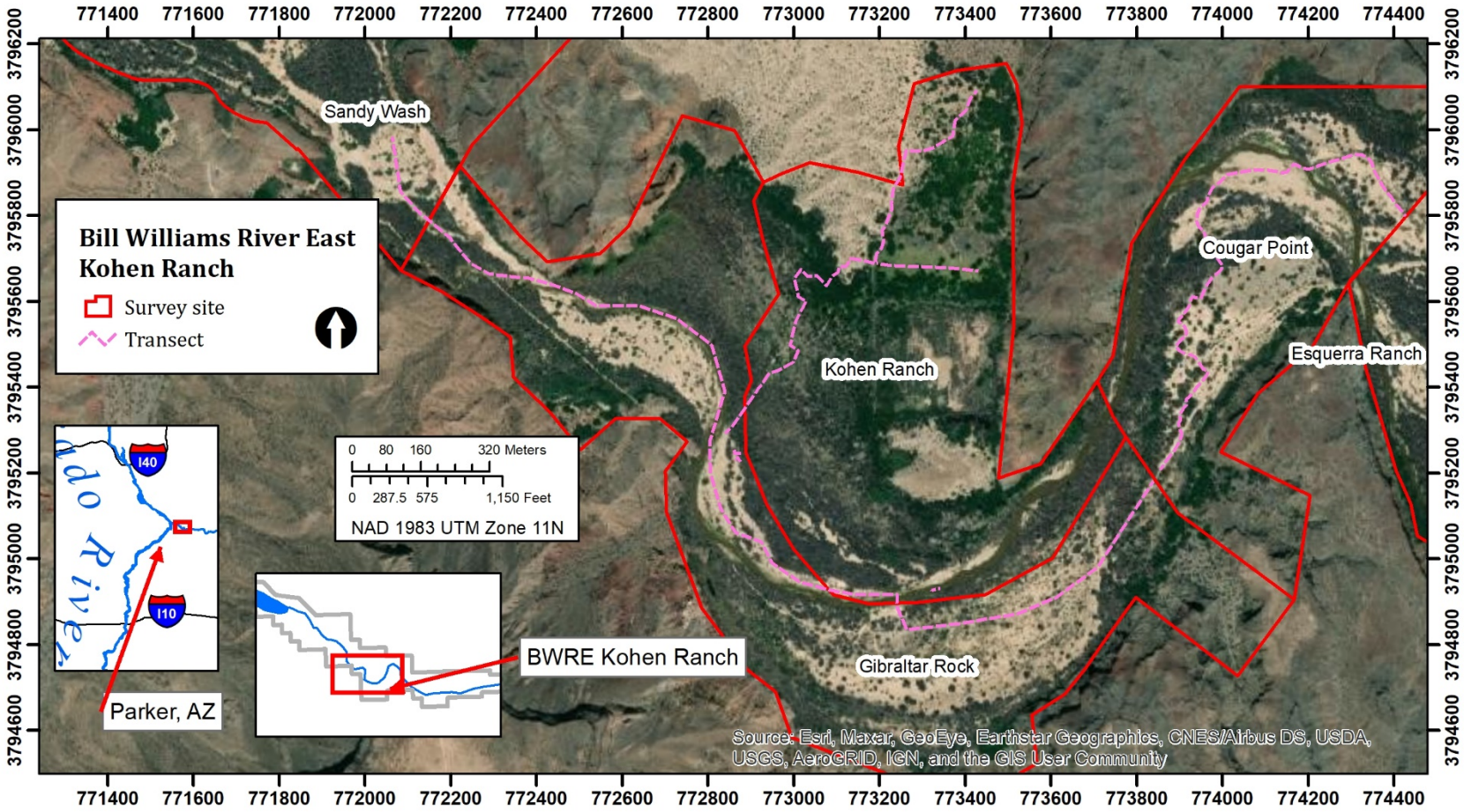

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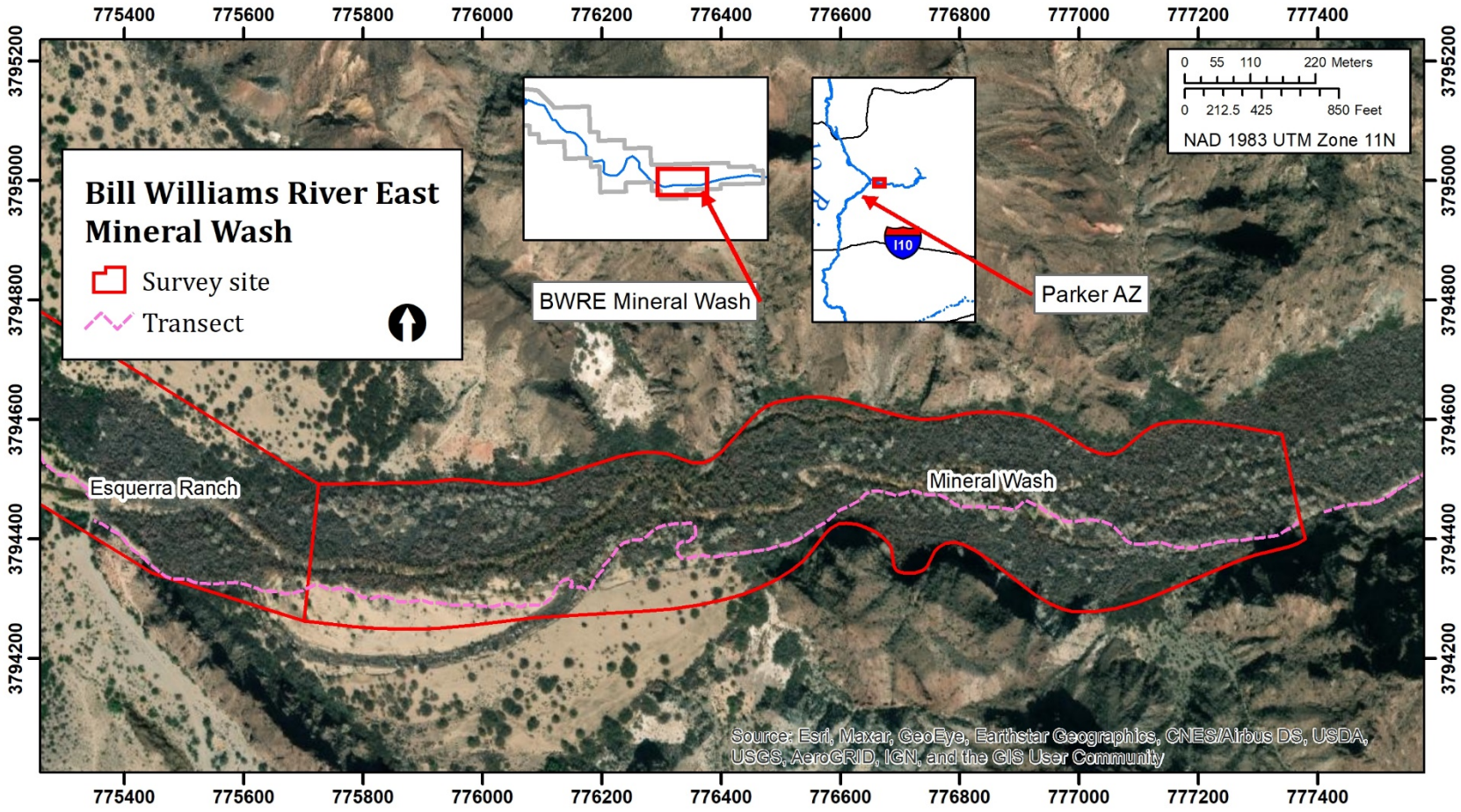

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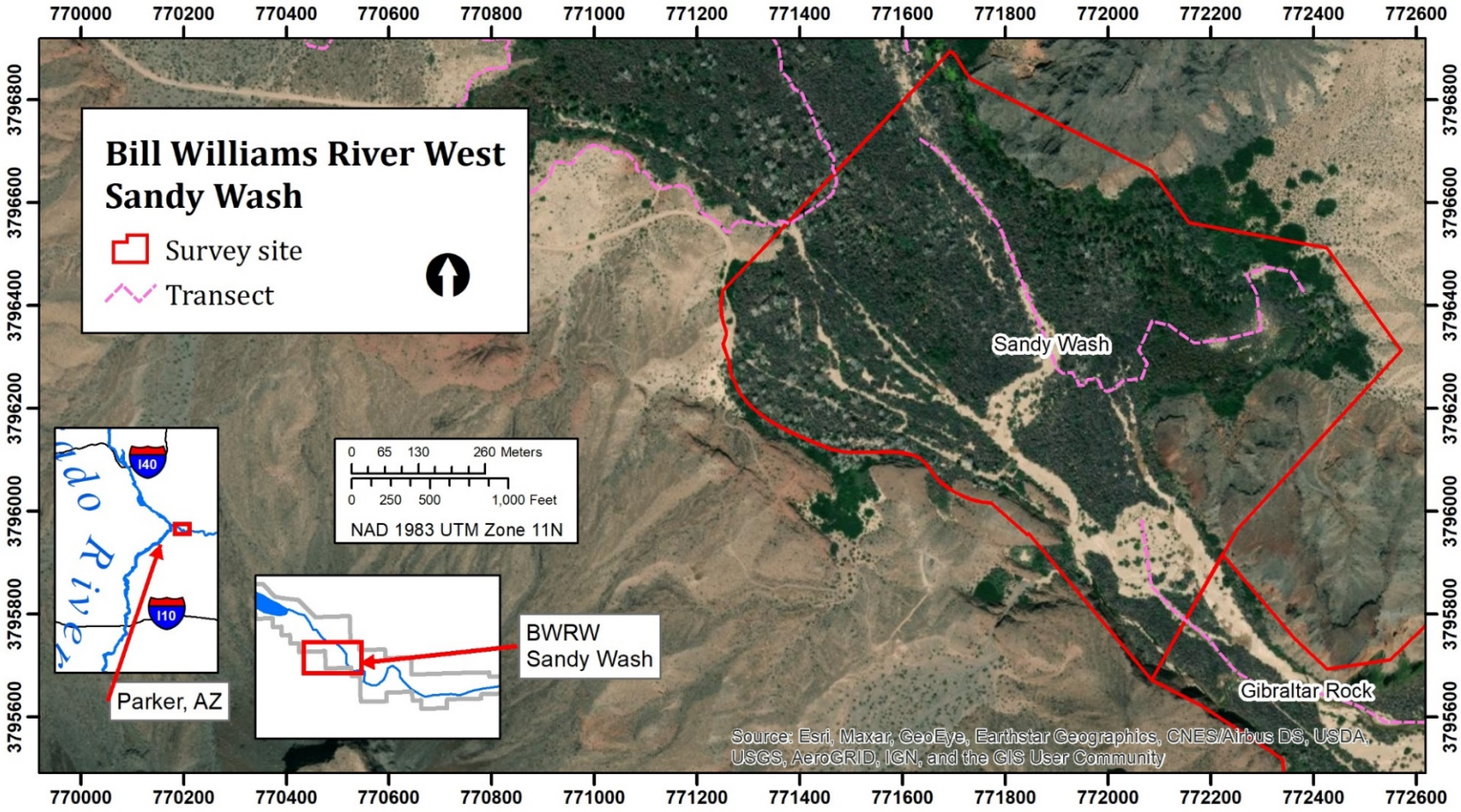

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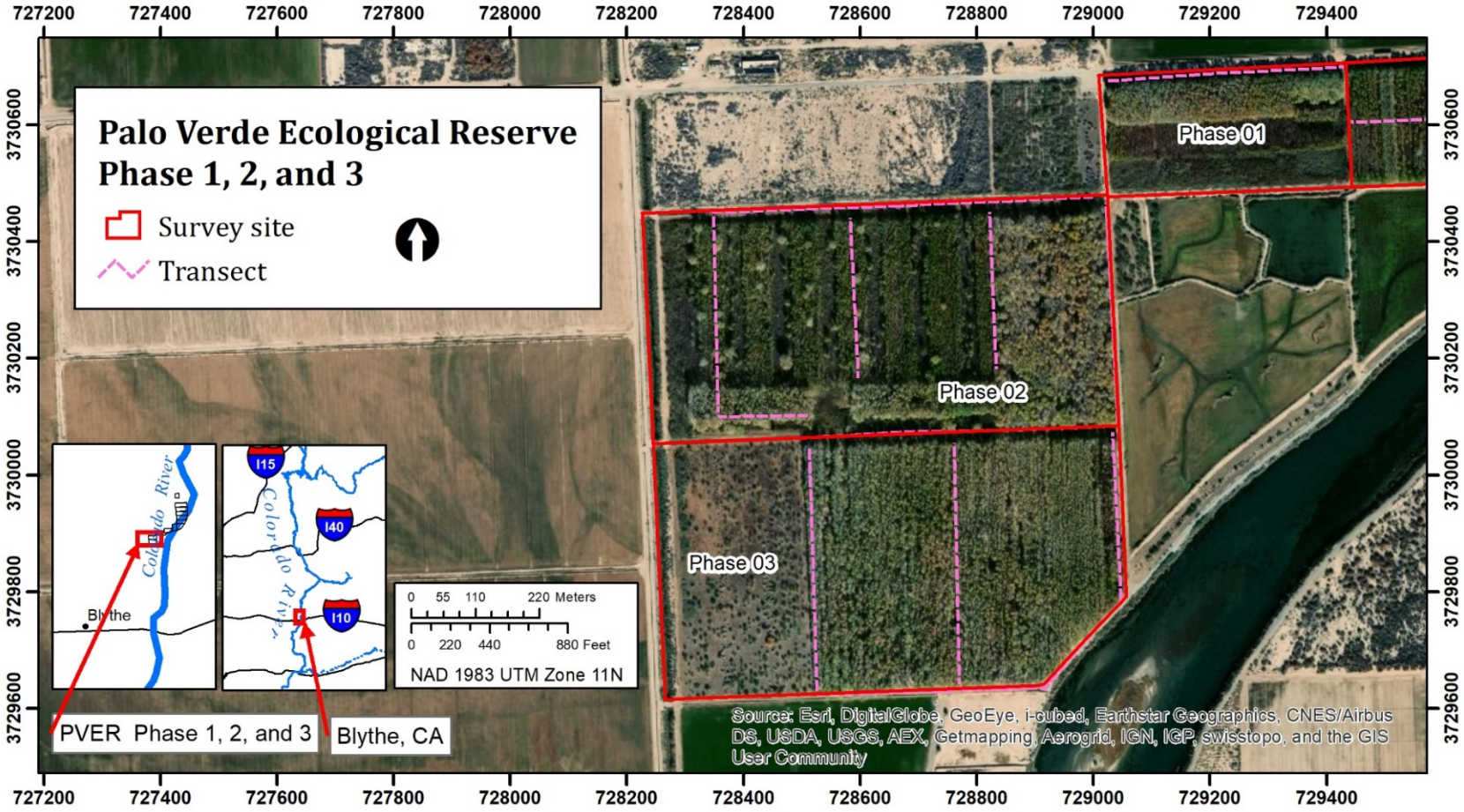

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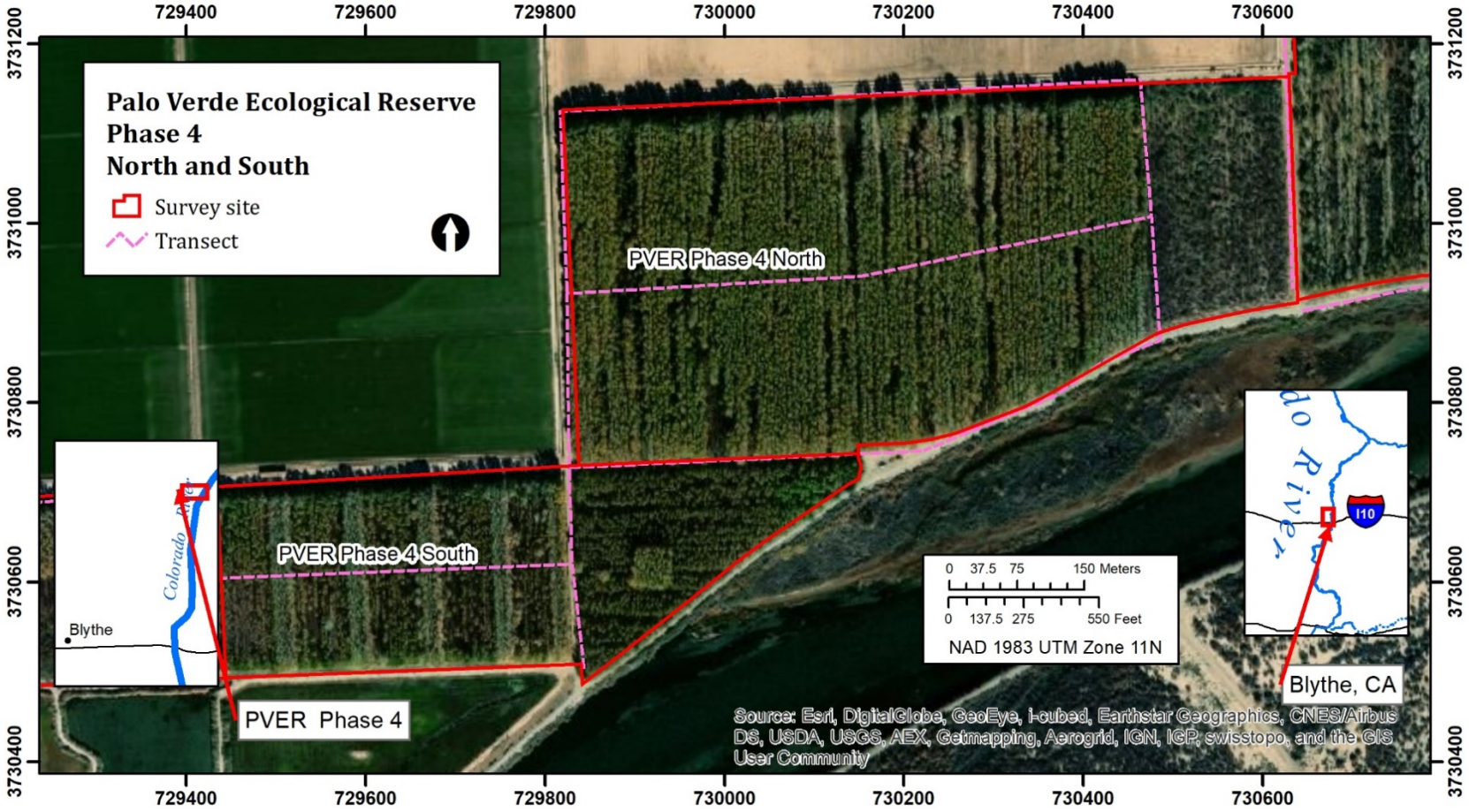

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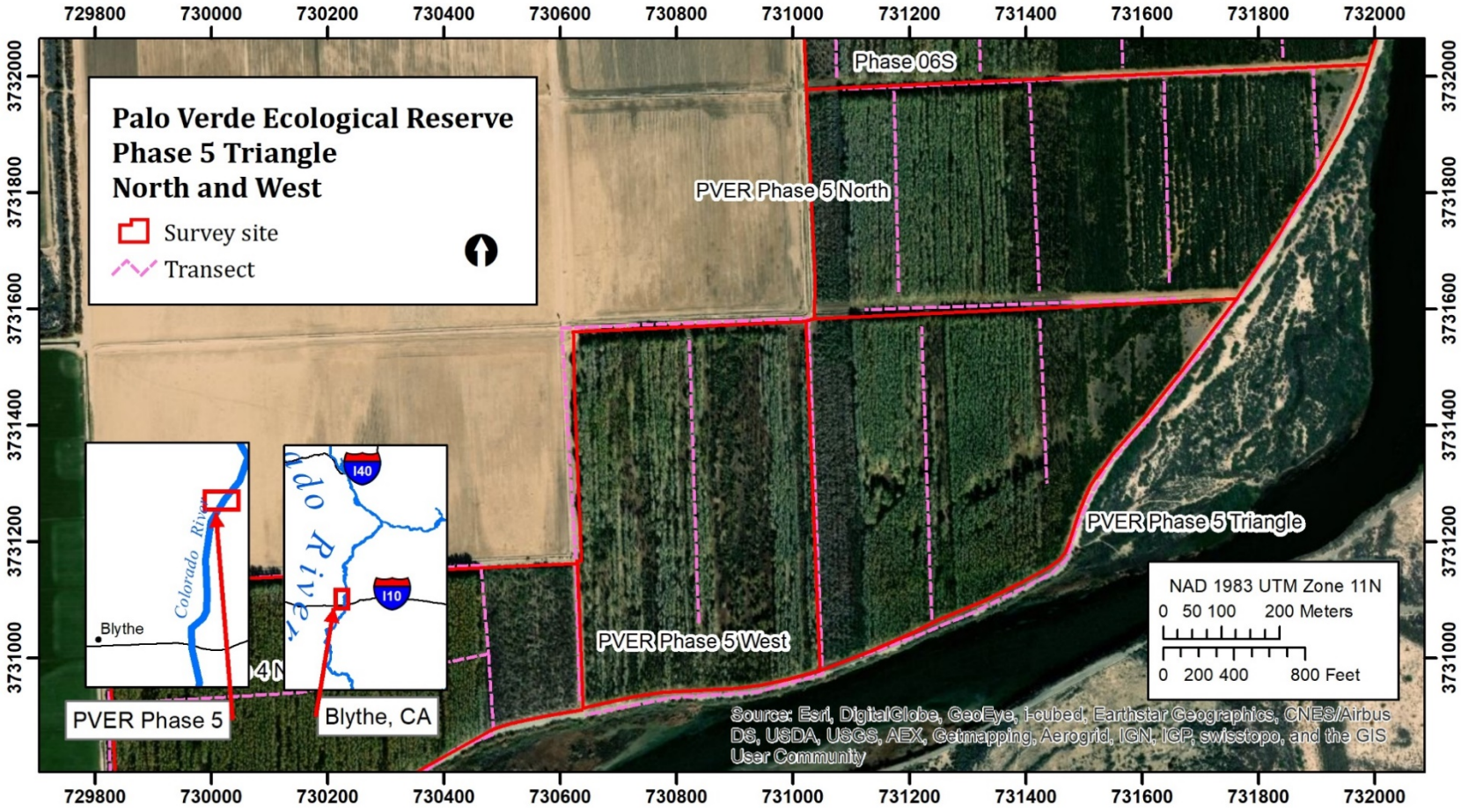

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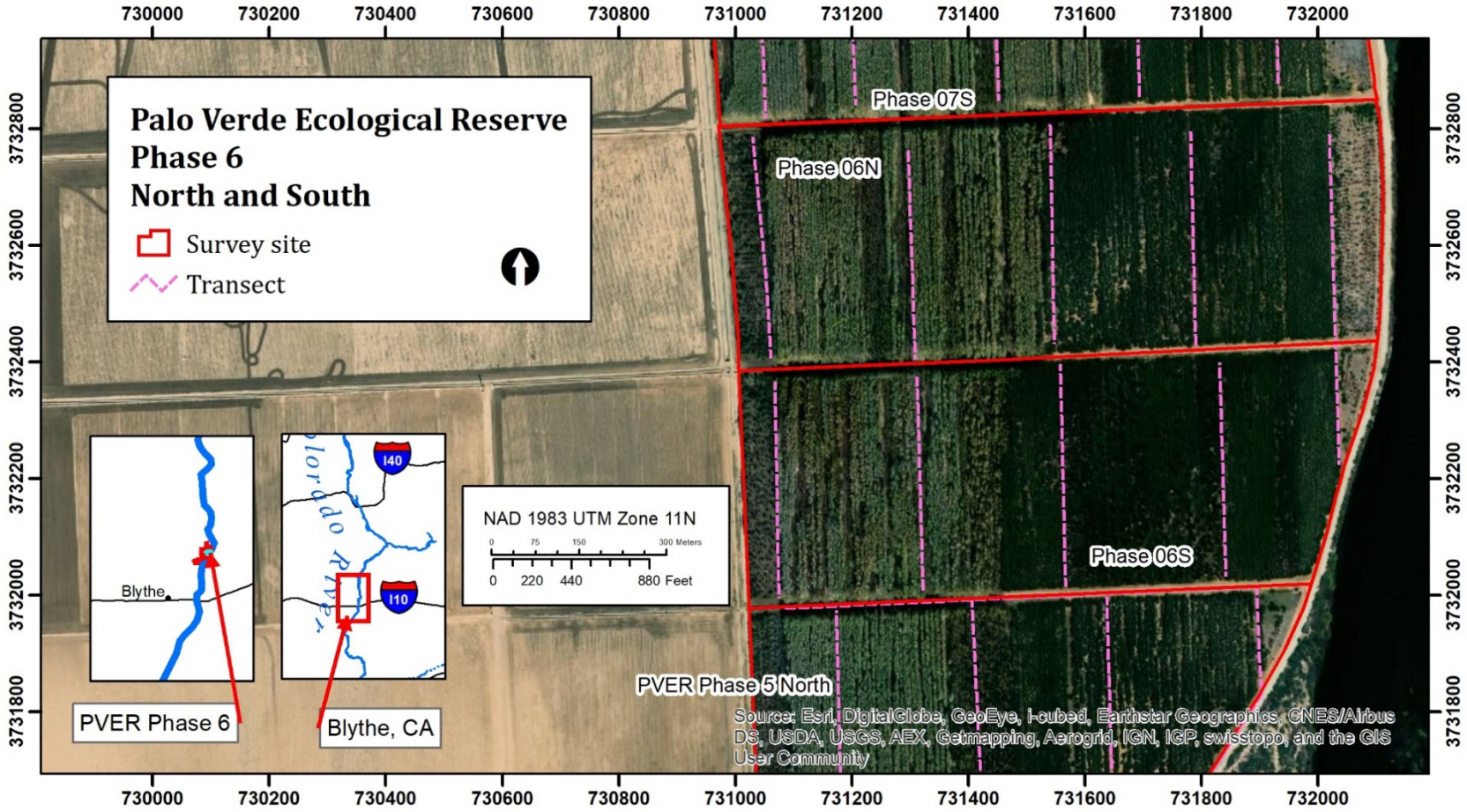

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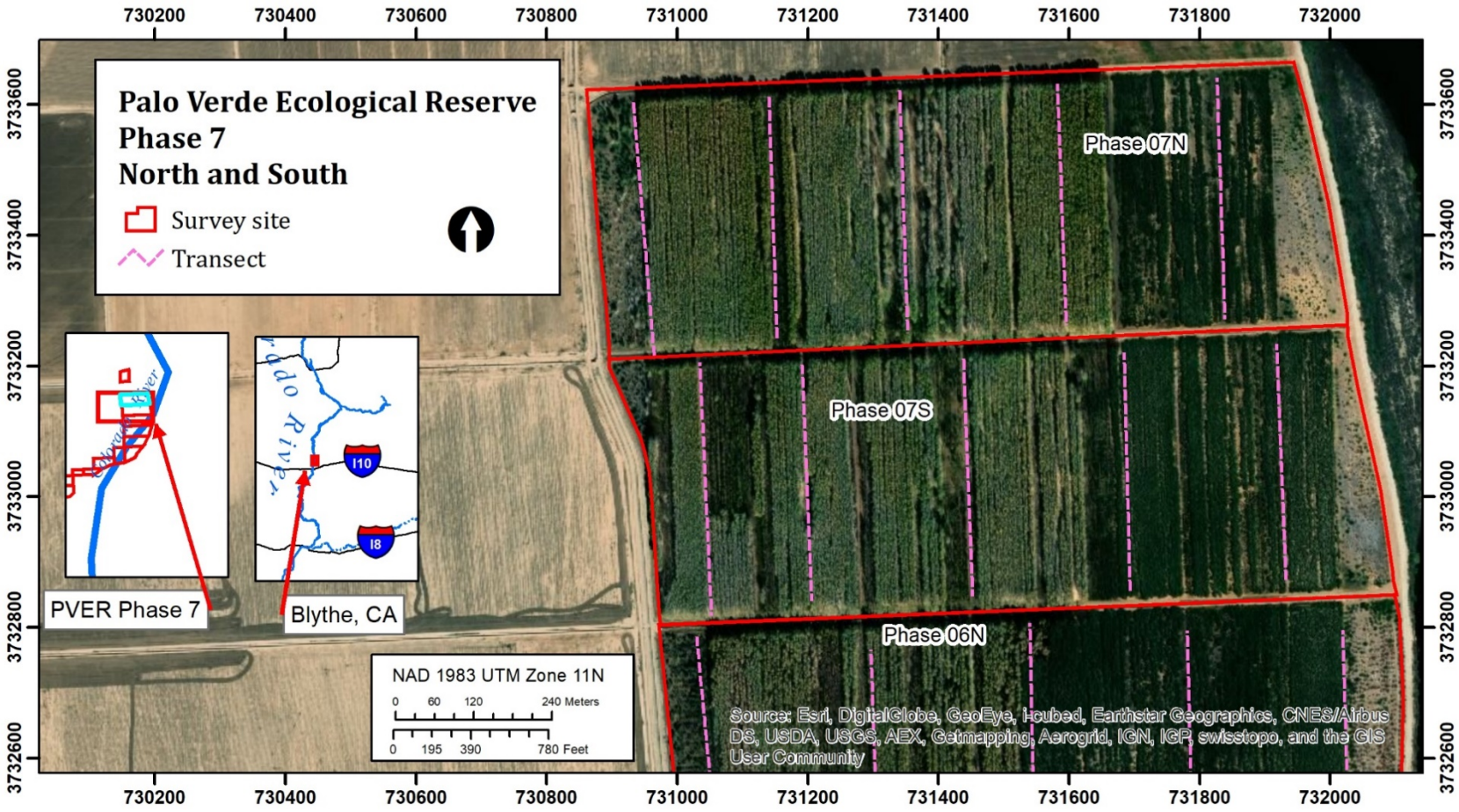

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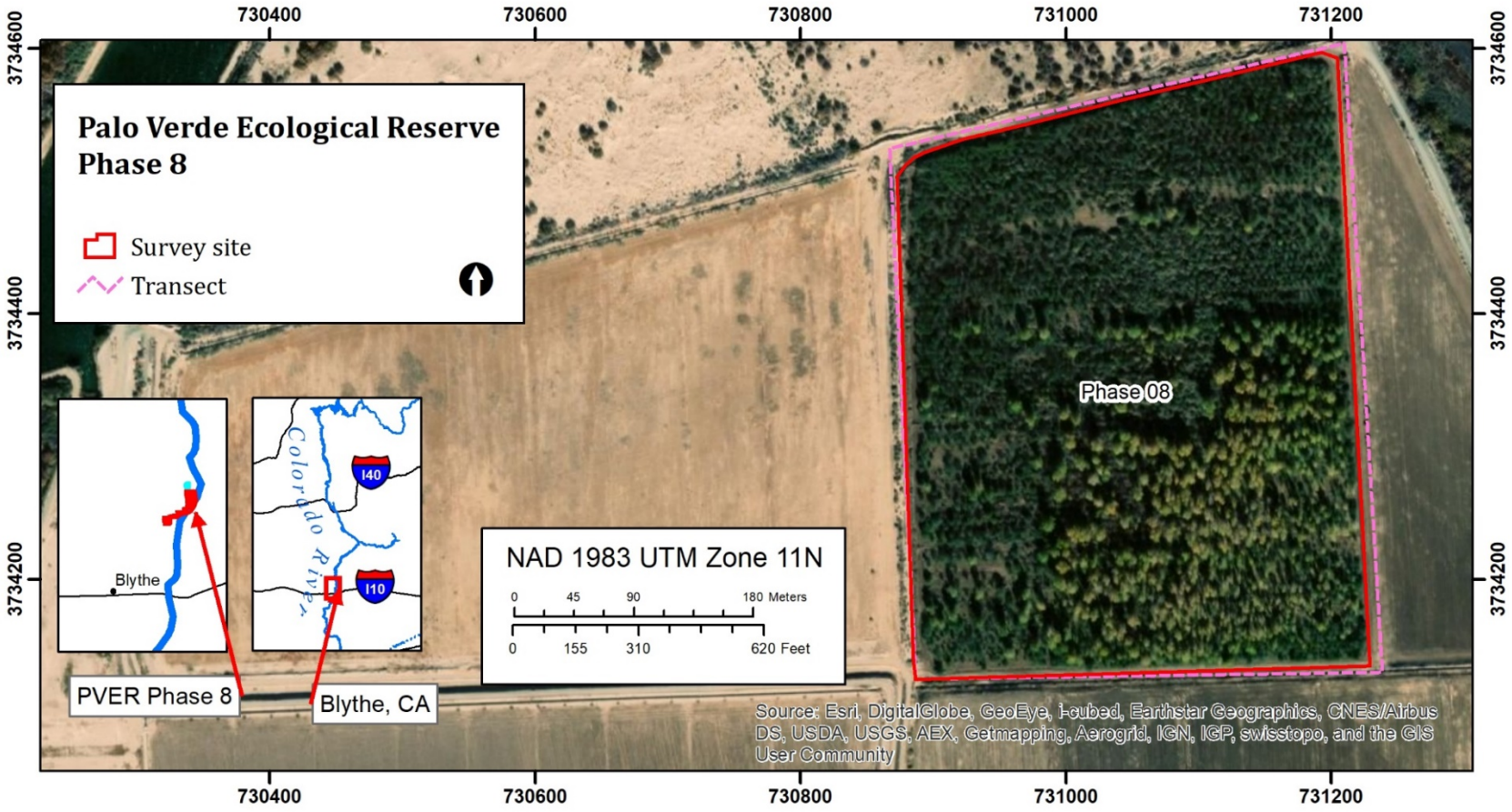

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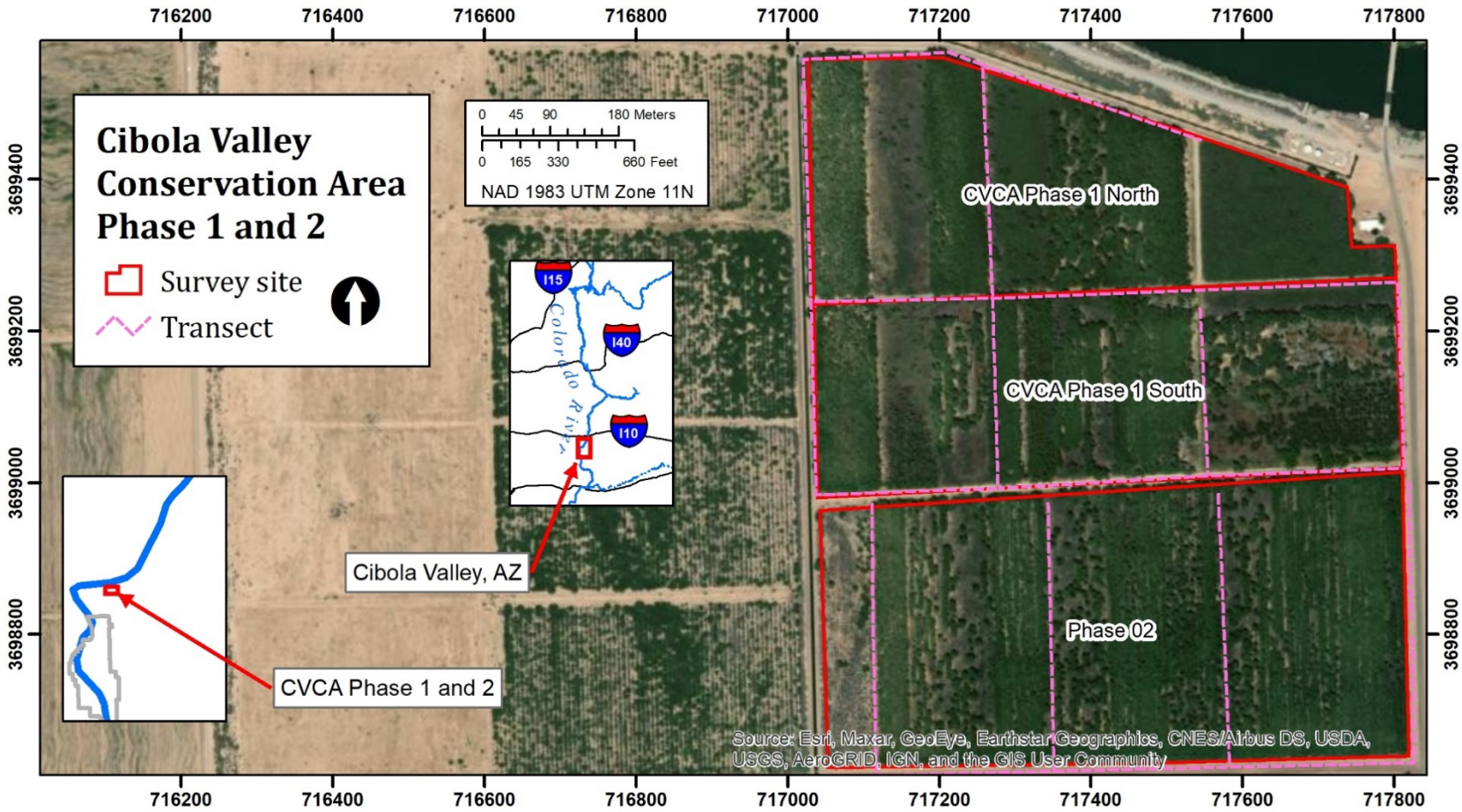

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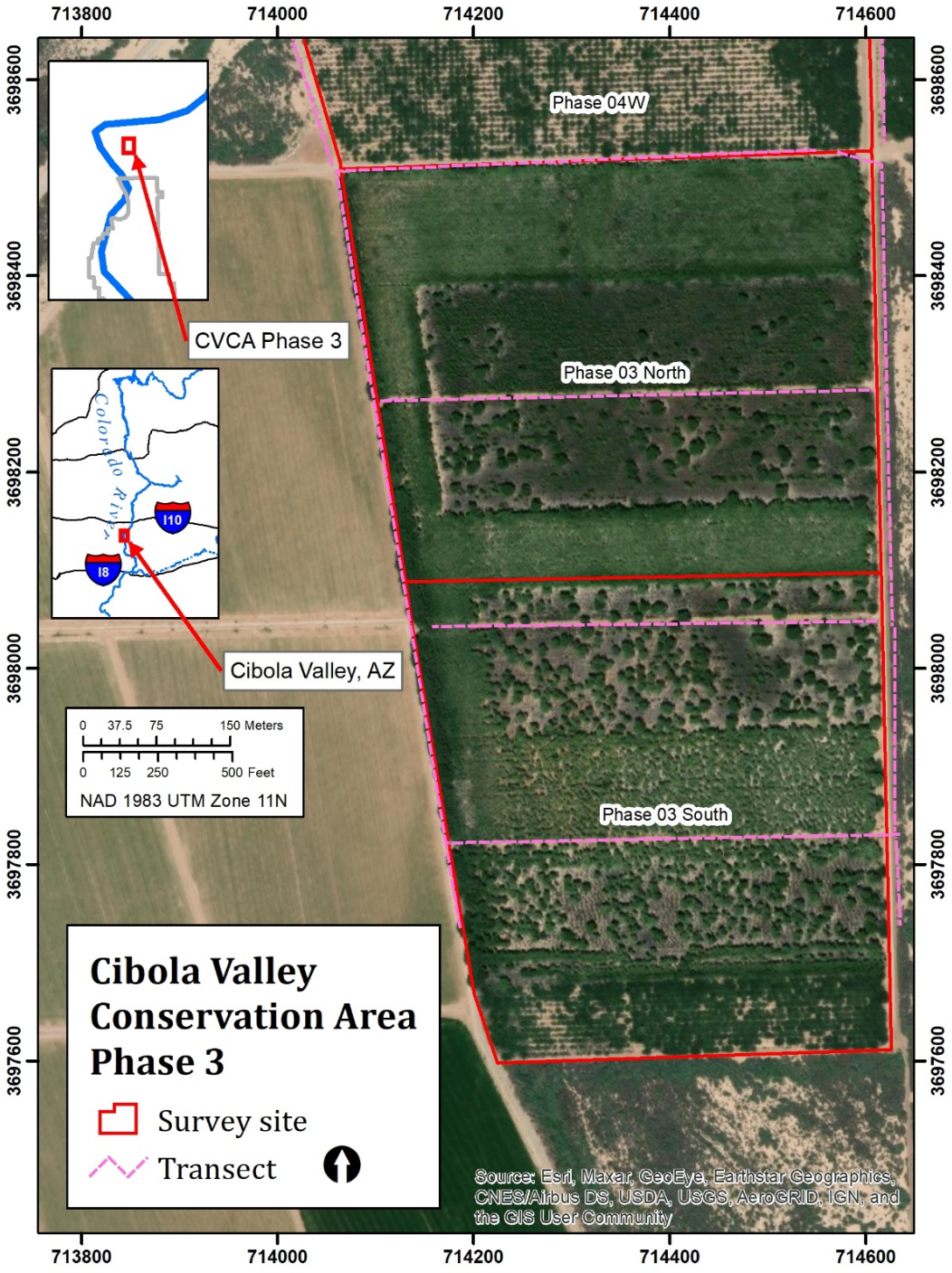

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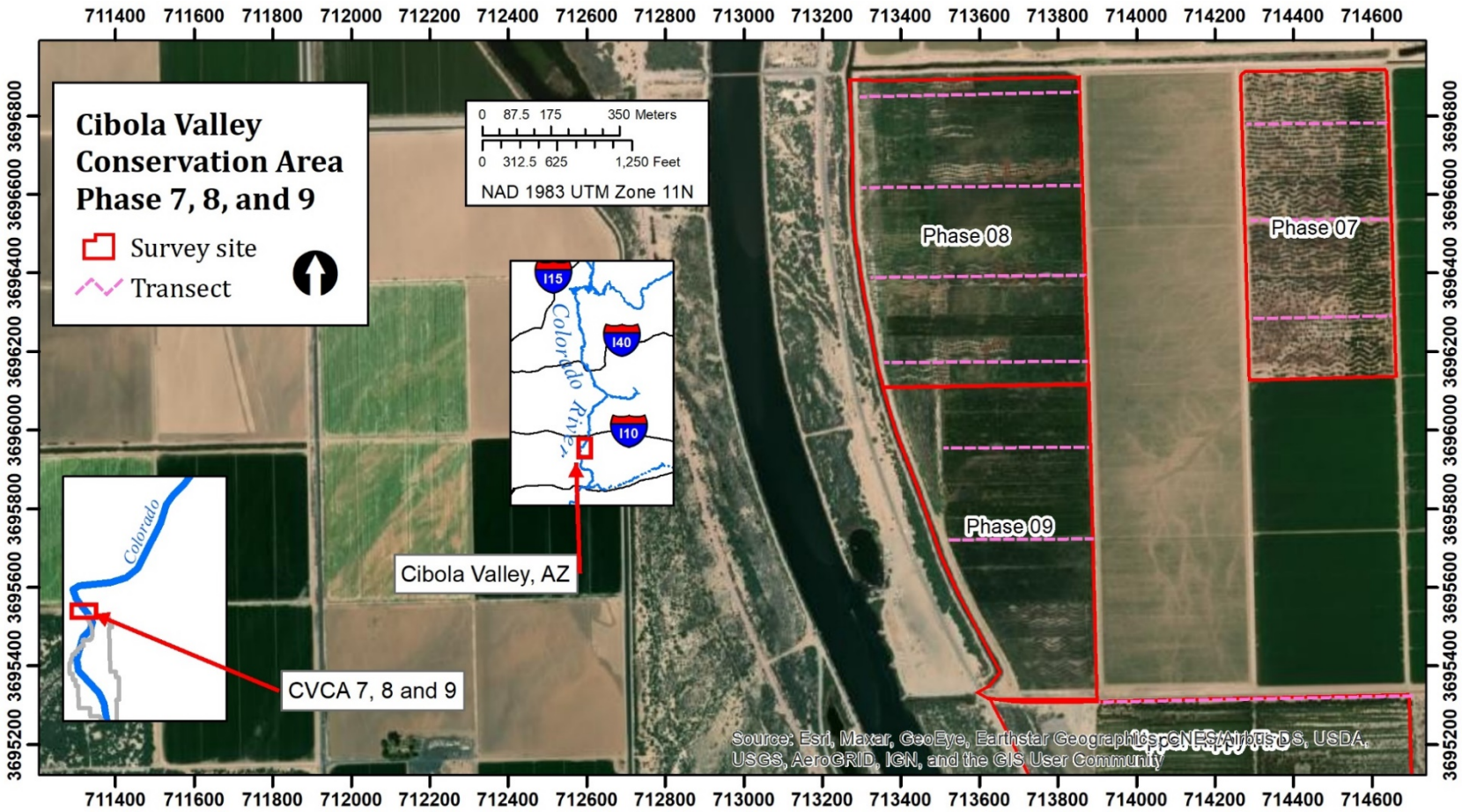

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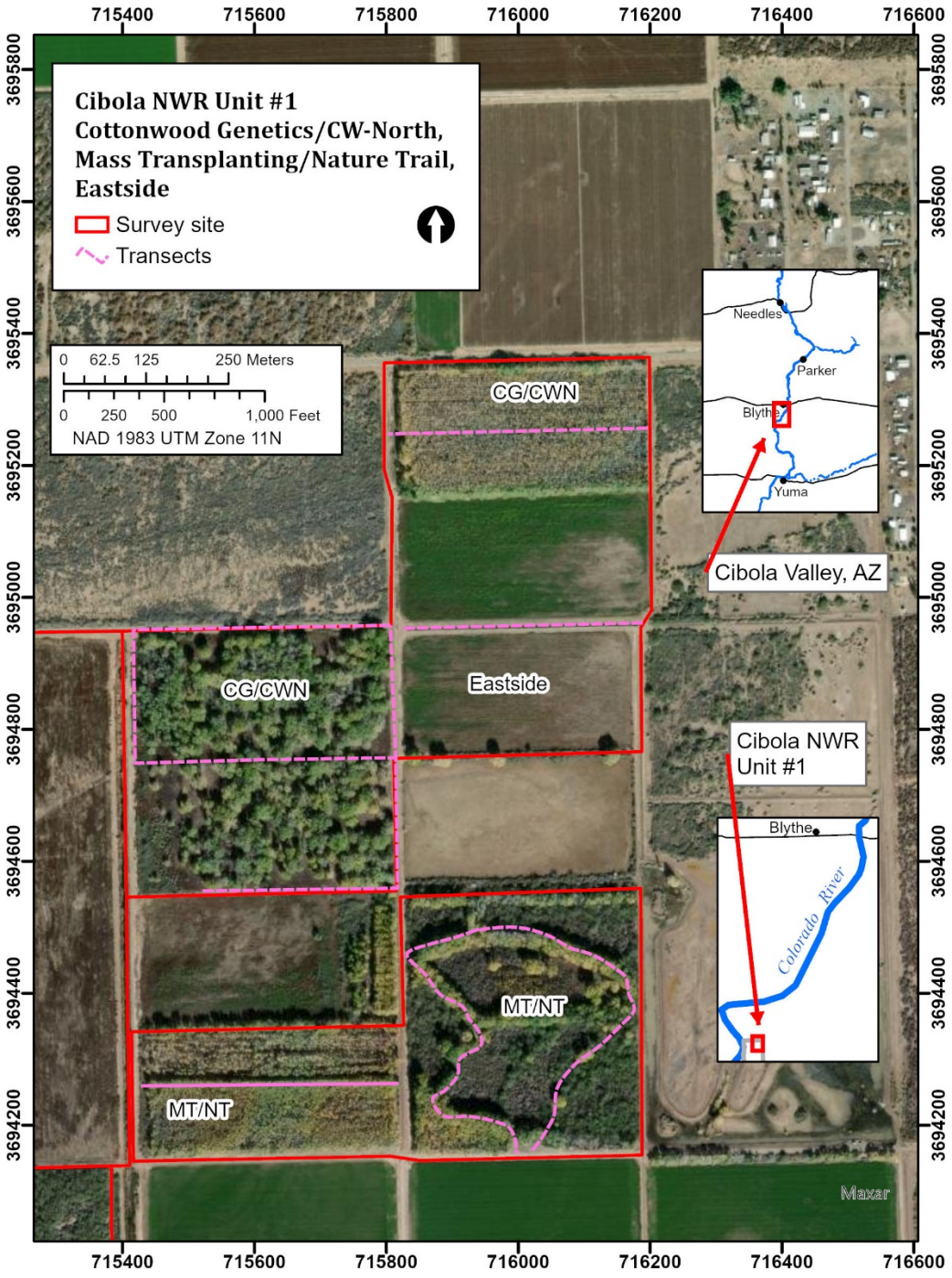

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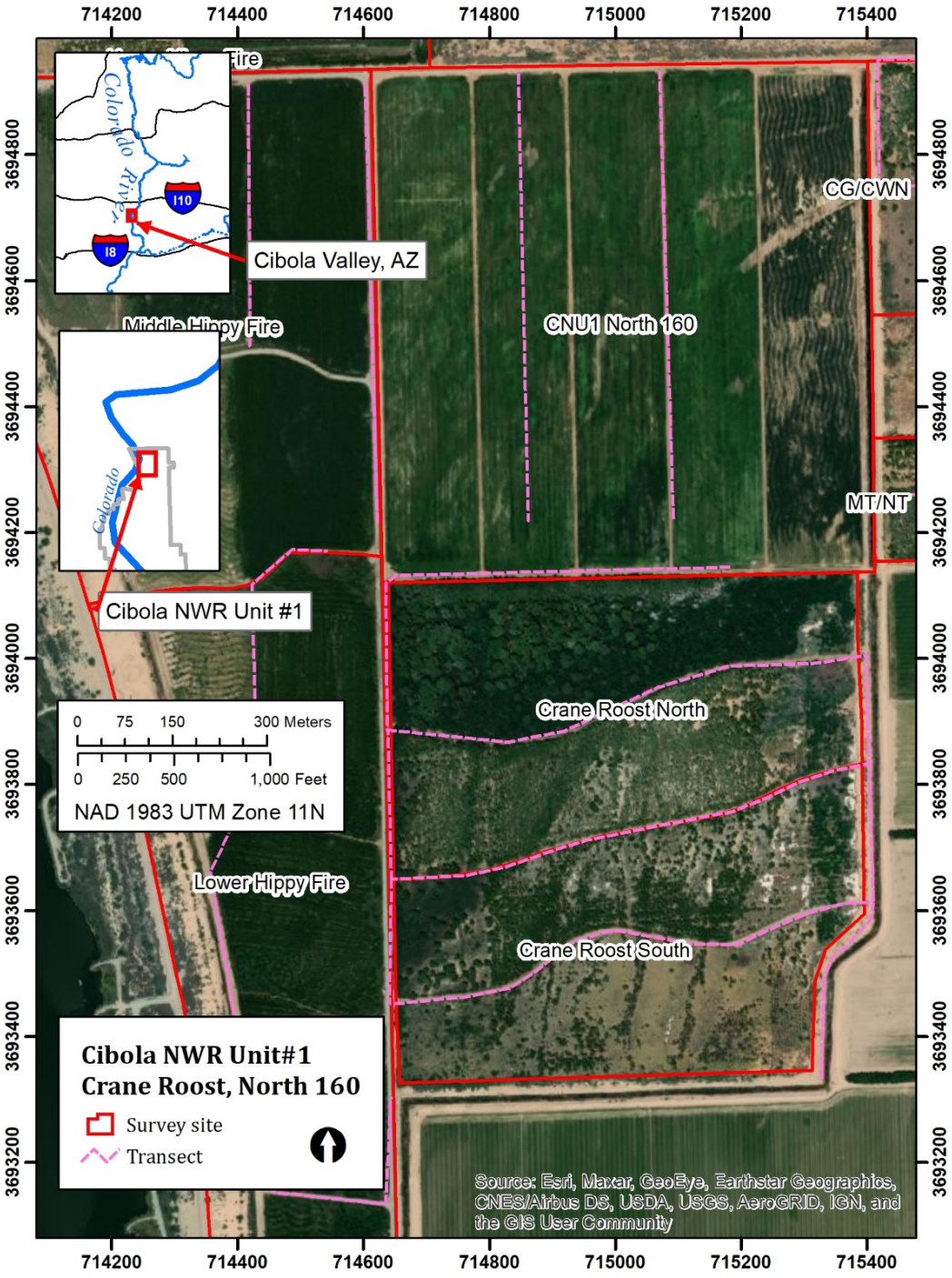

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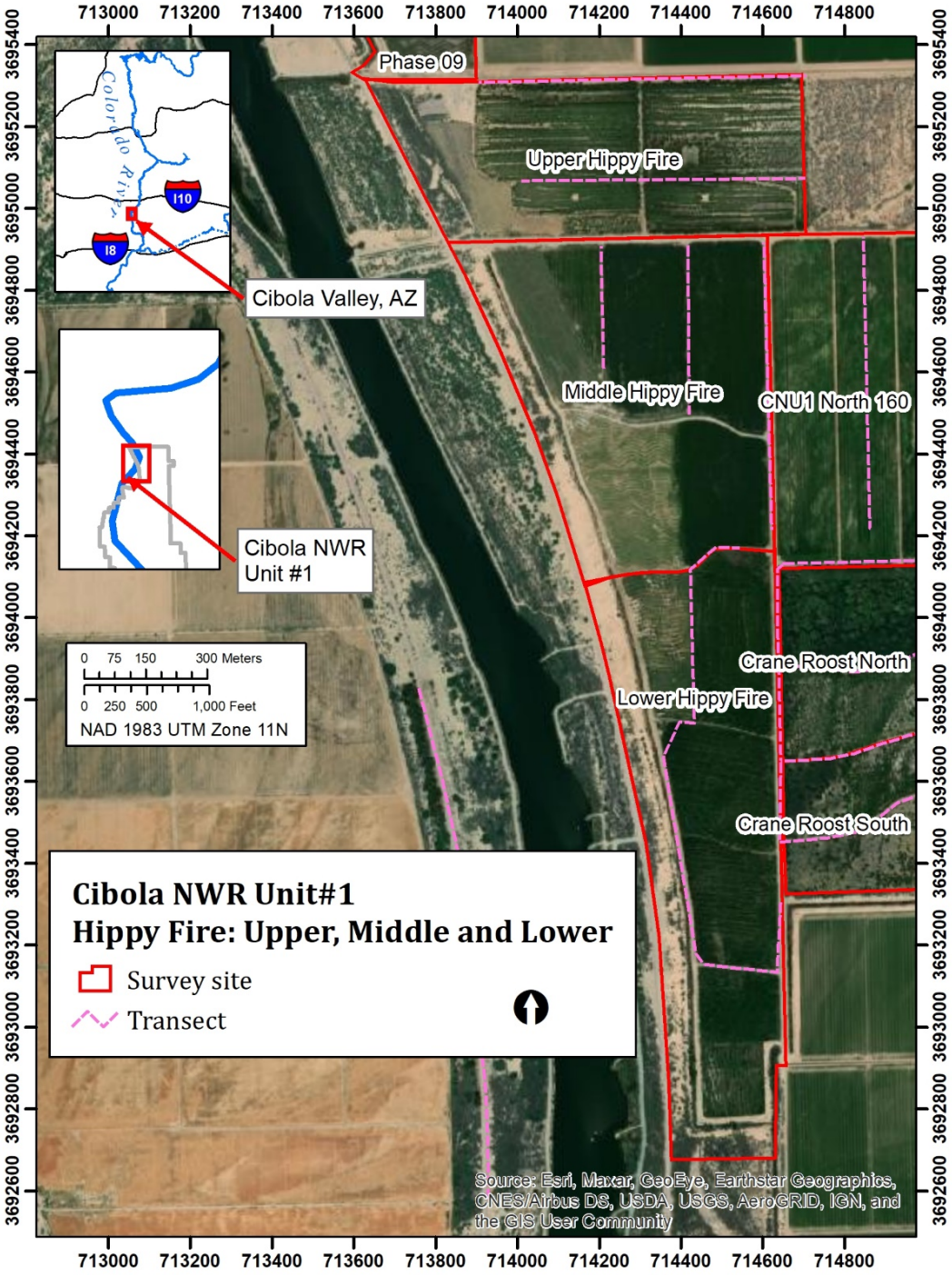

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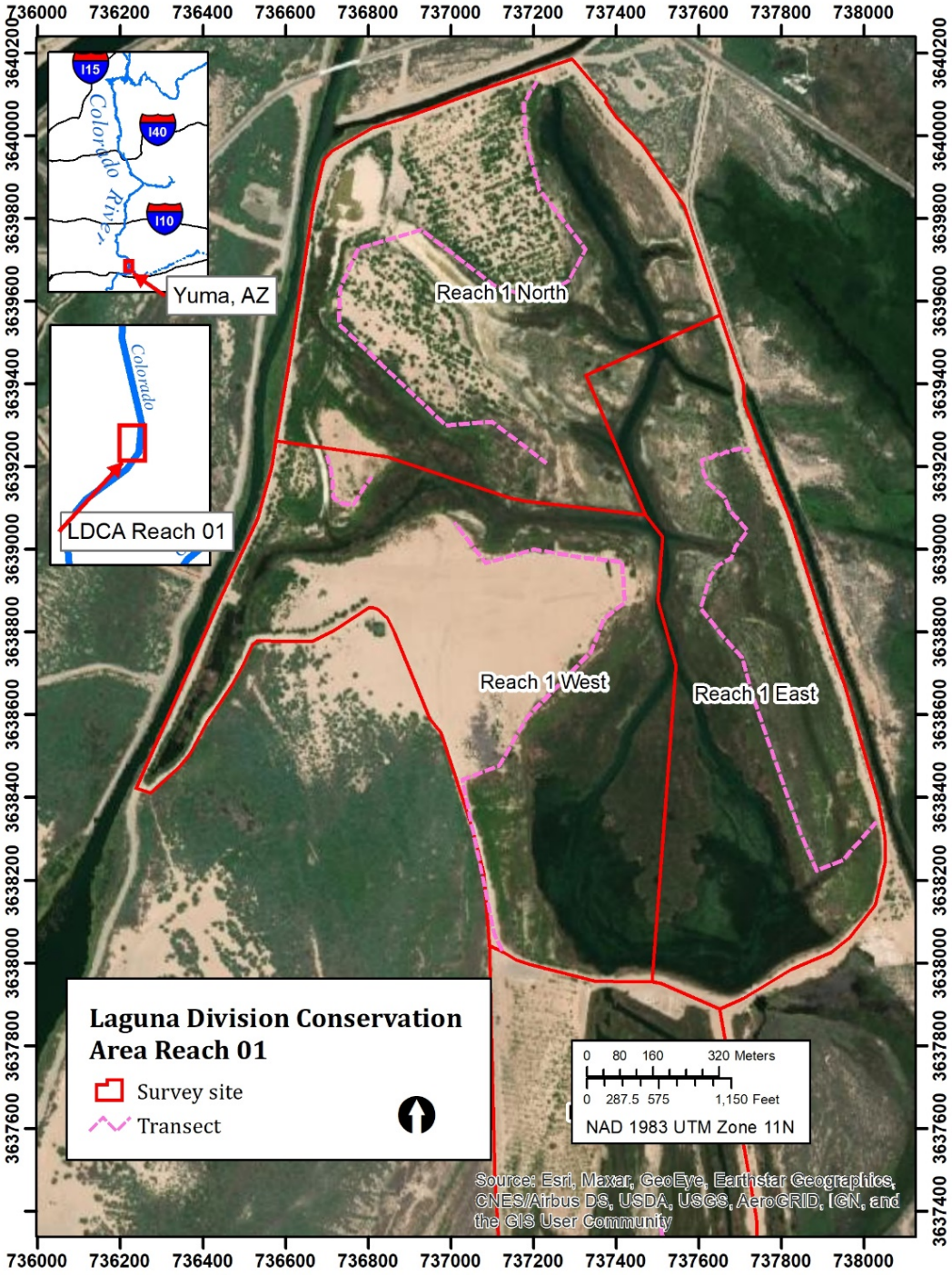

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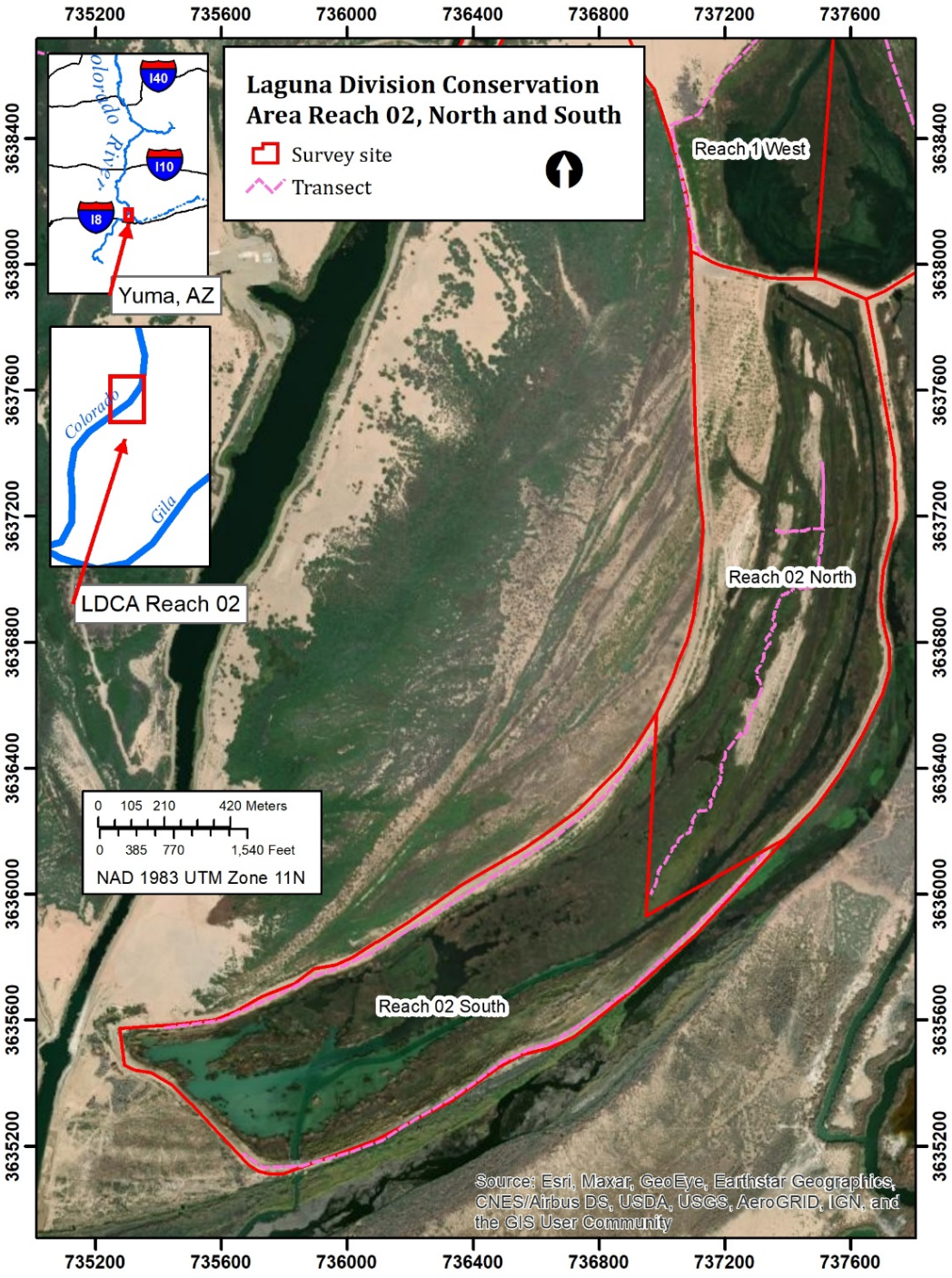

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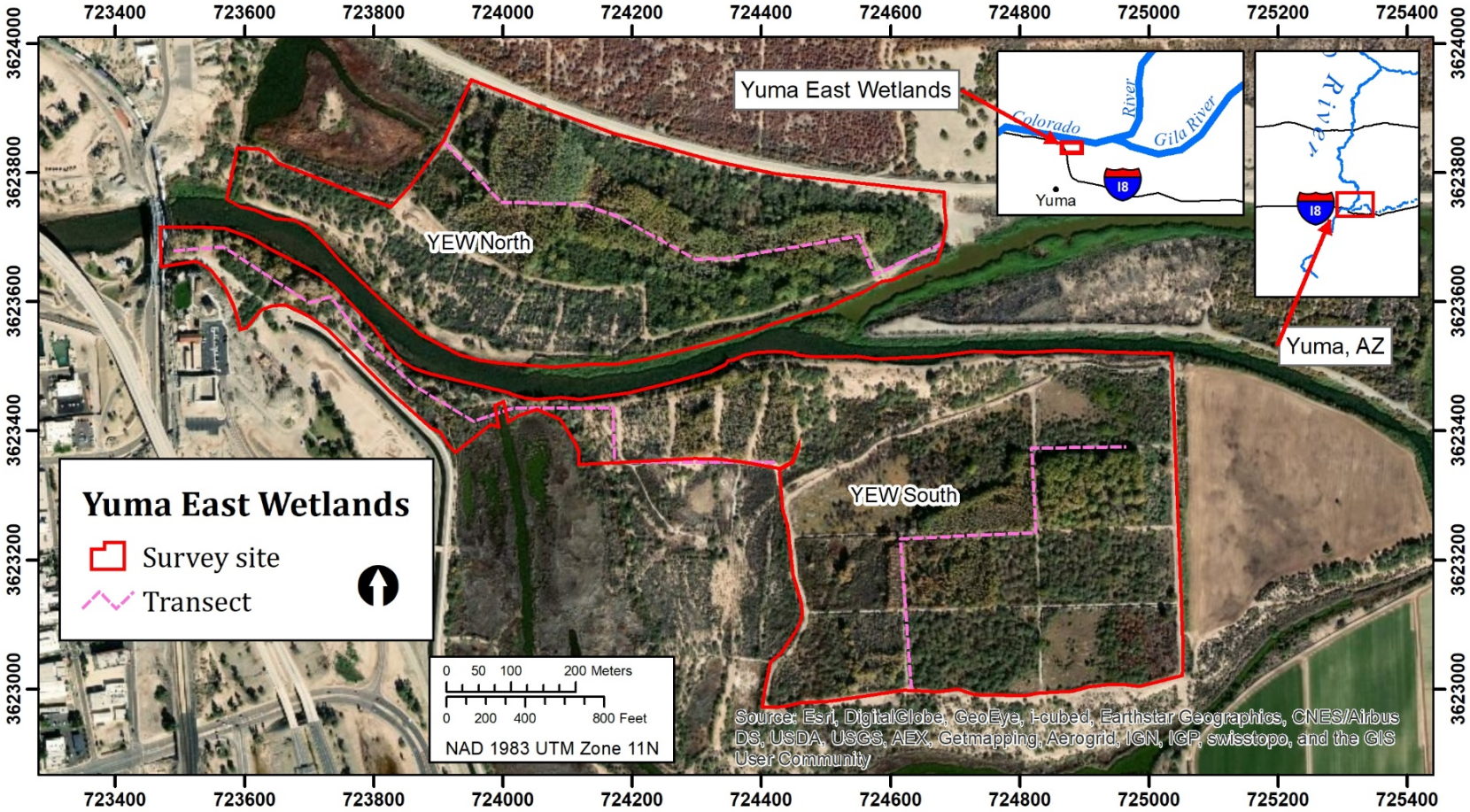

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ATTACHMENT 2

A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

M. Halterman, Harvey & Associates Ecological Consultants; M.J. Johnson, Colorado Plateau Research Station; J.A. Holmes, Colorado Plateau Research Station; and S.A. Laymon, U.S. Fish and Wildlife Service, 2016.

A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo.

FINAL DRAFT 22 April 2015

Cover: Western Yellow-billed Cuckoo. Photograph taken by Murrelet Halterman

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A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo.

By Murrelet Halterman, Harvey & Associates Ecological Consultants, Matthew J. Johnson, Colorado Plateau Research Station, Jennifer A. Holmes, Colorado Plateau Research Stations and Stephen A. Laymon, US Fish and Wildlife Service

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A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo

By Murrelet D. Halterman, H.T. Harvey & Associates; Matthew J. Johnson and Jennifer A. Holmes, Colorado Plateau Research Station, Northern Arizona university; and Stephen A. Laymon, US Fish and Wildlife Service

Purpose

Our intent is to detail the current standard survey protocol and survey data interpretation for the western Distinct Population Segment (DPS) of Yellow-billed Cuckoos (*Coccyzus americanus*). It is intended to determine if a habitat patch contains one or more Yellow-billed Cuckoos, and is not designed to establish the exact distribution and abundance of cuckoos at a site. This protocol is intended to maximize detectability and efficiency; determining precise Yellow-billed Cuckoo numbers, locations, and breeding status requires many more visits and additional observation. This survey protocol also does not address issues and techniques associated with nest monitoring or other cuckoo research activities, but we discuss basic natural history and nest searching information in order to enhance surveyor understanding. This document is not intended to provide comprehensive coverage of that information. For more information on Yellow-billed Cuckoo biology see Hughes (1999), the final listing rule (79 FR 59992) and proposed critical habitat rule (79 FR 48547) for the species, and reports cited in this document.

Background

As early as 1944 the species was noted to be declining in California due to habitat loss and alteration (Grinnell and Miller 1944). The western population of the Yellow-billed Cuckoo was petitioned for listing as a federally endangered species in 1999 (USFWS 2001). In 2002 the western DPS was determined to be warranted but precluded for listing by higher priority species. On October 3, 2013 the proposed rule to list the western DPS of the Yellow-billed Cuckoo as a Threatened species was published in the Federal Register (78 FR 61621) and on October 3, 2014 the final listing rule was published (79 FR 59992) and the listing went into effect November 3, 2014.

At the time of the initial petition in 1999, little was known of the extent of the western population outside of California. Since then there has been additional research on distribution, ecology, and habitat use of the Yellow-billed Cuckoo in the western United States. We now have information on the population distribution in most of the western states, although there are still many areas that have not been thoroughly surveyed.

Breeding populations exist in California in the Sacramento Valley along the Sacramento River and some tributaries (although recent surveys found no evidence of breeding (Dettling and Howell 2011)), the South Fork Kern River, and restoration sites near Blythe on the lower Colorado River (Figure 1; Halterman et al 2001, McNeil et al 2013, Stanek and Stanek 2012). In Arizona, cuckoos are known to breed primarily within the Bill Williams, Big Sandy , Agua Fria, Verde River, Gila River, Santa Cruz and San Pedro river watersheds, as well as multiple

restoration sites along the lower Colorado River (Corman and Magill 2002, Halterman 2009, Johnson et al. 2010, McNeil et al. 2013). In New Mexico they breed on the Gila River and the middle Rio Grande (Stoleson and Finch 1998, Woodward et al. 2002, Ahlers and Moore 2012). In Colorado there are small numbers along the Colorado River and upper Rio Grande (Beason 2010). There are no known breeding populations in Oregon (Marshall et al. 2003). In Idaho there is reported breeding on the Snake River (Cavallaro 2011). In Nevada they may occasionally breed on the Carson, Virgin and Muddy Rivers (Halterman 2001, McKernan and Braden 2002, Tomlinson 2010, McNeil et al. 2013).

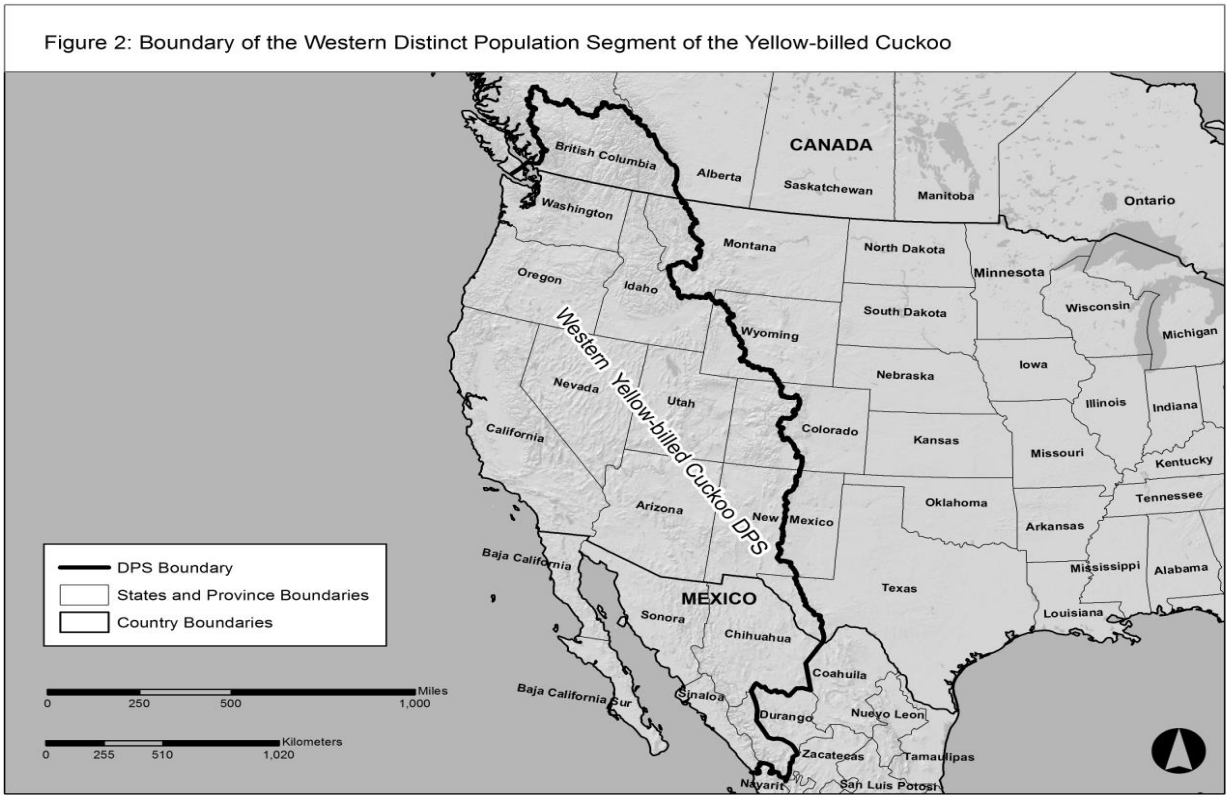

Figure 1. Range of the western Distinct Population Segment of the Yellow-billed Cuckoo.

In order to advance our understanding of the distribution of Yellow-billed Cuckoos, we need an effective and standardized survey protocol and uniform reporting of survey results. Cuckoos seldom call on their own and have a relatively low level of responsiveness to playback (Halterman 2009), and thus can be difficult to detect, making it difficult to accurately track populations. This document is intended to provide clear guidelines to agencies, consultants, volunteers, and researchers, to monitor Yellow-billed Cuckoo populations and determine habitat occupancy. Because of the similarity of habitat use and survey techniques, some information was borrowed with permission from the SWFL protocol (Sogge et al. 2010).

Section 1. Natural History

Breeding Range and Taxonomy

Western Yellow-billed Cuckoos historically bred throughout riparian systems of western North America from southern British Columbia to northwestern Mexico (Hughes 1999). They inhabited the deciduous riparian woodlands once lining most rivers and streams. Since at least the 1850s, Yellow-billed Cuckoo populations have declined dramatically (Roberson 1980, Gaines and Laymon 1984, Laymon and Halterman 1987) and breeding cuckoos have been extirpated over much of the western range, including British Columbia, Oregon, and Washington (Hughes 1999). Although the western Yellow-billed Cuckoo has been described as a subspecies called the California Cuckoo (*Coccyzus americanus occidentalis*) (Ridgeway 1887, AOU 1956), there has been debate about its taxonomic status. There is research that both supports (Franzreb and Laymon 1993, Pruett et al. 2001), and refutes subspecies status (Banks 1988 and 1990, Fleischer 2001). The range of the Distinct Population Segment of the Yellow-billed Cuckoo is essentially the same as the range of the subspecies.

Migration and Winter Range

The Yellow-billed Cuckoo is a Neotropical migrant bird that winters in South America east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (78 FR 61621). The winter range and migration routes of the western Yellow-billed Cuckoo are poorly known. Eastern and western cuckoos may intermingle on the wintering grounds and in migration, or they may have separate wintering grounds and migration routes. Geolocator data is available from one single cuckoo captured during the breeding season on the middle Rio Grande River in New Mexico (Sechrist et al. 2012). This data indicates that the bird spent five months, from late November through April, in eastern Bolivia, southwestern Brazil, Paraguay, and northeastern Argentina. This cuckoo traveled south to southern Sonora, Mexico, in late July, then back to the Rio Grande before migrating southeast through Texas and eastern Mexico in August and September, and Honduras, Panama, and Columbia in October, and the upper Amazon basin in November. In the Spring it followed a different migration route through Brazil, Columbia, Venezuela, the Caribbean, the Yucatan Peninsula in Mexico, to the lower Rio Grande, then to the Conchas River in Chihuahua, Mexico, then back to the Rio Grande near its original capture point in early July (Sechrist et al. 2012, 78 FR 61621). There's little additional information on the western Yellow-billed Cuckoo's migration routes. Research indicates that the San Pedro River, and the lower Colorado River and its tributaries are migratory corridors (Halterman 2009) and a migrating flock was recorded by Miller (1950) in the Cape region of Baja California Sur in late May or early June (78 FR 61621).

Breeding Habitat

Breeding western Yellow-billed Cuckoos are riparian obligates and currently nest almost exclusively in low to moderate elevation riparian woodlands with native broadleaf trees and shrubs that are 20 hectares (ha) (50 acres (ac)) or more in extent within arid to semiarid landscapes (Hughes 1999, 79 FR 59992). They are most commonly associated with cottonwood–willow–dominated vegetation cover, but the composition of dominant riparian vegetation can

vary across its range. In California, habitat often consists of willows (*Salix* spp) mixed with Fremont cottonwoods (*Populus fremontii*) and, in other portions of its range, narrow-leaf cottonwood (*Populus augustifolia*) and mesquite (*Prosopis* spp.) are important habitat components. In Arizona, habitat may also contain box elder (*Acer negundo*), Arizona alder (*Alnus oblongifolia*), Arizona walnut (*Juglans major*), Arizona sycamore (*Platanus wrightii*), oak (*Quercus* spp.), netleaf hackberry (*Celtis reticulata*), velvet ash (*Fraxinus velutina*), Mexican elderberry (*Sambuccus mexicanus*), tamarisk (*Tamarix* spp.), and *Baccharis* ssp.; (Corman and Magill 2000, Corman 2005, Johnson et al. 2010). Occupancy rates (the percent of patches surveyed with at least one cuckoo detection) in Arizona were highest in cottonwood/willow/ash/ mesquite habitat (70.7% occupancy), cottonwood/willow/ash/mesquite/with less than 75% tamarisk habitat (60.7% occupancy), and mesquite bosque/hackberry habitat (60.0% occupancy). Yellow-billed Cuckoos were much less common in sycamore/cottonwood habitat (46.2% occupancy), sycamore/alder/willow/ash/walnut habitat (33.3% occupancy), and habitat comprised of greater than 75% tamarisk cover (33.3% occupancy; Johnson et al. 2010).

At the landscape level, the amount of cottonwood–willow-dominated vegetation cover and the width of riparian habitat influence western Yellow-billed Cuckoo breeding distribution (Gaines and Laymon 1984, Halterman 1991, Holmes et al. 2008, Givertz and Greco 2009, Johnson et al. 2012, 79 FR 59992). Riparian patches used by breeding cuckoos vary in size and shape, ranging from a relatively contiguous stand of mixed native/exotic vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Yellow-billed Cuckoos mainly nest in patches that are as large as 80 ha (several hundred ac); for example, San Pedro River, Arizona or Elephant Butte Reservoir, New Mexico, but they will nest in areas as small as 20 ha (Beal Lake Conservation Area at Havasu National Wildlife Refuge in Arizona (McNeil et. al. 2013). They have not been found nesting in isolated patches 0.4–0.8 ha (1-2 ac) or narrow, linear riparian habitats that are less than 10-20 meters (m) (33-66 ft) wide, although single birds have been detected in such isolated patches or linear habitats during migration or the early breeding season (mid-late June). In California, Yellow-billed Cuckoos are most likely to be found in patches of willow–cottonwood riparian habitat greater than 80 ha (200 ac) in size. Yellow-billed Cuckoos rarely used smaller patches of habitat (under 20 ha in size), particularly when patches were distant from other patches of riparian habitat (Laymon and Halterman 1989). In Arizona, on the lower Colorado River, Yellow-billed Cuckoos used large patches of habitat (> 20 ha) and areas with dense canopy closure for nesting (McNeil et al. 2013), and habitat modeling identified several important features associated with cuckoo breeding habitat: (1) a 4.5 ha (11.1 ac) core area of dense cottonwood-willow vegetation and (2) a large (72 ha/178 ac) native forest surrounding the core (Johnson et al 2012). The odds of cuckoo occurrence decreased rapidly as the amount of tamarisk cover increased or when cottonwood-willow vegetation was scarce (Johnson et al. 2012). On the Verde River in Arizona, sites occupied by cuckoos were at least 100 m (330 feet) wide; 79% of occupied sites were over 200 m (650 ft) wide, and 92% had at least 5 ha (12 ac) of mesquite in the uplands bordering the riparian patch. On average, occupied sites were larger than unoccupied sites (mean riparian patch width of occupied sites was 253 m (830 ft), and 134 m (440 ft) for unoccupied sites (Holmes et al. 2008).

At large spatial scales, cuckoos have been observed using newly formed sapling stands of riparian vegetation, first documented on the Sacramento River (Halterman 1991). Since then, cuckoos have been recorded using flood irrigated, fast-growing, restoration habitat that was less

than a year old for foraging, and less than two years old for nesting (McNeil et al. 2013). Ahlers et al. (2014) found increasing numbers of cuckoos on the middle Rio Grande River in NM, likely in response to an increase of young riparian habitat through natural regeneration. The same was found on the Kern River where the majority of detections and all of the nests were found within the relatively younger habitat (Stanek and Stanek 2012). Johnson et al. (2008) found cuckoos nesting at a newly formed site, with three years old willows, on the Lake Mead/ Colorado River Delta, over 100 km from the nearest known breeding population. Although the mechanisms driving these fluctuations are unknown, it seems likely that availability of suitable breeding habitat and prey abundance are driving factors behind these changes (Greco 2012, Koenig and Leibhold 2005, Barber at al. 2008, Johnson et al. 2008, McNeil et al. 2013).

Yellow-billed Cuckoo habitat can be characterized and quantified in a number of ways, depending on the objectives of the observers. For the purposes of this protocol, we use a relatively simple approach, similar to that used in the Southwestern Willow Flycatcher (*Empidonax traillii extimus*) protocol (Sogge et al. 2010), that can be used to broadly describe and classify survey sites based on woody plant species composition and habitat structure. As described above, these, along with patch size and connectivity, have been documented as important components of cuckoo habitat, but they are likely not the only ones. Measuring other potentially important aspects of cuckoo habitat such as food availability, predators, hydrology, and environmental factors such as temperature and humidity, are beyond the scope of this protocol.

The general categories used to characterize cuckoo habitat in this protocol are based on the composition of the tree/shrub vegetation at the site: native broadleaf (>75% of cover from native trees/shrubs); exotic/introduced (>75% of cover from exotic trees/shrubs); mixed native/exotic-mostly native (51% - 75% cover from native trees/shrubs); and mixed native/exotic-mostly exotic (51% - 75% cover from exotic trees/shrubs). Each site's canopy and understory canopy height, canopy and understory canopy cover, and the cover of particular dominant plant species in the canopy and understory canopy are also recorded. Examples of each category can be seen in Appendix 1.

The native broadleaf tree/shrub category for breeding sites within the Western Yellow-billed Cuckoo range are described above, and often have a distinct overstory of willow, cottonwood, or other broadleaf trees, with recognizable sub-canopy layers and an understory of mixed species trees and shrubs, including tamarisk. Sites are classified as native broadleaf if greater than 75% of the cover is contributed by native broadleaf species. Exotic/introduced are sites where exotic/introduced trees/shrubs contribute 75% or greater of the vegetation cover. These sites are typically dominated by tamarisk or Russian olive (*Elaeagnus angustifolia*). Mixed native/exotic sites ("mixed exotic native-mostly native" and "mixed exotic native-mostly exotic) include mixtures of native broadleaf trees and shrubs mixed with exotic/introduced species such as tamarisk and Russian olive. The exotics are primarily in the understory canopy, but may be a component of the canopy, and the native/exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat. If a particular site is dominated primarily by natives (i.e. 51% - 75% native) it is classified as mixed exotic native-mostly native. If it is dominated primarily by exotics/introduced species (i.e. 51% - 75% exotic) it is classified as mixed exotic native-mostly exotic.

The ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high too poor to unsuitable; the best habitats are those in which cuckoo reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding cuckoos. Small habitat patches may also provide critical stopover sites for refueling and resting during migration. There also may not be enough cuckoos in a given area, particularly at the periphery of its current range, to fill all available habitat.

Breeding Chronology and Biology

Western Yellow-billed Cuckoos are late spring migrants. In Arizona and California, a few individuals occasionally arrive in mid- to late May, but the majority do not arrive until mid-June, with late migrants straggling into early July (Corman 2005; Laymon 1998a). Nesting typically occurs between late June and late July, but may occasionally begin as early as late May, and continue into September. Cuckoos have been observed in California as late as mid-September (M. Halterman, pers. obs., McNeil and Tracy 2013, Parametrix and SSRS 2015) and mid-October in southeastern Arizona (Corman 2005). In southeastern Arizona (and possibly in other parts of the southwest), nesting may regularly continue into September, with some birds occasionally noted feeding older fledglings into early October (Corman and Magill 2000, Halterman 2002).

Nests and Eggs

Both adults build the nest, incubate the eggs, and brood and feed the young. Nest building may take as little as half a day, with additional material added to the nest as incubation proceeds (Halterman 2009). Nests are typically well-concealed in dense vegetation (Halterman 2002; Laymon et al. 1997; McNeil et al 2013). Typical clutch size varies from two to four eggs, but exceptionally one and five egg clutches have been observed. Larger clutches are likely the result of conspecific parasitism (Hughes 1999; Laymon et al 1997; Laymon 1998a; McNeil et al. 2013). Eggs, which are a pale bluish-green, are usually laid every second day, but the interval may be variable (Hughes 1999). Eggs are incubated from 9-11 days (Hughes 1999) and young cuckoos fledge five to eight days after hatching, with six days being typical (Laymon and Halterman 1985, Halterman 2009). Males incubate the eggs at night, and both sexes alternate incubation and nestling care during the day (Halterman 2009, Payne 2005). Males appear to be the primary caregiver of the young post-fledging (Halterman 2009).

Typically Western Yellow-billed Cuckoos have one brood per year (Ehrlich et al 1988). In California at the South Fork Kern River, in years of abundant food resources, two and even three broods have successfully fledged. Double brooding was observed in less than half of the 12 years of study there and triple brooding was observed only once (Laymon 1998a). Double broods have been regularly observed on the upper San Pedro River (Halterman 2009) and on the lower Colorado and Bill Williams rivers (McNeil et al. 2013). Triple broods have occasionally been observed at these sites.

Fledglings continue to be dependent on the adults for approximately 14-21 days, seeking food from adults by giving short "cuk-cuk-cuk" calls. At approximately 14 days, fledglings give louder calls, but appear to lack the full range of adult vocalizations. The fledglings may continue to be dependent on the adults until they are 28-32 days old (Halterman 2009, McNeil et al. 2013). Young birds can be distinguished for several weeks post-fledging by the paler yellow coloration on the bill, and a shorter tail with slightly paler coloration (dark gray instead of black; Pyle 1997). It is very difficult to see these subtleties in the field, however, and aging fully-grown juveniles can be problematic for all but the most experienced observers (Halterman 2008).

Vocalizations

Cuckoos call infrequently, with an unsolicited vocalization rate of one call/hour (Halterman 2009). Their vocalizations are described by Hughes (1999) and others (Bent 1940, Hamilton and Hamilton 1965, Potter 1980). Common calls include variations of the contact call. This is a series of "kuk" notes with or without "kowlp" notes, given by both sexes (Halterman 2009; Hughes 1999). Also commonly heard is the "coo" call, apparently given primarily by females (Halterman 2009). A very soft "coo" call seems to be given by adults to nestlings. Adults also give an alarm consisting of a low "wooden knocking" call, continued until the threat leaves the area. This call is typically given in the vicinity of a nest or fledgling. Calls are described in detail in the Survey Protocol Section, Yellow-billed Cuckoo Identification, below.

Food and Foraging

Cuckoos eat a wide variety of prey items. These are primarily large arthropods such as cicadas, katydids, grasshoppers, and caterpillars, but may also include small lizards, frogs, spiders, tent caterpillars, and a variety of other insects. There is evidence to suggest that population levels and breeding may be closely tied to abundance of certain food items (Clay 1929, Bent 1940, Preble 1957, Hamilton and Hamilton 1965, Nolan and Thompson 1975, Laymon 1980, Koenig and Liebhold 2005, Halterman 2009, McNeil et al. 2013). Cuckoos typically perch inconspicuously while visually searching nearby vegetation for prey (Hamilton and Hamilton 1965, Stiles and Skutch 1989). This foraging method contributes to the difficulty of detection. They may venture out into surrounding low vegetation (flooded fields, younger habitat, sacaton (*Sporobolus* sp.) grassland) after observing prey items while perched in the riparian (Halterman 2002; McNeil et al. 2013).

Site Fidelity and Local Population Fluctuations

Little is known about population substructure, dispersal of young and post-breeding adults, juvenile and adult site fidelity, or the factors influencing breeding site detection and selection. Research indicates that the San Pedro River, lower Colorado River and tributaries are migratory corridors, in addition to being breeding areas (Halterman 2009). Cuckoos were captured and equipped with transmitters in suitable nesting habitat on these rivers; and many of these birds left the area before breeding. A small number of birds that left their banding location were detected in the same season at other riparian sites. These within-season movements varied from 1 km to nearly 500 km (Halterman 2002, McNeil et al. 2013). Additional research is needed at other

sites, particularly with more northern populations, to determine if these movements occur range wide.

Between-year fluctuations in estimated populations have been observed at multiple locations throughout the range. From 1997 to 2004, the estimated population on the Bill Williams River fluctuated between 6 and 28 pairs (20 to 78 survey detections/year; Halterman 2008). The estimated population of the South Fork Kern River fluctuated from less than 5 pairs to more than 20 pairs over a 12 year period (Laymon et al. 1997). The population on the San Pedro River fluctuated greatly from 2001 to 2007, with numbers halving from 2003 to 2006, then apparently doubling from 2006 to 2007 (Halterman 2008). Populations on the Sacramento River have shown year-to-year fluctuations (Halterman 1991) and decade-to-decade fluctuations (Laymon and Halterman 1987, Halterman et al. 2001, Dettling and Howell 2011).

The methods used to estimate population size varied between studies, but it is clear that Yellow-billed Cuckoo populations increase or decrease locally well beyond the expected fluctuations of a closed population. These studies indicate a species that is not only capable of, but likely adapted to, locating and utilizing resources that are highly variable in time and space. Multiple years of surveying are therefore required to obtain a reasonable estimation of occupancy, habitat use, and distribution.

Little is known about survivorship of Yellow-billed Cuckoos, though the Institute for Bird Populations reports an estimated annual survival probability of 50% (NBII/MAPS Avian Demographics Query Interface). Limited data from the San Pedro River, Arizona, with color-banded birds, indicates that a small percentage of the population (about 5%) returns to the breeding sites each year (Halterman 2009). On the lower Colorado River, primarily in LCR-MSCP habitat creation sites, about 10% of the banded birds were recaptured in the area one or more years after initial capture (McNeil et al. 2013). Returning birds on the San Pedro were re-sighted approximately 25 m (80 ft) and over 2 km (1.2 miles) from their banding location (Halterman 2009). Returning birds banded as adults on the lower Colorado River were re-sighted between approximately 25 m (80 ft) and 40 km (25 miles) from their banding location (McNeil et al. 2013). Returning birds banded as nestlings/fledglings on the Lower Colorado River were re-sighted between ~30 m (100 ft) to ~80 km (50 miles) from their banding location (McNeil et al. 2013). Breeding pairs of banded cuckoos at this site were found using the same territory for up to three years (Laymon 1998a).

Threats to the Cuckoo and Habitat

The decline of the western Yellow-billed Cuckoo is primarily the result of riparian habitat loss and degradation. Within the three states with the highest historical number of Yellow-billed Cuckoos, past riparian habitat losses are estimated to be about 90 to 95 percent in Arizona, 90 percent in New Mexico, and 90 to 99 percent in California (Ohmart 1994, USDOI 1994, Noss et al. 1995, Greco 2008). Many of these habitat losses occurred historically, and although habitat destruction continues, many past impacts have ramifications that are ongoing and affect the size, extent, and quality of riparian vegetation within the range of the western Yellow-billed Cuckoo. Principal causes of riparian habitat destruction, modification, and degradation in the range have occurred from alteration of hydrology due to dams, water diversions, management of river flow that differs from natural hydrological patterns, channelization, and levees and other forms of

bank stabilization that encroach into the floodplain (79 FR 48547). These losses are further exacerbated by conversion of floodplains for agricultural uses, such as crops and livestock grazing. In combination with altered hydrology, these threats promote the conversion of existing primarily native habitats to monotypic stands of non-native vegetation, reducing the suitability of riparian habitats for the cuckoo.

Because of the absence or near absence of nesting by Yellow-billed Cuckoos in monotypic stands of tamarisk and other nonnative vegetation, the available literature suggests that conversion of native or mixed (native and non-native) riparian woodlands to nearly monotypic stands of tamarisk and other non-native vegetation, coupled with the inability of native vegetation to regenerate under altered hydrological conditions, is a significant threat to the western Yellow-billed Cuckoo now and in the future (79 FR 48547). Non-native vegetation occurs across most of the range; its establishment can be caused by altered hydrology or other disturbances, which are widespread throughout the range. Non-native vegetation is expected to increasingly modify and decrease habitat for the western Yellow-billed Cuckoo within a majority of its range in the United States and northern Mexico. Other threats to riparian habitat include long-term drought and climate change.

Section 2. Survey Protocol

This basic protocol has changed little since it was first written in 1998 (Laymon 1998) and expanded in 1999 (Halterman 1999). There have been a number of refinements as research has increased our knowledge of this elusive species. The greatest change is in interpretation of results. Previous versions of this protocol have been used effectively to survey hundreds of sites in the western United States.

Yellow-billed Cuckoos are challenging to survey for a number of reasons. They have a low unsolicited calling rate, averaging about one call/hour making standard point count surveys particularly ineffective (Halterman 2009). They have large home ranges, with average 95% kernel home ranges varying from 19.5 ha (48.2 ac) to 42.3 ha (104.5 ac), depending on location, breeding status, and gender of the individual (Halterman 2009, McNeil et al. 2013, Sechrist et al. 2009). This brevity of peak of activity, along with the potential for double and triple brooding, further complicates complete survey coverage. The peak of cuckoo nesting activity lasts only about one month, with breeding activity of the western DPS of the Yellow-billed Cuckoo peaking in July (Laymon et al. 1997, Halterman 1991, 2009; McNeil et al. 2013), but in some years breeding can start in May and end in September. Detection rates also peak during July and drop off dramatically after mid-August regardless of breeding status (Laymon et al 1997, Halterman 2008, Ahlers 2012, McNeil et al. 2013). Males and females are sexually monomorphic in appearance and in many behaviors (Halterman 2009). Breeding can only be confirmed by finding an active nest, seeing fledglings, distraction or alarm displays, or copulation. These render interpretation of survey results problematic. Given these challenges, no methodology can assure 100% detection rates. This protocol does provide an effective tool for detecting cuckoos when surveys are conducted by trained surveyors.

The secretive and sometimes subtle life history characteristics of this species influence how Yellow-billed Cuckoo surveys should be conducted and form the basis upon which this protocol

was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding cuckoo absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for this and other rare and secretive species (Johnson et al 1981, Sogge et al. 1997, Conway and Simon 2003).

The primary objective of this protocol is to provide a standardized survey technique to detect Yellow-billed Cuckoos, estimate breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the experience, preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with Yellow-billed Cuckoos or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to visually distinguish Yellow-billed Cuckoos from similar species, and be able to distinguish Yellow-billed Cuckoo calls from similar vocalizations of other species. Visual sightings of cuckoos are relatively rare and often fleeting, and surveyors experienced with bird identification and behavioral observations of nesting birds will be best able to understand these brief observations. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and ability to remain alert and aware of cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and among sites, and among years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on cuckoo status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

Like previous versions, this revised protocol is based on call-playback techniques. However, it includes changes in the timing of surveys to increase the probability of detecting cuckoos and to help determine if detected cuckoos are breeders or migrants. A detailed description of surveys and timing is discussed in the section "Timing and Number of Visits." The current survey data sheets are easier to use and submit than previous versions, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that they are comparable to the current and widely used Southwestern Willow Flycatcher (SWFL) survey forms.

This protocol is intended to determine if a habitat patch contains Yellow-billed Cuckoos, and is not designed to establish the location of nests or the exact distribution and abundance of cuckoos at a site. Determining precise cuckoo numbers and locations requires many more visits and

additional time observing behavior. This survey protocol also does not address issues and techniques associated with nest monitoring or other cuckoo research activities. Those efforts are beyond the scope needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to cuckoos. If nest monitoring is a required component of your study, personnel experienced with and permitted for nest searching and monitoring must be included in the project. We provide general information on nest searching so surveyors will recognize the behavior of cuckoos near a nest, and thus avoid unnecessary disturbance around a nest that might cause nest abandonment or predation.

Biologists who are not expert birders or specialists with Yellow-billed Cuckoos can effectively use this protocol. However, please note that prior to conducting any surveys, all surveyors are required to attend or have attended a U.S. Fish and Wildlife Service (USFWS)-approved Yellow-billed Cuckoo survey training workshop, and have knowledge and experience with bird identification, survey techniques, avian breeding behavior, and ecology sufficient to effectively apply this protocol.

Permits

Federal endangered species 10(a) 1(A) recovery permits are required to conduct surveys for Yellow-billed Cuckoos in all USFWS regions where the western Yellow-billed Cuckoo DPS breeds. State permits may also be required, and both federal and state permits may take several months to obtain so please plan ahead. Permits or permission are often required to access potential survey locations. The level of permitting will depend on the applicant's expertise in observing and handling cuckoos and attending a USFWS-approved Yellow-billed Cuckoo survey protocol workshop.

Permits will cover a range of activities, and will depend on the applicants experience level and needs. Permits are required for the following activities: surveys, nest searching and monitoring, banding adults and nestlings, attaching transmitters to cuckoos, radio telemetry, and blood and feather sample collection.

Pre-Survey Preparation

Pre-survey preparation is essential to conducting efficient, quality surveys. It is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results. All surveyors are required to attend a USFWS-approved, survey protocol workshop prior to conducting surveys and should carefully study the Yellow-billed Cuckoo Identification section, below. It is especially critical for surveyors to be familiar with Yellow-billed Cuckoo vocalizations before going in the field. Surveyors should study calls, songs, drawings, photographs, and videos (if available) of Yellow-billed Cuckoos. An excellent source of vocalizations is the xeno-canto website (www.xeno-canto.org). This site is a community shared bird-sound database.

Surveyors should also become familiar with cuckoo habitat. If possible, visit as many known Yellow-billed Cuckoo breeding sites as possible and study photos of cuckoo habitat. Such visits are usually part of the Yellow-billed Cuckoo survey protocol workshops. All visits should be

coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to cuckoos. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective cuckoo coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if cuckoos have been previously detected at the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where cuckoos have previously been detected. However, please realize if it has been several years since a location has been surveyed, some habitat sections may have changed, for better or worse. As an example, newer riparian sections may have developed in size and density to become appropriate nesting/foraging areas.

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. It is the individual surveyor's responsibility to survey all suitable habitat within the respective site. It's best to layout and walk transects in advance of the surveys. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and transect start and stop points (if previously surveyed), where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant water, muddy or swampy conditions, and quicksand, crawling through dense thickets, and exposure to rattlesnakes, skunks, and biting insects.

The day before conducting the survey, set a time for departure to the site. Surveying generally occurs in the early morning, beginning just before sunrise and continuing, depending on environmental factors (including noise levels), until 1100 or until temperatures reach 40C/104F whichever comes first. Know the directions to the survey site and estimate the time it will take to get to the first point by driving and walking, possibly in the dark. If possible, preload you're GPS (or other navigation device) with survey transects and survey points. Your departure time for the following morning should ensure arrival at the starting point approximately one hour before sunrise. If the survey takes more than two hours, make an effort to start at the opposite end of the transect for each survey round, so that all points are surveyed in the earlier hours. This may not always be logistically possible.

It is imperative that all surveyors exercise safety first. Be aware of hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

Table 1. List of items for conducting Yellow-billed Cuckoo surveys.

Required Items	Details
USGS Map and/or aerial photo (orthorectified; color photocopies) of survey area	A marked copy is required to be attached to survey datasheets submitted at the end of the season. The survey site needs to be delineated and detections clearly marked. If the survey area differed between visits, individual surveys should be delineated.
Broadcast equipment (e.g., Audio device, and speakers) and batteries	Must be capable of broadcasting recorded calls 100 m without distortion (recommended speaker volume of 70 db). Having a fully charged device and extra batteries as well as back-up/extra broadcast equipment is highly recommended to avoid abandoning a survey due to equipment failure. Use only provided contact call for broadcast.
Standardized survey form	Multiple copies for each survey.
Recorded contact/kowlp calls	Acquired by attending Yellow-billed Cuckoo protocol workshop.
Binoculars	A pair with 7-10 power that can provide crisp images in poor lighting conditions.
GPS device with extra batteries	With start and stop UTMs for previously surveyed areas. All surveyor locations at time of detection should be recorded as waypoints. The compass direction and distance to individual detections are recorded from the waypoint.
Compass	The compass bearing is taken, and distance to the detected cuckoo(s) is estimated, from the surveyor's waypoint. The compass feature on the GPS unit is often much more difficult to use in the field than a compass. A compass may also help surveyors navigate through the patch more easily than using the GPS.
Clipboard or electronic device	Survey results and observations should be recorded directly onto the survey data form to ensure that all required data is collected and recorded.
Pens, Pencils, and Sharpies	Take multiples of each.
Device to record time	Use the GPS unit, watch, or phone
Optional Items	**Details**
Cell phone/portable radio	For communication between surveyors and for safety.
Camera	Helpful for habitat photos of survey sites, especially where cuckoos are found.
Laser Rangefinder	For measuring distance to detections (if possible) and height of trees.
Hard copy of start/stop UTMs	Use as a back-up for the GPS unit.

Yellow-billed Cuckoo Identification

Yellow-billed Cuckoos are a slender, medium-sized bird, about 30 cm in length, and weighing about 60 grams. The upperparts are grey-brown, the underside is clean white, and the tail is long with white spots at the end of the central rectrices. A flash of bright rufous in the wings is usually visible in flight, and occasionally while perched. The legs are blue-gray, but are seldom visible since cuckoos typically perch so that the legs are hidden under the belly. The bill is long and slightly down-curved, with a mostly black upper mandible and lower mandible ranging from yellow to orange with a black tip. Flight is generally direct and agile. Sexes are similar, and although females average larger than males, this difference is seldom visible in the field (Pyle

1997, Halterman 2009). In general, look for a slender bird with a bright white chest, long tail, and grey-brown head contrasting with a white throat.

When seen clearly, this species is unmistakable. Often you will only have a fleeting glimpse of a bird, so you need to quickly assess what you've seen. Be sure to study all available photos and video of cuckoos. Familiarization with images of both cuckoos and similar species will aid in rapid and correct identification in the field. There are a number of species that can be mistaken for cuckoos when seen briefly. These include:

1. Ash-throated Flycatchers (*Myiarchus cinerascens*) are the most similar to cuckoos, with a slender build, rufous in the wings, a relatively long tail, and agile flight pattern. They often fly closer during cuckoo call playback. The breast typically appears gray, the head is "puffy", and there is no strong contrast between brown upperparts and white underparts. Look for the shorter bill and tail when this species is perched.
2. Mourning Doves (*Zenaida macroura*) are heavier, the breast appears tan/gray, the tail is pointed, and the flight is relatively heavy and direct.
3. White-winged Doves (*Zenaida asiatica*) are much larger, with tan/gray breast, and show a bold flash of white in the wings in flight.
4. Northern Mockingbirds (*Mimus polyglottos*) are slender with a relatively long tail tipped with white. Look for the large white wing patches and lack of strong contrast between the chest and back.
5. The rusty flash of a Northern Flicker's (*Colaptes auratus*) wings are reminiscent of the rufous flash in a cuckoo's wings, but either calls or subsequent views will aid in correct identification.
6. Brown-crested Flycatchers (*Myiarchus tyrannulus*) are also similar, but the bright yellow belly and the larger head facilitate correct identification.
7. Loggerhead Shrikes (*Lanius ludovicianus*) and both California (*Toxostoma redivivum*) and Crissal thrashers (*Toxostoma crissale*) may also look like cuckoos when seen fleetingly.

The majority of Yellow-billed Cuckoo detections are from birds that are heard but never seen (Halterman et al 2001; Halterman 2009, McNeil et al. 2013), so it is critically important to know the calls of this species as well as similar species. There are two commonly heard calls, which can be given by males or females. Each call can be confused with calls of a number of other birds, especially when heard at a distance. We will discuss each in detail:

1. Contact call - also referred to as the "kowlp" call. This is a series of a variable number of "kuk" notes followed by a variable number of "kowlp" notes. This can be given at any time during the breeding season. Individuals may give calls with variable combinations of kuks and kowlps, and may omit one or the other of the notes altogether. Although distinctive when heard clearly, there are several species with similar calls, particularly when heard from a distance. The most similar species is the Yellow-breasted Chat (*Icteria virens*), which sometimes appears to give calls mimicking the cadence of cuckoo calls following playback. Chats also typically give a single diagnostic sharp "chuck". Familiarization with the calls of this species is critical to correct identification where the two co-occur. Pied-billed Grebe (*Podilymbus podiceps*) calls can also sound very similar

to cuckoo calls; the fact that the call emanates from a wetland will usually help distinguish this species, though this call is loud, carries well, and the presence of a wetland may not be known. Less similar, but still worth learning, are most woodpecker and accipiter calls.

2. Coo call. This is given with greatest frequency in the early and middle part of the breeding season. It typically consists of a 5-8 evenly-pitched and evenly-spaced "coo" notes, ending with 1-3 notes on a lower pitch. The number of coo notes may vary from one or two notes to several minutes of continuous calling. Although diagnostic when heard clearly, there are a number of species with similar calls. The most similar is Greater Roadrunner (*Geococcyx californianus*); its call is a series of "coos" which drop in pitch with each note. Distant notes of both Mourning and White-winged dove calls can sound almost identical to cuckoo coos, but the pattern is very different, with only 1-3 coo notes heard. Both dove species typically repeat their calls, so the initially questionable coo can usually be identified with careful attention. Other sounds which, when heard from a distance and at the edge of hearing, could be (and have been) confused with the cuckoo coo call include noisy cows, barking dogs, and machinery.

Less commonly heard, but important to know, is the cuckoo alarm call, sometimes called the knocker call. This is a short series of soft wooden "kuk-kuk-kuk-kuk" notes. This is typically given near a nest or fledglings, but can be heard anytime a cuckoo is disturbed. The call typically is given multiple times, and at relatively close range. It is best to assume that the alarmed bird is near a nest or young, particularly in July and August, and leave the area to avoid further disturbance.

An excellent source of vocalizations of all these species is the xeno-canto website (www.xeno-canto.org). This site is a community shared bird-sound database.

Timing and Number of Visits

The timing of this protocol is intended to assess Yellow-billed Cuckoo presence, and potentially estimate abundance and distribution. Accurate population determination is beyond the scope of this protocol, but conducting surveys during the peak of breeding activity will increase the probability of detecting any cuckoos that are present. This call-playback technique detects cuckoos that may otherwise be overlooked. Multiple surveys at each site are important, and with appropriate effort, avian biologists without extensive experience with cuckoos can find and verify Yellow-billed Cuckoo presence.

There are three survey periods. Surveys are conducted for the sole purpose of assessing whether Yellow-billed Cuckoos are present at a site. A minimum of four survey visits are required (Figure 2). Four surveys conducted during the three survey periods listed in Figure 2 will have an 80% probability of detecting an individual cuckoo (Carstensen et al. 2015, Halterman 2009) and a 95% probability of detecting cuckoos, when they are present at a site during the breeding season (McNeil et al. 2013, Carstensen et al. 2015).

Prior to the field season, we suggest developing a sampling schedule, based on the survey periods (Figure 2) and the number and extent of sites to be surveyed. Yellow-billed Cuckoo surveys should be scheduled to begin after a thorough training session (including attending a survey protocol workshop). Initiation of sampling is tailored to the phenology of the Yellow-billed Cuckoo in the study region, and is generally timed to begin after resident individuals have arrived, presumably to breed, within the region. Due to differences in breeding seasons across the western US, a survey window of ± 3 days is acceptable for the start and end of each survey period. Each survey site is visited a minimum of four times within the breeding season, with a minimum of 12 days and a maximum of 15 days between surveys at a particular site.

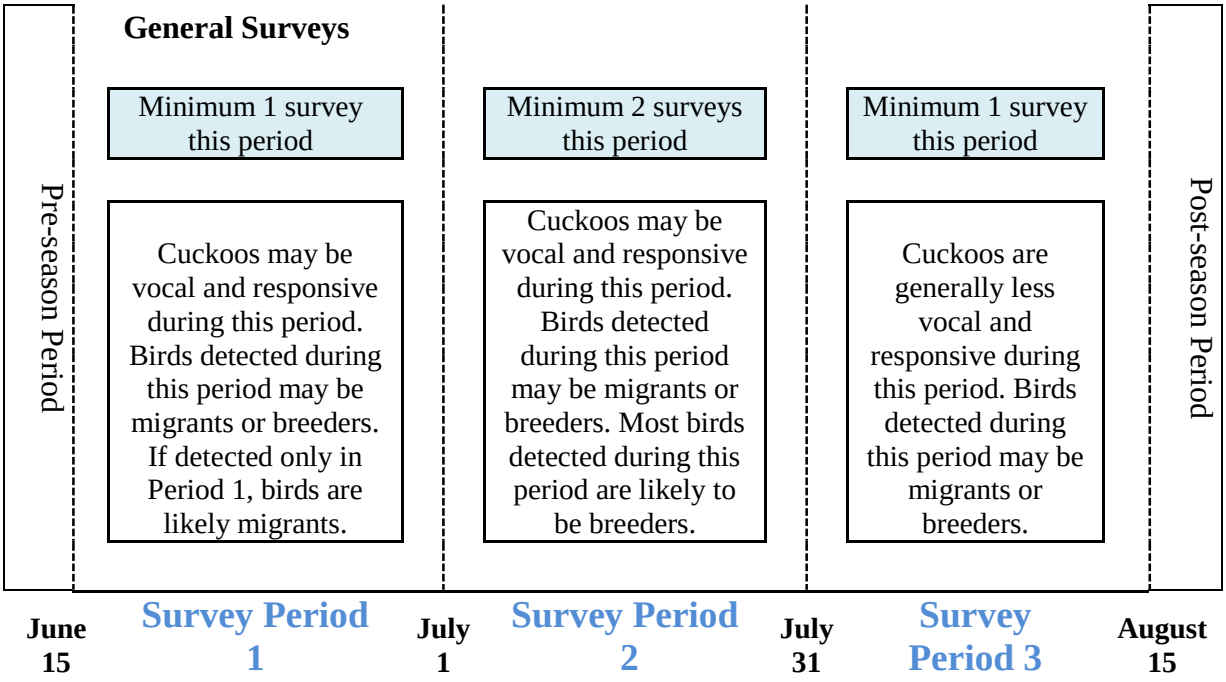

Figure 2. Recommended number and timing of visits during each survey period for Yellow-billed Cuckoo surveys.

If breeding confirmation is required, more visits will be needed and they must be conducted by surveyors permitted to search for nests. Even with additional effort, it may not be possible to verify breeding activity during a season. When developing a survey schedule for multiple surveyors, care should be given to scheduling so that multiple surveyors do not overlap areas, and the risk of a surveyor mistaking a broadcast call for a cuckoo is reduced. Additionally, if surveyors are working on adjacent plots, they should communicate both during and after surveys to avoid double counting.

Pre-season Survey Period: late May to June 14. No surveys required. This spans the earliest time that cuckoos may arrive on breeding grounds, but most cuckoos present during this period are likely migrants. However, cuckoos will occasionally begin breeding during this time.

Survey Period 1: June 15 to June 30. One survey is required. This survey occurs as migrating birds are passing through, and breeding birds arrive. Although many birds detected during this time may be migrants, surveys during this time will help with seasonal survey detection interpretation, and will also allow surveyors to familiarize themselves with all survey areas.

Survey Period 2: July 1 (+ or – 3 days) to July 31 (+ or – 3 days). Two surveys are required during this period. Cuckoos encountered during this time are mostly breeders, though migrants, wandering individuals, and young of the year may be encountered. This is the period when breeding activity is most likely to be observed (e.g. copulation, food carries, alarm calls). Extra time should be taken to cautiously observe all cuckoos encountered during this time, while avoiding disrupting potentially breeding birds.

Survey Period 3: August 1 to August 15. One survey is required, and most breeding birds are finishing breeding activities and departing. Cuckoos are typically much less vocal and responsive during this time than during Survey Period 2.

Post-breeding Period: August 16 through September. Cuckoos in the southwest may initiate nesting, build second or third nests, or provide care for fledglings in this period (Halterman 2009; McNeil et al. 2013). This is particularly true in southeastern Arizona where local conditions often allow for a lengthier breeding season. Surveys during this time will help clarify cuckoo use of the site, and length of time on the site. Birds encountered during this period may also be migrants. Cuckoos are less vocal during this time than during Survey Period 2.

The best way to confirm breeding status of cuckoos detected at a site is to do follow-up visits and observe cuckoo behavior at a distance. Careful notes should be taken during these visits. Playback calls should not be used during follow up visits, and great care must be taken in order to avoid disturbing nesting birds.

Survey Methods

The survey methods described below fulfill the primary objective of assessing the presence of Yellow-billed Cuckoos within a survey area during that breeding season. This protocol is primarily a call-back technique, a proven method for eliciting response from nearby Yellow-billed Cuckoos, when conducted as described below. This technique has also been used extensively to survey for Willow Flycatchers (Sogge et al. 2010) and increases the detectability of species that occur in low densities or in dense vegetation (Johnson et al. 1981, Sogge et al. 1997). The call-back technique simulates the presence of a cuckoo in the area, which may elicit a response from a cuckoo (if there is one in the area), increasing its detectability. At each site, surveyors should broadcast a series of recorded Yellow-billed Cuckoo contact/“kowlp” calls, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby cuckoos, this method also allows for positive identification by comparing the responding bird’s vocalizations to the known Yellow-billed Cuckoo recording.

It is recommended that cuckoo surveys not be conducted at the same time as other state or federal permitted bird surveys. For example, it is preferable that a surveyor not conduct a cuckoo survey at the same time that they are conducting a Southwestern Willow Flycatcher survey or

Least Bell's Vireo (*Vireo bellii pusillus*) survey. Doing so could negatively impact the detection of one or more species being surveyed and impair the ability to compare survey results to surveys where only one species was actively surveyed.

Begin surveys as soon as there is enough light to safely walk (just before sunrise) and continue, depending on the temperature, wind, rain, background noise, and other environmental factors, until 1100. Surveys should not be conducted after temperatures reach 40 degrees C (104 F). If the detectability of cuckoos is being reduced by environmental factors (e.g. excessive heat, cold, wind, or noise), surveys planned for that day should be postponed until conditions improve. Within a study area all potentially suitable habitat patches should be surveyed. A patch is defined as an area of riparian habitat 5 ha or greater in extent that is separated by at least 300 m from an adjacent patch of apparently suitable cuckoo habitat. The 5 ha is considered a typical minimum size for cuckoo occupancy, as no cuckoos have been detected attempting to nest in patches this size or smaller in Arizona or California (Halterman et al. 2001, Johnson et al. 2010). Suitable habitat falls into two types: 1. multi-layered riparian vegetation, with riparian canopy trees (at least a few within the patch) and at least one layer of understory vegetation; 2. mesquite and/or hackberry bosque, primarily in southeastern Arizona or when adjacent to habitat 1 above. Suitable breeding habitat often includes dense young riparian cottonwood/willow vegetation (Halterman 1991, Greco et al. 2002, McNeil et al. 2013).

Surveys can be conducted from the edge (within 10 m) when a patch is less than 200 m in width, provided the entire perimeter is surveyed. It is critical to survey all suitable habitat within an area. Small, linear patches may be thoroughly covered by a single transect along the perimeter. For larger sites, when suitable habitat exceeds 200 m in width, use a systematic survey path that assures complete patch coverage throughout the length and width of the site. Area with multiple, adjacent transects should be surveyed concurrently and in coordination (via text message or radio contact). This will help minimize duplicate detection of the same cuckoo, potentially on different transects/sites, and enable a more accurate territory estimation. The surveyor can skip over areas of unsuitable habitat (e.g. an extensive cobble bar) between patches, if the unsuitable habitat is at least 300 m in extent. Areas with small, narrow stringers of habitat, steep banks, and backwater sloughs can be surveyed by playback from a boat. It is the surveyor's responsibility to ensure all suitable habitat within the site is thoroughly surveyed.

The broadcast consists of five contact/kowlp calls, each spaced one minute apart. For consistency and comparability of the data, use only the call provided during the protocol training workshop (or from the authors). The recording should be played at approximately 70db. The standard survey forms are shown in Appendix 2. Negative data is important, so complete the datasheet for all surveys conducted, regardless of detections. There are other forms which may be better suited to specific research needs. For those forms, it is best to contact specific researchers directly.

Arrive at the broadcast-point and wait at least one minute to listen for unsolicited cuckoo calls (i.e. cuckoos that may be calling before broadcast of the calls). Listen carefully for cuckoos, recognize and shift your attention from other bird species songs and calls, and focus on listening for cuckoos. The majority of responses occur after the first or second broadcast call, so surveyors need to be alert and prepared before beginning playback (McNeil et al. 2013, Carstensen et al.

2015). During this time, fill in the general information, location information, and survey conditions at the top of the "Yellow-billed Cuckoo Survey Data Form" (Appendix 2). Detailed instructions for completing datasheets are given in Appendix 1.

If you do not hear any cuckoos during the initial listening period, begin the first broadcast. Listen and watch intently for responding cuckoos during and after each of the five broadcast calls. This includes watching for movement as silent birds may move closer to investigate. If no cuckoo is detected at the broadcast-point after five broadcast calls, continue 100 m along the transect and start a new broadcast as described above. Use additional datasheets, (Appendix 2: Continued Survey Data Form) for additional broadcast-points within the transect. Use the back of each datasheet to record observations and comments, linking the data by recording the "note #" in the right column of the survey data table on the front of the datasheet, and on the back of the datasheet along with the corresponding observations and comments.

Response to the broadcast call could take several forms. One or more Yellow-billed Cuckoos may move quietly (without calling) toward the surveyor, so it is critical to watch carefully for responding birds from any direction, including behind you. Cuckoos that fly silently toward the survey are difficult to detect and necessitate the full attention of the surveyor. In between broadcast calls, surveyors should be listening for cuckoos, and not be filling out the datasheet. Cuckoos may respond by calling from a distance, so listen for these responses. Cuckoos typically respond with the contact/kowlp call, but may also respond with a coo call or, rarely, an alarm call. When a cuckoo is detected, terminate the broadcast, as it may divert the bird from normal breeding activity or attract the attention of predators. Concentrate on observing the bird rather than immediately recording data. Several hundred cuckoos have been banded in the western United States over the last decade; carefully check cuckoos for leg bands, and carefully record the band color, combination and order. Record all data for the detection(s), including the compass bearing and estimated distance from the observer to the detected cuckoo(s), as described in Appendix 3.

After a cuckoo has been detected and appropriate data collected, move 300 m further along the transect before resuming the survey. This will minimize the likelihood of detecting the same cuckoo (Halterman 2009, McNeil et al 2013). While it is unusual for cuckoos to move 300 m after being detected by a surveyor, the surveyor should be aware of the possibility, attempt to track an individual's movements, and use their judgment to estimate if subsequent detections are separate individuals or the same individual. Please make note of all observations about individual movements and the reasoning used in determining number of individuals on the back of the data sheet.

When a cuckoo is encountered between broadcast points (i.e. an unsolicited detection is made while traveling to, from, or between broadcast points), stop and record all information in the same manner as if the detection was made during a broadcast. Do not broadcast calls. After making observations and recording information regarding the detection(s), move 300 m from the point where the detection was made, along the transect. Continue with the procedures for conducting a survey broadcast.

Interpreting and Reporting Survey Results

This protocol is intended to be used to assess if a habitat patch contains a Yellow-billed Cuckoo. Therefore, the best way to interpret survey detections is a simple detection/non-detection determination. Determination of numbers and breeding status of cuckoos is more complex, and caution should be used when interpreting survey detection data. Because of the cuckoo's elusive and mobile nature, it is easy to both over- and under-estimate cuckoo populations. Over-estimation may occur when highly mobile individuals are detected on subsequent surveys hundreds of meters from their original detection and counted as "new" individuals (Halterman 2009, McNeil et al. 2013). Underestimation may occur because cuckoos vocalize infrequently, and respond and are detected less than half the time they are present during call playback (Halterman 2009).

The following information is one method of interpreting detection data, and should be used with caution. After the survey is completed, locations of cuckoos should be plotted as UTM coordinates on either USGS quad maps or in a GIS (geographic information system). Detection locations can be compared to estimate the total number of cuckoos detected at a site during a survey season. Separation of adjacent detections is based primarily on the distance between detections. If cuckoos are located greater than 300 m apart on the same survey, they are considered separate detections (Holmes et al. 2008, Halterman 2009, Henneman 2009). McNeil et al. (2013) and Ahlers et al. (2012) have developed similar methods for determining the number of Yellow-billed Cuckoo territories, and this should be consulted for a detailed interpretation of survey results.

Although it is difficult to accurately determine number of territories and breeding status, Holmes et al. (2008), and, later, the Southern Sierra Research Station developed a method of interpreting detections to estimate possible, probable, and confirmed breeding territories (Table 2). This determination is often only possible when follow-up visits are made to areas where cuckoos were detected during surveys. These visits may be part of nest searching or mist netting efforts. The following is from Holmes et al. (2008) and McNeil et al. (2013), and should be used, in addition to total detections, when reporting breeding status.

Table 2. Interpretation of results to estimate breeding status (from Holmes et al. 2008 and McNeil et al. 2013)

Estimation Type	Term	Definition
Breeding Territory Estimation	Possible breeding territory (PO)	Two or more total detections in an area during two survey periods and at least 10 days apart. For example, within a certain area, one detection made during Survey Period 2 coupled with another cuckoo detection made 10 days later, also during Survey Period 2, warrants a PO territory designation.
	Probable breeding territory (PR)	Three or more total detections in an area during at least three survey periods and at least 10 days between each detection. PO territory plus YBCUs observed carrying food (single observation), carrying a stick (single observation), traveling as a pair, or exchanging vocalizations.
	Confirmed breeding territory (CO)	Observation of copulation, stick carry to nest, carrying food (multiple observations), distraction display, nest, or fledgling.
Population estimation	Minimum breeding territory	The observed number of confirmed breeding territories (CO).
Occupancy estimation	Site occupancy	Occupancy is based on two or more total survey detections during two or more survey periods and at least 10 days apart. Multiple detections in an area over an extended period of time suggest that the area may have been used for breeding.

Section 3. Nest Searching

Nest searching

CAUTION: Because of the possibility of observer-induced nest abandonment, nest searching and monitoring should only be conducted when part of focused research activities. Special permitting is required to conduct nest searching and monitoring, for both federal and state. We provide general information on nesting activity and nest searching here so surveyors are familiar with the behaviors, and can avoid inadvertent use of those techniques.

Yellow-billed Cuckoos will nest in a wide variety of substrates, with placement height ranging from 1 m (3 ft) to 20 m (65 ft) (Hughes 1999). Nests are usually placed on either a fairly thin branch (horizontal or vertical) in larger trees or shrubs, or next to the trunk of a smaller diameter

at breast height (DBH) tree (Halterman 2002, 2008). Nests have been observed in a number of plant species including willow, cottonwood, alder, ash, mesquite, hackberry, seep willow (*Baccharis salicolifolia*) sycamore (*Plantanus* spp.), and tamarisk. There is usually a fairly high percentage of vegetation cover directly above the nest, and several meters around the nest (Laymon et al. 1997, Halterman 2005, McNeil et al. 2013).

Nesting cuckoos can be very sensitive to disturbance, especially during the pair formation and nest building stage. Nests located prior to the first egg are particularly susceptible to abandonment. At least five nests were abandoned during seven years of study on the Bill Williams River National Wildlife Refuge, possibly due, at least in part, to human disturbance (Halterman 2001, Halterman et al. 2009). Surveyors must be alert to cuckoos' behavioral signs of disturbance near a nest, which include alarm calls given repeatedly while watching the intruder, broken wing displays, or flying in with prey, then eating it instead of going to the nest. If these occur, the observer has been detected, the cuckoo is distressed, and the observer should move back. Recorded calls should not be used to elicit a response during nest searching and monitoring activities, as cuckoos have been observed leaving the nest in response to a recorded call.

Nest searching is done using two methods. Please use this information to avoid unintentionally searching for nests. When cuckoos make a nest exchange, typically one bird will call 10m or more from the nest, and the mate on the nest will answer (M. Halterman, unpublished data). The first method uses the observation of these behaviors. Two to three people will work together, triangulating on the vocalizations. The second method involves carefully searching all vegetation in the area where a cuckoo has vocalized several times, and a nest is suspected. Following the flight direction of cuckoos carrying food can also be used to locate nests.
If a nest is inadvertently found, observers should leave the area after marking the general nest location with a GPS and making brief notes of the general description of the nest site (e.g., plant species used for nest substrate, approximate height of nest, and placement within the tree/shrub canopy). GPS readings are taken no closer than 10 m from the nest, to avoid disturbance. A general description of the nest site should be completed soon after leaving the area. This information may be used for follow-up monitoring by an appropriately permitted individual.

Special Considerations

To avoid adverse impacts to Yellow-billed Cuckoos, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.

2. Do not play the recording more than necessary or needlessly elicit vocal responses once Yellow-billed Cuckoos have been located. This may distract breeding birds from caring for eggs or young. If cuckoos are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators. Stop

playing the survey recording as soon as you have confirmed the presence of a Yellow-billed Cuckoo, and do not play the recording again until you have moved 300 m from the estimated or known location of the previously detected cuckoo.

3. Proceed cautiously while moving through Yellow-billed Cuckoo habitat. Continuously check the area around you to avoid disturbance to nests of Yellow-billed Cuckoos and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.

4. Do not approach known or suspected nests. Nest searching and monitoring require specific State and Federal permits, have their own specialized methodologies (e.g. Martin and Geupel 1993), and are not intended to be a part of this survey protocol.

5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a "dead end" trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix a small flag at least 10 m away and hidden from view of the nest. Record the compass bearing to the nest on the flagging. Report your findings to an agency cuckoo coordinator or a biologist who is permitted to monitor nests.

6. If you use flagging to mark an area where cuckoos are found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized/permitted nest monitoring, flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.

7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, magpies, and accipiters. If such predators are in the immediate vicinity, wait for them to leave before playing the recording, or move on to the next broadcast-point.

8. Non-indigenous plants and animals can pose a significant threat to cuckoo habitat and may be unintentionally spread by field personnel, including those conducting cuckoo surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another, visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). Several non-native species of concern in survey locations are the tamarisk leaf beetle (*Diorhabda* spp.), quagga

mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot's feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

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Appendix 1. Instructions for Completing the Yellow-billed Cuckoo Survey and Detection Form and Survey Continuation Sheet.

These instructions are provided as guidance for completing the standard survey form (see Appendix 2). It is important to complete all fields of the datasheet using a standardized format as described. Write clearly so that others can easily read the data. In addition to documenting sites with cuckoos, it is important to know areas where cuckoos were not detected; datasheets for these areas would have all information on the datasheet completed, including vegetation data, and the total number of cuckoo detections for each survey would be "0". Describe any unique habitat features in comments.

Attach the following: (1) copy of USGS quad/topographical map or similar (REQUIRED) of survey area, outlining survey site and location of cuckoo detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected cuckoos or their nests; (3) photos (if taken) of the interior of the patch, exterior of the patch, and overall site. Submit completed forms to both the appropriate state Yellow-billed Cuckoo coordinator and the US Fish and Wildlife Service (USFWS) by October 15 of the survey year. Forms can also be completed digitally (Microsoft Word or Excel) and submitted via email with attached or embedded topographic maps and photographs.

We recommend scanning or otherwise imaging data sheets immediately after the day's survey is completed. In the event of loss or damage to the data sheet, the information can be salvaged.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the cuckoo survey coordinators for each state and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your state or USFWS cuckoo coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the state or USFWS cuckoo coordinator). If you are uncertain if the site was previously surveyed, contact your state or USFWS cuckoo coordinator.

County. Record the county where the site is located.

State. Record the state where the site is located.

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Elevation. This can be obtained from a handheld GPS unit, USGS quad map, or a GIS elevation layer. Please use the most accurate information available. Please record data in meters.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Site Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units.

Datum. Indicate the datum in which the coordinates are expressed: WGS84, or NAD83. The datum can be selected in the settings of your GPS unit. For uniformity of data we suggest using NAD83.

Ownership. Circle the appropriate owner for the site (BLM, Reclamation, NPS, USFWS, USFS, Tribal, State, Private, or other (Municipal/County)).

Was site surveyed in previous year? Circle yes or no.

If yes, what site name was used? If the site was surveyed in the previous year, record the site name used in the previous year.

Survey Visit #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. Note: A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple sub-sites and use separate survey forms for each. Casual, pre-season, supplemental, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the comments section on page 2 or in the survey continuation sheet.

Observer(s). Record your first initial(s) and last name(s).

Date: Indicate the date that the survey was conducted using the format mm/dd/yyyy.

Start and Stop. Record the start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hrs. Calculate the total hours, rounded to the nearest tenth (0.1) hour, based on time spent surveying the site and the number of surveyors. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed different sections of one site concurrently and independently, sum the number of hours each observer spent surveying the site.

Total Number of YBCUs detected. Record the total number of unique individual adult/fledgling Yellow-billed Cuckoos detected during this particular survey. Do not count nestlings. (But do record whether nestlings or fledglings were found in the comments section.)

Detection Type. Record how the cuckoo was detected using two codes. First, record whether the detection was "Incidental" (with a code of "I") if the cuckoo not was detected during the 6 minutes of each playback/broadcast survey point. If the cuckoo was detected during a playback/broadcast survey, record it as a "P". Second, record whether the detection was A = aural (you only heard a cuckoo), V = Visual (you only saw it), or B = both (you heard and saw it).

Vocalization Type. If the detection was aural, record the type of vocalization heard as "CN" = Contact/kowlp, "CO" = coo, "AL" = alarm (soft knocker call) "OT" = other (and describe the "other" vocalization under notes section.

Playback Number (#). Record the number of times the 'kowlp' call was played before the cuckoo responded.

Behavior Code. Record the appropriate breeding behavior code(s), for the behavior observed using the following codes (listed on the datasheet): AN = at nest, BI = brooding or incubating, CF = adult carrying food, CN = carrying nest material,, COP = copulation, CP = catches prey, DD = distraction displays/defense of nesting area, EF = eats food, FL = recently fledged young of species incapable of flight, FLY = flying, FO = foraging, FS = adult carrying a fecal sac, FY = adults feeding nestlings, JUV = juvenile, NB = nest building, NE = active nest with unbroken eggs in it, NY = nest with young seen or heard in it, ON = occupied nest, PR = preening, SI = sitting, US = used, inactive nest with blue-green eggshells. This list should be printed and taken into the field for reference.

Surveyor Detection Coordinates. Enter the UTM Easting (E) and Northing (N) for the location of the surveyor when the cuckoo was detected. The direction (compass bearing) and distance to the detected cuckoo are estimated from this point.

Distance. Estimate as accurately as possible, the distance in meters to the detected cuckoo.

Bearing. Estimate, as accurately as possible, the compass bearing in degrees to the detected cuckoo from the surveyor location. The compass declination should be set to the magnetic declination of the survey area. Magnetic declination values can be located on USGS 7.5 minute quad maps or can be found using an internet search for "your state" + magnetic declination.

Cuckoo Number (#). Record a sequential number, starting with the number 1 for the first observation of the survey, in the row pertaining to the broadcast - point in which the observation was made. Use this reference number for other note-worthy information in the note section on the datasheet - record the cuckoo number and detailed notes regarding your observations including breeding behavior.

Corrected Coordinates. The Yellow-billed Cuckoo location is calculated based on the surveyor's location, distance, and bearing. This is generally calculated and entered after the survey using GIS or maps.

Survey Summary. At the end of the survey season, complete the survey summary on the front page of the datasheet, near the bottom. Record the total number of detections made (across all surveys at the site); the number of possible breeding territories (see interpreting and reporting survey results); and the total number of survey hours (the sum of all hours spent surveying the site).

Notes. As described above, for each detection during which a cuckoo was observed, record the Note # followed by detailed notes describing the observation(s), or other note-worthy information. Attach additional pages or use the continuation sheet if needed.

Page 2 of Survey Form

Name of Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Provide the reporting individual's phone number; include the area code.

E-mail. Provide the reporting individual's E-mail.

U.S. Fish and Wildlife Service (USFWS) Permit #. List the full number of the required federal permit under which the survey was completed.

State Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State wildlife agency permit.

Site Name. Same as for page 1 of the survey form.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Did you survey the same general area during each visit to this site this year? Yes/No. Circle Yes or No; if No, summarize in the comments below.

If site was surveyed last year, did you survey the same general area this year? Yes/No. Circle Yes or No; if No, record the reason and how the survey varied in the comments below.

Overall Vegetation Characteristics: This describes the overall vegetation characteristic for the site, namely which species predominantly comprise the tree/shrub layer. Check one of the following categories:

Native broadleaf plants - >75 % of the tree/shrub layer of the site is composed of native broadleaf plants.

Exotic/introduced plants - >75 % of the tree/shrub layer of the site is composed of exotic/introduced plants.

Mixed native and exotic plants (mostly native) – 51% -75% of the tree/shrub layer of the site is composed of native broadleaf plants.

Mixed native and exotic plants (mostly exotic) – 51% -75% of the tree/shrub layer of the site is composed of exotic/introduced plants.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate. Specify units used.

Estimated Canopy Cover. Estimate the percent canopy cover for the site.

Overstory Vegetation. Estimate the percent cover provided by the dominant overstory plant species at the site: cottonwood, tamarisk, Goodding's willow, Russian olive, coyote willow, and 'other". If other than the species listed, specify the species.

Average height of understory canopy. The understory canopy comprises a distinct layer (that does not have to be present throughout the site) below the overstory canopy. Provide the best estimate of the average height of the top of the understory canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate. Specify units used.

Estimated Understory Canopy Cover. Estimate the percent understory canopy cover for the site.

Understory Vegetation. Estimate the percent cover provided by the dominant understory plant species at the site: cottonwood, tamarisk, Baccharis, Goodding's willow, Russian olive, New Mexico olive, coyote willow, and 'other". If other than the species listed, specify the species.

Was surface water or saturated soil present at or within 300 meters of the site? Circle yes or no.

Was this true of all patches surveyed? Circle yes or no.
Comments. Provide comments regarding differences between survey patches within the site. For example, if the average canopy for the site is 30% cover, but within one patch it is 60%, describe this. Also note any significant differences between dominant overstory and understory vegetation among patches within the site. Document these differences with photographs whenever possible and reference comments to photos number whenever available. Note potential threats (e.g., livestock, ORV, hunting, etc.) to the site. If *Diorhabda* beetles are observed, contact your

USFWS and state cuckoo coordinator immediately. Attach additional pages or use the continuation sheet if needed.

Page 3 of Survey Form

Yellow-billed Cuckoo survey and detection form, continued: Please use this form for additional detections, follow-up visits, and any other circumstance when more detail is needed. Please use the detailed instructions above for filling out the form.

Page 4 of Survey Form

Record the survey data, survey visit number, point number and UTM for each survey point for each of the four protocol surveys. Recording point number and UTM is optional. Use additional sheets as needed.

Appendix 2. Yellow-billed Cuckoo survey and detection form.

Yellow-Billed Cuckoo Survey Form

Site Name:					County:							State:							
USGS Quad Name:												Elevation:							
Creek, River, Wetland, or Lake Name																			
Site Coordinates:	Start:	E			N							UTM Zone:							
	Stop:	E			N							Datum:							
Ownership:	BLM	Reclamation	NPS	USFWS	USFS	Tribal	State	Private	Other (Municipal/County)										
Was site surveyed in previous year?	Yes	No	Unknown		If yes, what site name was used?														
Survey # Observer(s) (Last Name, First Initial)	Date (m/d/y) Survey, Time, Total Hours	Total Number of YBCUs detected.	Time Detected (AM):	Detect Type: I=Incidental P=Playback A=aural V=visual B=both	Voc. Type: CN=Contact CO=coo AL=alarm OT=other (describe)	Playback #: Number of times 'Kowlp' call played before YBCU responded	Behavior code	Surveyor Detection Coordinates		Distance (m)	Bearing	Cuckoo #	Corrected Coordinates	
								UTM E	UTM N				UTM E	UTM N
Survey Period #1	Date:																		
Observer(s):	Start:																		
	Stop:																		
	Total hrs:	Total:																	
Survey Period #2	Date:																		
Observer(s):	Start:																		
	Stop:																		
	Total hrs:	Total:																	
Survey Period #3	Date:																		
Observer(s):	Start:																		
	Stop:																		
	Total hrs:	Total:																	
Survey Period #4	Date:																		
Observer(s):	Start:																		
	Stop:																		
	Total hrs:	Total:																	
Survey Period #5	Date:																		
Observer(s):	Start:																		
	Stop:																		
	Total hrs:	Total:																	
Survey Summary:	# Det	#PO	#PR	#CO	#Nests found	Total Survey Hours:													
Total YBCUs*																			

Notes (refer to Cuckoo # associated with individual detections)

*Include justification for these designations.

Behavior Codes: AN = at nest, BI = brooding or incubating, CF = adult carrying food, CN = carrying nest material, COP = copulation, CP = catches prey, DD = distraction displays/defense of nesting area, EF = eats food, FL = recently fledged young of species incapable of flight, FLY = flying, FO = foraging, FS = adult carrying a fecal sac, FY = adults feeding nestlings, JUV = juvenile, NB = nest building, NE = active nest with unbroken eggs in it, NY = nest with young seen or heard in it, ON = occupied nest, PR = preening, SI = sitting, US = used, inactive nest with blue-green eggshells.

YBCU Data Form appendix 2 cont.

Fill in the following information completely

Name of Reporting Individual _____ Date Report completed_____

Affiliation _____ Phone # Email _____

USFWS Permit #_____ State Permit #_____

Site Name_____

Length of area surveyed_____ (in kilometers = km)_____

Did you survey the same general area during each visit to this site this year? Yes / No If no, summarize in comments below_____

If site was surveyed last year, did you survey the same general area this year? Yes / No If no, summarize in comments below_____

Overall Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

Native broadleaf plants (>75% native)		Mixed native and exotic plants (mostly nati	
Exotic/introduced plants (>75% exotic)		Mixed native and exotic plants (mostly exot	

Average height of canopy (m)_____ (specify units)_____

Estimated Canopy Cover (percent)_____

Overstory Vegetation: (provide percent estimate of the following dominant species). Use <1%; 10%, 25%, 50%, 75%, 90%, 100%.

	Cottonwood		Goodding's Willow			Coyote Willow		Other (specify)
	Tamarisk		Russian Olive			Other (specify)		Other (specify)

Average height of understory canopy (m)_____ (specify units)_____

Estimated Understory Cover (percent)_____

Understory Vegetation: (provide percent estimate of the following dominant species).Use <1%; 10%, 25%, 50%, 75%, 90%, 100%.

	Cottonwood		Goodding's Willow		Coyote Willow	Other (specify)	
	Tamarisk		Russian Olive		Other (specify)	Other (specify)	
	Baccharis		New Mexico Olive				

Was surface water or saturated soil present at or adjacent to site within 300 meters? Yes No (circle one)

Was surface water or saturated soil present at or adjacent to all patches surveyed? Yes No (circle one)

Comments. Please provide comments regarding differences between the survey patches within the site. For example, if the average canopy for this site is 30% cover, but within one patch it is 60% cover - please note. Also, please note significant differences between dominant overstory and understory vegetation among the patches. Document these differences with photographs whenever possible. Make sure to reference comments to photo number whenever available.

Please provide USGS 7.5 minute quad (or similar)showing survey area to each survey form_____

YBCU Data Form Appendix 2 Cont.

Yellow-billed Cuckoo Survey and Detection Form, continued

Name of Reporting Individual_____ Phone #_____

Affiliation_____ Email_____

Site Name_____

Survey # Observer(s) (Last Name, First Initial)	Date (m/d/y) Survey, Time, Total Hours	Time Detected (AM):	Detect Type: I=Incidental P=Playback A=aural V=visual B=both	Voc. Type: CN=Contact CO=coo AL=alarm OT=other (describe)	Playback #: Number of times 'Kowlp' call played before YBCU responded	Behavior code	Surveyor Detection Coordinates	Distance (m)	Bearing	Cuckoo #	Corrected Coordinates	
							UTM N				UTM E	UTM N

Notes - Cont. (refer to Cuckoo # associated with individual detections)

YBCU Data Form Appendix 2 Cont.

Broadcast point coordinates. Pleaserecord for each survey. (optional)					
Date			Date		
Survey visit number			Survey visit number		
Point#	UTME	UTMN	Point#	UTME	UTMN
Point# 1			Point# 1		
Point# 2			Point# 2		
Point# 3			Point# 3		
Point# 4			Point# 4		
Point# 5			Point# 5		
Point# 6			Point# 6		
Point# 7			Point# 7		
Point# 8			Point# 8		
Point# 9			Point# 9		
Point# 10			Point# 10		
Point# 11			Point# 11		
Point# 12			Point# 12		
Point# 13			Point# 13		
Point# 14			Point# 14		
Point# 15			Point# 15		
Point# 16			Point# 16		
Point# 17			Point# 17		
Point# 18			Point# 18		
Point# 19			Point# 19		
Point# 20			Point# 20		
Point# 21			Point# 21		
Point# 22			Point# 22		
Point# 23			Point# 23		
Point# 24			Point# 24		
Point# 25			Point# 25		
Point# 26			Point# 26		
Point# 27			Point# 27		
Point# 28			Point# 28		
Point# 29			Point# 29		
Date			Date		
Survey visit number			Survey visit number		
Point#	UTME	UTMN	Point#	UTME	UTMN
Point# 1			Point# 1		
Point# 2			Point# 2		
Point# 3			Point# 3		
Point# 4			Point# 4		
Point# 5			Point# 5		
Point# 6			Point# 6		
Point# 7			Point# 7		
Point# 8			Point# 8		
Point# 9			Point# 9		
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Point# 23			Point# 23		
Point# 24			Point# 24		
Point# 25			Point# 25		
Point# 26			Point# 26		
Point# 27			Point# 27		
Point# 28			Point# 28		
Point# 29			Point# 29		

ATTACHMENT 3

Instructions for Completing the Revised Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) Survey Summary Form, Draft Addendum to Appendices 1 to 3 for Yellow-billed Cuckoo Survey Protocol in Arizona, New Mexico, and Texas

U.S. Fish and Wildlife Service (USFWS) and Bureau of Reclamation (Reclamation). 2019. Draft Addendum to Appendices 1 to 3 for yellow-billed cuckoo survey protocol in Arizona, New Mexico, and Texas *in* M.D. Halterman, M.J. Johnson, J.A. Holmes, and S.A. Laymon. 2016. A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo: Draft. U.S. Fish and Wildlife Techniques and Methods. Prepared by S. Sferra, V. Ryan, and M. White for the USFWS, SW Region, Albuquerque, New Mexico, and Bureau of Reclamation, Technical Service Center, Denver, Colorado.

FIELD VERSION. | COMPLETE FINAL VERSION IN EXCEL FOR SUBMISSION | PLEASE READ YOUR PERMIT AND SURVEY INSTRUCTIONS

Yellow-Billed Cuckoo Survey Summary Form for electronic submission (Form revised 2021)

Site Name: | County: | Elevation (m): | State:

USGS Quad Name: | Creek, River, Wetland, Canyon, or Lake Name:

Site Coordinates (UTM): UTM Zone: | Start: **E** **N** | Magnetic North Declination:

NAD 83 preferred Datum: | Stop: **E** **N**

Was site surveyed in a previous year? (Yes, No, Unknown): | If yes, what name was used?:

Survey # Observer(s) (Last Name, First Initial)	Date (m/d/y) Survey, Time, Total Hours	Total # of YBCUs	Survey Number:	YBCU#:	Time Detected (AM):	Detection Method: **I** = Incidental **P** = Playback	Detection Type: **A**=Aural **V**=Visual **B**=Both	Vocalization Type: **CN**= Contact **CO**=coo **AL**=alarm **OT**=other	Number of 'kowlp' calls played prior to response:	Behavior Observed: (refer to codes)	Surveyor Detection Coordinates		Distance (m):	Bearing (in number degrees):	Corrected Coordinates (automatically generated)	
											UTM E (6 digits)	UTM N (7 digits)			UTM E	UTM N
Survey	Date:		1												0	0
1			1												0	0
Observer(s):	Start:		1												0	0
			1												0	0
	Stop:		1												0	0
			1												0	0
	Total hrs:	Total:	1												0	0
			1												0	0
Survey	Date:		2												0	0
2			2												0	0
Observer(s):	Start:		2												0	0
			2												0	0
	Stop:		2												0	0
			2												0	0
	Total hrs:	Total:	2												0	0
			2												0	0
Survey	Date:		3												0	0
3			3												0	0
Observer(s):	Start:		3												0	0
			3												0	0
	Stop:		3												0	0
			3												0	0
	Total hrs:	Total:	3												0	0
			3												0	0
Survey	Date:		4												0	0
4			4												0	0
Observer(s):	Start:		4												0	0
			4												0	0
	Stop:		4												0	0
			4												0	0
	Total hrs:	Total:	4												0	0
			4												0	0

Survey	Date:		5												0	0
5			5												0	0
Observer(s):	Start:		5												0	0
			5												0	0
	Stop:		5												0	0
			5												0	0
	Total hrs:	Total:	5												0	0
			5												0	0

Survey Summary REQUIRED	Total Survey Hours:	Tot. # of Detections:	Total Estimated Breeding Territories: (refer to Territory Defintions below)			Number of Nests Found:
			Number of PO BreedingTerritories:	Number of PR Breeding Territories:	Number of CO Breeding Territories:	
	0	0				

Detection Comments/Additional Behaviors/Nest UTM:

Breeding Behavior Observation Codes	
Brooding/Incubating	BI
Carrying Nest Material	MAT
Copulation	COP
Distraction Display	DD
Feeds Mate	FM
Feeds Nestling	FN
Fledgling	FLG
Nest Building	NB
Carry Food	CF
Kowlp Exchange/Pair	VEX

Breeding Territory Definitions

Possible Breeding Territory (PO):	Probable Breeding Territory (PR):	Confirmed Breeding Territory (CO):
Detections within a 300 - 500 m area during at least 2 surveys and 12 - 14 days apart.	Detections within a 300-500 m area during at least 3 surveys and 12-14 days apart; or PO territory plus purposeful food carry (single observation, bird does not eat food), stick carry (single observation), multiple incidents of alarm calls in same area, or PO territory plus pair exchanging multiple kowlp or alarm calls (not coos) within 100 m of one another.	Observation of active nest (or multiple stick carries to nest being built), copulation, fledgling (unable to fly) with adult; or PR plus multiple food carries to same area or distraction display (dropped wings).

Site Name: | Date Report Completed:

Name of Reporting Individual: | Phone #:

Affiliation: | Email:

USFWS Permit #: | State Permit #:

Ownership: Primary: | Owner Name (if applicable):

Did you survey the same general area during each visit to this site this year (if no, summarize in comments section below)?

If site was surveyed last year, did you survey the same general area this year (if no, summarize in comments section below)?

Length of survey area (km):

Overall Vegetation Characteristics:

Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

Native broadleaf plants (>75% native) | Mixed native and exotic plants (mostly native 51%-75%)

Exotic/introduced plants (>75% exotic) | Mixed native and exotic plants (mostly exotic 51%-75%)

Average Overstory/Canopy (where playback calls were used):

List up to 5 species of overstory vegetation and proportion of average canopy cover of each species . Click on dropdown menu to select scientific name. If species is missing, select OTHER and include scientific name in Comments. For relative percent cover, the total should equal 100%.

		Relative			Relative
Species 1:		% Cover	Species 3:		% Cover
Species 2:		% Cover	Species 4:		% Cover
			Species 5:		% Cover

General Overstory/Canopy Characteristics:

Average Height (top of trees) of Overstory (meters; do not include a range):

Estimated Absolute (as opposed to relative) Canopy Cover (percent; may be < 100%):

Average Subcanopy (if present; where playback calls were used):

List up to 5 species of subcanopy vegetation (if present) and estimate proportion of average subcanopy cover of each species. Click on dropdown menu to select scientific name. If species is missing, select OTHER and include scientific name in Comments. For relative percent cover, the total should equal 100%.

		Relative			Relative
Species 1:		% Cover	Species 3:		% Cover
Species 2:		% Cover	Species 4:		% Cover
			Species 5:		% Cover

General Subcanopy Characteristics:

Average Height (top of trees) of Subcanopy (meters; do not include a range):

Estimated Absolute (as opposed to relative) Subcanopy Cover (percent; may be < 100%):

Average Understory (if present; where playback calls were used):

List up to 5 species of understory/ shrub vegetation (not all sites will have a separate understory) and estimate proportion of average understory cover of each species. Use scientific names. For relative percent cover, the total should equal 100% even if more than 5 species present.

		Relative			Relative
Species 1:		% Cover	Species 3:		% Cover
Species 2:		% Cover	Species 4:		% Cover
			Species 5:		% Cover

General Understory Characteristics:

Average Height (top) of Understory (meters; do not include a range):

Estimated Absolute (as opposed to relative) Understory Cover (percent; may be < 100%):

Immediate Adjacent Habitat Along Entire Transect (Outside of survey site):

Categorize adjacent habitat (e.g. rock outcrop, desert/scrub/thornscrub, urban/residential, agriculture/pasture, orchard, oak woodland, pinyon-juniper woodland, mixed conifer forest, grassland, marsh/wet meadow, open water, ditch/irrigation). List up to 5 categories of adjacent habitat, and estimate proportion of percent cover (should =100%). If adjacent habitat type is missing, select "OTHER" and enter habitat type in Comments.

Category 1:		% Cover		Category 3:	% Cover
Category 2:		% Cover		Category 4:	% Cover
				Category 5:	% Cover

Is the survey area or adjacent area (within 300 m) dominated by surface water or saturated soil during at least 2 surveys?

Perennial, intermittent, or ephemeral drainage (or body of water:):

Comments. If surface water changed between surveys please describe in this section. Provide comments regarding differences between the survey patches within the site. For example, if the average canopy for this site is 30% cover, but within one patch it is 60% cover--please note. Please note significant differences between dominant overstory, subcanopy, and understory vegetation among the patches. Document these differences with photographs whenever possible. referencing comments to photo number whenever available. Note potential threats (e.g., livestock, ORV, hunting, etc.) to the site. If *Diorhabda* beetles are observed, provide location and photos. Attach additional pages or use the continuation sheet if needed.

See state and federal permit reporting requirements. Excel forms (spreadsheets) must be emailed in Excel format. Maps and photos may be compiled into a pdf. Results must be submitted by October 15, following each survey season.

Yellow-Billed Cuckoo Survey Summary Form Page 3 (OPTIONAL) (Form Revised June 2021)

Site Name: Date Report Completed:

Additional Yellow-billed Cuckoo Detections

Comments:	Date:	Survey Number:	YBCU#:	Time Detected (AM):	Detection Method: **I** = Incidental **P** = Playback	Detection type: **A** = Aural **V** = Visual **B** = Both	Voc. Type: **CN**= Contact **CO**=coo **AL**=alarm **OT**=other	Number of 'kowlp' calls played prior to response:	Behavior Observed: (refer to codes)	Surveyor Detection Coordinates		Distance (m):	Bearing (in number degrees):	Corrected Coordinates	
										UTM E (6 digits)	UTM N (7 digits)			UTM E	UTM N
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