



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

2020 Annual Report



January 2021

Lower Colorado River Multi-Species Conservation Program

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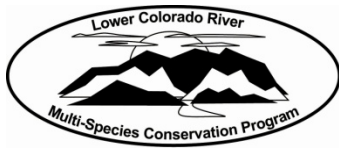
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RECLAMATION

Lower Colorado River Multi-Species Conservation Program

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

2020 Annual Report

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**Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
Lower Colorado Basin
Boulder City, Nevada
<http://www.lcrmscp.gov>**

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ACRONYMS AND ABBREVIATIONS

ac	acre(s)
AOU	American Ornithologists' Union
BLCA	Beal Lake Conservation Area
BWR	Bill Williams River
Bill Williams River NWR	Bill Williams River National Wildlife Refuge
BWR East	Bill Williams River East
BWR West	Bill Williams River West
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 (<i>Coccyzus americanus occidentalis</i> , western cuckoo)
CVCA	Cibola Valley Conservation Area
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)
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.
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 (<i>Coccyzus americanus</i> , cuckoo; referred to as <i>Coccyzus americanus occidentalis</i> in the LCR MSCP's regulatory documents)
YEW	Yuma East Wetlands

Symbols

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

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Attachments

Attachment	
1	Maps of Survey Sites and Transects, Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Study Area, 2020
2	A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo (<i>Coccyzus americanus occidentalis</i>)
3	Instructions for Completing the Revised Yellow-billed Cuckoo (<i>Coccyzus americanus occidentalis</i>) Survey Summary Form

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 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.

Six conservation areas managed by the LCR MSCP were surveyed in 2020, including Planet Ranch, 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. A stretch of suitable habitat within the Bill Williams River National Wildlife Refuge comprising Bill Williams River East (BWR East) and Bill Williams River West (BWR West) was also surveyed. Reclamation surveyed one other LCR MSCP conservation area, the Beal Lake Conservation Area, which is reported separately. Another LCR MSCP conservation area, the Dennis Underwood Conservation Area, will be surveyed under this contract in future years. The same sites were surveyed for cuckoos in 2020 as in 2019, except for the addition of Planet Ranch, previously surveyed by Reclamation, and the removal of Beal Lake Conservation Area surveys, which Reclamation took over.

Following the current survey protocol, from June 15 to August 6, 2020, the Southern Sierra Research Station surveyed 41 sites ranging from 9 to 212 hectares, totaling approximately 1,714 hectares. Over four surveys at each site, surveyors recorded 304 survey detections, including 11 at BWR East, 5 at BWR West, 7 at Planet Ranch, 122 at the PVER, 35 at the Cibola Valley Conservation Area, 76 at Cibola NWR Unit #1, 43 at the LDCA, and 5 at Yuma East Wetlands.

After or between surveys, 297 followup visits were conducted in areas of activity to determine breeding status and to resight previously banded birds. Eighty-four breeding territories were estimated in the study area, including 37 possible, 28 probable, and 19 confirmed breeding territories.

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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 positively resighted, two capture attempts were permitted to recapture the bird. If no cuckoos carrying GPS tags were resighted or recaptured, an alternate option was to capture two birds at a site where no previous capture attempts have occurred in order to provide information on site fidelity and dispersal. In 2020, surveyors positively resighted six cuckoos banded in previous years; none were GPS-tagged birds. In lieu of resighting and capturing any GPS-tagged birds, two attempts were made to capture adults at the LDCA Reach 1 North site in 2020, resulting in the capture of one female. Additionally, five chicks were opportunistically banded from low nests at the LDCA and Cibola NWR Unit #1 (Upper and Middle Hippy Fire).

Nest searching and monitoring were not part of the project scope of work in 2020, 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. Twelve nests were found in the study area during followup visits in 2020: seven at the PVER (Phases 3, 4, and 6), three at Cibola NWR Unit #1 (Upper and Middle Hippy Fire), and two at the LDCA (one in each reach) where breeding was confirmed for the first time. The nests were not typically monitored; however, some monitoring occurred to determine the banded status of adults. The fates of six nests were discovered during resight attempts, with all successfully fledging at least one young. The fates of six other nests are unknown.

Chapter 1 – Introduction and Project Background

YELLOW-BILLED CUCKOO HISTORY ON THE LOWER COLORADO RIVER

The Bureau of Reclamation (Reclamation) has been conducting surveys for the western distinct population segment of yellow-billed cuckoo (*Coccyzus americanus*, western cuckoo, cuckoo – referred to as yellow-billed cuckoo, western yellow-billed cuckoo, and *Coccyzus americanus occidentalis* in the Lower Colorado River Multi-Species Conservation Program [LCR MSCP’s regulatory documents]) along the lower Colorado River (LCR) since 1998. From 1975 to 1979, 242 cuckoos were estimated along the LCR, with an additional 208 at the Bill Williams Delta (Rosenberg et al. 1991). By 1986, the estimate for the LCR had declined to 18 cuckoos and 50–60 at the Bill Williams Delta (Rosenberg et al. 1991). Other reports describe population changes based on surveys conducted annually since 2006 (Haltermann et al. 2009; Johnson et al. 2008; McNeil and Tracy 2013; McNeil et al. 2010, 2011, 2012, 2013a, 2013b, 2020; Parametrix Inc. [Parametrix], and Southern Sierra Research Station [SSRS] 2015, 2016a, 2016b, 2018, 2019). Most cuckoos on the LCR are currently located in conservation areas managed by the LCR MSCP (McNeil et al. 2020; Parametrix and SSRS 2019). A major factor for the decline of cuckoos in the West, including along the LCR, has been the loss of habitat within riparian systems (Gaines and Laymon 1984; Rosenberg 1991). The Proposed Rule for Threatened Status for the western cuckoo occurred on October 3, 2013 (78 FR 61621). 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 distinct population segment 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, have been issued by the USFWS (Haltermann et al. 2016) (USFWS and Reclamation 2019).

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 the 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 efforts 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. The locations to be surveyed under this contract include the Beal Lake Conservation Area (BLCA) (surveyed by Reclamation in 2020), 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 (at an appropriate age), Laguna Division Conservation Area (LDCA), and Yuma East Wetlands (YEW) (see chapter 2, figure 1; see chapter 3, tables 1 and 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. 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 (BWR) between Planet Ranch and Lake Havasu (see chapter 2, figure 1). Surveys and followup visits will be conducted for 4 years (2019–22). In 2023, a summary report will be prepared showing results of the previous 4 years. All services will be conducted in accordance with the LCR MSCP's Habitat Conservation Plan (LCR MSCP 2004a), the associated biological opinion (File Number: 02-21-04-F-0161) (USFWS 2005a) and Section 10(a)(1)(a) permit (TE-086834-0) (USFWS 2005b), and the LCR MSCP biological assessment (LCR MSCP 2004b).

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 approximately 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, figure 1). Sites that a cuckoo would potentially use were defined in the LCR MSCP Habitat Conservation Plan as at least 10 hectares (ha) (25 acres [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 previous survey history. However, most nesting occurs in patches 20 ha or more in extent (Halterman et al. 2016). Additionally, territory sizes (95% kernel density estimates) in this study area averaged approximately 20 ha (50 ac) based on observations of 77 radio-tracked cuckoos from 2009 to 2012 (McNeil et al. 2013b), and no nests have been found in the study area in patches smaller than about 20 ha (50 ac). Thus, most small, isolated patches are unlikely to support breeding. The SSRS surveyed all LCR MSCP conservation areas at least 2 years old and containing suitable habitat, except for the BLCA, which was surveyed by Reclamation in 2020 (Raulston 2020, personal communication) and is reported separately.

In 2020, the SSRS surveyed all sites surveyed in 2019, except for the Bill Williams River East (BWR East) site, Gibraltar Rock, which was not surveyed due to a lack of suitable habitat, and the BLCA. Due to new habitat becoming suitable, one site within Cibola NWR Unit #1 was added, North 160. Planet Ranch, surveyed by Reclamation in 2019 (LCR MSCP 2020), was surveyed by the SSRS in 2020. A total of 41 sites were surveyed in 2020 (see chapter 2, table 1).

Within each site, 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).

SITE DESCRIPTIONS

Sites surveyed in 2020 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 at Cibola NWR Unit #1 Nature Trail (Nature Trail)/Mass Transplanting and CW-North/Cottonwood Genetics

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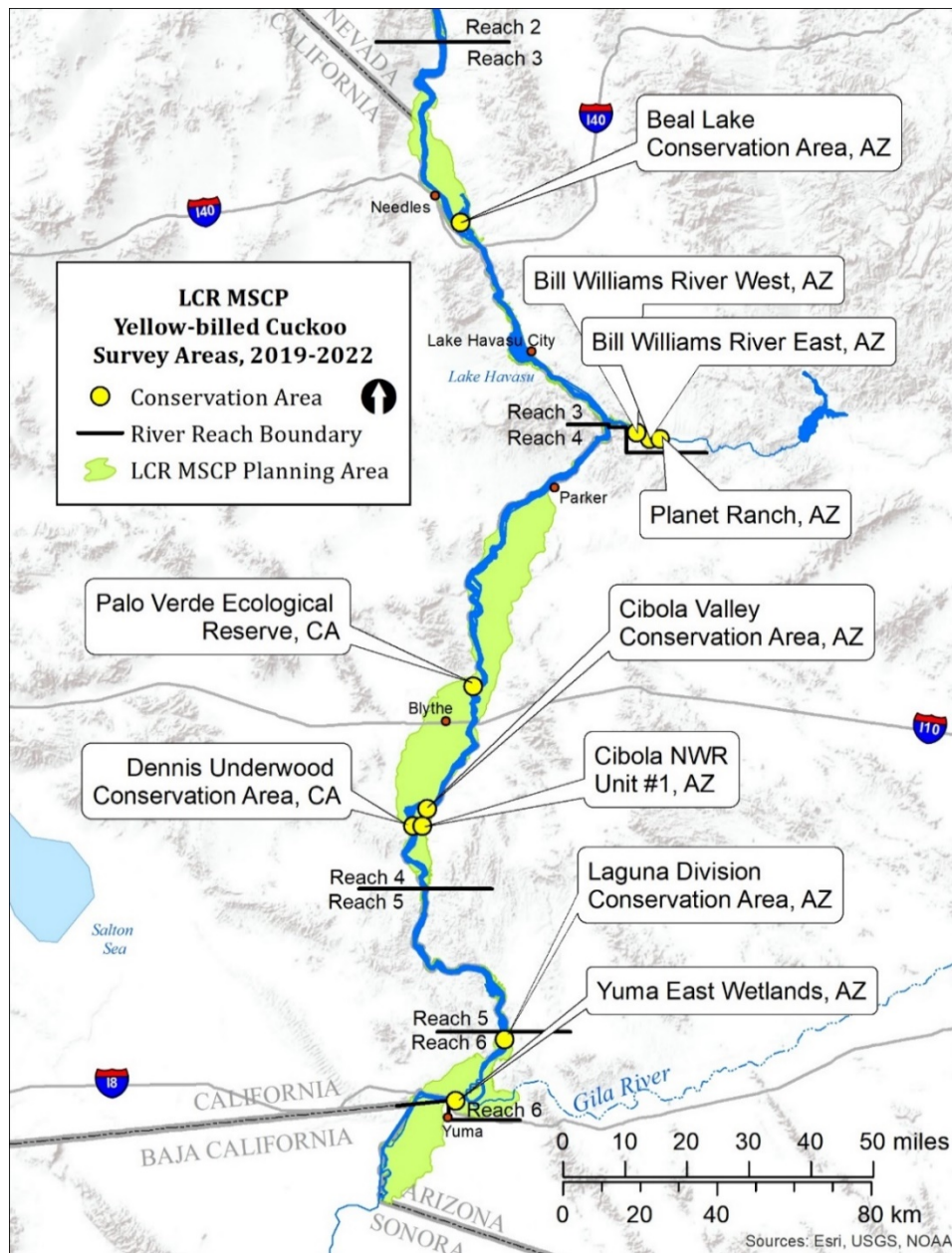


Figure 1.—LCR MSCP cuckoo survey areas, 2019–22.

(see chapter 2, table 1). The conservation areas are described in more detail in annual reports and restoration development plans available at https://lcrmscp.gov/steer_committee/technical_reports.html Survey detections and estimated territories (see chapter 3, table 5) are included here for each site surveyed in 2020.

All detections summarized in the following site descriptions were assessed by spatial location, observed behaviors, and associated dates, and they are used

to categorize the breeding status for each occupied patch as a possible (PO), probable (PR), or confirmed (CO) breeding territory (following Halterman et al. 2016; USFWS and Reclamation 2019) (see chapter 3, table 4). 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 also listed in chapter 3, table 5.

Bill Williams River National Wildlife Refuge

La Paz and Mohave Counties, Arizona

The BWR East and Bill Williams River West (BWR West) areas are within the Bill Williams River NWR (figure 2). This refuge was established in 1993 and was formerly part of the Havasu National Wildlife Refuge. 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 BWR 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 2004–05 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). 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>. Unlike previous releases designed to mimic a late winter storm, water was discharged as needed for dam repairs and diver safety.

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 season may have helped recharge the aquifer.

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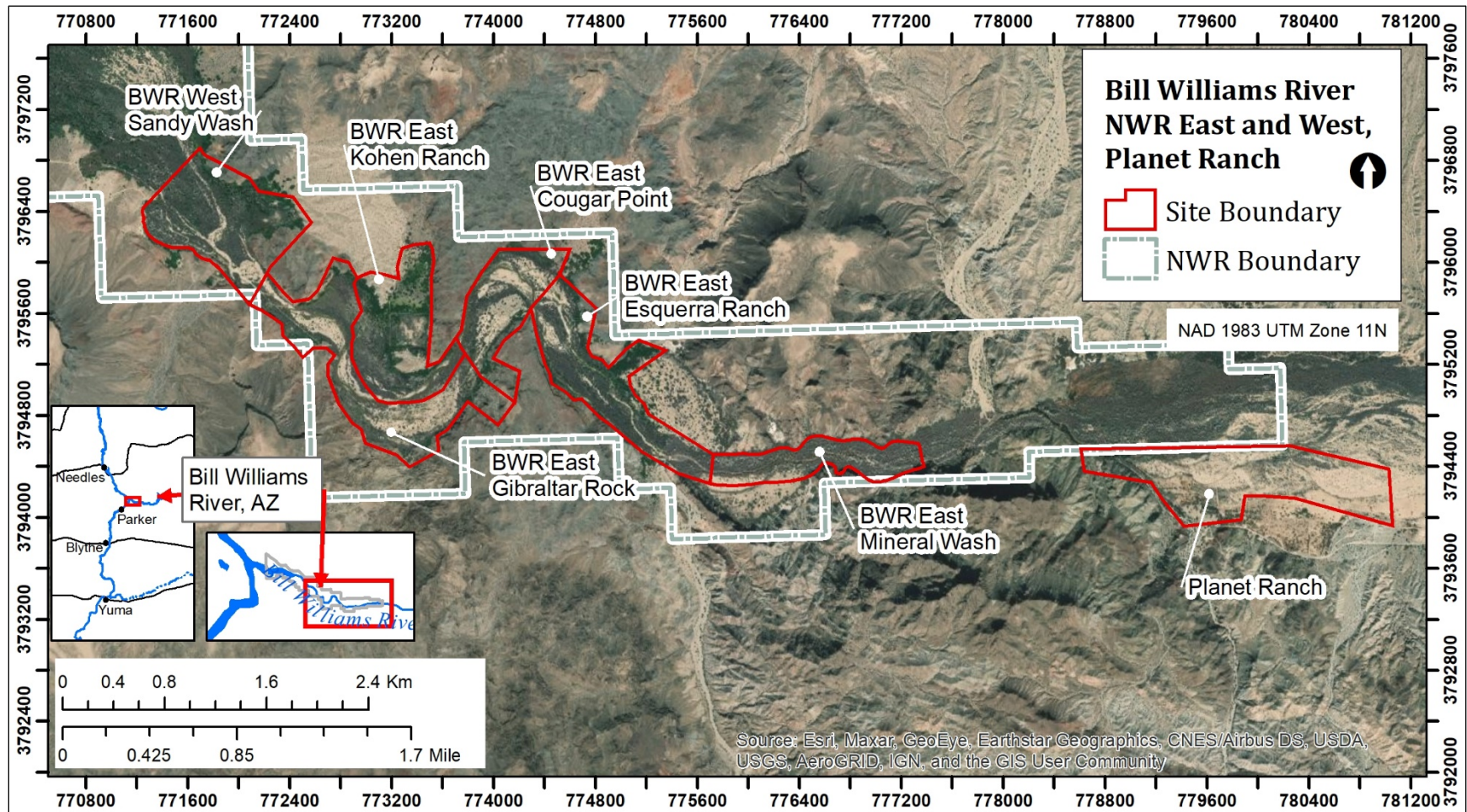


Figure 2.—BWR East, BWR West, and Planet Ranch, showing sites surveyed in 2020.

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 area 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 BWR East and BWR West areas were removed from the study area after 2015 due to a reduced scope of work, with BWR 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 (LCR MSCP 2017). Thus, in 2017, the riparian forest between Mineral Wash (BWR East) and Sandy Wash (BWR West) was included again in annual surveys. This stretch of the river was surveyed in 2020. Planet Ranch was surveyed by Reclamation in 2019 and by the SSRS in 2020.

Changes, such as dropped or added transects, are discussed in each site description below. Five sites at the Bill Williams River NWR were surveyed in 2020, and one other site previously surveyed in 2019 (Gibraltar Rock) was not surveyed in 2020 due to a lack of suitable habitat.

Many routes and trails previously used for cuckoo surveys were unusable or not found due to the large amount of downfall across the trails or channel alteration by 2020 dam releases. Areas of previously suitable habitat also became unsuitable due to long-term drought. Before surveys began, crews spent several days evaluating habitat and creating 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 (23 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 BWR (see figure 2). 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 3 years, the understory became dominated by dead

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tamarisk, cottonwood, and willow. After the release of dam water 2 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, where California black rail (*Laterallus jamaicensis coturniculus*) and Yuma clapper rails (also known as Yuma Ridgway's rail = *Rallus obsoletus yumanensis*) were detected this year. Deadfall from this year's release washed downstream, creating large log jams. To the east and west are mixed native-exotic forest, a continuation of the habitat of Esquerra Ranch.

In 2020, there were seven survey detections, one PO territory, and one PR territory at this site.

Site: Kohen Ranch

68.5 ha (169.3 ac)

Section: C1937

Kohen Ranch is a 2-km section of the Bill Williams River NWR approximately 38 km 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). This restored area north and east of the original site boundary includes approximately 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 3 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 2 years ago, new cohorts of cottonwood and willow can be seen along the riverbed. With this year's release, more of the dead understory brush has been cleared, 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.

In 2020, there were three survey detections and one PO territory 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 approximately 38 km (24 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). 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 BWR corridor. The river flowed during spring and summer in 2018 and also during cuckoo surveys in 2019 and 2020. This year's flood release from Alamo Dam turned most of the dead tamarisk accumulating in the eastern edge into large piles. The eastern edge also appears most impacted from prior drought, and some of the older cottonwood-willow forest is dying or dead.

In 2020, there was one survey detection and no territories 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-mi) section of the Bill Williams River NWR approximately 38 km (24 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). This section gradually widens into a floodplain laced with dry river channels. It has 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. The western section is mostly dead cottonwood-willow and tamarisk. The main transect loops around the eastern end of the broad floodplain, following an old river channel and road. Most trees along the road have died due to prolonged drought. 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. Another transect was added in 2020 to capture new

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habitat. Hikers and researchers use this accessible site. In 2018, the BWR flowed during spring and again in mid-July. In 2019, the wash was dry, except in the east section, which had some ponding. With this year's release and 2 years of new growth, the northeastern section hosts a marsh understory, where California black rails and western least bitterns (*Ixobrychus exilis hesperis*) were detected this year.

In 2020, there were five survey detections and one CO territory (fledgling).

Area: Planet Ranch

Mohave and La Paz Counties, Arizona

Site: Planet Ranch

34.8 ha (86 ac)

Section: C1801

Planet Ranch is a 2-km (1-mi) section of the mid-BWR approximately 33 km (21 mi) west of Alamo Lake. This site was previously surveyed by Reclamation, with cuckoos present in 2019 (LCR MSCP 2020), and was first surveyed by the SSRS in 2020. The site was acquired to create and manage disconnected backwaters within a mosaic of native land covers types for LCR MSCP species (LCR MSCP 2020). The restoration concept includes development of at least 60 acres of backwater, improvements to protect the site from flows within the BWR and adjacent drainages, and establishment of a mosaic of cottonwood, Goodding's willow, and honey mesquite (Hannon et al. 2018). Public access to the Planet Ranch road crosses the BWR and provides vehicular travel from Mohave County to La Paz County. During farming and development of the area, public use is limited to the north-south Planet Ranch road. Cave Wash (surveyed in past years) is to the north of the designated survey boundaries, with gallery cottonwood-willow forest. Following the survey transect created by Reclamation in 2019, the SSRS surveyed the area to the south, with open alluvial plains interspersed with cottonwoods, which hosts a thriving overstory of cottonwood-willow and a semi-dense understory of mesquite.

In 2020, there were seven survey detections and one PR territory at this site.

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 3). 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 approximately 414 ha (1,023 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 now 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 2020.

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 both 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 sap, possibly from insect infestations. All sites contain stressed, dying, or dead trees.

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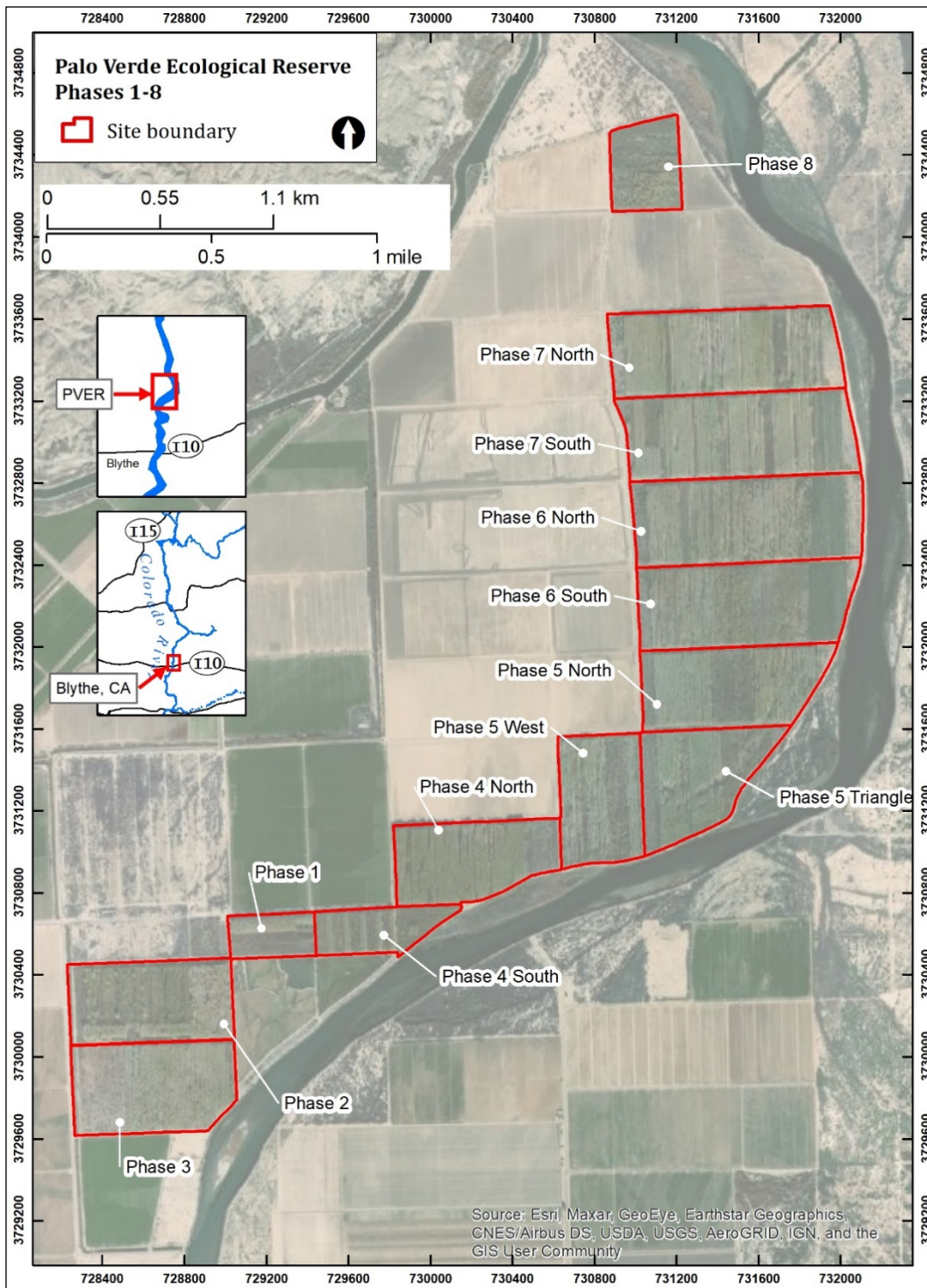


Figure 3.—PVER Phases 1–8, showing sites surveyed in 2020.

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 3). Mature cottonwoods and Goodding's willow are present and at the southern edge is a dense patch of senescing coyote willow (*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. 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 2020, there were two survey detections and one PO territory 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 3). 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 the many 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 2020, there were 15 survey detections, 2 PO territories, 1 PR territory, and 1 CO territory (copulation) 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 3). 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

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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 2020, there were seven survey detections and one CO (nest) 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 3). 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 are 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 2020, there were five detections, one PO territory, and two CO territories (nests) in Phase 4 North and three 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 3). This site 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 2020, there were 13 survey detections, 1 PO territory, 1 PR territory, and 1 CO territory (fledgling) in Phase 5 North; 6 detections, 3 PO territories, and 1 PR territory in Phase 5 Triangle; and 11 detections and 2 PO territories 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 3). 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 2020, there were 16 survey detections, 2 PO territories, 3 PR territories, and 2 CO (1 nest and 1 copulation) territories in Phase 6 North and 15 detections, 1 PO territory, 1 PR territory, and 3 CO (nests) territories 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 3). The eastern and western end plots are planted with honey mesquite and native grasses (LCR MSCP 2011, 2012a). 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 perimeter. PVER Phase 7 shows similar habitat site changes as in the PVER Phase 6 description, with yellowing and stressed mesquite along the eastern and western borders. Due to its large size, this phase is surveyed as two sites: Phase 7 North and Phase 7 South.

In 2020, there were 9 detections, 3 PO territories, and 1 PR territory in Phase 7 North and 17 detections, 2 PO territories, 1 PR territory, and 1 CO (copulation) territory 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 3). It was planted with honey mesquite and alkali sacaton (*Sporobolus airoides*) in 2013, and scattered cottonwoods have naturally colonized (LCR MSCP 2012b). The trees are growing well and appeared mostly healthy and green during the cuckoo breeding season, though some cottonwoods appear stressed. 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 2020, there were three 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 4). 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 2020.

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 (see figure 4) 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 cottonwood, Goodding's willow, and coyote willow. 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 canals. In 2020, the site had many dying, downed, and stressed trees. Most interspersed stands of coyote willow 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.

For the first year since 2008 when surveys began in CVCA Phase 1, there were no survey detections in either Phase 1 North or Phase 1 South in 2020.

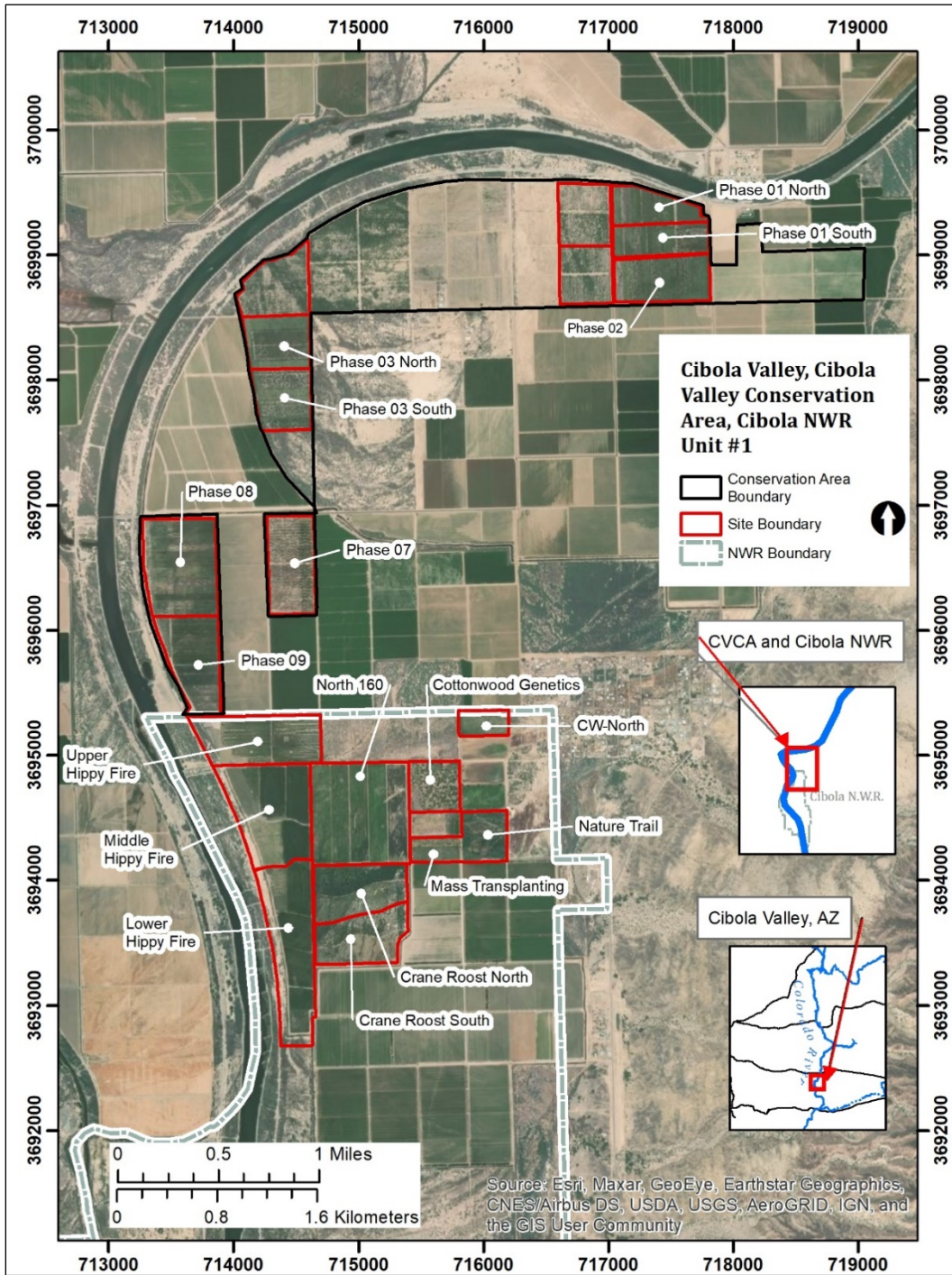


Figure 4.—The CVCA and Cibola NWR Unit #1, showing sites surveyed in 2020.

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Site: Phase 2

27.5 ha (67.9 ac)

Section: C2528

CVCA Phase 2 was planted in 2008 (LCR MSCP 2007c, 2010d) (see figure 4) to create an additional 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 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.

For the first year since 2009 when surveys began in CVCA Phase 2, there were no survey detections at this site in 2020.

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 4). The site was planted in 2007 (LCR MSCP 2007d, 2010e). By 2020, most patches of coyote willows appeared water stressed and were dying or dead. The site has low canopy cover, except for the dense plantings of cottonwoods along the western border, which appear healthy. 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 2020, there were four survey detections and one PO territory in Phase 3 North and three detections and one PO 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, 400 m (1,312 ft) east of Phase 8, and 1.2 km (0.75 mi) east of the Colorado River (see figure 4).

Plantings in 2015 converted the area from active agricultural fields to honey mesquite and cottonwoods, which along with earlier phases was designed to create a mosaic of native vegetation (Stegmeier et al. 2018a, 2018b).

In 2020, there were seven survey detections, one PO territory, and one CO territory (copulation) 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, 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 4). 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 2020, there were 12 survey detections, 1 PO territory, 1 PR territory, and 1 CO territory (fledgling) 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 4) 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 2020, there were nine survey detections and two PR territories 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 4). The refuge, created in 1964, spans over 6,475 ha (16,000 ac), including both the historical river

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channel and another 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. Eight sites were surveyed in 2020, including North 160, a new site that became suitable in 2020. 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.

Site: Cottonwood Genetics/CW-North

24.6 ha (60.9 ac)

Section: C2741

Cottonwood Genetics was planted in 2005 with 1,000 trees propagated at a research greenhouse at Northern Arizona University for a university project conducted in association with Reclamation (Nelson 2007) (see figure 4). Researchers used the plantings to assess the influence of stand-level genetic diversity on communities and ecosystem processes. The site is a park-like grove of mature cottonwoods with an open understory. It is bordered by an agricultural field 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 4). It consists of a mostly cottonwood overstory and ground cover dominated by Bermuda grass (*Cynodon dactylon*). The plot is bordered on the north by Baseline Road and agricultural fields. Fallow fields of sparse tamarisk, arrowweed (*Pluchea sericea*), and quailbush (*Atriplex lentiformis*) extend east and west. Cottonwood Genetics is 200 m (656 ft) to the southwest, separated by an agricultural field. The Nature Trail is 580 m (1,903 ft) to the south, separated by an agricultural field. All sites were later incorporated into Cibola NWR Unit #1 (LCR MSCP 2009d, 2009e; Stegmeier et al. 2018e).

In 2020, there were 10 survey detections and 1 PR territory in the Cottonwood Genetics and 1 survey detection in CW-North.

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 4). 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. To the south is a younger plot planted in 2009 consisting of cottonwood, Goodding's willow, and coyote willow (LCR MSCP 2009f).

In 2020, there were six survey detections and no territories 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 willow, Goodding's willow, cottonwood, and honey mesquite (LCR MSCP 2009f) (see figure 4). 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, and some willows have defoliated tops and are resprouting from the base.

In 2020, there were four survey detections and one PR territory 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 4). This site grew rapidly and was intermittently checked for cuckoos in 2014. It was first surveyed in 2015. Nesting cuckoos in this area may have been using the adjacent sites Middle Hippy Fire and North 160, but without banded birds, it was not possible to determine.

In 2020, there were nine survey detections, two PO territories, and two CO territories (nests).

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 4). The site is bordered by Upper Hippy Fire to the north and Lower Hippy Fire to the south. 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 2020, there were 20 survey detections, 1 PO territory, 2 PR territories, and 1 CO territory (nest) at this site.

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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 4). The site is bordered by dirt and gravel access roads, an irrigation canal, and Crane Roost to the east, the LCR to the west, and Middle Hippy Fire to the north.

In 2020, there were nine survey detections and one PO and one PR territory 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 4). Some open areas are invaded by non-native Johnsongrass (*Sorghum halepense*).

The Nature Trail was first planted in 1999 (LCR MSCP 2007b) (see figure 4). 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. The site is invaded with Johnsongrass, and many willows and understory trees are dead or stressed.

In 2020, there were five survey detections one PO territory, and one PR territory at this site.

Site: North 160

63.9 ha (158 ac)

Section: C2742

North 160 borders some older plantings in Cibola NWR Unit #1, including Mass Transplanting and Cottonwood Genetics to the east, Crane Roost to the south, and

Hippy Fire to the west. The acreage in Cibola NWR Unit #1 is set aside for restoration and has been divided into five areas, with North 160 designated as Area Number 4. Once a fallowed agricultural field, it was planted in 2018 (Stegmeier et al. 2018h). In 2019, at only 1 year of age, cuckoo surveyors noticed unbanded cuckoos from adjacent sites, Crane Roost and Hippy Fire, foraging in this site. The only cuckoo nest ever found 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, when it became suitable for breeding.

In 2020, there were 12 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 1; figure 5). The LDCA is downstream from Imperial Dam and upstream of Laguna Dam and encompasses approximately 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 salt cedar 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.

The new 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 maneuver through due to varying water levels and dense vegetation. Reach 1 was first surveyed in 2016, with Reach 2 added in 2018.

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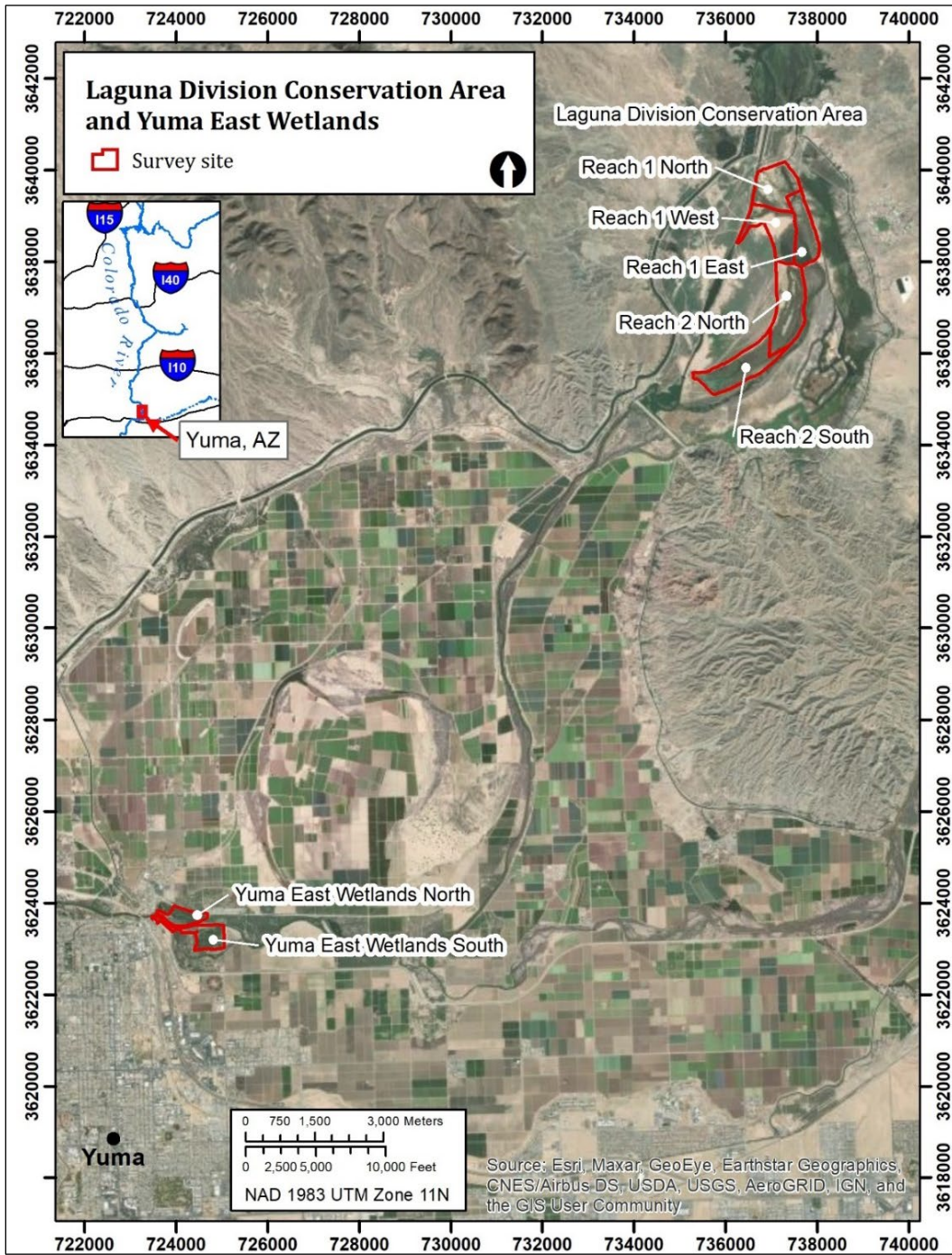


Figure 5.—The LDCA and YEW, showing sites surveyed in 2020.

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 5) 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 2020, 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. This site is divided into three survey routes, Reach 1 East, Reach 1 West, and Reach 1 North, to ensure full survey coverage.

In 2020, there were 7 detections, 2 PO territories, and 1 PR territory at Reach 1 East; 11 detections, 1 PO territory, 1 PR territory, and 1 CO territory (nest) at Reach 1 North; and 14 detections, 2 PO territories, and 1 PR territory at Reach 1 West. The 2020 nest is the first found at this site. One adult and two chicks were banded at this nest (further described in chapter 4).

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 5). 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, there were seven survey detections, one PO territory, and one CO territory (nest) in Reach 2 North, and four survey detections and no territories in Reach 2 South. The nest was the first found in Reach 2. The nest is described in chapter 4.

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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 5). Until planting began in 2003, the area was a mix of exotic plants, 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 5). 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 large 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. This site had four detections in 2017, two detections in 2018, and no detections in 2019 or 2020.

In 2020, there were no survey detections or 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 5) and consists of a mosaic of cottonwoods, Goodding's willows, and honey mesquite mixed with open areas.

In 2020, there were five survey detections, one PO territory, and one PR territory at this site.

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 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). Standardized surveys and territory estimates continued in 2020 in six LCR MSCP conservation areas and a stretch of the Bill Williams River NWR comprising BWR East and BWR West. The surveyed conservation areas described in chapter 2 include Planet Ranch, PVER, CVCA, Cibola NWR Unit #1, LDCA, and YEW.

METHODS

Survey Sites

Sites surveyed in 2020 included all sites surveyed in 2019, except Gibraltar Rock, which was removed due to lack of suitable habitat, and the BLCA, with Reclamation now conducting surveys at this site. One new site in Cibola NWR Unit #1 was added in 2020 after becoming suitable habitat at 2 years post-planting: North 160 (table 1; see chapter 2 for detailed descriptions). Additional survey transects were added in 2020 to BWR East Kohen Ranch, Sandy Wash, and CVCA Phases 7, 8, and 9 to increase habitat coverage.

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, Hippy Fire, and LDCA Reach 1 were each divided into two or three sites [e.g., PVER Phase 4 North/South, Upper/Middle/Lower Hippy Fire] – see 2019 annual report, McNeil et al. 2020). One more site, LDCA Reach 2, was divided into two survey sites in 2020, becoming Reach 2 North and Reach 2 South.

Surveys

Four surveys were conducted per site in 2020 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]).

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Table 1.—Sites surveyed for cuckoos in the LCR MSCP study area, 2020

Area	Site	Hectares	Acres
BWR East	Esquerra Ranch	73.9	182.6
	Mineral Wash	41.0	101.2
	Kohen Ranch	68.5	169.3
BWR West	Sandy Wash	80.8	199.6
Planet Ranch	Planet Ranch	98.8	244.1
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
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	22.6	55.9
	Cottonwood Genetics/CW-North	24.6	60.9
	Crane Roost North	29.9	74.0
	Crane Roost South	27.3	67.6
	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

Table 2.—Cuckoo survey dates for the LCR MSCP study area, 2020

Survey period	Survey number	Survey dates
1	1	June 15 to June 28
2	2	June 29 to July 12
2	3	July 13 to July 26
3	4	July 27 to August 7

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 spaced 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 on adjacent roads, for greater visual detectability or if the interior was inaccessible. Surveyors used Samsung Galaxy S8+ phones (Android operating system) with Collector for ArcGIS™ version 18.0.3 and build 1033 (Esri) to locate survey points and record field data. During all field work, surveyors also recorded the presence of other LCR MSCP avian focal species (table 3). After field 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, 2020

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

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At each survey point, surveyors recorded the location, time, and presence of live cicadas. 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 call-playback and recorded the true bearing and estimated distance from the surveyor to the bird, time of detection, number of calls broadcast, response type, behavior, vocalizations, and presence and color combinations of any leg bands observed. Surveyors also recorded any observed 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 may be recognized by observant surveyors.

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 \leq 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 (e.g., estimated distance and bearing, behavior, and vocal codes) and were used to help determine breeding status.

Breeding Territory Estimates

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 spatial location, observed behaviors, and dates to determine initial territories and to categorize the breeding status for each territory as a possible (PO), probable (PR), or confirmed (CO) breeding territory (Halterman et al. 2016; USFWS and Reclamation 2019) (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 calls 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 reneesting with another male after leaving an active nest (Halterman 2009), polygyny/multiple maternity of nests (McNeil 2015), and one or both adults reneesting following a successful or failed nest. The number of actual territories represents

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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 over-estimates 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 the attached GPS tag (see Parametrix and SSRS 2019). Observations made during these followup visits were used to refine the breeding status of estimated territories, such as upgrading a PO to a PR or CO territory if breeding evidence was observed. Followup visits occurred at all sites where cuckoos were detected and were concentrated in areas such as the LDCA, where no previous breeding evidence had been detected.

RESULTS

From June 15 to August 6, 2020, surveyors recorded 1,776 survey points across 164 survey visits to 41 sites, yielding 304 survey detections (table 5). Overall survey detections peaked during survey 2 (early to mid-July, $n = 92$), with similar numbers during survey 3 ($n = 89$) (table 5). Detections peaked on survey 1 at the BWR West, Planet Ranch, and the LDCA and on survey 3 at the PVER, Cibola NWR Unit #1, and YEW. At the CVCA (Phases 3, 7, 8, and 9), detections were consistent over surveys 2 to 4 ($n = 10$). For the first year since surveys began in 2008 at CVCA Phase 1, there were no survey detections in either Phase 1 or Phase 2 (2009) in 2020.

Eighty-four estimated or confirmed breeding territories were recorded in the study area, including 37 PO, 28 PR, and 19 CO territories. 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. Followup visits led to the resighting of 6 adults and the discovery of 12 nests.

Table 5.—Yellow-billed cuckoo survey results and breeding territory estimates, LCR MSCP study area, 2020

Area	Site	Detections by survey					Territories ¹			Size (ha)	Detections per ha/ 20 ha
		1	2	3	4	Total	PO	PR	CO		
BWR East	Esquerra Ranch	1	4	1	1	7	1	1	0	73.9	0.09/1.89
	Kohen Ranch	1	1	1	0	3	1	0	0	68.5	0.04/0.88
	Mineral Wash	0	1	0	0	1	0	0	0	41.0	0.02/0.49
	BWR East total	2	6	2	1	11	2	1	0	183.4	0.06/1.2
BWR West	Sandy Wash	2	1	1	1	5	0	0	1	80.8	0.06/1.24
	BWR West total	2	1	1	1	5	0	0	1	80.8	0.06/1.24
Planet Ranch	Planet Ranch	4	2	1	0	7	0	1	0	98.8	0.07/1.42
	Planet Ranch total	4	2	1	0	7	0	1	0	98.8	0.07/1.42
PVER	Phase 1	0	0	2	0	2	1	0	0	8.9	0.22/4.49
	Phase 2	4	4	6	1	15	2	1	1	31.6	0.47/9.49
	Phase 3	3	1	3	0	7	0	0	1	34	0.21/4.12
	Phase 4 North	1	4	0	0	5	1	0	2	28.4	0.18/3.52
	Phase 4 South	0	2	1	0	3	0	0	0	12.8	0.23/4.69
	Phase 5 North	3	4	3	3	13	1	1	1	33.7	0.39/7.72
	Phase 5 Triangle	0	2	1	3	6	3	1	0	28.3	0.21/4.24
	Phase 5 West	0	4	4	3	11	2	0	0	25.3	0.43/8.7
	Phase 6 North	2	6	5	3	16	2	3	2	46.7	0.34/6.85
	Phase 6 South	3	6	5	1	15	1	1	3	42.2	0.36/7.11
	Phase 7 North	5	2	1	1	9	3	1	0	45.5	0.2/3.96
	Phase 7 South	2	3	7	5	17	2	1	1	45.0	0.38/7.56
	Phase 8	1	0	1	1	3	1	0	0	44.7	0.07/1.34
PVER total	24	38	39	21	122	19	9	11	427.1	0.29/5.71	

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Table 5.—Yellow-billed cuckoo survey results and breeding territory estimates, LCR MSCP study area, 2020

Area	Site	Detections by survey					Territories ¹			Size (ha)	Detections per ha/ 20 ha
		1	2	3	4	Total	PO	PR	CO		
CVCA	Phase 1 North/South	0	0	0	0	0	0	0	0	37.2	0/0
	Phase 2	0	0	0	0	0	0	0	0	27.5	0/0
	Phase 3 North	0	3	1	0	4	1	0	0	21.9	0.18/3.65
	Phase 3 South	2	1	0	0	3	1	0	0	21.8	0.14/2.75
	Phase 7	1	1	2	3	7	1	0	1	29.3	0.24/4.78
	Phase 8	1	3	5	3	12	1	1	1	44.7	0.27/5.37
	Phase 9	1	2	2	4	9	0	2	0	31.2	0.29/5.77
	CVCA total	5	10	10	10	35	4	3	2	213.6	0.16/3.28
Cibola NWR Unit #1	Cottonwood Genetics/ CW-North	3	3	3	2	11	0	1	0	24.6	0.45/8.94
	Crane Roost North	2	1	2	1	6	0	0	0	29.9	0.2/4.01
	Crane Roost South	1	1	2	0	4	0	1	0	27.3	0.15/2.93
	Lower Hippy Fire	0	3	3	3	9	1	1	0	49.6	0.18/3.63
	Middle Hippy Fire	4	4	8	4	20	1	2	1	49.3	0.41/8.11
	Mass Transplanting/Nature Trail	1	2	2	0	5	1	1	0	37.8	0.13/2.65
	North 160	2	4	2	4	12	0	4	0	63.9	0.19/3.76
	Upper Hippy Fire	1	3	1	4	9	2	0	2	37.8	0.24/4.76
	Cibola NWR Unit #1 total	14	21	23	18	76	5	10	3	320.2	0.24/4.75

Table 5.—Yellow-billed cuckoo survey results and breeding territory estimates, LCR MSCP study area, 2020

Area	Site	Detections by survey					Territories ¹			Size (ha)	Detections per ha/ 20 ha
		1	2	3	4	Total	PO	PR	CO		
LDCA	Reach 1 East	2	2	3	0	7	2	1	0	78.1	0.09/1.79
	Reach 1 North	5	4	2	0	11	1	1	1	65.0	0.17/3.38
	Reach 1 West	9	2	2	1	14	2	1	0	82.6	0.17/3.39
	Reach 2 North	4	1	2	0	7	1	0	1	112.9	0.06/1.24
	Reach 2 South	0	3	1	0	4	0	0	0	98.8	0.04/0.81
	LDCA total		20	12	10	1	43	6	3	2	437.4
YEW	YEW North	0	0	0	0	0	0	0	0	26.8	0/0
	YEW South	0	2	3	0	5	1	1	0	40.6	0.12/2.46
	YEW total	0	2	3	0	5	1	1	0	67.4	0.07/1.48
All sites	Grand total	71	92	89	52	304	37	28	19	1,828.7	0.17/3.32

¹ PO = possible breeding territory, PR = probable breeding territory, and CO = confirmed breeding territory.

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 nest monitoring may occur to determine the banded status of adults, and some monitoring occurred at nests of conservation interest, such as nests with irregular hatching dates. Without continued nest monitoring and banding, nest fate and the parentage of most nests become unknown, and the ability to compare results to previous years is lost.

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 or over 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, as cuckoos may respond to broadcast survey calls from the nest (following Martin and Geupel 1993). Searchers also targeted the dawn vocal exchange 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 by stick nests

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containing 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 Navigation Satellite System location was recorded with distance and direction to the nest. A more accurate position was sometimes recorded after nesting activity had ceased. Nest site characteristics such as nest substrate height, species, and 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 nest stage and try to resight banded adults. To determine nest stage, observers watched nests through binoculars or a spotting scope. If nests were low enough (below 7 m [23 ft]), experienced personnel sometimes used a telescoping mirror pole to check nest contents. Most nest 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 was suggested by the appearance of two eggs in one 24-hour period during laying or the appearance of a new egg 3 or more days after laying had apparently ceased (MacWhirter 1989), based on observations that cuckoos typically lay 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 locate the bird. If a GPS bird were positively resighted, a banding crew would visit the area as soon as possible to attempt to recapture it (see below).

Banding

In 2020, 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 2020 would carry over into 2021, when four attempts could be made.

To capture adult cuckoos, a suitable net lane, such as a gap in the vegetation, was found or created, and a modified target mist net technique was used (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). Recorded vocalizations were then broadcast from speakers on either side of the mist net 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 2020 were banded with a silver Federal band on one leg and a pinstriped (two or three-striped) 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 June 26 and July 31, 2020, 12 nests were found in the study area (table 6), including 7 nests at the PVER (1 in Phase 3, 2 in Phase 4 North, 1 in Phase 6 North, 3 in Phase 6 South), 3 at Cibola NWR Unit #1 (2 in Upper Hippy Fire, 1 in Middle Hippy Fire), and 2 at the LDCA (one each in LDCA Reaches 1 and 2). No nests were found during or directly after surveys; all 12 nests were found during followup visits while attempting to resight GPS-tagged birds or determine breeding status. Known nesting activity began June 20 at LDCA Reach 1 (nest #1) and ended August 5 in PVER Phase 6 (nest #4). The nests were found in cottonwood (n = 9), Goodding's willow (n = 2), and honey mesquite (n = 1).

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Table 6.—Yellow-billed cuckoo nests found in the LCR MSCP study area, 2020

Area	Site	Nest #	Date found	Tree sp.¹	Tree height (m)	Nest height (m)
PVER	Phase 3	1	July 19	POPFRE	13.4	11.8
	Phase 4	1	July 20	POPFRE	7	5.9
	Phase 4	2	July 21	PROGLA	17	13.4
	Phase 6	1	July 1	POPFRE	18	12
	Phase 6	2	July 16	POPFRE	18	12.8
	Phase 6	3	July 20	POPFRE	18	14
	Phase 6	4	July 26	POPFRE	18	11.4
Cibola NWR Unit #1	Middle Hippy Fire	1	July 18	POPFRE	6	3.5
	Upper Hippy Fire	1	June 28	SALGOO	9	5.75
	Upper Hippy Fire	2	July 9	SALGOO	10	4
LDCA	Reach 1	1	June 26	POPFRE	15	3.5
	Reach 2	2	July 31	POPFRE	2	1.2

¹ POPFRE = Fremont cottonwood, PROGLA = honey mesquite, and SALGOO = Goodding’s willow.

The fates of most nests were not determined, though some were during attempts to resight nesting adults. Six of the 12 nests successfully fledged at least 1 young, 1 nest was depredated in the chick stage, and the fates of the other 5 nests are unknown. The six successful nests included PVER Phase 6 nest #s 1 and 2, Middle Hippy Fire nest #1, Upper Hippy Fire nest #s 1 and 2, and LDCA Reach 1 nest #1. Five young were opportunistically banded from three low nests: LDCA Reach 1 nest #1 (two chicks), Upper Hippy Fire nest #1 (two chicks) and Middle Hippy Fire nest #1 (one fledgling) (see below, “Banding”). Three whole eggs abandoned in 2020 were collected from two nests: Middle Hippy Fire nest #1 (one egg) and Upper Hippy Fire nest #1 (two eggs) and sent for examination to the Western Foundation of Vertebrate Zoology, Camarillo, California. Any results will be shared with Reclamation.

Notable Nests

Upper Hippy Fire Nest #1

The nest was found on a followup visit, after observing from afar frequent visits to a dense willow thicket at the edge of the plot within 4 m (13 ft) of a gravel road (figures 6 and figure 7). Several followup visits were conducted to resight the



Figure 6.—Upper Hippy Fire nest #1 with three eggs and one chick about to fledge, July 11, 2020.

(Photo D. Tracy.)



Figure 7.—Upper Hippy Fire nest #1: one already fledged, one newly hatched, and two eggs, July 12, 2020.

(Photo by D. Tracy.)

parents, eventually identified as a seventh-year female banded as a chick in 2014 in PVER Phase 6 South (JAG) and an after-second-year male banded in Middle Hippy Fire in 2019 (GAL). The female was not seen between 2014 and 2020 and had dispersed 40.7 km (25.3 mi) from her natal site to breed. A different pair of banded adults nested within 36 m (118 ft) of this nest's location in 2019, neither of them were resighted in 2020. When found, the nest contained one egg being

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incubated, with another whole egg found on the ground. Three more eggs were laid, considerably past normal timing (daily or every other day until clutch completion). The 5- to 7-day period between the first two eggs and the later three suggests the eggs may have been laid by two or more females (MacWhirter 1989). Of the five eggs, two hatched and fledged; one was found on the ground; one shell, assumed to be from a hatchling, was found on the ground with the chick missing; and one egg remained abandoned in the nest.

LDCA Reach 1 Nest #1

This was the first cuckoo nest found at the LDCA since planting. The nest was low, in a small scraggly cottonwood between a larger grove of taller dense cottonwoods to the north, and a sometimes flooded dry 4-m (13-ft)-wide bare channel at the edge of a marshy area of cattails and open water to the east. A pair was detected in the area during the first survey on June 25. Surveyors observed adults foraging in a dense mesquite grove directly north of the cottonwood grove (figure 8), and during a followup visit early on June 26, the nest was located by following nest exchange calls. On June 30, the nest contained a 1-day-old chick and two eggs. A banding team returned July 6 and banded two chicks at 5 and 6 days old (figures 9 and figure 10) (see above, “Banding”). A banding crew also attempted to capture the nesting pair at the direction of Reclamation, with a female (MRO) captured (see above, “Banding”). The banding of chicks and adults at this site may provide future information on site fidelity and dispersal.



Figure 8.—LDCA Reach 1 nest #1 in a cottonwood grove bordering a mesquite plot.

(Photo by D. Tracy)



Figure 9.—Extracting two chicks from LDCA Reach 1 nest #1 for banding.
(Photo by D. Tracy)



Figure 10.—Five- and 6-day-old chicks in nest, LDCA Reach 1 nest #1.
(Photo by D. Tracy)

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LDCA Reach 2 Nest #1

This was the first cuckoo nest found in LDCA Reach 2 and the second found in this conservation area. The nest area was located during the third survey on July 22 when the surveyor heard several alarm calls, usually indicative of a nest or recently fledged area. The nest was found the next morning by slowly walking through the area systematically searching. The area consists of a linear grove of dense young cottonwoods surrounded by tall arrowweed and cattails (figures 11 and figure 12). The nest was fairly low in the fork of a small cottonwood and contained two chicks estimated at 0 to 1 day old. There were raccoon tracks in the mud near the nest when found, but no more visits to the nest occurred in time to determine the fate. The nest was revisited on August 5, with no response to playback calls and no adults or juveniles detected at the site. The nest tree, already with dying and brown leaves during brooding, was now almost entirely brown (figure 13).



**Figure 11.—LDCA Reach 2 nest #1 \approx 1.2-m high
in a small cottonwood tree.**

(Photo by C. Henke)



Figure 12.—Young dense cottonwood grove where LDCA Reach 2 nest #1 was found.

(Photo by C. Henke)



Figure 13.—Browning leaves of LDCA Reach 2 nest tree when revisited on August 5.

(Photo by C. Henke)

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Resights

Six cuckoos banded in previous years were positively resighted in 2020, including four males and two females (table 7); none were GPS tagged. Five of the six were at least 5 years old (table 7), reflecting an ageing population of banded cuckoos in the study area. One male (FUJ) and one female (JAG) dispersed from the PVER to Cibola NWR Unit #1.

Table 7.—Cuckoos resighted in the LCR MSCP study area, 2020

Site	Resight date	Bird ID ¹	Color bands ²	Age ³	Sex ⁴	Original capture site	Original capture date
North 160	June 29	FUJ	S/W-IB-W	A5Y	M	PVER 5 Triangle	July 28, 2016
PVER 6 South	July 1	TAS	S/W-G-W	A6Y	M	PVER 6 South	June 19, 2015
Upper Hippy Fire	July 11	GAL	S/V-IB-V	ASY	M	Middle Hippy Fire	July 6, 2019
Upper Hippy Fire	July 11	JAG	Lv-Bk/R	7Y	F	PVER 6 South	July 28, 2014
PVER 6 South	July 21	NIP	S/R-IB-R	A5Y	F	PVER 7 South	Aug. 23, 2016
PVER 6 South	July 26	SER	S/W-Lv-W	A8Y	M	PVER 5 North	July 12, 2013

¹ Bird ID: unique three-character identifier of the individual cuckoo.

² Color bands (left/right, top to bottom): Bk = black, G = green, IB = light blue, Lv = lavender, R = red, S = silver, V = violet, and W = white; hyphen (-) indicates a split band consisting of two or three colors.

³ Age: 7Y = seventh year, ASY = after second year, A5Y = after fifth year, etc.

⁴ Sex (confirmed by DNA test): F = female, and M = male.

Banding

As no GPS-tagged cuckoos were positively resighted in 2020, the option was exercised to band birds at a site with no previous banding. At the request of Reclamation, banders attempted to recapture the adults at LDCA nest #1. One attempt was made on July 5, with no captures. On July 6, the female was captured near the nest, banded, and released (table 8), with both adults later seen returning to the nest area. Additionally, five chicks were opportunistically banded from low nests (table 8).

Table 8.—Cuckoos newly banded in the LCR MSCP study area, 2020

Date banded	Site	Age ¹	Band number	Bird ID ²	Color bands ³
July 6	LDCA Reach 1	AHY	1212-27577	MRO	S/O-W-O
July 6	LDCA Reach 1	L	1212-27575	N1 C1	G-V/S
July 6	LDCA Reach 1	L	1212-27576	N1 C2	O-IB/S
July 11	Cibola NWR Unit #1 Upper Hippy Fire	L	1212- 27578	N1 C1	mB-W-mB/S
July 17	Cibola NWR Unit #1 Upper Hippy Fire	L	1212- 27580	N1 C2	Y-mB/S
July 18	Cibola NWR Unit #1 Middle Hippy Fire	L	1212- 27581	N1 C1	Bk-R/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): Bk = black, G = green, IB = light blue, mB = mid-blue, O = orange, R = red, S = silver, V = violet, W = white, and Y = yellow; hyphen (-) indicates a split band consisting of two or three colors.

DISCUSSION

For the first time since surveys began in the study area in 2008, no cuckoos were detected at the adjoining CVCA Phases 1 or 2 (planted 2006 and 2008 respectively), and the younger Phases 7–9 adjacent to Cibola NWR Unit #1, now 5, 4, and 3 years old, respectively, have replaced the older phases in attracting nesting cuckoos to the area. Since the first confirmed breeding in Phase 1 in 2008 (Haltermann et al. 2009), these two phases supported a sizable though varying population, peaking in detections and confirmed breeding territories in 2011 (McNeil et al. 2013b). In 2019, there were no detections in Phase 1 and just seven in Phase 2 (McNeil et al. 2020). Drought, fire, and possibly reduced irrigation may have contributed to increased tree and shrub stress and death and reduced the overall habitat quality of these sites for cuckoos. The apparent abandonment of the older CVCA phases by cuckoos may also relate to the age of the 64-ha (160-ac) cottonwood-willow forest, now 12-14 years old, and supports observations that nesting cuckoos prefer young stands of cottonwood-willow forest (McNeil et al. 2013b; Parametrix and SSRS 2019; Stanek et al. 2020).

The Bill Williams River NWR has seen a recent increase in cuckoo activity since surveyors detected no cuckoos there in 2017 (Parametrix and SSRS 2018, 2019), which may be related to the recent dam releases that have caused habitat

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regeneration along the main river channel. At the LDCA, the confirmation of nesting in both reaches met an objective to confirm breeding in areas without previous confirmation. This area has grown from small sparse trees to many large dense patches of cottonwood-willow forest and spreading mesquite bosque. The seasonal detection trend observed at the LDCA, as well as BWR West and Planet Ranch, with peaks during the first survey period, suggests some cuckoos detected on these surveys were migrating through the areas on the way to breeding sites elsewhere.

Dying and stressed Goodding's and coyote willows, cottonwoods, and honey mesquite were again observed in 2020 at the PVER, CVCA, and Cibola NWR Unit #1. A reduction in leaf mass and canopy cover is expected to reduce available nesting habitat (McNeil et al. 2013b). Additionally, reduced canopy cover of cottonwoods can result in cicadas emerging earlier and at lower densities (Smith et al. 2006). Disturbances that alter the emergence timing or abundance of prey could have consequences for the species' reproductive cycle. Tree health at breeding sites, and changes in cicada emergence phenology compared to nesting phenology, all warrant further discussion, reserved for the summary report.

Reduced banding since 2016 has led to both fewer yearly resights and an ageing cohort of banded cuckoos in the study area. The limited banding that has continued throughout the project, despite the variable annual effort, may still be informative. Mark-recapture data are necessary for measuring annual survivorship, a critical measure of population stability, annual growth rate, and habitat quality (Lebreton et al. 1992).

Cuckoos are nesting in the large, young phases in CVCA, Cibola NWR Unit #1, and LDCA as expected (Parametrix and SSRS 2019), though some continue to nest in the older PVER Phases 3, 4, and 6. In recent years, the PVER has supported the largest known breeding population in California, and the most productive area within the LCR MSCP study area, from 2011 (McNeil et al. 2013b) to now. There has, however, been a downward trend in survey detections and territories here since the high of 204 detections in 2014 (Parametrix and SSRS 2019), and 2 more dispersal events were recorded from the PVER to Cibola NWR Unit #1 in 2020, suggesting some of the decline at the PVER is due to cuckoos moving to younger habitat.

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ATTACHMENT 1

Maps of Survey Sites and Transects, Lower Colorado River
Multi-Species Conservation Program Study Area, 2020

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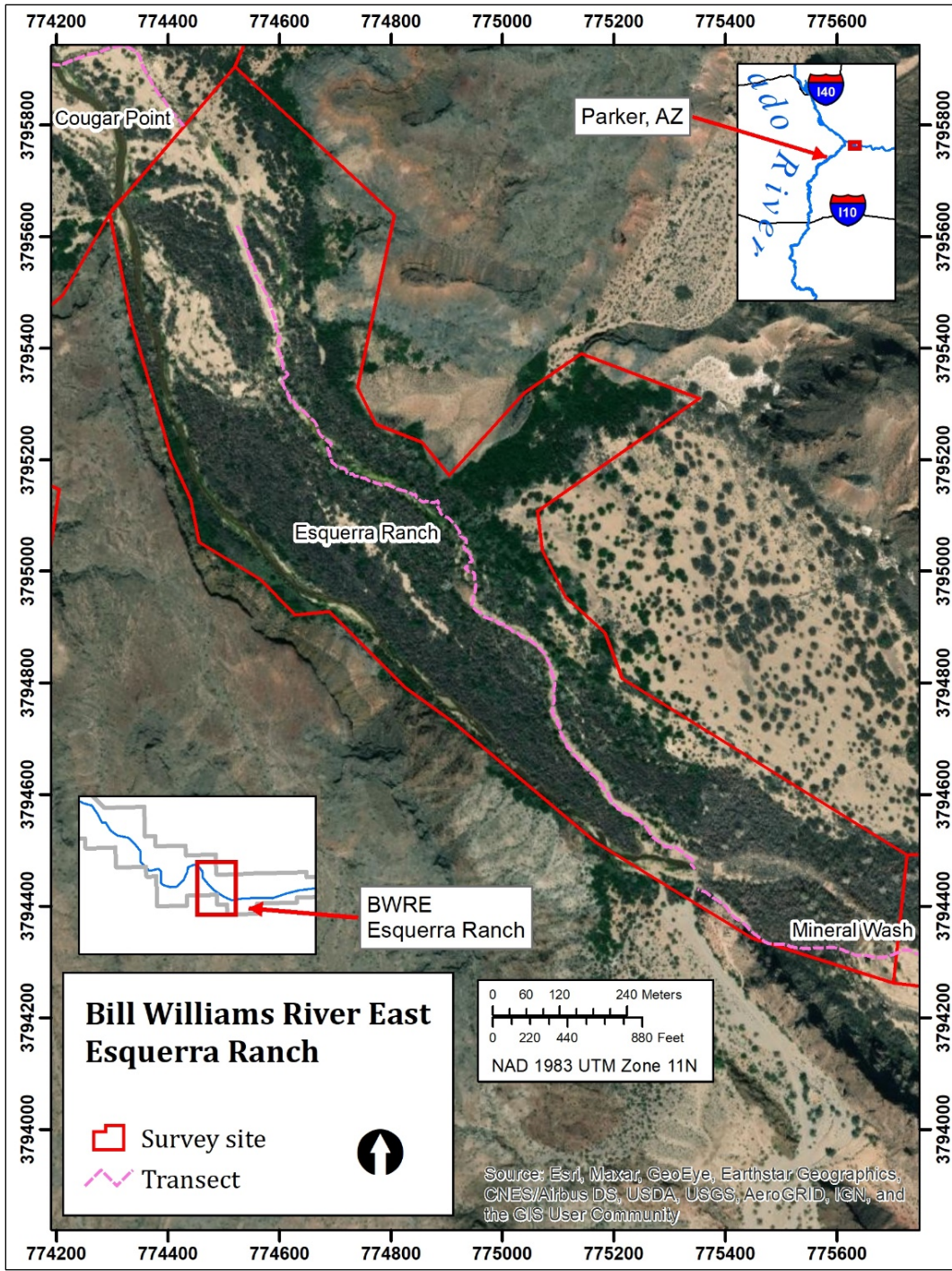


Figure 1.—Bill Williams River East (Esquerra Ranch) yellow-billed cuckoo survey site showing transect, 2020.

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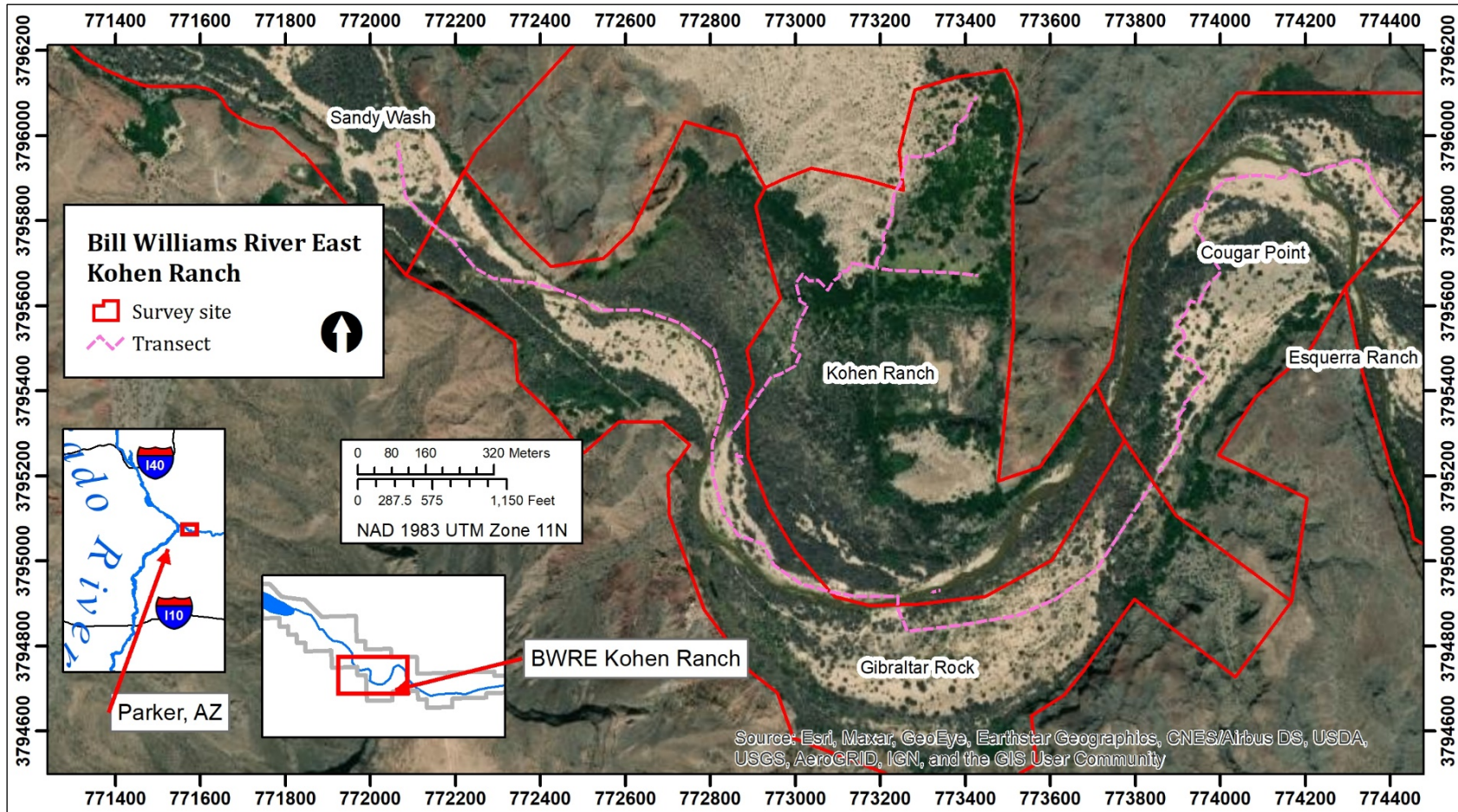


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Lower Colorado River Multi-Species Conservation Program Study Area, 2020

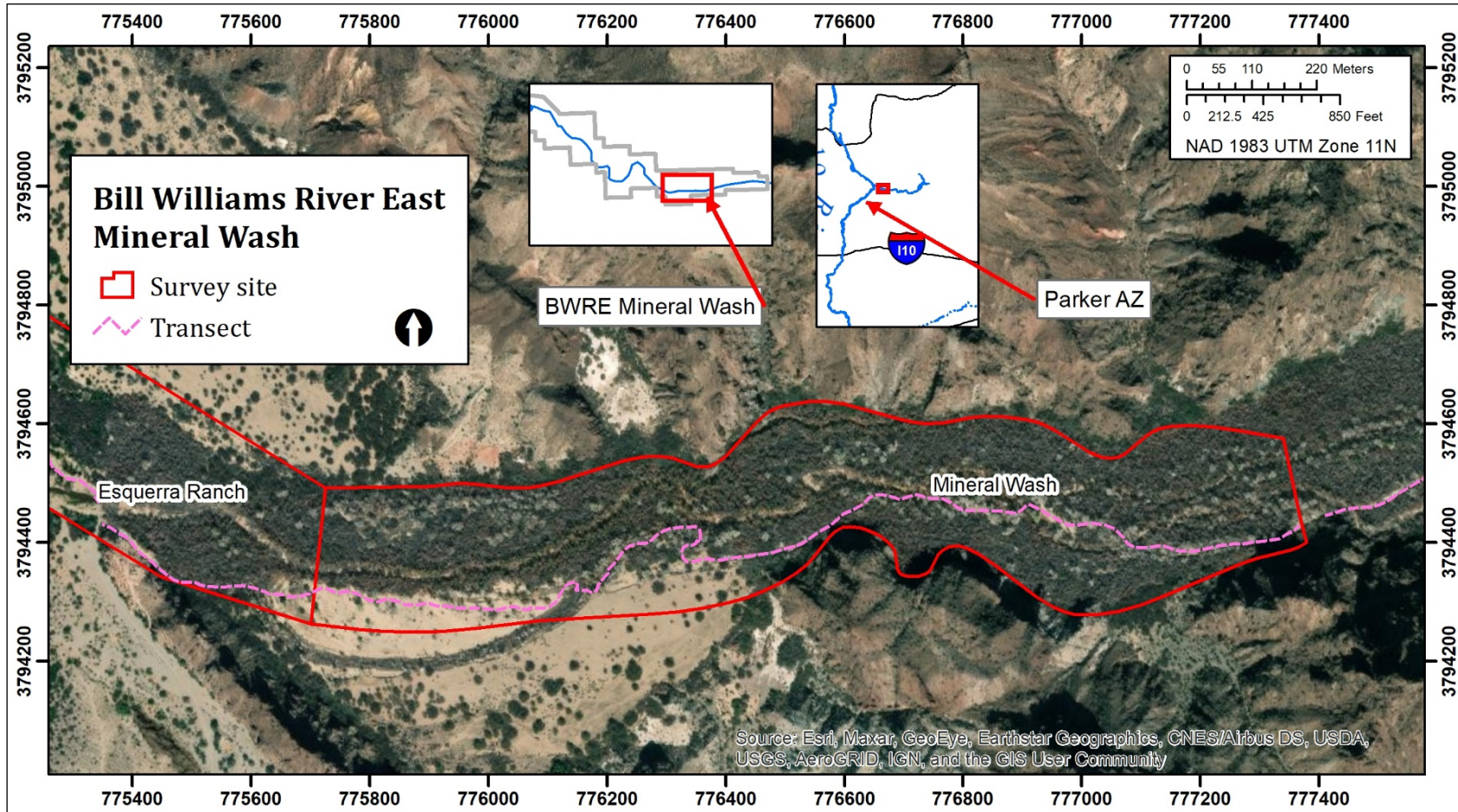


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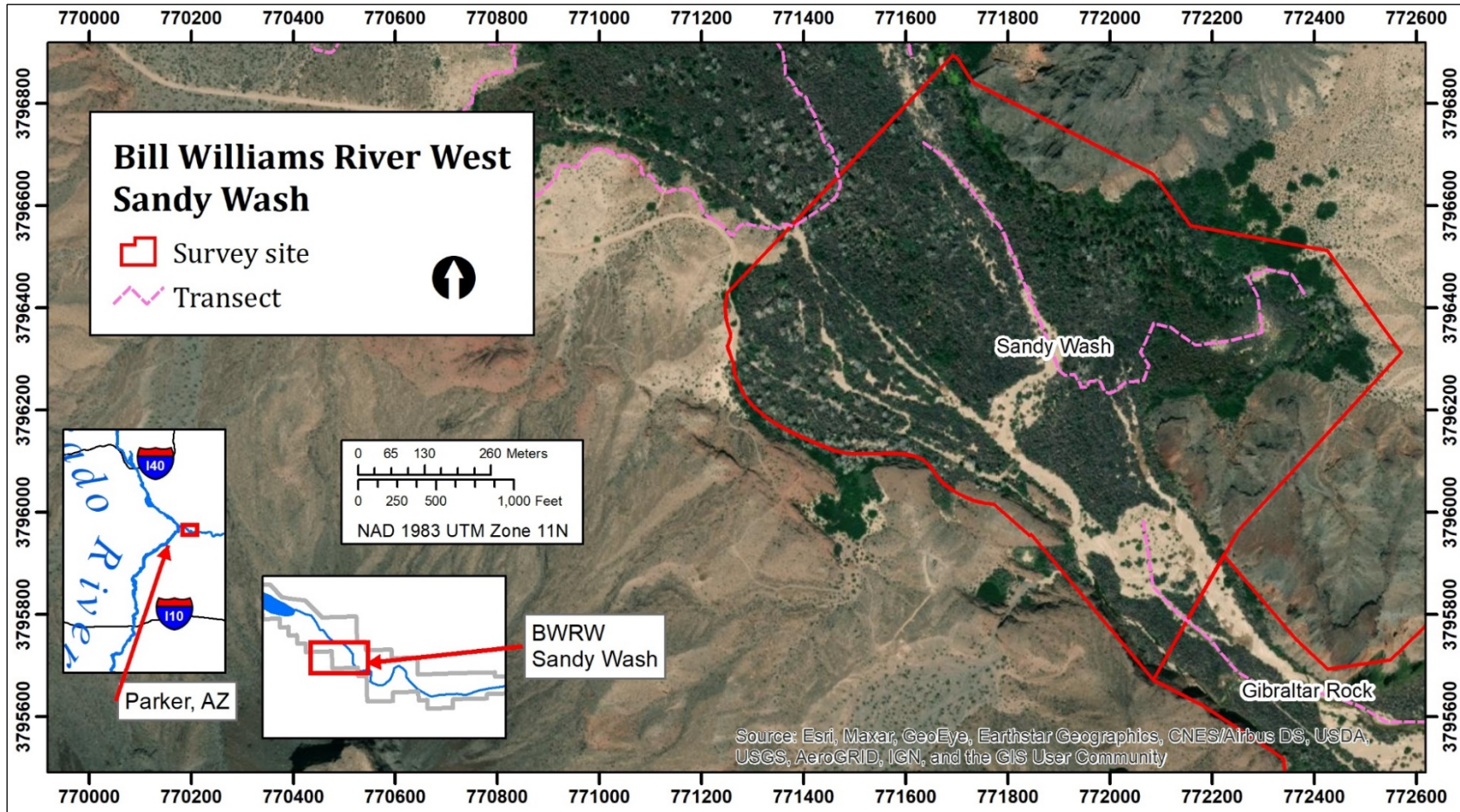


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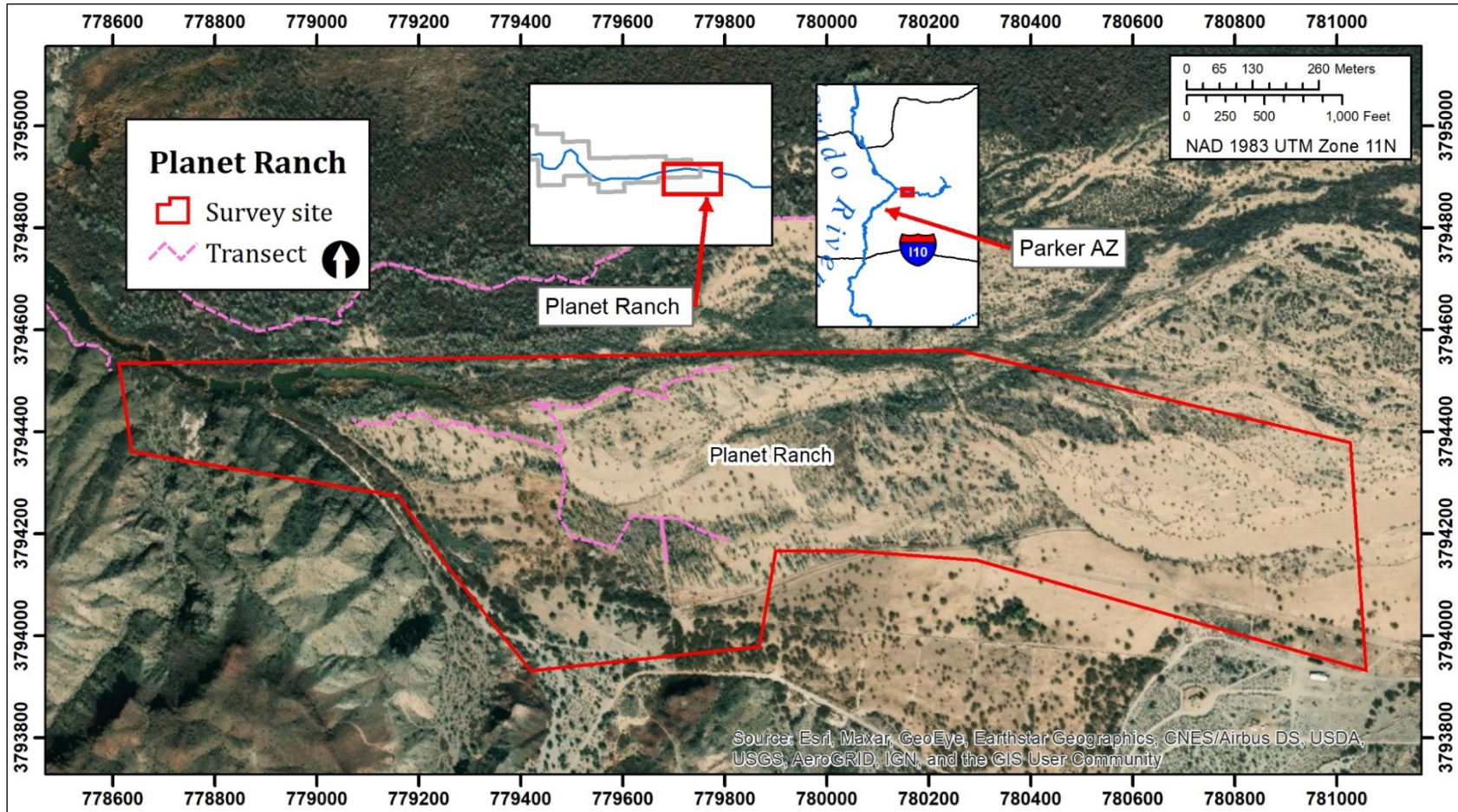


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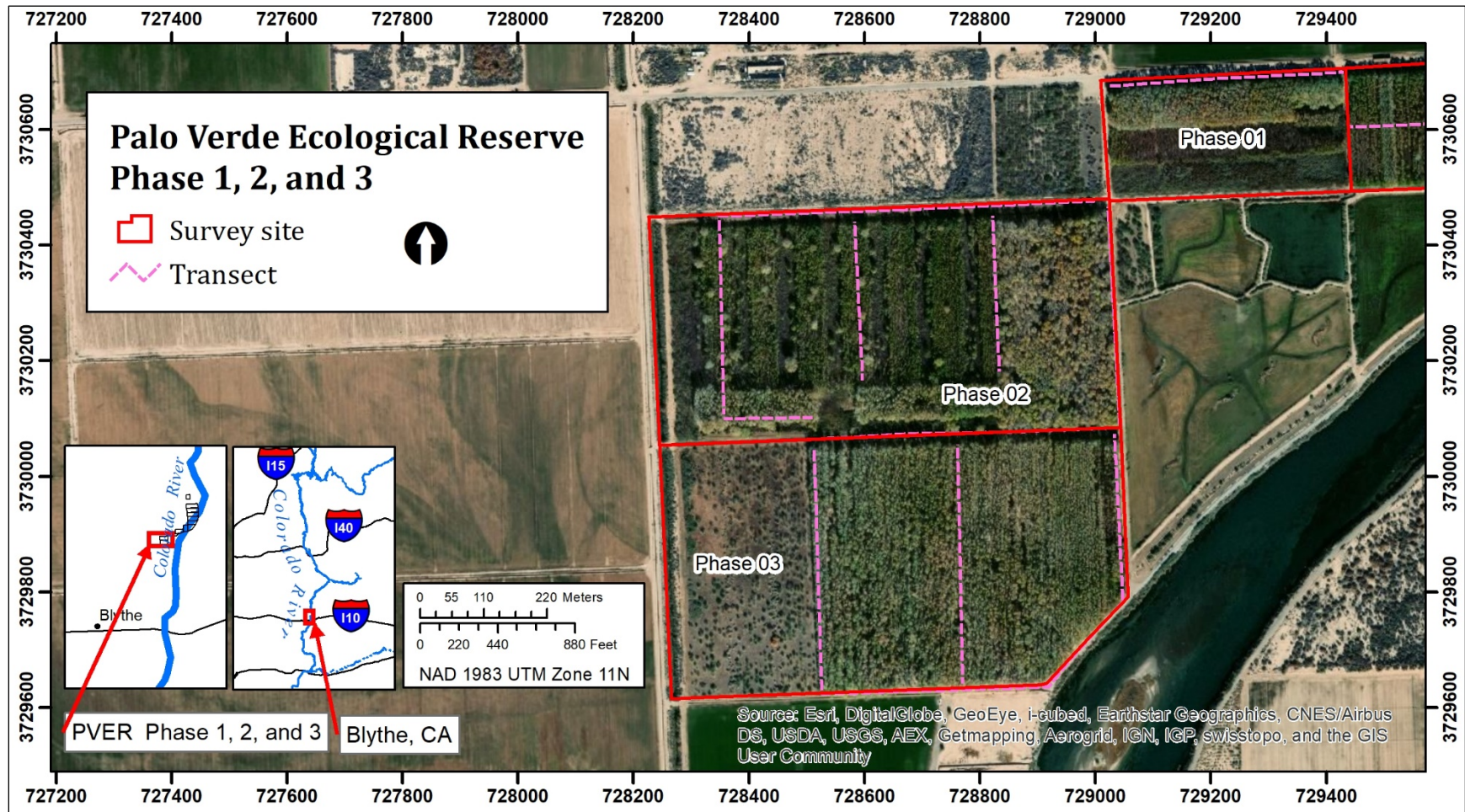


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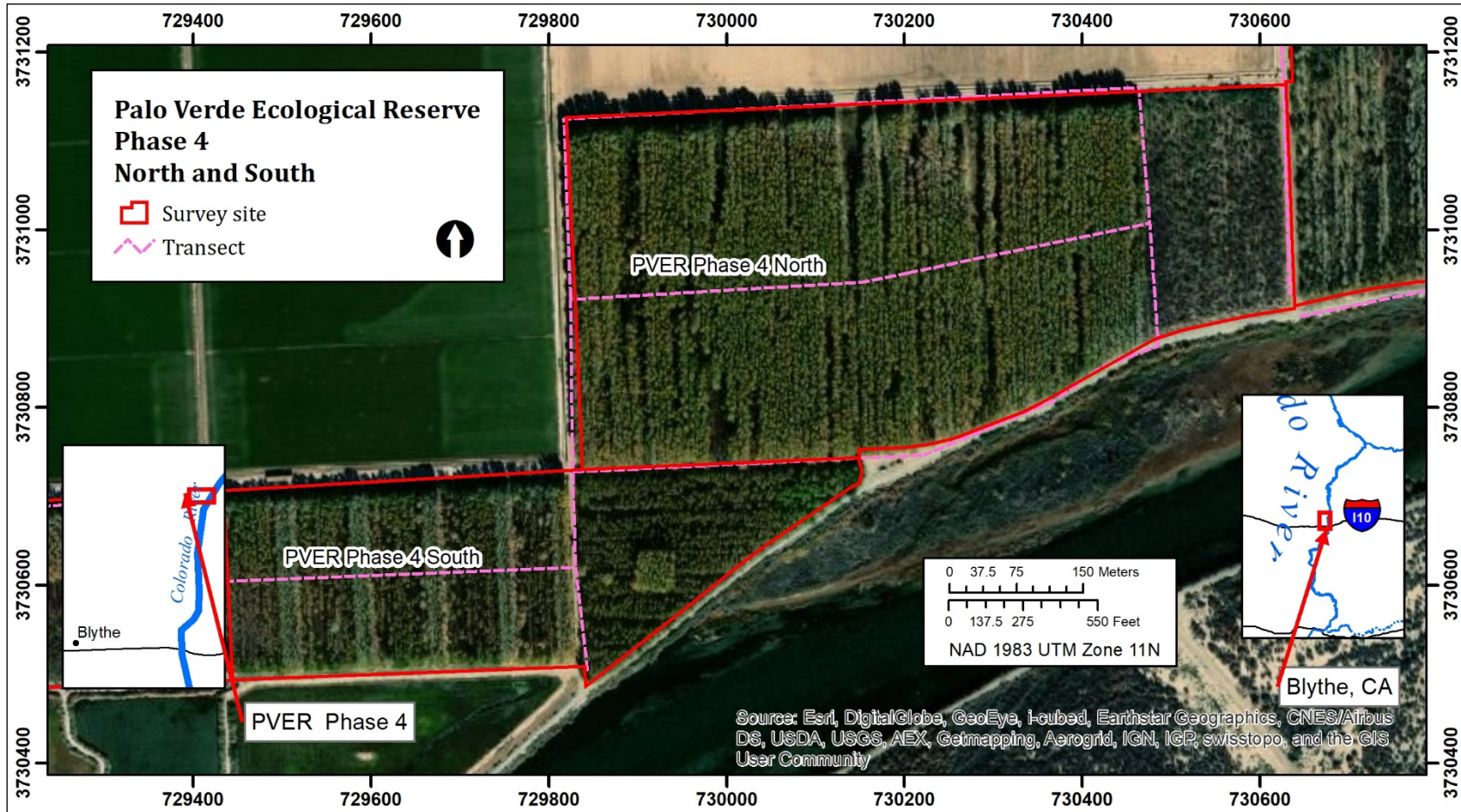


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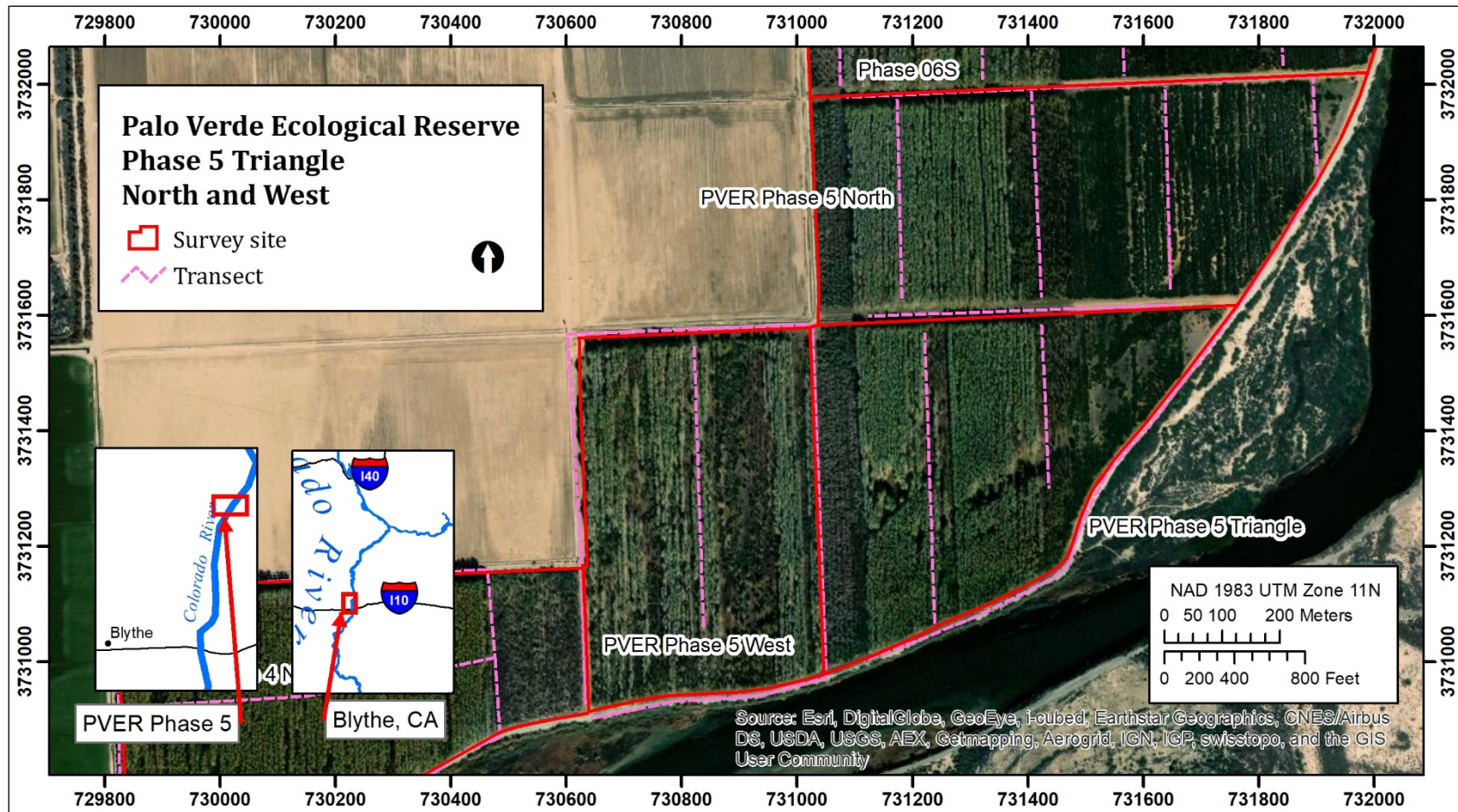


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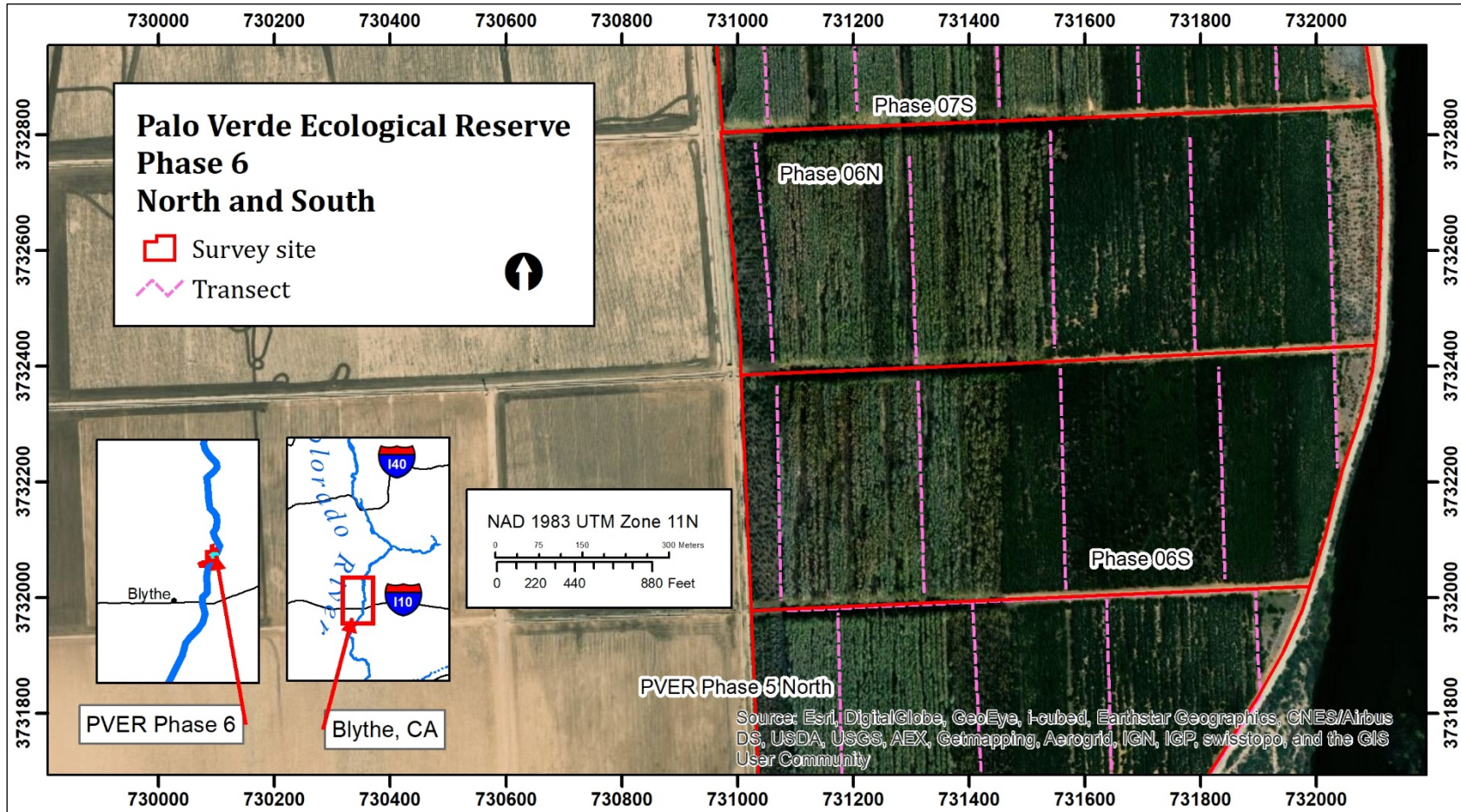


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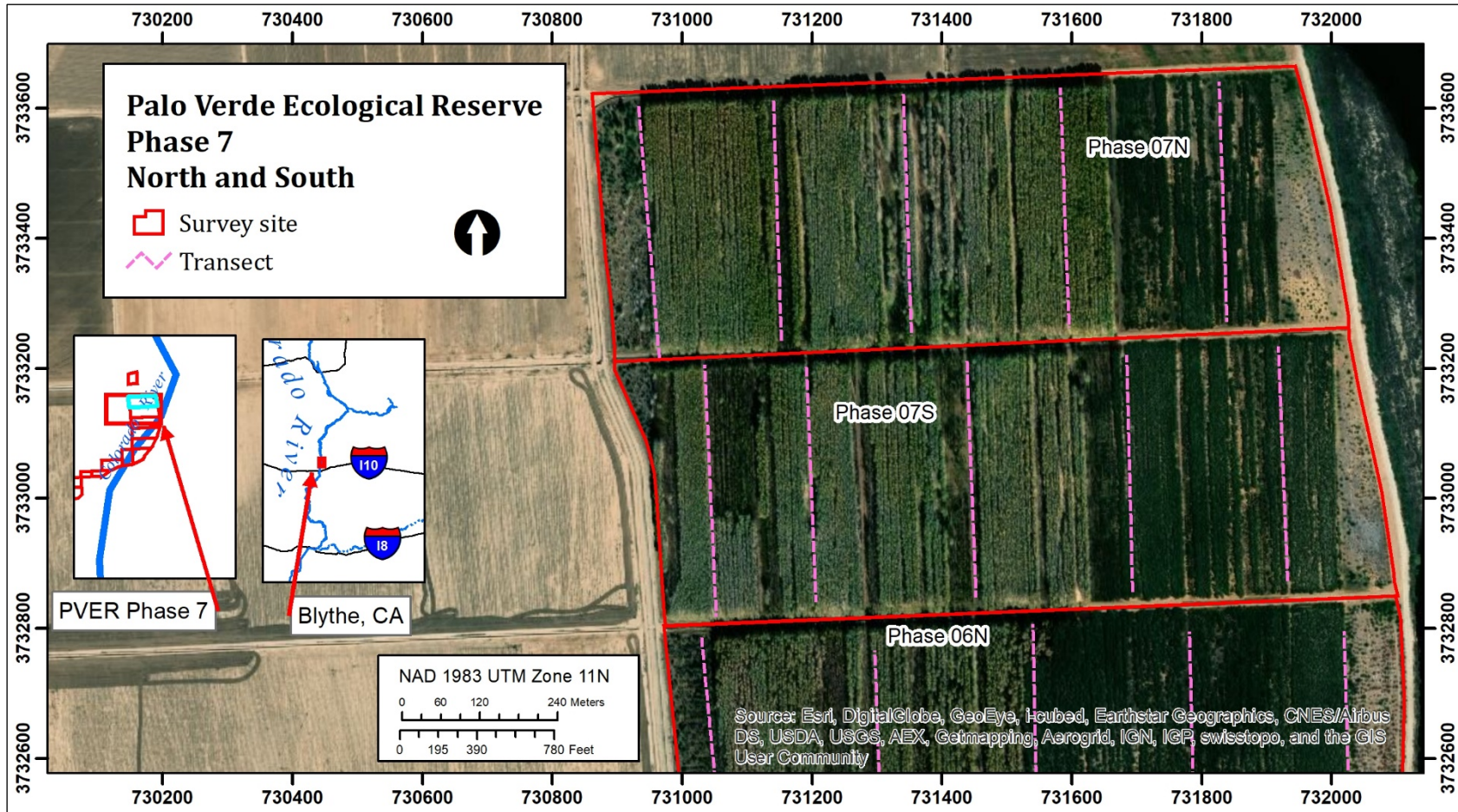


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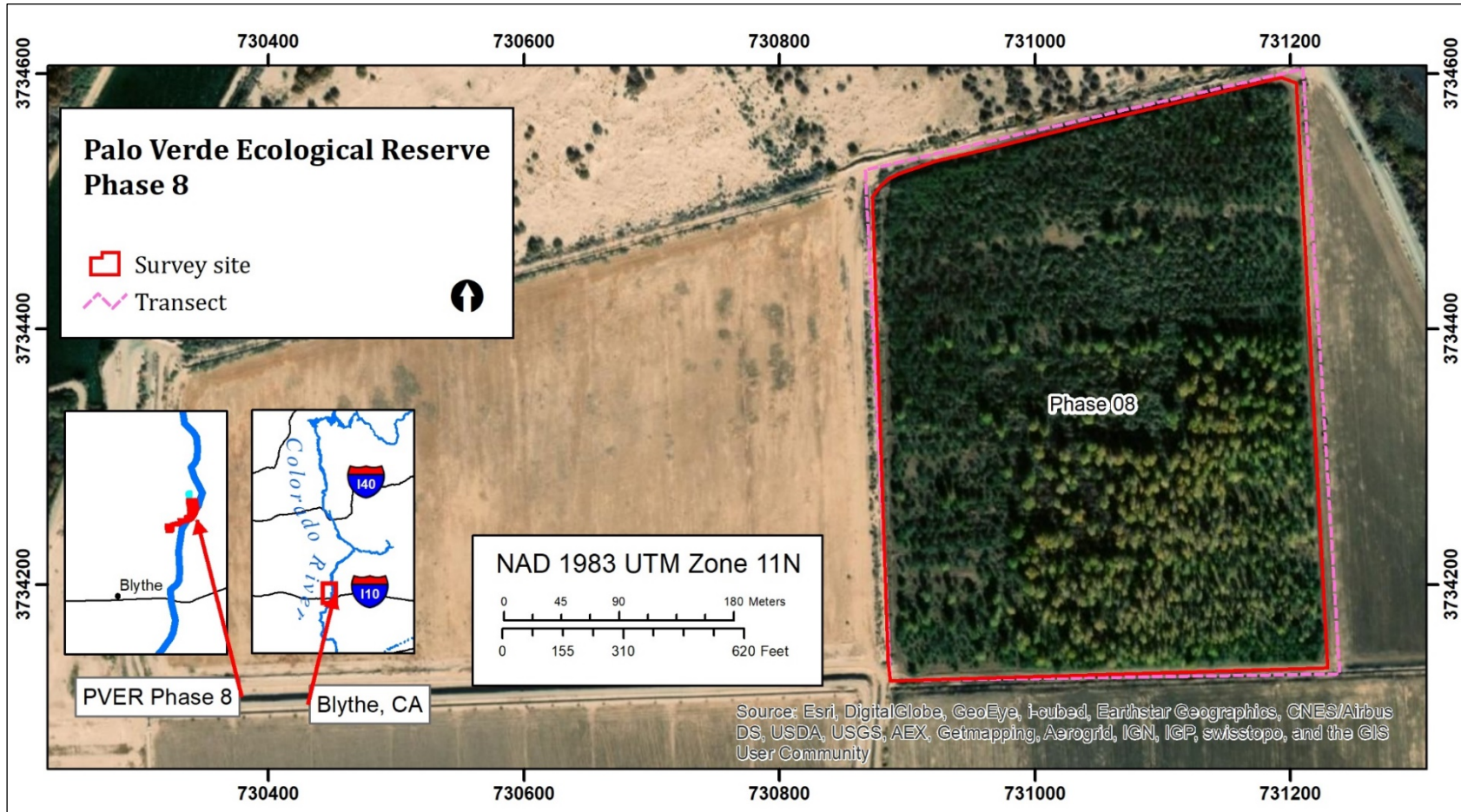


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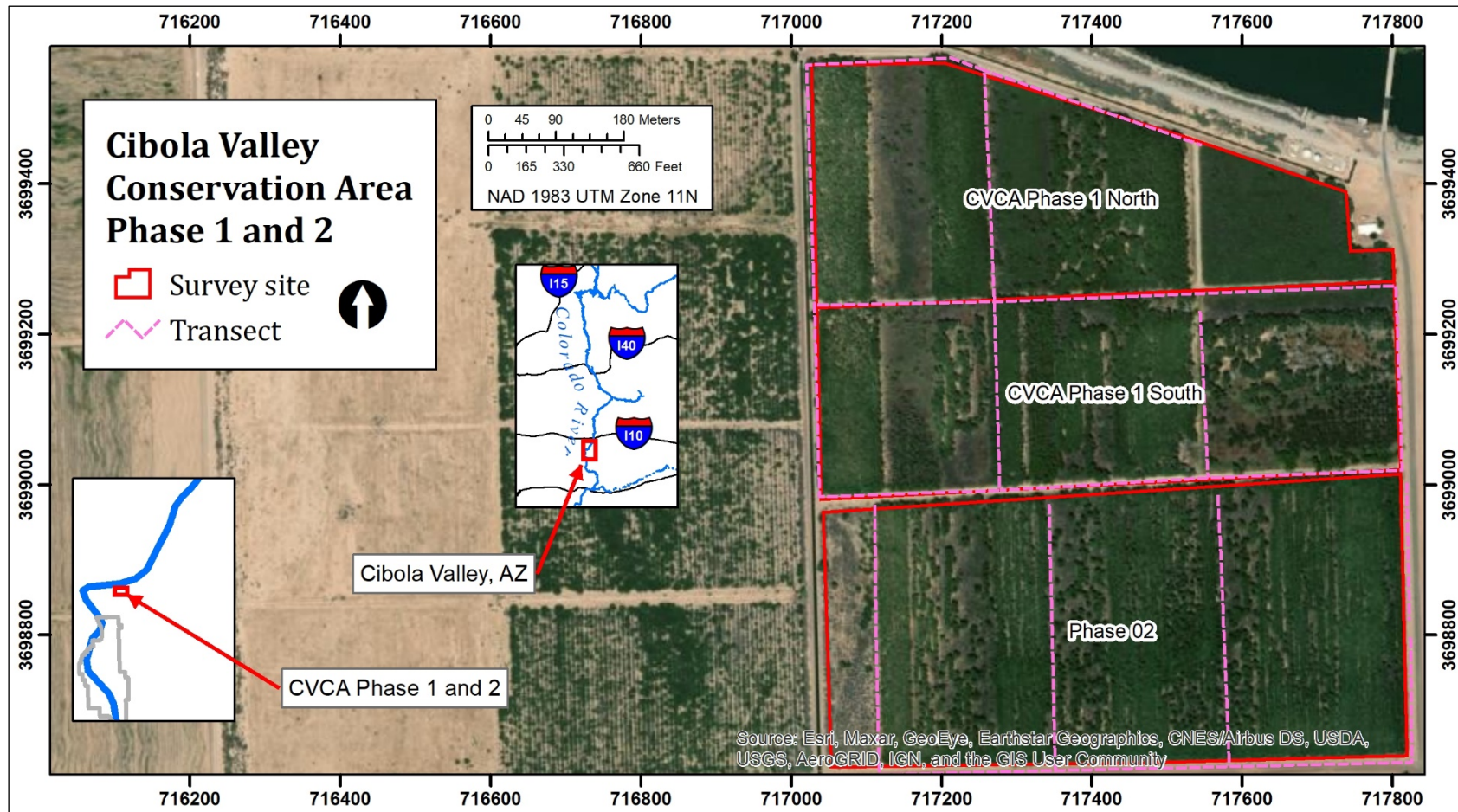


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Attachment 1 – Maps of Survey Sites and Transects,
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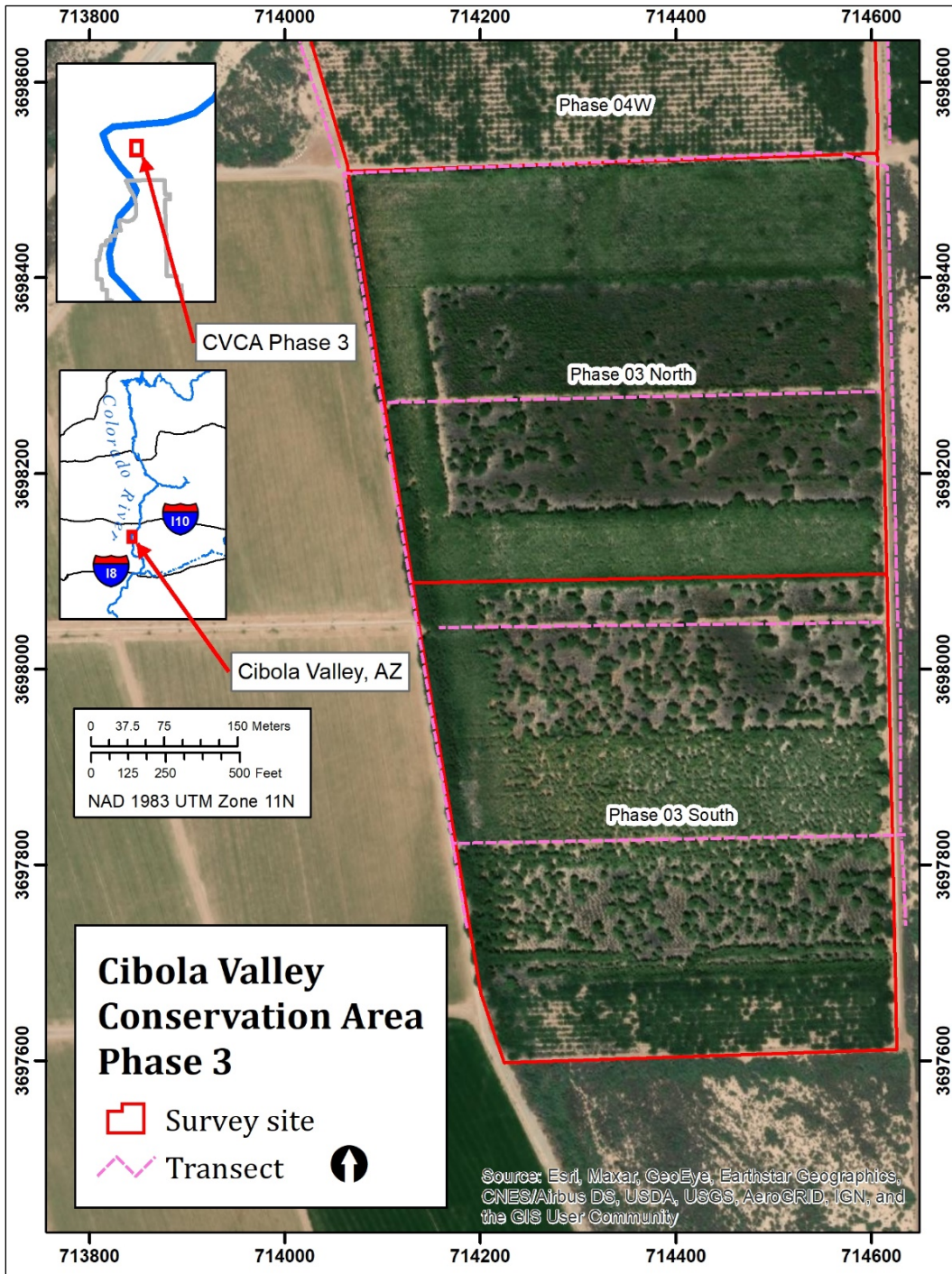


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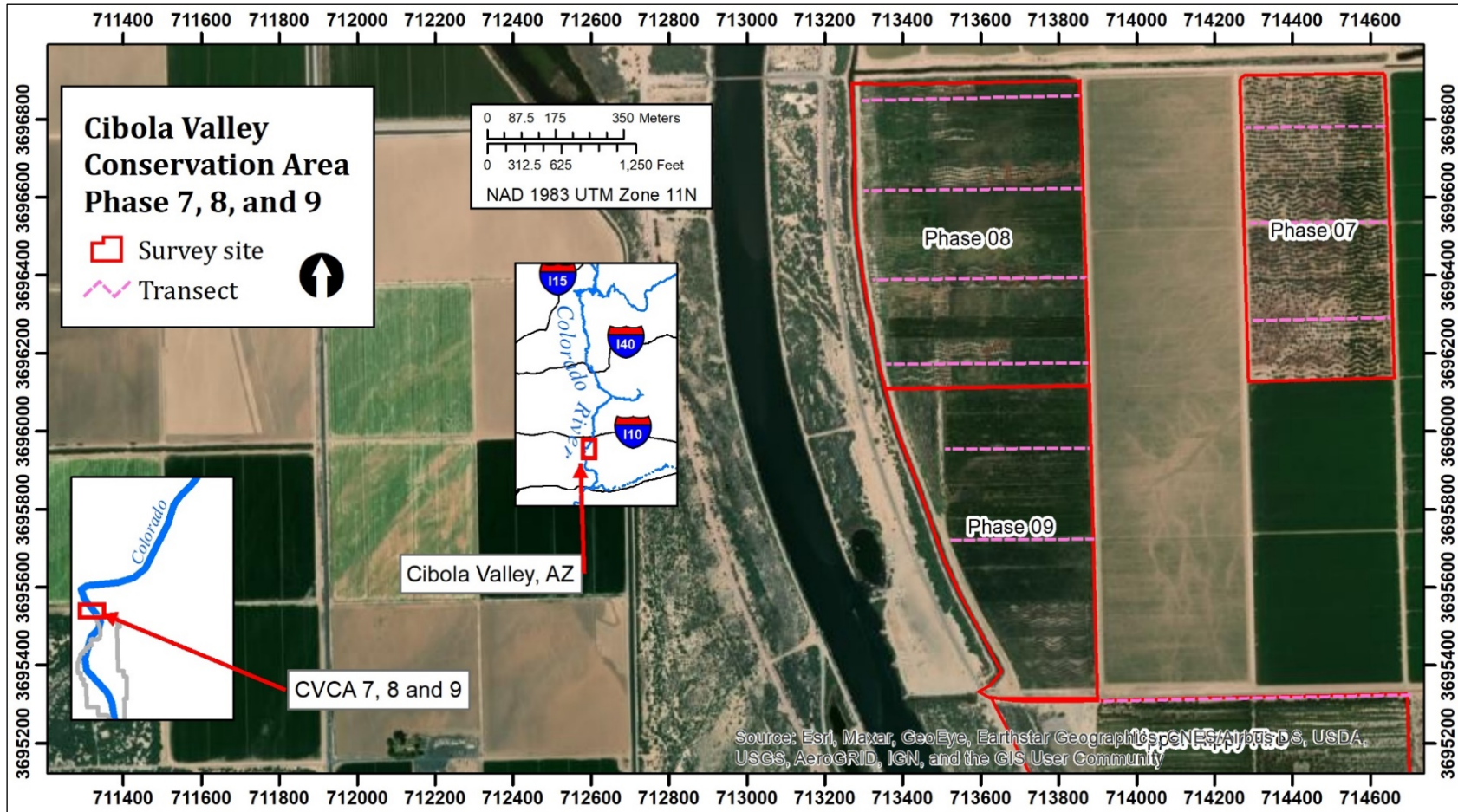


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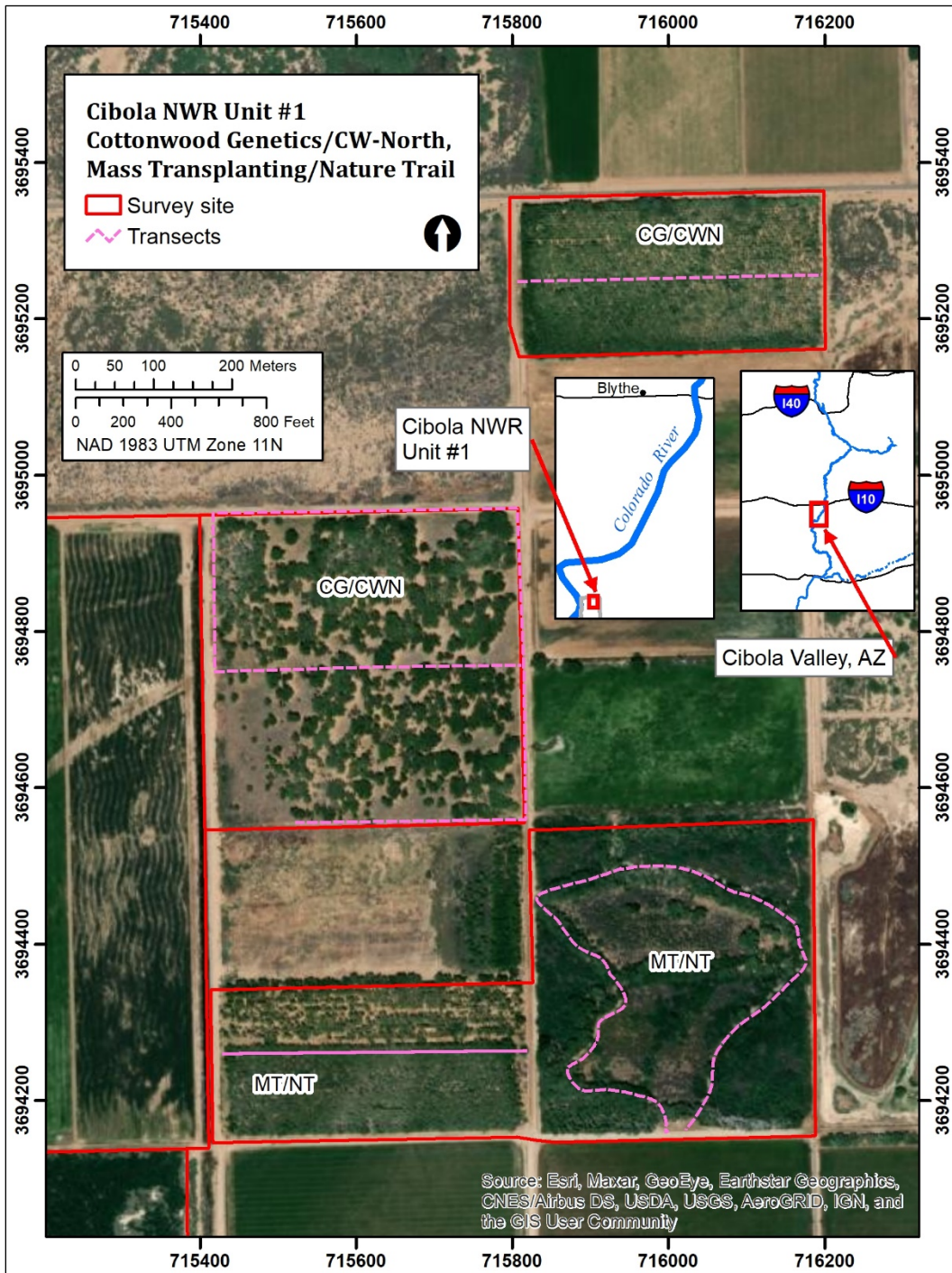


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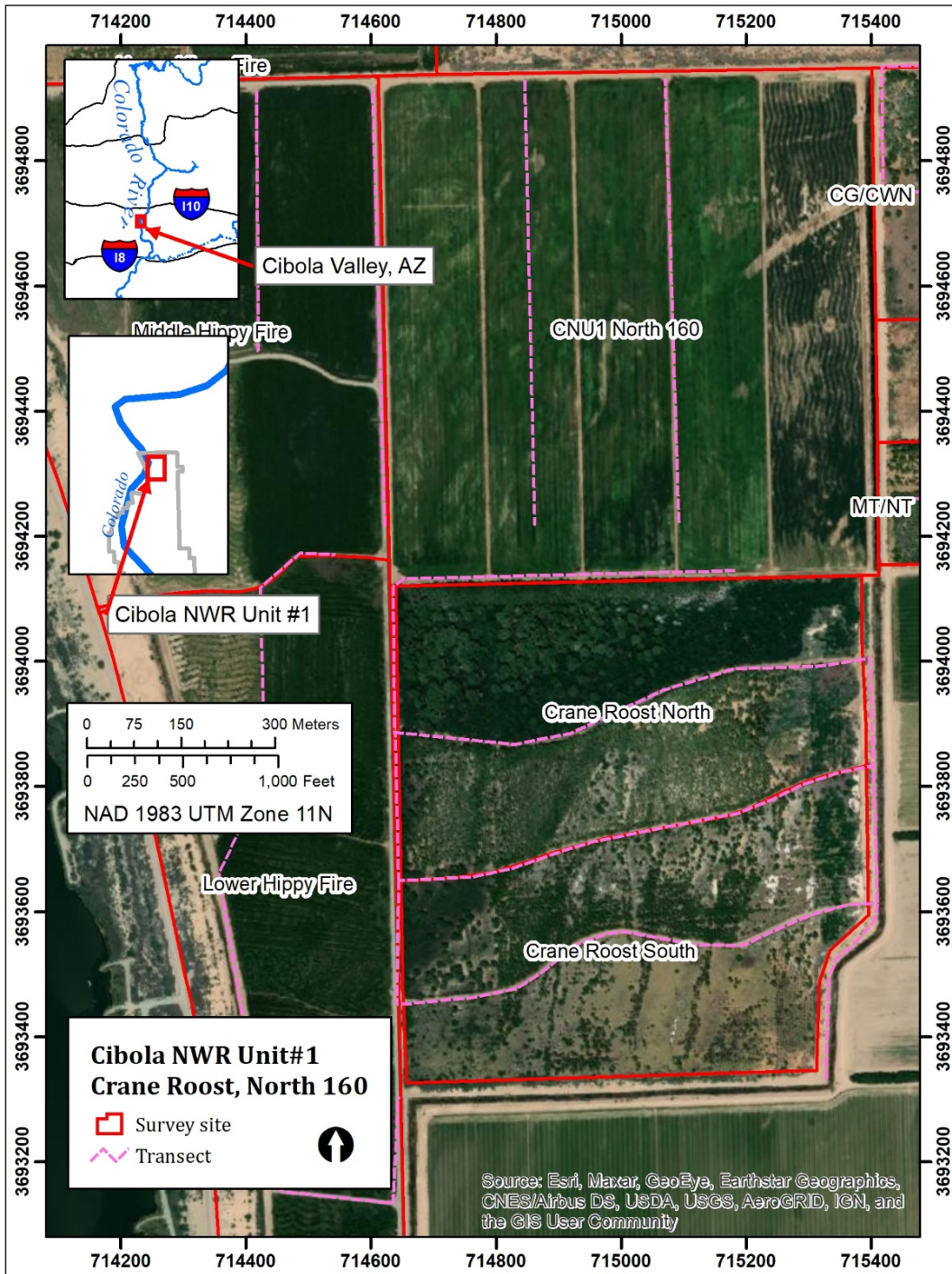


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**Attachment 1 – Maps of Survey Sites and Transects,
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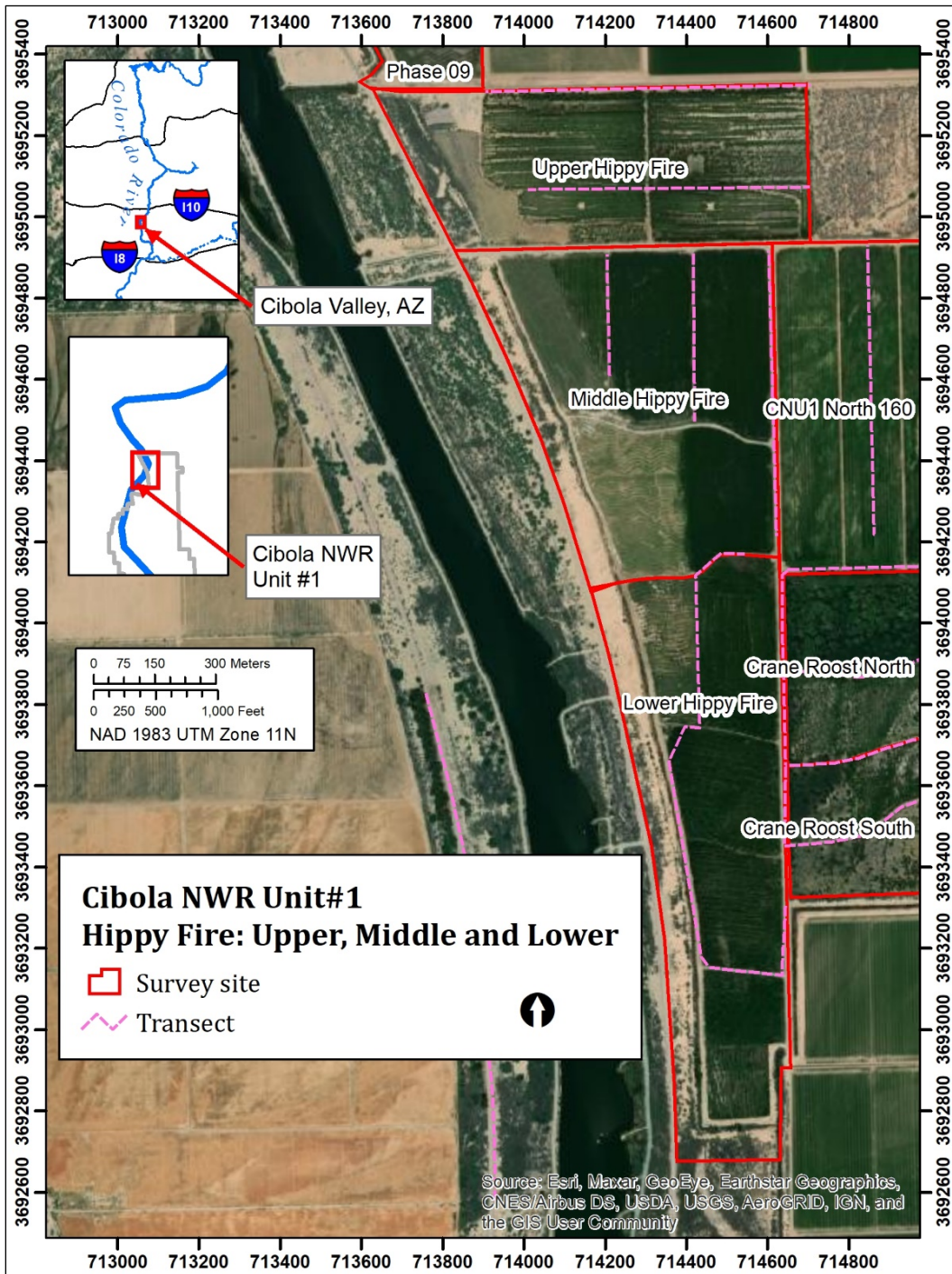


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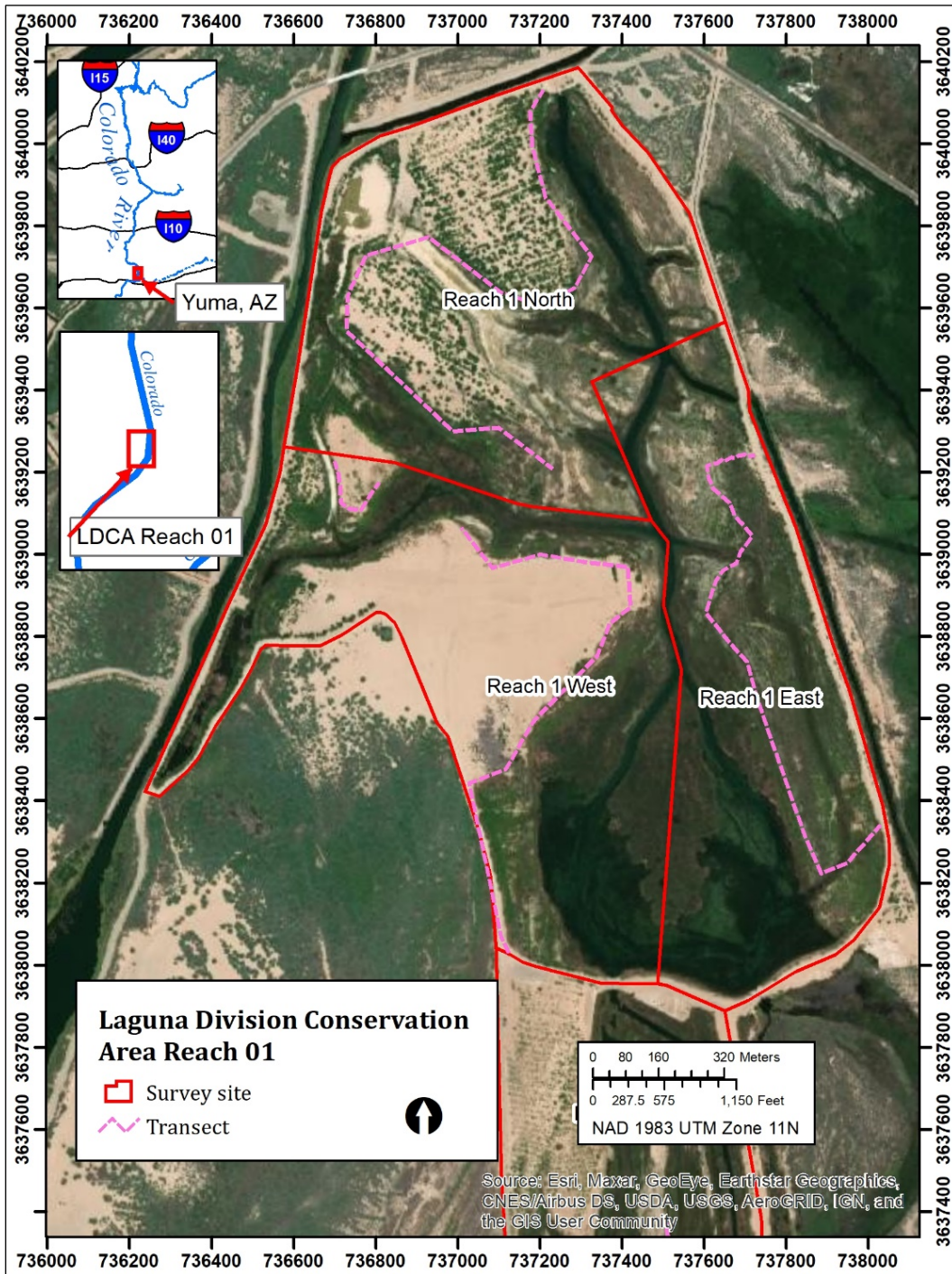


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Attachment 1 – Maps of Survey Sites and Transects,
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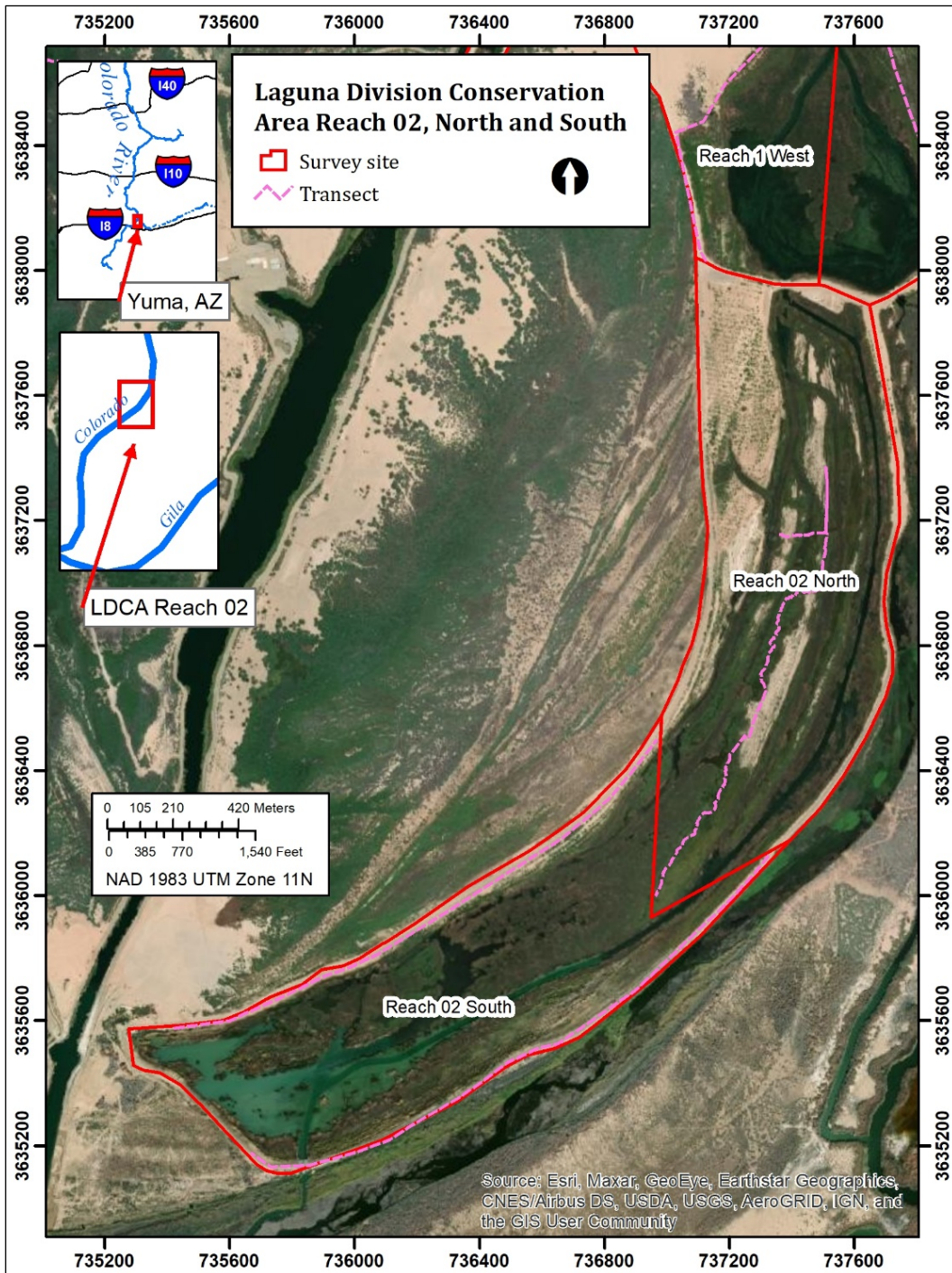


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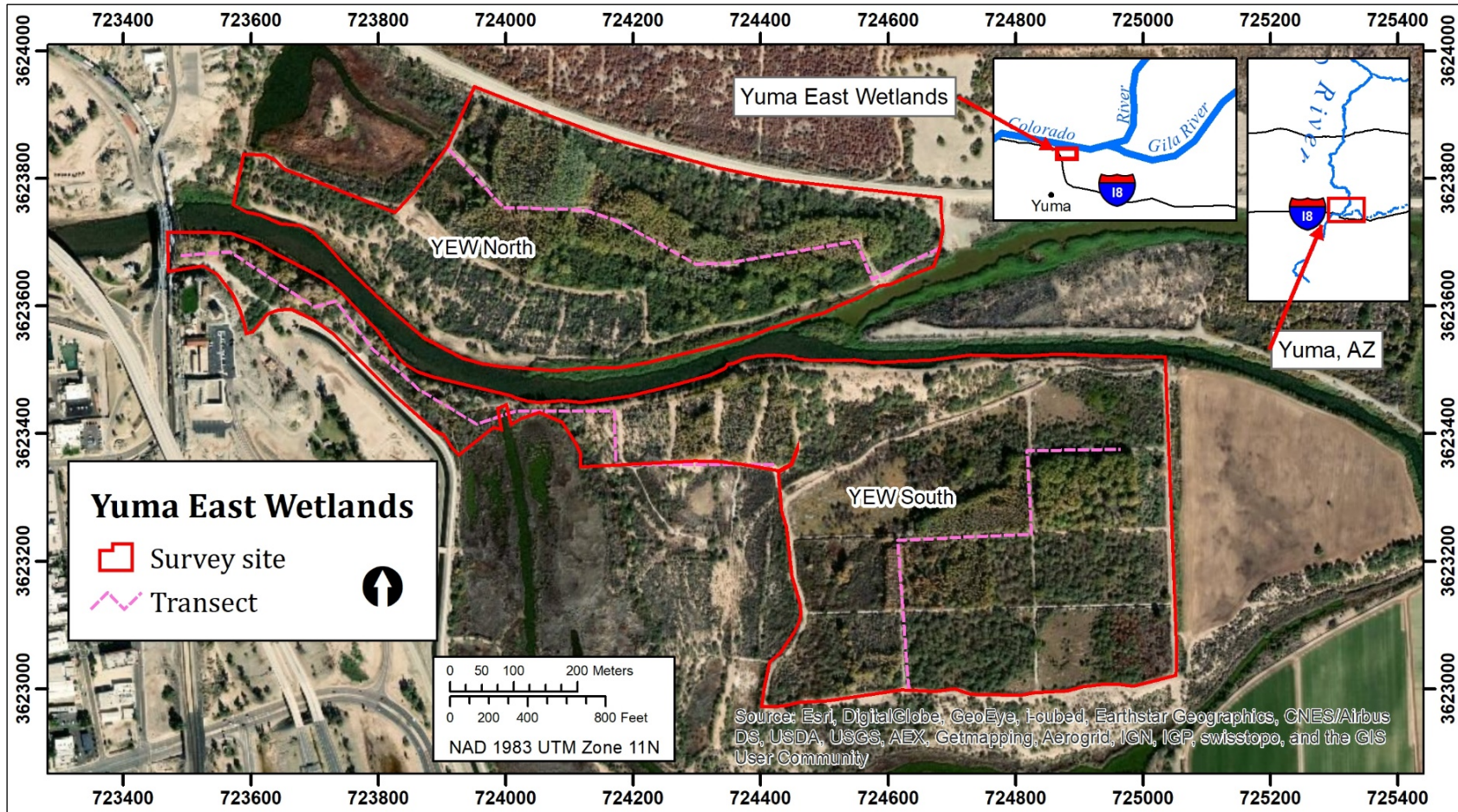


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ATTACHMENT 2

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

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

DRAFT May 2016



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 D. Halterman, Independent Researcher, Matthew J. Johnson, Colorado Plateau Research Station, Jennifer A. Holmes, Colorado Plateau Research Stations and Stephen A. Laymon, US Fish and Wildlife Service

DRAFT

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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, Independent Researcher; 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).

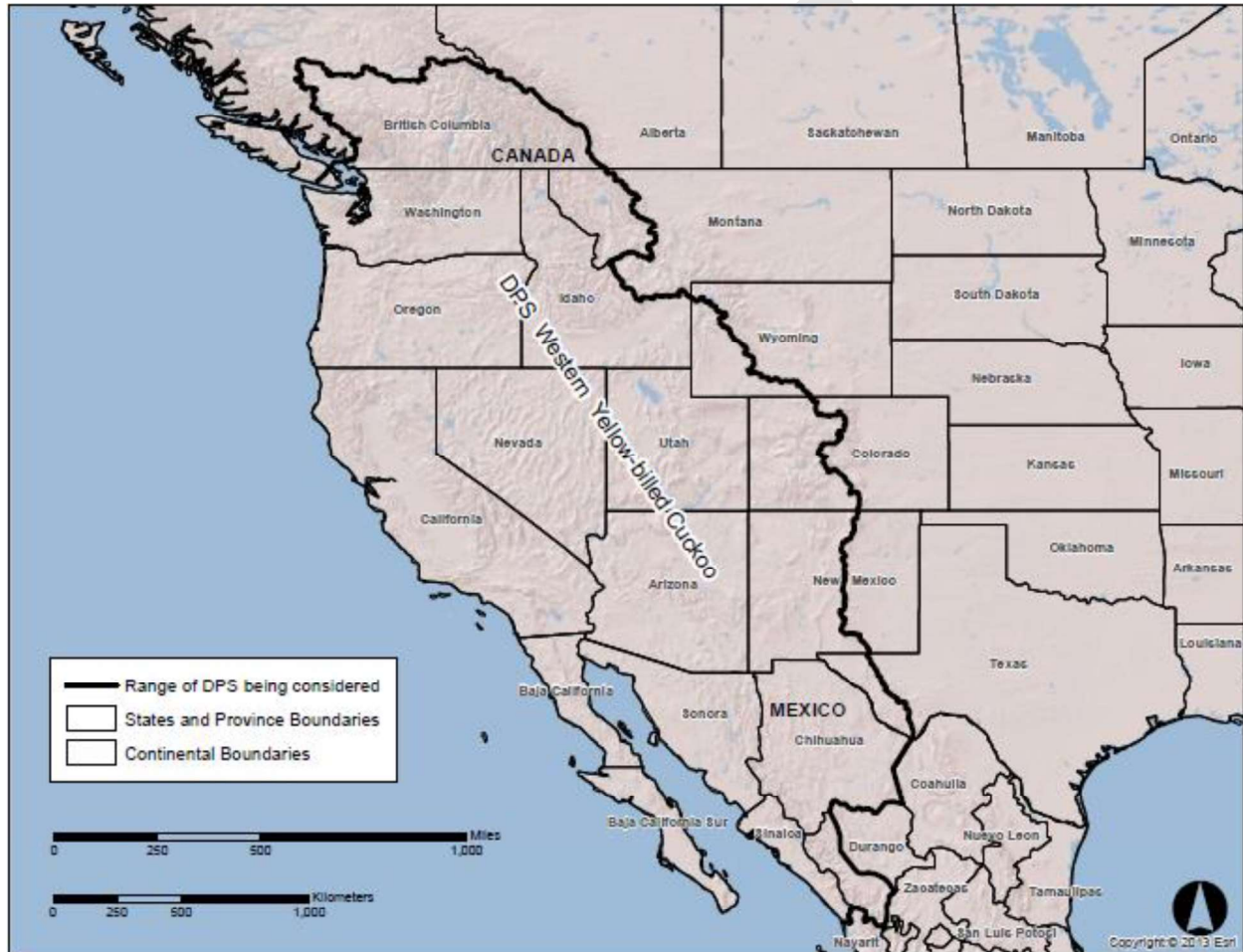


Figure 1. Range of the western Distinct Population Segment of the Yellow-billed Cuckoo.

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 (*Sambucus 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 et 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.

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, USDOJ 1994, Noss et al. 1995) 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.

Non-Protocol (Exploratory) Surveys

Under special circumstances, it may be permissible to use call-playback in a way that does not follow the protocol. They are intended to assess whether an area merits full protocol surveys, and to increase general distribution knowledge. These exploratory surveys will allow agency personnel (or others working with their approval) to survey 1-3 times at sites that are not scheduled for regular surveys. These exploratory surveys are not intended to be conducted in project areas. These surveys are not intended to estimate the distribution and abundance of cuckoos at the site, and can only be conducted by individuals with all appropriate State and Federal permits and permissions.

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 your 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 the 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 UTM's	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.

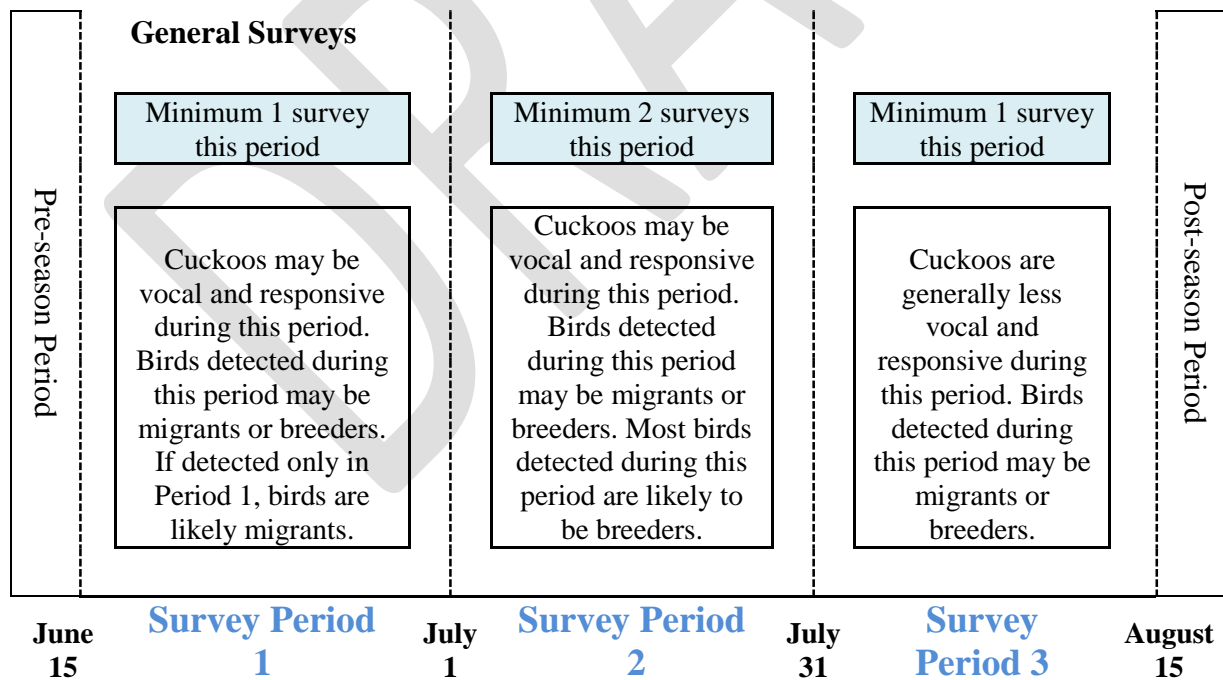


Figure 2. Recommended number and timing of visits during each survey period for Yellow-billed Cuckoo surveys.

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.

Reporting Requirements and Datasheets

Reporting requirements may vary by region and entity (Federal, State, and Private, for example). Check your permits and other information from permitting agencies for reporting requirements. Although these requirements vary, there is information that is required by any permitting agency, such as the location of the area surveyed and the location and number of cuckoo detections. For

your convenience we have provided three sample datasheets. These can be obtained from any of the following websites:

https://www.fws.gov/southwest/es/Documents/R2ES/YBCU_SurveyProtocol_FINAL_DRAFT_22Apr2015.pdf

<https://www.fws.gov/southwest/es/arizona/Yellow.htm>

<https://www.facebook.com/groups/746657762142636/>

1. Yellow-billed Cuckoo Survey Seasonal Summary Form. This form is meant to be completed at the end of the survey season, to summarize data collected across the survey periods. One form can be used for each site surveyed. If required, it can be filled out and submitted at the end of the season. There are three associated documents:
 - a. PDF for printing.
 - b. Excel file for data entry and electronic submission. This includes a formula to convert distance and direction from the observer to correct the estimated location (UTM) of a cuckoo detection.
 - c. Yellow-billed Cuckoo Survey Summary Form Instructions (Appendix 1, this document).
2. Optional Yellow-billed Cuckoo Daily Datasheet. This form can be printed and used for each day's survey, and has room for notes and additional observations. It is not currently required in any Regions, and is provided as a convenience to surveyors.
 - a. PDF for printing and field use.
 - b. Optional Yellow-billed Daily Datasheet Instructions (Appendix 2, this document).
3. Site **Description** Form. This form can be used to describe the general characteristics of the site being surveyed. The intent is for one form to be filled out for each site surveyed. This form is included in the 2015 version of the Seasonal Summary Form, so you not need to complete this form separately if you are using the older form.
 - a. PDF for printing and use in the field.
 - b. Excel file for data entry and electronic submission.
 - c. Site Description Form Instructions (Appendix 3, this document).

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 can be obtained from <http://www.fws.gov/southwest/es/>. 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).

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 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.

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 Federal and State permitting are required to conduct nest searching and monitoring. We provide general information on nesting activity and nest searching here so surveyors are familiar with the behaviors, and can avoid inadvertent use of these 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 salicifolia*) 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 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 should be 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.

Nest monitoring

If authorized to do so, surveyors can monitor active nests to determine nest fate. Nesting activity can be monitored and recorded by an observer sitting quietly 30-40 m from the nest for several hours. A blind or dense cover should be utilized for all nest monitoring and feeding observations. Signs of disturbance include an adult cuckoo giving a soft repetitive knocking call around the observer, and adults flying in with food, but not going to the nest. If these behaviors are observed for more than 20 minutes, the observer should leave the area. Also, because cuckoos are sensitive to disturbance at the nest, nest checks should only be conducted every 3-4 days (Halterman 2000). Both sexes incubate the eggs and care for the young (Nolan and Thompson 1975, Potter 1980, Payne 2005). Nest exchanges occur, on average, every two hours during incubation

(Halterman 2009). Nest exchanges increase when cuckoos are feeding nestlings, with up to 22 exchanges per day observed on the San Pedro River NCA (Halterman 2009).

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 Seasonal Summary Form.

NOTE- CHECK YOUR PERMIT – REPORTING REQUIREMENTS VARY BETWEEN REGIONS

These instructions are provided as guidance for completing the Survey Summary Form. 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.

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). Forms can also be completed digitally 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. For uniformity of data, please use 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 was not detected during the 6 minutes of each call playback survey point. If the cuckoo was detected during a Call playback 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 “CON” = Contact/kowlp, ”COO” = coo, “ALA” = alarm (soft knocker call) ,“OV” = 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).

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. Use the provided “Yellow-Billed Cuckoo Survey Summary Form for electronic submission” datasheet, which will calculate these coordinates.

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 in the protocol); 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: Yellow-billed Cuckoo Survey Seasonal Summary Form, continued

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 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 2 of Survey Summary 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.

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Appendix 2. Instructions for Completing the OPTIONAL Yellow-billed Cuckoo Daily Datasheet

Total YBCU detections: at the end of the survey, record the total number of cuckoos detected during the survey. This is the actual number of detections. Interpretation of survey results (i.e. detections vs. number of cuckoos actually present) can be discussed in your report, but not here.

Page __ of __ : It is important to track number of pages, especially when datasheets are scanned.

Surveyor name: Record the first and last name of the primary surveyor.

Surveyor email: Record the best email address for the primary surveyor.

Surveyor phone number: Record the best phone number for the primary surveyor.

Site Code: Letter or alphanumeric code that denotes a particular site, intended to track sites throughout the season and across years. When applicable, you may use the same code identification as for Southwestern Willow Flycatcher sites.

Site Name: Write the full, unique name of the site to be surveyed. When applicable, you may use the same site name identification as for Southwestern Willow Flycatcher sites (Obtain these from your USFWS office).

Survey Period: The survey period in which the survey is being conducted (1-4), as defined in the protocol. Period 1 (one survey required): June 15-June 30. Period 2 (two surveys required): July 1 –July 31. Period 3 (one survey required): August 1-August 15.

Visit #: In many cases, this will be the same as the survey period, as most sites will be surveyed only once during a survey period. If more than one visit is conducted within one or more survey periods, number the visits sequentially, from the start of the survey season to the end. Such visits are typically for follow-up to determine breeding status.

Date: The month (mm) / day (dd) / year (yyyy) the survey is conducted.

Drainage: The name of the river, stream, or drainage where the site is located.

State, County: State two letter code (i.e. AZ); County full name (i.e. Coconino)

Additional Observers: First and last name of all additional surveyors.

Survey Start/End Time (hhmm): Write in the time of the start and end of the initial broadcast-point count (at the transect starting point) using the hour and minute format in military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Wind (0-5): Record wind measured with an anemometer. Alternatively, record the Beaufort wind code (0 through 5; Page 2 of form) as it applies to the strength of the wind during the survey. Record the average wind condition, not the maximum condition (e.g., periods of gusty winds). Do not survey if wind is greater than code 4.

Cloud Cover: Record cloud cover as: clear (C: <25%), partly overcast (PO: 25%-49%), mostly overcast (MO: 50-74%), or overcast (O: 75%+) If there are patches of clouds in different areas of the sky, try to visualize gathering all of them together into one part of the sky and recording what percent of cloud cover that would represent.

Precip (0-5): Record the appropriate code (0 through 5). Surveyors should not be surveying if rain is more than an intermittent drizzle. See chart on datasheet, Pg. 2.

Noise (0-3): Record the noise code (0-3) that applies to background noise conditions during the transect, as it relates to your ability to hear cuckoos. Record the average noise conditions, not the maximum condition. 0 = Quiet - no noise that interferes with bird detection. 1 = Faint Noise - slight noise that has only a minimal effect of bird detection. 2 = Moderate Noise - probably can't hear some birds beyond 100m. 3 = Loud Noise - Only the closest birds are detected. See chart on datasheet, Pg. 2.

Temperature: Record the ambient temperature; specify if collected in Fahrenheit or Celsius.

NAD: Surveyors should be using NAD 83.

UTM Start/Stop: Enter the UTM Easting (E) and Northing (N) for the transect starting point, and again for the end of the transect.

Start and Stop GPS Accuracy: The accuracy of the GPS reading for the UTM's, recorded in meters.

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

General survey data.

Call Point Start Time (hhmm): Write in the time of the start of the individual broadcast-point count (when the surveyor first arrives at the point) using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Survey Call Point UTM Coordinates: Enter the UTM Northing (N) and Easting (E) for the individual survey point.

Waypoint Number: Record this if you are saving them on your GPS unit.

Yellow-billed Cuckoo detections:

(Reminder: When a cuckoo is detected at a point, terminate the broadcast. **Do not continue to play the recording once a cuckoo is detected.**)

Detection #: When a cuckoo is detected, record a unique number for the detection. If it is the first detection of the survey visit, the detection number is “1”. If more than one cuckoo is detected at the point, record the second detection in the next row on the data sheet, and record the detection number as “2”. In the columns to the left (Point Start Time, UTM coordinates) record “” to denote that these values are the same as those in the row directly above. Also, if more than one cuckoo is detected at a point, be sure to thoroughly describe your observations under “Notes”. If you think the same cuckoo is detected later at a different point during the survey or incidentally before or after the survey, give that bird a new detection number, but make a note of this. .

Time of Detection: Record the time that the cuckoo was detected, using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Record how the cuckoo was detected. **I = Incidental** (between call broadcast points) or **P = Playback** (following broadcast calls).

Detection type: **A = Aural**, **V = Visual**, or **B = Both**. If the cuckoo was detected both by sight and sound (i.e., “B”), write in parenthesis the order in which the type of detections occurred. For example, “B (A/V), and describe the detection(s) under “Note #” as detailed below.

Compass Bearing (°): Record the estimated compass bearing, in degrees, to the detected cuckoo. The compass declination should be set to zero.

Estimated Distance (m): Record the horizontal distance in meters between the broadcast point (where you are standing), and the location or presumed location of the cuckoo where you first detect it.

Accuracy of Estimate (Est. Accuracy): Indicate relative accuracy of your estimate using the codes shown in Table 1. Determine your pace by counting your steps per measured distance. Recalibrate your pace prior to and throughout the field season to ensure accuracy. Code reminders are on Pg. 2 of the datasheet.

Table 1. Codes for quantifying the degree of accuracy in estimating the distance to a detected cuckoo.

Accuracy Code	Explanation
1	Measured distance, using laser rangefinder or pacing, to a known location.
2	Measured distance, using laser rangefinder or pacing, to an estimated location.
3	Estimated location of detection and distance, feel confident it was within 25 m of true location.
4	Estimated location of detection and distance, feel confident it was within 50 m of true location.

5	Estimated location of detection and distance, feel confident it was within 100 m of true location.
6	Little confidence in your estimate, a complete “guesstimate”.

Vocal codes (Vocalization codes): Record the appropriate code (see Pg. 2, data sheet), or series of codes for any calls heard when you made the detection. Use more than one code, when appropriate.

Behavior/Breeding: Record the appropriate breeding behavior code(s), for the behavior observed using the codes on Pg. 2 data sheet. You may enter more than one code in this box. Note that if you use Vocal Exchange (VEX) you will enter data in 2 rows, one for each bird. Use more than one code, when appropriate.

Note #: To record observations of cuckoo detections, or other note-worthy information, first 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 the space on the bottom of the data sheet to record detailed notes regarding your observations. Use the back of the data sheet if more space is needed.

***:** Two blank columns are provided so surveyors can record additional information that may be of interest, such as cicada presence, presence of other avian species of interest, etc.

Data Entry, Data Proof, Data Scan: These are provided for QA/QC of your data.

Review your federal and state permit requirements. Be sure to submit appropriate forms and reports on time to USFWS and other agencies. Retain a copy for your records.

Appendix 3. Instructions for Completing the Yellow-billed Cuckoo Survey Site Description Form

These instructions are provided as guidance for completing the Yellow-billed Cuckoo Survey Site Description Form. It is important to complete all fields of the datasheet using a standardized format as described. Type or write clearly so that others can easily read the data. Describe any unique habitat features in Comments.

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.

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

Site Name: Write the full, unique name of the site to be surveyed. When applicable, you may use the same site name identification as for Southwestern Willow Flycatcher sites (Obtain these from your USFWS office).

State. Record the state where the site is located.

County. Record the county where the site is located.

Name of Reporting individual: Record the first and last name of the primary surveyor.

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

Phone #: Record the best phone number for the primary surveyor.

Email: Record the best email address for the primary surveyor.

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 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.

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

NAD: Surveyors should be using NAD 83.

USGS Quad Name(s). Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps. Please list the names of all Quads covered by the survey site.

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.

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.

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

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.

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.

Native/Exotic:

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

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

Overstory Vegetation. Provide the scientific names of the five most common species in the overstory, and the estimated percent cover provided each species. It is possible for there to be an overstory present with no understory. Use the following cover categories: <1%, 10%, 25%, 50%, 75%, 90%, 100%.

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

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

Understory Vegetation. The understory canopy comprises a distinct woody layer (that does not have to be present throughout the site) below the overstory canopy. For example, a cottonwood overstory might have a willow understory. It's also possible that there may only be an overstory, with no understory. Willow or mesquite, for example, may have no understory. Provide the scientific names of the five most common species in the understory, and the estimated percent cover provided each species. Use the following cover categories: <1%, 10%, 25%, 50%, 75%, 90%, 100%.

Average height of understory canopy. Provide the best estimate of the average height, in meters, 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.

Estimated Overall Understory Cover. Estimate the percent understory cover for the site.

Describe adjacent habitat: Describe the types of habitat adjacent to the survey area. Include upland vegetation type, such as agricultural or residential areas, roads, and any other relevant information.

Adjacent Habitat. Provide the names of the five most common types of adjacent habitat, and the estimated percent cover provided each type. Alternatively, you can list up to five types of surrounding land use. For example: Fallow Ag field, 50%; suburb, 25%, Walnut orchard, 25%. Use the following cover categories: <1%, 10%, 25%, 50%, 75%, 90%, 100%.

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 2. The first four sections are required in case pages become separated.

Site Name.

Name of Reporting Individual.

Phone Number.

E-mail.

Map: 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, openings, 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) as required by your permits. When required or recommended, forms should be completed digitally (Microsoft Word or Excel) and submitted via email with attached or embedded topographic maps and photographs.

OPTIONAL Yellow-Billed Cuckoo Daily Datasheet

Total YBCU Detections

Page 1 of

Surveyor name:			Surveyor email:				Surveyor Phone:					
Site Code:		Site Name:			Survey Period:		Visit #:		Date (mm/dd/yy):		Additional observers:	
Drainage:			State:		County:							
Survey Start	Time:		Wind:		Cloud cover:		Precip:		Noise:		Temp:	
Survey End	Time:		Wind:		Cloud cover:		Precip:		Noise:		Temp:	
NAD:	Start Easting			Start Northing			Start GPS Accuracy (m):					
Zone:	Stop Easting			Stop Northing			Stop GPS Accuracy (m):					

Call Point Start Time	Survey Call Point UTM Coordinates								Waypoint Number	If a YBCU is detected, please provide the information below											Note #	*	*		
										Detection # <small>separate line for each YBCU</small>	Time of Detection	I=Incidental P=Playback	A=aural V=visual B=both	Compass Bearing (°)	Estimated Distance (m)	Est. Dist. Accuracy (use codes on pg. 2)	Vocal Code <small>(you can use more than one code)</small>	Behavior/ Breeding Code <small>(you can use more than one)</small>							
	Easting	Northing																							

Notes: _____

		Date	Initials
Data Entry:			
Data Proof:			
Data Scan :			

* Blanks provided for region-specific or project-specific data. Please define these fields in "Notes" or the space provided.

Yellow Billed Cuckoo Survey Summary 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	C u c k o o #	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.
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VOCALIZATION	CODE	BEHAVIOR	CODE	BEHAVIOR	CODE	BREEDING	CODE
Contact	CON	No visual	NV	Catches Prey	CP	Copulation	COP
Coo	COO	Sitting	ST	Carry Food	CF	Feeds Mate	FM
Knock/Alarm	ALA	Foraging	FO	Eats Food	EF	Carry Nest Material	CN
Juvenile Calls	JUVC	Preening	PRE	At Nest	AN	Brooding/Incubating	BI
Other Vocalization	OV	Flying	FLY	Juvenile	JUV	Feeds Nestling	FN
		Distraction Display	DD	Vocal Exchange	VEX	Feeds Fledgling	FF

NB = nest building, NE = active nest with unbroken eggs in it, NY = nest with young seen or heard in it, ON = occupied nest, US = used, inactive nest with blue-green eggshells.

ATTACHMENT 3

Instructions for Completing the Revised Yellow-billed
Cuckoo (*Coccyzus americanus occidentalis*) Survey Summary
Form

Instructions for completing the revised Yellow-billed Cuckoo Survey Summary Form

Draft Addendum to Appendices 1 to 3 for yellow-billed cuckoo survey protocol in Arizona, New Mexico, and Texas: in Halterman et. al. (2016)

June, 2019

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Contacts for questions or comments: Susan Sferra at susan_sferra@fws.gov, Vicky Ryan at Vicky_ryan@fws.gov, or Meghan White at mwhite@usbr.gov.

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Introduction: These revised instructions are provided as guidance for completing the revised Yellow-billed Cuckoo (cuckoo) Survey Summary Form for Arizona, New Mexico, and Texas. The revised Excel Survey Summary data entry form automatically creates a database as data are entered. In addition to improvements in formatting and data storage, the instructions and form were revised to improve standardization of vegetation data and estimation of Possible, Probable, and Confirmed breeding territories.

To apply for a federal permit (USFWS Recovery Permit Application): To download a form for a federal permit: <http://www.fws.gov/forms/3-200-55.pdf>. If you have already applied for a federal permit, you may email permitsR2ES@fws.gov regarding the status of your application. Note that new federal permit applications submitted within the last few months may still be under review.

To apply for a state permit:

Each state has different permitting and reporting requirements. To survey in Arizona, in addition to your federal permit, you must apply for a scientific collecting license from the Arizona Game and Fish Department annually. A specific survey location is required at time of

submission. Expect up to 30 days for review and processing. Currently, there is no fee for this process. For more information and the application:

<https://www.azgfd.com/license/speciallicense/scientificcollection/>.

Email scpermits@azgfd.gov if you have questions.

No state permits are required for protocol surveys in New Mexico or Texas, but they are required for nest monitoring and handling cuckoos. Permit applications are available at: <http://www.wildlife.state.nm.us/download/enforcement/scientific-educational/scientific/Scientific-Collection-Permit-Application-or-Renewal-Form.pdf>. For any questions pertaining to New Mexico Department of Game and Fish permits, please email dqf.permits@state.nm.us. For any questions pertaining to Texas Park and Wildlife Division permits, please email wpoffice@tpwd.state.tx.us

Permit Reporting: The appropriate contacts in your State and Federal permits are usually the State and USFWS Ecological Services Field Office yellow-billed cuckoo leads and the State and Federal permits coordinators. Prior to conducting surveys, email the name of the area you intend to survey to your USFWS Ecological Service Field Office cuckoo lead. This information is needed to avoid duplication of effort. Survey field forms are posted at <http://www.fws.gov/southwest/es/arizona/Yellow.htm>. Complete data forms (spreadsheets) for all sites surveyed, regardless of whether or not cuckoos were detected.

CHECK YOUR PERMIT – REPORTING REQUIREMENTS VARY BETWEEN REGIONS AND STATES

For annual reports, Permittees in Arizona, New Mexico, and Texas are required to submit digitally:

- (1) copies of all field data forms in Excel format (posted at <http://www.fws.gov/southwest/es/arizona/Yellow.htm>) with positive or negative survey results;
- (2) copy of USGS quad/topographical map or similar of survey area, survey route, outline of survey site, location of cuckoo detections by survey number or date, nests (if any), and estimated territories;
- (3) sketch or preferably an aerial photo showing survey area, survey route, outline of survey site location of cuckoo detections by survey number or dates, nests (if any), and estimated territories;
- (4) photos (if taken) of the interior of the patch, exterior of the patch, and overall site (may be compiled in pdf);
- (5) bird photos (if taken) (may be compiled in pdf); and
- (6) if available, GIS files (i.e., shapefile, personal or file geodatabase) of #2 above.

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. Permittees will be responsible for making sure that they submit the data to the appropriate USFWS Ecological Services Field Office and state in which surveys were conducted. Permittees (federal) must send a copy to landowner/land manager where surveyors were conducted.

Federal permits (send to): Arizona: [susan sferra@fws.gov](mailto:susan_sferra@fws.gov), New Mexico: vicky_ryan@fws.gov and [clinton smith@fws.gov](mailto:clinton_smith@fws.gov), Texas: [clayton napier@fws.gov](mailto:clayton_napier@fws.gov),

vicky_ryan@fws.gov, and clinton_smith@fws.gov.

State permits (follow state reporting requirements; also send a copy of federal annual report): Arizona: scpermits@azqfd.gov. New Mexico: nhnm@unm.edu. Texas: Texas Parks & Wildlife Department, Wildlife Division – Wildlife Permitting Office, 4200 Smith School Road, Austin, Texas 78744.

We recommend scanning or otherwise imaging field 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 Summary Form for electronic submission

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.

Elevation (meters): 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. If elevation changed from start to finish, use the average elevation and include notes in the comments.

State: Record the state where the site is located.

USGS Quad Name: Provide the full quad name, as shown on the appropriate standard USGS 7.5-minute topographic maps. Please list the names of all USGS 7.5-minute topographic maps covered by the survey site. To find the name of the USGS map where a site is located, open the USGS 7.5-minute topographic map index at the following website:

<http://www.fws.gov/southwest/es/arizona/Yellow.htm>.

Creek, River, Wetland, Canyon, or Lake Name: Provide the name of the riparian feature, such as the lake or watercourse (including ephemeral washes), where the survey is being conducted. If the drainage or canyon name is different than the riparian feature, use the name of the riparian feature. For example, Bonito River instead of Rio Grande.

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. Note that we do not need the coordinates for the detailed route taken by the surveyor(s) but see permit requirements for site outline and general survey route and associated geospatial files. A marked general survey route taken by the surveyor(s) on copies of a USGS quad/topographical map and aerial photo (or sketch if no aerial photo is available) will provide the needed information, especially for non-linear routes in wide expanses of habitat or side drainages. Surveyors may also provide additional points defining the area surveyed in the Comments section if the site is wide or nonlinear.

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

Datum: For uniformity of data, we prefer that you use NAD83.

Magnetic North Declination: The compass declination should be set to the magnetic declination of the survey area. Arizona ranges from 10-12° from east to west. New Mexico ranges from 9-10° from east to west within the range of the western yellow-billed cuckoo. Magnetic declination values can be located on USGS 7.5 minute quad maps, can be found using an internet search for “your state” + magnetic declination, or can be calculated on the following website at <https://www.ngdc.noaa.gov/geomag/declination.shtml>.

Was site surveyed in previous year? Click on drop down menu and select yes, no, or unknown.

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 #: Survey 1 – 5.

See the protocol for an explanation of the number of required visits (also known as surveys) for each survey period. Note: A single survey is defined as a complete protocol-based survey that occurs over no more than one 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. At least four surveys are required for completion of a full season of protocol-level surveys at any site. Although not required, we encourage additional surveys through September in Arizona and New Mexico, especially when conducting surveys for proposed projects. Cuckoo nests and fledglings have been documented as late as early October. Surveys conducted 12 - 14 days apart are recommended, based on a population study on the lower Colorado River (McNeil et al. 2013). If surveys are conducted only 10 days apart, only 40 days of the breeding season are covered. In addition some cuckoos may remain onsite for 10 days prior to leaving area and may be counted on two surveys. If surveys are conducted more than 16 days apart, an entire cuckoo breeding cycle may be missed. Surveys conducted 15 days apart are acceptable, but are not as ideal as 12-14 days apart if start date of a breeding cycle is unknown. Some extenuating circumstances such as wind, rainfall, flooding, and access may require some surveys to be only 10 days apart.

Protocol surveys require morning visits, but you may also conduct supplemental evening surveys if time permits. 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 or in the Additional Yellow-billed Cuckoo Detections section.

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 12-hour rather than 24-hour format (e.g., 4:00 am hours rather than 0400). You must use a semi-colon.

Total hrs: Calculate the total hours, rounded to the nearest quarter (0.25) 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 Cuckoos detected during this particular survey. When uncertain whether a detection represents a new individual, include comments on why you are uncertain (such as you were unsure whether the bird followed you or you were unsure whether the same bird was detected in different parts of the survey areas, or the bird was detected only briefly, or other cuckoo behavior). Do not count nestlings. (But do record whether nestlings or fledglings were found, in the Detection Comments section).

YBCU #: 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. Keep track of different cuckoos in the Detection Comments section using both Survey # and YBCU #. Document any information in the Detection Comments that may indicate whether a cuckoo is the same or a different bird than documented previously.

Time Detected: Time of cuckoo detection. Report time in 12-hour rather than 24-hour format (e.g., 8:00 am rather than 0800). You must use a semi-colon.

Detection Method: Record whether the detection was "Incidental" (with a code of "I") if the cuckoo not was detected during the 6 minutes of each call playback survey point. If the cuckoo was detected during a Call playback survey, record it as a "P".

Detection Type: 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 Detection Comments section.

Number of 'kowlp' calls played prior to response: Record the number of times the ‘kowlp’ call was played before the cuckoo responded. A cuckoo vocalizing prior to playback or responding immediately after playback number 1 was likely already nearby and may be near or at the center of its territory. Surveyors should be especially vigilant for signs of breeding behavior. Cuckoos that do not respond until after several calls are broadcast may be present but silent, may be approaching from other areas, or may be following surveyors. Counting the number of broadcast calls also helps the surveyor pay attention to the survey.

Behavior Observed (refer to codes): If observed, record the appropriate behavior code provided at the bottom of the first sheet or see all codes provided at the end of this document in Addendum Appendix 1. Surveyors should be familiar with these behaviors to help in assessing territory and breeding status. More than one code may be used. If a nest is inadvertently found while conducting surveys, observers should 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. Surveyors are not authorized to monitor nests (repeated visits within 20 meters of nest tree) unless specifically stated in your State and Federal permits. Habitat density, nest height, surveyor noise, and surveyor visibility play a role in the level of disturbance to cuckoos. Surveyors must be alert to behavioral signs of disturbance near a cuckoo nest, which include alarm calls given repeatedly while watching the intruder, broken wing displays, or flying in with prey and eating the prey item instead of going to the nest. If these occur, the observer has been the cuckoo is distressed, and the observer should move back (Halterman et al. 2016).

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 (meters): Estimate as accurately as possible, the distance in meters to the detected cuckoo. Periodically, double check your distance estimation accuracy with a measuring tape in the same habitat type between surveys.

Bearing (in number degrees): Estimate, as accurately as possible, the compass bearing in numerical degrees to the detected cuckoo from the surveyor location (such as 360 degrees rather than North). See Magnetic North declination above.

Corrected Coordinates: The Cuckoo location is calculated based on the surveyor’s location, distance, and bearing. You do not enter data into the Corrected Coordinates fields. This Excel data sheet contains a formula that will automatically calculate corrected coordinates and populate these fields.

Survey Summary (REQUIRED):

Surveyors MUST complete all fields in the Survey Summary section of the form. Surveyors have the best knowledge of the behavior, habitat, and location of birds detected on each survey visit, which are used to determine numbers of Possible, Probable, and Confirmed breeding territories. Guidance in estimating the numbers of breeding territories is provided in Table 1 below (updated and revised from Table 2 of the Survey Protocol). These estimates are important and are used by regulatory and land management agencies.

Table 1. Possible, Probable, and Confirmed breeding territory estimation using cuckoo detections. A site is occupied if at least one Possible breeding territory (PO), Probable breeding territory (PR), or Confirmed breeding territory (CO) is present. This table is revised and updated from Table 2 of the Survey Protocol, based on Holmes et al. (2008), McNeil et al. (2013), and Dillon et al. (2017).

Breeding Territory Estimation ¹	
Possible breeding territory (PO)	Detections within a 300 - 500 m area during at least 2 surveys and 12 - 14 days apart.
Probable breeding territory (PR)	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.
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).

¹ Surveys conducted 12 - 14 days apart are recommended, based on a population study on the lower Colorado River (McNeil et al. 2013). If surveys are conducted only 10 days apart, only 40 days of the breeding season are covered. In addition, some cuckoos may remain onsite for 10 days prior to leaving area and may be counted on two surveys. If surveys are conducted more than 16 days apart, an entire cuckoo breeding cycle may be missed. Surveys conducted 15 days apart are acceptable, but are not as ideal as 12-14 days apart if start date of a breeding cycle is unknown. Some extenuating circumstances such as wind, rainfall, flooding, and access may require some surveys to be only 10 days apart.

Total Survey Hours: The number of survey hours for the entire field season. The number of survey hours during each survey will be automatically summed and entered into this field.

Total Number of Detections: The number of individual cuckoos detected during each survey will be automatically summed and entered into this field. Example: If 3 cuckoos (unique individuals) were detected on the first survey, 2 cuckoos were detected on the 2nd survey, and no cuckoos were detected on surveys 3 and 4, the total number of cuckoo detections would be 5 even if the 2 cuckoos detected on the 2nd survey were 2 of the same individuals as on survey 1.

Number of PO Breeding Territories: Record the total number of Possible breeding territories following protocol guidelines and Table 1 (revised from Table 2 in the Survey Protocol, also summarized on form).

Number of PR Breeding Territories: Record the total number of Probable breeding territories following protocol guidelines and revised Table 1 (revised from Table 2 in the Survey Protocol, also summarized on form).

Number of CO Breeding Territories: Record the total number of Confirmed breeding territories following protocol guidelines and revised Table 1 (revised from Table 2 in the Survey Protocol, also summarized on form).

Number of Nests Found: Record total number of nests found (if any encountered). Surveyors are not authorized to monitor nests within 20 meters of the nest tree unless specifically stated in your State and Federal permits.

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

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

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

Name of Reporting Individual: Indicate the full first and last name of the reporting individual (preferably the primary surveyor).

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

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

Email: Provide the reporting individual's email.

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.

Ownership: Primary: Click on drop down menu and select from list.
(BLM, BOR, NPS, USFWS, USFS, Tribal, State, Private, or other (Municipal/County)).

Did you survey the same general area during each visit to this site this year? Click on drop down and select Yes or No. If No, summarize in the comments section.

If site was surveyed last year, did you survey the same general area this year? Click on drop down and select Yes or No. If No, record the reason and how the survey varied in the comments section.

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

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 Overstory/Canopy (where playback calls were used):

Provide the scientific names of the five most common species in the overstory/canopy and proportion of overstory cover provided by each species in cuckoo breeding habitat (relative cover). Overstory may consist of more than one habitat type. For example, cottonwood/willow habitat bordered by mesquite may both be part of the breeding habitat. For relative percent cover, the total should equal 100%, even if more than five species are present. Appendix 2 at the end of this document and the dropdown menu on the form include most, but not all, of the species in southwestern cuckoo habitat. If one of the five most common species present is not

included, click on “Other” and include the scientific name of the species in the Comments section.

General Overstory/Canopy Characteristics:

Average Height (top of trees) of Overstory (meters; do not include a range): Provide the best estimate of the average height of the top of the overstory/canopy throughout the survey in meters. Although canopy height can vary, give only a single (not a range) overall height estimate.

Estimated Absolute (as opposed to relative) Canopy Cover (percent; may be < 100%): Estimate of the absolute percent overstory/canopy cover of the site. This measure of cover is not equal to the species relative covers previously recorded and may be less than 100% if canopy openings are present. The open streambed should not be included in the estimate.

Average Subcanopy (if present; where playback calls were used): Fill out this section if two distinctive tree layers are present and can be differentiated into an overstory/canopy and subcanopy layer (as opposed to overstory/canopy and understory layers). Provide the scientific names of the five most common species in the subcanopy and proportion of average subcanopy cover provided by each species in cuckoo breeding habitat (relative cover). For relative percent cover, the total should equal 100%, even if more than five species are present. Appendix 2 at the end of this document and the dropdown menu on the form include most, but not all, of the species in southwestern cuckoo habitat. If one of the five most common species present is not included, click on “Other” and include the scientific name of the species in the Comments section.

General Subcanopy Characteristics:

Average Height of Subcanopy (meters): Provide the best estimate of the average height of the top of the subcanopy throughout the survey in meters. Although subcanopy height can vary, give only a single (not a range) overall height estimate.

Estimated Absolute (as opposed to relative) Subcanopy Cover (percent; may be < 100%): Estimate the absolute percent overall subcanopy cover at the site. This measure of cover is not equal to the species relative covers previously recorded and may be less than 100% if subcanopy openings are present. The open streambed should not be included in the estimate.

Average Understory (if present; where playback calls were used): The understory comprises a distinct woody or herbaceous layer (that does not have to be present throughout the site) below the overstory canopy and subcanopy in cuckoo breeding habitat. This is the shrub or ground cover layer, including tree regeneration, perennial shrubs, grasses, and/or annual herbaceous growth. For example, a cottonwood overstory might have shrub-sized young cottonwoods or willows and shrubs directly below, immediately

adjacent to, or in small patches in between the overstory. Or there may only be an overstory and subcanopy with no understory. List up to 5 species of understory and estimate proportion of understory cover of each species. Use scientific names. For percent cover the total should equal 100%, even if more than five species are present.

General Understory Characteristics:

Average Height (top) of Understory (meters; do not include a range): Provide the best estimate of the average height of the top of the understory throughout the site in meters. Although understory height can vary, give only a single (not a range) overall height estimate.

Estimated Absolute (as opposed to relative) Understory Cover (percent; may be < 100%): Estimate the absolute percent understory cover for the site. This measure of cover is not equal to the species relative covers previously recorded and may be less than 100% if openings are present. The open streambed should not be included in the estimate.

Immediate Adjacent Habitat Along Entire Transect (Outside of survey site): Categorize habitat adjacent to the survey area (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). Adjacent habitat should not be part of the breeding habitat. For example, if mesquite borders riparian habitat and contributes toward breeding habitat it is not considered adjacent habitat and should be included in the overstory and understory estimates. List up to 5 categories of adjacent habitat and estimate the proportion of percent cover (should equal 100%). If a category of adjacent habitat present is not included, click on "Other" and include the name of the adjacent habitat in the Comments section. Additional information on some of the adjacent habitat types:

- Desert/Scrub/Thornscrub is a broad category of habitat types that may contain creosote, cacti, arid-adapted shrubs, and thorny trees such as mesquite, acacia, and grey thorn. Tree cover, if present, is generally shorter and sparser than in breeding habitat. Examples: adjacent habitat along Agua Fria, Gila, lower San Pedro, Verde, Bill Williams, lower Colorado, Big Sandy, Santa Cruz rivers and tributaries in AZ and along ephemeral drainages in southeastern AZ.
- Orchard: pecan, almond, apple, pistachio. etc.
- Oak Woodland may include other trees and is primarily in the foothills and mountains of southeastern AZ. Example: Coronado National Forest.
- Mixed Conifer Forest. Example: Coronado National Forest.
- Grassland. Examples: along Gila R, Mimbres R, and Rio Grande in NM; Upper San Pedro R, Canelo Hills, and drainages in Buenos Aires National Wildlife Refuge, in AZ.

Is the survey area or adjacent area (within 300 meters) dominated by surface water or saturated soil during at least two surveys? Click on drop down menu and select Yes, No, or

Unknown. Provide information in the Comments section if surface water or saturated soil changed between surveys.

Perennial, intermittent, ephemeral drainage (or body of water): Click on drop down menu and select Perennial, Ephemeral, or Intermittent. We are interested in whether the drainage (or body of water) supporting vegetation used by cuckoos is perennial, intermittent, or ephemeral during the breeding season. Tanks, ponds, lakes, cienegas, irrigation ditches, irrigation system, etc. would be characterized by the frequency and duration the water source is available during the breeding season. See the descriptions below. Provide information in the comments section of any changes in hydrology.

Perennial - water flowing year-round, mostly from upstream waters or groundwater. Or a lake with water during the entire breeding season.

Intermittent - water flowing during certain times of the year mostly from upstream waters and groundwater. Examples: A streambed that contains pools of water in between dry reaches throughout the breeding season. In artificial systems, water may be delivered on a schedule, such as one day per week, with gradual drying in between deliveries. An irrigation ditch that contains water for two days every week. An irrigation system supporting revegetated riparian habitat.

Ephemeral - water present or flowing only after precipitation, such as during the summer monsoon. Examples: A wash that is temporarily moist or flowing from a summer rain. A tank that holds water temporarily after a summer rain.

Comments: Provide comments regarding differences between survey patches or where cuckoos were detected 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, subcanopy, 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 Summary Form for electronic submission

Yellow-Billed Cuckoo Survey Summary Form Page 3 (OPTIONAL). Please use this form for additional detections, follow-up visits, evening visits, and any other circumstance when more detail is needed.

Addendum to Literature Cited

- Dillon, K., D. Moore, and D. Ahlers. 2017. Lower Rio Grande Yellow-billed Cuckoo Survey Results -2016. Selected Sites within the Lower Rio Grande Basin from Elephant Butte Dam, NM to El Paso, TX. Bureau of Reclamation, Technical Service Center, Fisheries and Wildlife Resources. Denver, CO.
- Halterman, M.D., 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, 45 p.
- Holmes, J.A., C. Calvo, and M.J. Johnson. 2008. Yellow-billed cuckoo distribution, abundance, habitat use, and breeding ecology in the Verde River watershed of Arizona, 2004–2005. Final Report. Admin Rept. Arizona Game and Fish Dept. 34 pp.
- McNeil, S.E., D. Tracy, J.R. Stanek, and J.E. Stanek. 2013. Yellow-billed cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2008–2012 summary report. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV, by SSRS. http://www.lcrmscp.gov/reports/2012/d7_sumrep_08-12.pdf.
- McNeil, S.E. and D. Tracy. Yellow-billed Cuckoo Behavior Codes. Southern Sierra Research Station. Weldon, CA.

Appendix 1. Yellow-billed Cuckoo behavior codes (McNeil and Tracy 2019).

Behavior code	Description	Evidence of Breeding or Pair Activity? (0=No, S=suggestive-need more evidence, P=probable, C=confirms)	Note
CAP	Capture (e.g. in mist net)	0	For banding studies
DT	Dropped Transmitter (radio-tagged birds only)	0	For telemetry studies
FLC	Flies Closer (response to playback)	0	Added for response/detection study. Also useful to ID a catchable cuckoo (flies toward playback).
FLU	Flush (possibly off nest)	S	Flush, possibly off nest in response to surveyor. (Normally cuckoos avoid being seen up close. If a cuckoo flies right in front of you, often it's because you just flushed it (made it fly) off nest.
NOS	No Signal (radio-tagged birds only)	0	For telemetry studies
PA	Pair	S	Useful to hone in on territory centers
PN	Possible Nest	S	Useful to hone in on territory centers, and reduce excessive point-taking
RC	Repeat Call (from same location)	S	Useful to hone in on territory centers, and reduce excessive point-taking
RO	Roost Site (nocturnal)	S	Location of calling birds pre-dawn. Useful to locate nests (incubating males often call from nest pre-dawn)
RS	Resight band	0	For banding studies
MA	Mistnet Attempt	0	For banding studies
TD	Territorial Display	S	Useful to hone in on territory centers
NV	No Visual	0	

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Behavior code	Description	Evidence of Breeding or Pair Activity? (0=No, S=suggestive-need more evidence, P=probable, C=confirms)	Note
BW	Bill Wipe	0-S	Sometimes indicates agitated behavior near a nest
FS	Fecal Sac Carry	C	
AN	At Nest	C	
US	Used Nest	C	Nests inactive when found (active earlier in season)
CP	Catches Prey	0	
EF	Eats Food	0	
FLY	Flying	0	
FO	Forages	0	
JUV	Juvenile	C (in area)	Older than fledgling, able to fly.
PRE	Preening	0-S	Sometimes indicates agitated behavior near a nest
ST	Sitting	0	Useful for band/resight QA (resighting bands usually requires sitting birds)
FY	Feeds Young	C	
BI	Brooding or Incubating	C	
CF	Carry Food	0-S	Suggests but does not confirm breeding. Other evidence needed
MAT	Carry Nest Material	P	Best to find the nest to confirm breeding
COP	Copulation	C	Best to find the nest to confirm breeding
DD	Distraction Display	C	Best to find the nest to confirm breeding
FLG	Fledgling	C	Indicates a nest nearby (fledgling = unable to fly)
FM	Feeds Mate	S	
FN	Feeds Nestling	C	
NB	Nest Building	C	
VEX	Vocal (kowlp) Exchange	S	

Appendix 2. Woody Plant Species List for Arizona, New Mexico, and Texas.

Veg Code	Common Name	Genus	Species
ABCO	White fir	<i>Abies</i>	<i>concolor</i>
ABSP	Fir species	<i>Abies</i>	species
ACSP	Acacia species	<i>Acacia/Senegalia</i>	species
ACGR	Catclaw acacia	<i>Senegalia</i> (old genus is Acacia)	<i>greggii</i>
ACSP	Acacia Species	<i>Acacia</i>	species
ACGL	Rocky Mountain Maple	<i>Acer</i>	<i>glabrum</i>
ACNE	Boxelder	<i>Acer</i>	<i>negundo</i>
ACSP	Maple species	<i>Acer</i>	species
ALIN	Thinleaf Alder	<i>Alnus</i>	<i>incana ssp. tenuifolia</i>
ALOB	Arizona alder	<i>Alnus</i>	<i>oblongifolia</i>
ALRH	White alder	<i>Alnus</i>	<i>rhombifolia</i>
ALSP	Alder species	<i>Alnus</i>	species
AMFR	Indigobush	<i>Amorpha</i>	<i>fruticosa</i>
APCA	Dogbane	<i>Apocynum</i>	<i>cannabinum</i>
ARXA	Texas madrone	<i>Arbutus</i>	<i>xalapensis</i>
ARSP	Manzanita	Arctostaphylos	species
BASP	Baccharis species	Baccharis	species
BAMBOO	Bamboo	Bamboo	species
Burned	Burned	Burned	Burned
CACTUS	Cactus species	Cactus	species
CAIL	Pecan	<i>Carya</i>	<i>illinoensis</i>
CEEH	Desert hackberry Same species with 2 diff scientific names being used. Other name is <i>Celtis pallida</i> .	<i>Celtis</i>	<i>ehrenbergiana</i>
CELA	Sugar hackberry	<i>Celtis</i>	<i>laevigata</i>
CERE	Western hackberry Net-leaved hackberry Canyon hackberry	<i>Celtis</i>	<i>reticulata</i>
CESP	Hackberry species	<i>Celtis</i>	species
CRSP	Palo verde (2 species) Foothills Palo Verde (<i>Cercidium microphyllum</i>) or Blue Palo Verde (<i>Cercidium floridum</i>)	<i>Cercidium</i>	species

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Veg Code	Common Name	Genus	Species
CHLI	Desert willow	<i>Chilopsis</i>	<i>linearis</i>
CONIFER	Conifer species	Conifer	species
COX	Dogwood species	<i>Cornus</i>	species
CUAR	Arizona cypress	<i>Cupressus</i>	<i>arizonica</i>
ELAN	Russian Olive	<i>Elaeagnus</i>	<i>angustifolia</i>
FONE	New Mexico Olive, Privet, New Mexican Forestiera	<i>Forestiera</i>	<i>neomexicana</i>
FOPU	New Mexico Olive, Stretchberry	<i>Forestiera</i>	<i>pubescens</i>
FOX	New Mexico Olive species	<i>Forestiera</i>	species
FREX	European ash	<i>Fraxinus</i>	<i>excelsior</i>
FRVE	Arizona Ash, Velvet Ash	<i>Fraxinus</i>	<i>velutina</i>
FRSP	Ash	<i>Fraxinus</i>	species
JGX	Walnut species	<i>Juglans</i>	species
JUMA	Arizona walnut	<i>Juglans</i>	<i>major</i>
JUNI	Black walnut	<i>Juglans</i>	<i>nigra</i>
JURE	English walnut	<i>Juglans</i>	<i>regia</i>
JUMO	One-seed juniper	<i>Juniperus</i>	<i>monosperma</i>
JUPA	Alligator Juniper	<i>Juniperus</i>	<i>pachyphloea</i>
JUSC	Rocky Mountain Juniper	<i>Juniperus</i>	<i>scopulorum</i>
JUSP	Juniper species	<i>Juniperus</i>	species
LYSP	Wolfberry species	<i>Lycium</i>	species
MAX	Apple tree species	<i>Malus</i>	species
MIMO	Mimosa	<i>Mimosa</i>	species
MOAL	White mulberry	<i>Morus</i>	<i>alba</i>
MOMI	Texas mulberry	<i>Morus</i>	<i>microphylla</i>
MOSP (AZ)	Mulberry	<i>Morus</i>	species
N	None	None	none
Other	Other	Other	Other
OTLE	Ironwood	<i>Olneya</i>	<i>tesota</i>
PASP	Palo Verde	<i>Parkinsonia</i>	species
PIEN	Engelmann's spruce	<i>Picea</i>	<i>engelmannii</i>
PIPU	Blue spruce	<i>Picea</i>	<i>pungens</i>
PISP	Spruce Species	<i>Picea</i>	species
PIED	Pinyon pine	<i>Pinus</i>	<i>edulis</i>
PIPO	Ponderosa pine	<i>Pinus</i>	<i>ponderosa</i>
PICE	Mexican Pinyon Pine	<i>Pinus</i>	<i>cembroides</i>
PISP	Pine	<i>Pinus</i>	species

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Veg Code	Common Name	Genus	Species
PLWR	Arizona Sycamore	<i>Plantanus</i>	<i>wrightii</i>
POAN	Narrowleaf Cottonwood	<i>Populus</i>	<i>angustifolia</i>
PODE	Rio Grande Cottonwood, includes subspecies <i>wislizenii</i>	<i>Populus</i>	<i>deltoides</i>
POFR	Fremont Cottonwood	<i>Populus</i>	<i>fremontii</i>
POSP	Populus species	<i>Populus</i>	species
PRGL	Honey mesquite	<i>Prosopis</i>	<i>glandulosa</i>
PRPU	Screwbean mesquite	<i>Prosopis</i>	<i>pubescens</i>
PRSP	Mesquite	<i>Prosopis</i>	species
PRVE	Velvet Mesquite	<i>Prosopis</i>	<i>velutina</i>
PNSP	Fruit trees- domestic (almond, prune, etc.	<i>Prunus</i>	species
PRVI	Chokecherry	<i>Prunus</i>	<i>virginiana</i>
PSME	Douglas-fir	<i>Pseudotsuga</i>	<i>menziesii</i>
PTTR	Hoptree	<i>Ptelea</i>	<i>trifoliata</i>
QUGA	Gambel's oak	<i>Quercus</i>	<i>gambelii</i>
QUGR	Grey oak	<i>Quercus</i>	<i>grisea</i>
QULO	Valley oak	<i>Quercus</i>	<i>lobata</i>
QUMU	Chinaquapin oak	<i>Quercus</i>	<i>muehlenbergii</i>
QUSP	Oak species	<i>Quercus</i>	species
RHMI	Gray littleleaf sumac	<i>Rhus</i>	<i>microphylla</i>
RHSP	Sumac species	<i>Rhus</i>	species
RHTR	Three-leaf sumac	<i>Rhus</i>	<i>trilobata</i>
RONE	New Mexico locust	<i>Robinia</i>	<i>neomexicana</i>
ROWO	Wild rose	<i>Rosa</i>	<i>woodsii</i>
ROSP	Rose species	<i>Rosa</i>	species
ROAR	Arizona Rose	<i>Rosa</i>	<i>arizonica</i>
RUSP	Blackberry	<i>Rubus</i>	species
SAAM	Peachleaf willow	<i>Salix</i>	<i>amygdaloides</i>
SABE	Bebb willow	<i>Salix</i>	<i>bebbiana</i>
SABO	Red Willow (Bonpland)	<i>Salix</i>	<i>bonplandiana</i>
SAEX	Coyote willow/ Sandbar Willow	<i>Salix</i>	<i>exigua</i>
SAGE	Geyer Willow	<i>Salix</i>	<i>geyeriana</i>
SAGO	Tree willow, Goodding's willow, Black willow	<i>Salix</i>	<i>goodingii</i>

Draft Addendum - Instructions for completing the Yellow-billed Cuckoo Survey Summary Form
USFWS and USBR
June 2019

Veg Code	Common Name	Genus	Species
SAIR	Bluestem willow, Sandbar willow	<i>Salix</i>	<i>irrorata</i>
SALA	Arroyo willow	<i>Salix</i>	<i>lasiolepis</i>
SALE	red willow	<i>Salix</i>	<i>laevigata</i>
SALU	Yellow willow	<i>Salix</i>	<i>lutea</i>
SAMO	Park willow	<i>Salix</i>	<i>monticola</i>
SANI	Black willow	<i>Salix</i>	<i>nigra</i>
SATA	Yewleaf willow	<i>Salix</i>	<i>taxifolia</i>
SASP	Willow species	<i>Salix</i>	species
SAME	Mexican elderberry	<i>Sambucus</i>	<i>mexicana</i>
SASA	Soapberry	<i>Sapindus</i>	<i>saponaria</i>
SNAG	Snag (any species)	SNAG	SNAG
TAAP	Athel tamarisk	<i>Tamarix</i>	<i>aphylla</i>
TACH	Five-stamen saltcedar	<i>Tamarix</i>	<i>chinensis</i>
TAPE	Saltcedar	<i>Tamarix</i>	<i>pentandra</i>
TARA	Saltcedar	<i>Tamarix</i>	<i>ramosissima</i>
TASP	Salt Cedar / Tamarisk (TACH, TARA, TAPE). Does not include athel tamarisk.	<i>Tamarix</i>	species (<i>chinensis</i> / <i>ramosissima</i> / <i>pentandra</i>)
ULPA	Chinese Elm	<i>Ulmus</i>	<i>parvifolia</i>
ULPU	Siberian elm	<i>Ulmus</i>	<i>pumila</i>
ULSP	Elm species	<i>Ulmus</i>	species
U	Unknown	Unknown	Unknown
ZIOB	Grey Thorn Old name is <i>Condalia lycioides</i>	<i>Ziziphus</i>	<i>obtusifolia</i>