



Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Yellow-billed Cuckoo Surveys on the Lower Colorado River

2017 Annual Report



February 2018

Work conducted under LCR MSCP Work Task D7

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

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National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

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Palo Verde Irrigation District
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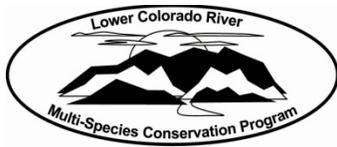
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Lower Colorado River Multi-Species Conservation Program

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ACRONYMS AND ABBREVIATIONS

ac	acre(s)
Ag	gold
Bill Williams River NWR	Bill Williams River National Wildlife Refuge
BLCA	Beal Lake Conservation Area
Cibola NWR	Cibola National Wildlife Refuge
Cibola NWR Unit #1	Cibola National Wildlife Refuge Unit #1 Conservation Area
COB	confirmed breeding territory
CVCA	Cibola Valley Conservation Area
DNA	deoxyribonucleic acid
DPS	distinct population segment
ESA	Endangered Species Act
F	female
ft	foot/feet
g	gram(s)
GPS	Global Positioning System
ha	hectare(s)
Havasu NWR	Havasu National Wildlife Refuge
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	male
m	meter(s)
mB	mid-blue
MDB	Microsoft Access database
MEFF	mobile electronic field form
Mg	magenta
mi	mile(s)

n =	number equals (sample size)
NWR	National Wildlife Refuge
oz	ounce(s)
Parametrix	Parametrix, Inc.
POS	possible breeding territory
PRB	probable breeding territory
PVER	Palo Verde Ecological Reserve
R	red
Reclamation	Bureau of Reclamation
S	silver
SSRS	Southern Sierra Research Station
USFWS	U.S. Fish and Wildlife Service
YBCU	yellow-billed cuckoo (<i>Coccyzus americanus occidentalis</i>)
YEW	Yuma East Wetlands

Symbols

©	copyright
°C	degrees Celsius
°F	degrees Fahrenheit
>	greater than
≥	greater than or equal to
≤	less than or equal to
#	number
%	percent
±	plus or minus
®	registered
™	registered trademark

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Attachments

Attachment

- 1 Maps of Yellow-billed Cuckoo Survey Sites, Lower Colorado River, 2017

EXECUTIVE SUMMARY

This report details field work conducted in 2017 to provide an annual reference for the status of yellow-billed cuckoos (*Coccyzus americanus occidentalis*) (YBCU) utilizing created habitat developed under the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). In December 2013, the Bureau of Reclamation (Reclamation) contracted with Parametrix, Inc., to monitor YBCUs within suitable habitat along the lower Colorado River as part of an ongoing 50-year plan to conserve at least 26 species from Lake Mead to the Southerly International Boundary with Mexico (LCR MSCP 2004a). Parametrix, Inc., subcontracted the Southern Sierra Research Station to implement a large portion of the work. Following extensive loss of riparian forest over the past century, the western population of YBCUs was listed as a threatened species under the Endangered Species Act on November 3, 2014 (U.S. Fish and Wildlife Service 2014). The LCR MSCP was created to balance the use of Colorado River water resources with the conservation of native species and their habitats (LCR MSCP 2004b). This work may also help inform other habitat restoration programs for western YBCUs.

The objectives of this 5-year study include assisting Reclamation in the documentation and standardization of data, documenting the presence of YBCUs in the study area, and monitoring population parameters that can be used to assess habitat quality, including nest success, breeding density, productivity, and survival. To document the presence of YBCUs in 2017, standardized call-playback surveys were conducted within LCR MSCP conservation areas covering approximately 1,426 hectares (3,523 acres) of habitat. From June 16 to August 10, surveys were conducted during 4 survey periods at 32 sites. Surveyors recorded 212 total survey detections and confirmed 27 breeding territories, including 21 nests. Detections and territory estimates were considerably lower than in previous years, with different patterns observed as follows: Bill Williams River sites had no detections, and the number of detections were lower at the Beal Lake Conservation Area, Palo Verde Ecological Reserve, and the Cibola Valley Conservation Area. The causes of the lower counts are not immediately clear, and a full discussion is reserved for 2018. Survey detections remained stable at the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1) and Yuma East Wetlands, and they increased at the Laguna Division Conservation Area.

Previously, from 2008 to 2015, nest searches and monitoring measured nest success, breeding density, and productivity in the lower Colorado River YBCU population. Mist netting/mark-recapture techniques were used to measure survival rates and population viability. Additionally, in 2014 and 2015, Global Positioning System (GPS) tags were deployed to assess pre- and post-breeding movements. In 2016, the study objective was narrowed to no longer include population monitoring, although some mist netting was retained to allow for retrieval of previously deployed GPS tags.

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In 2017, mist netting was reduced to 2 days, resight and nest searching attempts were limited to 50 days total, and other nests were found opportunistically during surveys or resight attempts. Three new YBCUs were captured, and two previously banded YBCUs were recaptured in 2017. One of the recaptured YBCUs was the seventh recaptured of 14 that were originally fitted with GPS tags in 2014 and 2015. The GPS tag retrieved in 2017 recorded one stopover location on September 22, 2015, in the State of Jalisco, Mexico, before it failed. This location is among a cluster of points in Jalisco and Michoacán, Mexico, where three other GPS-tagged YBCUs from this study area were previously recorded. Falling within a 660-kilometer (410-mile) stretch from Nayarit to Michoacán, this area was used by all YBCUs tracked to date from the LCR MSCP study area. This data reinforces the importance of this largely unprotected region of western Mexico for YBCUs during fall migration.

An additional 23 YBCUs previously banded in this study area were resighted in 2017. Of particular interest was a resight of the oldest YBCU now recorded, an adult male aged 8+ years and previously captured in 2010 at the Cibola NWR Unit #1 Crane Roost site. This YBCU successfully nested in 2017 at its 2010 capture site.

Conditions change from year to year, and the analysis of multiple years of data in 2018, the final year of this project, will help to provide a better understanding of the status of the lower Colorado River YBCU population.

INTRODUCTION

Lower Colorado River Multi-Species Conservation Program

In 2005, the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) “was created to balance the use of Colorado River water resources with the conservation of native species and their habitats” (LCR MSCP 2004b). This coordinated, comprehensive, long-term multi-agency effort focuses on conserving habitat, working toward the recovery of threatened and endangered species, and reducing the likelihood of additional species being listed (LCR MSCP 2004b). The Bureau of Reclamation (Reclamation) is the implementing agency of the LCR MSCP.

The LCR MSCP covers areas within the historical flood plain of the Colorado River from Lake Mead to the United States-Mexico International Boundary, a distance of about 644 kilometers (km) (400 river miles) (LCR MSCP 2004b). A Habitat Conservation Plan (HCP) was designed to provide Endangered Species Act (ESA) compliance over the 50-year period of the program (LCR MSCP 2004a).

Areas covered in the HCP include more than 3,278 hectares (ha) (8,100 acres [ac]) of riparian, marsh, and backwater habitat for six federally (or ESA) listed species and 20 other covered species “that are included under the ESA incidental take authorization and are either currently listed or proposed for listing as threatened or endangered under the ESA or are protected under Arizona, California, or Nevada law; or may become listed during the 50-year LCR MSCP term affected by covered activities” (www.lcrmscp.gov).

Yellow-billed Cuckoo History and Biology

The yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (YBCU) was listed as endangered in California (California Department of Fish and Game 1978), a species of special concern in Arizona (Arizona Game and Fish Department 1988), and a U.S. Forest Service sensitive species in Arizona and New Mexico (U.S. Department of Agriculture-U.S. Forest Service 1988). In 2014, the U.S. Fish and Wildlife Service (USFWS) listed the western distinct population segment (DPS) of YBCUs as threatened (USFWS 2014). The LCR MSCP will refer to the western DPS of YBCUs as YBCUs or western YBCUs in this report.

Western YBCUs are riparian obligate birds that migrate between their breeding grounds in the United States and wintering areas in South America (Sechrist et al. 2012; USFWS 2014; McNeil et al. 2015). They are among the last neotropical migrants to arrive in Arizona and California to breed, beginning to arrive in late

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May (Bent 1940). Their diet during the breeding season consists primarily of large insects, such as grasshoppers, katydids, caterpillars, mantids, and cicadas, and can include tree frogs and small lizards (Bent 1940; Hamilton and Hamilton 1965; Nolan and Thompson 1975; Hughes 2015). Breeding often coincides with the availability of large insects (Ehrlich et al. 1992). The population has declined mainly due to loss of their preferred riparian breeding habitat (USFWS 2014). Nesting usually occurs between late June and late July but can begin as early as late May and continue until late September (Hughes 2015). In the lower Colorado River (LCR) region, their nesting period primarily occurs from late June to late August, peaking in mid- to late July. YBCUs at the Palo Verde Ecological Reserve (PVER), located north of Blythe, California, have been documented nesting into September (McNeil et al. 2013; McNeil and Tracy 2013; Parametrix, Inc., [Parametrix] and Southern Sierra Research Station [SSRS] 2015), and adults tending to fledglings may remain in this area until early October.

Tree species primarily used by YBCUs for nesting in this study area include Goodding's willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*, hereafter cottonwood), and tamarisk (*Tamarix* spp.). Other trees or large shrubs used for nesting include honey mesquite (*Prosopis glandulosa*), screwbean mesquite (*P. pubescens*), seep willow (*Baccharis salicifolia*), and coyote willow (*S. exigua*) (McNeil et al. 2013).

Nests are built by both sexes and consist of a loose platform of sticks. Clutch sizes range from one to five (Payne 2005), averaging two to three (Laymon 1998). From 2008 through 2012, clutch sizes in the study area averaged 2.8 (n = 72; McNeil et al. 2013). Eggs are generally laid daily until clutch completion (Jay 1911). Incubation begins once the first egg is laid and lasts for 9 to 11 days (Potter 1980, 1981; Hughes 2015). Both sexes incubate, with males tending the nest overnight (Halterman 2009). Young hatch asynchronously and are fed mostly large insects (Laymon and Halterman 1985; Laymon et al. 1997; Halterman 2009). After fledging at 5 to 9 days, young may be dependent on adults for up to 3 weeks (Laymon and Halterman 1985; McNeil et al. 2013). Fall migration begins in August, and most birds have left by mid-September (Hughes 2015; McNeil et al. 2013).

The “Surveys and Habitat Occupancy” section describes YBCU surveys that were conducted in 2017 to estimate presence, habitat occupancy, and breeding territories. The “Population Monitoring” section describes other tasks included in the scope of work such as nest detection, mist netting, color banding, recaptures, and Global Positioning System (GPS) tag retrieval.

Data collected over only a 1-year period are prone to increased error in parameter estimation due to stochastic or unknown events that may change on a yearly basis. Year-to-year differences may not be indicative of trends, and conclusions made annually may change from year to year. Therefore, multi-year analyses with biologically relevant covariates is required for reliably detecting ecologically

important differences within and among populations and for identifying important sources of variation that could potentially be managed in the future. Similarly, long-term mark-recapture data require numerous years to compare variation that may be impacting populations of a species. Previous research has indicated that at least 10 years of data are necessary for most wild bird populations in order to assess survival and population growth rates (Amstrup et al. 2005). For this project, a thorough analysis of the data from multiple years of YBCU monitoring conducted on the LCR (2014–18) will be presented in the final summary report.

Project Scope of Work

Objectives of the 5-year study during 2014–18 include:

1. Assist Reclamation in the documentation and standardization of data collected for the YBCU project. This will be accomplished by implementing standardized mobile electronic field forms (MEFFs) and creating data dictionaries, metadata, and quality assurance/quality control processes following completion of field work (after the 2014 field season, all data will be collected electronically when feasible).
2. Document the presence of YBCU in suitable habitat within the LCR MSCP region. In 2016, the scope of work for this project was reduced, and surveys for YBCUs were conducted in LCR MSCP conservation areas only.
3. Monitor and document population parameters that can be used to assess habitat quality, including nest success, breeding density, productivity, and survival rates.

Changes to Data Collection in 2016 and 2017

From 2008 to 2014, data collected during YBCU field work under the LCR MSCP were recorded in the field using paper data forms and Garmin GPS units, then imported into Microsoft Access database (MDB) forms at the project field houses. Additionally, in 2014, a subset of data was entered while in the field into MEFFs created in TerraSync™ version 5.41 and loaded onto Trimble® Juno 3B GPS units (Trimble Navigation, Ltd., Sunnyvale, California) to evaluate the use of MEFFs for future data collection on the YBCU project. GPS Pathfinder Office version 5.6 (Trimble Navigation, Ltd., Sunnyvale, California) was used to transfer, differentially correct, review, and address any additional errors identified in MEFF data files, which were then exported to MDB files. Beginning in 2015, all data were collected on MEFFs with Juno GPS units

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and processed in GPS Pathfinder Office. When possible, data were directly entered into MEFFs in the field. If field conditions interfered with electronic collection, data were entered into field notebooks, and spatial locations were recorded with Garmin GPS units if necessary and then transferred into MEFFs later. Difficulties encountered in 2015 included multiple YBCU observations occurring simultaneously, which impeded recording all data into MEFFs in a timely manner, and dense canopy and steep canyons or other factors that affected satellite communications with TerraSync™.

In 2016, the MEFFs were revised to address the problems identified in 2015 (Parametrix and SSRS 2016b). All tasks were included in a single MEFF in order to improve data entry and allow increased time for observation. Some MEFFs were simplified, and fewer data were recorded overall, due in part to the reduced scope of work. The simplification of MEFF data collection also enabled easier management of the data within a central MDB, allowing for quicker review of all data as they were collected.

Additional changes beginning with the 2016 field season and continuing into 2017 included the removal of nest monitoring and banding from the scope of work. An additional 50 visits (followup visits) were included to locations where YBCUs were detected in order to gather information on banded birds, or nesting if breeding had not been previously confirmed. The additional capture of YBCUs for banding or placement of tracking equipment has been discontinued. In 2016, an additional change in the YBCU survey protocol (Halterman et al. 2016) reduced the number of surveys conducted per site from five to four. Due to the elimination of the fifth survey per site conducted in 2016 and 2017, comparisons of survey detections with previous years is limited to the first four surveys conducted per year only.

SURVEYS AND HABITAT OCCUPANCY

Introduction

Long-term monitoring programs focus on the status and trends of species' distribution and can effectively document a species' annual state and changes in their condition through time (MacKenzie et al. 2006). Through repeated surveys, the annual status of populations can be assessed by examining within-season distribution, occupancy, and abundance patterns (both spatial and temporal) across the landscape. The analysis of multi-year datasets can reveal emergent trends in a number of population parameters, including fluctuations and responses to environmental changes such as habitat restoration or creation.

YBCUs are difficult birds to study (Hughes 2015), as they can have large overlapping home ranges, are furtive, call infrequently, and often engage in behaviors to avoid detection (Hamilton and Hamilton 1965; Laymon et al. 1997). In addition, YBCUs have a short nesting cycle, females may engage in polyandrous behavior (Haltermann 2009), an individual or pair may have multiple broods, and the detection of transient birds during surveys may complicate survey results (McNeil et al. 2013). Call-playback surveys alone are inadequate to accurately estimate breeding abundance or density, prompting the development of alternative methods (McNeil et al. 2013), as described below in “Breeding Territory Estimates” section.

Methods

Study Area and Survey Site Selection

Surveys of potential and previously occupied YBCU habitat were conducted at sites spanning approximately 300 km (186 river miles) of the LCR from the Beal Lake Conservation Area (BLCA) (located in the Havasu National Wildlife Refuge [Havasu NWR]) in northern Arizona to Yuma, Arizona (the LCR MSCP study area) (figure 1). Habitat that a YBCU would potentially use in the study area was defined in the LCR MSCP Habitat Conservation Plan as at least 10 ha (25 ac) of contiguous riparian vegetation containing cottonwood and Goodding’s 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). However, based on later telemetry observations at LCR restoration sites, YBCU territories averaged 20 ha (50 ac) in size (McNeil et al. 2013). Occasionally, smaller patches of habitat were also surveyed depending on their location and quality. Detailed descriptions of the study area are included in the “Results” section along with survey results by site.

In 2014, Reclamation instituted a three-tiered naming convention to be used for all projects conducted under the LCR MSCP (table 1). The area encompassed by the LCR MSCP boundary has been divided into standardized areas, sites, and sections, with areas covering the largest geographic extent and sections the smallest. Several projects may be ongoing within these areas during the same breeding season; therefore, section boundaries were delineated by Reclamation based on the needs of various projects occurring within those locations, and they may not entirely encompass all YBCU habitat. For the YBCU project, a GPS unit was used to determine the boundaries of potential breeding habitat within each section. Where boundaries were inaccessible, georeferenced 2004–13 aerial imagery was used to estimate the boundaries. Once potential breeding habitat was identified within a section, survey transects were established (as described below).

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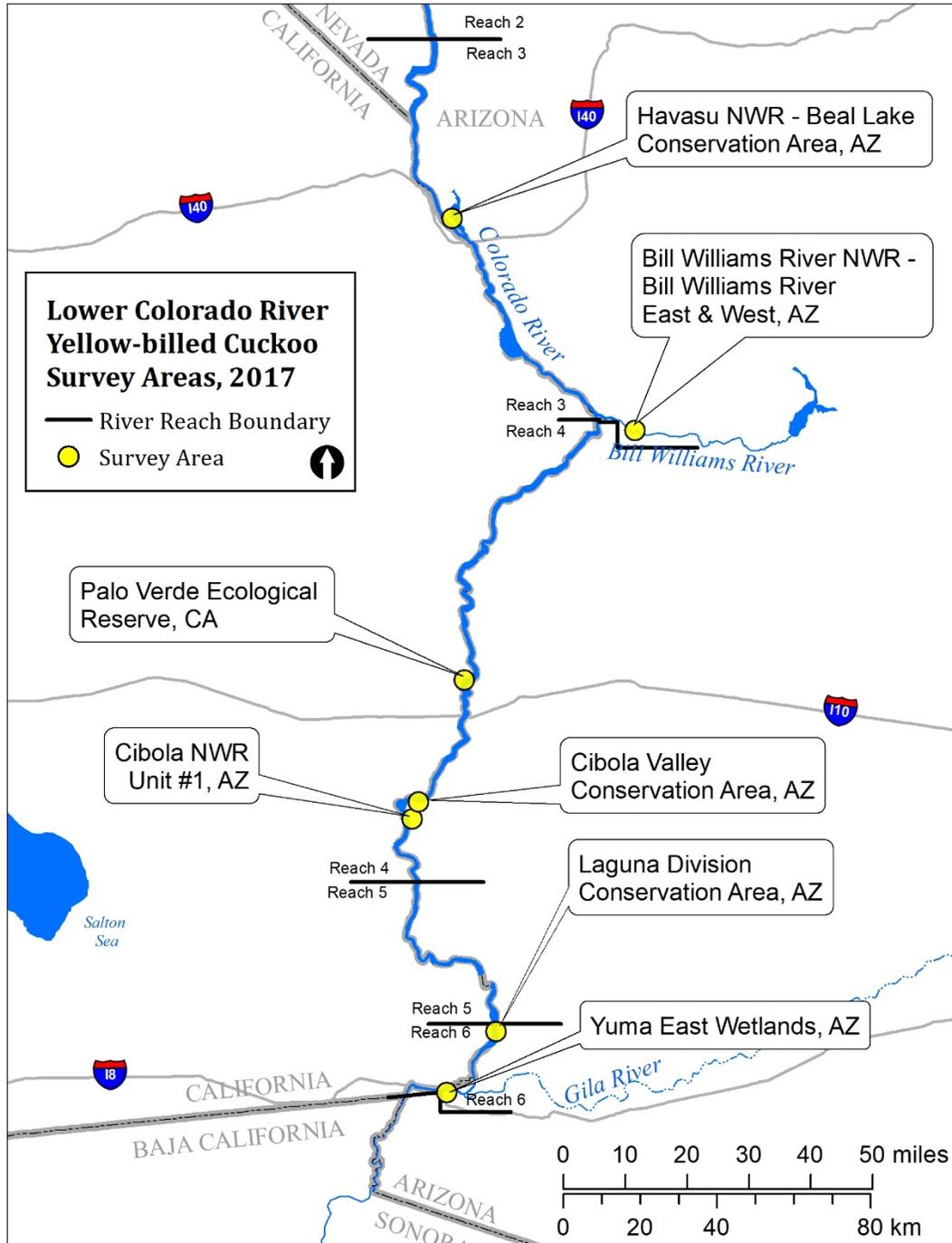


Figure 1.—The 2017 LCR MSCP yellow-billed cuckoo study area from Reach 2 to Reach 6 along the LCR.
Sites are clustered within areas.

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Table 1.—Naming conventions for the YBCU project under the LCR MSCP

Term	Definition
Study area	Potential YBCU breeding habitat along a 322-km (200-mi) stretch of the LCR and tributaries from the Overton Wildlife Management Area (Nevada) to Yuma, Arizona.
River reach (reach)	A discrete watershed segment used for the analysis of impacts and conservation measures (LCR MSCP 2004a). Survey results are grouped by each river reach in this report.
Survey area (area)	A collection of clustered monitored sites (see figure 1).
Survey site (site)	At least 20 ha (49 ac) of potential breeding habitat that contains cottonwood and Goodding's willow of structural types I-III (sites with an overstory averaging > 4.6 m [15 ft] tall) (Anderson and Ohmart 1984) that can be monitored in one morning. For full coverage of the area, one or more linear transects were traversed.
Section	A spatially explicit location that may include transects, survey points, plots, net lanes, trap lines, etc., used for different projects under the LCR MSCP.
Transect	Spatially explicit trails spaced 200 to 250 m (656 to 820 ft) throughout potential breeding habitat from which YBCU surveys were conducted.
Survey point (point)	Spatially explicit location where YBCU call-broadcasts were played to elicit responses. Points are spaced 100 m (328 ft) apart along transects (Haltermann et al. 2016).

Survey Schedule

Surveys in the study area were previously conducted annually if one or more potential breeding territories were reported during either of the previous two breeding seasons. In addition, all LCR MSCP conservation areas at least 2 years old that contain suitable structure and vegetation types were also surveyed. In 2016, Reclamation reduced the scope of this project to only include surveys within suitable habitat in LCR MSCP conservation areas.

Sites previously surveyed in the Bill Williams River-East and Bill Williams River-West areas were removed from surveys in 2015 due to a reduced scope of work for this project. With the addition of Planet Ranch to the LCR MSCP, portions of the Bill Williams River National Wildlife Refuge (Bill Williams River NWR) became creditable acres under the program. In 2017, riparian forest between Sandy Wash and Mineral Wash (within the Bill Williams River-East area, in addition to one site in the Bill Williams River-West area), were placed back into areas surveyed. Thirty-two sites were surveyed in the conservation areas in 2017 (see figure 1; table 2). In this report, some of the adjacent sites are presented together as one site, including two sites at the BLCA and five sites at Yuma East Wetlands (YEW).

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Table 2.—LCR MSCP yellow-billed cuckoo survey areas and sites, 2017

Geographic area	LCR MSCP conservation area	Pre-2014 site code	Current LCR MSCP site name	Size (ha)
Needles, Arizona	Beal Lake Conservation Area (Reach 3)	HAVBR	CPhase 05	19.7
			CPhase 06	15.8
Parker, Arizona	Bill Williams River-East (Reach 3)	BWPT	Cougar Point	49.7
		BWER	Esquerra Ranch	73.9
		BWGR	Gibraltar Rock	90.1
		BWKR	Kohen Ranch	43.4
		BWMW	Mineral Wash	41.0
	Bill Williams River-West (Reach 3)	BWSW	Sandy Wash	80.8
Blythe, California	Palo Verde Ecological Reserve (Reach 4)	PVER1	Phase 01	25.0
		PVER2	Phase 02	31.6
		PVER3	Phase 03	34.0
		PVER4	Phase 04	41.2
		PVER5	Phase 05	87.4
		PVER6	Phase 06	89.0
		PVER7	Phase 07	91.6
		PVER8	Phase 08	14.6
Cibola, Arizona	Cibola Valley Conservation Area (Reach 4)	CVCA1	Phase 01	37.2
		CVCA2	Phase 02	27.5
		CVCA3	Phase 03	43.9
		CVCA4	Phase 04	24.4
Cibola, Arizona	Cibola National Wildlife Refuge Unit #1 Conservation Area (Reach 4)	CIBGEN	Cottonwood Genetics	16.5
		CIBCR	Crane Roost	57.3
		CIBNTH	CW North	7.3
		N/A	Hippy Fire	58.8
		CIBMT	Mass Transplanting	16.2
		CIBCNT	Nature Trail	14.5
Yuma, Arizona	Laguna Division Conservation Area (Reach 6)	N/A	Reach 1	225.8
	Yuma East Wetlands (Reach 6)	YUEW	A North Channel	8.2
			South AC	9.1
			South C	13.6
			I	18.0
			J	18.6

Surveys

In 2017, the most current YBCU survey protocol was used (Halterman et al. 2016), which required conducting four standardized YBCU call-broadcast surveys (table 3) at each of the 32 sites. Surveys were conducted on foot between sunrise and 11:00 a.m., or until temperatures reached 40 degrees Celsius (°C) (104 degrees Fahrenheit [°F]). When possible, adjacent sites were surveyed on the same day to minimize the potential for double counting the same individual. Radios were used to communicate among surveyors when adjacent patches were surveyed at the same time.

Table 3.—YBCU survey period dates for the LCR MSCP study area, 2017

Survey period	Dates
1	June 15 to June 29
2	June 30 to July 13
3	July 14 to July 27
4	July 28 to August 10

Surveys were conducted along one or more parallel transects spaced approximately 200 to 250 m (650 to 820 ft) apart, with survey points spaced every 100 m (328 ft) along transects. Surveys 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 transects ran along habitat edges, such as on adjacent roads, for greater visual detectability or because the interior was inaccessible. Trimble® Juno 3B GPS units (± 15 m horizontal accuracy) were used to locate survey points. At each point, surveyors recorded the location, time, and any LCR MSCP avian focal species detected (table 4).

At each survey point, surveyors listened and watched for YBCUs for 1 minute. If none were detected, an MP3 player and hand-held speaker were used to broadcast a 5-second YBCU contact call (the “kowlp” call [Hughes 2015]), at approximately 70 decibels (calibrated with a decibel-meter before each survey) (Halterman et al. 2016), once per minute, for 5 minutes. A 5-second call was followed by 55 seconds of active listening. If a YBCU was detected, call-playback was immediately discontinued, and surveyors recorded the true bearing and estimated the 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. Any observed breeding evidence was recorded, including individuals carrying food or nesting material, copulation, a juvenile, or a nest. Surveyors then progressed along the transect 300 m (984 ft) from the estimated location of the detected YBCU to avoid additional disturbance and the potential for repeat detections of the same YBCU.

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Table 4.—Avian focal species monitored for the LCR MSCP in 2017

Scientific name	Common name	American Ornithologists' Union code recorded
<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher	WIFL
<i>Coccyzus americanus occidentalis</i>	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>Dendroica petechial sonorana</i> = <i>Setophaga petechia sonorana</i>	Sonoran yellow warbler	YEWA ^a
<i>Piranga rubra</i>	Summer tanager	SUTA
<i>Rallus longirostris yumanensis</i> (also known as Yuma Ridgway's rail = <i>R. obsoletus yumanensis</i>)	Yuma clapper rail = Yuma Ridgway's rail	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

^a Referred to as YWAR in the LCR MSCP Habitat Conservation Plan (LCR MSCP 2004a).

An individual YBCU visually observed or heard during a survey, including any detected while traveling between survey points, was recorded as a 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.

It is difficult to tell individual YBCUs apart by call or appearance; however, occasionally, individuals having unique calls or behaviors may be recognized by an observant surveyor as would birds with different leg band combinations. Detections > 300 m (984 ft) apart during a single survey were generally counted as separate individuals, and separate survey detections, although surveyors used their judgment to determine whether multiple detections within 300 m (984 ft) were the same individual. The distance between separate individuals of 300 m (984 ft) is somewhat arbitrary, but is reasonable for most areas, because it corresponds to the typical minimum distance found between active nests based on SSRS field data records.

In recent years, using the standard distance of 300 m (984 ft) in higher-density nesting areas (e.g., PVER Phases 06 and 07) results in undercounting of individuals and territories (Parametrix and SSRS 2015). In order to compensate for potential undercounting at known high-density sites (confirmed by active nests ≤ 200 m [656 ft] apart), the distance used to separate individuals and territories was reduced to 200 m (656 ft). Detections of one individual observed more than once were considered repeat detections, and detections occurring before or after surveys were classified as incidental detections. Data collected for repeat detections were the same as data collected for survey detections, (e.g., estimated distance and bearing, behavior, and vocal codes). To standardize the survey data within the study area, the number of detections and confirmed breeding territories were calculated per 20 ha (49 ac), the average size of a YBCU territory previously determined for this study area (McNeil et al. 2013).

Breeding Territory Estimates

To estimate breeding territory abundance, patches were called potential breeding territories if detections occurred in that area during two or more survey periods. A single detection in a patch was considered an unreliable indicator of breeding status due to the transient nature of non-breeding YBCUs (Johnson et al. 2007; McNeil et al. 2013). All detections were assessed by spatial location, observed behaviors, and associated dates, and were used to categorize the breeding status for each occupied patch as a possible (POS), probable (PRB), or a confirmed (COB) breeding territory (table 5). All detections were used to estimate breeding territories, including those made during surveys and all other activities such as mist netting and resight attempts, as described in the “Population Monitoring” section. Any fledglings or juveniles detected that could have come from territories already counted were not included as new territories.

The POS, PRB, and COB counts were used to estimate the number of breeding territories and not the number of breeding pairs. Territories represent two adults associated with a single nest. Factors that complicate territory estimates include polyandrous females that reneest with another male after leaving an active nest (Halterman 2009) and one or both adults reneesting following a successful or failed nest. Referring to each nesting attempt as an additional pair may then be inappropriate.

Proportion of Habitat Occupied

To estimate the proportion of habitat occupied (≥ 2 total detections at least 12 days apart), similarly sized sample units were used to control for variation in site size (see table 6). The proportion of habitat occupied within each area was the number of occupied sample units divided by the total number of sample units surveyed.

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Table 5.—Definitions for YBCU breeding territory estimation

Estimation type	Term	Definition
Breeding territory estimation	Possible breeding territory (POS)	Two or more total detections in an area during two survey periods and at least 12 days apart. For example, within a certain area, one detection made during survey period 2 coupled with another detection made 12 days later during survey period 3 warrant a POS territory designation.
	Probable breeding territory (PRB)	Three or more total detections in an area during at least three survey periods and at least 12 days between each detection, plus YBCUs observed carrying food (single observation), carrying a stick (single observation), traveling as a pair, or exchanging vocalizations.
	Confirmed breeding territory (COB)	Observation of copulation, stick carry (multiple observations), food carry (multiple observations), distraction display, an active nest, or confirmed fledgling.
Population estimation	Minimum territory estimate	The observed number of confirmed breeding territories (COB).
Habitat occupancy	Occupancy	Occupancy is based on two or more total detections in an area during two or more survey periods. Multiple detections of YBCUs in an area suggest that these areas were inhabited for an extended period and may have been used for breeding.
	Sample unit	To control for variation in site/section size, the proportion of habitat occupied was calculated using similarly sized areas or sample units. Sections with contiguous habitat (more than 30 ha [74 ac]) were divided into equal area sample units or into smaller physical/practical sample units. Sample units range from 15 ha (37 ac) to approximately 25 ha (62 ac) and are wholly contained within sections. For sections smaller than 30 ha (74 ac), the section was the sample unit boundary.

Results

Site Descriptions

Sites are described by geographic area from north to south. Each area may contain several sites, and sites may contain one or more sections. An overview of the study area locations is provided on figure 1. Due to the Federal listing of

this species, and for protection of nesting birds, site maps showing specific nesting areas are not included in this annual report. Results of all detections are also listed in table 6.

Havasu National Wildlife Refuge, Arizona

The Havasu NWR was established in 1941 and encompasses over 48 km (30 river miles) of the LCR and adjacent land from Needles, California, to Lake Havasu City, Arizona. YBCU habitat within the Havasu NWR is almost entirely within the Topock Marsh area, a historical river meander east of the main river channel currently managed as wildlife habitat. Water levels are seasonally manipulated to benefit wildlife and recreation. One area within the Havasu NWR, the BLCA, was surveyed in 2017.

Area: Beal Lake Conservation Area (BLCA)

Mohave County

Sites: *CPhase 05 and CPhase 06*

35.5 ha (87.8 ac)

Sections: *C1505 and C1506*

The BLCA lies approximately 3 km (1.9 mi) south of Topock Platform between Beal Lake and Topock Marsh and contains two sites surveyed together. The sites consist of a mosaic of native trees planted in the historical Colorado River flood plain. Approximately 43 ha (106 ac) planted from 2003 to 2005 (LCR MSCP 2008a, 2010) were surveyed for YBCUs. Multiple access roads cross the sites and define the perimeters. The sites are irrigated throughout the nesting season via an irrigation ditch bordering the southeastern edge, which connects Beal Lake to the southwest with Topock Marsh to the northeast. There were three survey detections and one POS territory estimated at the BLCA in 2017 (see table 6).

Bill Williams River National Wildlife Refuge: Bill Williams River-East and Bill Williams River-West

Mohave and La Paz Counties, Arizona (Bill Williams River Drainage)

The Bill Williams River-East and Bill Williams River-West areas are within the Bill Williams River NWR. The Bill Williams River NWR was established in 1993 (formerly part of Havasu NWR established in 1941) to protect the largest remaining natural riparian forest in the lower Colorado River Valley. It is located 14.3 km (8.9 mi) south of Lake Havasu City, Arizona, and consists of 2,430 ha (6,000 ac) of the Bill Williams River drainage managed by the USFWS. The Bill Williams River NWR extends from Lake Havasu upstream along the Bill Williams River for about 16 km (10 mi) and historically has supported the most extensive and productive YBCU breeding habitat in the LCR watershed. Portions of the Bill Williams River contain perennial surface water. The managed hydrologic regime historically enabled overbank flooding necessary for natural

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regeneration of native vegetation and persistence of cottonwood-willow forest. In the past, occasional winter releases from Alamo Dam resulted in some natural riparian forest regeneration. The last significant flood release was in the winter of 2004–05.

The vegetation composition and structure in the eastern half of the Bill Williams River NWR significantly differs from that found downstream of Gibraltar Rock in the western half. East of Gibraltar Rock, shallow underground bedrock and cliffs bordering the riparian area increase perennial flows and surface water; west of Gibraltar Rock, the river channel widens into a sandy, broad flood plain that persists to the western edge of the Bill Williams River NWR at its interface with Lake Havasu. Five sites within Bill Williams River-East and one site in Bill Williams River-West were surveyed in 2017. The Bill Williams River sites from east to west are described below.

Area: Bill Williams River-East

Site: Mineral Wash

41.0 ha (101.3 ac)

Section: Mineral Wash

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 flood plain. It comprises a cottonwood-Goodding's willow overstory with a mesquite bosque edge and an understory of honey mesquite and tamarisk. Arborescent Sonoran Desert scrub line the cliffs to the north and south, including saguaro (*Carnegiea gigantea*) and creosote bush (*Larrea tridentata*). 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 is found in the immediate river corridor. A few large cottonwoods grow in the outer ecotone area. The river flowed in this area in the spring but remained dry over summer. There were no survey detections at this site in 2017.

Site: Esquerra Ranch

73.9 ha (182.6 ac)

Section: Esquerra Ranch

This site lies between Mineral Wash and Cougar Point and begins near the intersection of Mineral Wash Road and the Bill Williams River. The transect runs along the river channel to a river bend known as Cougar Point. It is bounded by a steep cliff on the southwest and a broad dry upland area (the site of the historical Esquerra Ranch house) to the northeast. It is currently open, with many fallen cottonwood and Goodding's willow snags. Mostly dead and some scattered live tamarisk create a tangled understory beneath the trees. The river has not flowed here for at least a year. Arborescent desert scrub line the cliffs to the north and south. There were no survey detections at this site in 2017.

Site: Cougar Point

49.7 ha (122.8 ac)

Section: Cougar Point

This site is the western section of the pre-2009 Big Bend transect and lies between the Esquerra Ranch and Gibraltar Rock transects. It follows the river bend around Cougar Point and has a cottonwood-Goodding's willow overstory with a mesquite bosque edge and an understory of honey mesquite and tamarisk. Arborescent desert scrub line the cliffs to the north and south. The north includes an area of previous forest regeneration after flooding in 2005. The southern part skirts older forest along the old river channel. Several meanders previously contained perennial water; however, the river has remained dry here since at least 2015. Few cottonwoods are still alive, and all willows (*Salix goodingii* and *S. exigua*) have died. There were no survey detections at this site in 2017.

Site: Kohen Ranch

43.4 ha (107.2 ac)

Section: Kohen Ranch

The site covers areas of natural regeneration that occurred following prolonged flooding during 2005. The transect begins at the historical Kohen Ranch and heads northeast following the northern edge of the riparian corridor and paralleling the Gibraltar Rock transect. The transect passes through mature cottonwood forest with a mesquite bosque edge and an understory of honey mesquite and tamarisk. Arborescent desert scrub line the cliffs to the south, and a 2009 USFWS mesquite restoration is at the northern edge. The densest and tallest forest is in the immediate river corridor. Most trees are dead due to drought. A 300- by 400-m section hosts most of the live plants. The river did not flow in this area over spring or summer. There were no survey detections at this site in 2017.

Site: Gibraltar Rock

90.1 ha (222.6 ac)

Section: Gibraltar Rock

This site is located between Cougar Point and Sandy Wash and south of Kohen Ranch. The eastern portion of the transect is generally xeric and open, with patches of large native trees and a dense understory of tamarisk. The western half of the transect is drier, with small patches of large native trees and a dense understory of tamarisk, traversing along the old refuge road near the Gibraltar Rock cliff formation. The river did not flow here during spring or summer. Light recreational hiking occurs here. There were no survey detections at this site in 2017.

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Area: Bill Williams River-West

Site: Sandy Wash

80.8 ha (199.7 ac)

Section: Sandy Wash

This site connects Gibraltar Rock to the southeast, Fox Wash to the north, and Cross River to the northwest (the latter two were not surveyed in 2017). This section of the Bill Williams River NWR gradually widens into a flood plain laced with dry river channels. The transect makes a loop around the eastern end of the broad flood plain, following an old road and river channel. Hikers and researchers frequently use this easily accessible site. It has a cottonwood-Goodding's willow overstory with a mesquite bosque edge and an understory of honey mesquite and tamarisk. Arborescent desert scrub line the cliffs to the north and south. The eastern side has more life than the western side. Most riparian trees here are dead due to drought. The river did not flow here during spring or summer. There were no survey detections at this site in 2017.

Palo Verde Valley, California

Area: Palo Verde Ecological Reserve (PVER)

Riverside County

The PVER is located 12 km (7.5 mi) north of Blythe, California. The 547-ha (1,351-ac) area was acquired by the State of California in 2004. Riparian restoration activities are being implemented by Reclamation, with public use and hunting managed by the California Department of Fish and Wildlife. Details of planting and management are outlined in the Palo Verde Ecological Reserve Restoration Development Plan: Overview (LCR MSCP 2006), including the specific development plans for each phase (see www.lcrmcp.gov). Phases 01 to 08 were surveyed in 2017, comprising approximately 400 ha (988 ac) of near-contiguous irrigated riparian forest spanning 5 linear km (3.1 mi) bordering the LCR. The phases were surveyed as they became potential breeding habitat, with Phase 07 first surveyed completely in 2014 and Phase 08 in 2016. Farming activity, including overhead crop dusting, occurs regularly in many adjacent fields, which can be noisy during planting and harvesting. Farm equipment travels along the main road and all perimeter and some interior roads during the breeding season. The first session of dove hunting in California is September 1–15. During this period, all phases experience hunting-related disturbance.

Site: Phase 01 **25.0 ha (61.8 ac)**
Sections: C2337 and C2338

Phase 01 Section C2337 was planted in 2006 as a nursery plot. The trees are predominately large cottonwood and Goodding's willow. The southern edge includes a dense planting of coyote willow. Section C2338 is sparsely planted with honey mesquite. The site is bordered by dirt access roads on all sides. An agricultural field borders the north, and a partly constructed marsh lies to the south of Section C2337. There were no survey detections at this site in 2017.

Site: Phase 02 **31.6 ha (78.0 ac)**
Sections: C2339 and C2340

Phase 02 was planted in 2007. The site consists mostly of alternating Goodding's willow, coyote willow, and cottonwood plantings, designed to maximize the amount of edge between Goodding's willow and coyote willow, and is considered preferred habitat for the southwestern willow flycatcher (*Empidonax traillii extimus*) (LCR MSCP 2006). The eastern half of Section C2340 contains a small field planted with genetically diverse cottonwood trees (unlike the remaining plantings within Phase 02, which were planted from nursery pole cuttings). The site is bordered on all sides by dirt access roads and irrigation canals on the west, north, and south. There were six survey detections and one POS territory estimated at this site in 2017 (see table 6).

Site: Phase 03 **34.0 ha (84.0 ac)**
Sections: C2341 and C2342

Phase 03 was planted with cottonwood and Goodding's willow strips for southwestern willow flycatcher habitat in 2008 and 2009. The species composition and density was planted to mimic a natural riparian landscape when fully mature. This site is bordered by dirt access roads on all sides and to the east by the LCR and newly created marsh area. The southern edge is bordered by a large, cleared and partially constructed housing development. There were seven survey detections and one POS, one PRB, and one COB (one nest) territories estimated at this site in 2017 (see table 6).

Site: Phase 04 **41.2 ha (101.9 ac)**
Sections: C2343, C2344, and C2345

Phase 04 was planted with cottonwood and Goodding's willow strips in 2009. It is bordered by actively farmed agriculture fields to the west and north. Dirt access roads surround the perimeter, and irrigation canals are present on the west and north sides. There were 10 survey detections and 1 POS, 1 PRB, and 1 COB (1 nest) territories located at this site in 2017 (see table 6).

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Site: Phase 05 **87.4 ha (216.1 ac)**
Sections: C2346, C2347, C2348, C2349, and C2350

Phase 05 was planted with cottonwood and Goodding's willow strips in 2010. This site is slightly different from other PVER phases, which have more contiguous canopy cover, as this site has several open meadows. It is bordered by agricultural fields to the west and the LCR to the east. Dirt access roads surround the perimeter, and an irrigation canal is on the western boundary. There were 25 survey detections and 1 POS, 3 PRB, and 2 COB (2 nests) territories located at this site in 2017 (see table 6).

Site: Phase 06 **89.0 ha (219.8 ac)**
Sections: C2351, C2352, C2353, C2354, and C2355

Phase 06 was planted with cottonwood, Goodding's willow, *Baccharis* spp., and open areas of native grasses, quailbush (*Atriplex lentiformis*), and honey mesquite in 2011. This site is bordered by agricultural fields, an irrigation canal to the west, and the LCR to the east. Dirt access roads surround the perimeter. There were 47 survey detections and 4 POS, 4 PRB, and 9 COB (6 nests) territories located at this site in 2017 (see table 6).

Site: Phase 07 **91.6 ha (226.5 ac)**
Sections: C2356, C2357, C2358, C2359, and C2360

Phase 07 was planted with cottonwood, Goodding's willow, coyote willow, *Baccharis* spp., and open areas of native grasses, quailbush, and honey mesquite in 2012. This site is bordered by agricultural fields to the west and north, the LCR to the east, and Phase 06 to the south. Dirt access roads surround the perimeter. There were 40 survey detections and 5 POS, 1 PRB, and 12 COB (9 nests) territories located at this site in 2017 (see table 6).

Site: Phase 08 **14.6 ha (36.1 ac)**
Section: Phase 08

Phase 08 was planted with honey mesquite and alkali sacaton (*Sporobolus airoides*) in 2013, and scattered cottonwoods have naturally colonized here. The site is bordered by agricultural fields to the south, the LCR to the east, and disturbed areas to the north and west. Dirt access roads surround the perimeter. There were two survey detections and one POS territory at this site in 2017 (see table 6).

Cibola Valley, Arizona

Area: Cibola Valley Conservation Area (CVCA)

La Paz County

The CVCA is located 24.2 km (15 mi) south of Blythe, California, south and east of the Colorado River and the California-Arizona border. Within Cibola Valley, 412.4 ha (1,019 ac) of land owned by the Mohave County Water Authority has been identified for riparian restoration as outlined in the Cibola Valley Conservation Area restoration development plans (LCR MSCP 2007a-d, 2009). Riparian restoration has been implemented by Reclamation, with hunting and public access managed by the Arizona Game and Fish Department. From 2006 to 2009, 107.2 ha (264.9 ac) of native riparian trees were planted in four phases, which were all surveyed in 2017. Phases 01 and 02 are located in adjacent fields, and Phases 03 and 04 are approximately 2.6 km (1.6 mi) to the west.

Site: Phase 01

37.2 ha (91.8 ac)

Sections: C2525 and C2526

This site consists of six fields planted in 2006 (LCR MSCP 2007b). 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 01, and additional interior dirt roads cross the site. The northern, southern, and western boundaries have cement-lined irrigation canals. There were four survey detections and one POS territory estimated at this site in 2017 (see table 6).

Site: Phase 02

27.5 ha (67.9 ac)

Sections: C2527 and C2528

Phase 02 was planted in 2008 (LCR MSCP 2007c). The site is adjacent to, and south of, Phase 01, separated by a dirt access road and a concrete-lined irrigation ditch. Cottonwoods and Goodding's willows are the co-dominant trees. Agricultural fields are located to the east and south, and Highway 78 is directly to the east. There were eight survey detections, one POS territory, and one PRB territory estimated at this site in 2017 (see table 6).

Site: Phase 03

43.9 ha (108.4 ac)

Sections: C2529, C2530

Phase 03 is located 2.6 km (1.6 mi) west of Phase 01 and 02 and 400 m (1,312 ft) east of the Colorado River. This site was planted in 2007 with cottonwoods, Goodding's willows, and coyote willows (LCR MSCP 2007d). Dirt access roads line the perimeter and bisect the plantings, restored or native vegetation surrounds

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three sides of the site, and an agricultural field is located to the west. There were three survey detections and no breeding territories estimated at this site in 2017 (see table 6).

Site: *Phase 04*
Sections: *C2531, C2532*

24.4 ha (60.4 ac)

Phase 04 is located immediately north of Phase 03, 2.6 km (1.6 mi) west of Phases 01 and 02, and 200 m (656 ft) southeast of the Colorado River. This site was planted in 2009 with honey mesquite and quailbush (LCR MSCP 2008b). Dirt access roads line the perimeter and bisect the plantings, and restored or natural vegetation surrounds the site. There were no survey detections at this site in 2017.

Cibola National Wildlife Refuge, Arizona

Area: **Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1)**

La Paz County

The Cibola National Wildlife Refuge (Cibola NWR) is 29.8 km (18.5 mi) south of Blythe, California, within the historical flood plain of the Colorado River. The Cibola NWR, covering more than 6,475 ha (16,000 ac), was created in 1964 and includes both the historical river channel and a channel constructed in the late 1960s. The old channel still receives irrigation, and portions are maintained as wildlife habitat, while the new channel carries the main Colorado River flow and is extensively levied. Within the Cibola NWR, agricultural fields border tamarisk and mesquite-dominated uplands. Most YBCU habitat on the Cibola NWR is in conservation areas, receiving varying degrees of irrigation. Six sites surveyed in 2017 were all in Cibola NWR Unit #1 (see table 6).

Site: *Cottonwood Genetics*
Section: *Cottonwood Genetics*

16.5 ha (40.7 ac)

Ten thousand trees propagated at a Northern Arizona University research greenhouse were planted at this site in 2005 in association with Reclamation. The plantings were used to assess the influence of stand-level genetic diversity on communities and ecosystem processes. The site is a park-like grove of mature cottonwood with an open understory. There was one survey detection and no breeding territories estimated at this site in 2017 (see table 6).

Site: Crane Roost

57.3 ha (141.6 ac)

Sections: C2726, C2727, and C2728

Two sections of this site (C2726 and C2727) are similar and encompass an older area originally planted in 2005. The older area consists of tall emergent cottonwoods, a grove of dense honey mesquites, and seep willow and tamarisk. Both sections also contain a younger plot planted beginning in 2009, which consists of cottonwoods, Goodding's willows, and coyote willows. Section C2726 is bordered on the north by an access road and an agricultural field. Section C2727 is bordered on the west by an access road and irrigation canal, next to Hippy Fire Section 30. Section C2728 comprises more recently planted (LCR MSCP 2009) fields of mixed cottonwoods and Goodding's willows just south of Section C2726 and east of Section C2727. The section contains surface salt deposits, and riparian plantings are shorter and sparser in this section. There were 22 survey detections and 3 PRB and 1 COB (1 nest) territories at this site in 2017 (see table 6).

Site: CW-North

7.3 ha (17.9 ac)

Section: CW-North

CW-North is a small, open, structurally homogeneous site with a cottonwood overstory and ground cover dominated by Bermuda grass (*Cynodon dactylon*). The site is bordered on the north by Baseline Road and agricultural fields. Fallow fields of sparse tamarisk, arrowweed (*Pluchea sericea*), and quailbush extend east and west. The Cottonwood Genetics Site is 200 m (656 ft) southwest, separated by an agricultural field. The Cibola National Wildlife Refuge Unit #1 Conservation Area Nature Trail (Nature Trail) is 580 m (1,903 ft) to the south, separated by three agricultural fields. There were no survey detections at this site in 2017.

Site: Hippy Fire

58.8 ha (145.2 ac)

Sections: 20 and 30

Upper Hippy Fire (Area 2) was developed to create riparian habitat managed for southwestern willow flycatchers, YBCUs, and other LCR MSCP covered species. In 2013, approximately 29 ha (72 ac) of active agricultural fields (Section 20) were converted to cottonwood, Goodding's willow, coyote willow, honey mesquite, seep willow, salt grass (*Distichlis spicata*) and alkali sacaton (LCR MSCP 2013). First surveyed in 2015, a 30-ha (74-ac) section adjacent to Crane Roost was added to the surveys conducted in 2017. There were 16 survey detections and 2 POS, 1 PRB, and 1 COB (1 nest) territories at this site in 2017 (see table 6).

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Site: Mass Transplanting

16.2 ha (20.1 ac)

Section: Mass Transplanting

This site is west of and adjacent to the Nature Trail. It was planted in 2005 and 2006 and consists of a grove of cottonwood and Goodding's willow, with some open grassy areas. Approximately 1,821 seedlings per ha (4,500 per ac) were planted to inhibit the growth of non-native species, although some open areas are now invaded by non-native Johnsongrass (*Sorghum halepense*). There were no survey detections at this site in 2017.

Site: Nature Trail

14.5 ha (35.8 ac)

Section: Nature Trail

This site was first planted in 1999. The transect follows a gravel trail winding through the habitat. Species composition and height vary across the site, creating structural diversity. More than one-half of the site was planted with screwbean mesquite. Cottonwoods dominate the higher canopy over 30% of the site. The understory includes Goodding's willows, honey and screwbean mesquite, seep willows, and coyote willows. Much of the surrounding area is agricultural, and bordering the site to the north and east are seasonally flooded fields for wintering waterfowl. The site is heavily invaded with Johnsongrass. There were three survey detections and one POS territory estimated at this site in 2017 (see table 6).

Yuma, Arizona

Area: Laguna Division Conservation Area (LDCA)

Yuma County

The LDCA is located on Reclamation withdrawn lands along the LCR within the Laguna Division section of Reach 6. The LDCA is downstream from Imperial Dam and upstream of Laguna Dam and encompasses approximately 585 ha (1,200 ac). Prior to restoration, the area consisted of tamarisk shrub land and wetlands along the abandoned river channel between the Laguna Settling Basin and the Mittry Lake Wildlife Area. The project created a mosaic of marsh and riparian areas consisting of open water/marsh, cottonwood, Goodding's willow, coyote willow, and honey mesquite areas planted in 2013–15. Multiple meandering channels were constructed, and the hydrology of the site is managed to create and sustain four specific land cover types (cottonwood-willow, honey mesquite, marsh, and backwater) that meet LCR MSCP conservation criteria for target species of mammals and birds as outlined in the LCR MSCP Habitat Conservation Plan. Target species included the southwestern willow flycatcher, California black rail (*Laterallus jamaicensis coturniculus*), Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]), western least bittern (*Ixobrychus exilis hesperis*),

YBCU, and the Yuma hispid cotton rat (*Sigmodon hispidus eremicus*) (LCR MSCP 2012). Baseline surveys by SSRS in the remnant riparian areas from 2009 through 2012 (McNeil et al. 2013) detected a few migrant YBCUs utilizing the area.

Site: Reach 1 225.8 ha (558.0 ac)

Section: Reach 1

In 2017, the 3-year-old planted cottonwoods, Goodding's willows, and coyote willows at this site were generally sparse, spindly, and short with intermittent denser patches. There were 9 detections and two POS territories estimated at this site in 2017, although they were likely transient birds, as YBCUs were only detected during the first two surveys (see table 6).

Area: Yuma East Wetlands (YEW)

Yuma County, Arizona

YEW is located along the banks of the Colorado River in the city of Yuma, Arizona. Until recently, the area was a mix of exotic plants, trash dumps, and squatter camps. Before becoming part of the LCR MSCP, YEW was part of the Yuma Crossing Natural Heritage Area and was jointly managed by the city of Yuma, the Quechan Tribe, the Arizona Game and Fish Department, and private ownership. Planting at YEW began in winter 2003–04. The site is promoted as a recreation area with trails and restrooms. The site is highly managed, with new plantings, clearing, and frequent irrigation. Site workers, hikers, bike riders, and homeless people are encountered here. Noise disturbance in this area can be high due to irrigation pumping and associated farming practices, railroad traffic, and vehicular traffic on I-8 west of YEW.

Sites: A North Channel and J

26.8 ha (66.2 ac)

Sections: C4708, C4703

This site is immediately east of the Ocean to Ocean Bridge north of the Colorado River. The cottonwood-dominated Site J to the north parallels the river and is connected to a small wetland area and park to the west. There were four survey detections and one PRB territory estimated at this site in 2017 (see table 6).

Sites: South AC, South C, and I

40.6 ha (100.3 ac)

Sections: C4702, C4710, and C4711

This site is immediately east of the Ocean to Ocean Bridge south of the river. Site South AC parallels the river and consists of a mosaic of plantings of cottonwoods, Goodding's willows, and honey mesquite. Farther south and east, several rectangular patches of mixed-species plantings are found in sites South C and site I. There were two survey detections and one POS territory at this site in 2017 (see table 6).

Survey Summary

From June 16 to August 10, 2017, surveys were conducted during 4 survey periods at 32 sites, yielding 212 survey detections (figure 2; see table 6). Detections were highest at the PVER sites throughout the season with 137 total detections, representing 65% of all survey detections, and 29% of the surveyed area in 2017. Focal avian species encountered during field activities are shown in table 7.

Breeding Territory Estimates

Based on the timing, location, and persistence of all detections, 23 POS, 16 PRB, and 27 COB territories were estimated in the study area (see table 6). The most common evidence of breeding were nests detected in the study area (n = 21) (see the “Population Monitoring” section). The other six COB territories were confirmed by detecting fledglings and copulations.

Proportion of Habitat Occupied

The overall proportion of surveyed habitat occupied by YBCUs was 46.8% (36 of 77 sample units). By area, the proportion of surveyed habitat occupied was:

- 50% at the BLCA (1 of 2 sample units)
- 0% at Bill Williams River-East (0 of 13 sample units)
- 0% at Bill Williams River-West (0 of 3 sample units)
- 91.7% at the PVER (22 of 24 sample units)
- 37.5% at the CVCA (3 of 8 sample units)
- 60% at Cibola NWR Unit #1 (6 of 10 sample units)
- 16.7% at the LDCA (2 of 12 sample units)
- 40% at YEW (2 of 5 sample units)

Discussion

Overall survey detections and territory estimates in 2017 were considerably lower than those during 2013–16 at the BLCA, Bill Williams River NWR areas, the CVCA, and the PVER (McNeil and Tracy 2013; Parametrix and SSRS 2015, 2016a, 2016b). The lack of any detections at the Bill Williams River NWR sites is indicative of the current dry conditions found there. The additional lower counts are not immediately clear, but will be addressed further in 2018, following the final year of surveys under this 5-year project. Detections remained stable at Cibola NWR Unit #1 and YEW, and detections increased at the LDCA (figure 2 and table 6).

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Table 6.—LCR yellow-billed cuckoo survey detections and territory estimates, 2017

Area	Site	Detections per survey period (2017 date)				Total	Estimated territories			Size (ha)	Detections per ha/20 ha	COB per ha/20 ha
		1	2	3	4		POS	PRB	COB			
Beal Lake Conservation Area (BLCA)	CPhase 05 and CPhase 06	2 (6/28)	1 (7/13)	0 (7/27)	0 (8/10)	3	1	0	0	35.5	0.08 / 1.69	0 / 0
	BLCA Total:	2	1	0	0	3	1	0	0	35.5	0.15 / 3.05	0 / 0
Bill Williams River-East	Cougar Point	0 (6/22)	0 (7/6)	0 (7/21)	0 (8/4)	0	0	0	0	49.7	0 / 0	0 / 0
	Esquerra Ranch	0 (6/21)	0 (7/5)	0 (7/20)	0 (8/2)	0	0	0	0	73.9	0 / 0	0 / 0
	Gibraltar Rock	0 (6/27)	0 (7/11)	0 (7/25)	0 (8/8)	0	0	0	0	90.1	0 / 0	0 / 0
	Kohen Ranch	0 (6/19)	0 (7/3)	0 (7/17)	0 (8/1)	0	0	0	0	43.4	0 / 0	0 / 0
	Mineral Wash	0 (6/20)	0 (7/4)	0 (7/18)	0 (8/2)	0	0	0	0	41.0	0 / 0	0 / 0
	Bill Williams River-East total:	0	0	0	0	0	0	0	0	298.2	0 / 0	0 / 0
Bill Williams River-West	Sandy Wash	0 (6/26)	0 (7/10)	0 (7/24)	0 (8/7)	0	0	0	0	80.8	0 / 0	0 / 0
	Bill Williams River-West total:	0	0	0	0	0	0	0	0	80.8	0 / 0	0 / 0
Palo Verde Ecological Reserve (PVER)	Phase 01	0 (6/20)	0 (7/4)	0 (7/19)	0 (8/3)	0	0	0	0	25.0	0 / 0	0 / 0
	Phase 02	1 (6/20)	0 (7/4)	3 (7/18)	2 (8/1)	6	1	0	0	31.6	0.19 / 3.8	0 / 0
	Phase 03	1 (6/20)	2 (7/4)	2 (7/18)	2 (8/1)	7	1	1	1	34.0	0.21 / 4.12	0.03 / 0.59
	Phase 04	0 (6/20)	4 (7/4)	5 (7/19)	1 (8/3)	10	1	1	1	41.2	0.24 / 4.85	0.02 / 0.48
	Phase 05	3 (6/17)	5 (7/1)	6 (7/15)	11 (7/29)	25	1	3	2	87.4	0.29 / 5.72	0.02 / 0.46
	Phase 06	10 (6/18)	13 (7/2)	9 (7/16)	15 (7/30)	47	4	4	9	89.0	0.53 / 10.57	0.1 / 2.02
	Phase 07	8 (6/16)	11 (6/30)	14 (7/14)	7 (7/28)	40	5	1	12	91.6	0.44 / 8.73	0.13 / 2.62
	Phase 08	0 (6/19)	1 (7/3)	1 (7/17)	0 (7/31)	2	1	0	0	14.6	0.14 / 2.74	0 / 0
	PVER total:	23	36	40	38	137	14	10	25	414.5	0.33 / 6.61	0.06 / 1.21
Cibola Valley Conservation Area (CVCA)	Phase 01	2 (6/25)	2 (7/9)	0 (7/23)	0 (8/6)	4	1	0	0	37.2	0.11 / 2.15	0 / 0
	Phase 02	2 (6/25)	4 (7/9)	2 (7/23)	0 (8/6)	8	1	1	0	27.5	0.29 / 5.83	0 / 0
	Phase 03	3 (6/26)	0 (7/11)	0 (7/25)	0 (8/8)	3	0	0	0	43.9	0.07 / 1.37	0 / 0
	Phase 04	0 (6/26)	0 (7/11)	0 (7/25)	0 (8/8)	0	0	0	0	24.4	0 / 0	0 / 0
	CVCA total:	7	6	2	0	15	2	1	0	132.9	0.11 / 2.26	0 / 0
Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1)	Cottonwood Genetics	1 (6/27)	0 (7/12)	0 (7/27)	0 (8/9)	1	0	0	0	16.5	0.06 / 1.21	0 / 0
	Crane Roost	7 (6/27)	8 (7/13)	6 (7/26)	1 (8/10)	22	0	3	1	57.3	0.38 / 7.68	0.02 / 0.35
	CW-North	0 (6/27)	0 (7/12)	0 (7/27)	0 (8/9)	0	0	0	0	7.3	0 / 0	0 / 0
	Hippy Fire	7 (6/28)	2 (7/12)	6 (7/26)	1 (8/10)	16	2	1	1	58.8	0.27 / 5.45	0.02 / 0.34
	Mass Transplanting	0 (6/27)	0 (7/12)	0 (7/27)	0 (8/9)	0	0	0	0	16.2	0 / 0	0 / 0
	Nature Trail	1 (6/27)	1 (7/12)	1 (7/27)	0 (8/9)	3	1	0	0	14.5	0.21 / 4.14	0 / 0
	Cibola NWR Unit #1 total:	16	11	13	2	42	3	4	2	170.5	0.25 / 4.93	0.01 / 0.23
Laguna Division Conservation Area (LDCA)	Reach 1	7 (6/27)	2 (7/12)	0 (7/25)	0 (8/8)	9	2	0	0	225.8	0.04 / 0.8	0 / 0
	LDCA total:	7	2	0	0	9	2	0	0	225.8	0.04 / 0.8	0 / 0
Yuma East Wetlands (YEW)	A North Channel and J	3 (6/26)	1 (7/11)	0 (7/24)	0 (8/6)	4	0	1	0	26.8	0.15 / 2.99	0 / 0
	South AC, South C, and I	1 (6/26)	1 (7/11)	0 (7/24)	0 (8/7)	2	1	0	0	40.6	0.05 / 0.98	0 / 0
	YEW total:	4	2	0	0	6	1	1	0	67.4	0.09 / 1.78	0 / 0
ALL SITES TOTAL		59	58	55	40	212	23	16	27	1425.6	0.15 / 2.97	0.02 / 0.38

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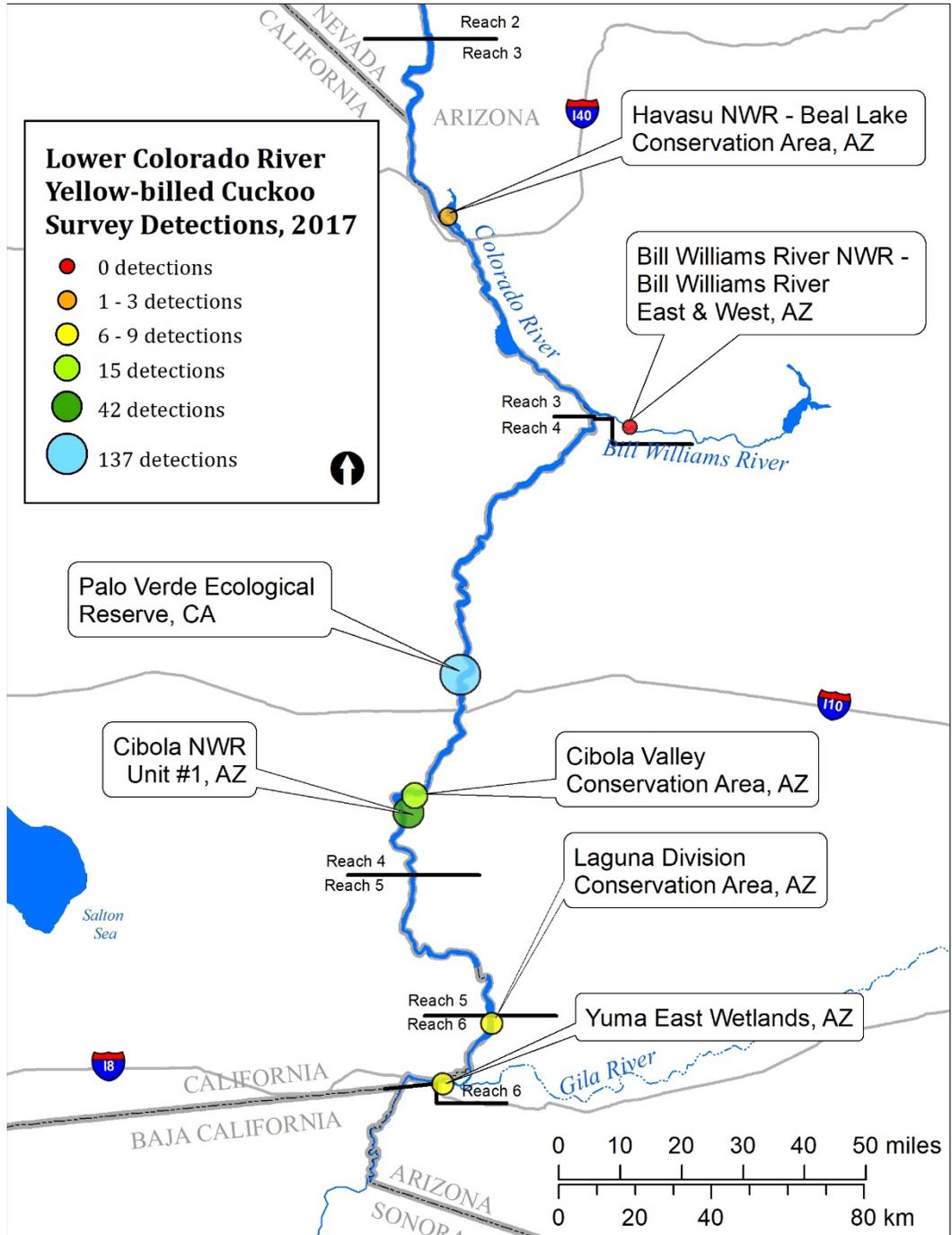


Figure 2.—Map of the LCR MSCP study area showing YBCU survey results by area in 2017.

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Table 7.—Focal avian species encountered during YBCU field work, 2017
(The number of times each species was recorded is displayed for each site)

Site	Arizona Bell's vireo	California black rail	Yuma clapper rail	Gila woodpecker	Summer tanagers	Sonoran yellow warbler
Cottonwood Genetics					1	
Cougar Point				5		
CPhase 05, 06	4				5	4
Crane Roost	1					
CVCA Phase 01				2	2	5
CVCA Phase 02					2	1
CVCA Phase 03				4	3	
CVCA Phase 04				1		
Esquerra Ranch	5			8	2	
Gibraltar Rock				7		
Hippy Fire					1	1
Kohen Ranch	4			4		
Mass Transplanting	1				1	
Mineral Wash	6			8	3	3
Nature Trail	3			3		
PVER Phase 02	3				2	
PVER Phase 03					4	
PVER Phase 04					1	
PVER Phase 05	2				4	3
PVER Phase 06					7	16
PVER Phase 07					21	8
Reach 1	5		2			2
Sandy Wash				4		1
South AC, South C, I				1		1

POPULATION MONITORING

Introduction

The objectives of the original Yellow-billed Cuckoo Monitoring Statement of Work in 2014 included utilizing population parameters to:

1. Assess whether YBCUs are increasing due to LCR MSCP conservation area development
2. Provide a reference for the status of YBCUs utilizing created habitat
3. Assess habitat quality (determination of habitat quality through vegetation monitoring has since been removed from the scope of this contract)

In general, wildlife population status and trends should be defined in terms of site- and habitat-specific measures of productivity, density, and survival (Van Horne 1983). Annual productivity and reproductive success are measured by finding and monitoring nests. Population densities are estimated from a combination of survey data (see the “Surveys and Habitat Occupancy” section) and by compiling known breeding evidence. Survival rates are measured through data collected throughout multi-year mark-recapture projects, which include banding data.

In 2016, nest monitoring and mark-recapture were removed from the scope of work for this project; however, some mist netting was retained in 2017 to recapture birds that were previously fitted with GPS tags in 2014 and 2015. Followup visits were conducted to identify the banded status of individual YBCUs, which sometimes led to additional nests being identified in the study area. These nests were observed to determine the identities of nesting adults and to potentially retrieve the remaining GPS tags from YBCUs in the study area.

GPS tags were used to gain a better understanding of pre- and post-breeding habitat use, and were attached to a subset of annually captured birds in 2014 and 2015. PinPoint GPS tags (Lotek Systems Inc., Ontario, Canada) are lightweight electronic data loggers capable of measuring geographical location data for up to 12 months, including areas a bird may migrate to or overwinter. These tags help identify potential areas that may benefit from additional habitat conservation and management. Data stored within the logger should remain indefinitely, but birds must be recaptured in order to collect that data. The loggers store geographic locations (latitude and longitude) on pre-designated dates, averaging 10-m (3-ft) accuracy in open areas and up to 50-m (164-ft) accuracy under dense canopy cover.

Methods

Mist Netting

The health and welfare of wild birds is paramount, and the guidelines for safety of the birds recommended in *North American Bird Banding Techniques, Volume II* (Canadian Wildlife Service and USFWS 1977) and the *Guidelines to the Use of Wild Birds in Research, Third Edition* (Fair et al. 2010) were followed in this project. Mist netting is a safe, common, and effective means of capturing adult birds (Spotswood et al. 2011), and all netting and banding was conducted by experienced, federally permitted banders or subpermittees. All banders and banding assistants attended western YBCU survey training as well as specialized mist net setup and banding training. Given the potential for temperatures to be lethal to bird eggs (40.5 to 44 °C [104.9 to 111.2 °F]) (Conway and Martin 2000; Webb 1987), care was taken not to deter adults from incubating, and all field activities ceased when the ambient temperature reached 40 °C (104 °F).

After locating a potentially banded adult, a suitable net lane was found or created, and a target mist net technique modified from Sogge et al. (2001) was used to capture the bird. Two to four 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., Carlisle, Pennsylvania) and placed in a vegetation gap of similar canopy height. Recorded YBCU vocalizations were broadcast from speakers on either side of the mist net to lure YBCUs toward the net. Capture attempts ceased when temperatures reached 40 °C (104 °F) or when YBCUs became unresponsive.

To increase the number of unique leg band color combinations available for this project, the Federal aluminum bands were color anodized. Different colors have been used over the years, including gold (Ag) from 2008–10, mid-blue (mB) in 2011, magenta (Mg) in 2012–13 (McNeil et al. 2013; McNeil and Tracy 2013), red (R) in 2014 (Parametrix and SSRS 2015), and red or unanodized silver (S) in 2015 and 2016 (Parametrix and SSRS 2016a, 2016b). In 2017, only the existing band inventory from previous years was used, and unbanded YBCUs were given a silver or red 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 wing rule was used to measure wing and tail length, calipers were used to measure bill length, and a 100-gram (g) (a 3.5-ounce [oz]) Pesola® or 400-g [14.1-oz] 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. 2014).

During all field work, field crews attempted to resight previously banded YBCUs by observing birds with binoculars or photographing the legs of YBCUs visually

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detected. Resight data were recorded into a field notebook and then transferred into a MEFF once the color combination was confirmed or the banded bird was no longer seen by the observers.

Sexing of captured birds is required for population demographic measurement; however, the sexes look alike, and although females average slightly larger than males (Pyle 1997), individuals cannot be reliably sexed by morphology. To sex birds, a small amount of blood was extracted from the brachial vein of each newly captured YBCU adult and placed on filter paper and dried. Deoxyribonucleic acid (DNA) was then extracted from each dried blood sample at the University of Arizona Genetics Core, and the DNA samples were sexed by S. McNeil, SSRS Avian Biologist, at the University of Arizona Culver Laboratory of Conservation Genetics (see McNeil 2015).

PinPoint Global Positioning System Tags

In 2014 and 2015, 14 YBCUs (six females and one male each year) captured at the PVER were fitted with Lotek PinPoint-10 GPS tags (Parametrix and SSRS 2015, 2016a). Due to the observed site fidelity of many breeding YBCUs, those confirmed or suspected to be breeding were targeted for capture to increase the likelihood of recapturing them the following year. The GPS tags weighed 1.1 g (0.04 oz), and the transmitters weighed 0.7 g (0.02 oz), totaling 1.8 g (2.0 g [0.07 oz] with harness, $\leq 3\%$ total body mass). A DLC-1 Universal Serial Bus Interface reader connecting the tag to a computer running PinPoint Host version 2.1.0.15 software (Fowler 2014) was used to charge and program the GPS tags to record locations on up to 20 specific dates outside the peak breeding season.

Recapture is required to retrieve GPS tags to download data. During 2017, if a GPS bird was resighted or suspected to be in an area, two mist netting attempts were allowed to recapture the bird. On recapture, the GPS tag and harness were removed, and the area of attachment was thoroughly examined for any signs of injury or abrasion. PinPoint Host software (Fowler 2014) version 2.12.0.12 was used to recharge the GPS tag and download the stored spatial data to a text file, and ArcMap™ version 10.5 (© Esri) was used to map the locations.

Yellow-billed Cuckoo Nests

Nests were found opportunistically during or after surveys and during followup visits while attempting to locate GPS-fitted birds. Nest searching attempts were also conducted at the LDCA and YEW, where no nesting has been documented during this project. 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 YBCU 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 distraction displays for over 5 minutes, observers moved at least 100 m (328 ft) away, returning cautiously after at least 30 minutes to revisit the site. Observers checked for predators before visiting a potential nest and minimized the time spent at the nest. Because flagging may increase predation risk, it was used sparingly, and flags were placed at least 10 m (32.8 ft) away from nests when possible.

Yellow-billed cuckoos may respond to call-playback from their nest; therefore, during or after surveys, all accessible suitable vegetation surrounding survey detections were briefly searched. Their nests can appear similar to nests of mourning doves (*Zenaida macroura*) and other dove species, and YBCUs and doves may also use each other's old nests (Jay 1911; McNeil et al. 2013; McNeil and Tracy 2010, personal observation). Yellow-billed cuckoo nests were therefore confirmed by containing one or more bluish eggs or YBCU chicks. Recently used YBCU nests were identified by the presence of bluish egg fragments in the nest or observed on the ground directly below the nest.

After finding a nest, flagging was placed at least 10 m (32.8 ft) away so observers could relocate the nest, and the GPS location was recorded. A basic description of the nest was recorded, including the species of nest substrate, approximate substrate height, and approximate nest height, to assist in relocating or avoiding the nest. All observations made near active nests were completed as quickly as possible to reduce the potential to disturb nesting birds. Sometimes data were recorded in a field notebook first and then entered into a MEFF on the Trimble® Juno 3B GPS unit at a later time when observers were away from the nest.

Results

Captures, Recaptures, Resights, and GPS Tag Retrieval

On July 31 and August 1, 2017, two mist net attempts occurred at the PVER Phase 07 site after the potential resighting of a GPS-fitted bird. Five adult YBCUs were captured, including three new captures that were subsequently banded and two recaptures of previously banded birds (table 8). One of seven birds fitted with a PinPoint GPS tag in 2015 was among the birds captured in 2017. The harness with attached GPS tag was removed, and a thorough examination of the bird verified there were no injuries incurred from wearing the harness for an extended period. The GPS tag was recharged, and on initial attempts to view the stored data, the software immediately showed signs of a malfunctioning GPS tag. After initially indicating no data had been recorded, use of a new PinPoint Host software version revealed that one fall stopover location was collected before the GPS tag failed, on September 22, 2015, in the State of Jalisco Mexico, 50 km (31 mi) south of Lake Chapala near Guadalajara (figure 3).

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Table 8.—YBCUs captured or recaptured in the LCR MSCP study area, 2017

N/R # ^a	Date	PVER site	Bird ID ^b	Band #	Color bands ^c	Age ^d	Sex ^e
R-1	July 31	Phase 07	BRO ^f	1713-67948	S / Bk-V-Bk	ATY	F
R-2	July 31	Phase 07	BOO	1352-59073	S / R-V	ATY	F
N-1	July 31	Phase 07	VBO	1713-67909	S / Ag-Y	AHY	F
N-2	August 1	Phase 07	ARC	1713-67910	S / R-Lv	AHY	F
N-3	August 1	Phase 07	HOR	1713-67941	R / mB-Lv	AHY	F

^a N/R #: sequential new capture (N) or recapture (R) number for the year.

^b Bird ID: unique two-to-three-character identifier of an individual YBCU.

^c Color bands (left to right, top to bottom): S = silver, Lv = lavender, Bk = black, R = red, Y = yellow, V = violet, Ag = gold, and mB = mid blue. A hyphen (-) indicates a split band consisting of two or three colors.

^d Age: AHY = after hatching year, and ATY = after third year.

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

^f PinPoint GPS tag number 40247 retrieved.

Twenty-three other previously banded YBCUs were resighted and identified in 2017 (table 9), including a male originally captured as an adult in 2010 at Crane Roost and resighted for the first time since 2010, at the same site. Its 2017 nest was around 350 m (1,148 ft) from its 2010 capture location (figure 4 and table 10), and a fledgling was later detected near the nest during a presence survey. Most birds were resighted at or near their original capture site, except for two females that dispersed from their natal sites between the PVER and CVCA (table 9). One female (BAT) dispersed 34 km (21 mi) from PVER Phase 04 to CVCA Phase 01; the other female (DEV) dispersed 37 km (23 mi) from CVCA Phase 02 to PVER Phase 07.

Yellow-billed Cuckoo Nests

Between June 27 and August 4, 2017, 21 YBCU nests were found in the study area (table 10) after surveys or during resight attempts. These included 19 nests at the PVER (Phases 03 to 07) and 2 nests at Cibola NWR Unit #1 (Crane Roost and Hippy Fire). Documented breeding activity in 2017 began on June 16 at the PVER Phase 07 and continued into mid-August when field work ended. Nests were located in Goodding's willows (n = 11, 52%), cottonwoods (n = 9, 43%) and a honey mesquite (n = 1, 5%) (table 10).

In 2017, nests were not monitored to determine fate of the nests as they had been previously because this objective was removed from the project scope of work. However, one nest at PVER 07, Nest 1, was visited by observers occasionally after they thought they had potentially seen a GPS-tagged YBCU near the nest. Then, after the expected fledging date had passed, the nest was visited regularly to attempt to understand what was happening. Although the nest was found on June 27, it was determined to still be active on August 15, with both adults still incubating 50 days after being originally discovered. No evidence of hatching, such as food carries to the nest, was ever observed at this nest.

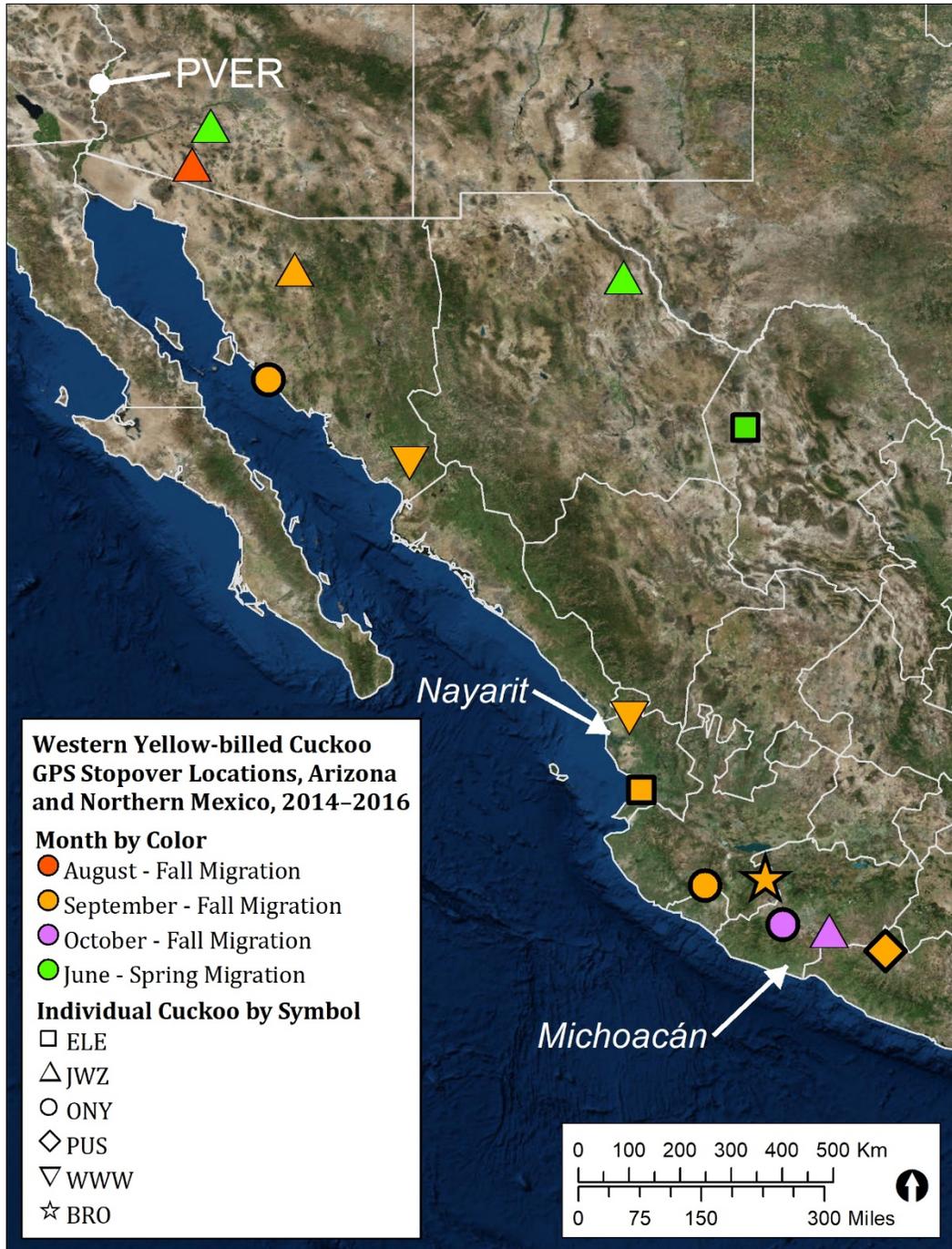


Figure 3.—GPS stopover locations of six YBCUs tracked between the PVER and South America between 2014 and 2016. The star indicates the GPS point retrieved in 2017.

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Table 9.—YBCUs resighted in the LCR MSCP study area, 2017

Site	Resight date	Bird ID ^a	Color bands ^b	Age ^c	Sex ^d	Original capture site	Original capture date
Crane Roost	June 28	RP ^e	W Ag/mB-O	A8Y	M	Crane Roost	June 19, 2010
Hippy Fire	July 13	ORE	mB-G/R	4Y	M	Crane Roost	July 23, 2014
CVCA Phase 01	July 11	BAT	O-V-O/S	SY	F	PVER Phase 04	July 28, 2016
PVER Phase 05	July 29	NIP	S/R-IB-R	ASY	F	PVER Phase 07	Aug. 23, 2016
PVER Phase 05	Aug. 1	CHU	S/O-R	ATY	F	PVER Phase 07	July 6, 2015
PVER Phase 06	June 29	WAN	S/Y-Lv-Y	A5Y	F	PVER Phase 06	July 12, 2013
PVER Phase 06	July 1	WHT	W-R/S	TY	F	PVER Phase 07	Aug. 5, 2015
PVER Phase 06	July 7	DOT	G-IB/S	SY	F	PVER Phase 07	July 20, 2016
PVER Phase 06	July 7	ANT	V-Y-V/S	TY	M	PVER Phase 07	July 19, 2015
PVER Phase 06	July 20	KIL	R/IB-V-IB	ASY	M	PVER Phase 06	June 16, 2016
PVER Phase 06	July 21	HTO	V-W/Mg	TY	F	PVER Phase 07	July 9, 2015
PVER Phase 06	July 25	TET	S/IB-Bk-IB	ASY	F	PVER Phase 06	July 27, 2016
PVER Phase 06	July 25	FRL	S/Lv-Ag-Lv	ATY	M	PVER Phase 07	July 3, 2015
PVER Phase 06	July 31	PAW	R/Bk-Ag-Bk	ASY	F	PVER Phase 07	Aug. 13, 2016
PVER Phase 07	May 31	GOR	S/Y-IB	ATY	M	PVER Phase 07	July 31, 2015
PVER Phase 07	June 16	CRU	R/Bk-Y	A4Y	M	PVER Phase 05	June 30, 2014
PVER Phase 07	June 29	DEV	W-Ag-W/R	4Y	F	CVCA Phase 02	Aug. 1, 2014
PVER Phase 07	July 1	RIP	IB-V-IB/S	TY	F	PVER Phase 07	Aug. 7, 2015
PVER Phase 07	July 4	IRO	R-W/R	SY	F	PVER Phase 07	July 9, 2016
PVER Phase 07	July 7	PEN	S/R-O-R	ASY	M	PVER Phase 07	July 1, 2016
PVER Phase 07	July 24	STR	S/V-Bk	ASY	M	PVER Phase 07	July 29, 2015
PVER Phase 07	July 25	PER	S/G-O	ASY	F	PVER Phase 07	Aug. 13, 2016
PVER Phase 07	Aug. 5	CHC	S/IB-G	ATY	F	PVER Phase 07	July 29, 2015

^a Bird ID: unique two-to-three-character identifier of an individual YBCU.

^b Color bands (left / right, top to bottom): Ag = gold, Bk = black, G = green, IB = light blue, Lv = lavender, mB = mid blue, O = orange, R = red, S = silver, V = violet, W = white, and Y = yellow. A hyphen (-) indicates a split band consisting of two or three colors.

^c Age: SY = second year, TY = third year, 4Y = fourth year, ASY = after second year, ATY = after third year, A4Y = after fourth year, A5Y = after fifth year, and A8Y = after eighth year.

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

^e RP is now the oldest YBCU on record.



Figure 4.—This adult male yellow-billed cuckoo was captured at the Cibola NWR in 2010, and resighted in 2017, aged 8+ years nesting at the same site.

Discussion

Persistent incubation by YBCUs of probable infertile eggs has been observed in the study area previously (Parametrix and SSRS 2016a); however, the 50+ day incubation period observed in 2017 at PVER Phase 07 is much longer than the previously observed failed incubation periods observed in this study area of 15 to 20 days (Parametrix and SSRS 2016a); typical incubation for this species is 10 days (Hughes 2015). This behavior of incubating unhatched eggs may have prevented this pair from successfully breeding in 2017, given that several individuals or pairs making two or three nesting attempts per season have been documented in the study area (McNeil et al. 2013). Non-viability of eggs was found to be rare in this study area from 2008 to 2012 (McNeil et al. 2013). However, nest monitoring has been removed from the current project objectives; therefore, it is no longer possible to determine hatch rates or how often unhatched eggs occur within this population.

The resighting of a banded male aged 8+ years at Crane Roost is the oldest documented YBCU, surpassing the previously oldest, a 7-year-old male documented at the same site in 2015 (Parametrix and SSRS 2016a). This 2017 resight verifies the importance of long-term (since 2008) capture-recapture-resight data. This YBCU was banded 7 years ago and had not been resighted until 2017. It is possible this individual has been present within the study area, possibly at

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Table 10.—YBCU nests found in the LCR MSCP study area, 2017

Site	Nest #	Male ^a	Female ^a	Date found	Nest tree species ^b
Crane Roost	1	RP	UB	June 27	PROGLA
Hippy Fire	1	ORE	UB	July 13	POPFRE
PVER Phase 03	1	UB	UB	July 23	SALGOO
PVER Phase 04	1	UB	UB	July 24	POPFRE
PVER Phase 05	1	NIP	UB	July 29	POPFRE
PVER Phase 05	2	CHU	UB	Aug. 01	SALGOO
PVER Phase 06	1	ANT	DOT	July 05	SALGOO
PVER Phase 06	2	KIL	HTO	July 08	POPFRE
PVER Phase 06	3	FRL	TET	July 17	POPFRE
PVER Phase 06	4	UB	BOO	July 19	POPFRE
PVER Phase 06	5	UK	WHT	July 25	SALGOO
PVER Phase 06	6	UB	UB	July 29	POPFRE
PVER Phase 07	1	CRU	DEV	June 27	POPFRE
PVER Phase 07	2	PEN	UB	July 07	SALGOO
PVER Phase 07	3	B	UB	July 07	SALGOO
PVER Phase 07	4	UK	UK	July 07	SALGOO
PVER Phase 07	5	UK	UK	July 08	POPFRE
PVER Phase 07	6	STR	UB	July 14	SALGOO
PVER Phase 07	7	IRO	UB	July 17	SALGOO
PVER Phase 07	8	PER	UB	July 22	SALGOO
PVER Phase 07	9	CHC	UK	Aug. 04	SALGOO

^a Two-to-three-character unique identifier of the nesting male or female; B = banded (identity unconfirmed), UB = unbanded, and UK = unknown.

^b Nest substrate species: POPFRE = Fremont cottonwood, PROGLA = honey mesquite, and SALGOO = Goodding's willow.

the same site, each year since 2010 when first captured, yet remained undetected probably due to the difficulty of resighting YBCU color bands. Apart from contributing to longevity and site fidelity estimates for this population, continued resight data will improve knowledge regarding survival estimates and varying detection probability of individuals.

The recapture in 2017 of one YBCU previously GPS tagged in 2015 now totals seven GPS-tagged YBCUs from the PVER to be recaptured and six to be tracked between the PVER and South America. Five GPS tags retrieved in 2015 and

2016 (Parametrix and SSRS 2016a, 2016b) indicated that fall migration routes generally follow within approximately 100 km (62 mi) of the western coasts of Mexico and Central America. The additional data point collected from the retrieved GPS tag in 2017 is among a cluster of points collected from Jalisco and Michoacán that were previously recorded by three other GPS-tagged birds, and lies within a 660-km (410-mi) stretch from Nayarit to Michoacán, Mexico, which was used by all six YBCUs tracked to date. The data reinforce the importance of this largely unprotected agricultural region of western Mexico for this population of YBCUs during fall migration.

The development of light-level geolocators and GPS tags has helped to determine stopover and wintering sites of many long-distance migrants, including species that were previously unknown (Bridge et al. 2013; McKinnon et al. 2013; McNeil et al. 2015). Additional future tracking of YBCUs across their breeding range would enable a greater understanding of the migratory connectivity and environmental and human threats facing the entire western DPS and may reveal additional differences between the threatened western population and the more numerous eastern population.

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ATTACHMENT 1

Maps of Yellow-billed Cuckoo Survey Sites,
Lower Colorado River, 2017

ATTACHMENT 1

Maps of Yellow-Billed Cuckoo Survey Sites, LCR, 2017

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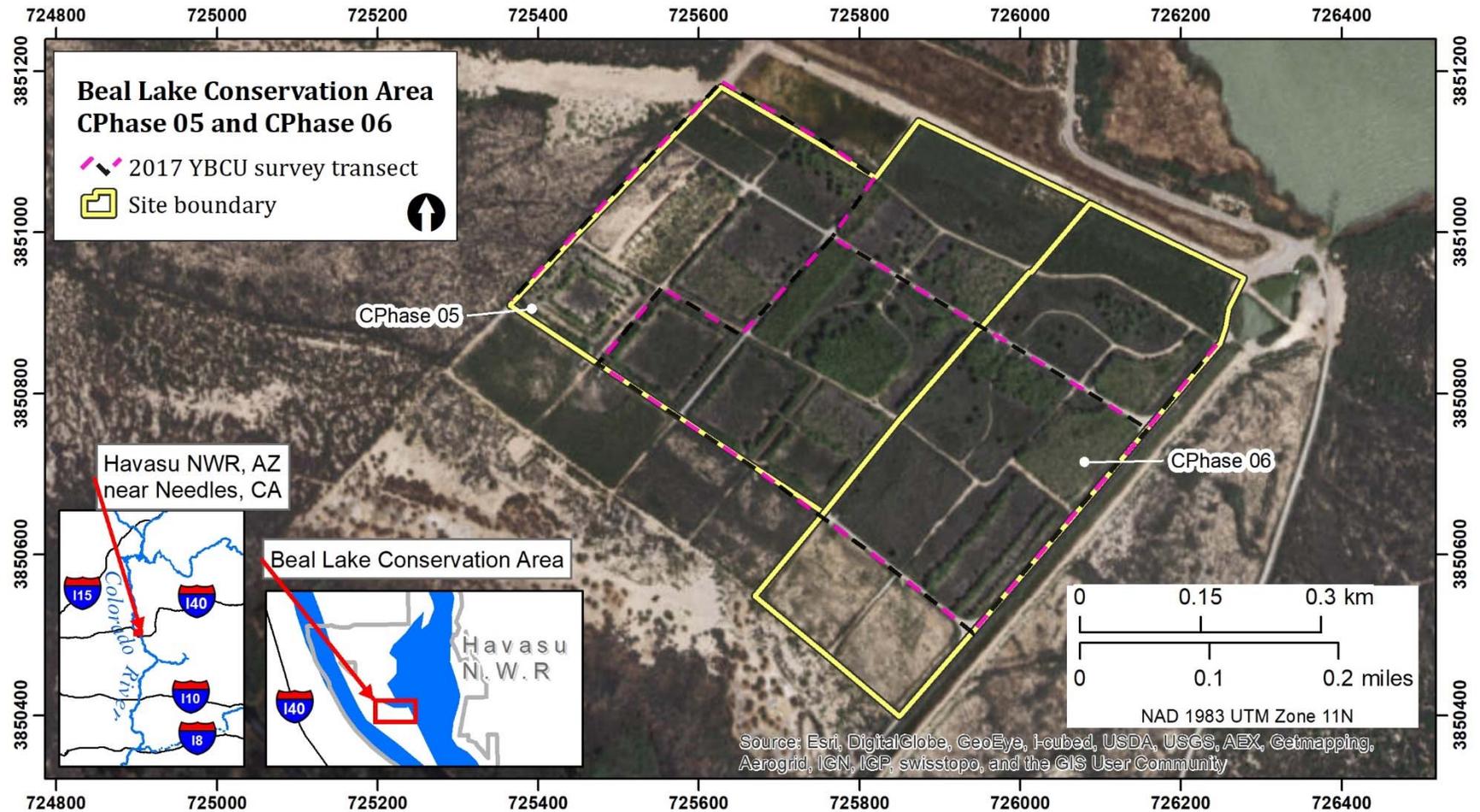


Figure 1.—Beal Lake Conservation Area, CPhase 05 and CPhase 06 YBCU survey sites and transects, 2017.

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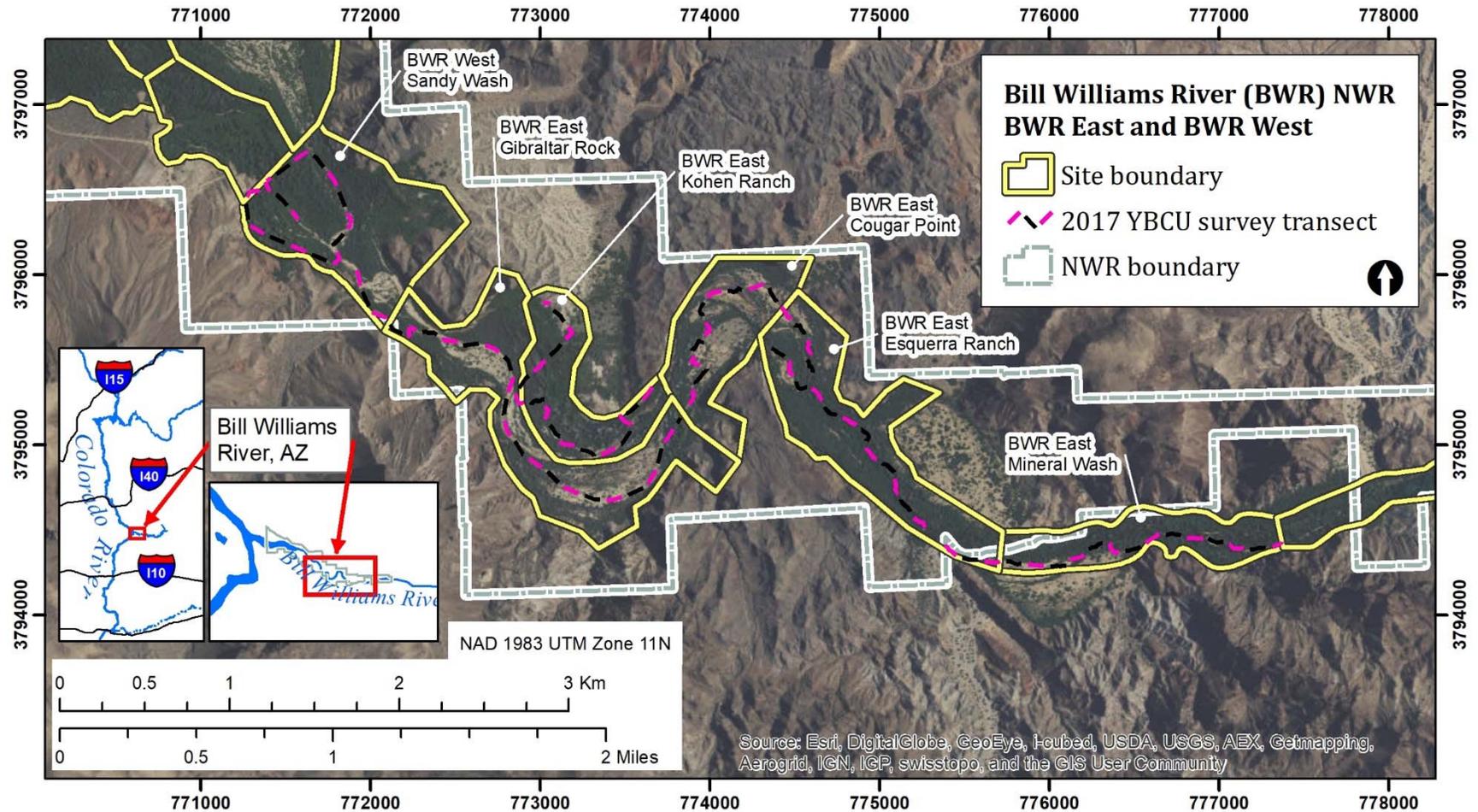


Figure 2.—Bill Williams River East and West YBCU survey sites and transects, 2017.

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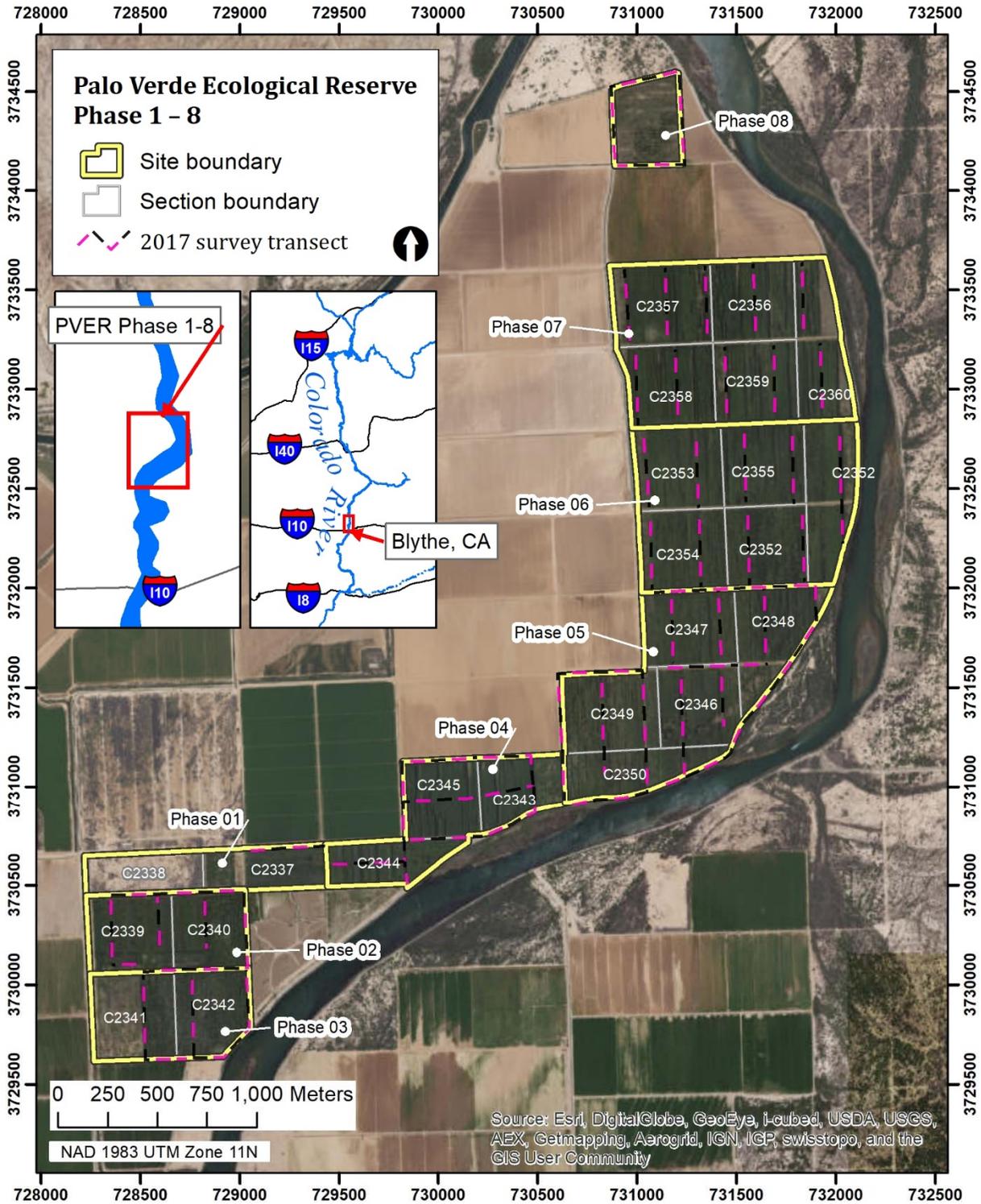


Figure 3.—PVER Phase 01 to 08 YBCU survey sites and transects, 2017.

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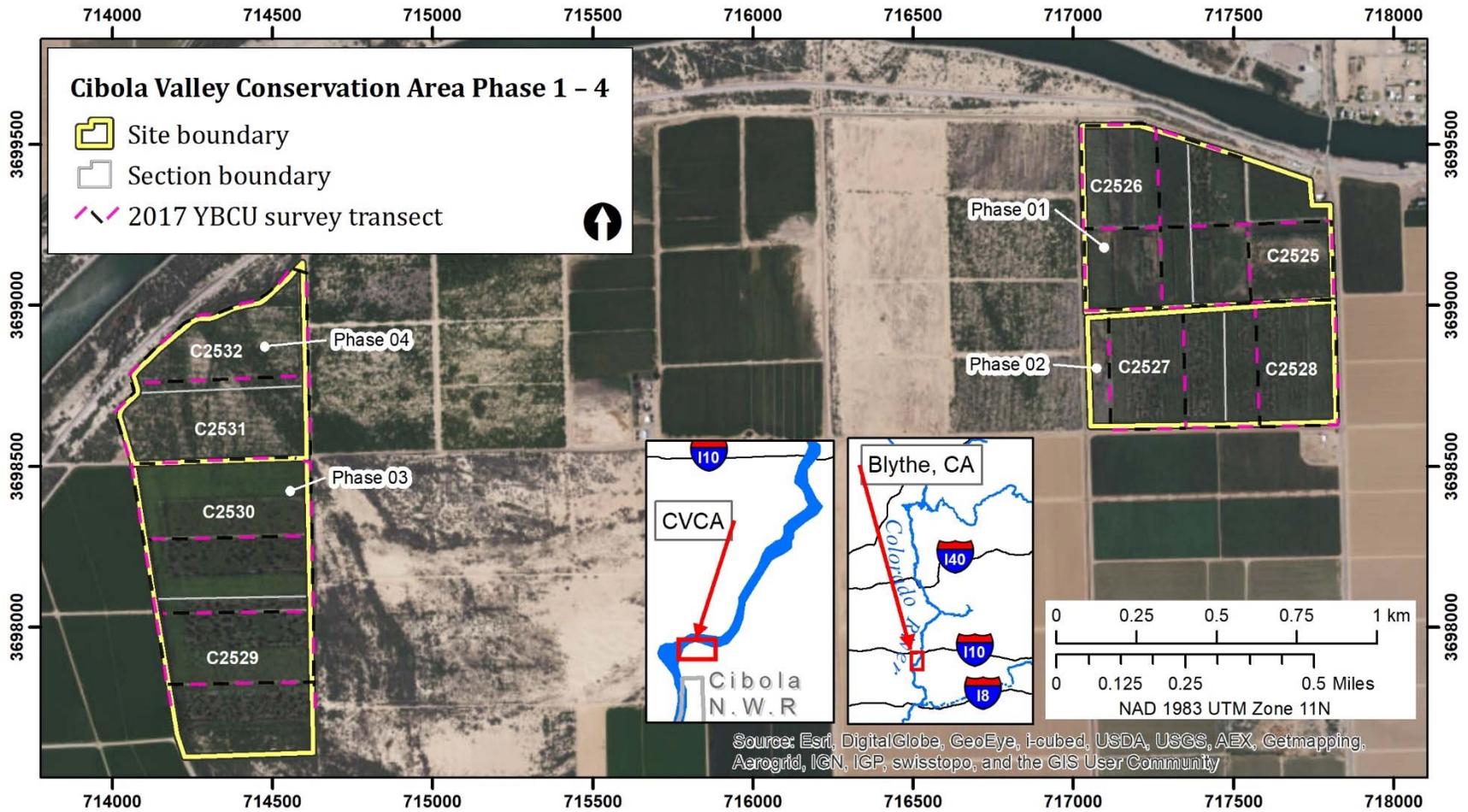


Figure 4.—CVCA Phase 01 to 04 YBCU survey sites and transects, 2017.

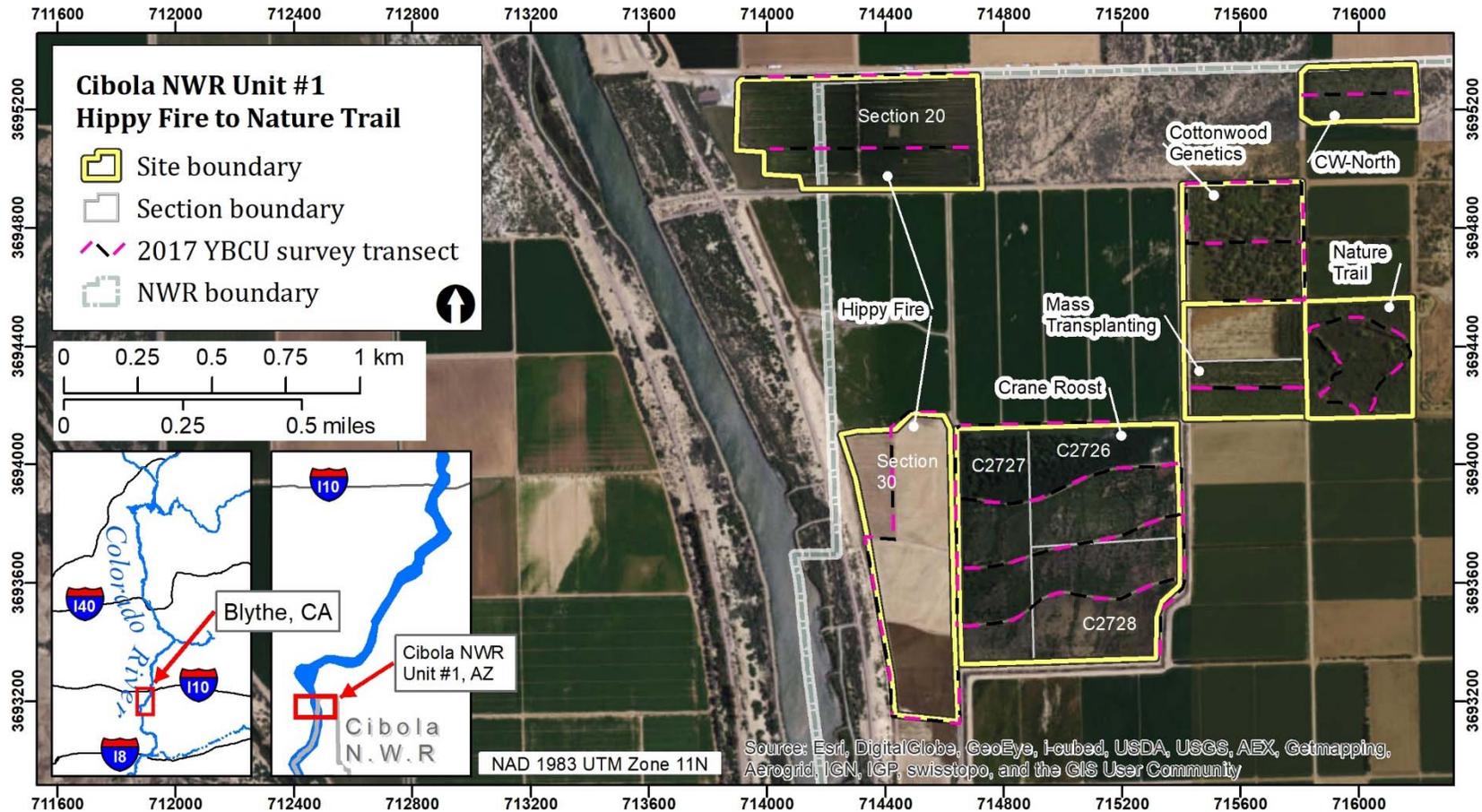


Figure 5.—Cibola NWR Unit #1 – Hippy Fire, CW-North, Cottonwood Genetics, Mass Transplanting, and Nature Trail YBCU survey sites and transects, 2017.

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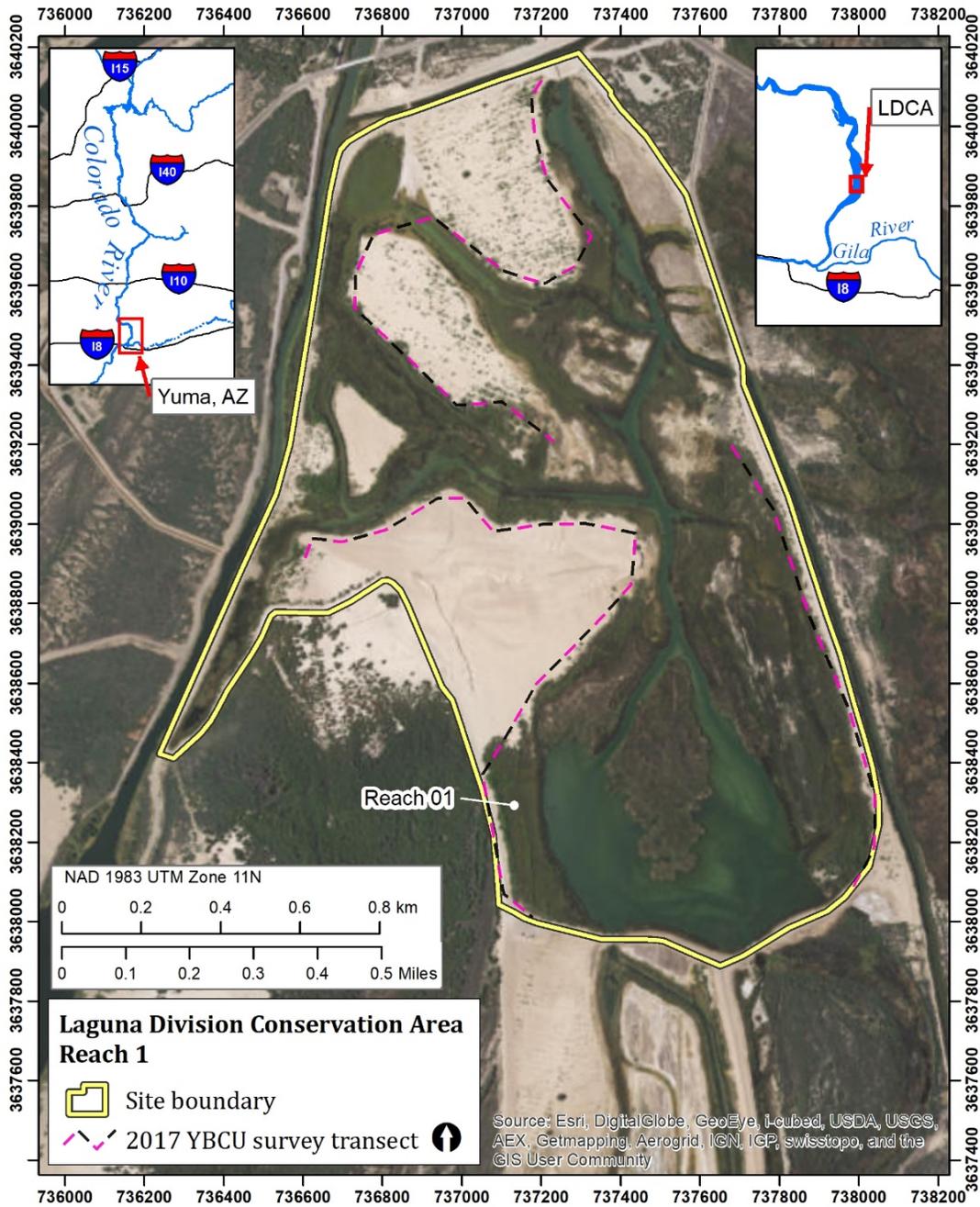


Figure 6.—Laguna Division Conservation Area - Reach 1 YBCU survey site and transects, 2017.

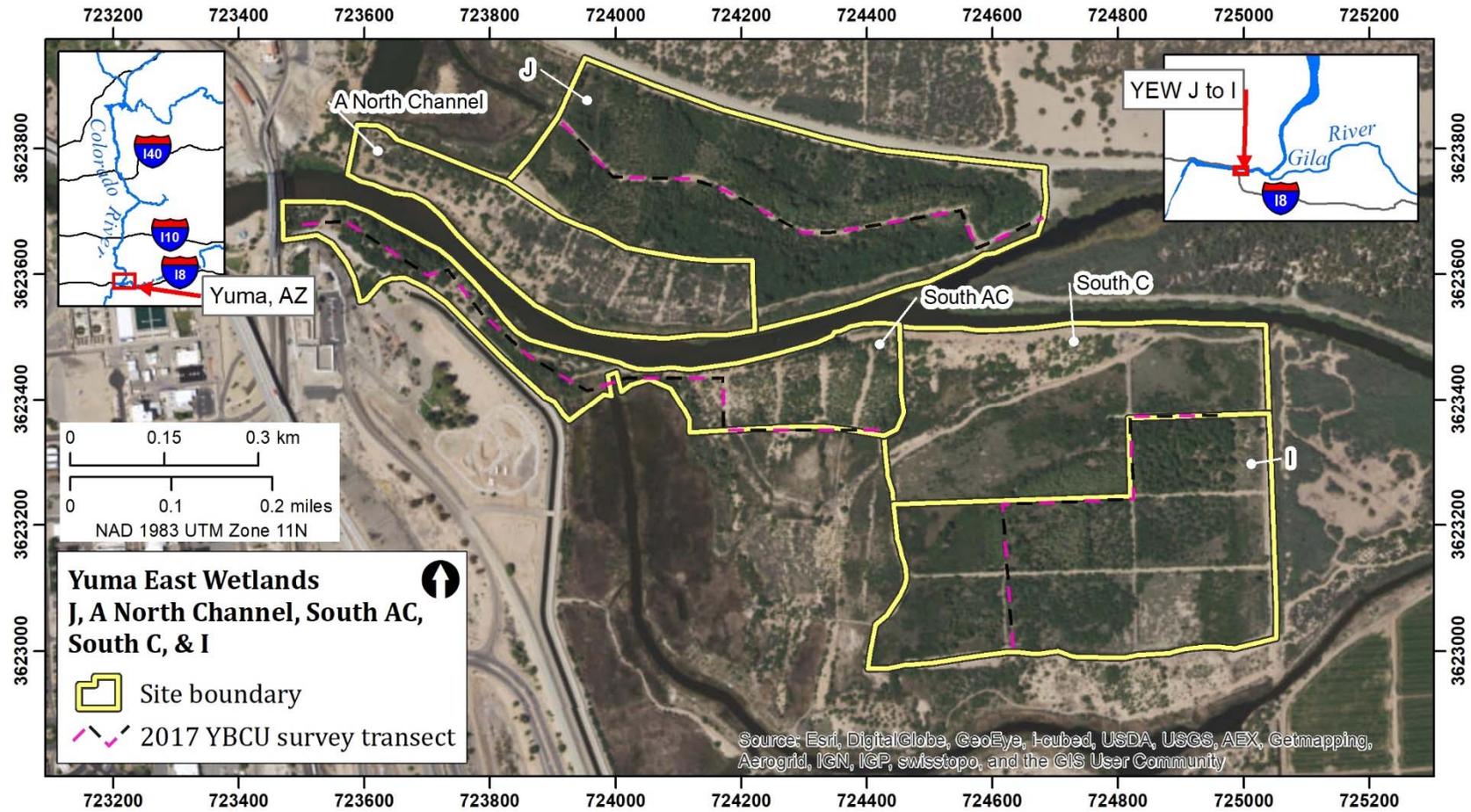


Figure 7.—Yuma East Wetlands J, A North Channel, South AC, South C, and I YBCU survey sites and transects, 2017.