# Lower Colorado River Multi-Species Conservation Program

*Balancing Resource Use and Conservation*

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

## 2022 Annual Report

**January 2023**

**Work conducted under LCR MSCP Work Task F10**

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

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

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## 2022 Annual Report

*Prepared by:*

D. Tracy and C.L. Squibb

Southern Sierra Research Station, Weldon, California

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

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ac | acre(s) |
| BLCA | Beal Lake Conservation Area |
| Bill Williams River NWR | Bill Williams River National Wildlife Refuge |
| BWR East | Bill Williams River East |
| BWR West | Bill Williams River West |
| Cibola NWR Unit #1 | Cibola National Wildlife Refuge Unit #1 Conservation Area |
| CO | confirmed breeding territory |
| cuckoo | western distinct population segment of yellow-billed cuckoo (*Coccyzus americanus occidentalis*, western cuckoo) |
| CVCA | Cibola Valley Conservation Area |
| DNA | deoxyribonucleic acid |
| DPS | distinct population segment |
| ft | foot/feet |
| FR | Federal Register |
| GNSS | Global Navigation Satellite System |
| GPS | Global Positioning System |
| ha | hectare(s) |
| HCP | Habitat Conservation Plan |
| LCR | lower Colorado River |
| LCR MSCP | Lower Colorado River Multi-Species Conservation Program |
| LDCA | Laguna Division Conservation Area |
| m | meter(s) |
| MP3 | MPEG-3 coding format for digital audio |
| n | sample size |
| Nature Trail | Cibola National Wildlife Refuge Unit #1 Conservation Area Nature Trail |

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

## Symbols

| | |
|---|---|
| ≈ | approximately |
| °C | degrees Celsius |
| °F | degrees Fahrenheit |
| > | greater than |
| ≥ | greater than or equal to |
| < | less than |
| ≤ | less than or equal to |
| # | number |
| % | percent |
| ™ | unregistered trademark |

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# EXECUTIVE SUMMARY

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

Six conservation areas managed by the LCR MSCP were surveyed in 2022, including Planet Ranch, the Palo Verde Ecological Reserve (PVER), the Cibola Valley Conservation Area (CVCA), Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), the Laguna Division Conservation Area (LDCA), and Yuma East Wetlands (YEW). Also surveyed was a stretch of suitable habitat within the Bill Williams River National Wildlife Refuge (Bill Williams River NWR) comprising Bill Williams River East (BWR East). Reclamation surveyed one other LCR MSCP conservation area, the Beal Lake Conservation Area (reported separately). The Dennis Underwood Conservation Area was planted in 2019 with 70 hectares (ha) (172 acres [ac]) of honey mesquite (*Prosopis glandulosa*); the proposed Fremont cottonwood *(Populus fremontii*) and Goodding's willow (*Salix gooddingii*) plantings will not reach 2 years post-planting under this contract. The same sites were surveyed for cuckoos in 2022 as in 2021, except as follows: at the Bill Williams River, Planet Ranch was surveyed to replace the loss of the Sandy Wash site, which burned in a wildfire in 2021.

From June 15 to August 8, 2022, the Southern Sierra Research Station conducted standardized cuckoo surveys at 41 sites ranging from 9 to 112 ha, totaling approximately 1,718 ha (4,245 ac) of habitat surveyed. Four surveys at each site resulted in 179 survey detections, including 4 at BWR East, 3 at Planet Ranch, 90 at the PVER, 18 at the CVCA, 56 at Cibola NWR Unit #1, 7 at the LDCA, and 1 at YEW.

After or between surveys, 286 followup visits were conducted in areas of activity to determine breeding status and to resight previously banded birds. Forty-nine breeding territories were estimated in the study area, including 17 possible, 14 probable, and 18 confirmed territories.

The main objective of resighting was to locate up to seven cuckoos fitted with Lotek PinPoint-10 Global Positioning System (GPS) tags in 2014 and 2015 that have not yet been recaptured. If a GPS-tagged bird was resighted, two capture attempts were permitted to recapture the bird. If no GPS-tagged cuckoos were resighted, an alternate option was to capture two cuckoos at a site where no previous capture attempts have occurred, to provide information on site fidelity and dispersal across the study area. In 2022, surveyors positively resighted one cuckoo banded but not GPS-tagged in a previous year. In lieu of resighting any GPS-tagged birds, at the request of Reclamation, two netting attempts were made at YEW and the LDCA, without success. No chicks were opportunistically banded this season.

Nest searching and monitoring were not part of the project scope of work in 2022, but field activities such as surveys and followup visits to determine breeding status or to resight banded adults sometimes led to the discovery of nests. Thirteen nests were found in the study area in 2022: five at the PVER (Phases 3, 6, and 7), and eight at Cibola NWR Unit #1 (Upper Hippy Fire, Middle Hippy Fire, North 160, Crane Roost South, and Eastside). The nest found at North 160 (planted in 2019) confirmed breeding at this site. Nests were not typically monitored; however, some monitoring was required to determine the banded status of adults. The fates of eleven nests were discovered during resight attempts: nine nests successfully fledged at least one young, and two nests failed; one was depredated, and one failed from unknown causes. The fates of two unmonitored nests are unknown.

# INTRODUCTION AND PROJECT BACKGROUND

## Yellow-billed Cuckoo History on the Lower Colorado River

Since 1998, the Bureau of Reclamation (Reclamation) has been conducting surveys along the lower Colorado River (LCR) for the western distinct population segment (DPS) of yellow-billed cuckoos (*Coccyzus americanus*, western cuckoo, cuckoo – referred to as yellow-billed cuckoo, western yellow-billed cuckoo, and *Coccyzus americanus occidentalis* in Lower Colorado River Multi-Species Conservation Program [LCR MSCP] regulatory documents]). From 1975 to 1979, 242 cuckoos were estimated along the LCR, with an additional 208 at the Bill Williams River delta (Rosenberg et al. 1991). By 1986, estimated cuckoos on the LCR had declined to 18 cuckoos and 50–60 at the Bill Williams River delta (Rosenberg et al. 1991). Other reports describe population changes based on surveys conducted annually since 2006 (Halterman et al. 2009; Johnson et al. 2008; McNeil and Tracy 2013; McNeil et al. 2010, 2011, 2012, 2013a, 2013b, 2020; Parametrix, Inc. [Parametrix] and the Southern Sierra Research Station [SSRS] 2015, 2016a, 2016b, 2018, 2019; Tracy and Squibb 2022; Tracy et al. 2021). Most cuckoos on the LCR are currently located in conservation areas managed by the LCR MSCP (McNeil et al. 2020; Parametrix and SSRS 2019; Tracy and Squibb 2022; Tracy et al. 2021).

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


**Figure 1.—Boundary of the western DPS of yellow-billed cuckoos.**
USFWS, Federal Register 2014.

## Lower Colorado River Multi-Species Conservation Program

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

Past reports on cuckoo monitoring in the study area since 2006 are found on the LCR MSCP website www.lcrmscp.gov. They provide information on sites previously surveyed under contract with Reclamation. Locations to be surveyed under this contract may include the Beal Lake Conservation Area (BLCA) (surveyed by Reclamation in 2020, 2021 and 2022), Bill Williams River National Wildlife Refuge (Bill Williams River NWR) (middle section of the refuge), Planet Ranch, Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), Cibola Valley Conservation Area (CVCA), Palo Verde

Ecological Reserve (PVER), Dennis Underwood Conservation Area, Laguna Division Conservation Area (LDCA), and Yuma East Wetlands (YEW) (figure 2).

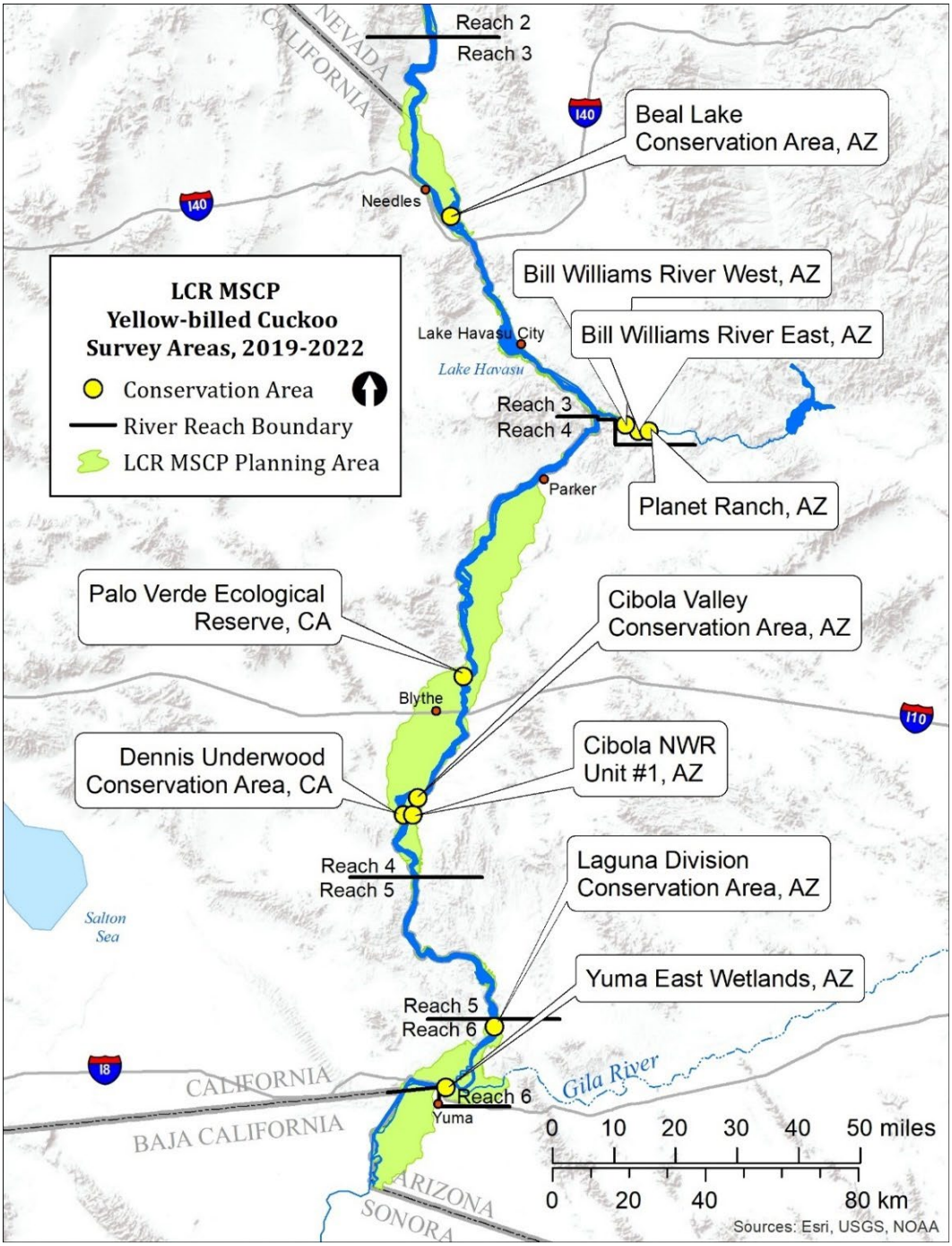


**Figure 2.—LCR MSCP cuckoo survey areas, 2019–2022.**

## Project Scope of Work

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

# SURVEYS

## Introduction

Objectives of this project include documenting the presence of western cuckoos in suitable habitat within the LCR MSCP study area, determining their breeding status in areas of activity, and resighting cuckoos previously fitted with Global Positioning System (GPS) tags in the hopes of recapturing them to retrieve their migration data (see Parametrix and SSRS 2019). Standardized surveys and territory estimates continued in 2022 in six LCR MSCP conservation areas (Planet Ranch, PVER, CVCA, Cibola NWR Unit #1, LDCA, and YEW) and parts of the Bill Williams River NWR within the BWR East area.

## Methods

### Survey Sites

Surveys of potential and previously occupied cuckoo habitat were conducted at sites spanning 300 kilometers (186 river miles) of the LCR and tributaries from the Havasu National Wildlife Refuge near Needles, California, to Yuma, Arizona (the study area; see figure 1). Sites that a cuckoo would potentially use are defined in the HCP as at least 10 hectares (ha) (25 acres [ac]) of contiguous riparian vegetation containing Fremont cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*) trees of structural types I–III: an overstory averaging > 4.6 meters [m] or 15 feet [ft] tall (Anderson and Ohmart 1984; LCR MSCP 2004a). Occasionally, smaller patches of habitat were surveyed

depending on their location, perceived quality, and survey history; however, most nesting has been documented in patches of at least 20 ha (50 ac) (Halterman et al. 2016), matching the average size of a breeding territory in the study area (19.6 ha 95% kernel density estimate, n = 70 radio-tracked cuckoos) (McNeil et al. 2013b), also the size of the smallest known breeding site in the study area (BLCA).

In 2022, the SSRS surveyed all LCR MSCP conservation areas with suitable habitat at least 2 years old, except for the BLCA which Reclamation surveyed in 2022, and is not reported here. Sites surveyed in 2022 included all sites surveyed in 2021, except Sandy Wash in the Bill Williams River West (BWR West), which has not yet recovered since burning in a 2021 wildfire (Tracy and Squibb 2022). Planet Ranch was surveyed in place of Sandy Wash. A total of 41 sites were surveyed in 2022 (table 1).

LCR MSCP conservation areas are described in more detail in previous annual reports and restoration development plans available at https://lcrmscp.gov/steer_committee/technical_reports.html https://www.lcrmscp.gov/publications. Detailed site descriptions and maps are not included in this report; instead, they will be included in the 2019–2022 summary report.

Within each site, hand-held Global Navigating and Satellite System (GNSS) units and georeferenced aerial imagery were used to determine the boundaries of potential breeding habitat within each site. Survey transects were then established (described in chapter 3). Site boundaries reflected those used in 2020 and 2021 (Tracy et al. 2021).

## Surveys

Four surveys were conducted per site following the standard cuckoo survey protocol (Halterman et al. 2016) from mid-June to early August, 2022 (table 2). Surveys were conducted on foot between sunrise and 11:00 a.m. or until temperatures reached 40 degrees Celsius (°C) (104 degrees Fahrenheit [°F]). When possible, adjacent sites were surveyed on the same day to minimize double counting of individuals. Radios were used to communicate among surveyors when adjacent patches were surveyed concurrently.

**Table 1.—Sites surveyed for cuckoos in the LCR MSCP study area, 2022**

| Area | Site[1] | Hectares | Acres |
|---|---|---|---|
| BWR East | Esquerra Ranch | 73.9 | 182.6 |
| | Mineral Wash | 41.0 | 101.2 |
| | Kohen Ranch | 68.5 | 169.3 |
| Planet Ranch | Planet Ranch | 99.0 | 244.6 |
| PVER | Phase 1 | 8.9 | 21.9 |
| | Phase 2 | 31.6 | 77.9 |
| | Phase 3 | 34 | 84.0 |
| | Phase 4 North | 28.4 | 70.2 |
| | Phase 4 South | 12.8 | 70.3 |
| | Phase 5 North | 33.7 | 83.3 |
| | Phase 5 Triangle | 28.3 | 70.2 |
| | Phase 5 West | 25.3 | 62.5 |
| | Phase 6 North | 46.7 | 115.5 |
| | Phase 6 South | 42.2 | 104.3 |
| | Phase 7 North | 45.5 | 112.6 |
| | Phase 7 South | 45.0 | 111.2 |
| | Phase 8 | 15.0 | 37.1 |
| CVCA | Phase 1 North | 17.7 | 43.8 |
| | Phase 1 South | 19.5 | 48.0 |
| | Phase 2 | 27.5 | 67.9 |
| | Phase 3 North | 21.9 | 54.3 |
| | Phase 3 South | 21.8 | 54.0 |
| | Phase 7 | 29.3 | 72.3 |
| | Phase 8 | 44.7 | 111.5 |
| | Phase 9 | 31.2 | 77.2 |
| Cibola NWR Unit #1 | Mass Transplanting/Nature Trail | 22.7 | 55.9 |
| | Cottonwood Genetics/CW-North | 24.6 | 60.9 |
| | Crane Roost North | 29.9 | 74.0 |
| | Crane Roost South | 27.3 | 67.6 |
| | Eastside | 15.1 | 37.3 |
| | Lower Hippy Fire | 49.6 | 122.6 |
| | Middle Hippy Fire | 49.3 | 121.7 |
| | Upper Hippy Fire | 37.8 | 93.5 |
| | North 160 | 63.9 | 158.0 |
| LDCA | Reach 1 North | 65.0 | 160.8 |
| | Reach 1 East | 78.1 | 193.0 |
| | Reach 1 West | 82.6 | 204.2 |
| | Reach 2 North | 112.9 | 279.1 |
| | Reach 2 South | 98.8 | 244.0 |
| YEW | YEW North | 26.8 | 66.2 |
| | YEW South | 40.6 | 100.3 |

[1] Some adjacent sites are presented together as one survey site, such as Cibola NWR Unit #1 Nature Trail (Nature Trail)/Mass Transplanting and Cottonwood Genetics/CW-North.

**Table 2.—Cuckoo survey dates for the LCR MSCP study area, 2022**

| Survey period | Survey number | Survey dates |
|---|---|---|
| 1 | 1 | June 15 – June 28 |
| 2 | 2 | June 29 – July 12 |
| 2 | 3 | July 13 – July 26 |
| 3 | 4 | July 27 – August 8 |

Surveys were conducted along one or more parallel transects ≈200 m (650 ft) apart, with survey points spaced every 100 m (328 ft) along transects. Survey points were assumed to cover 100 to 125 m (328 to 410 ft) of habitat on either side of each transect. Most transects traversed through habitat; however, some ran along edges such as adjacent roads for greater visual detectability or if the interior was inaccessible. Surveyors used Samsung Galaxy S8+ phones (Android operating system) with ArcGIS Field Maps ™ version 22.3.1 (Esri) to navigate to survey points and record data. During all field work, surveyors also recorded other LCR MSCP avian focal species detected (table 3). After data were collected each morning, they were synchronized to ArcGIS Online for further processing.

**Table 3.—Avian species monitored during field work in the LCR MSCP study area, 2022**

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

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

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

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

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

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

## Breeding Territories

Habitat patches were considered occupied if detections occurred in an area (< 100 m [328 ft] apart) during two or more surveys (i.e., at least 12 days apart). All survey detections were assessed by location, observed behaviors, and dates to estimate territories and to categorize the status for each as a possible (PO), probable (PR), or confirmed (CO) breeding territory (Halterman et al. 2016; USFWS and Reclamation 2019, 2021) (table 4). Fledglings or juveniles detected that could have come from a territory already counted were not counted as new territories.

**Table 4.—Definitions for cuckoo breeding territory estimation**

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

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

less than twice the number of territories if individuals nest more than once per season. The CO territory count is the most conservative estimate of breeding territories. PR territories are based on solid observations and a sound definition (Halterman et al. 2016; McNeil et al. 2013b) and, when summed with CO territories, provides a reasonable estimate of breeding territories. The sum of all PO, PR, and CO territories provides the maximum estimate and may over-estimate the true number of breeding territories.

### Followup Visits

After surveys, and on days between survey visits, followup visits were conducted in areas of previous activity, both to determine breeding status, and to resight seven cuckoos previously GPS tagged in the study area that may still be wearing their harness with attached tag (see Parametrix and SSRS 2019). Detections during these visits were used to refine the breeding status of estimated territories, such as upgrading a PO or PR to a CO territory if breeding evidence was observed. Followup visits were focused in areas where previous breeding evidence has not been recorded.

## Results

### Surveys

From June 15 to August 8, 2022, surveyors recorded 1,994 survey points across 164 survey visits to 41 sites, yielding 179 survey detections (table 5). Survey detections peaked during survey 2 (early to mid-July, n = 56). By survey area, detections peaked on survey 2 at the PVER, Cibola NWR Unit #1, and LDCA and peaked on survey 3 at BWR East and YEW. Planet Ranch had single detections across surveys 1–3. The fourth surveys had the fewest detections in all areas, except for the CVCA, where they remained consistent across all surveys. Detections per hectare were highest in PVER 6 South (0.50, or 9.95 per 20 ha), followed by Cibola NWR Eastside (0.40, or 7.94 per 20 ha) (table 5).

### Breeding Territories

A total of 49 breeding territories were estimated or confirmed in the study area, including 17 PO, 14 PR, and 18 CO territories. Followup visits led to the confirmed resighting of a previously banded adult and the discovery of 13 nests (discussed in chapter 3). Maps showing survey detections, estimated territories, and nests are in a separate document due to the confidentiality of breeding location data related to federally listed species.

**Table 5.—Cuckoo survey detections, estimated territories, and detections per hectare in the LCR MSCP study area, 2022**

| Area | Site | Detections by survey | | | | | Territories[1] | | | Size (ha) | Detections per ha / 20 ha |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Total | PO | PR | CO | | |
| BWR East | Esquerra Ranch | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 73.9 | 0 / 0 |
| | Kohen Ranch | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 68.5 | 0.03 / 0.58 |
| | Mineral Wash | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 0 | 41.0 | 0.05 / 0.98 |
| | **BWR East total** | **1** | **0** | **2** | **1** | **4** | **1** | **0** | **0** | **183.4** | **0.02 / 0.44** |
| Planet Ranch | Planet Ranch | 1 | 1 | 1 | 0 | 3 | 0 | 1 | 0 | 99.0 | 0.03 / 0.61 |
| | **Planet Ranch total** | **1** | **1** | **1** | **0** | **3** | **0** | **1** | **0** | **99.0** | **0.03 / 0.61** |
| PVER | Phase 1 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 8.9 | 0.22 / 4.49 |
| | Phase 2 | 1 | 3 | 1 | 2 | 7 | 0 | 1 | 0 | 31.6 | 0.22 / 4.43 |
| | Phase 3 | 1 | 4 | 3 | 2 | 10 | 0 | 1 | 2 | 34 | 0.29 / 5.88 |
| | Phase 4 North | 2 | 1 | 1 | 0 | 4 | 1 | 0 | 0 | 28.4 | 0.14 / 2.82 |
| | Phase 4 South | 1 | 1 | 2 | 0 | 4 | 0 | 0 | 1 | 12.8 | 0.31 / 6.25 |
| | Phase 5 North | 4 | 2 | 1 | 0 | 7 | 1 | 0 | 0 | 33.7 | 0.21 / 4.15 |
| | Phase 5 Triangle | 1 | 0 | 1 | 2 | 4 | 1 | 1 | 0 | 28.3 | 0.14 / 2.83 |
| | Phase 5 West | 0 | 4 | 1 | 2 | 7 | 1 | 0 | 0 | 25.3 | 0.28 / 5.53 |
| | Phase 6 North | 4 | 1 | 0 | 1 | 6 | 1 | 1 | 0 | 46.7 | 0.13 / 2.57 |
| | Phase 6 South | 6 | 5 | 6 | 4 | 21 | 1 | 1 | 3 | 42.2 | 0.50 / 9.95 |
| | Phase 7 North | 2 | 2 | 4 | 2 | 10 | 0 | 2 | 1 | 45.5 | 0.22 / 4.40 |
| | Phase 7 South | 2 | 3 | 0 | 0 | 5 | 1 | 0 | 0 | 45.0 | 0.11 / 2.22 |
| | Phase 8 | 0 | 1 | 1 | 1 | 3 | 0 | 0 | 1 | 15 | 0.2 / 4.00 |
| | **PVER total** | **25** | **28** | **21** | **16** | **90** | **8** | **7** | **8** | **397.4** | **0.23 / 4.53** |

Table 5.—Cuckoo survey detections, estimated territories, and detections per hectare in the LCR MSCP study area, 2022

| Area | Site | Detections by survey | | | | | Territories[1] | | | Size (ha) | Detections per ha / 20 ha |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Total | PO | PR | CO | | |
| CVCA | Phase 1 North | 1 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 17.7 | 0.11 / 2.26 |
| | Phase 1 South | 1 | 1 | 1 | 1 | 4 | 0 | 1 | 0 | 19.5 | 0.21 / 4.10 |
| | Phase 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27.5 | 0 / 0 |
| | Phase 3 North | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21.9 | 0 / 0 |
| | Phase 3 South | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21.8 | 0 / 0 |
| | Phase 7 | 1 | 1 | 1 | 0 | 3 | 0 | 1 | 0 | 29.3 | 0.10 / 2.05 |
| | Phase 8 | 2 | 1 | 2 | 2 | 7 | 1 | 1 | 0 | 44.7 | 0.16 / 3.13 |
| | Phase 9 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 31.2 | 0.06 / 1.28 |
| | **CVCA total** | **6** | **4** | **4** | **4** | **18** | **3** | **3** | **0** | **213.6** | **0.08 / 1.69** |
| Cibola NWR Unit #1 | Cottonwood Genetics/CW-North | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 24.6 | 0.08 / 1.63 |
| | Crane Roost North | 1 | 1 | 0 | 1 | 3 | 0 | 0 | 0 | 29.9 | 0.10 / 2.01 |
| | Crane Roost South | 3 | 3 | 1 | 1 | 8 | 1 | 0 | 1 | 27.3 | 0.29 / 5.86 |
| | Eastside | 2 | 2 | 1 | 1 | 6 | 0 | 1 | 1 | 15.1 | 0.40 / 7.94 |
| | Lower Hippy Fire | 0 | 2 | 2 | 1 | 5 | 0 | 0 | 1 | 49.6 | 0.10 / 2.02 |
| | Middle Hippy Fire | 3 | 4 | 4 | 3 | 14 | 2 | 1 | 1 | 49.3 | 0.28 / 5.68 |
| | Mass Transplanting/Nature Trail | 2 | 0 | 1 | 2 | 5 | 0 | 1 | 0 | 22.7 | 0.22 / 4.41 |
| | North 160 | 2 | 4 | 2 | 2 | 10 | 1 | 0 | 4 | 63.9 | 0.16 / 3.13 |
| | Upper Hippy Fire | 0 | 1 | 1 | 1 | 3 | 0 | 0 | 2 | 37.8 | 0.08 / 1.59 |
| | **Cibola NWR Unit #1 total** | **13** | **18** | **13** | **12** | **56** | **4** | **3** | **10** | **320.2** | **0.17 / 3.50** |

**Table 5.—Cuckoo survey detections, estimated territories, and detections per hectare in the LCR MSCP study area, 2022**

| Area | Site | Detections by survey | | | | | Territories[1] | | | Size (ha) | Detections per ha / 20 ha |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Total | PO | PR | CO | | |
| LDCA | Reach 1 East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78.1 | 0 / 0 |
| | Reach 1 North | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 65.0 | 0.02 / 0.31 |
| | Reach 1 West | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 82.6 | 0.02 / 0.48 |
| | Reach 2 North | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 112.9 | 0.02 / 0.35 |
| | Reach 2 South | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 98.8 | 0.02 / 0.40 |
| | **LDCA total** | **1** | **5** | **1** | **0** | **7** | **1** | **0** | **0** | **437.4** | **0.02 / 0.32** |
| YEW | YEW North | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26.8 | 0 / 0 |
| | YEW South | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 40.6 | 0.02 / 0.49 |
| | **YEW total** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **67.4** | **0.01 / 0.30** |
| **All sites** | **Grand total** | **47** | **56** | **43** | **33** | **179** | **17** | **14** | **18** | **1,718.4** | **0.10 / 2.08** |

[1] Territory category: CO = confirmed breeding territory; PO = possible breeding territory; PR = probable breeding territory.

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# NESTS, RESIGHTS, AND BANDING

## Introduction

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

## Methods

### Nests

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

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

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

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

## Resights

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

## Banding

In 2022, if a cuckoo previously fitted with a GPS tag was resighted, up to two attempts would be made to recapture the bird to remove the tag and retrieve the data. If no birds carrying GPS tags were resighted or captured, other options were proposed, one being the capture of two birds at a site with no previous capture

attempts. If no capture attempts were made, these attempts would carry over into upcoming years. For example, two unused capture attempts in 2021 would carry over into 2022, when four attempts could be made.

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

# Results

## Nests

Between June 28 and August 9, 2022, 13 nests were found in the study area, including 8 at Cibola NWR Unit #1 (3 in North 160, 2 in Upper Hippy Fire, 1 in Crane Roost South, 1 in Eastside, 1 in Middle Hippy Fire) and 5 nests at the PVER (3 in Phase 6, 1 in Phase 3, 1 in Phase 7) (table 6). Twelve nests were found on followup days while attempting to resight GPS-tagged birds or determine breeding status. The remaining nest (PVER 7 Nest 1) was found immediately after a survey on a followup visit to an area of high vocal activity.

**Table 6.—Cuckoo nests found in the LCR MSCP study area in 2022**

| Area | Site | Nest # | Date found | Tree species[1] | Tree height (m) | Nest height (m) |
|---|---|---|---|---|---|---|
| CibNWR | North 160 | N1 | June 28 | POPFRE | 13 | 7 |
| CibNWR | Middle Hippy Fire | N1 | June 28 | POPFRE | 11 | 9.5 |
| CibNWR | Crane Roost South | N1 | July 8 | SALGOO | 12 | 5.25 |
| CibNWR | Upper Hippy Fire | N1 | July 11 | SALGOO | 11 | 7.5 |
| CibNWR | Eastside | N1 | July 12 | POPFRE | 10.5 | 9 |
| PVER | PVER 6 South | N1 | July 12 | SALGOO | 13 | 9 |
| CibNWR | North 160 | N2 | July 13 | POPFRE | 8.5 | 4.5 |
| PVER | PVER 6 South | N2 | July 14 | POPFRE | 17 | 10.5 |
| PVER | PVER 7 North | N1 | July 19 | POPFRE | 18 | 12 |
| PVER | PVER 6 South | N3 | August 1 | SALGOO | 8.5 | 6 |
| CibNWR | Upper Hippy Fire | N2 | August 5 | POPFRE | 18 | 12 |
| CibNWR | North 160 | N3 | August 8 | POPFRE | 10 | 5 |
| PVER | PVER 3 | N1 | August 9 | POPFRE | 18 | 15 |

[1] POPFRE = Fremont cottonwood; SALGOO = Goodding's willow.

Known nesting activity in the study area began June 28 at Cibola NWR Unit #1 (North 160 Nest 1, Middle Hippy Fire Nest 1) and ended on August 9 at PVER 3 Nest 1, with the successful fledging of the nest. The 13 nests were found in Fremont cottonwood (n = 9) and Goodding's willow (n = 4). Nest tree heights ranged from 8.5 to 18 m, averaging 13 m. Nest heights were 4.5 to 15 m and averaged 8.6 m high.

The fates of some nests were ascertained during attempts to resight adults as observers monitored nests. Nine of the 13 found nests successfully fledged at least 1 young, and 2 failed, with 1 depredated. The fates of the other two nests are unknown. The nine successful nests included PVER 6 South Nests 2 and 3, PVER 3 Nest 1, Cibola NWR Unit #1 (Upper Hippy Fire Nests 1 and 2, Crane Roost South Nest 1, Eastside Nest 1, and North 160 Nests 1 and 3).

### *Nests with Unusual Fates*

Crane Roost South Nest 1 was found on July 8 with three eggs. It was revisited on July 15, with two nestlings and a third smaller chick dead on the ground below the nest. One egg remaining in the nest indicated a fourth egg had been laid, suggesting another female had visited. The dead chick may have been pushed out of the nest accidently during the laying event or removed from the nest by the egg layer. The nest was revisited on July 19, with a 6-day-old chick remaining. The egg was gone. The last chick fledged by July 20.

Eastside Nest 1 was found on July 12 on a spindly cottonwood branch 9 m high. An adult was seen approaching the nest with a cicada, so at least one chick was expected; however, the nest contents were not seen. A week later, on July 19, a 5-day-old chick was observed in the nest, though eggs shells in the nest and on the ground indicated at least one other chick may have already fledged. On return to the nest on July 22 when the chick would be 8 days old, the adult appeared to be brooding or incubating. No food carries to the nest were observed, leading staff to suspect new egg laying sometime between July 19–22. The nest was mirrored on July 25 with one new egg visible. It was rechecked on August 1 and found to be empty, with no sign of the egg. The egg or nestling may have been depredated or removed by an adult cuckoo. Infanticide may occur if food sources are limited by the parent or to induce a female to renest sooner (Halterman 2009).

## Resights

One cuckoo banded in a previous year was positively resighted in 2022 (table 7). MAC was first satellite tagged in 2019 under a separate Smithsonian funded study and resighted twice in 2022: once near Hippy Fire Middle Nest 1 and as the

female parent at Upper Hippy Fire Nest 1. Surveyors caught glimpses of two other banded cuckoos or partial-resight that were not identified to individual. No GPS-tagged birds were positively resighted in 2022.

**Table 7.—Cuckoos resighted in the LCR MSCP study area in 2022**

| Resight site | Resight date | Bird ID[1] | Color bands[2] | Age[3] | Sex[4] | Original capture site | Original capture date |
|---|---|---|---|---|---|---|---|
| Middle Hippy Fire | June 27 | MAC | R/mB-Lv-mB | A4Y | F | Upper Hippy Fire | July 7, 2019[5] |
| PVER 3 | July 10 | UNK | O-UNK/S | AHY | UNK | UNK | UNK |
| Upper Hippy Fire | July 15 | MAC | R/mB-Lv-mB | A4Y | F | Upper Hippy Fire | July 7, 2019[5] |
| PVER 6 South | Aug 7 | UNK | UNK/G-Y | AHY | UNK | UNK | UNK |

[1] Bird ID: unique three-character identifier of the individual cuckoo.
[2] Color bands (left/right, top to bottom): G = green; Lv = lavender; mB = mid-blue; O = orange; R = red; S = silver; Y = yellow; UNK = unknown color. A hyphen (-) indicates a split band consisting of two or three colors.
[3] Age: AHY=after hatch year; A4Y = after fourth year.
[4] Sex (based on behavior; not yet confirmed by genetic test): F = female; UNK = unknown sex.
[5] Banded under a separate Smithsonian-funded study.

In previous years, due to extensive banding, nesting adults were more readily identified, and resights at nests could be used to identify renesting, double brooding by females, or serial renesting by the same pair. With the cessation of most banding after 2016, resights at nests have dropped considerably, and just one nesting adult this year was identified as a returning female (MAC, previously banded under a Smithsonian study in 2019). It is possible that MAC was associated with Middle Hippy Fire Nest 1 as she was first resighted near that nest, but the nest failed before it could be confirmed. She was later resighted at Upper Hippy Fire Nest 2, days later and some 300 m away. MAC had previously nested in this same area in Upper Hippy Fire Nest 1 in 2019 and was resighted at Upper Hippy Fire Nest 1 in 2021.

## Banding

As no GPS-tagged cuckoos were resighted in 2022, the SSRS exercised the option to attempt to band birds at the LDCA as requested by Reclamation. A banding crew visited the LDCA immediately after detections in survey period 2 on July 2 and July 3; however, no cuckoos were located. Another attempt occurred at YEW after detections in survey period 2 on July 16 and 17, again with cuckoos no

longer found at the site. As no survey detections occurred in survey period 3 at either site, no additional capture attempts were made. No adult cuckoos were captured in the study area in 2022. No chicks were banded either. In previous years, chicks in low nests (< 7 m) were opportunistically banded. In 2022, three low nests were found, but no chicks were able to be banded.

# DISCUSSION

Higher detections and estimated territories at PVER indicate more cuckoos continue to use this conservation area compared to the similarly sized Cibola NWR Unit #1, where unlike at the PVER, new plantings continue. The first nest was found in 3-year-old North 160 in Cibola NWR Unit #1, again confirming cuckoos successfully nesting in young habitat. The lack of ongoing detections in the southern conservation areas, YEW and the LDCA, including just one detection at YEW in 2022, suggests that cuckoos only passed through these sites in 2022. Over time, changes to conditions in the study area may reduce habitat quality for the cuckoos, while improving conditions for other taxa, further discussed in the 2019–2022 summary report.

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Work was conducted under USFWS TE Permit TE_017549-7, Mary Whitfield and Diane Tracy. Expiration date October 8, 2024.

# ATTACHMENT 1

Maps of Survey Sites and Transects, Lower Colorado River Multi-Species Conservation Program Study Area, 2022

# FIGURES

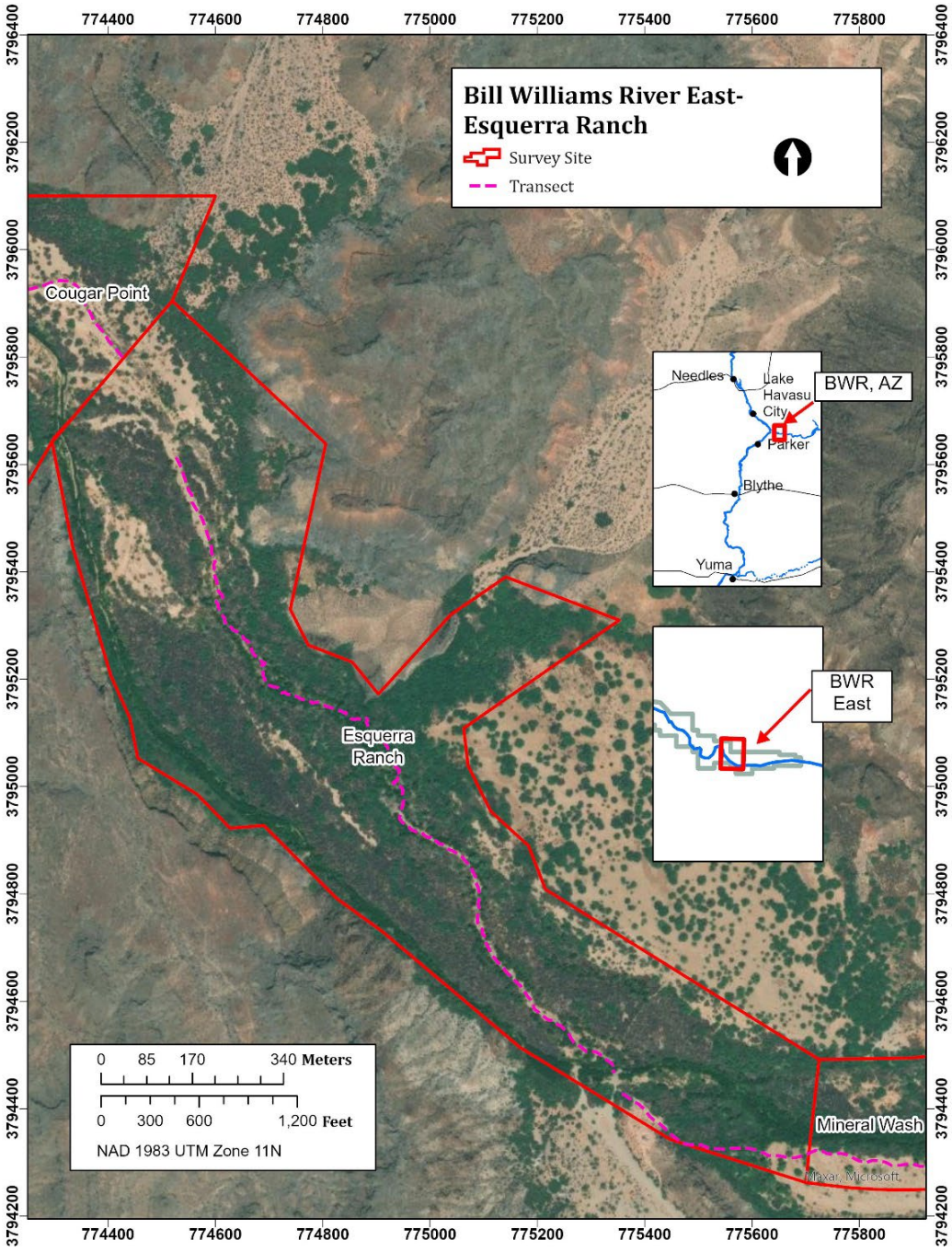



**Figure 1-1.—Bill Williams River East Esquerra Ranch yellow-billed cuckoo (YBCU) survey site showing transect, 2022.**

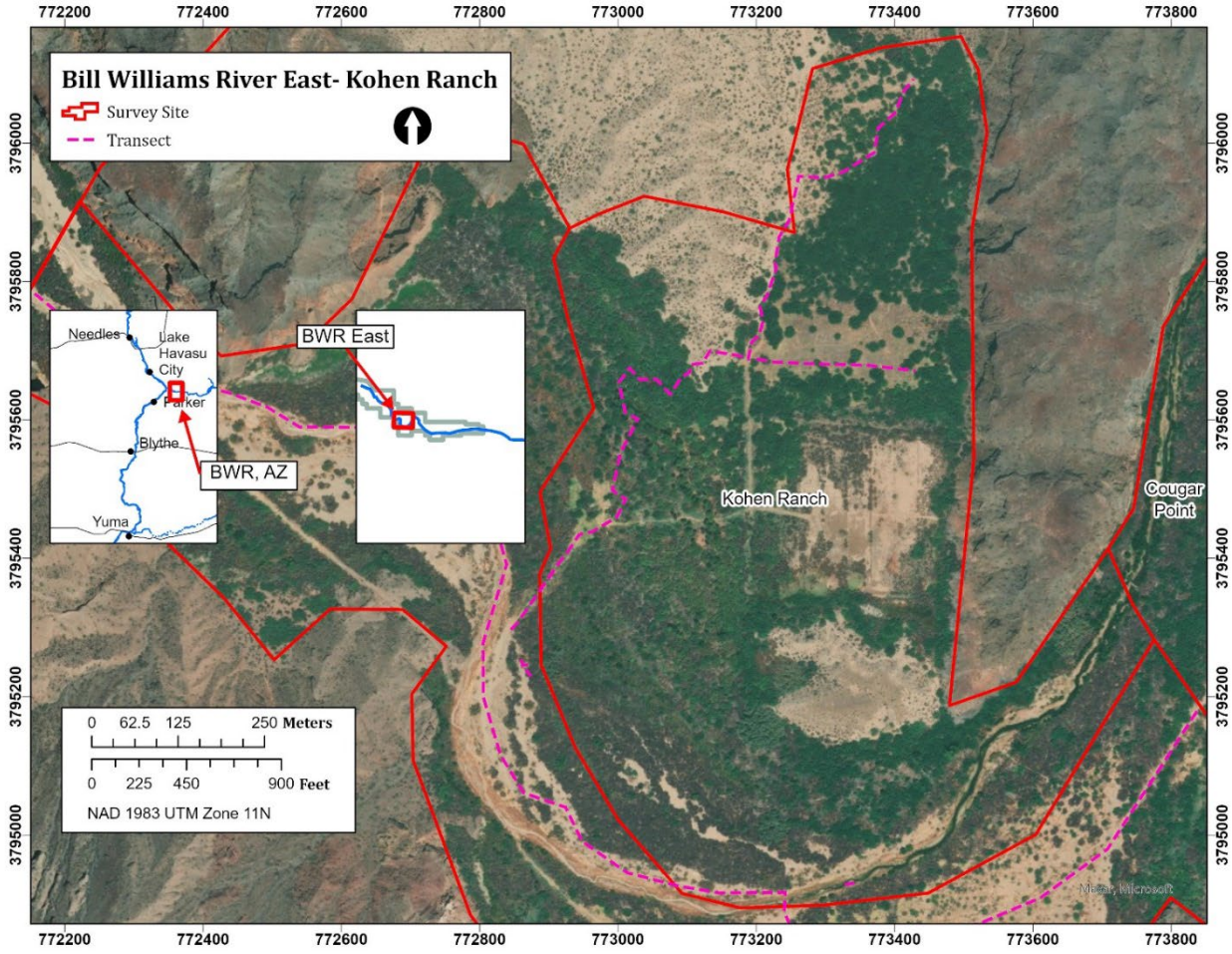



Figure 1-2.—Bill Williams River Kohen Ranch YBCU survey site showing transects, 2022.

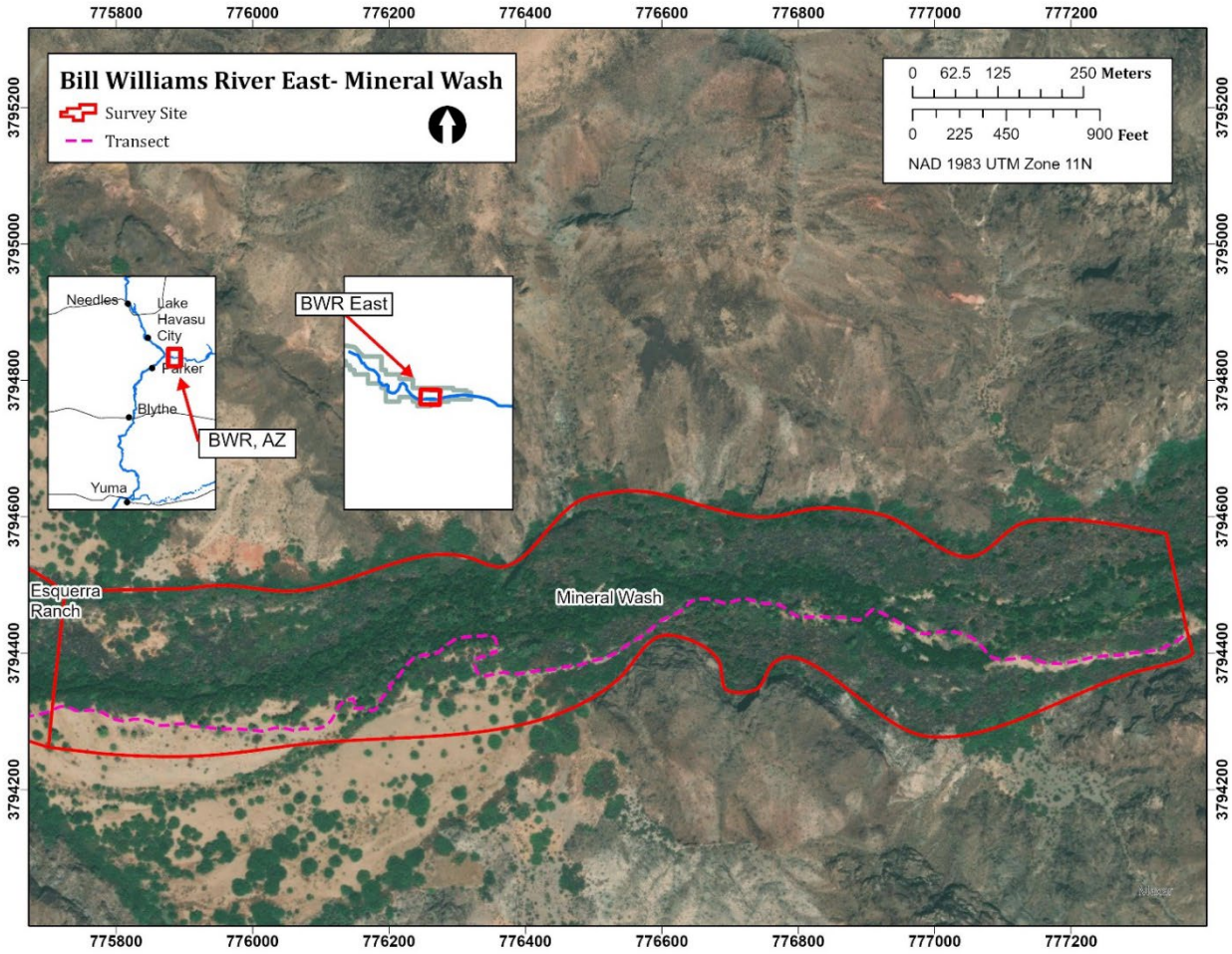



Figure 1-3.—Bill Williams River East Mineral Wash YBCU survey site showing transect, 2022.

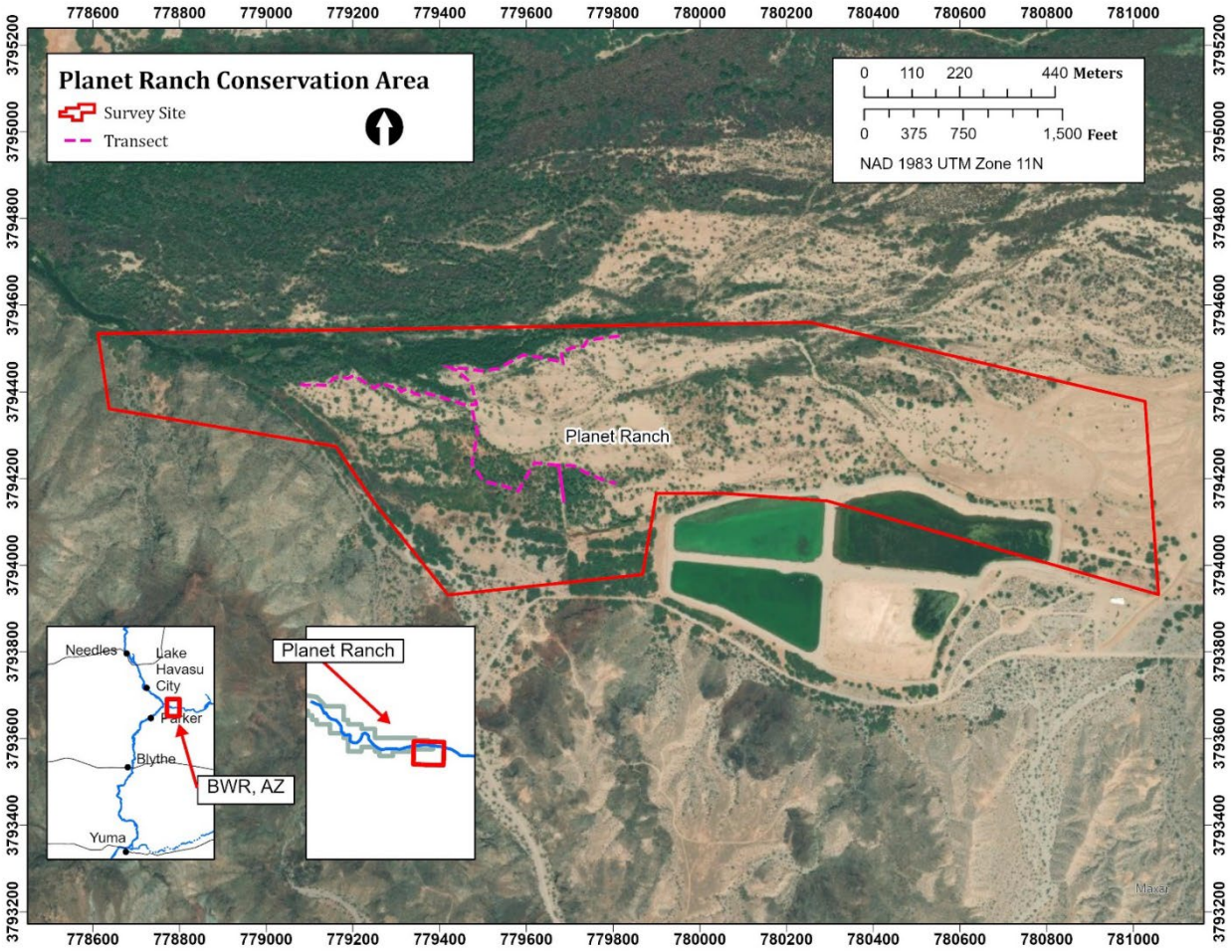



Figure 1-4.—Planet Ranch YBCU survey site showing transect, 2022.

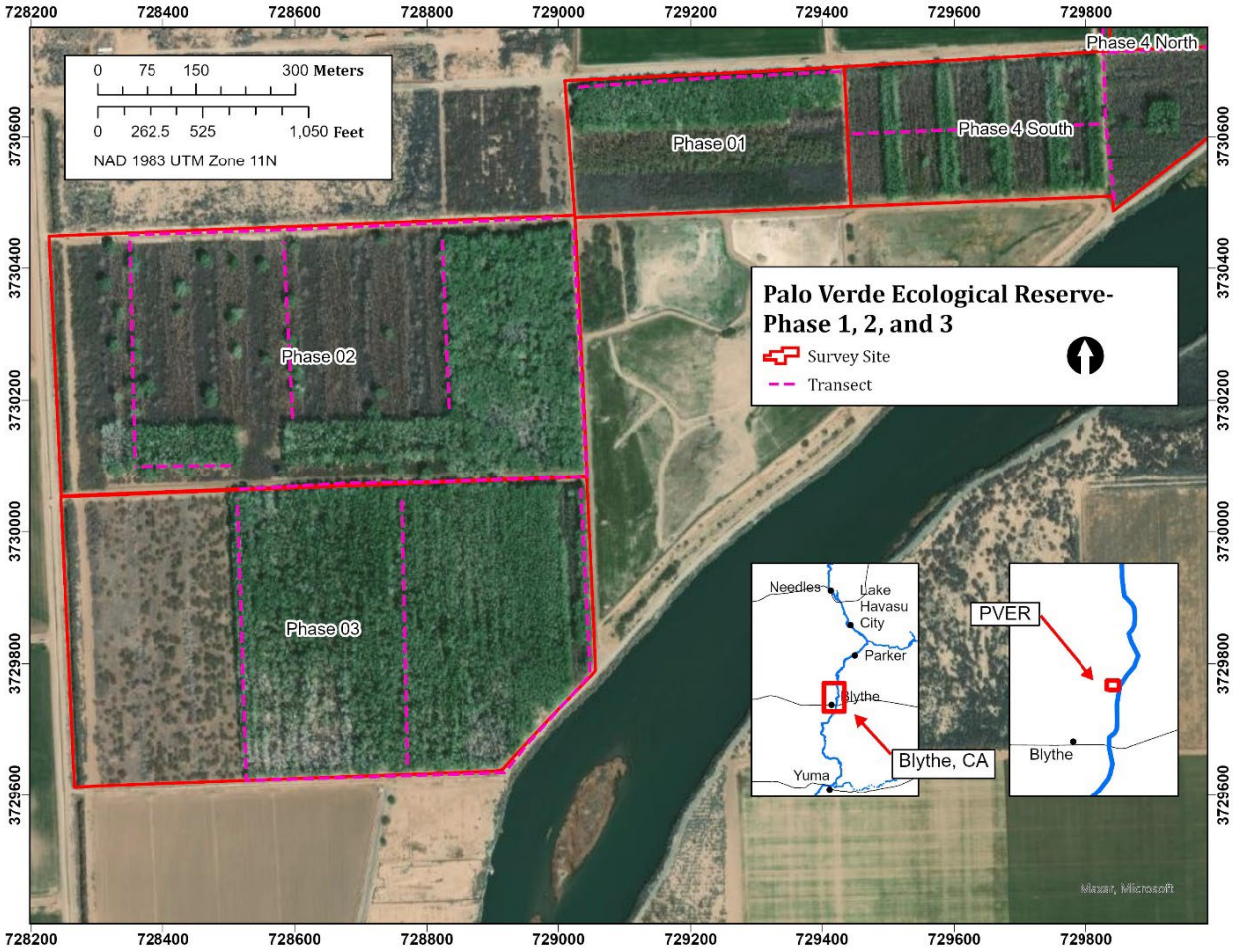



**Figure 1-5.—Palo Verde Ecological Reserve (PVER) Phase 1, 2, and 3 YBCU survey sites showing transects, 2022.**

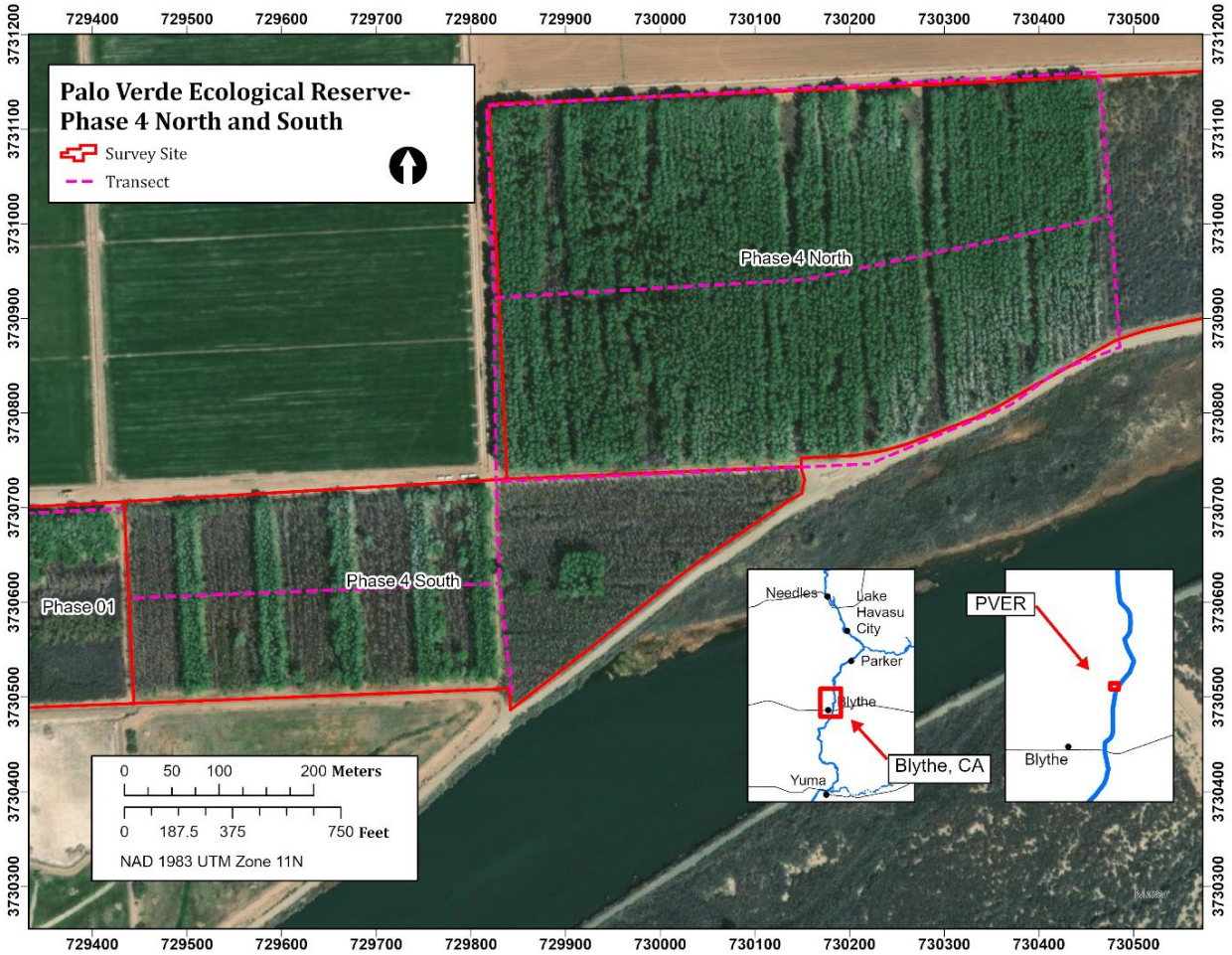



Figure 1-6.—PVER Phase 4 YBCU survey sites showing transects, 2022.

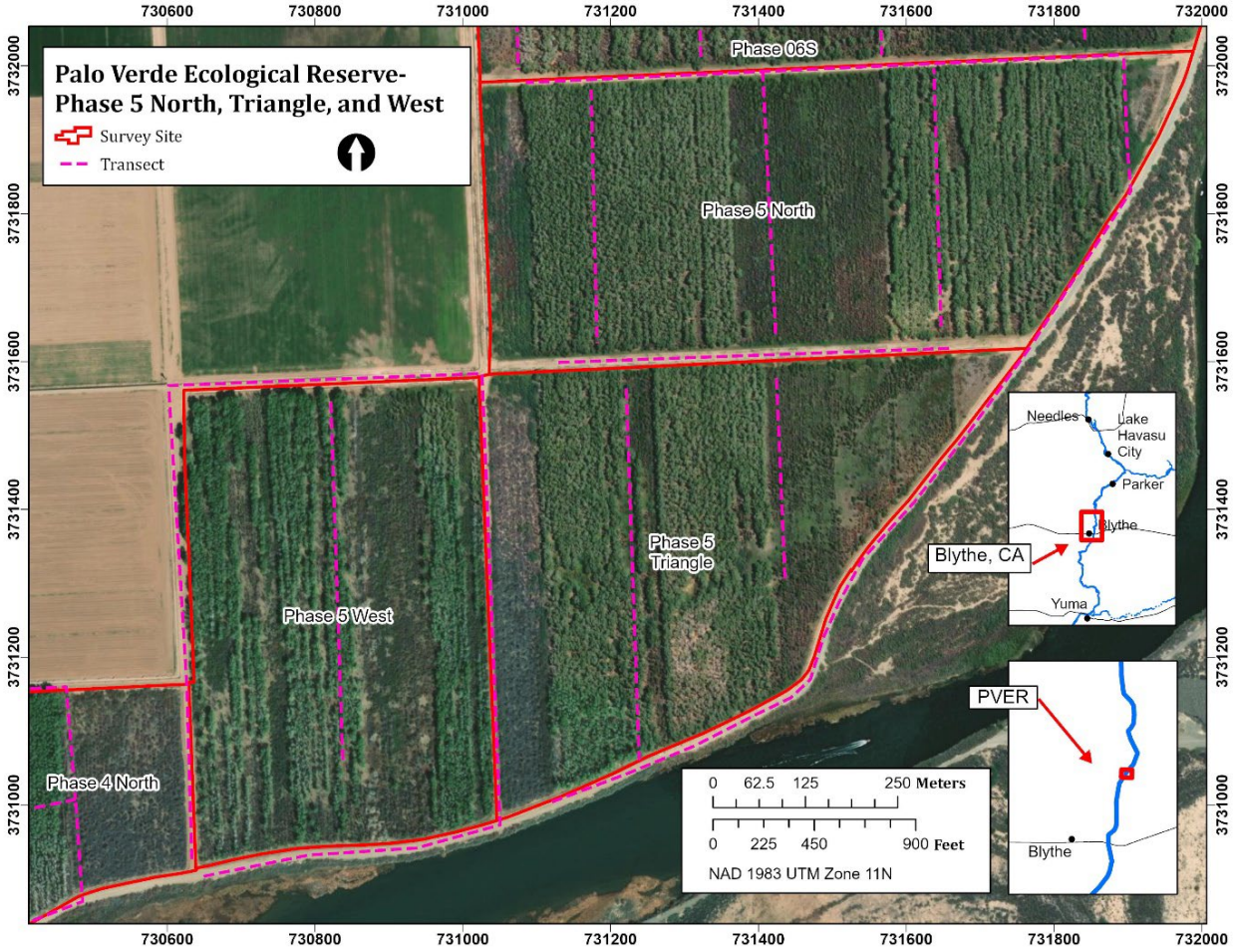



Figure 1-7.—PVER Phase 5 YBCU survey sites showing transects, 2022.

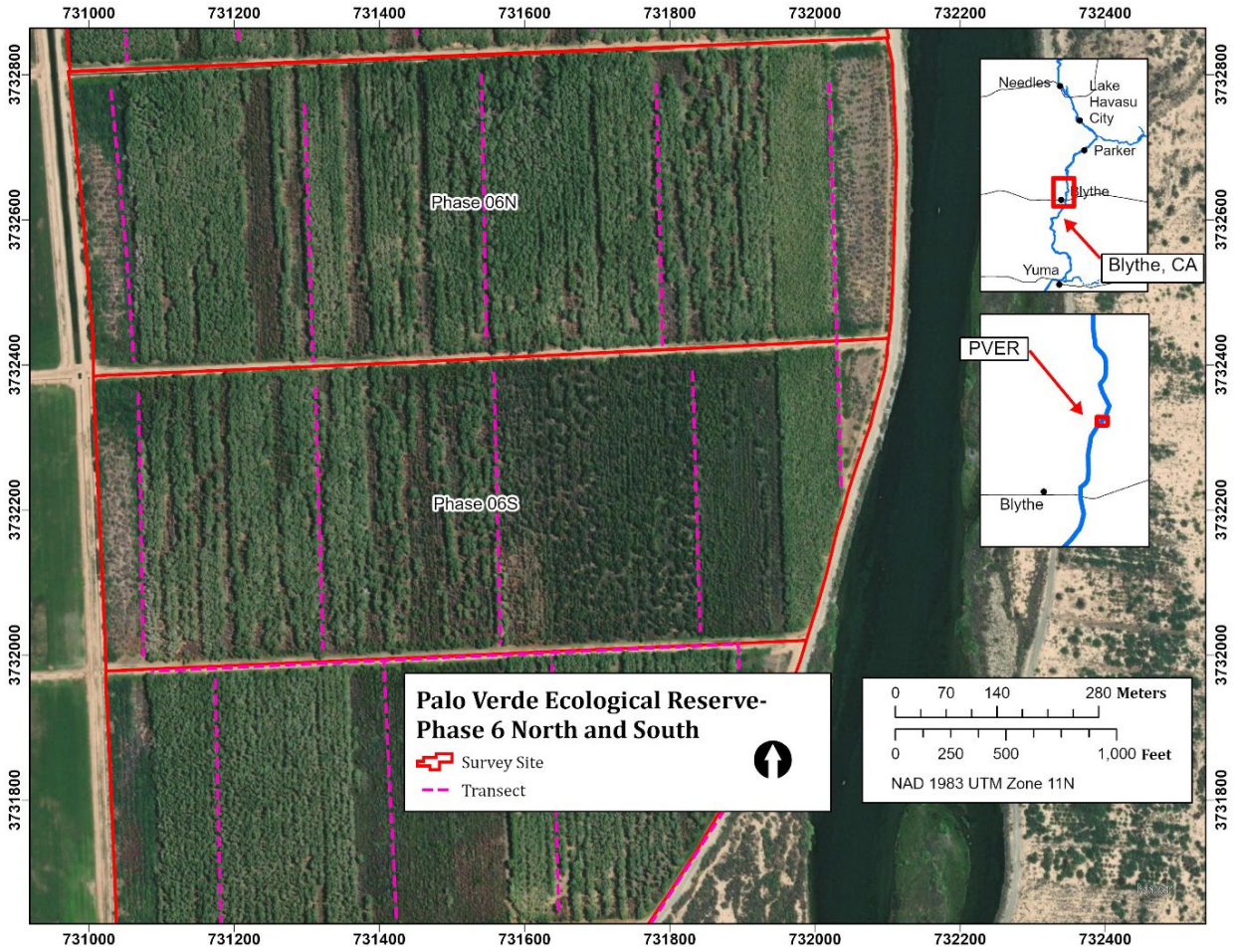



Figure 1-8.—PVER Phase 06 YBCU survey sites showing transects, 2022.

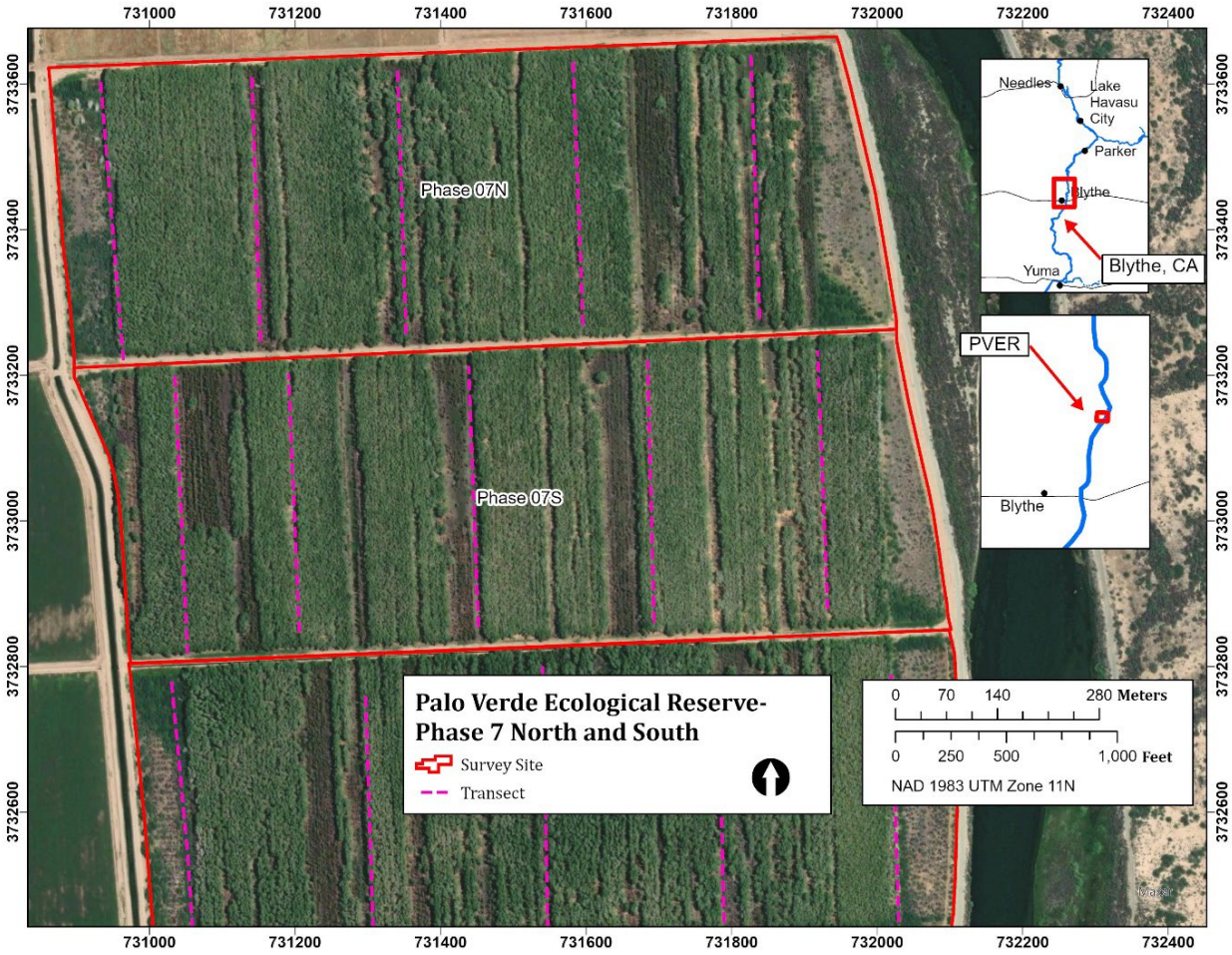



Figure 1-9.—PVER Phase 7 YBCU survey sites showing transects, 2022.

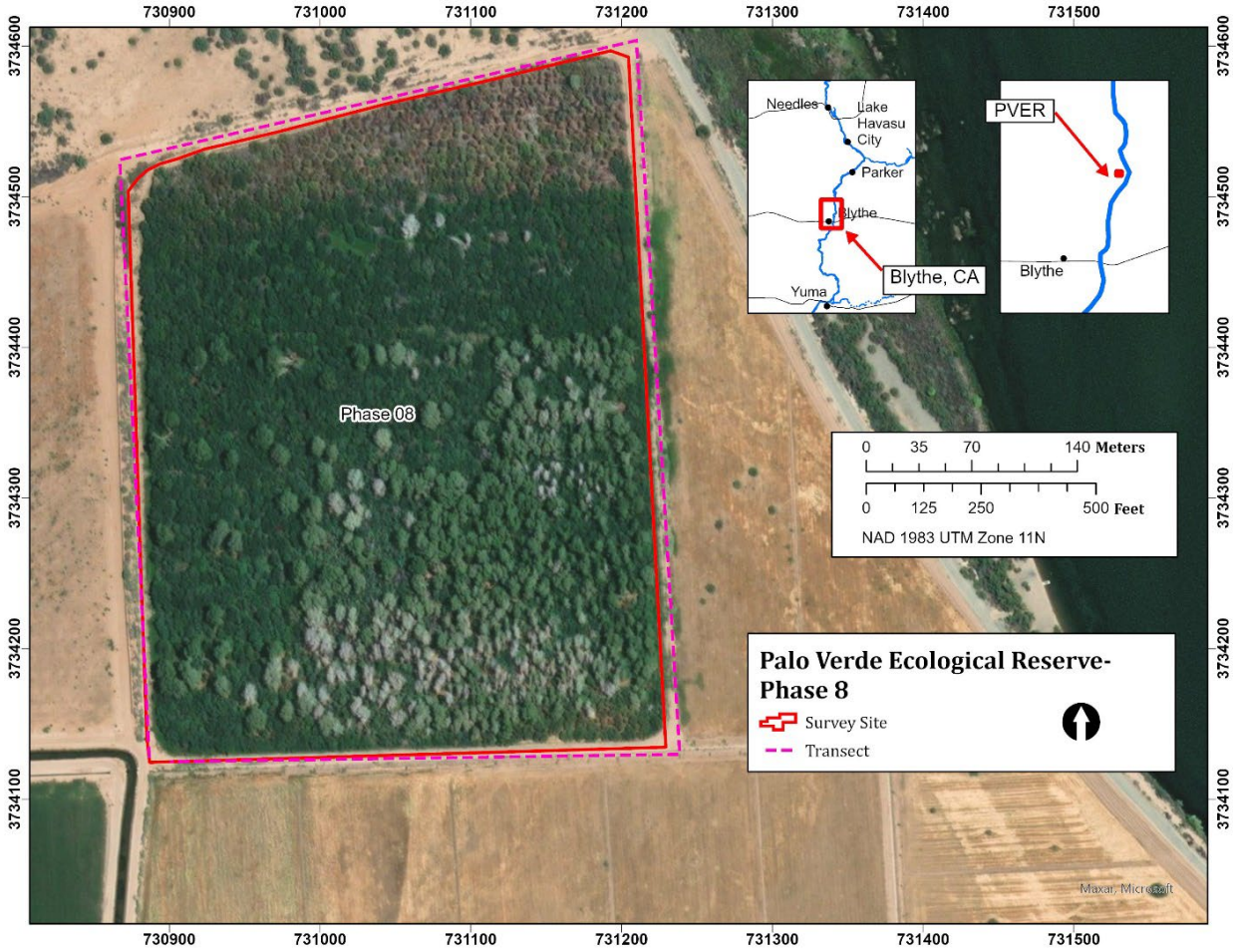



Figure 1-10.—PVER Phase 8 YBCU survey site showing transects, 2022.

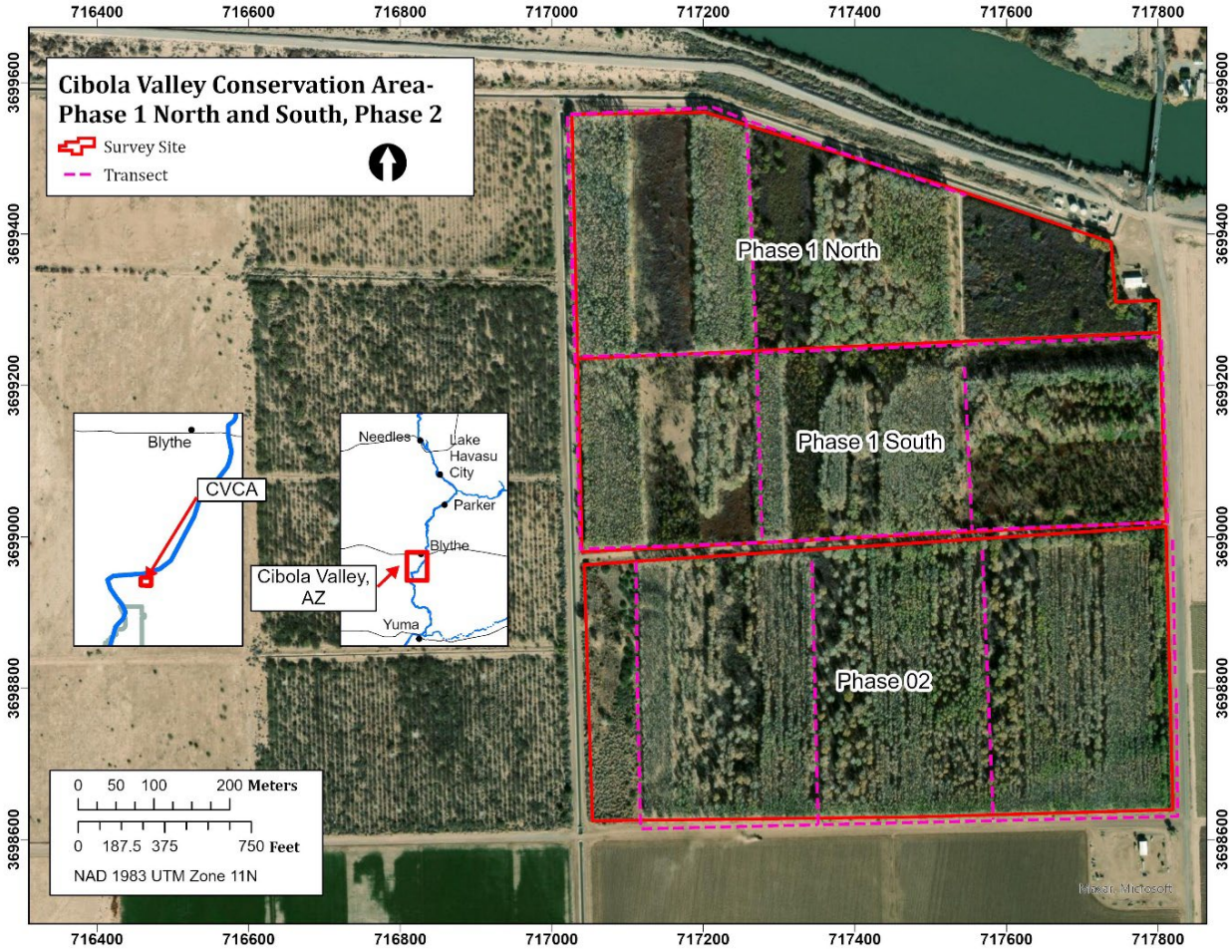



**Figure 1-11.—Cibola Valley Conservation Area (CVCA) Phase 1 and 2 YBCU survey sites showing transects, 2022.**

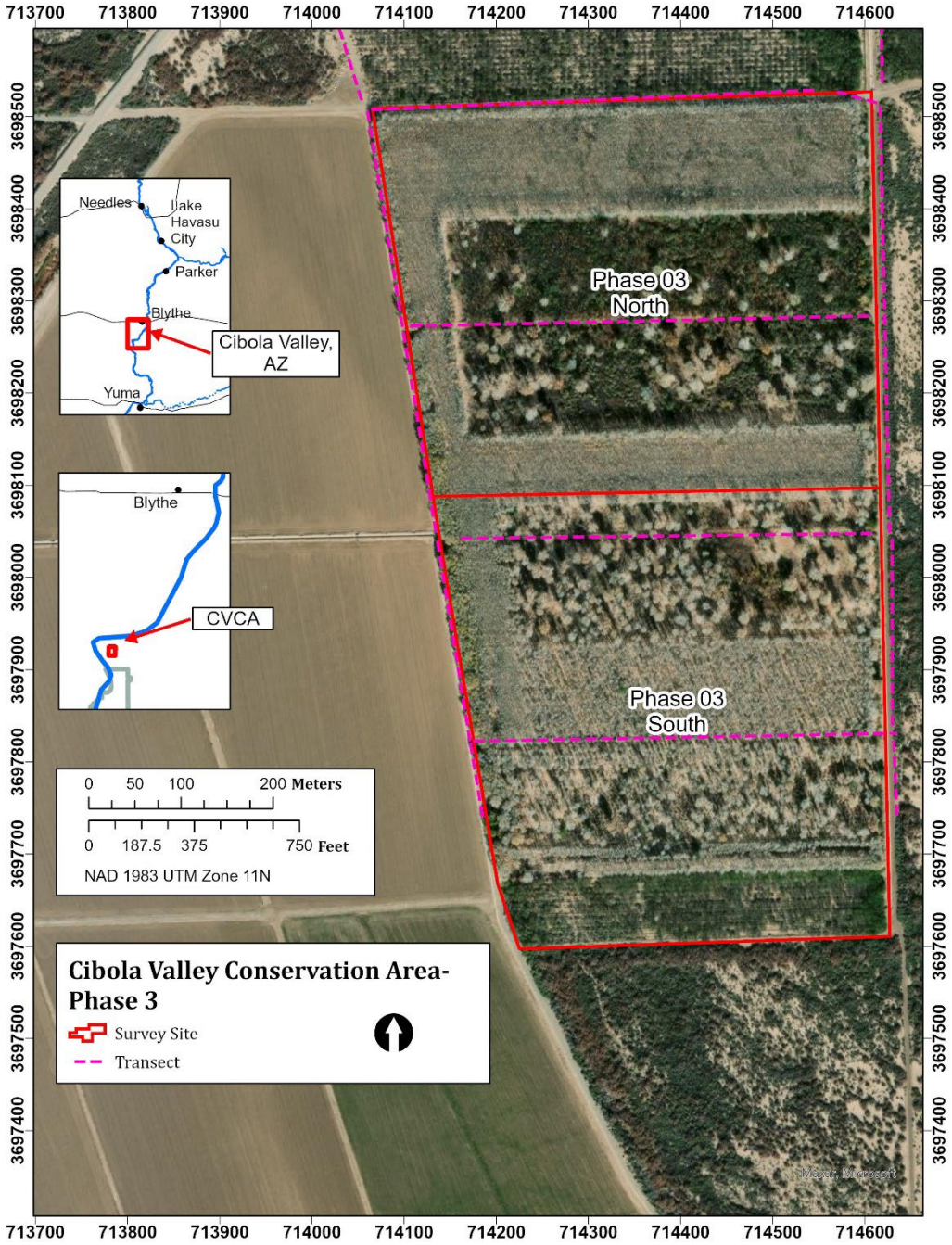



Figure 1-12.—CVCA Phase 3 YBCU survey sites showing transects, 2022.

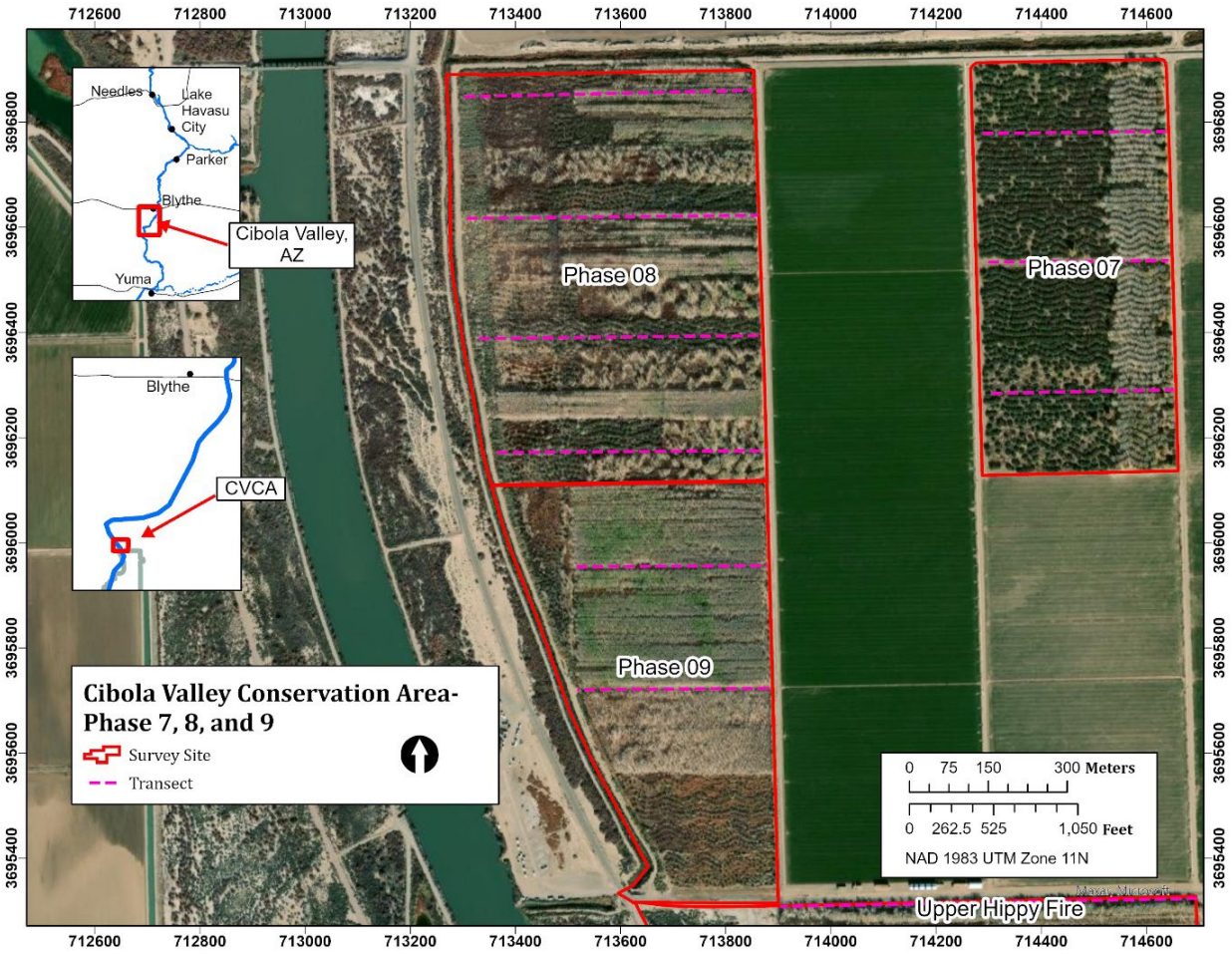



Figure 1-13.—CVCA Phases 7, 8, and 9 YBCU survey sites showing transects, 2022.

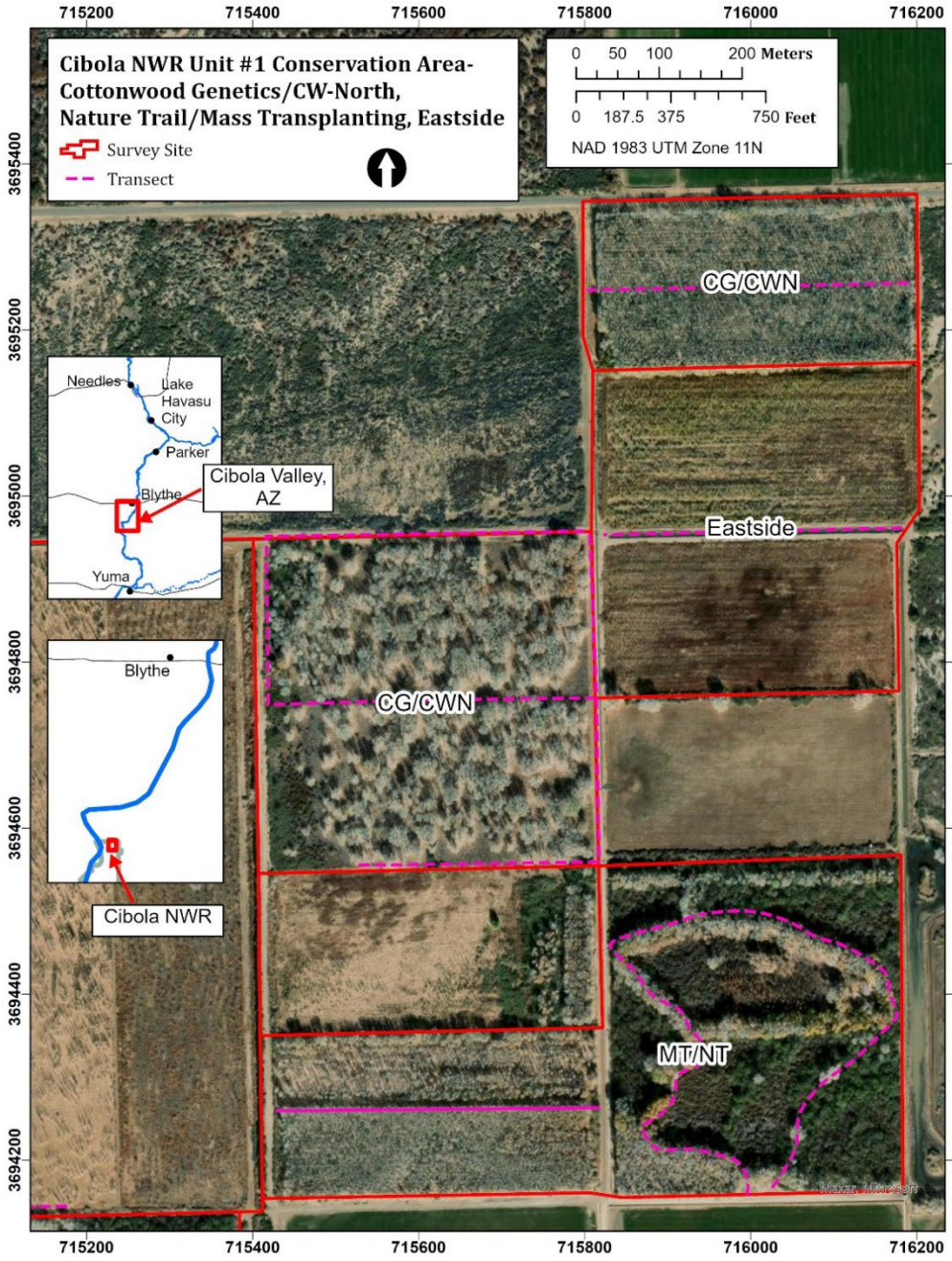



Figure 1-14.—Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1) – CW-North, Cottonwood Genetics, Mass Transplanting, Nature Trail, and Eastside YBCU survey sites showing transects, 2022.

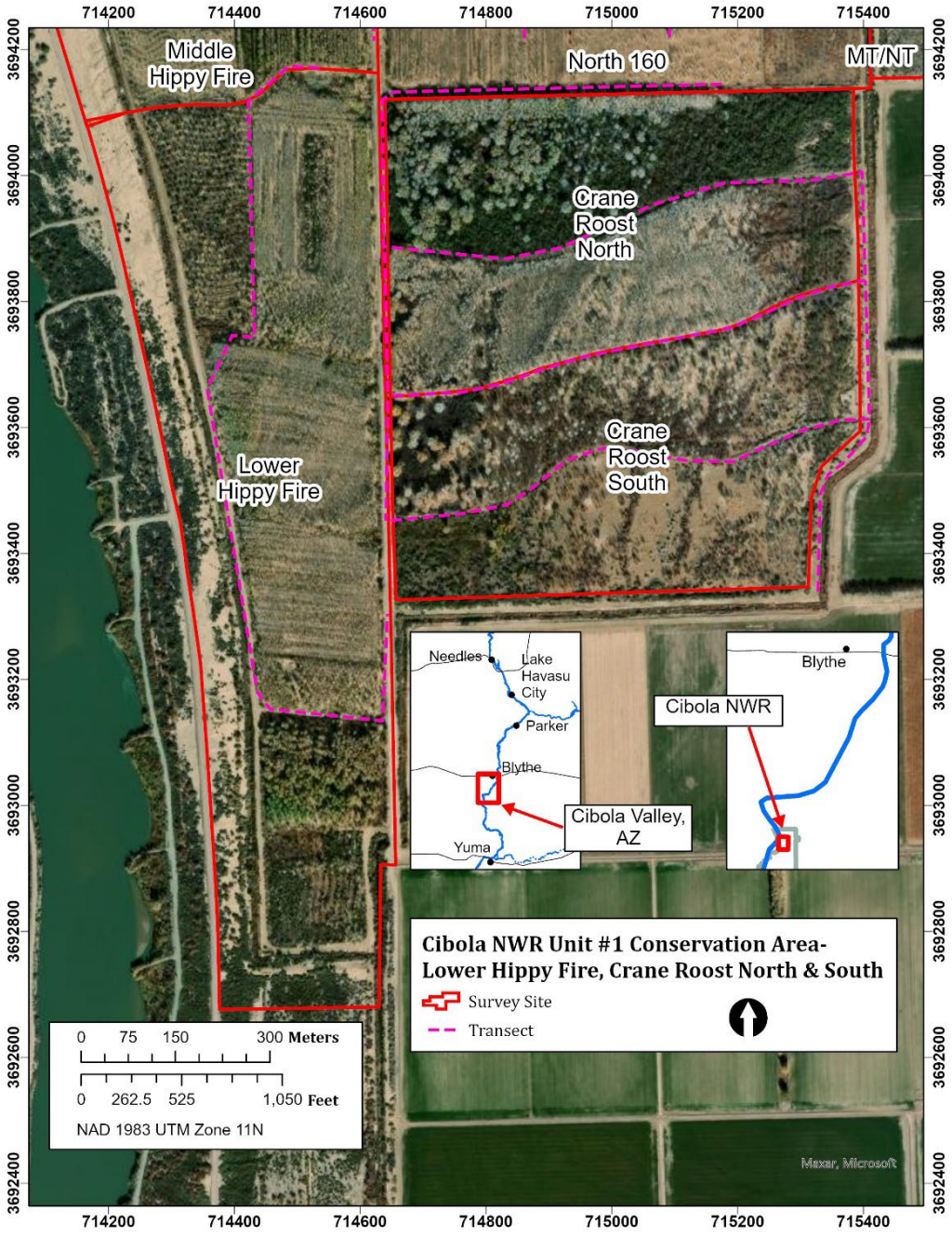



**Figure 1-15.—Cibola NWR Unit #1 Crane Roost and Lower Hippy Fire YBCU survey sites showing transects, 2022.**

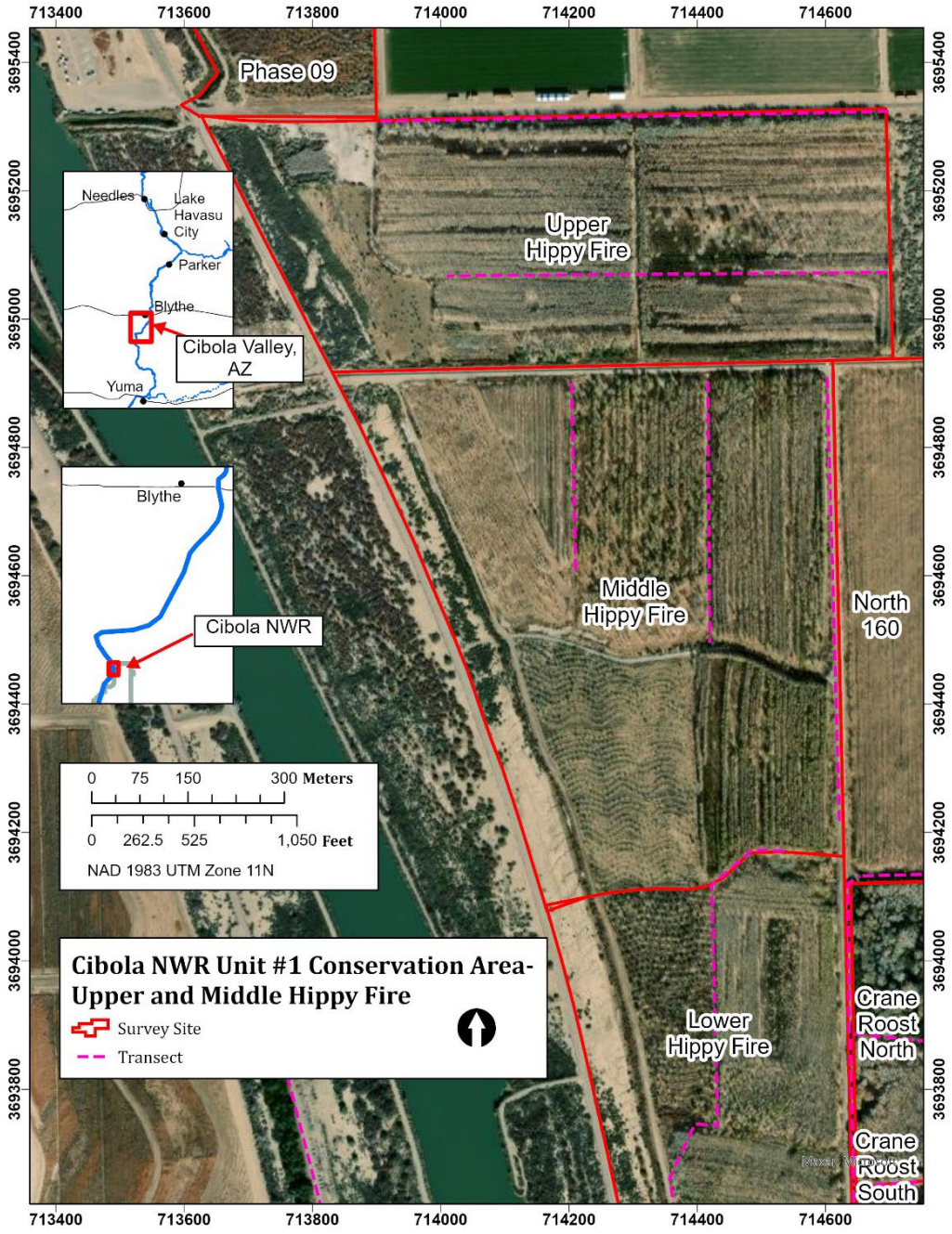
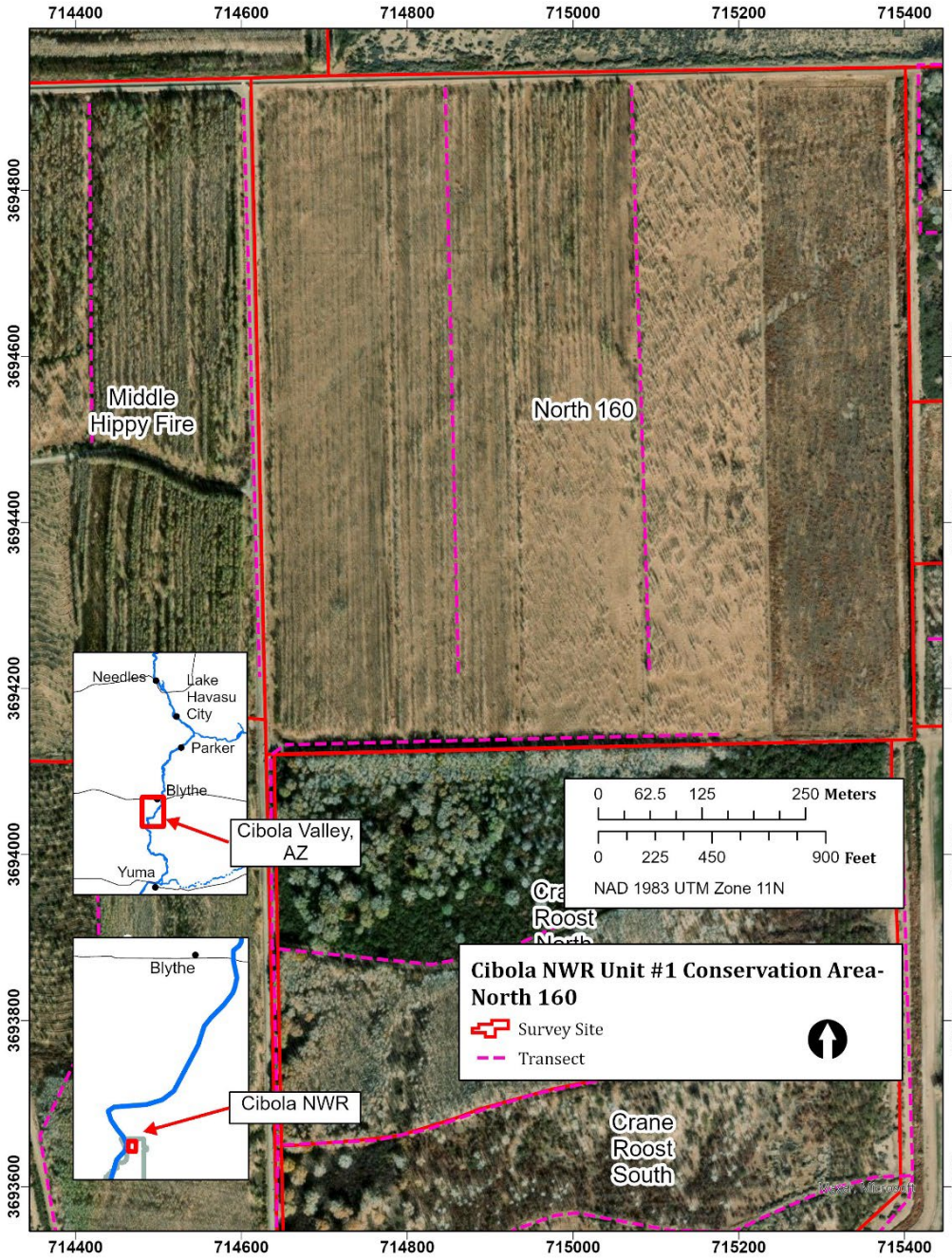



Figure 1-16.—Cibola NWR Unit #1 Hippy Fire Upper and Middle YBCU survey sites showing transects, 2022.

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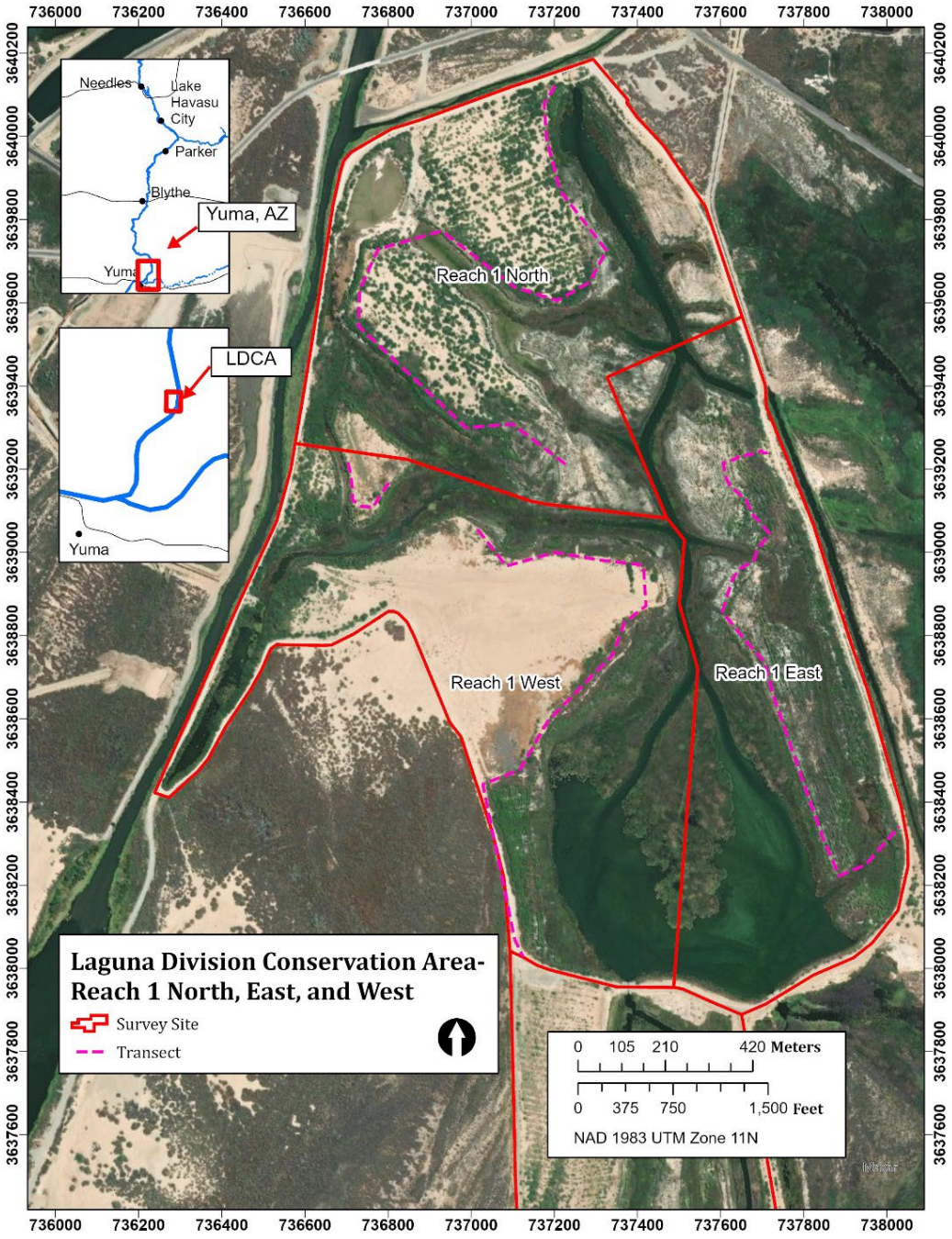


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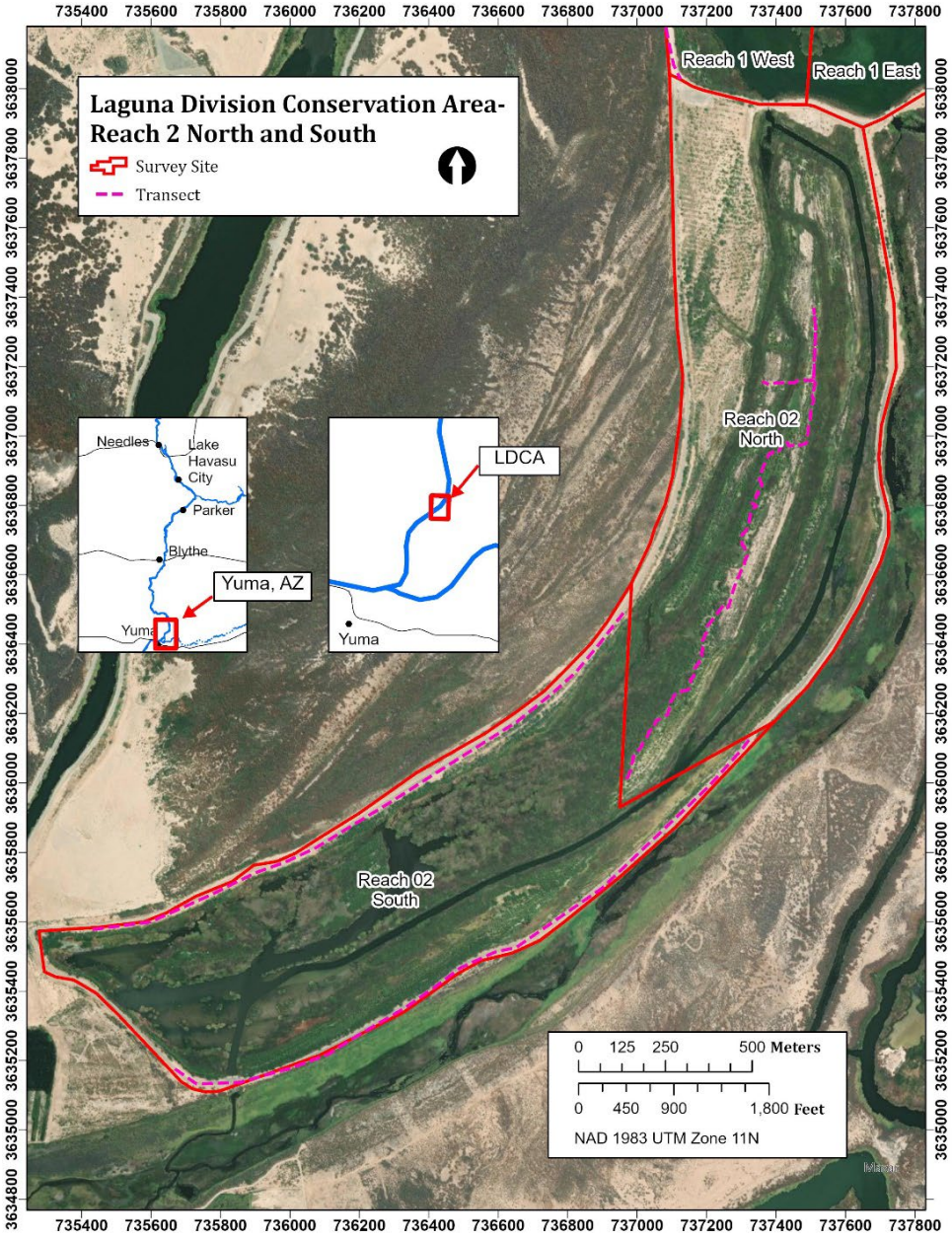


Figure 1-19.—LDCA Reach 2 YBCU survey sites showing transects, 2022.

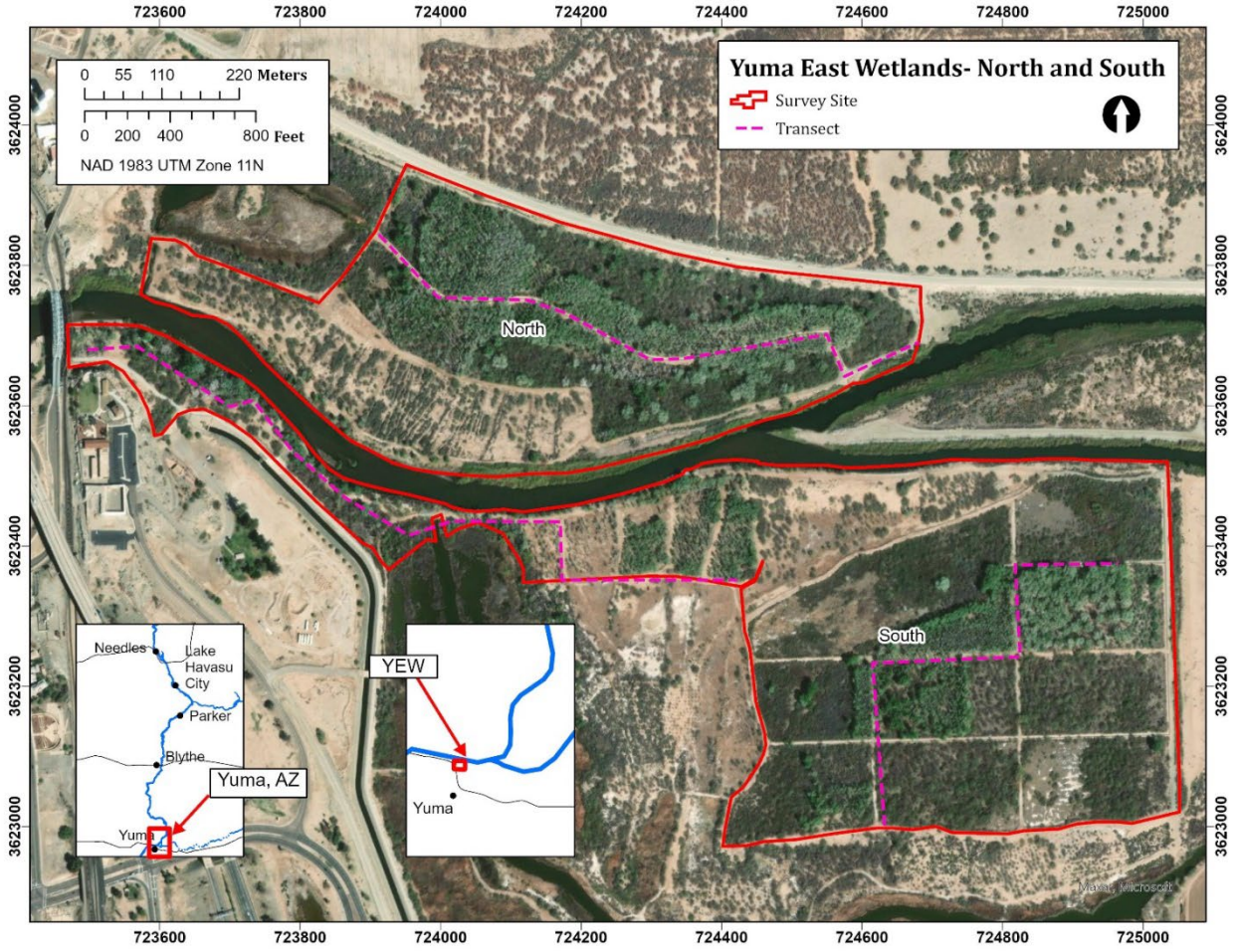


Figure 1-20.—Yuma East Wetlands YBCU survey sites showing transects, 2022.

# ATTACHMENT 2

A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo (*Coccyzus americanus*) – Final Draft, April 22, 2015

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

FINAL DRAFT 22 April 2015

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

Murrelet Halterman, Ph.D, H. T. Harvey & Associates Ecological Consultants, 1241 Johnson Ave. #105, San Luis Obispo, CA 93407. (760) 417-0765. mhalterman@harveyecology.com

Matthew J. Johnson, Colorado Plateau Research Station, Northern Arizona University, Box 5614, Flagstaff, AZ 86011. (928) 523-7764. Matthew.Johnson@nau.edu.

Jennifer A. Holmes, Colorado Plateau Research Station, Northern Arizona University, Box 5614, Flagstaff, AZ 86011. (928) 523-7076. Jennifer.Holmes@nau.edu

Stephen A. Laymon, Sacramento Fish and Wildlife Office, US Fish and Wildlife Service, 2800 Cottage Way, Sacramento, CA 95825. 916-414-6626. Stephen_Laymon@fws.gov

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

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

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# Table of Contents

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

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

## Purpose

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

## Background

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

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

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

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

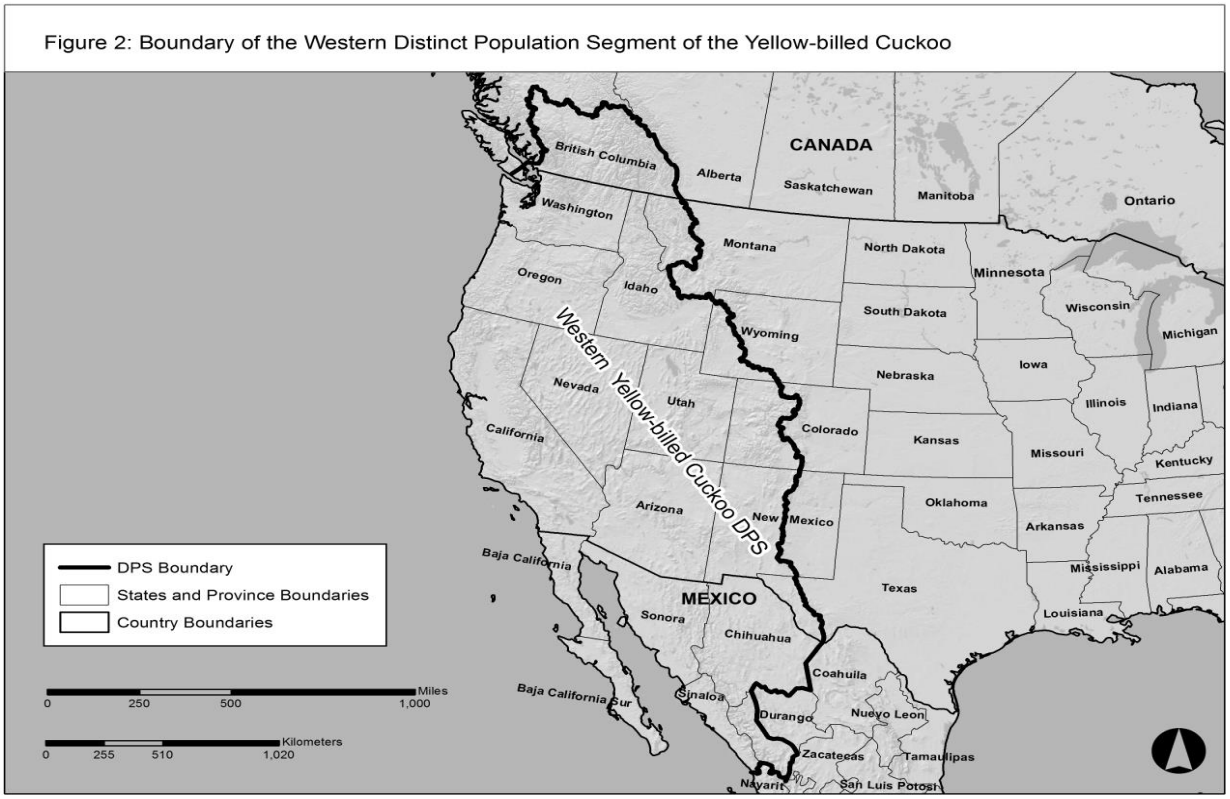


**Figure 1.** Range of the western Distinct Population Segment of the Yellow-billed Cuckoo.

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

## Section 1. Natural History

### Breeding Range and Taxonomy

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

### Migration and Winter Range

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

### Breeding Habitat

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

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

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

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

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

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

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

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

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

**Breeding Chronology and Biology**

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

**Nests and Eggs**

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

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

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

**Vocalizations**

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

**Food and Foraging**

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

**Site Fidelity and Local Population Fluctuations**

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

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

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

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

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

**Threats to the Cuckoo and Habitat**

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

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

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

## Section 2. Survey Protocol

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

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

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

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

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

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

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

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

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

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

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

**Permits**

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

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

**Pre-Survey Preparation**

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

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

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

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

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

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

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

## Equipment

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

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

## Yellow-billed Cuckoo Identification

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

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

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

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

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

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

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

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

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

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

**Timing and Number of Visits**

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

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

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

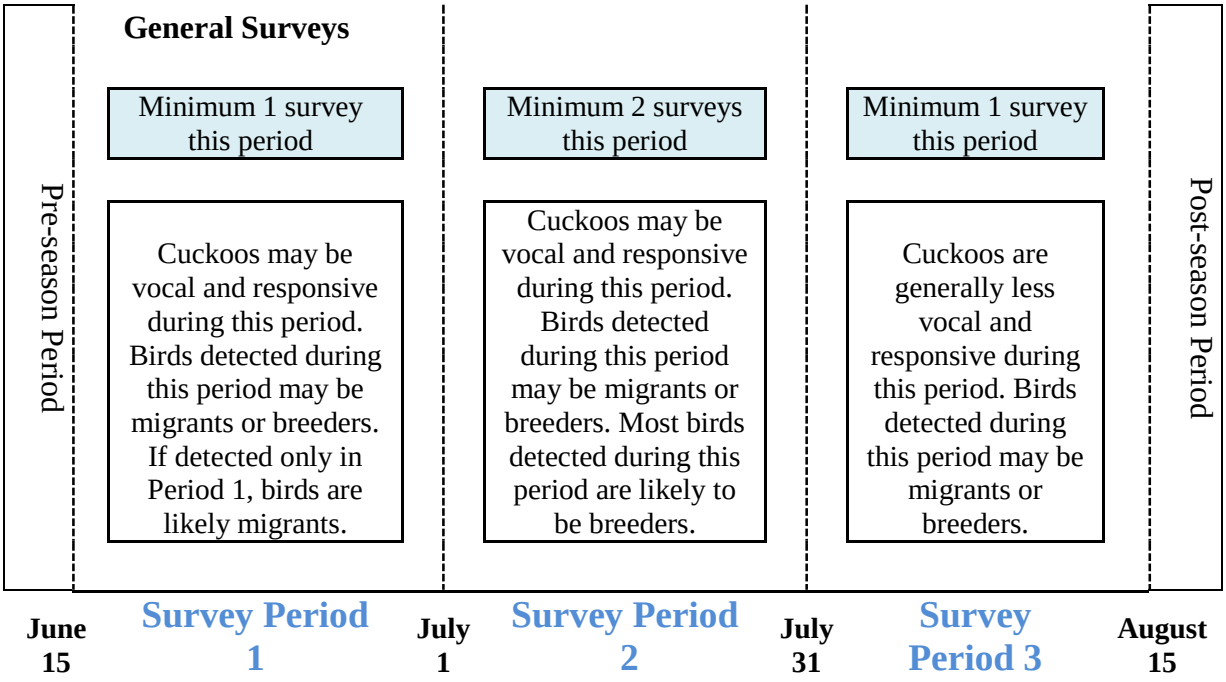


**Figure 2.** Recommended number and timing of visits during each survey period for Yellow-billed Cuckoo surveys.

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

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

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

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

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

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

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

**Survey Methods**

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

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

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

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

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

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

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

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

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

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

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

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

## Interpreting and Reporting Survey Results

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

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

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

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

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

## Section 3. Nest Searching

### Nest searching

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

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

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

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

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

**Special Considerations**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Page 1 of Survey Form**

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

**County.** Record the county where the site is located.

**State.** Record the state where the site is located.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Page 2 of Survey Form**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Page 3 of Survey Form**

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

**Page 4 of Survey Form**

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

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

## Yellow-Billed Cuckoo Survey Form

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

**Notes** (refer to Cuckoo # associated with individual detections)

*Include justification for these designations.

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

***YBCU Data Form appendix 2 cont.***

**Fill in the following information completely**

Name of Reporting Individual _____ Date Report completed_____

Affiliation _____ Phone # Email _____

USFWS Permit #_____ State Permit #_____

Site Name_____

Length of area surveyed_____ (in kilometers = km)_____

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

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

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

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

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

Estimated Canopy Cover (percent)_____

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

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

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

Estimated Understory Cover (percent)_____

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

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

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

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

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

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

*YBCU Data Form Appendix 2 Cont.*

**Yellow-billed Cuckoo Survey and Detection Form, continued**

Name of Reporting Individual_____ Phone #_____

Affiliation_____ Email_____

Site Name_____

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

***YBCU Data Form Appendix 2 Cont.***

| Broadcast point coordinates. Pleaserecord for each survey. (optional) | | | | | |
|---|---|---|---|---|---|
| Date | | | Date | | |
| Survey visit number | | | Survey visit number | | |
| Point# | UTME | UTMN | Point# | UTME | UTMN |
| Point# 1 | | | Point# 1 | | |
| Point# 2 | | | Point# 2 | | |
| Point# 3 | | | Point# 3 | | |
| Point# 4 | | | Point# 4 | | |
| Point# 5 | | | Point# 5 | | |
| Point# 6 | | | Point# 6 | | |
| Point# 7 | | | Point# 7 | | |
| Point# 8 | | | Point# 8 | | |
| Point# 9 | | | Point# 9 | | |
| Point# 10 | | | Point# 10 | | |
| Point# 11 | | | Point# 11 | | |
| Point# 12 | | | Point# 12 | | |
| Point# 13 | | | Point# 13 | | |
| Point# 14 | | | Point# 14 | | |
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| Point# 24 | | | Point# 24 | | |
| Point# 25 | | | Point# 25 | | |
| Point# 26 | | | Point# 26 | | |
| Point# 27 | | | Point# 27 | | |
| Point# 28 | | | Point# 28 | | |
| Point# 29 | | | Point# 29 | | |
| | | | | | |
| Date | | | Date | | |
| Survey visit number | | | Survey visit number | | |
| Point# | UTME | UTMN | Point# | UTME | UTMN |
| Point# 1 | | | Point# 1 | | |
| Point# 2 | | | Point# 2 | | |
| Point# 3 | | | Point# 3 | | |
| Point# 4 | | | Point# 4 | | |
| Point# 5 | | | Point# 5 | | |
| Point# 6 | | | Point# 6 | | |
| Point# 7 | | | Point# 7 | | |
| Point# 8 | | | Point# 8 | | |
| Point# 9 | | | Point# 9 | | |
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| Point# 14 | | | Point# 14 | | |
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| Point# 25 | | | Point# 25 | | |
| Point# 26 | | | Point# 26 | | |
| Point# 27 | | | Point# 27 | | |
| Point# 28 | | | Point# 28 | | |
| Point# 29 | | | Point# 29 | | |

**Appendix 3.** Yellow-billed Cuckoo habitat photos for Arizona, New Mexico and California.

# ATTACHMENT 3

Yellow-Billed Cuckoo (*Coccyzus americanus*) Survey Summary Form

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

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

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

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

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

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

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

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

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

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

**Detection Comments/Additional Behaviors/Nest UTM:**

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

## Breeding Territory Definitions

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

Site Name: | Date Report Completed:

Name of Reporting Individual: | Phone #:

Affiliation: | Email:

USFWS Permit #: | State Permit #:

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

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

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

Length of survey area (km):

**Overall Vegetation Characteristics:**

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

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

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

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

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

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

**General Overstory/Canopy Characteristics:**

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

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

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

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

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

**General Subcanopy Characteristics:**

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

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

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

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

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

**General Understory Characteristics:**

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

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

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

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

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

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

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

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

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

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

Site Name: Date Report Completed:

## Additional Yellow-billed Cuckoo Detections

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